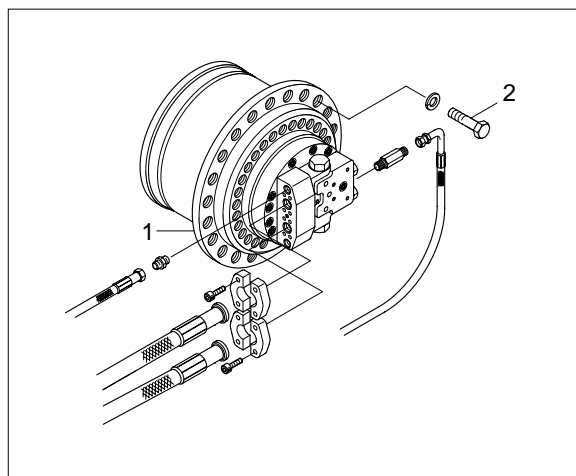


## GROUP 6 TRAVEL DEVICE

### 1. REMOVAL AND INSTALL

#### 1) REMOVAL

- (1) Swing the work equipment 90° and lower it completely to the ground.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.
- ▲ Escaping fluid under pressure can penetrate the skin causing serious injury.
- ※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.
- (4) Remove the track shoe assembly.  
For details, see **removal of track shoe assembly**.
- (5) Remove the cover.
- (6) Remove the hose.  
※ Fit blind plugs to the disconnected hoses.
- (7) Remove the bolts and the sprocket.
- (8) Sling travel device assembly(1).
- (9) Remove the mounting bolts(2), then remove the travel device assembly.  
· Weight : 275kg(606lb)

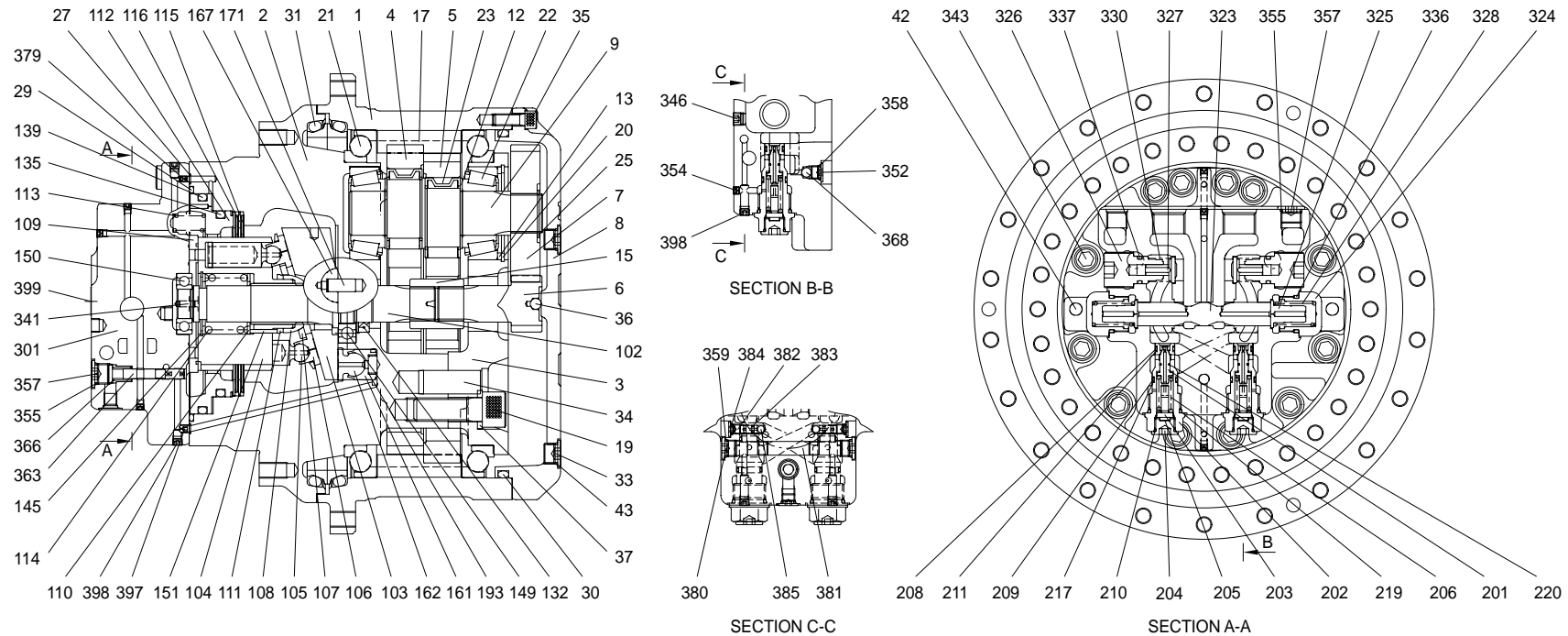


#### 2) INSTALL

- (1) Carry out installation in the reverse order to removal.
- (2) Bleed the air from the travel motor.
  - ① Remove the air vent plug.
  - ② Pour in hydraulic oil until it overflows from the port.
  - ③ Tighten plug lightly.
  - ④ Start the engine, run at low idling, and check oil come out from plug.
  - ⑤ Tighten plug fully.
- (3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

## 2. TRAVEL MOTOR

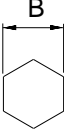
### 1) STRUCTURE



1	Hub	23	Needle roller bearing	106	Shoe	151	Needle roller	219	O-ring	354	Hexagon socket plug
2	Spindle	25	Snap ring	107	Retainer plate	161	Piston	220	Piston seal	355	O-ring
3	Hold flange	27	O-ring	108	Thrust ball	162	Shoe	301	Rear flanger	357	Plug
4	RV gear A	29	O-ring	109	Timing plate	167	Pivot	323	Spool	358	O-ring
5	RV gear B	30	O-ring	110	Washer	171	Parallel pin	324	Plug	359	O-ring
6	Input gear	31	Floating seal	111	Washer	193	Spring	325	Stopper	363	Spool
7	Spur gear	33	Plug	112	Piston	201	Valve	326	Plug	368	Steel ball
8	Cover	34	Parallel pin	113	Spring	202	Sleeve	327	Valve	379	Filter
9	Crank shaft	35	Hexagon socket bolt	114	Spring	203	Spring retainer	328	Spring	380	Plug
12	Spacer	36	Steel ball	115	Friction plate	204	Plug	330	Spring	382	Plug
13	Distance piece	37	Washer	116	Mating plate	205	Shim	336	O-ring	383	O-ring
15	Coupling	42	Parallel pin	132	Oil seal	206	Spring	337	O-ring	384	O-ring
17	Pin	43	O-ring	135	O-ring	208	O-ring	341	Parallel pin	385	Steel ball
19	Hexagon socket bolt	102	Shaft	139	O-ring	209	O-ring	343	Hexagon socket bolt	397	Orifice
20	Snap ring	103	Swash plate	145	Snap ring	210	O-ring	346	Hexagon socket bolt	398	Hexagon socket plug
21	Ball bearing	104	Cylinder block	149	Ball bearing	211	Back up ring	352	Plug	399	Name plate
22	Taper roller bearing	105	Piston	150	Ball bearing	217	Back up ring				

## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

Tool name		Remark	
Allen wrench		5, 6, 8, 10, 14	
Socket for socket wrench, spanner	Socket	22, 30, 32, 41	
	Rod	5, 6, 8, 10, 14, 19	
Torque wrench	Capable of tightening with the specified torques		
Pliers	-		
(-) Driver	150mm		
Plastic and iron hammer	Wooden hammer allowed. Normal 1 or so		
Steel rod approx	7 × 7 × 200mm		
Monkey wrench	-		
Oil seal inserting jig	-		
Bearing pliers	-		
Seal tape	-		
Eye bolt	M12, M16		
Press(0.5 ton)	-		
Oil stone	-		
Bearing assembling jig	-		
Liquid packing	Loctite #577		
Screw lock	Loctite #243		

### (2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Hexagon socket bolt	19	M24 × 3.0	72.3 ± 11.0	523 ± 79.6
Hexagon socket plug	33	PF 1/2	10.0 ± 2.0	72.3 ± 14.5
Hexagon socket bolt	35	M12 × 1.75 × 32	10.4 ± 1.6	75.2 ± 11.6
Sleeve	202	PF 1	25.0 ± 5.0	181 ± 36.2
Plug	204	PF 1/2	10.0 ± 2.0	72.3 ± 14.5
Plug	324	M36 × 1.5	45.0 ± 9.0	326 ± 65.1
Plug	326	M36 × 1.5	26.0 ± 4.0	188 ± 28.9
Hexagon socket bolt	343	M16 × 2.0	25.7 ± 4.0	186 ± 28.9
Plug	346	PF 1/4	3.0 ± 0.5	21.7 ± 3.6
Plug	352	PF 1/4	3.0 ± 0.5	21.7 ± 3.6
Hexagon socket plug	354	NTPF 1/16	1.0 ± 0.25	7.2 ± 1.8
Plug	357	PF 1/2	10.0 ± 2.0	72.3 ± 14.5
Plug	380	PF 3/8	6.0 ± 1.0	43.4 ± 7.2
Plug	382	PF 1/8	1.5 ± 0.25	10.8 ± 1.8
Hexagon socket plug	398	PF 1/8	1.25 ± 0.25	9.0 ± 1.8

### **3. DISASSEMBLY**

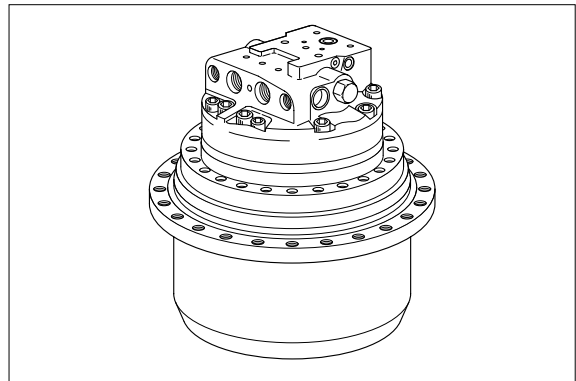
#### **1) GENERAL PRECAUTIONS**

- (1) Before disassembling the motor, check the items to be inspected and, for remedy against trouble, closely examine the nature of the trouble, so that the motor can be disassembled effectively.
- (2) To disassemble the motor, use the disassembling procedures described in section 2) and select a clean place.
- (3) Place a rubber or vinyl sheet or other such protective materials on your working bench to protect the surface of the motor to be serviced.
- (4) During disassembly, give a match mark to the mating surfaces of each part.
- (5) Arrange removed parts in order so that they will not become damaged or missing during disassembly.
- (6) Once seals have been disassembled, they should be replaced even if damage is not observed. Have replacement seals ready on hand before starting your disassembling job.

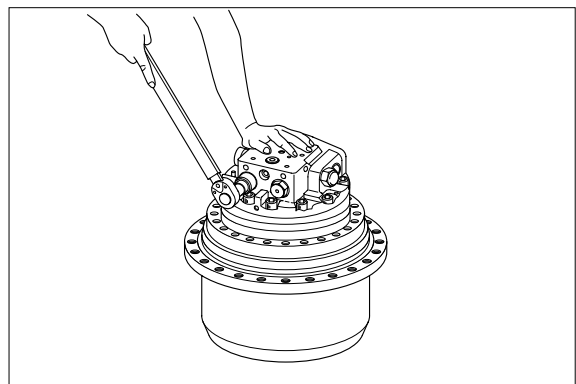
## 2) DISASSEMBLING PROCEDURE

### (1) Disassembling the brake valve section and the hydraulic motor section

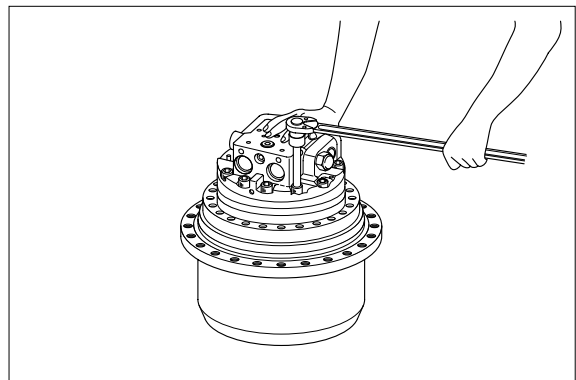
- ※ When inspecting or repairing the motor, use the disassembling procedures described below.
- ※ Numbers in parentheses ( ) following the part name denote the item numbers shown in the attached assembly drawings.
- ※ Prior to disassembly, install the motor on an inversion working bench.



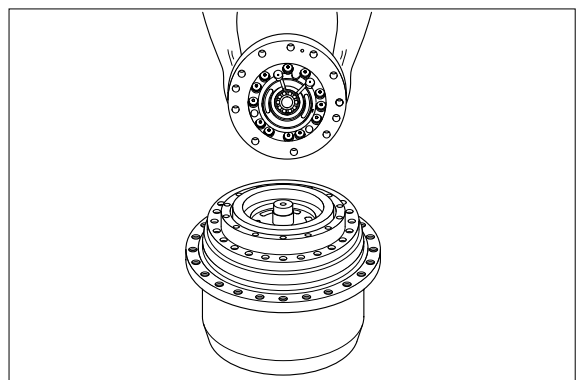
- ① Remove valve kit from the rear flange (301).
  - ② Remove the O-rings(208, 209, 210) and back up rings(211, 217) from the valve kit.
- ※ Do not reuse the O-ring after removal.



