

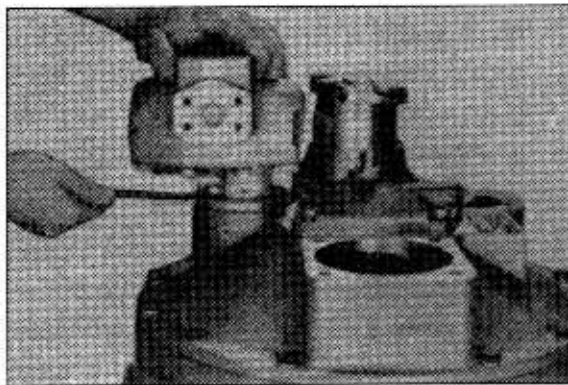
## GROUP 4 DISASSEMBLY AND ASSEMBLY

### 1. TORQUE CONVERTER

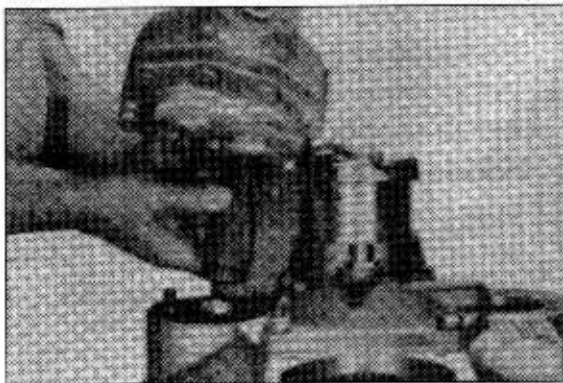
#### 1) DISASSEMBLY

※ Cleanliness is of extreme importance and an absolute must in the repair and overhaul of this unit. Before attempting any repairs, the exterior of unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

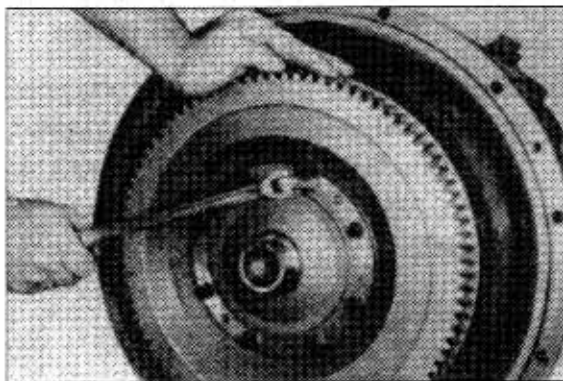
- (1) Remove pump stud nuts and washers.



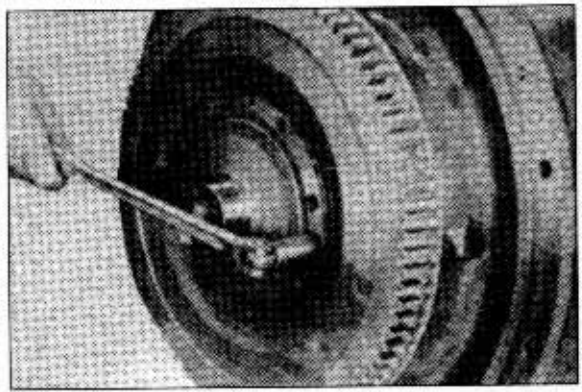
- (2) Remove pump assembly and drive sleeve.



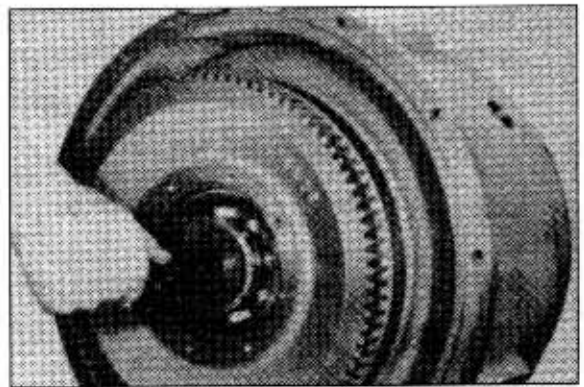
- (3) Remove impeller cover bearing cap bolts.



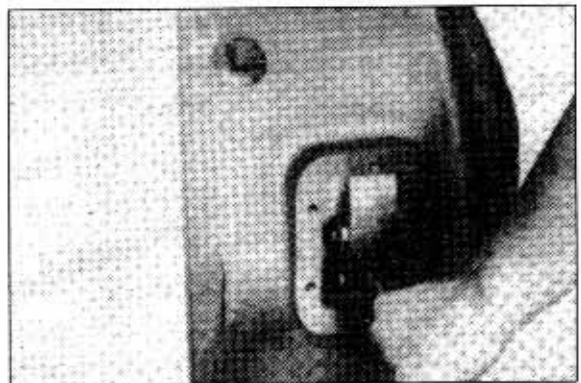
- (4) Install two bolts in threaded holes in bearing cap. Turn bolts evenly and remove bearing cap.



- (5) Remove bearing retainer plate snap ring.

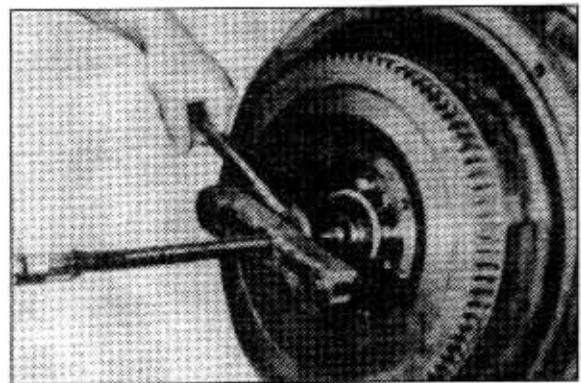


- (6) Remove impeller to impeller cover bolts.

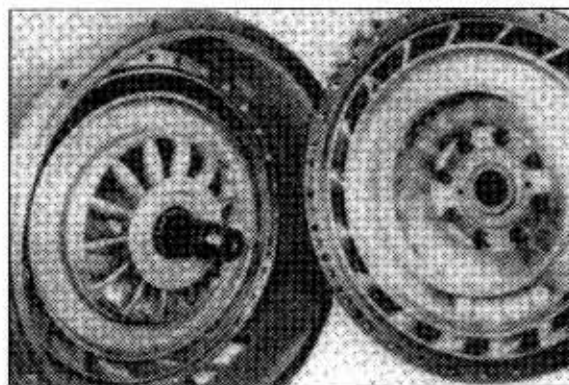


- (7) Using a puller, remove bearing retainer plate, impeller cover, and turbine from turbine shaft.

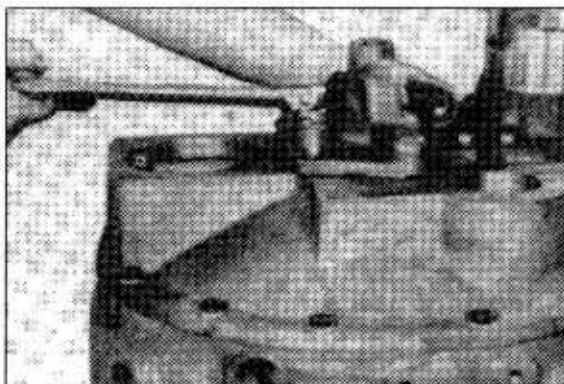
▲ Secure impeller cover with a chain to prevent assembly from dropping.



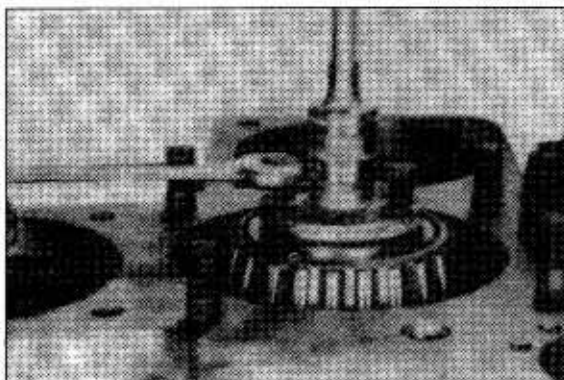
- (8) Turbine and impeller cover removed. Block impeller cover on the outer diameter and drive turbine hub from impeller bearing.



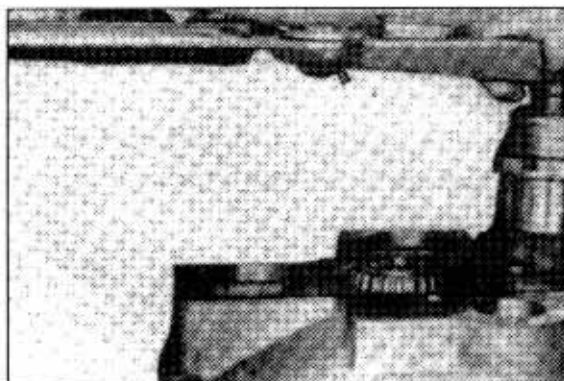
- (9) Remove turbine shaft bearing cap.



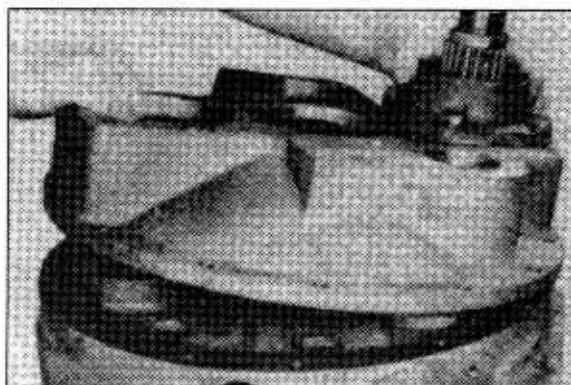
- (10) Remove lock wire and adaptor bolts from adaptor. Install two bolts in threaded holes in adaptor. Turn bolts evenly and remove adaptor.



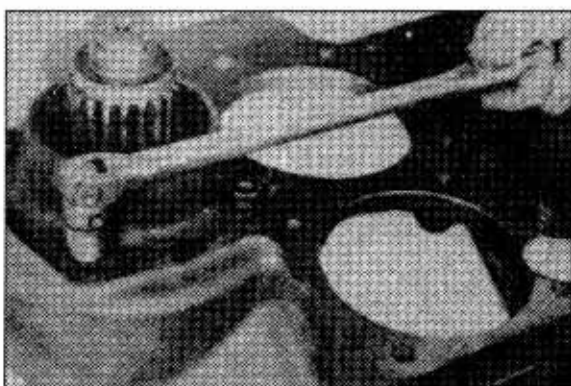
- (11) Lock output gears with a soft bar and remove output flange nut. Remove flange washer, O-ring and flange.



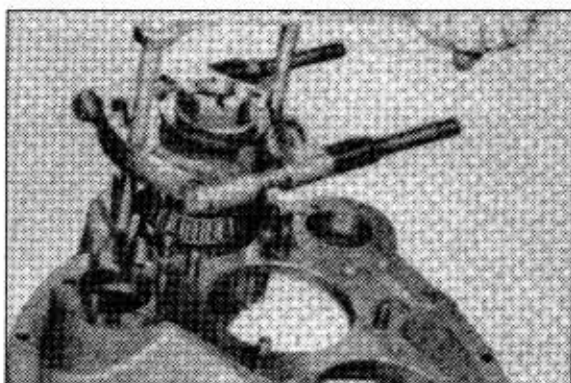
- (12) Remove rear housing cover bolts.  
Remove rear housing.



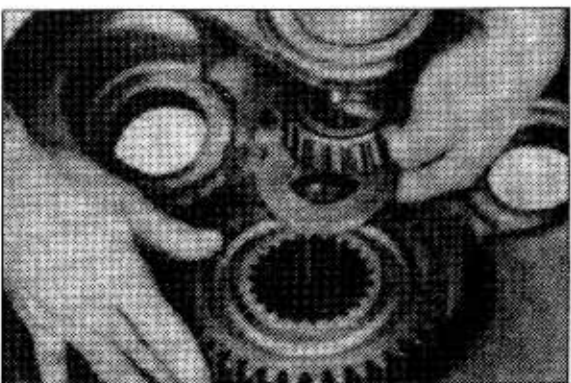
- (13) Remove output shaft bearing cap.



- (14) Using a split puller as shown remove  
output shaft and outer taper bearing.

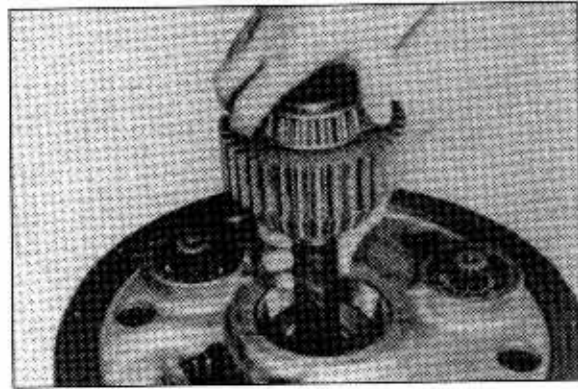


- (15) Remove output gear, washer and inner  
taper bearing from rear housing.

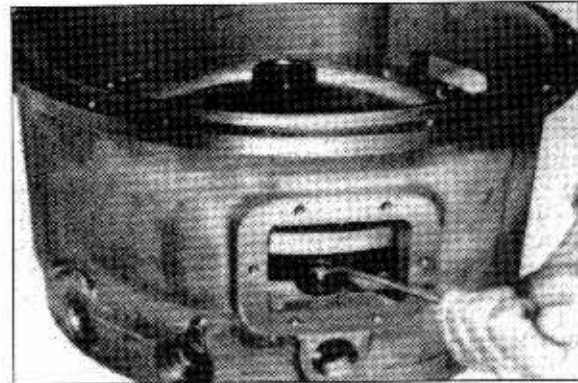




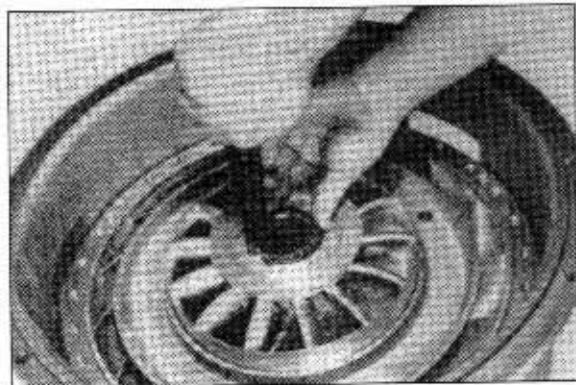
- (16) Remove turbine shaft and bearing assembly from converter housing.



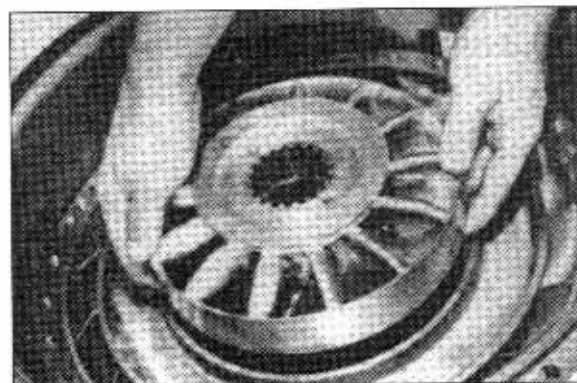
- (17) Remove three(3) oil baffle retainer bolts and washers from housing.



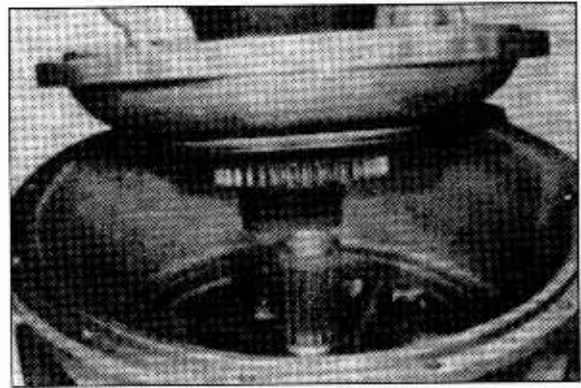
- (18) Remove reaction member retainer ring.



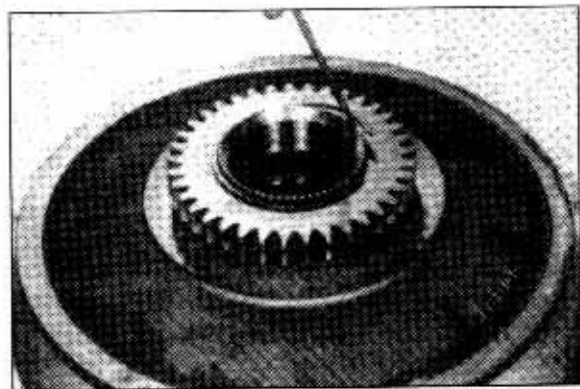
- (19) Remove reaction member from stator support. If reaction member is tight, threaded holes are provided to pull same from stator support.



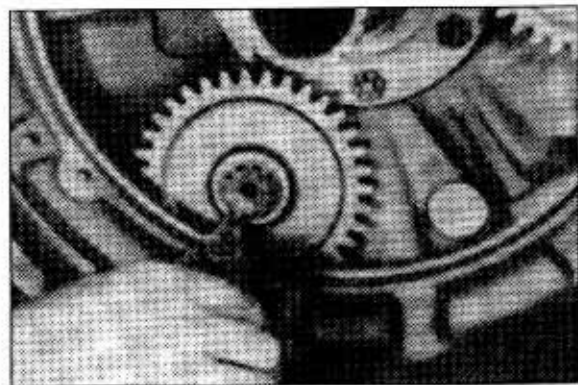
- (20) Remove impeller and baffle assembly from converter housing.



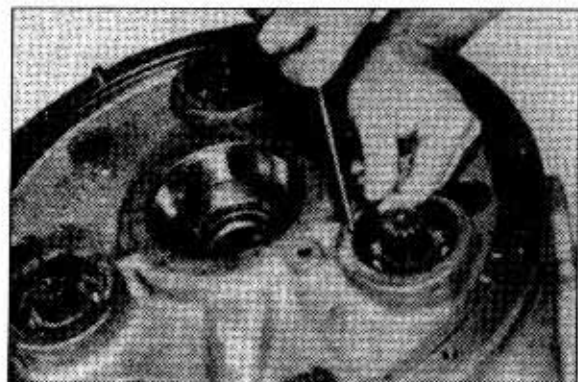
- (21) Remove pump drive gear retainer ring. Remove pump drive gear and oil baffle from impeller hub.



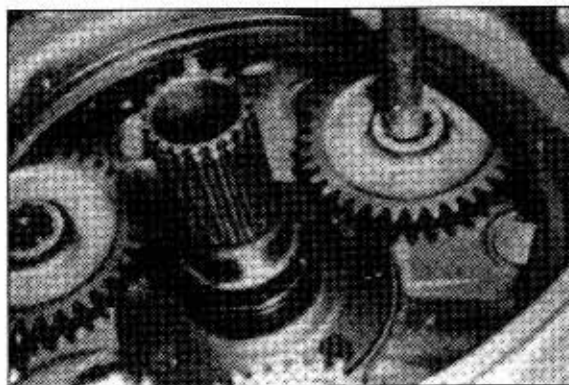
- (22) Remove pump driven gear retainer rings.



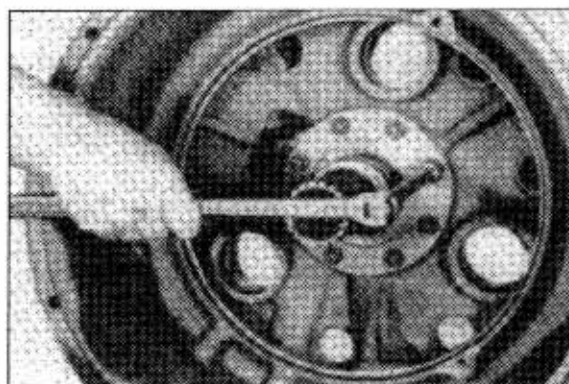
- (23) Remove pump shaft rear bearing retainer ring and washer.



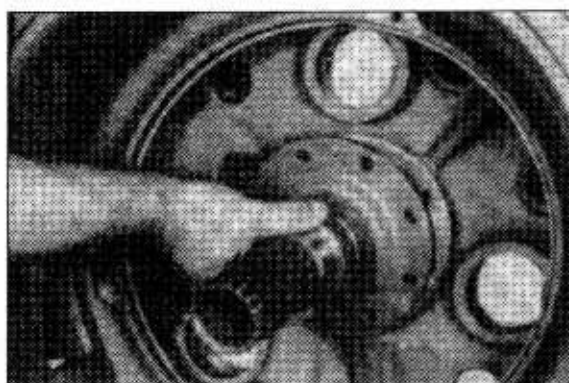
(24) Using a soft bar tap pump shaft assemblies from converter housing.



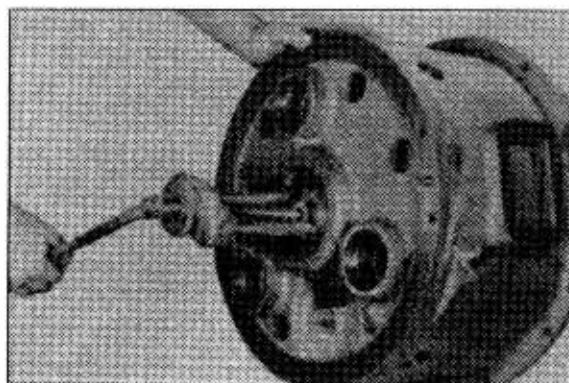
(25) Remove bolts from stator supports.



(26) Remove stator support.



(27) If inner turbine shaft bearing cup is to be replaced remove as shown on the right figure.



## **2) CLEANING AND INSPECTION**

### **(1) CLEANING**

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

- ▲ Care should be exercised to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

- **Bearings**

Remove bearings from cleaning fluid and strike flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisturefree compressed air. Be careful to direct air stream across bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

- **Housings**

Clean interior and exterior of housings, bearing caps etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

- ▲ Care should be exercised to avoid inhalation of vapors and skin rashes when using alkali cleaners.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or lapping compound.

## **(2) INSPECTION**

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

- **Bearings**

Carefully inspect all rollers, cages and cups for wear, chipping or nicks to determine fitness of bearings for further use. Do not replace a bearing cone or cup individually without replacing the mating cup or cone at the same time. After inspection dip bearings in recommended type Automatic Transmission Fluid and wrap in clean lintless cloth or paper to protect them until installed.

- **Oil seals, gaskets, etc.**

Replacement of spring load oil seals, O-rings, metal sealing rings, gaskets and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. Apply a thin coat of Permatex No.2 on the outer diameter of the oil seal to assure an oil tight fit into the retainer. When assembling new metal type sealing rings, same should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all O-rings and seals with recommended type Automatic Transmission Fluid before assembly.

- **Gears and shafts**

If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they are not sprung, bent, or splines twisted, and that shafts are true.

- **Housings, covers, etc.**

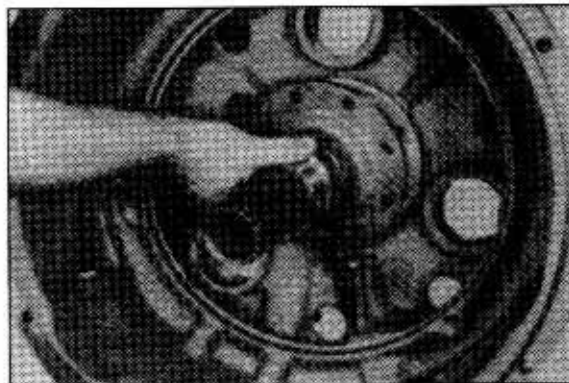
Inspect housings, covers and bearing caps to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.



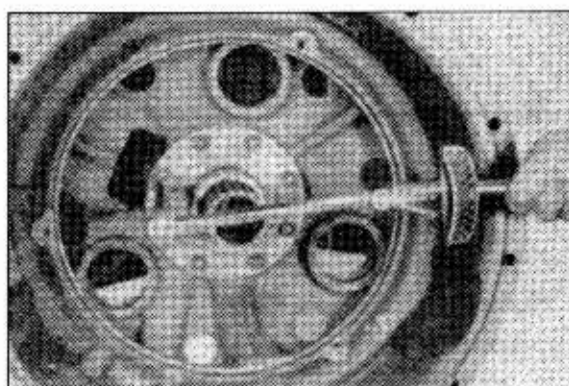
### 3) ASSEMBLY

※ Instructions given below on assembly of components are given in the sequence that must be followed in rebuilding.

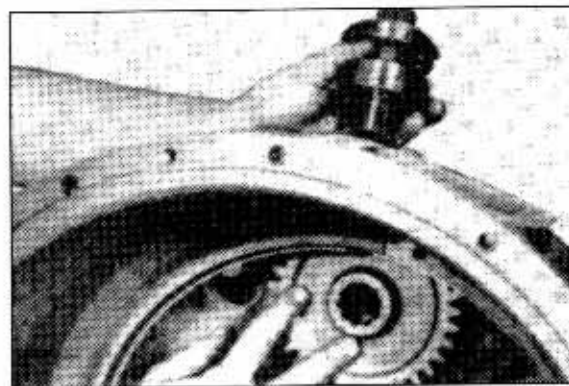
(1) Install stator support.



(2) Install support self locking bolts and tighten 11.1~12.2kgf · m(80~88bf · ft).



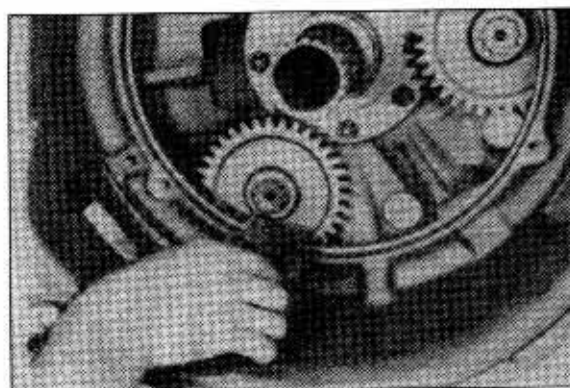
(3) With pump driven gear in position, install pump shaft and bearing assembly through rear of case and into pump driven gear.



- (4) Install pump bearing retainer washer and ring.

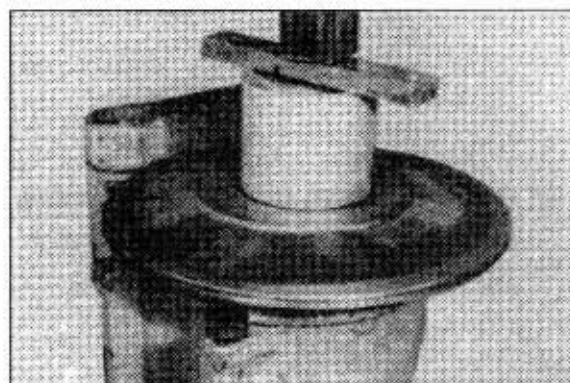


- (5) Install pump driven gear to shaft retainer ring. Repeat procedure for all pump shafts and gears.

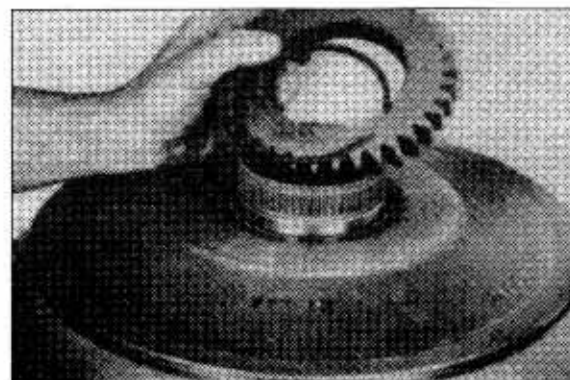


- (6) Apply a thin coat of No.2 Permatex to outer diameter of oil seal and press into bore of oil baffle. Lip of seal must be upward.

- ※ Before installing oil baffle remove impeller hub bolts and install new impeller to hub O-ring.



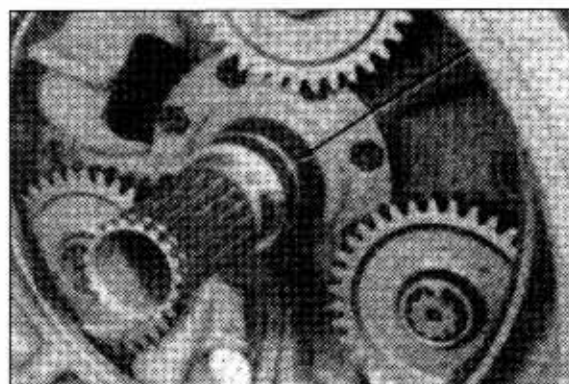
- (7) Install oil baffle on impeller and hub assembly. Use caution as not to damage oil seal. Install pump drive gear and retainer ring.



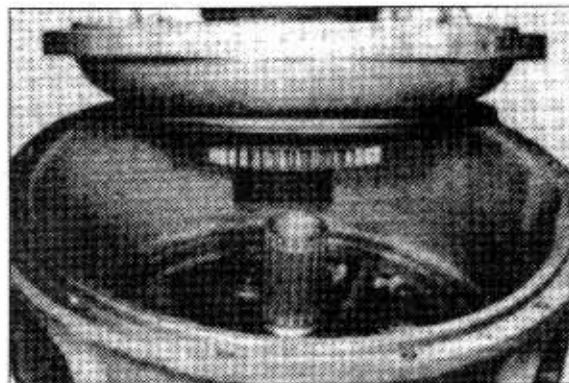
- (8) Install oil baffle O-ring. Lubricate O-ring with automatic transmission fluid.



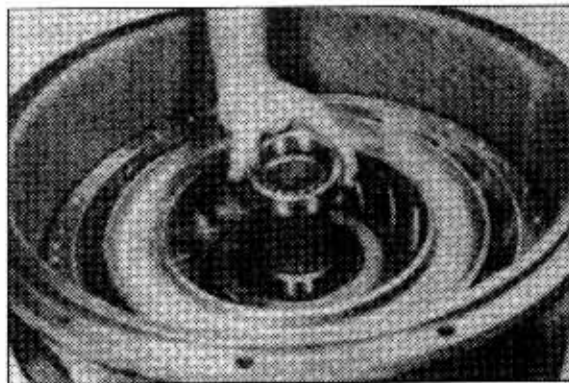
- (9) Install new sealing ring expander spring and oil sealing ring on support. Expander spring gap to be 180° from sealing ring hook joint.



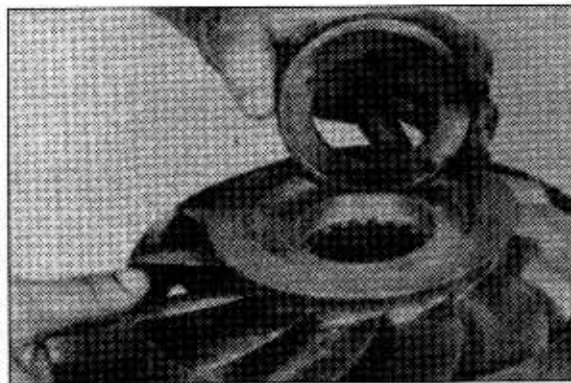
- (10) Install impeller and oil baffle assembly over stator support and into converter housing. Use caution as not to damage oil baffle O-ring.



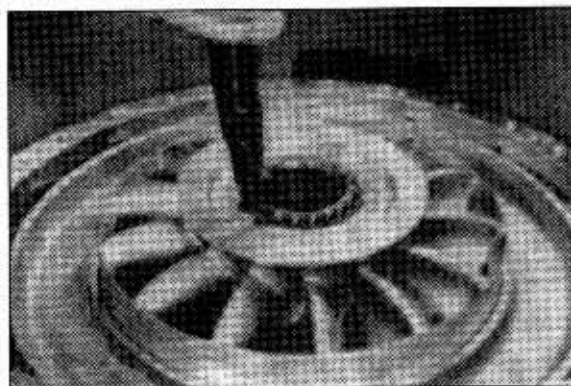
- (11) Install impeller hub bearing inner race.



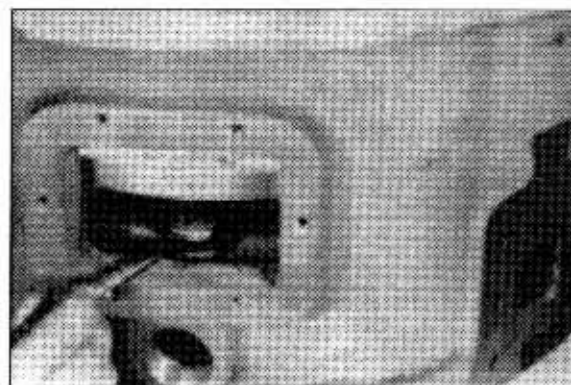
- (12) Press roll pin in reaction member. Press spacer on roll pin.



- (13) Install reaction member on stator support and secure with retainer ring.



- (14) Install oil baffle lockwashers and flat washers on baffle bolts. Install bolts and washers in converter housing. Tighten evenly and securely.

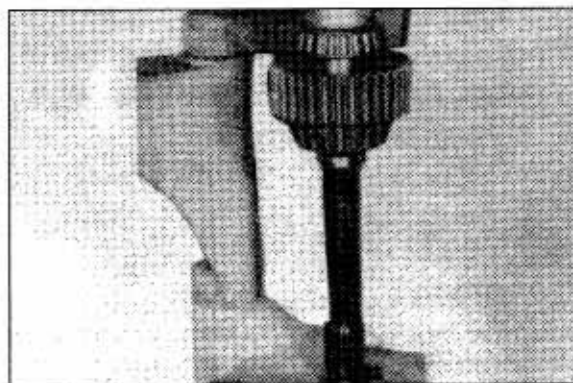


- (15) Using a soft bar install turbine shaft inner bearing cup.

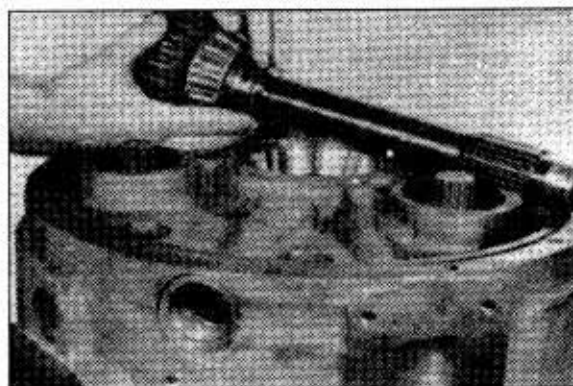




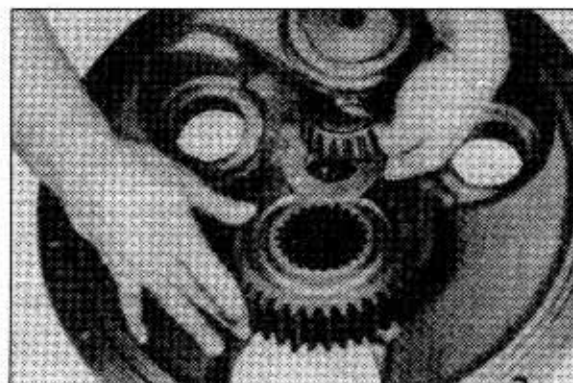
- (16) Install turbine shaft inner bearing, gear and outer bearing on shaft.



- (17) Install turbine shaft oil sealing ring. Block converter housing on pilot end and install turbine shaft assembly in converter housing.



- (18) Position output shaft inner bearing, gear spacer and gear in converter housing rear cover.

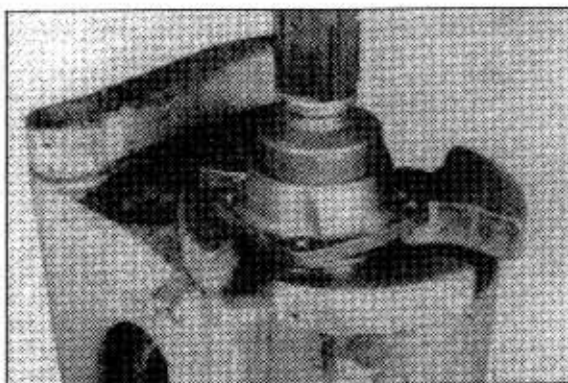


- (19) Press outer bearing on output shaft. Turn rear cover over and position output shaft in output gear and spacer. Press output shaft into inner bearing.

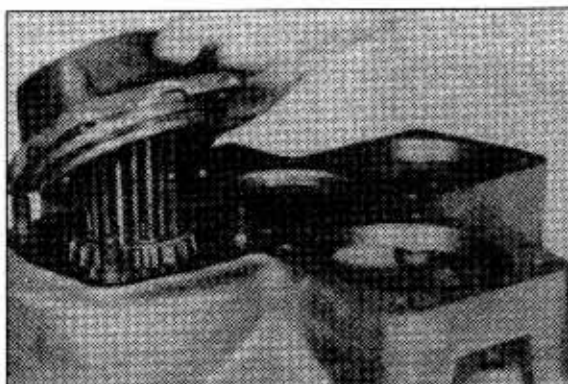




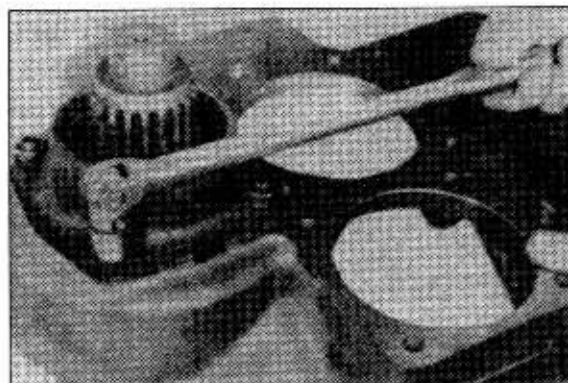
- (20) Apply a thin coat of Permatex No.2 on the outer diameter of the output shaft oil seal. Press oil seal in bearing cap with lip of seal down.



- (21) Install new O-ring on output shaft bearing cap. Install bearing cap on output shaft.

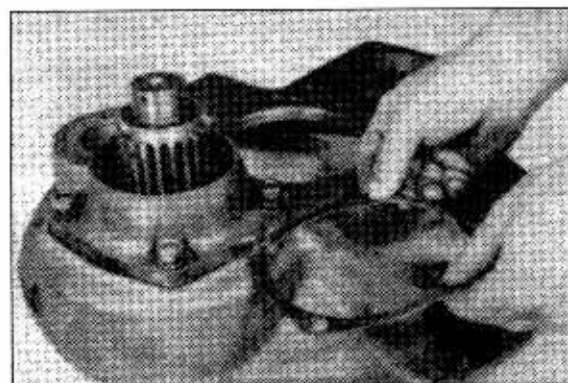


- (22) Install stud nuts and tighten securely. This is to insure proper seating of taper bearings.



- (23) Loosen stud nuts. Tighten stud nuts evenly finger tight, this will prevent bearing cap from moving while selecting shims. Check gap between bearing cap and rear cover with shims used as a feeler gauge. Remove sufficient shims to produce a 0.050mm tight condition.

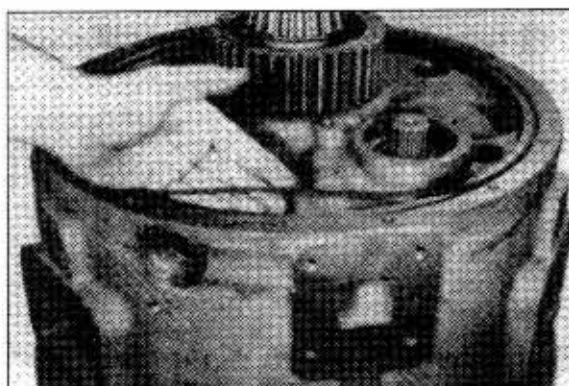
※ Example : Gap is 0.254mm; Final shim pack thickness to 0.203mm.



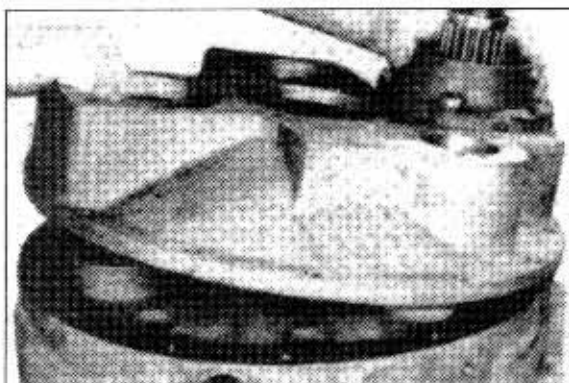
- (24) Install shim pack, bearing cap, stud lockwashers and stud nuts. Tighten nuts to 8.8~9.7kgf · m(64~70lbf · ft) torque.



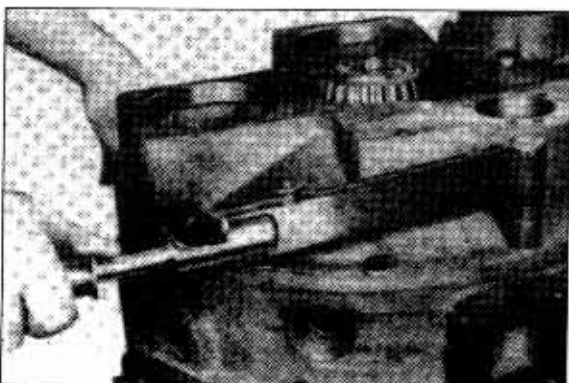
- (25) Install converter housing to rear cover O-ring.



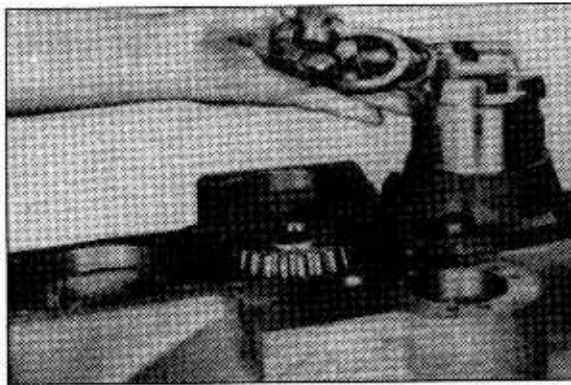
- (26) Install rear cover and output shaft on converter housing.



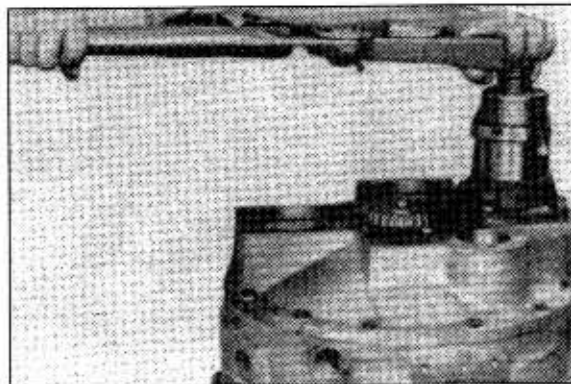
- (27) Install rear cover bolts and lockwashers. Tighten bolts 5.7~6.2kgf · m(41~45lbf · ft) torque.



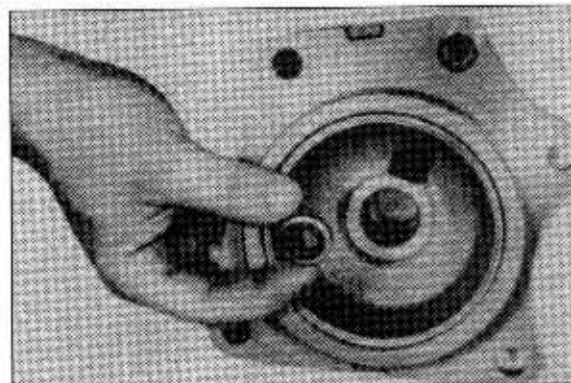
- (28) Using a soft bar, lock converter output gears. Install output flange, flange O-ring, washer, and nut.



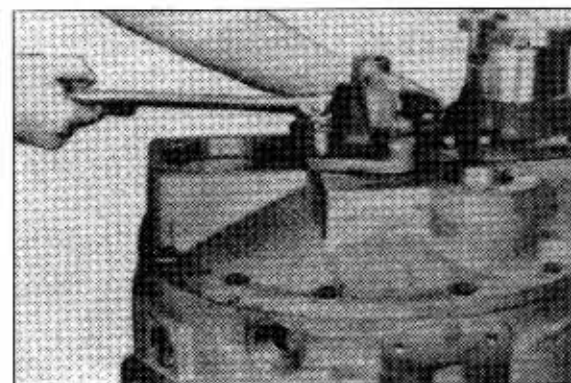
- (29) Tighten flange nut 34.6~41.5kgf · m (250~300lbf · ft) torque.



- (30) If governor drive is used, install new oil seal (Lip of seal up) in turbine shaft bearing cap. Install turbine shaft outer bearing cup in bearing cap.

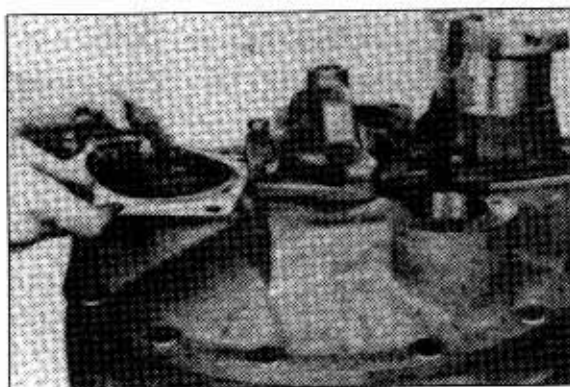


- (31) Install bearing cap on turbine shaft. Install stud nuts and tighten securely. This is to insure proper seating of taper bearings.



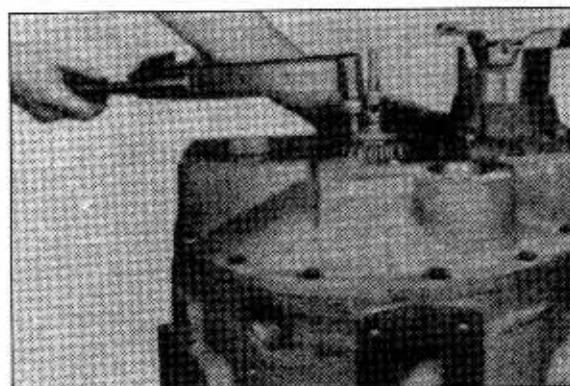
(32) Loosen stud nuts. Tighten stud nuts evenly finger tight, this will prevent bearing cap from moving while selecting shims. Check gap between bearing cap and rear cover with shims used as a feeler gauge. Add sufficient shims to produce a 0.050mm loose condition.

※ Example : Gap is 0.254mm; Final shim thickness to be 0.304mm.  
Remove bearing cap.

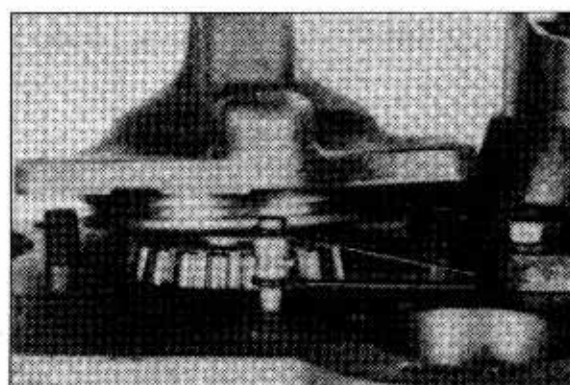


(33) Install adaptor on turbine shaft.

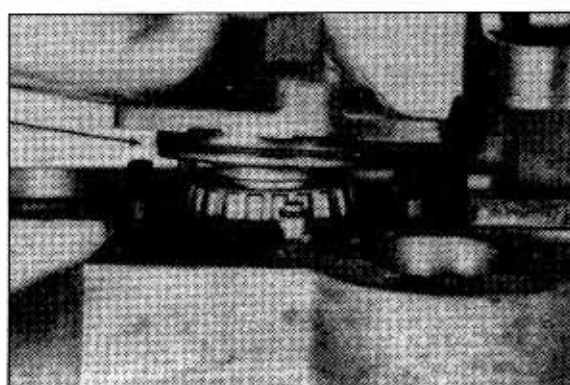
※ Adaptor will vary for lock-up, lock-up and governor drive, and governor drive. Assembly and disassembly is the same for all. Install bolts and tighten 3.6~4.0kgf · m(26~29lbf · ft) torque.



(34) Install O-rings on lube tube(See arrows).  
Using bearing cap as a guide for lube tube flange, install lube tube in rear housing.

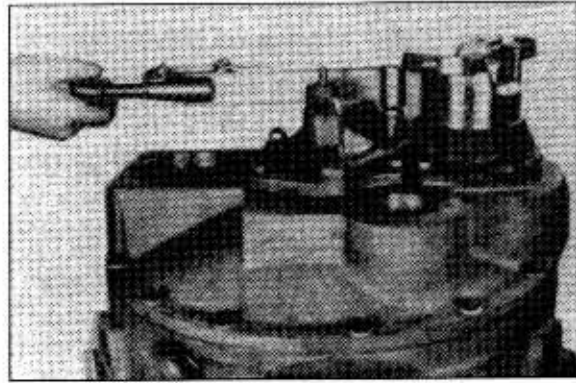


(35) With bearing cap shims and new O-ring(See arrow) in position install bearing cap.

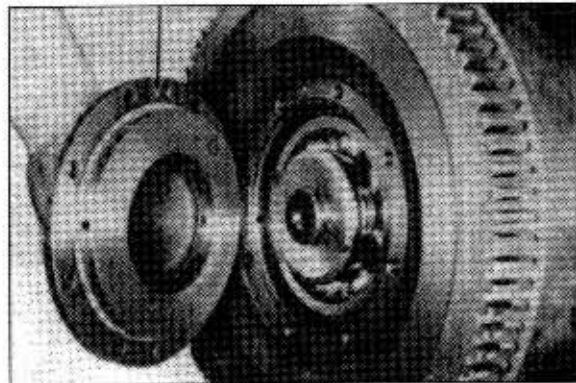




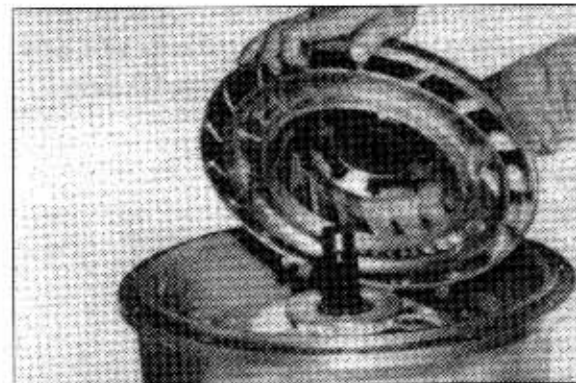
- (36) Install lockwashers and nuts. Tighten nuts 8.8~9.7kgf · m(64~70lb · ft) torque.



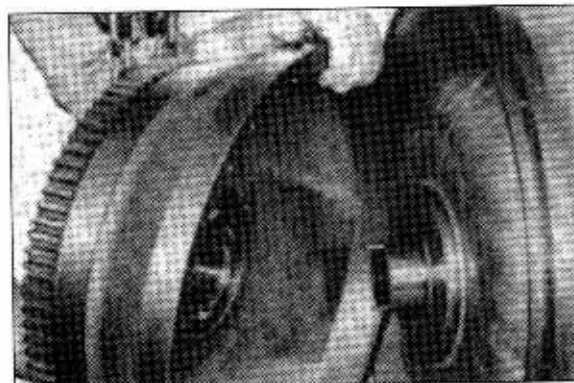
- (37) Position new O-ring(See arrow) on impeller cover bearing cap. Install bearing cap on impeller cover and tighten 7.2~7.9kgf · m(52~57lb · ft) torque.



