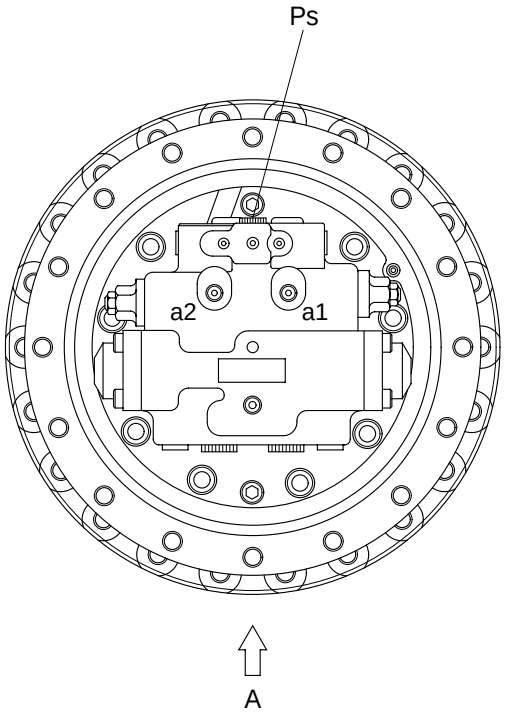
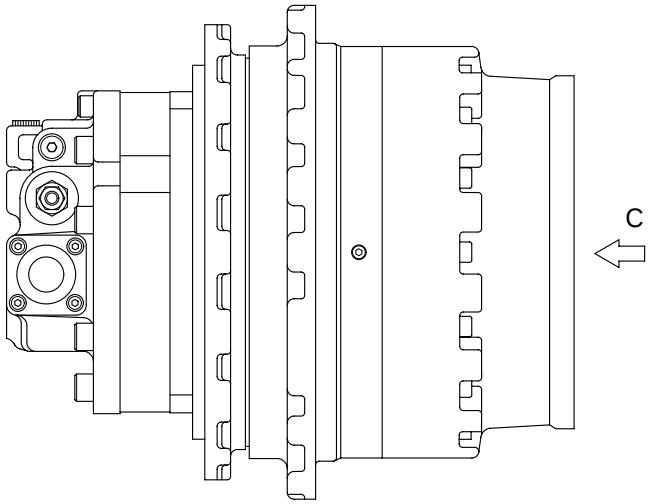
GROUP 4 TRAVEL DEVICE

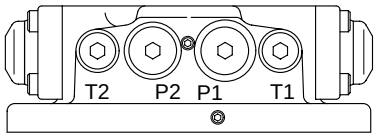
1. CONSTRUCTION

Travel device consists travel motor and gear box.

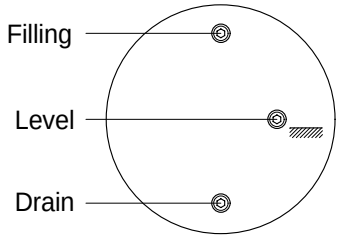
Travel motor include counter balance valve, cross over relief valve.



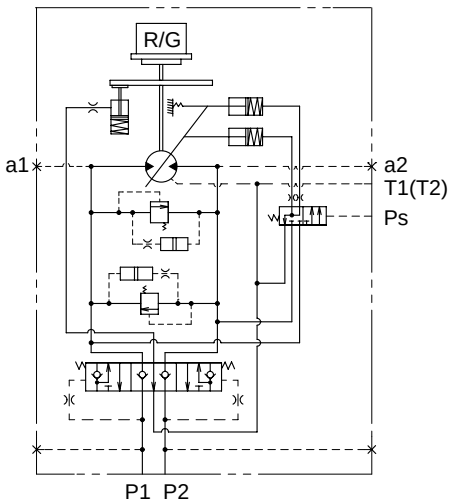




VIEW A



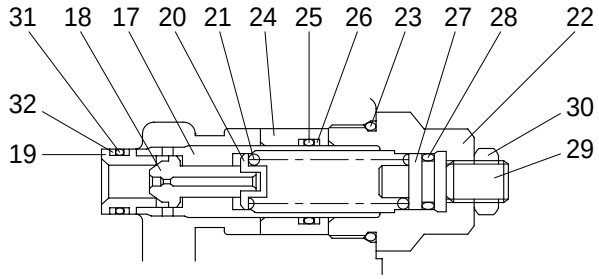
VIEW C



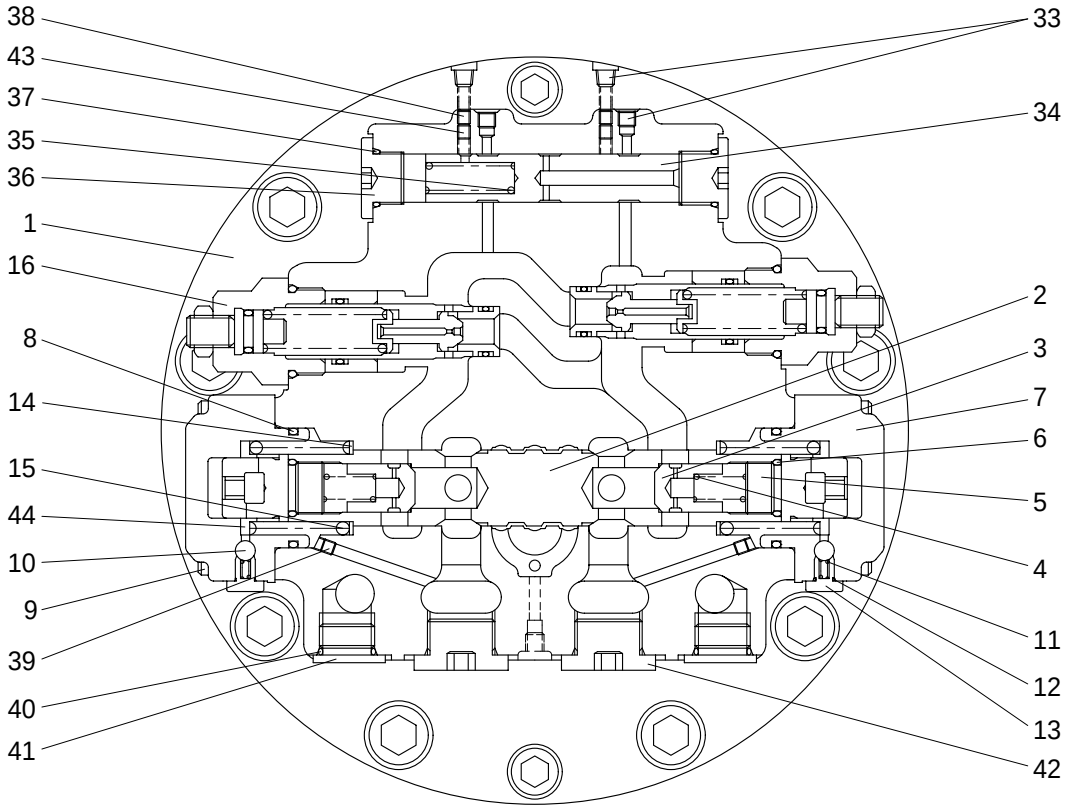
Hydraulic circuit

Port	Port name	Port size
P_1	Main port	PT 3/4
P_2	Main port	PT 3/4
a1	Gauge port(For P_1)	PT 1/4
a2	Gauge port(For P_2)	PT 1/4
T_1	Drain port	PF 1/2
T_2	Drain port	PF 1/2
Ps	2 speed control port	PT 1/4