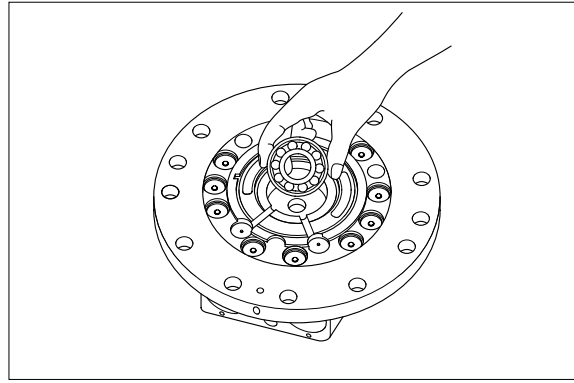
- ③ Remove the twelve hexagon socket head bolts(343).



- ④ Remove the rear flange kit(301) from the spindle(2).
- ※ Pay attention, shaft(102) may pulled up with the rear flange kit.
  - ※ Proceed to pages 8-83 through 8-87 to see the brake valve disassembling procedure.

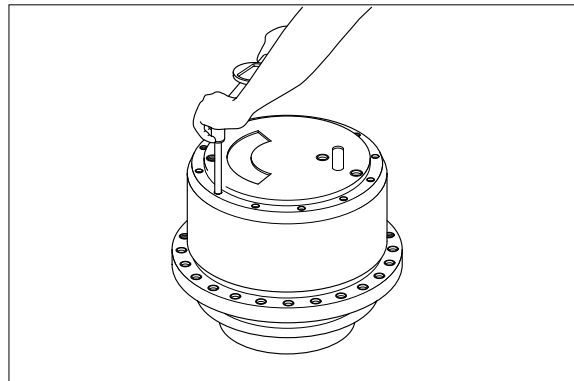


- ⑤ Remove the timing plate(109), the two pins(341) and the ball bearing(150) from the rear flange kit(301).
- ⑥ Remove the two O-ring(27) and O-ring (29) from spindle(2).
- ※ Do not reuse the O-rings(27, 29) after removal.
- ※ Proceed to pages 8-89 through 8-90 to see the description of the hydraulic motor disassembling procedure.

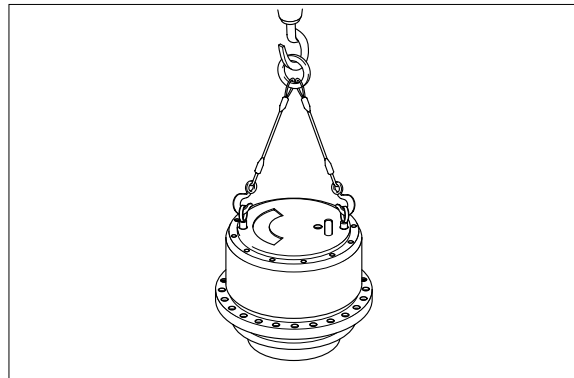


**(2) Disassembling the reduction gear/  
Hydraulic motor shafts and oil seals**

- ① Turn the motor and cover(8) over.
- ② Remove three plugs(33).
- ③ Remove twelve hexagon socket head bolts(35).



- ④ Install two eye bolt(PF 1/2) to the threads for plugs(33).
- ⑤ Fasten hook to the eye bolts then lift up cover(8).
- ※ When cover(8) do not come up easily due to friction of O-ring(30), bang cover (8) evenly using a plastic hammer.
- ⑥ Remove O-ring(30) from cover(8).
- ※ Do not reuse the removed O-ring.
- ⑦ Drain lubricating oil from the reduction gear.
- ※ Proceed to page 8-92 through 8-95 to see the reduction gear disassembling procedure.



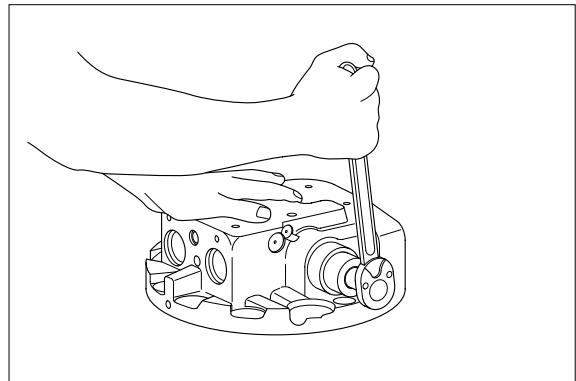
### 3) DISASSEMBLY OF BRAKE VALVE

#### (1) Disassembly of the spool(323)

- ① Remove the two plugs(324) from the rear flange(301).

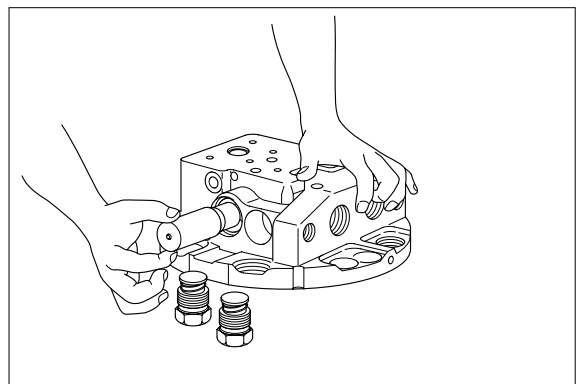
Remove the two O-ring(336) from the plug(324).

- ※ Removal of the two plugs(324) from the rear flange(301) is facilitated by loosening plugs(324) with rear flange (301) attached to the spindle(2).
- ※ Do not reuse the O-ring(336) after removal.



- ② Remove the two springs(328), the two stoppers(325), and the spool(323) from the rear flange(301).

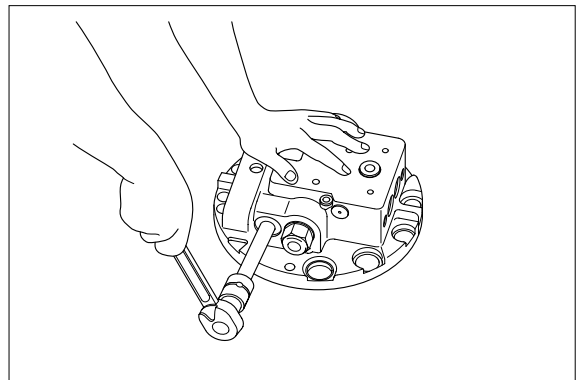
- ※ Be careful not to damage the outer surface of the spool(323) and the sliding surface of the rear flange(301).
- ※ Spool is selectively fitted to the rear flange(301). When replacing either or them, therefore, the rear flange kit should be replaced.



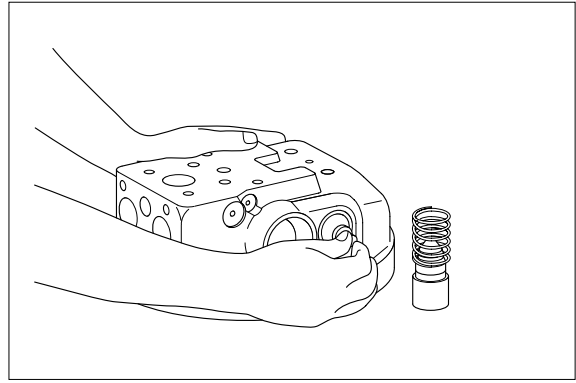
#### (2) Disassembly of the check valves

- ① Remove the two plugs(326) from the rear flange(301).

- ※ Removal of the two plug(326) from the rear flange(301) is facilitated by loosening plug(326) with the rear flange (301) attached to the spindle(2).



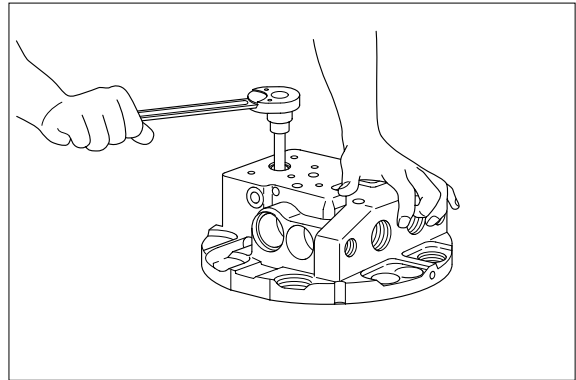
- ② Remove the two springs(330) and the two valves(327) from the rear flange(301).  
\* Be careful not to damage the seat sections of the valves(327) or rear flange (301).



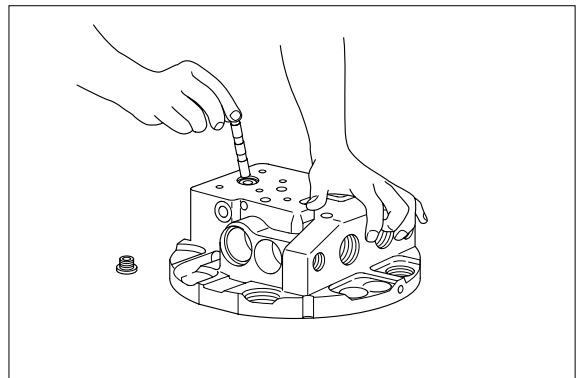
- ③ Remove the O-ring(337) from the plug (326).  
\* Do not reuse the O-ring(337) after removal.

**(3) Disassembly of the spool(363) from the rear flange(301)**

- ① Remove plug(357) from rear flange(301).  
\* Removal of plug(357) from rear flange(301) is facilitated by loosening plugs(324) with rear flange(301) attached to spindle(2).



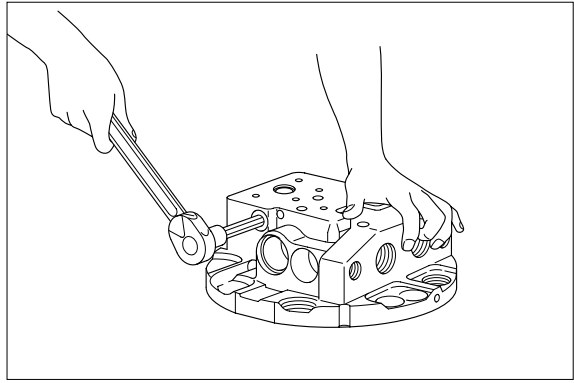
- ② Take out spool(363) from rear flange (301).  
③ Remove O-ring(355) from plug(357).  
\* Do not reuse removed O-ring(355).





**(4) Removal inner parts of the rear flange assembly**

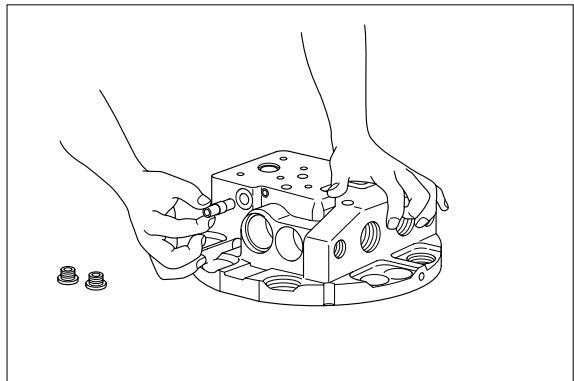
- ① Remove the two plugs(380) from rear flange(301).



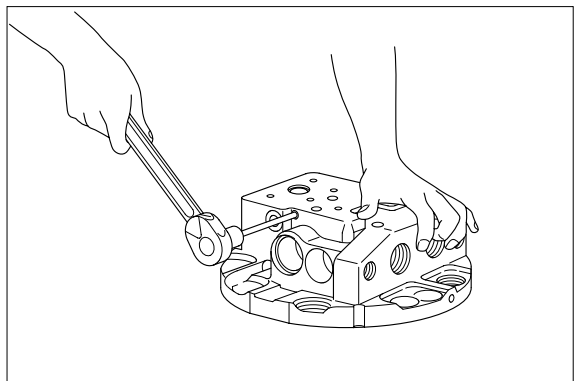
- ② Remove the two O-rings(359) from each plug(380).

- ③ Take out piston(381) from rear flange (301).

- ※ Do not reuse removed the O-rings(359).
- ※ Be careful not to scratch the outer surface of the piston(381) and the sliding surface of the rear flange(301).
- ※ Piston(381) is selectively fitted to rear flange(301). When replacing either of them, therefore, the rear flange kit should be replaced.



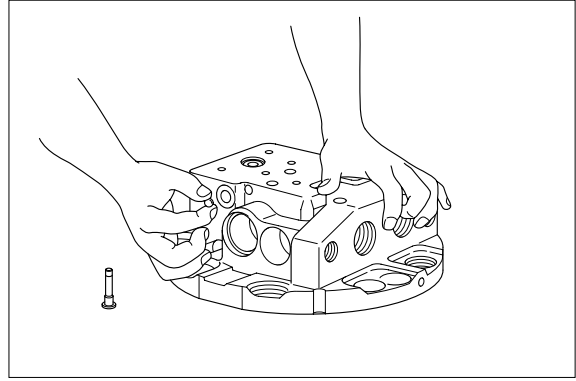
- ④ Removed the two plugs(382) from rear flange(301).



- ⑤ Take out each two O-rings(383, 384) from each plug(382).

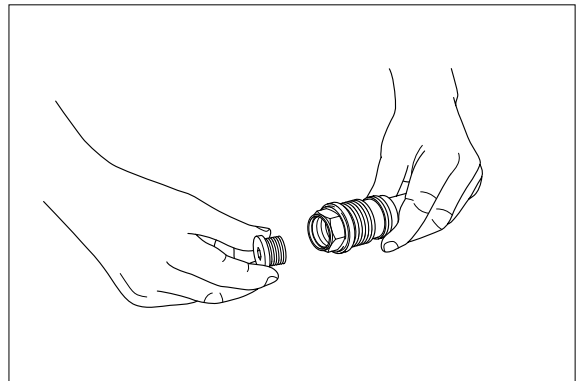
- ※ Do not reuse removed O-rings(383, 384).

- ⑥ Take out two steel balls(385) from the rear flange.