- (38) Install turbine assembly on turbine shaft.

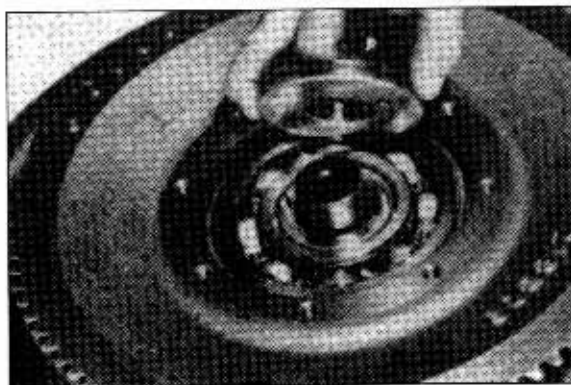


- (39) Install impeller cover and bearing assembly on turbine hub. Drive bearing into position. Align holes in impeller with impeller cover and install bolts and lockwashers. Tighten bolts evenly and securely.

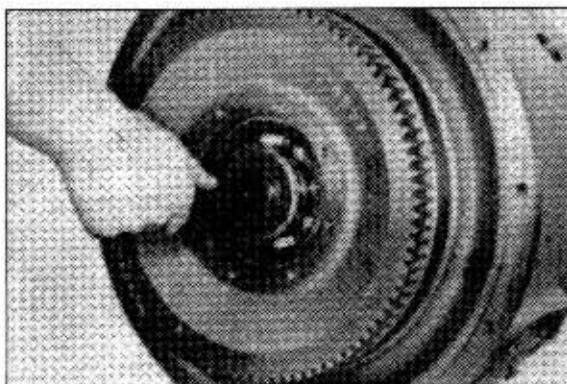




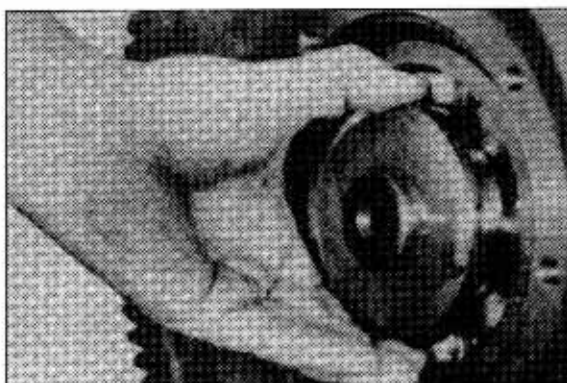
(40) Install bearing retainer plate.



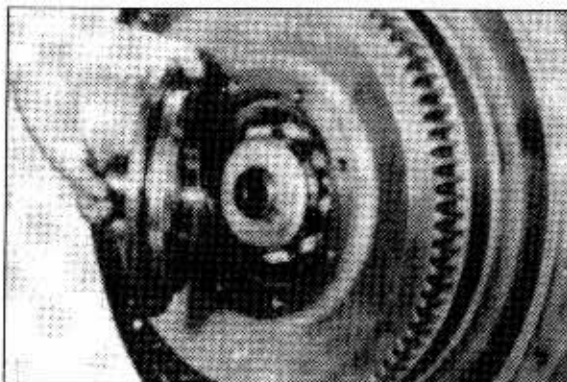
(41) Install bearing plate retainer ring.



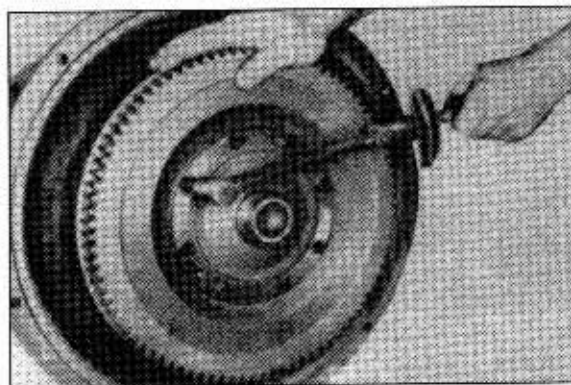
(42) Install new sealing ring expander spring and oil sealing ring on bearing plate. Expander spring gap to be 180° from sealing ring hook joint.



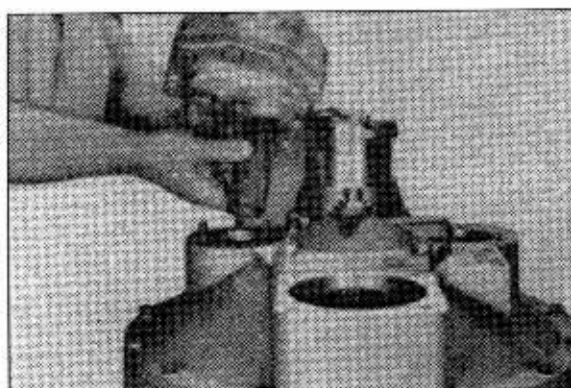
(43) Position new O-ring on impeller cover bearing cap. Install bearing cap on impeller cover.



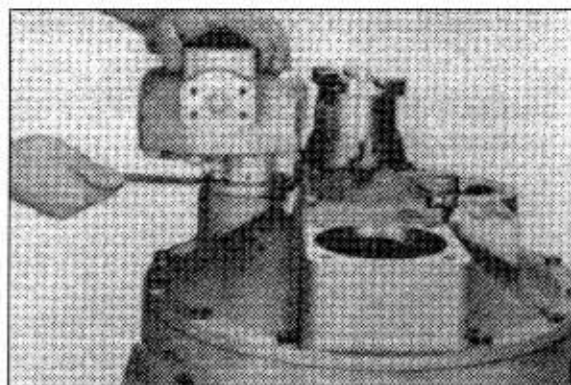
- (44) Install self locking bearing cap bolts in bearing cap and tighten 7.2~7.9kgf · m (52~57lbf · ft) torque.



- (45) Install pump drive-sleeve and pump on converter housing rear cover.



- (46) Install lockwashers and stud nuts. Tighten securely.

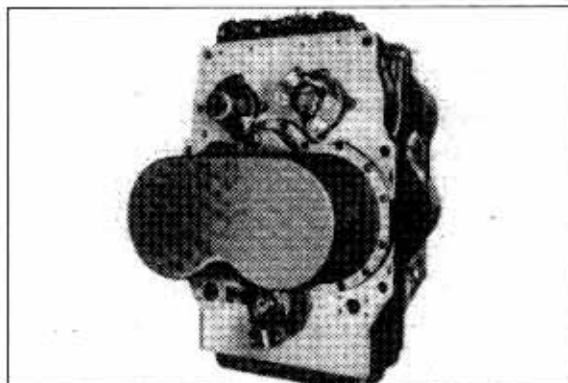


## 2. TRANSMISSION

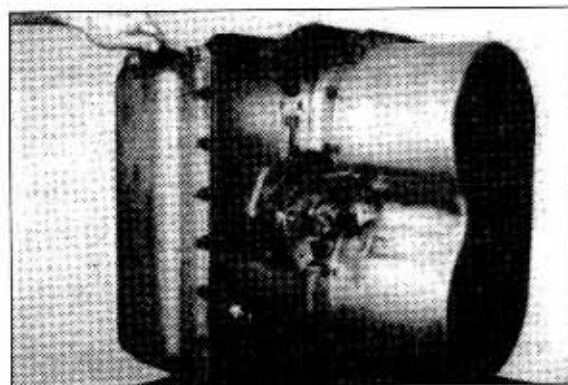
### 1) DISASSEMBLY

▲ Cleanliness is of extreme importance and an absolute must in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

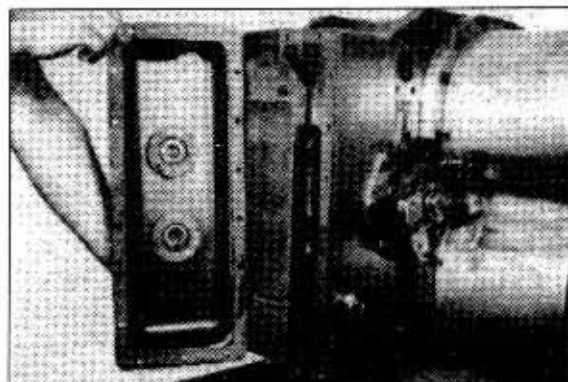
(1) Input side view of transmission.



(2) Position transmission on a sturdy transmission bench or cart. Remove sump pan bolts.



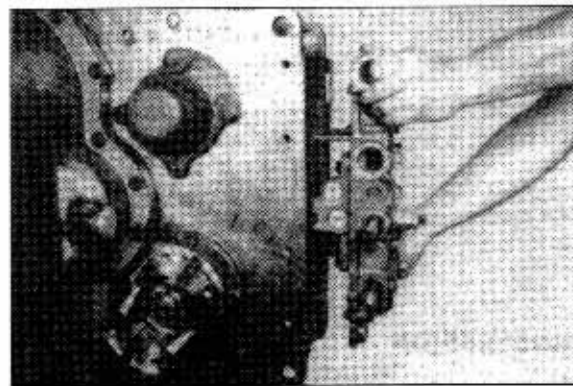
(3) Remove sump pan and magnets.



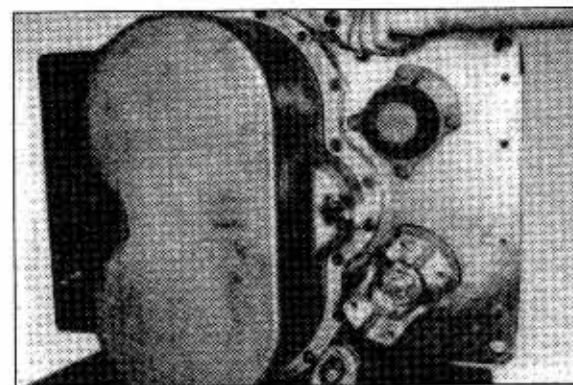
- (4) Remove sump screen and baffle assembly bolts. Remove sump screen and gasket.



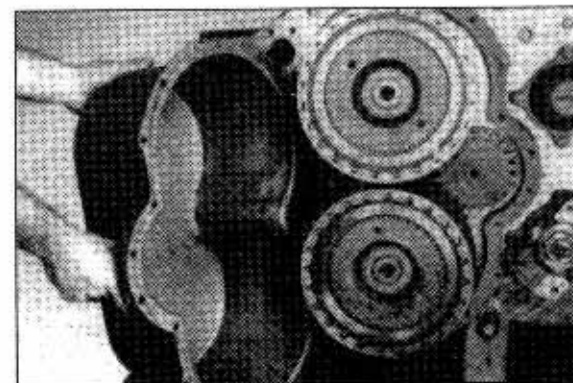
- (5) Remove control cover bolts.  
\* Aligning studs were used to facilitate cover removal.



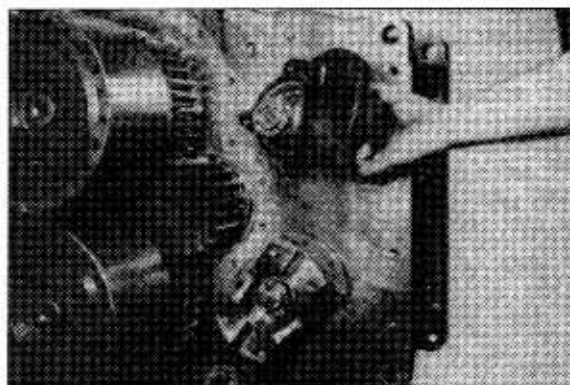
- (6) Remove 1st and 2nd clutch cover bolts.



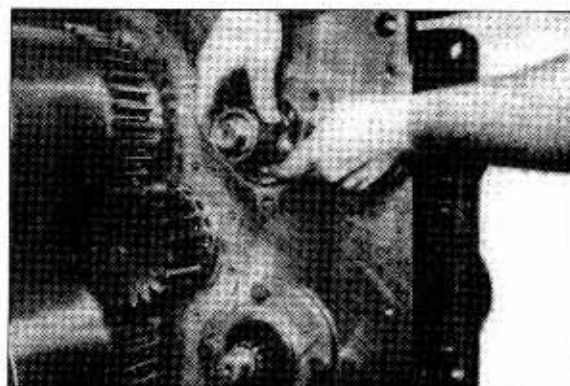
- (7) Remove clutch cover.



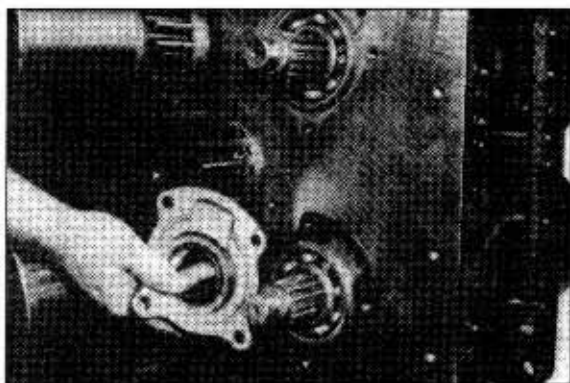
(8) Remove reverse shaft bearing cap.



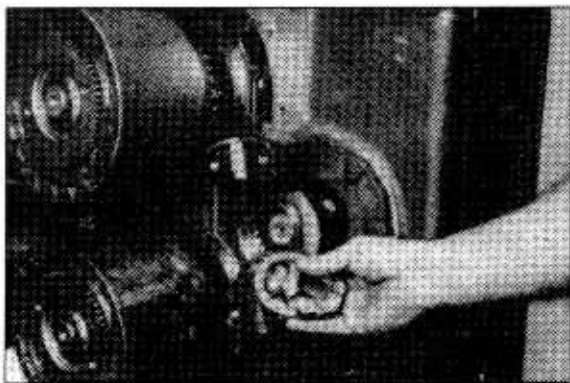
(9) Remove input flange nut, washer, O-ring and flange. Remove reverse shaft nut and bearing spacer.



(10) Remove input shaft bearing cap bolts and bearing cap.

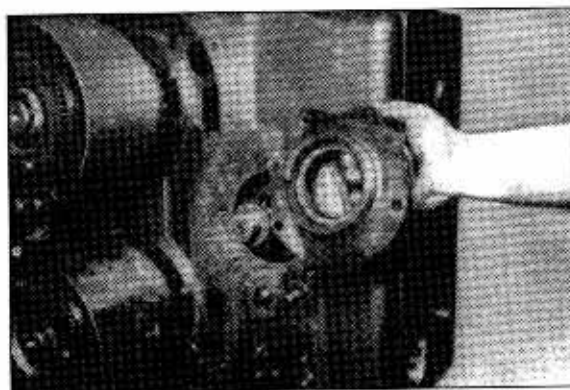


(11) Remove output flange nut, washer, O-ring and output flange on both front and rear of transmission. If axle disconnect is used remove disconnect as an assembly.

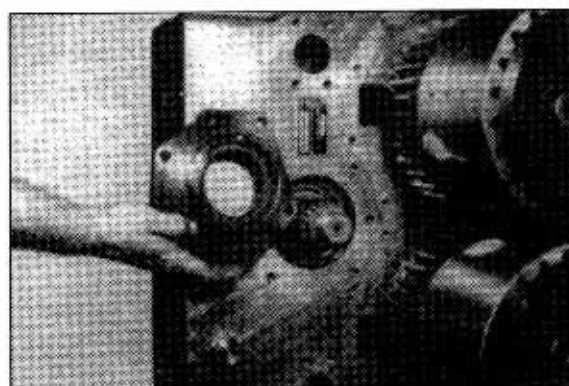




- (12) Remove output shaft bearing cap bolts.  
Remove bearing cap and shims.



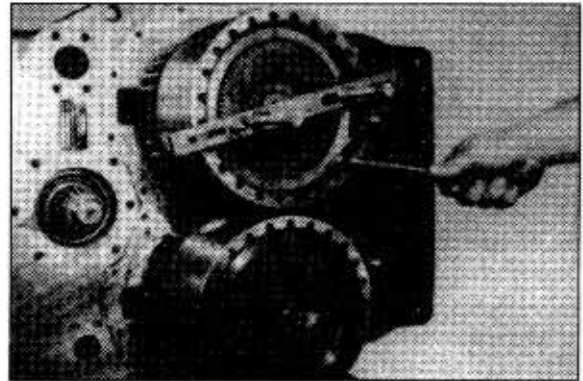
- (13) Remove rear output shaft bearing cap.



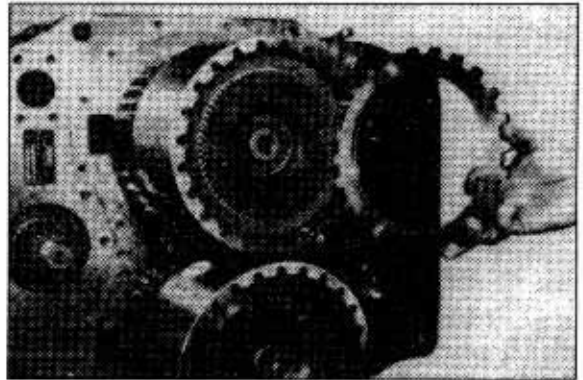
## 2) CLUTCH DISASSEMBLY

\* 1st, 2nd, 3rd and 4th clutches are disassembled in a similar manner. The 1st and 2nd clutches are larger than the 3rd and 4th clutches and the 1st and 2nd clutch drums have a removable and replaceable clutch drum hub gear. Clutch being disassembled is the 2nd speed clutch.

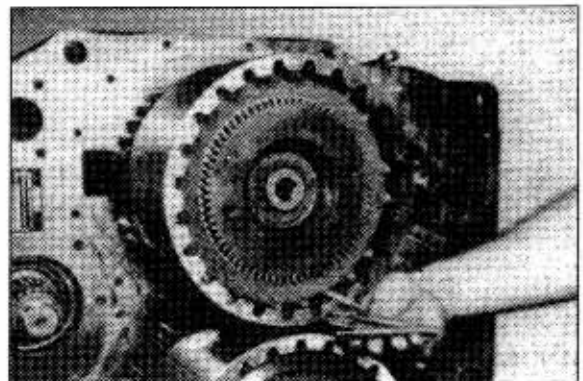
- (1) Depress end plate and remove end plate retainer ring.



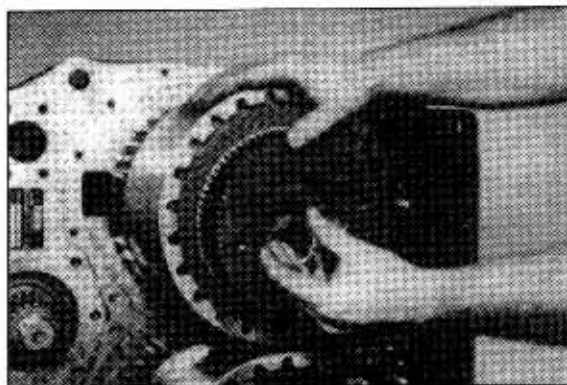
- (2) Remove end plate.



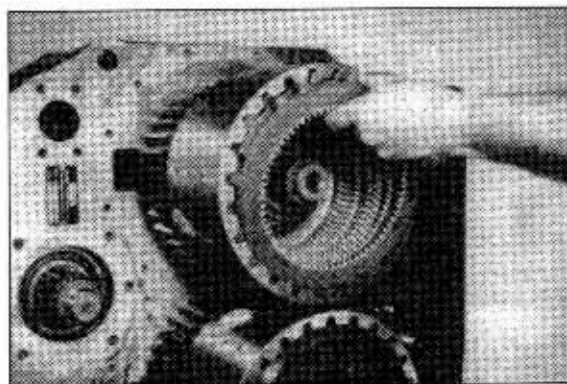
- (3) Remove clutch piston return springs and pins.



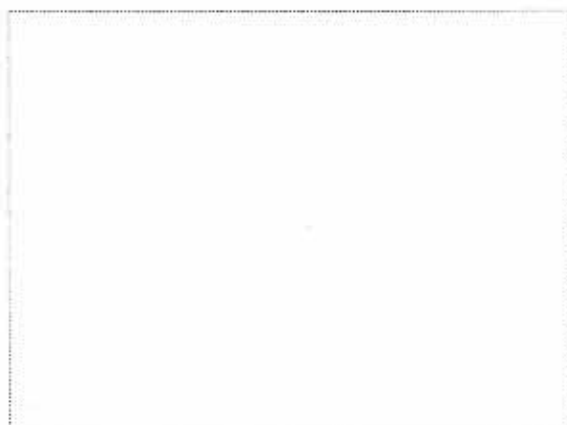
- (4) Remove clutch disc hub retainer ring and clutch disc hub. Threaded holes are incorporated in the disc hub to facilitate removal.



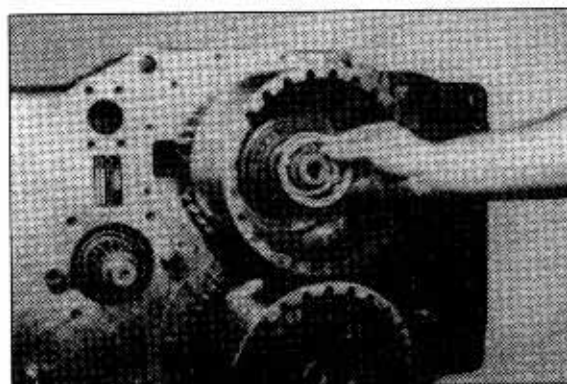
- (5) Remove inner and outer clutch discs.



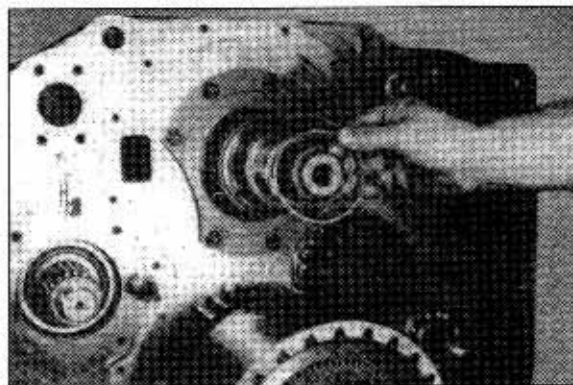
- ※ All clutch parts removed from this point on must be kept together. The clutch retainer ring, washer, taper bearings, drum and clutch support must be kept together for proper reassembly. Mark each part removed to match with the clutch support. These parts must be reassembled on the same support they were removed from. If taper bearings, clutch support or clutch drum are to be replaced, reassemble with new parts as explained later in this text.



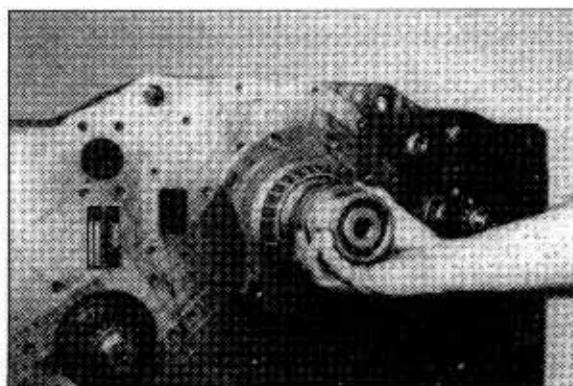
- (6) Remove clutch drum retainer ring and washer. Remove clutch drum and taper bearing.



- (7) Remove clutch support oil sealing ring and sealing ring expander spring.

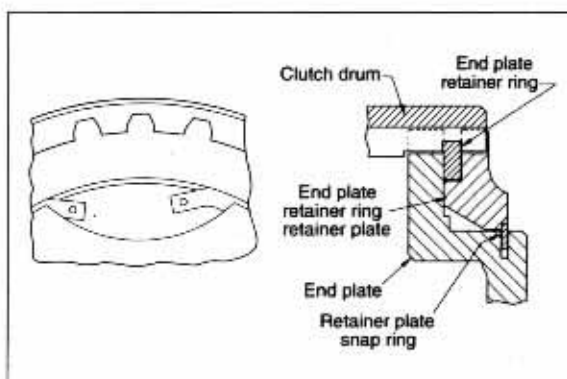


- (8) Remove clutch support bolts and support. Disassemble the 1st, 3rd, and 4th clutches as explained in (1)~(8).

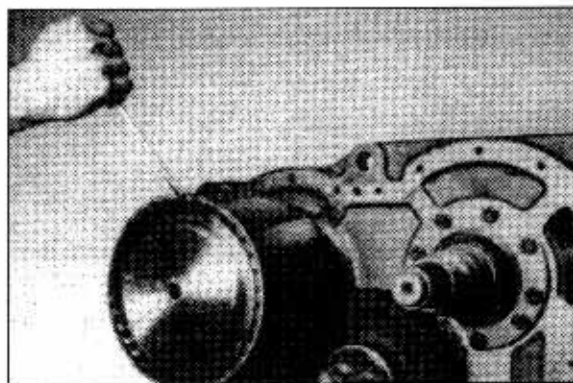


### 3) INPUT(FORWARD) AND REVERSE CLUTCH DISASSEMBLY

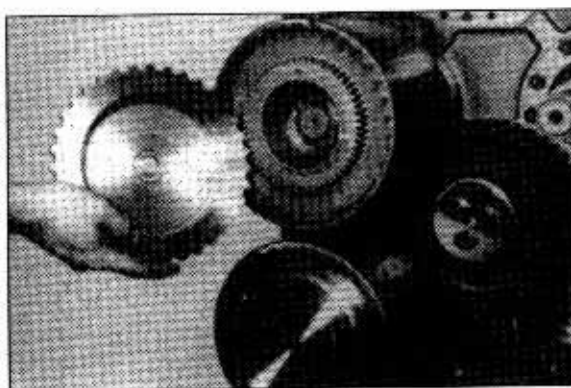
- \* Squeeze ends of end plate ring retainer plate snap ring. Remove ring retainer plate. See drawings.



- (1) Remove end plate retainer ring.



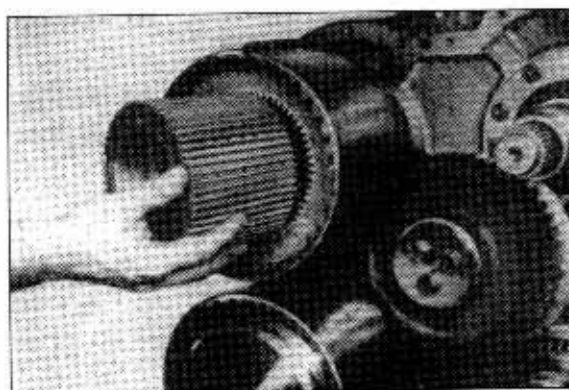
(2) Remove end plate.



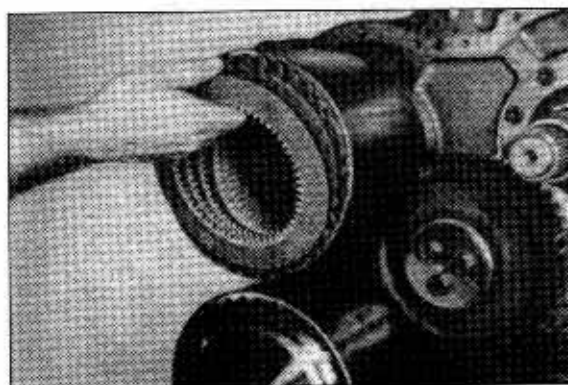
(3) Remove clutch disc hub retainer ring.



(4) Remove clutch disc hub.

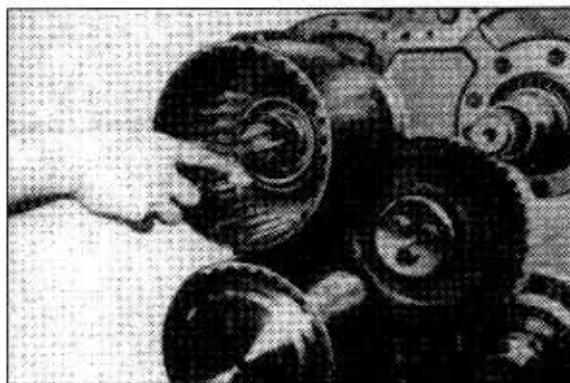


(5) Remove inner and outer clutch discs.

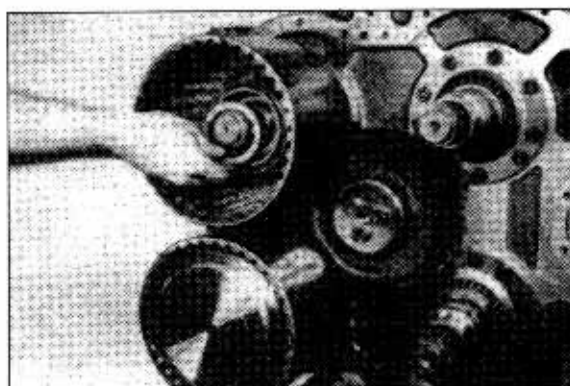




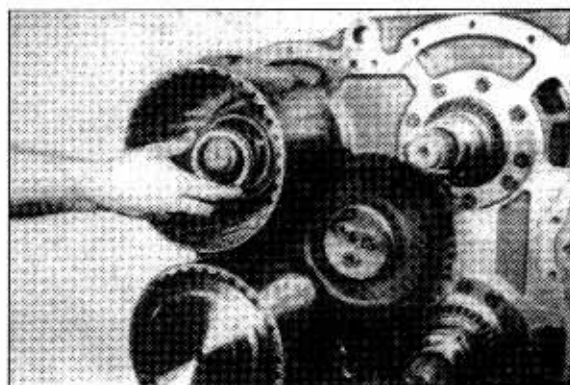
(6) Remove clutch drum retainer ring.



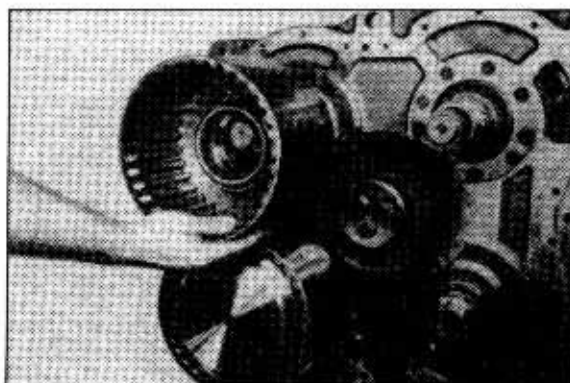
(7) Remove retainer washer.



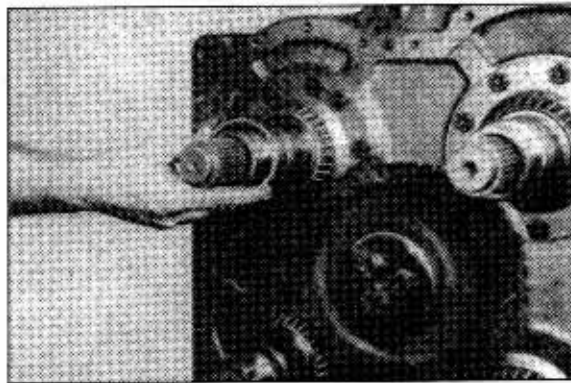
(8) Remove clutch drum outer taper bearing.



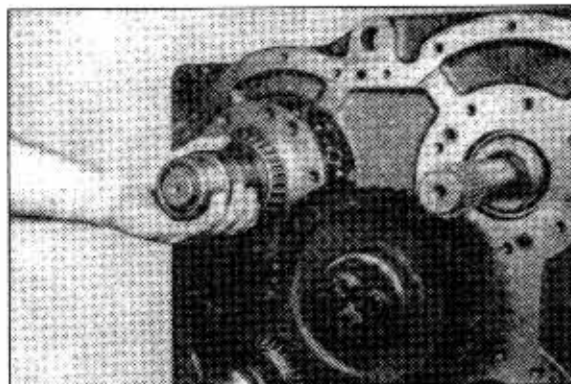
(9) Remove clutch drum. See page 3-106 for belleville washer disassembly and assembly.



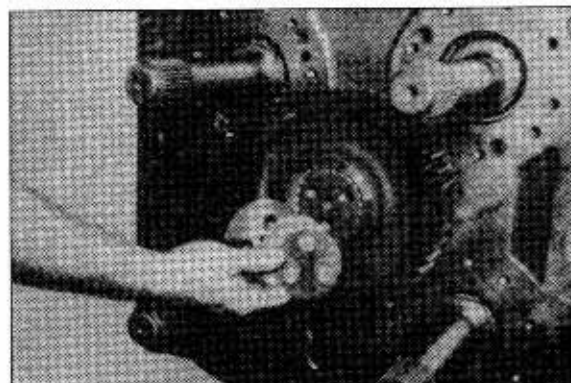
(10) Remove clutch support oil sealing rings.



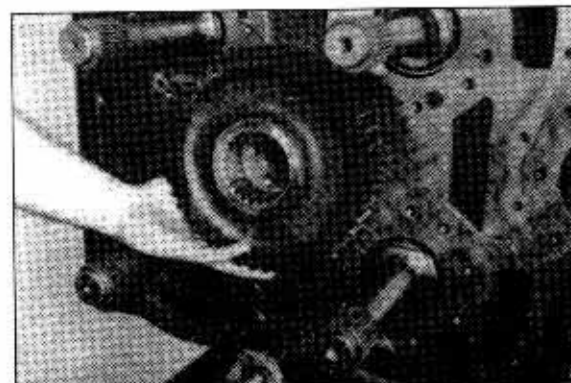
(11) Remove clutch support bolts and supports.



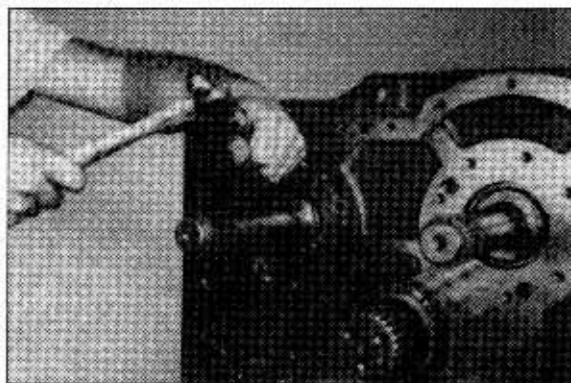
(12) Remove the idler gear retaining plate bolts, retaining plate and shims.



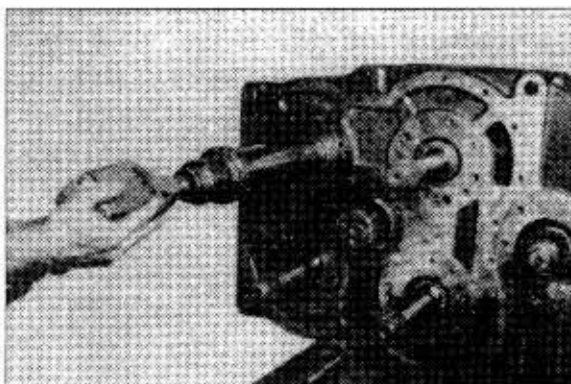
(13) Remove idler gear.



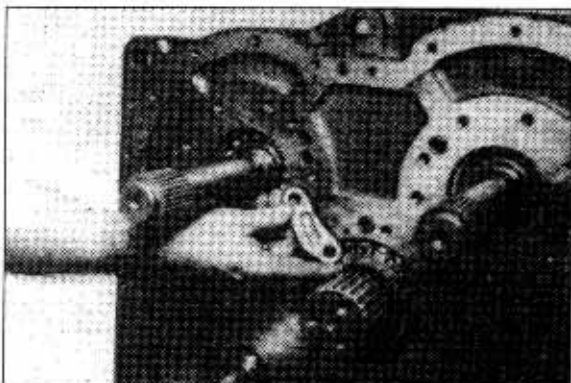
(14) Straighten tangs on bearing nut lock.



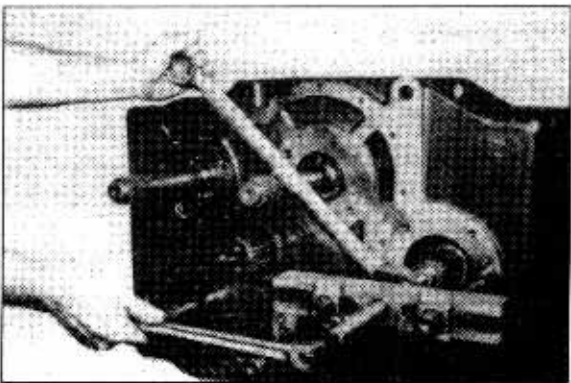
(15) Lock transmission gears with a soft bar to prevent shaft from turning. Remove the outer bearing jam nut, the nut lock and the bearing inner lock nut.



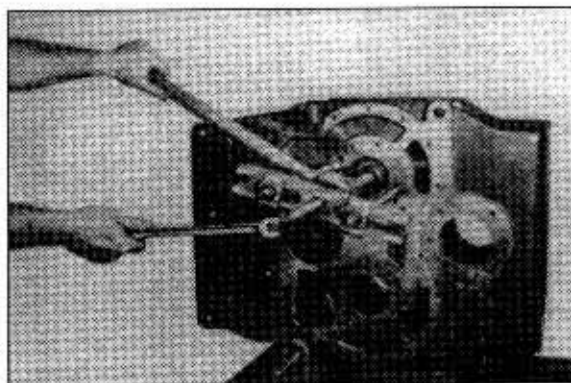
(16) Remove idler shaft crossover lube plate bolts and plate.



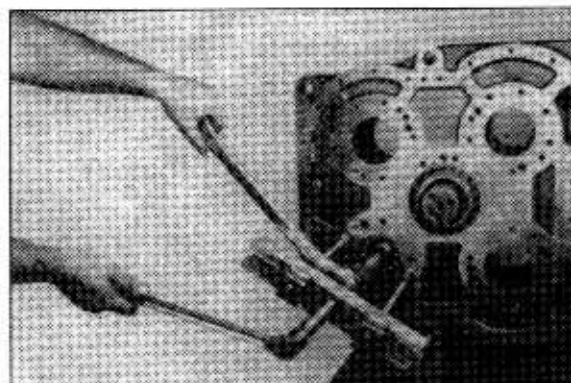
(17) Press output shaft from transmission housing. Output shaft may be removed from either side.



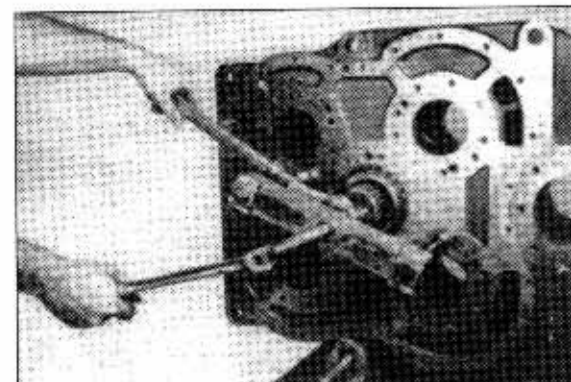
- (18) Remove the 1st, 3rd, 2nd and 4th clutch shafts as shown (2nd and 4th being removed).



- (19) Remove the reverse and input shaft (Forward) as shown (Input shaft being removed).

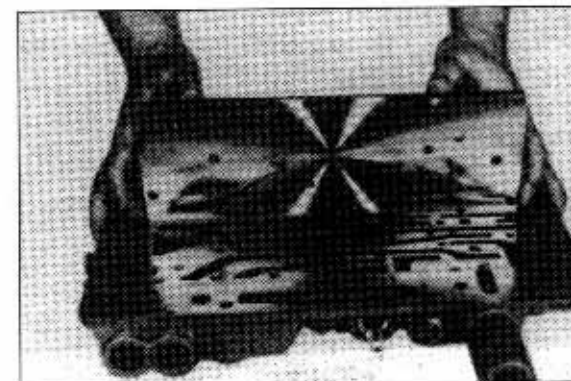


- (20) Remove idler shaft as shown.

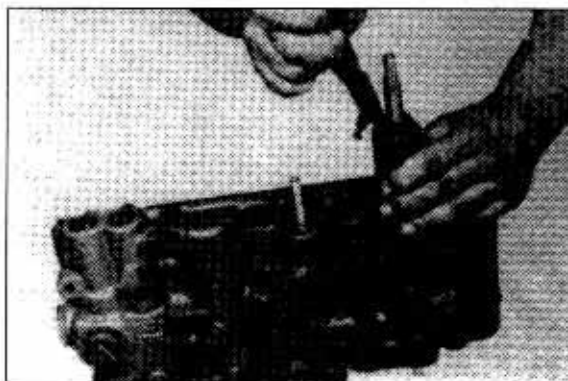


#### 4) DISASSEMBLY OF CONTROL COVER

- (1) Remove bolts from oil circuit plate.  
Remove oil circuit plate.  
※ Do not lose detent springs.



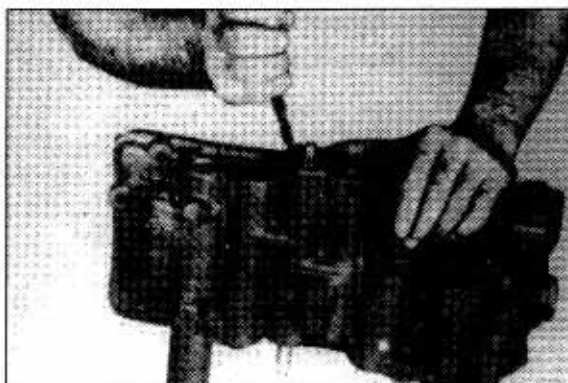
- (2) Remove speed selector valve assembly retainer ring.



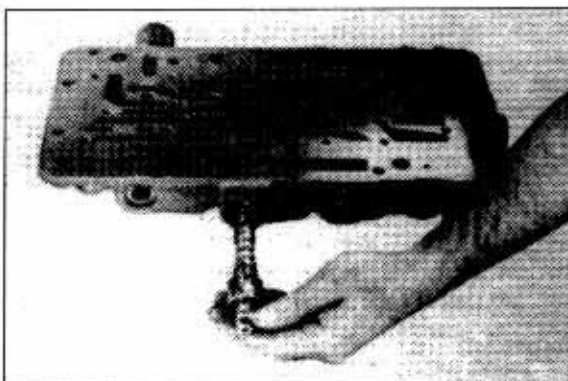
- (3) Tap lightly on opposite end of speed selector valve. Valve and valve oil seal will come out together.



- (4) Remove forward and reverse selector valve retainer ring.



- (5) Tap lightly on opposite end of forward and reverse selector valve. Valve and valve oil seal will come out together.

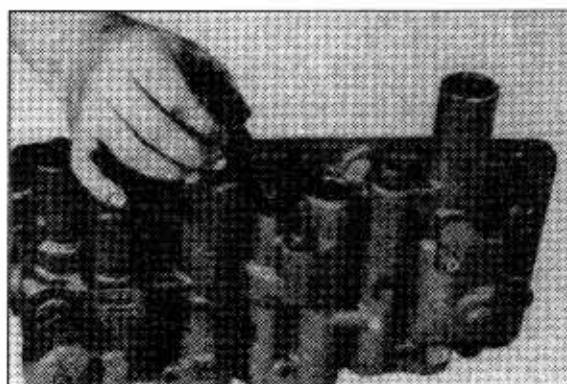




- (6) Remove shut-off valve plug and O-ring.  
Remove shut-off valve.



- (7) Remove shut-off valve spring.  
\* When removing roll pins, it is recommended a press be used to depress valve stop, valve and spool springs.



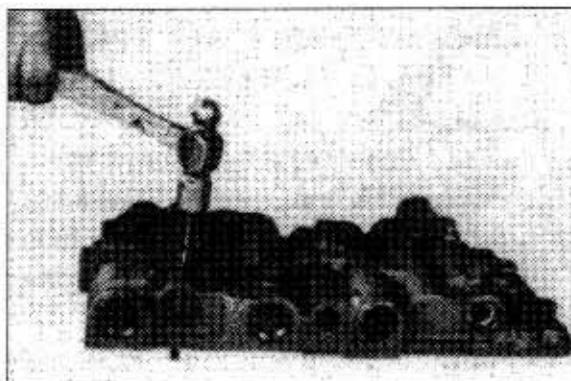
- (8) Depress regulating valve spring stop and spring. Remove roll pin.



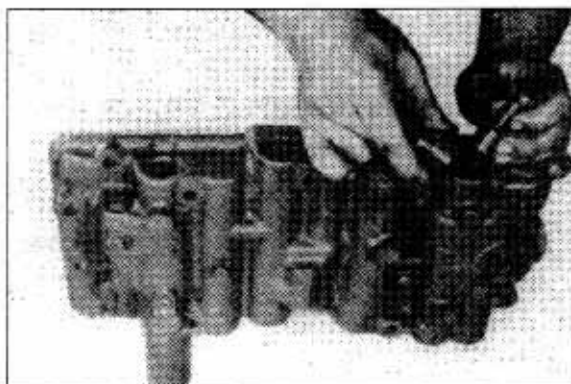
- (9) Release press slowly. Springs will push spring stop from control housing. Remove spring stop and inner and outer spring.



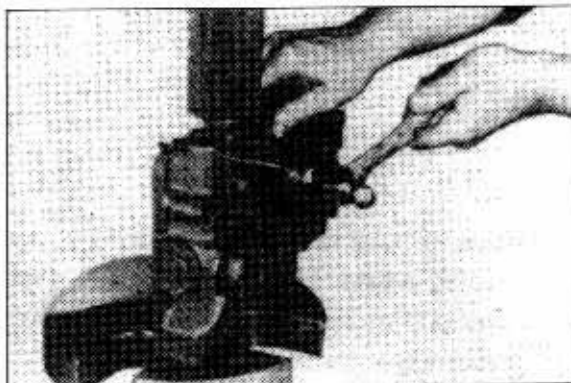
- (10) Remove roll pin on opposite end.  
Depressing valve stop is not necessary as  
the springs were removed in figure(8).



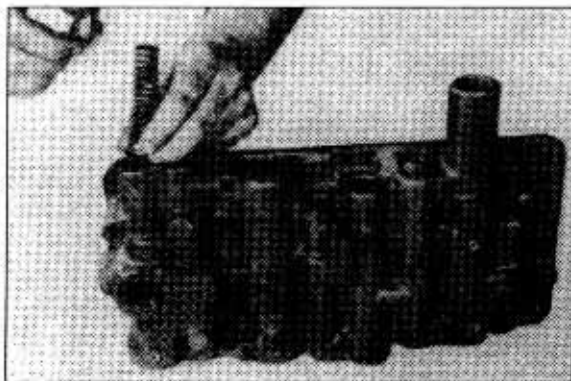
- (11) Remove regulating valve stop and valve  
from control housing.



- (12) Depress safety valve spring and spring  
stop.



- (13) Remove safety valve spring stop, valve  
spring, and safety ball valve.



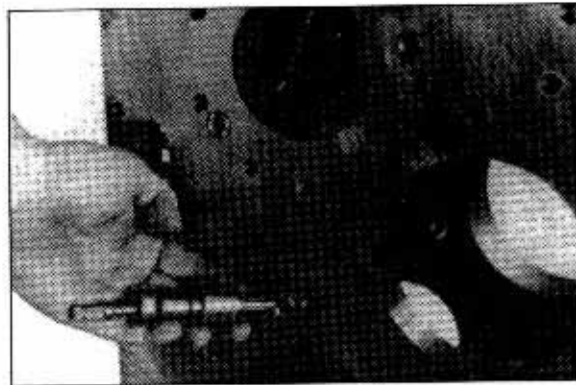
## 5) TRANSMISSION INTERNAL TUBING

These tubes are not to be removed unless damaged. They should, however, be cleaned and checked for leaks when transmission is disassembled. The tubes are divided into two groups. The high pressure or clutch pressure lines and the low or lubricating pressure lines.

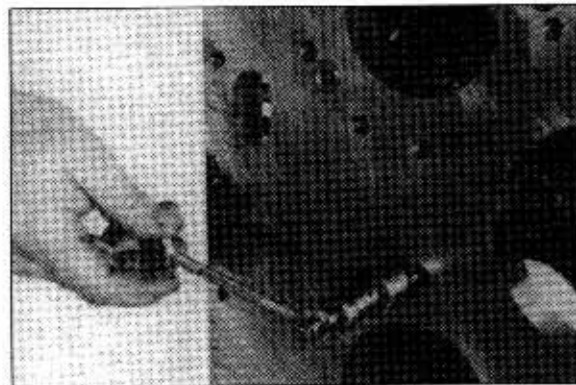
When necessary to replace any tubes, tool CE-805 is required. The procedure for using tool is as follows:

1. Install tubing in housing with end flush with case.
2. Slide collar over end of tube and press into bore of case.

- (1) Pull mandrel on tool all the way back and insert tool in tube.



- (2) Turn mandrel with hand until tool is firmly seated in tube. Using a 3/8" wrench, turn mandrel as far as possible. Use this procedure to install all tubes in housing.



### **Principle of tool**

Tool has roller which expands when mandrel is inserted. As mandrel is turned, the rollers expand against the internal bore of tubing. This forces tube to expand against collar which has a groove on inside diameter : When tube is expanded into this groove it is locked into position.

### **Cleaning and repair of tool**

This tool is a precision instrument and must be treated as such. After each use, remove mandrel and rollers and flush tool with cleaning solvent. Inspect rollers and mandrel for chips and flaking. If rollers or mandrel need to be replaced, they may be purchased.

## **6) CLEANING AND INSPECTION**

### **(1) Cleaning**

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and slushed up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

- ▲ Care should be exercised to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

#### **• Bearings**

Remove bearings from cleaning fluid and strike larger side of cone flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture-free compressed air. Be careful to direct air stream across bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

#### **• Housings**

Clean interior and exterior of housings, bearing caps etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

- ▲ Care should be exercised to avoid inhalation of vapors and skin rashes when using alkali cleaners.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or lapping compound.

## **(2) Inspection**

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

- **Bearings**

Carefully inspect all rollers, cages and cups for wear, chipping or nicks to determine fitness of bearings for further use. Do not replace a bearing cone or cup individually without replacing the mating cup or cone at the same time. After inspection dip bearings in recommended type Automatic Transmission Fluid and wrap in clean lintless cloth or paper to protect them until installed.

- **Oil seals, gaskets, etc.**

Replacement of spring load oil seals, O-rings, metal sealing rings, gaskets and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. Apply a thin coat of Permatex No.2 on the outer diameter of the oil seal to assure an oil tight fit into the retainer. When assembling new metal type sealing rings, same should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all O-rings and seals with recommended type Automatic Transmission Fluid before assembly.

- **Gears and shafts**

If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they are not sprung, bent, or splines twisted, and that shafts are true.

- **Housings, covers, etc.**

Inspect housings, covers and bearing caps to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.



