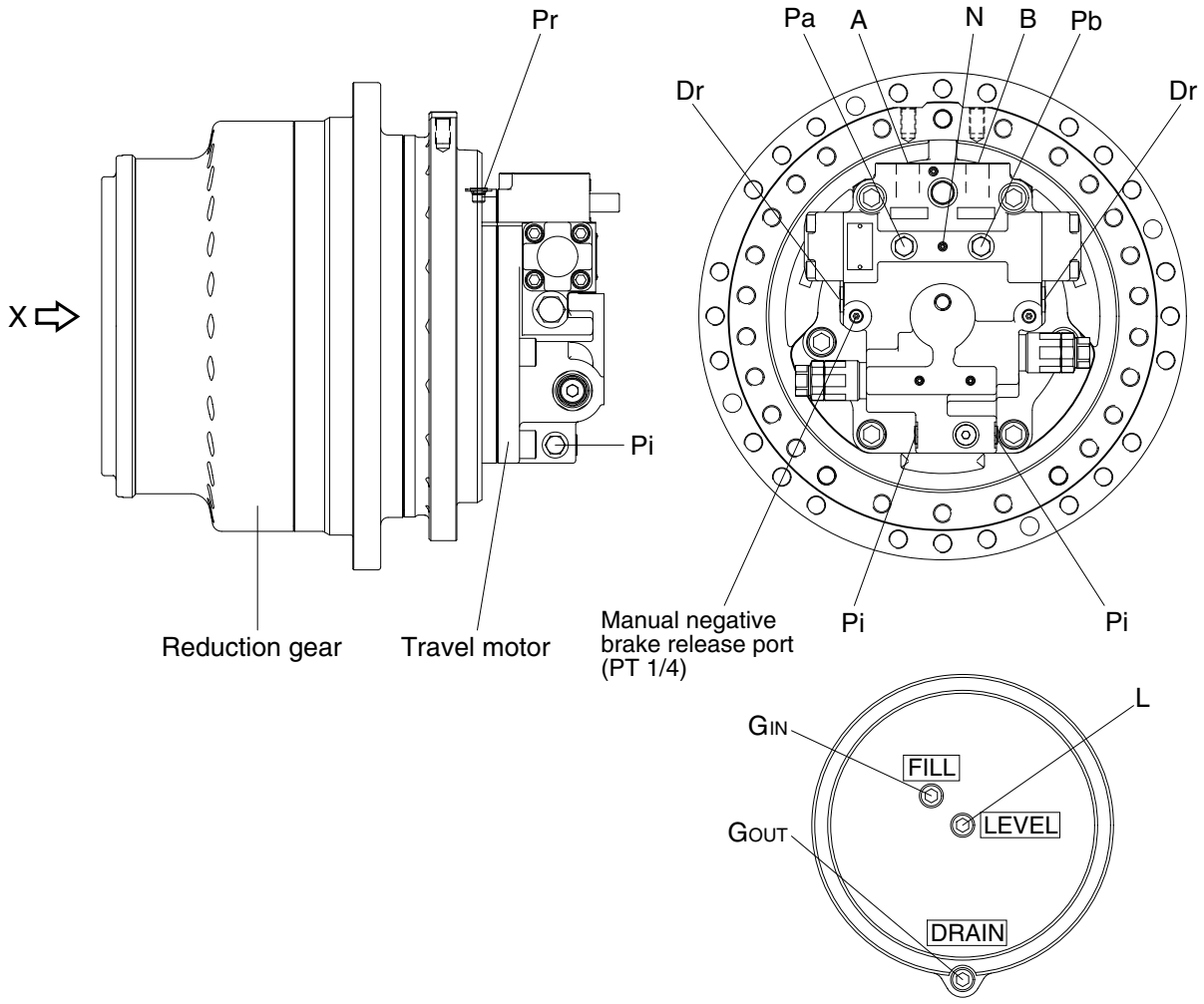
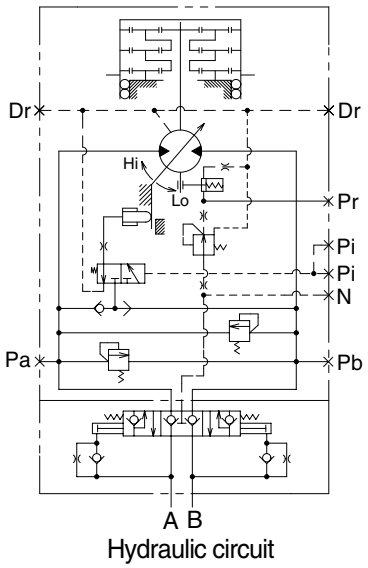
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

Travel device consists travel motor and gear box.

Travel motor include counter balance valve, cross over relief valve.