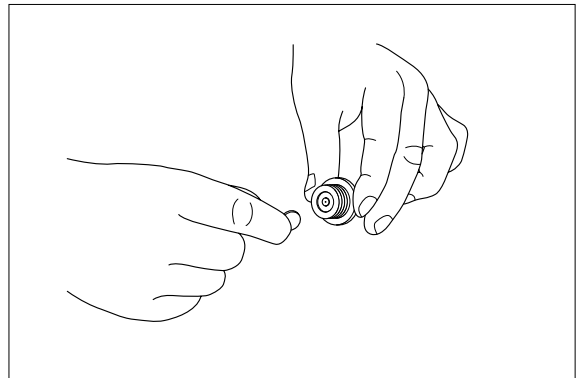


**(5) Removal of the valve kit**

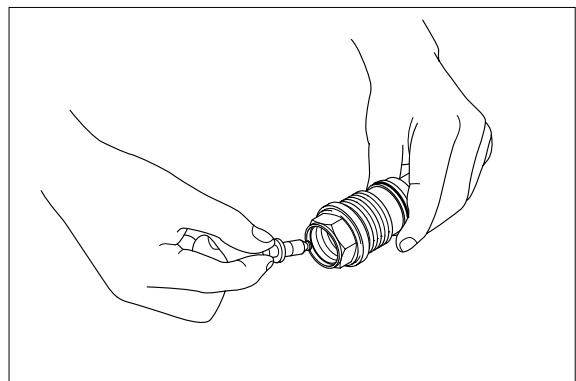
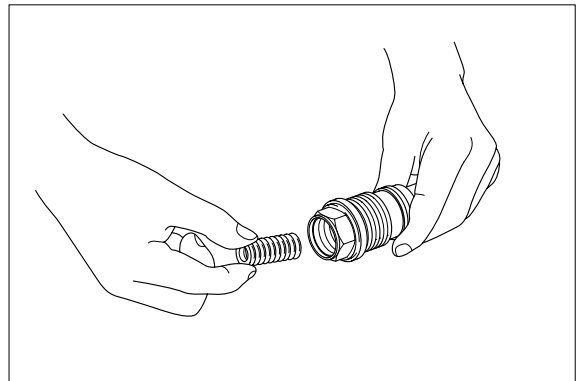
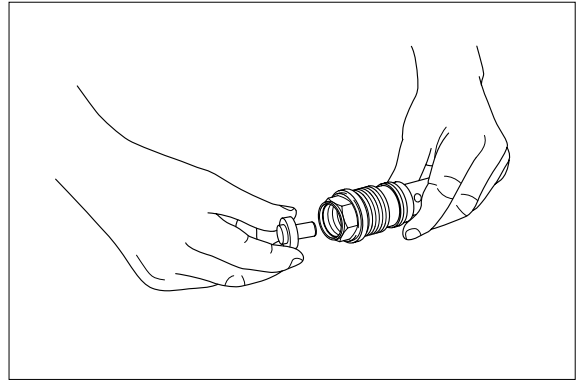
- ① Remove the plug(204) from sleeve(202).  
※ The valve kit is pressure adjusted by shim(205), when replacing of inner parts, therefore, the valve kit should be replaced.



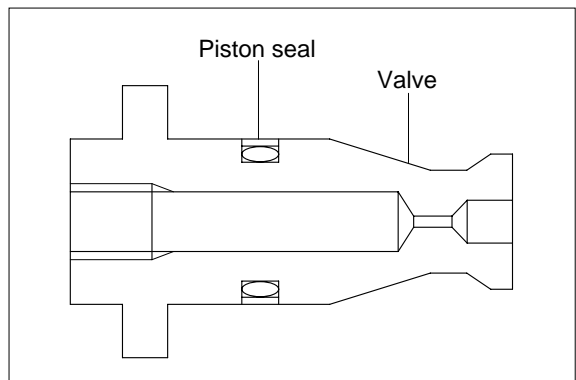
- ② Remove the O-ring(210) from plug(204).  
③ Take out shim(205) from plug(204).  
※ Do not reuse removed the O-ring(210).



- ④ Take out spring retainer(203), spring (206) and valve(201) in that order.



- ⑤ Remove piston seal(220) from valve (201).



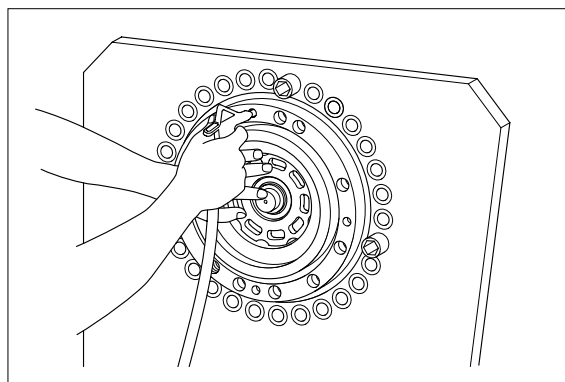
#### 4) DISASSEMBLY OF HYDRAULIC MOTOR

##### (1) Disassembly of the parking brake parts

① Remove the piston(112) by injecting compressed air from the parking brake access hole in the spindle(2).

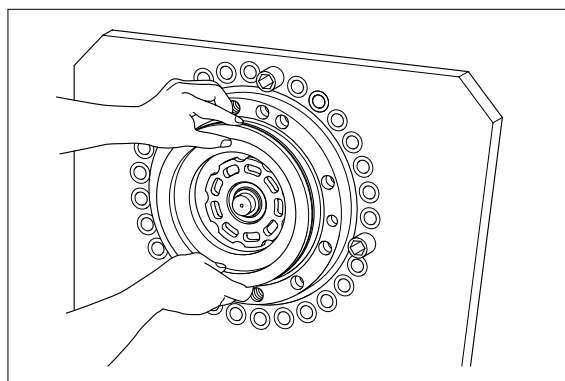
※ Take care that abrupt injection of compressed air(3~5kgf/cm<sup>2</sup>) may cause the piston(112) to pop out.

To ensure your safety, apply a protective cover to the piston.



② Remove the two O-rings(135, 139) from the piston(112).

※ Do not reuse O-rings(135, 139) after removal.



##### (2) Disassembly of the internal parts of the motor

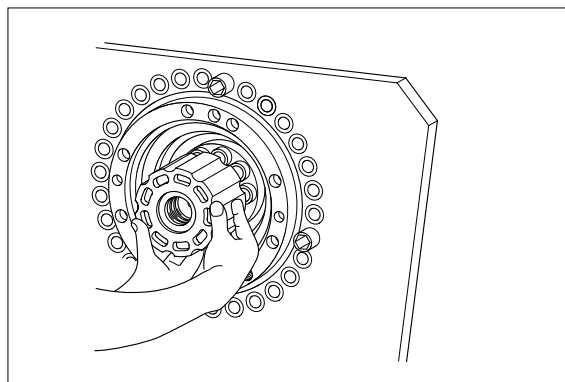
① Lay the motor body on the side.

② Drain out the oil from the motor.

③ Hold the cylinder block(104) with both hands, and remove it from the spindle(2).

※ When laying the motor on its side, place a receptacle under it to receive spilling hydraulic oil.

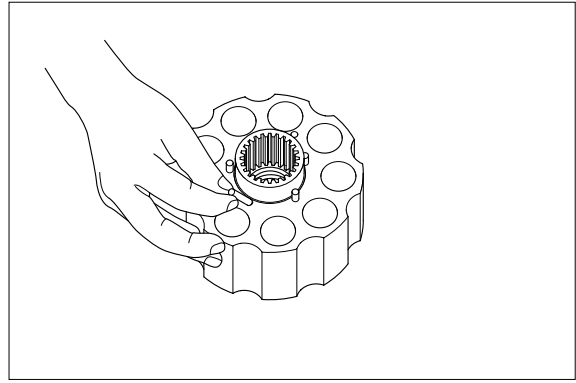
※ Before pull out cylinder block(104), turn it alternately clockwise & counterclockwise two or three times to separate the piston kit from swash plate(103). This means that the parts attached to the cylinder block(104) come out of it and fall in the spindle.



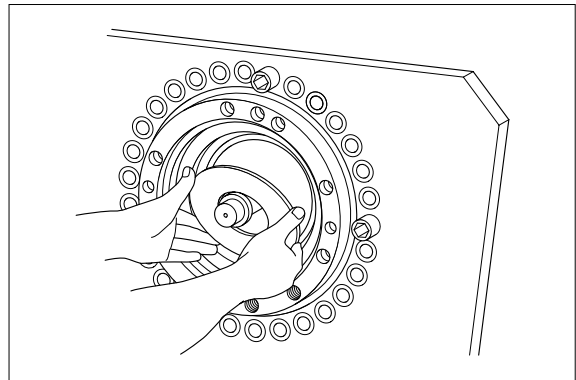
④ Detach the two friction plates(115) and two mating plates(116) from cylinder block(104) which has been taken out in step ③.

⑤ Separate the piston assembly(105, 106), retainer plate(107), thrust ball(108), washer(111) and five needle rollers(151) from cylinder block(104) which has been taken out in step ③.

※ Cylinder block(104), piston assembly, retainer plate, etc. which are included in cylinder & piston kit and are not supplied one by one, therefore, cylinder & piston kit should be replaced.(Refer to class shown in parts list.)



⑥ Take out swash plate(103) from spindle (2).

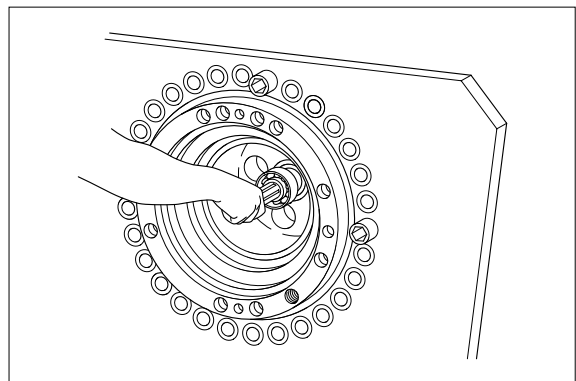


⑦ Take out shaft(102) from spindle(2). At this time, ball bearing(149) is also taken out together with shaft(102).

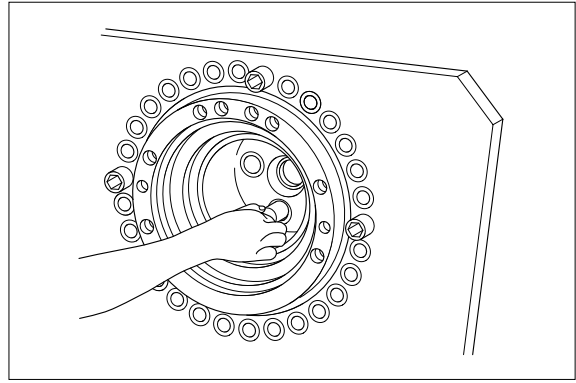
※ Oil seal(132) cannot be taken out.  
※ Lightly shaft(102) end on the reduction gear side with a plastic hammer to make the removal easier.

Take notice when removing the shaft (102) rap strongly and swiftly, the shaft will come quickly free from the spindle.

⑧ Take out two pivots(167) and two pins (171) from spindle(2).

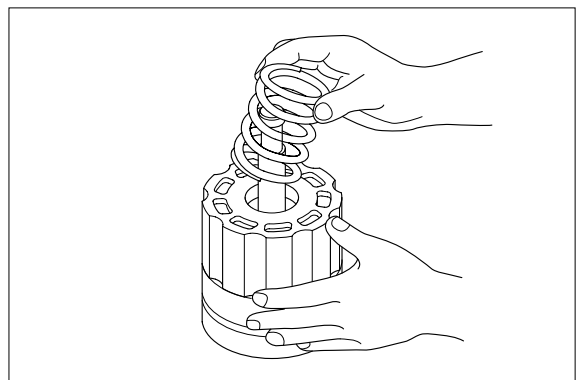


- ⑨ Remove the piston assembly and spring (193) by compressed air(3~5kgf/cm<sup>2</sup>) through the passage for the piston assembly in spindle(2).
- \* Piston(161) and shoe(162) are included in the piston assembly and are not supplied one by one, therefore, the piston assembly should be replaced.
  - \* Abrupt compressed air causes the piston assembly to spring out which dangerous. The piston assembly can be taken out safely by putting a protective cover or the lie on it.



### (3) Disassembly of the cylinder block

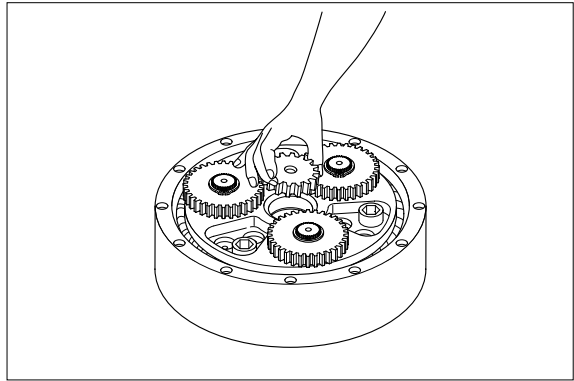
- ① Place the cylinder block on the work bench and take out snap ring(145) with the snap ring pliers while pressing the retainer against washer(110).
- \* Before compressing spring(114), make sure that cylinder block(104), retainer and press arbor are in good alignment: This is for galling or denting cylinder block(104).
  - \* Put a vinyl cover on the sliding surface of cylinder block(104) for protection.
- ② Slacking the press force slowly, until free of the spring force.
- \* Do not remove spring(114) if it not to be replaced.
  - \* When disassembling there is a possibility that the spring may be injured. Slacking very slowly in order to prevent injury to the spring.
- ③ Remove the snap ring(145), washer(110), spring(114) and washer(110).