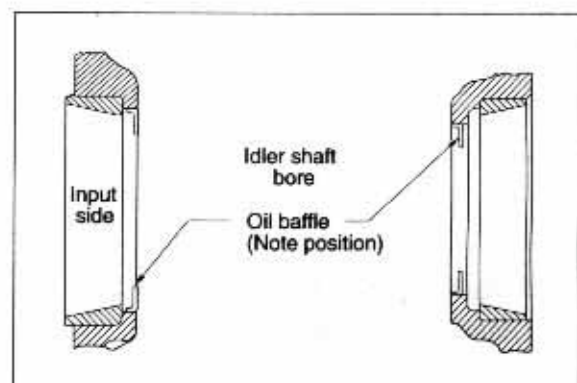
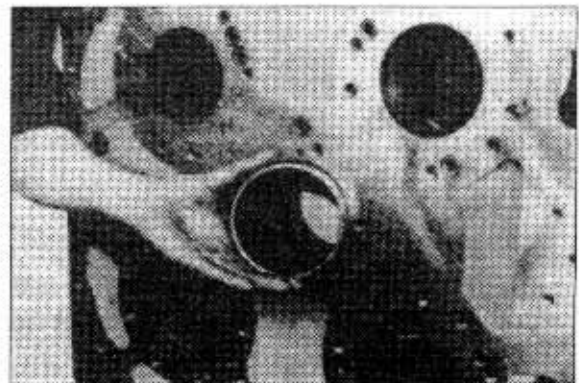
## 7) ASSEMBLY OF TRANSMISSION

Instructions given below on assembly of components of transmission assembly are given in the sequence that must be followed in rebuilding. Principle of operations cited and views shown are similar and parallel on all shafts. The various drive shafts are assembled in the following order :

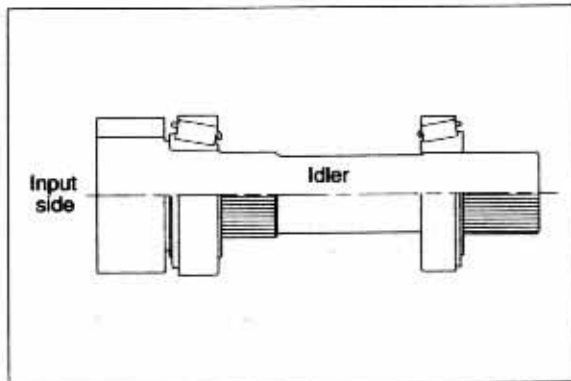
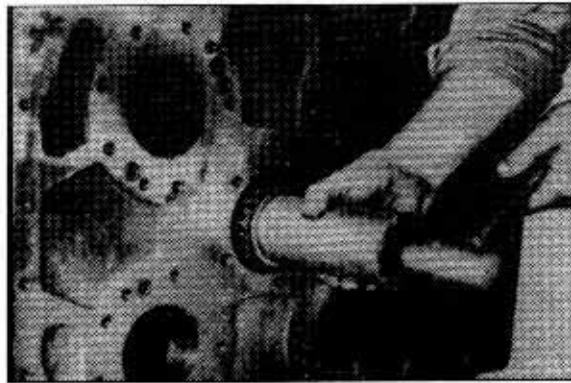
1. Idler shaft
2. Input shaft
3. Reverse shaft
4. First and third shaft
5. Second and Fourth shaft
6. Output shaft

### Assembly of idler shaft

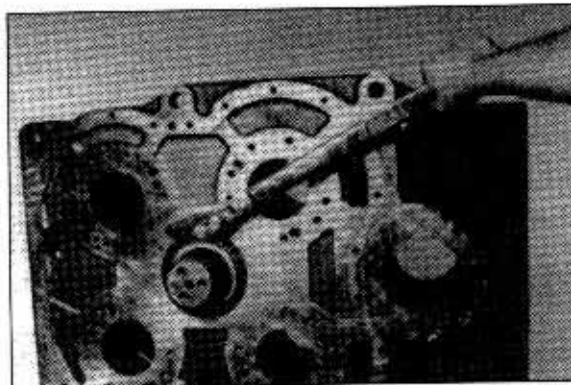
- (1) With oil baffles in position (See below figure) install idler shaft taper bearing cups in both sides of transmission housing.



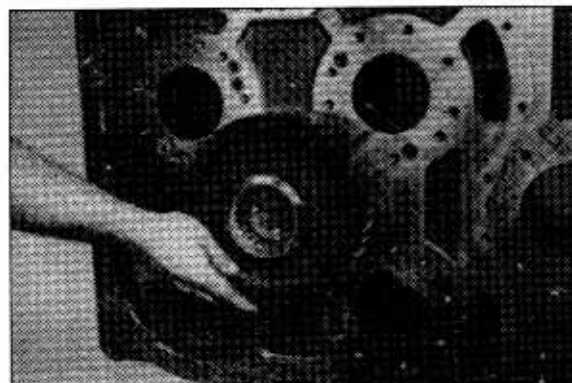
- (2) With the large taper bearing pressed on the idler shaft next to the gear, position shaft and bearing in transmission housing from the input side. Block idler shaft and from the opposite side tap taper bearing on shaft. Be sure taper bearing is fully seated.



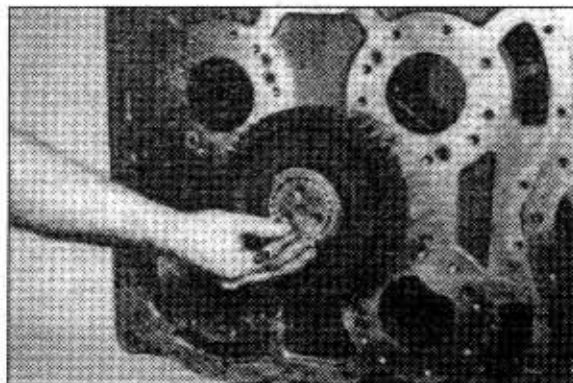
- (3) Install idler shaft cross over lube plate and bolts. Tighten bolts 11.3~12.4kgf · m (82~90lbf · ft) torque.



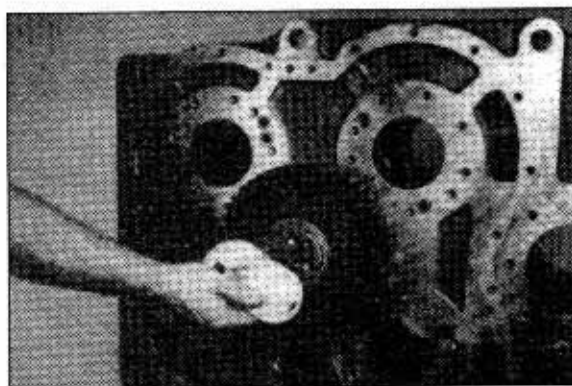
- (4) Position large idler gear on idler shaft. Be sure gear is tight against bearing.



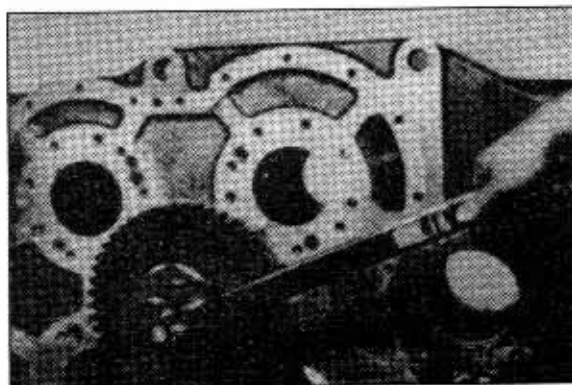
- (5) Using a micrometer depth gauge, measure the distance from the hub of the gear to the end of the idler shaft, record this distance.



- (6) Choose and check shim pack with micrometer. When the proper amount of shims as recorded in figure(5) is achieved, remove one 0.1016mm shim.



- (7) Position shims and retaining plate on idler gear and shaft. Install retaining plate bolts. Block idler gear to prevent turning and torque retainer plate bolts 15.6~17.1kgf · m(113~124lbf · ft) torque.

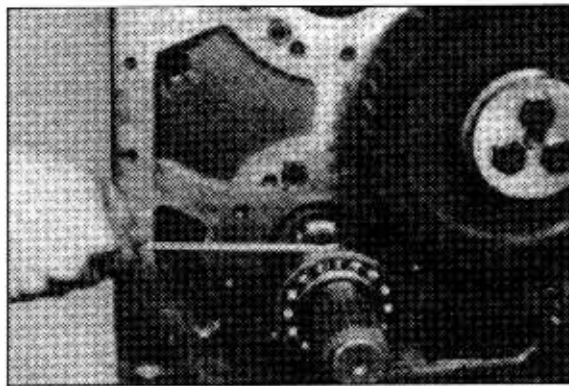


- (8) Using the threaded hole provided in the center of the retainer plate, install a 5/8-11 hexagon head bolt until tight in hole. Check rolling torque on idler shaft. Proper rolling torque is 0.07~0.11kgf · m(0.5~0.8lbf · ft). Add shims for less rolling torque, remove shims for more rolling torque.



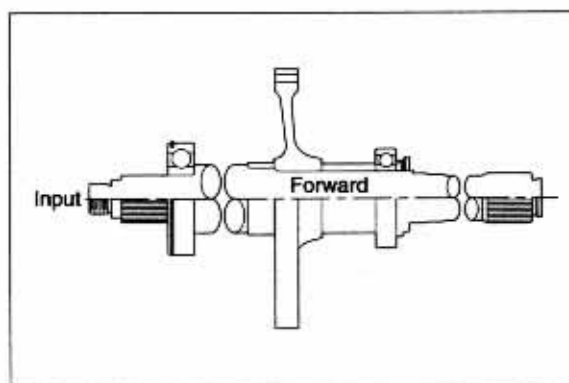
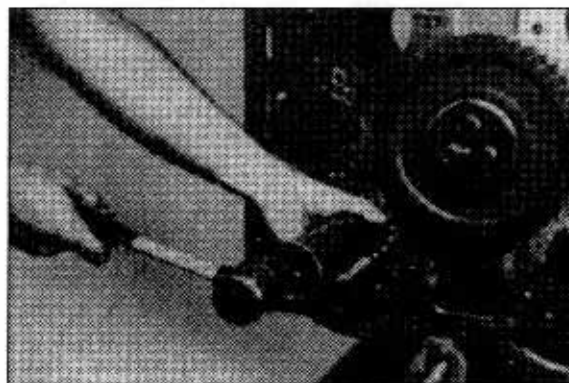
## 8) ASSEMBLY OF FORWARD(INPUT) AND REVERSE SHAFTS

- (1) Press roller bearing on threaded end of input shaft. Install short spacer on shaft opposite threaded end. Position input gear in case with longer offset of gear to the rear. Install input shaft and bearing into front case bore and through input gear. Push bearing and shaft in case bore until bearing snap ring shoulders against transmission case. Do not remove shaft pusher. Install large spacer on shaft against input gear. Position rear bearing on shaft. Align bearing lock ball with notch in bearing bore.



- (2) Drive rear roller in place.

※ Bearing must be driven in tight. Check gear spacer on shaft. When spacer can not be turned by hand, stack up between input gear spacer and rear roller bearing is tight. Do not attempt to draw bearings up tight with bearing lock nuts. Remove shaft pusher.



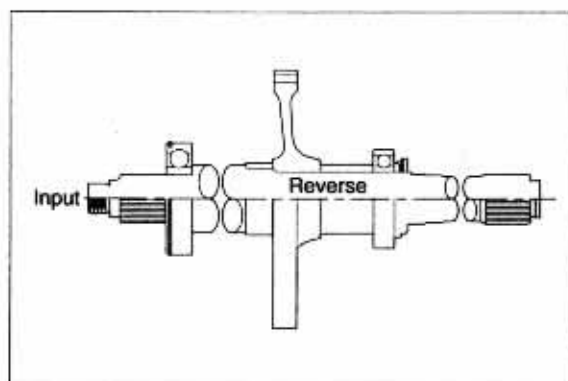
- (3) Apply a thin coat of Permatex No. 2 on the outer diameter of the input shaft oil seal. Press seal, lip of seal inward, into input shaft bearing cap.



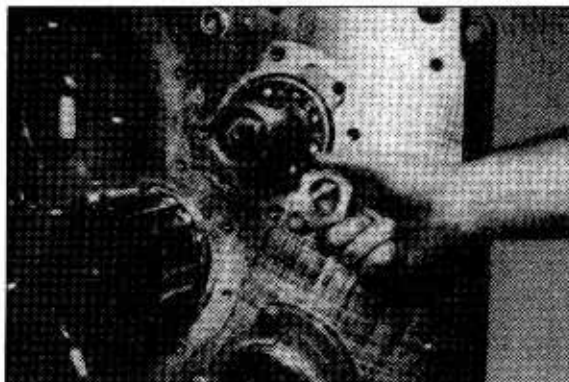
- (4) With a new gasket in place, position bearing cap and seal on shaft. Install bearing cap bolts and tighten 7.9~8.7kgf · m(57~63lbf · ft) torque.



- (5) Assemble the reverse shaft as explained in figure(1) and (2).

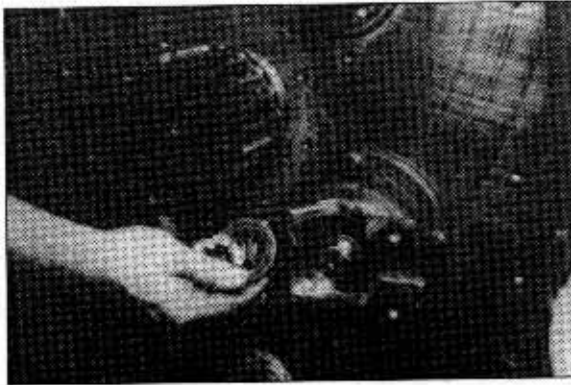


- (6) On the reverse shaft install the front bearing spacer and nut.

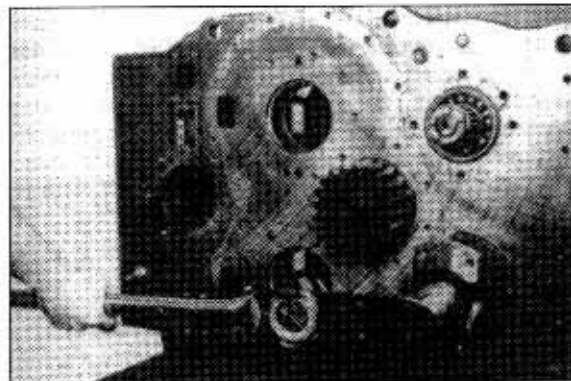




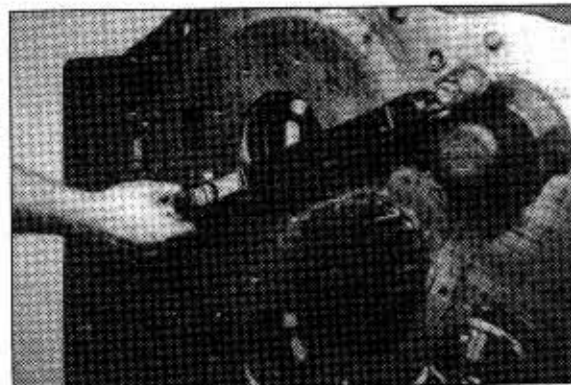
- (7) On the input shaft install the input flanges, flange O-ring washer and flange nut.



- (8) Block input and reverse shafts to prevent turning. Tighten input flange nut and reverse shaft nut  $20.7\text{--}24.2\text{kgf} \cdot \text{m}$  ( $150\text{--}175\text{lb} \cdot \text{ft}$ ) torque. Install nut cotters.



- (9) With new gasket in place position reverse shaft bearing cap on shaft. Install bearing cap bolts and tighten  $7.9\text{--}8.7\text{kgf} \cdot \text{m}$  ( $57\text{--}63\text{lb} \cdot \text{ft}$ ) torque.



## 9) ASSEMBLY OF 1ST & 3RD & 2ND & 4TH SHAFTS

- (1) Press the double taper bearing assembly on the 1st & 3rd shaft tight against shoulder on shaft.

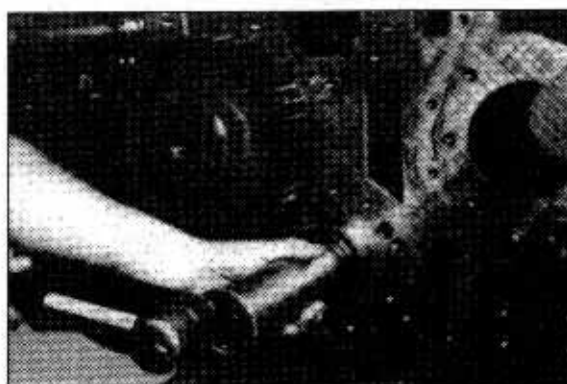
※ These bearings are in matched sets and under no circumstances can any of the four(4) parts be changed or mixed up with another bearing. Position the 1st & 3rd gear in the transmission case with long hub of gear toward the input side of the case. Insert shaft into shaft bore and through the 1st & 3rd gear. Align double taper bearing lock pin with notch in bearing bore.

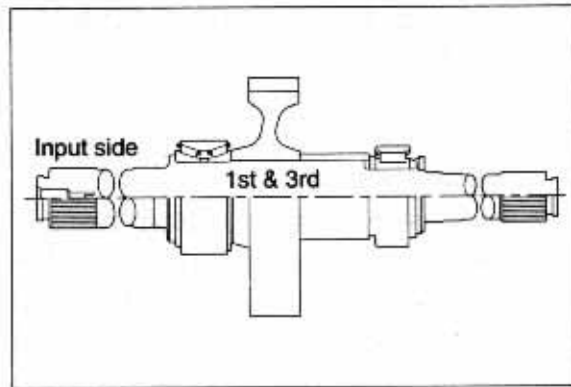


- (2) Push shaft assembly in case until taper bearing shoulders are against locating ring in bore of case. Do not remove shaft pusher.



- (3) On opposite end of shaft, position long spacer on shaft and against the gear. Install bearing spacer(Washer) against long spacer. Drive rear bearing tight against washer. Check long spacer on shaft. When spacer can not be turned by hand, stack up between the front and rear bearing is tight. Do not attempt to draw bearing up tight with bearing lock nuts. Remove shaft pusher. This was left on only to hold shaft while installing roller bearing.



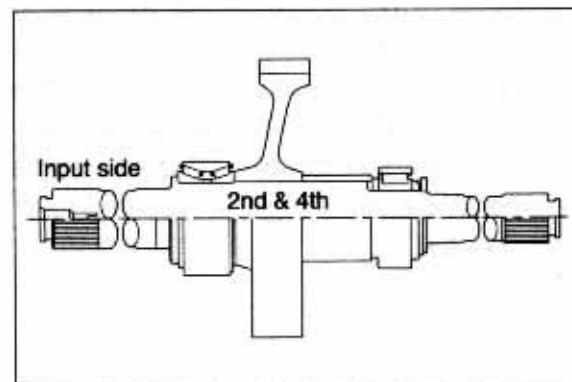
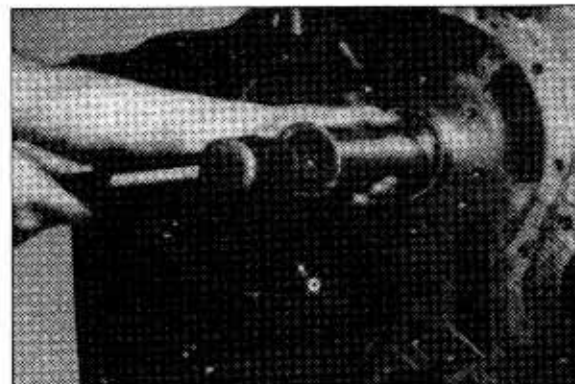


- (4) Press the double taper bearing assembly on the 2nd & 4th shaft tight against shoulder on shaft.

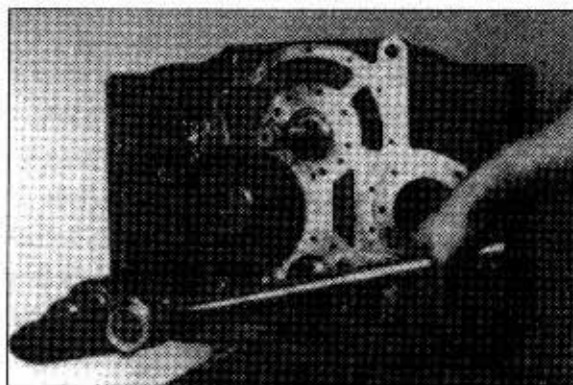
※ These bearings are in matched sets and under no circumstances can any of the four(4) parts be changed or mixed up with another bearing.

Install the long spacer on the 2nd & 4th shaft against the double taper bearing. Position the 2nd & 4th gear in the transmission case with the long hub of the gear toward the input side of the case. Insert shaft into shaft bore and through the 2nd and 4th gear. Align double bearing lock pin with notch in bearing bore.(See figure(1)). Use shaft pusher as shown in figure(2). Push shaft assembly in case until taper bearing shoulders in bore of case. Do not remove shaft pusher. On opposite end of the shaft install bearing spacer(Washer) against the gear. Drive rear bearing tight against washer.

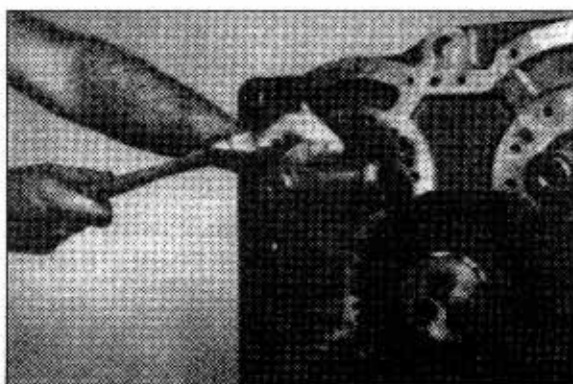
※ Bearings must be driven in tight. Check long spacer on shaft. When spacer can not be turned by hand, stack up between the front and rear bearing is tight. Do not attempt to draw bearing up tight with bearing lock nuts.



- (5) Lock gears using a soft bar, and install bearing inner lock nut(All four shafts). Tighten lock nuts  $24.2\sim 27.7\text{kgf} \cdot \text{m}$  ( $175\sim 200\text{lbf} \cdot \text{ft}$ ) torque. Install nut locks and outer lock nuts. Tighten outer lock nuts  $24.2\sim 27.7\text{kgf} \cdot \text{m}$  ( $175\sim 200\text{lbf} \cdot \text{ft}$ ) torque.

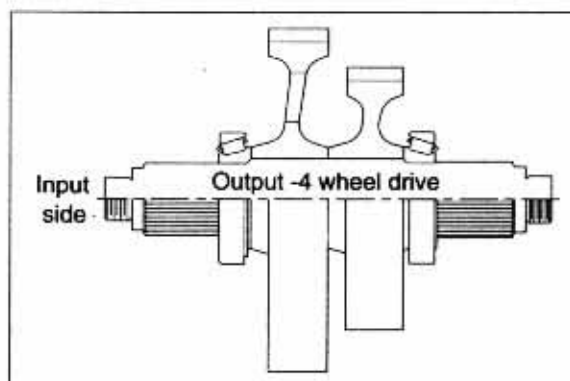


- (6) Bend a portion of the nut lock over one flat of the inner lock nut. Bend a portion of the nut lock over one flat of the outer lock nut.

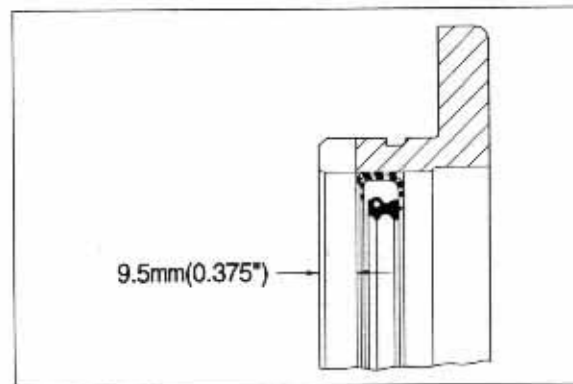
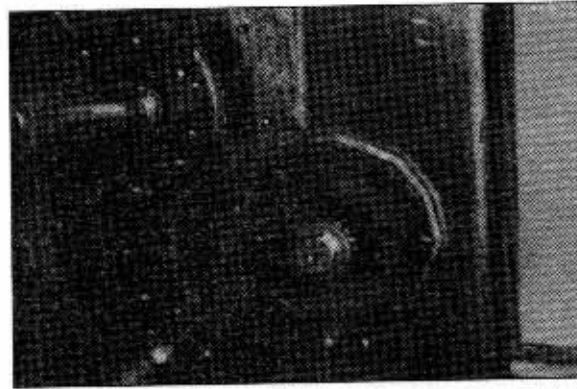


#### 10) OUTPUT SHAFT ASSEMBLY

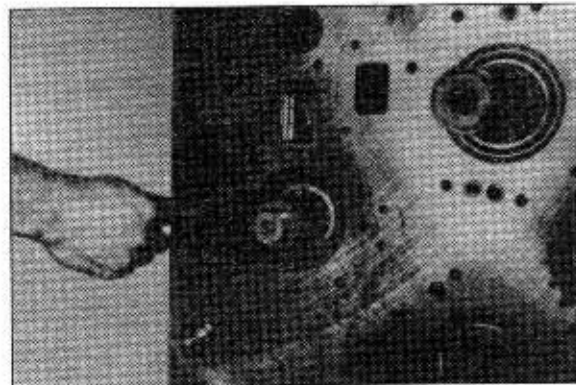
- (1) This shaft(Threaded on both ends) is used for continuous 4 wheel drive with one side capped, see on the right figure.



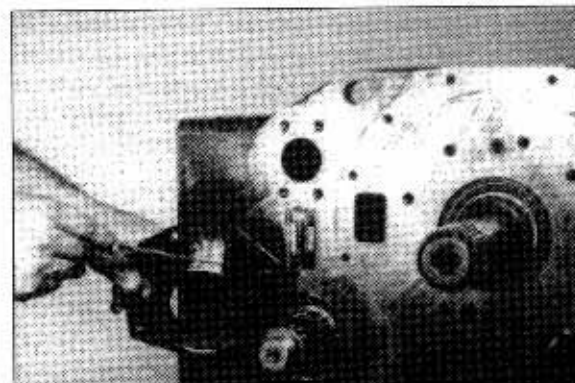
- (2) Press taper bearing(Large diameter of taper inward) over threaded end of output shaft against shoulder on shaft. Position large output gear in transmission case to the input side(Front) with longer offset of gear hub to the front. Position small output gear in transmission case to the rear with longer offset of gear hub to the front. Insert output shaft through the rear bore of case and through small and large output gears. Figure(1), page 3-99, shows proper stack up of gears. Install taper bearing cup over rear bearing. Apply a very light coat of Permatex No.2 to the outer diameter of the output oil seal. Press seal in output bearing cap to depth shown on the right figure. Position a New O-ring on bearing cap. Position bearing cap assembly on output shaft. Install bearing cap bolts and tighten 7.9~8.7kgf · m(57~63lbf · ft) torque.



- (3) Block output shaft and install front taper bearing(Large diameter of taper inward) on output shaft until bearing shoulders against large output gear. Install bearing cup over front bearing.



- (4) Apply a thin coat of Permatex No.2 on the outer diameter of the output shaft oil seal. Press oil seal, lip of seal inward, into output shaft bearing cap. See figure(2). Install a new O-ring on output shaft bearing cap. Lubricate ring with automatic transmission fluid. Install bearing cap and shims. Do not tighten bearing cap bolts.



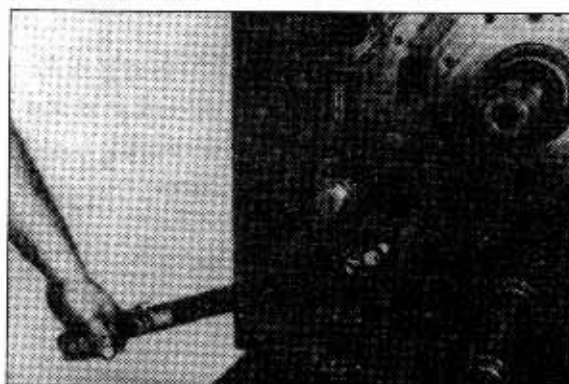


- (5) Using an meter kilogram torque wrench on the output flange nut, determine the amount of torque required to turn gear train.



- (6) Tighten output shaft bearing cap bolts 7.9–8.7kgf · m(57–63lbf · ft) torque.

Add or remove shims from bearing cap to adjust preload. When bearings are adjusted properly, it will take 0.07–0.09kgf · m(0.5–0.7lbf · ft) more torque to turn gear train with cap bolts torque than when bolts were loose.

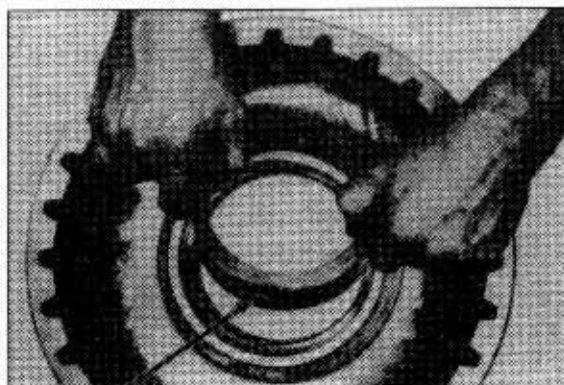


### 11) CLUTCH DRUM REASSEMBLY

If clutch drum taper bearings, clutch support, or clutch drum are to be replaced, reassemble with new parts as explained in figure (1)-(7).

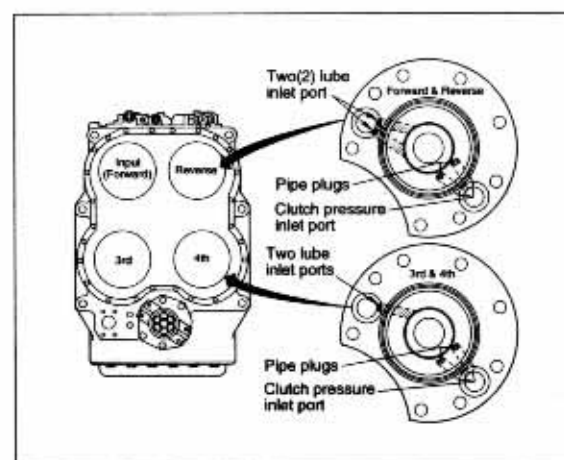
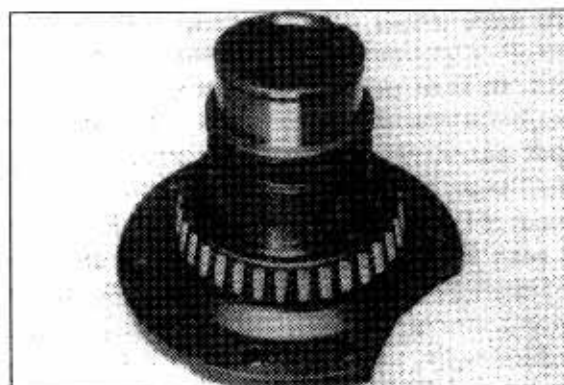
- ※ Do not install clutch support on transmission housing until proper stack up of parts in the clutch drum is achieved. Mark all parts of each set (Clutch support, clutch drum taper bearing, washer and snap ring) and keep together.

- (1) Insert lock ball in clutch piston ring outer race. Press outer race and ball in clutch drum. Install the inner and outer taper bearing cups in the clutch drum.

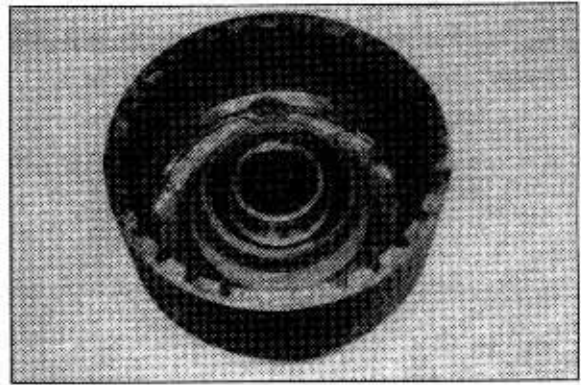


- (2) Press inner taper bearing on clutch support.

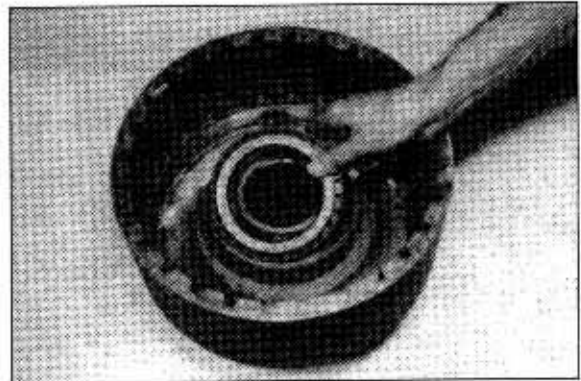
- ※ The input (Forward) and reverse clutch supports are different than the 3rd and 4th supports. The 3rd and 4th supports have one (1) lube hole (See line drawing) and the input (Forward) and reverse supports have two (2) lube holes (See line drawing).



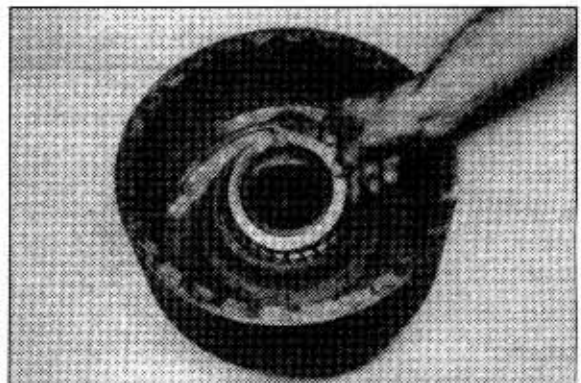
- (3) Position clutch drum and cup assembly on clutch support. Be sure the proper drum is matched to the proper support. See page 3-102(2).



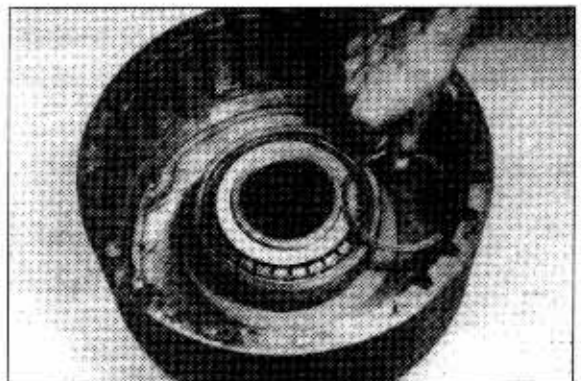
- (4) Install outer taper bearing.



- (5) Position outer bearing retainer washer on clutch support aligning tang on washer with notch on support.



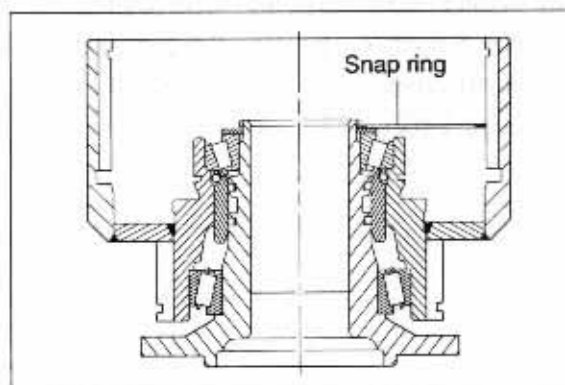
- (6) Clutch drum retainer ring is selected at assembly for proper thickness. Variable thickness rings are used in snap ring grooves to assure proper taper bearing tightness. Check ring as shown for tight ring to bearing fit.



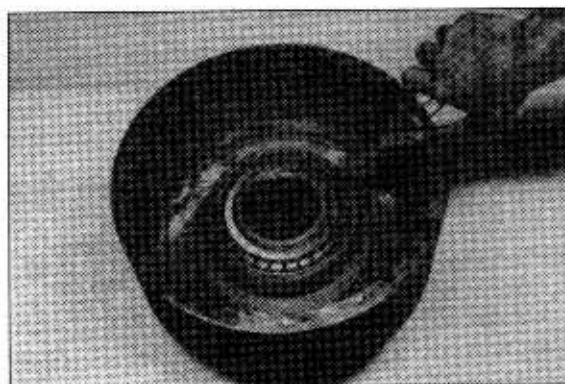
- ※ Select a variable thickness snap ring at assembly to assure a tight stack up parts.

• Variable thicknesses are :

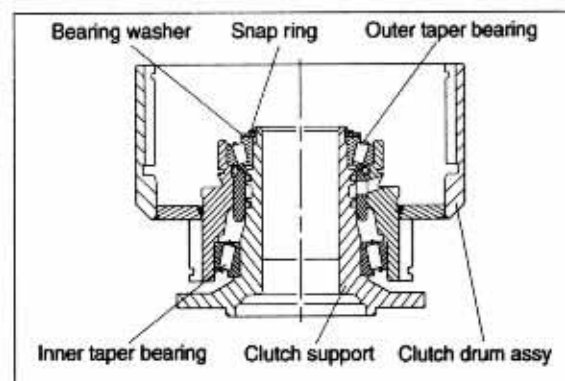
.100	.109.118	.127
.103	.112.121	.130



- (7) Install retainer ring, being certain ring is in full position in ring groove.
- ※ Use ring that will give the tightest fit between washer and snap ring groove.



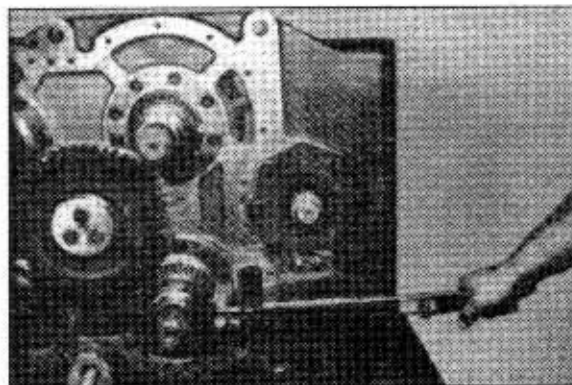
- ※ After parts have been matched with each other do not mix with other clutch parts. Remove retainer ring and washer. Remove drum assembly from clutch drum support.



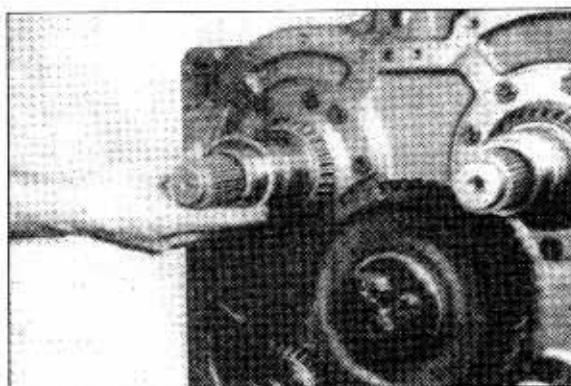
- (8) Position clutch support and taper bearing assembly on transmission housing. See page 3-102(2).



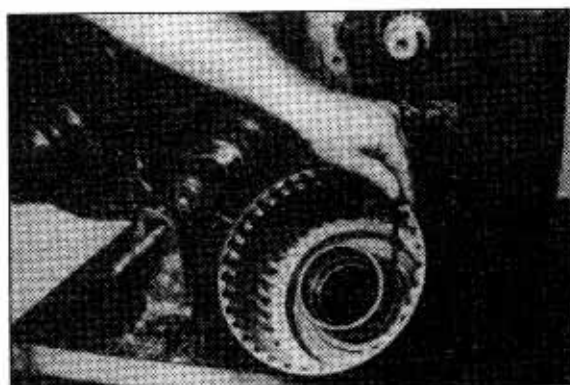
- (9) Tighten support bolts 11.1~12.2kgf · m  
(80~88lbf · ft) torque.



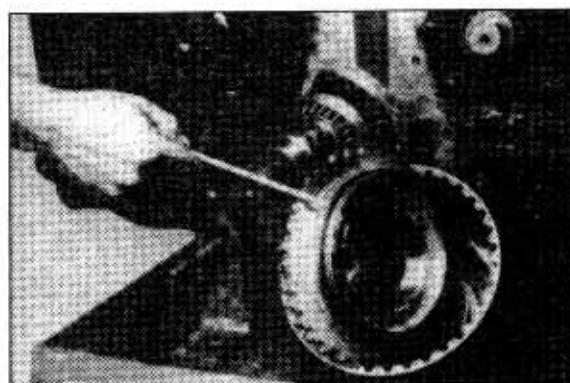
- (10) Install two lock type oil sealing rings on each clutch support. Lock rings in position. Grease rings to facilitate drum to support assembly.



- (11) Install a new clutch piston inner sealing ring.



- (12) Install a new clutch piston outer sealing ring. Position clutch piston in clutch drum.

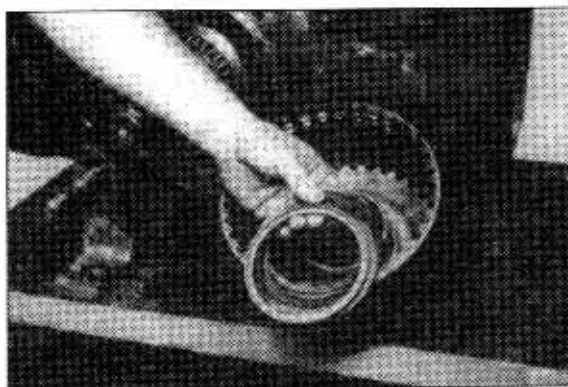




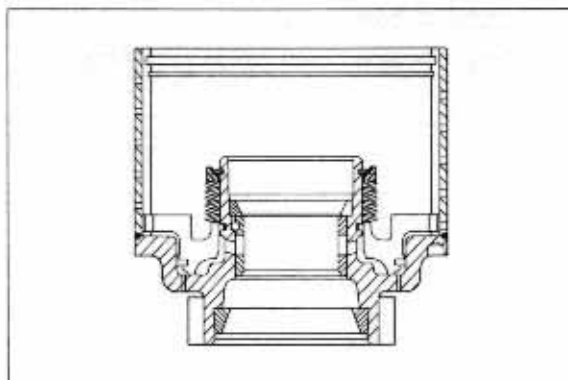
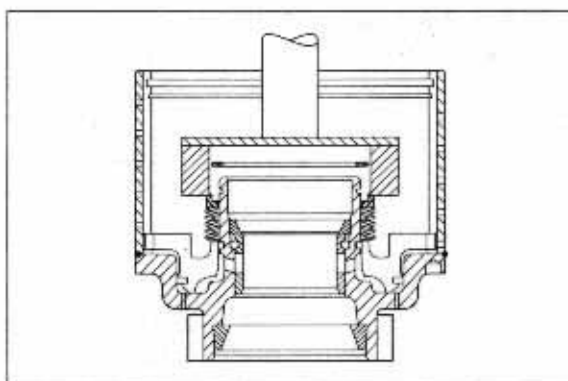
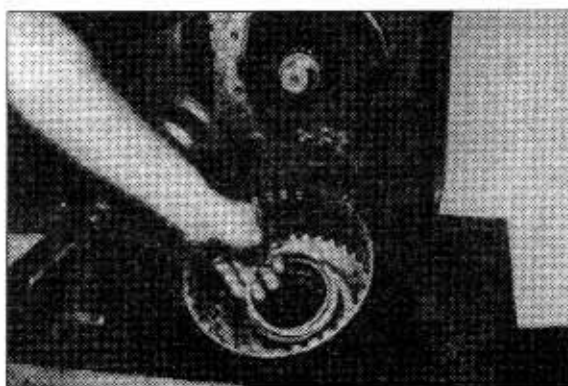
## 12) INPUT(FORWARD) & REVERSE CLUTCH ASSEMBLY

(Reverse clutch being assembled)

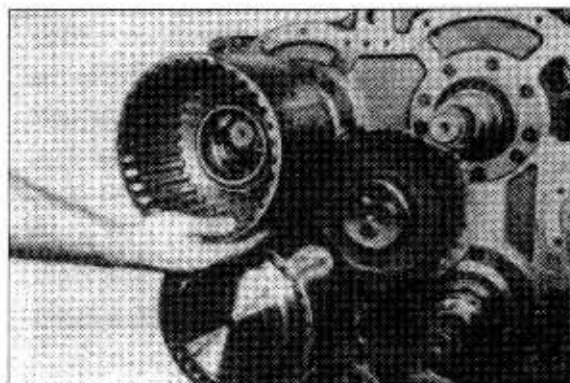
- (1) Position belleville washers against the clutch piston as shown in below figure. Concave sides against each other. Five(5) sets, total of ten(10) washers in each clutch, input(Forward) and reverse. Locate snap ring retainer on belleville washers.



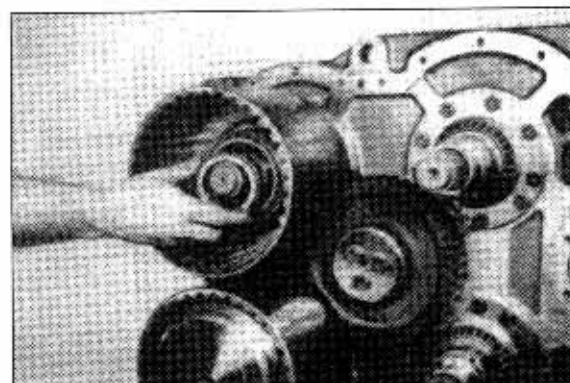
- (2) Position snap ring over clutch hub. Compress snap ring retainer and belleville washers below snap ring groove(See below figure). Install snap ring in full position in snap ring groove and release tension on ring retainer. Retainer must fit all around snap ring(See below figure).



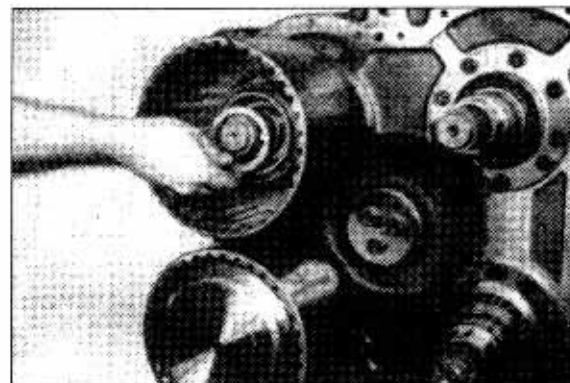
- (3) Position clutch drum on support, being sure the drum is matched with the support as explained in page 3-78(5).



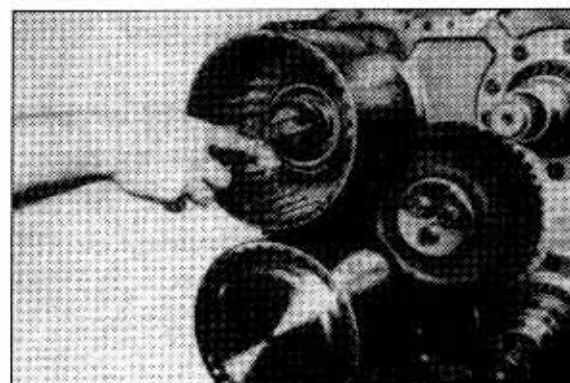
- (4) Position matched outer taper bearing in clutch drum and over clutch support.



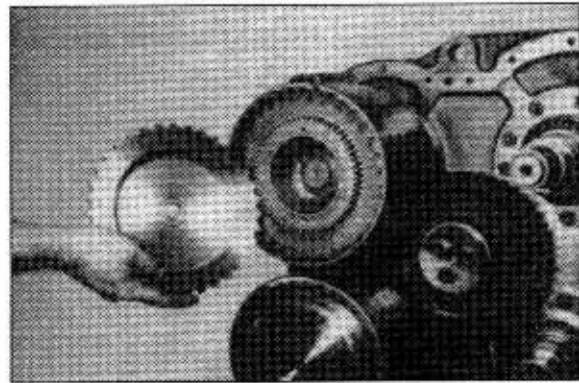
- (5) Position matched retainer washer on clutch support aligning tang on washer with notch in support.



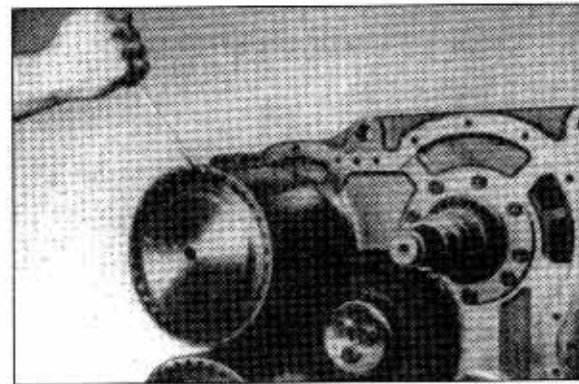
- (6) Install selected clutch drum snap ring, being certain ring is in full position in ring groove. Check to make sure end play on clutch drum does not exceed 0.1270mm.



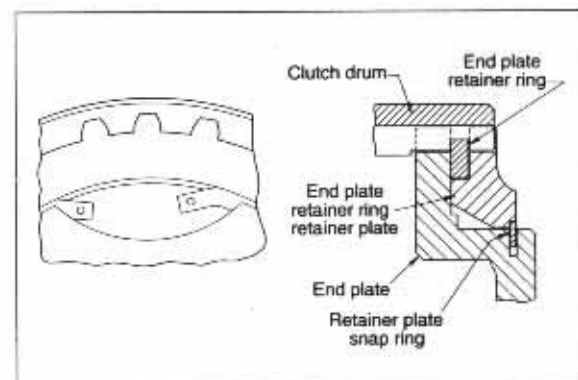
- (7) Install the clutch disc hub and hub retainer ring. Install one friction disc next to the piston. Install one steel disc. Alternate clutch plates until a quantity of sixteen(16) inner friction plates and fifteen(15) outer steel plates are installed. You start with a friction plate and end with friction plate. Position clutch end plate against clutch plates.



- (8) Install end plate retainer ring.



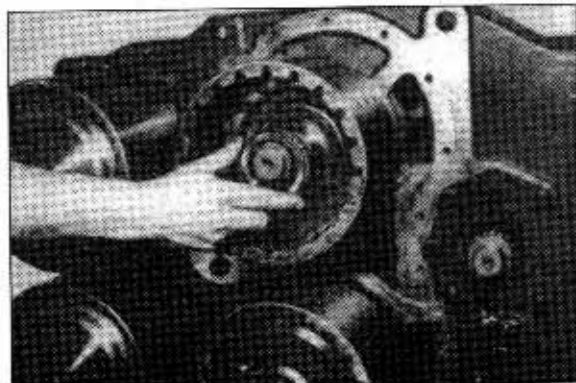
- (9) With the retainer plate snap ring in place in the clutch end plate, squeeze the ends of the snap ring together. Install ring retainer plate over snap ring and against the end plate. Release the snap ring in undercut of retainer plate. Be sure ring is in full position over retainer plate(See line drawing).



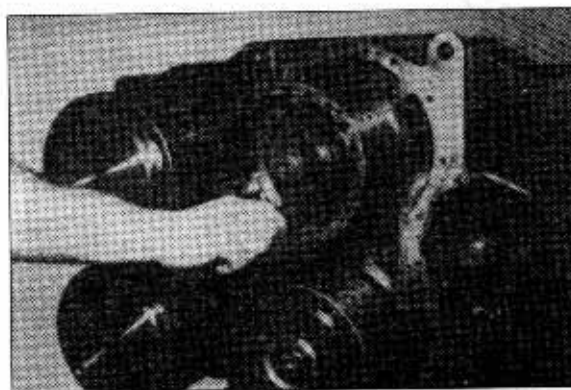
### 13) 3RD & 4TH CLUTCH ASSEMBLY

(4th being assembled)

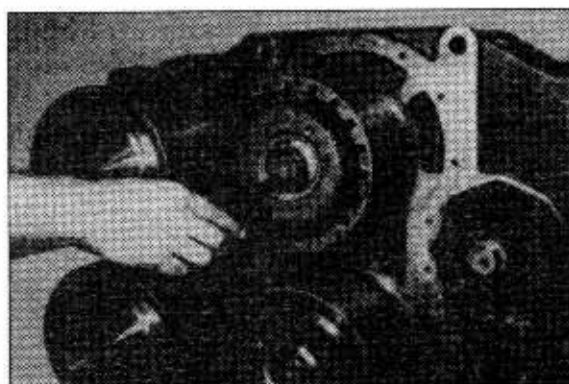
- (1) Position clutch drum on support, being sure the drum is matched with the support as explained in page 3-78(5). Position matched outer taper bearing in clutch drum and over clutch support.