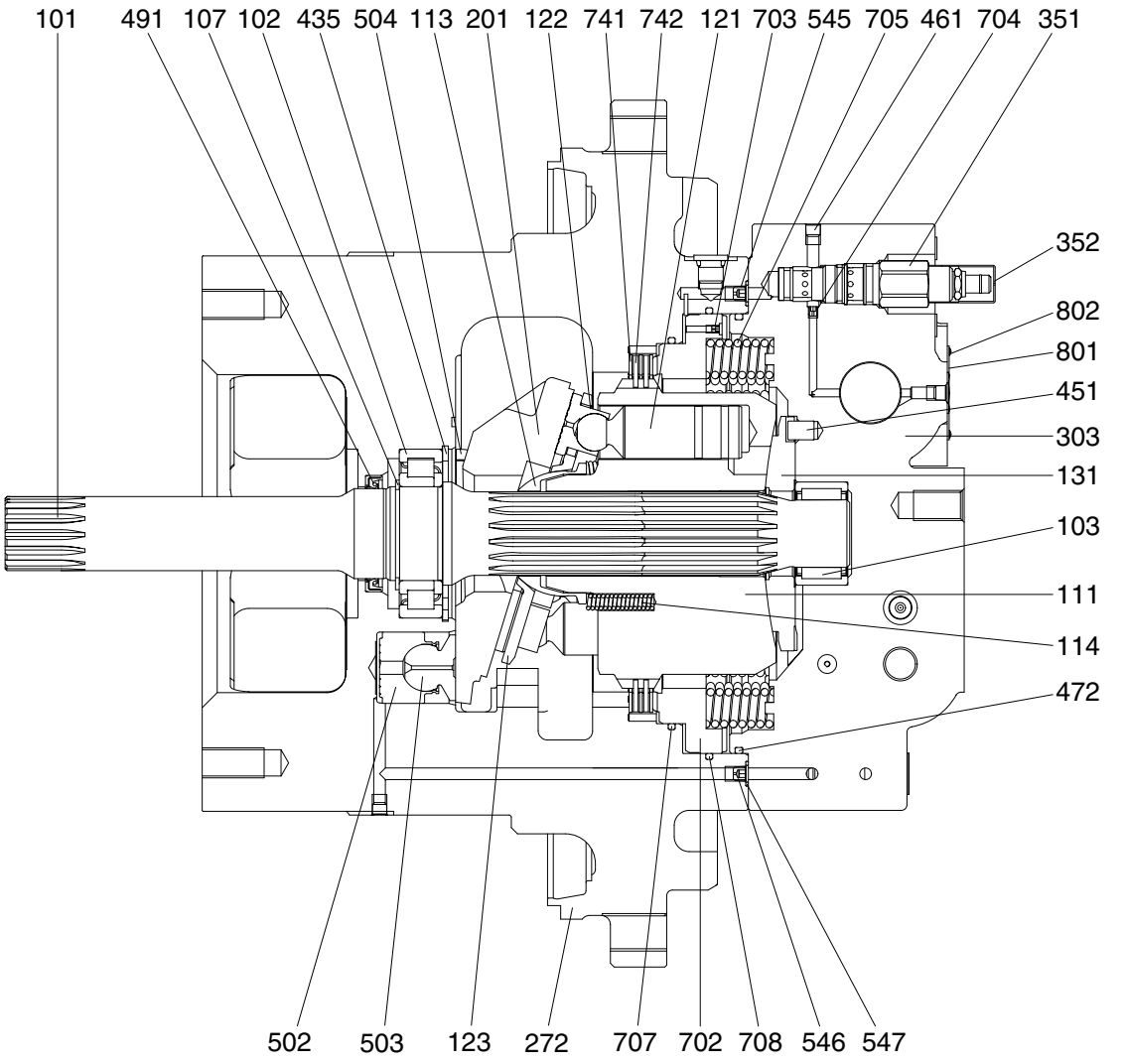




Hydraulic circuit

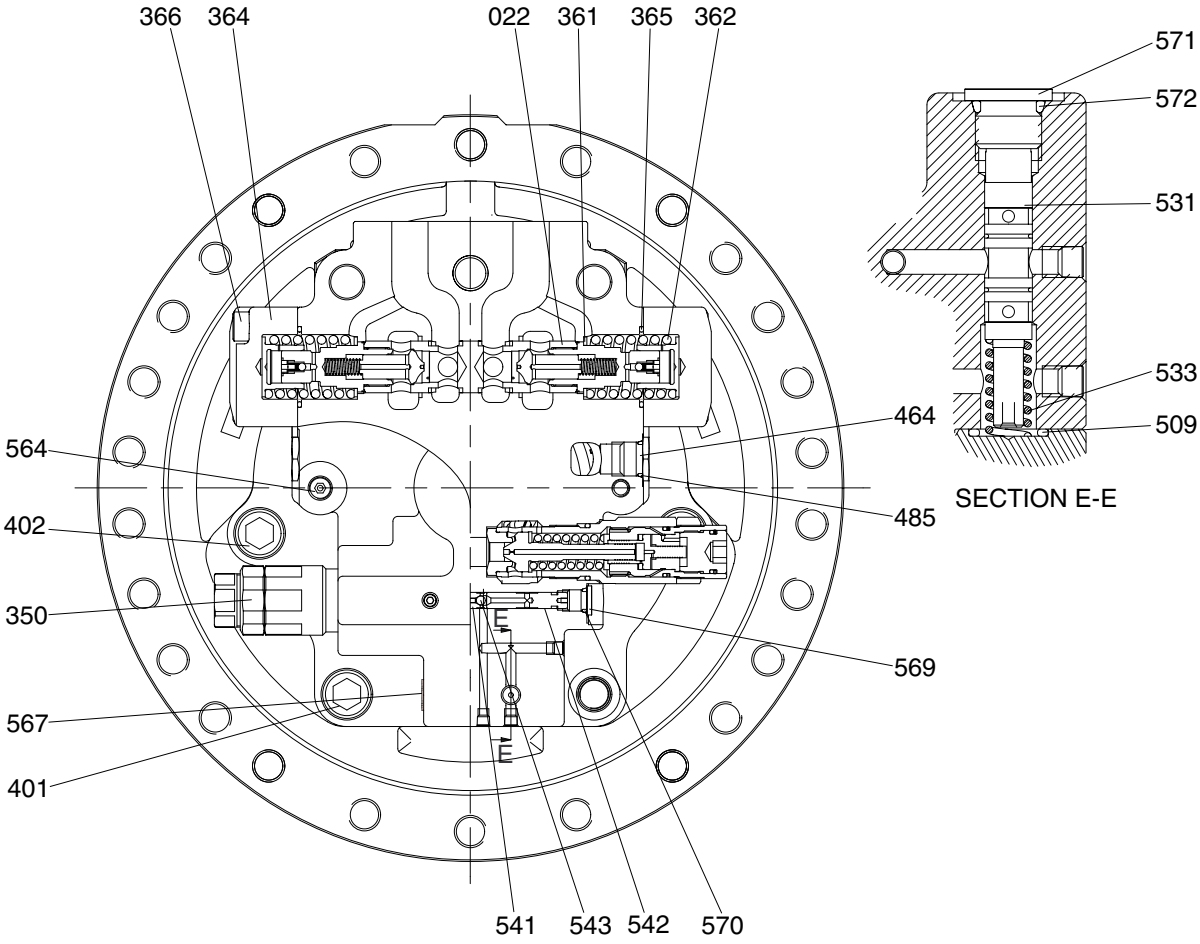
Port	Port name	Port size
A	Main port	SAE 6000 psi 1"
B	Main port	SAE 6000 psi 1"
Pi	Pilot port	PF 1/4
Dr	Drain port	PF 1/2
N	Negative brake release port	NPTF 1/16
Pa, Pb	Pressure gauge port	PF 1/4
Pr	Brake release pressure gauge port	PF 1/4
L	Level gauge	PF 1/2
GIN	Gear oil inlet port	PF 1/2
GOUT	Gear oil drain port	PF 1/2