## 5) DISASSEMBLY OF REDUCTION GEAR

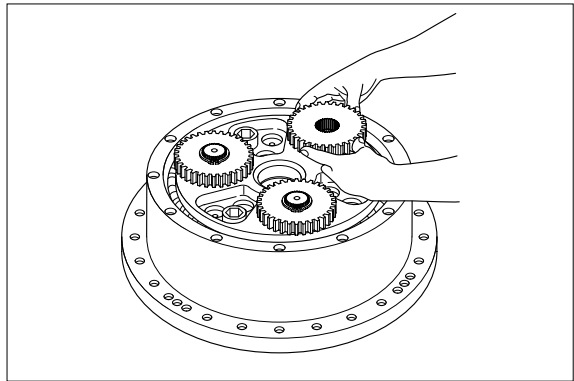
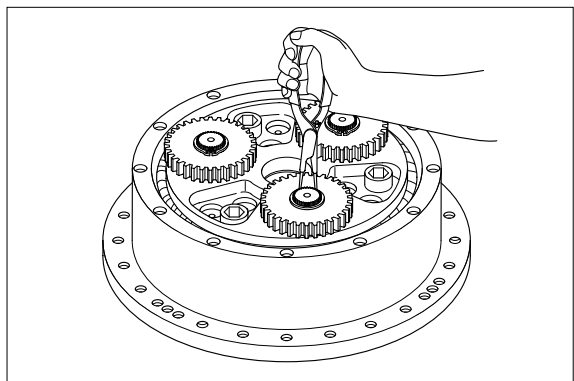
### (1) Disassembly of the input gear

- ① Remove steel ball(36) and input gear(6) from coupling(15).



### (2) Disassembly of the spur gear

- ① Remove the three snap rings(25) from each crank shaft(9).
  - ② Remove the three spur gears(7) from each crank shaft.
- ※ Take notes when removing the snap ring with a snap ring plier, the snap ring will spring out form its groove.

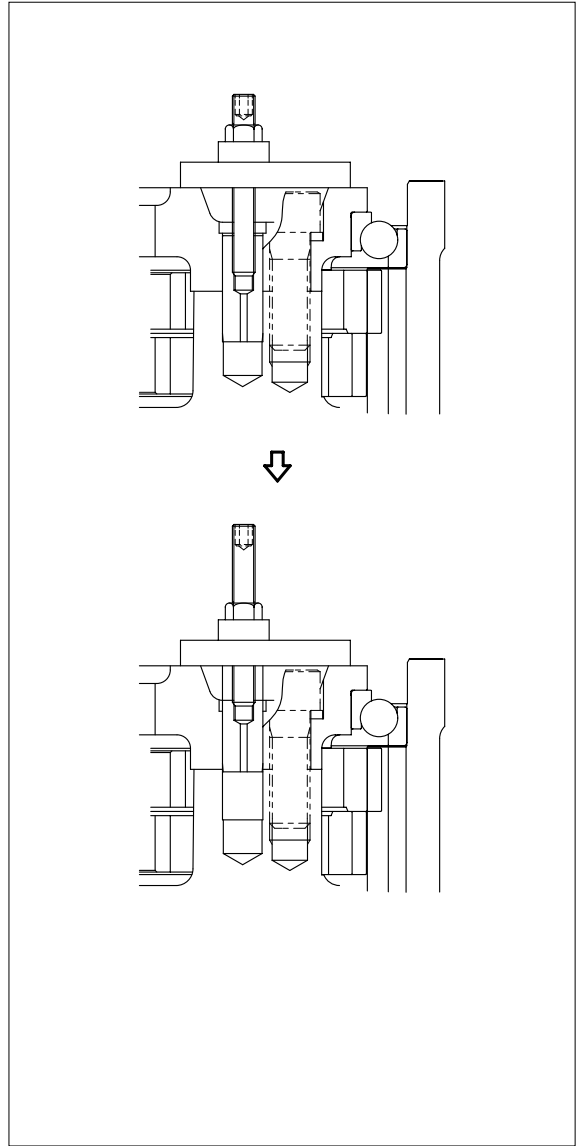


### (3) Disassembly of the coupling

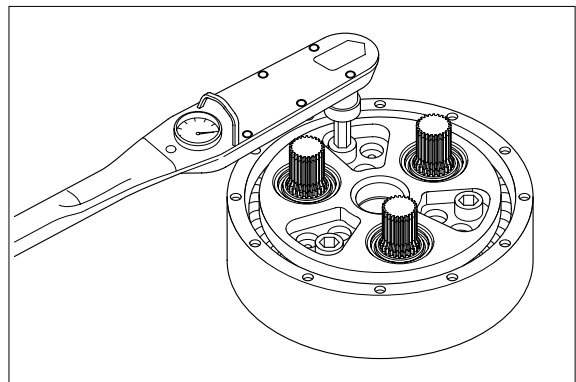
- ① Remove coupling(15) from shaft(102).

#### (4) Removal of the hold flange

- ① Turn the motor upside down, bringing the spindle to top.
- ② Install two fixing jigs to fasten down spindle(2) to hub(1). At the same time the fixing jig screwed symmetry.
  - ※ Fasten hub(1) and spindle(2) securely before removing hold flange(3) so that spindle(2) will not fall from the work bench.
- ③ Turn the motor upside down once again, bringing the hold flange(3) to top.
- ④ Remove three snap rings(20) and three distance pieces(13) from hold flange(3).
  - ※ Put an identification marks on distance pieces(13) and hold flange(3) as to their location. Hold flange(3) and distance pieces(13) must be reassembled in its original position.
- ⑤ Remove the caulking portion of hold flange(3) for six parallel pins(34) with air grinder.
  - ※ Wear a protection glasses and a mask when removing the caulking portion.
- ⑥ Install puller and screwed puller bolt to parallel pin(34) and screwed the puller nut then parallel pin is pulled up. Pulling up parallel pin until reaches to surface of the puller.



- ⑦ Slowly remove three hexagon socket head bolts(19).
  - ※ The thread lock compound used on hexagon socket head bolts(19) may cause the bolts to seize during removal. The hexagon socket head bolts should be removed slowly by hand.

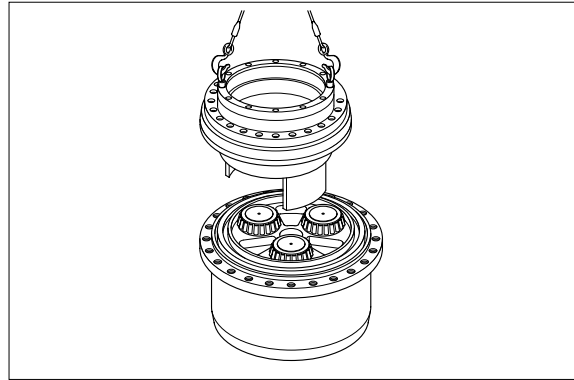


- ⑧ Remove hold flange(3) from spindle(2).
  - ※ Put an identification marks on hold flange (3) and spindle(2) as to their location. Hold flange(3) and spindle(2) must be reassembled in its original position.



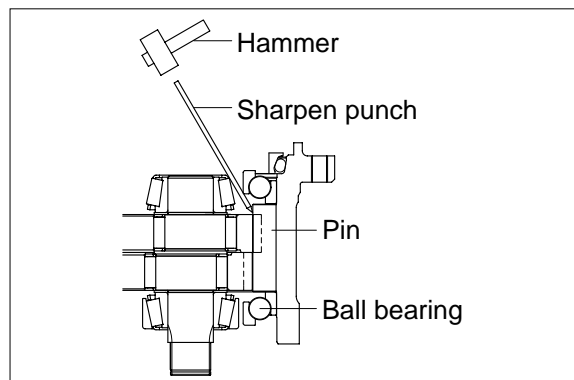
### (5) Disassembly of spindle(2)

- ① Fasten two eye bolts to spindle(2).  
Remove spindle(2) from hub(1).
- ※ When hanging up spindle(2), be careful not to scratch the retainer of ball bearing (21).



### (6) Removal the RV gear assembly, ball bearing(21) and pin(17)

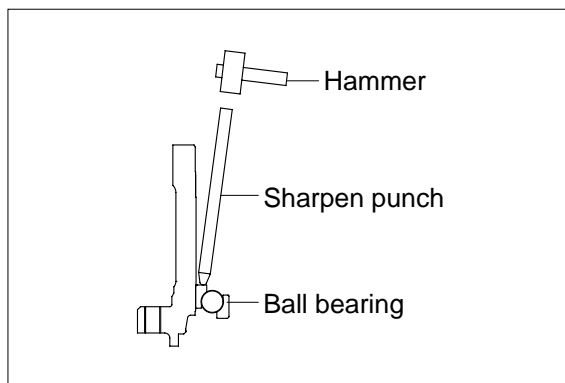
- ① Remove ball bearing(21) from hub(1) using a sharpen punch with hammering to pin(17). At the same time the RV gear assembly and pins(17) also removed.
- ※ When removing ball bearing(21), move a sharpen punch to one of three or four equidistant positions along the side of pins(17) end each after hammering the sharpen punch so as to keep the distortion of ball bearing(21).
- ※ When ball bearing(21) comes off from hub(1), ball bearing(21), RV gear assembly and pins(17) will drop. To prevent damage due to the dropping, place a receptacle covered with a rubber under the work bench.
- ※ The RV gear kit, crank shaft(9), spacer (12), tapered roller bearing(22) and needle bearing(2) are included in the RV gear assembly and are not supplied one by one, therefore, the RV gear assembly should be replaced.



**(7) Disassembly of ball bearing(21)**

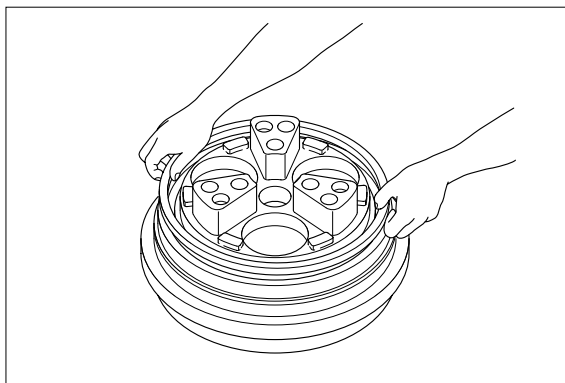
- ① Remove the floating seal(31) from hub(1).
- ② Turn the motor upside down.
- ③ Remove the ball bearing(21) from hub(1) by applying a sharpen punch to ball bearing(21) and hammering the punch.

※ When ball bearing(21) comes off from hub(1), the ball bearing will drop. To prevent damage due to the dropping, place a receptacle covered with a rubber under the work bench.



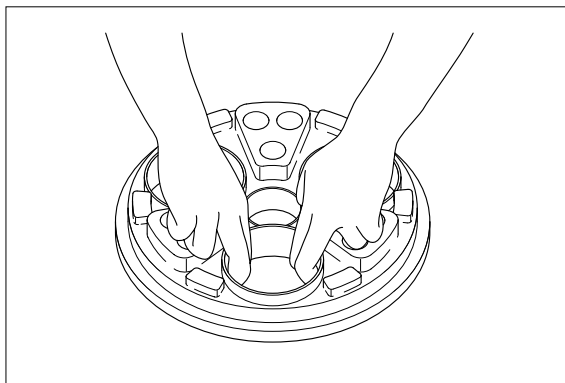
**(8) Disassembly spindle fittings**

- ① Remove the floating seal(31) from hub(1).
- ② Remove the outer ring of tapered roller bearing(22) from spindle(2).



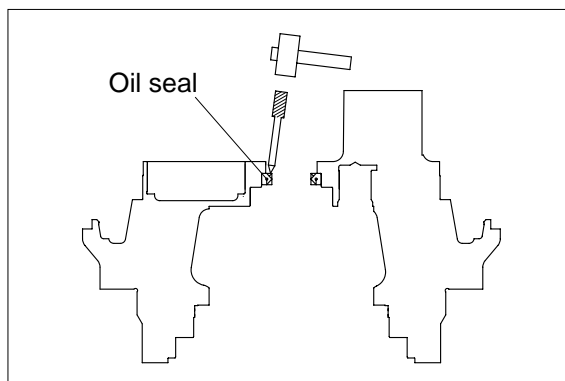
**(9) Disassembly the outer ring of tapered roller bearing(22) from hold flange(3)**

- ① Remove three outer rings of tapered roller bearings(22) from hold flange(3).



**(10) Disassembly of oil seal(132)**

- ① Remove oil seal(132) from spindle(2) as shown below.
- ※ Do not reuse removed oil seal(132).



**(11) Disassembly of ball bearing(149)**

- ① Place a retainer on the press work bench.  
Insert shaft(102) into retainer.
  - ② Remove ball bearing(149) from shaft  
(102) by pressing on the shaft end with a  
press.
- \* Do not remove ball bearing(149) if it is not  
be replaced.
  - \* Do not reuse removed ball bearing(149).