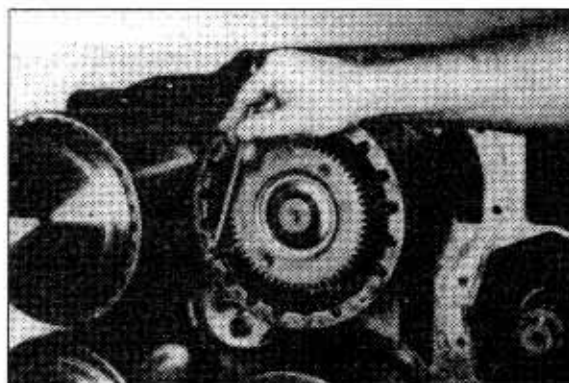
- (2) Position matched retainer washer on clutch support, aligning tang on washer with notch in support. Install selected clutch drum snap ring being certain ring is in full position in ring groove. Check to make sure end play on clutch drum does not exceed 0.1270mm.



- (3) Install the clutch disc hub and hub retainer ring.



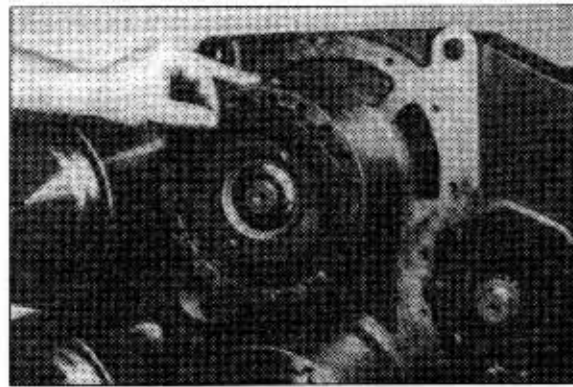
- (4) The outer disc has teeth missing on the outer diameter. This is to allow passage for the clutch release springs. Insert two or more release springs in drum and against the teeth of the clutch piston.



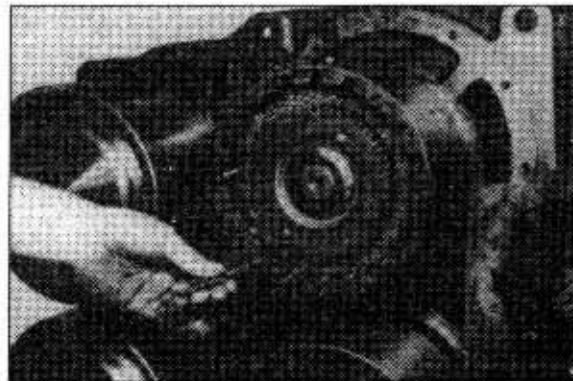
- (5) Install one friction disc next to the piston.



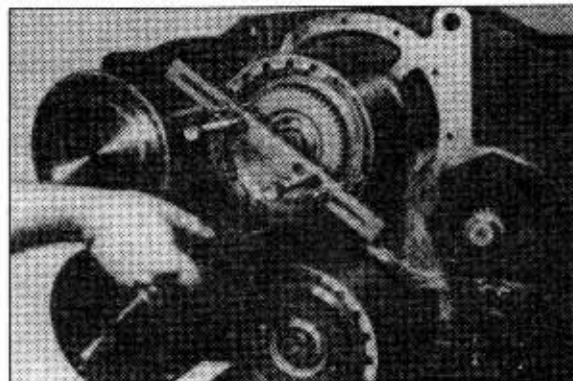
- (6) Install one steel disc. Alternate clutch plates until a quantity of ten(10) inner friction plates and nine(9) outer steel plates are installed. If assembly is correct each release spring is against a tooth on the clutch piston and you start with an inner disc and end with an inner disc.



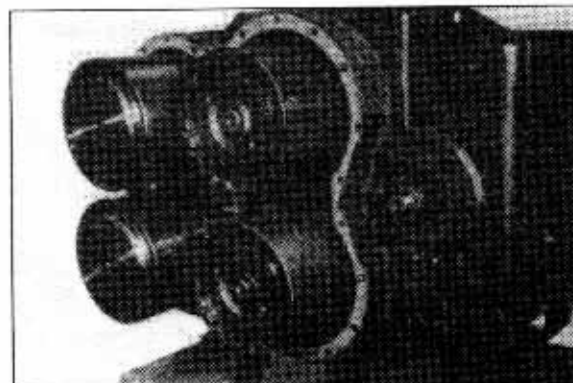
- (7) Install remaining clutch release springs and pins in open passages in the steel outer discs. Total quantity six(6) springs and six(6) pins.



- (8) Position end plate against last friction disc. Compress end plate and install end plate retainer ring.



- (9) Position new clutch cover gasket on transmission housing, a thin coat of chassis grease will hold the gasket in place. Use aligning studs to hold clutch cover spacer in place. Position outer gasket on cover spacer.

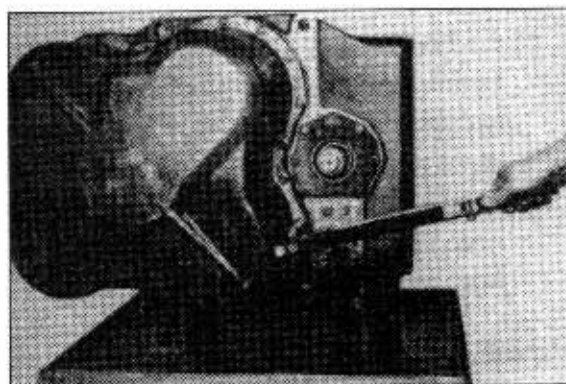




- (10) Position clutch cover on aligning studs. Install all of the cover bolts and washers. Remove aligning studs and install remaining bolts and washers.

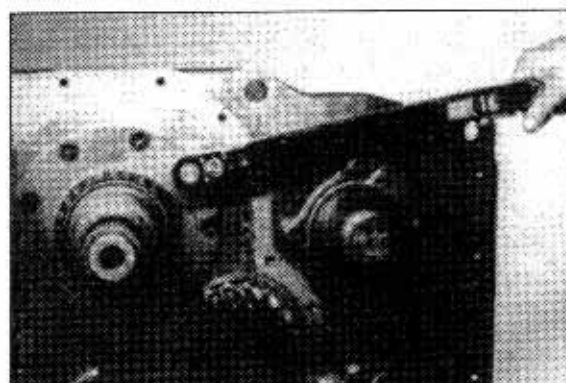


- (11) Tighten cover bolts 3.2~3.5kgf · m (23~25lbf · ft) torque.



- (12) Position the 1st & 2nd clutch supports on housing. Install support bolts and tighten 11.1~12.2kgf · m(80~88lbf · ft) torque. Install new clutch support sealing rings and expander springs. Expander spring gap to be 180° from sealing ring hook joint. Lock rings in position. Grease rings to facilitate drum to support assembly.

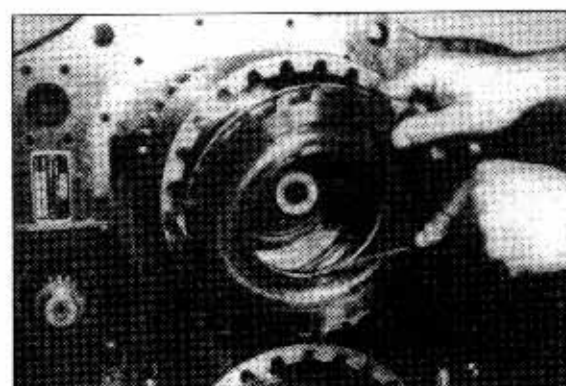
※ Oil sealing ring expander springs used under the oil sealing rings on the 1st and 2nd supports only.



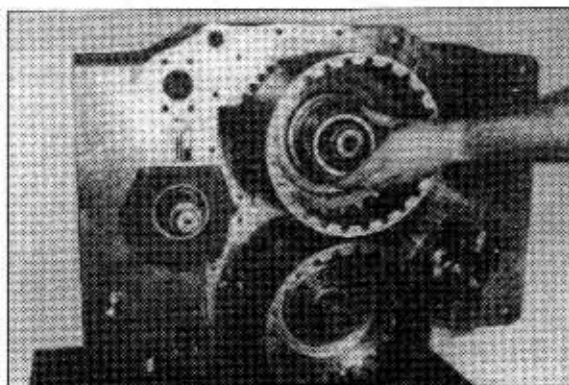
#### 14) ASSEMBLY OF 1ST & 2ND CLUTCHES

(2nd being assembled)

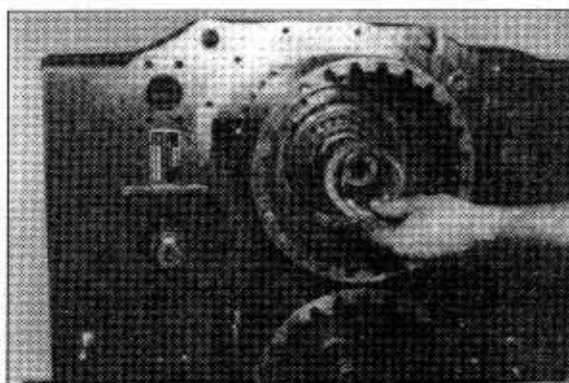
- (1) Position clutch drum on support, being sure the drum is matched with the support as explained in page 3-78(5). Install new inner and outer clutch piston oil sealing rings.



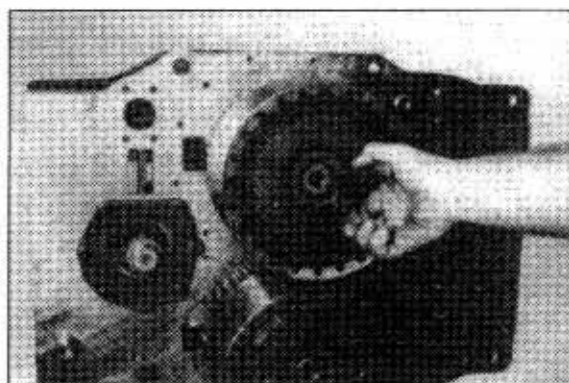
- (2) Position matched outer taper bearing in clutch drum and over support.



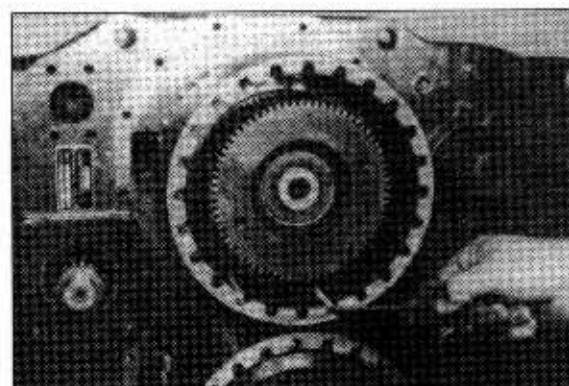
- (3) Position matched drum retainer washer on clutch support aligning tang on washer with notch in support. Install selected clutch drum snap ring, being certain ring is in full position in ring groove. Check to make sure end play on clutch drum does not exceed 0.1270mm.



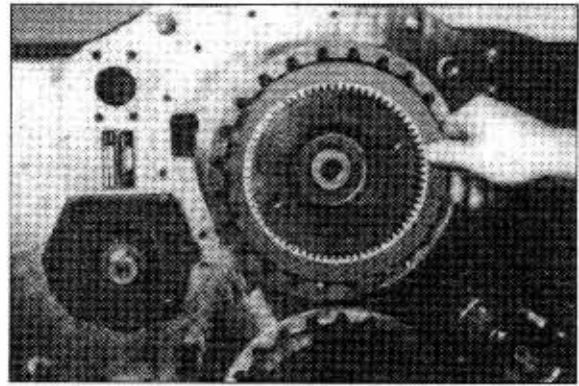
- (4) Install clutch disc hub and hub retainer ring.



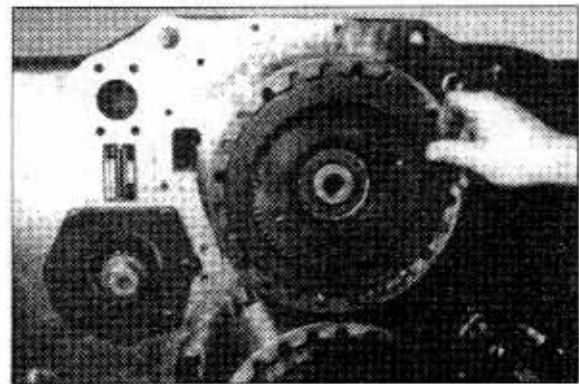
- (5) The outer disc has teeth missing on the outer diameter. This is to allow passage for the clutch release springs. Insert two or more release springs in drum and against the teeth of the clutch piston.



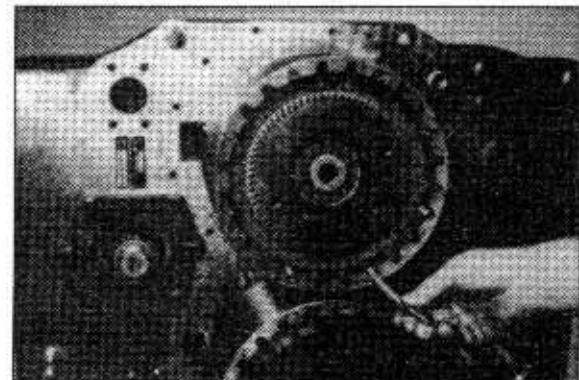
- (6) Install one inner clutch disc(Spline teeth on inner diameter) on disc hub and against the clutch piston.



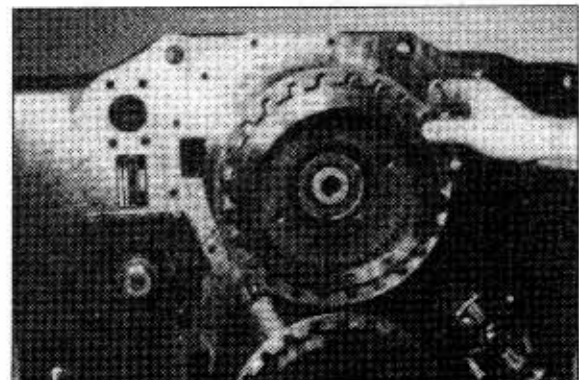
- (7) Install one steel outer disc, install next inner disc, alternate clutch discs, outer against inner, and always align the teeth on each outer disc with the teeth on the preceding outer disc. If assembly is correct each release spring is against a tooth on the clutch piston and you start with an inner disc and end with an inner disc. There are twelve(12) inner discs and eleven(11) outer discs.



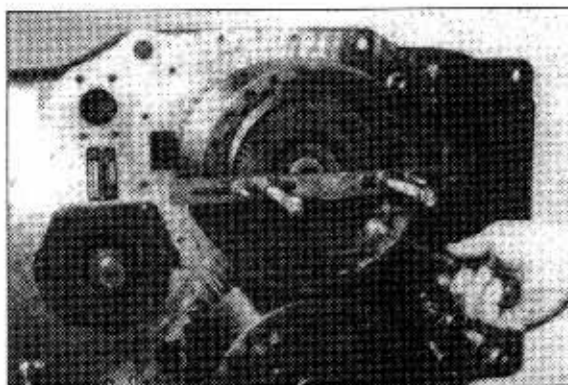
- (8) Install remaining clutch release springs and pins in open passages in the steel outer discs. Total quantity eight(8) springs and eight(8) pins.



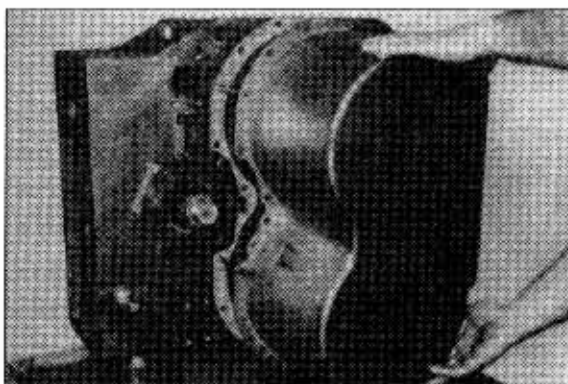
- (9) Position end plate against last friction disc.



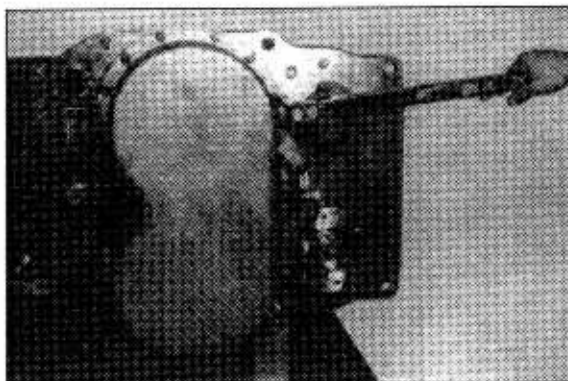
- (10) Compress end plate and install end plate retainer ring.



- (11) Position a new clutch cover gasket on transmission housing. Use aligning studs to hold clutch cover in position. Install all of the bolts and washers. Remove aligning studs and install remaining bolts and washers.



- (12) Tighten cover bolts 3.2~3.5kgf · m (23~25lbf · ft) torque.

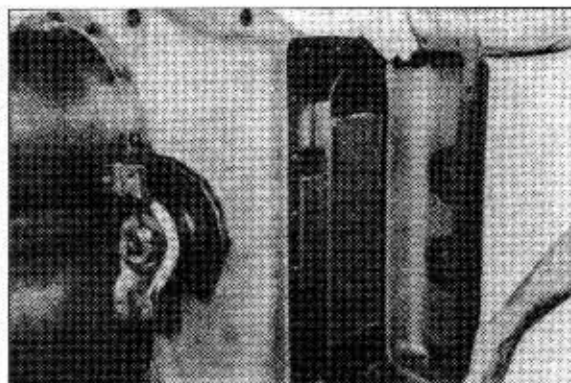


- (13) Install output flange, flange O-ring, washer and flange nut. Block output shaft or use a soft bar to block the gear train, tighten output flange nuts 34.6~41.5kgf · m (250~300lbf · ft) torque. Install new gasket on sump screen opening. Install sump screen and baffle assembly in housing and secure with bolts and lockwashers. Tighten 3.2~3.5kgf · m (23~25lbf · ft) torque.

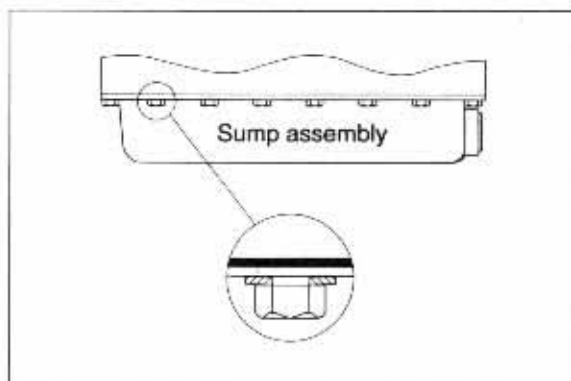




- (14) Install new gasket on transmission sump pan. Set pan magnets over welded washers in sump pan. Secure pan with bolts and belleville washers.



- (15) Tighten sump pan bolts 3.2~3.5kgf · m (23~25lbf · ft) torque.



#### 15) ASSEMBLY OF CONTROL COVER

- ※ Lubricate all valves, springs, O-rings, sleeves and oil seals with a light coat of automatic transmission fluid.

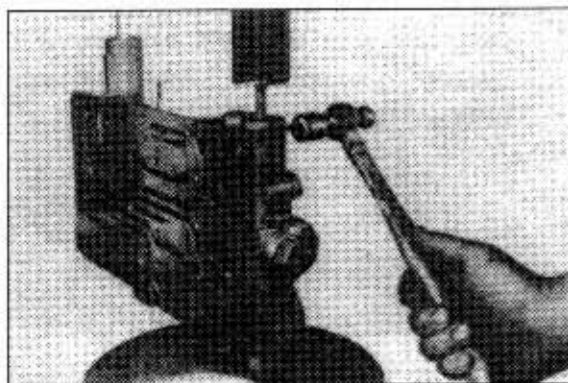


- (1) Install safety valve ball and spring in cover. With new O-ring in position install spring stop on spring.

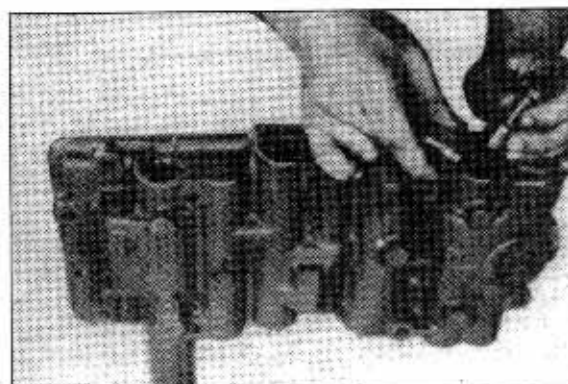




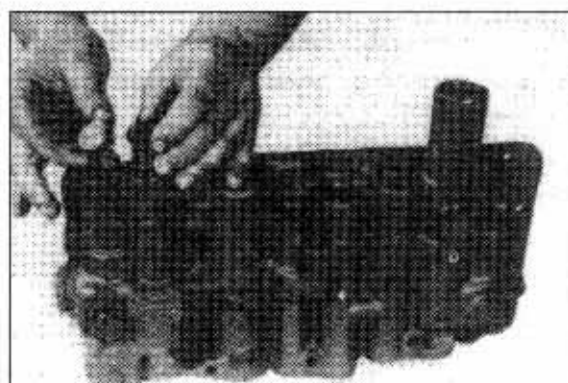
- (2) Depress spring stop and spring. Install spring stop roll pin.



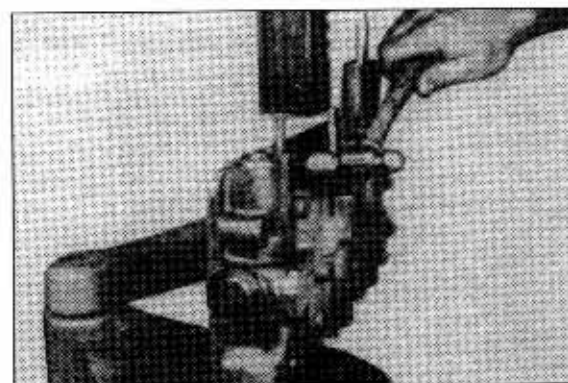
- (3) Install regulating valve spool in valve cover. Install new O-ring on valve stop. Install valve stop in cover and retain with roll pin.



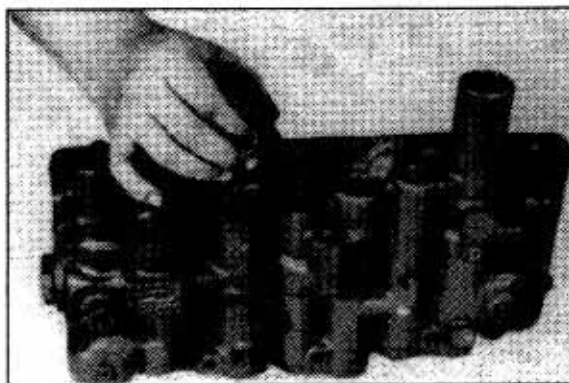
- (4) At opposite end of regulating valve install inner and outer valve spring. Install new O-ring on spring stop. Install spring stop on springs.



- (5) Depress spring stop and spring. Install spring stop roll pin.



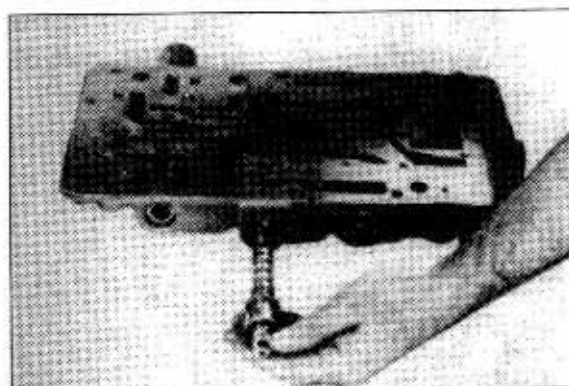
(6) Install shut-off valve spring.



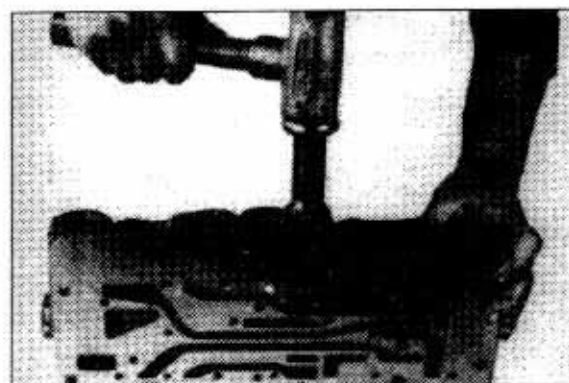
(7) Install shut-off valve in housing. Depress valve and spring with valve plug. Tighten plug securely.



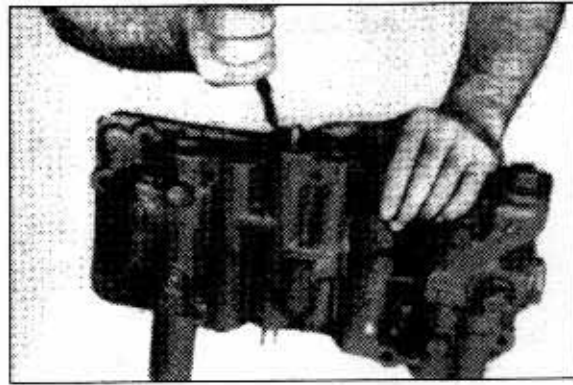
(8) Install forward and reverse selector valve in housing. Install selector valve stop washer and oil seal on selector valve.



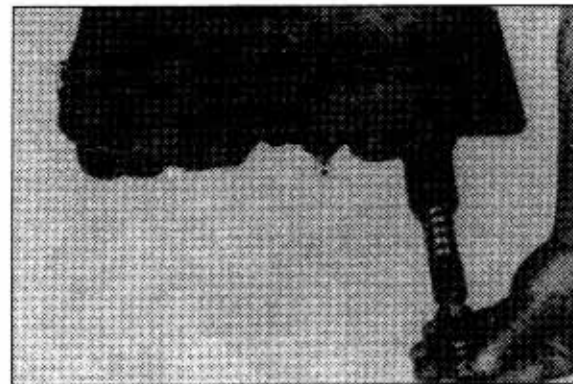
(9) Apply a light coat of Permatex No.2 on the outer diameter of a new selector valve oil seal. Install oil seal in housing.



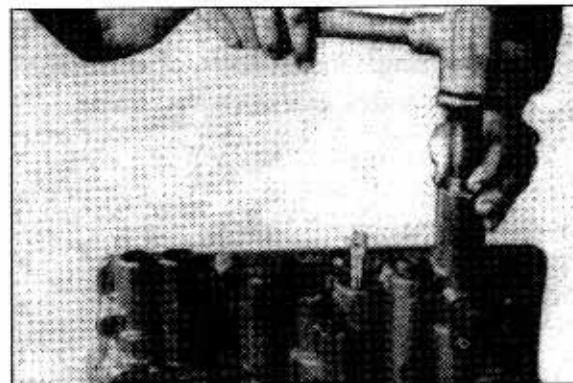
(10) Install oil seal retainer ring.



(11) Install speed selector valve in housing.  
Install selector valve stop washer and oil  
seal on selector valve.



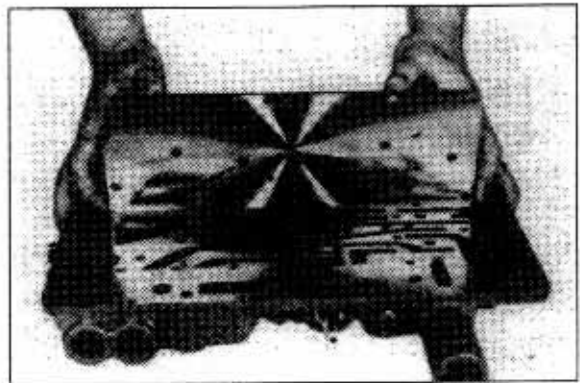
(12) Apply a light coat of Permatex No.2 on the  
outer diameter of a new selector valve oil  
seal. Install oil seal in housing.



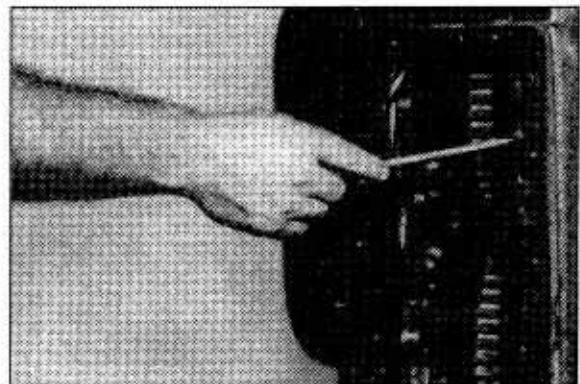
(13) Install oil seal retainer ring.



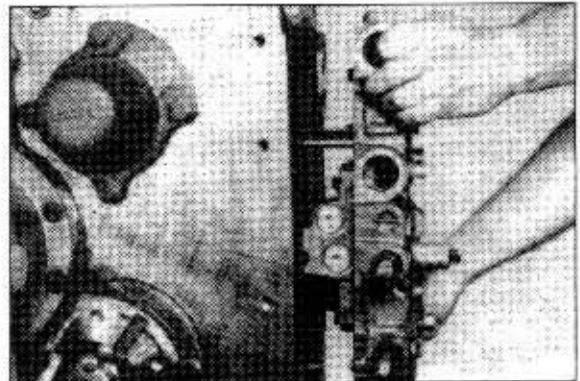
- (14) Install poppet balls and poppet springs in drilled ports in control cover. Install control cover plate. Secure with bolts and external shake proof washers. Tighten 1.7~2.2kgf · m (12~16lbf · ft) torque.



- (15) Position new control cover gasket and O-rings on transmission housing. Aligning studs will hold gasket in place and facilitate cover installation.



- (16) Locate control cover on aligning studs.



- (17) Install control cover bolts and washers, tighten 3.2~3.5kgf · m (23~25lbf · ft) torque.

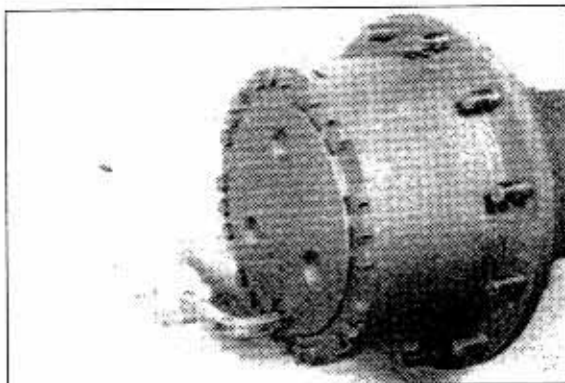


### 3. AXLE

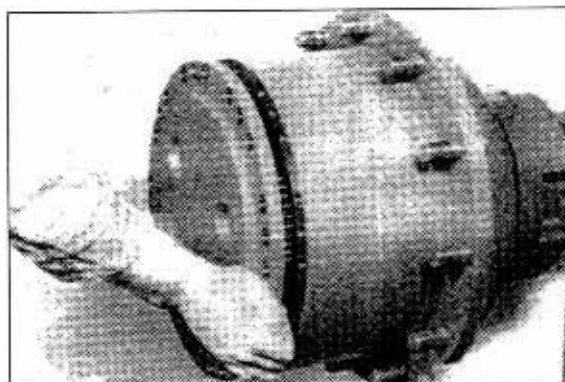
#### 1) FINAL DRIVE

##### (1) DISASSEMBLY

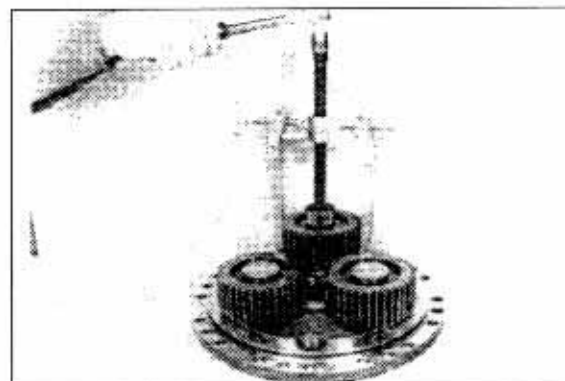
- ① Loosen oil drain plug and drain oil.



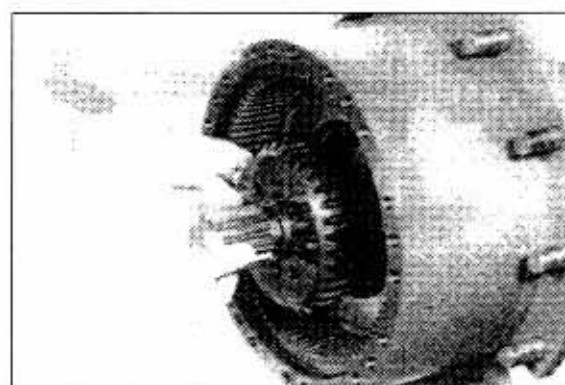
- ② Loosen hexagon head screws and lift off the planetary carrier.



- ③ Squeeze out circlip and pull off the planetary gears.  
Remove thrust washer.

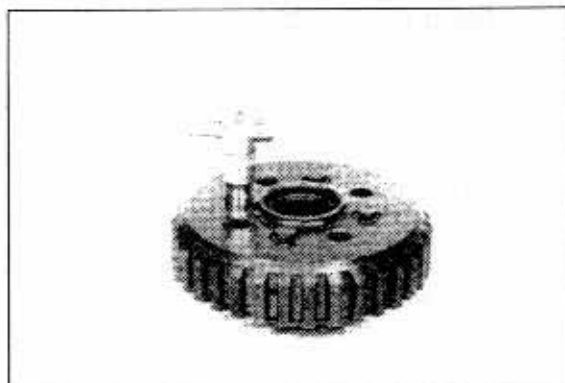


- ④ Pull sun gear along with inner plate carrier from the stub shaft, respectively out of the plate pack.

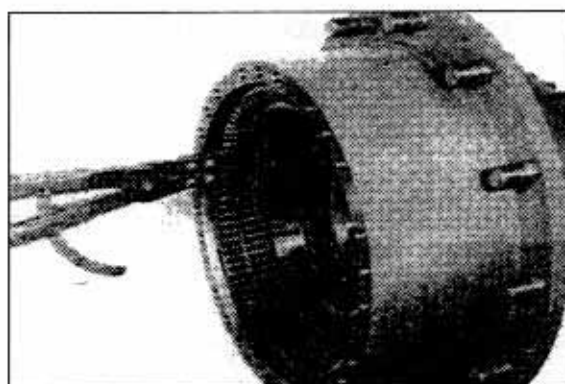




- ⑤ Loosen locking screws and remove ring from the inner plate carrier.



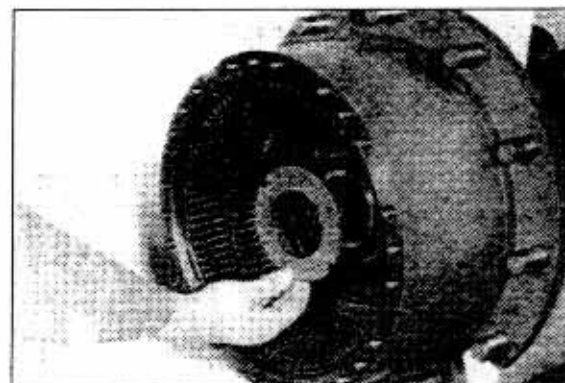
- ⑥ Squeeze out circlip.



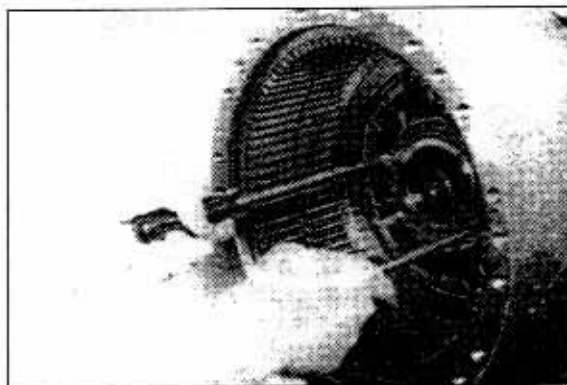
- ⑦ Remove backing plate and plate pack.



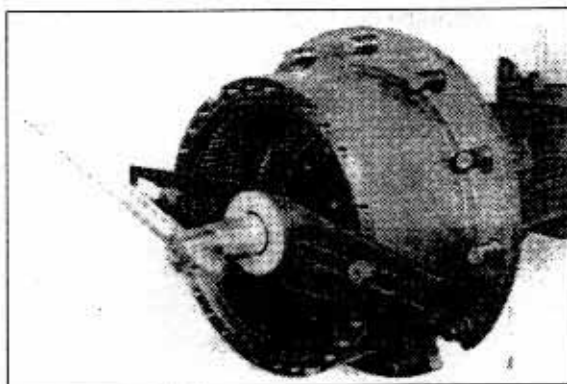
- ⑧ Remove thrust washer.



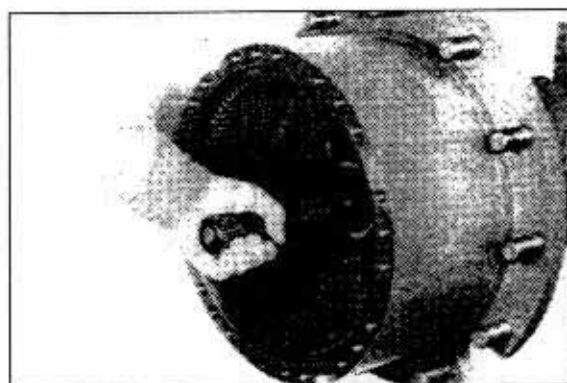
⑨ Remove lock plate.



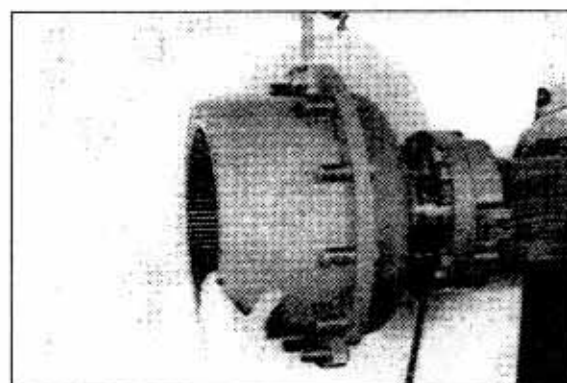
⑩ Loosen and remove slotted nut.



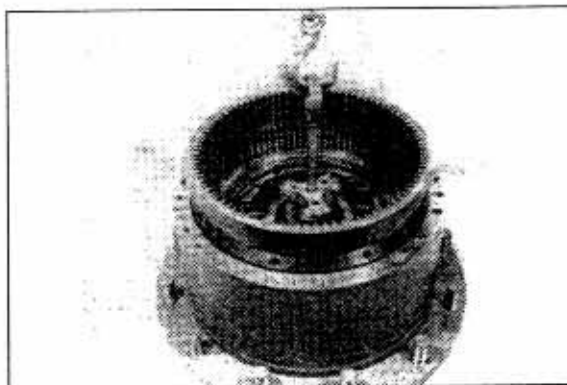
⑪ Pull stub shaft out of the axle housing.



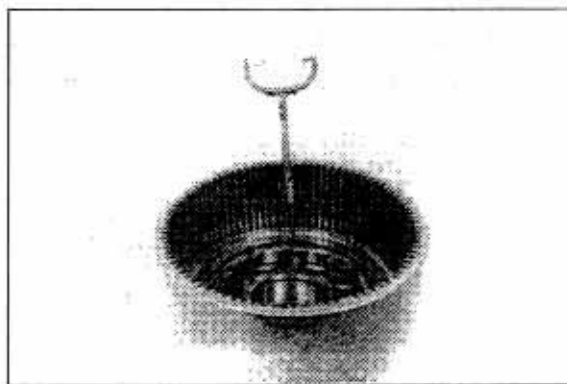
⑫ Separate complete hub from hub carrier.



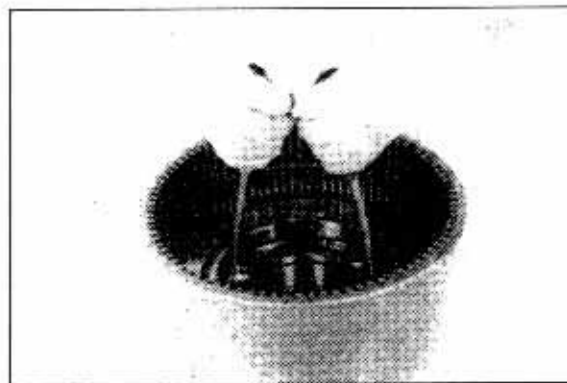
- ⑬ Lift internal gear and internal gear carrier out of the hub.  
Remove released spacer.



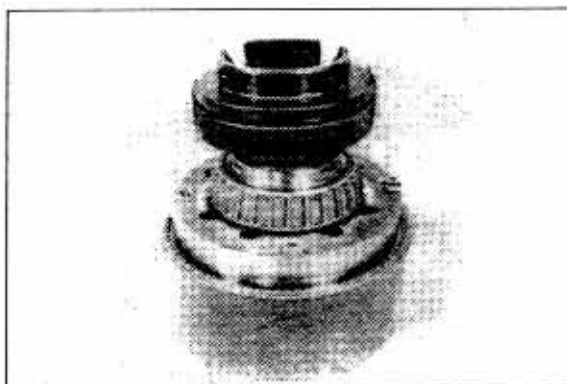
- ⑭ Unhook return springs.



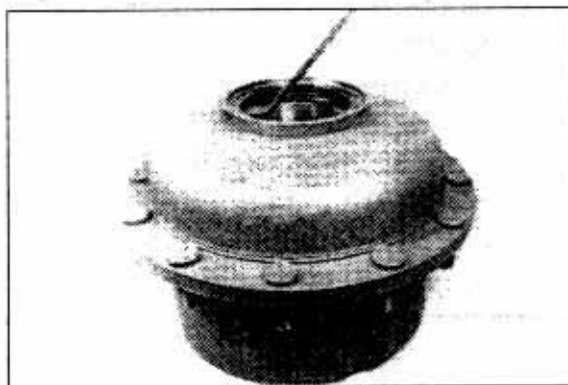
- ⑮ Take out the piston and remove sealing components.



- ⑯ Pull off tapered roller bearing from the internal gear carrier.



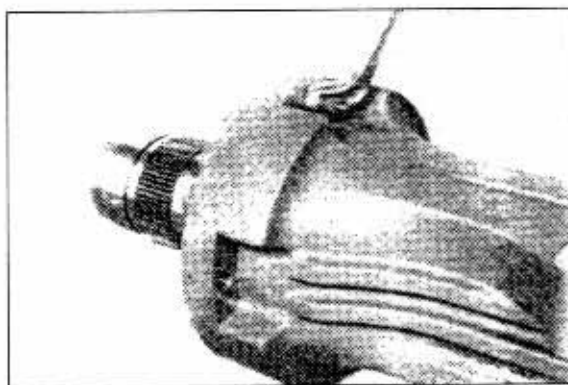
- ⑰ Pry shaft seal out of the hub and remove the bearing inner race.



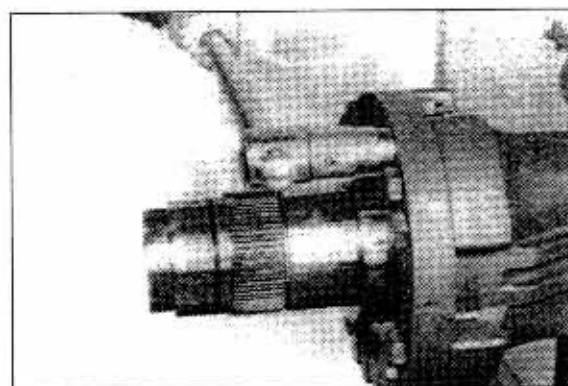
- ⑱ If required drive out and remove the two bearing outer races.



- ⑲ Remove bleeder valve.



- ⑳ Loosen hexagon head screws and separate the hub carrier from the axle housing.

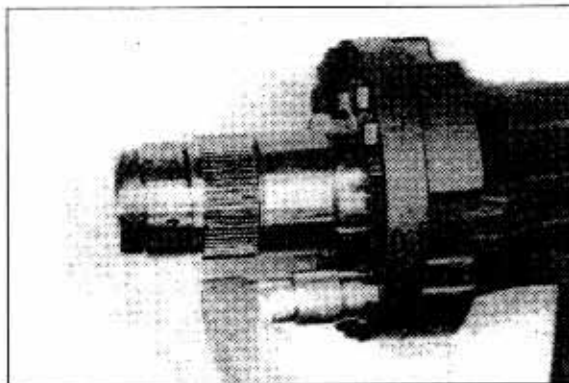


## (2) ASSEMBLY

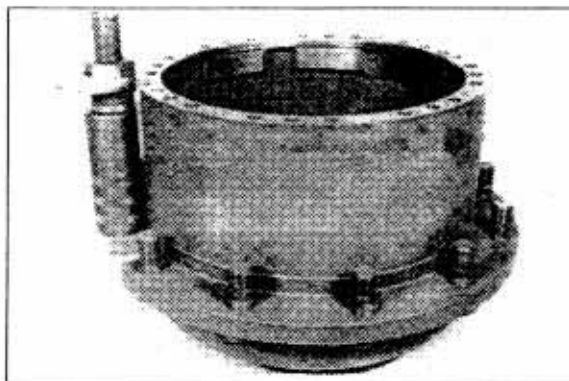
### Hub carrier

- ① Fasten hub carrier on the axle housing by means of hexagon head screws.

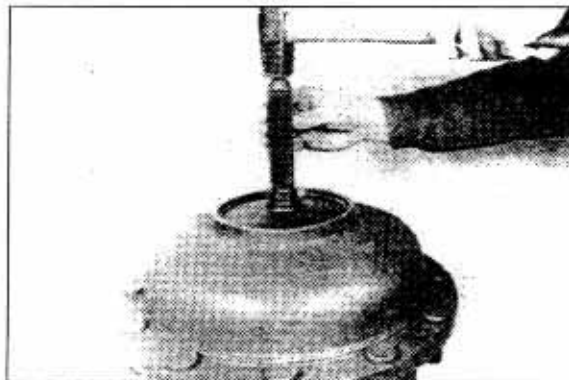
※ Pay attention to the installation position.  
Cover flange-mounted surface with sealing compound.



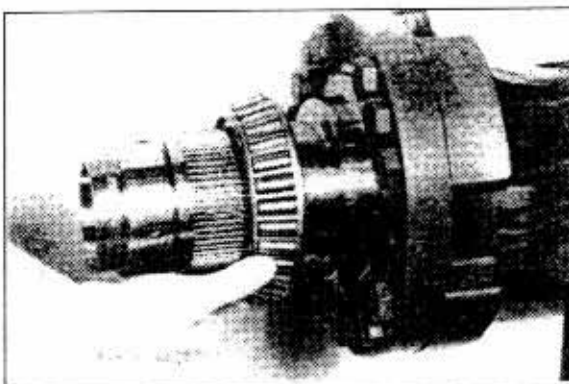
- ② Pull the wheel studs into the hub bores, using a special device.



- ③ Drive both bearing outer races firmly against shoulder.

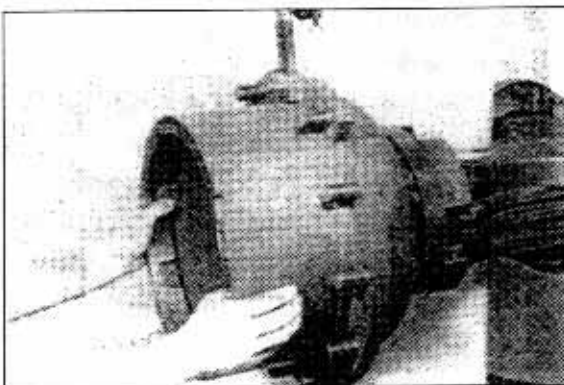


- ④ Guide the bearing inner race over the end of the hub carrier until contact is obtained.

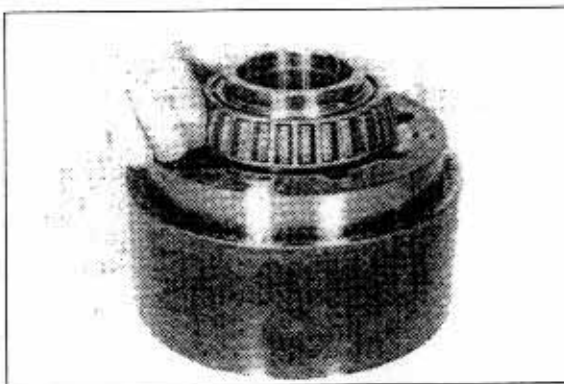




- ⑤ Guide hub over the end of the hub carrier.



- ⑥ Heat bearing inner race and place it firmly against shoulder.



- ⑦ Assemble spacer  $s=5.4\text{mm}$  (Empirical value).

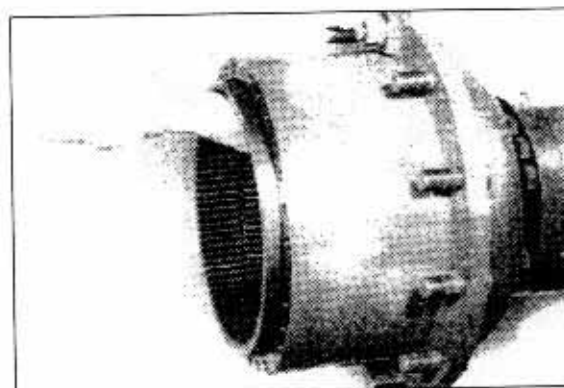
※ If hub carrier, hub as well as internal gear carrier are not renewed we recommend to install the existing spacer again.

Decisive, however, is the rolling resistance of the wheel bearing, see figure ⑩, page 3-127.



- ⑧ Screw installer over the threads of the hub carrier.

Guide complete internal gear over the hub carrier splines and fix the hub.



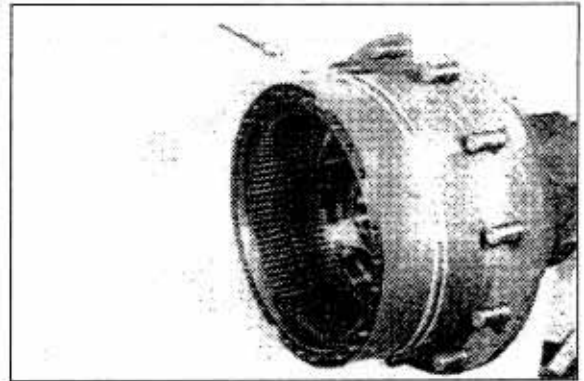
- ⑨ Tighten slotted nut by continuous turning of the hub.

• Torque limit : 204~224kgf · m  
(1475~1623lbf · ft).



#### Rolling resistance of the wheel bearing

- ⑩  $T = F \times R$ , from that results : Tractive Force  $F = T/R$   
 $T$  = Rolling resistance in kgf · m  
 $F$  = Tractive Force kgf  
 $R$  = Radius in m



Nominal value/Bearing rolling moment :

• 1.4~2.0kgf · m(10.3~14.8 lbf · ft)

- ※ For already run-in bearings try to find the lower value.

If the required rolling resistance is not obtained correct by means of a corresponding spacer(Figure ⑦).

After adjustment of the wheel bearing remove hub again.



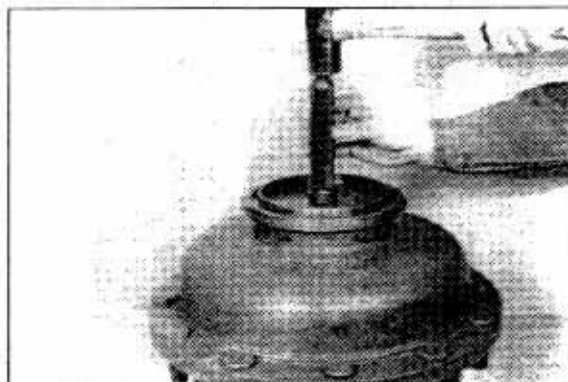
#### Hub

- ⑪ Insert bearing inner race into the hub.