1) TRAVEL MOTOR(1/2)



101	Drive shaft	303	Valve casing	547	O-ring
102	Roller bearing	351	Reducing valve	702	Brake piston
103	Needle bearing	352	Cover	703	Orifice
107	Snap ring	435	Snap ring	704	Orifice
111	Cylinder block	451	Pin	705	Brake spring
113	Spherical bushing	461	Plug	707	O-ring
114	Cylinder spring	472	O-ring	708	O-ring
121	Piston	491	Oil seal	741	Separation plate
122	Shoe	502	Piston	742	Friction plate
123	Set plate	503	Shoe	801	Name plate
131	Valve plate	504	Pivot ball	802	Rivet
201	Swash plate	545	Orifice		
272	Shaft casing	546	Orifice		

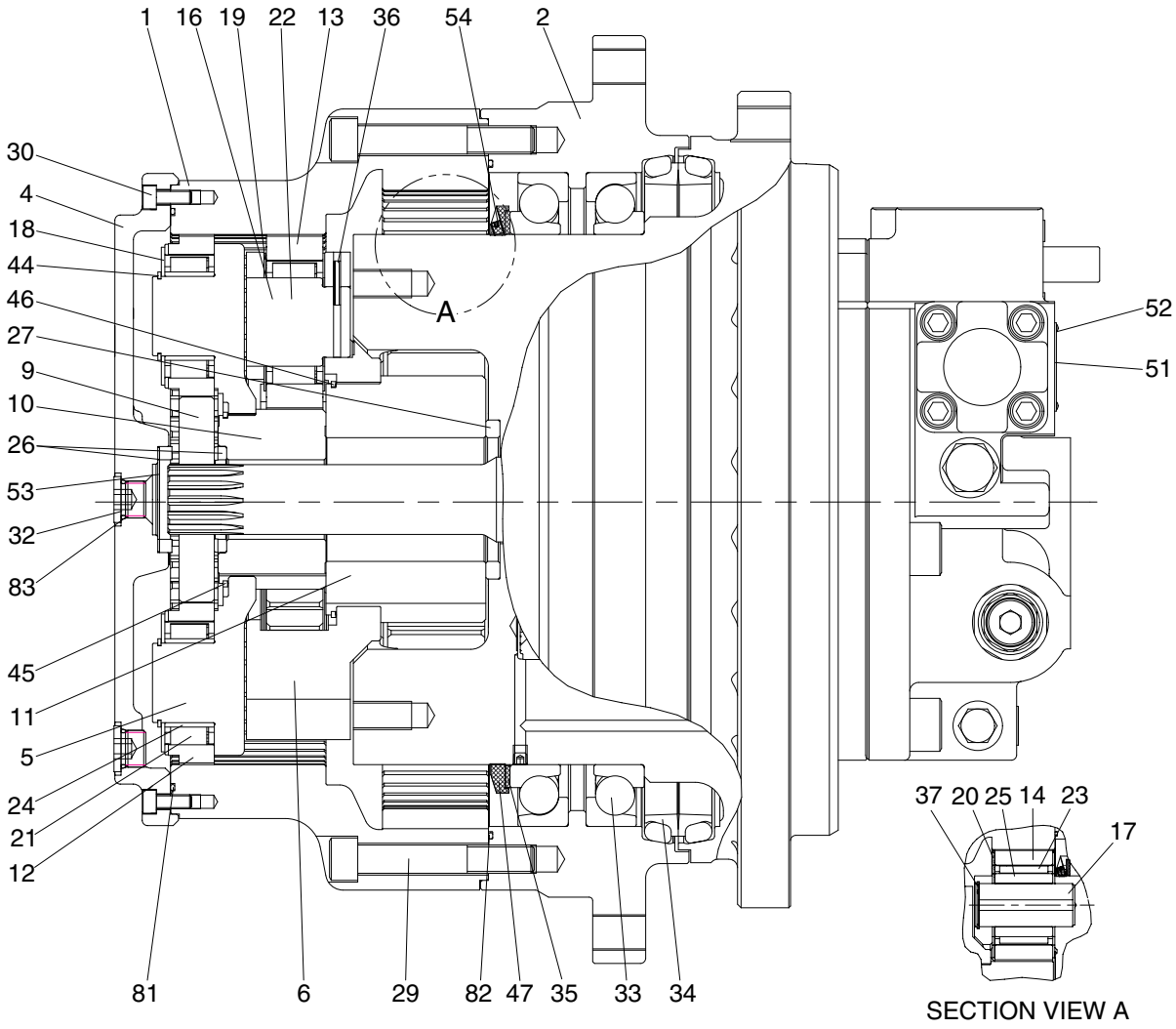
TRAVEL MOTOR(2/2)