## **4. ASSEMBLY**

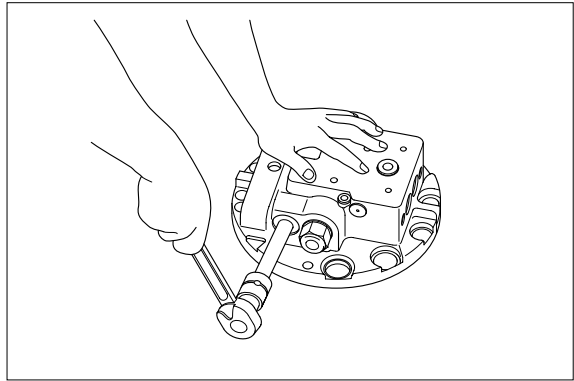
### **1) GENERAL PRECAUTIONS**

- (1) Reassemble in work area that is clean and free from dust and grit.
- (2) Handle parts with bare hands to keep them free of linty contaminates.
- (3) Repair or replace the damaged parts.  
Each parts must be free of burrs its corners.
- (4) Do not reuse O-rings, oil seal and floating seal that were removed in disassembly.  
Provide the new parts.
- (5) Wash all parts thoroughly in a suitable solvent.  
Dry thoroughly with compressed air.  
Do not use the cloths.
- (6) When reassembling oil motor components of motor, be sure to coat the sliding parts of the motor and valve with fresh hydraulic oil.(NAS class 9 or above)
- (7) Use a torque wrench to tighten bolts and plugs, to the torque specified as follows.

## 2) ASSEMBLY OF BRAKE VALVE

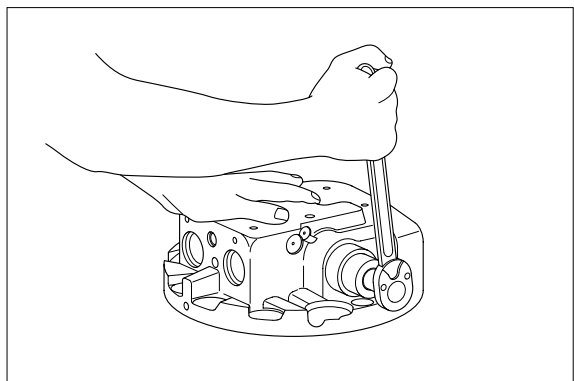
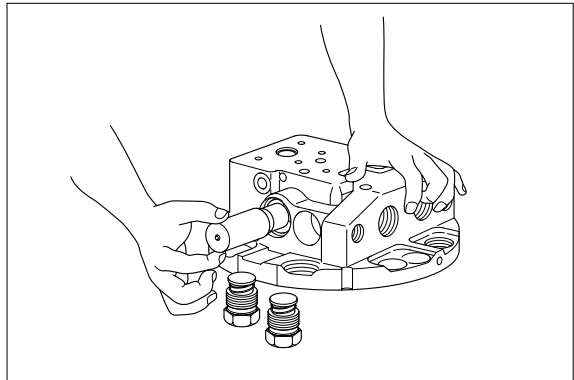
### (1) Assembly of the check valve

- ① Fit the O-ring(337) on the plug(326).
  - ② Insert the spring(330) and the valve(327) into the plug(326), and then grease the spring(330) and the valve(327) and hand-lock the former.
  - ③ Insert the plug(326) in conjunction with the spring(330) and the valve(327) into the rear flange(301), and tighten the plug to the required torque.
- ※ Apply grease to the O-ring(337).
  - ※ Tighten the plug(326) to a torque of  $26 \pm 4 \text{kgf} \cdot \text{m}$  ( $188 \pm 29 \text{lb} \cdot \text{ft}$ ).



### (2) Assembly of the spool

- ① Insert the spool(323) into the rear flange (301).
- ※ Apply a working fluid to the spool(323) and insert it into the rear flange(301).
  - ※ Align the center of the hole in the rear flange with the axial center of the spool to prevent damage to the inner surface of the rear flange and the outer surface of the spool due to contact.
  - ※ Above mentioned damage causes internal leakage after reassembly, thus degrading the motor performance.
- ② Attach the O-ring(336) to the plug(324).
  - ※ Apply grease to O-ring(336).
- 
- ③ Install stopper(325) and the spring(328) into both plugs(324) and tighten the plugs(324) into the rear flange(301) at the required torque.
- ※ Apply grease to the O-ring(355).
  - ※ Required torque :  $45 \pm 9 \text{kgf} \cdot \text{m}$   
( $325 \pm 65 \text{lb} \cdot \text{ft}$ )
  - ※ Even if either the rear flange(301) or the spool(323) is to be replaced, their entire assembly(kit) must be replaced.

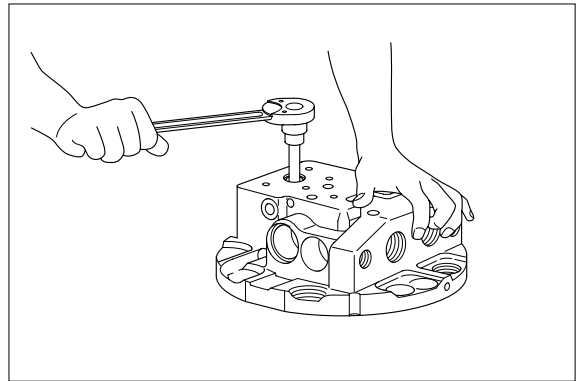
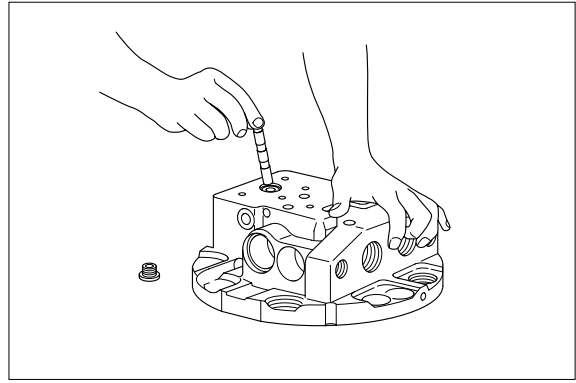


### (3) Assembly of the two-speed control valve

- ① Fit O-ring(355) on plug(357).
  - ② Insert spring(366) in spool(363) and insert spool(363) to rear flange(301).
- ※ Apply grease to O-ring(355).
  - ※ Apply hydraulic oil to spool(363).
  - ※ Align the center of the hole in the rear flange with the axial center of the spool to prevent damage to the inner surface of the rear flange and the outer surface of the spool due to contact.

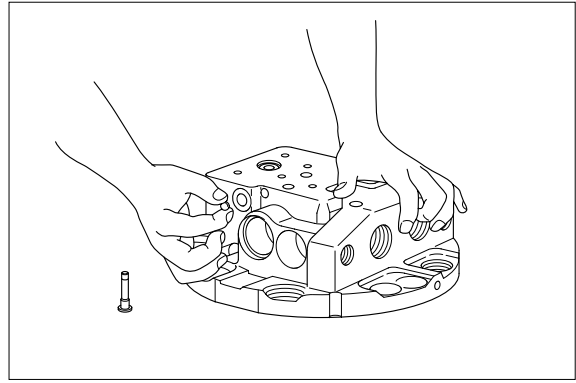
Above mentioned damage causes internal leakage after reassembly, thus degrading the motor performance.

- ③ Tighten plug(357) to rear flange(301) with specified torque.
- ※ Tightening torque :  $10 \pm 2 \text{kgf} \cdot \text{m}$   
( $72.3 \pm 14.5 \text{lbf} \cdot \text{ft}$ )

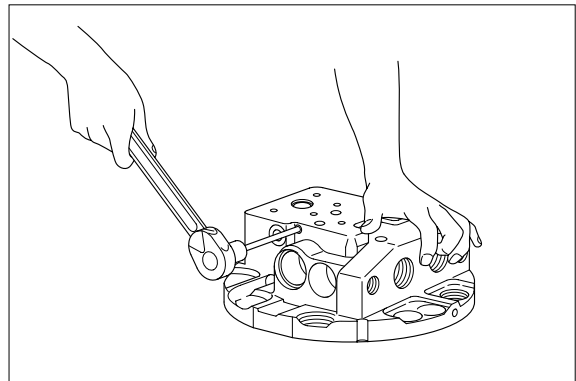


**(4) Assembly the inner parts of the rear flange assembly**

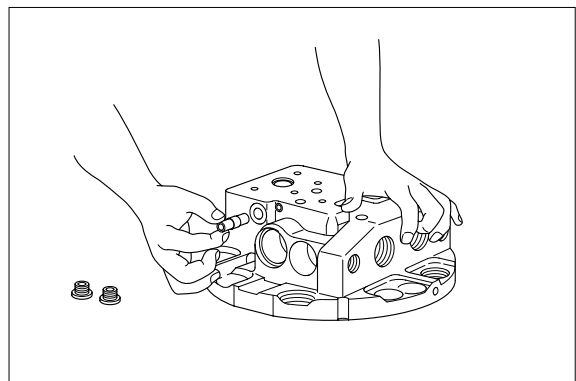
- ① Insert steel ball(385) to rear flange(301).



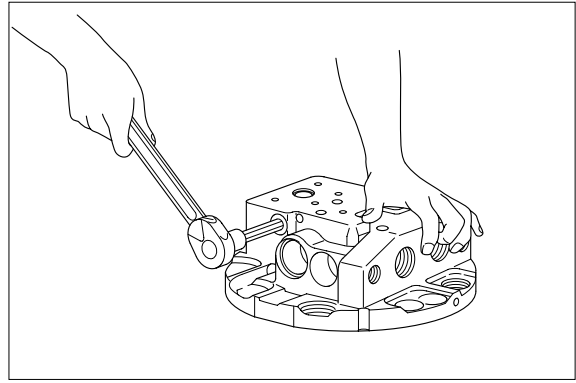
- ② Fit O-rings(383, 385) on plug(382).  
③ Tighten plug(382) to rear flange(301) with specified torque.  
\* Tightening torque :  $1.5 \pm 0.25 \text{kgf} \cdot \text{m}$   
 $(10.8 \pm 1.8 \text{lbf} \cdot \text{ft})$   
· Apply grease to O-rings(383, 384).



- ④ Insert piston(381) to rear flange(301).  
\* Apply hydraulic oil to piston(381) and then insert it into rear flange(301).  
\* Align the center of the hole in the rear flange with the axial center of the spool to prevent damage to the inner surface of the rear flange and the outer surface of the piston due to contact. The above mentioned damage causes internal leakage after reassembly, thus degrading the motor performance.  
\* Rear flange(301) and piston(381) constitutes a rear flange kit. When replacing either of them, therefore, replace the rear flange kit.

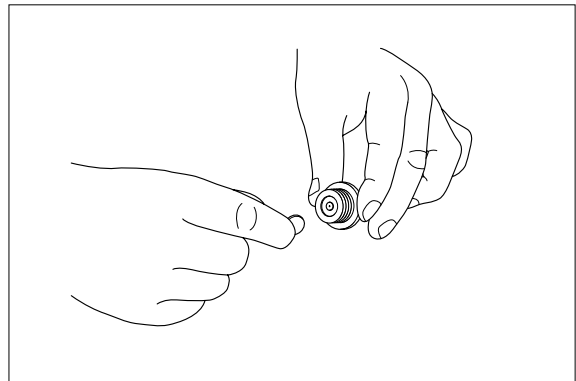


- ② Fit O-ring(359) on plug(380).
- ③ Install plug(380) to rear flange(301), and tighten plug(380) to rear flange(301) with the specified torque.
- ※ Tightening torque :  $6 \pm 1 \text{ kgf} \cdot \text{m}$   
( $43.4 \pm 7.2 \text{ lbf} \cdot \text{ft}$ )

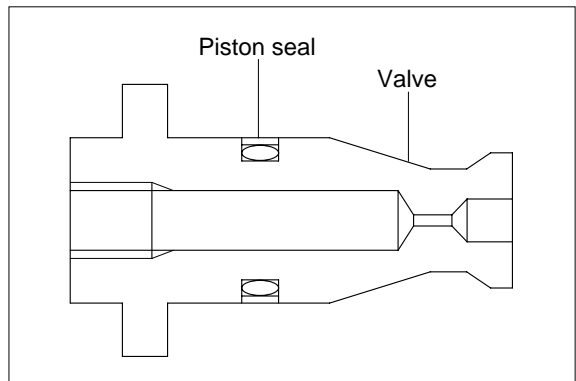


#### (5) Assembly of the relief valve

- ① Fit O-rings(208, 209, 219) and back up rings(211, 217) on sleeve(202).
- ② Fit O-ring(210) on plug(204).
- ※ Apply grease to the O-ring.
- ③ Insert shim(205) into plug(204).
- ※ Use the disassembled shim, because the pressure adjustment made by shim.  
When replacing the inner parts of relief valve, therefore, the valve kit should be replaced.



- ④ Fit piston seal(220) to valve(201).
- ※ Piston seal(220) consist of O-ring and polyester ring, apply grease to them and then fit the O-ring and after fit the polyester ring to valve(201).





⑤ Insert valve(201), spring(206) and spring retainer(203) to sleeve(202) and tighten plug(204) fitted with shim(205) to the specified torque.