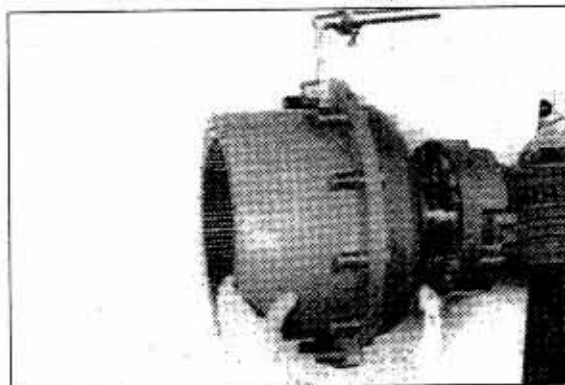


- ② Cover outside of shaft seal with Loctite and drive it in.

※ Installation depth(7.0~7.8mm) is determined by the special tool.  
If necessary, heat cover plate prior to assemble the hub and install it.



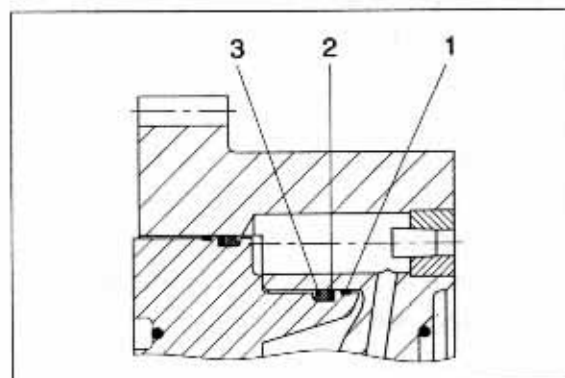
- ③ Guide hub over the hub carrier end carefully against shoulder.



#### **Complete internal gear carrier Pre-assemble piston**

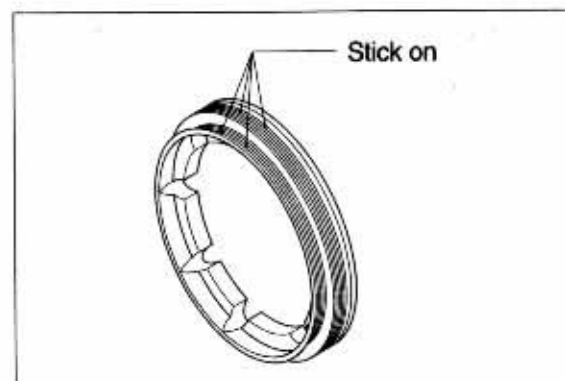
- ④ The draft on the left shows the installation position of the back-up sealing elements.

1 = Back-up ring  
2 = Packing ring  
3 = U-section ring



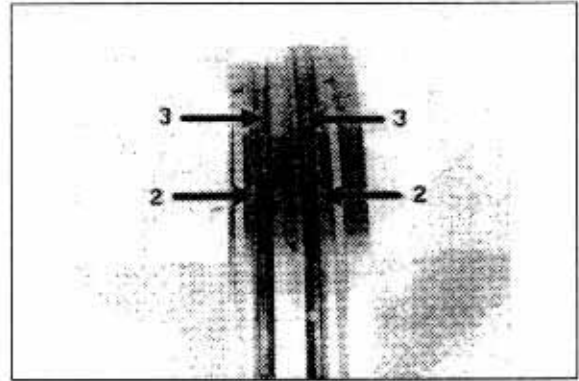
- ⑤ Clean the piston with spirit.

Stick on support ribbons at two points by means of Loctite. The support ribbons must adhere exactly around the whole circumference. Remove any sticking residues.



- ⑥ Install packing rings(2) and U-section rings(3).

※ Pay attention to the installation position, see draft ④, page 3-128.



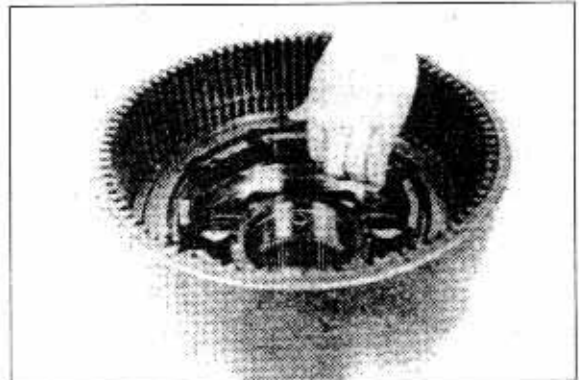
- ⑦ Insert piston into the installer(S).

※ Lubricate sealing and back-up elements, (Use W-10 oil).

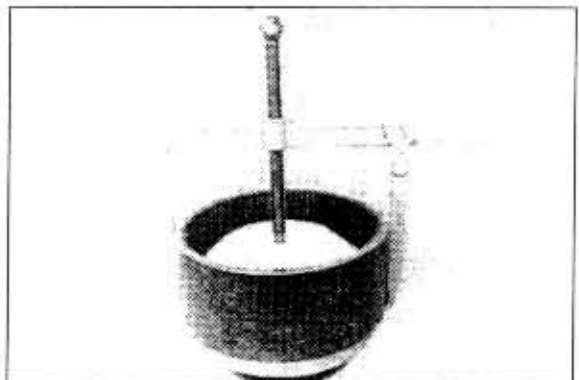


- ⑧ Insert piston with installer into the internal gear carrier.

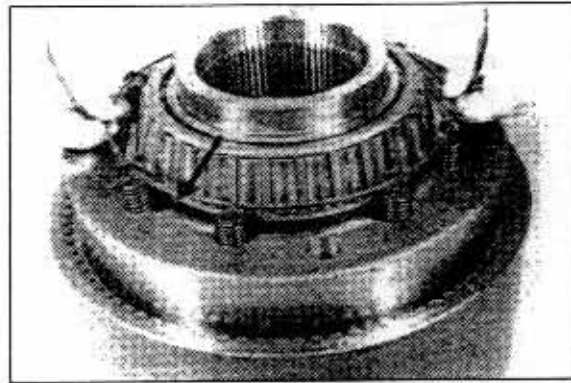
※ Pay attention to the radial installation position, (Openings for return springs). With installed condition, the support ribbon openings must show upwards.



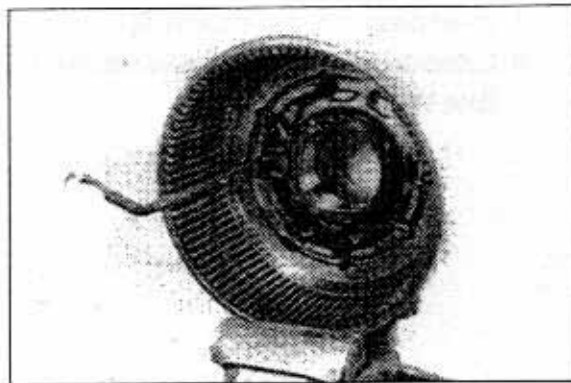
- ⑨ Press piston carefully against shoulder, using clamping plate and two-leg puller.



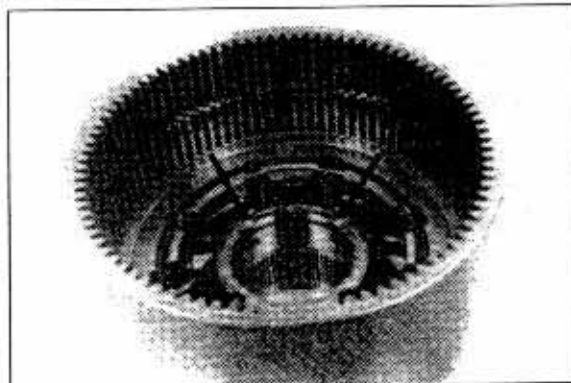
- ⑩ Engage return springs (With lug showing outwards) on the circlip and assemble it in the internal gear carrier.
- ※ Pay attention to the radial installation position of the circlip (See arrow).



- ⑪ Insert 2nd circlip and engage return springs.
- ※ Pay attention to the radial installation position of the circlip.

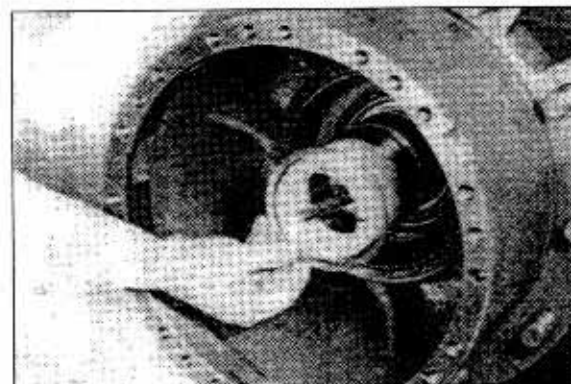


- ⑫ Insert O-ring into the groove of the internal gear carrier and grease it slightly. Mark the location of the oil supply holes on the face, (See arrow).



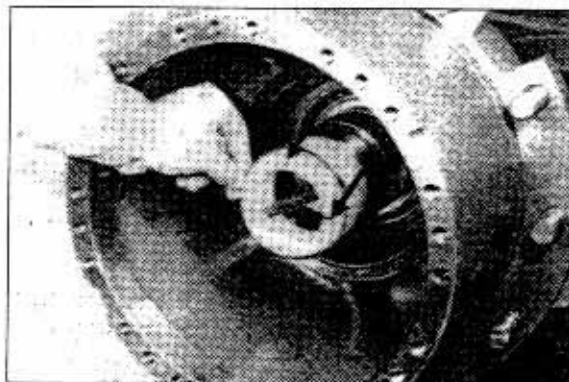
#### **Assemble internal gear carrier**

- ① Screw installer over the threads of the hub carrier. Assemble the spacer determined in Figure ⑦, page 3-126.

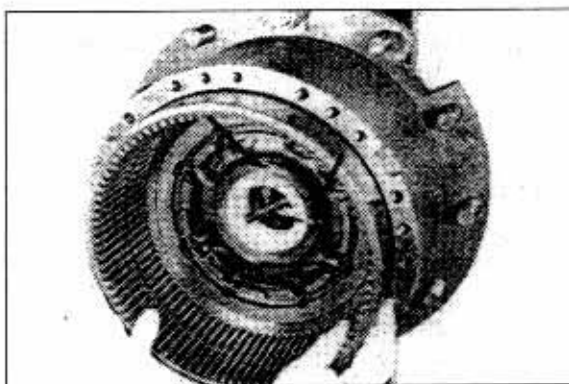




- ② Guide O-ring over the hub carrier and insert it into the groove.  
Mark the radial location of the oil supply bores on the face(See arrows).

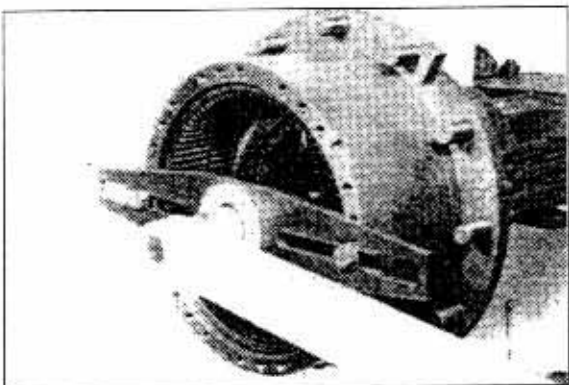


- ③ Guide the complete internal gear over the splines of the hub carrier. At the same time pay attention to the overlapping of the oil holes(Hub carrier, internal gear carrier)(See arrows).

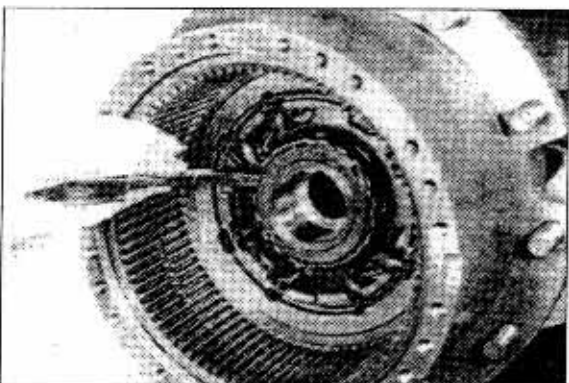


- \* During this step, it is absolutely necessary to respect the central location of the hub in order to make a correct assembly of the internal gear-internal gear carrier possible, and to avoid a damage of the two O-rings.

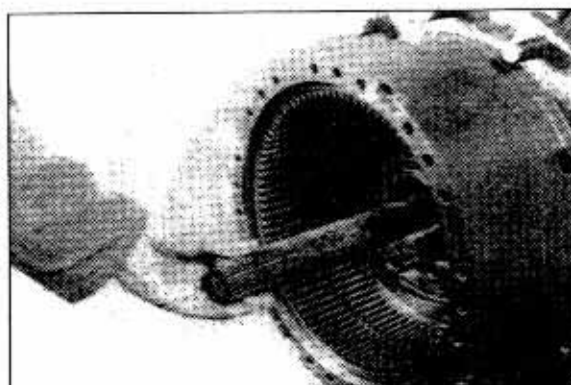
- ④ Tighten slotted nut by continuous turning of the hub finally.  
• Torque limit : 204~224kgf · m  
(1475~ 1623lbf · ft)



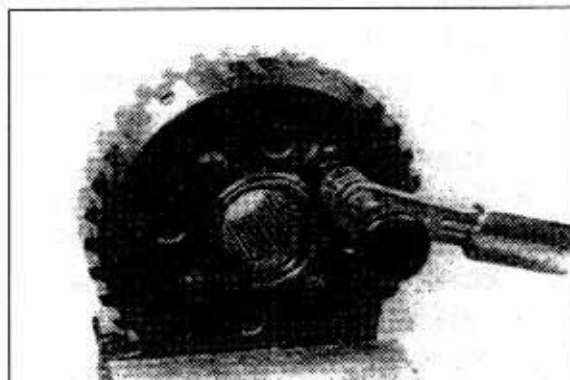
- ⑤ Install lock plate and secure slotted nut.



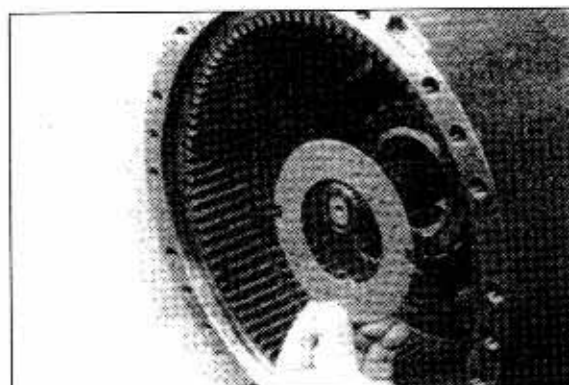
- ⑥ Assemble stub shaft until contact is obtained.



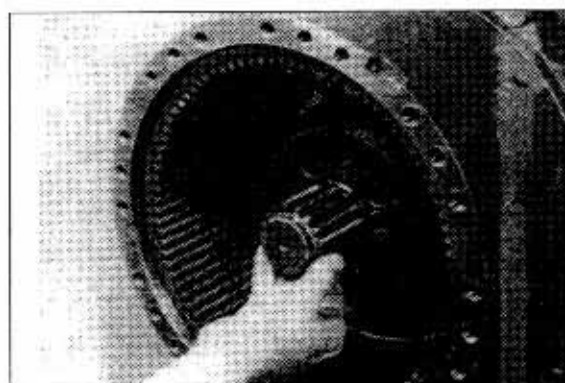
- ⑦ Screw oil seal with inner plate carrier.  
• Torque limit : 5.1kgf · m(36.9lbf · ft)



- ⑧ Install thrust washer.

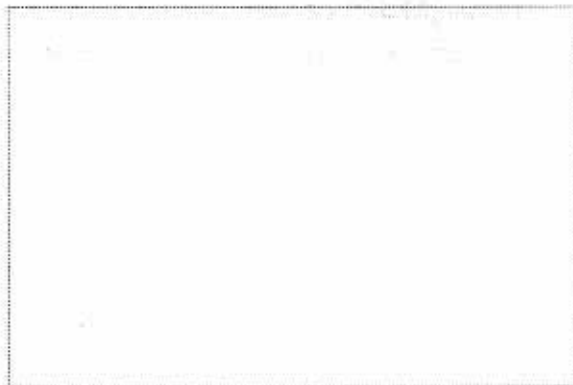


- ⑨ Guide the inner plate carrier(Along with the sun gear) upon the stub shaft splines.



**Adjust plate clearance according to the following table :**

Number of inner plates	Number of friction faces	Plate 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



**⑩ Determine piston stroke**

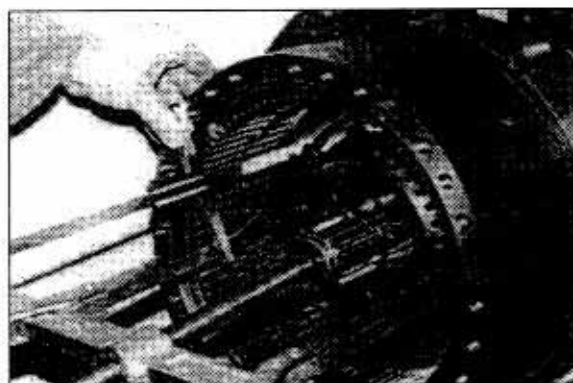
(Nominal value 2.4~2.8mm)

Squeeze in circlip and place it against shoulder towards the outside.

Determine dimension A from the flange-mounted surface/hub to the plane surface/piston.

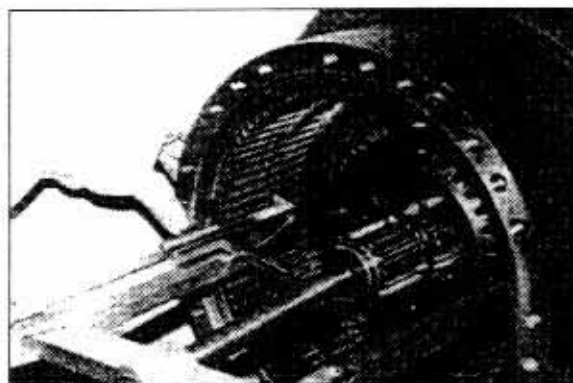
Dimension A e.g. 121.50mm

\* Pay attention to the correct location of the piston against the internal gear carrier.



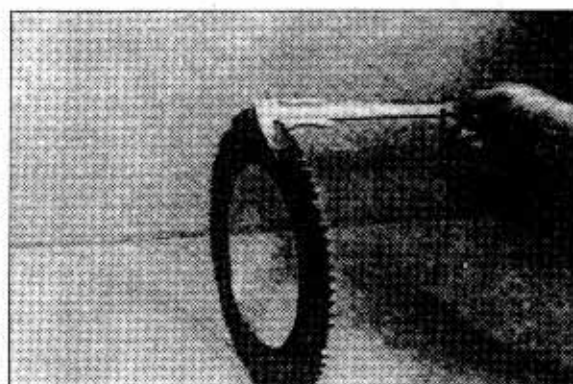
**⑪ Measure dimension B from the flange-mounted surface/hub to the inner plane surface of the circlip.**

Dimension B e.g. 75.20mm



**⑫ Outer plate : 4 x 4.5mm**

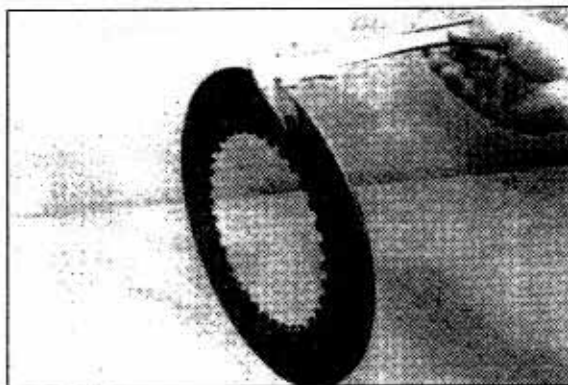
Dimension C e.g. 18.00mm



⑬ Inner plate :  $3 \times 4.5\text{mm}$

Dimension D e.g.

13.50mm



⑭ Dimension E = Backing plate

Dimension E e.g.

18.00mm



⑮ Example

Dimension A 121.50mm

Dimension B -75.20mm

Dimension C -18.00mm

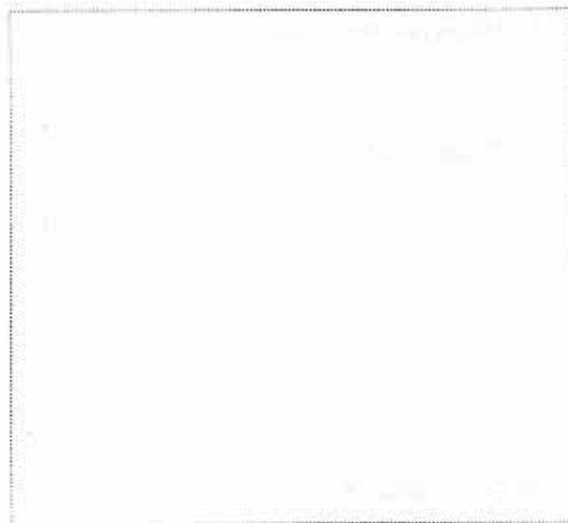
Dimension D -13.50mm

Dimension E -12.00mm

Difference = Plate clearance 2.80mm

\* If the required plate clearance according to the Table, page 3-133, is not obtained, correct with corresponding outer plate.

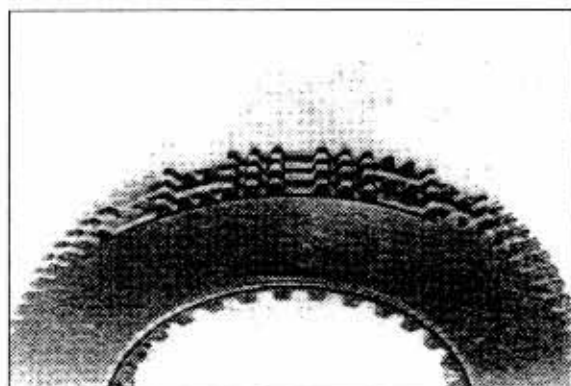
If necessary, mount thinner outer plates on the piston side, respectively backing plate side.



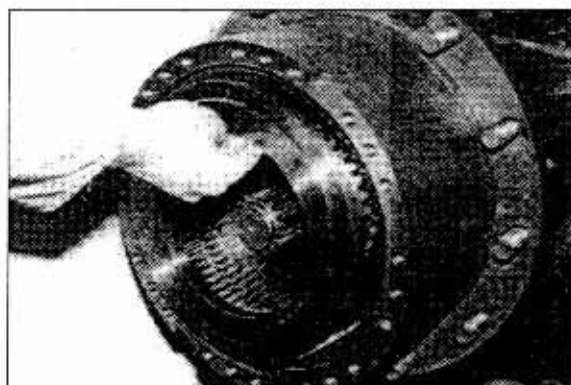
- ⑩ Install alternating outer and inner plates(Starting with one outer plate).



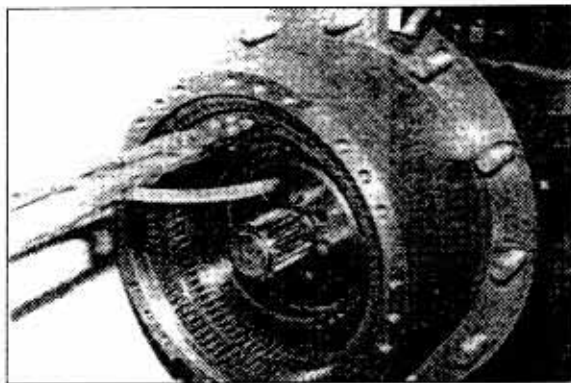
- ⑪ The illustration on the right shows the required arrangement of the outer plates.



- ⑫ Insert backing plate-stepped plane surface is showing outwards.



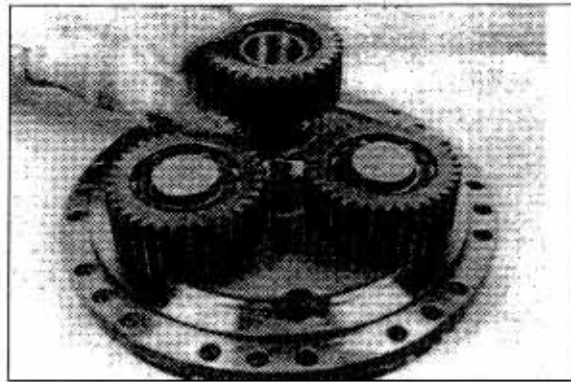
- ⑬ Fix the plate pack by means of circlip.



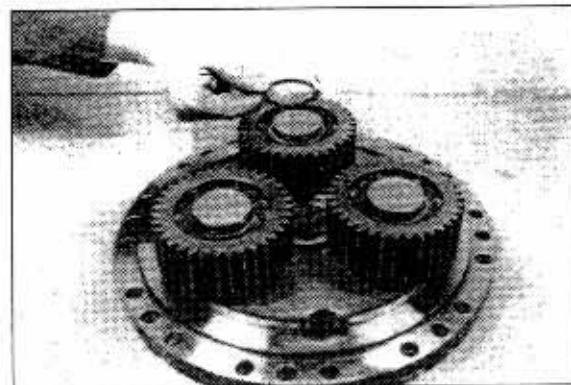


- ②⑩ Heat planetary gear and place it upon the planetary carrier.

\* Pay attention to the installation position, large radius of the bearing inner race showing to the planetary carrier (Downwards).



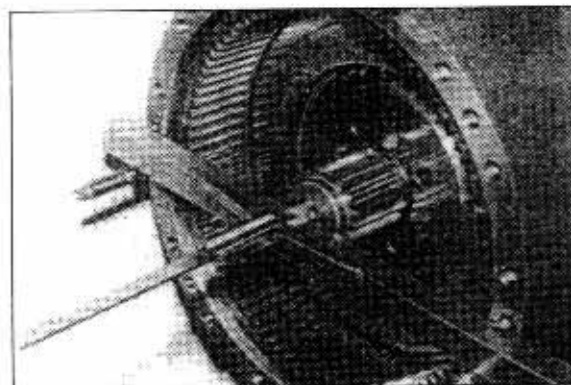
- ②⑪ Squeeze in circlip.



**Determine end play of the sun-gear shaft**(Nominal value 0.3~0.6mm)  
(Try to find the higher value).

- ②⑫ Place sun gear and plate carrier against shoulder.

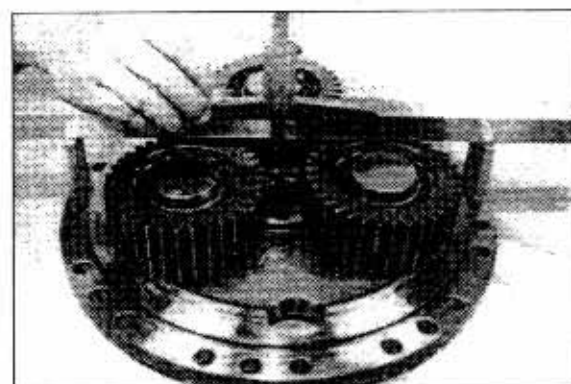
Dimension A e.g. 6.00mm



- ②⑬ Determine dimension B from the flange-mounted surface to the thrust washer.

Dimension B e.g. 5.50mm

\* For the measurement, lay thrust washer into the planetary carrier.



②④ **Example**

Dimension A 6.00mm

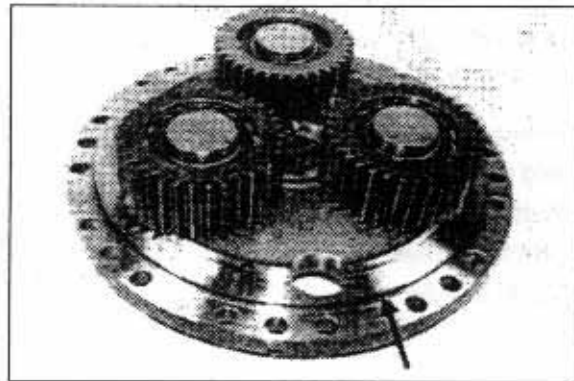
Dimension B -5.50mm

Required end play  
of the sun-gear shaft =0.50mm

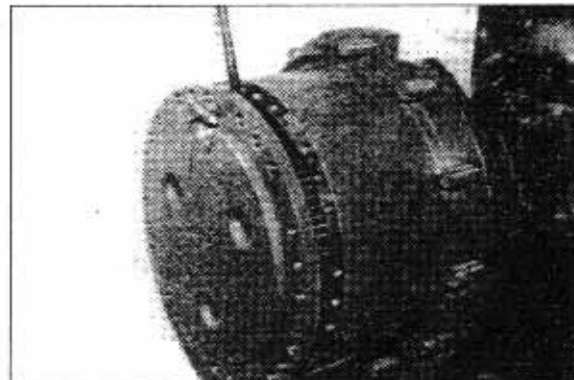
- ※ Remove thrust washer again and make it adhere with Loctite.



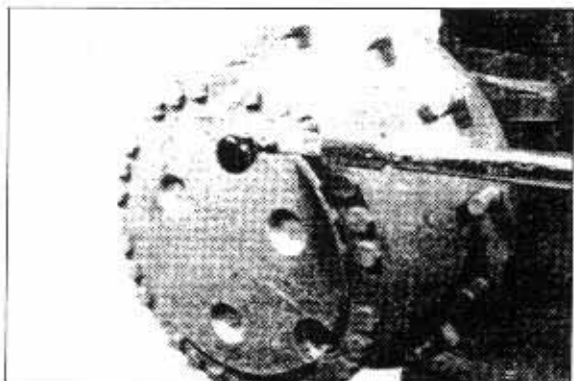
- ②⑤ Insert new O-ring into the ring groove of the planetary carrier (Arrow).



- ②⑥ Assemble planetary carrier until contact is obtained.



- ②⑦ Tighten hexagon head screws.



### Check tightness of the brake hydraulic system

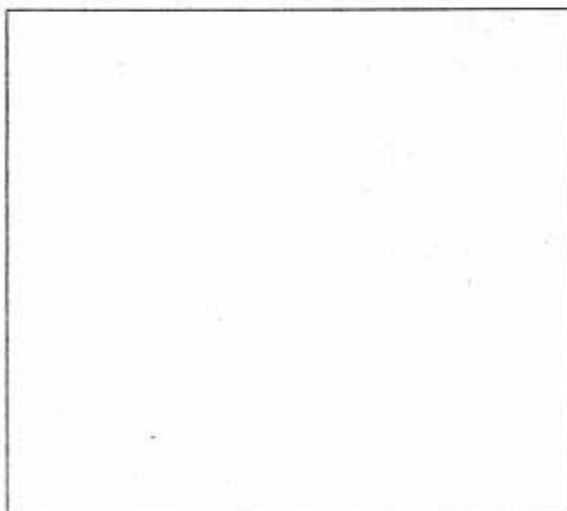
#### \* Bleed the brake.

After having applied the brake for about 10 times carry out the following pressure test.

Using a suitable pressure apparatus (Lukas or similar) with stopcock build up an actuating pressure of 120 bar.

Close the stopcock and pressurize the brake for 5 minutes with this pressure.

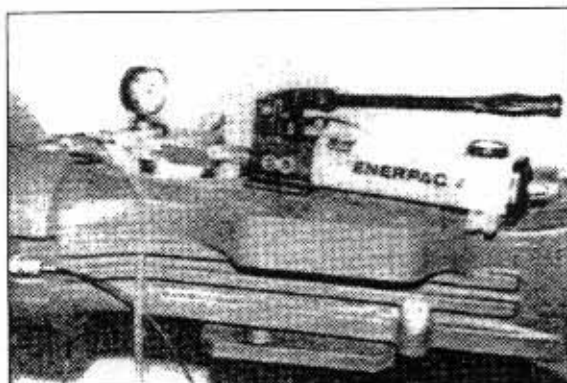
After this time, the pressure may have dropped to 117 bar only.



#### ⊗ Afterwards, build up a pressure of 5 bar and close the stopcock.

Within 5 minutes there may be no pressure break.

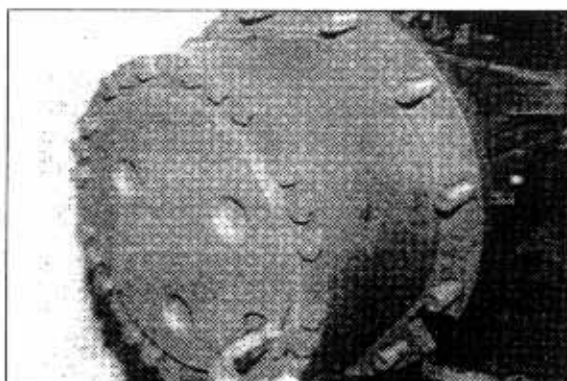
Install bleeder valve.



#### ⊗ Tighten oil drain plug.

• Torque limit : 5.1kgf · m(36.9lbf · ft)

#### \* Before the axle is put into Service, pay attention to the Lubrication Instructions, page3-195.



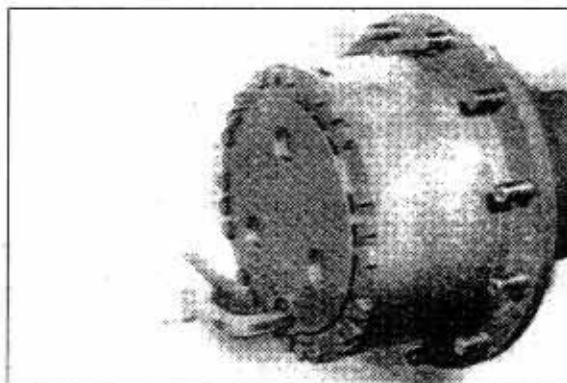
## 2) DIFFERENTIAL CARRIER

(Version with screwed bearing caps)

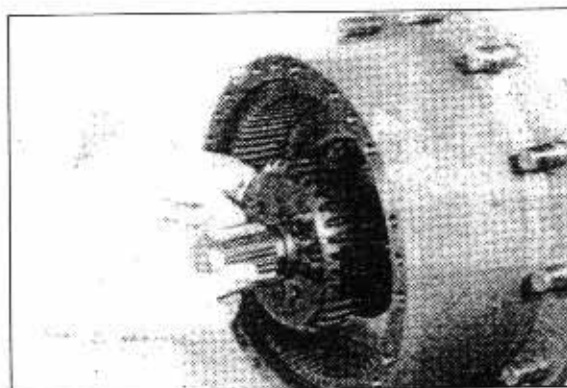
### (1) DISASSEMBLY

Remove the two stub shafts prior to separate the differential carrier from the axle housing, see figure ①~③.

- ① Drain oil from the final drive and the axle housing. Loosen hexagon head screws and separate planetary carrier from the hub, using eye hook.

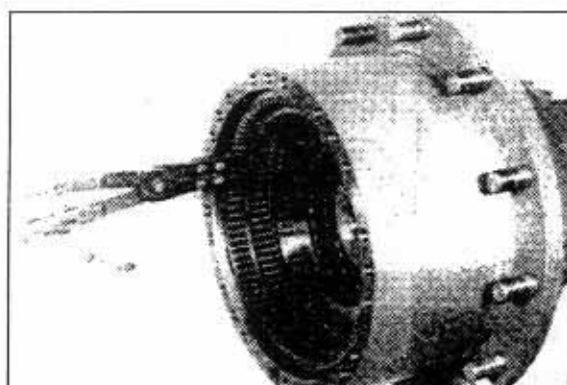


- ② Pull inner plate carrier (Along with sun gear) from the stub shaft.

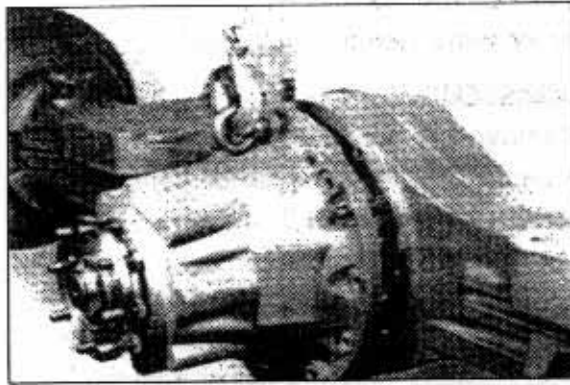


- ③ Pull stub shaft out of the axle housing. Squeeze out circlip and remove the plate pack.

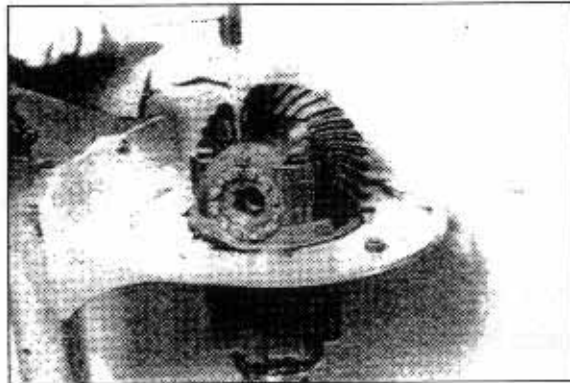
※ This step is necessary to make the later installation of the inner plate carrier possible.



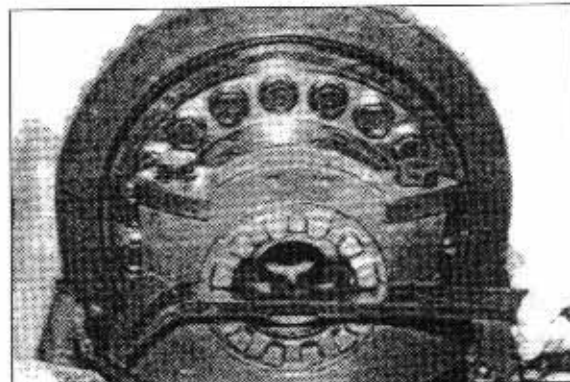
- ④ Loosen hexagon head screws and separate the differential carrier from the axle housing.



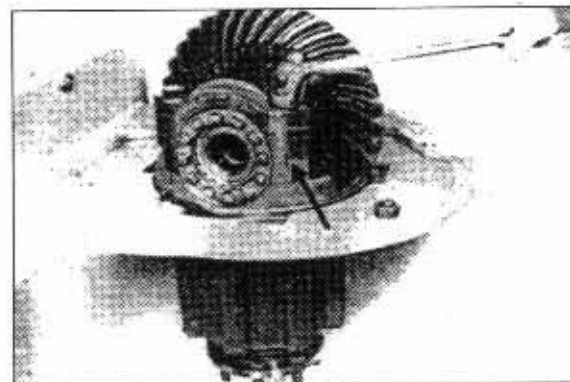
- ⑤ Fasten the differential carrier in the assembly jig.  
Remove lock wire and drive roll pins out.



- ⑥ Loosen adjusting nuts.

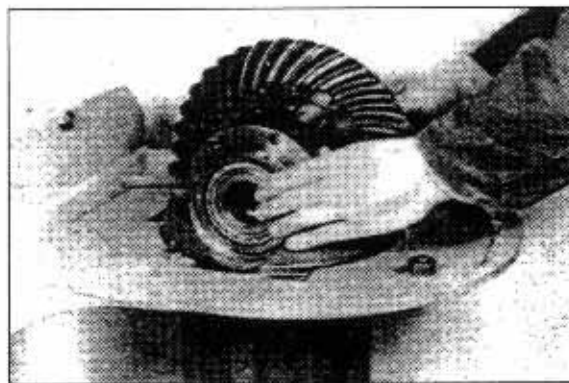


- ⑦ Loosen hexagon head screws and remove the two bearing caps.  
※ Mark bearing caps with housing, see arrow.



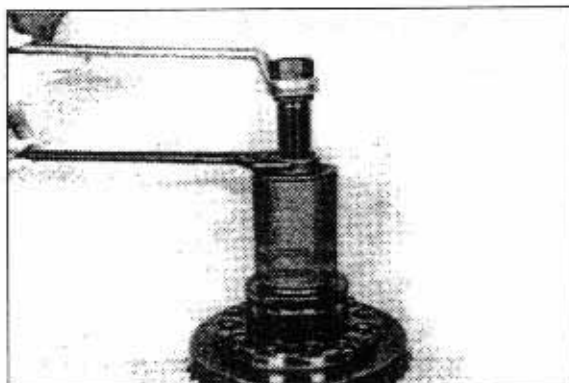


- ⑧ Remove adjusting nuts.  
Remove differential assembly from the axle carrier.

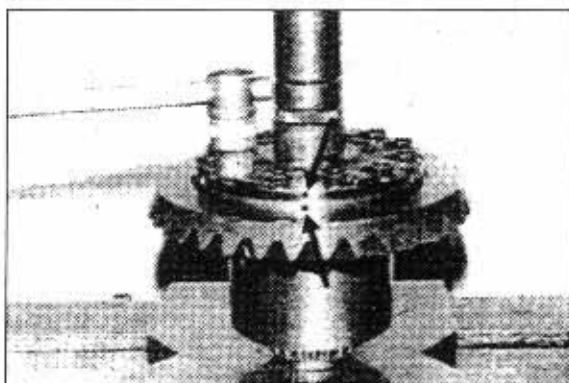


### Differential

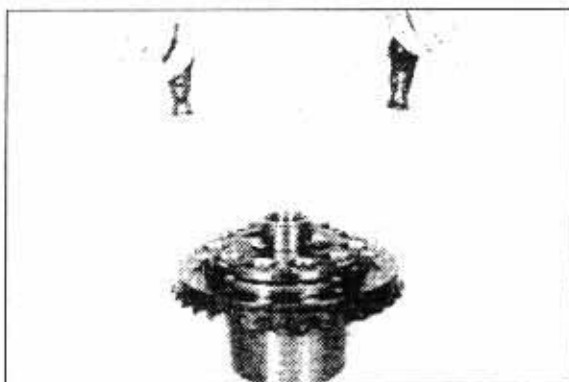
- ① Pull the two bearing inner races of the tapered roller bearing from the differential case halves.



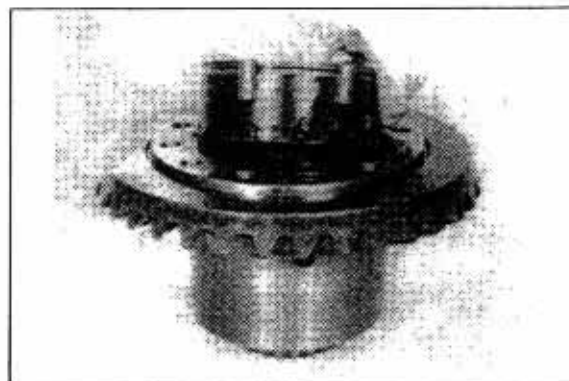
- ② Mark housing cover with differential.  
Clamp the differential case halves, loosen the locking screws.



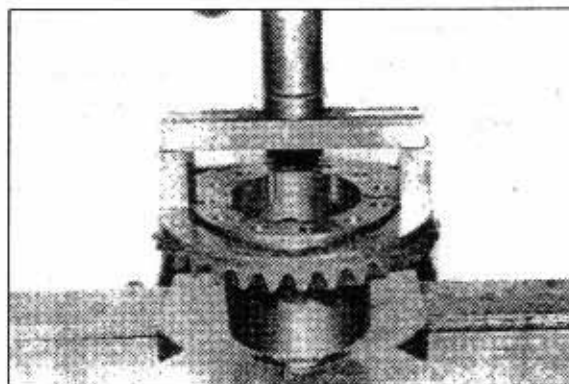
- ③ Back off the cover.  
※ Pay attention to the released thrust washer.



- ④ Take all components of the multi-disk self-locking differential out of the differential case.

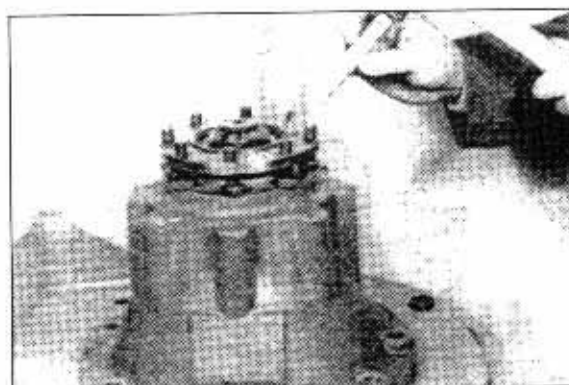


- ⑤ Press crown wheel from the differential case.

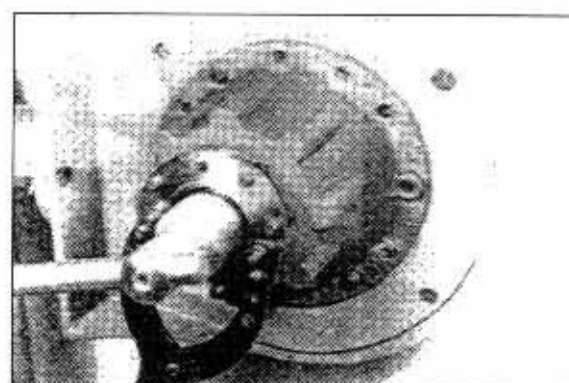


#### **Drive unit**

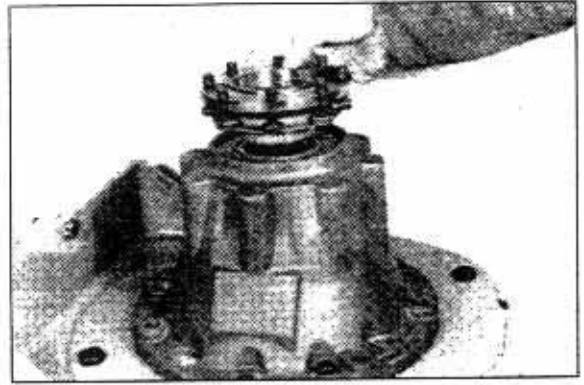
- ① Unlock slotted nut or hexagon head screw(According to the version) and remove lock plate.



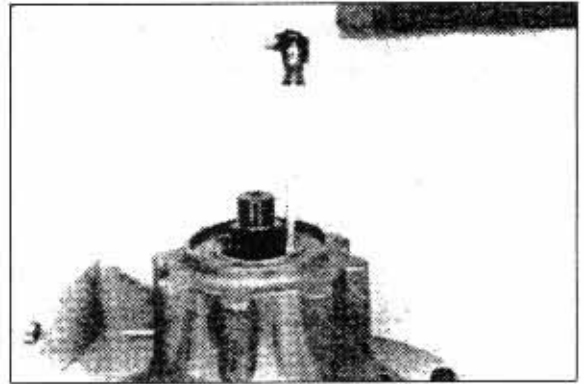
- ② Loosen slotted nut or hexagon nut(According to the version) and remove it along with washer.



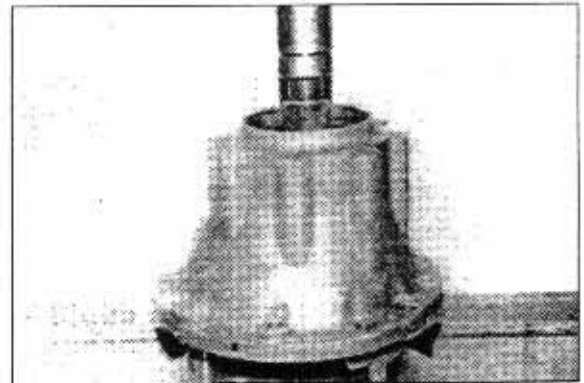
③ Pull off the drive flange.



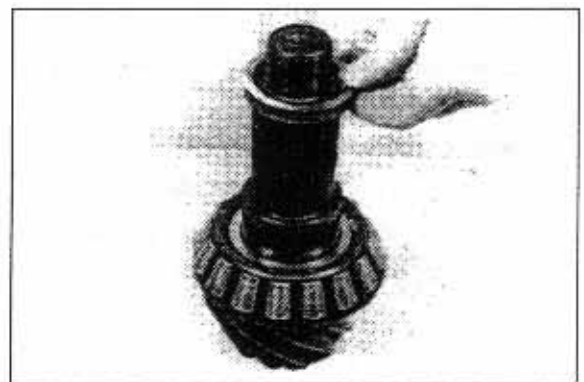
④ Pry out the shaft seal.



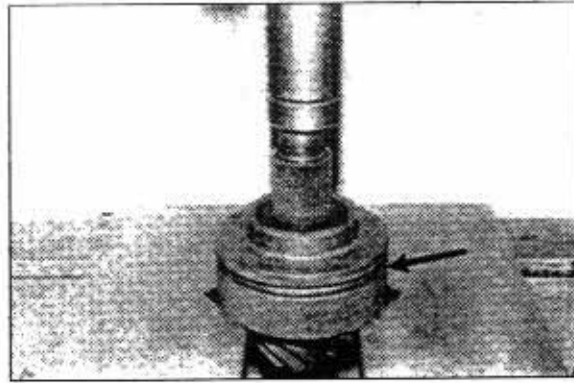
⑤ Press drive pinion out of the axle carrier.  
\* Pay attention to the released tapered roller bearing.



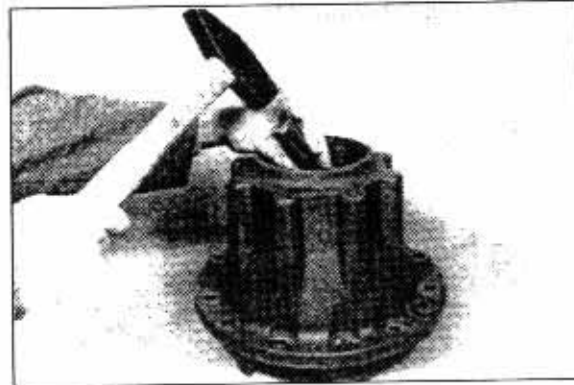
⑥ Remove spacer from the drive pinion end.



- ⑦ Press tapered roller bearing from the drive pinion, using grab sleeve(See arrow.).



- ⑧ If necessary, drive the two bearing outer races out of the axle carrier bores.



## (2) Assembly

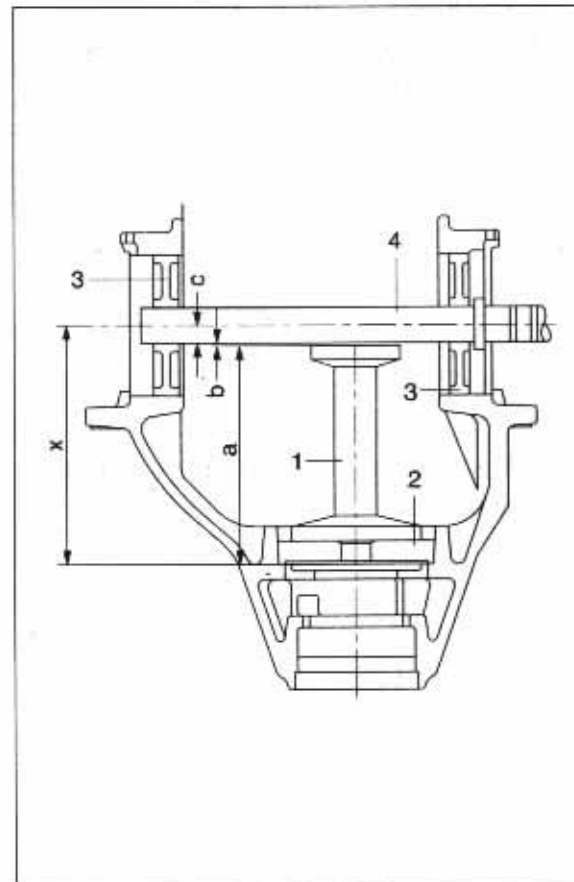
- ※ If crown wheel or drive pinion are damaged, the two parts must be renewed as a set.