37007TM03

022	Counterbalance spool	402	Hex socket bolt	543	Steel ball
350	Relief valve	464	VP plug	564	Plug
361	Washer	485	O-ring	567	VP plug
362	Counterbalance spring	509	O-ring	569	RO plug
364	Counterbalance cover	531	Tilting spool	570	O-ring
365	O-ring	533	Tilting spring	571	RO plug
366	Hex socket bolt	541	Seat	572	O-ring
401	Hex socket bolt	542	Stopper	702	Brake piston

2) REDUCTION GEAR

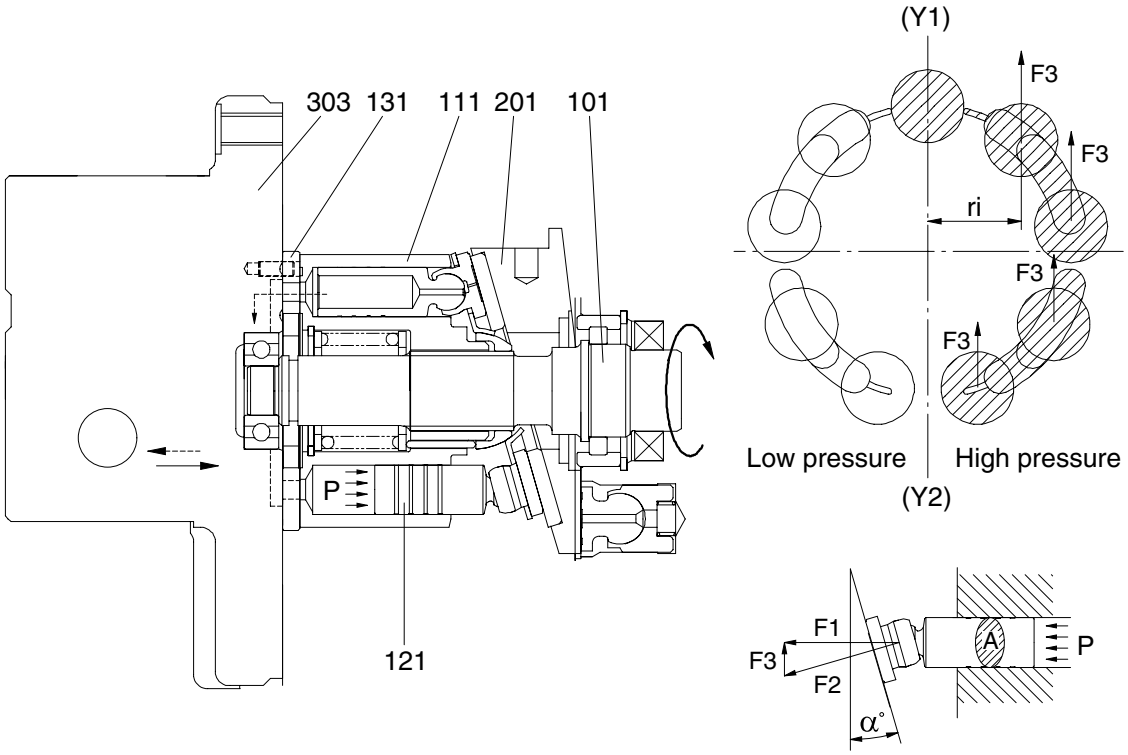


37007TRG01

1	Ring gear	19	Side plate	35	Shim
2	Housing	20	Side plate	36	Spring pin
4	Side cover	21	Needle cage	37	Snap ring
5	Carrier 1	22	Needle cage	44	Snap ring
6	Carrier 2	23	Needle cage	45	Clip
9	Sun gear 1	24	Inner ring	46	W clip
10	Sun gear 2	25	Floating bushing	47	Nut ring
11	Sun gear 3	26	Thrust ring	51	Name plate
12	Planetary gear 1	27	Thrust ring	52	Rivet
13	Planetary gear 2	29	Socket bolt	53	Washer
14	Planetary gear 3	30	Socket bolt	54	Set screw
16	Pin 2	32	RO plug	81	O-ring
17	Pin 3	33	Angular bearing	82	O-ring
18	Side plate	34	Floating seal	83	O-ring

2. FUNCTION

1) GENERATION OF TORQUE



The pressurized oil delivered from the hydraulic pump flows to valve casing(303) of the motor, passes through the brake valve mechanism, and is introduced into cylinder block(111) via valve plate(131). This oil constructively introduced only to one side of (Y1)-(Y2) connecting the upper and lower dead points of stroke of piston(121). The pressurized oil led to one side in cylinder block(111) pushes each piston(121) four or five and generates a forec [F(kgf) = P(kgf/cm^2) $\times$ A(cm^2)].

This force acts on swash plate(201), and is resolves into components(F2 and F3) because swash plate(201) is fixed at an angle(α) with the axis of drive shaft(101).

Radial component(F3) generates respective torques(T=F3$\times$ri) for (Y1)-(Y2). This residual of torque[T=S(F3$\times$ri)] rotates cylinder block(111) via piston(121).

Since the cylinder block(111) is spline coupled with drive shaft(101).