1) TRAVEL MOTOR(1/2)



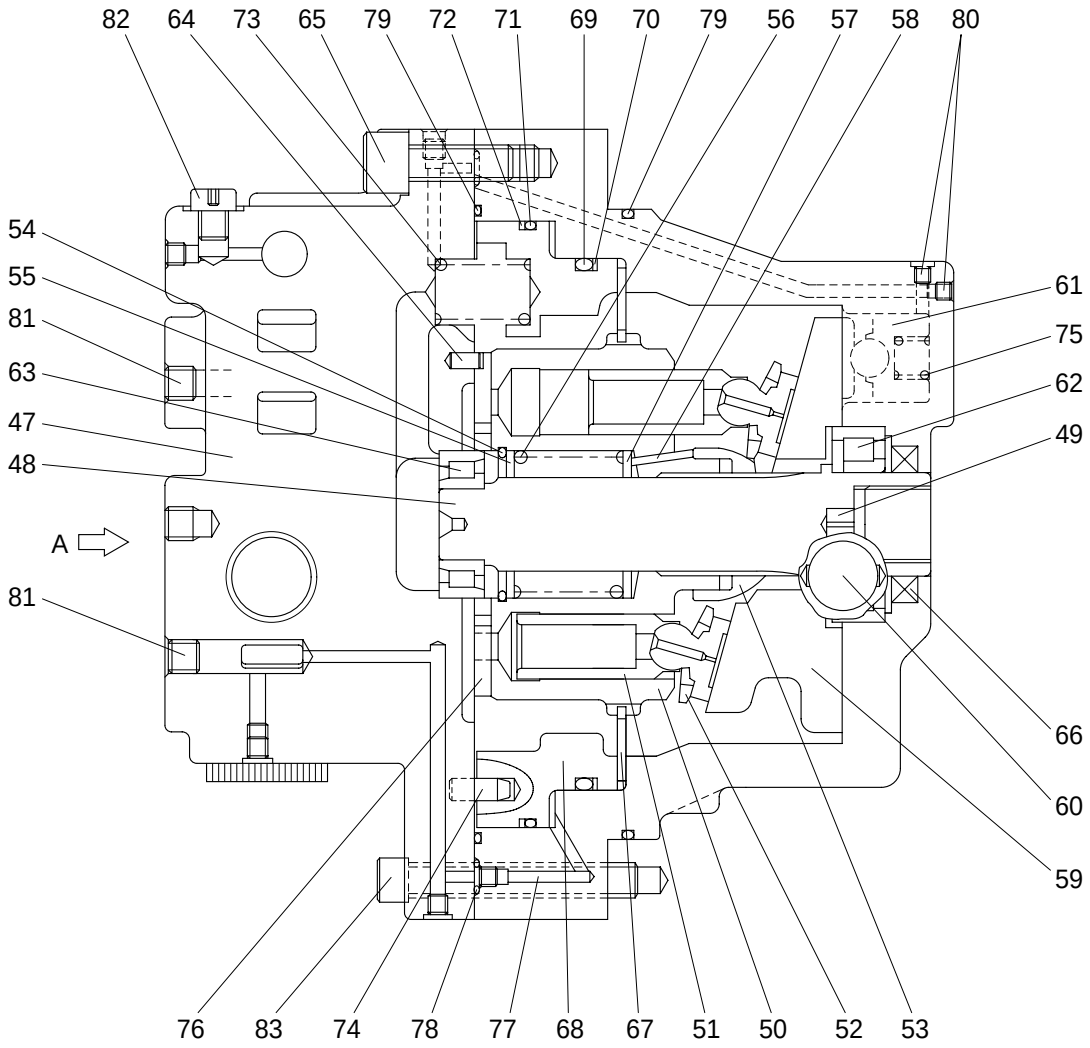
RELIEF VALVE DETAIL



VIEW A

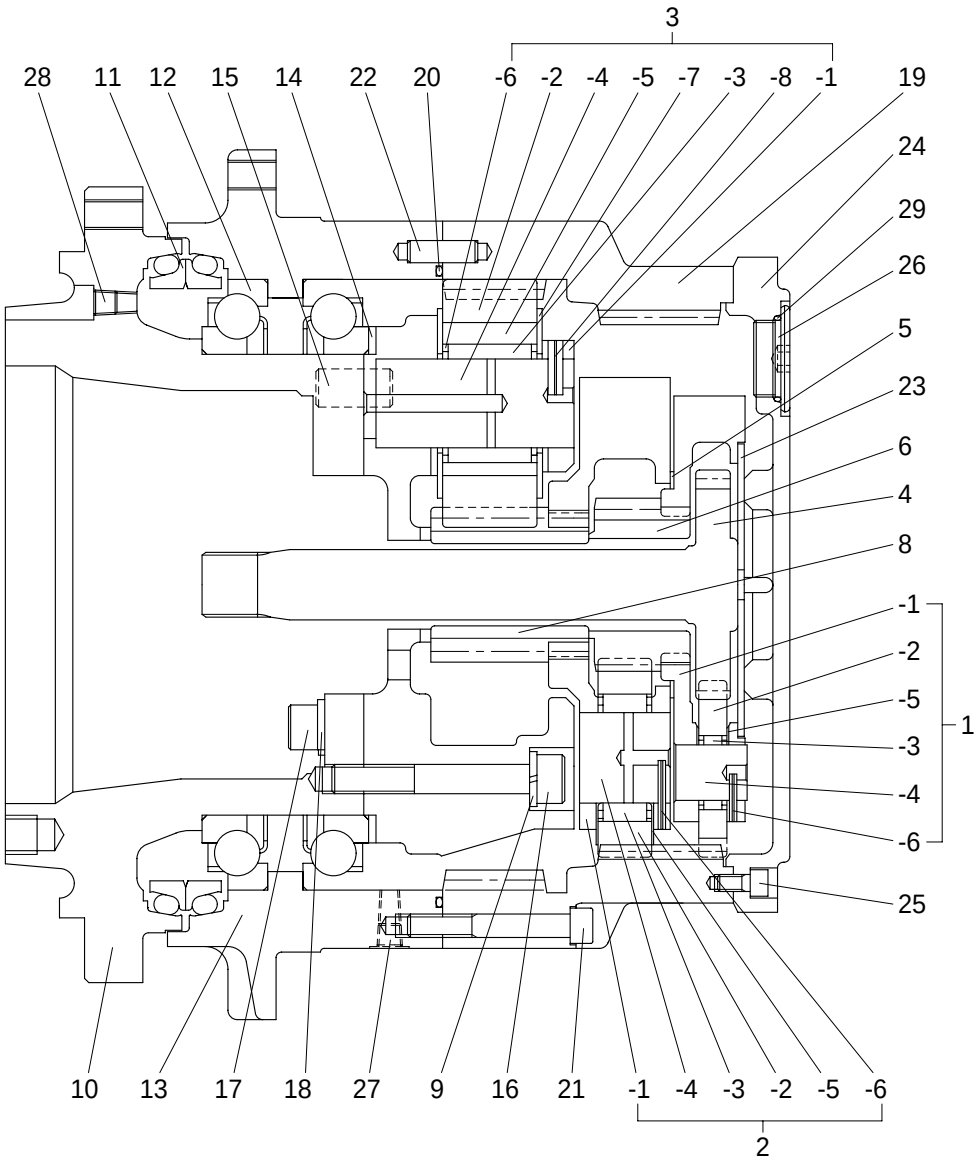
1	Base plate	17	Relief housing	33	Plug
2	Plunger	18	Poppet	34	Spool
3	Check valve	19	Poppet seat	35	Spring
4	Spring	20	Spring seat	36	Plug
5	Plug	21	Spring	37	O-ring
6	O-ring	22	Plug	38	Orifice
7	Cap	23	O-ring	39	Orifice
8	O-ring	24	Free piston	40	O-ring
9	Socket head bolt	25	O-ring	41	Plug
10	Steel ball	26	Back up ring	42	Plug
11	Spring	27	Spring guide	43	Orifice
12	O-ring	28	O-ring	44	Flange
13	Plug	29	Set screw		
14	Spring seat	30	Nut		
15	Spring	31	O-ring		
16	Relief valve assembly	32	Back up ring		