If a new complete crown wheel set is installed, pay attention that crown wheel and drive pinion have the same mating numbers.

When replacing a complete crown wheel set or axle carrier, pay attention to the Draft.

### Determine thickness of shim-to obtain a correct contact pattern

- ※ The following measuring operations must be carried out with utmost care. Inexact measurements would cause an incorrect contact pattern and require a renewed disassembly and assembly of the drive pinion as well as the differential(Partial) after the contact pattern has been taken, page3-196.



Install adjusting pieces(3) and fasten the two bearing caps provisionally.  
Install stop washer(2) and measuring pin(1) and introduce measuring shaft(4) (See draft).

**CK-Drive**

- 1 = Measuring pin
- 2 = Stop washer
- 3 = Adjusting piece
- 4 = Measuring shaft

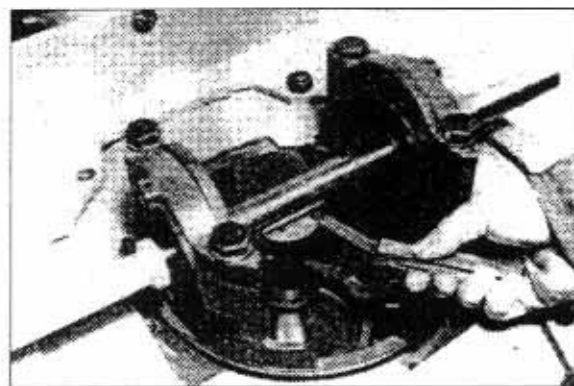


- ① Determine gap(Dimension b) between measuring pin and measuring shaft with feeler gauge.

Dimension b e.g. 0.70mm

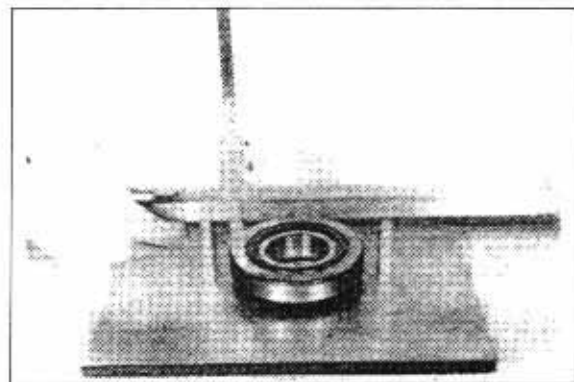
**EXAMPLE I**

Dimension a(=measuring piston)	166.80mm
Dimension b	+0.70mm
Dimension c (1/2 ø measuring shaft)	+15.00mm
gives Dimension X	<u>182.50mm</u>



- ② Measure bearing width.

Bearing width e.g. 33.50mm

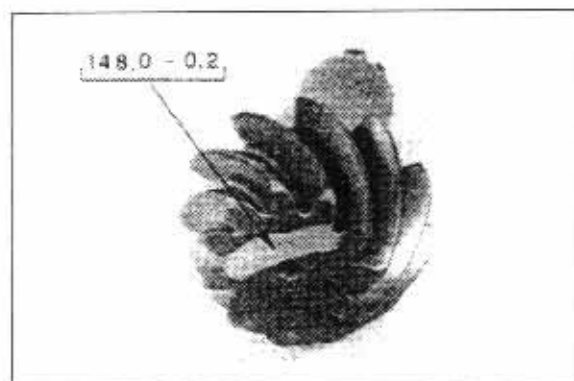


- ③ Read pinion dimension.

Pinion dimension e.g.  $148.0_{-0.2}$  147.80mm

**EXAMPLE I**

Bearing width	33.50mm
Pinion dimension	+147.80mm
gives dimension X1	<u>181.30mm</u>





**EXAMPLE II**

Dimension X 182.50mm

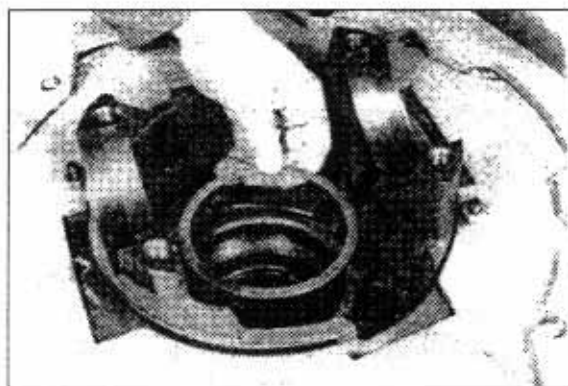
Dimension X1 -181.30mm

Difference = Shim thickness  $s=1.20\text{mm}$

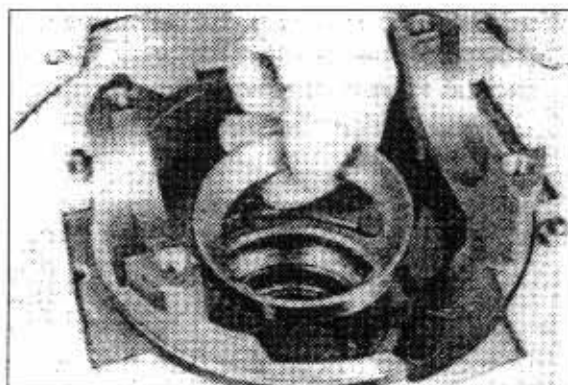
Now, remove bearing caps, shims, measuring shaft and measuring pin again.



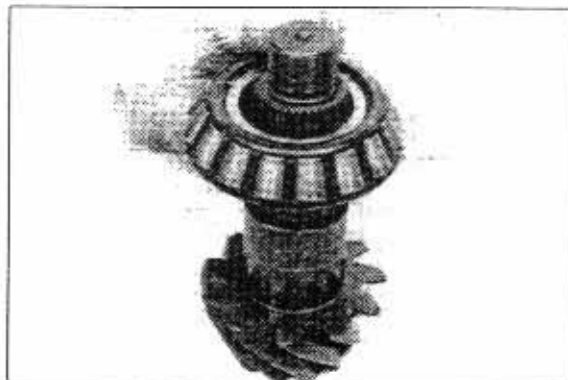
- ④ Lay shim(s = 1.20mm) into the housing bore.



- ⑤ Undercool bearing outer race and press it firmly against shoulder. Install the drive flange side bearing outer race correspondingly.



- ⑥ Heat bearing inner race, guide it over the drive pinion end until contact is obtained.  
\* Pay attention to a correct contact, reset after the cooling.



### Adjust rolling resistance of the drive pinion bearing

- ① Nominal value : DK/CK 0.11~0.23kgf · m  
 HK 0.15~0.31kgf · m  
 LK/RK 0.31~0.46kgf · m

Lay measuring ring over the drive pinion collar.

- ※ Configuration and description of the measuring ring, see below draft.

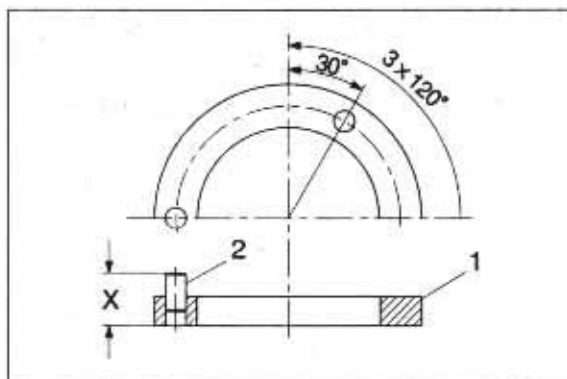


Draft for the determination of the spacer :

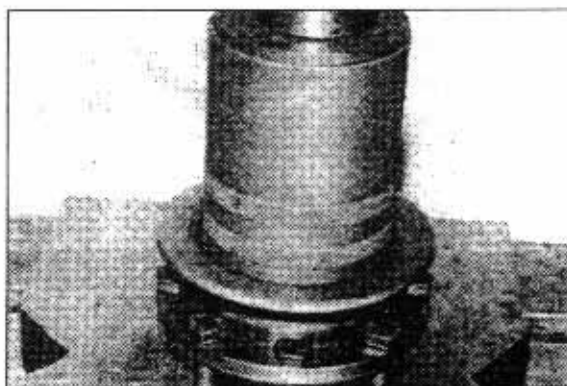
1 = Measuring ring

2 = Roll pin (Set of 3, each spaced for 120°)

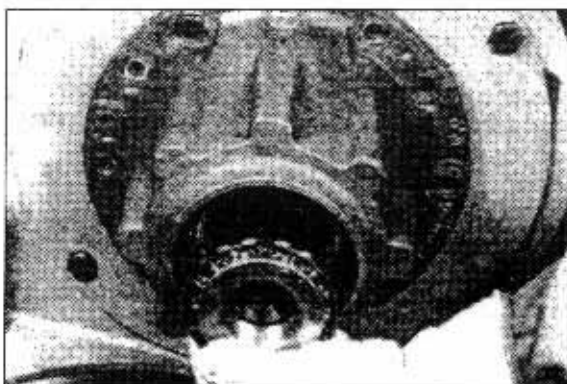
- ※ Dimension X = Thickness of spacer.



- ② If necessary (According to the version), insert hexagon head screws into the drive flange bores and press the dust shield upon the collar of the drive flange.



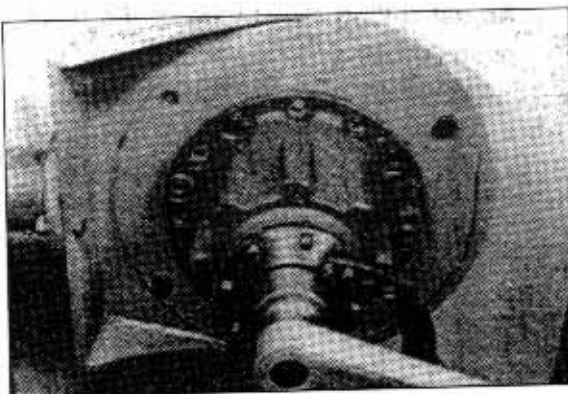
- ③ Insert the drive pinion into the axle carrier and assemble the heated bearing inner race until contact is obtained.



- ④ Guide drive flange over the drive pinion splines.

Apply washer and tighten slotted nut until the required rolling resistance is obtained.

- ※ When tightening, make several full revolutions of the drive pinion in both senses, and check the rolling resistance continuously.



- ⑤ Loosen slotted nut, pull off drive flange and remove the pinion again.

Take off measuring ring and determine dimension X (See draft, page 3-147).

Dimension X e.g.  $s=8.55\text{mm}$

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

Lay spacer(e.g.  $s = 8.55\text{mm}$ ) instead of the measuring ring over the drive pinion end.

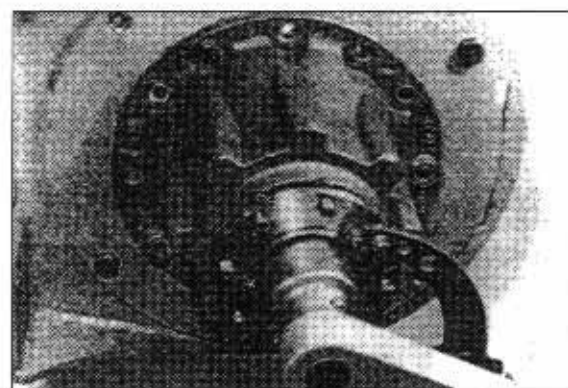
Install drive pinion again.



- ⑥ Replace drive flange, apply washer and tighten slotted nut.

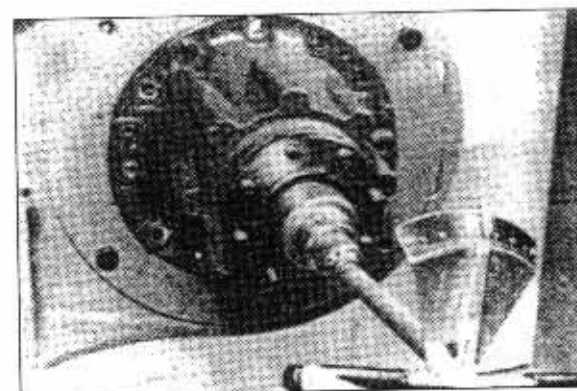
• Torque limit : RK	112kgf · m
LK	122kgf · m
CK	71kgf · m

- ※ When tightening, make several full revolutions of the drive pinion in both senses.



- ⑦ Check rolling resistance.

- ※ If the required rolling resistance is not obtained correct again with one corresponding spacer.

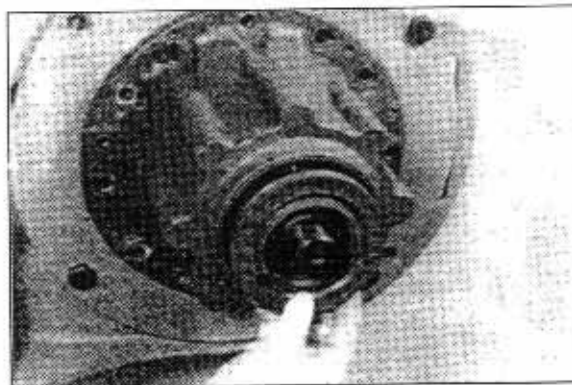


- ⑧ Remove the drive flange and install the shaft seal.

※ Pay attention to the contact.

If the shaft seal outer diameter is rubber-coated, the sealing face must be wetted with spirit.

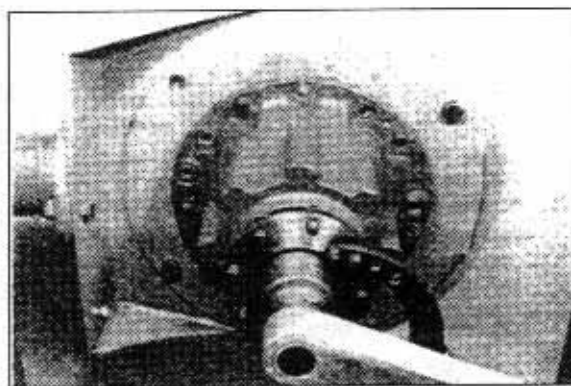
Otherwise use sealing compound Loctite  
Fill cavity between sealing lip and dust lip with grease.



- ⑨ Replace drive flange, assemble washer and tighten slotted nut, respectively hexagon nut(According to the version) finally.

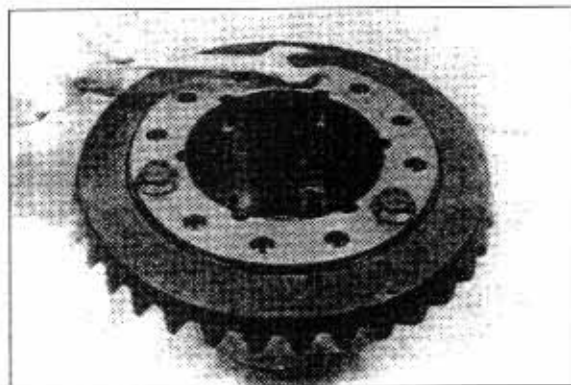
• Torque limit : RK	112kgf · m
LK	122kgf · m
CK	71kgf · m

※ The securing of the slotted nut, respectively hexagon nut(According to the version) is carried out after the contact pattern is taken.



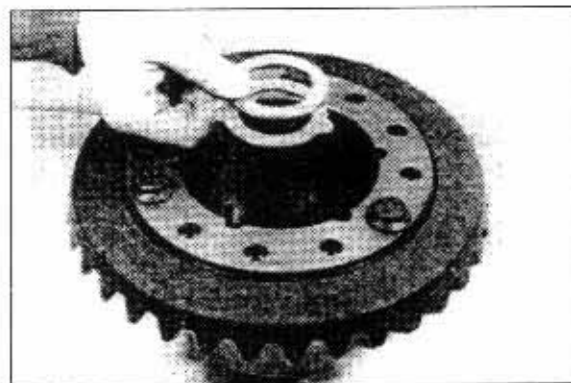
#### Differential

- ① Heat the crown wheel, center and fasten it provisionally.

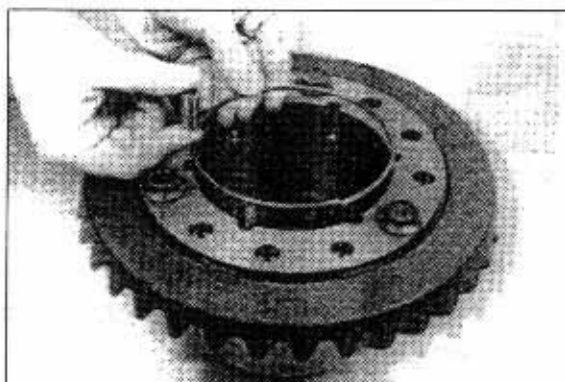


- ② Insert the two thrust washers into the differential case half.

※ Mount the brass washer on top with the lubricating groove facing the side gear.



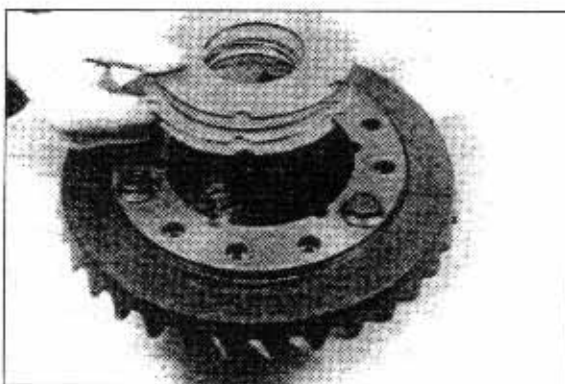
- ③ Insert circlip and install drive pin.



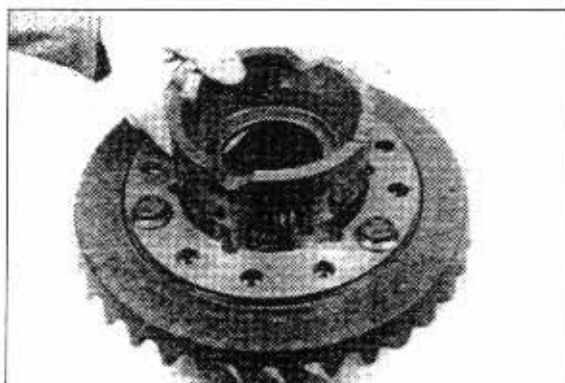
- ④ Assemble alternating outer and inner plates, starting with one outer plate.

※ Number and installation position of the outer and inner plates, see corresponding spare parts list (According to the version).

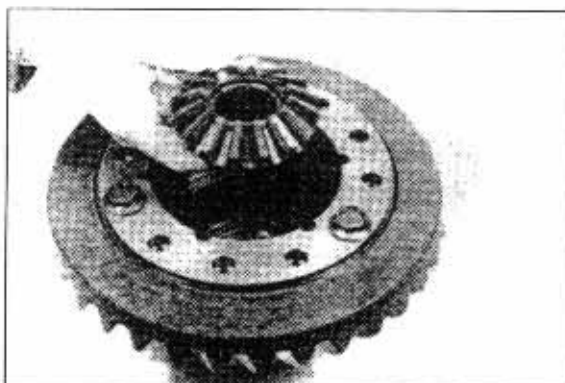
The total height(Thickness) of the plate pack must be equal on both differential sides. Plate thickness of outer plates may be different.



- ⑤ Mount pressure ring.

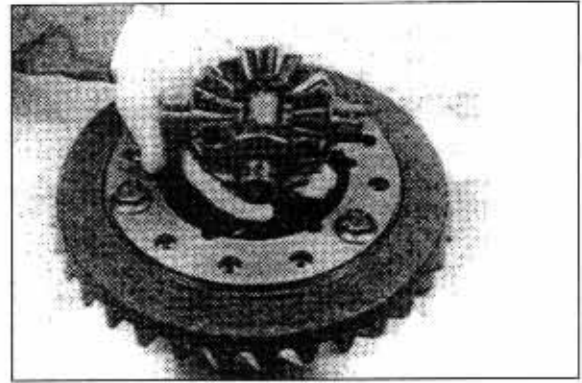


- ⑥ Insert side gear and assemble inner plates at the same time.

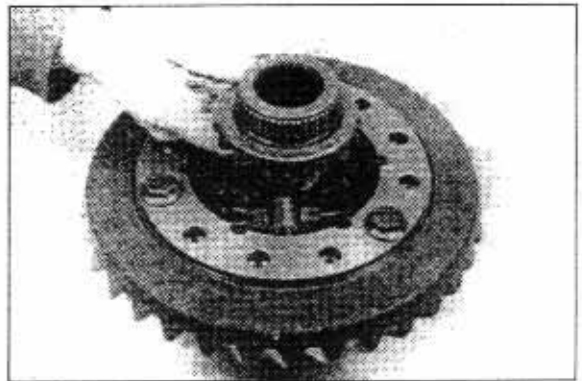




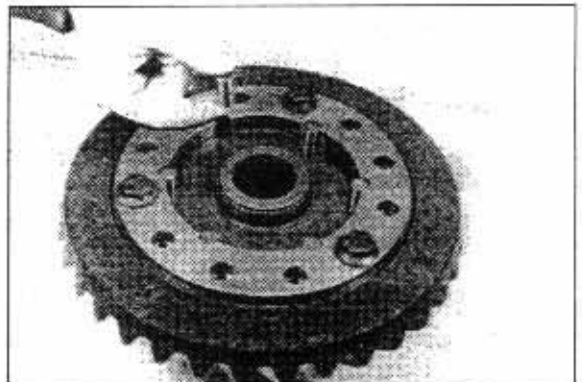
- ⑦ Insert the complete differential spider.



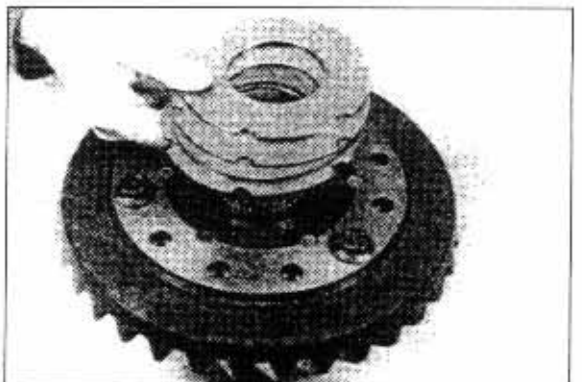
- ⑧ Replace the second side gear.



- ⑨ Install the second pressure ring and insert all drive pins.  
\* Pay attention to the radial installation position of the pressure ring.



- ⑩ Assemble alternating inner and outer plates, starting with one inner plate.  
\* Number and installation position of the inner and outer plates, see corresponding list of spare parts (According to the version).

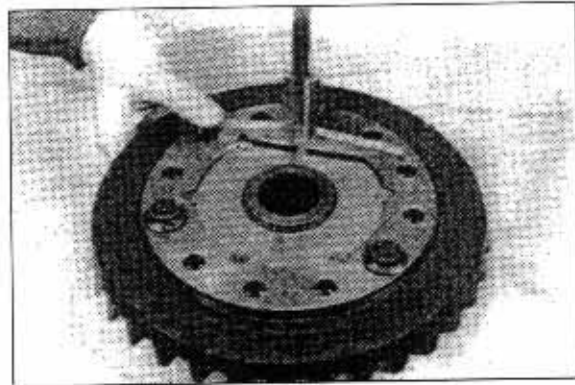


### Determine plate clearance

⑪ Differential case :

Measure dimension A from the flange-mounted surface to the outer plate.

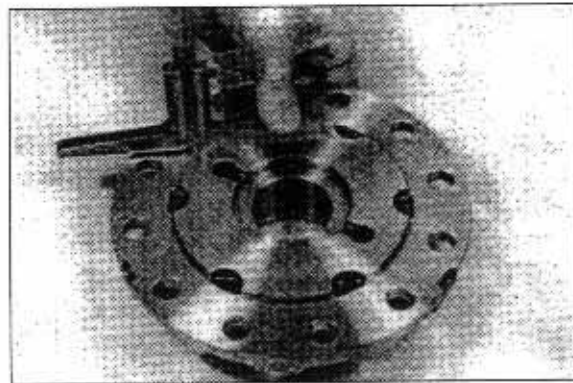
Dimension A e.g. 3.40mm



⑫ Housing cover :

Determine dimension B from the contact face(Outer plate) to the flange-mounted surface.

Dimension B e.g. 3.10mm



⑬ **EXAMPLE**

Dimension A 3.40mm

Dimension B -3.10mm

Difference = Plate clearance 0.30mm

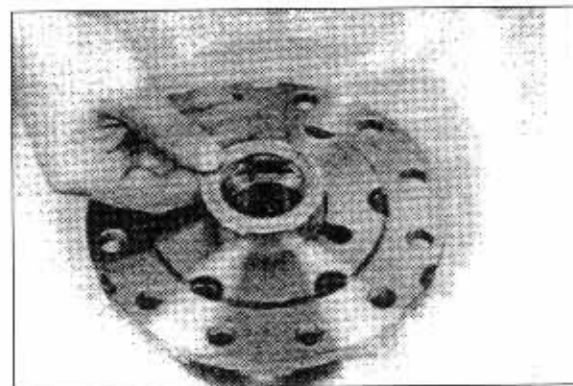
- \* The prescribed end play(=plate clearance) is 0.2~0.8mm, whilst the lower value should be found.

The end play is corrected by installing outer plates of corresponding thickness, whilst the plate thickness must be equal on both differential sides.



⑭ Make the two thrust washers adhere with grease in the housing cover.

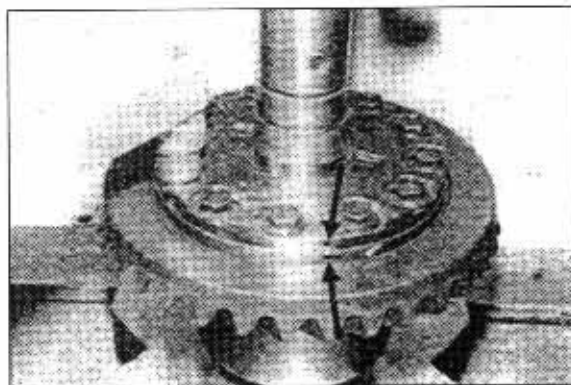
- \* Mount the brass washer on top with the lubricating groove facing the side gear.



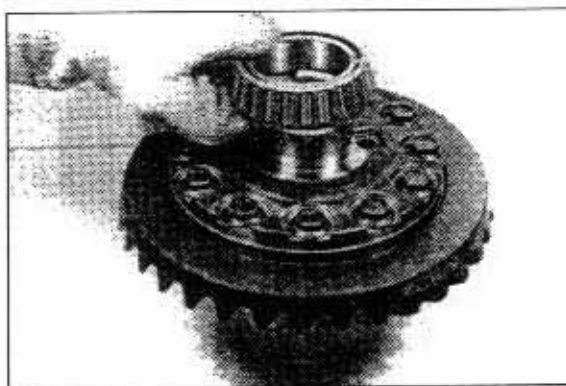
⑮ Fasten the housing cover by means of locking screw.

※ Pay attention to the installation position - see markings.

Only single use of the locking screws is admitted.

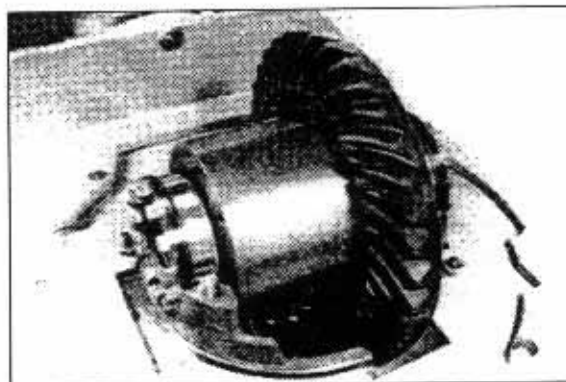


⑯ Heat the two bearing inner races and place them against shoulder.



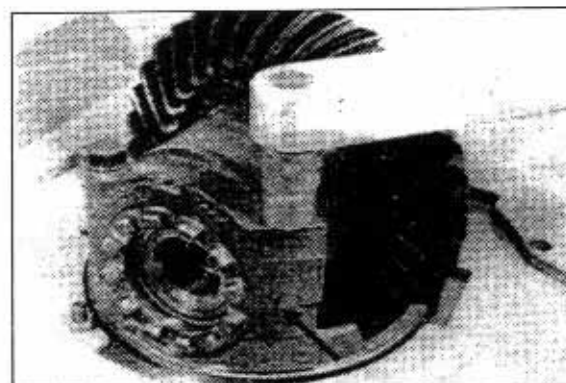
⑰ Install the two bearing outer races and insert the differential assembly into the housing.

Now, fix the differential by means of the adjusting nuts.



⑱ Install the two bearing caps and tighten them by means of hexagon head screw.

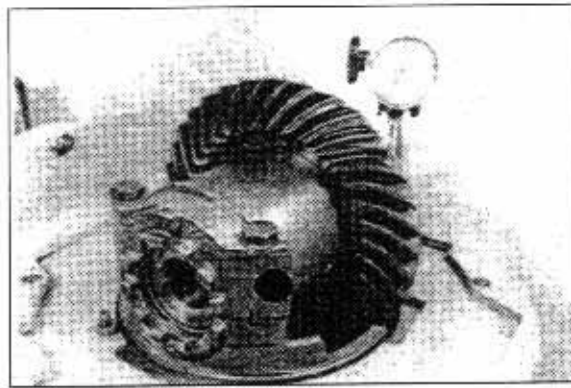
※ Pay attention to the marking(Arrow).



### Adjustment of the bearing preload and the backlash

- ① Apply dial indicator right angled on the outer diameter of the tooth flank/crown wheel.

Adjust the adjusting nut on the crown wheel side until the required backlash-see value engraved on the crown wheel outer diameter- is obtained.



- ② Screw in the adjusting nut (Opposite the crown wheel side) until the differential bearing is free of play.

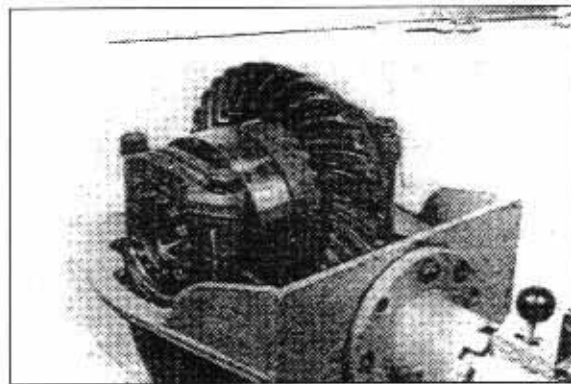
Now, tighten adjusting nut further for 2 notches to obtain the required bearing preload of the differential bearing  $0.3-0.4 \text{ kgf} \cdot \text{m}$ .

Check backlash again and correct if necessary.

- \* At this step make several full revolutions of the differential.

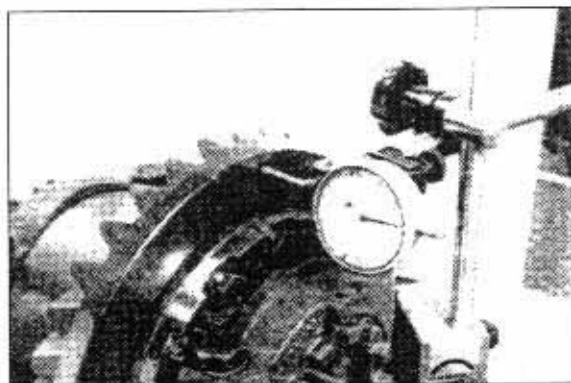
Determine yoke width ;

e.g. CK  $258 \pm 0.1 \text{ mm}$



- ③ Apply dial indicator on the plane face/crown wheel, make at least one revolution of the crown wheel and record the run-out.

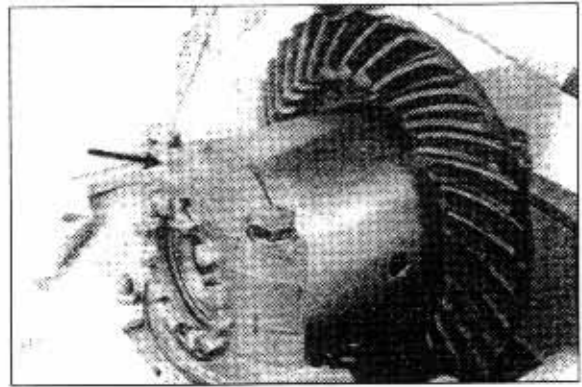
Admitted run-out maximum  $0.08 \text{ mm}$ .



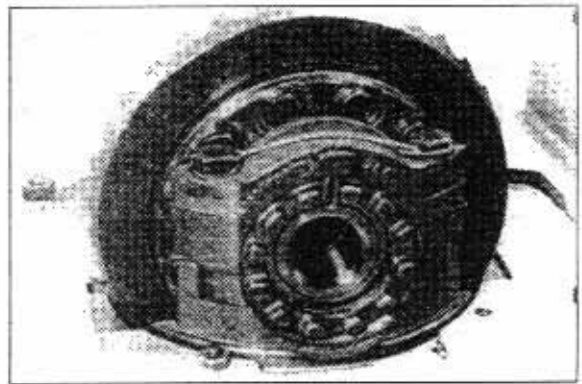
- ④ Check contact pattern on the crown wheel : Cover some tooth flanks of the crown wheel with gear marking compound. Roll the crown wheel over the drive pinion to and fro. Take the contact pattern and compare it with Page "Examples of contact patterns", page 3-196.



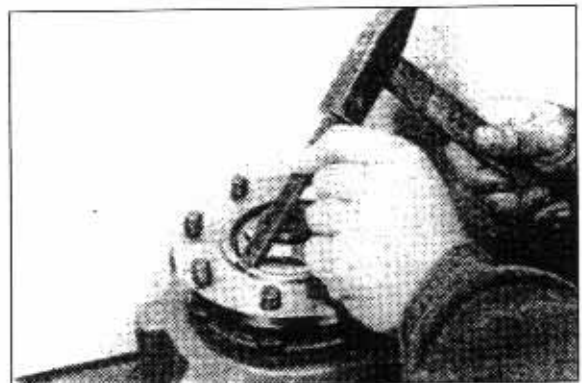
- ②③ In case of a greater contact pattern deviation a spacing error has been made during the assembly of the drive pinion which must be absolutely corrected.  
Fix the two adjusting nuts by means of toll pins, respectively cotter pins (According to the version).



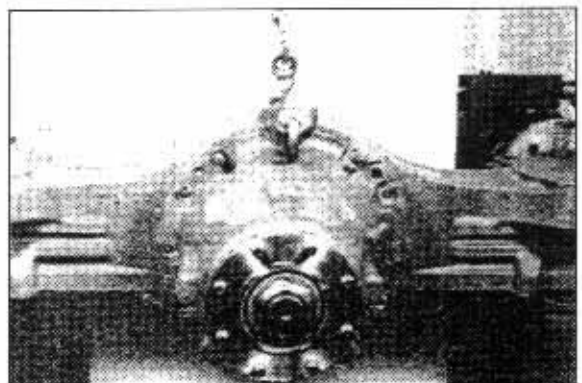
- ②④ Secure hexagon head screws of the bearing cap fastening against getting loose by means of lock wire(  $\varnothing$  1.6mm).



- ②⑤ Tilt differential carrier.  
Insert lock plate firmly against shoulder and caulk it on the drive flange, using a suitable tool.



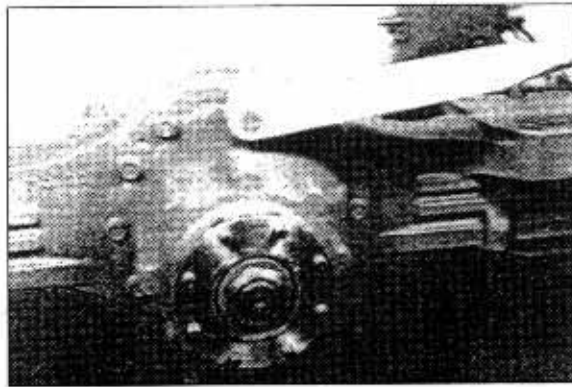
- ②⑥ Cover flange-mounted surface with sealing compound Loctite.  
Screw in two adjusting screws and place the differential carrier against the axle housing until contact is obtained.





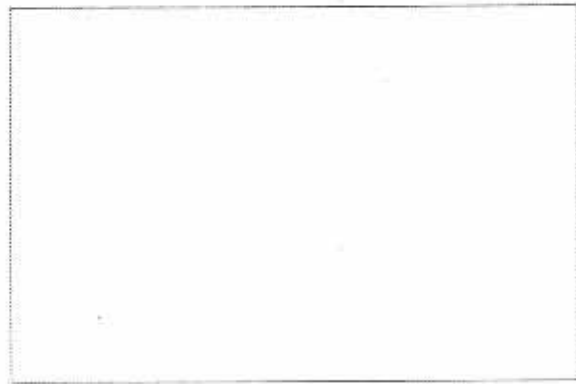
⑦ Fasten differential carrier on the axle housing by means of hexagon head screws.

※ Cover hexagon head screws with sealing compound Loctite.



※ Now, install the stub shafts again and complete the final drive.

Before the axle is put into service, pay attention to the lubrication instruction, page 3-195.



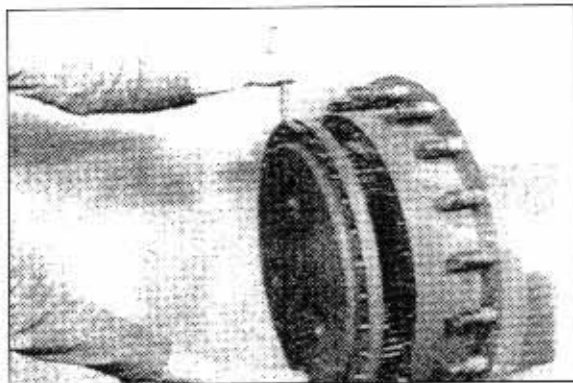
### 3) DIFFERENTIAL CARRIER

(Version with cast-on bearing caps)

#### (1) DISASSEMBLY

- ※ Remove the two stub shafts prior to separate the differential carrier from the axle housing, see figure①~④.

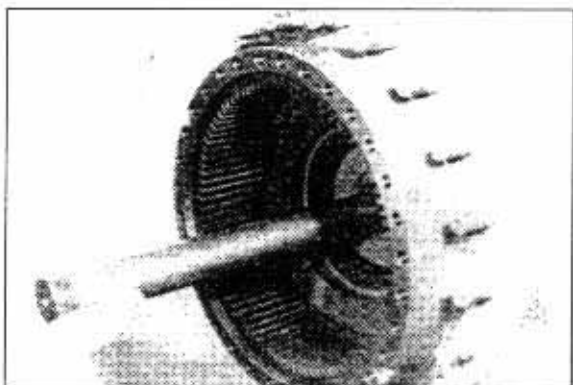
- ① Drain oil from the final drive and the axle housing. Loosen hexagon head screws and separate planetary carrier from the hub, using eye bolt.



- ② Pull inner plate carrier (Along with sun gear) from the stub shaft.

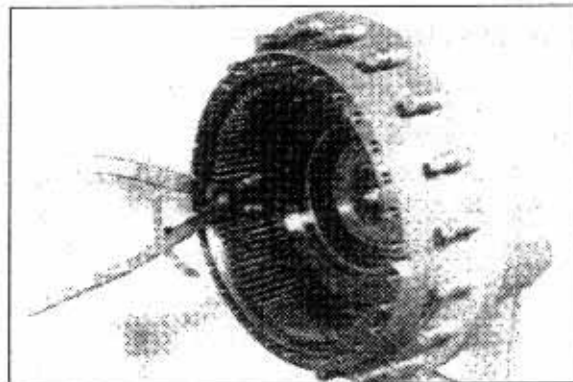


- ③ Pull stub shaft out of the axle housing.

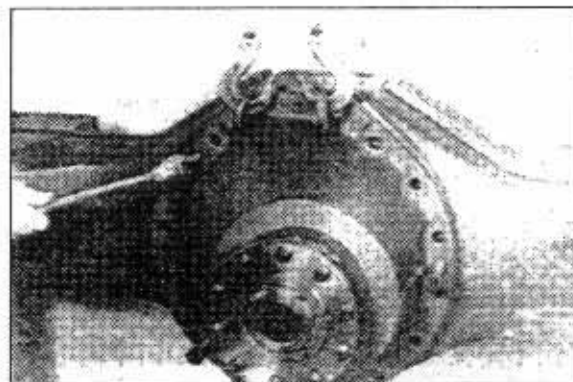


- ④ Squeeze out circlip and remove plate pack.

\* This step is necessary to allow the later installation of the inner plate carrier.

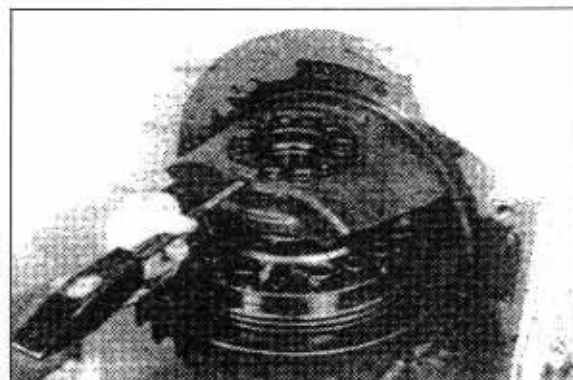


- ⑤ Loosen hexagon head screws and separate the differential carrier from the axle housing, using back-off screws.

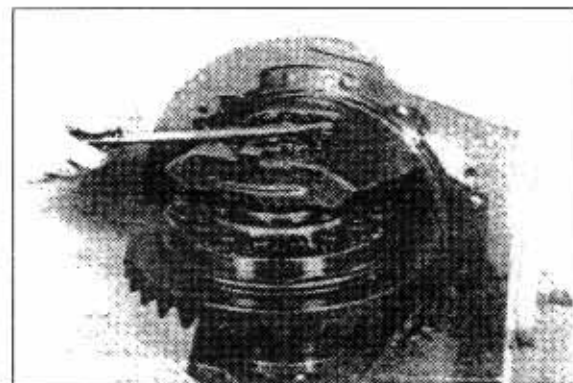


#### **Differential**

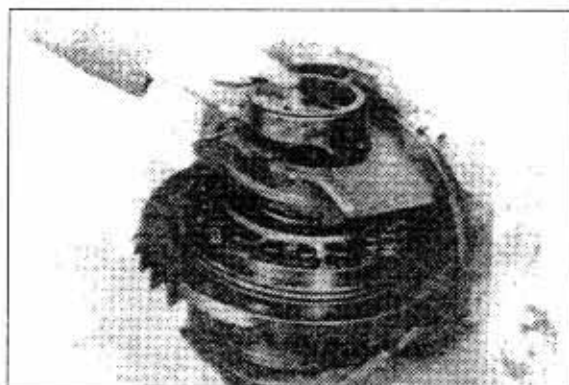
- ① Fasten the differential carrier in the assembly jig.  
Drive out the roll pin on the crown wheel side.



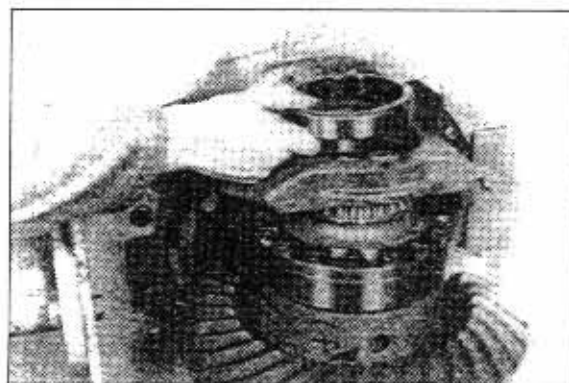
- ② Loosen and remove adjusting nut.



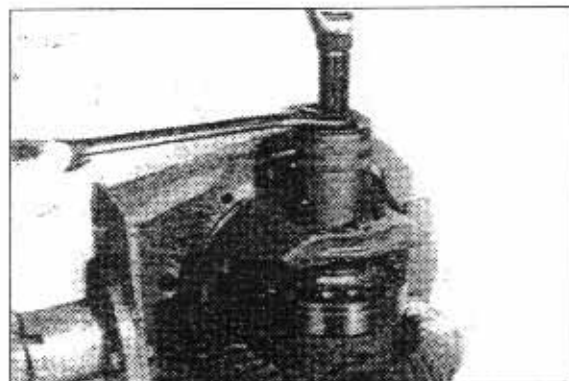
- ③ Lift differential and remove bearing outer race.



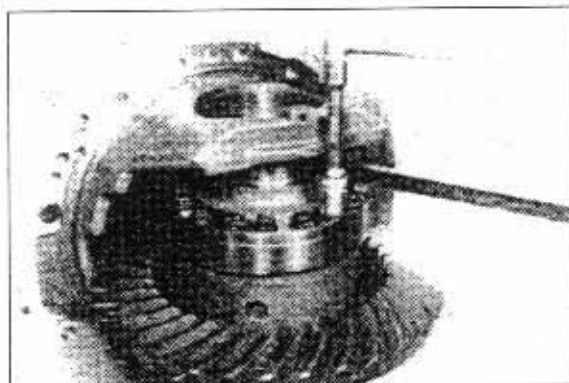
- ④ Tilt axle carrier 180°.  
Drive out roll pin (Opposite the crown wheel side), remove adjusting nut and bearing outer race (See figure).



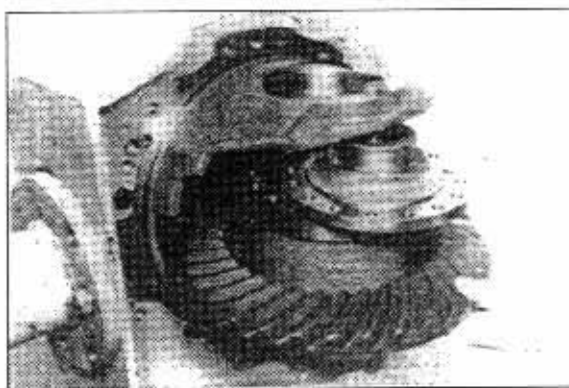
- ⑤ Pull off bearing inner race from the housing cover, respectively differential case.



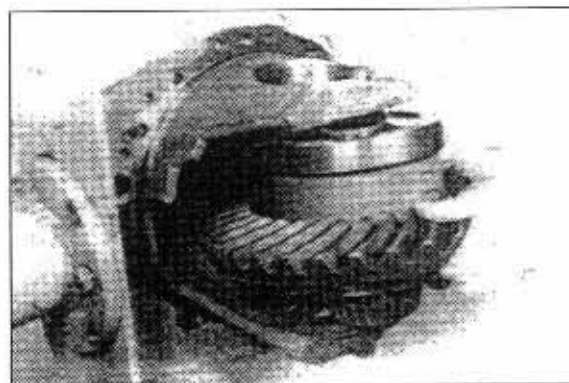
- ⑥ Mark housing cover with differential case.  
Loosen locking screws.



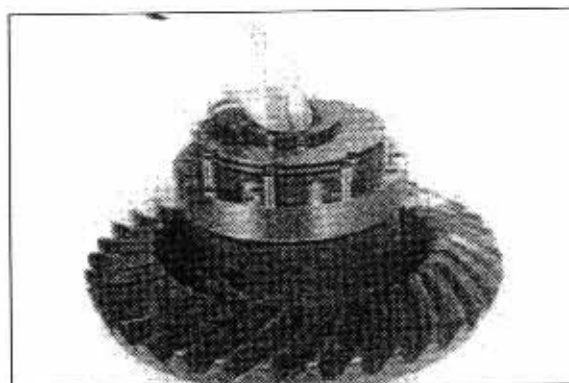
- ⑦ Separate housing cover from differential case and pull it out of the axle carrier.



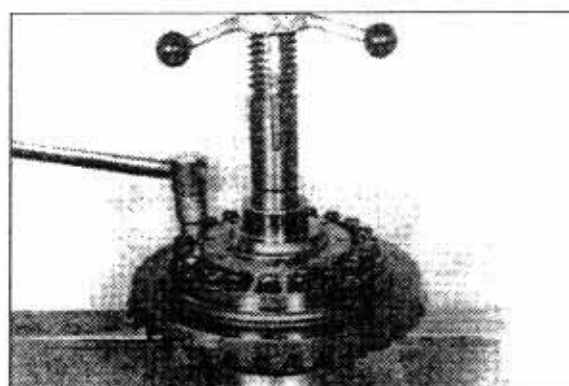
- ⑧ Lift differential carrier out of the axle carrier.



- ⑨ Take all components of the multi-disk self-locking differential out of the differential case.



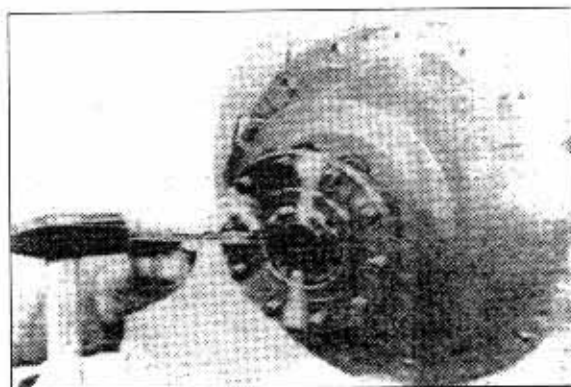
- ⑩ Clamp the differential housing.  
Loosen locking screws and separate the crown wheel from the differential case.



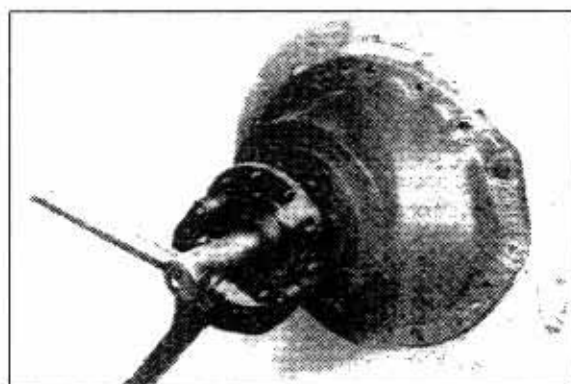


### Drive unit

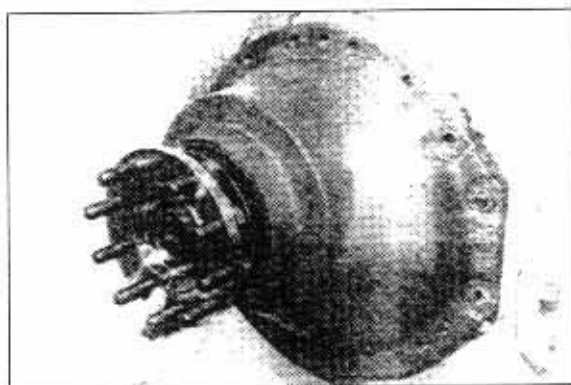
- ① Unlock slotted nut or hexagon nut (According to the version) and remove lock plate.



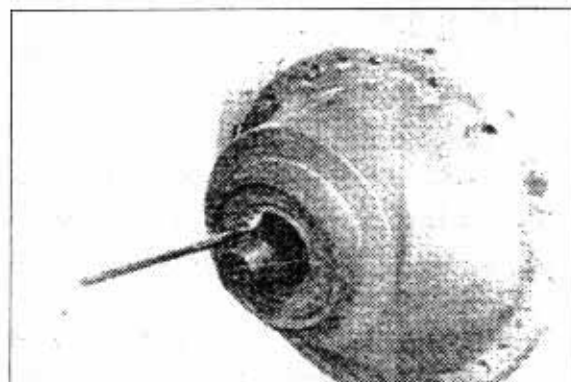
- ② Loosen slotted nut or hexagon nut (According to the version) and remove it along with washer.



- ③ Pull off drive flange.



