GROUP 4 DISASSEMBLY AND ASSEMBLY

1. TRANSMISSION

1) CLEANING AND INSPECTION OF TRANSMISSION

(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.**

① **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 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.

② **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.

(1) 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 Automatic Transmission Fluid and wrap in clean lintless cloth or paper to protect them until installed.

(2) 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.

(3) Gears and shafts

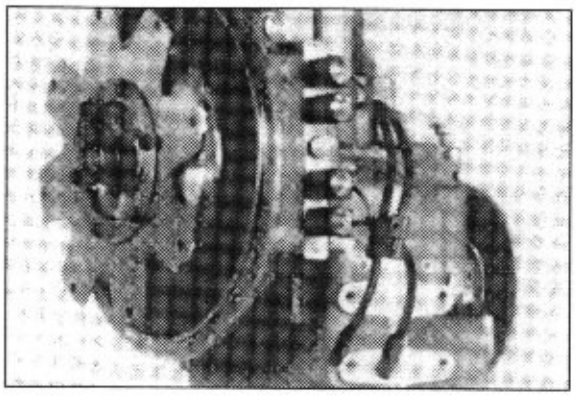
If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks, or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect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

(4) Housing, covers, etc.

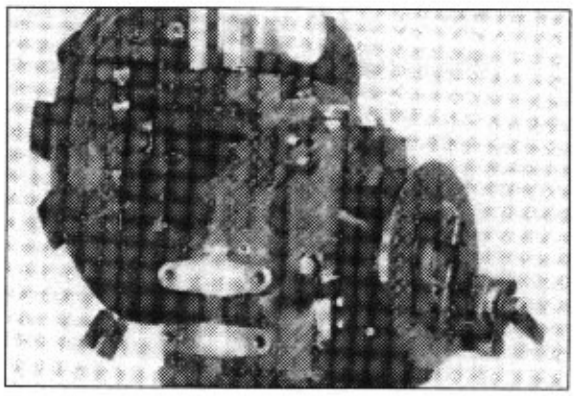
Inspect housings, covers, and bearing caps to be certain they are thoroughly clean and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.

3) DISASSEMBLY OF TRANSMISSION

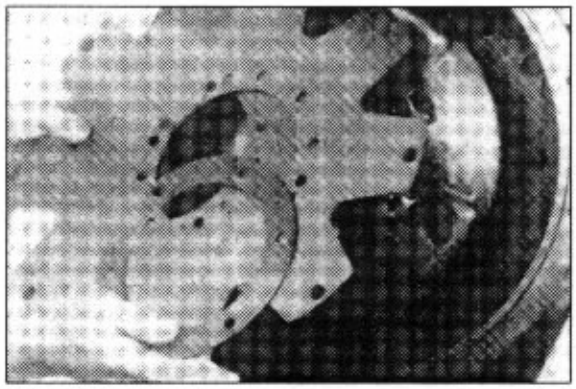
(1) Side view of T12000 short drop transmission.



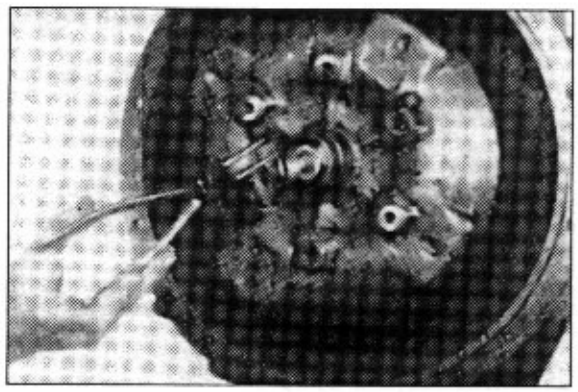
(2) Rear view showing electric control.



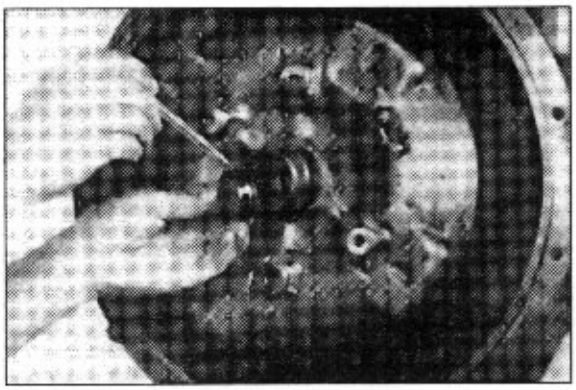
(3) Remove drive plate attaching capscrews and washers. Remove drive plate and backing ring.



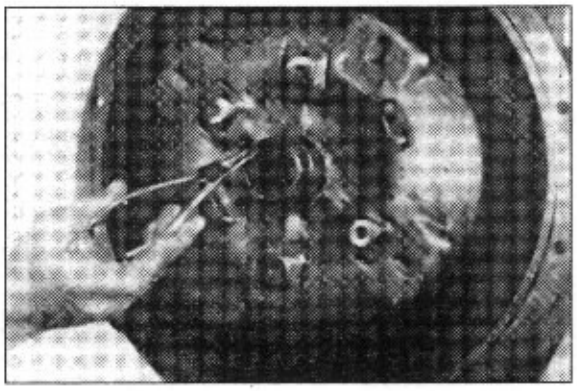
(4) Remove torque converter plug retainer ring.



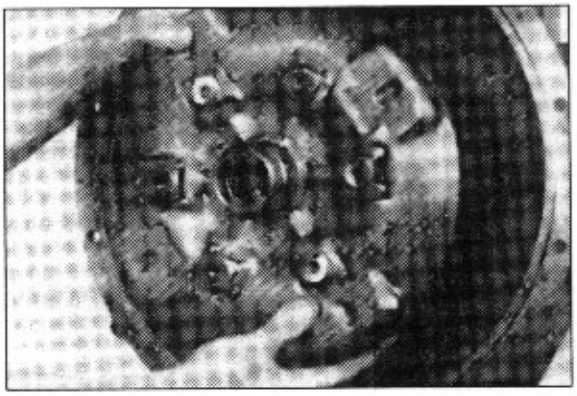
(5) Remove plug and O-ring.



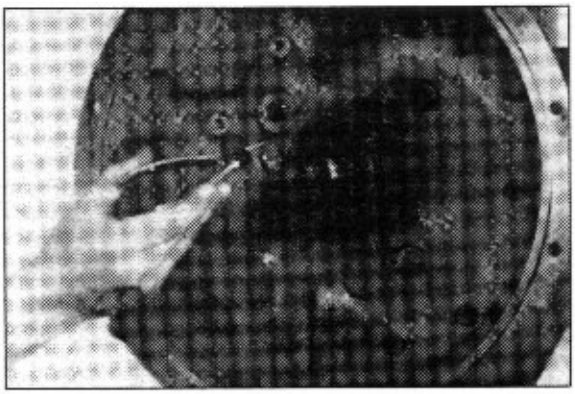
(6) Remove torque converter to turbine shaft retainer ring.



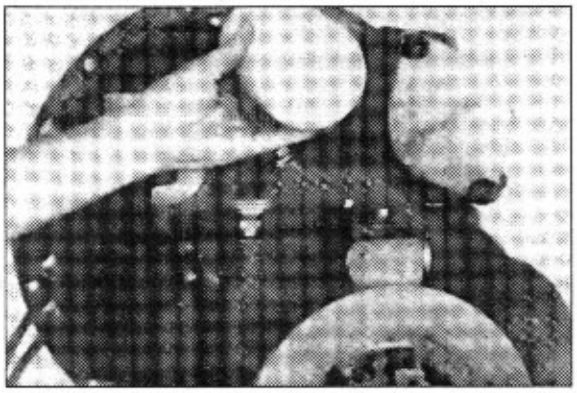
(7) Remove torque converter assembly.



(8) Remove torque converter to shaft locating ring.

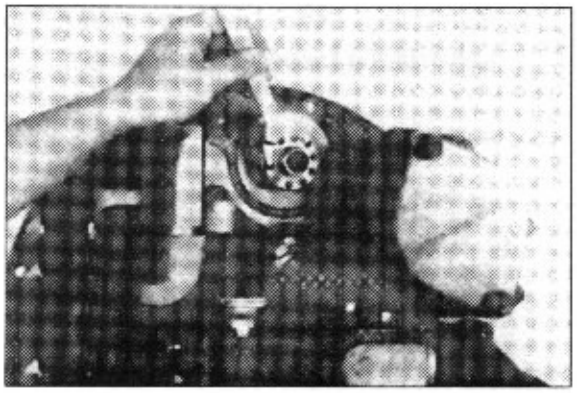


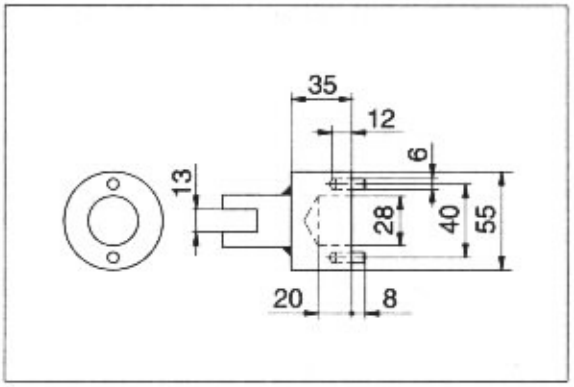
(9) Remove filter assembly.



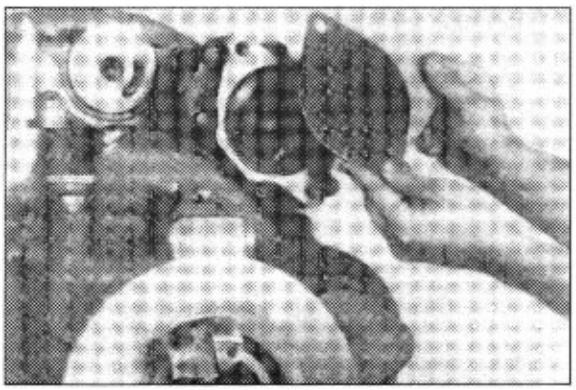
(10) Remove pressure regulator and regulator sleeve.

※ Special tool can be fabricated.

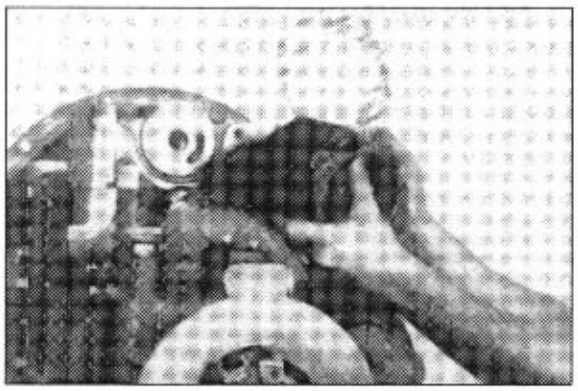




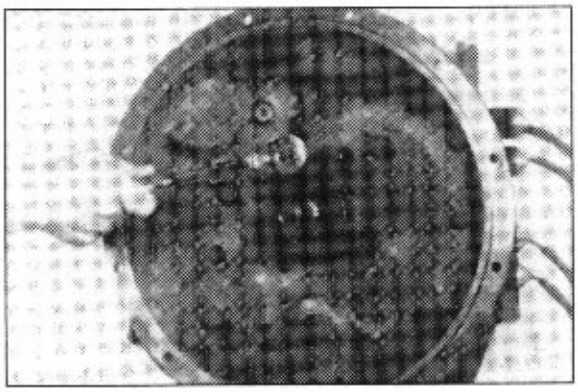
(11) Remove charging pump permanent pump hole cover. (Not used when auxiliary pump is used.)



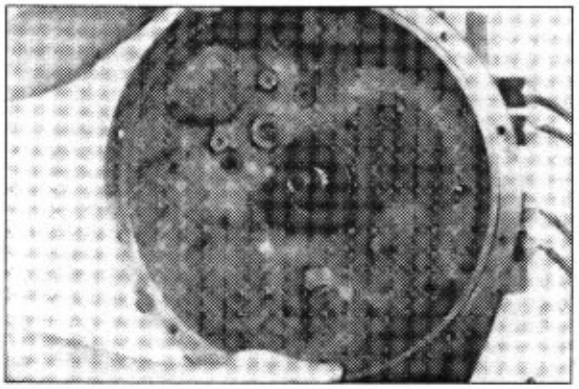
(12) Remove pump mounting bolts and washers. Remove pump and gasket.



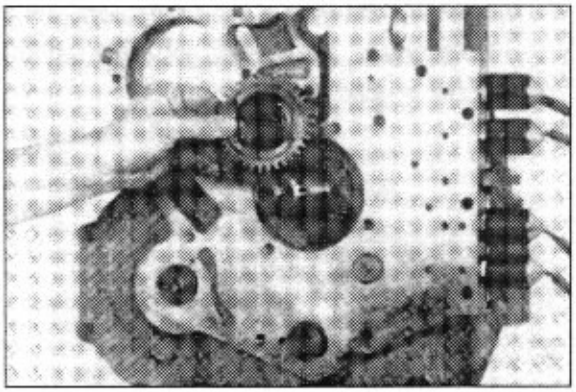
(13) Remove converter housing to transmission case bolts and washers.



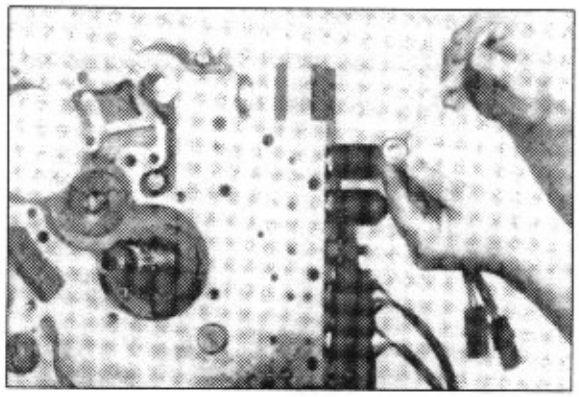
(14) Remove converter housing and gasket.



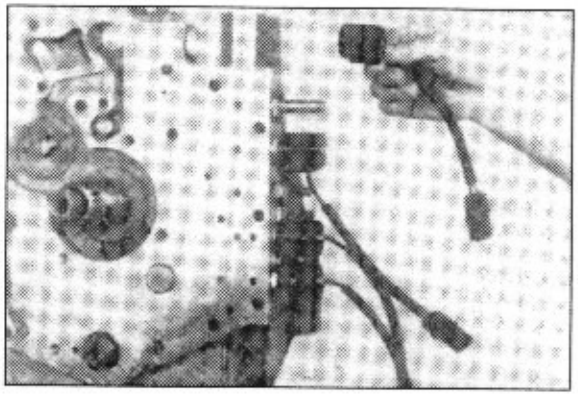
(15) Remove impeller hub gear.



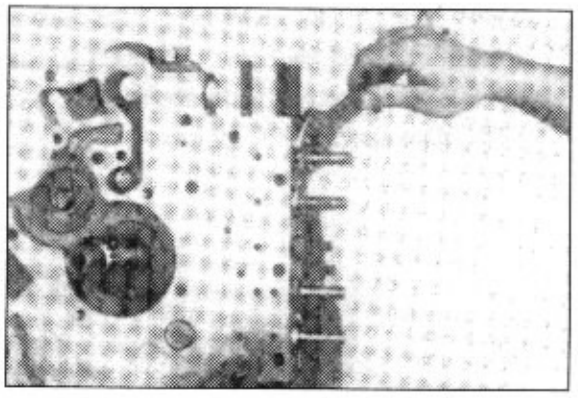
(16) Remove solenoid valve cartridge retainer nut and O-ring.



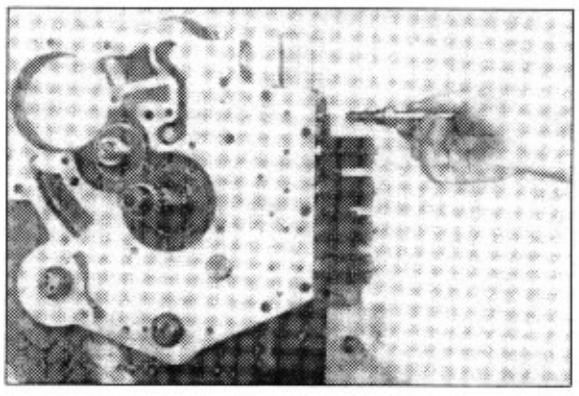
(17) Remove solenoid coil and O-ring.



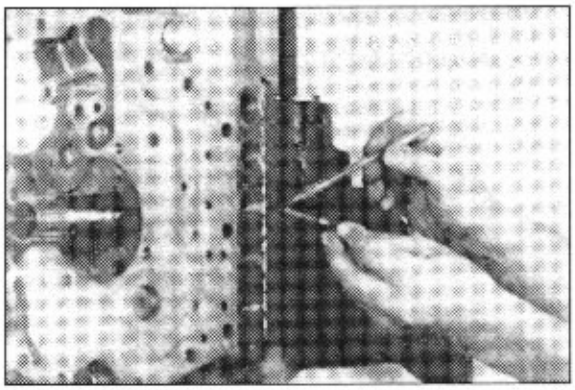
(18) Loosen solenoid valve cartridge.



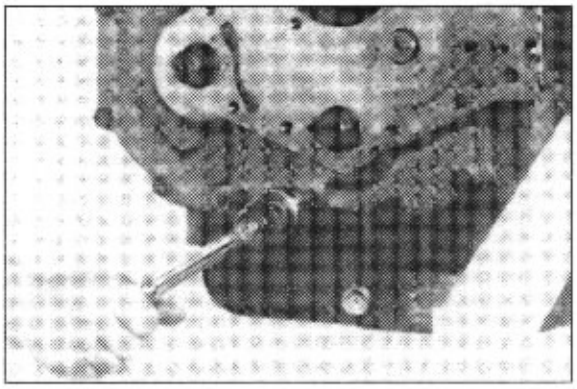
(19) Remove valve. Repeat procedures figures(16) through (19) for remaining solenoid valves. See figure(20).



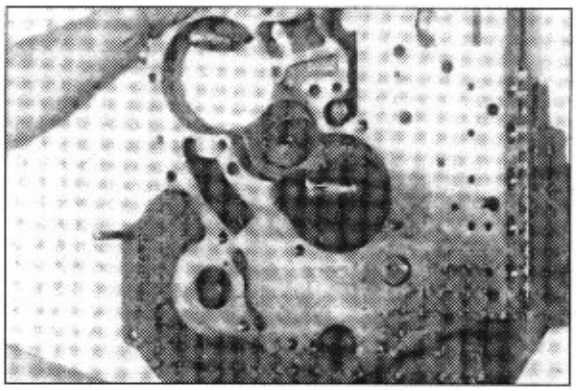
(20) Remove bore plug and O-rings. This plug is used in the middle bore position in the 3 speed version only.



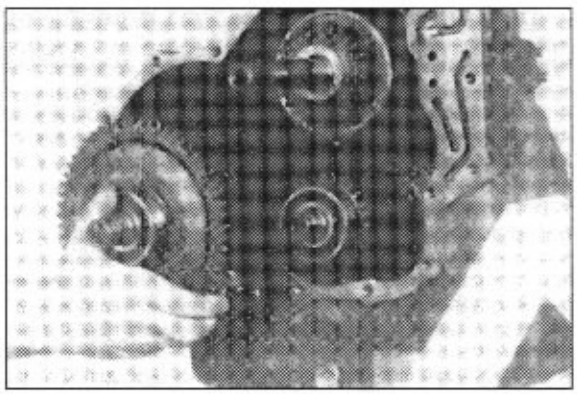
(21) Remove spacer plate bolts and washers.



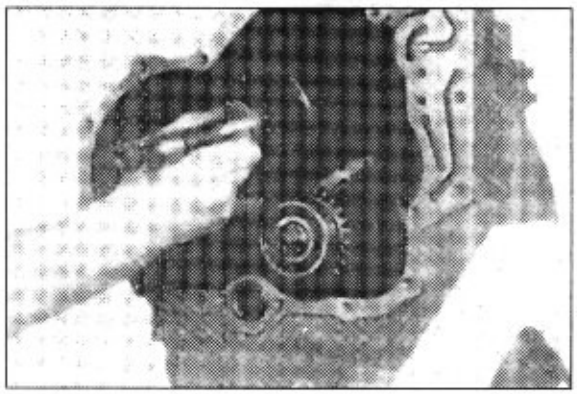
(22) Pry spacer plate away from transmission case at dowel pin holes. Remove spacer plate and gasket. Note aligning studs to facilitate spacer removal.



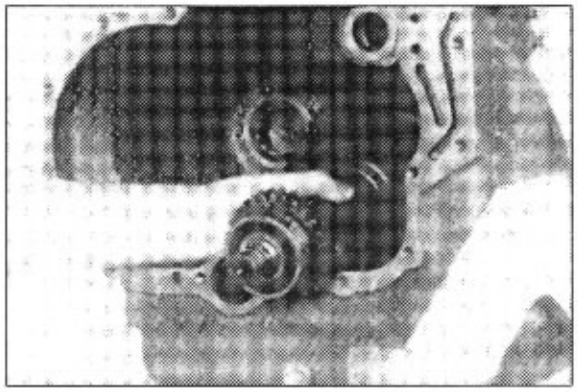
(23) Remove 1st and 2nd clutch assembly.



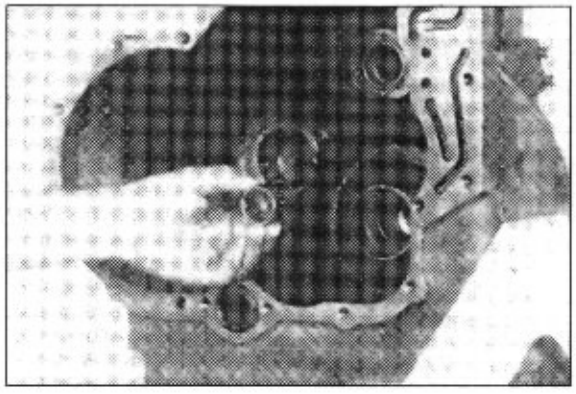
(24) Remove forward and reverse clutch assembly.



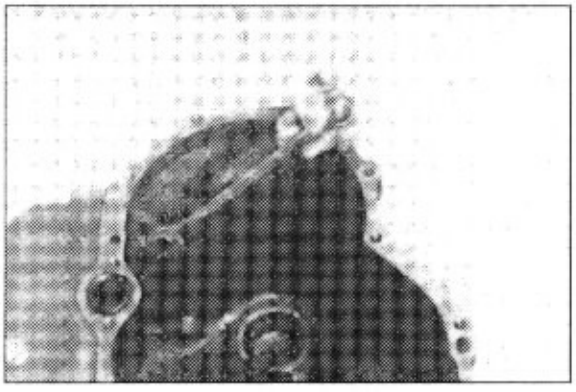
(25) Remove 3rd clutch assembly.



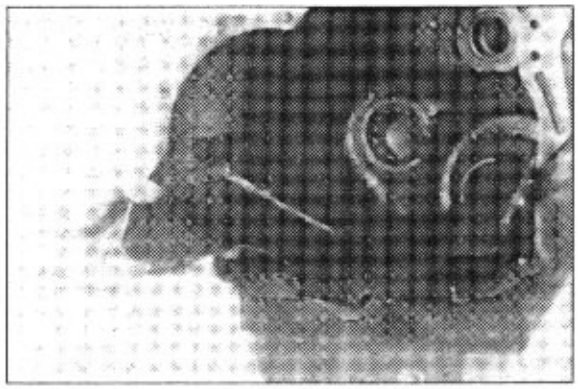
(26) Remove 3rd speed clutch shaft pilot bearing.



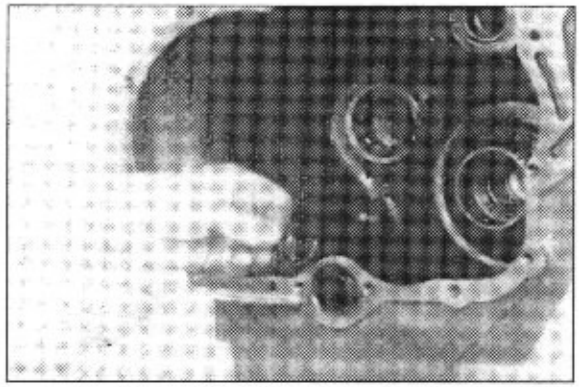
(27) Remove oil baffle capscrew and washer.



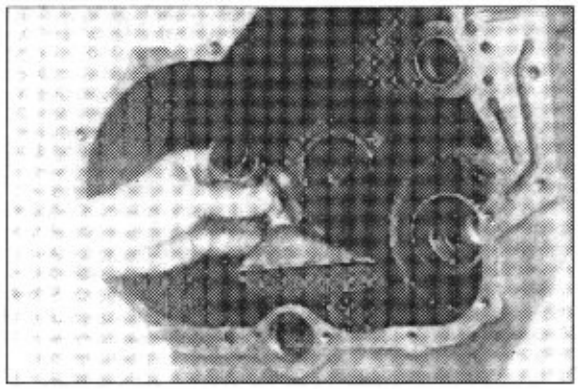
(28) Remove oil baffle.



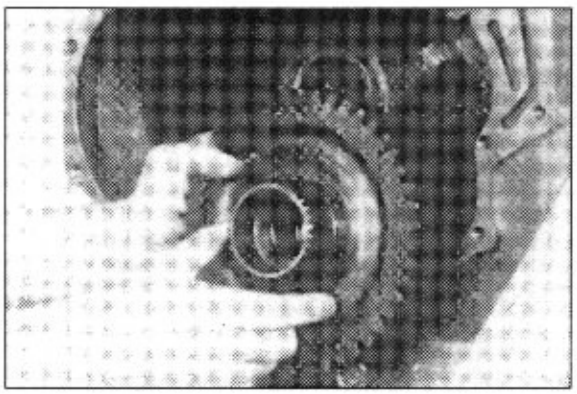
(29) Remove oil supply tube O-ring.



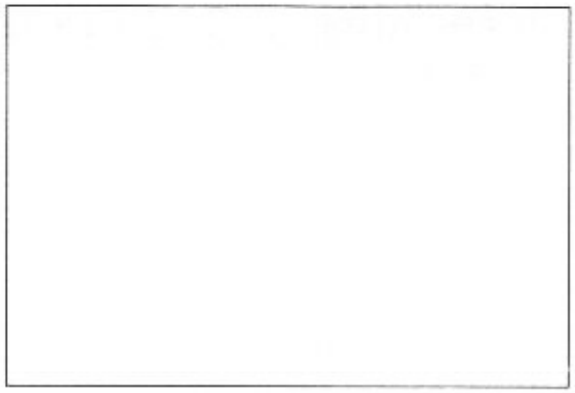
(30) Remove supply tube and screen assembly.



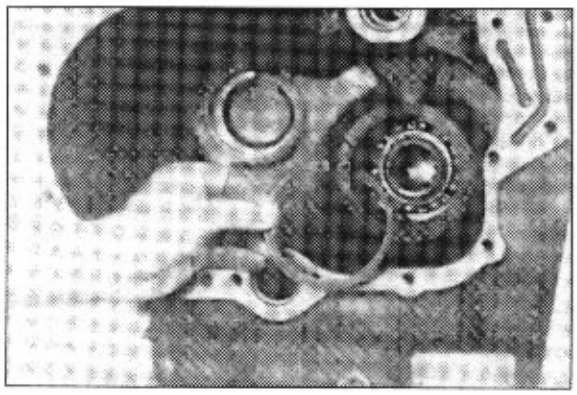
(31) Remove 3rd clutch gear and output shaft.



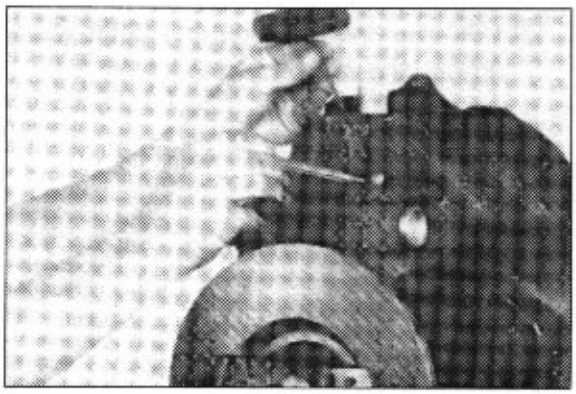
(32) Remove 1st and 2nd clutch shaft rear roller bearing. Remove 3rd gear roller bearing.



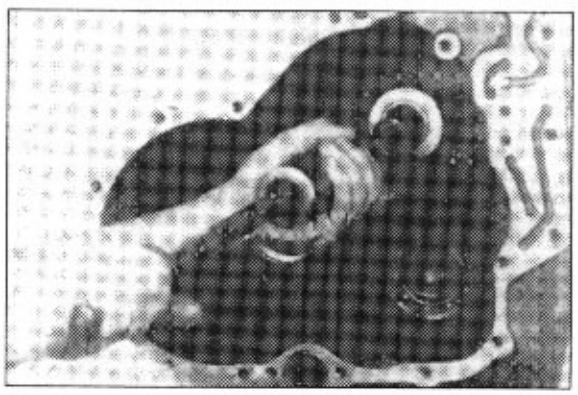
(33) Remove roller bearing locating ring.



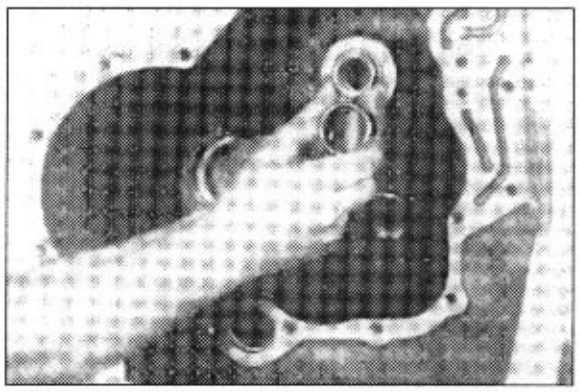
(34) Remove inner case set screw plug. Remove clutch shaft distributor sleeve set screw.



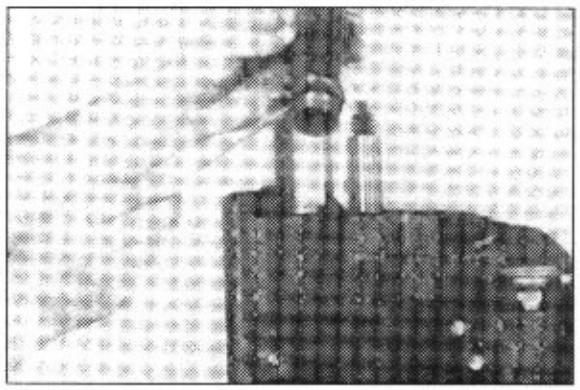
(35) Use a hammer puller(or any suitable puller) as shown to remove distributor sleeve and shaft pilot bearing.



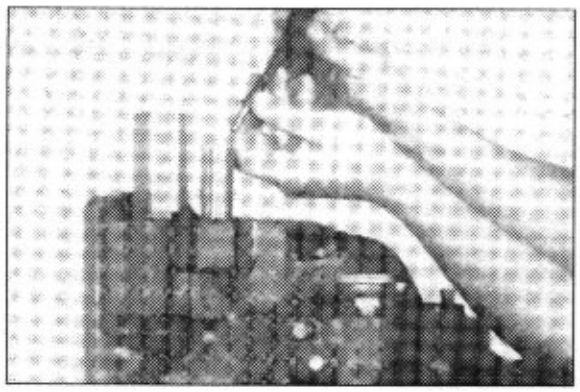
(36) Pilot bearing and distributor sleeve removed.



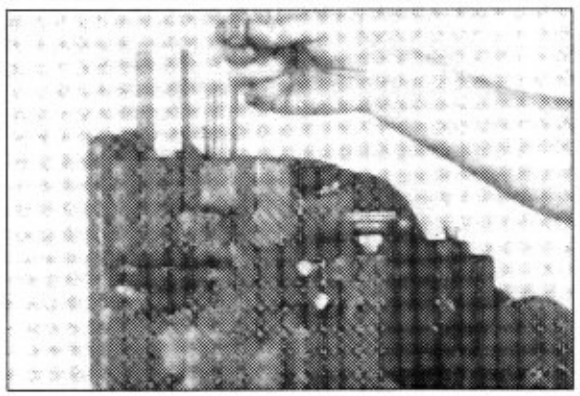
(37) Remove dual modulator housing sleeve and O-ring.



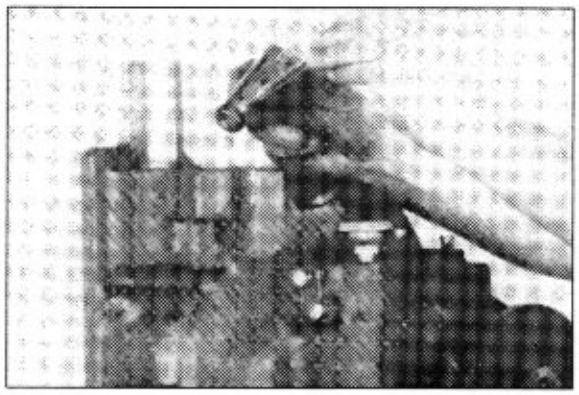
(38) Remove inner, middle, and outer valve springs and valve stop pin.



(39) Remove accumulator spool.

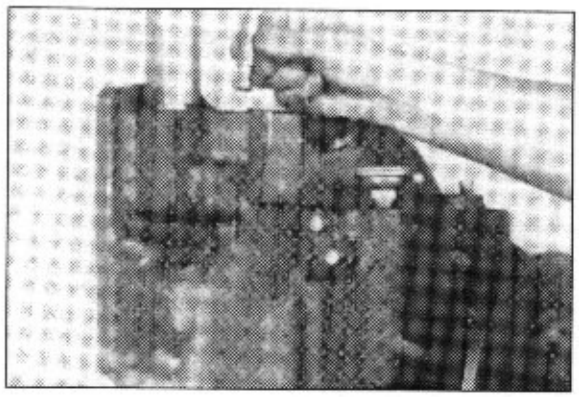


(40) Remove modulation housing sleeve and O-ring.

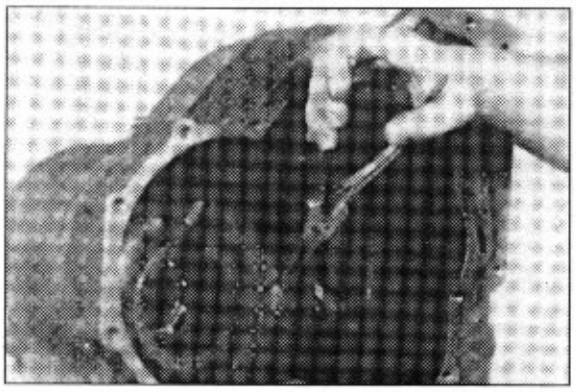


(41) Remove diverter sleeve.

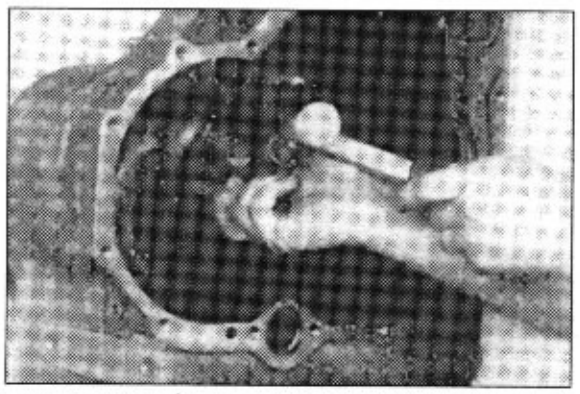
※ Diverter sleeve has a 5/16~24 threaded hole in end of it. A threaded rod screwed into end of it will facilitate removal of diverter sleeve.



(42) Remove output flange to bearing retainer ring.

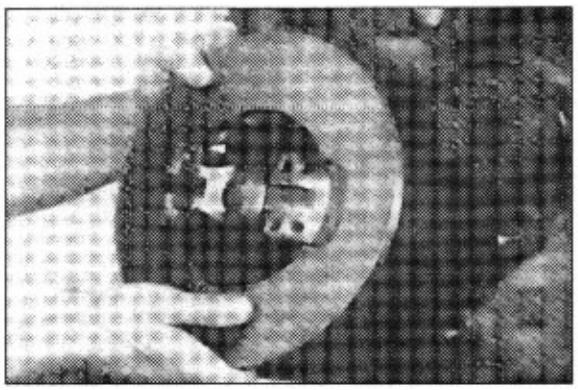


(43) Tap output flange from rear bearing.

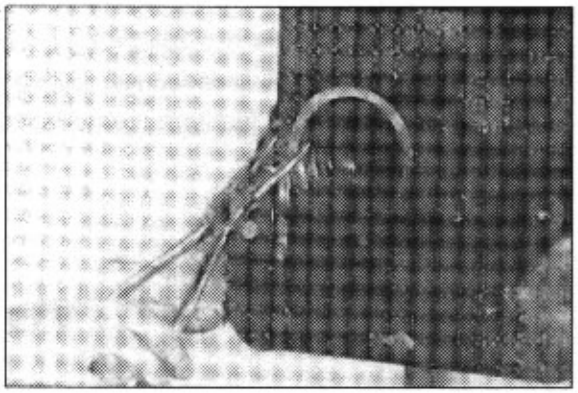


(44) Remove output flange.

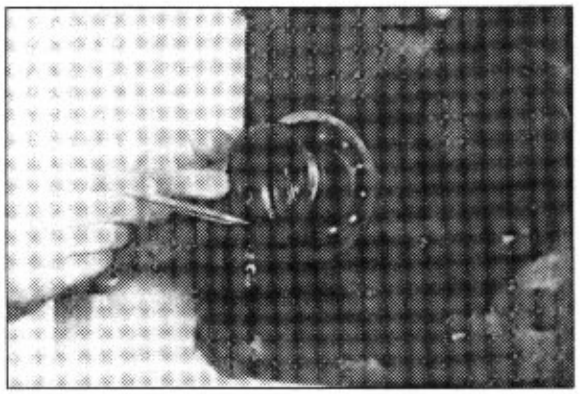
※ This machine have not brake disc.



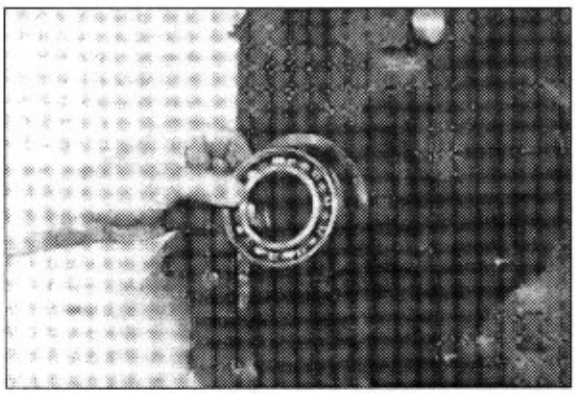
(45) Remove output seal sleeve retainer ring.



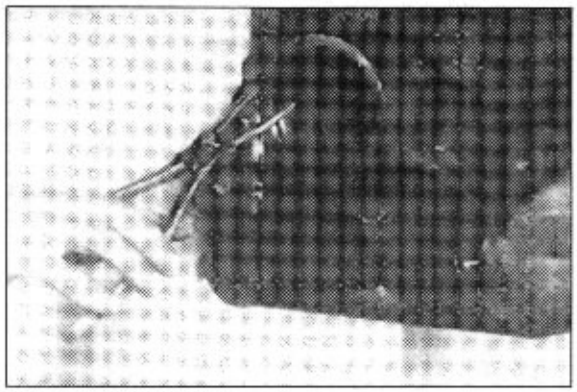
(46) Remove seal sleeve, seal and O-ring.



(47) Remove output flange bearing.



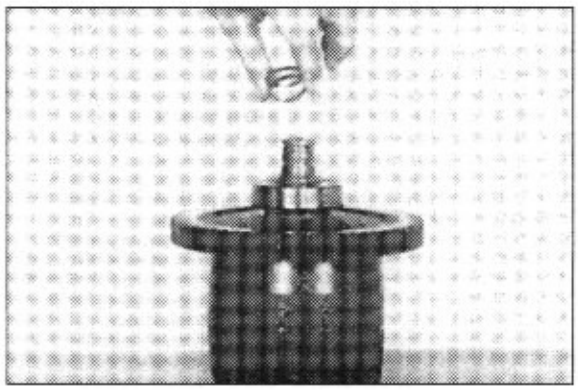
(48) Remove bearing locating ring.



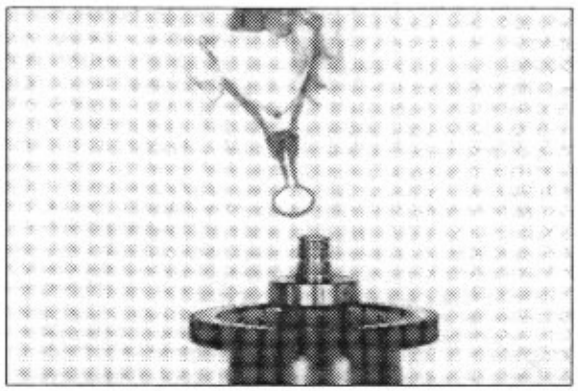
4) LOW(1ST) AND 2ND CLUTCH

(1) Low(1st) being disassembled

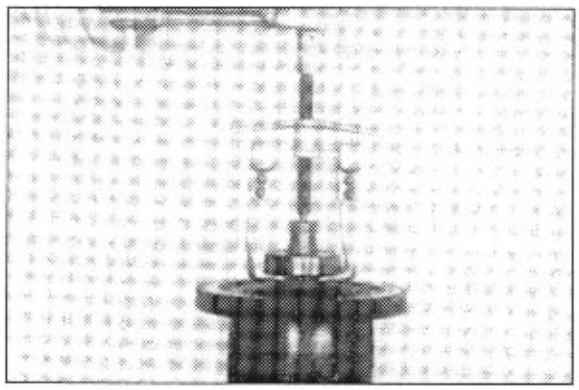
① Remove clutch shaft oil sealing rings.



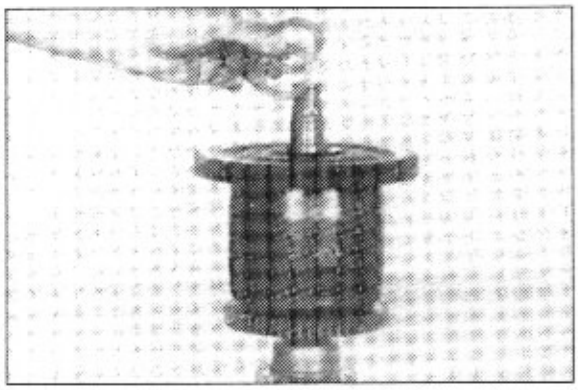
② Remove front bearing retainer ring.



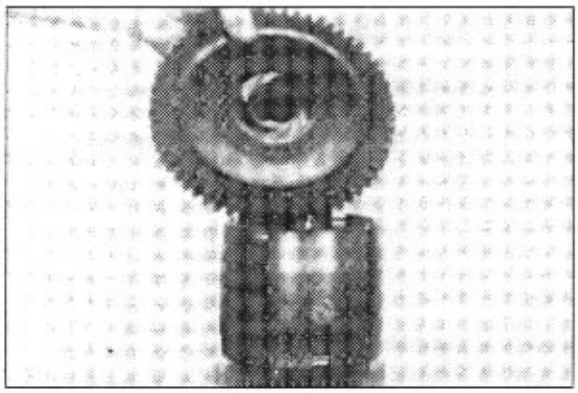
③ Remove front bearing.



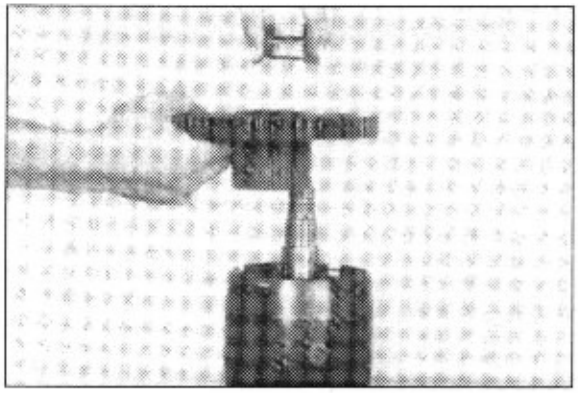
④ Remove outer thrust washer, bearing, and inner thrust washer.



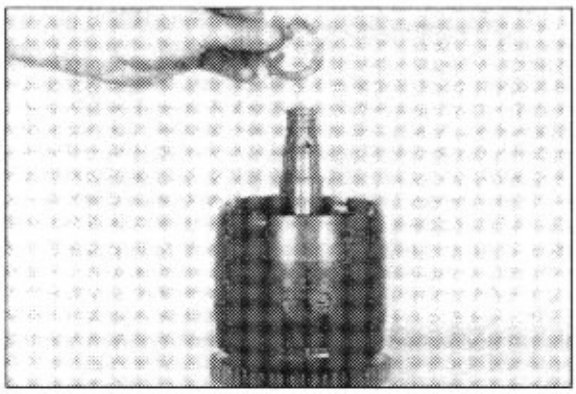
⑤ Remove clutch gear and disc hub.



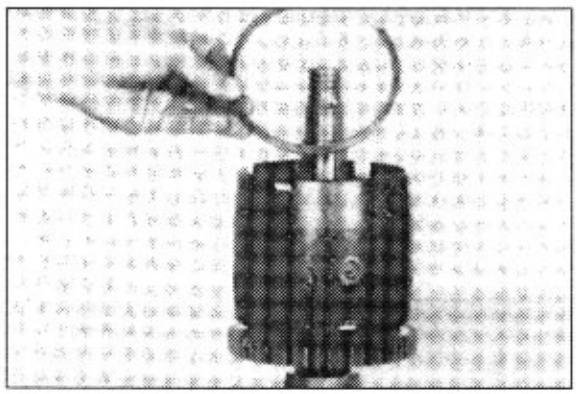
⑥ Clutch gear and bearings removed.



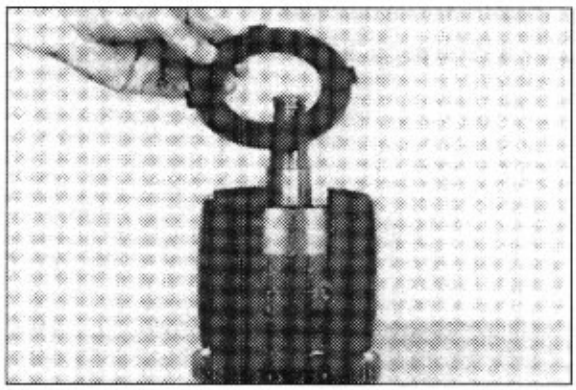
⑦ Remove outer thrust washer, thrust bearing, and inner thrust washer.



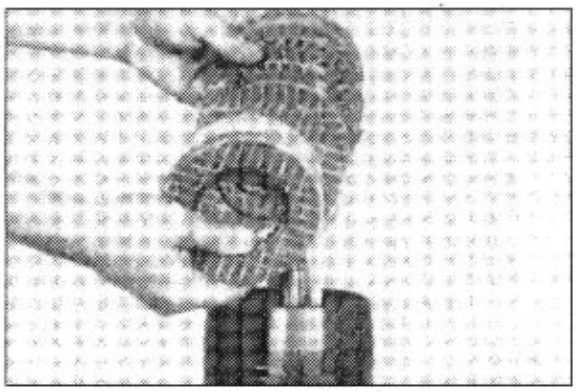
⑧ Remove clutch disc end plate retainer ring.



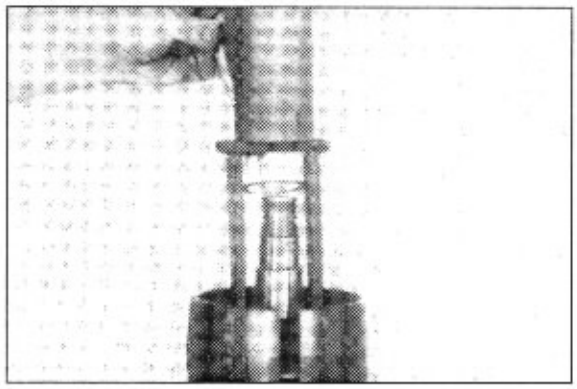
⑨ Remove clutch disc end plate.



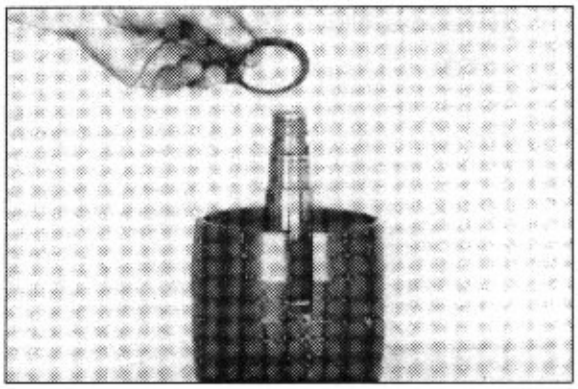
⑩ Remove inner and outer clutch discs.



⑪ Compress disc springs and remove retainer ring.

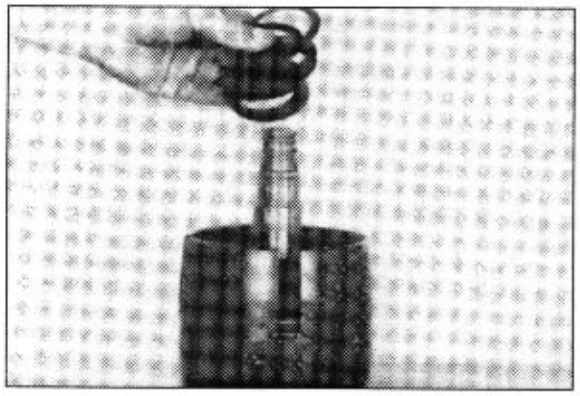


⑫ Remove retainer ring retainer.

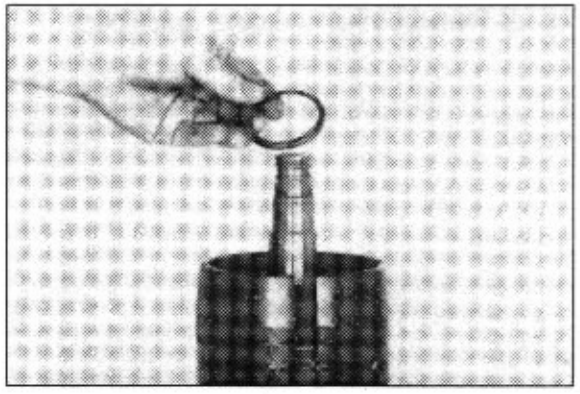


⑬ Remove disc springs.

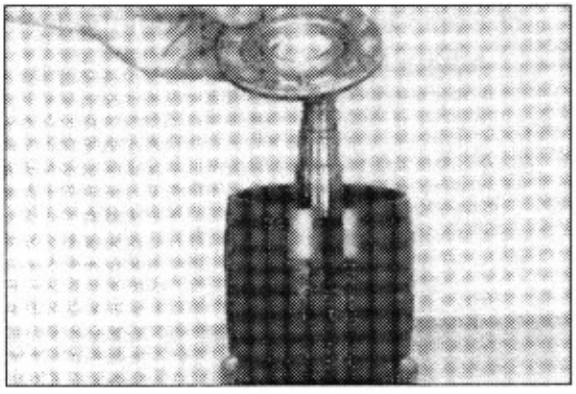
※ See page 3-140.



⑭ Remove clutch piston wear plate.

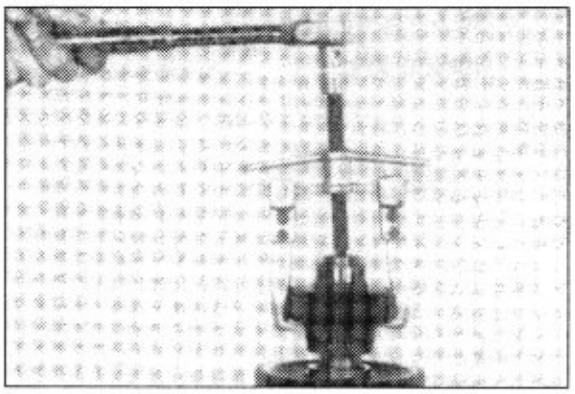


⑮ Turn clutch over and tap clutch shaft on a block of wood to remove clutch piston.