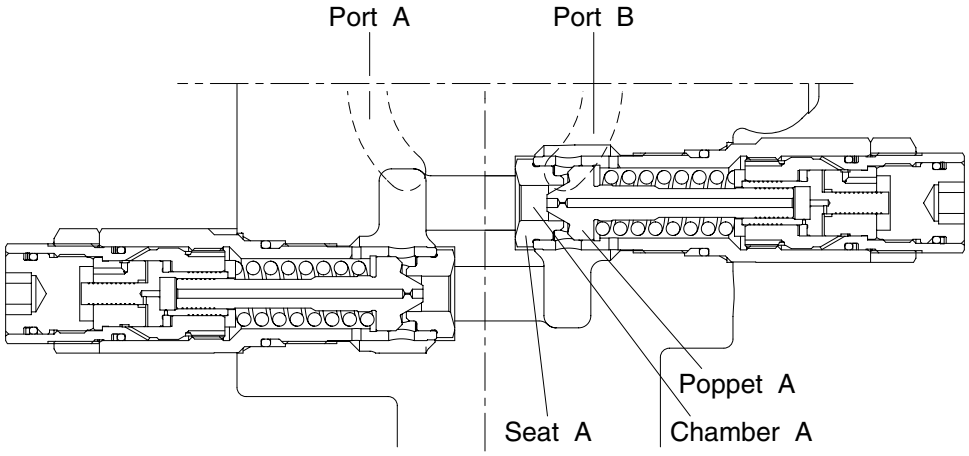
So the drive shaft(101) rotates and the torque is transmitted.

2) RELIEF VALVE

The relief valve mainly has the following two functions :

(1) To keep the starting pressure of the hydraulic motor at a constant value and bypass to the return line excessive oil generated at the motor inlet depending upon the acceleration speed of the driven inertia.

(2) To generate a brake pressure at the outlet during stopping of the driven inertia, and stop it forcedly.

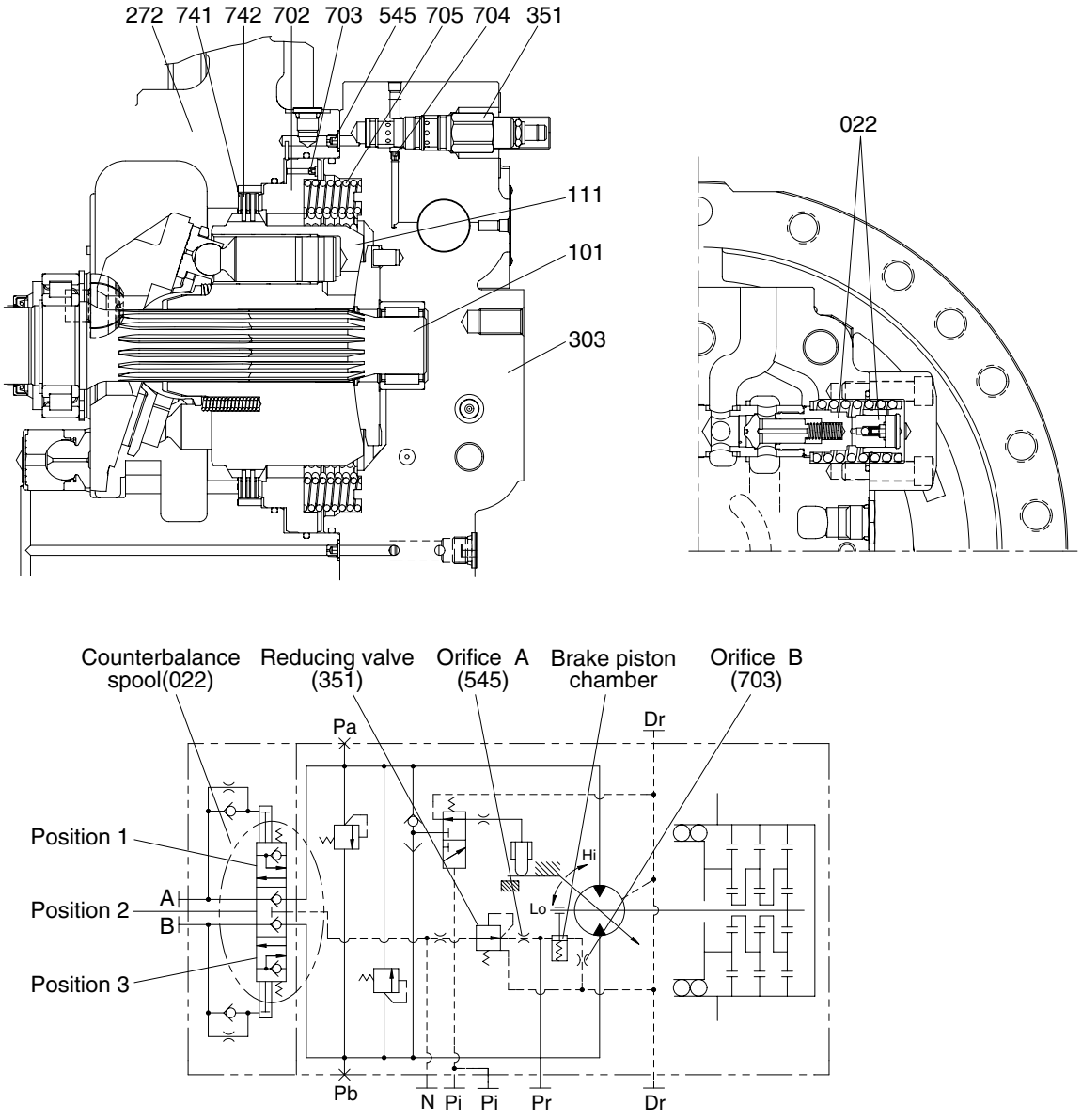


3607A2TM06

The chamber A is always connected to the port A of the motor.
When the pressure at port A increases and the force pushing poppet A is higher than the set pressure of the spring, then poppet A is pushed up from the contact surface of seat A, and oil flows from chamber A to port B.