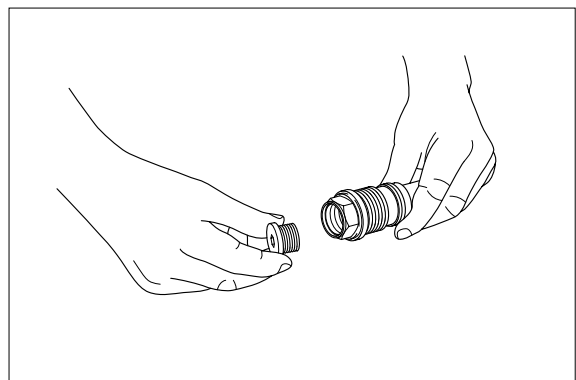
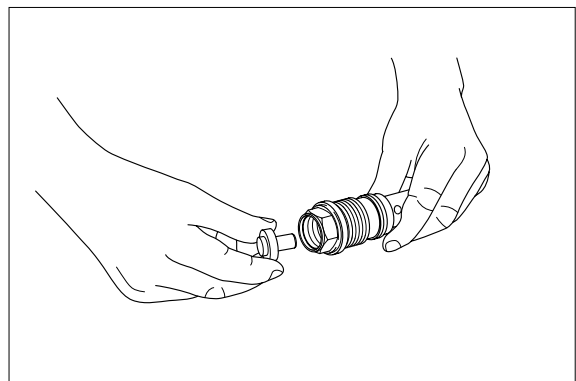
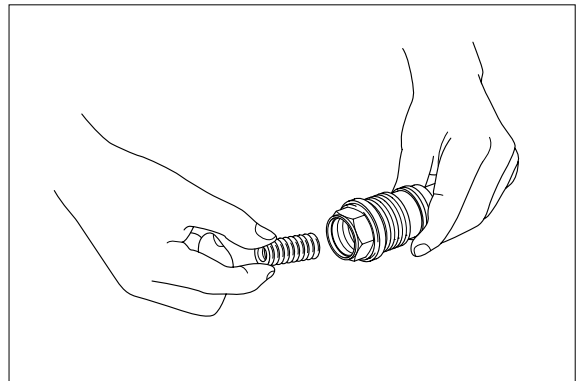
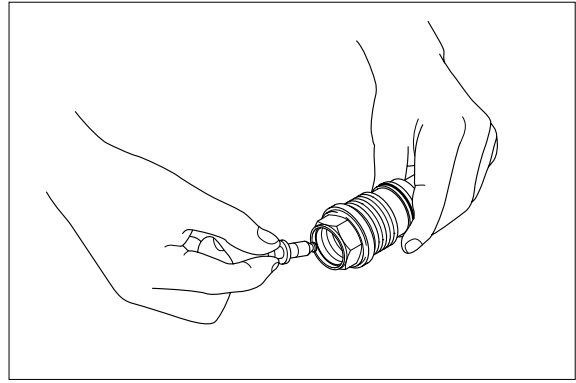
※ Apply hydraulic oil to valve(201) and then insert it to sleeve(202).

※ Align the center of hole in sleeve(202) with the axial center of valve(201) to prevent damage to the inner surface of the sleeve and outer surface of the valve due to contact.

· Tightening torque :  $10 \pm 2 \text{kgf} \cdot \text{m}$   
( $72.3 \pm 14.5 \text{lb} \cdot \text{ft}$ )

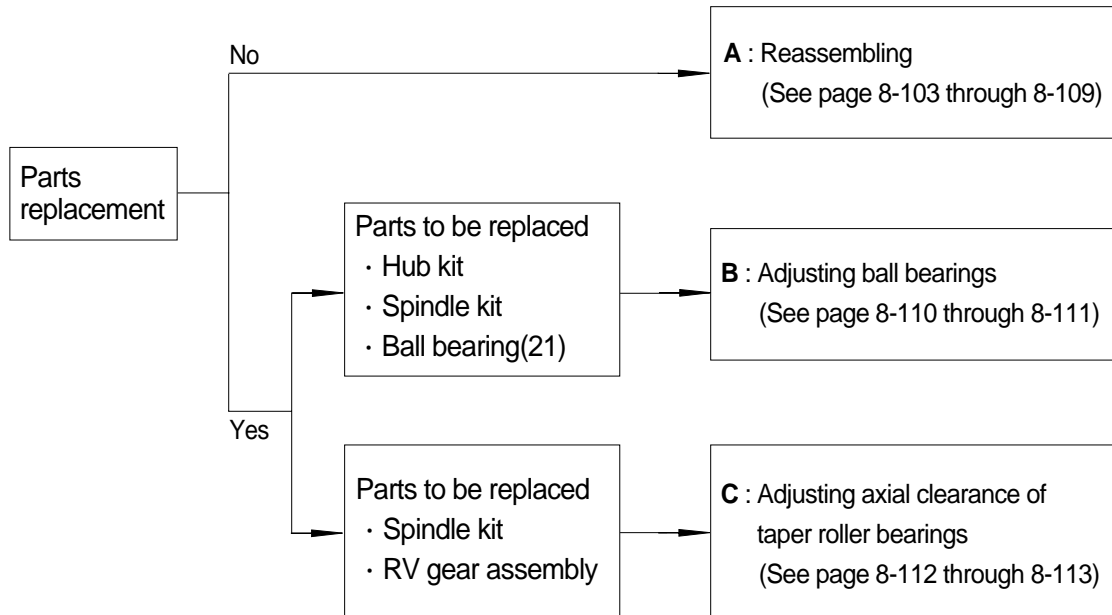
※ Use the disassembled parts, because the relief valve is pressure adjusted. When replacing the inner parts of the relief valve, therefore, the valve kit should be replaced.

※ Apply grease to mating surface of the shim and then fit into the plug. The above mentioned will keep the two faces practically glued together, the shim will not drop down when install the plug to the sleeve.



### 3) ASSEMBLY OF REDUCTION GEAR AND HYDRAULIC MOTOR

- ※ Before reassembling the reduction gear and the hydraulic motor following completion of parts replacement, one of the following two operations must be carried out:
  - Selecting a distance piece(12) of the appropriate thickness.
  - Selecting a thrust bearing(20) of the appropriate thickness.
- ※ Reassembling must be down only after clearance adjustment of these parts.
- ※ Prior to the start of reassembling, check for parts that require replacement.



- ※ If all of the above-name parts can be reused in reassembly, be sure to make these adjustments. Disregard of these adjustments will result in malfunction or premature failure of the motor.

## A : REASSEMBLING

### (1) Assembly of the hub(1) section

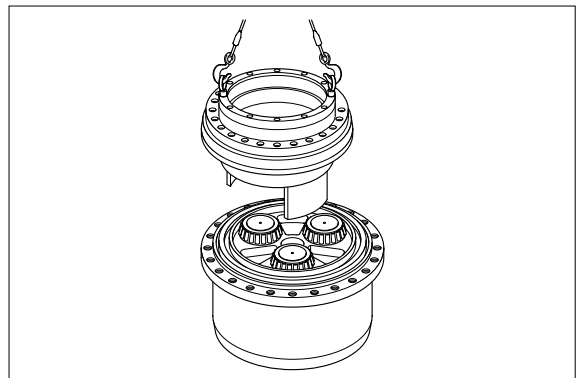
- ① Bring hub(1) in suspended state over to the work stand, and lower it into the stand slowly. Bolt the hub(1) to the stand by using three fixing jigs.
- ② Press ball bearing(21) into hub(1) by using fitting jig and hammer.
- ③ Install floating seal into hub(1) by using fitting jigs.
  - ※ Do not use grease put on O-ring.
  - ※ Install floating seal into hub(1) using installation jigs in the following order.  
Fitting jig, floating seal, then, fitting jig.  
Press fitting jig until it comes to touch fitting jig.
  - ※ Check to be sure that it is true and square in hub(1).

### (2) Assembly of the spindle(2)

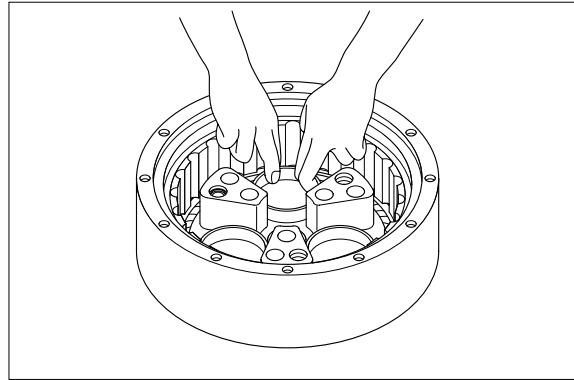
- ① Install floating seal into spindle(2) by using fitting jigs.
  - ※ Do not use grease put on O-ring.
  - ※ Install floating seal into spindle(2) using installation jigs in the following order.  
Fitting jig, floating seal, then, fitting jig.  
Press fitting jig until it comes to touch fitting jig.
  - ※ Check to be sure that it is true and square in spindle(2).

### (3) Assembly of the hub(1) and spindle(2)

- ① Install two eye bolts to tapped holes of spindle(2) in opposite positions.
- ② Lift and carry spindle(2) over in suspended state to hub(1) and gently lower it into hub(1).



- ③ Remove two eye bolts and install two fixing jigs to hold, hub(1) and spindle(2) in opposite. Tighten two fixing jigs equally.
- ④ Turn over the work stand to bring the hub (1) to top side.
- ⑤ Fit three outer races of taper roller bearings(22) into spindle(2).
- ※ Please turn over 180 degrees.



**(4) Assembly of the RV gear assembly**

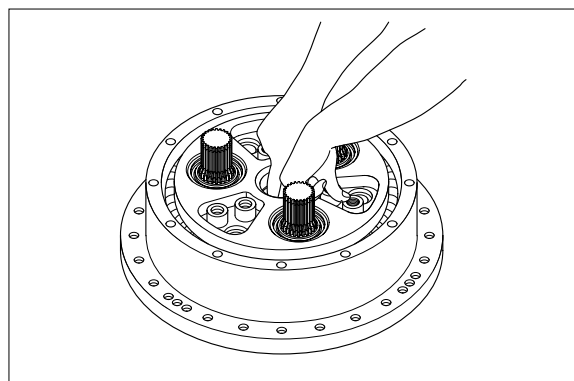
- ① Install lifter into center hole of RV gear assembly.
- ② Lift and carry RV gear assembly over in suspended state to spindle(2) and gently lower it into spindle(2).
- ③ Insert 24 parallel pins into between RV gear A(4), B(5) and hub(1).
- ※ Apply gear oil to each pins before inserting it.

**(5) Assembly of the ball bearing(21)**

- ① Press ball bearing(21) into hub(1) by using fitting jig and hammer.
- ※ When pressing ball bearing(21) into hub(1) be sure to keep it true and square by shifting hammer around.
- ② Install three outer races of taper roller bearings on it.

**(6) Assembly of the hold flange(3)**

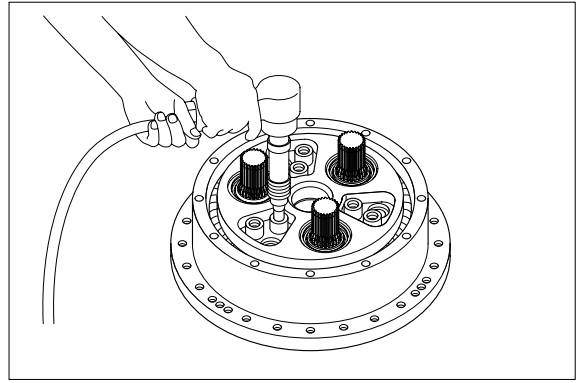
- ① Install hold flange(3) to spindle(2) by inserting it into ball bearings(21).
- ※ Install hold flange(3) to spindle(2) in the same position as before disassembly, as indicated by the mating marks for spindle (2) and crankshaft(9).



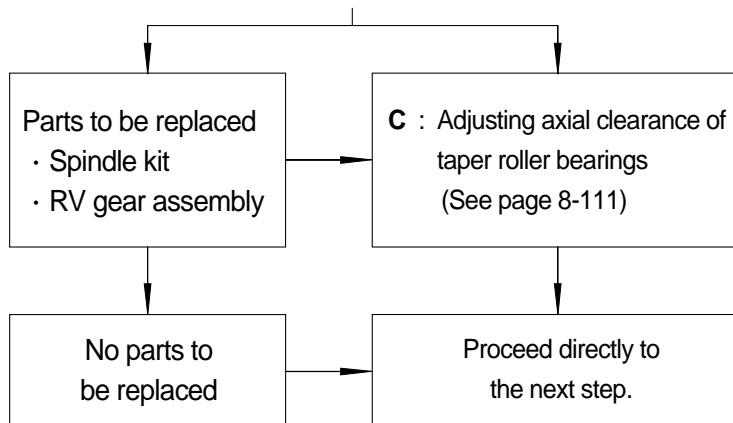
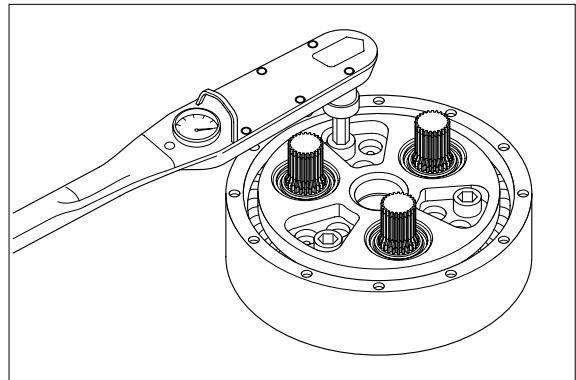
**(7) Assembly of the Parallel pins(34) and tighten hexagon socket bolts**

- ① Apply loctite to tapped holes and install plain washers into three bolts holes.
- ② Tighten three hexagon socket bolts with about 20kgf · m(144.7lbf · ft).
- ③ Drive parallel pins by air vibrator to the bottom of parallel pins holes.
- ④ Does calking by calking jig to parallel pins holes.

- ※ If parallel pins and hexagon socket bolts are smeared with oil or grease, degrease it with degreasing agent, clean it with solvent and let it stand and get dry.
- ※ Do not make a mistake a position and a direction.

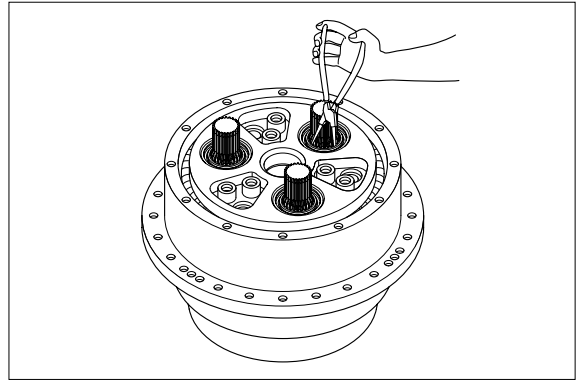


- ⑤ Tighten tree hexagon socket bolts with a torque of  $72.3 \pm 11 \text{kgf} \cdot \text{m} (522.9 \pm 79.6 \text{lbf} \cdot \text{ft})$ .