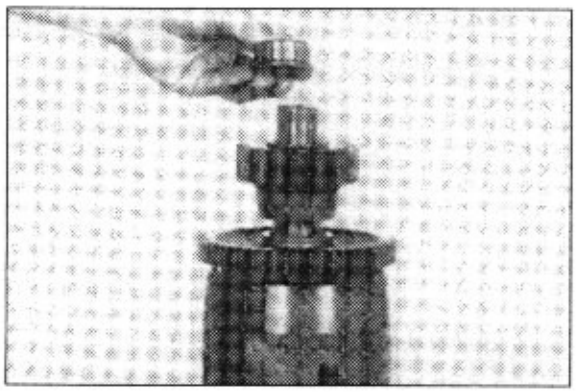


(2) 2nd clutch disassembly

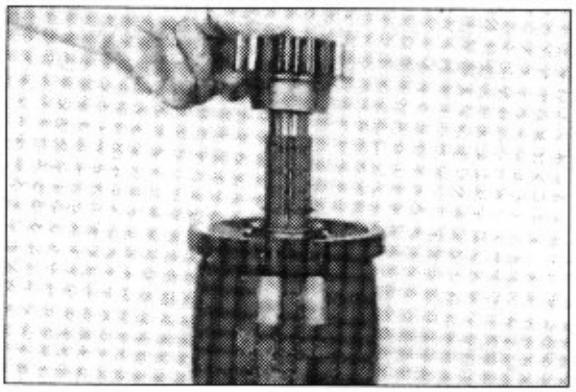
① Using a gear puller as shown, remove gear and rear bearing inner race.



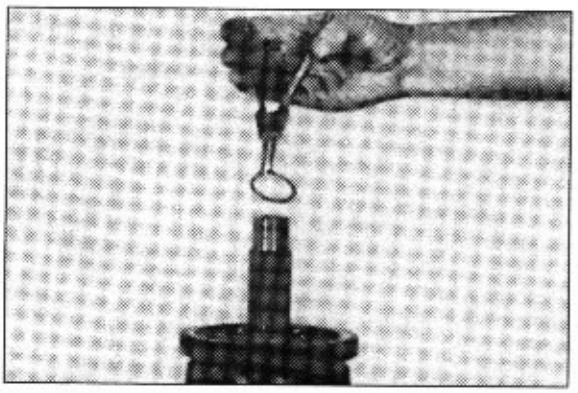
② Remove inner race from shaft.



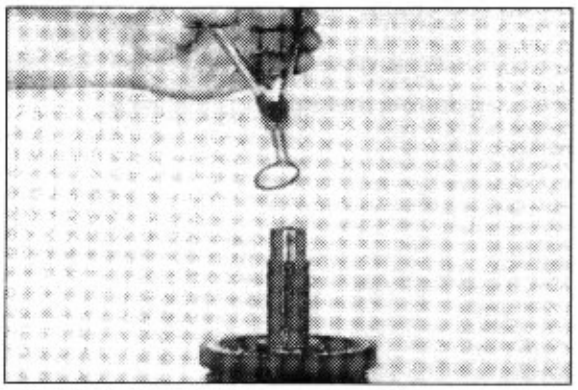
③ Remove gear from shaft.



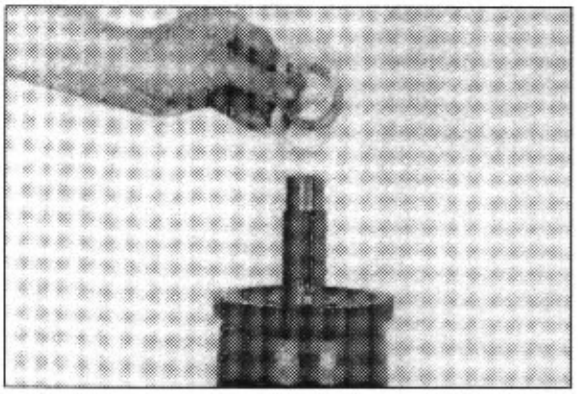
④ Remove gear locating ring from shaft.



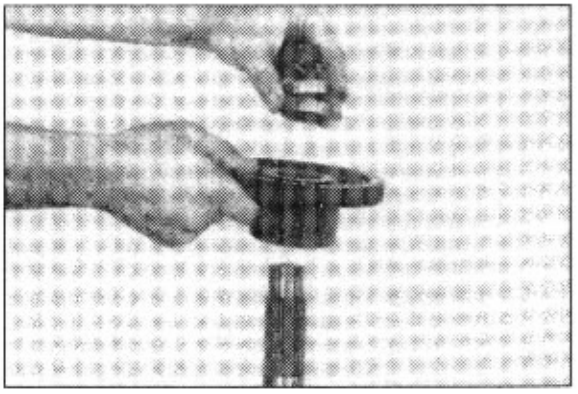
⑤ Remove thrust bearing and clutch gear retainer ring.



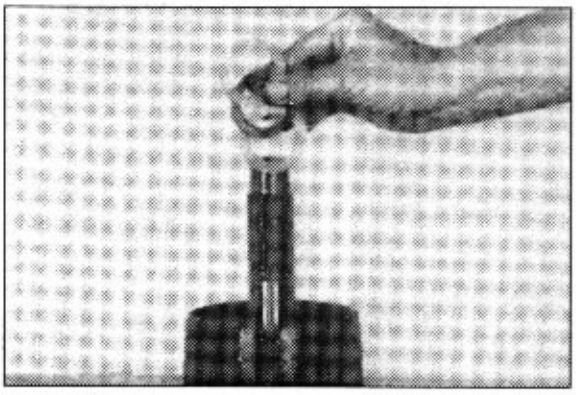
⑥ Remove outer thrust washer, thrust bearing, and inner thrust washer.



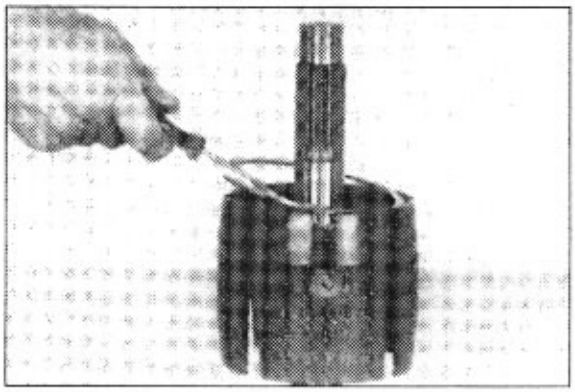
⑦ Remove clutch gear and hub and gear bearings.



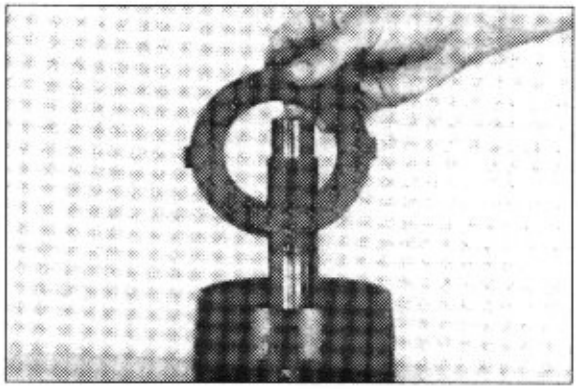
⑧ Remove outer thrust washer, thrust bearing and inner thrust washer.



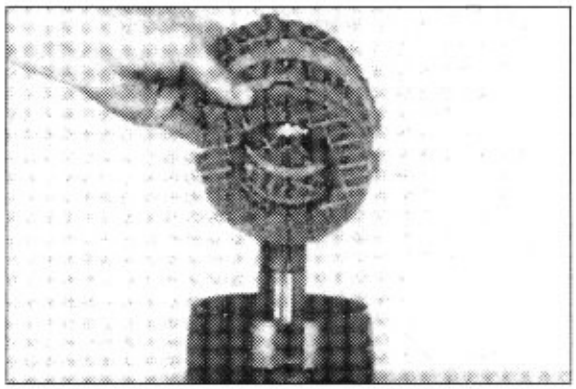
⑨ Remove clutch disc end plate retainer ring.



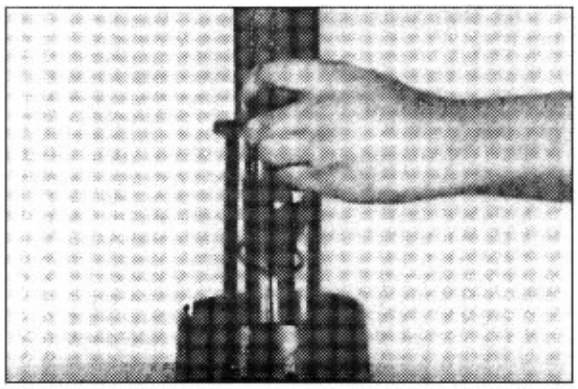
⑩ Remove end plate.



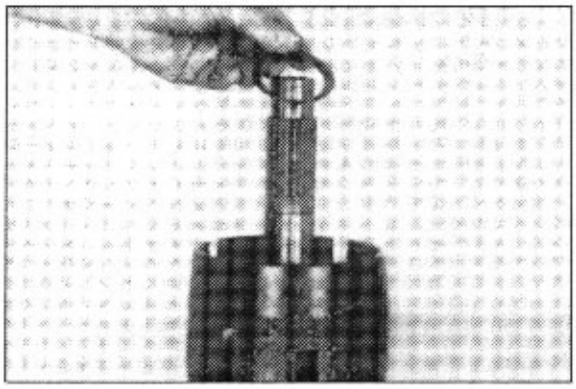
⑪ Remove clutch discs.



⑫ Compress disc springs and remove retainer ring.

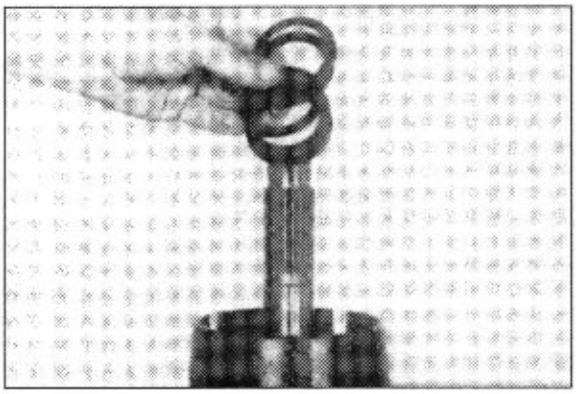


⑬ Remove retainer ring retainer.

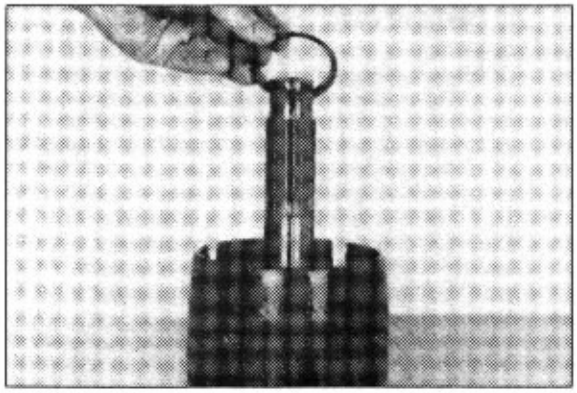


⑭ Remove disc springs.

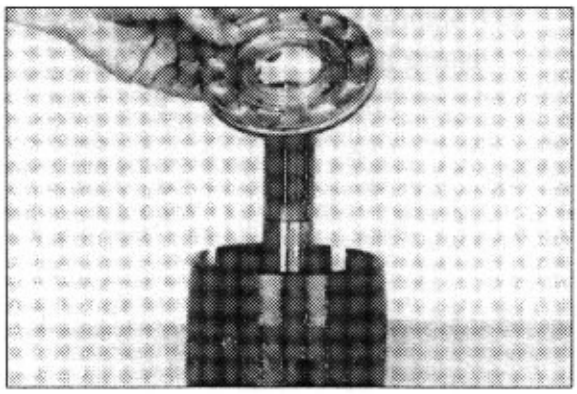
※ See page 3-140.



⑮ Remove clutch piston wear plate.



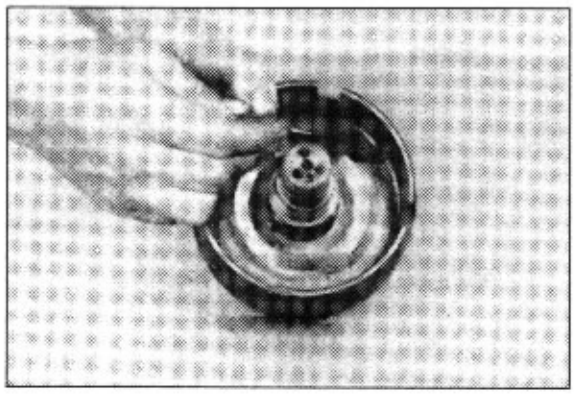
⑯ Remove clutch piston.



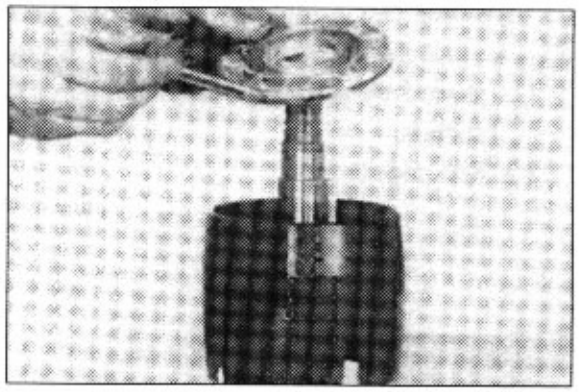
(3) Reassembly of low(1st) clutch

※ See Cleaning and inspection page 3-45, 46.

① Two bleed valves in clutch drum must be clean and free of any foreign material.

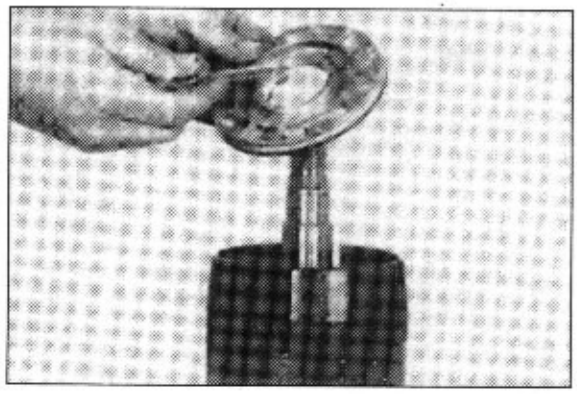


② Install clutch piston outer seal ring.

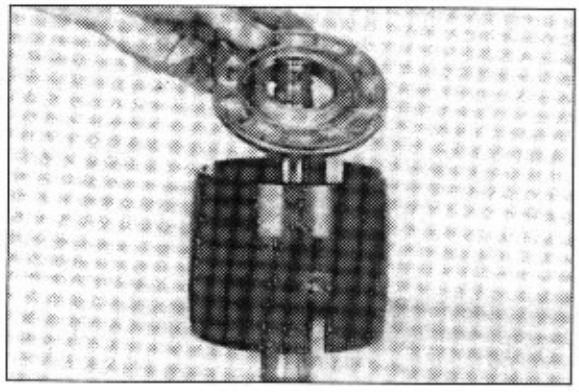


③ Install clutch piston inner seal ring.

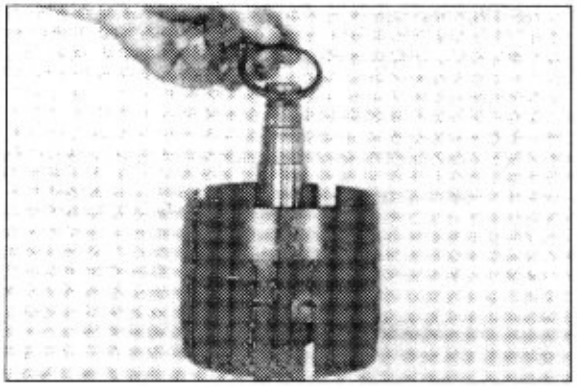
※ Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new seal ring. Rotate piston until seal ring is flush with outer diameter of piston.



④ Position piston in low clutch drum as shown. Use caution as not to damage inner and outer piston sealing rings.

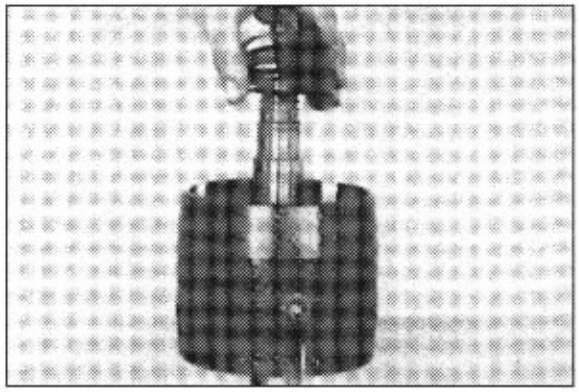


⑤ Position clutch piston wear plate on piston.

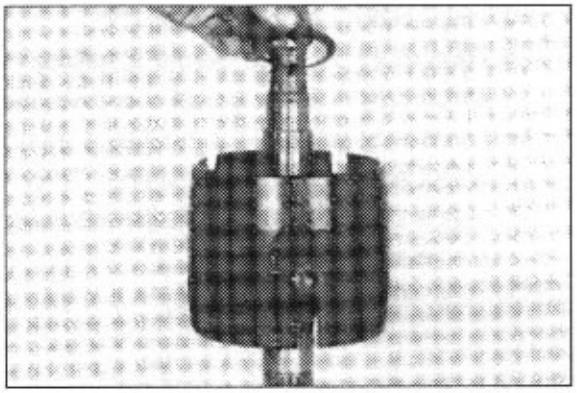


⑥ Install piston return disc springs. First spring with large diameter of bevel toward wear plate. Alternate seven(7) springs.

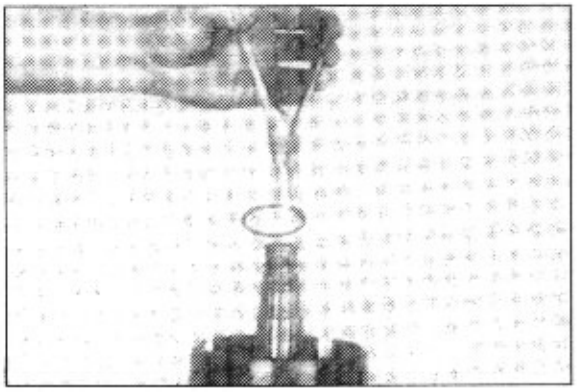
※ See page 3-140.



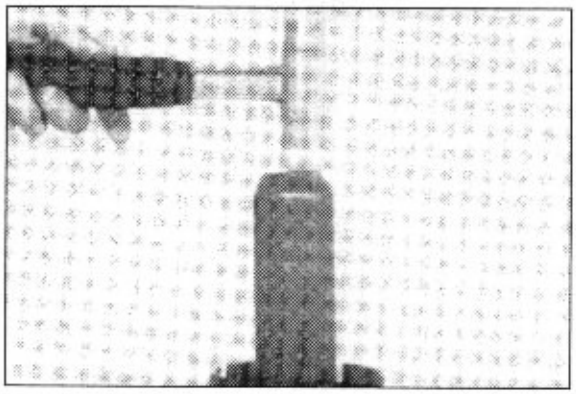
⑦ Position return spring retainer on clutch shaft.



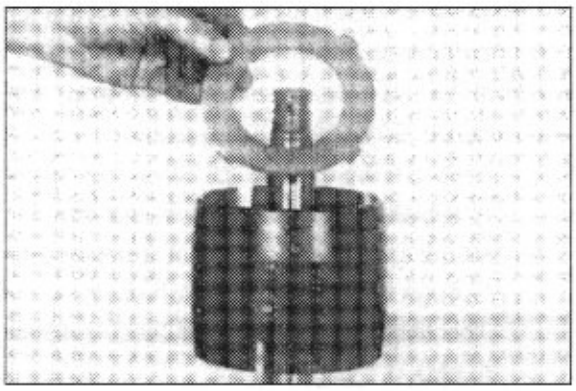
⑧ Start ring on shaft with snap ring pliers.



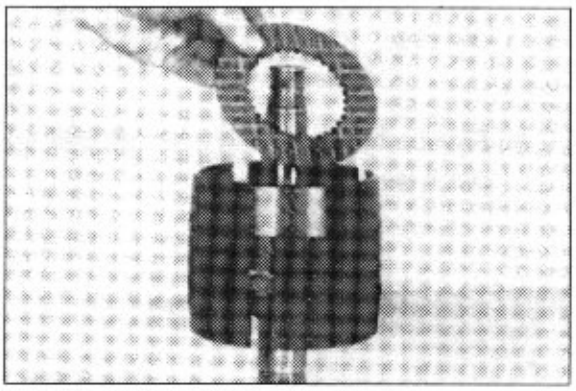
⑨ Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.



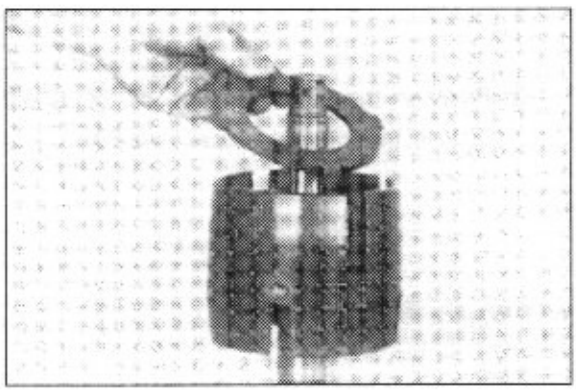
⑩ Install first steel(Outer) clutch disc.



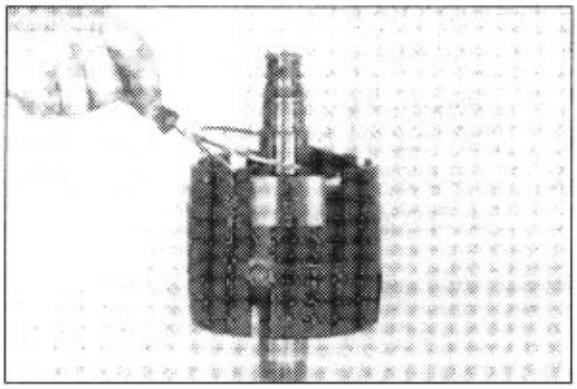
⑪ Install first friction(Inner) clutch disc. Alternate steel and friction until ten(10) steel and ten(10) friction discs are in position.



⑫ Install clutch disc end plate.

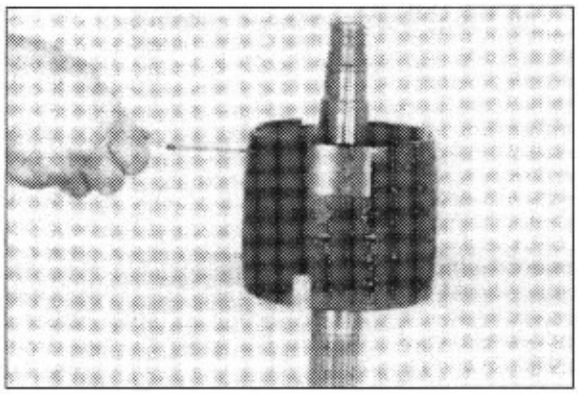


⑬ Install end plate retainer ring.

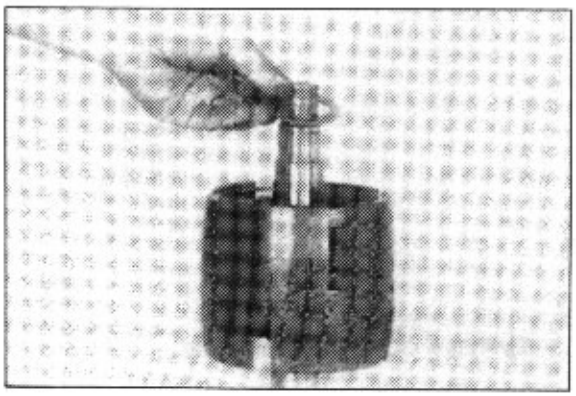


※ Low(1st) clutch pack must be checked for clutch disc clearance.

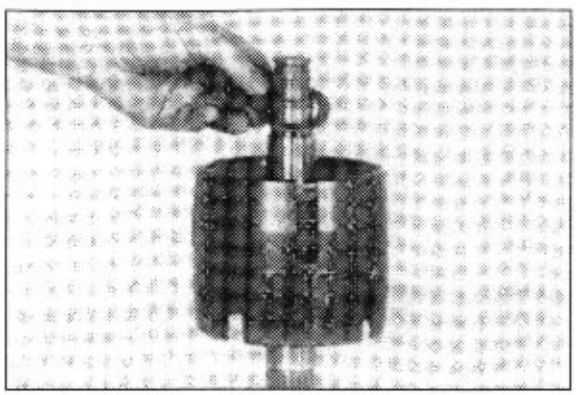
⑭ With the clutch assembly on end, the clutch discs will fall to the piston.
Measure the distance between the clutch end plate and end plate retainer ring by inserting a feeler gauge or taper gauge through the slots in the clutch drum.
The required clearance is 2.03~3.43mm (0.080~0.135in).
If the clearance is greater than 3.43mm (0.135in), add one steel disc under the end plate.



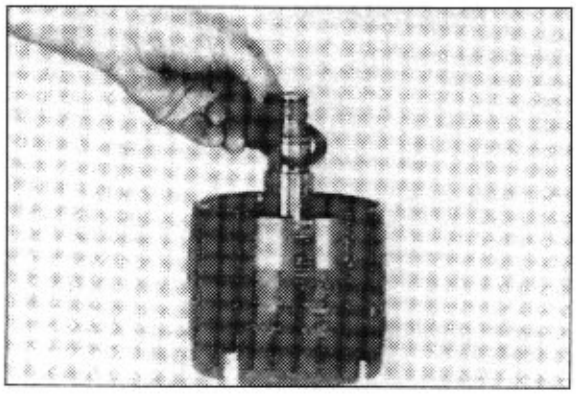
⑮ Position thrust bearing inner washer on clutch shaft.



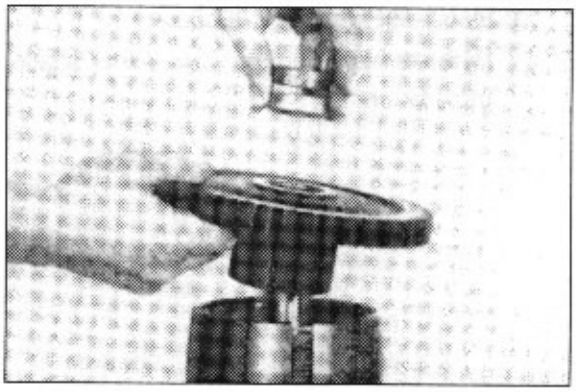
⑯ Position thrust bearing on clutch shaft against inner thrust bearing washer.



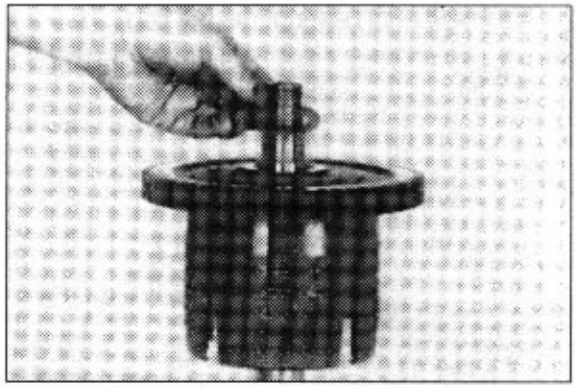
⑰ Install outer thrust bearing washer against bearing.



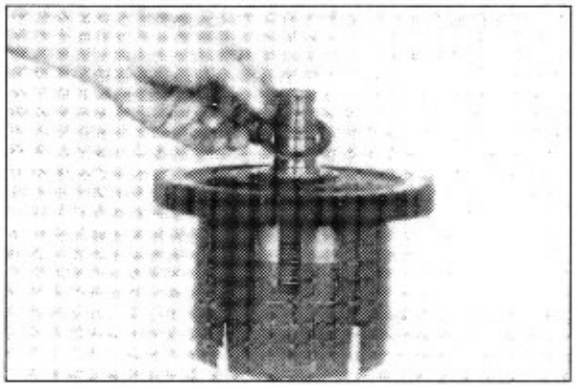
⑱ Press bearing in clutch gear and disc hub, being certain bearings are pressed flush with face of gear on both sides.
Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



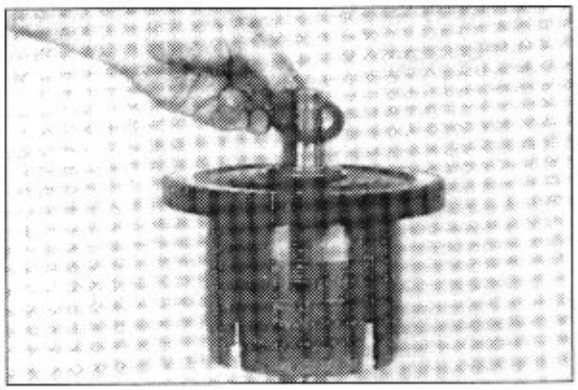
⑲ Position inner thrust washer on shaft.



⑳ Position thrust bearing on shaft.

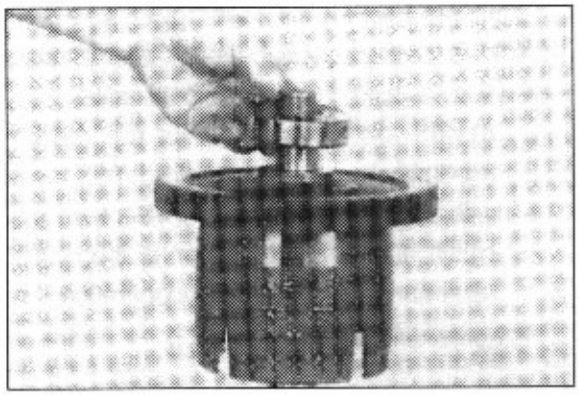


㉑ Position outer thrust washer on shaft.

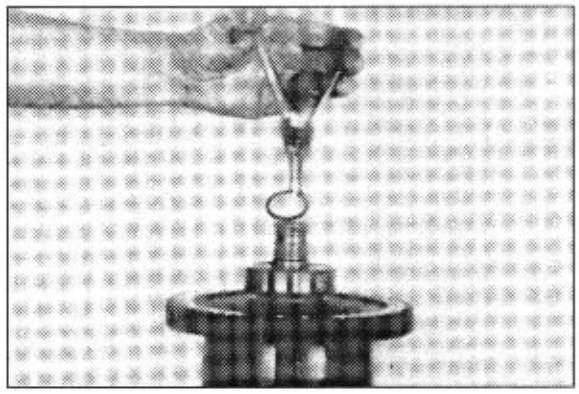


㉒ Install clutch shaft front bearing.

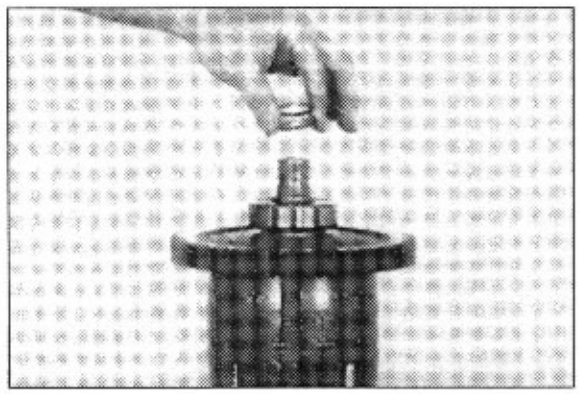
※ Bearing has a shield in it. This shield must be up.



㉓ Install front bearing retainer ring.

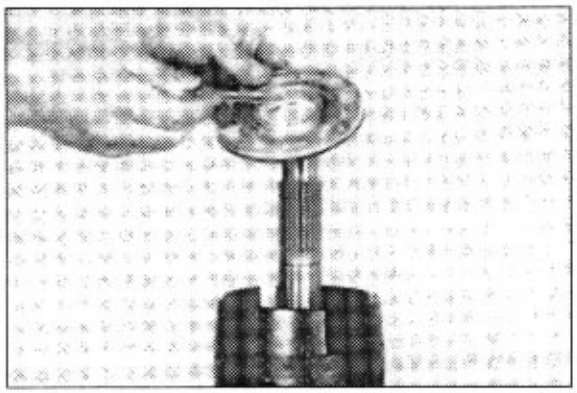


㉔ Install clutch shaft oil sealing rings. Grease rings to facilitate reassembly into front housing.

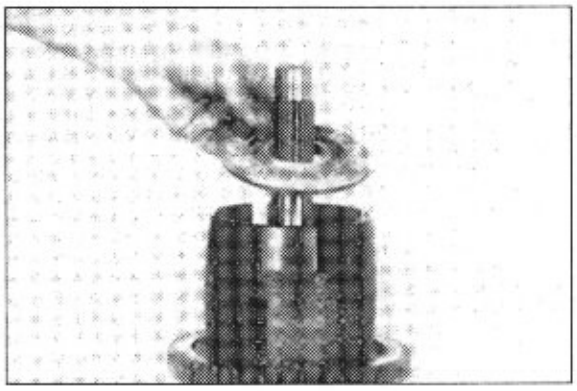


(4) 2nd clutch reassembly

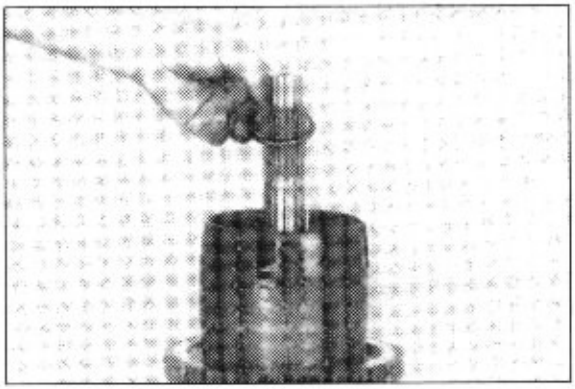
① Install inner and outer clutch piston seal rings. Size inner ring as explained in figure at page 67, ③.



② Position piston in clutch drum, using caution as not to damage piston sealing rings.

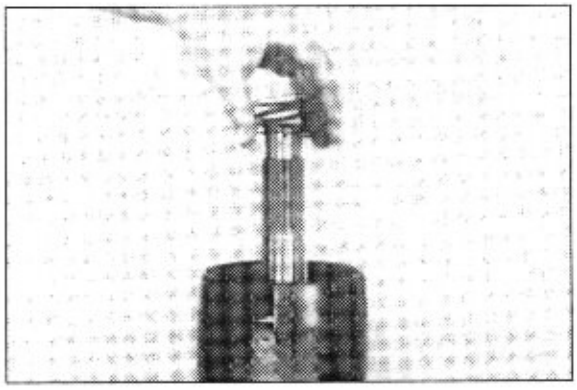


③ Install clutch piston wear plate.

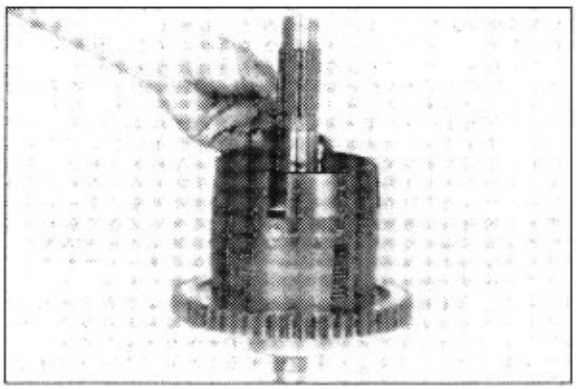


④ Install piston return disc springs. First spring with large diameter of bevel toward wear plate. Alternate five(5) springs.

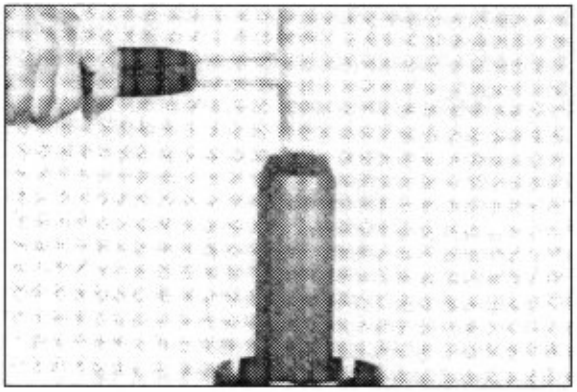
※ See page 3-140.



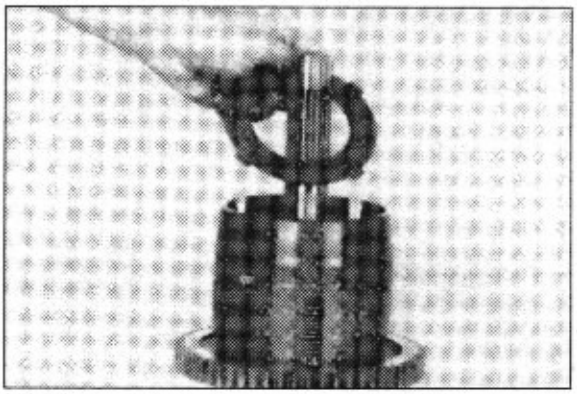
⑤ Position return spring ring retainer on clutch shaft.



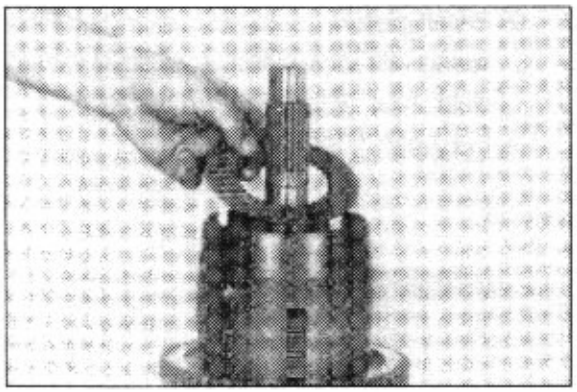
⑥ Start ring on shaft with snap ring pliers. Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.



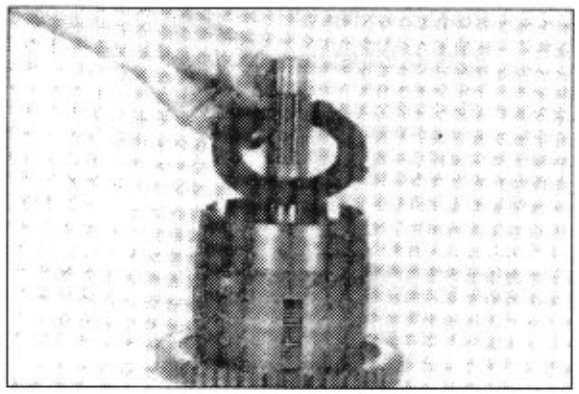
⑦ Install first steel(Outer) clutch disc.



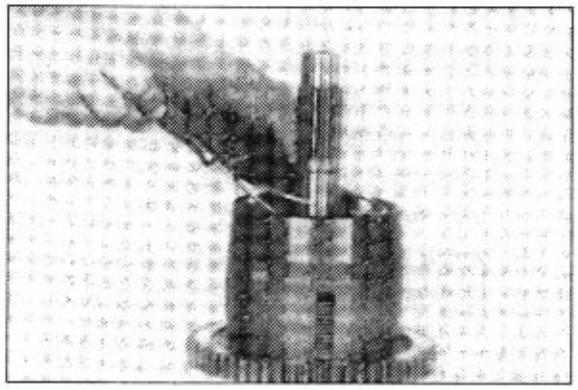
⑧ Install first friction(Inner) clutch disc. Alternate steel and friction until five(5) steel and five(5) friction discs are in position.



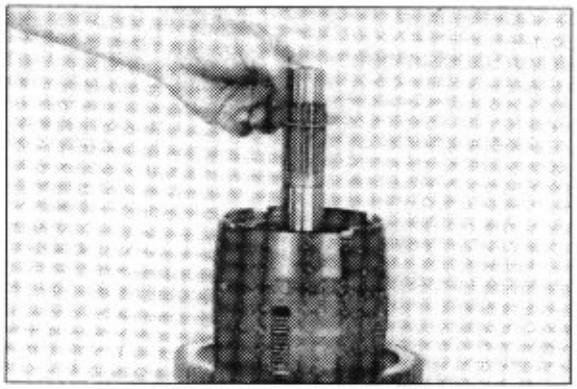
⑨ Install clutch disc end plate.



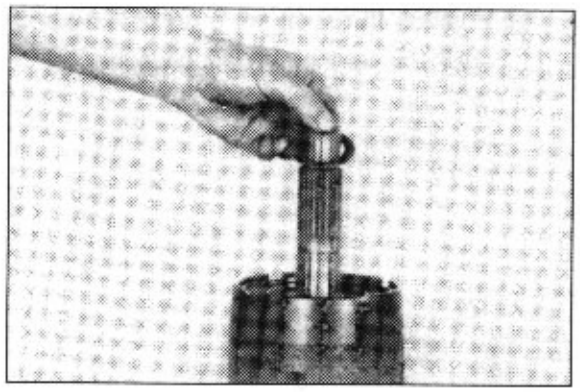
⑩ Install end plate retainer ring.



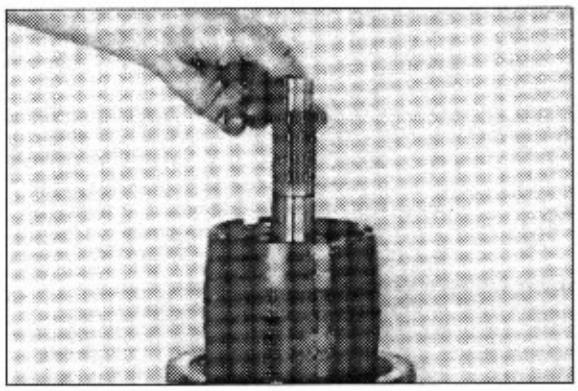
⑪ Position thrust bearing inner washer on clutch shaft.



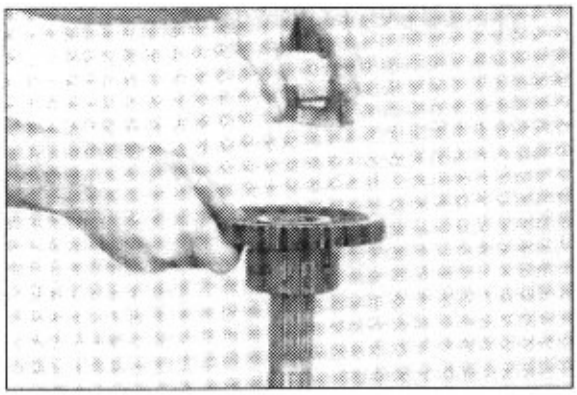
⑫ Position thrust bearing on clutch shaft against inner thrust bearing washer.



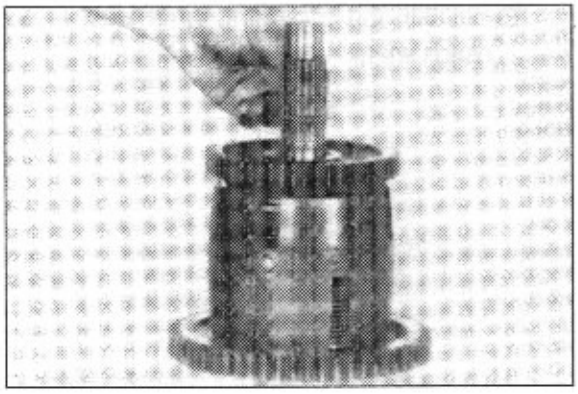
⑬ Install outer thrust bearing washer against thrust bearing.



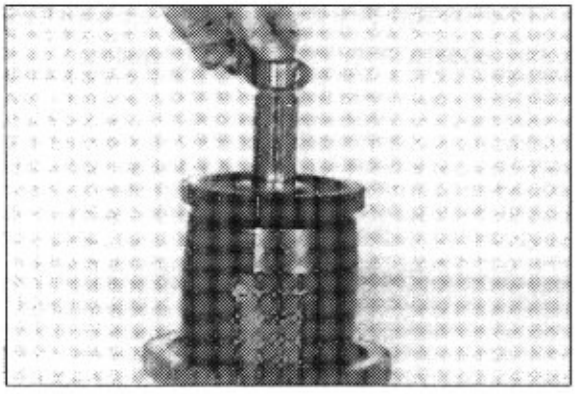
⑭ Press needle bearings in clutch gear and disc hub, being certain bearings are pressed flush with face of gear on both sides. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



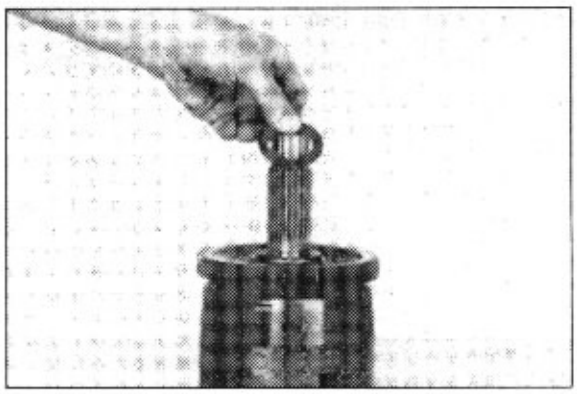
⑮ Position thrust bearing inner washer on clutch shaft.



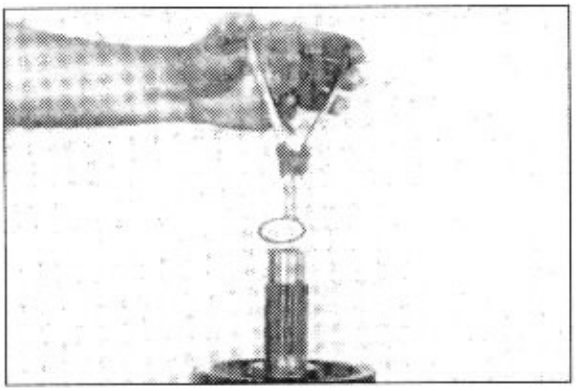
⑯ Position thrust bearing on clutch shaft against inner thrust bearing washer.



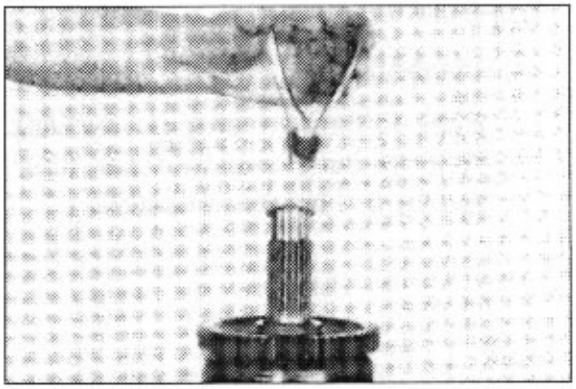
⑰ Install outer thrust bearing washer against bearing.



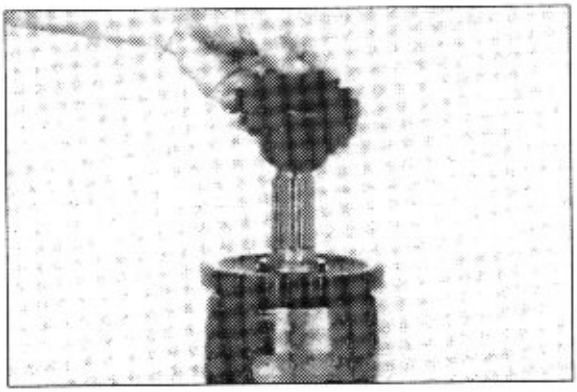
⑱ Install thrust washer retainer ring.



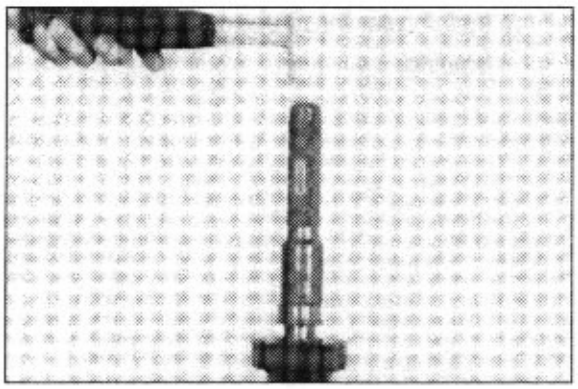
⑲ Install clutch shaft gear locating ring.



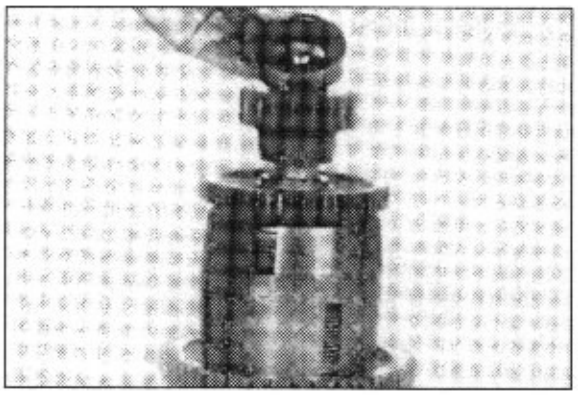
⑳ Install clutch shaft gear on clutch shaft with long hub of gear down.



㉑ Install rear bearing inner race on clutch shaft with bearing race shoulder down.



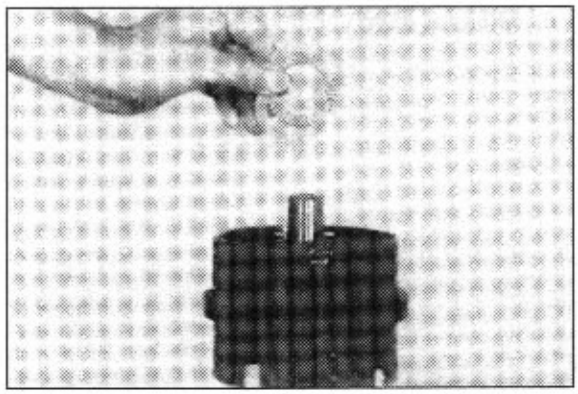
㉒ Position rear bearing on bearing race.



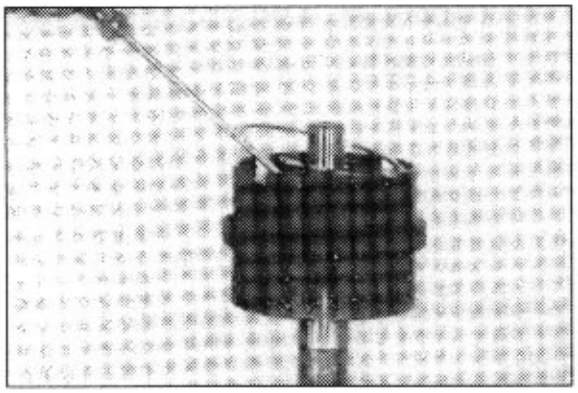
5) 3RD CLUTCH

(1) Disassembly

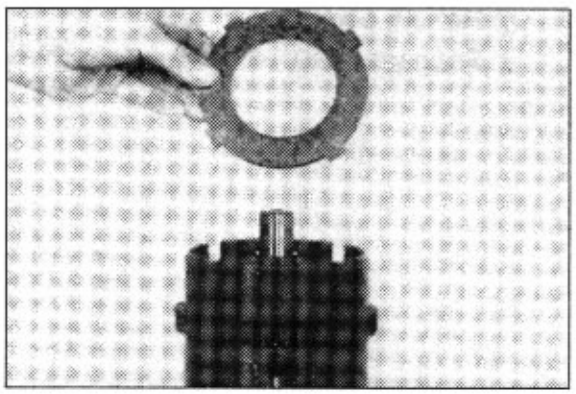
① Remove thrust washer retainer ring. Remove outer thrust washer, thrust bearing, and inner thrust washer.



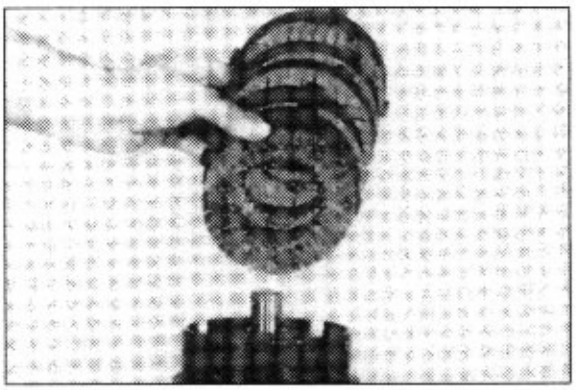
② Remove end plate retainer ring.