3) NEGATIVE BRAKE

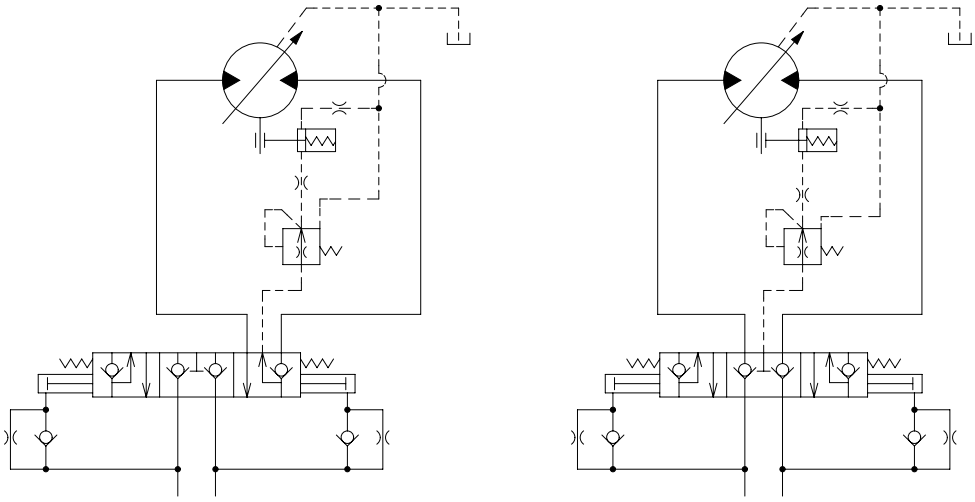
The negative brake is released applying to the brake piston(702) the pressure led through the built-in counterbalance spool sub-assembly(022).
With no pressure working, the brake force is always ensured.



37072TM01

The brake force is the friction force generated on the surfaces of the friction plates(742) spline-coupled with the cylinder block(111), when their rotation is restricted by the shaft casing(272), separation plate(741), and brake piston(702).
Without pressure being applied to the brake piston, the brake piston is pushed by fourteen brake springs(705), and the friction plate and separation plate are held between the brake and shaft casing. This holding force functions as the friction force. This friction force restrains the shaft(101) spline-coupled with the cylinder block, and this function is the brake.

4) PRESSURE RELEASE VALVE (Flow control valve)



3607A2TM08

This brake is of a backpressure-insensitive type. In other words, since the counterbalance spool used be overlapped at the neutral position, the pressure release valve prevents the circuit backpressure from working into the brake chamber when the machine stops traveling and works, and so the specified brake torque is available even on a slope.

During normal traveling, the pressure coming through the counterbalance valve is applied to the brake chamber to release the break, and is also applied to the pressure release valve section.

This pressure release valve is of a constant differential pressure type, and irrespective of the working pressure, the passing flow is constant and approximately 1 to 2 ℓ / min.

When the condition changes from traveling to stop, the counterbalance spool returns to its neutral position. The brake piston is pushed by the brake spring, and the oil in the brake chamber flow to the motor drain line via the pressure release valve. Then the brake torque is generated.

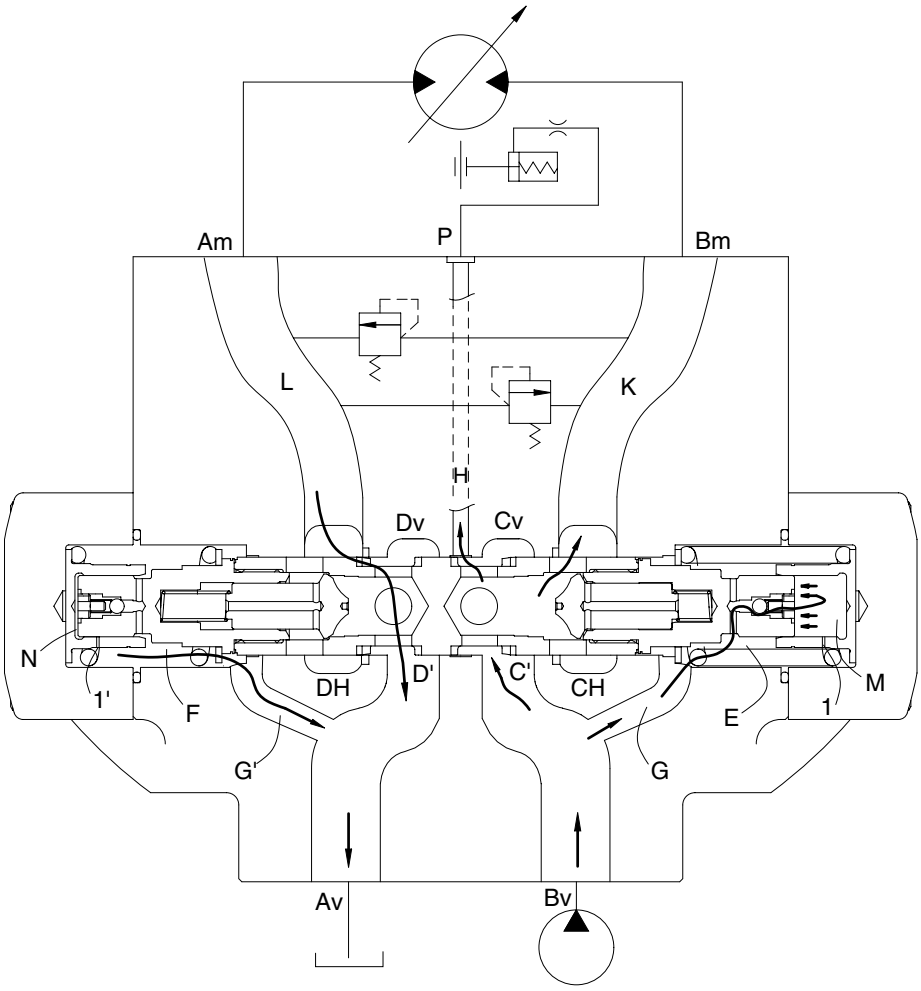
5) RELEASING METHOD OF NEGATIVE BRAKE

In releasing the negative brake without applying the brake releasing pressure, follow the procedures shown below.