TRAVEL MOTOR(2/2)



47	Casing	60	Steel ball	73	Spring
48	Shaft	61	Piston assembly	74	Pin
49	Spring pin	62	Roller bearing	75	Spring
50	Cylinder block	63	Roller bearing	76	Valve plate
51	Piston assembly	64	Spring pin	77	Orifice
52	Retainer plate	65	Socket head bolt	78	O-ring
53	Retainer holder	66	Oil seal	79	O-ring
54	Snap ring	67	Disc plate	80	Plug
55	Collar	68	Brake piston	81	Plug
56	Spring	69	O-ring	82	Plug
57	Collar	70	Back up ring	83	Socket head bolt
58	Pin	71	O-ring		
59	Swash plate	72	Back up ring		

2) REDUCTION GEAR

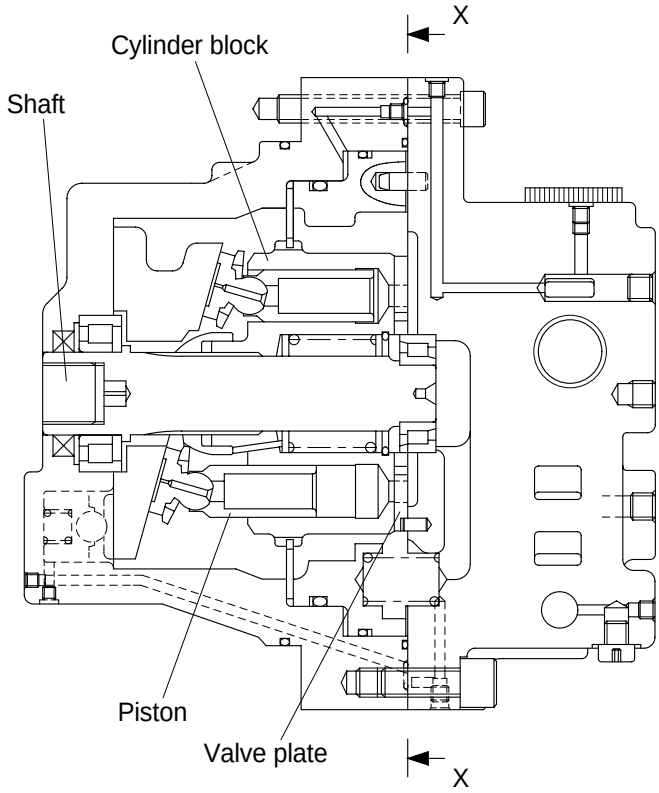


1	Holder A assembly	3-2	Planet gear C	14	Shim(0.1~0.05t)
1-1	Holder A	3-3	Roller bearing	15	Pin
1-2	Planet gear A	3-4	Gear shaft C	16	Socket head bolt
1-3	Needle bearing	3-5	Floating bushing	17	Socket head bolt
1-4	Gear shaft A	3-6	Collar	18	Plate
1-5	Thrust washer	3-7	Thrust washer	19	Ring gear
1-6	Spring pin	3-8	Spring pin	20	O-ring
2	Holder B assembly	4	Drive gear	21	Socket head bolt
2-1	Holder B	5	Thrust plate	22	Pin
2-2	Planet gear B	6	Sun gear B	23	Thrust plate(1.8~3.2t)
2-3	Needle bearing	8	Sun gear C	24	Cover
2-4	Gear shaft B	9	Spring washer	25	Socket head bolt
2-5	Thrust washer	10	Flange	26	Plug(PF 3/4)
2-6	Spring pin	11	Floating seal	27	Plug(PT 1/4)
3	Holder C assembly	12	Angular bearing	28	Plug(PT 1/8)
3-1	Holder C	13	Housing		

2. FUNCTION

1) HYDRAULIC MOTOR

(1) Rotary group



(1) The cylinder block contains nine pistons. The end face of the cylinder block is in contact with the valve plate that has two semicircular ports B and C(Distributor valve that changes over high and low pressures).

(2) Principle of generating torque

If high pressure oil(Pressure P) is admitted to port P,force F(=PXA, A : Cross-sectional area of a piston) per piston acts on the shaft and generates radial component Ft. As the result, the total sum of radial forces of the pistons on the high pressure side produces a rotating torque in the direction of the shaft.

Inversely, if high pressure oil is admitted to port C, the motor turns in the opposite direction.