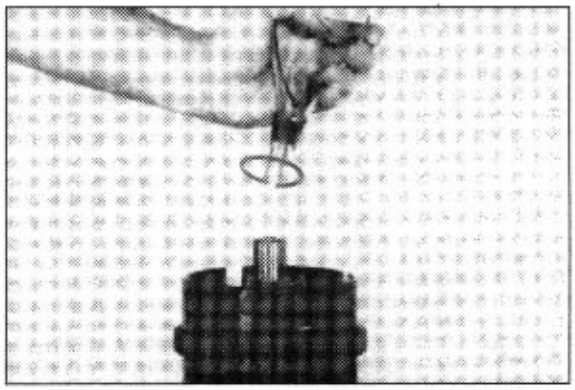
③ Remove end plate.



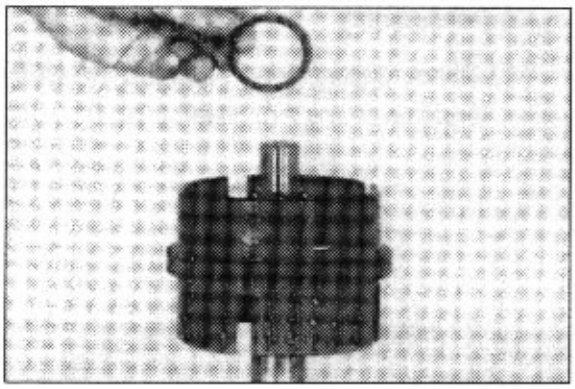
④ Remove clutch discs.



⑤ Compress disc springs and remove retainer ring.

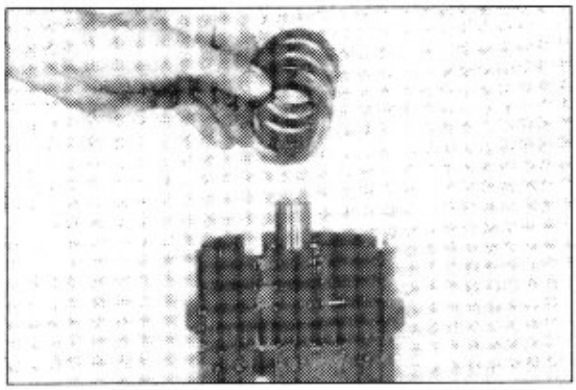


⑥ Remove retainer ring retainer.

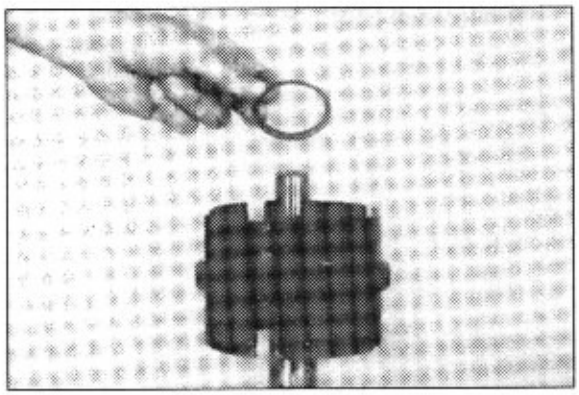


⑦ Remove disc springs.

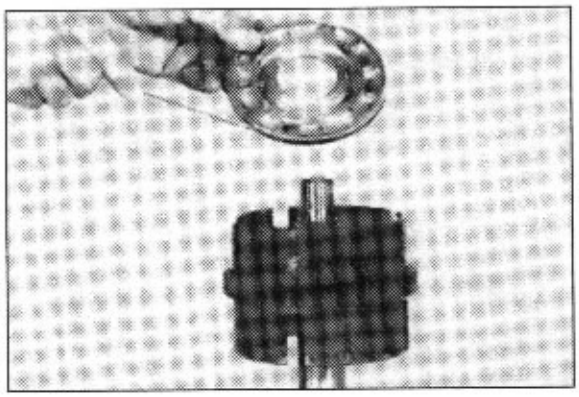
※ See page 3-140.



⑧ Remove clutch piston wear plate.

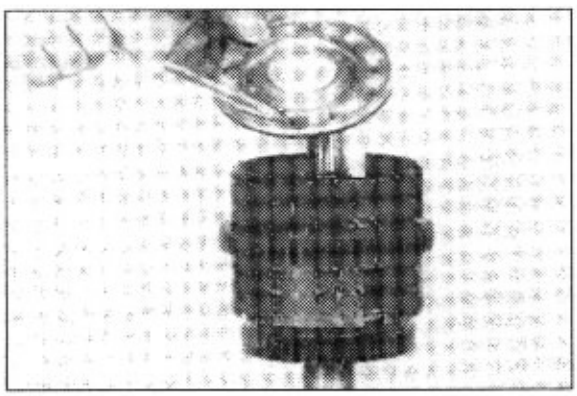


⑨ Remove clutch piston.

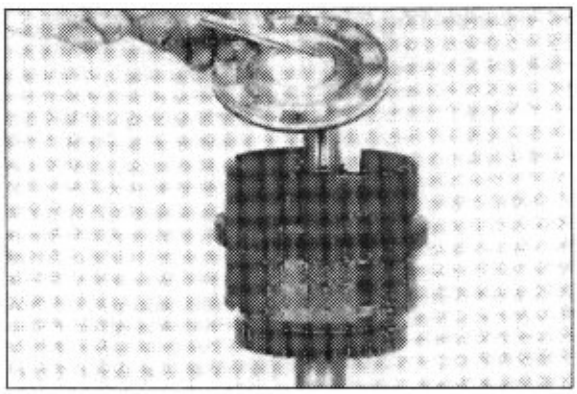


(2) Reassembly

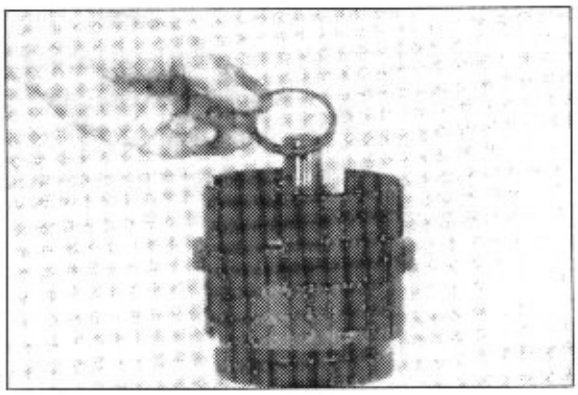
① Clutch piston bleed ball must be clean and free of any foreign material.



② Install inner and outer clutch piston seal rings. Size inner ring as explained at page 67, ③. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.

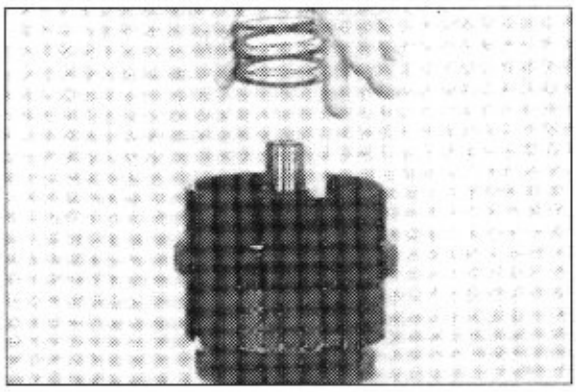


③ Install clutch piston wear plate.

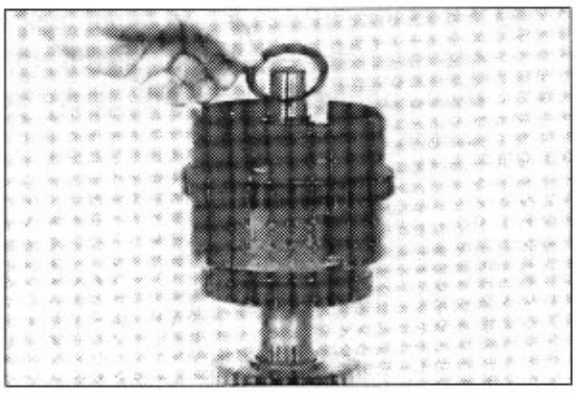


④ Install piston return disc springs. First spring with large diameter of bevel toward wear plate. Alternate five(5) springs.

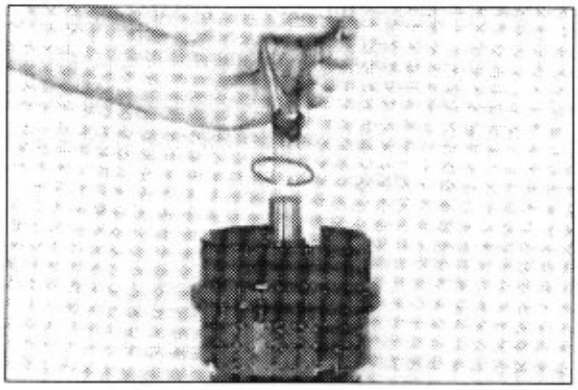
※ See page 3-140.



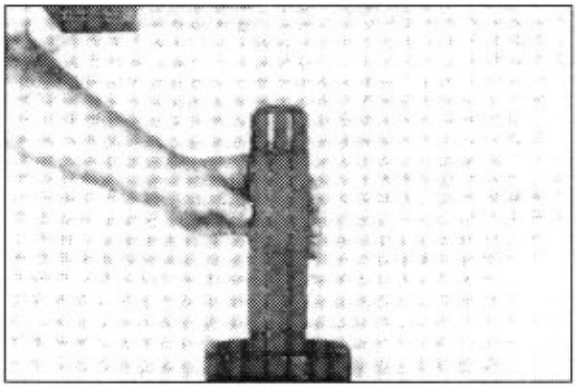
⑤ Position return spring ring retainer on clutch shaft.



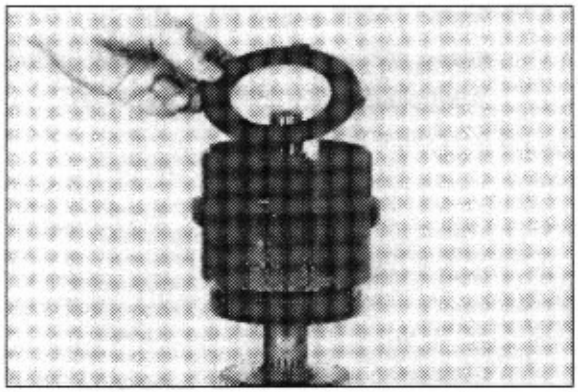
⑥ Start ring on shaft with snap ring pliers.



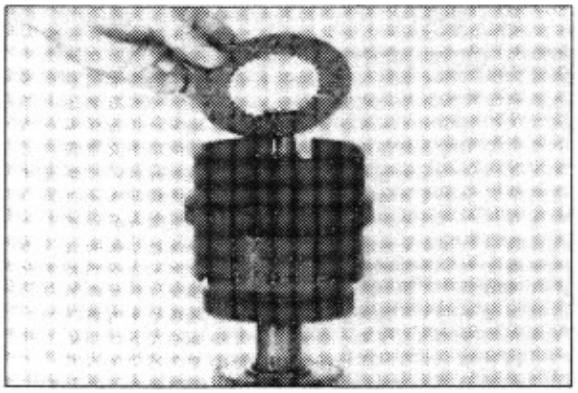
⑦ Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.



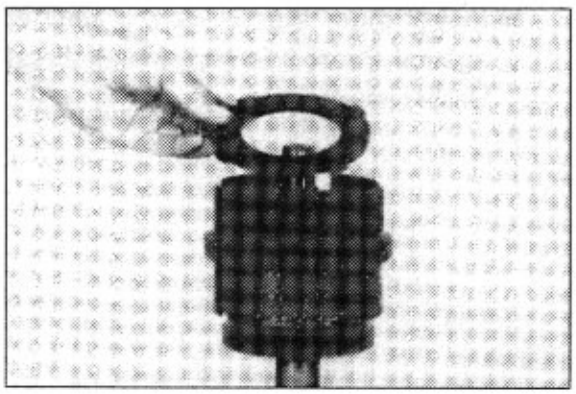
⑧ Install first steel(Outer) clutch disc.



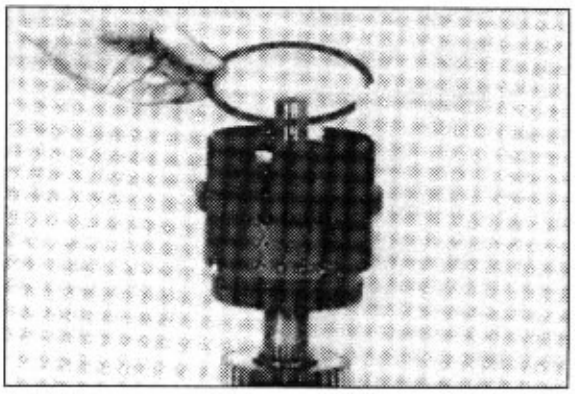
⑨ Install first friction(Inner) clutch disc. Alternate steel and friction until five(5) steel and five(5) friction discs are in position.



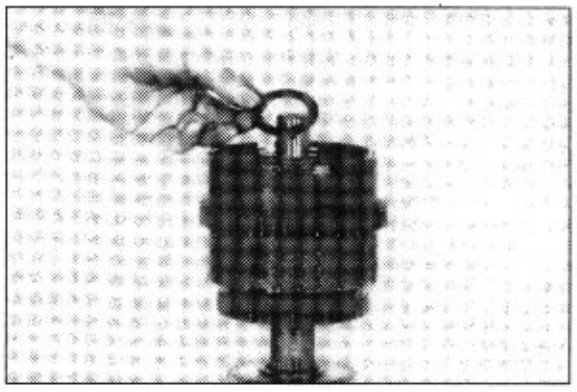
⑩ Install clutch disc end plate.



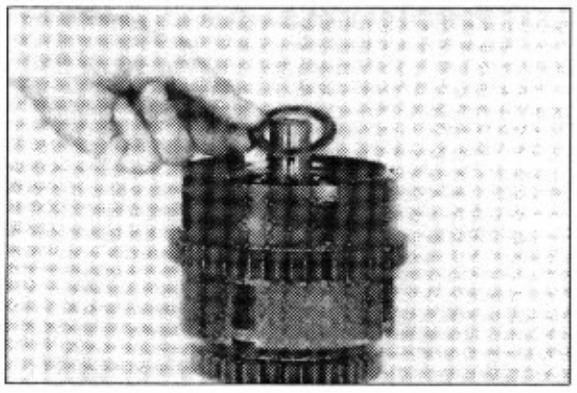
⑪ Install end plate retainer ring.



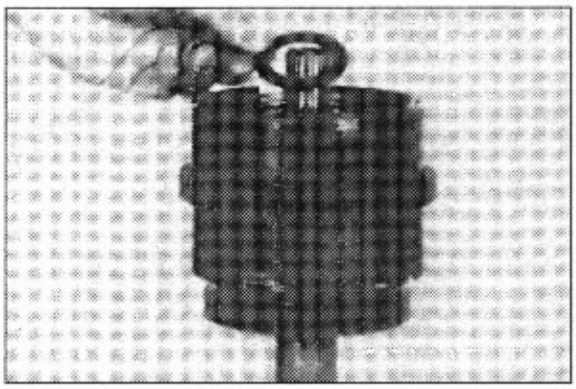
⑫ Position thrust bearing inner washer on clutch shaft.



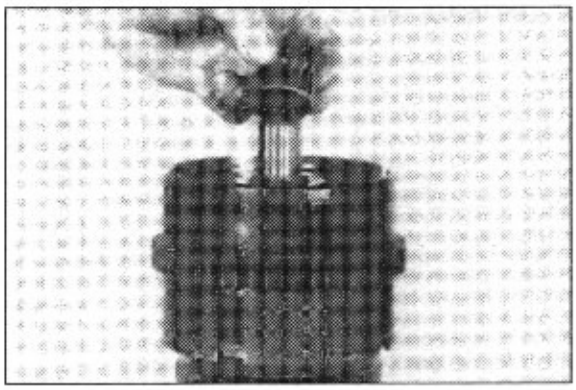
⑬ Position thrust bearing on clutch shaft against inner thrust bearing washer.



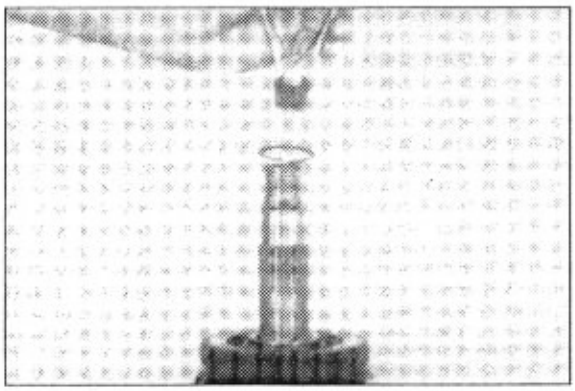
⑭ Install outer thrust bearing washer against thrust bearing. Install thrust washer retainer ring.



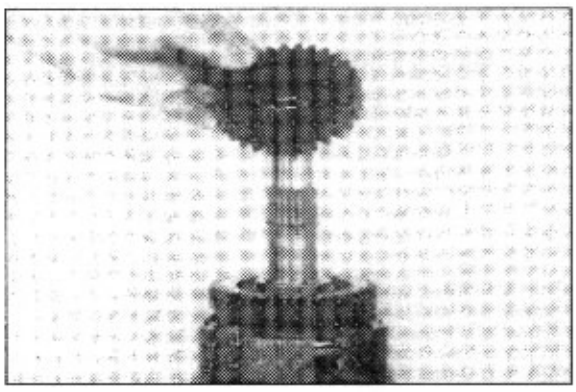
⑮ Install 3rd clutch pilot bearing on clutch shaft. A coat of high quality grease will hold pilot bearing in position.



⑯ Install clutch shaft gear locating ring.

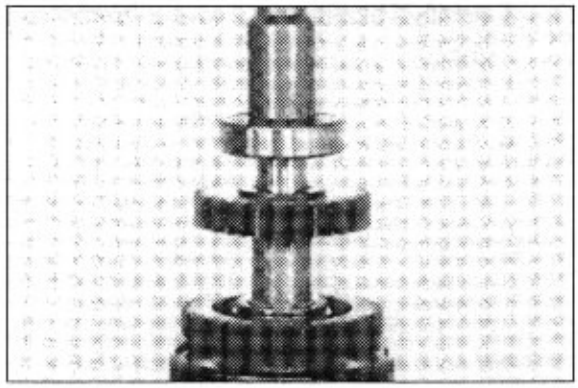


⑰ Position gear on clutch shaft.

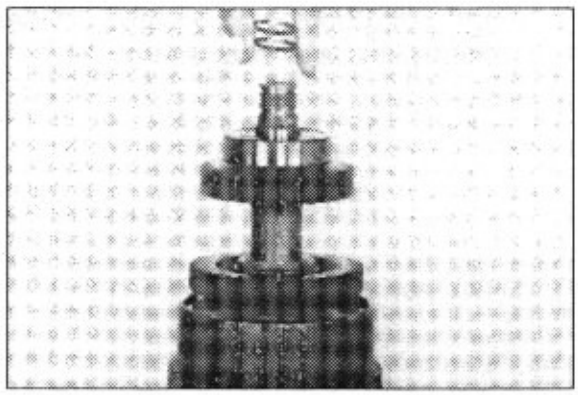


⑱ Install clutch shaft front bearing.

※ Bearing has a shield in it. This shield must be up.



⑲ Install clutch shaft oil sealing rings. Grease rings to facilitate reassembly into front housing.

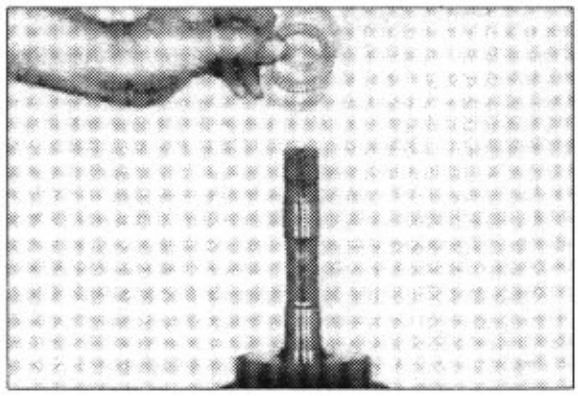


6) FORWARD AND REVERSE CLUTCHES

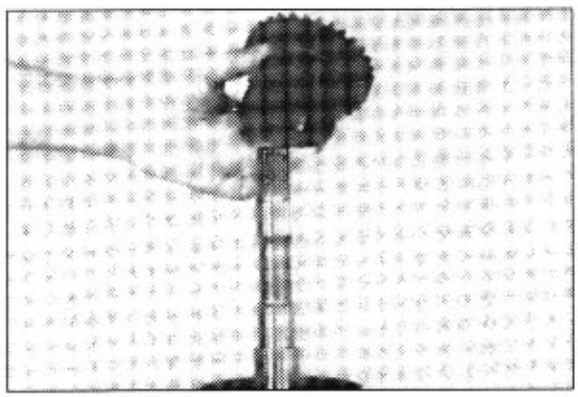
※ This transmission have not external gear teeth on the forward and reverse clutch drum.

(1) Reverse clutch being disasembled

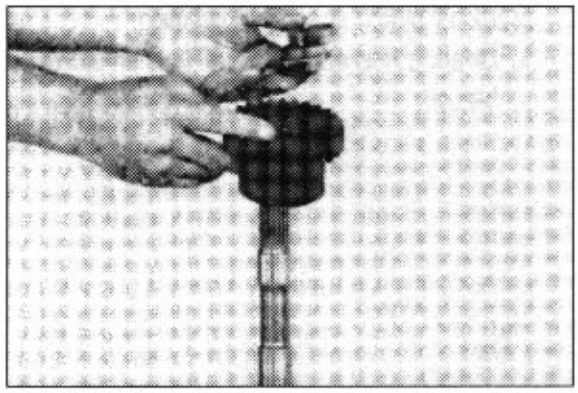
① Remove outer thrust washer, thrust bearing, and inner thrust washer.



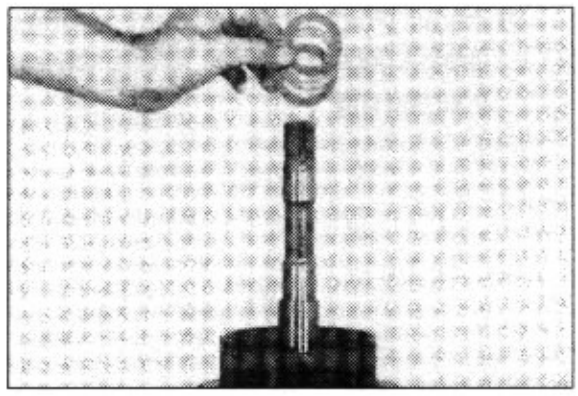
② Remove clutch gear and disc hub.



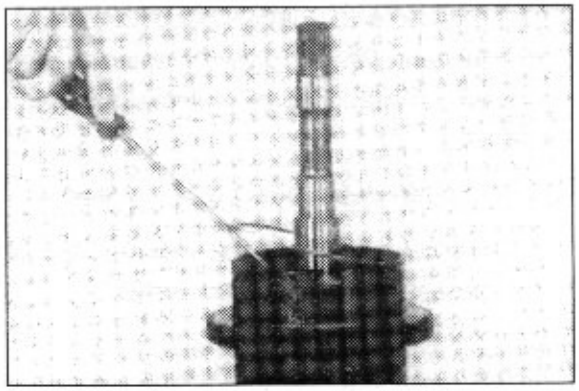
③ Remove bearings and spacer from clutch gear.



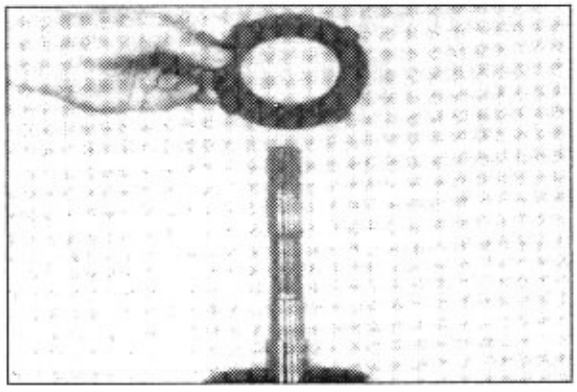
④ Remove outer thrust washer, thrust bearing, and inner thrust washer.



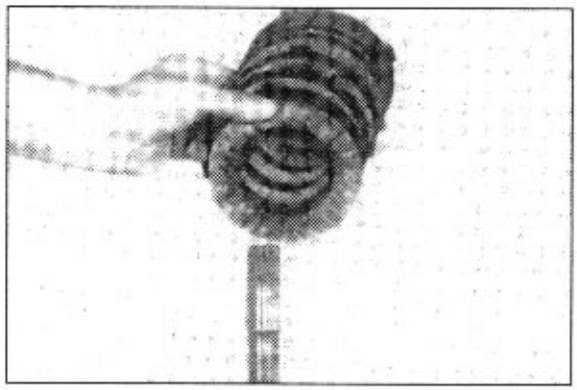
⑤ Remove end plate retainer ring.



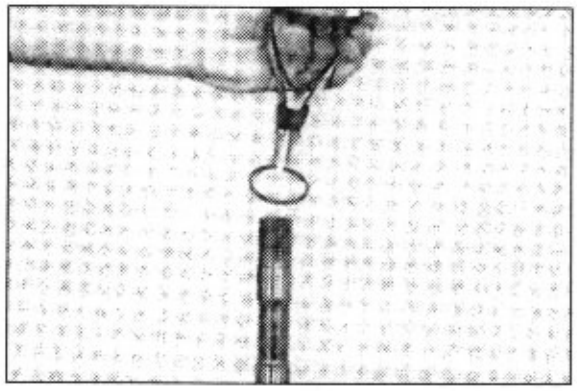
⑥ Remove end plate.



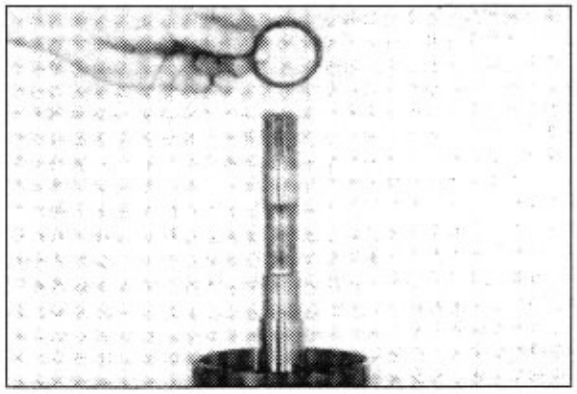
⑦ Remove clutch discs.



⑧ Compress disc springs and remove retainer ring.

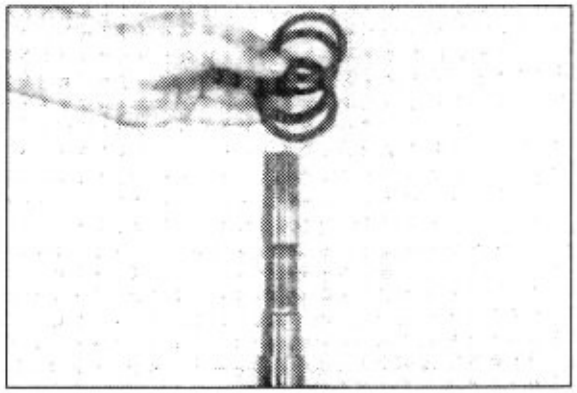


⑨ Remove retainer ring retainer.

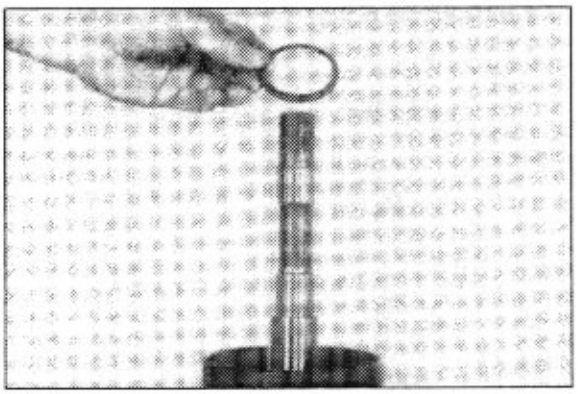


⑩ Remove disc springs.

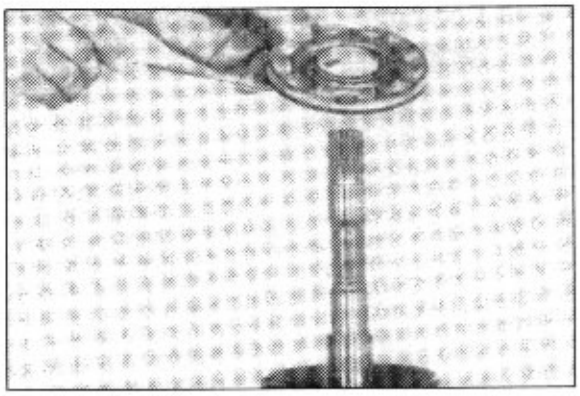
※ See page 3-140.



⑪ Remove **clutch piston wear plate.**

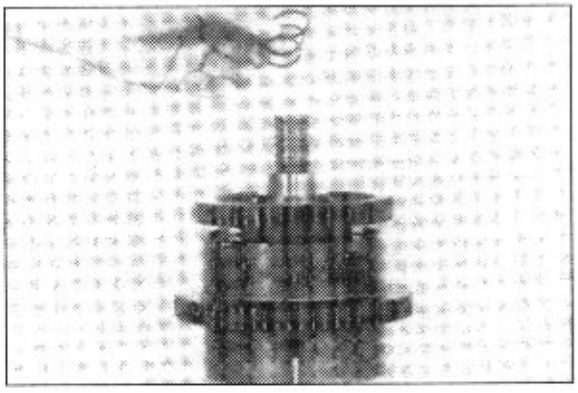


⑫ Remove clutch piston.

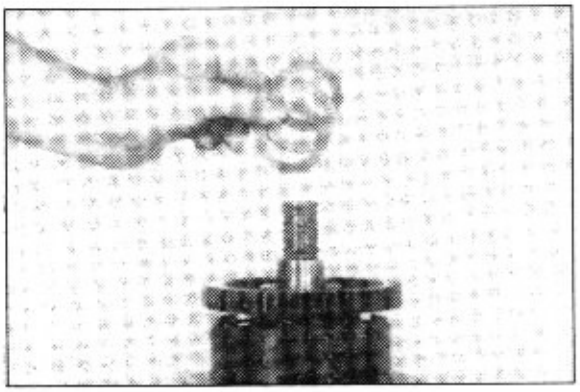


(2) Disassembly of forward clutch

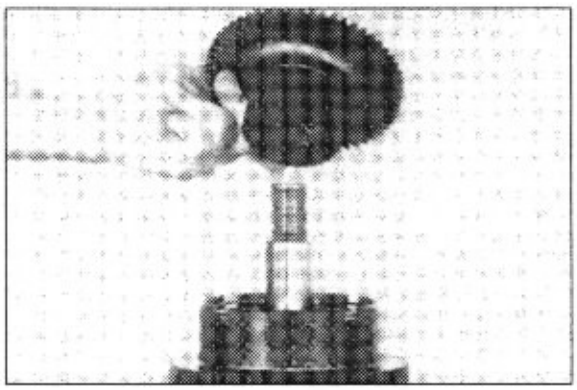
① Remove clutch shaft oil sealing rings.



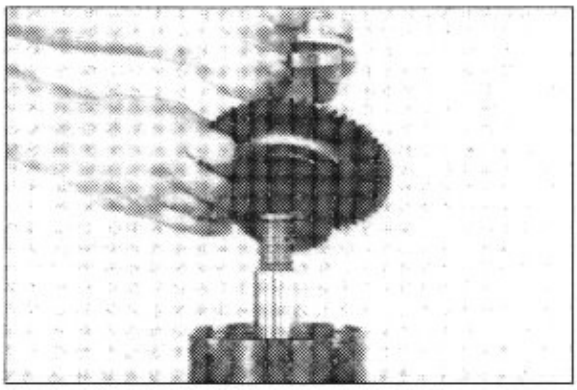
② Remove outer thrust washer, thrust bearing, and inner thrust washer.



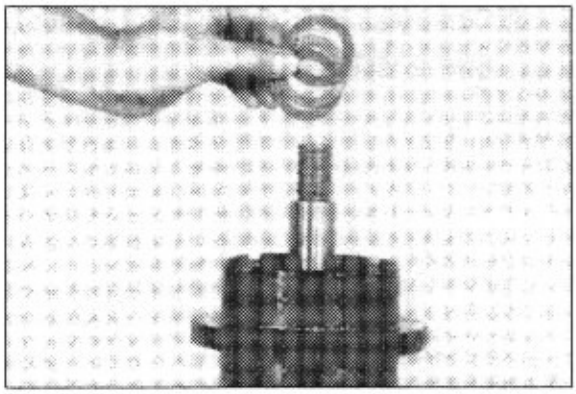
③ Remove clutch gear and disc hub.



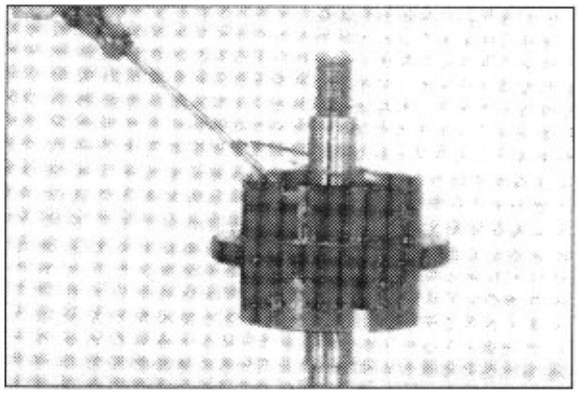
④ Remove bearings and spacer from clutch gear.



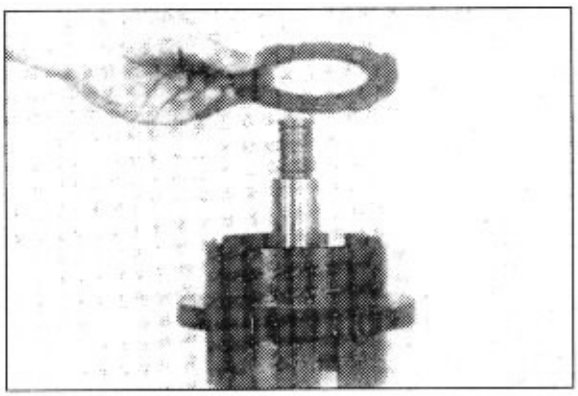
⑤ Remove outer thrust washer, thrust bearing, and inner thrust washer.



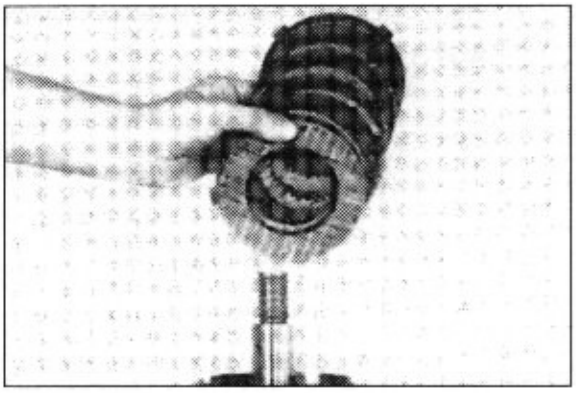
⑥ Remove end plate retainer ring.



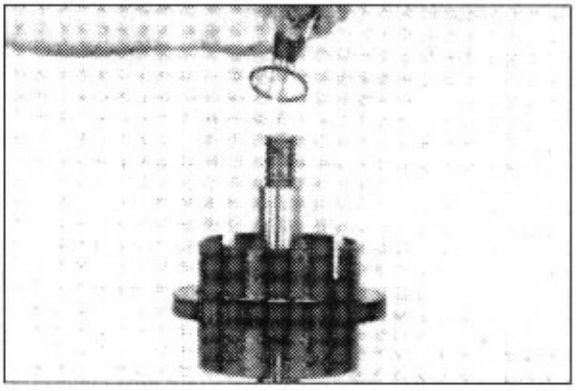
⑦ Remove end plate.



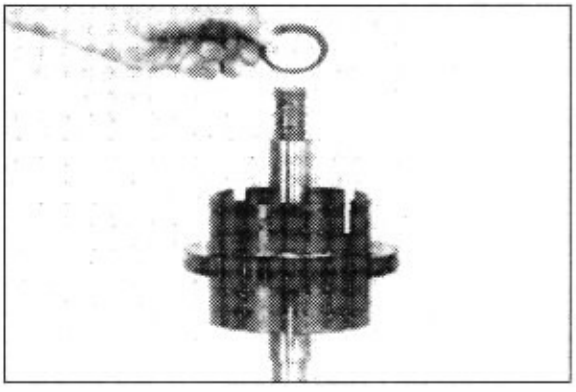
⑧ Remove clutch discs.



⑨ Compress disc springs and remove retainer ring.

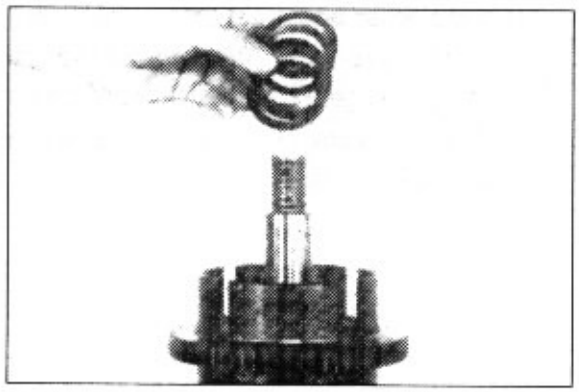


⑩ Remove retainer ring retainer.

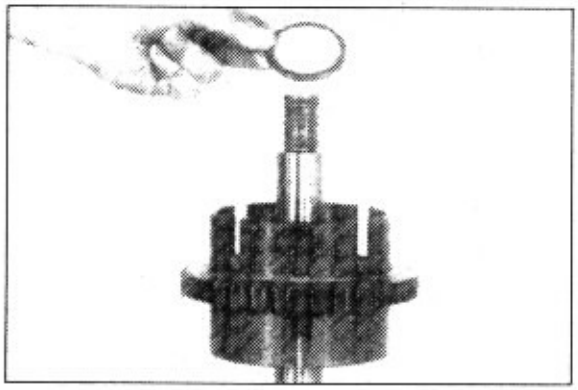


⑪ Remove disc springs.

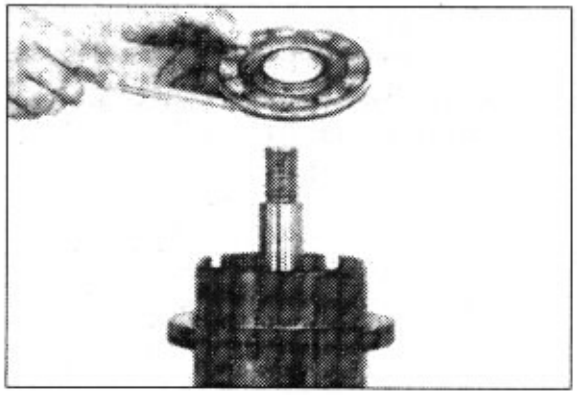
※ See page 3-138.



⑫ Remove clutch piston wear plate.



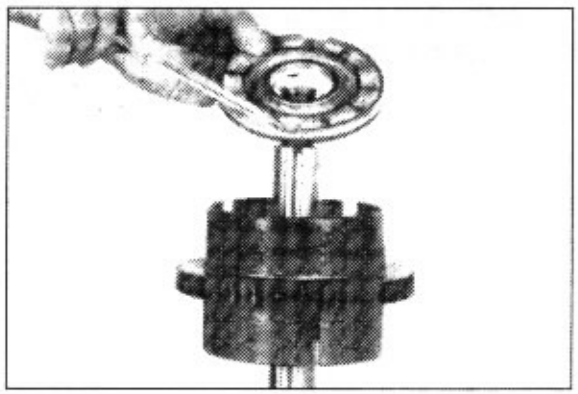
⑬ Remove clutch piston.



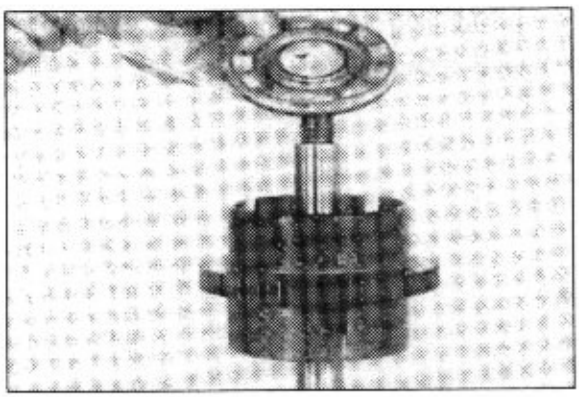
(3) Reassembly of forward clutch

※ See Cleaning and inspection page 3-45, 46.

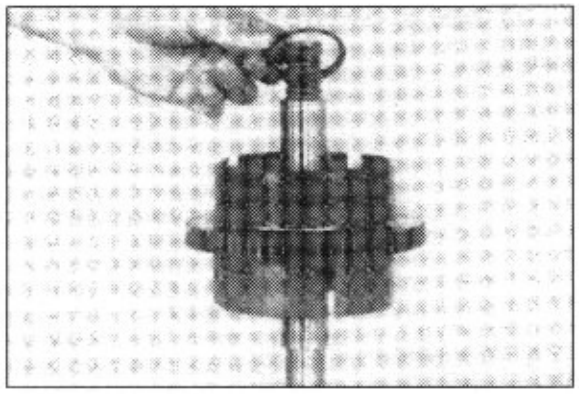
① Clutch piston bleed orifice must be clean and free of any foreign material.



② Install inner and outer clutch piston seal rings. Size inner ring as explained in figure at page 67, ③. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.

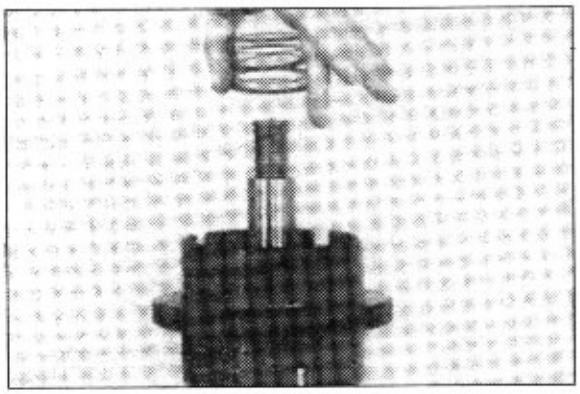


③ Install clutch piston wear plate.

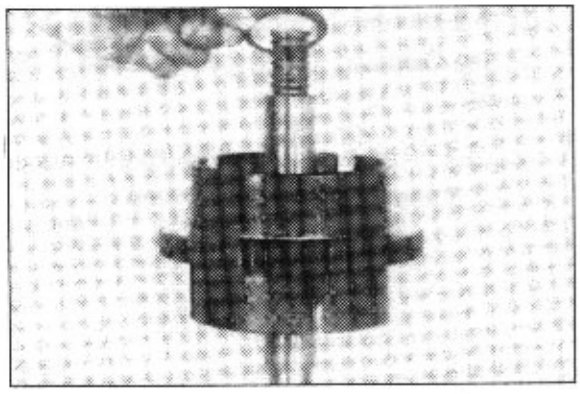


④ Install piston return disc springs. First spring with large diameter of bevel toward wear plate. Alternate five(5) springs.

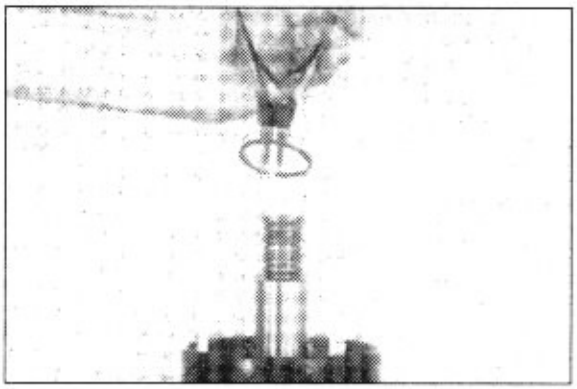
※ See page 3-140.



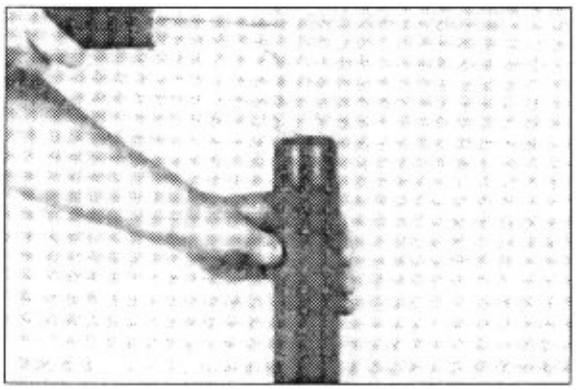
⑤ Position return spring ring retainer on clutch shaft.



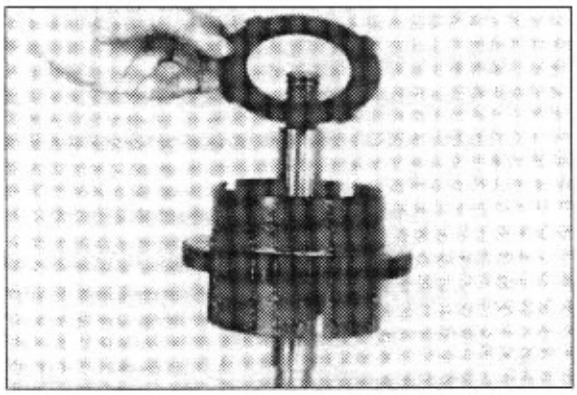
⑥ Start ring on clutch with snap ring pliers.



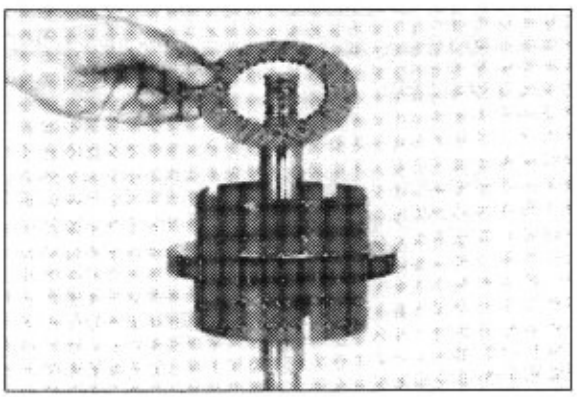
⑦ Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.



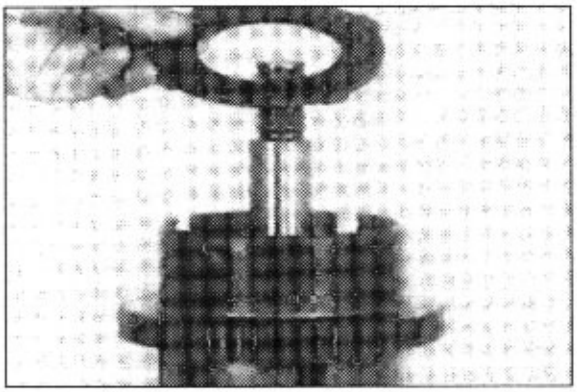
⑧ Install first steel(Outer) clutch disc.



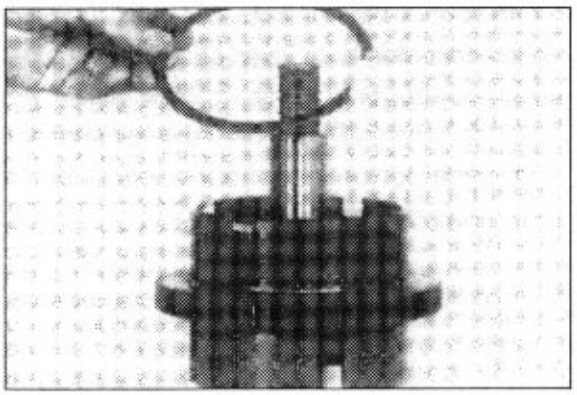
⑨ Install first friction(Inner) clutch disc. Alternate steel and friction until six(6) steel and six(6) friction discs are in position.



⑩ Install clutch disc end plate.

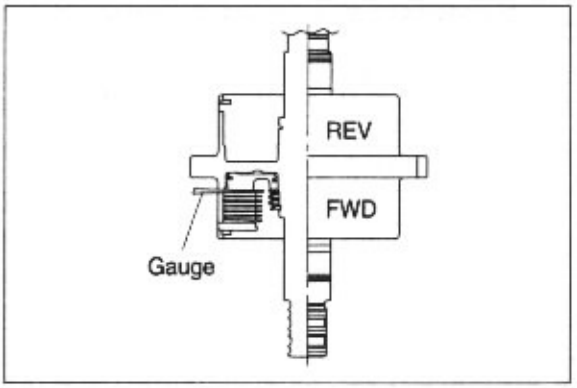


⑪ Install end plate retainer ring.

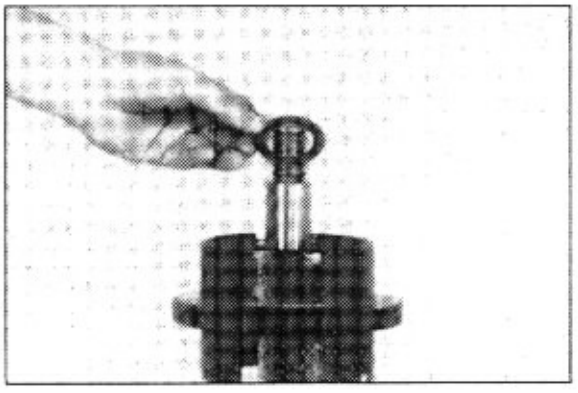


※ Forward clutch pack must be checked for clutch disc clearance.

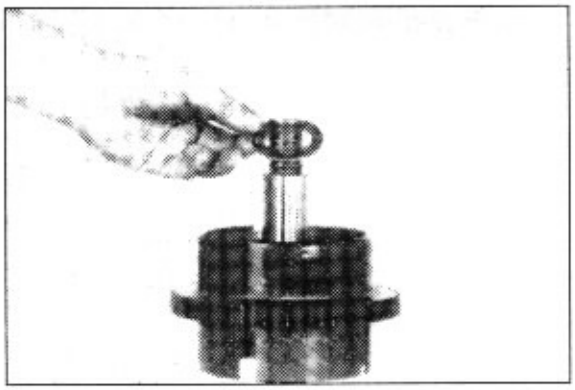
⑫ Stand the clutch assembly on end. The clutch discs on the bottom will fall to the end plate.
Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum.
The required clearance is 1.22~2.74mm (0.048~0.108in).
If the clearance is greater than 2.74mm (0.108in), add one steel disc under the end plate.



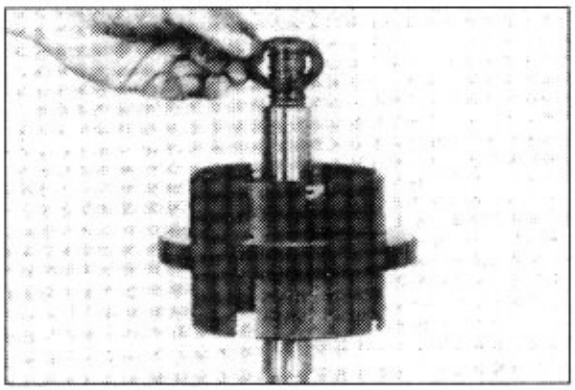
⑬ Position thrust bearing inner washer on clutch shaft.



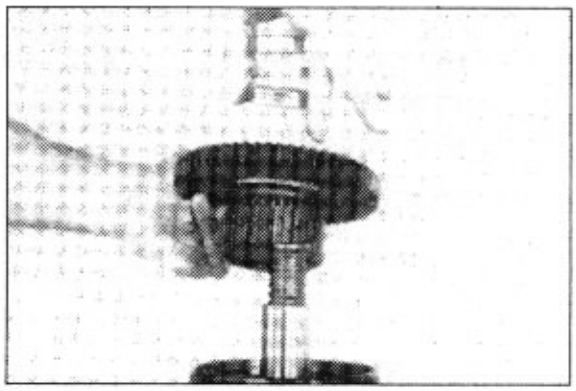
⑭ Position thrust bearing on clutch shaft against inner thrust bearing washer.



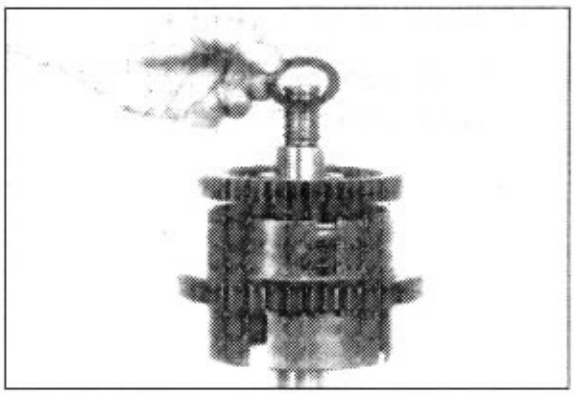
⑮ Install outer thrust bearing washer against thrust bearing.