Details of work	Tools
Remove two plugs(564) from the valve casing(303). (For their position, see the attached installation dimension) Tighten an M10 screw of 135mm in length into a tapped hole of the brake piston(702). Then the condition having the brake release pressure is attained and the brake is released.	Socket wrench 6mm 8mm

Note : Even with the negative brake released, the hydraulic motor will not turn. When it is difficult to generate the working pressure due to failure of the pump or so, and the whole machine is to be pulled for transportation without removing the hydraulic motor, connect pressure measurement ports A_M and B_M with a short hose or something. Then the machine can be pulled slowly.

6) COUNTERBALANCE VALVE



Suppose port Bv is connected to the hydraulic pump and Port Av, to the tank. The oil supplied from the hydraulic pump passes through Bv, Cv and C' in sequence, pushes up the poppet of the check valve, passes through K to Port Bm, and is supplied to the hydraulic motor to turn it.

Therefore, the pump discharge oil pressure increases, and the pressure is led via passage G to spring room E and via the ball check valve to dumping room M. When the pressure in rooms E and M exceeds the value equivalent to the force of the spring which holds the spool at its neutral position, the spool begins to move left. Since the working oil in room N flows into room F via throttle 1' or clearance 2' and that in room F is discharged via passage G' through port Av to the tank, the spool moves left to have passage L-Dm-D'-Dv composed. In addition, passage Cv-H-P is also composed, and the pump discharge pressure in port Bv is led to port P.

Because of the throttle or clearance provided for the working oil flow from room N, this changeover motion of the spool is comparatively slow.

When the pump discharge pressure is higher, the spool movement is larger and the above opening area of the spool is larger.

When the pump discharge pressure falls, pressures in rooms E and M fall and the spool will move right due to the spring on the room F side.

Since working oil in room M flows to room E via throttle 1 and that in room E, to port Bv via passage G, the spool moves right.

When the pressure at port Bv falls down to the tank pressure, the pressure in room E also falls to the tank pressure and becomes equal to that in room F, and so the spool returns to its neutral position.

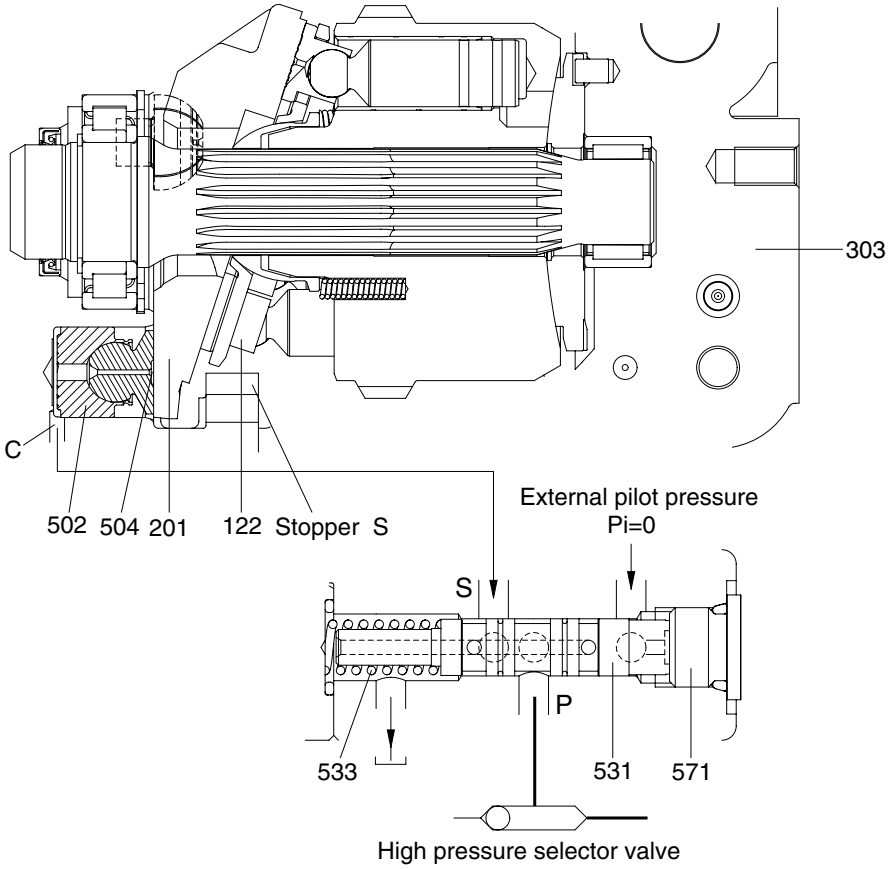
7) DISPLACEMENT CHANGEOVER SECTION

As a supporting mechanism for the swash plate(201) on which the shoes(122) slide, the pillar system is adopted to support the load with semi-cylindrical sliding bearings provided at both ends of the mechanism.

The capacity is changed by changing the tilting angle of this swash plate.

This is a mechanism that swash plate was pushed by tilting position, and the tilting angle of the swash plate is decided in two positions (Large and Small) by controlling the flows to and from these piston rooms with the displacement changeover valve section.