The output torque and revolution of the motor available by the above-mentioned principle depend upon pressure(P) and inflow rate(Q) supplied to the motor and are calculated as below:

· Output torque

$$T=\frac{P\times D\times \eta m}{2\times \pi \times 100}\ (kg\cdot m),\quad N=\frac{Q\times 1000\times \eta v}{D}\ (rpm),$$

Where ; D : Displacement capacity(cc/rev)

P : Effective drive pressure(kg/cm^2)

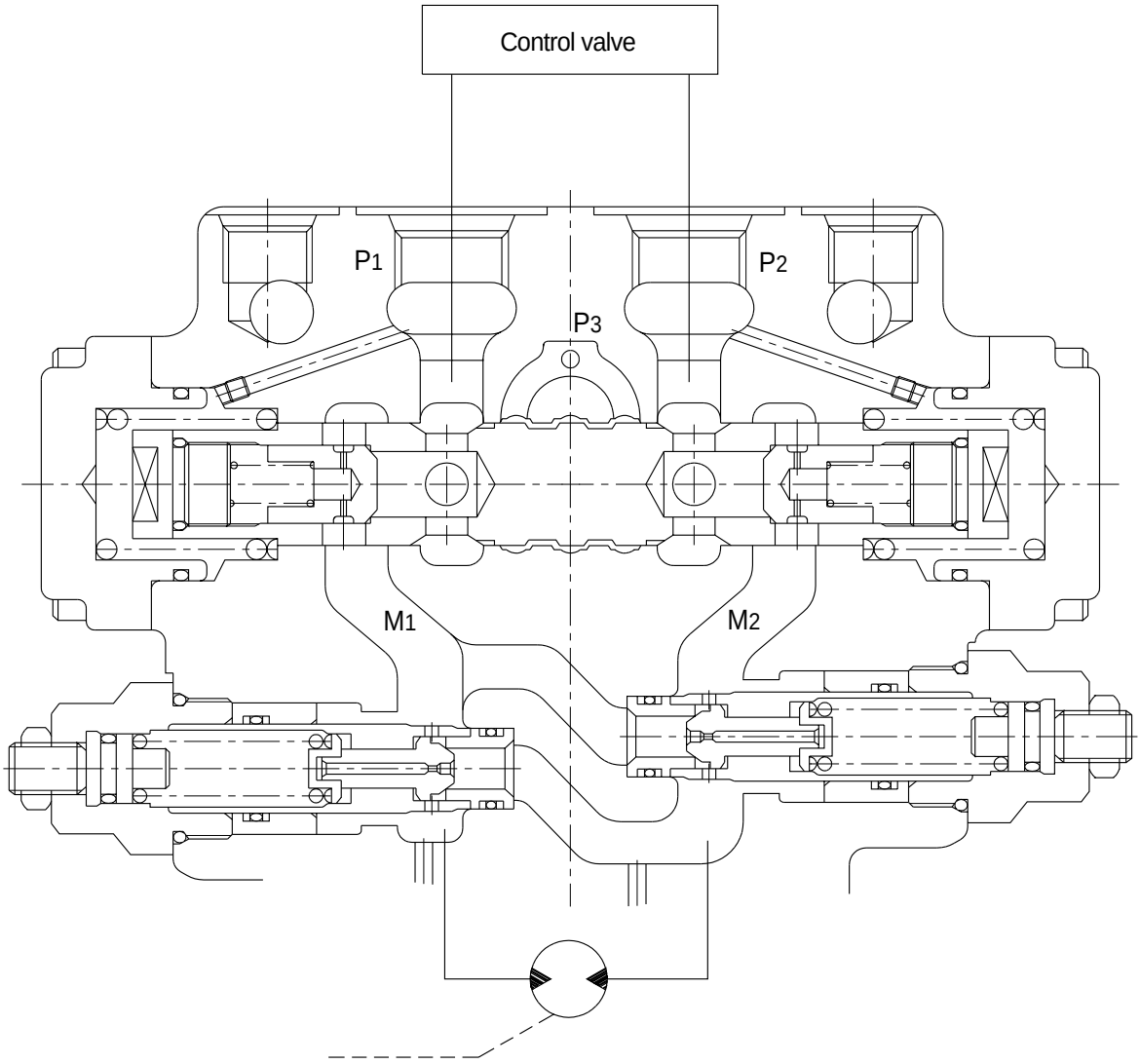
Q : Incoming flow(ℓ /min)

ηm : Mechanical efficiency($\%\times 10^{-2}$)

ηv : Volumetric efficiency($\%\times 10^{-2}$)