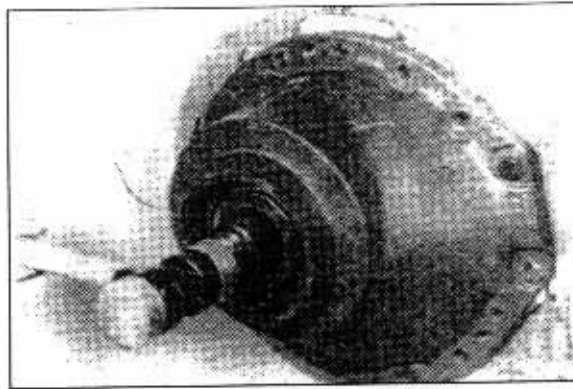
- ④ Pry out shaft seal.



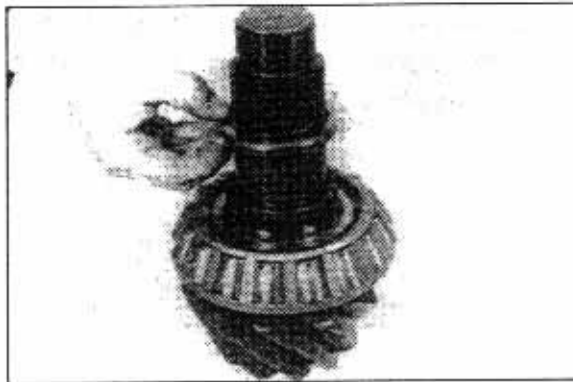
- ⑤ Drive the drive pinion out of the axle carrier.

※ Pay attention to the released tapered roller bearing.

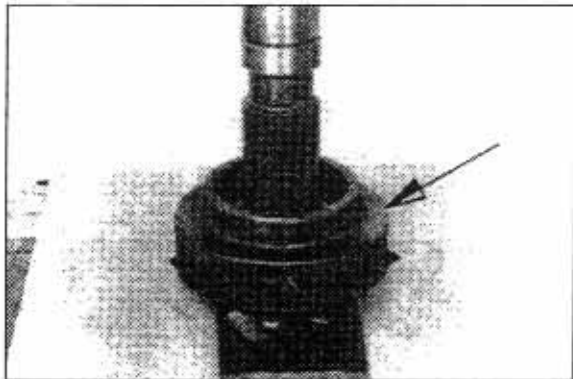
If necessary, drive the two bearing outer races out of the axle carrier bores.



- ⑥ Pull spacer from the drive pinion end.



- ⑦ Press tapered roller bearing from drive pinion -using grab sleeve, see arrow.

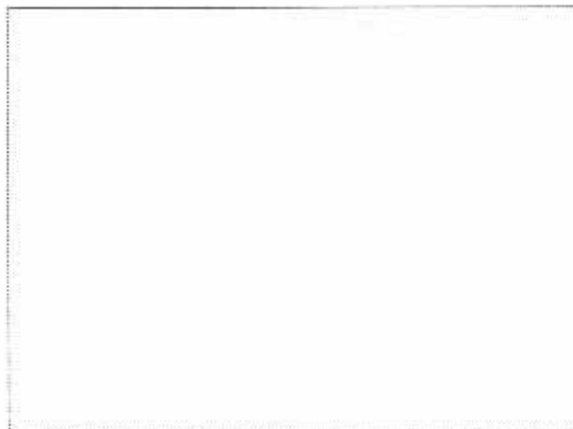


## (2) ASSEMBLY

※ If crown wheel or drive pinion are damaged, the two parts must be renewed as a set.

If a new complete crown wheel set is installed, pay attention that crown wheel and drive pinion have the same mating numbers.

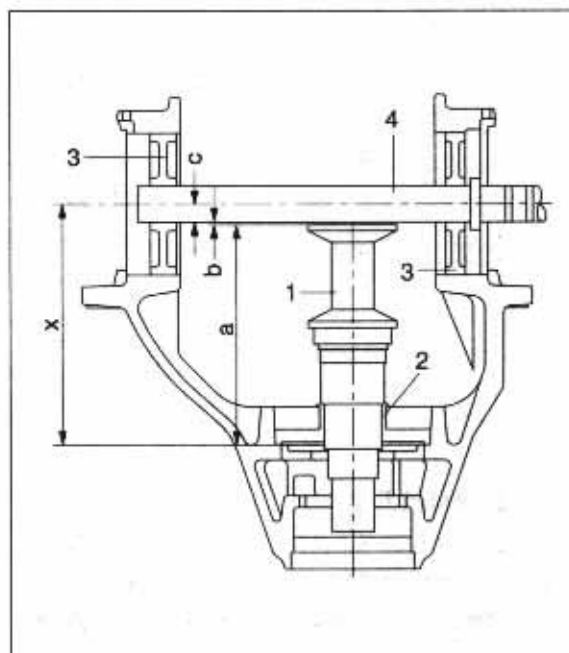
When replacing a complete crown wheel set or axle carrier, pay attention to the Draft.



**Determine thickness of shim-to obtain a correct contact pattern**

- ※ The following measuring operations must be carried out with utmost care. Inexact measurements would cause an incorrect contact pattern and require a renewed disassembly and assembly of the drive pinion as well as the differential(Partial) after the contact pattern has been take, page 3-196.

Install adjusting pieces(3) and fasten the two bearing caps provisionally. Install thrust washer(2) and measuring pin(1) and introduce measuring shaft(4) (See draft).



- ① Determine gap(Dimension b) between measuring pin and measuring shaft with feeler gauge.

Dimension b e.g. 0.70mm

**EXAMPLE I**

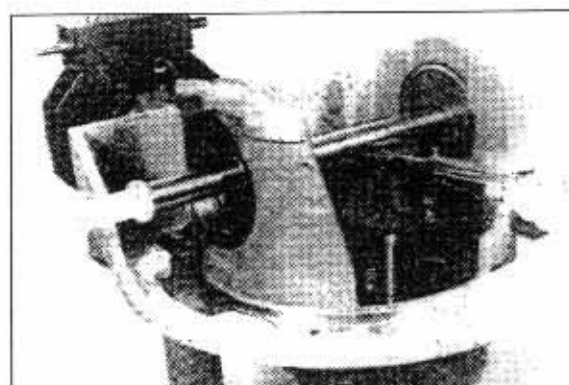
Dimension a(=measuring pin) 226.00mm

Dimension b +0.70mm

Dimension c (1/2 ø measuring shaft)

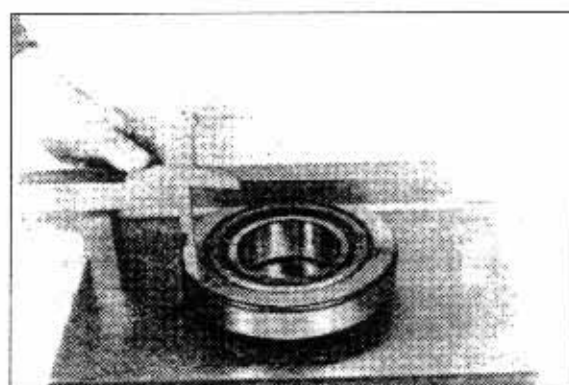
+15.00mm

gives Dimension X 241.70mm



- ② Measure bearing width.

Bearing width e.g. 42.45mm

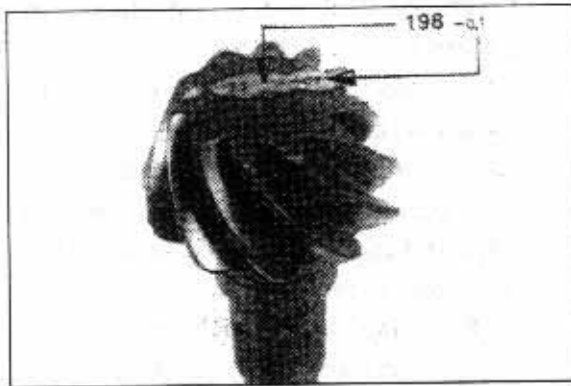


- ③ Read pinion dimension.

Pinion dimension e.g.  $198_{-0.1}$  197.90mm

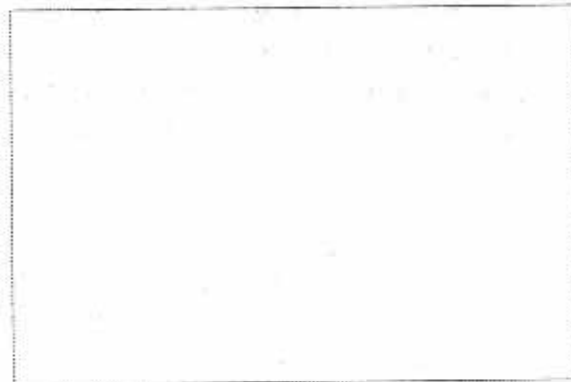
**EXAMPLE I**

Bearing width	42.45mm
Pinion dimension	+197.90mm
gives dimension X1	240.35mm

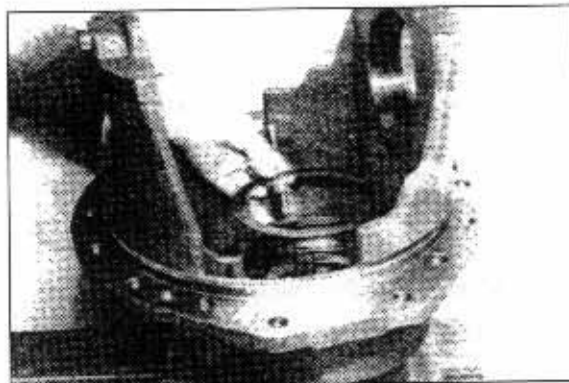


**EXAMPLE II**

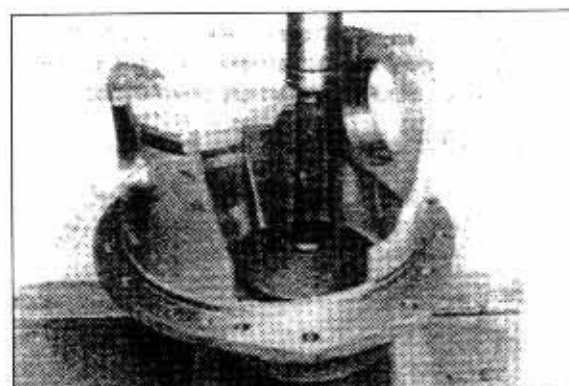
Dimension X	241.70mm
Dimension X1	-240.35mm
Difference = Shim thickness	s = 1.35mm



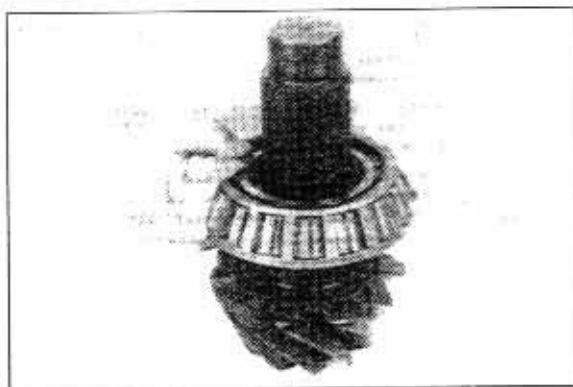
- ④ Lay shim (According to the example  $s = 1.35\text{mm}$ ) into the housing bore.



- ⑤ Undercool bearing outer race and press it firmly against shoulder. Install the drive flange side bearing outer race correspondingly.



- ⑥ Heat bearing inner race, guide it over the drive pinion end until contact is obtained.

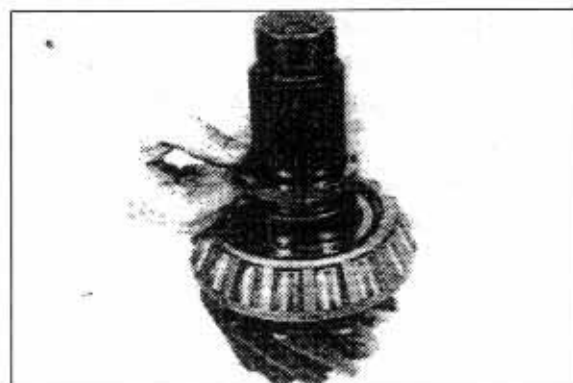


**Adjust rolling resistance of the drive pinion bearing**

- ⑦ Nominal value : DK/CK 0.11~0.23kgf · m  
HK 0.15~0.31kgf · m  
LK/RK 0.31~0.46kgf · m

Lay measuring ring over the drive pinion collar.

- ※ Configuration and description of the measuring ring, see below draft.

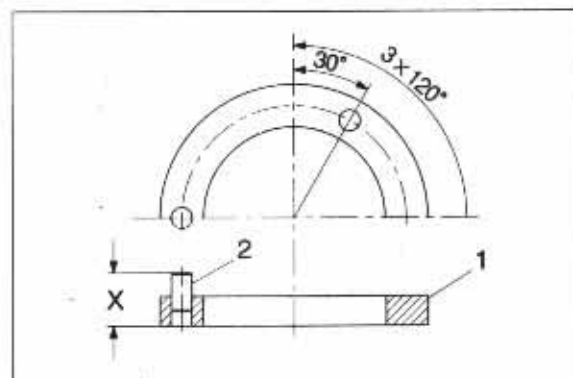


Draft for the determination of the spacer :

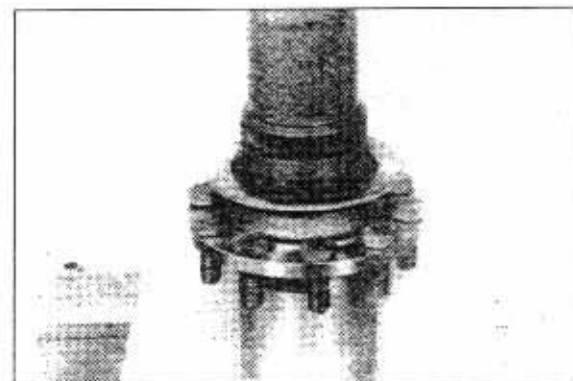
1 = Measuring ring(S)

2 = Roll pin(Set of 3, each spaced for 120°)

- ※ Dimension X = Thickness of spacer.

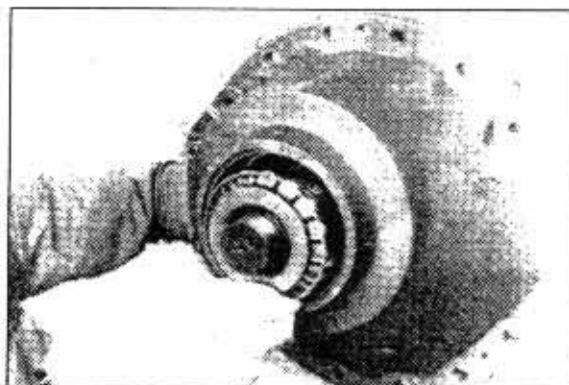


- ⑧ If necessary(According to the version), insert hexagon head screws into the drive flange bores and press the dust shield upon the collar of the drive flange.

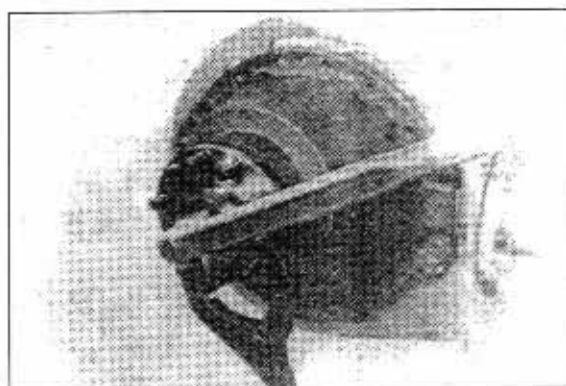




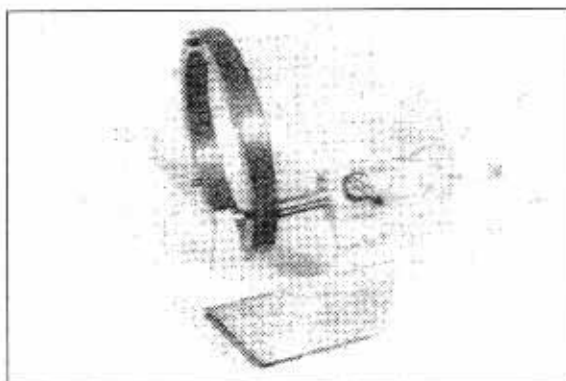
- ⑨ Insert the drive pinion into the axle carrier and assemble the heated bearing inner race until contact is obtained.



- ⑩ Apply washer and tighten slotted nut until the required rolling resistance is obtained.  
 ※ When tightening, make several full revolutions of the drive pinion in both senses, and check the rolling resistance continuously.



- ⑪ Loosen slotted nut, tighten drive flange and remove the pinion again.  
 Take off measuring ring and determine dimension X (See draft, page 3-165).  
 Dimension X e.g.  $s = 7.79\text{mm}$   
 ※ Dimension X corresponds to the thickness of the spacer to be installed.  
 Lay spacer (e.g.  $s = 7.79\text{mm}$ ) instead of the measuring ring over the drive pinion end. Install drive pinion again.

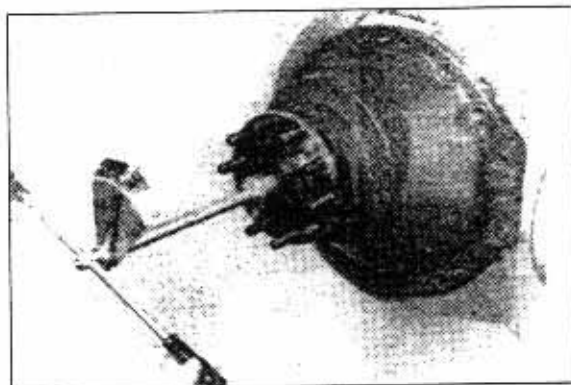


- ⑫ Replace drive flange, apply washer and tighten slotted nut.  
 • Torque limit : RK 112kgf · m  
                   HK/LK 122kgf · m  
                   DK/CK 71kgf · m  
 ※ When tightening, make several full revolutions of the drive pinion in both senses.



⑬ Check rolling resistance

- ※ If the required rolling resistance is not obtained correct again with one corresponding spacer.



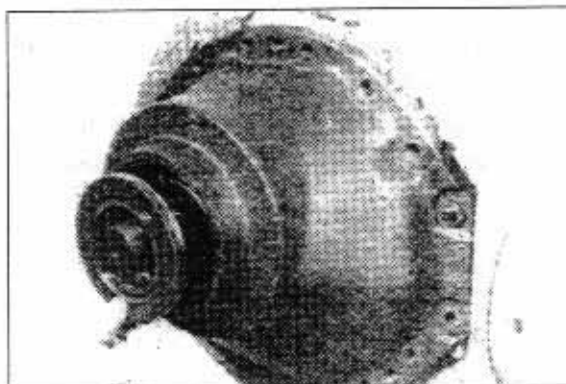
⑭ Install shaft seal.

If the outer diameter of the shaft seal is rubber-coated, wet the sealing lip with spirit. Otherwise use the sealing compound Loctite. Fill cavity between sealing lip and dust lip with grease.

Without figure.

Place dust shield over the axle carrier collar (  $\varnothing$  160mm) until contact is obtained.

- ※ For version with additional dust shield only.

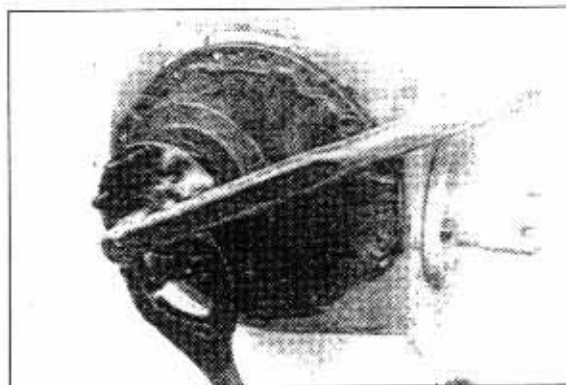


⑮ Replace drive flange.

Assemble washer and tighten slotted nut, respectively hexagon nut(According to the version) finally.

• Torque limit : RK	112kgf · m
HK/LK	122kgf · m
DK/CK	71kgf · m

- ※ The securing of the slotted nut, respectively hexagon nut(According to the version) is carried out after the contact pattern is taken.



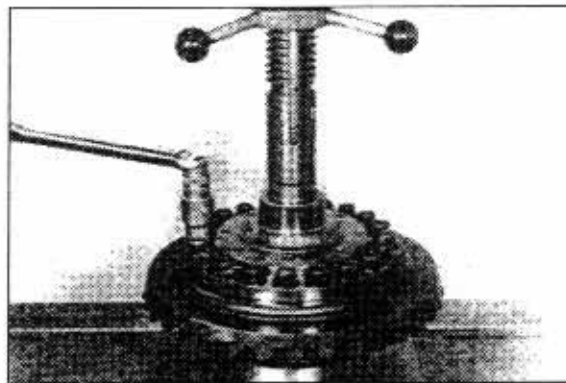
**Differential**

- ① Heat the crown wheel and place it against the differential case half until contact is obtained.

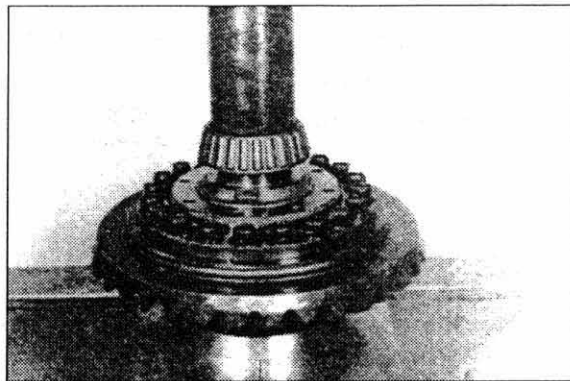
Clamp differential case by means of press.

Tighten locking screws.

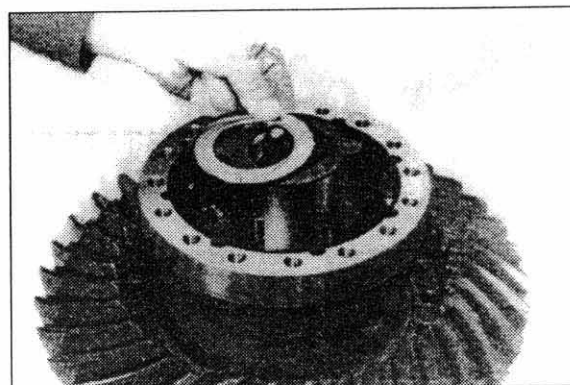
- ※ Only single use of the locking screws is admitted.



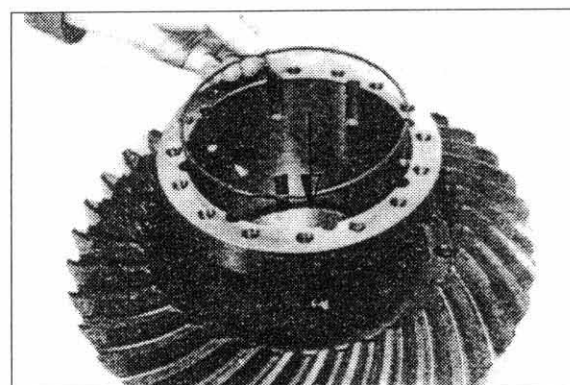
- ② Press bearing inner race firmly against shoulder.



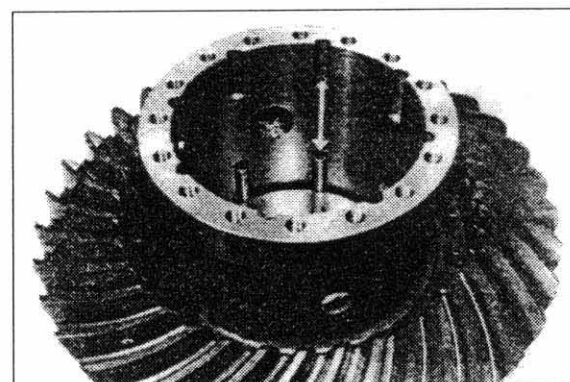
- ③ Lay the two thrust washers into the differential case half.  
※ Mount brass washer on top with the lubricating groove facing the side gear.



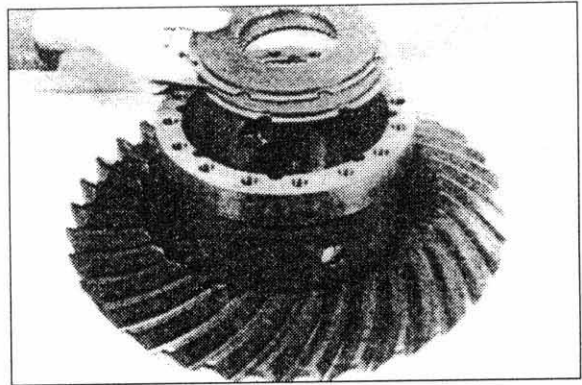
- ④ Lay snap ring into the ring groove, see arrow.



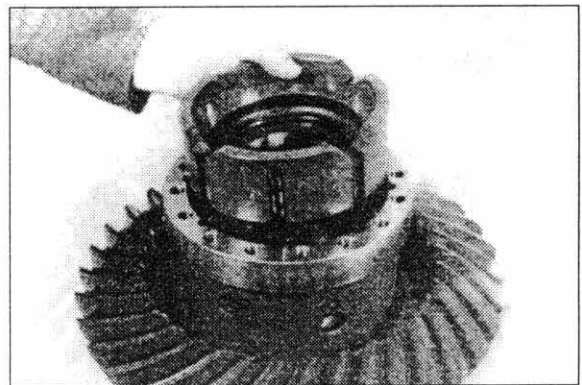
- ⑤ Insert drive pin, see arrow.



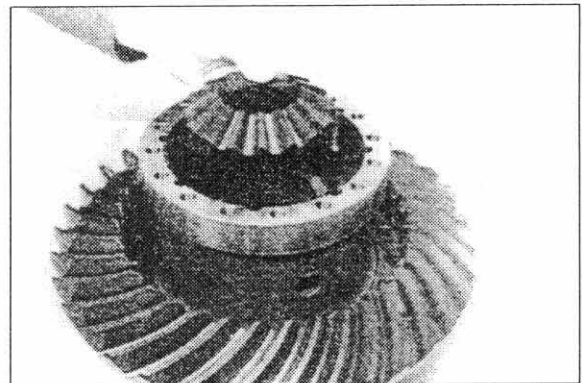
- ⑥ Assemble alternating outer and inner plates, starting with one outer plate.
- ※ Number and installation position of outer and inner plates, see corresponding list of spare parts(According to the version).
- The total height(Thickness) of the plate pack must be equal on both differential sides. Plate thickness of outer plates may be different.



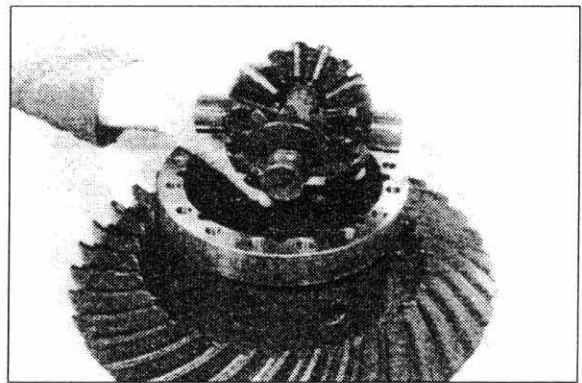
- ⑦ Replace pressure ring.



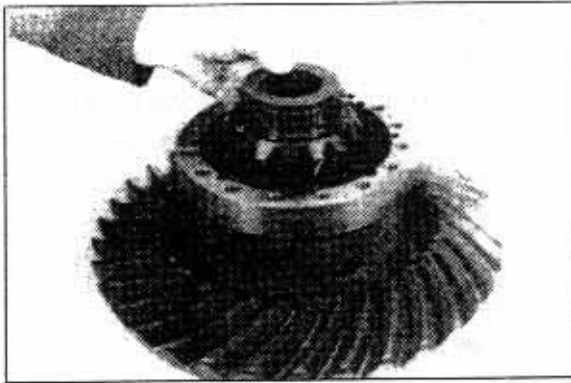
- ⑧ Insert side gear and assemble inner plates at the same time.



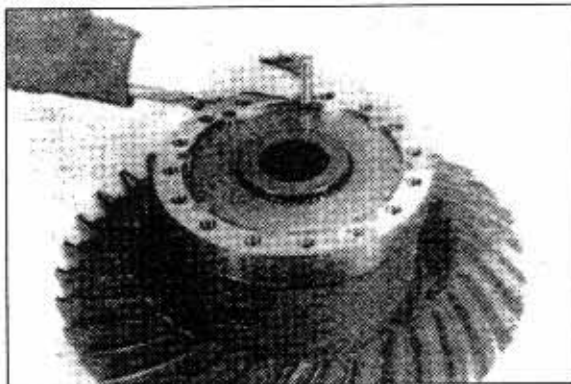
- ⑨ insert the differential spider assembly.



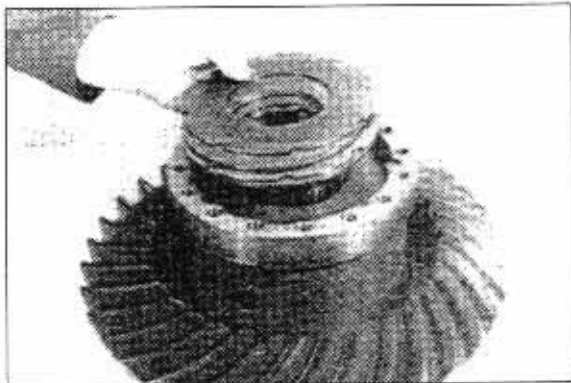
- ⑩ Replace second side gear.



- ⑪ Install second pressure ring and insert all drive pins.  
※ Pay attention to the radial installation position of the pressure ring.

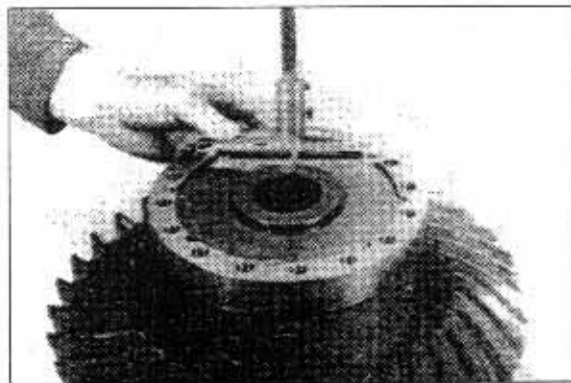


- ⑫ Assemble alternating inner and outer plates, starting with one inner plate.  
※ Number and installation position of inner and outer plates, see corresponding list of spare parts(According to the version).



**Determine plate clearance**

- ⑬ Differential case :  
Measure dimension A from the flange-mounted surface to the outer plate.  
Dimension A e.g. 4.00mm

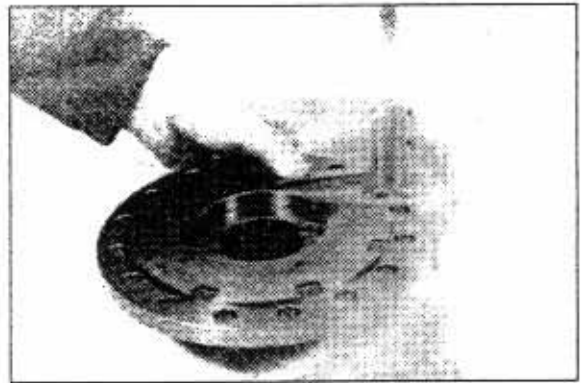




⑭ Housing cover :

Determine dimension B from the contact face(Outer plate) to the flange-mounted surface.

Dimension B e.g. 3.80mm



**EXAMPLE**

Dimension A 4.00mm

Dimension B -3.80mm

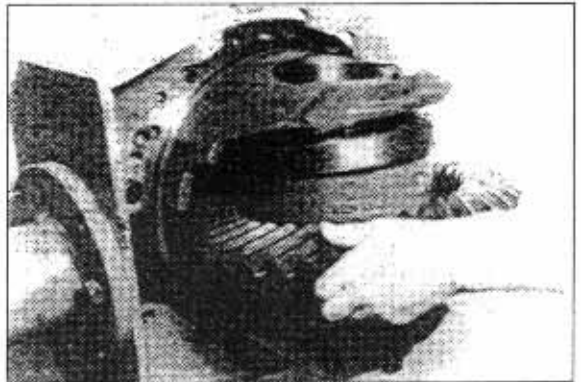
Difference = Plate clearance 0.20mm

- \* The prescribed end play(=plate clearance) is 0.2~0.8mm, whilst the lower value has to be found.

The end play is corrected by the installation of outer plates of corresponding thickness, whilst the plate pack thickness must be equal on both differential sides.

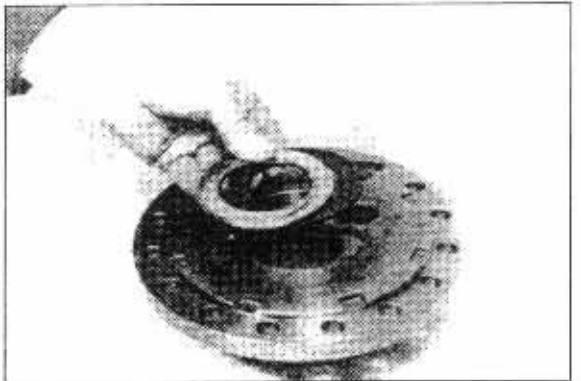


⑮ Insert pre-assembled differential case half in the axle carrier.



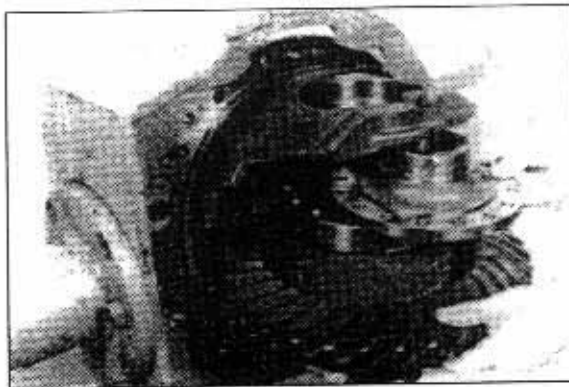
⑯ Make the two thrust washers adhere with grease in the housing cover.

- \* Mount the brass washer on top with the lubricating groove facing the side gear.



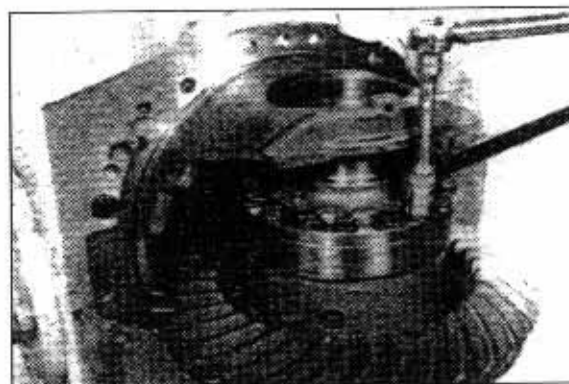
- ⑰ Lay housing cover over the differential case.

※ Pay attention to the installation position - see markings.



- ⑱ Fasten the housing cover by means of locking screws.

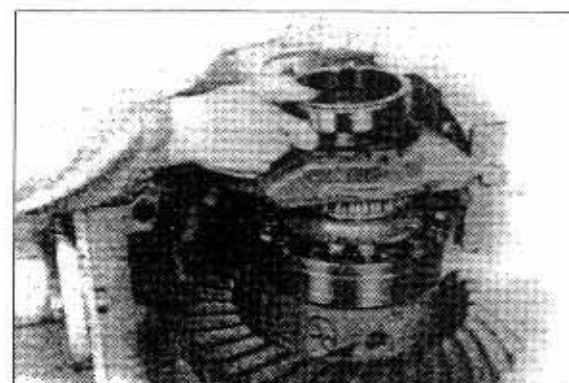
※ Only single use of the locking screws is admitted.



- ⑲ Heat bearing inner race and place it against the housing cover until contact is obtained.

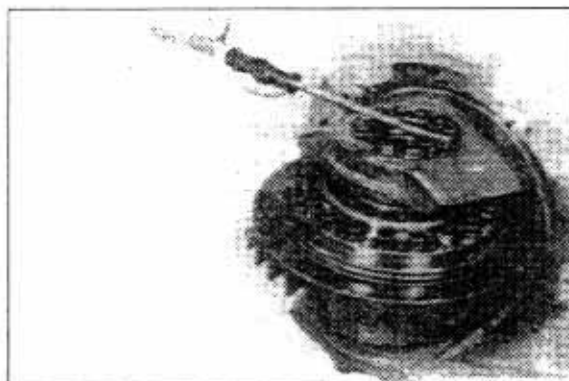


- ⑳ Insert bearing outer race into the bearing bore and fix it by means of adjusting nut.



- ②① Tilt axle carrier 180°.

Insert the crown wheel side bearing outer race into the bearing bore and fix it for the present with the second adjusting nut.



### **Adjustment backlash and bearing preload**

- ②② Apply dial indicator right angled on the outer diameter of the tooth flank/crown wheel.

Adjust the adjusting nut on the crown wheel side until the required backlash-see value engraved on the crown wheel outer diameter- is obtained.



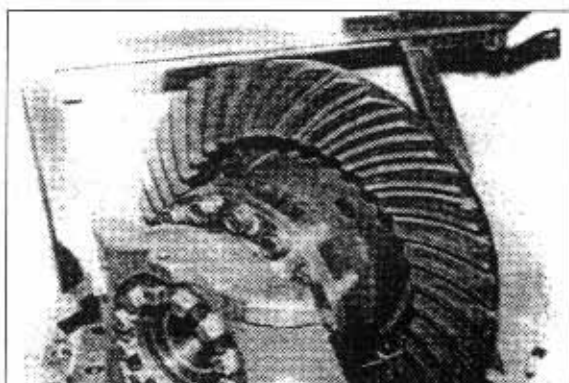
- ②③ Screw in the adjusting nut (Opposite the crown wheel side) until the differential bearing is free of play.

Now, tighten adjusting nut further for 2 notches to obtain the required bearing preload of the differential bearing 0.3~0.4kgf · m.

Check backlash again and correct if necessary.

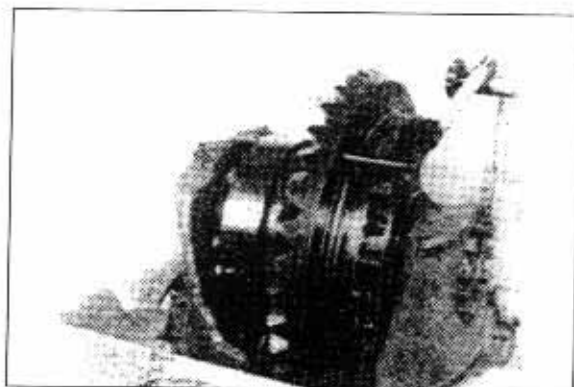
- ※ At this step make several revolutions of the differential.

Determine yoke width.



- ②④ Apply dial indicator on the plane face/crown wheel, make at least one revolution of the crown wheel and record the run-out.

Admitted run-out maximum 0.08mm.



- ② Check contact pattern on the crown wheel : Cover some tooth flanks of the crown wheel with gear marking compound.

Roll the crown wheel over the drive pinion to and fro.

Take the contact pattern and compare it with Page "Examples of contact patterns", page 3-196.

In case of a greater contact pattern deviation, a spacing error has been made during the assembly of the drive pinion, which must be absolutely corrected.

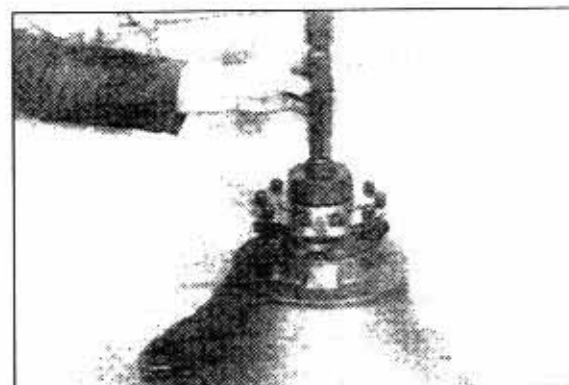


- ③ Secure the two adjusting nuts.

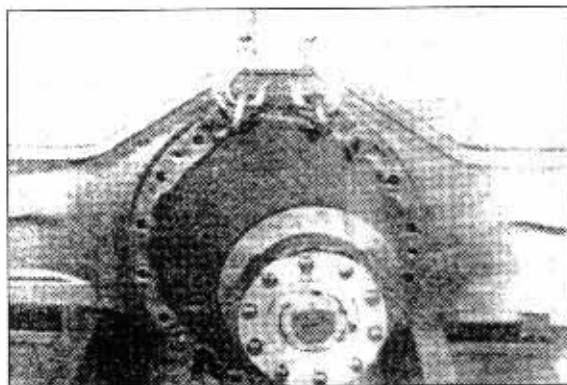


- ④ Tilt differential carrier.

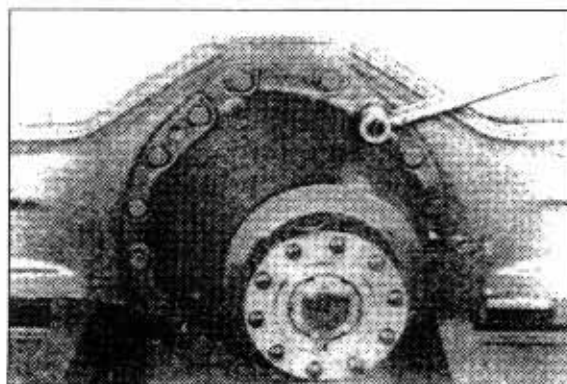
Insert lock plate until contact is obtained and caulk it on the drive flange.



- ⊗ Cover flange-mounted surface with sealing compound Loctite.  
Screw in two adjusting screws and place the differential carrier against the axle housing until contact is obtained.



- ⊗ Fasten differential carrier on the axle housing by means of hexagon head screws.
- ※ Cover threads hexagon head screws with sealing compound.



- ※ Now, install stub shafts again and complete the final drive.  
Before the axle is put into service pay attention to the lubrication instructions page, page 3-195.





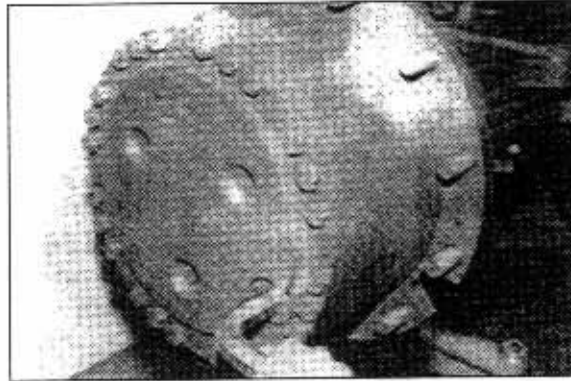
#### 4) DIFFERENTIAL CARRIER

(Version with screwed and cast-on bearing caps)

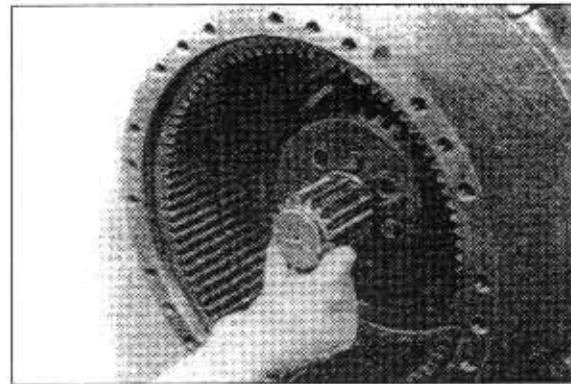
##### (1) DISASSEMBLY

※ Remove the two stub shafts prior to separate the differential carrier from the axle housing, see figure ①~③.

① Drain oil from the final drive and the axle housing. Loosen hexagon head screws and separate planetary carrier from the hub, using eye bolt.

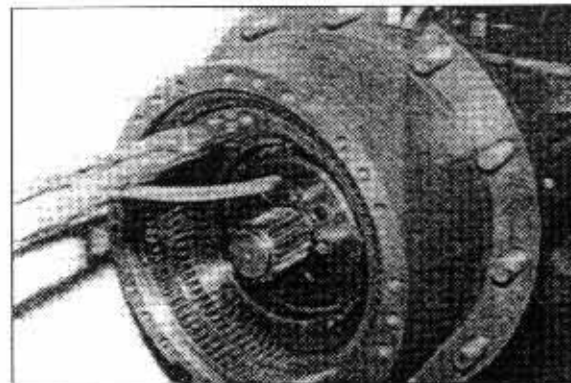


② Pull inner plate carrier along with sun gear from the stub shaft.

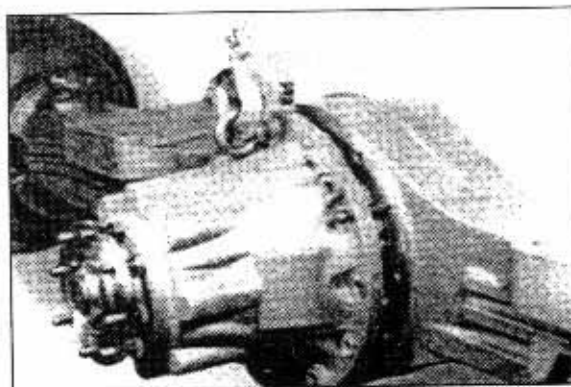


③ Pull stub shaft out of the axle housing, squeeze out circlip and remove the plate pack.

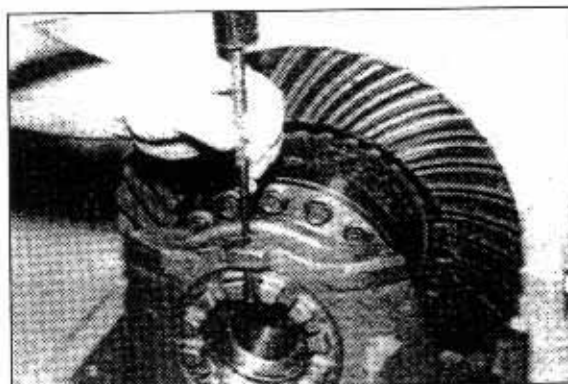
※ This step is necessary to allow the later installation of the inner plate carrier.



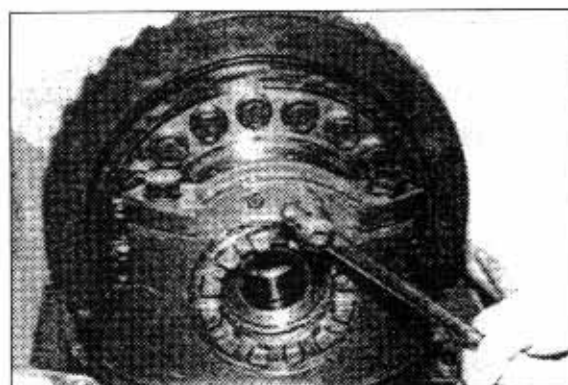
- ④ Loosen hexagon head screws and separate the differential carrier from the axle housing.



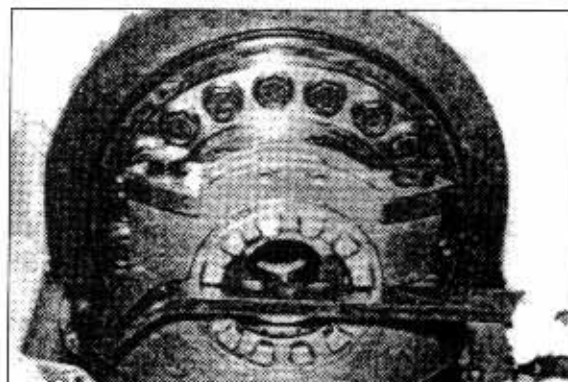
- ⑤ Fasten the differential carrier in the assembly jig.  
Drive out the roll pin.



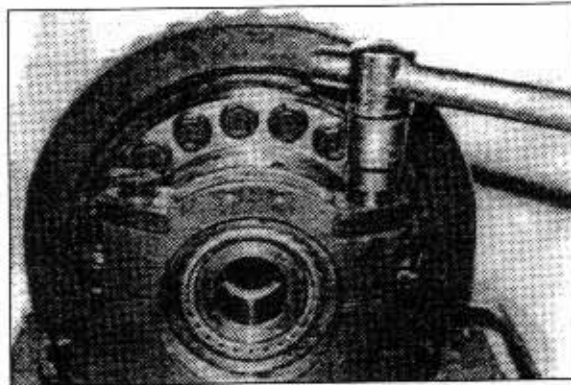
- ⑥ Remove lock wire and lock plate.



- ⑦ Loosen and remove the two adjusting nuts.



- ⑧ Loosen hexagon head screws and remove bearing caps.

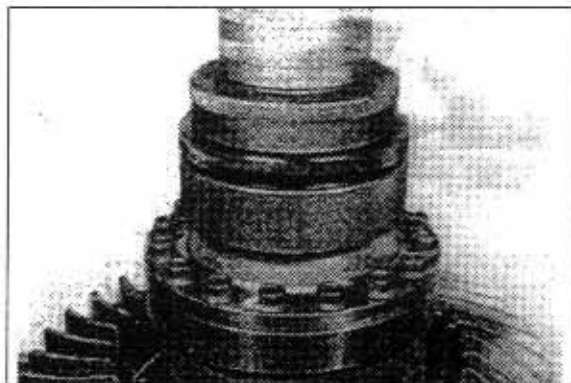


- ⑨ Lift the differential assembly out of the axle carrier.  
※ Pay attention to the released bearing outer races.

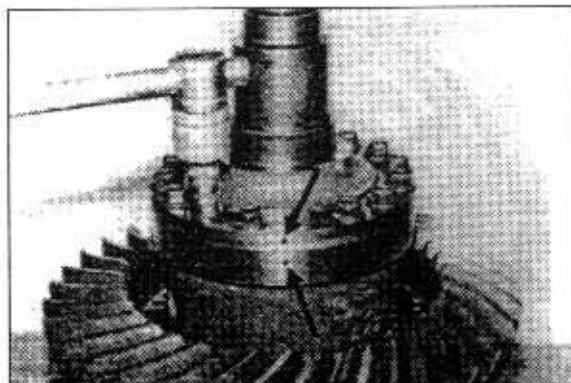


#### Differential

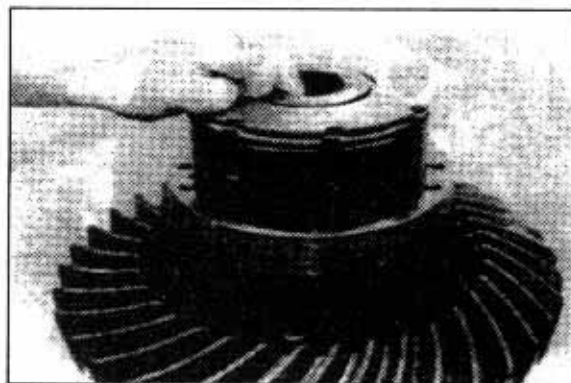
- ① Pull off the two bearing inner races from the housing cover, respectively differential case.



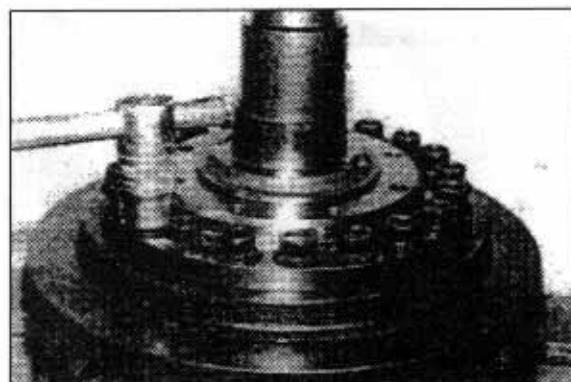
- ② Mark housing cover with differential case, loosen locking screws.