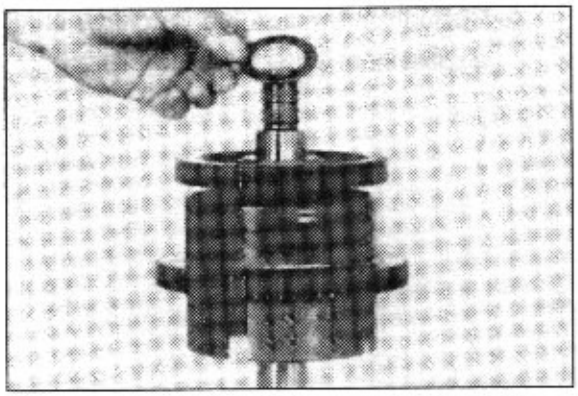
⑯ Press one bearing in clutch gear, flush with face of gear. Install bearing spacer next to bearing. Press second bearing in gear, flush with face of gear. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



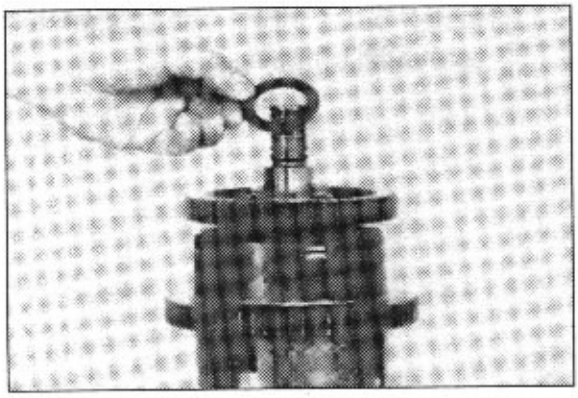
⑰ Position inner thrust washer on shaft.



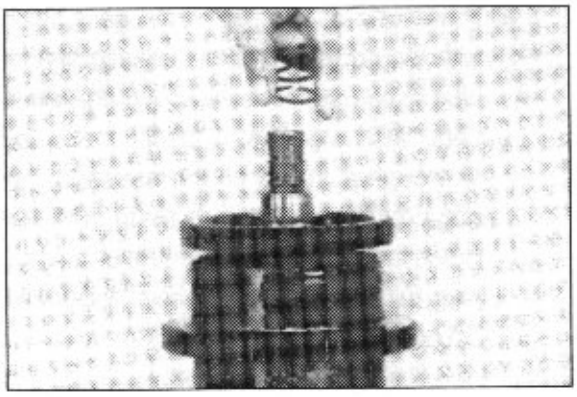
⑱ Position thrust bearing on shaft.



⑲ Position outer thrust washer on shaft.

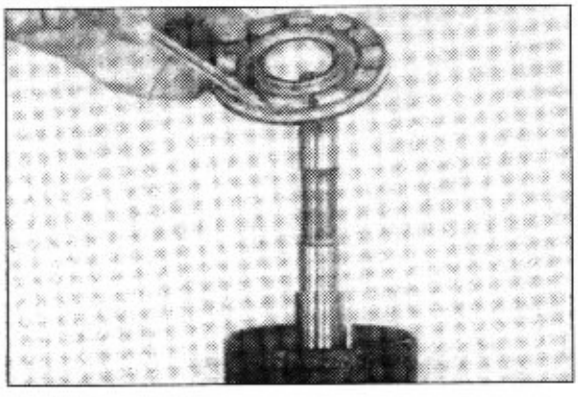


⑳ Install clutch shaft oil sealing rings. Grease rings to facilitate reassembly into front housing.

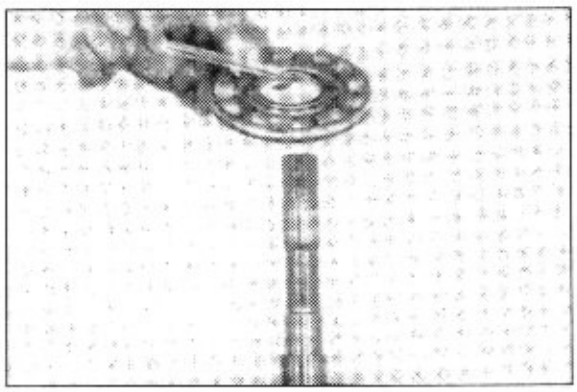


(4) Reverse clutch reassembly

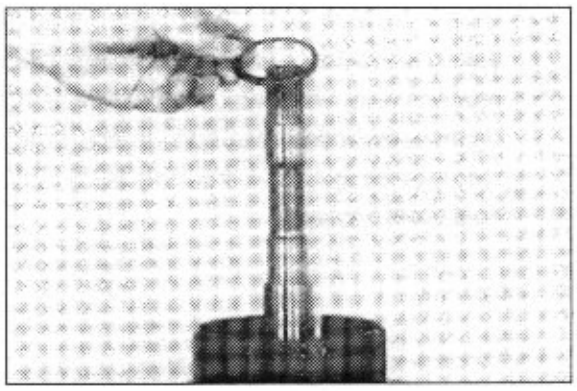
① Clutch piston bleed orifice must be clean and free of any foreign material.



② Install inner and outer clutch piston seal rings. Size inner ring as explained at page 67, ③. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.

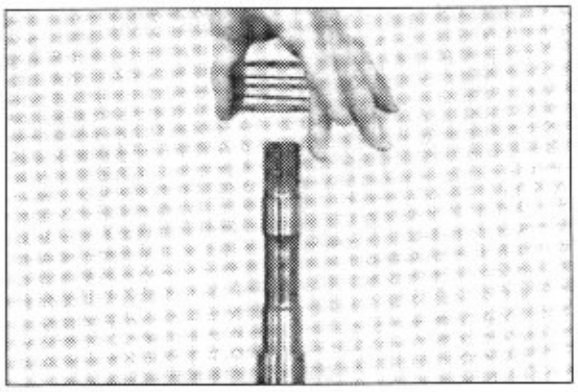


③ Install clutch piston wear plate.

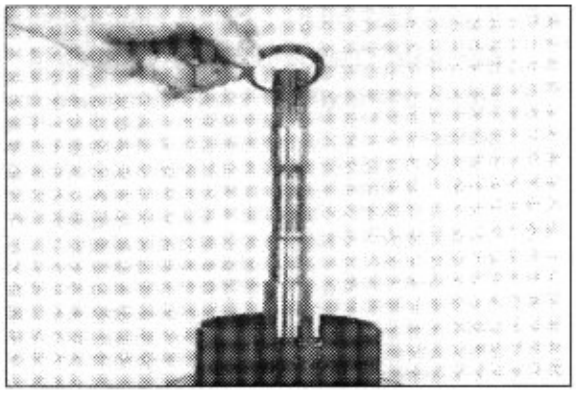


④ Install piston return disc springs. First spring with large diameter of bevel toward wear plate. Alternate five(5) springs.

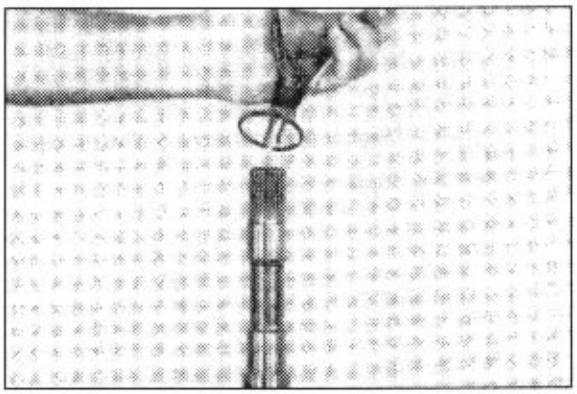
※ See page 3-140.



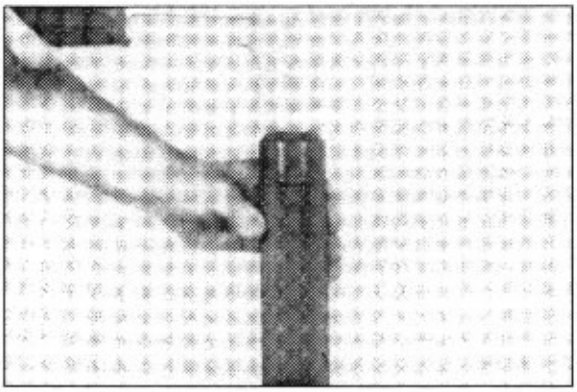
⑤ Position return spring ring retainer in clutch shaft.



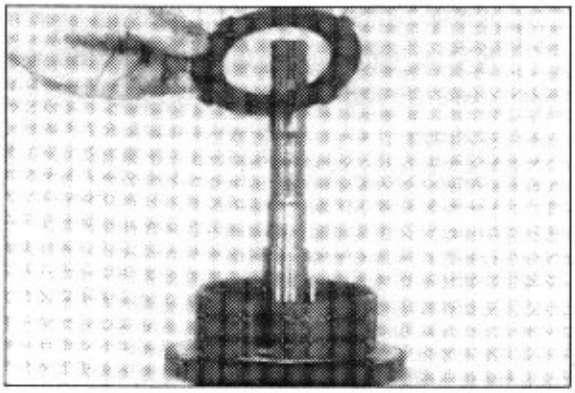
⑥ Start ring on shaft with snap ring pliers.



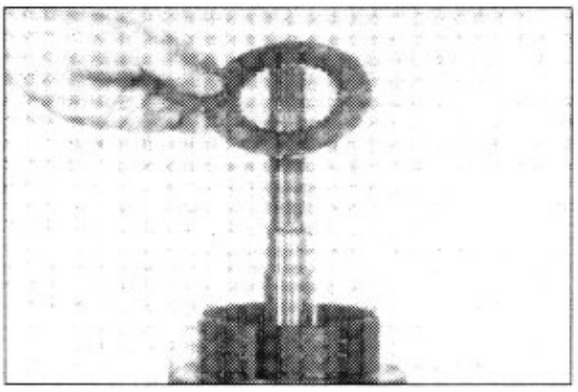
⑦ Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.



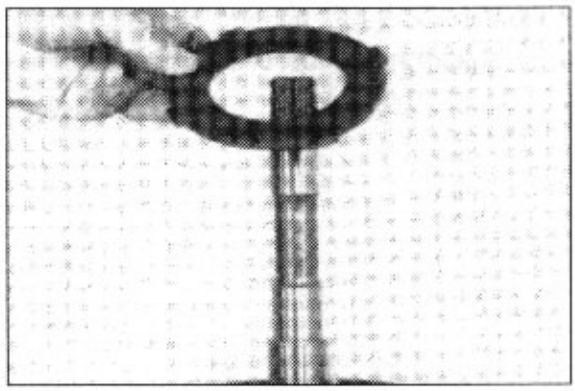
⑧ Install first steel(Outer) clutch disc.



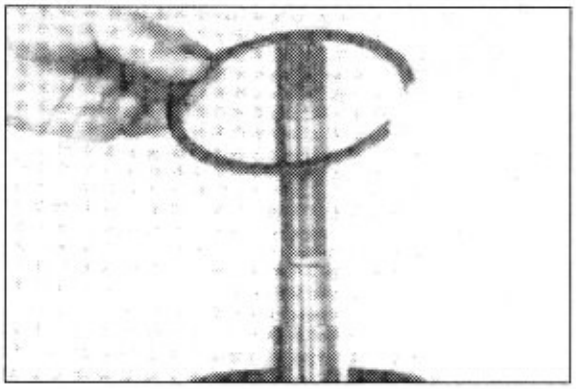
⑨ Install first friction(Inner) clutch disc. Alternate steel and friction until six(6) steel and six(6) friction discs are in position.



⑩ Install clutch disc end plate.

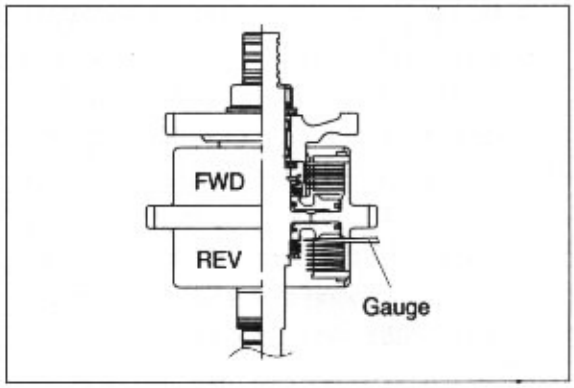


⑪ Install end plate retainer ring.

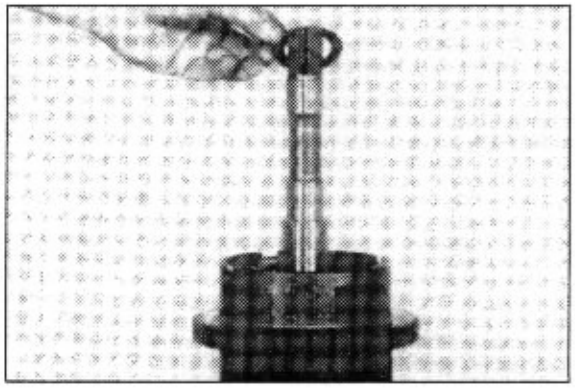


※ Reverse clutch pack must be checked for clutch disc clearance.

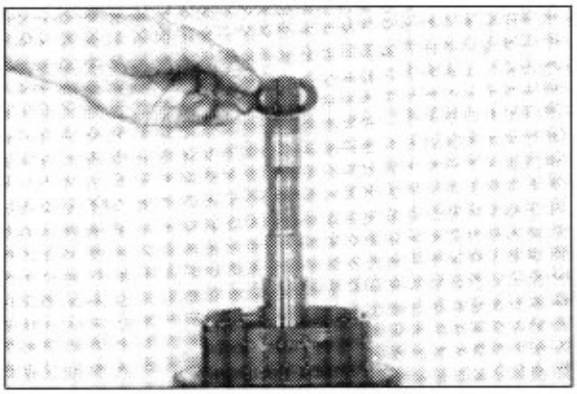
⑫ Stand the clutch assembly on end. The clutch disc on the bottom will fall to the end plate.
Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum.
The required clearance is 1.22~2.74mm (0.048~0.108in).
If the clearance is greater than 2.64mm (0.108in), add one steel disc under the end plate.



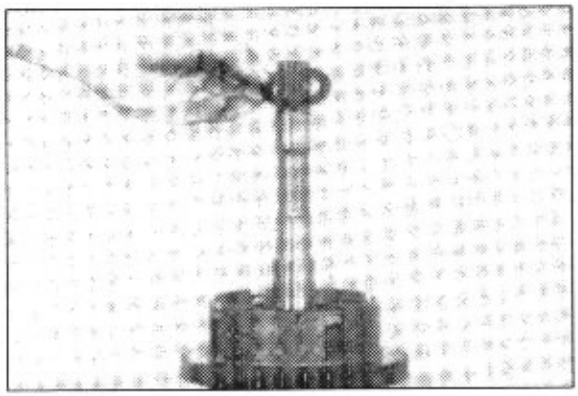
⑬ Position thrust bearing inner washer on clutch shaft.



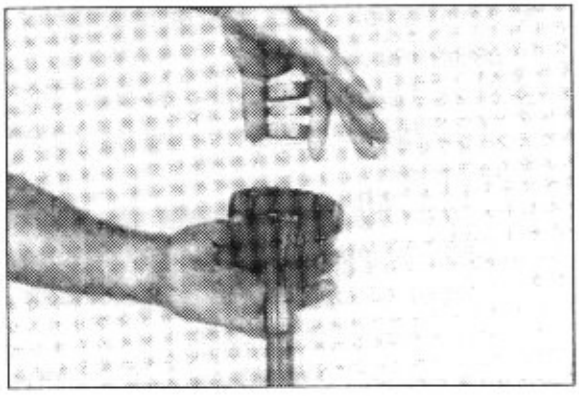
⑭ Position thrust bearing on clutch shaft against inner thrust bearing washer.



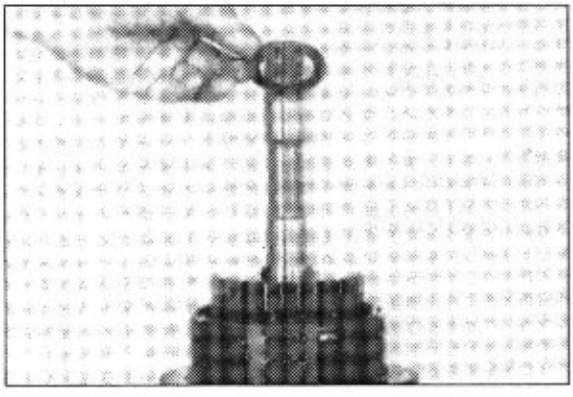
⑮ Install outer thrust bearing washer against bearing.



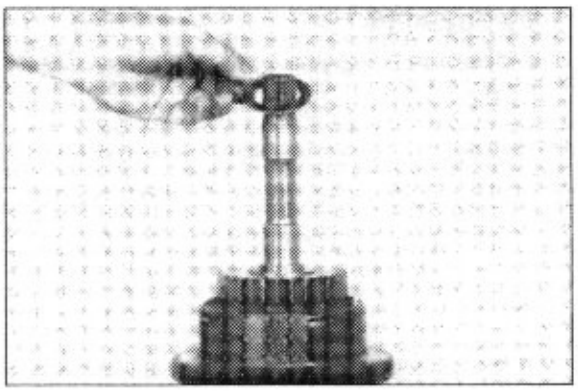
⑯ Press one bearing in clutch gear, flush with face of gear. Install bearing spacer next to bearing. Press second bearing in gear, flush with face of gear. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



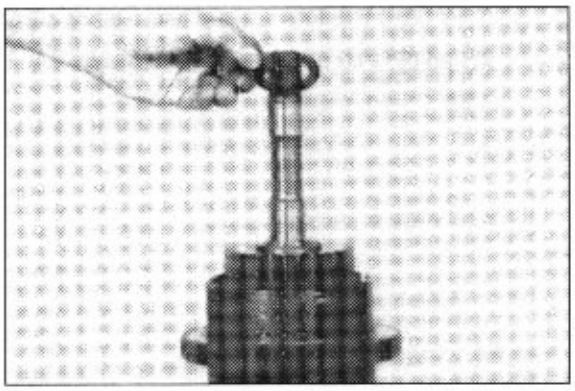
⑰ Position inner thrust washer on shaft.



⑱ Position thrust bearing on shaft.



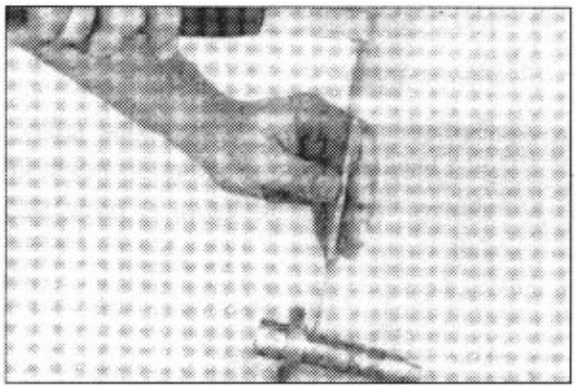
⑲ Position outer thrust washer on shaft.



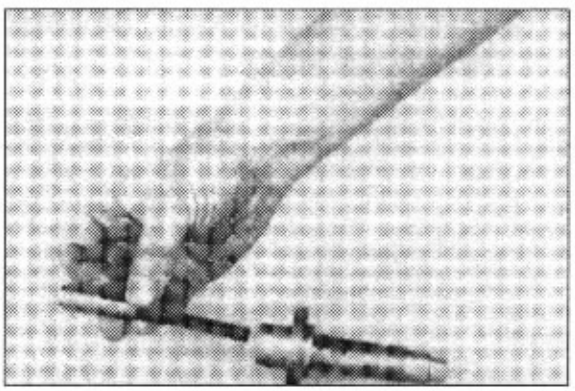
7) REGULATOR VALVE

(1) Disassembly

① Tap pin from regulator valve sleeve. Use caution as valve spool is under spring pressure.



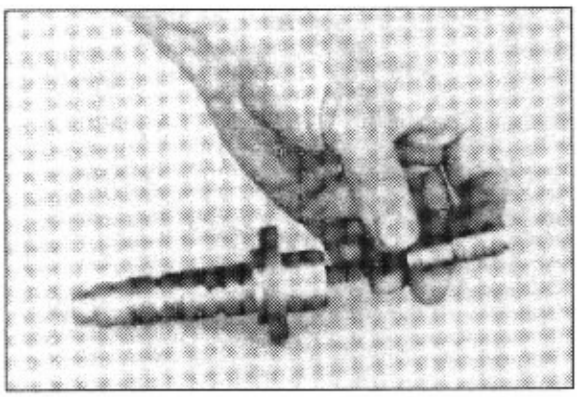
② Remove regulator valve piston and pressure regulator valve spring.



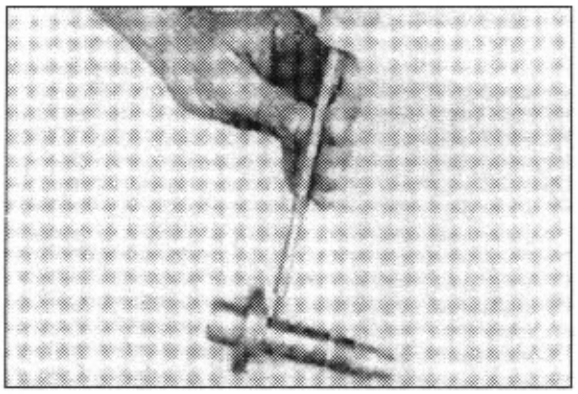
(2) Reassembly

※ See Cleaning and inspection page 3-45, 46.

① Install pressure regulator valve spring and regulator valve piston as an assembly into regulator valve sleeve.



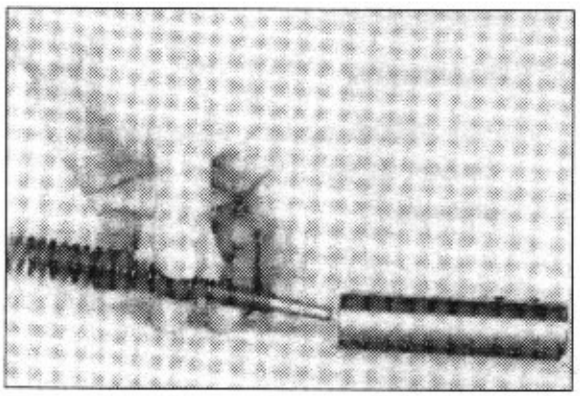
② Compress valve spring and valve and install pin into regulator valve sleeve.



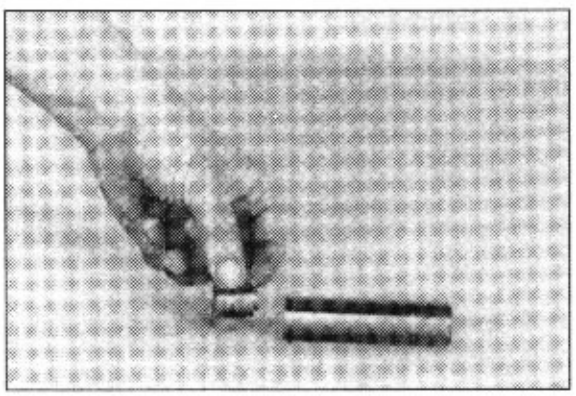
6) DUAL MODULATED VALVE ASSEMBLY

(1) Disassembly

① Remove inner, middle, and outer spring and stop pin from modulation housing sleeve. Reference figure at page 56, (38).

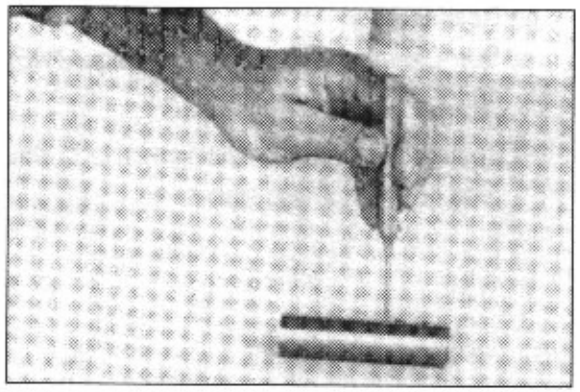


② Remove accumulator spool. Reference figure at page 56, (39).

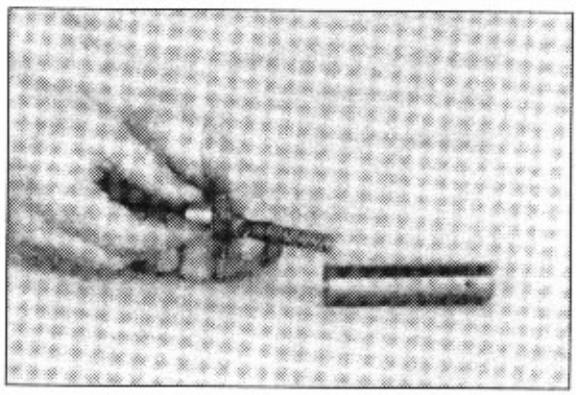


③ Remove cross pin from sleeve.

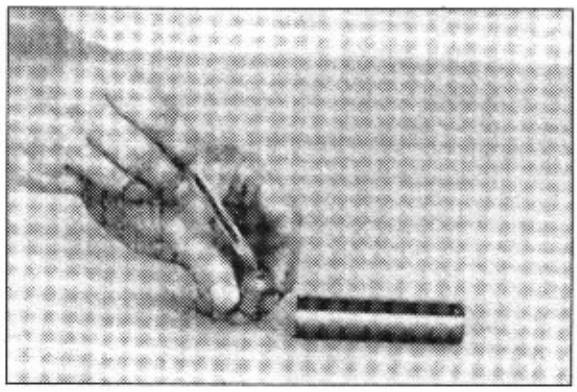
※ This pin is the shortest of the two sleeve pins.



④ Remove regulator spool spring, retainer spring, and spacer spring from housing sleeve.

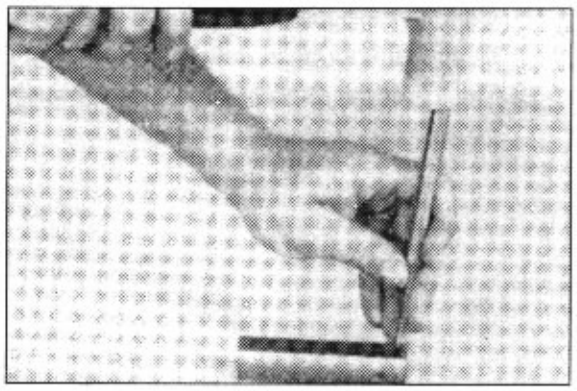


⑤ Remove regulator spool.



⑥ Remove 2nd sleeve pin.

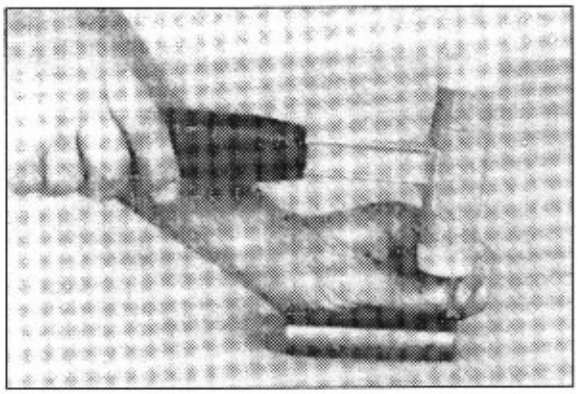
※ This pin is the longer of the two sleeve pins.



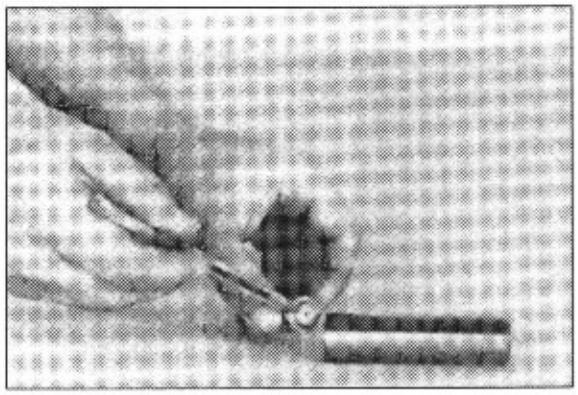
(2) Reassembly

※ See **Cleaning and inspection page 3-45, 46.**

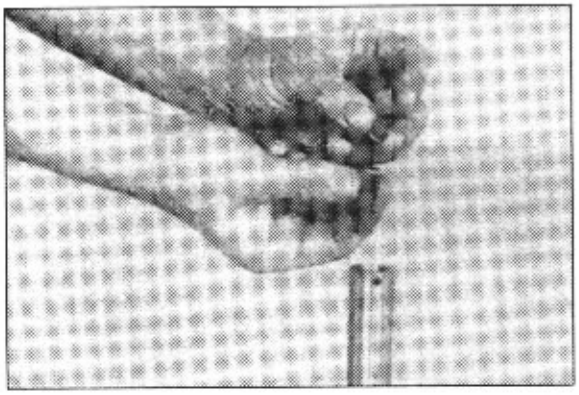
① Install the longer of the two pins in the end hole of housing sleeve.



② Check orifice in regulator spool to be free and clear of any foreign material. Insert spool in sleeve housing with orifice end against cross pin.

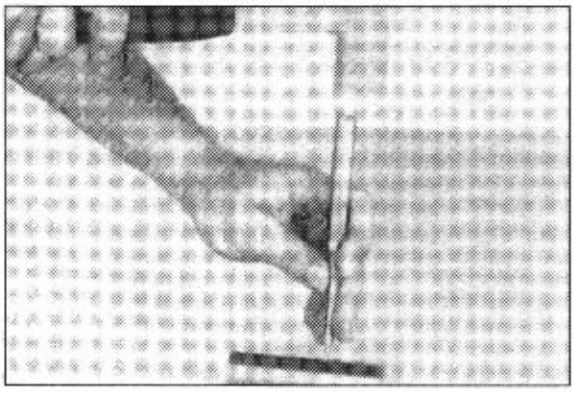


③ Install spring spacer in spring retainer. Install spring in spring retainer against spacer. Install spring retainer, spring, and spacer in housing sleeve and into regulator spool.

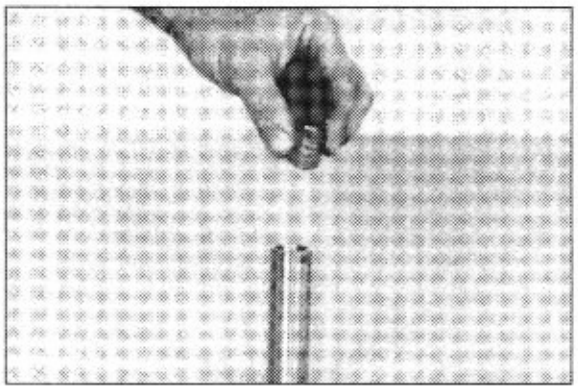


④ Compress regulator spool and spring in sleeve far enough to install cross pin.

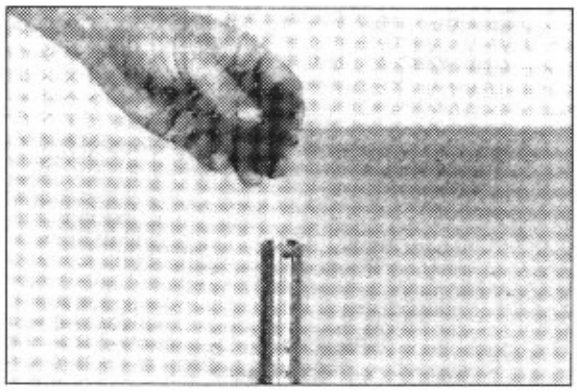
※ This pin is the shortest of the two housing sleeve pins. Install pin.



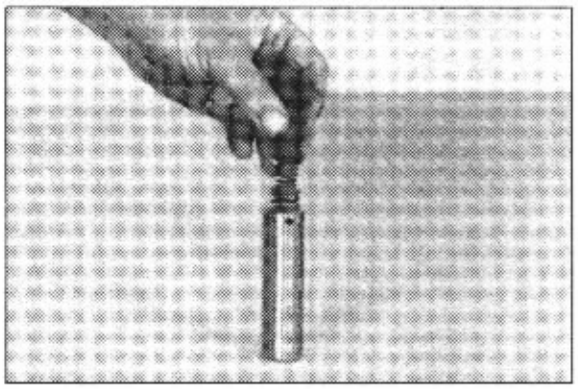
⑤ Position accumulator spool in sleeve as shown.



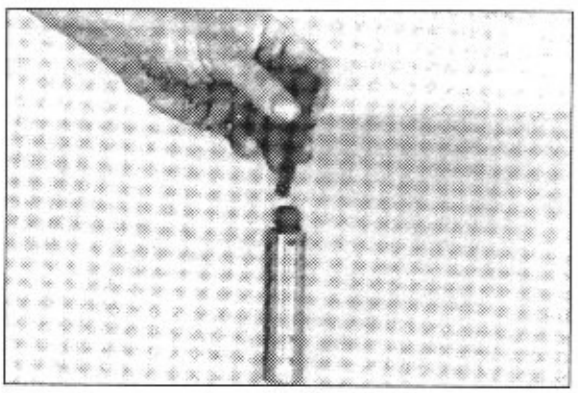
⑥ Install outer accumulator spring.



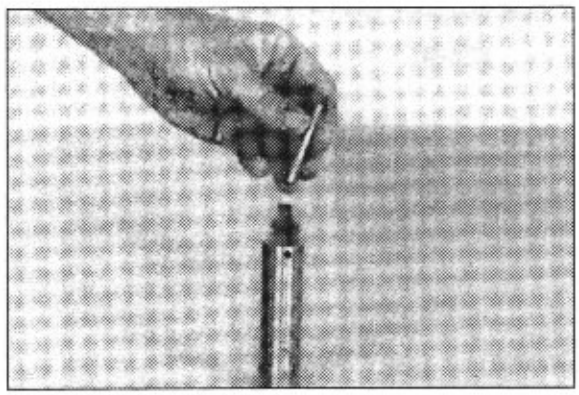
⑦ Install middle spring.



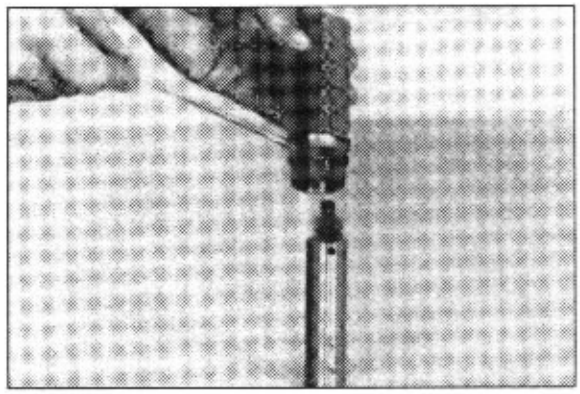
⑧ Install inner spring.



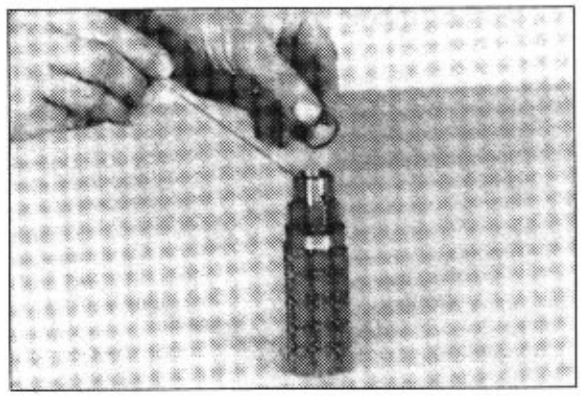
⑨ Install stop pin in inner spring.



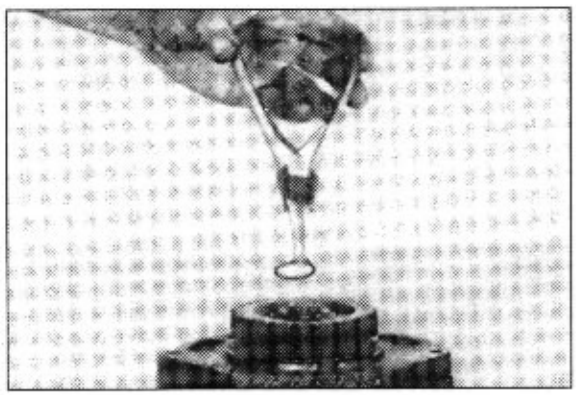
⑩ Install new O-ring on modulator valve housing.



⑪ Install new O-ring on modulator housing sleeve.



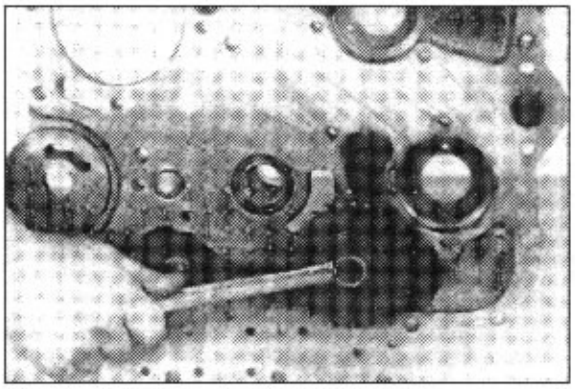
⑫ If charging pump or pump drive gear are to be replaced, remove retainer ring and drive gear.



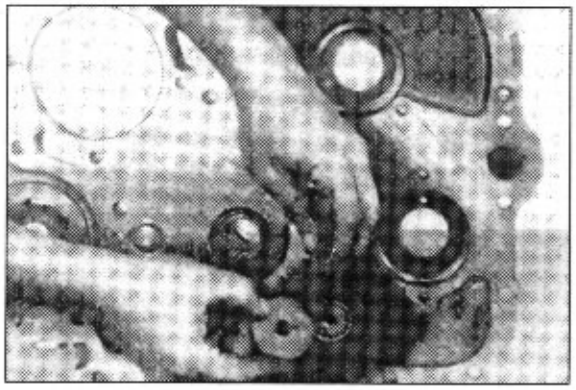
7) SPACER PLATE

(1) Disassembly

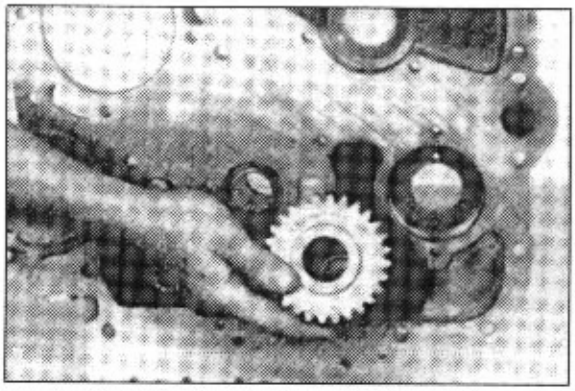
① Remove reverse idler gear end plate capscrew and washer.



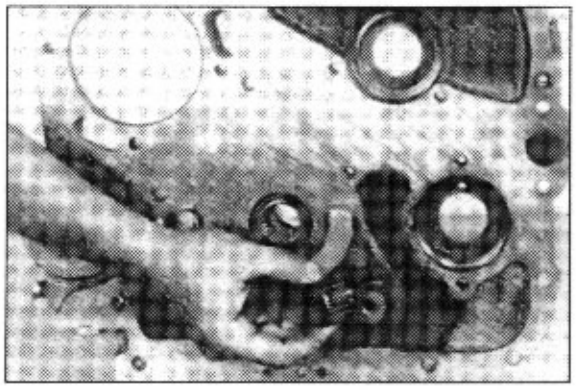
② Remove end plate and dowel pin.



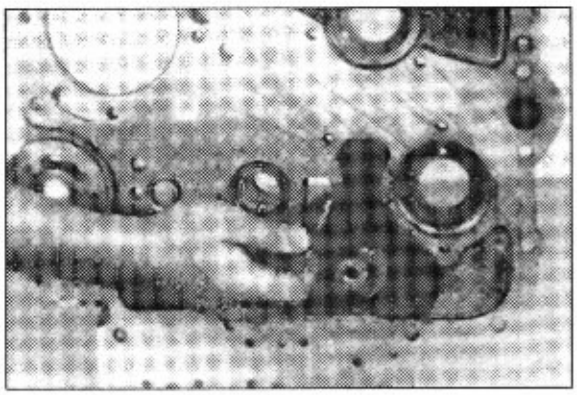
③ Remove reverse idler gear.



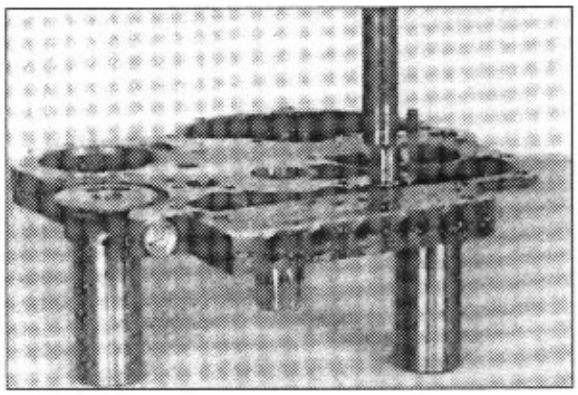
④ Remove reverse idler gear bearing.



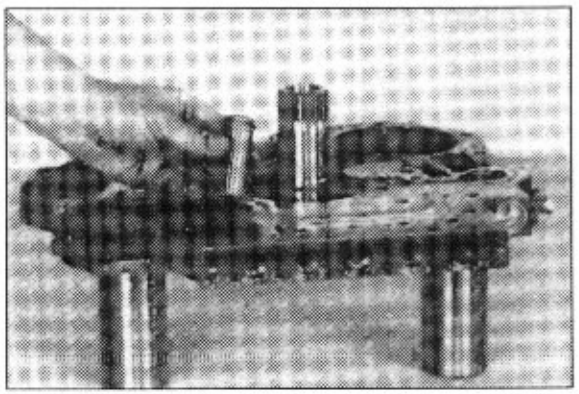
⑤ Remove idler gear tanged thrust washer.



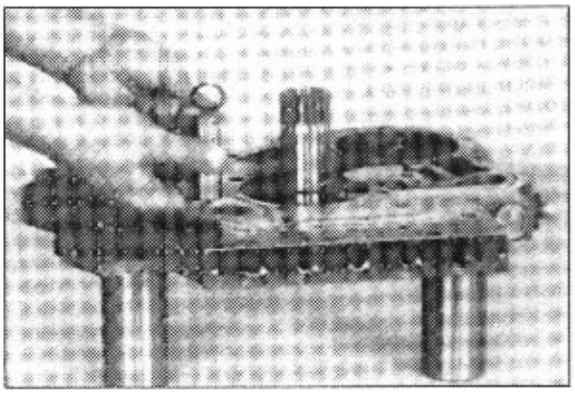
⑥ If reverse idler shaft is to be replaced, support spacer plate around idler shaft opening and press idler shaft from spacer. Do not drive on idler shaft as doing so may cause damage to spacer plate.



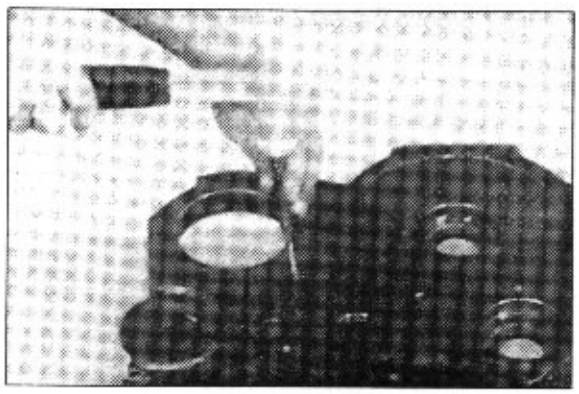
⑦ Idler shaft and locating ring removed.



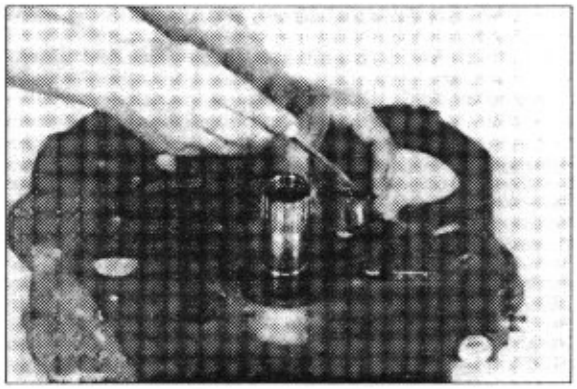
⑧ Remove locating ring from idler shaft.



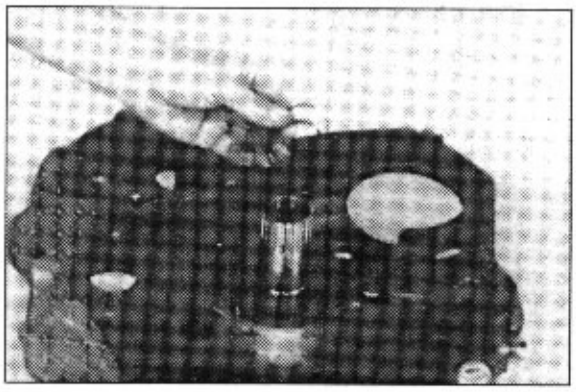
⑨ Tap pump drive idler shaft from spacer plate.



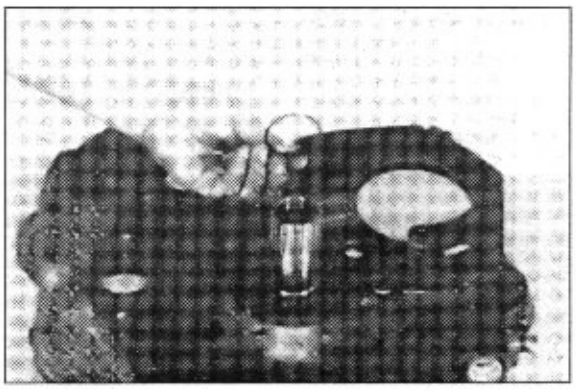
⑩ Remove pump drive idler shaft and thrust washer.



⑪ Remove stator support oil sealing ring. Remove sealing ring expander ring.

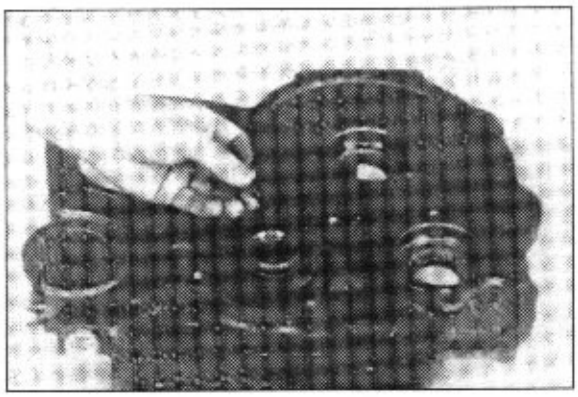


⑫ The stator support is held in place by two(2) retaining rings. Remove converter end retainer ring from groove.

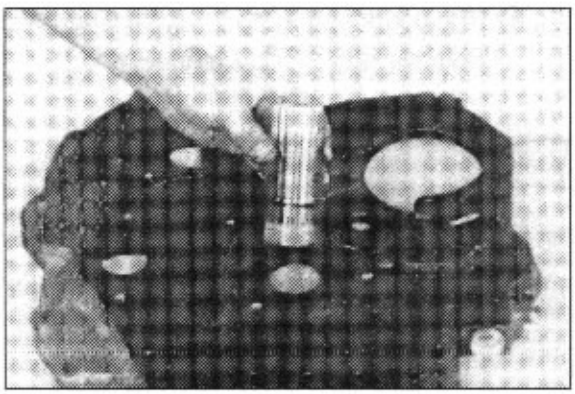


⑬ Remove thrust washer.

⑭ Push support toward transmission side far enough to expose retainer ring. Remove retainer ring.

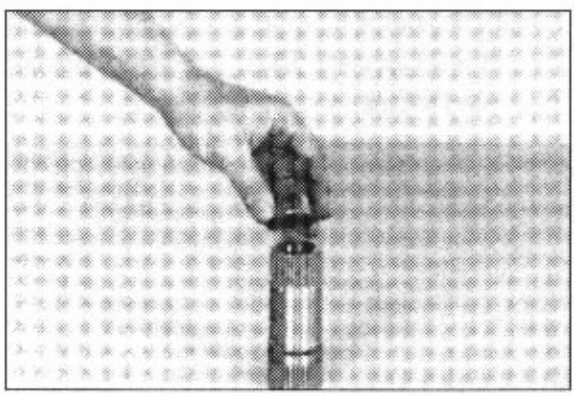


⑮ From converter end, remove stator support.

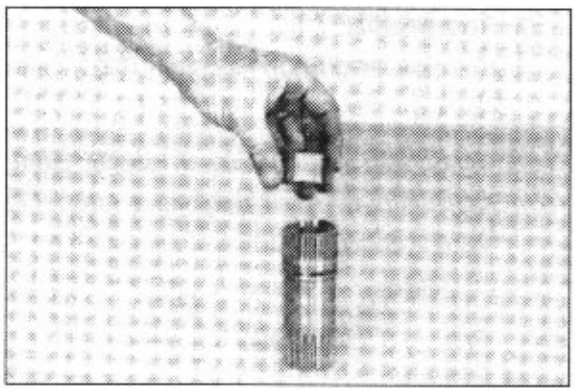


⑯ If support bushing is to be replaced, remove from stator support.

※ Bushing must be removed from same end as needle bearing.

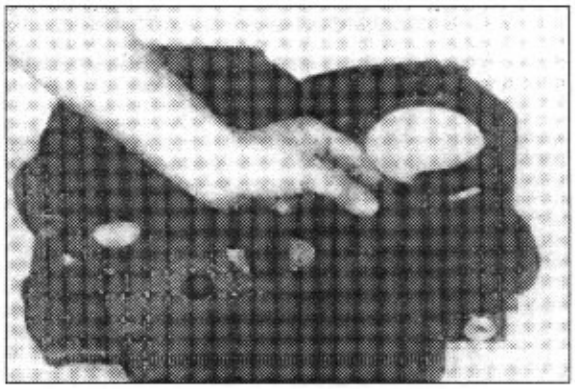


⑰ If support bearing is to be replaced, remove from stator support.

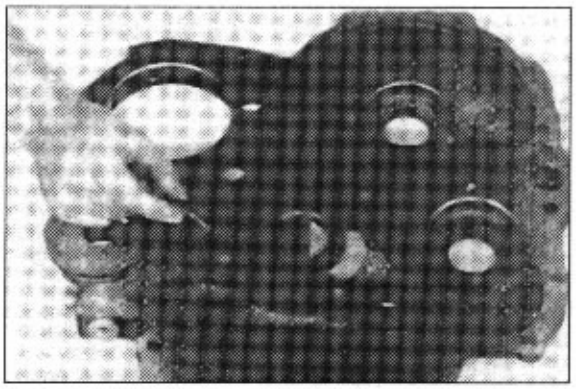


⑱ Compress converter safety valve spring and remove retaining washer.

⑲ Remove safety valve spring.



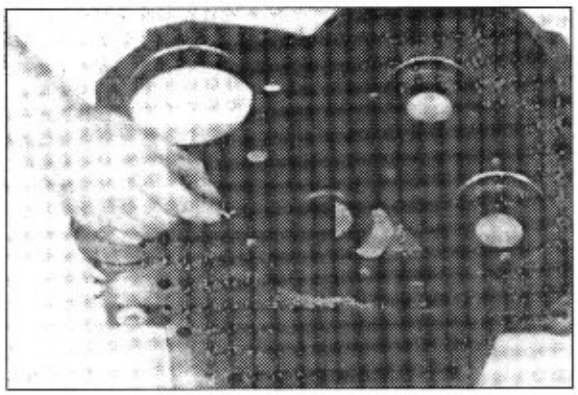
⑳ Turn spacer plate over and remove safety valve poppet.



(2) Reassembly

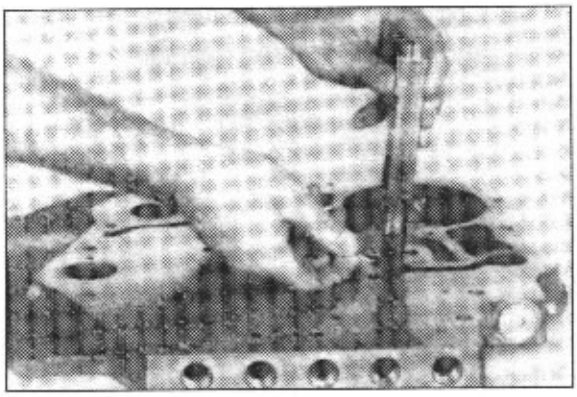
※ See **Cleaning and inspection page 3-45, 46.**

① From transmission side of spacer plate, position converter safety valve poppet in bore in spacer.