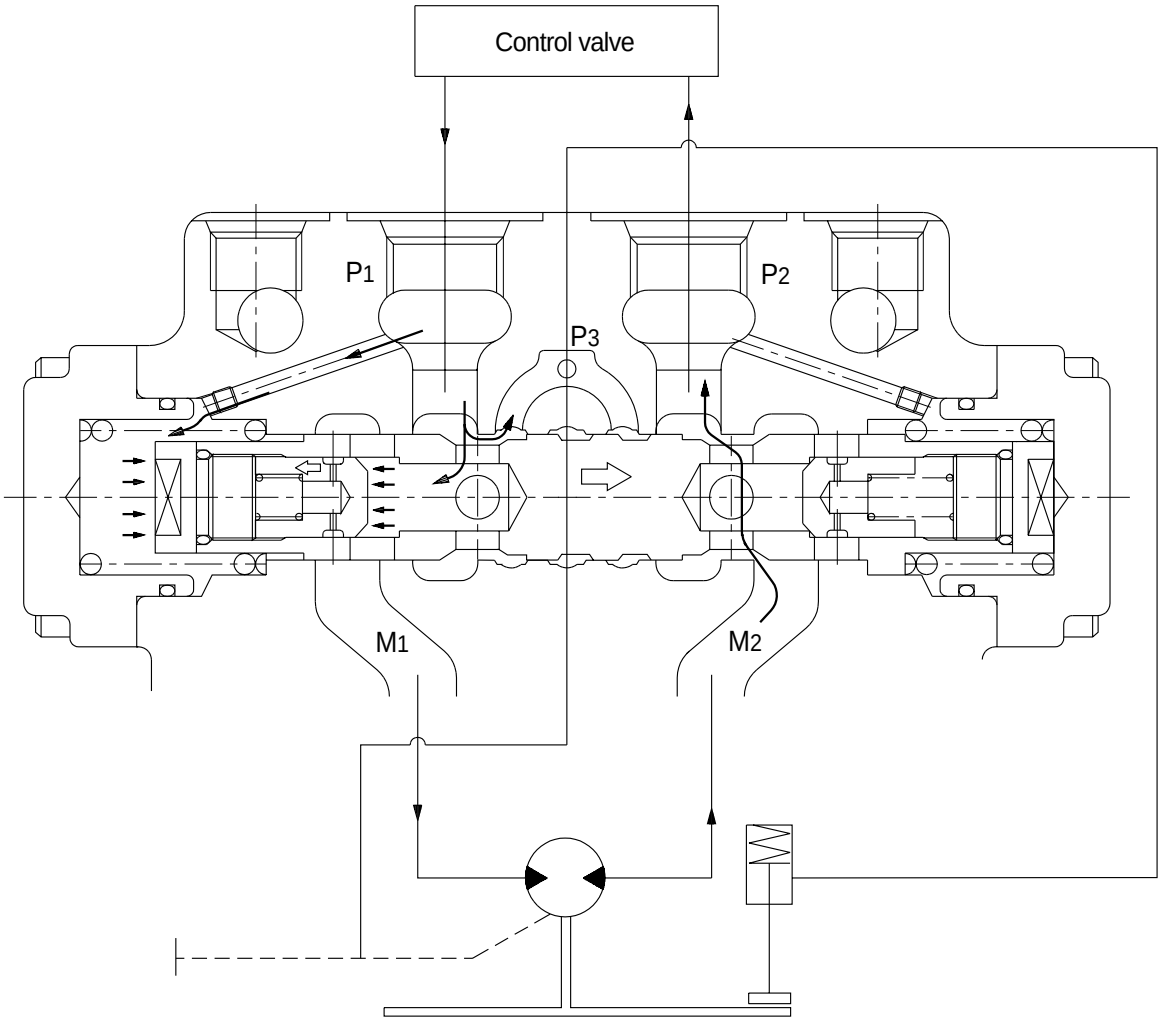
2) COUNTER BALANCE VALVE

(1) Neutral position



Counter balance valve controls according to oil supply so as to prevent reckless of running of the motor.
When the control valve is in neutral position, oil does not supply the port P1 and P2.
This blocks the motor port to prevent the motor from rotating.

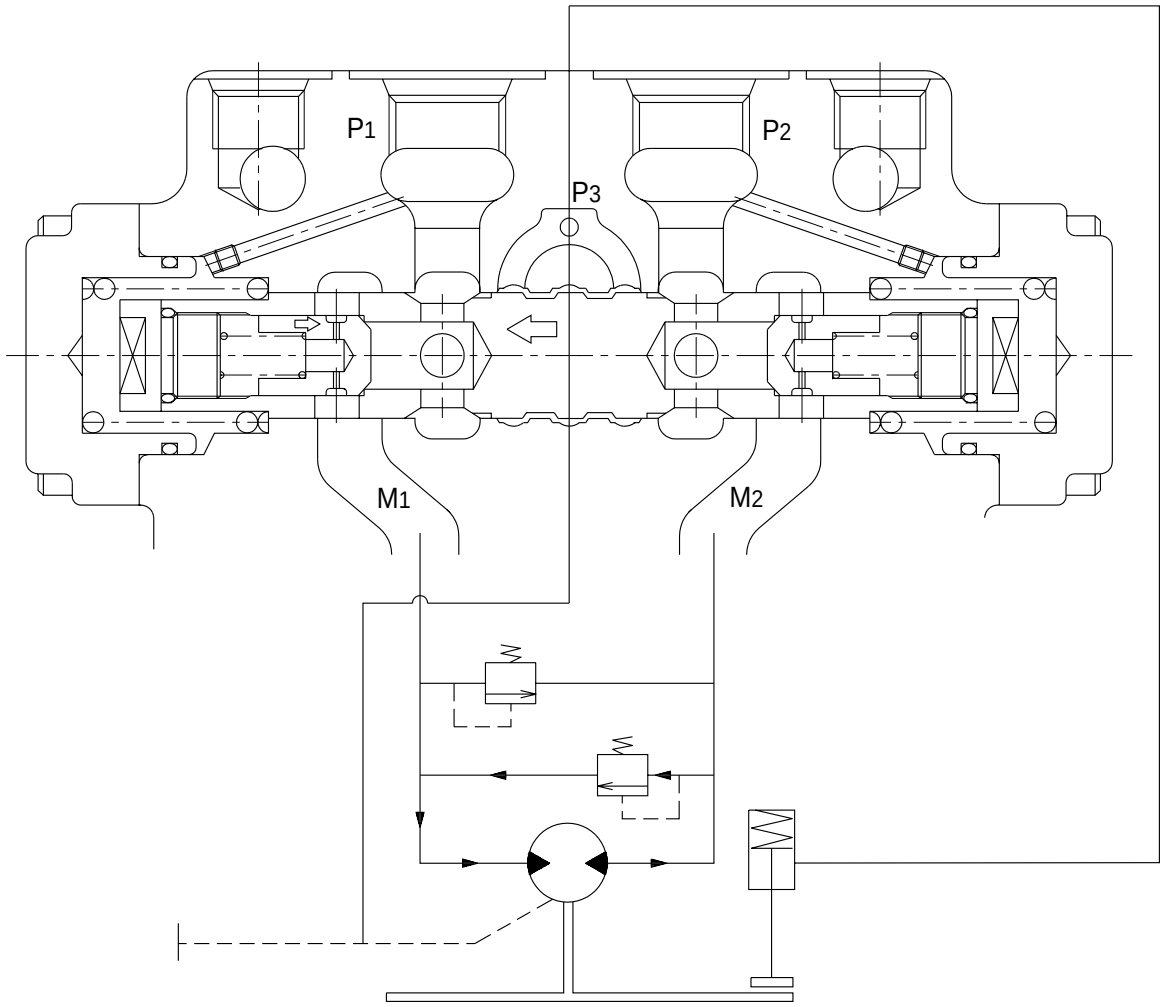
(2) Counter balance function



Oil discharged from main pump flows into the counter balance valve port P1 via control valve.
The oil flows into piston motor via check valve and M1 port.
Since the return oil from motor port M2 is blocked by check valve, the pressure of port P1 is increased.
Accordingly, the pressure applied through the orifice to left chamber of plunger and move plunger rightward.
Port M1 is connected by notch of plunger to port P2, then the return oil of motor port M2 is discharged, and the travel motor starts revolution.

※ Reversed when hydraulic oil pressure is applied to port P2.

(3) Brake function

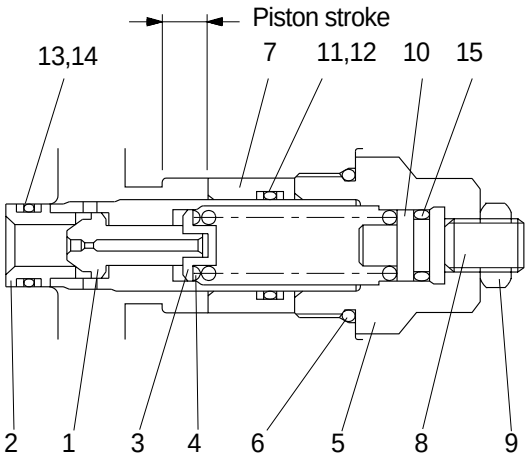


When the travel lever return to neutral position, the oil from the main pump is blocked, and the plunger return the neutral position by spring force.

But the motor is rotated by inertia, so the pressure at the output port of motor rises, then motor is braked.

If the pressure reaches the set pressure of relief valve, oil flows into port M1. As a result, the shock pressure caused by inertia force is released and prevent cavitation of port M1.