- ③ Take all components of the multi-disk self-locking differential out of the differential case.

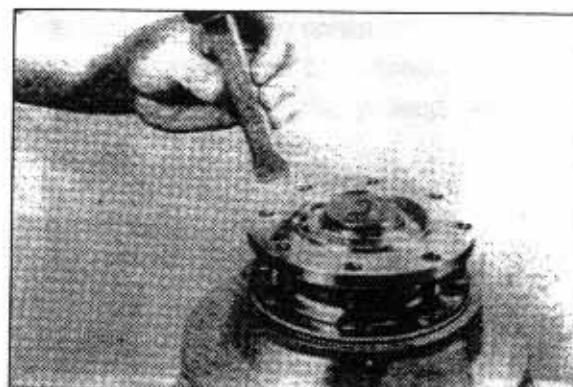


- ④ Clamp the differential case half.  
Loosen locking screws and separate the crown wheel from the differential case.

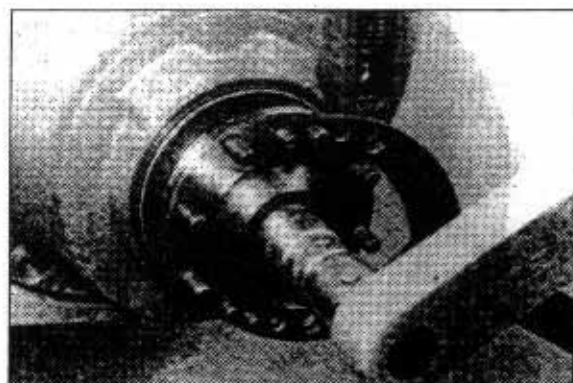


#### Drive unit

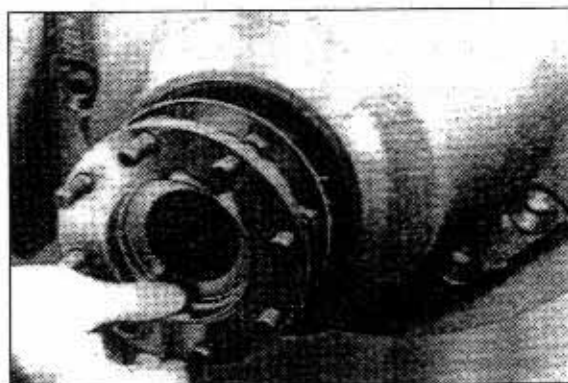
- ① Unlock slotted nut and remove lock plate.



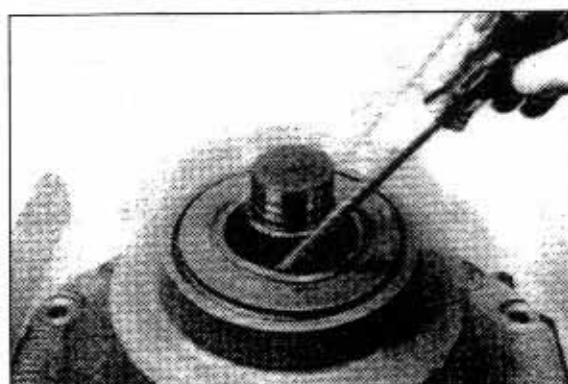
- ② Loosen slotted nut or hexagon nut  
(According to the version) and remove it  
along with washer.



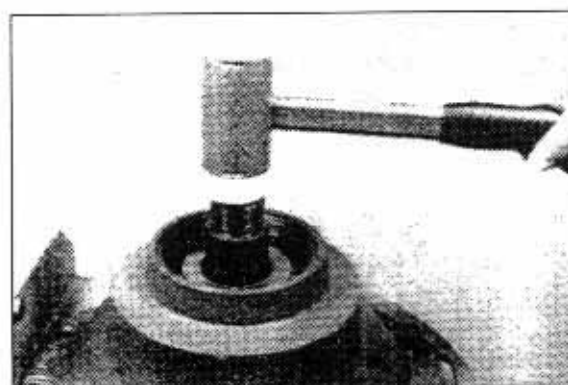
③ Pull off drive flange.



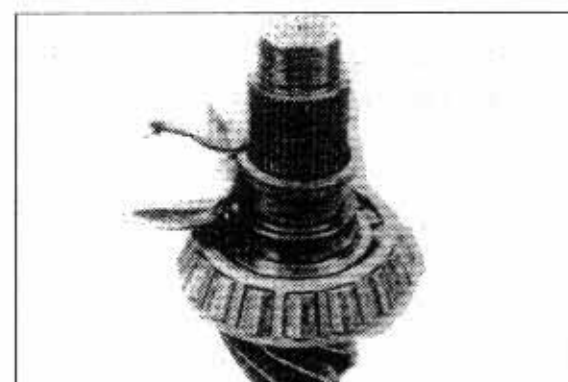
④ Pry out shaft seal.



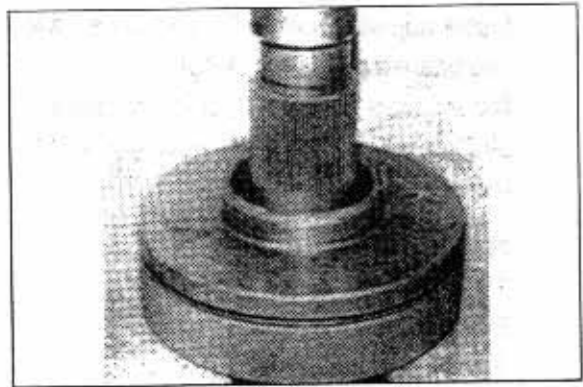
⑤ Press drive flange out of the axle carrier.  
※ Pay attention to the released tapered roller bearing.



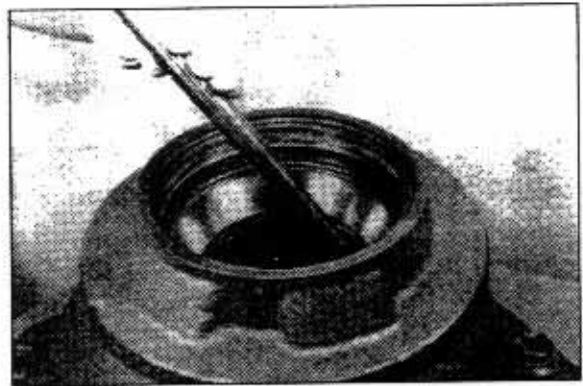
⑥ Pull spacer from the drive pinion end.



- ⑦ Separate the tapered roller bearing from the drive pinion.



- ⑧ If necessary, drive the two bearing outer races out of the axle carrier.



## (2) ASSEMBLY

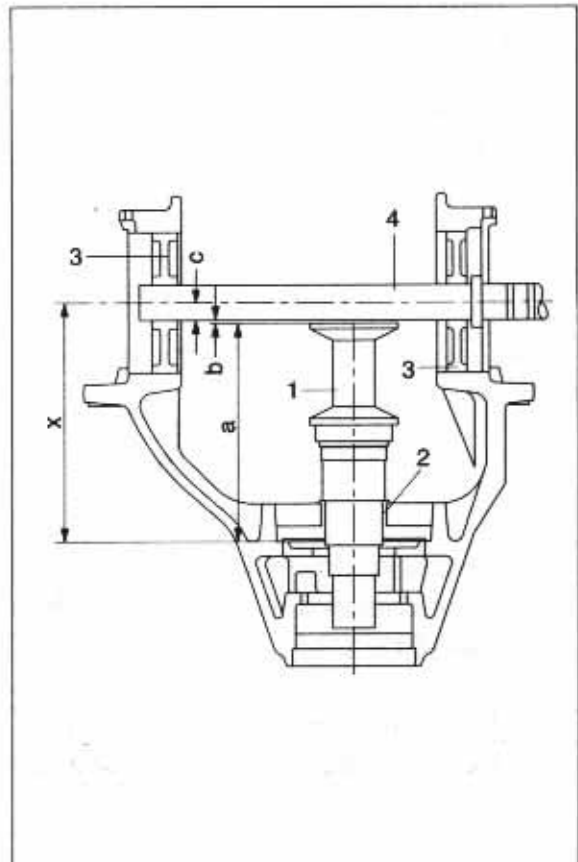
- \* If crown wheel or drive pinion are damaged, the two parts must be renewed as a set.

If a new complete crown wheel set is installed, pay attention that crown wheel and drive pinion have the same mating numbers.

When replacing a complete crown wheel set or axle carrier, pay attention to the Draft.

### Determine thickness of shim-to obtain a correct contact pattern

- \* The following measuring operations must be carried out with utmost care. Inexact measurements would cause an incorrect contact pattern and require a renewed disassembly and assembly of the drive pinion as well as of the differential(Partial) after the contact pattern is taken(Figure②, page3-192).





- ※ Install adjusting pieces(3) and fasten the two bearing caps provisionally.  
Mount stop washer(2) and measuring pin(1) and introduce measuring shaft(4)  
(See draft, page 3-181).

Special tools

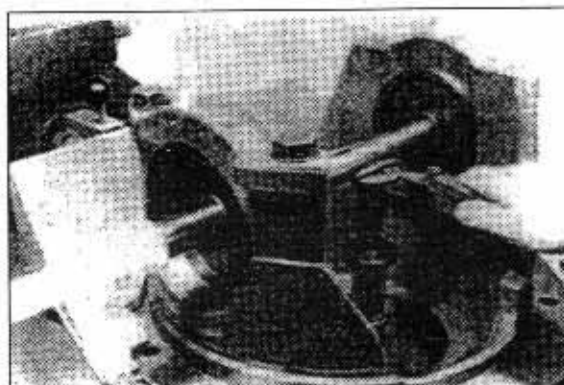
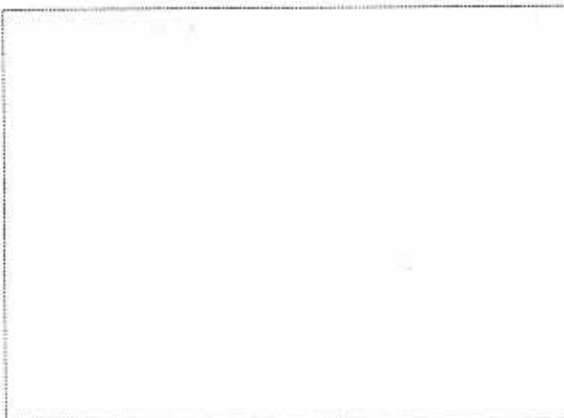
- 1 = Measuring pin  
2 = Stop washer  
3 = Adjusting piece  
4 = Measuring shaft

- ① Determine gap(Dimension b) between measuring piston and measuring shaft with feeler gauge.

Dimension b e.g. 2.50mm

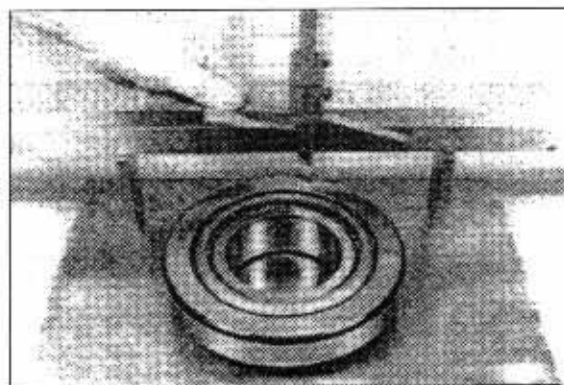
**EXAMPLE I**

Dimension a(=measuring piston)	224.00mm
Dimension b	+2.50mm
Dimension c (=1/2 $\phi$ measuring shaft)	+15.00mm
gives Dimension X	<u>241.50mm</u>



- ② Measure bearing width.

Bearing width e.g. 42.45mm



- ③ Read pinion dimension.

Pinion dimension e.g.  $198_{-0.15}^{+0.15}$  197.85mm

**EXAMPLE I**

Bearing width	42.45mm
Pinion dimension	+197.85mm
gives dimension X1	<u>240.30mm</u>



**EXAMPLE I**

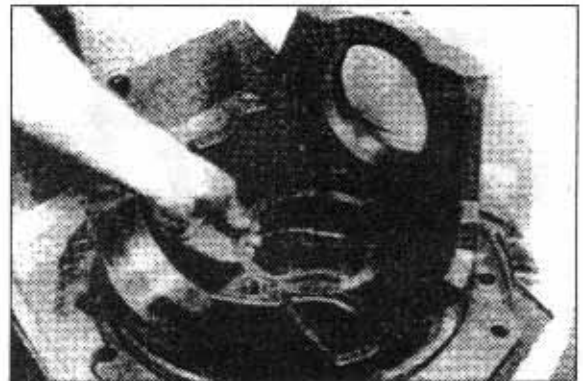
Dimension X 241.50mm

Dimension X1 -240.30mm

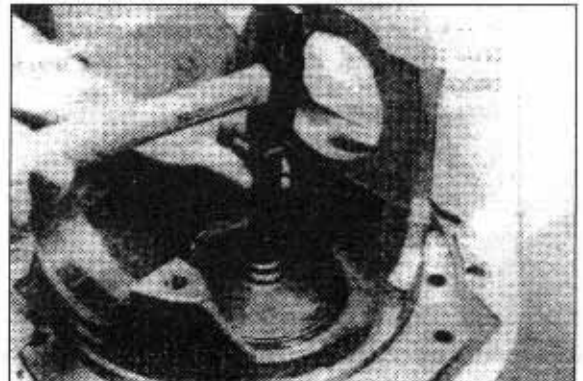
Difference = Shim thickness  $s = 1.20\text{mm}$



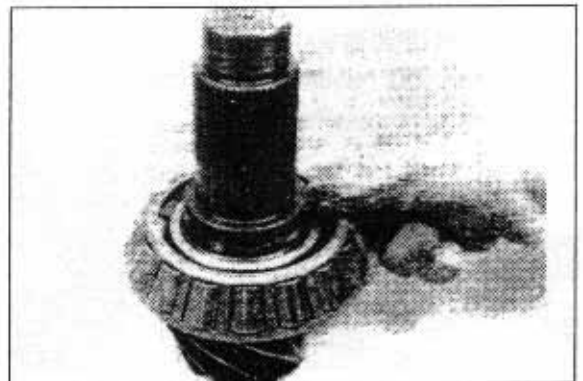
- ④ Lay shim (According to the example  $s = 1.20\text{mm}$ ) into the housing bore.



- ⑤ Undercool bearing outer race and place it firmly against shoulder. Install the drive flange side bearing outer race correspondingly.



- ⑥ Heat bearing inner race, guide it over the drive pinion end until contact is obtained.

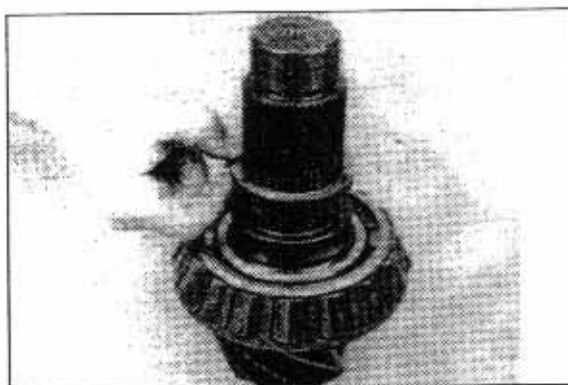


### Adjust rolling resistance of the drive pinion bearing

- ① Nominal value : DK/CK 0.11~0.23kgf · m  
 HK 0.15~0.31kgf · m  
 LK/RK 0.31~0.46kgf · m

Lay measuring ring over the drive pinion collar.

- ※ Configuration and description of the measuring ring, see below draft.

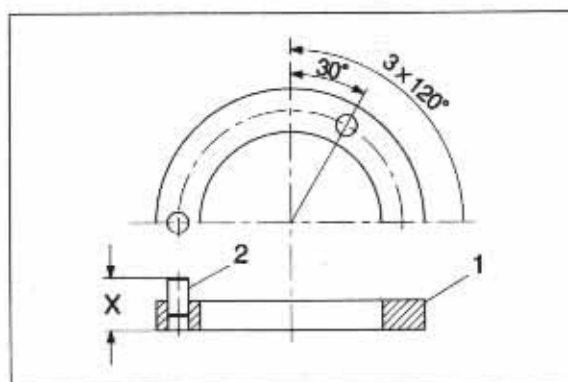


Draft for the determination of the spacer :

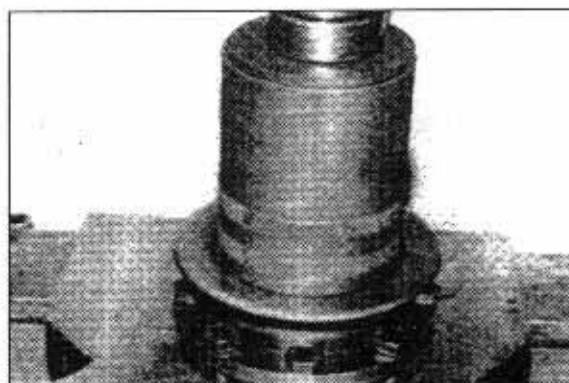
1 = Measuring ring(S)

2 = Roll pin(Set of 3, each spaced for 120°)

- ※ Dimension X = Thickness of spacer.



- ② If necessary(According to the version), insert hexagon head screws into the drive flange bores and press dust shield over the drive flange collar.



- ③ Insert drive pinion into the axle carrier and assemble heated bearing inner race until contact is obtained.



- ④ Guide drive flange over the drive pinion splines. Apply washer and tighten slotted nut, respectively hexagon nut (According to the version) until the required rolling resistance is obtained.

※ When tightening, make several revolutions of the drive pinion in both senses and check the rolling resistance continuously.



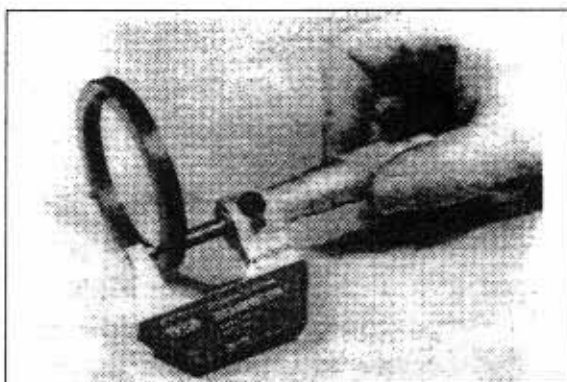
- ⑤ Loosen slotted nut, pull off drive flange and remove pinion again.

Remove measuring ring and determine dimension X (See draft, page 3-184).

Dimension X e.g.  $s = 7.97\text{mm}$

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

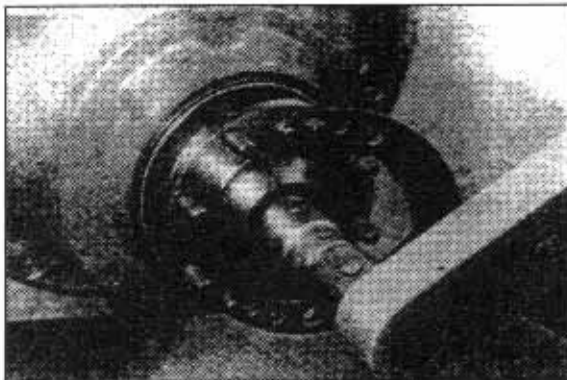
Lay spacer(e.g.  $s = 7.97\text{mm}$ ) instead of the measuring ring over the drive pinion end. Install drive pinion again.



- ⑥ Replace drive flange, mount washer and tighten slotted nut.

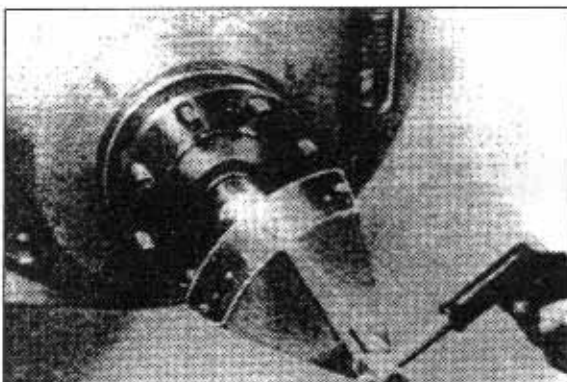
• Torque limit : DK/CK	71kgf · m
RK	112kgf · m
HK/LK	122kgf · m

※ When tightening, make several revolutions of the drive pinion in both senses.



- ⑦ Check rolling resistance.

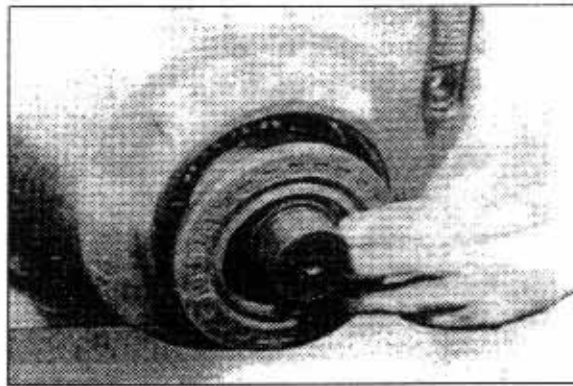
※ If the required rolling resistance is not obtained correct again with one corresponding spacer.



- ⑧ Remove drive flange and install shaft seal.

※ Pay attention to the contact.

If the outer diameter of the shaft seal is rubber-coated, wet the sealing lip with spirit. Otherwise use the sealing compound Loctite. Fill the cavity between sealing lip and dust lip with grease.

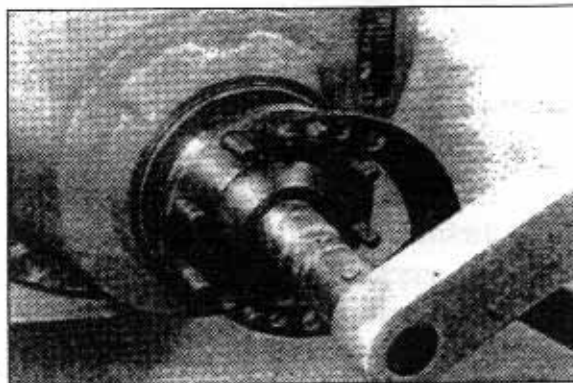


- ⑨ Replace drive flange.

Assemble washer and tighten slotted nut, respectively hexagon nut(According to the version) finally.

• Torque limit : DK/CK	71kgf · m
RK	112kgf · m
HK/LK	122kgf · m

※ The securing of the slotted nut, respectively hexagon nut(According to the version) is carried out after the contact pattern is taken.

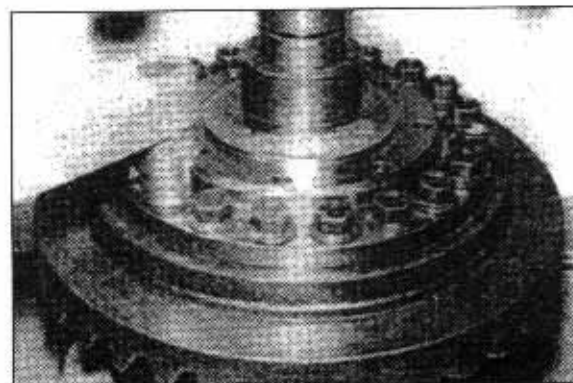


#### Differential

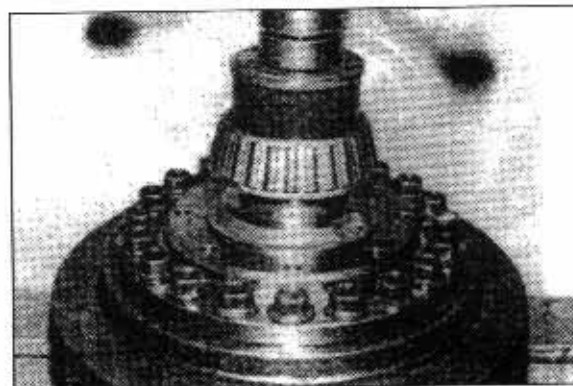
- ① Heat crown wheel and place it against the differential case half until contact is obtained.

Clamp the differential case by means of press and tighten locking screws.

※ Only single use of the locking screws is admitted.

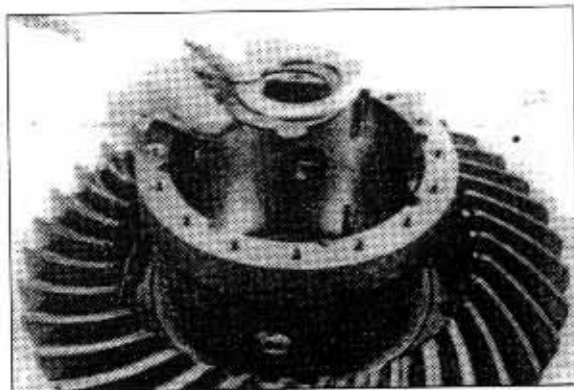


- ② Press the bearing inner race firmly against shoulder.

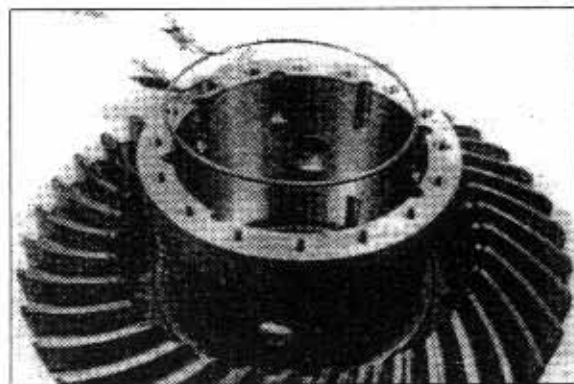




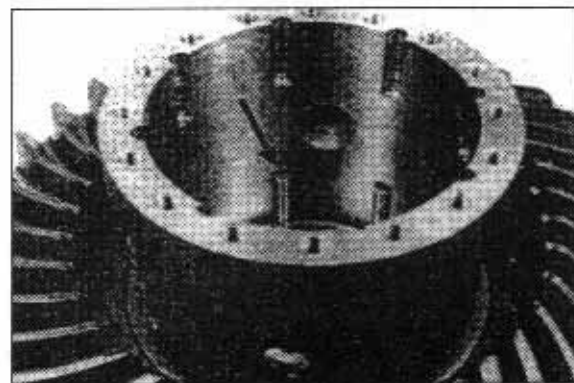
- ③ Lay the two thrust washers into the differential case half.
- ※ Mount brass washer on top with the lubricating groove facing the side gear.



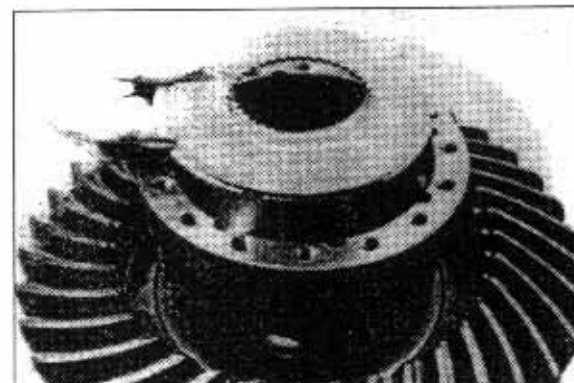
- ④ Lay snap ring into the ring groove, see arrow.



- ⑤ Insert drive pin, see arrow.

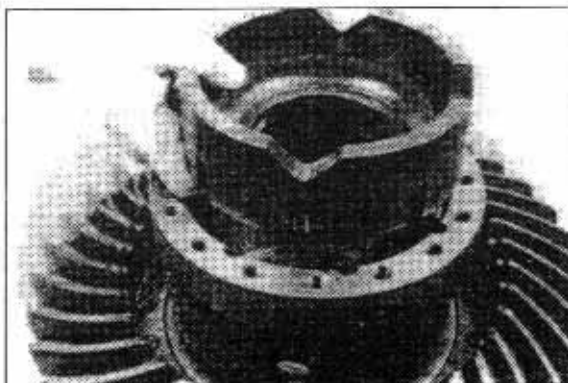


- ⑥ Assemble alternating outer and inner plates, starting with one outer plate.
- ※ Number and installation position of outer and inner plates, see corresponding list of spare parts.
- The total height(Thickness) of the plate pack must be equal on both differential sides. Plate thickness of outer plates may be different.

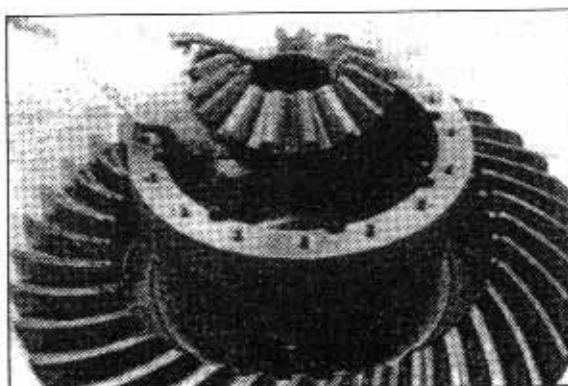




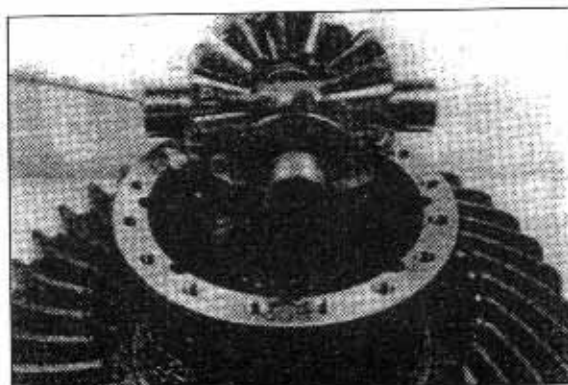
⑦ Replace pressure ring.



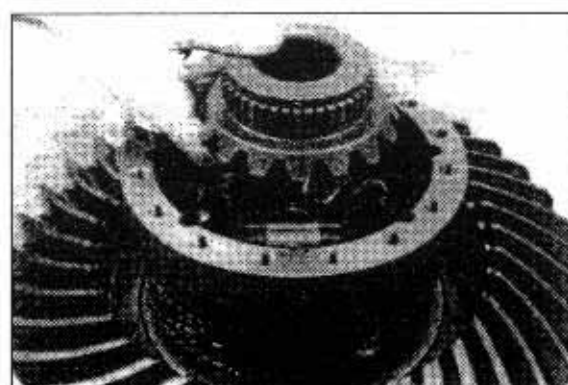
⑧ Insert side gear and assemble inner plates at the same time.



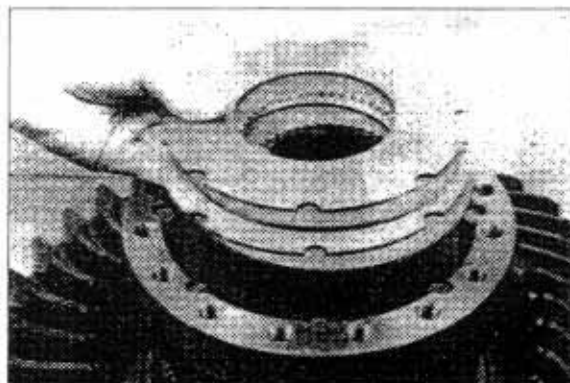
⑨ insert the differential spider assembly.



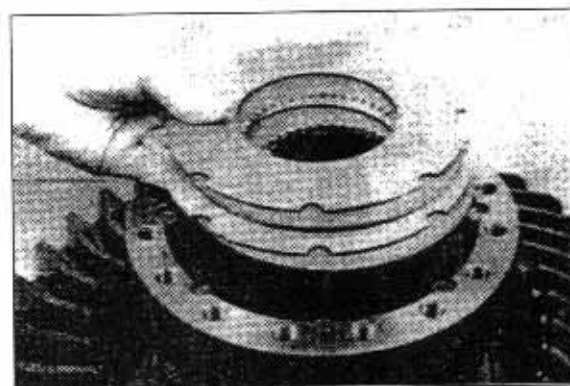
⑩ Replace second side gear.



- ⑪ Install second pressure ring and insert all drive pins.  
 \* Pay attention to the radial installation position of the pressure ring.

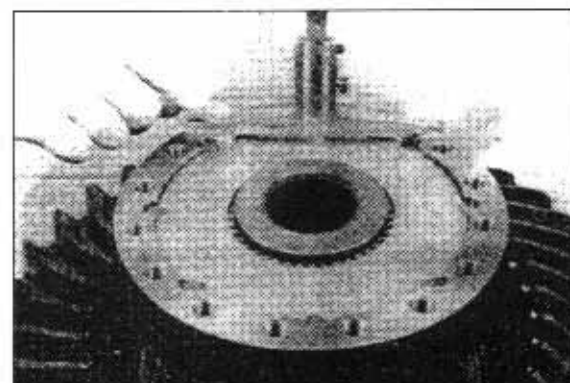


- ⑫ Assemble alternating inner and outer plates, starting with one inner plate.  
 \* Number and installation position of inner and outer plates, see corresponding list of spare parts.

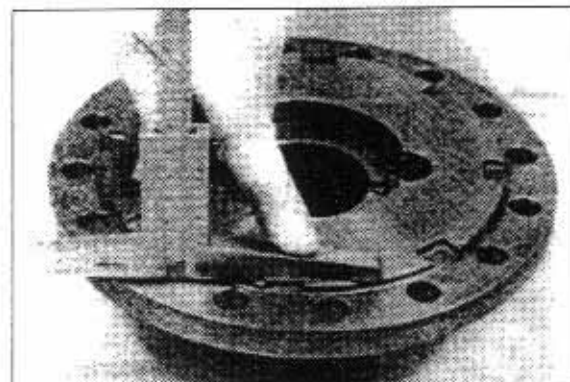


#### **Determine plate clearance**

- ⑬ Differential case :  
 Measure dimension A from the flange-mounted surface to the outer plate.  
 Dimension A e.g. 4.20mm



- ⑭ Housing cover :  
 Determine dimension B from the contact face(Outer plate) to the flange-mounted surface.  
 Dimension B e.g. 3.80mm



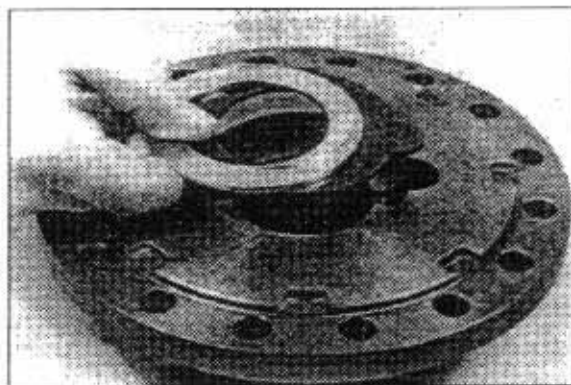
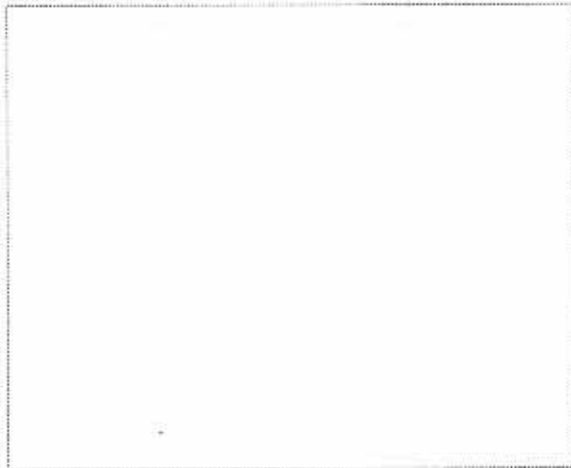
### EXAMPLE

Dimension A	3.40mm
Dimension B	-3.10mm
Difference = Plate clearance	0.30mm

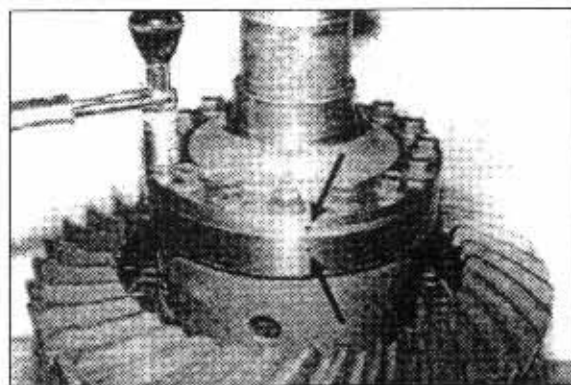
- ※ The prescribed end play(=plate clearance) is 0.2~0.8mm, whilst the lower value should be found.

The end play is corrected by the installation of outer plates of corresponding thickness whilst the plate pack thickness must be equal on both differential sides.

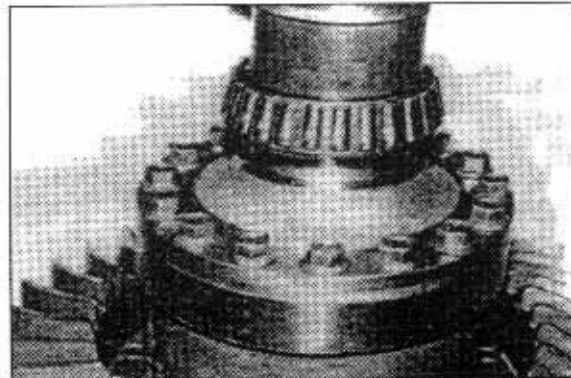
- ⑮ Make the two thrust washers adhere with grease in the housing cover.
- ※ Mount the brass washer on top with the lubricating groove facing the side gear.



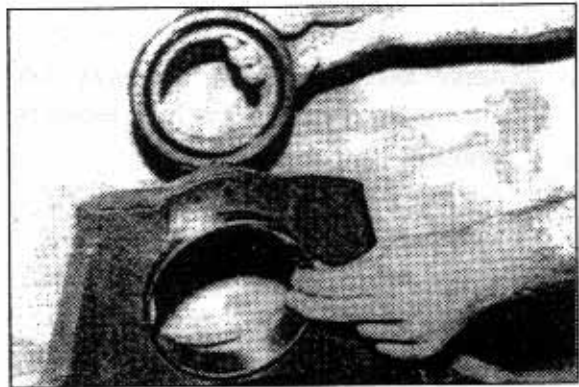
- ⑯ Lay housing cover over the differential case and fasten it by means of locking screws.
  - ※ Pay attention to the installation position-see markings.
- Only single use of locking screws is admitted.



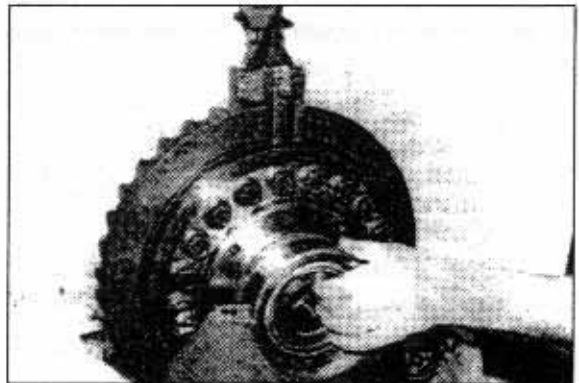
- ⑰ Heat bearing inner race and position it on the housing cover until contact is obtained.



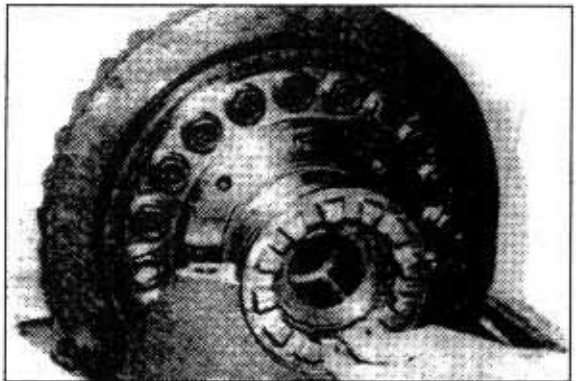
- ⑱ Insert 1st bearing outer race into the housing and fix it provisionally by means of adjusting nut.



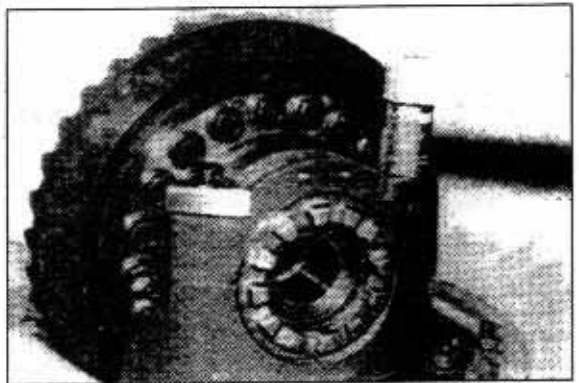
- ⑲ Mount 2nd bearing outer race and insert the differential assembly into the axle carrier.



- ⑳ Fix the crown wheel side bearing outer race by means of the second adjusting nut provisionally.



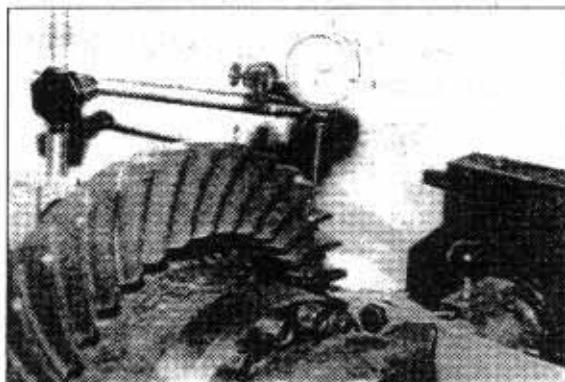
- ㉑ Replace bearing caps and tighten hexagon head screws.



### Adjust backlash and bearing preload

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

Adjust adjusting nut on the crown wheel side until the required backlash-see value engraved on the crown wheel outer diameter- is obtained.

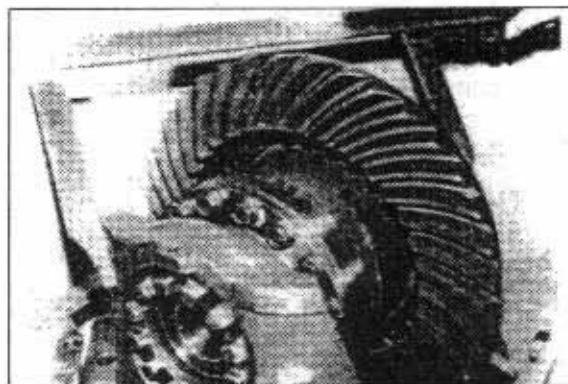


- ③ Screw in adjusting nut (Opposite the crown wheel side) until the differential bearing is free of play. Now, tighten adjusting nut further for 2 notches to obtain the required bearing preload of the differential bearing  $0.3\text{--}0.4 \text{ kgf} \cdot \text{m}$ . Check backlash again and correct if necessary.

\* At this step make several revolutions of the differential.

Determine yoke width.

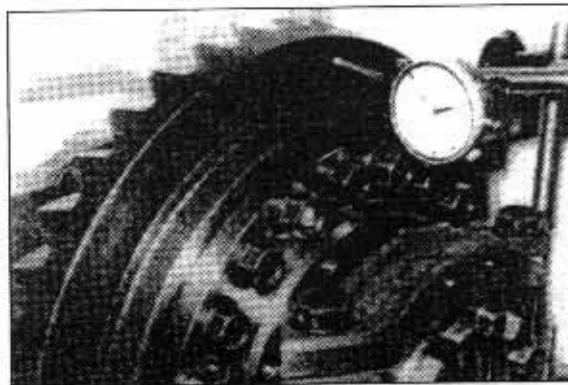
Yoke width e.g.  $358.00\text{mm}^{+0.05}\text{max.}$



- ④ Apply dial indicator on the plane face/crown wheel.

Make at least one revolution of the crown wheel and record the run-out.

Admitted run-out maximum  $0.08\text{mm}$ .



- ⑤ Cover some tooth flanks of the crown wheel with gear marking compound.

Roll the crown wheel over the drive pinion to and fro.

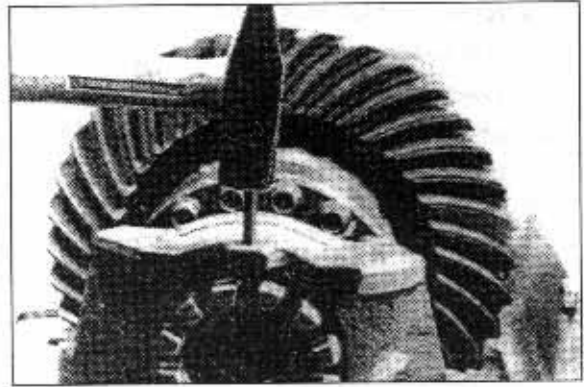
Take the contact pattern and compare it with Page "Examples of contact patterns", page 3-196.

In case of a greater contact pattern deviation, a spacing error has been made during the assembly of the drive pinion, which must be absolutely corrected.

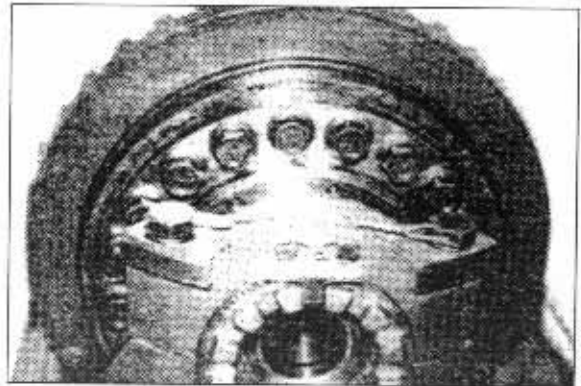




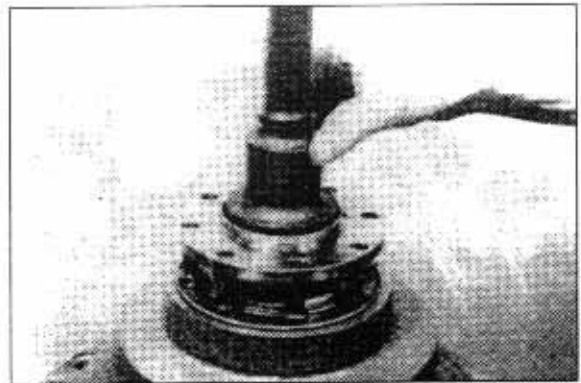
- ② Secure adjusting nuts.



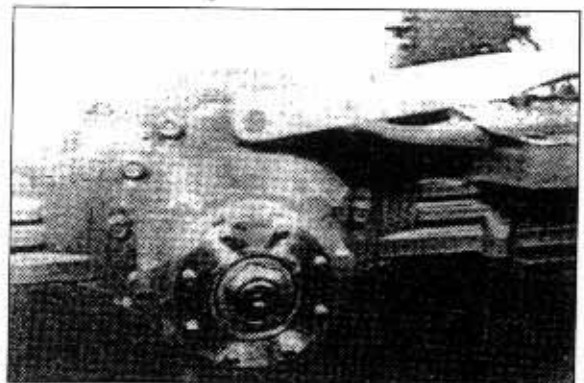
- ③ Secure adjusting nut and hexagon head screws according to the figure on the right.



- ④ Tilt differential carrier.  
Insert lock plate until contact is obtained and caulk on the drive flange.



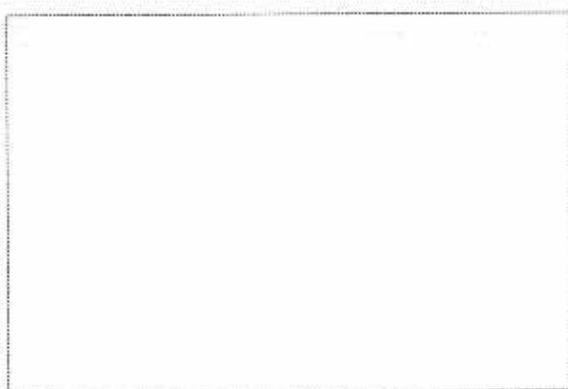
- ⑤ Cover flange-mounted surface with sealing compound Loctite.  
Screw in two adjusting screws and place the differential carrier against the axle housing until contact is obtained.





※ Now, install stub shafts again and complete the final drive.

Before the axle is put into service, pay attention to the lubrication instructions, page, page 3-195.



## 5) LUBRICATION INSTRUCTIONS

The basis for a correct lubrication of all axles and their parts is a horizontal plane of installation in every direction. (An inclined position of the differential carrier up to 5° is tolerable).

Place the machine in a horizontal position. All lubricating points must be cleaned carefully before refilling.

Drain oil only immediately after a longer run.

### (1) Oil level

1. Wheel end : Turn wheel hubs until the word "Ölstand" can be read in a horizontal position. Fill up oil to the overflow on the level plug.
2. Axle housing : Fill up oil, to the overflow on the level plug or the oil filler opening respectively, installed in the center(SAE 80W-90LSD/API GL-5).
3. Differential carrier, not installed in a axle : Fill up oil 20mm below the middle of the crown wheel.

### (2) Check

After a few minutes, if oil level has dropped fill up to the correct level until level remains constant. Oil level check monthly. Especially before you start a vehicle with new or repaired axles or their components respectively.

### (3) Oil change

**1st oil change after 200 operating hours. Further oil changes must be made every 1000 operating hours, or at least once a year.**

### (4) Brake

For the pneumatic-hydraulic or memory controlled brake actuation are admitted :

1. Motor oils SAE 10W according to specifications MIL-L-2104C, MIL-L-46152, API-CC, CD, SC, SD, SE, SF
2. ATF-oils(Type A/Suffix A, Dexron IID)

**\* Other brake fluids may be not used.**

### (5) Points of grease lubrication

At greasing points, use a multi-purpose grease with following properties : Lithium soap, drop point 170C, NLGI class 2. The grease must be anti-corrosive, water-resistant and wash stable.

Regrease all pressure grease fittings monthly.

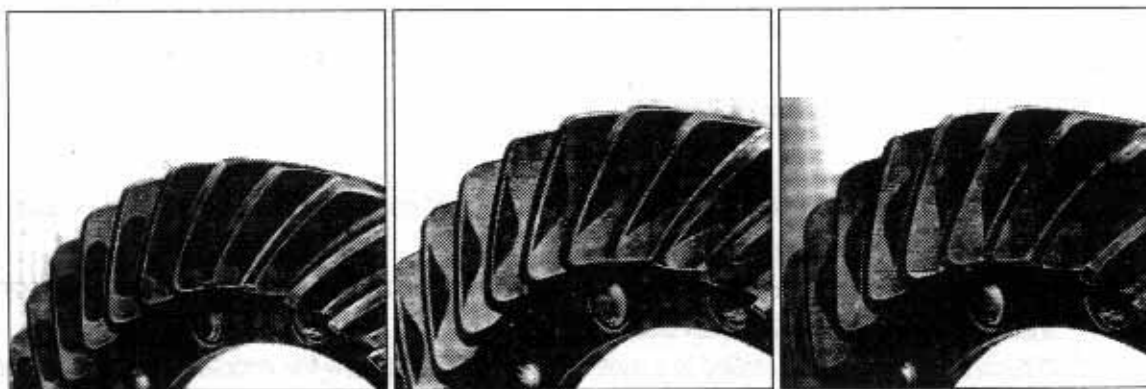
### (6) Important notes

Check correct torque limit of all screwed joints within regular intervals.(First check after 50 operating hours.)

Axles with multi-disk self-locking differentials : A slight noise could be noted, when oil without limited slip additives have been filled in. This noise can be regarded as harmless. In case of a heavy noise or when the tire is jerking, use EP-gear lubricants with Limited-Slip additives.

## 6) EXAMPLES OF CONTACT PATTERNS FOR THE GLEASON GEAR-TOOTH SYSTEM

### (1) Coast side(Concave)



### (2) Drive side(Convex)