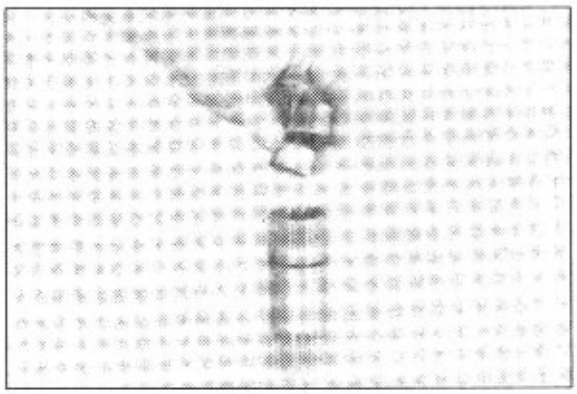


② Turn spacer over and position safety valve spring on poppet. Compress spring and install poppet retaining washer.

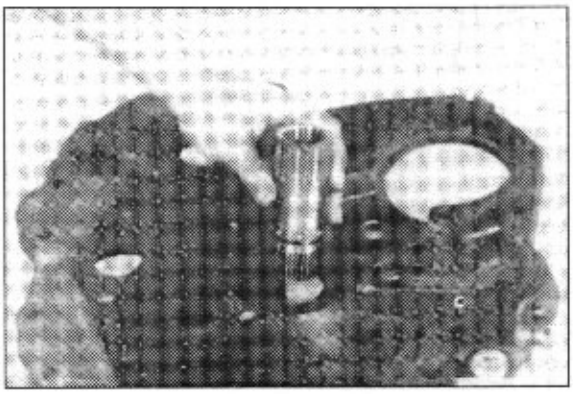
※ End of spring must go in recessed side of washer.



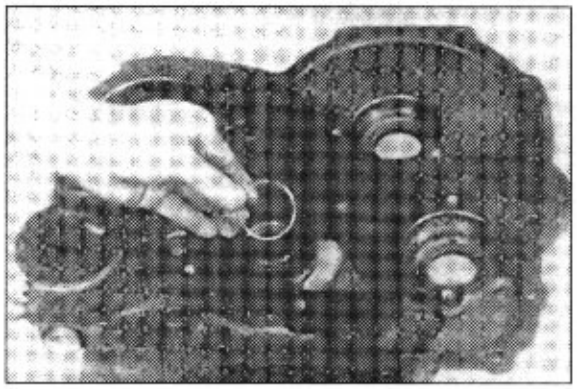
③ If stator support bushing was removed, install bushing in support. Install needle bearing in stator support.



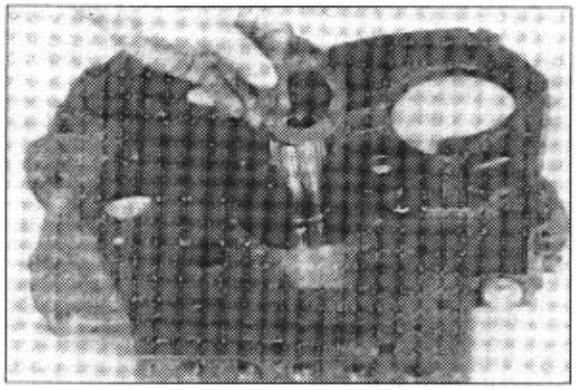
④ Install stator support in spacer plate.



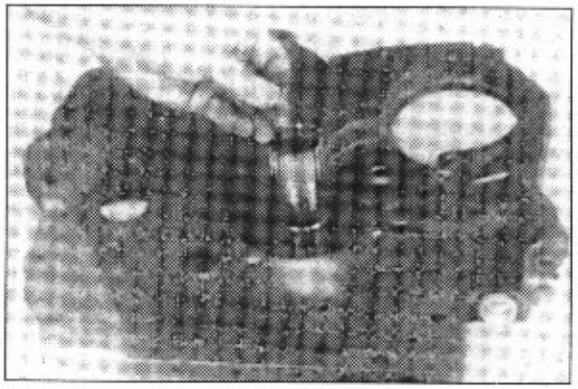
⑤ Install support locating ring.



⑥ Push support back through spacer until locating ring shoulders in support bore. Turn spacer plate over and position impeller hub gear washer on support.

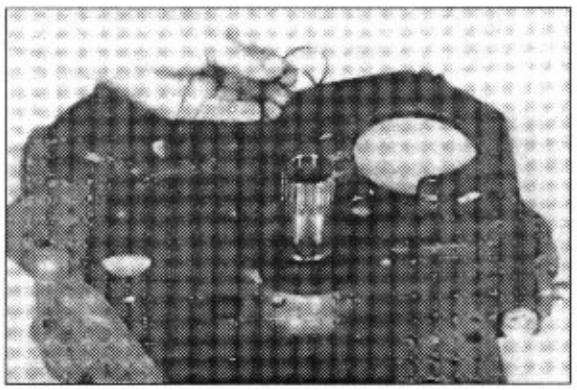


⑦ Install support retainer ring.

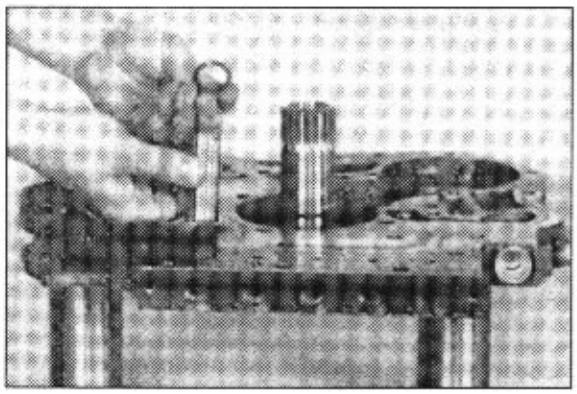


⑧ Install support oil sealing ring expander ring. Install oil sealing ring on expander ring.

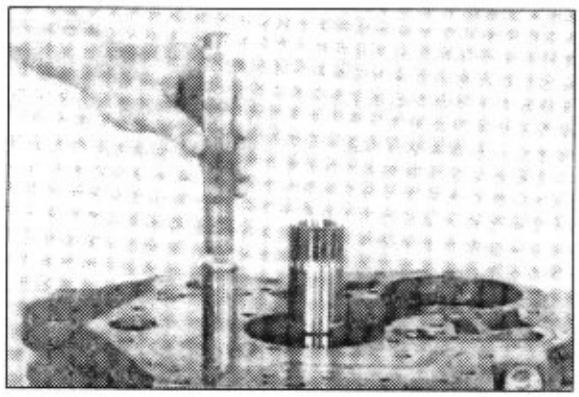
※ Expander spring gap to be 180 degrees from sealing ring hook joint.



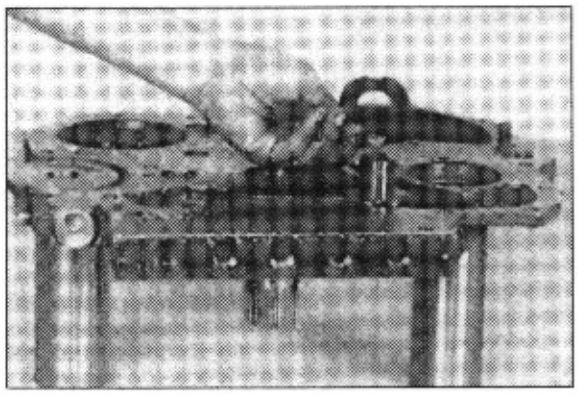
⑨ Install locating ring on reverse idler shaft.



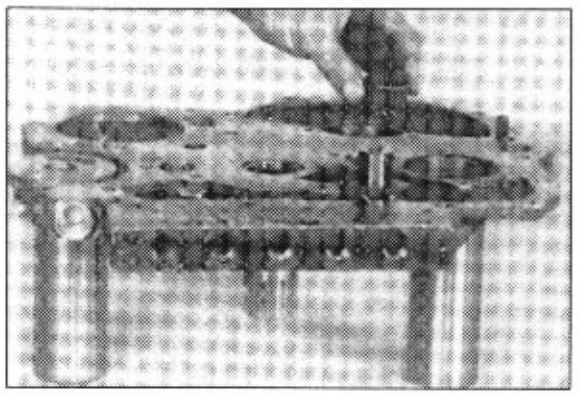
⑩ Support spacer plate and press idler shaft into position and tight against locating ring.



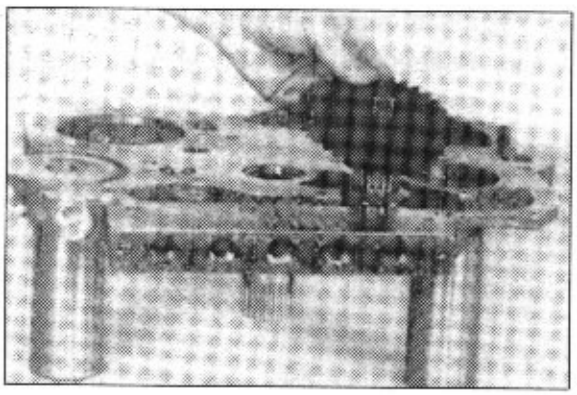
⑪ Turn spacer plate over and position tanged thrust washer on shaft, being certain tang in washer is in notch in spacer plate.



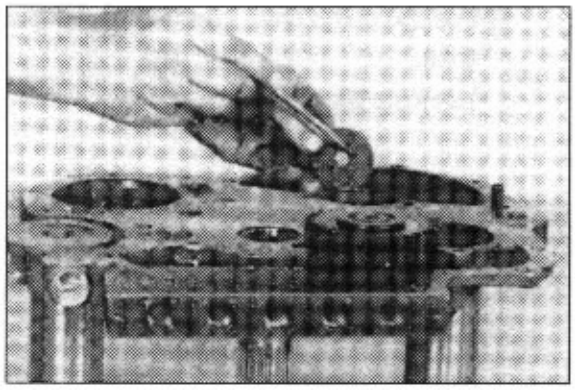
⑫ Position idler gear needle bearing on shaft. Lubricate bearing.



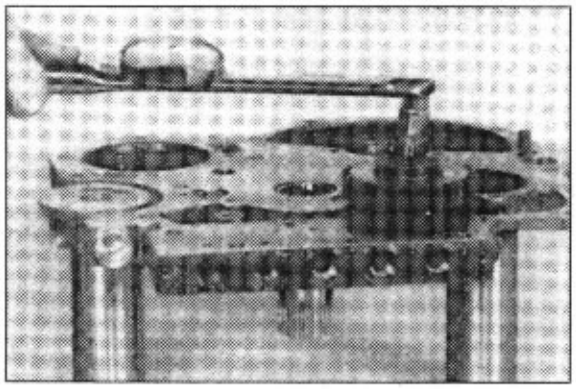
⑬ Position idler gear on bearing and shaft.



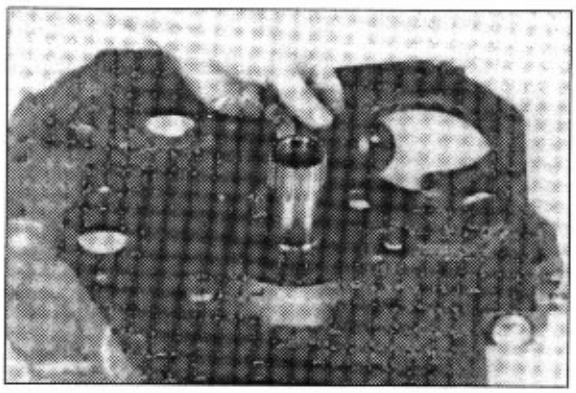
⑭ Position idler gear end plate and roll pin on idler shaft, aligning roll pin with hole in idler shaft.



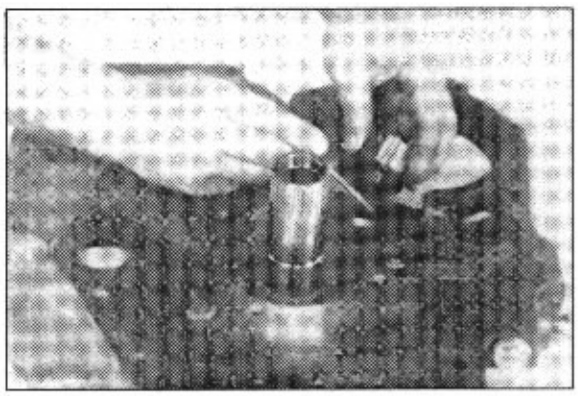
⑮ Install end plate capscrew and washer and tighten to specified torque.
See torque chart at page 3-141.



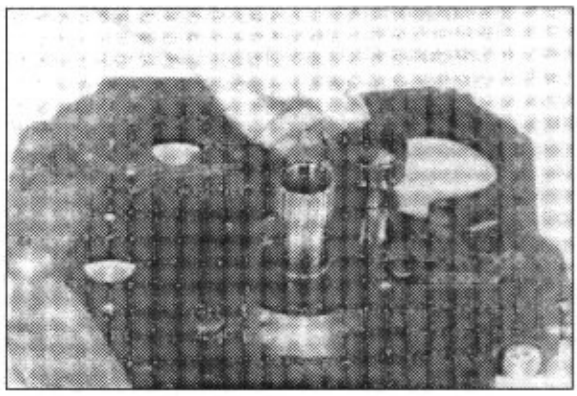
⑯ Position pump drive idler shaft washer on spacer plate.



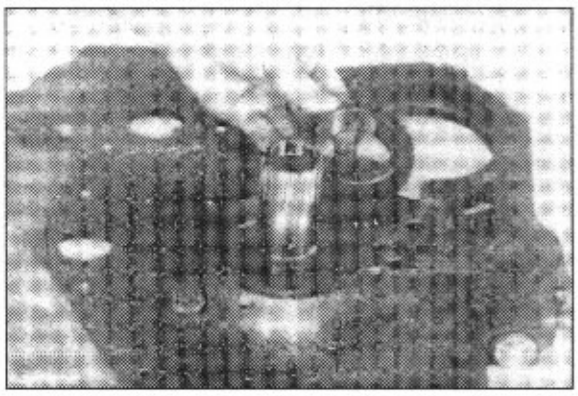
⑰ Install pump drive gear shaft through washer and into spacer plate aligning shaft roll pin with hole in spacer plate.



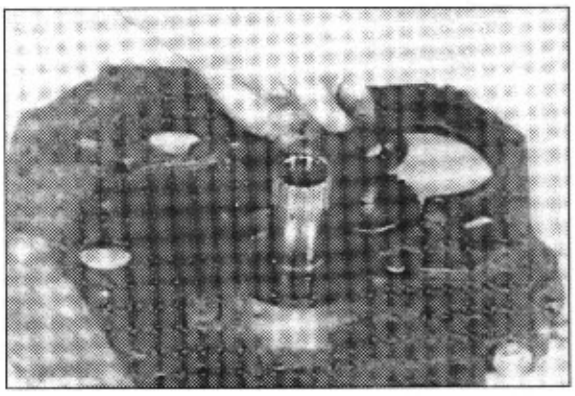
⑱ Position pump drive idler gear bearing on shaft.
Lubricate bearing.



⑲ Position idler gear on bearing.



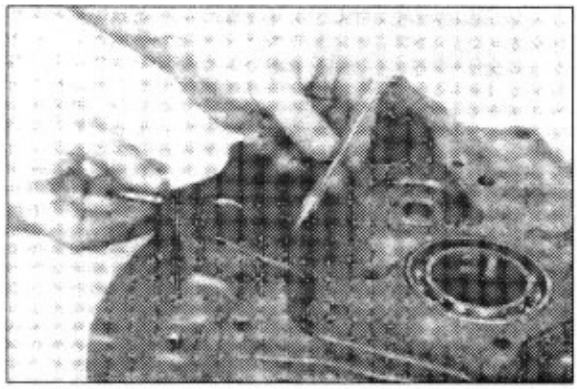
⑳ Install idler gear thrust washer on shaft, aligning hole in washer with roll pin in shaft.



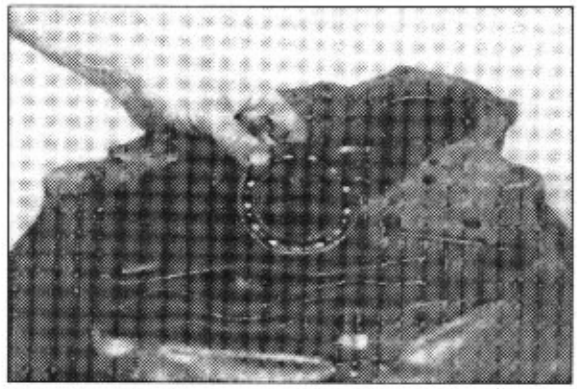
8) CONVERTER HOUSING

(1) Disassembly

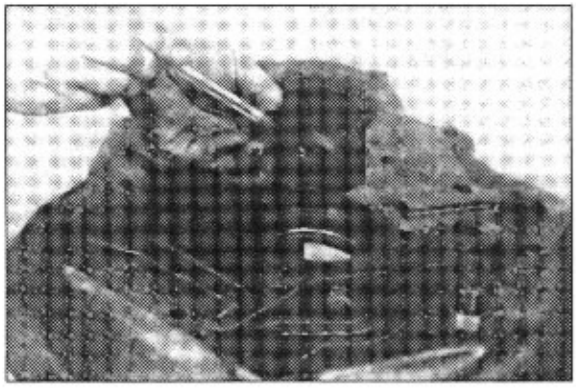
① Remove check valve ball assembly.



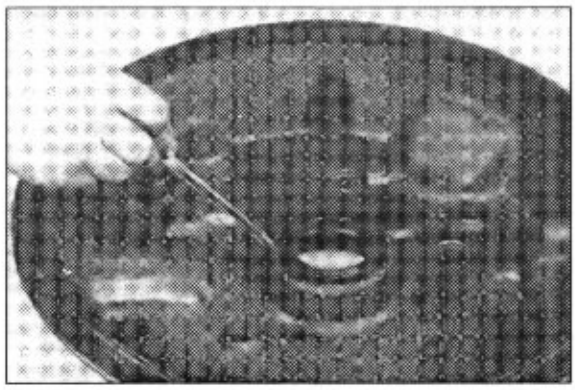
② Remove torque converter bearing.



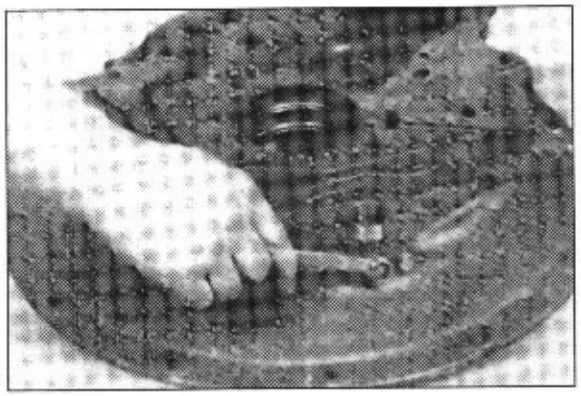
③ Remove oil distributor and O-rings.



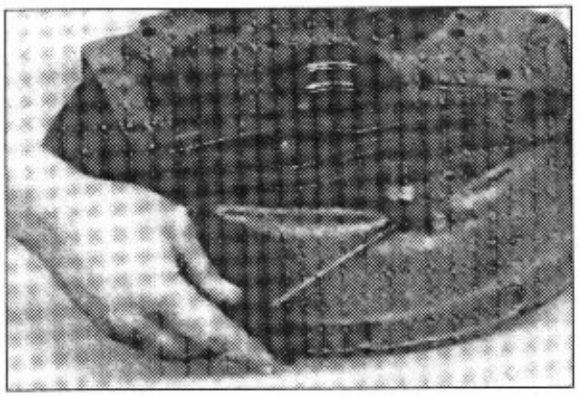
④ Remove converter oil seal.



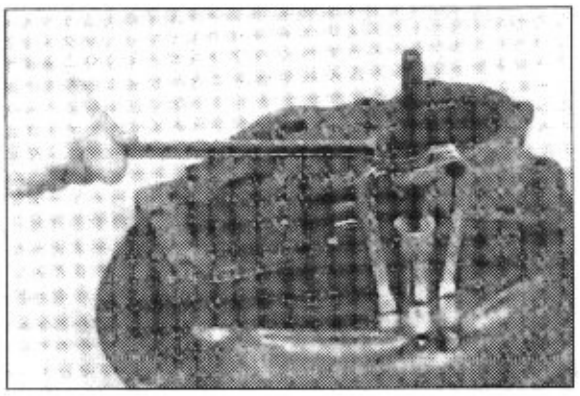
⑤ Remove converter housing plug(3rd clutch shaft on 3 speed).



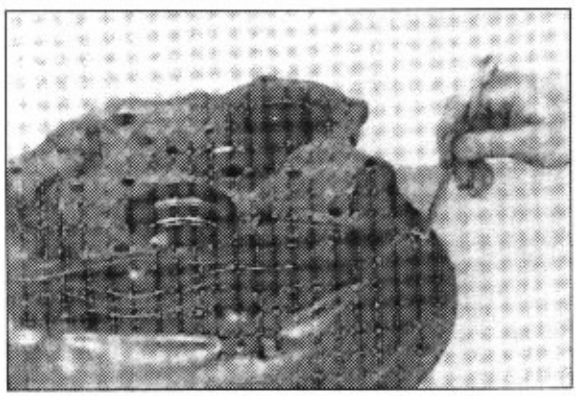
⑥ Remove oil distributor sleeve set screw.



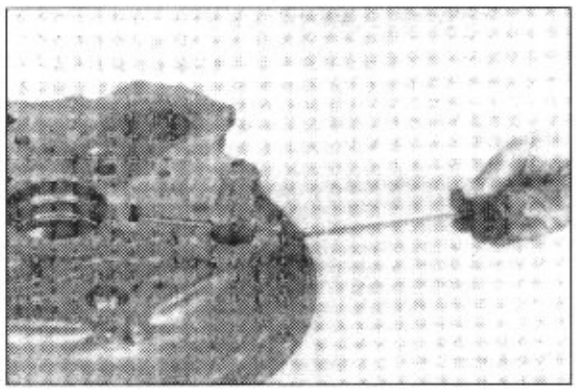
⑦ Using a puller as shown, remove oil distributor sleeve.(3rd)



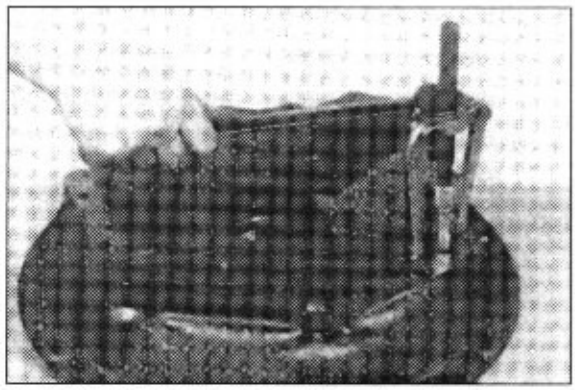
⑧ Remove converter housing plug.(1st and 2nd clutch shaft)



⑨ Remove oil distributor sleeve set screw.



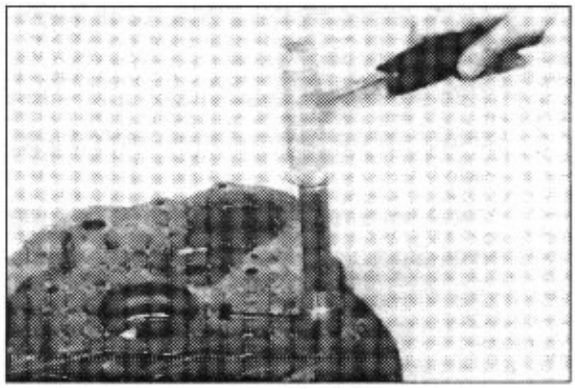
⑩ Using a puller as shown, remove oil distributor sleeve(1st and 2nd shaft)



(2) Reassembly

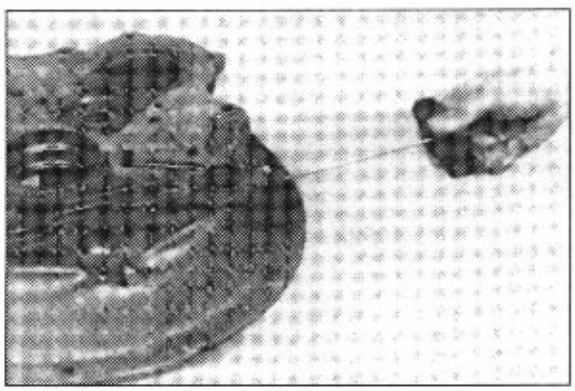
※ See Cleaning and inspection page 3-45, 46.

① Install 1st and 2nd clutch shaft oil distributor sleeve in converter housing, with inside diameter chamfer up, and the notch in the distributor aligned up with the retaining set screw hole in the converter housing.

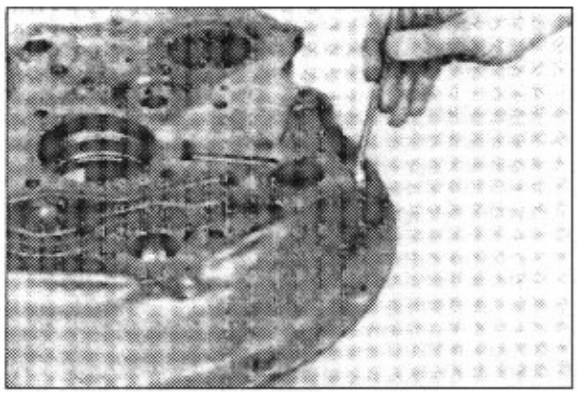


② Apply Loctite #243 to threads of sleeve set screw.

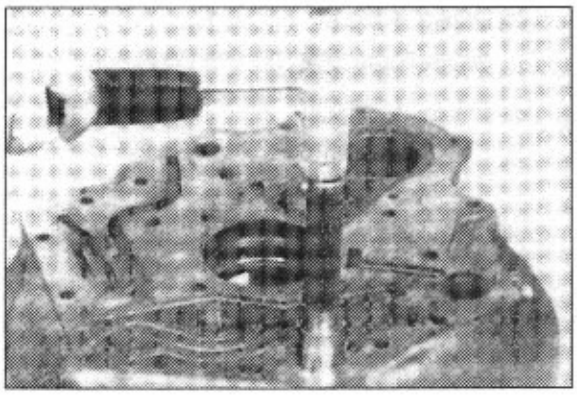
※ This set screw has a hole in it. Use caution as not to allow any Loctite to plug hole. Install set screw in converter housing and in oil distributor.



③ Install set screw plug.



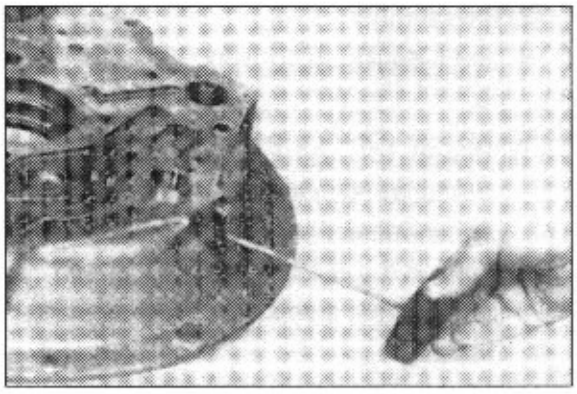
④ Install 3rd clutch shaft oil distributor sleeve in converter housing with inside diameter chamfer up, and the notch in the distributor aligned up with the retaining set screw hole in the converter housing.



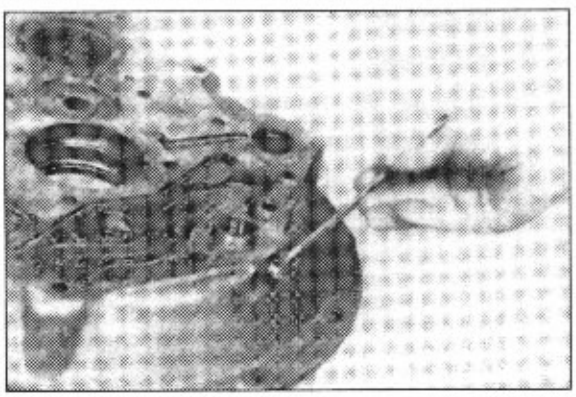
⑤ Apply Loctite #243 to threads of sleeve set screw.

※ This set screw has a hole in it. Use caution as not to allow any Loctite to plug hole.

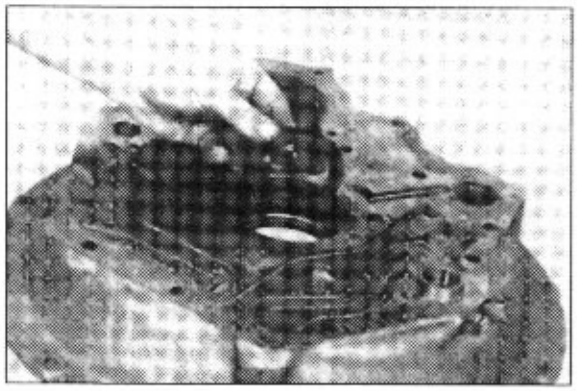
Install set screw in converter housing and in oil distributor.



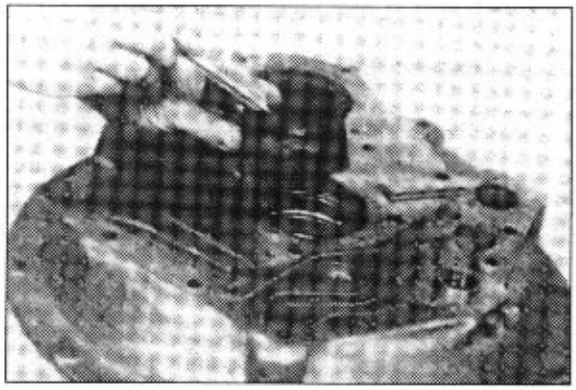
⑥ Install set screw plug.



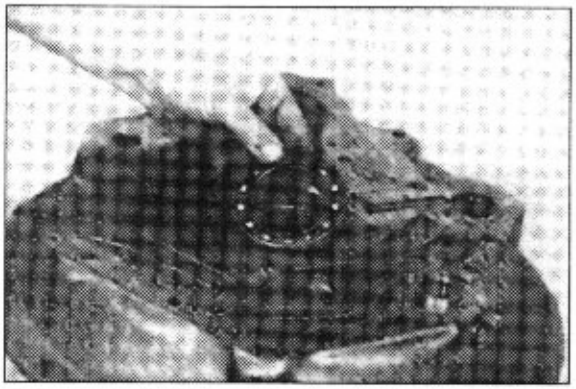
⑦ Apply a very light coat of Permatex #2 to the outer diameter of the converter housing oil seal. Press seal in housing with lip of seal in.



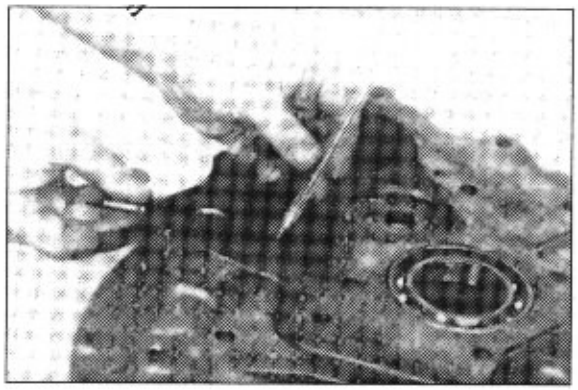
⑧ Install new O-rings on converter housing oil distributor. Install oil distributor in converter housing with long hub toward oil seal.



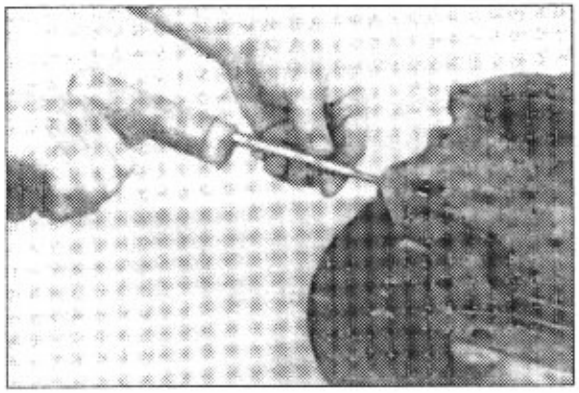
⑨ Press converter bearing in housing against shoulder.



⑩ Position ball check valve assembly in converter housing as shown.



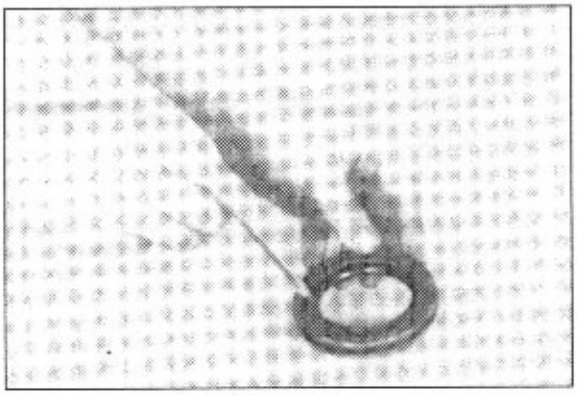
⑪ Tap check valve assembly in position.



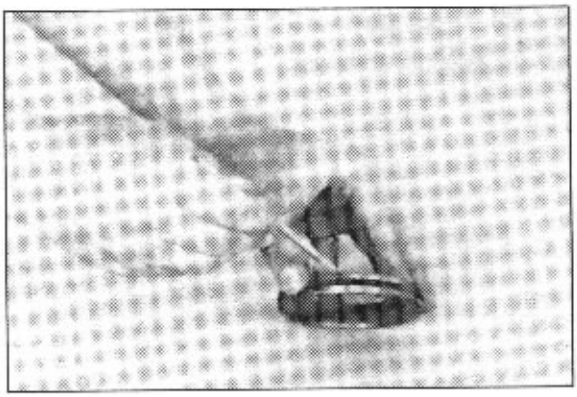
9) OUTPUT FLANGE OIL SEAL SLEEVE

(1) Disassembly

① Press output flange oil seal from seal sleeve.



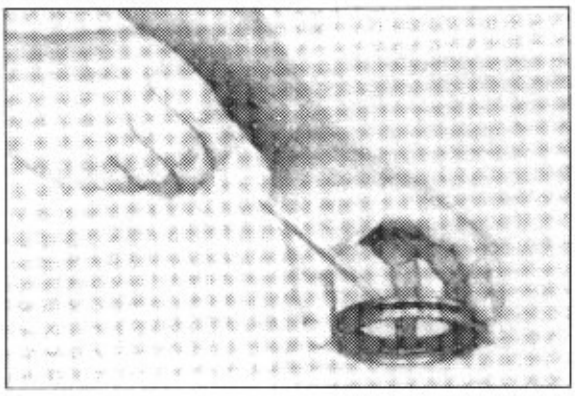
② Remove sleeve O-ring.



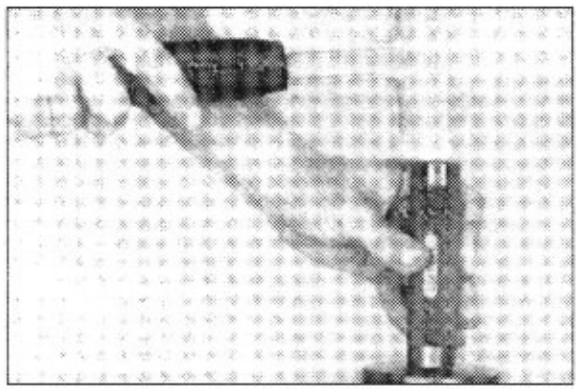
(2) Reassembly

※ See Cleaning and inspection page 3-45, 46.

① Install a new O-ring on oil seal sleeve.



② Apply a very light coat of Permatex #2 to the outer diameter of the output flange oil seal. Press oil seal in oil seal sleeve. Oil seal must be flush with one side of face of oil seal sleeve and lip of seal must be in.



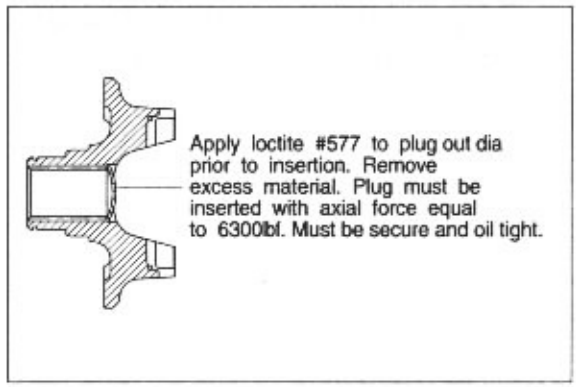
10) OUTPUT FLANGE REASSEMBLY

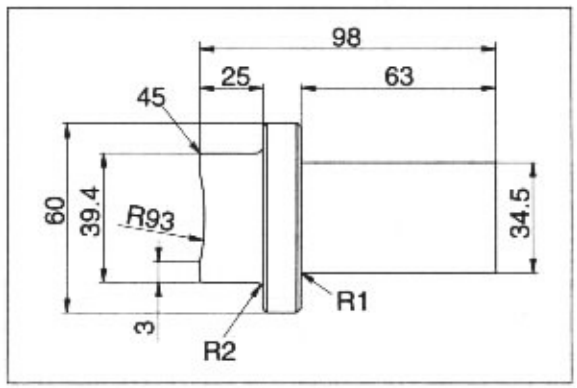
※ See Cleaning and inspection page 3-45, 46.

If output flange plug was removed for any reason, install new plug as follows : Apply a light coat of Loctite #577 to outer edge of expansion plug. Install plug in flange.

※ See figure right below for expansion plug installation tool fabrication.

It is imperative plug be installed properly to prevent oil leakage.

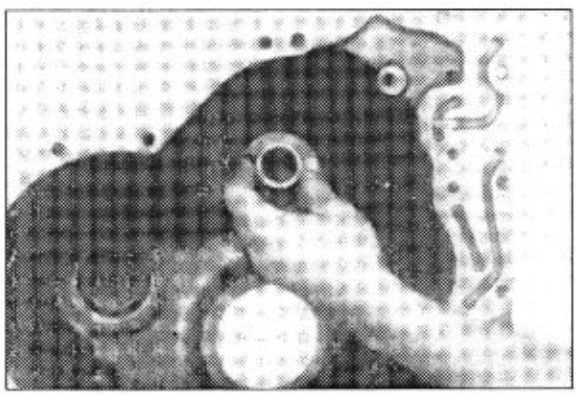




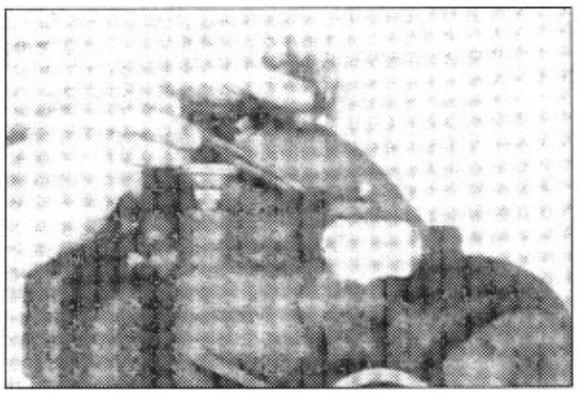
11) REASSEMBLY OF TRANSMISSION

※ See Cleaning and inspection page 3-45, 46.

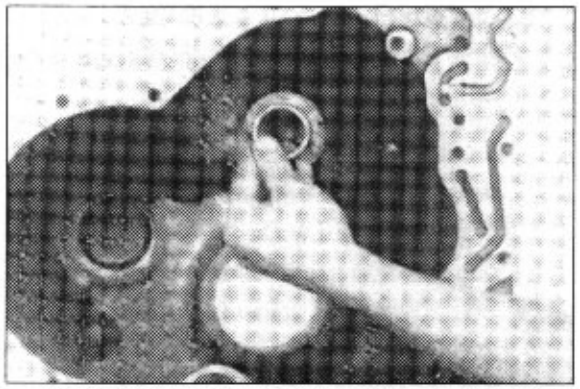
① Install forward-reverse oil distributor sleeve in transmission case with inside diameter chamfer out, (Toward front of transmission), and the notch in the distributor aligned up with the retaining set screw hole in the transmission case.



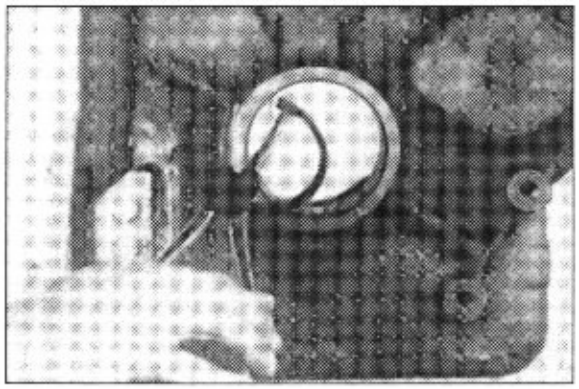
② Apply Loctite #243 and install set screw in transmission case and in oil distributor sleeve. Install set screw plug.



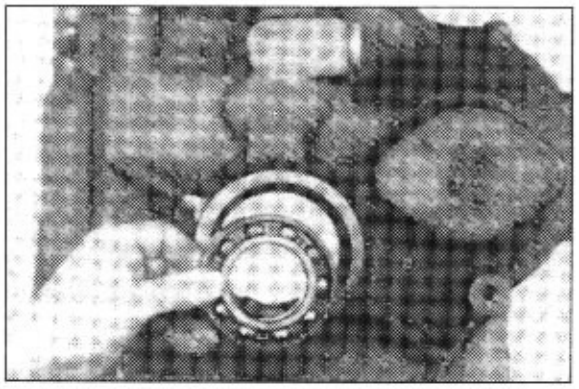
③ Install reverse and forward clutch shaft rear bearing in transmission case.



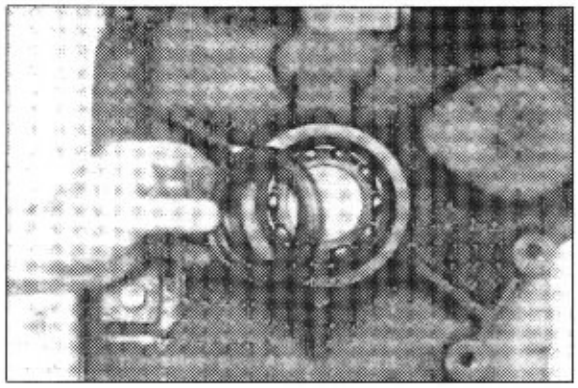
④ Install rear output bearing locating ring in transmission case.



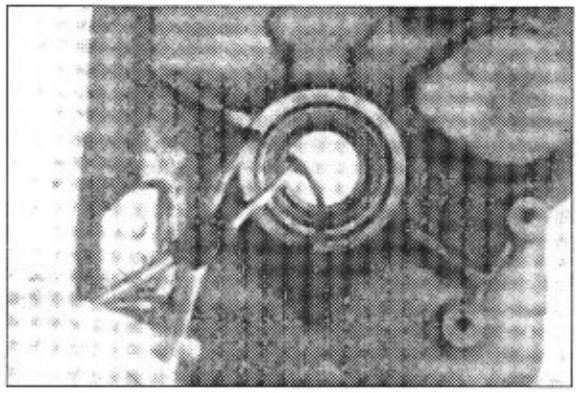
⑤ Install output bearing against locating ring.



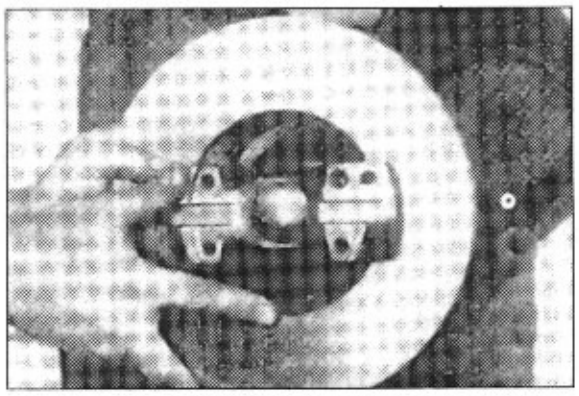
⑥ Position oil seal sleeve in transmission case with recessed portion of oil seal toward output bearing. This leaves a space between oil seal and output bearing.



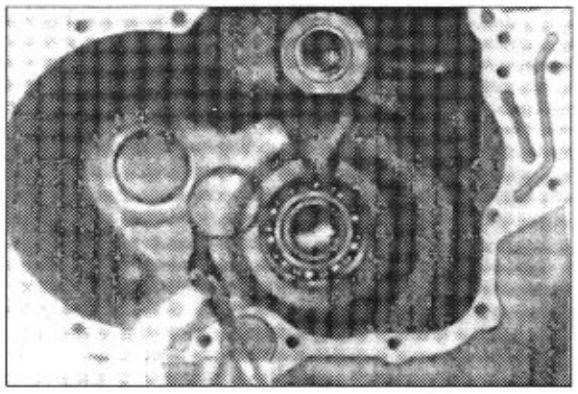
⑦ Install oil seal sleeve retainer ring.



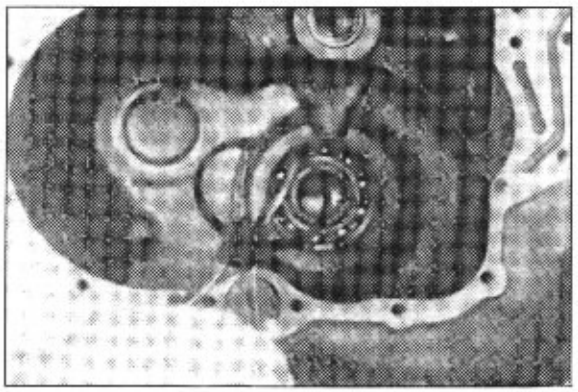
⑧ Install output flange through oil seal and rear output bearing. Use caution as not to damage seal.



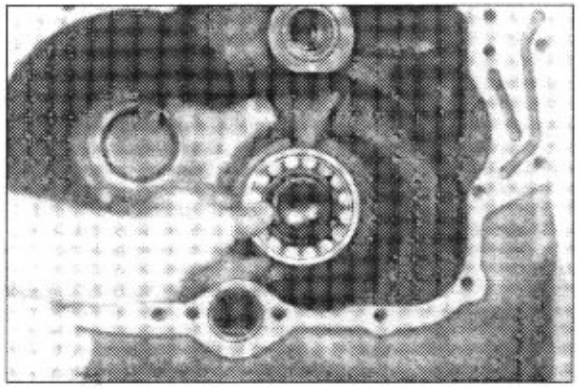
⑨ Install output flange to rear bearing retainer ring.



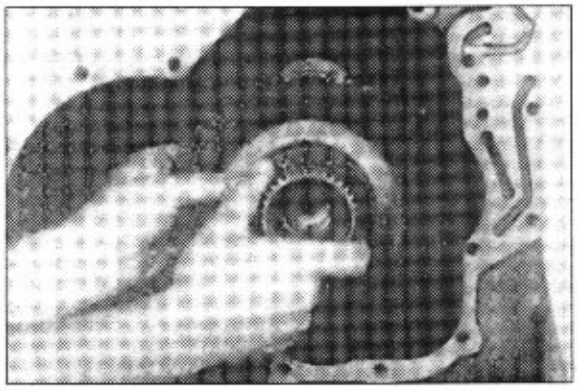
⑩ Install 3rd gear shaft bearing locating ring.



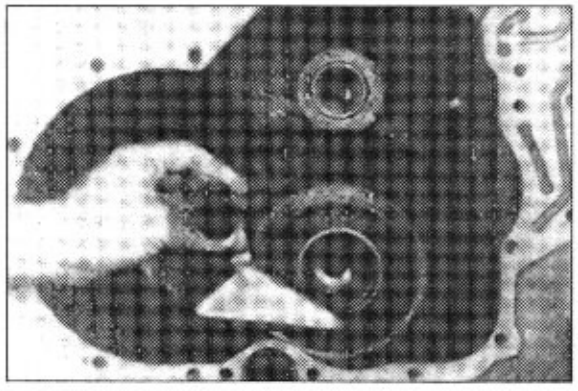
⑪ Install 3rd gear shaft bearing.



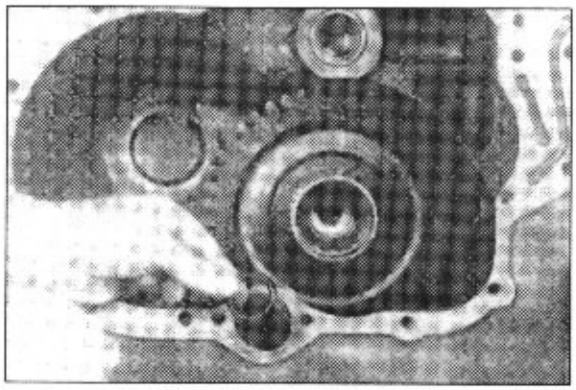
⑫ Position 3rd gear and shaft through bearing and into output flange.



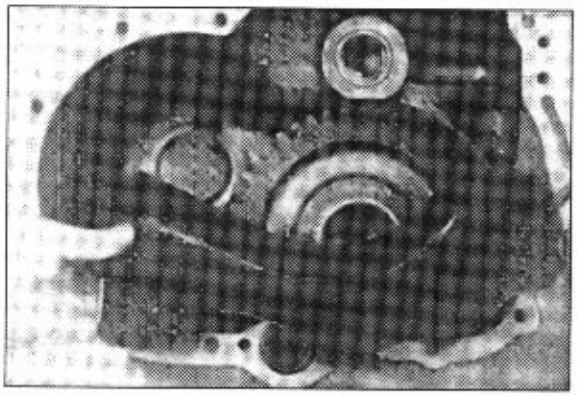
⑬ Position the oil suction tube and screen in transmission case.



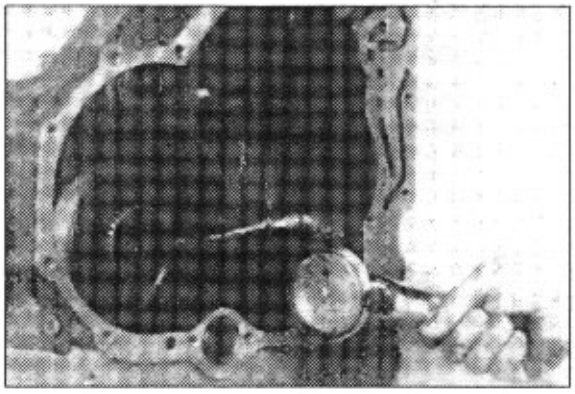
⑭ Push suction tube through opening in case and install O-ring.



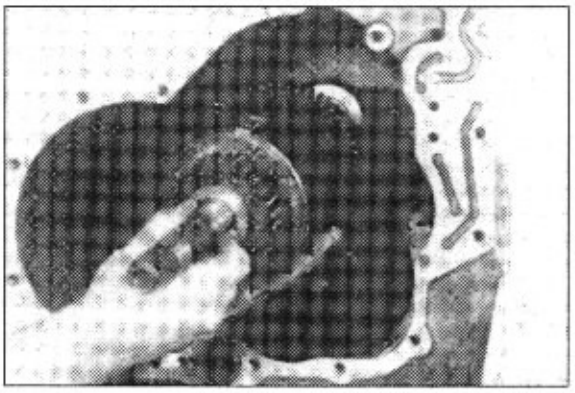
⑮ Position oil baffle in transmission case.



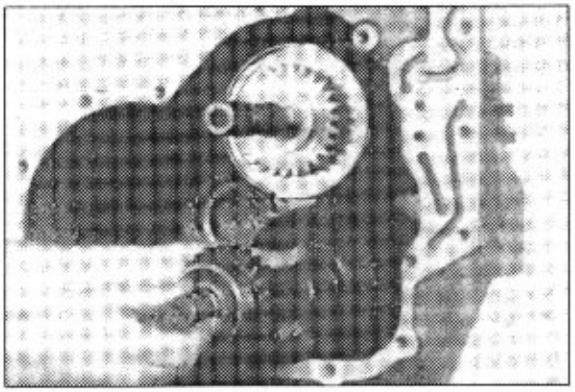
⑯ Install oil baffle capscrews and tighten to specified torque.
See torque chart at page 3-141.