3) RELIEF VALVE



1	Poppet
2	Poppet seat
3	Spring seat
4	Spring
5	Plug
6	O-ring
7	Shockless piston
8	Adjust screw
9	Nut
10	Spring guide
11	O-ring
12	Back up ring
13	O-ring
14	Back up ring
15	O-ring

(1) Construction of relief valve

The release valve determines the drive force and the brake force of the machine during running and is mounted to the cross line. The relief valve is provided with a shockless function to relieve shocks that may be generated at the beginning of acceleration and deceleration.

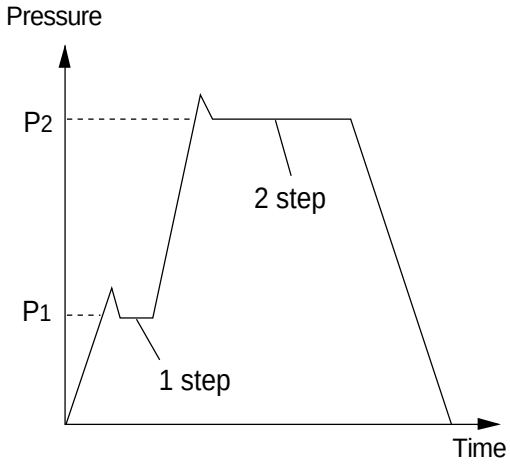
a) Differential area type interlocking relief valve

b) It consists of a shockless piston.

As explained above, the relief valve functions in the following two stages when the control valve is operated to drive or brake the piston motor.

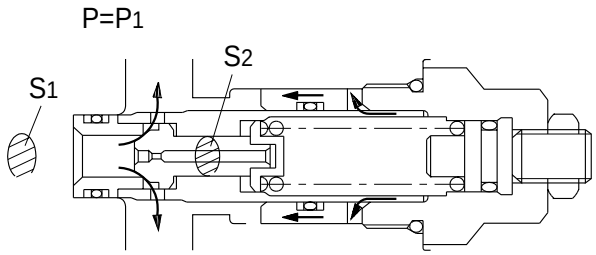
(2) Function of relief

Figure illustrates how the pressure acting on the relief valve is related to its rising process. Here is given the function, referring to the figure following page.



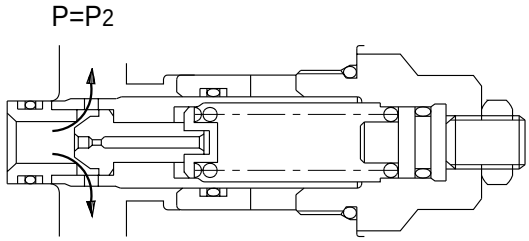
① **First stage**

At the beginning of the relief valve operation, the pressure in the spring chamber is held low by the shockless piston, with the result that the pressure receiving area of the poppet equals the area(S1) of the poppet seat. As the result, the pressure receiving area is comparatively large as compared to the area (S1-S2) obtained during regular relief setting. This makes the operating relief pressure low(About a third of a regular set pressure) which is maintained till the shockless piston finishes travel. The duration in which low pressure is held depends upon the diameter of the poppet orifice, the pressure receiving area of the piston and the piston stroke.



② **Second stage**

When the shockless piston finishes travel, the pressure in the spring chamber of the relief valve rises, equaling the pressures before and after the poppet to set it to a regular set pressure.



4) 2-SPEED CONTROL

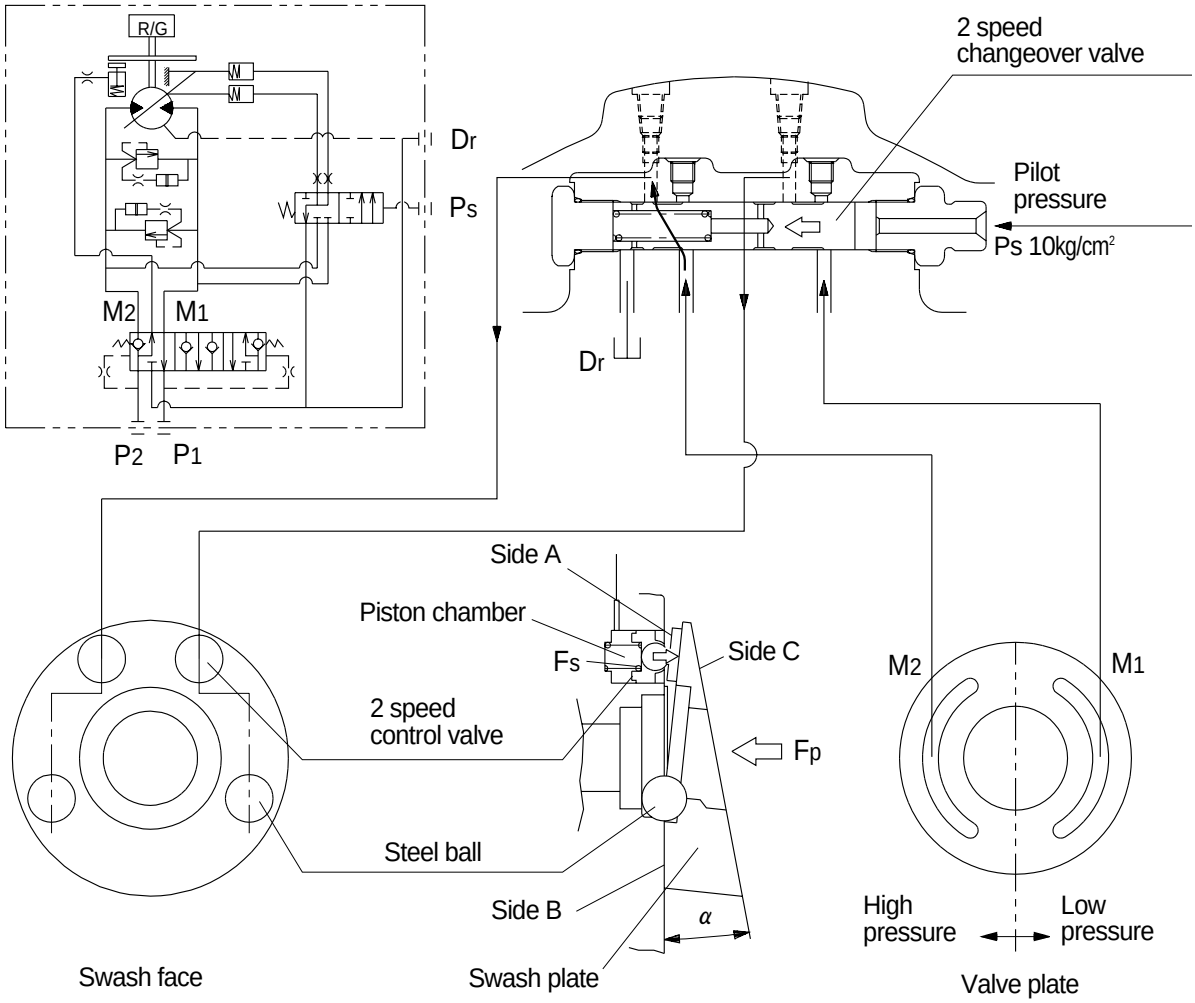
The 2-speed mechanism consists of a 2-speed changeover valve(Hereinafter called valve), a two-speed control piston(Hereinafter called piston)and a swash plate.