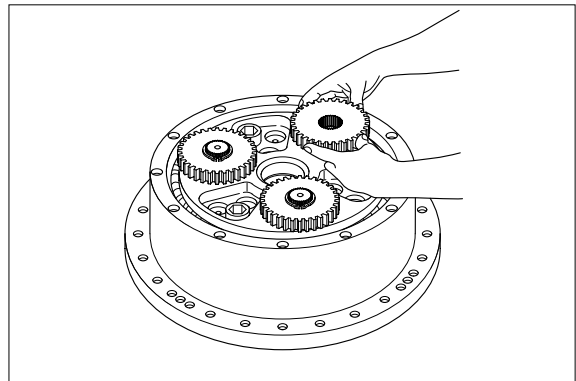
**(8) Assembly of the distance pieces and snap rings**

- ① Install distance pieces(13) into hold flange(3).
  - ② Install snap rings(20) into the snap rings grooves in hold flange(3).
- ※ Install distance pieces(13) and snap rings (20) in the same position as before disassembly as indicated by the matching marks on hold flange(3).

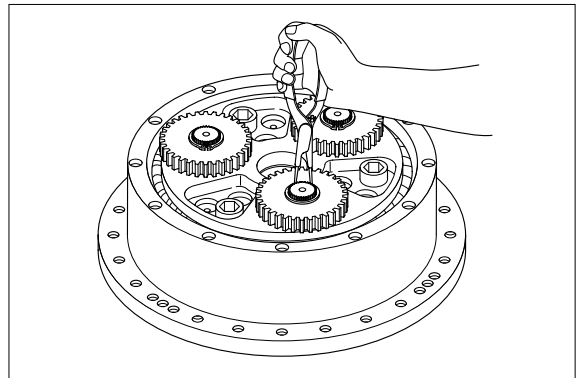


**(9) Assembly of the spur gears(7)**

- ① Install three spur gears(7) to crank shafts (9).
- ※ Install the gears to crank shafts in the same position defined by the matching marks, as illustrated here.

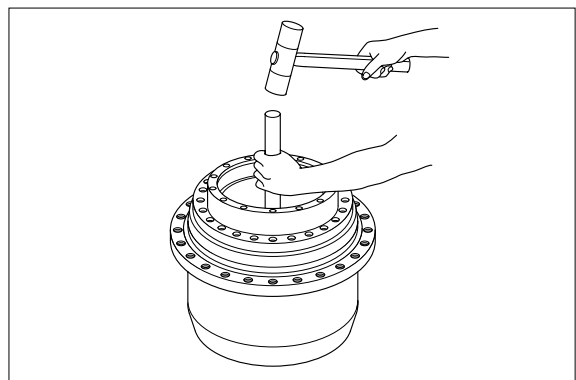


- ② Install three snap rings(25) into the snap rings grooves of crank shafts(9).
- ※ Snap rings(25) are possible to fly away.  
※ Sharp edge face should be upward.



**(10) Assembly of the oil seal(132)**

- ① Turn the work stand upside down.
  - ② Install oil seal(132) into the oil seals hole of spindle(2).
- ※ Apply lithium grease or withe petrolatum to the lip portion of oil seal(132), position the square over the bore of spindle(2).

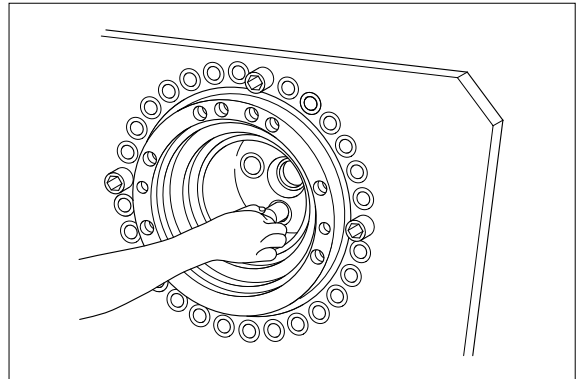


### (11) Assembly of the shaft(102)

- ① Install ball bearing(149) on shaft(102) by shrunk fitting.
- ※ Wear thick leather groves in handling the heated bearing.
- ※ Be sure to push the bearing all the way down until inner race seats on the shoulder.

### (12) Assembly of the piston assembly(161, 162)

- ① Install spring(193) into piston assembly (161, 162).
- ② Install it into spindle(2).
- ※ Apply grease to spring(193).
- ※ Apply hydraulic oil to piston assembly (161, 162).

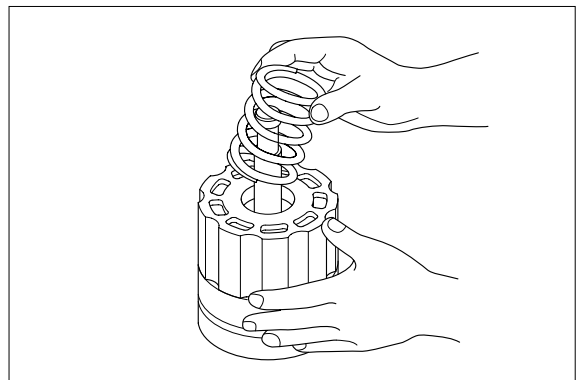


### (13) Assembly of the pivots(167)

- ① Fit two parallel pins(171) into spindle(2).
- ② Fit two pivots(167) to parallel pins(171).
- ※ Apply grease to the hemisphere surface of pivots(167).

### (14) Assembly of the cylinder block(104)

- ① Insert washer(110), spring(114), washer (110) in that order, into the shaft(102) bore of cylinder block(104).
- ② Set cylinder block(104) in the press in order to compress spring(114).
- ※ Wear thick leather groves in handling the heated bearing.
- ※ Be sure to push the bearing all the way down until inner race seats on the shoulder.

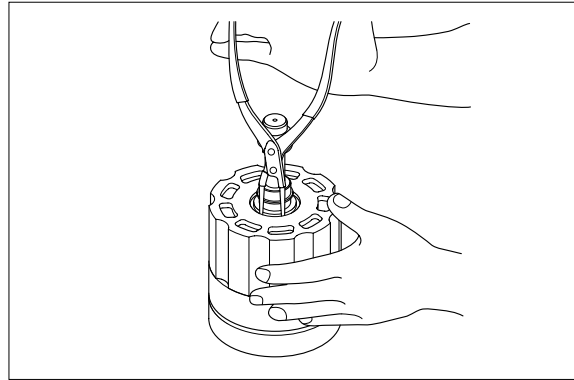


- ③ Place the retainer on the last inserted washer(110) and push down this tool with press arbor until the snap ring groove becomes cleared. Fit snap ring(145) into the groove and remove the press to leave the spring in compressed state.

※ When working on the cylinder block as above, protect its sliding face by covering it with a vinyl sheet, as shown.

※ Snap ring(145) are possible to fly away.

※ Refer to right drawing, how to install washers(110) and snap ring(145).

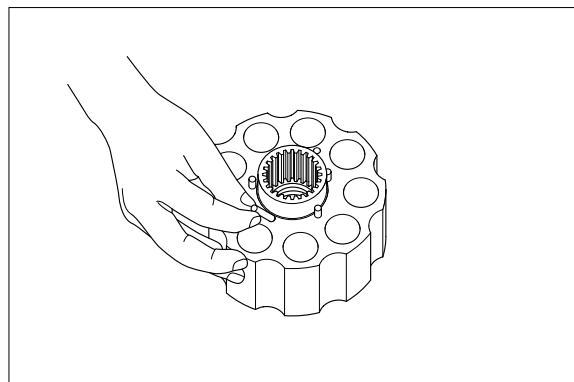


#### (15) Assembly of the motor assembly

- ① Install five needle rollers(151) to the pin holes of cylinder block(104).

② Install washer(111) onto five needle rollers(151).

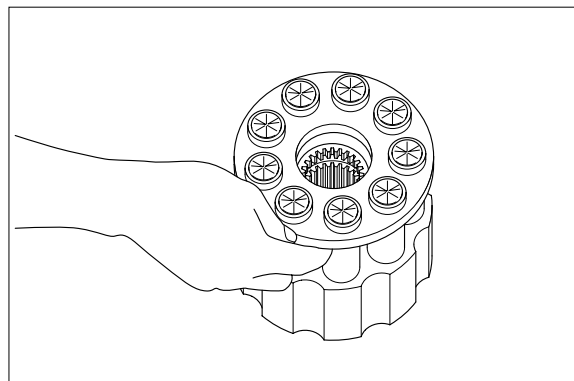
③ Install thrust bow(108) onto washer(111).



- ④ Insert nine piston assembly(105, 106) into retainer plate(107).

⑤ Insert it into cylinder block(104).

※ Immerse the sub assembly in hydraulic oil.



- ⑥ As usual under drawing, install swash plate(103), thrust ball(108), washer(111), retainer plate(107), needle rollers(151), cylinder block(104), piston assembly(105, 106) to shaft(102) and set lifter.

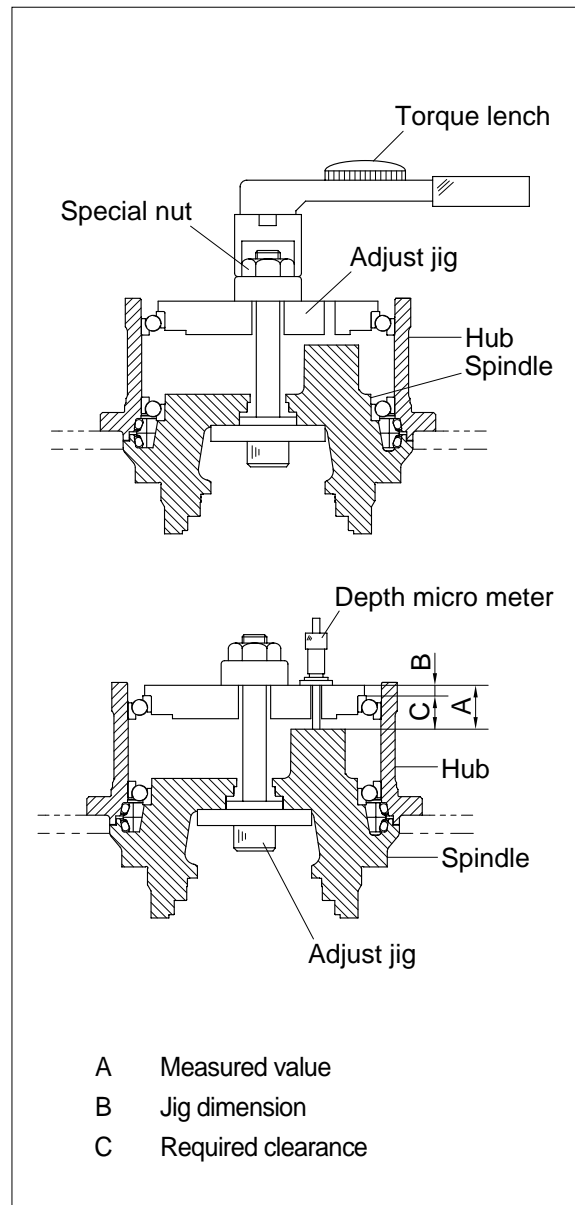


**(16) Assembly of the motor assembly**

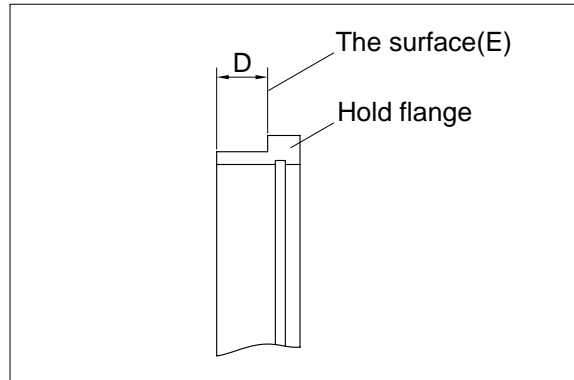
- ① Lift the motor assembly slowly and install it in spindle(2).
- ② After installed, remove lifter.
  - \* Two pivots holes of swash plate(103) adjust to matching two pivots(167).
  - \* Motor assembly does not injure by hitting another one.
  - \* After installed motor, turn cylinder block(104) by hand and check nothing loose. If cylinder block(104) is loose, again disassemble motor assembly and reassemble.