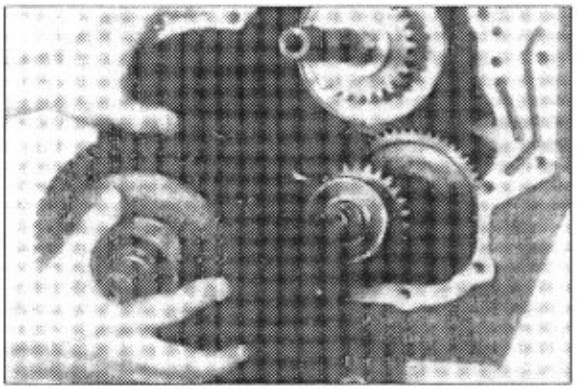
⑰ Position the forward and reverse clutch assembly shaft through the rear needle bearing and into the oil distributor sleeve. Use extreme caution as not to damage or break the clutch shaft oil sealing rings.



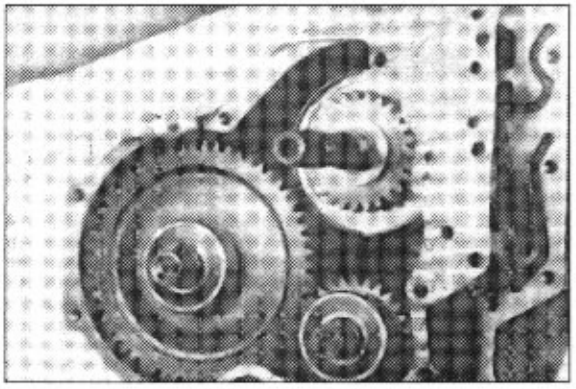
⑱ With the 3rd speed clutch shaft rear pilot bearing on shaft, install 3rd clutch assembly in 3rd clutch gear disc hub. Align splines on 3rd gear disc hub with internal teeth of friction discs. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs. Use caution as not to damage pilot bearing.



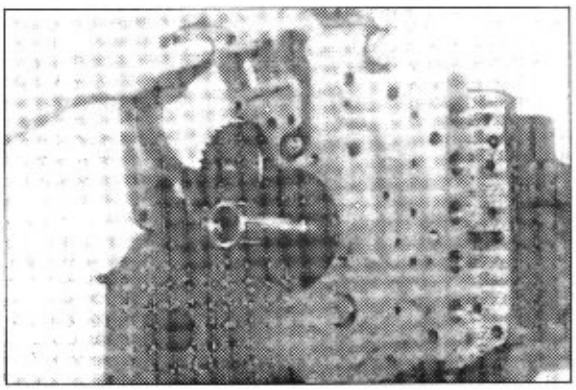
⑲ With the rear clutch shaft roller bearing in position on shaft, install the 1st and 2nd clutch assembly in transmission case.



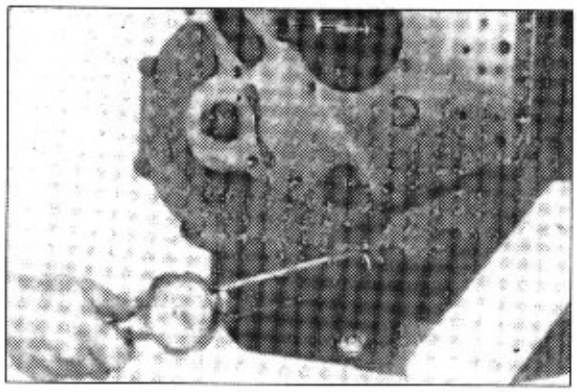
⑳ Position new transmission case to converter housing gasket on transmission case. A light coat of grease will hold gasket in position.



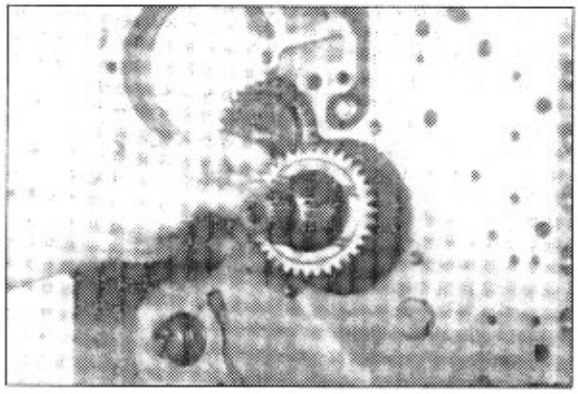
㉑ Install spacer plate assembly on transmission, aligning clutch shafts with opening in spacer plate. Use caution as not to damage oil sealing rings. Spacer plate must be tight against transmission case. Do not use bolts to pull spacer plate and case together. Tap spacer plate into position at dowel pins. Install spacer plate to transmission case capscrews.



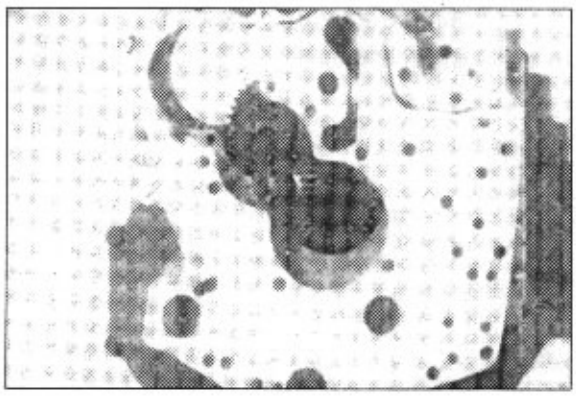
㉒ See note on figure at page 3-141 for proper capscrew installation and torque.



㉓ Position impeller hub gear on stator support.

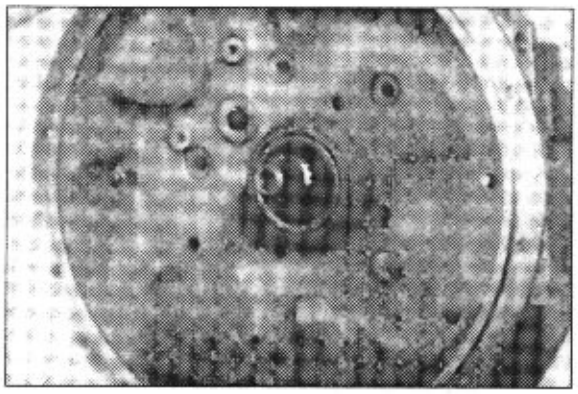


㉔ Position spacer to converter housing gasket on spacer. A light coat of grease will hold gasket in place.

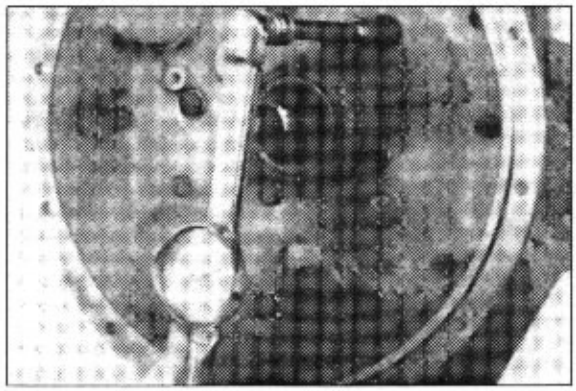


㉕ The use of aligning studs will facilitate converter housing to spacer installation. The transmission could be laid down to align the end of the clutch shafts into sealing ring sleeves in converter housing. Do not force this operation. Converter housing must be tight against transmission spacer.

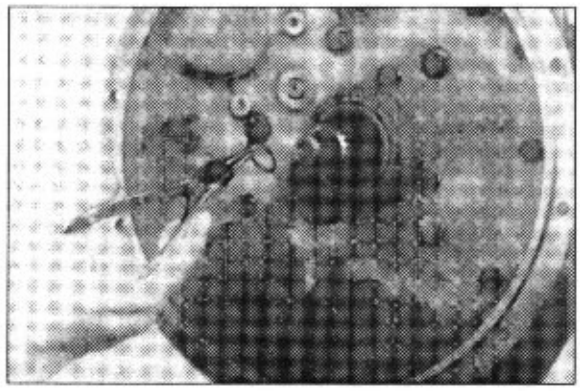
※ Do not use bolts to pull converter housing in place. Install converter housing to transmission case screws and lockwashers. See figures at page 3-141 for proper screw location and installation.



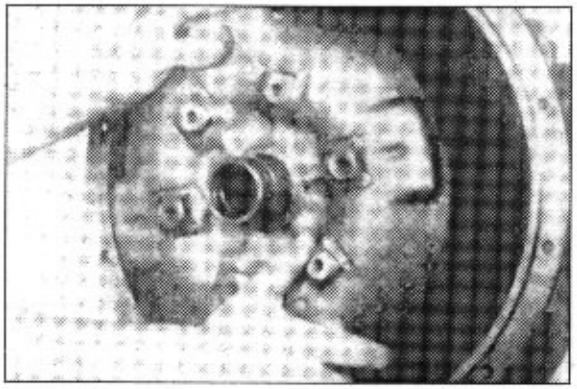
㉖ Tighten bolts to specified torque.
See note in figure ㉕. See figures at page 3-141 for proper screw location and installation.



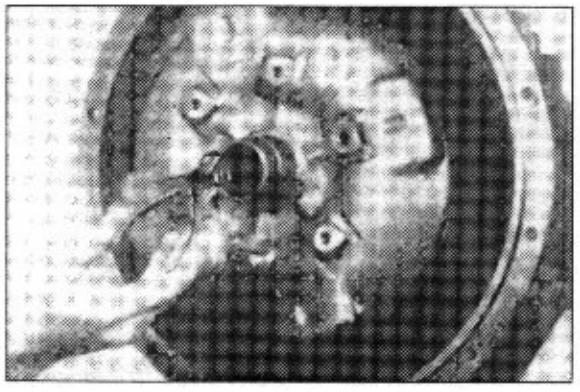
㉗ Install converter locating ring on turbine shaft.



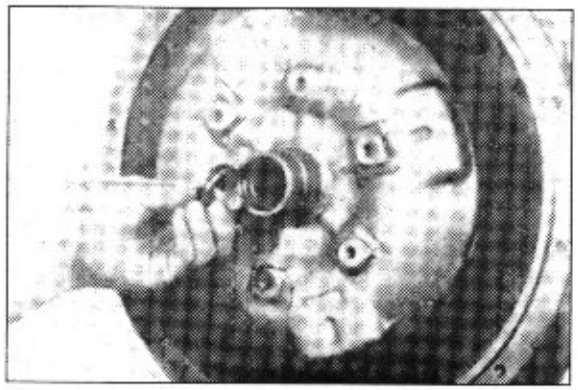
㉘ Position converter assembly on stator support and turbine shaft.



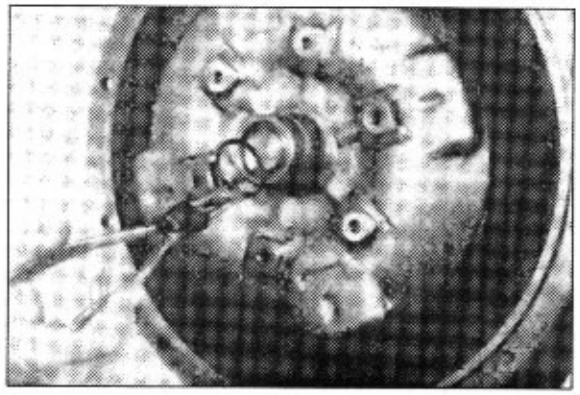
㉙ Install converter assembly retainer ring.



㉚ With new O-ring in place, install bore plug in converter assembly.



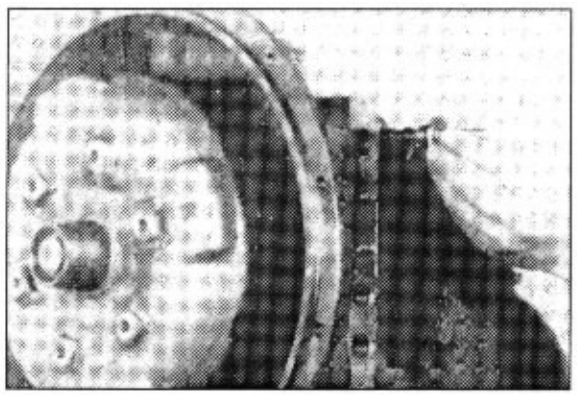
㉛ Install bore plug retainer ring.



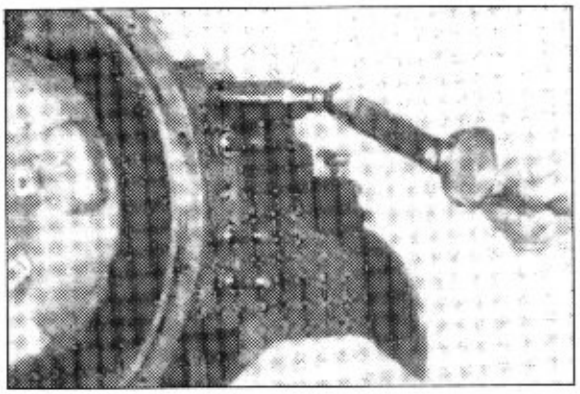
12) ELECTRIC CONTROL VALVE ASSEMBLY

※ A 3 speed transmission will have two different length solenoid cartridges. Two cartridges will be used for speed selection in lower two holes and two cartridges will be used in upper two holes for direction selection(Forward-Reverse). The two speed cartridges will be of same length but longer than the two direction cartridges. A bore plug is used in the center hole on 3 speed only.

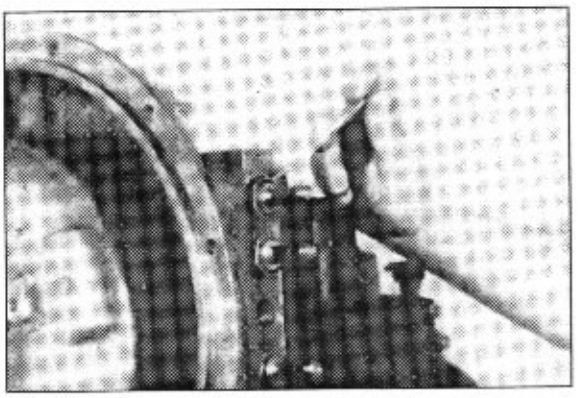
(1) With new O-rings in position on the solenoid cartridges, install cartridges as explained above. The 78.74mm(3.1in) length cartridges go in the top two holes, the 104.14mm(4.1in) length cartridges go in the two(2) or three(3) bottom holes depending on speed of transmission.



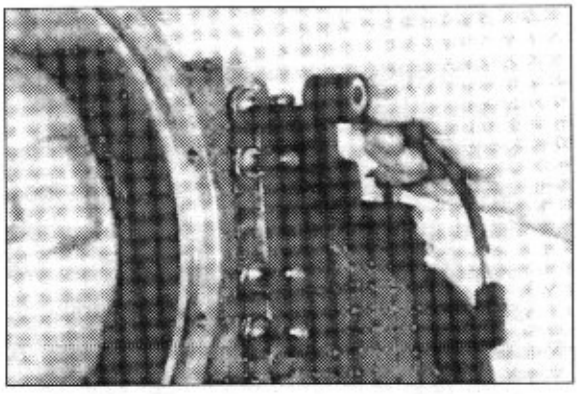
(2) Tighten cartridges to specified torque.
· Tightening torque : 2.2~2.8kgf · m
(16~20lbf · ft)



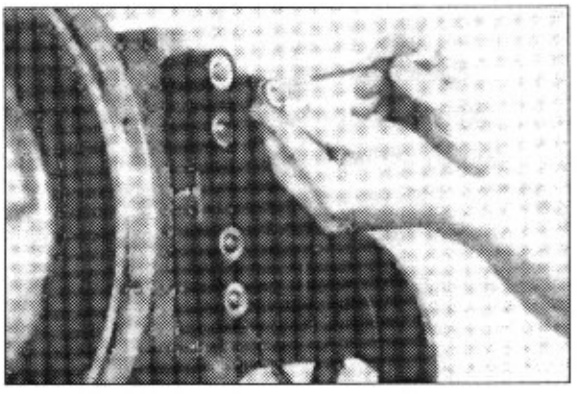
(3) Position a new cartridge to coil O-ring on cartridge.



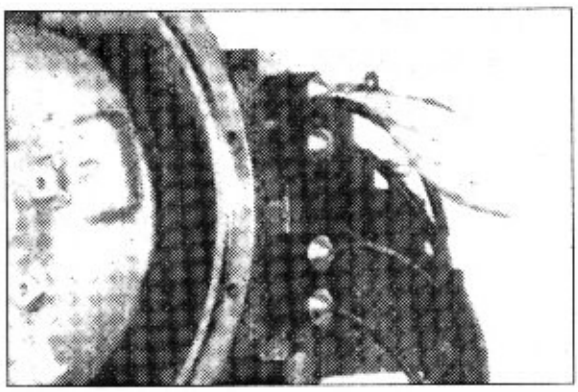
(4) Install coil and wire lead assembly on cartridge.



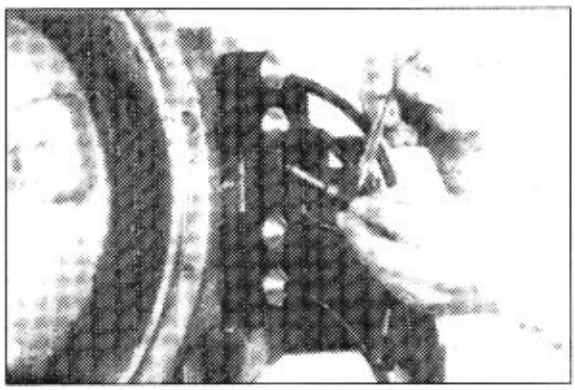
(5) With new O-ring in position, install coil to cartridge nut.



(6) Tighten cartridge nut per assembly instruction drawing.

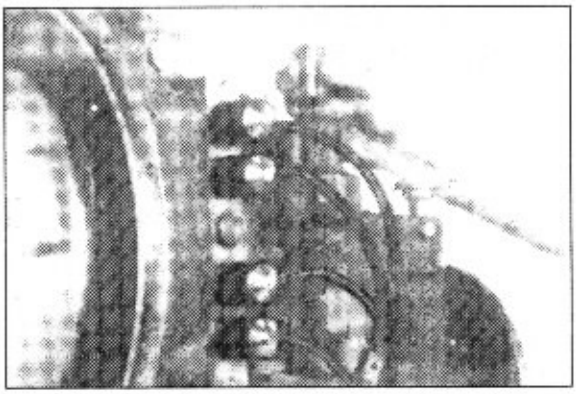


(7) On 3 speed transmission only, position new O-rings on the center hole bore plug. Install plug and tighten to specified torque at page 3-141.

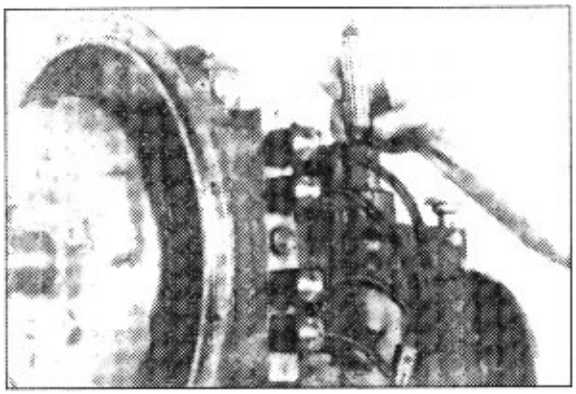


13) DUAL MODULATION INSTALLATION

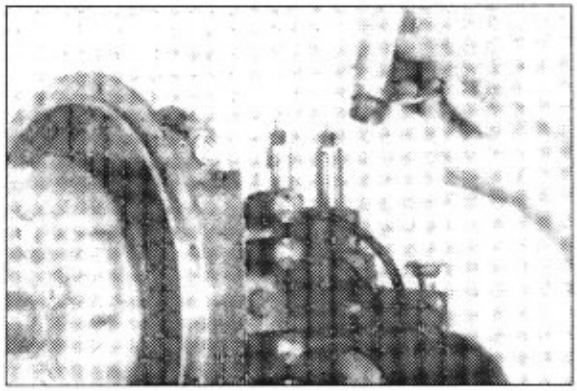
(1) Install modulation diverter in transmission case.



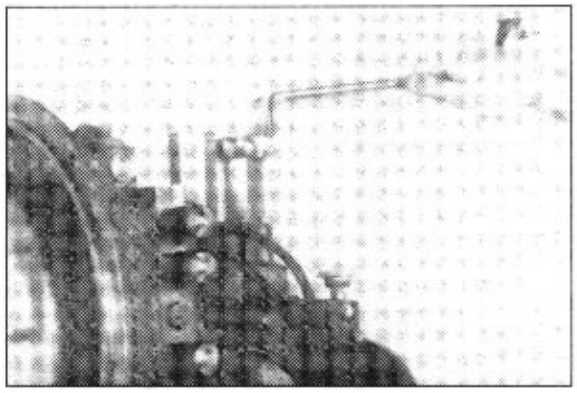
(2) With new lower end O-ring on modulation valve sleeve, install sleeve and spring assembly in transmission case.



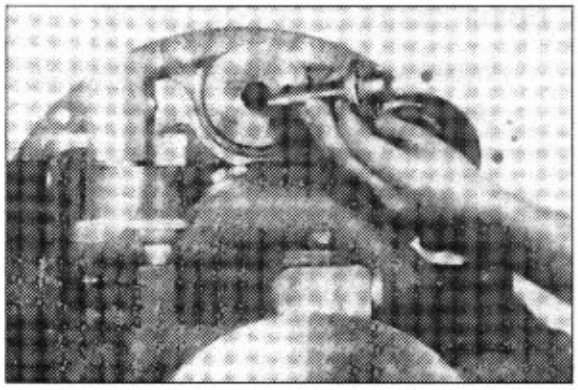
(3) With new O-ring in position, install modulator valve housing over spring and sleeve assembly.



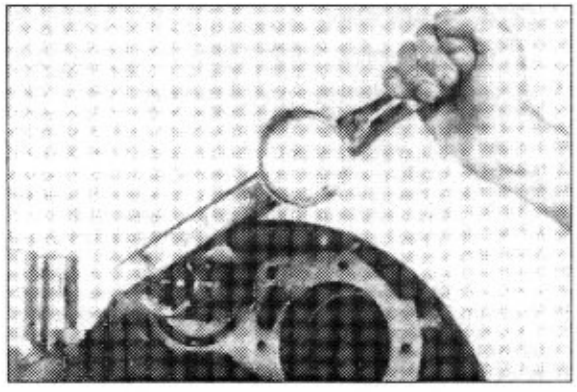
(4) Tighten modulator valve housing 8.3~9.0 kgf · m(60~65lbf · ft).



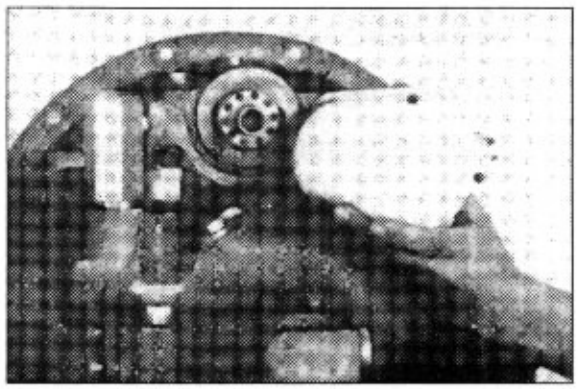
(5) Install regulator valve assembly in converter housing.



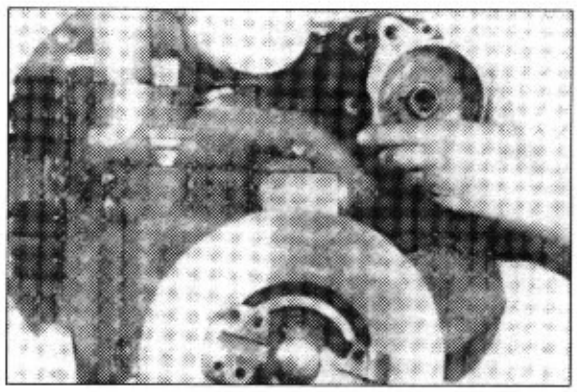
(6) A special tool can be fabricated to tighten the regulator valve. See third picture at page 53. Tighten valve assembly sleeve 6.2~7.0kgf · m(45~50lbf · ft).



(7) Install oil filter assembly on regulating valve. Tighten filter 2.8~3.5kgf · m (20~25lbf · ft).



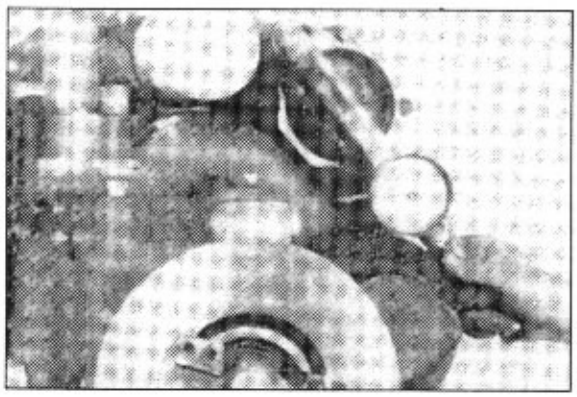
(8) With new gasket in place, install charging pump in converter housing.



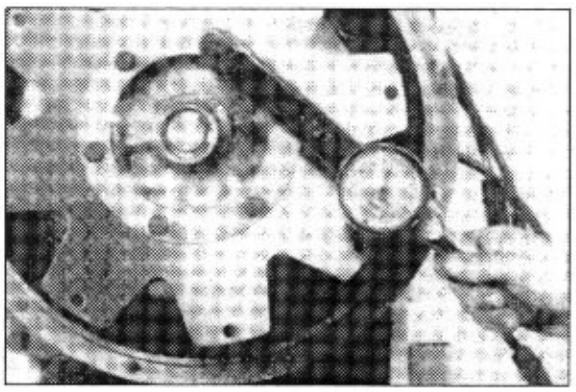
(9) Install charging pump to converter housing bolts and washers and tighten to specified torque. See torque chart at page 3-141.

Item	Size
9	3/8-18×3.25"
10	5/16-18×3.25"
11	5/16-18×2.0"

※ Refer to item No. parts manual 3190 page.



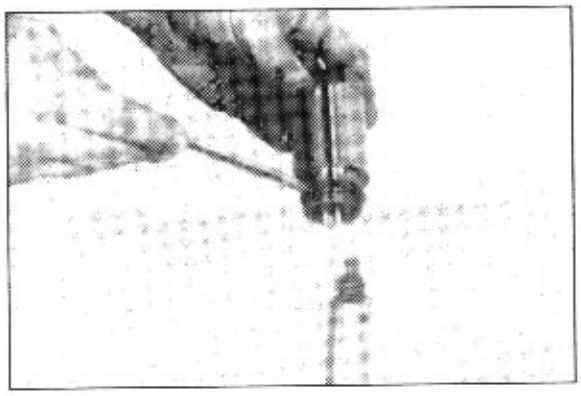
(10) Install drive plate.
· Tightening torque : 3.6~4.0kgf · m (26~29lbf · ft)



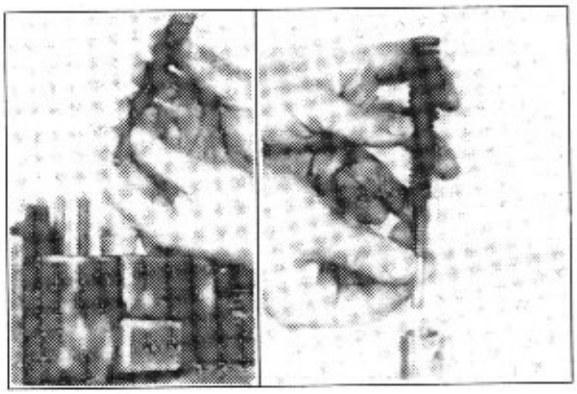
14) MODULATOR VALVE ASSEMBLY

(1) Disassembly

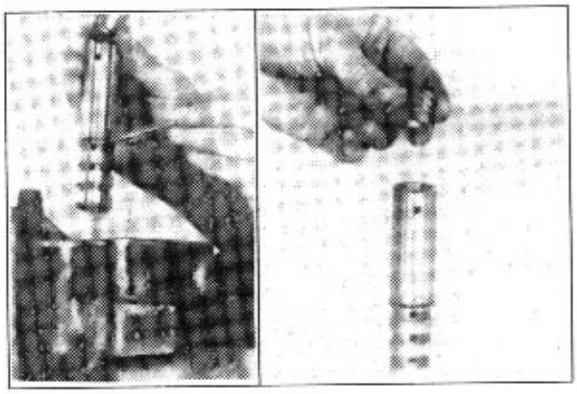
① Remove modulator valve body O-ring.



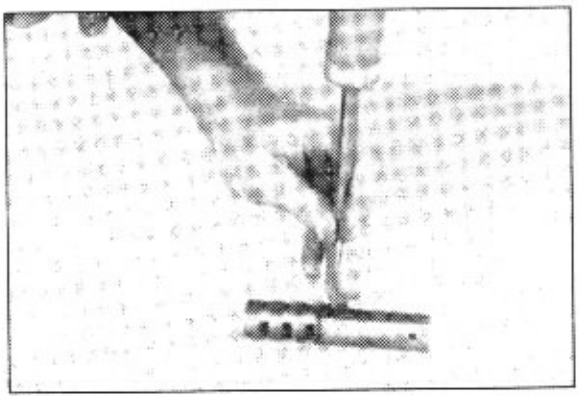
② Remove modulator valve outer, middle, and inner springs and spring stop.



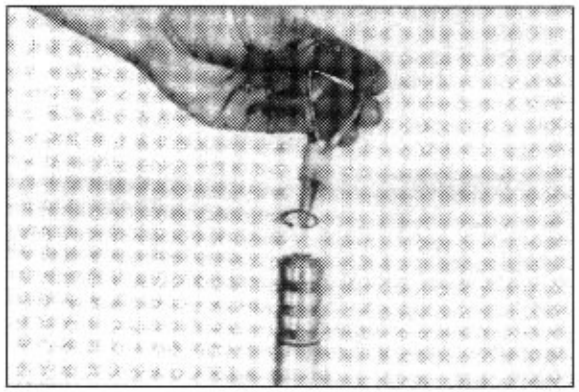
③ Remove accumulator spool.



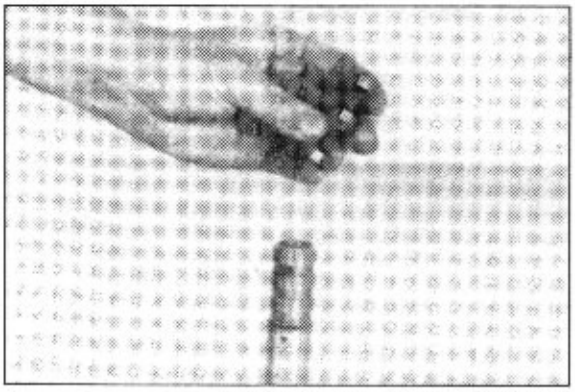
④ Remove modulator sleeve pin.



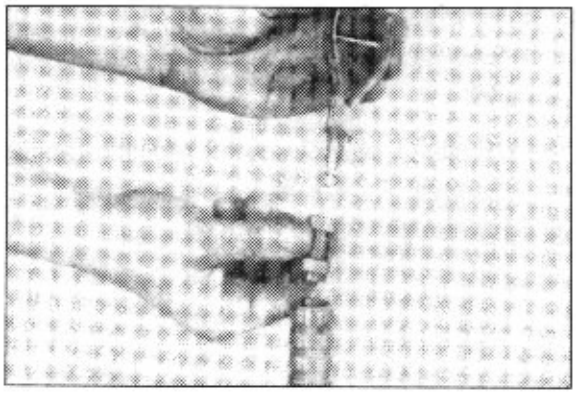
⑤ Remove regulator spool assembly retainer ring.



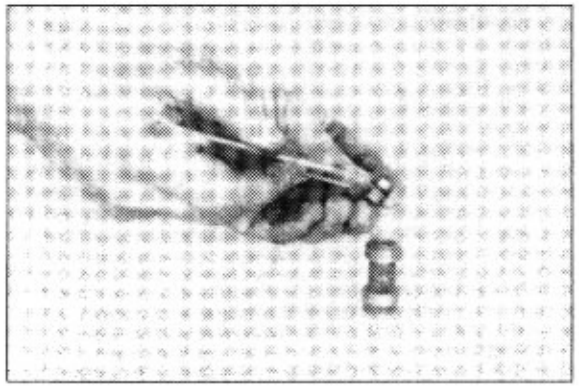
⑥ Remove regulator spool stop, spring, and spool and sleeve assembly.



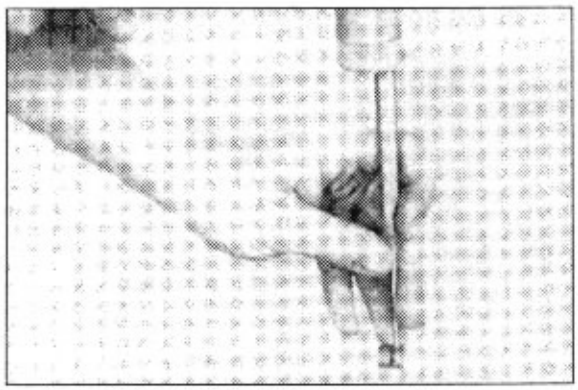
⑦ Remove regulator spool sleeve retainer ring.



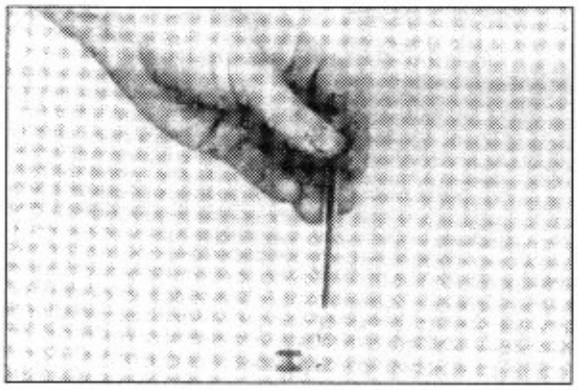
⑧ Remove regulator spool sleeve assembly. Remove O-ring.



⑨ Remove sleeve check ball retainer pin.



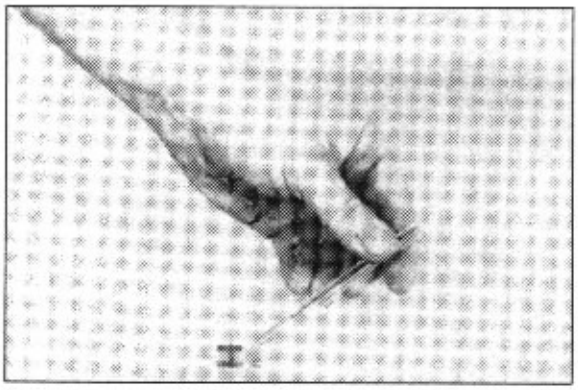
⑩ Remove check ball.



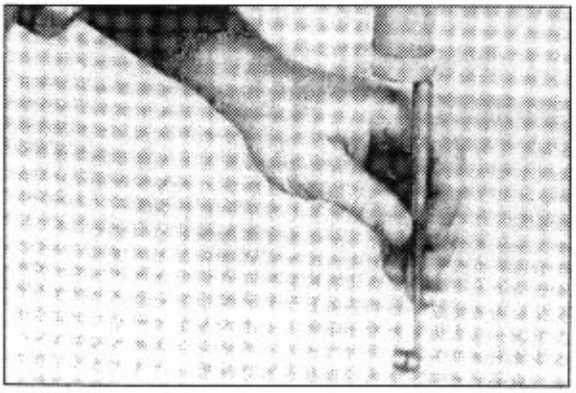
(2) Reassembly

※ See Cleaning and inspection page 3-45, 46.

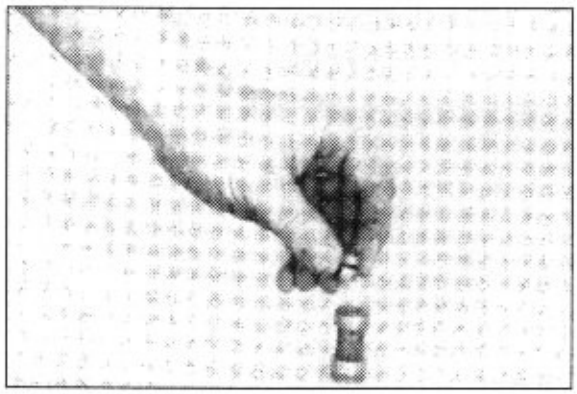
① Install a new O-ring on regulator spool sleeve. Position check ball in sleeve.



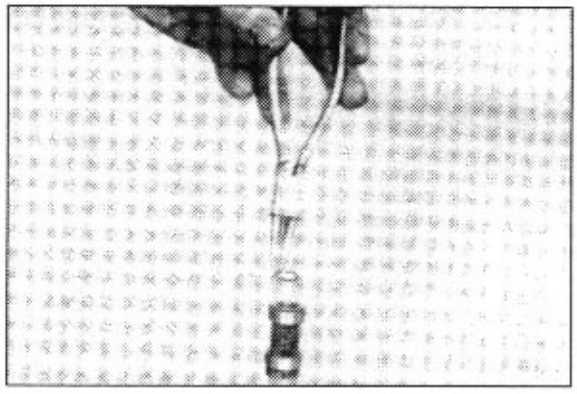
② Install check ball retainer pin.



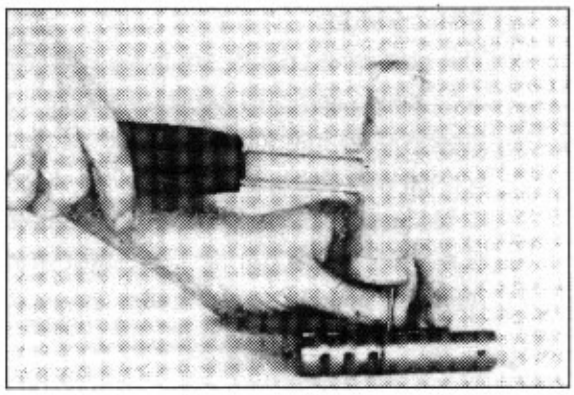
③ Position sleeve and ball assembly in regulator spool with check ball retainer pin up.



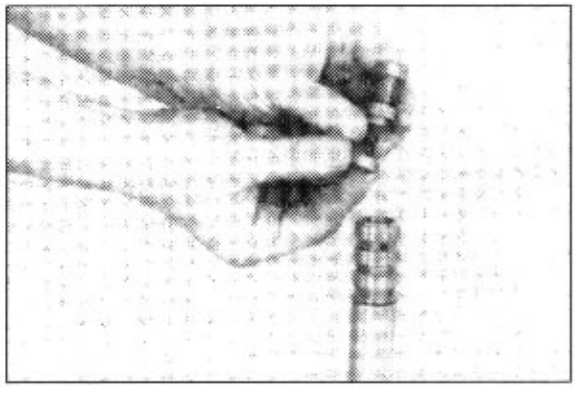
④ Install sleeve retainer ring.



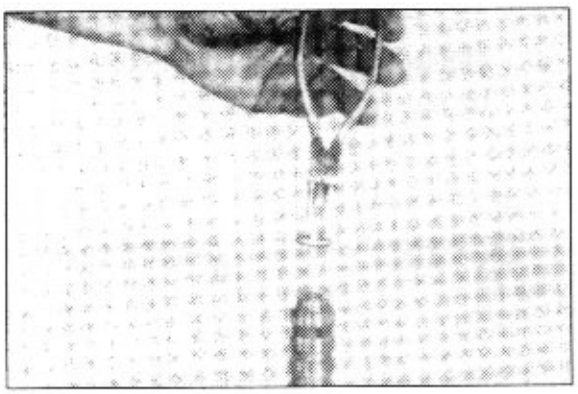
⑤ Install housing sleeve pin.



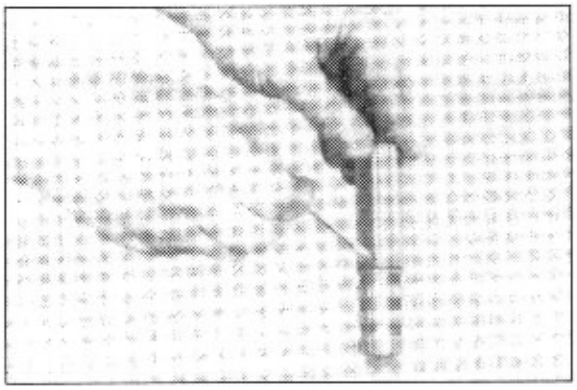
⑥ Install regulator spool stop, spring, and regulator spool and sleeve assembly in housing sleeve.



⑦ Compress regulator spool spring and install retainer ring.



⑧ Position new O-ring on modulation sleeve.



※ **Disk springs :**
The disc spring packs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack. Service replacement assemblies are banded together and must be replaced as assembly.

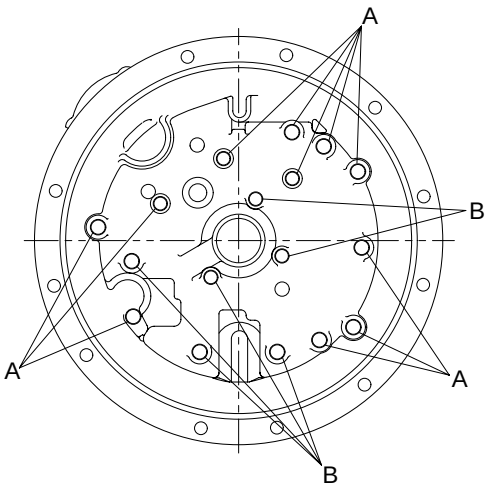
2. TORQUE CHART

1) TORQUE SPECIFICATION FOR LUBRICATED OR PLATED SCREWS AND NUTS

Nominal size	Grade 8.8 or 9.8		Grade 10.9	
	Coarse thread		Coarse thread	
	lbf · ft	kgf · m	lbf · ft	kgf · m
M10	30~37	4.1~5.1	44~48	6.1~6.6
M12	50~55	6.9~7.6	74~81	10.2~11.2

2) PIPE PLUG TORQUE CHART

Thread NPTF	Torque	
	lbf · ft	kgf · m
1/16-27	5~7	0.7~1.0
1/8-27	7~10	1.0~1.4
1/4-18	15~20	2.1~2.8
3/8-18	25~30	3.5~4.1
1/2-14	30~35	4.1~4.8
3/4-10	40~45	5.5~6.2



A M10 × 2.32 × 2.40"

B M10 × 1.17 × 1.20"

3) PIPE PLUG TORQUE CHART

Thread size	Torque	
	lbf · ft	kgf · m
M18 × 1.5 6H	25~30	3.5~4.1
M26 × 1.5 6H		6.2~6.9

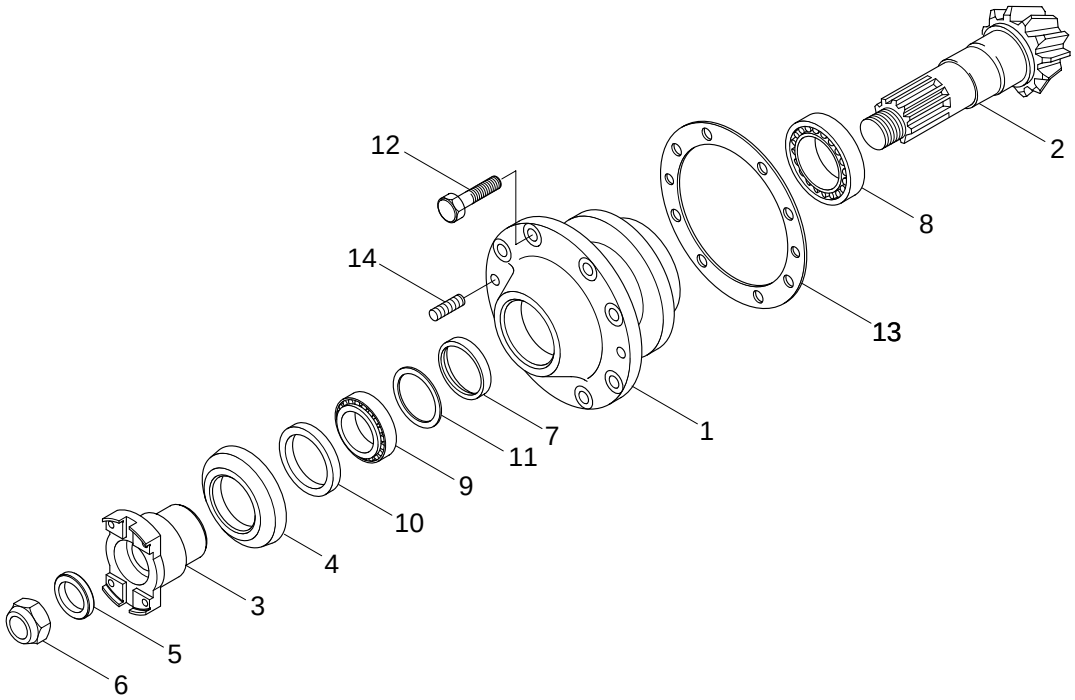
4) TORQUE SPECIFICATION FOR LUBRICATED OR PLATED SCREWS AND NUTS

Normal size	Grade 5				Grade 8			
	Fine thread		Coarse thread		Fine thread		Coarse thread	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
0.2500	1.2~1.5	9~11	1.1~1.4	8~10	1.5~1.8	11~13	1.2~1.5	9~11
0.3125	2.2~2.8	18~20	1.7~2.2	12~16	3.9~4.4	28~32	3.6~4.1	26~30
0.3750	3.6~4.0	26~29	3.2~3.5	23~25	5.1~5.7	37~41	4.6~5.0	33~36
0.4375	5.7~6.2	41~45	5.1~5.7	37~41	8.0~8.8	58~64	7.2~7.9	52~57
0.5000	8.8~9.7	64~70	7.9~8.7	57~63	12.4~13.7	90~99	11.1~12.2	80~88
0.5825	12.6~13.8	81~100	11.3~12.4	82~90	17.7~19.5	128~141	15.9~17.6	115~127
0.6250	17.7~19.5	128~141	15.6~17.1	113~124	24.9~27.4	180~198	21.8~24.2	158~175
0.7500	30.1~33.9	223~245	27.7~30.4	200~220	43.6~48.0	315~347	39.0~42.9	282~310

3. AXLE UNIT

1) INPUT SUB SYSTEM

(1) Disassembly of Input bevel pinion assembly



① Remove the filler plug(Item 5, page 3-177) and magnetic drain plug(Item 3, page 3-177) and drain the oil into a suitable container.
② Lock the brakes on the unit and slacken nut(6).
③ Slacken and remove bolts(12).
④ Remove the cork plugs from the holes(14) and insert two bolts(12).
⑤ Screw down the two bolts alternatively and evenly to break the seal and draw the assembly from the main casing.
⑥ On the bench, remove nut(6), washer(5) and coupling flange(3).
⑦ Press spiral bevel pinion(2) out of the assembly. Press from the threaded end.
⑧ Remove shim pack(11) and spacer(7).
⑨ If the bearings are to be reused, keep the bearings and shim pack together as a set.
⑩ Remove oil seal(10) from housing(1) and discard.

※ Cleaning and inspection

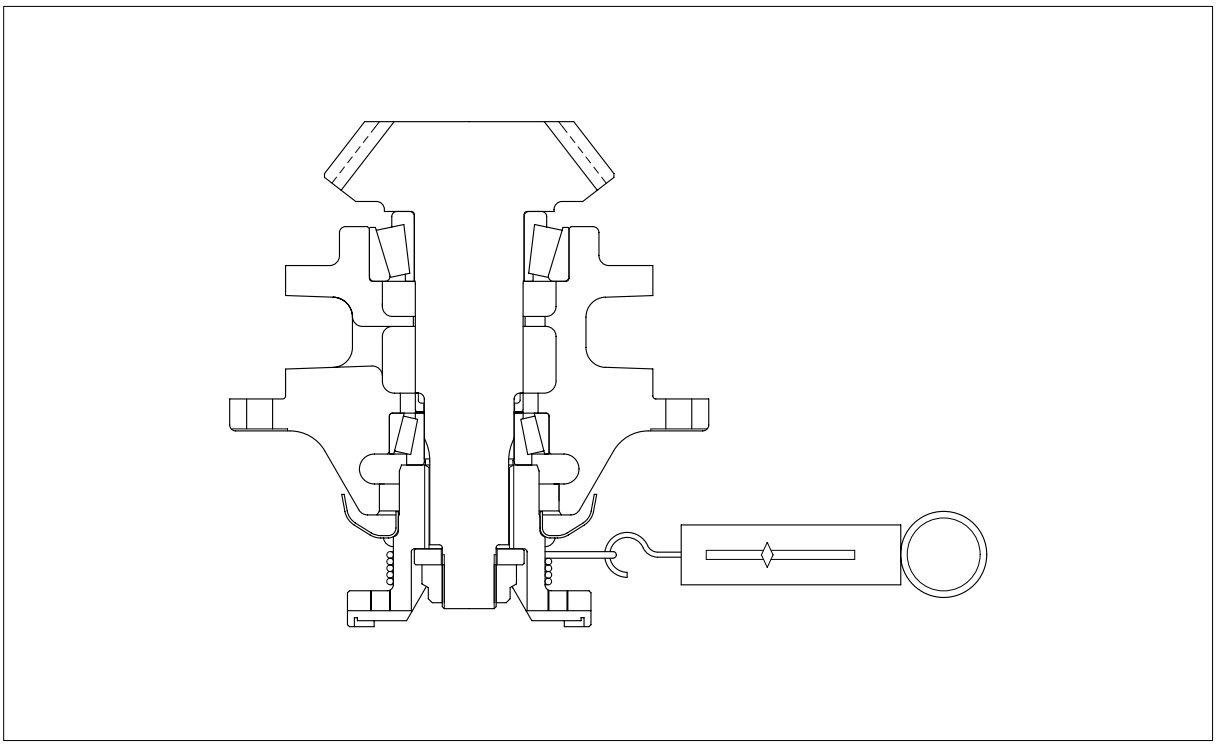
⑪ Thoroughly clean all parts with a suitable solvent prior to inspection.
⑫ Clean off old Loctite from joint faces.
⑬ All used oil seal, circlips, and self locking nuts must be replaced prior to re-assembly.
⑭ Examine all components for cracks, corrosion, wear, distortion or other damage and renew any part found to be defective.

(2) Assembly of input bevel pinion assembly

※ **Spiral bevel wheels and pinions are supplied as matched sets. When fitting spiral bevel sets ensure that the pairing numbers on the wheel and pinion match. The pairing number and backlash value are to be found on the outside face of the pinion head and the outside diameter of the wheel.**

The mounting distance is also marked on the pinion head. This value specified in ㎜(102.15 for example) is required for calculating the bevel pinion line shim pack thickness.

① Measure and record distance **E** from abutment face to the front face of the bevel pinion(See figure page 3-145).
② Press bearing cup(8) into the housing(1) with the thickest section to the rear.
※ **It is important that if reusing bearings, the previously mated cups and cones are reassemble together.**
③ Press bearing cup(9) into housing(1) with the thickest section to the rear.
④ Heat bearing cone(8) to 100℃(212℉) max.
⑤ Fit bearing cone(8) to bevel pinion(2). Note thickest section to head of pinion. Ensure that bearing is fully abutted to head of pinion.
⑥ Feed pinion(2) through housing(1) from the inboard side and fit bearing spacer(7).
※ **Recessed side towards pinion head.**
⑦ Select a trial shim pack(11) that provides for a small amount of end float.
※ **Maximum calculated shim pack is 1.1㎜(0.043in)**
⑧ Fit trial shim pack(11), inner bearing cone(9), coupling flange(3), washer(5), and temporary nut. Do not fit oil seal(10) at this time.
⑨ Tighten nut to seat bearings. Measure the end float with a dial indicator. Required shim pack size is : Trial shim pack size-measured end float-0.05㎜(0.002in).
⑩ Remove temporary nut, washer(5), inner bearing cone(9) and trial shim pack.
⑪ Insert required shim pack(13).
⑫ Fit bearing cone(9), washer(5) and temporary nut.
⑬ Lock bevel pinion and tighten temporary nut 14.3㎏f · m(103lbf · ft).



⑭ Measure the bearing preload torque(See figure above). Fasten a piece of cord to the coupling flange, wind the cord around the journal and attach the free end to a spring balance. Ignoring the initial starting force, a constant **pull**, for correct bearing adjustment, of 3.6~6.8kg must be obtained. Adjust the shims(Items 33) to obtain the above figure. Increase shims if figure is too high, decrease shims if figure is too low.