The swash plate, which has three faces A~C, is fixed to the motor case by two steel balls so that it can be tilted.

The two-speed changeover valve is fixed in the base plate.

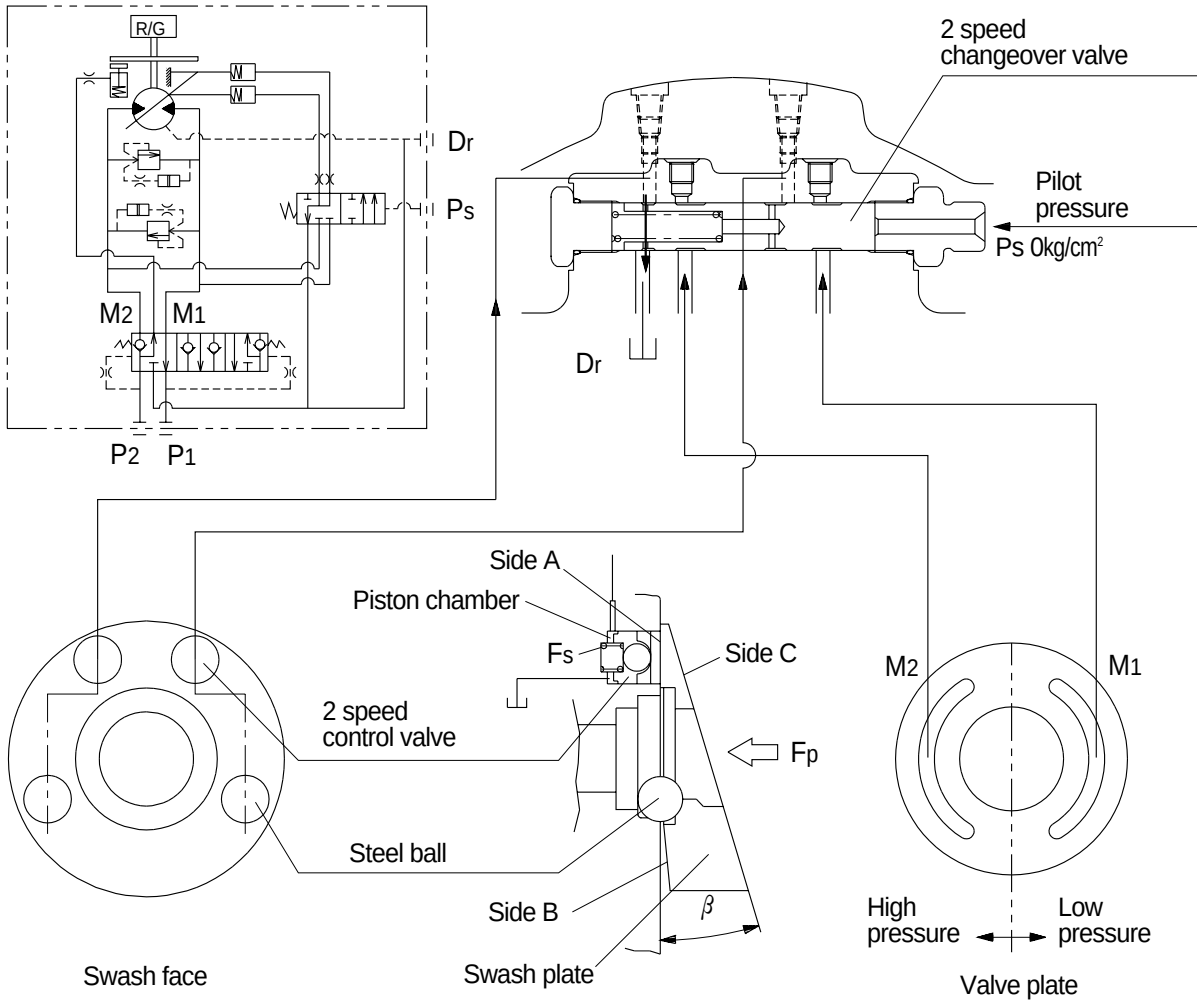
The two-speed control piston is fixed in the motor casing.

(1) High speed control



If pilot pressure from port Ps is exerted on the valve, it is switched to the condition shown in Fig. Causing the motor drive pressure to act on the 2 speed control piston. This pushes the swash plate up , inclines it to a position in which the propelling force(Fp) of the piston and the spring force(Fs) balance with the propelling force of the pistons and finally stabilizes upon contact of the face B of the swash plate with the casing. At that time, the tilting angle(β) of the swash plate is P and the motor revolution gets to the 2nd shift(High speed).