## B : ADJUSTING BALL BEARINGS

- ※ Ball bearings(22) must be given a correct pressure to serve its full life. If a part that affects the bearing pressure is replaced, therefore, readjust the bearing pressure according to the following procedure.
- ※ Take notice when motor is reassembled ensure that all adjustments are absolutely correct. Failure to have correct adjustments will result in damage to the motor early in use.
- ※ Parts that affect the bearing pressure include: Hub(1), spindle assembly and ball bearings(21).
- ※ Confirm and readjust the ball bearings pressure as follows:
  - (1) Attach the ball bearings pressure adjustment jig to spindle(2). Press fit ball bearings(21) into the hub(1) by tightening the special nut with a torque of  $12 \pm 2 \text{kgf} \cdot \text{m}$  ( $86.8 \pm 11.5 \text{lb} \cdot \text{ft}$ )
  - (2) Insert a depth micrometer through the measuring hole in ball bearings pressure adjustment jig and determine the depth as **A**.
  - (3) Because the **B** dimension of ball bearing pressure adjustment jig is known, clearance **C** can be determined as follows:
$$C = A - B$$



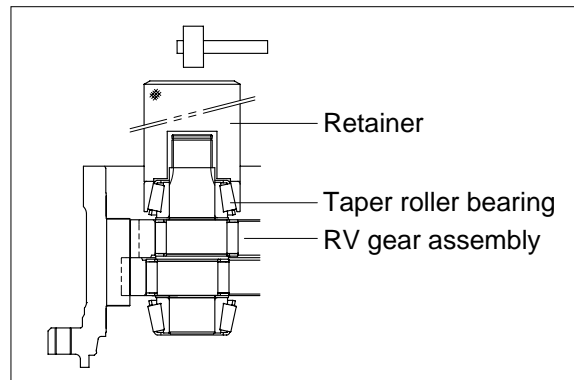
- (4) Measure dimension **D** of hold flange(3).
- (5) Based on the results obtained from step (2) through(4), adjust hold flange(3) as follows.(Dimension **C** is the required clearance of hold flange):
- ① If measured dimension **D** of hold flange (3) is smaller than the required value:  
Grind down surface **E** of hold flange(3) with a lathe or other machine so that dimension **D** equals the required value.
  - ② If measured dimension **D** of hold flange (3) is within the tolerance of the required value:  
Use hold flange(3) as it is.
  - ③ If measured dimension **D** of hold flange (3) is greater than the required value:  
Use a new spindle assembly.  
Dimension **D** of a new hold flange(3) allows for adjustment.
- (6) Remove the ball bearings pressure adjustment jig from spindle(2).



## C : ADJUSTING AXIAL CLEARANCE OF TAPER ROLLER BEARINGS

- ※ If any of the following parts has been replaced, readjust the axial clearance of the taper roller bearings(22) selecting distance pieces(13) having a suitable thickness:  
Hub(1), spindle assembly, RV gear assembly and snap rings(20).
- ※ Take notice when motor is reassembled ensure that all adjustments are absolutely correct.
- ※ Failure to have correct adjustments will result in damage to the motor early in use.
- ※ If none of the above parts has been replaced, on axial clearance adjustment is required.
- ※ Adjust the axial clearance of the taper roller bearings as follows:

- (1) Apply the retainer to the outer races of taper roller bearings(22) on the crankshafts(9) and lightly hammer it.
  - ※ Hammering makes insertion of the RV gear assembly into the spindle(2) easier.
- (2) Install the least thick distance pieces(13) in the hold flange(3).
- (3) Move the retainer to another point on distance pieces(13) each after lightly hammering it.
  - ※ Confirm that the RV gear assembly is secured to the spindle(2) in place.
- (4) Install the snap rings(20) in the snap ring grooves in the hold flange(3).
- (5) Measure the clearance between the snap rings(20) and the taper roller bearings(22) with a thickness gauge.



(6) Determine whether the thickness of the snap rings(20) is suitable.

$$\text{Max} = \boxed{\text{Thickness gauge thickness}} + \boxed{\text{Distance piece thickness}}$$

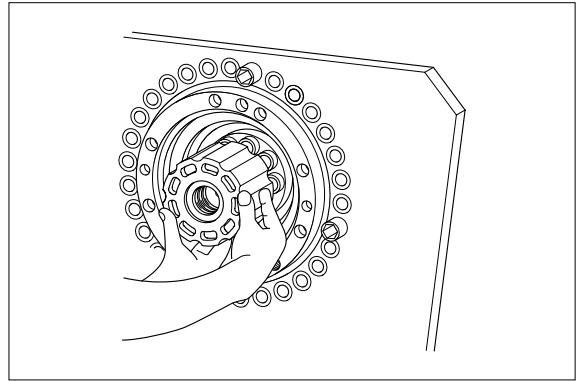
$$\text{Min} = \boxed{\text{Thickness gauge thickness}} + \boxed{\text{Distance piece thickness}} - 0.05$$

(7) Select another distance pieces from 17 available types, install it in between distance pieces(13) and snap rings(20).

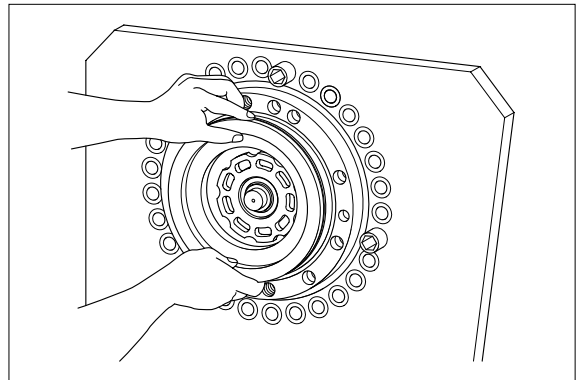
#### 4) ASSEMBLY PROCEDURE

##### (1) Assembling the brake valve section and hydraulic motor section

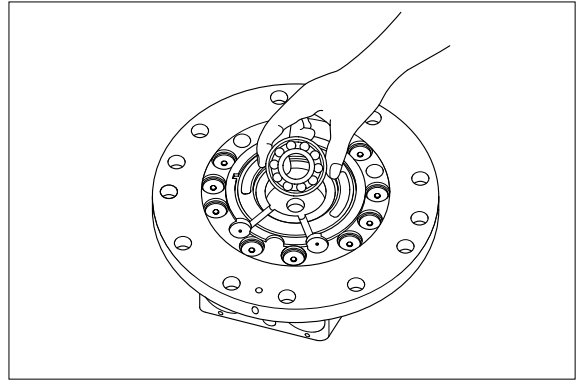
- ① Fit friction plate(115) and then mating plate(116), one by one, into the grooves of the outer surface of cylinder block(104).
  - ※ Immerse the friction plate in a hydraulic oil before fitting them.
  - ※ Do not make a mistake order, friction plate(115) and mating plate(116). Because it make braking torque down.



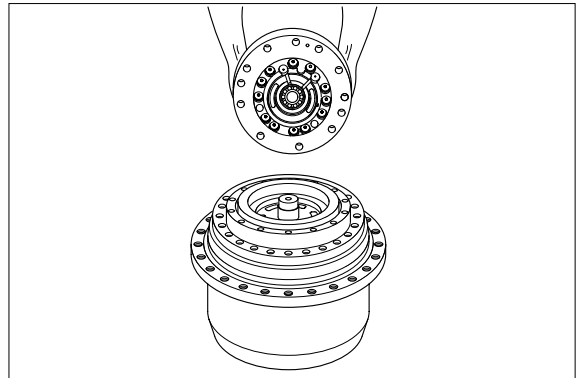
- ② Mount O-rings(135, 139) in the O-ring grooves of piston(112) after applying grease them.
- ③ Mount piston(112) in spindle(2).
  - ※ If the piston(112) do not fit into the spindle(2) because of the resistance of the O-ring tap the edge of the piston(112) lightly and equally with a plastic hammer. Be careful not to damage the O-ring at this time.



- ④ Ball bearing(150), parallel pin(341), timing plate(109), twelve springs(113) into the rear flange(101).
  - ※ Apply hydraulic oil to ball bearing(150). Apply grease timing plate(109) and twelve springs(113). Because the coat of grease will keep the two faces.



- ⑤ Hydraulic oil flow into spindle(2). Fit O-rings(27, 29) in the grooves provided in the mating face of spindle(2) without grease. Two parallel pins(42) into spindle(2). And install rear flange(301) onto spindle(2) so that the two parallel pins(42) on the spindle enter the dowel holes in the rear flange.
  - Quantity required : Hydraulic oil 1.7 liters

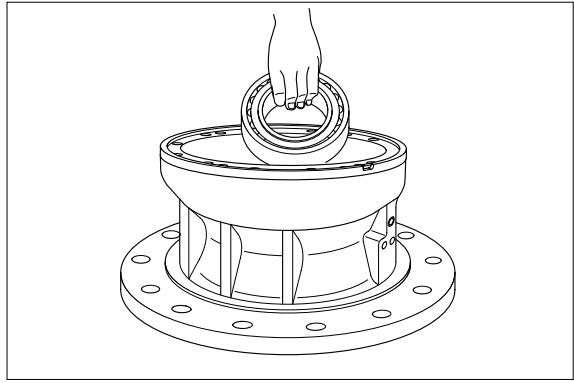


- ⑥ Tighten the twelve hexagon socket bolts (343) to the specified torque.

· Tightening torque :  $25.7 \pm 4 \text{kgf} \cdot \text{m}$   
( $185.9 \pm 28.9 \text{lb} \cdot \text{ft}$ )

- ⑦ The O-ring(355) insert a plug(357) and tighten it to the specified torque.(For not using drain port.)

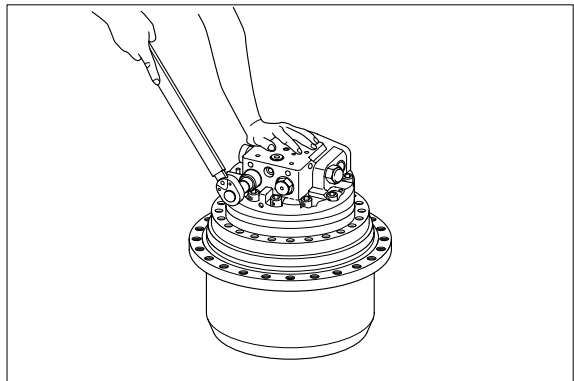
· Tightening torque :  $10 \pm 2 \text{kgf} \cdot \text{m}$   
( $72.3 \pm 14.5 \text{lb} \cdot \text{ft}$ )



- ⑧ Install relief valves to rear flange(301).

- ⑨ Tighten relief valves to the specified torque.

· Tightening torque :  $25 \pm 5 \text{kgf} \cdot \text{m}$   
( $180.8 \pm 36.2 \text{lb} \cdot \text{ft}$ )



## (2) Assembling the reduction gear / Hydraulic motor shafts and oil seal

- ① Install coupling(15) to motor shaft.

- ② Install input gear(6) to coupling(15). And steel ball(36) put into the hole of input gear(6).

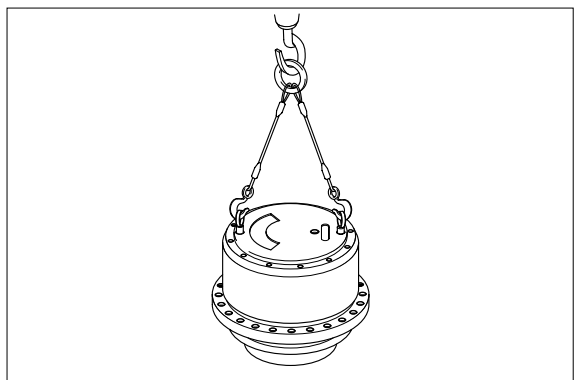
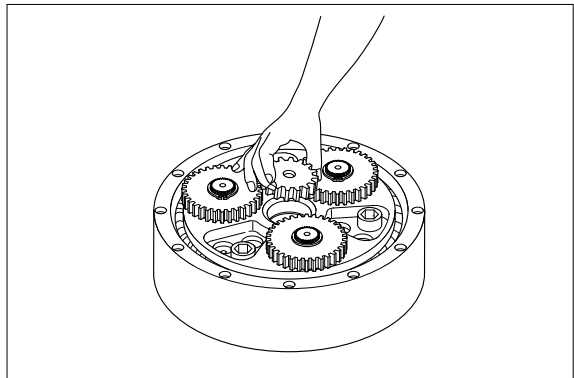
※ Apply grease to steel ball(26).

- ③ Fit O-ring(30) in the O-ring groove of cover(8).

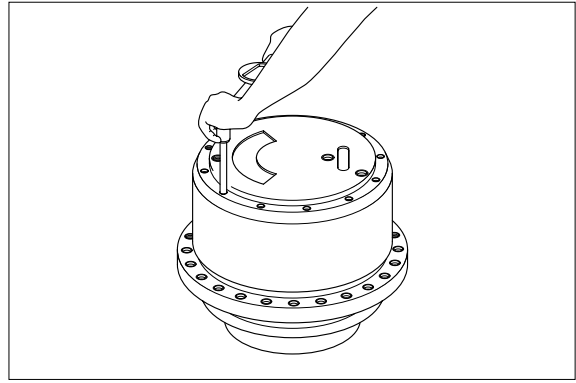
※ Apply grease to O-ring(30).

- ④ Lift and install cover(8) to hub(1) by using eye bolts, plastic hammer and lifting tool.

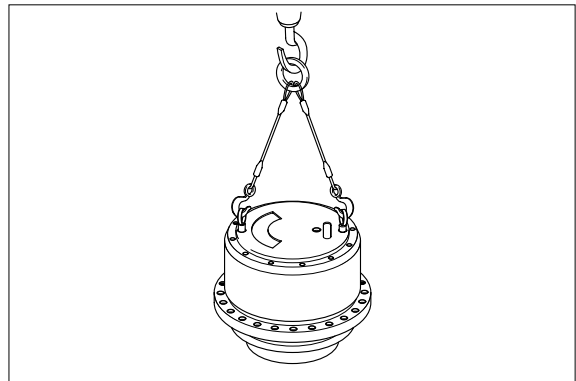
※ Need careful handling for not damaging O-ring(30).



- ⑤ Tighten the twelve hexagon socket bolts (35) to the specified torque.
- ⑥ Gear oil flow into the hub(1).
- Tightening torque :  $10.4 \pm 1.6 \text{kgf} \cdot \text{m}$   
( $75.2 \pm 11.6 \text{lb} \cdot \text{ft}$ )
  - Quantity required : Gear oil 5.4 liters



- ⑦ The O-ring(43) insert hexagon socket plugs(33) and tighten it to the specified torque.(For three gear oil ports.)
- Tightening torque :  $10 \pm 2 \text{kgf} \cdot \text{m}$   
( $72.3 \pm 14.5 \text{lb} \cdot \text{ft}$ )



- ⑧ This completes assembly.