⑮ Remove temporary nut(6), washer(5) and coupling flange(3).

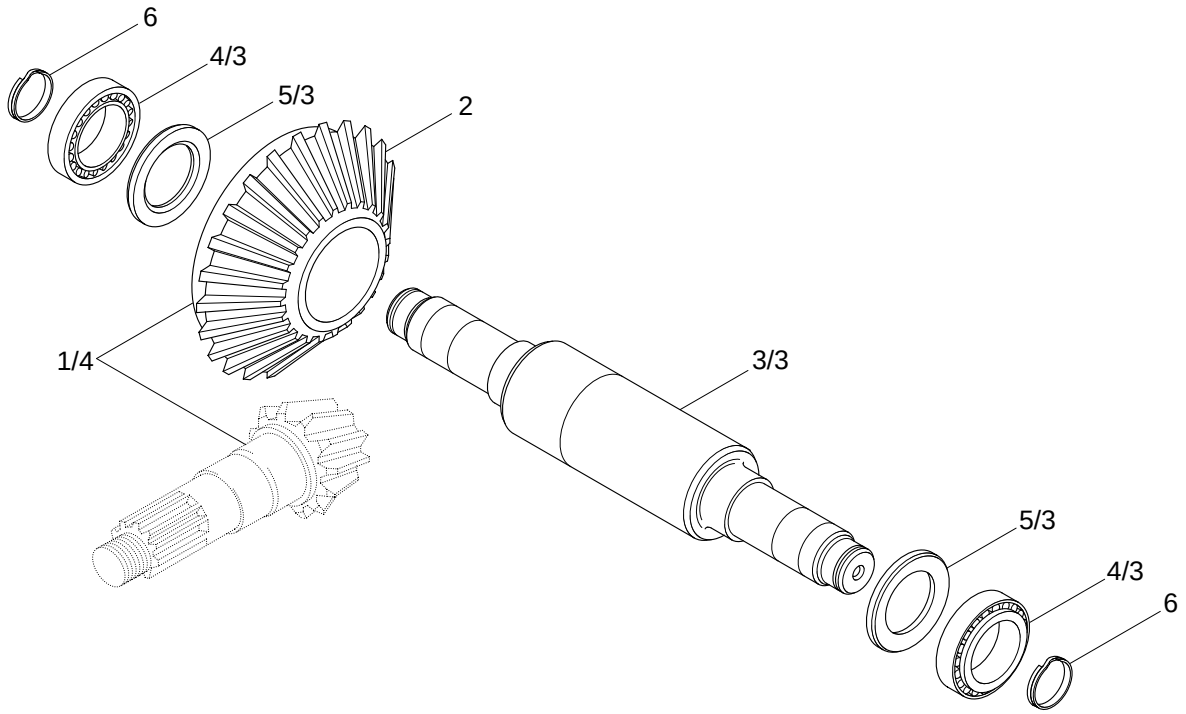
⑯ Fit oil sea(10) with the recessed side facing the pinion head.

⑰ Clean and grease oil seal track on coupling flange(3) and fit to pinion shaft.

⑱ Fit washer(5).

⑲ Apply Loctite grade 244 to threads of pinion shaft, fit nut(6) and torque tighten to 14.3kgf · m (103lbf · ft).

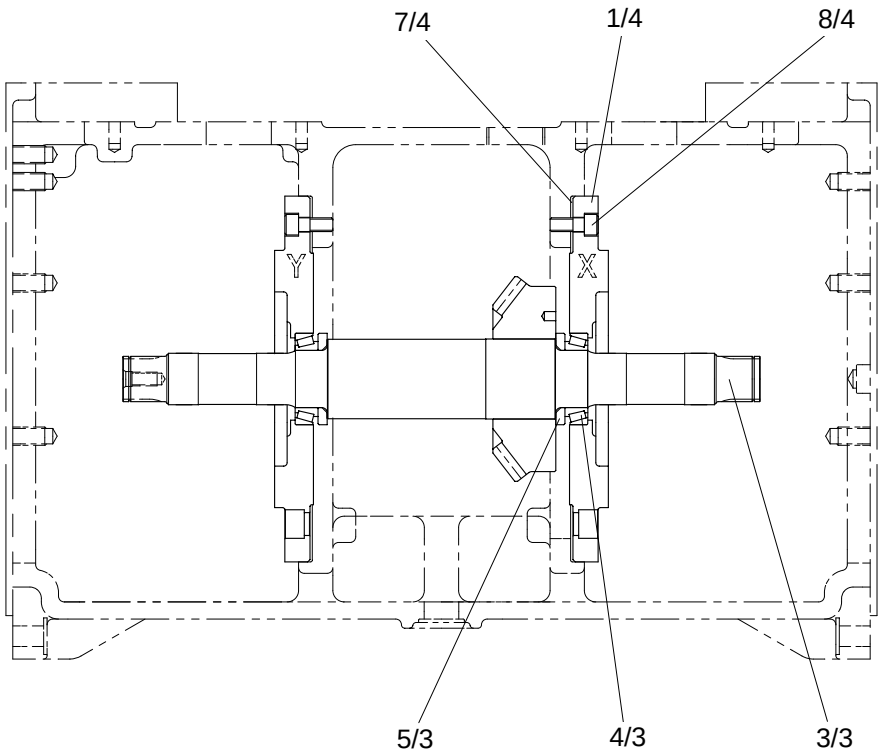
(3) Disassembly of cross shaft assembly



① Disconnect the brake operating assembly(See page 3-170).
② Remove the final drive assembly(See page 3-155).
③ Remove clutch assembly(See page 3-150).
④ At the adapter plate side marked **X** remove the five bolts(8/4, page 3-146).
⑤ Screw two of the bolts into the M12 tapped holes in the adapter plate and screw down the bolts alternatively and evenly to draw the adapter plate out of it's location diameter. Support the cross shaft(3/3) throughout and remove the adapter plate.
⑥ Remove the shim pack(7/4, page 3-146) and keep complete as a set if the parts are to be reused.
⑦ Withdraw the cross shaft complete and remove the bearing cones(4/3) and spacers(5/3).
⑧ If the bearings(4/3) are to be reused, keep the cup and cone from each side together as a set.

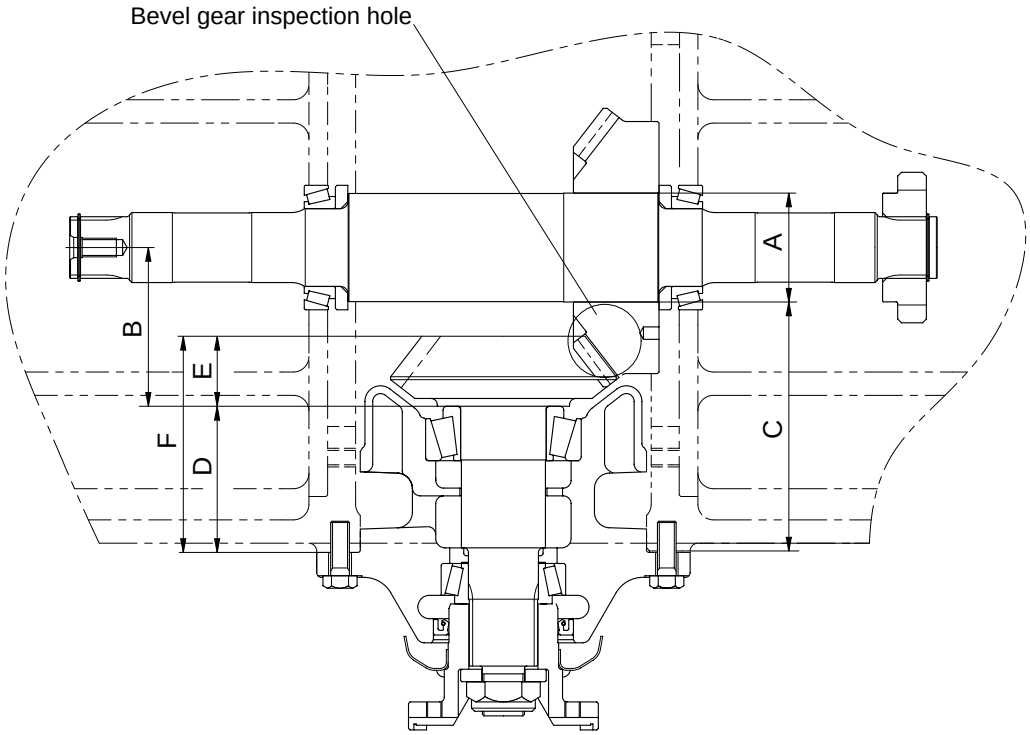
※ **See cleaning and inspection at page 3-142.**

(4) Assembly of cross shaft assembly



① Measure diameter **A**(The ground diameter adjacent to the bevel wheel face) and record.
② Press bearing outer cones(4/3) into both adapter plates(1/4). Note thickest section of cone to abutment face.
③ Fit bearing spacer(5/3) and inner bearing cone(4/3) to both ends of cross shaft(3/3). Note thickest section of bearing cone to center of shaft.
④ Fit one adapter plate(1/4) at side **Y** without shims. Secure with all five cap head screws(8/4) and torque tightened to 9.2kgf · m(66.4lbf · ft).
⑤ Select a trial shim pack for each adapter plate. Note maximum shim pack thickness is 2.82mm per side. If replacing a bevel set, it is suggested that the best trial shim pack is the same as use in the previous assembly.
Otherwise, it is suggested to start with 3.00mm(0.12in).
⑥ Position the cross shaft sub assembly with the bevel wheel outermost and pass the assembly through the bores from side **X** to locate in the bearing at side **Y**.
⑦ Using all the trial pack shims, fit the adapter plate(1/4) at side **X**. Use three cap head crews(8/4) and tighten evenly checking for end float of the cross shaft throughout. If a condition of no end float is encountered, remove the adapter plate at side **X**. Add more shims until an end float condition is achieved with the three cap head screws tightened to 9.2kgf · m(66.4lbf · ft).
⑧ Measure the end float of the cross shaft assembly using a dial indicator. Required shim pack size is : Trial pack thickness-end float-0.075mm(0.003in).
⑨ Remove the adapter plate(1/4) at side **X** and trial shim pack(7/4). Reassemble with the required shim pack at side **X**.

(5) Setting the mounting distance



① The nominal mounting distance for the bevel pinion is 102㎜. The actual mounting distance, which will vary due to manufacturing tolerances etc., is marked on the pinion head. This value(Specified in ㎜) is required for calculating the shim pack thickness. For the purposes of this exercise we will assume the value to be 102.15㎜.
② Apply a thin coat of suitable marking compound to the teeth of the pinion.
③ Retrieve measurement **E**(Thickness of pinion head).
④ Retrieve measurement **A**(Ground diameter adjacent to bevel wheel face).
⑤ Retrieve mounting distance **M**(From the head of the pinion).
⑥ Measure distance **C**(From the input housing mounting face to the ground diameter on the cross shaft).
⑦ Measure distance **F**(From the flange face of the input housing to front face of the bevel pinion).
⑧ Dimension **D** = **F** - **E**
⑨ Dimension **B** = **A**/2 + **C** - **D**
⑩ Shims required = **M** - **B**

Example
A = 70.13
C = 160.05
E = 44.90
F = 138.99
M = 102.15
D = **F** - **E** = 138.99 - 44.90 = 94.09
B = **A**/2 + **C** - **D** = 70.13/2 + 160.05 - 94.09 = 101.025
Required shim pack
= **M** - **B**
= 102.15 - 101.025
= 1.125㎜(0.0443 in)

⑪ Assemble a shim pack to the calculated thickness.

⑫ Assemble the input bevel pinion assembly and shims to the case and secure with 4 equally spaced hexagon head screws(12/1) and torque tighten to 8.6kgf · m(59.7lbf · ft).

⑬ Fit sun gear(1/6) to one end of the cross shaft.

⑭ Mount a dial gauge indicator to the axle casing with the spindle in contact, with and at right angles to a tooth on the sun pinion. Measure the backlash in the gear mesh, by rocking the wheel backwards and forwards, whilst holding the bevel pinion still. The backlash should be measured at three different positions around the sun gear.

※ **Since the sun gear is smaller in diameter than the bevel wheel, the measured backlash will be less than actual backlash in the ratio of the diameter of the two gears. Actual backlash is 0.15~25mm. To achieve this, measured backlash at the sun pinion is 0.09~0.15mm (0.0035~0.006in).**

⑮ Adjust the position of the crown wheel to obtain a backlash figure at the sun pinion of between 0.09~0.15mm(0.0035~0.006in). The total shim pack thickness was established earlier and remains the same. Move the wheel by transferring shims from one side to the other. To decrees backlash, take shims from side **Y** and add them to side **X**. Conversely, to increase backlash transfer shims from side **X** to side **Y**. The variation in tooth markings, pinion adjusting direction and correct markings are illustrated in figure at page 3-149.

⑯ Check the wheel and pinion contact pattern by applying a thin coat of suitable marking compound to the teeth of the pinion. Rotate the wheel backwards and forwards to show the tooth contact on the wheel.

⑰ After each adjustment of the pinion the backlash should be reset and the tooth markings rechecked.

⑱ Having achieved the required contact marking and backlash ; At one side(Left or right), mark any two cap head screws(8/4) that are most nearly at opposite sides of the cross shaft with a suitable marking pen. Remove the other three screws.

⑲ Apply Loctite grade 275 to the threads of the three cap head screws(12/1) fit in place and torque tighten to 9.2kgf · m(66.4lbf · ft).

⑳ Remove the two marked screws(12/1) and apply Loctite grade 275 to the threads. Fit the screws and torque tighten to 9.2kgf · m(66.4lbf · ft).

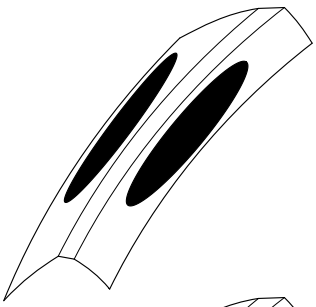
㉑ Repeat operations ⑱ to ⑳ on the adapter plate at the other side of the unit.

㉒ Remove the four hexagon head screws(12/1) securing the bevel pinion assembly and remove the assembly.

㉓ Clean the bevel pinion mounting face on the case and apply sealing compound Loctite 574.

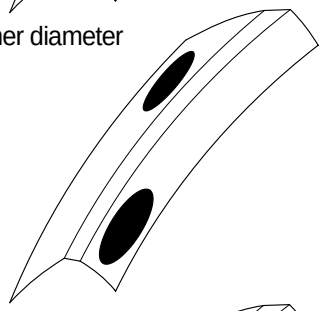
㉔ Remove the shims from the bevel pinion assembly, clean the mounting flange face and apply sealing compound Loctite 574.

㉕ Place the shims in position and fit the bevel pinion assembly. Torque tighten hexagon head screws(12/1) to 8.6kgf · m(59.7lbf · ft).



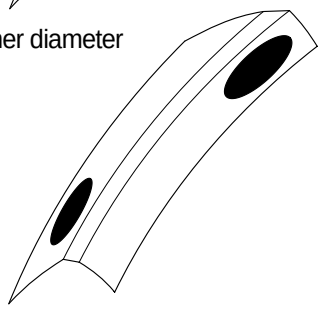
Inner diameter

Correct engagement of spiral bevel wheel and pinion.
No adjustment required length of contact 1/2 to 3/4 of tooth width.



Inner diameter

Spiral bevel pinion too closely in mesh.
Move pinion away from wheel.

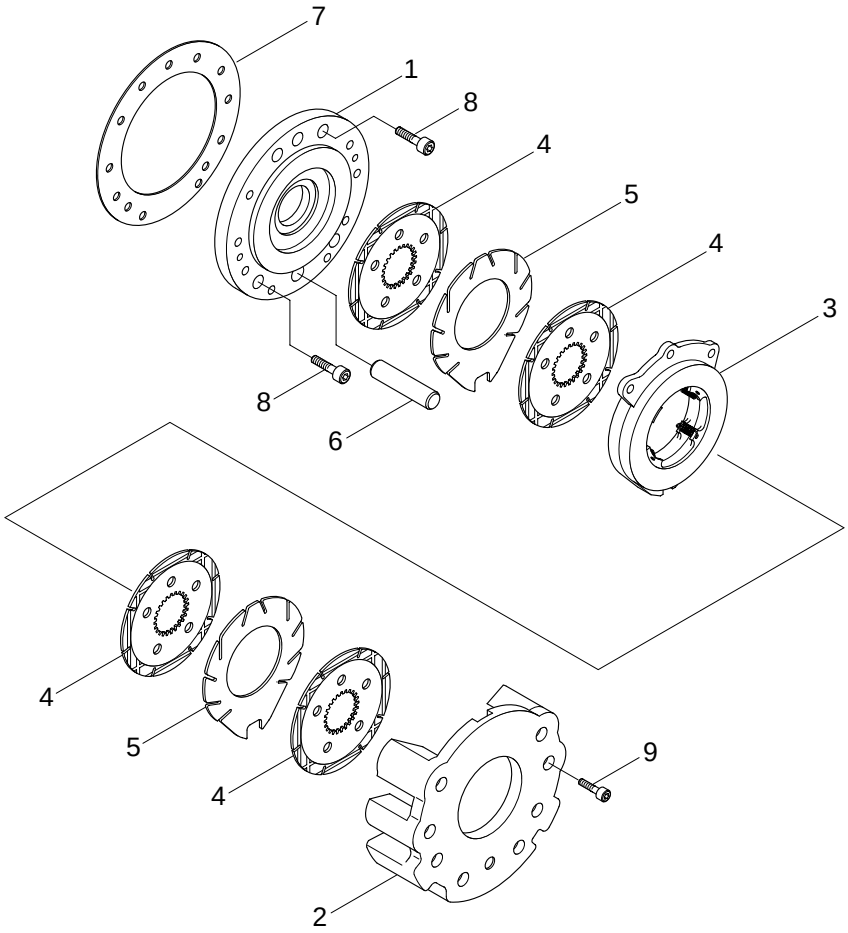


Inner diameter

Spiral bevel pinion too far out of mesh.
Move pinion closer to wheel.

2) CLUTCH SUB SYSTEM

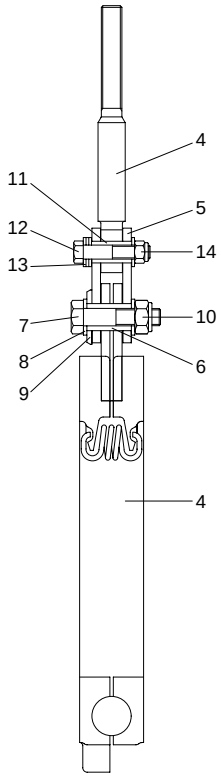
(1) Disassembly of clutch assembly

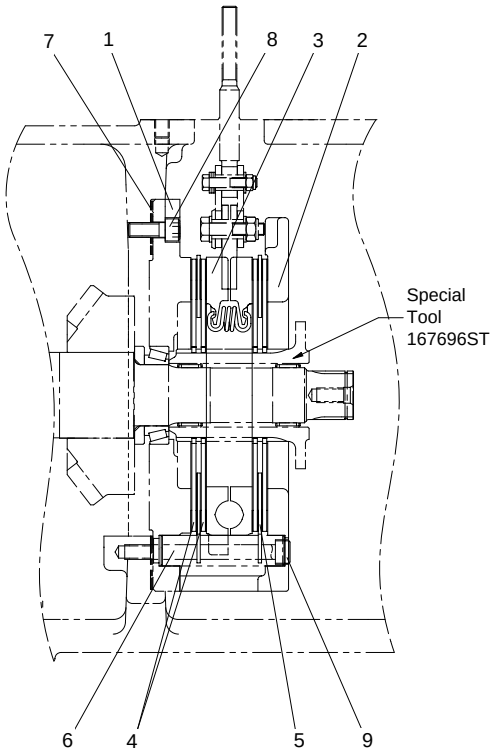


① Remove the filler plug(Item 5, page 3-177) and magnetic drain plug(Item 3, page 3-177) and drain the oil into a suitable container.
② Disconnect the brake operating assembly(See page 3-170).
③ Remove the final drive assembly(See page 3-155).
④ Remove clutch operating cylinder(See page 3-152).
⑤ Referring to figure at page 3-152, remove snap ring(6/3) and remove sun gear(1/6).
⑥ Carefully withdraw annulus gear(3/6) taking care not to damage the needle roller bearings or the bearing tracks on the cross shaft.
⑦ Protect the cross shaft bearing tracks.
⑧ Referring to figure at page 3-151, remove the eight socket head caps crews(9) and remove the clutch housing(2).
⑨ Remove the front clutch plates(4) and (5).
⑩ Remove the clutch actuator(3) withdrawing the pull rod assembly from the hole in the top of the main casing.
⑪ Remove the remaining clutch plates(4) and (5).

※ **See cleaning and inspection at page 3-142.**

(2) Assembly of clutch assembly





① Referring to, figure, assemble pull rod(4), link plates(5), bush(11), washers(13), bolt(12).

※ **Three washers under the head of bolt(12).**

② Apply Loctite grade 275 to threads of bolt(12), screw on nut(14) and torque tighten to 2.3kgf · m (17.0lbf · ft).

③ Assemble the above subassembly to clutch actuator(3/4) using bush(6), washer(9), washers(8) bolt(7) and nut(10).

※ **Assemble bolt(7) with head in the same direction as bolt(12).**

④ Apply Loctite grade 275 to threads of bolt(12) and torque tighten nut(10) to 4.7kgf · m(34.0lbf · ft).

⑤ Referring to figure, fit a M12 ×1.75 ×150mm long stud in each of the upper holes in the adapter plate to act as assembly aids.

⑥ Fit torque pin(6).

⑦ Fit sintered plate(4) locating the slot on the torque pin and supported between assembly aids.

⑧ Fit counter plate(5) resting on the torque pin and supported between assembly aids.

⑨ Fit sintered plate(4) as ⑦.

⑩ Thread pull rod through case and fit actuator(3). Note head of bolts(7) and (12) towards bevel gear assembly.

⑪ Fit sintered plate, counter plate and sintered plate as at actions ⑦ to ⑨ above.

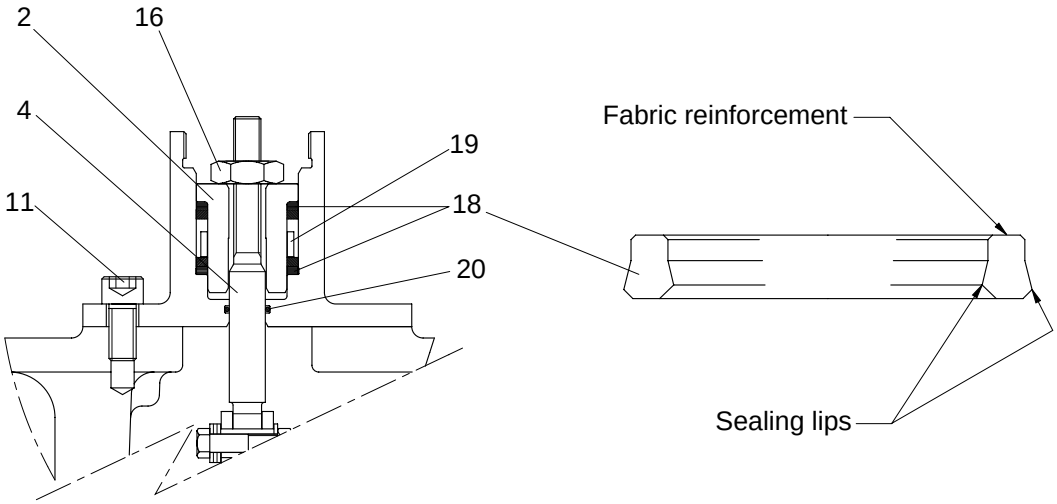
⑫ Use special tool 167696ST to line up the splined clutch plates and fit housing(2) over assembly aids.

⑬ Apply Loctite grade 275 to the threads of six M12 ×1.74 ×120 long socket head caps crews(9) and screw into position.

⑭ Remove the two assembly aids and Apply Loctite grade 275 to the two remaining M12 ×1.74 × 120 long socket head cap screws(9) and screw into position.

⑮ Torque tighten all eight cap screws to 9.2kgf · m(66.4lbf · ft).

⑯ If required, repeat processes ① to ⑮ at the other side of the case.



(3) Disassembly of clutch operating cylinder

① Referring to figure at page 3-154, Remove cap(22).

⚠ **This part is spring loaded.**

② Remove lock nuts(16) and (17).

③ Referring to figure, remove socket head cap screws(11).

④ Slide the unit of pull rod(4).

⑤ If the assembly is to be refitted without further disassembling, temporarily replace the spring(15) and end cap (22) to keep out debris. Also, remove O-ring(20) and discard.

⑥ If further disassembling is required, remove piston(2).

⑦ Remove the seals(18) and spacer(19) and discard.

※ **See cleaning and inspection at page 3-142.**

(4) Assembly of clutch operating cylinder

① Thoroughly clean all parts including cylinder mounting face on the case.
Grease O-ring seal(20) and fit to cylinder(1).

② Oil piston (2) and piston seals(18) and spacer seal(19) and fit to piston.

※ **Orientation of piston seals(Side with lips towards the spacer).**

③ Apply a bead of Loctite 574 to the cylinder mounting face of the case between the pull rod hole and the tapped holes.

④ Pass the cylinder sub assembly over the clutch pull rod taking care not to damage the O-ring seal(20).

⑤ Seat the cylinder on it's mounting face.

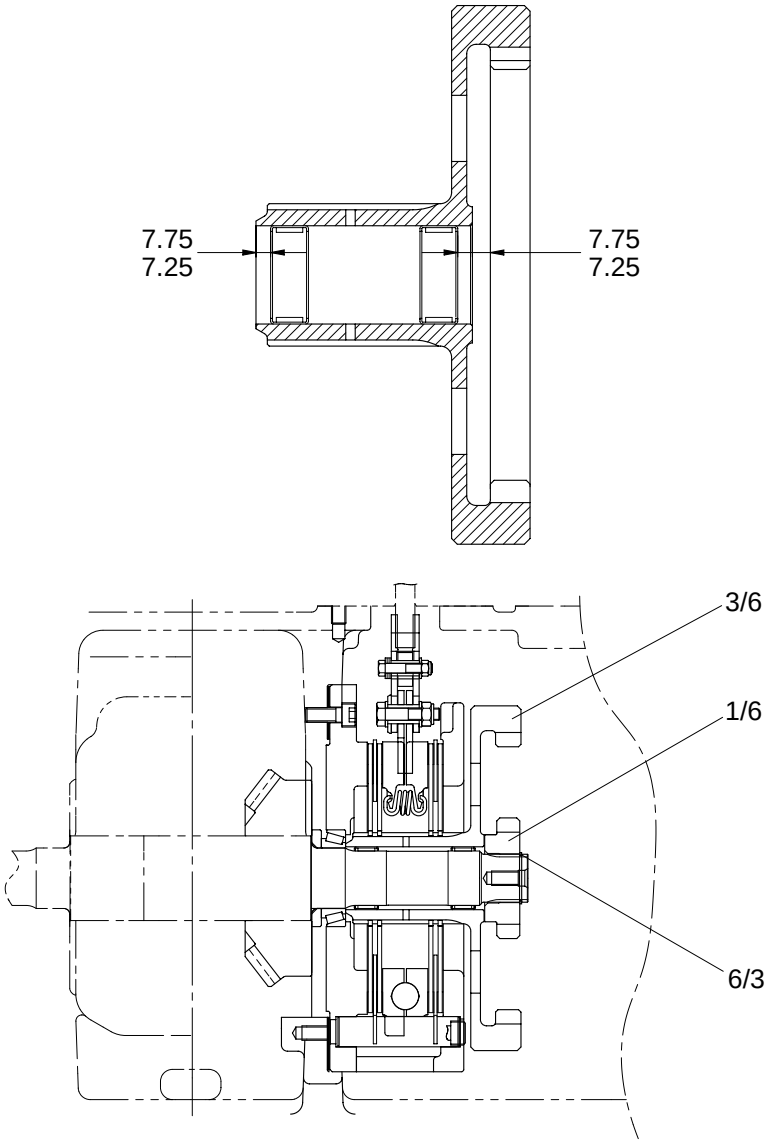
※ **The holes in the flange are not equally spaced and the unit will only fit in the correct orientation.**

⑥ Coat the threads of socket head cap screws(23) with Loctite 275, fit to the assembly and torque tighten to 7.6kgf · m(55.3lbf · ft).

⑦ Loosely fit nut(16).

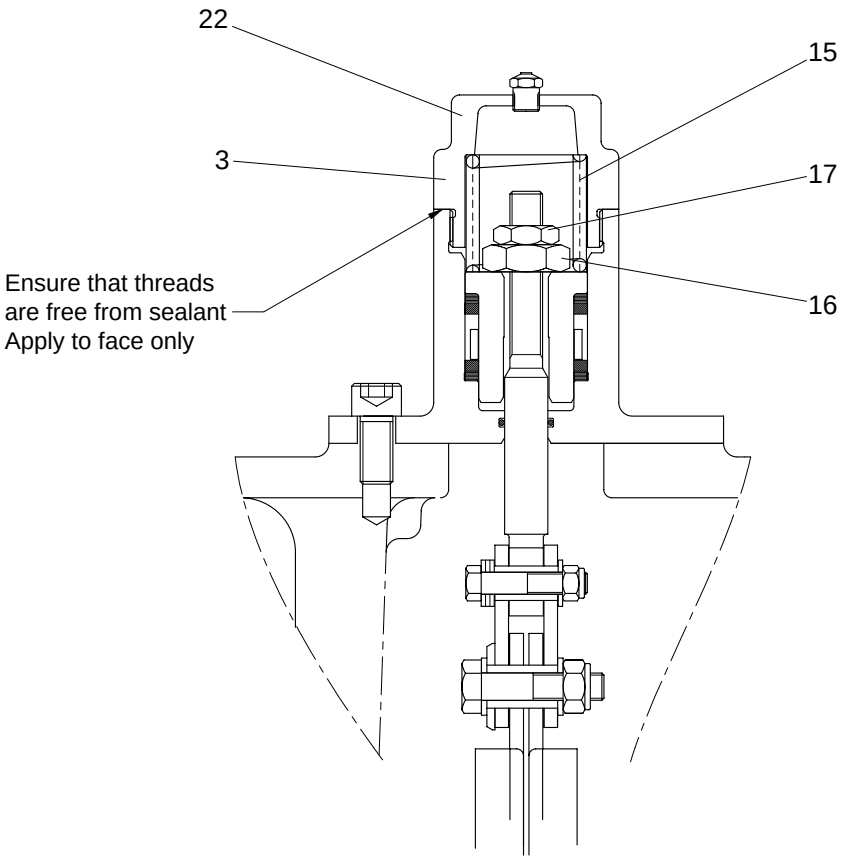
⑧ If required, repeat processes ①to ⑦ on the other side of the case.

(5) Assembly of annulus sub assembly



① Using special tool 167701ST pressing dolly, press the needle roller bearings(8) into the bore of the annulus to the setting dimensions shown in figure.
② Tighten nut(Item 16, page 3-152) to lock the clutch.
③ Remove special tool 167696ST(See page 3-151) and fit the annulus sub assembly over the cross shaft engaging with the splines of the clutch plates.
④ Fit sun gear(1/6) and secure in position with circlip(6/3).
⑤ If required, repeat processes ① to ④ on the other side of the case.

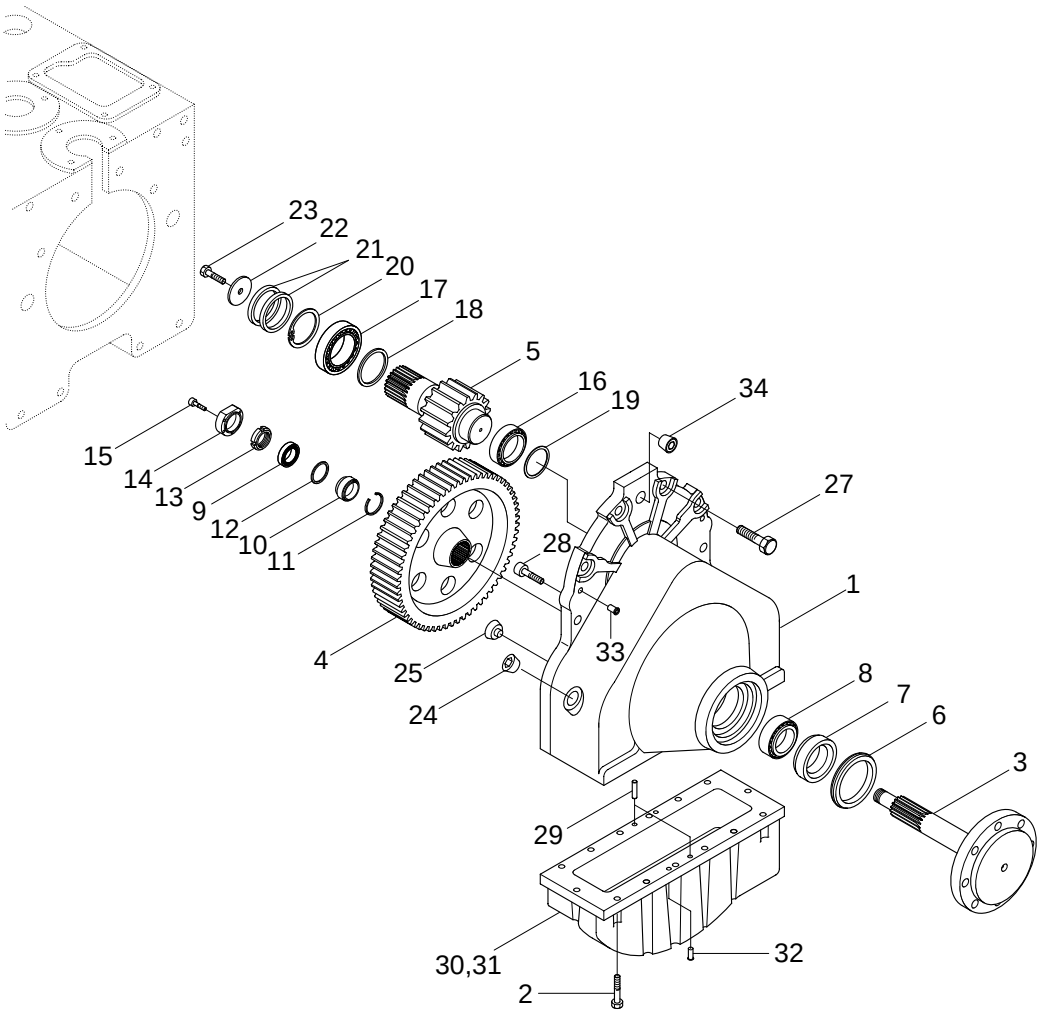
(6) Setting the clutch



① Tighten Brake adjuster nut(16) by hand until the actuator is fully expanded.
② Slacken off adjuster nut(16) until the clutch is just dragging.
③ Further slacken off adjuster nut(16) by 1.5 turns.
④ Fit lock nut(17) and tighten to 3.1kgf · m(22lbf · ft).
⑤ Fit spring(15).
⑥ Fit end cap(3) (See note re sealant) and torque tighten to 2.5~3.3kgf · m(14~18lbf · ft)
⑦ Fit relief valve(22) to the end cap(3).
⑧ Fit bleed screw(21) to the port facing the rear of the gearbox i.e. away from the input flange.
⑨ If appropriate connect the clutch hydraulic line to the forward facing port. Otherwise, fit protective blanking plug(24).
⑩ If required, repeat tasks ① to ⑨ on the other clutch assembly.

3) FINAL DRIVE SUB SYSTEM

(1) Disassembly of final drive assembly



① Remove the filler plug(Item 5, page 3-177) and magnetic drain plug(Item 3, page 3-177) and drain the oil into a suitable container.

② If service is to be carried out on the output pinion or wheel lines, remove one of the filler/level plugs(Item 24, page 3-176) and the drain plug(Item 25, page 3-176) and drain the oil into a suitable container.

③ Disconnect the brake operating assembly(See page 3-170).

④ Referring to figure at page 3-168, remove the two bolts(27/9) immediately above the dowel holes(7/2).

⑤ Fit special tools 167697ST(2-off) into the M16 holes vacated by bolts(27/9).

⑥ Remove socket head cap screws(28/9).

※ **Securely support the final drive housing using ropes, slings or other device to provide safe working conditions.**

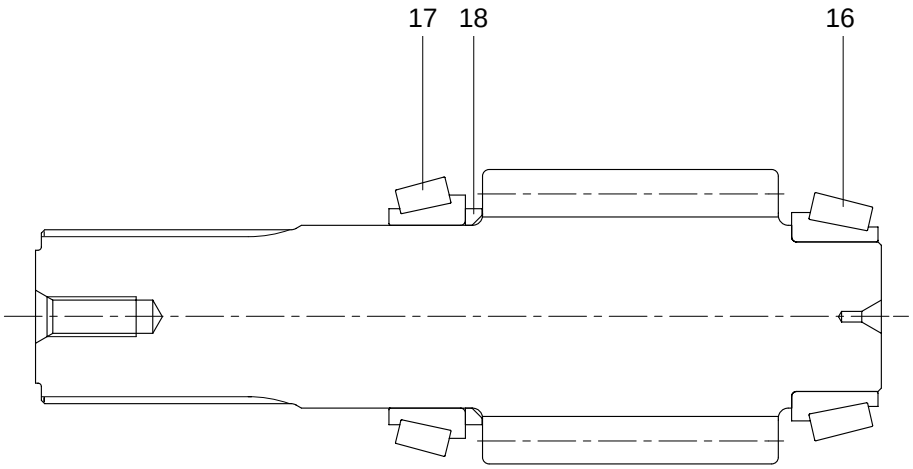
⑦ Remove the remaining hexagon head bolts(27/9).

⑧ Insert two of the bolts into the tapped holes immediately above the dowels(7).

⑨ Alternatively and evenly, screw the bolts in to break the Loctite seal and to draw off the housing from the dowels.

⑩ Further disassembling tasks are covered under the appropriate section.

※ **See cleaning and inspection at page 3-142.**



(2) Disassembly of final drive pinion

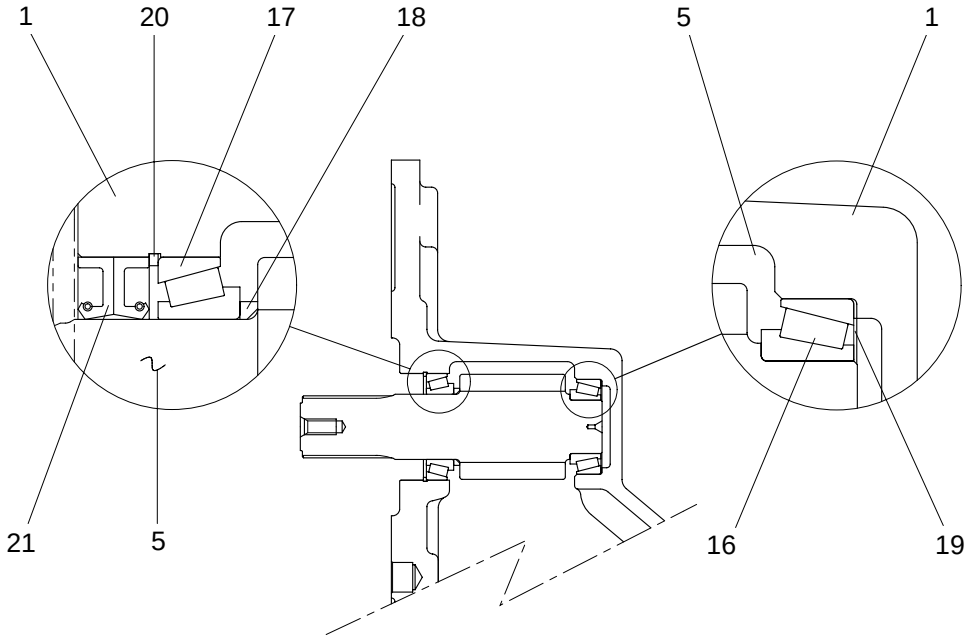
① Remove the planet carrier assembly(See page 3-162)
② Remove the brake assembly(See page 3-165)
③ Remove the output wheel line(See page 3-158)
④ Remove the oil seals(Item 21, page 3-157) and discard.
⑤ Referring to figure at page 3-157, remove circlip(20) and remove output pinion from the housing complete with bearing(17), spacer(18) and bearing cone(16).
⑥ Using a puller, remove bearing cup(16) from the housing(1).
⑦ Keep the bearing cups and cones together and preserve the shim pack if, after inspection, the bearings are to be reused.

※ **See cleaning and inspection at page 3-142.**

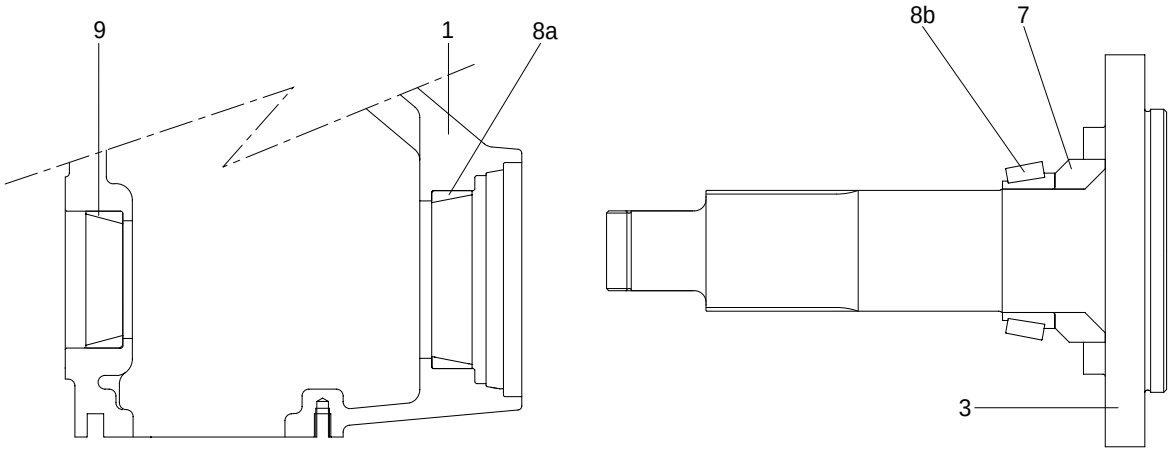
(3) Assembly of final drive pinion

① Fit bearing spacer(18) to pinion. Note fit side with large chamfer towards the gear teeth
② Using a bearing heater, heat bearing cone(17) to 120℃ max. and fit to pinion(5).
Note thickest section of the cone towards gear teeth.
③ Heat bearing cone(16) to 120℃ max and fit to pinion(5). Note thickest section towards gear teeth.

(4) Shimming the final drive pinion



① Fit bearing cup(16) in position in the bore without shims.
Note the thickest section of the bearing cone is towards the blind end of the bore.
② Place the pinion and bearing sub assembly in position and fit bearing cup(17) with the thickest section outwards.
③ Fit circlip(20).
④ Using a dial indicator on the end of pinion(5), measure and make a note of the pinion end float.
⑤ Select a shim pack of thickness = end float as measured + 0.05㎜(0.002in).
⑥ Remove circlip(20), bearing cup(17), pinion & bearing sub assembly and bearing cup(16).
⑦ Place the shim pack in the bottom of the pinion bore and place the bearing cup(16) in position. Note orientation of the cup.
⑧ Place the pinion and bearing sub assembly in position and fit bearing cup(17). Note orientation of the cup.
⑨ Locate circlip(20) behind the bearing cup(17).
⑩ Using special tool 167698ST gently tap circlip(20) into position in the grove.
⑪ Grease the sealing lip of the first oil seal(21) and fit in the bore with the recess facing towards the bearing. Gently press into position contacting the circlip(20). Take care to prevent damage to sealing lip from contact with the spline.
⑫ Grease the sealing lip of the second oil seal(21) and fit in the bore with the recess facing outwards. Gently press into position contacting the first oil seal. Take care to prevent damage to the sealing lip from contact with the spline.



(5) Disassembly of drive shaft

① Remove bottom cover(30RH) or (31LH) see figure at page 3-176.
② Locate the assembly on the bottom cover mounting face using a fixture or secure blocks tall enough to raise the wheel(4) clear of the bench.
③ Referring to figure at page 3-160, remove socket head cap screws(15).
④ Remove end cap(14).
⑤ Slacken the locknut(13) but leave in place for the moment.
※ **The assembly must be held securely before carrying out this operation.**
⑥ Position the assembly with it's mounting face uppermost. Support as necessary on block or use a fixture such that the output shaft flange is approx. 50㎜ above the bench/fixture.
⑦ Support the underside rim of the wheel using suitable packing pieces between the rim and the housing wall.
⑧ Remove locknut(13).
⑨ Press the drive shaft(3) from the assembly complete with bearing cone(8) and recover bearing cone(9) and spacer(10).
⑩ Slide the wheel out of the assembly through the bottom cover mounting face.
⑪ Recover the packing pieces.
⑫ Remove the output seals(Item 6, page 3-160) and discard.
⑬ If necessary, remove the bearing cone(8b) and seal spacer(7) from the drive shaft and remove bearing cups(8a) and (9) from the housing together with shim pack(12).
⑭ If the bearings(8) and (9) are to be reused, keep the cups and cone together and preserve the shim pack.
※ **See cleaning and inspection at page 3-142.**

(6) Assembly of drive shaft

① Press bearing cup(8) into housing(1).
※ **Thickest section of cup to the inside.**
② Fit bearing cup(9) into housing(1) without shims.
※ **Thickest section of cup to the inside.**
③ Fit seal spacer(7) to drive shaft(3). Note large chamfer in the bore to head of shaft.
④ Heat bearing cone(8) to 120℃ max. and fit to drive shaft(3) making sure that the seal spacer fully abuts the head of the shaft and that the bearing cone fully abuts the seal spacer.
※ **Thickest section of bearing cone to head of shaft.**

(7) Shimming the wheel line

① Place drive shaft with bearing through the output line. Do not fit output seals(6) or wheel(4).

② At the inboard side, fit bearing spacer(10).
Note fit side with large bore chamfer towards head of shaft. Do not fit snap ring(11).

③ Fit bearing cone(9).

④ Fit lock nut(13) and torque tighten to 86kgf · m(622lbf · ft).

※ **The assembly must be held securely before carrying out this operation.**

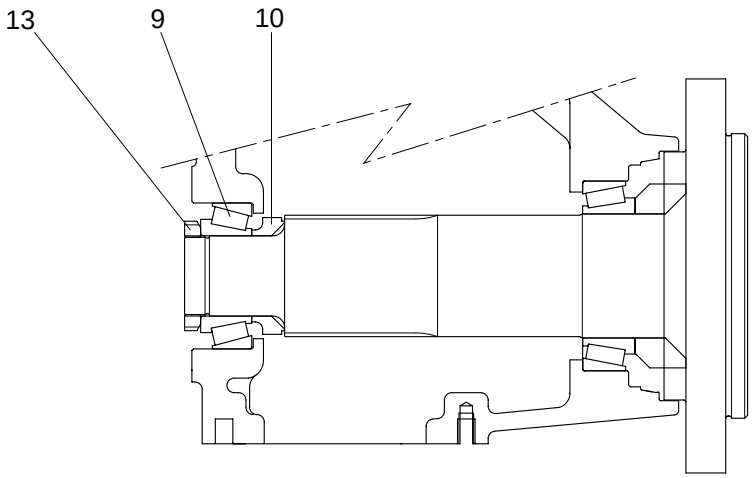
⑤ Measure end float using a dial indicator on the end of the shaft.

⑥ Required shim pack size is : end float +0.075㎜(0.003in).

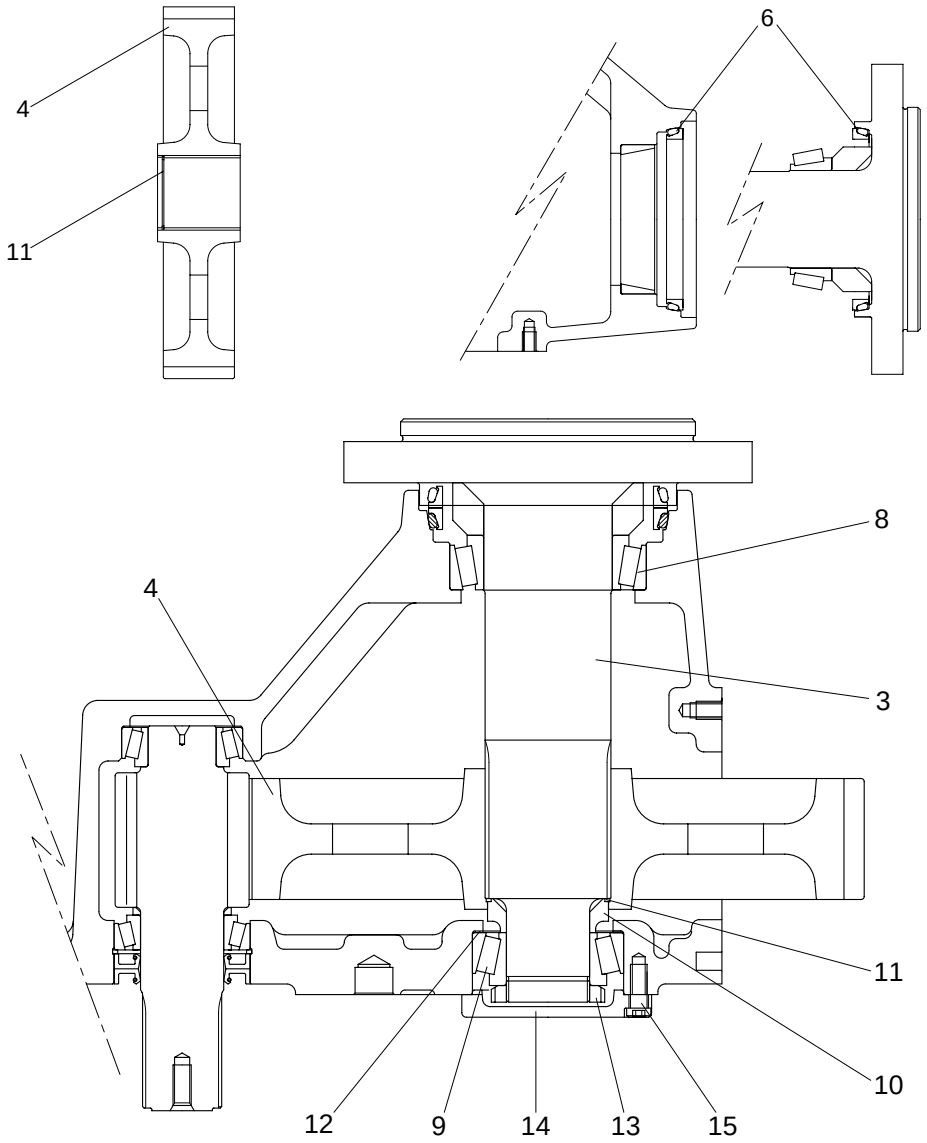
⑦ Select shims to the required thickness.

⑧ Remove lock nut(13).

⑨ Withdraw drive shaft(3) from the assembly making provision to protect bearing cone(9).



(8) Assembling the drive line



① Fit snap ring(11) into the groove in the splined bore of wheel(4).

② If working on the bench, assembly will be easier if the housing is laid on it's machined mounting surface as shown in figure.

③ Fit the shim pack(12) followed by bearing cup(9).

④ Referring to figure 22, grease the rubber element of one output seal(6) and insert into seal bore of the housing(1).

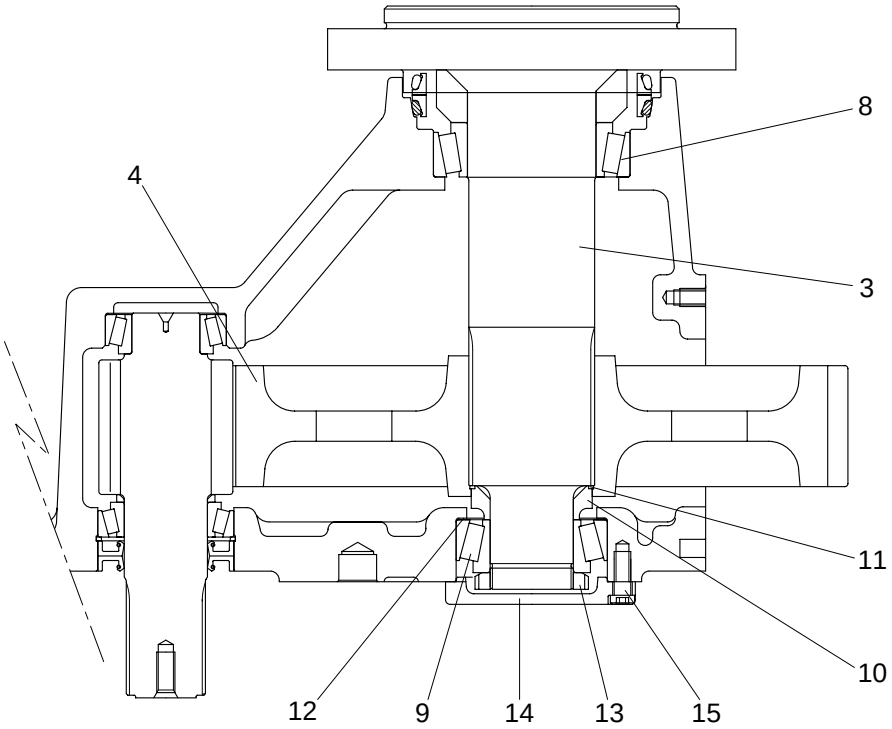
※ **The large metal face of the seal faces outwards. It is also important that this element of the seal is located normal to the axis of the bore.**

⑤ Thick compatible grease will be required to hold this seal in place.