(2) Low speed control

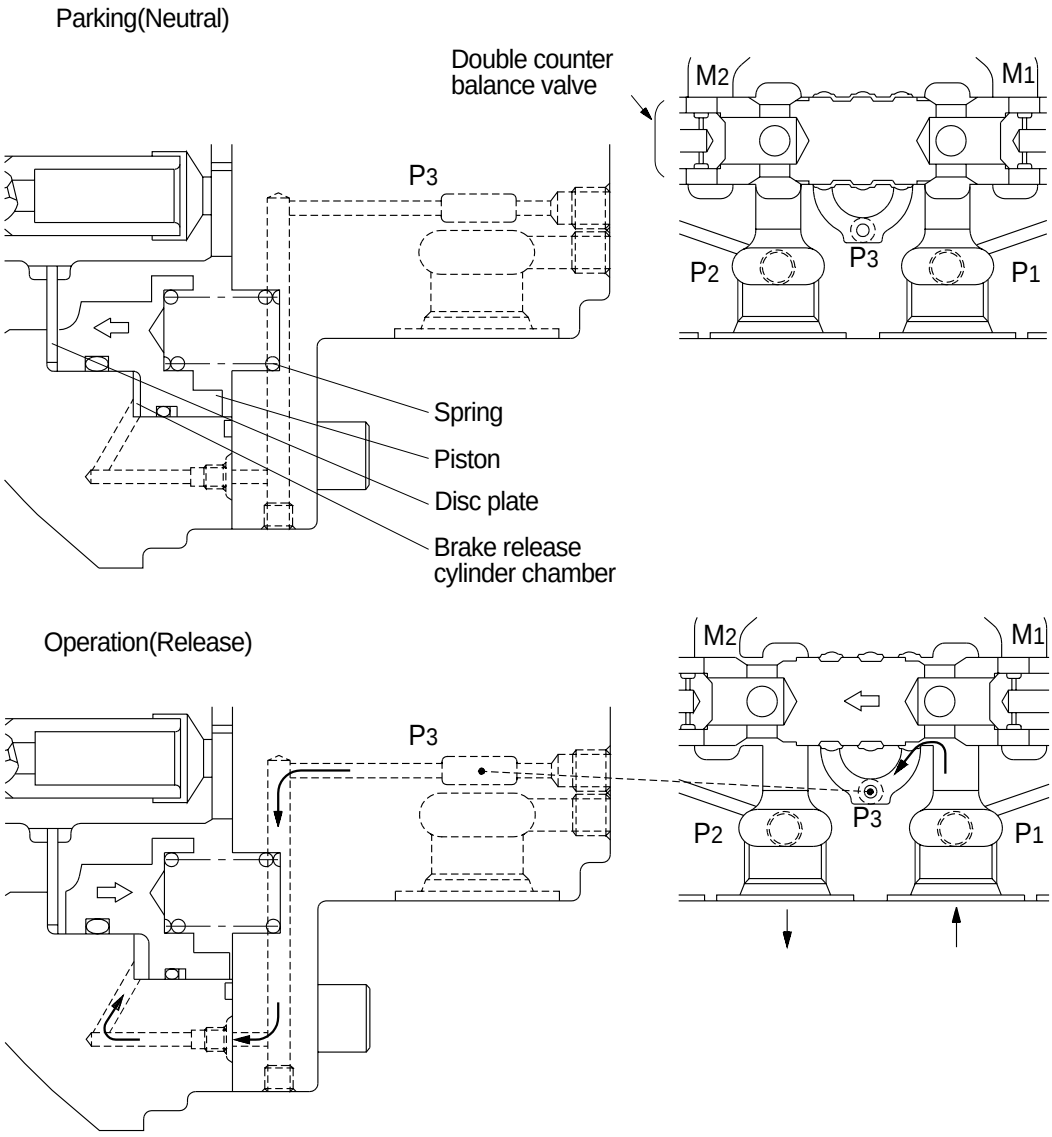


If the changeover pilot pressure Ps is shut off, the valve is brought to the condition in Fig. As the result the piston chamber is connected with the drain line in the motor casing.

Consequently, the swash plate is pressed by the combined force of the propelling force of the piston high pressure and the spring force till the face A of the swash plate comes in contact with the casing to stabilize the swash plate. On that occasion, the tilting angle(α) of the swash plate is and the motor revolution gets to the 1st shift(low speed)condition.

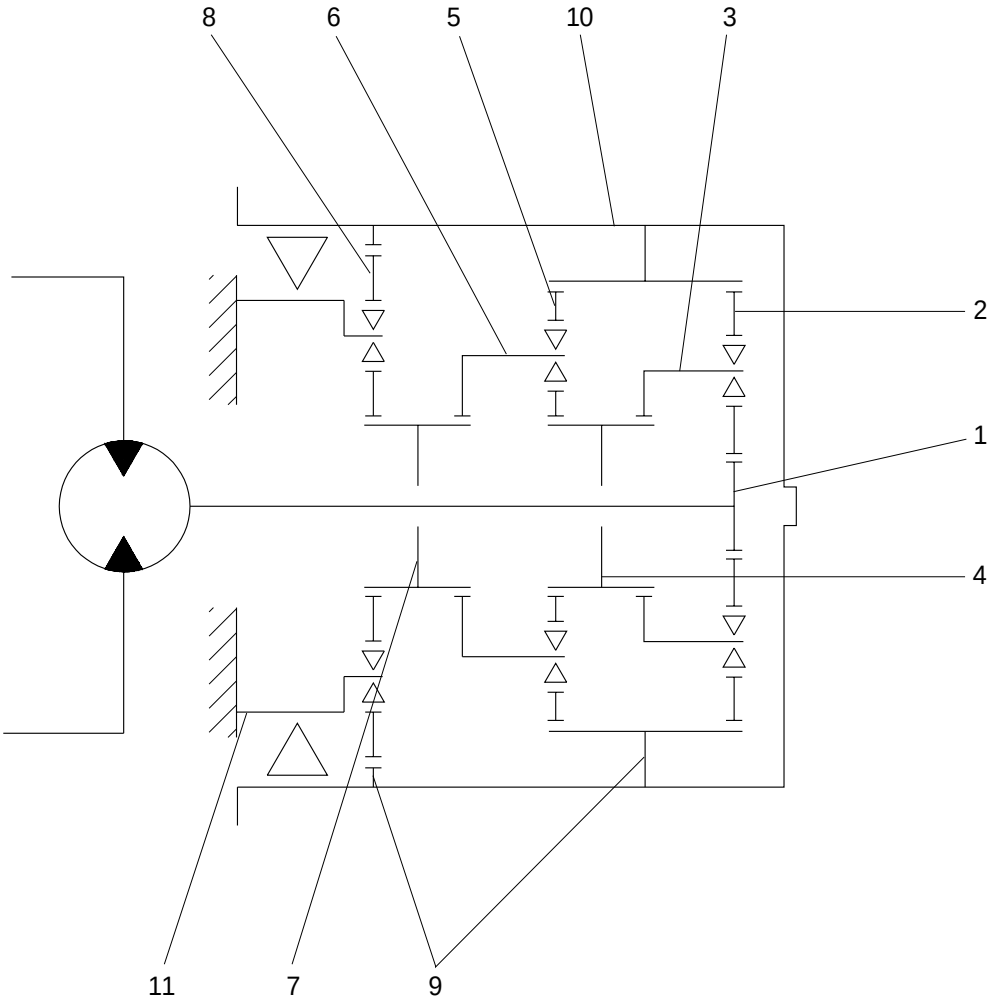
If the changeover pilot pressure is shut off at an engine stop or on some other occasion, the swash plate is pressed by the spring action till it contacts face A of the casing. The swash plate takes a tilting angle(α) a then to pick up the 1st shift(Low speed).

5) PARKING BRAKE



The parking brake is a negative brake consisting of a disc plate, brake piston and a spring.
When pressurized oil runs into the motor, it then runs into port P3 via the double counter balance valve and is admitted into the brake release cylinder chamber. The pressurized oil produces a force in proportion to the pressure receiving area of the piston. This force overcomes the spring action and pushes the brake piston to release the braking force.
At parking or on stop of the machine, the hydraulic oil in the brake release cylinder chamber is released to the tank, which causes a braking force to be produced by spring action.

6) GEAR BOX



1	Drive gear(1st sun gear)	5	2nd planetary gear	9	Ring gear
2	1st planetary gear	6	2nd carrier	10	Casing
3	1st carrier	7	3rd sun gear	11	3rd carrier
4	2nd sun gear	8	3rd planetary gear		

(1) The reduction gear is composed of a three stage planetary gear mechanism shown in the figure.