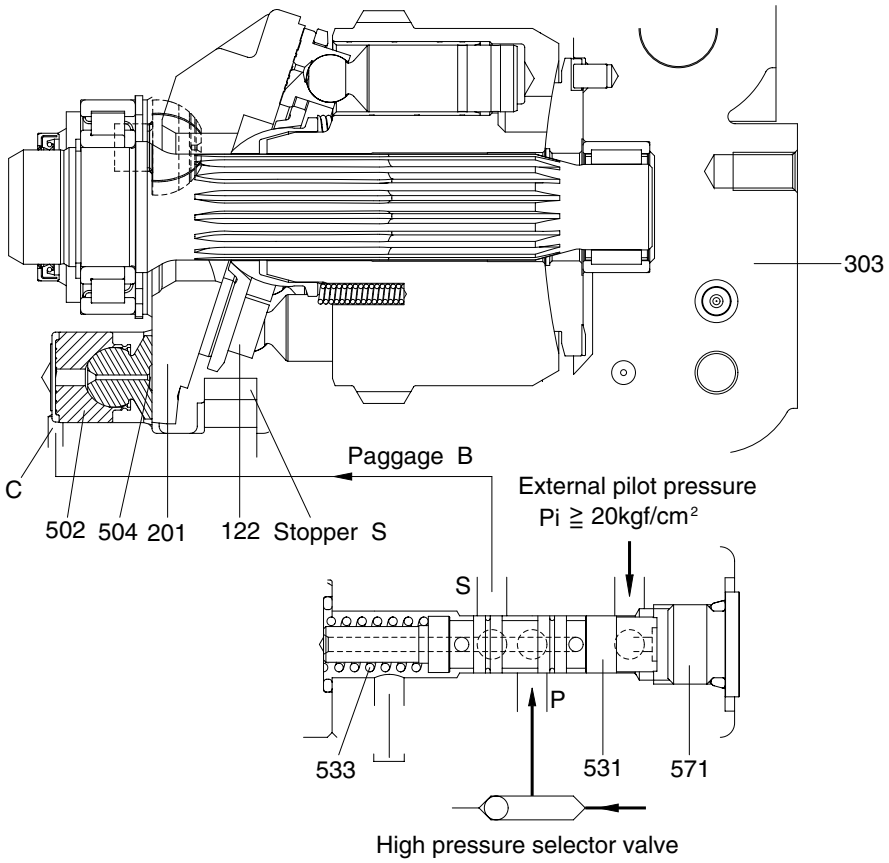
(1) External pilot pressure : $P_i = 0$ ..... Large displacement



3607A2TM04

By means of the built-in high pressure selector mechanism in the valve casing(303), the high pressure oil working on the motor functions to port P of the displacement-changeover valve. This pressure becomes the servo pressure. Since the spool(531) assembled in the displacement changeover valve is pressed to plug(571) by thy spring(533), the high pressure oil at port P is enclosed.

(2) External pilot pressure : Pi § [20kgf/cm² ——— small displacement

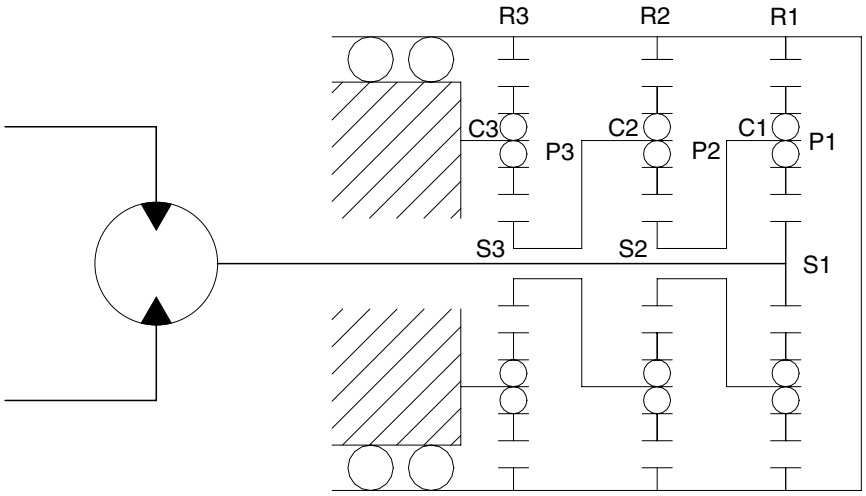


3607A2TM05

The force working on the spool(531) of the displacement-changeover valve becomes higher than that of the spring(533), and the spool moves left. The high pressure oil flows from port P of the displacement-changeover valve through port S and passage B to room C where it works.
The displacement changeover piston(502) is pushed light by the high pressure oil and the swash plate moves in the arrowed direction. The swash plate moves until it touched stopper S, and then is fixed there.

8) REDUCTION GEAR

The reduction gear is composed of a three-stage planetary gear mechanism shown in the following figure. Since the sun gear is designed to have a floating mechanism, errors of the gears and carrier pin hole pitches will not affect the gears' lives heavily.



3607A2TRG04

The input rotation of the hydraulic motor is transmitted to No. 1 sun gear (S1) and this drives No. 1 planetary gears (P1). This No. 1 planetary gears (P1) drive No.1 ring gear (R1) with the same force as the meshing tangential force with No. 1 sun gear (S1), and also No. 1 carrier (C1) with the same force as the meshing reaction force. In other words, No. 1 planetary gears (P1) revolve rotating. This rotation of No. 1 carrier (C1) becomes the output of the 1st stage, and is transmitted directly to No. 2 sun gear (S2).
(No. 1 carrier is spline-coupled with No. 2 sun gear.) Similarly the revolution of No. 2 planetary gear (P2) are transmitted via No.2 carrier (C2) to No. 3 sun gear (S3). Since No. 3 carrier (C3) supporting No. 3 planetary gears (P3) are fixed, No. 3 planetary gears (P3) do not revolve, but rotates to drive No. 3 ring gear (R3).
Therefore, the rotating case is driven by the overall driving torque of No1, 2 and 3 ring gears.
This reduction ratio is expressed as shown below:

$$i = \frac{(Z_{S1} + Z_{R1})\,(Z_{S2} + Z_{R2})\,(Z_{S3} + Z_{R3})}{Z_{S1} \cdot Z_{S2} \cdot Z_{S3}} - 1$$

where Z : Number of teeth of each gear
The direction of rotation is reverse to that of the input shaft.