⑥ Grease the rubber element of the other output seal(6) and insert in the recess of the drive shaft(3). Note the large metal face of the seal faces away from the head of the shaft. It is also important that this element of the seal is located normal to the axis of the shaft.

⑦ Referring to figure, pass the wheel(4) through the opening in the bottom of the housing and align the bore with the bearing bores.

※ **The side of the wheel with snap ring(11) fitted must face the housing mounting face.**



⑧ Lower the drive shaft(3) into position engaging with the splines of wheel(4). Continue to lower drive shaft until bearing cone(8) is seated in bearing cup(8).

⑨ Fit bearing spacer(10) on the drive shaft(3).

※ The large chamfer in the bore of spacer(10) must face towards the wheel(4).

⑩ Fit bearing cone(9) on the drive shaft(3).

※ **Thickest section of cone must face away from the wheel(4).**

⑪ If working on the bench, fit lock nut(13) to drive shaft(3).

※ **If will be helpful to raise the wheel(4) slightly in order to engage a sufficient number of threads of the lock nut.**

⑫ Turn the assembly upright and locate in the bottom cover mounting face using a fixture or secure blocks tall enough to raise the wheel(4) clear of the bench.

⑬ Tighten lock nut(13) by hand until the bearing elements are correctly seated(No end float).

⑭ Remove lock nut(13) and coat the threads of the drive shaft(3) with Loctite grade 275.

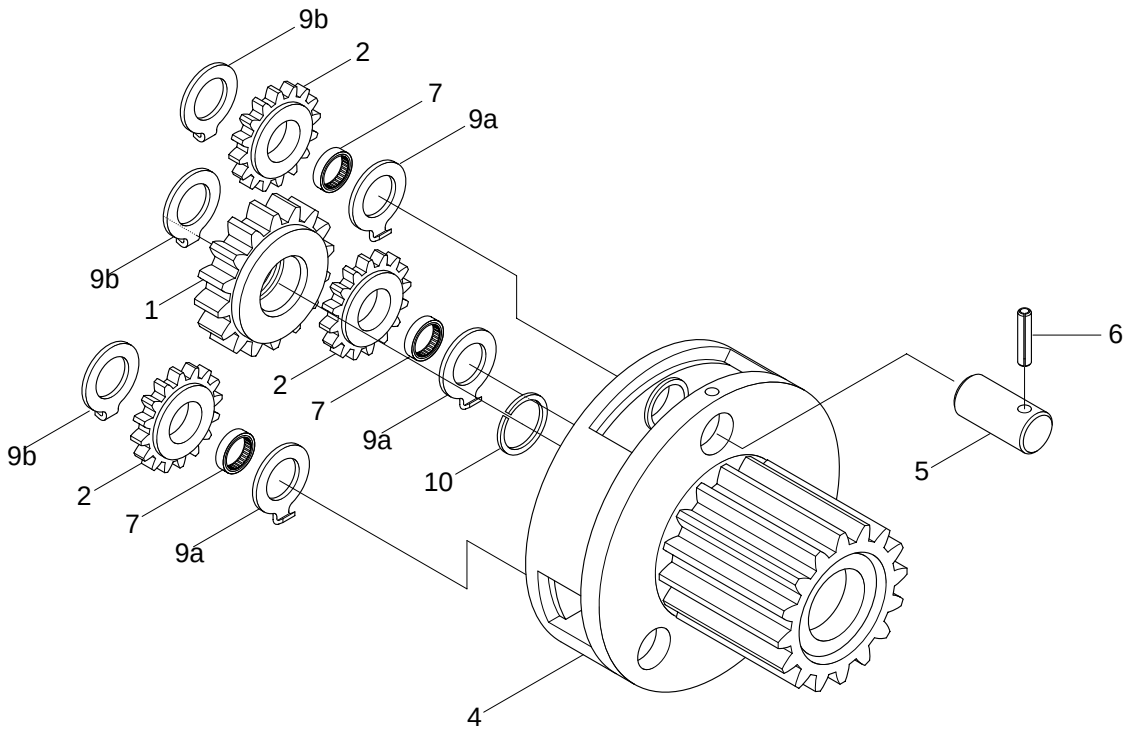
⑮ Re-fit lock nut(13) and torque tighten to 86kgf · m(622lbf · ft).

※ **The assembly must be held securely before carrying out this operation.**

⑯ Apply a bead of Loctite grade 574 to the face of the housing between the wheel line bore and the tapped holes and fit end cap(14).

⑰ Apply Loctite grade 275 to the threads of five socket head cap screws(15), insert and torque tighten to 6.3kgf · m(47.9lbf · ft).

(9) Disassembly of planet carrier assembly

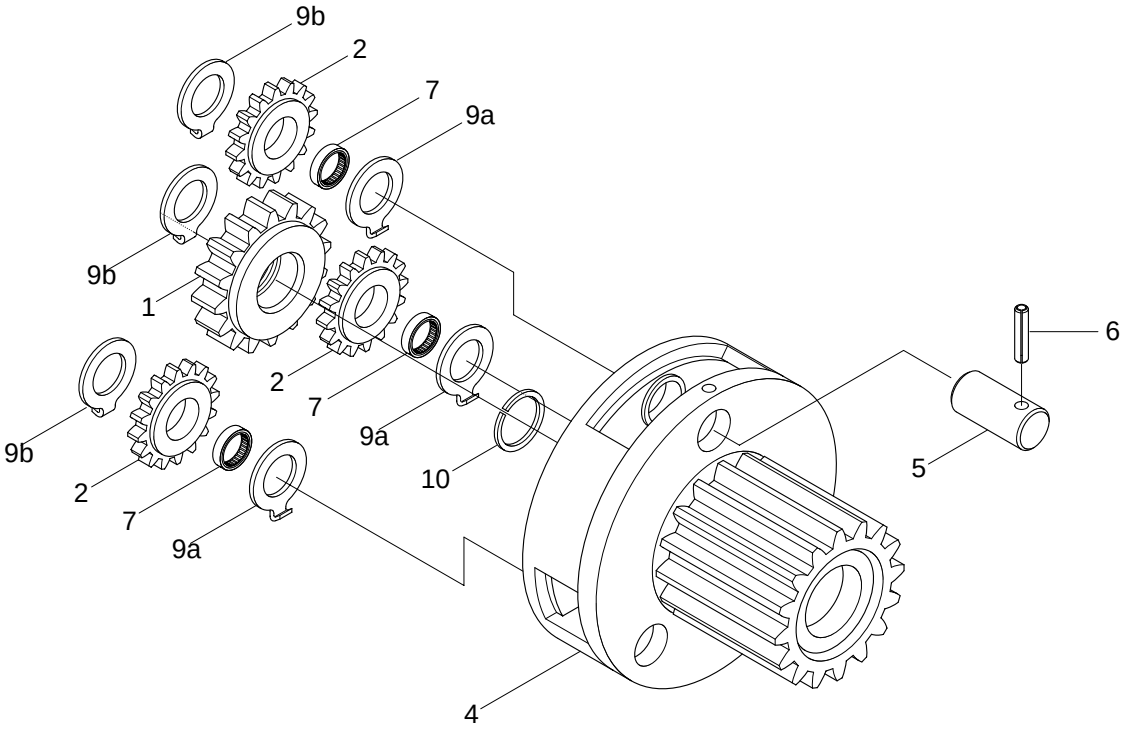


① Remove hexagon head screw(23) and washer(22). See figure at page 3-165.
② Referring to figure, drive retaining pins(6) full into planet pins(5).
③ Tap planet pins(5) out of the planet carrier(4).
④ Remove the planet gears(2) and side washers(9).
⑤ Drive the retaining pins(6) from the planet pins(4) and discard.
⑥ If necessary, press the needle roller bearings(7) out of the planet gears(2).
⑦ Remove snap ring(10) from the bore of the planet(4) carrier and discard.

※ **Cleaning and inspection**

① Thoroughly clean all parts with a suitable solvent prior to inspection.
② Retaining pins(6) and snap ring(10) must be replaced on re-assembly.
③ Examine all components for cracks, corrosion, wear, distortion or other damage and renew any part found to be defective.

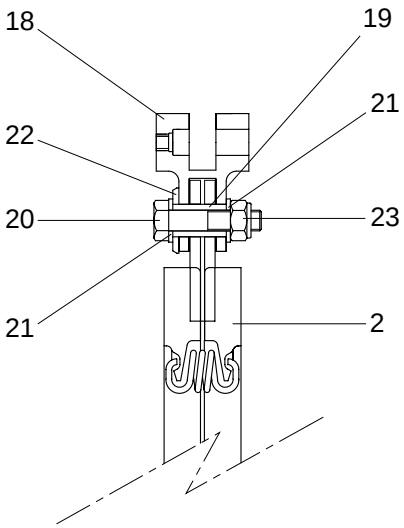
(10) Assembly of planet carrier assembly



① Fit needle roller bearing assembly(7) in the bore of planet pinion(2).
② Thread the planet pin(5) through the carrier wall from the splined shaft side.
③ Fit the side washer(9a) with the tab locating in the recess cast into the planet carrier wall.
④ From the splined boss side, slide the planet pin(5) far enough through the side washer(9a) to provide support.

※ **Position of retaining pin hole.**

⑤ Thread the planet gear(2) through the slot in the carrier diameter and push the planet pin(5) most of the way through the bearing(7).
⑥ Slide the side washer(9b) from the bore of the front planet carrier wall with the tab locating in the bore.
⑦ Slide the planet pin(5) through the side washer(9b) to provide support.
⑧ Line up the pin hole in planet pin(5) with the radial pin hole in the planet carrier wall at the splined boss side.
⑨ Slide the planet pin(5) into position maintaining the angular alignment of the pin hole until the pin holes line up axially.
⑩ Fit the retaining pin(6) in the planet carrier wall and drive into position flush with the outside diameter of the carrier.
⑪ Repeat actions ① to ⑩ for the remaining two planet gears.
⑫ Fit the snap ring(10) in the groove of the planet carrier splined bore.



(11) Disassembly of brake actuator assembly

① Remove brake assembly. See page 3-165.
② Referring to figure at page 3-163, remove self locking nut(23) and discard.
③ Remove bolt(20), washers(21) and (22).
④ Remove bush(19) and clevis(18).
⑤ Do not disassemble brake actuator(2). This is a propriety part and should be replaced in its entirety if defective, damaged or worn.

※ **Cleaning and inspection**

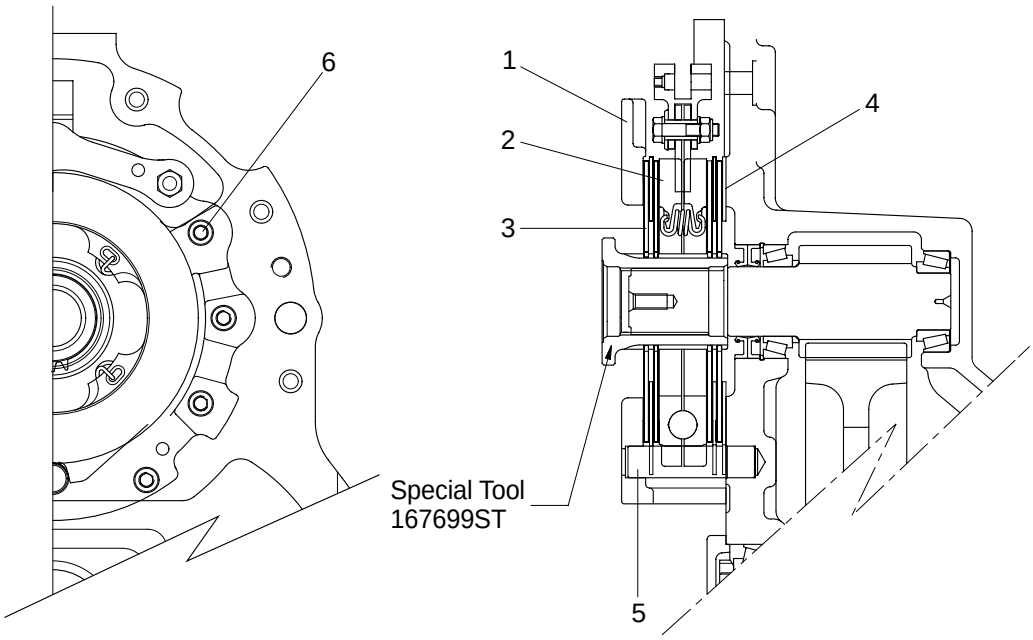
① Thoroughly clean all parts with a suitable solvent prior to inspection.
② Self-locking nut(23) must be replaced on re-assembly.
③ Examine all components for cracks, corrosion, wear, distortion or other damage and renew any part found to be defective.

(12) Assembly of brake actuator assembly

① Fit clevis(18) to actuator arms with the tapped hole on the left hand side of the assembly as shown.
② Fit bush(19).
③ Fit large washer(22) over bush(19) at the left hand side of the assembly.
④ Fit small washer(21) over hexagon head screw and insert screw into the assembly from the left hand side.
⑤ Fit small washer(21) over hex head screw at the right hand side of the assembly.
⑥ Fit self locking nut(23) on hexagon head screw(20) and torque tighten to 4.7kgf · m(33.9lbf · ft).

※ **It is important that the hexagon head screw(20) is inserted into the assembly from the side of the clevis(18) that has the tapped hole.**

(13) Disassembly of brake assembly

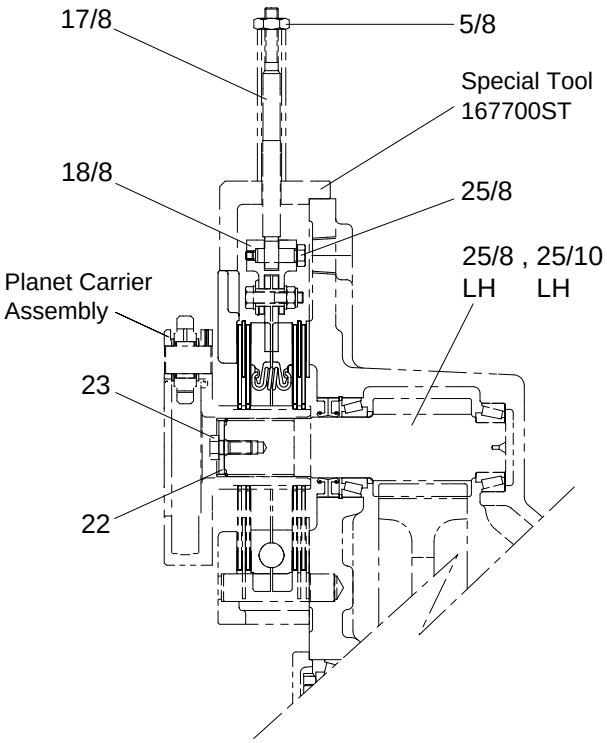


① Refering to figure, remove socket head cap screws(6).
② Remove housing(1).
③ Remove sintered plates(3), counter plates(4) and brake actuator(2).
④ Remove torque pin(5).

※ **Cleaning and inspection**

① Thoroughly clean all parts with a suitable solvent prior to inspection.
② Examine all components for cracks, corrosion, wear, distortion or other damage and renew any part found to be defective.
③ The sintered plates(3) must be replaced when the depth of the grooves is about half that of new plates. However, many factors affect the life of the brakes such as wear of the housings faces, brake actuator faces and linkages etc. A better indication of the need to replace plates, acuator and housing is when the limit of adjustment on the pull rod is reached.

(14) Assembly of brake assembly



① Fit a M12 ×1.75 ×150㎜ long stud in each of the holes on the clutch center line of the output assembly to act as assembly aids.

② Referring to figure at page 3-165, fit torque pin(5) into the ∅25㎜ in the output assembly.

③ Assemble in order on special tool 167699ST :
Sintered plate(3)
Counter plate(4)
Sintered plate(3)
Brake actuator assembly.

※ **The head of the hexagon set screw through the clevis must face towards the head of the special tool.**
Sintered plate(3)
Counter plate(4)
Sintered plate(3) and
Counter plate(4)

④ Load the special tool 167699ST with the above parts in position onto the splined extension of the output pinion(5/9 LH or 5/10 RH). Make sure that the slots in the counter plates(4) and brake actuator(2) are still located on the torque pin(5).

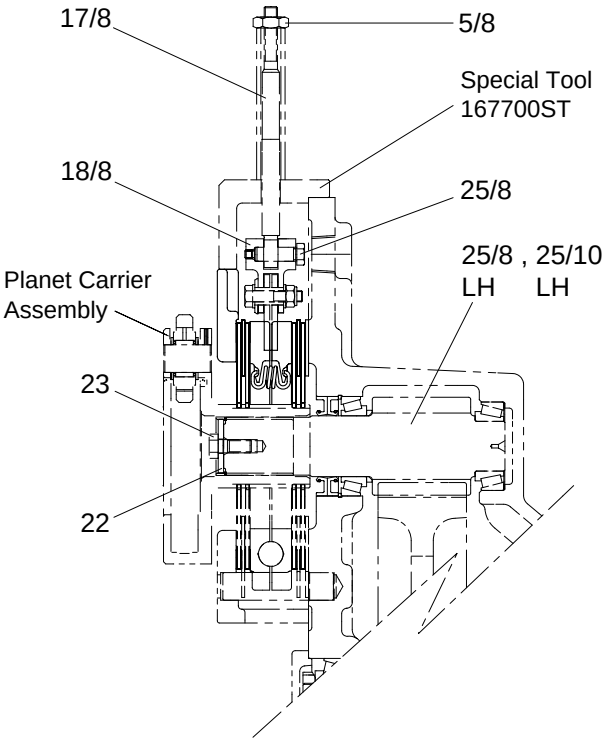
⑤ Load the housing(1) onto the two assembly aids(Studs) with the cast pillars towards the output assembly.

⑥ Centralise the counter plates and the brake actuator between the cast pillars of the housing(1) and slide the housing onto the torque pin(5).

⑦ Check that the slots of the counter plates and the brake actuator are still located on the torque pin.

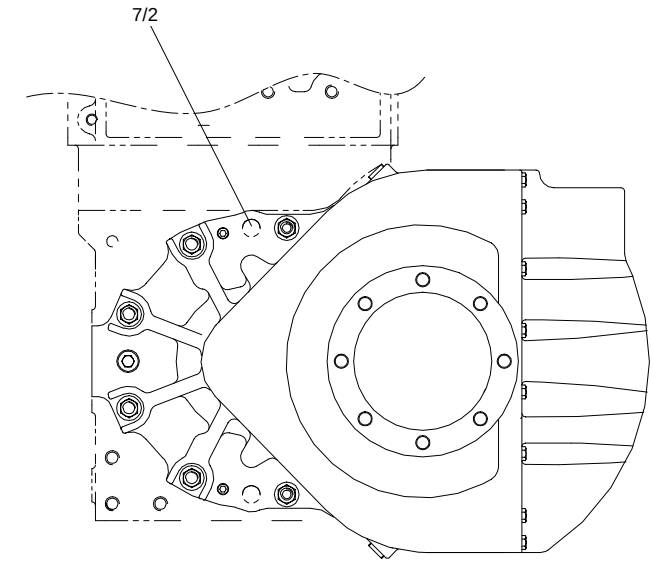
⑧ Apply Loctite grade 275 to the threads of four socket head cap screws(6).

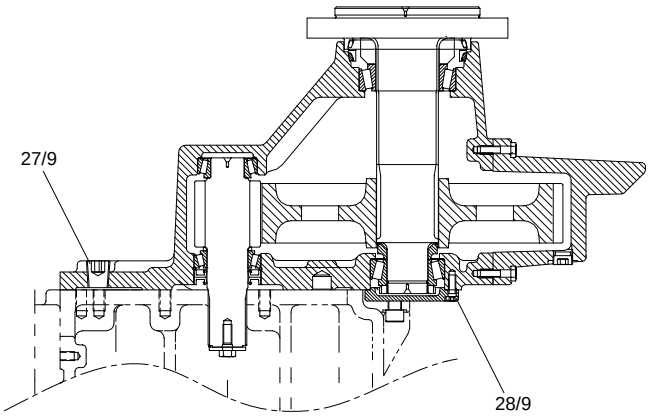
⑨ Insert the cap screws and torque tighten to 9.2㎏f · m(66.4lbf · ft).



⑩ Remove the two assembly aid studs.
⑪ Apply Loctite grade 275 to the two remaining socket head caps screws(6), screw into position and torque tighten to 9.2kgf · m(66.4lbf · ft).
⑫ Referring to figure, temporarily fit pull rod(17/8) into clevis(18/8). Pass clevis pin(25/8) through the hole in the housing and screw hand tight into clevis(18/8).
⑬ Place special tool 167700ST over pull rod(17/8) locating the step against the face of the housing and fit lock nut(5/8).
⑭ Tighten the lock nut(5/8) by hand to apply the brake.
⑮ Remove special tool 167699ST.
⑯ Fit the planet carrier assembly over the splines of the output pinion and into the teeth of the sintered plates.
⑰ Place the washer(22) over the hexagon head bolt(23).
⑱ Apply Loctite grade 275 to the threads of hexagon head bolt(23).
⑲ Screw hexagon head bolt(23) into the input pinion(5) and torque tighten to 8.6kgf · m(59.7lbf · ft).
⑳ Remove temporarily fitted lock nut(5/8), clevis pin(2/85), special tool 167700ST and pull rod(17/8).

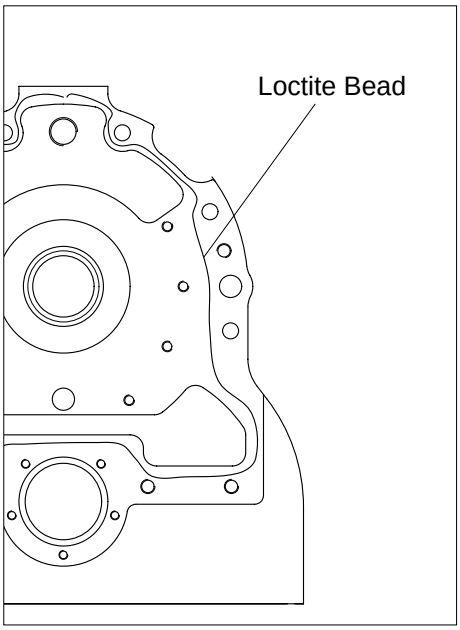
(15) Fitting the final drive assembly

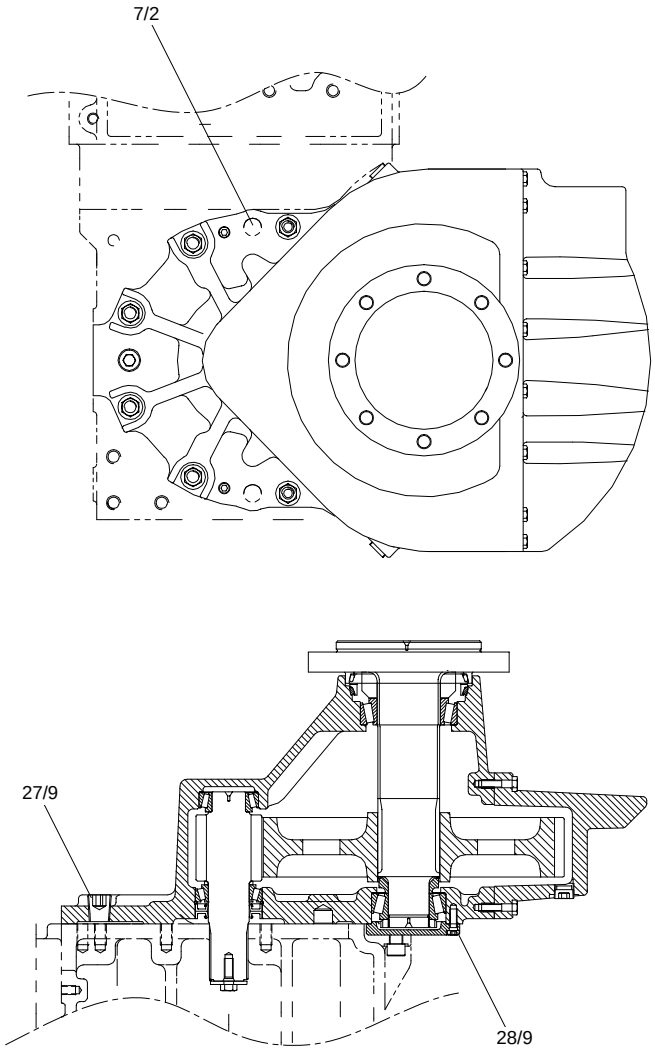




① Fit special tools 167697ST(2-off) to the Ø16 tapped holes above the dowel holes in the output housing mounting face of the case.
② Referring to figure, fit dowels(7/2) in the output housing.
③ Apply Loctite grade 5900 to the face of the output housing as shown in figure.
④ Load the assembly onto the two special tools 167697ST and slide forward to engage the planet gears with the annulus and sun gears.

※ **It is essential that suitable and stable lifting equipment be used. Assistance will be required.**



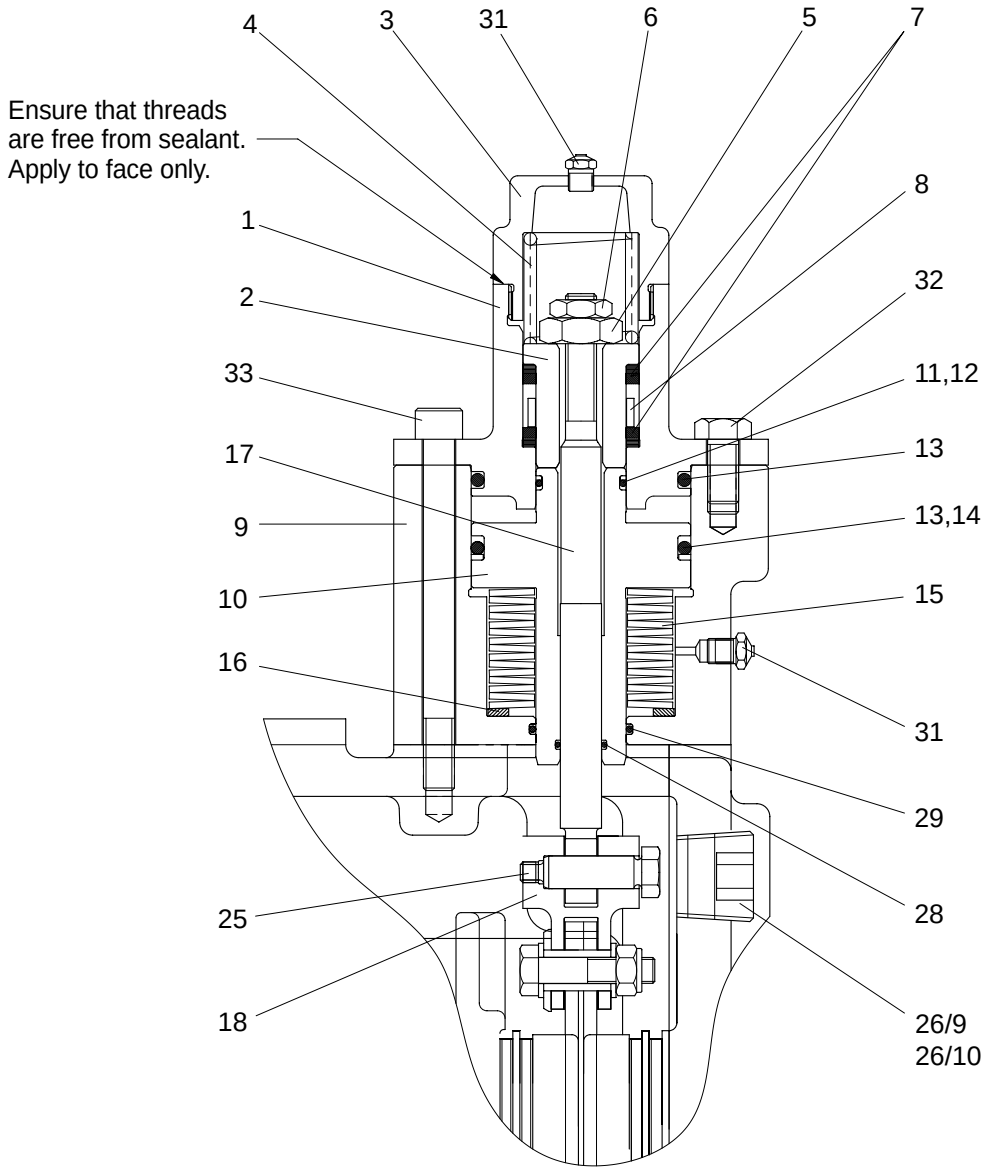


※ **Patience will be required to mesh the planetary gear system.**
It will be necessary to rotate both the bevel pinion and the output shaft to achieve meshing.
The planet gears may be accessed through the inspection cover faces on the top of the case.
Beware of trapped fingers.

⑤ Once meshing has been achieved, slide the assembly forward to engage the dowels in the case.
⑥ Temporarily insert two hexagon head bolts(27/9) into the two holes below the dowel holes and, if necessary, draw the assembly onto the dowels using the bolts.
⑦ Tighten the bolts to provide a secure assembly.
⑧ Remove the two special tools 167697ST.
⑨ Apply Loctite grade 275 to the threads of four hexagon head bolts(27/9), screw into position and torque tighten to 29kgf · m(210lbf · ft).
⑩ Apply Loctite grade 275 to the threads of four socket head cap screws(28/9), screw into position and torque tighten to 29kgf · m(210lbf · ft).
⑪ Remove the two hexagon head bolts(27/9) below the dowel hole.
⑫ Apply Loctite grade 275 to the threads of the two hexagon head bolts(27/9), screw into position and torque tighten to 29kgf · m(210lbf · ft).

4) BRAKE OPERATING SYSTEM

(1) Disassembly of brake operating assembly



① Disconnect the hydraulic lines to the ports and fit protective plugs.

② Remove end cap(3).

※ **This part is spring loaded.**

③ Remove spring(4).

④ Remove locknut(6).

⑤ Carefully remove locknut(5).

⑥ Remove socket head cap screws(33).

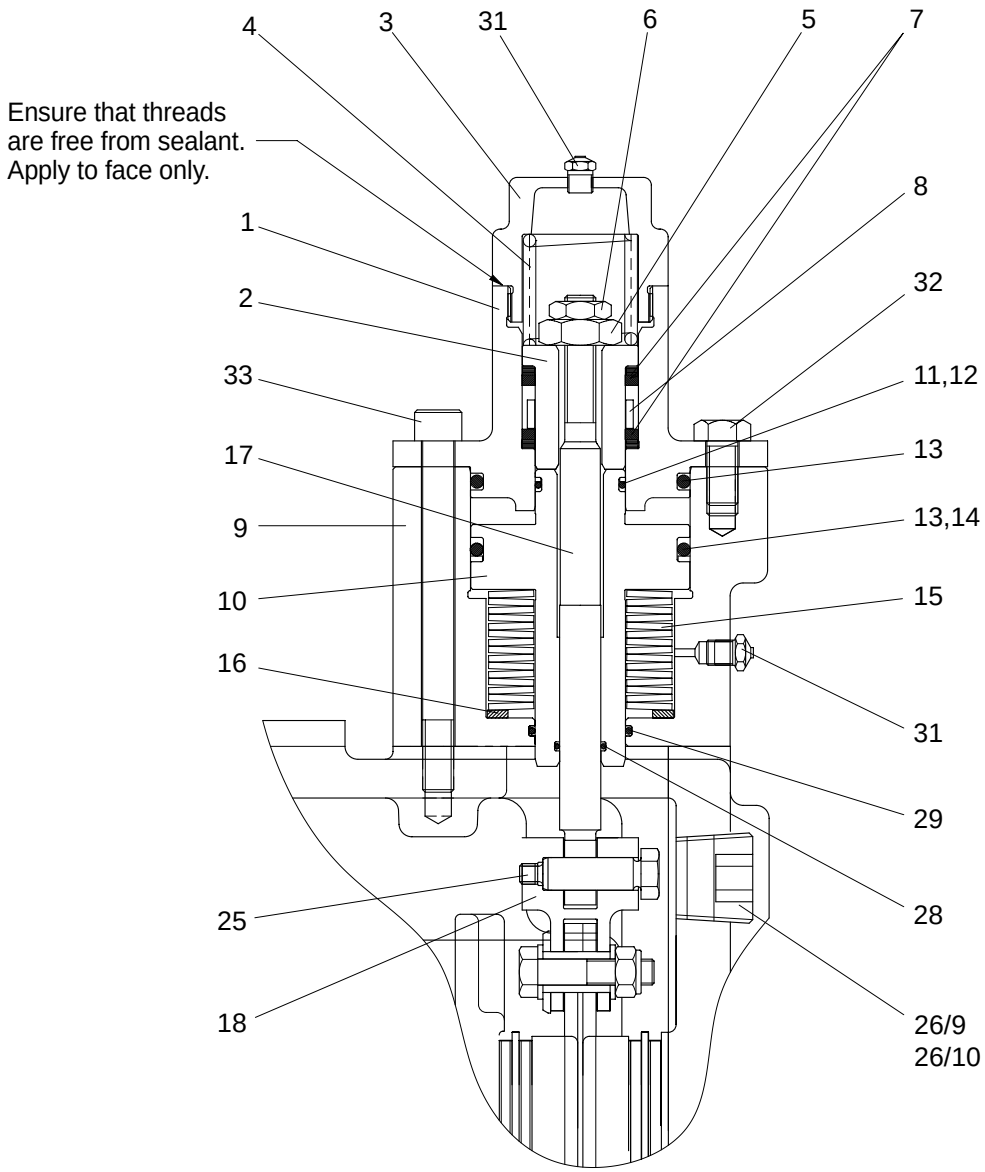
⑦ Slide the assembly off the pull rod(17).

⑧ If the assembly is to be refitted without further disassembling, temporarily replace the spring(4) and end cap(3) to keep out debris. Also replace O-ring seal(28).

⑨ If further disassembling is required, unscrew the hexagon head screws(32) a few turns each in turn to allow the service cylinder(to) come off squarely.

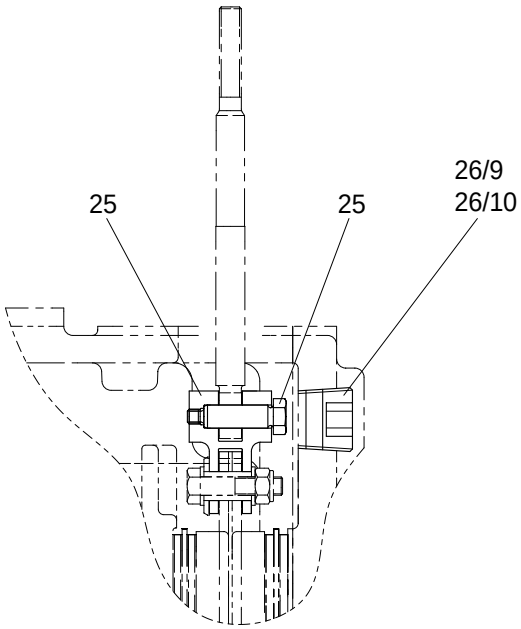
※ **The service cylinder(9) is spring loaded.**

⑩ Remove the service piston(2).



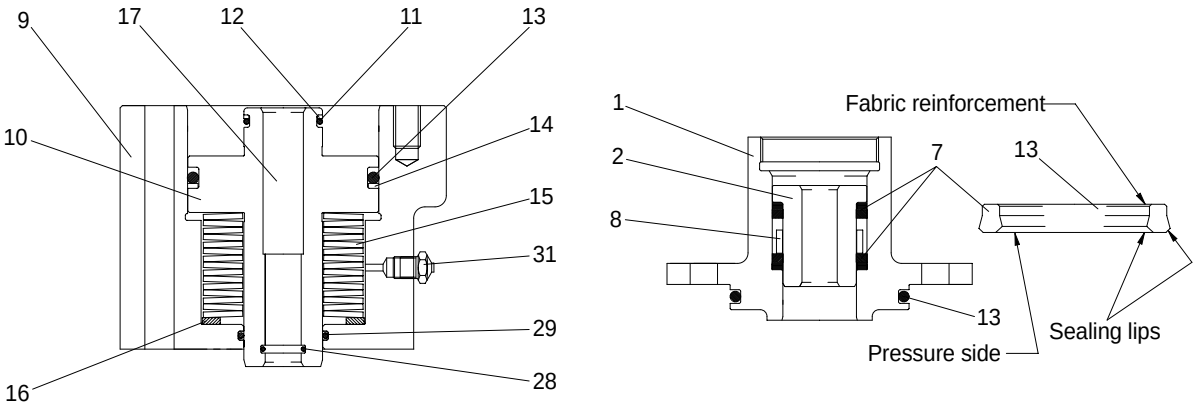
⑪ Remove the seals(7) and spacer(8) and discard.
⑫ Remove O-ring seals(13) from the service cylinder(1) and discard.
⑬ Remove failsafe piston(10).
⑭ Remove O-ring seal(13) and backup ring(14) from the failsafe piston(10) and discard.
⑮ Remove O-ring seal(11) and backup ring(12) from the failsafe piston(10) and discard.
⑯ Remove O-ring seal(28) from the bore of the failsafe piston(10) and discard.
⑰ Remove disc springs(15) and spacer(16).
⑱ Remove O-ring seal(29) from the bore of the failsafe cylinder(9) and discard.
⑲ Remove taper plug(26/9 LH) or (26/10 RH).
⑳ Remove clevis pin(25) and withdraw the pull rod from the brake actuator.
※ **See Cleaning and inspection at page 3-142.**

(2) Brake pull rod assembly



① Apply Loctite grade 275 to the threads of clevis pin(25).
② Pass the eye end of pull rod(17) through the hole in the top of the case and locate in the clevis(18).
③ Pass the clevis pin(25) through the tapped hole in the output housing and screw into clevis(18).
④ Torque tighten clevis pin(25) to 2.3kgf · m(17.0lbf · ft).

(3) Assembly of fail-safe cylinder unit



※ **All O-rings, backup rings and seals should be smeared with a coating of the operating fluid prior to assembly.**

① Fit O-ring(28) to the bore of piston(10).

② Fit O-ring(13) and backup ring(14) to piston(10). Ensure that the backup ring is position on the non-pressure side of the O-ring(On the long boss side).

③ Fit O-ring(11) and backup ring(12) to piston(10). Ensure that the backup ring is positioned on the non-pressure side of the O-ring(Away from the large piston diameter).

④ Fit O-ring(29) into cylinder(9).

⑤ Fit spacer(16) into cylinder(9).

⑥ Assemble 15-off disc spring(15) into cylinder(9), building the stack with alternate orientations.

※ **That the first disk must have it's concave side facing the spacer(16) as shown. Lubricate disks by coating with molybdenum disulphide grease(Duckhams Q5795 or suitable alternative).**

⑦ Slide the piston assembly into the cylinder(9) taking care not to damage the O-rings and backup rings in the process.

(4) Assembly of service cylinder unit

※ **All O-rings, backup rings and seals should be smeared with a coating of the operating fluid prior to assembly.**

① Referring to figure, assemble inner piston seal(7) into the bottom of cylinder(1). Ensure that the pressure side of the seal is uppermost.

② Fit spacer(8) and outer seal(7) into the bore of cylinder(1). Ensure the pressure side of the seal faces towards the spacer(8).

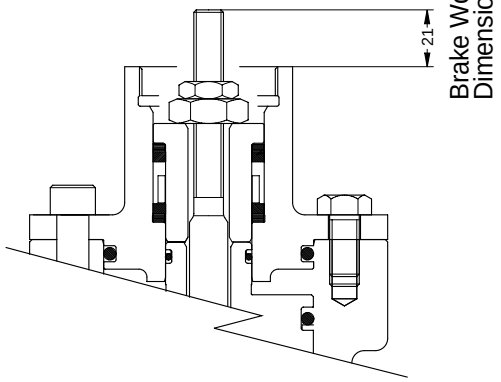
③ Carefully fit the piston(20) into the cylinder ensuring that the piston seals and spacer engage the piston without damage.

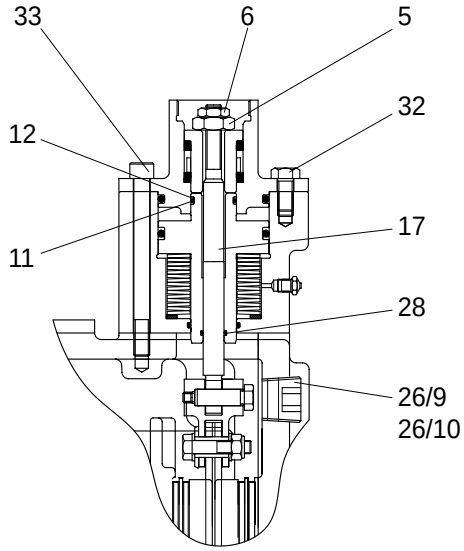
④ Fit O-ring(13) into the groove of cylinder(2).

⑤ Assemble service cylinder unit to the fail-safe unit, carefully engaging the O-ring(13), O-ring(11) and backup ring(12) so as to cause no damage.

⑥ Apply Loctite grade 275 to the threads of three hexagon head bolts(Item 32, page 3-174) and screw into position in the cylinder(9). Tighten the bolts down evenly and finally torque tighten to 7.6kgf · m (55.3lbf · ft).

(5) Fitting the assembly





① If fitting a new output housing, ensure that the machined top edge of the output housing is level to -0.12㎜ below the brake cylinder mounting face on the case.

② Apply a bead of Loctite grade 574 to the brake cylinder mounting surface of the case between the pull rod hole and the tapped holes.

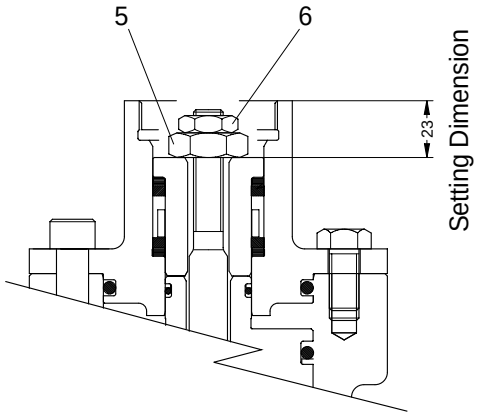
※ **This includes the machined top edge of the output housing.**

③ Slide the piston assembly over the brake pull rod(17) taking care not to damage O-ring(28). Orientate the cylinder such that the flat on the cylinder body lines up with the face of the output housing.

④ Apply Loctite grade 275 to the threads of three socket head cap screws(33), screw into the mounting holes and torque tighten to 7.6㎏f · m(55.3lbf · ft).

⑤ Fit nut(5) onto pull rod(17) and adjust brake as from page 3-175, ③.

(6) Brake adjustment procedure



① Carefully remove end cap(3).

※ **This component is spring loaded.**

② Remove return spring(4).

③ Hold adjusting nut(5), release and remove lock nut(6).

④ Adjust nut(5) until the setting dimension of 23㎜ is achieved.

⑤ Check the worn condition of the assembly by measuring the protrusion of the pull rod(17) above the end face of the service cylinder(1). This dimension should not exceed 21㎜ even though full plate wear may not be apparent.

※ **His action is not strictly necessary on new build. It is however, a useful check that the correct parts and quantities have been used.**

⑥ Fit lock nut(6).

⑦ Hold adjusting nut(5) and tighten lock nut(6).

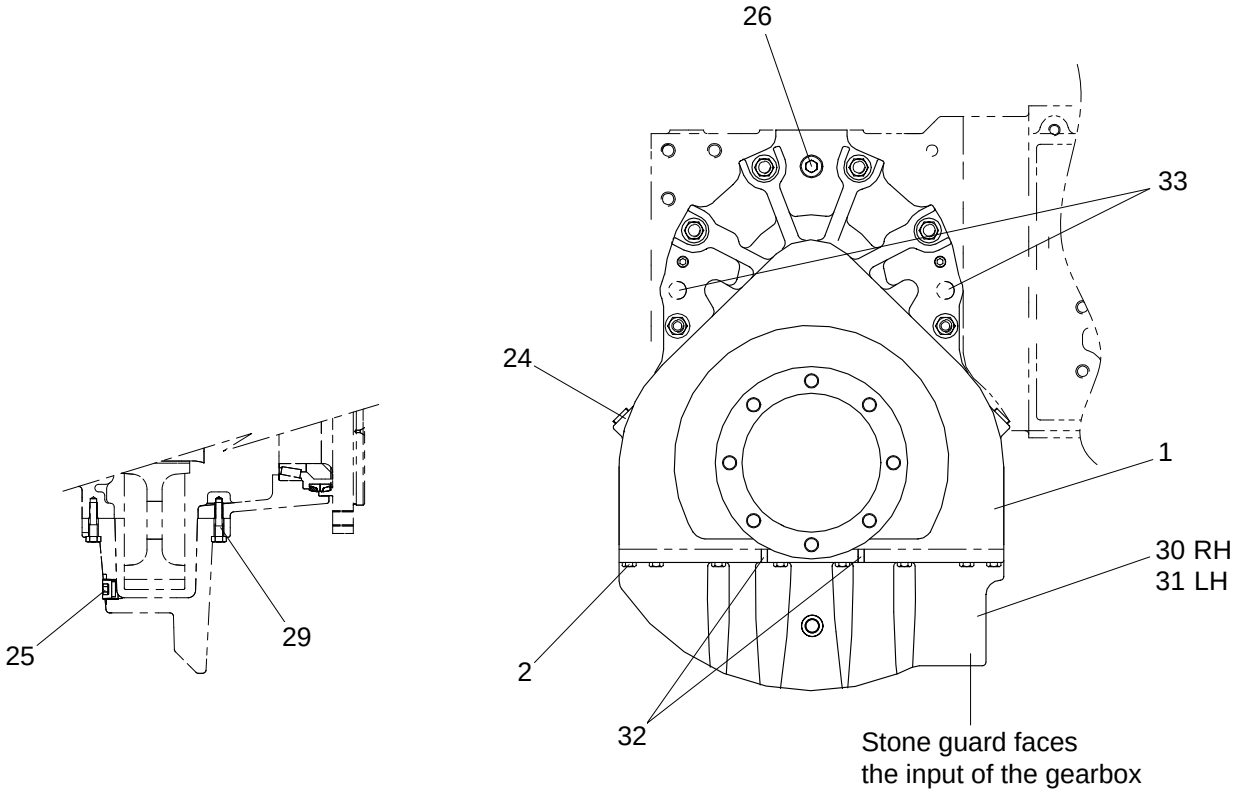
⑧ Recheck adjustment dimension of 23㎜.

⑨ Referring to figure at page 3-170, fit piston spring(4).

⑩ Fit end cap(3) -See note re sealant.

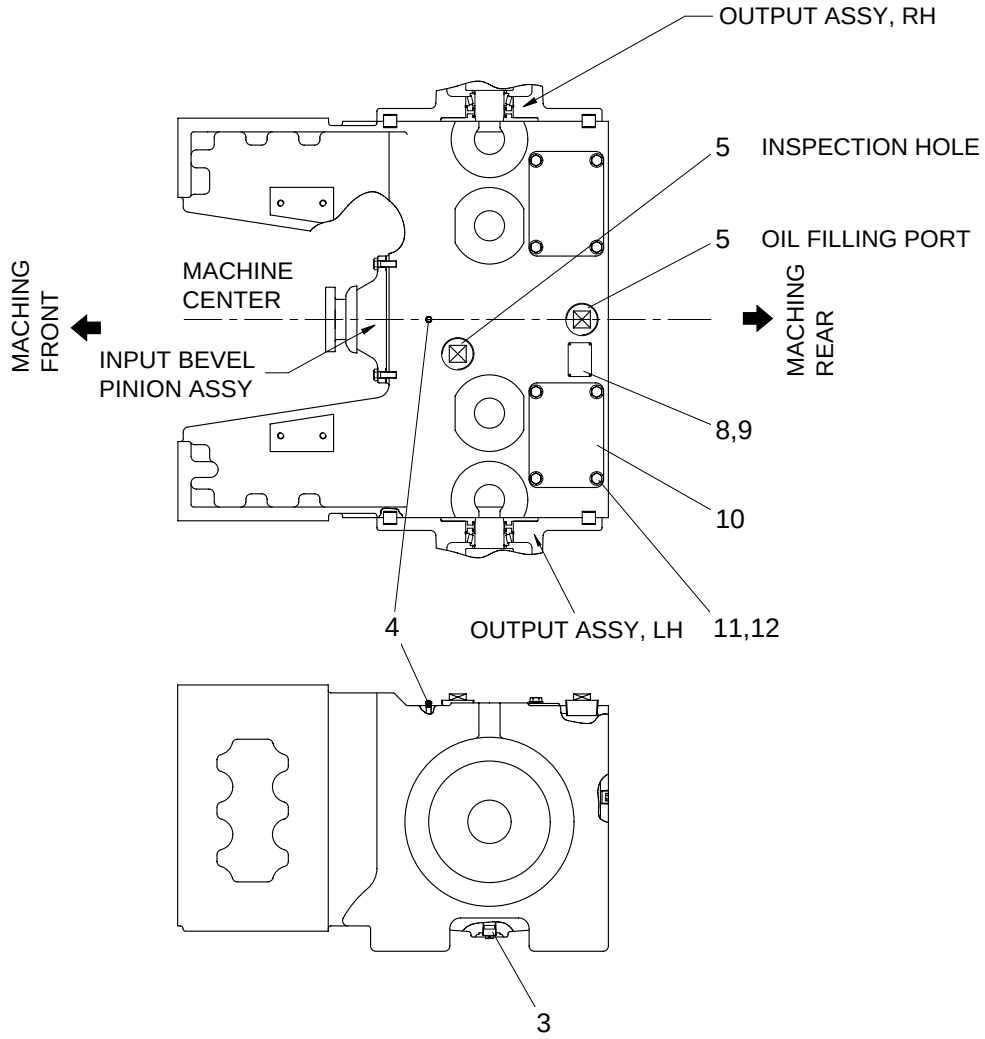
5) FINAL ASSEMBLY

(1) Output assembly bottom covers



① Fit dowels(29) to the casing(1).
② Apply a bead of Loctite grade 574 around the edge of the bottom cover mounting face between the inside edge and the tapped holes.
③ Apply Loctite grade 275 to two hexagon head screws(2).
④ Load the bottom cover(30 LH or 31RH) onto the two dowels(29) in casing(1) and fit the two screws(2) at opposite corners of the cover to hold in place.
⑤ Apply Loctite grade 275 to the twelve remaining hexagon head screws(2) and screw into position in casing(1).
⑥ Torque tighten all fourteen screws to 7.6kgf · m(55.3lbf · ft).
⑦ Fit drain plug(25).
⑧ Fit level/filler plugs(24).
⑨ Fit cork plugs(33) into the two M16 tapped holes.
⑩ Fit cork plugs(32) into the M12 tapped holes in the cover.
⑪ If required, repeat operations ① to ⑩ on the other side of the unit.

(2) Main case assembly



① Apply a bead of Loctite grade 574 to the cover faces on top of the case.
Apply between the inner edge of the aperture and the tapped holes.
② Fit covers(10).
③ Fit washers(12) over hexagon head screws(11) and apply Loctite grade 244 to the threads of the screws.
④ Fit hexagon head screws(11) and washers(12) to secure the covers and torque tighten to 4.1kgf · m(29.5lbf · ft).
⑤ Apply Loctite grade 244 to the threads of relief valve(4) and fit the valve into the tapped hole in the top of the case above the bevel pinion.
⑥ Apply Loctite grade 244 to the threads of taper plug(5) and fit into the inspection hole on top of the case above the bevel gears.
⑦ Temporarily fit the taper plug(5) to the oil filler port.
⑧ Apply Loctite grade 244 to the threads of taper plug(3) and fit into the drain hole on the underside of the case.