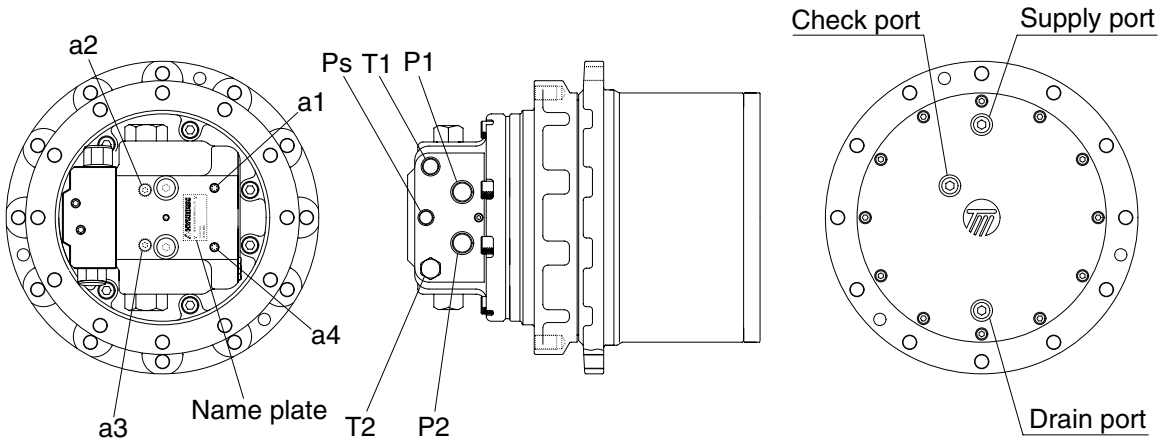
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

Travel device consists travel motor and gear box.

Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.



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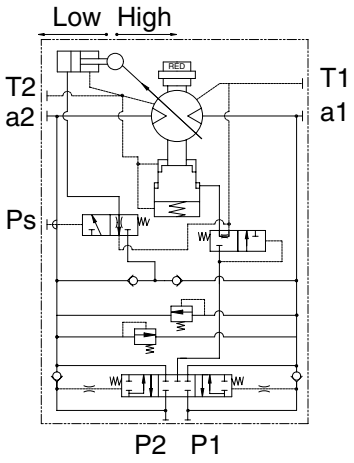

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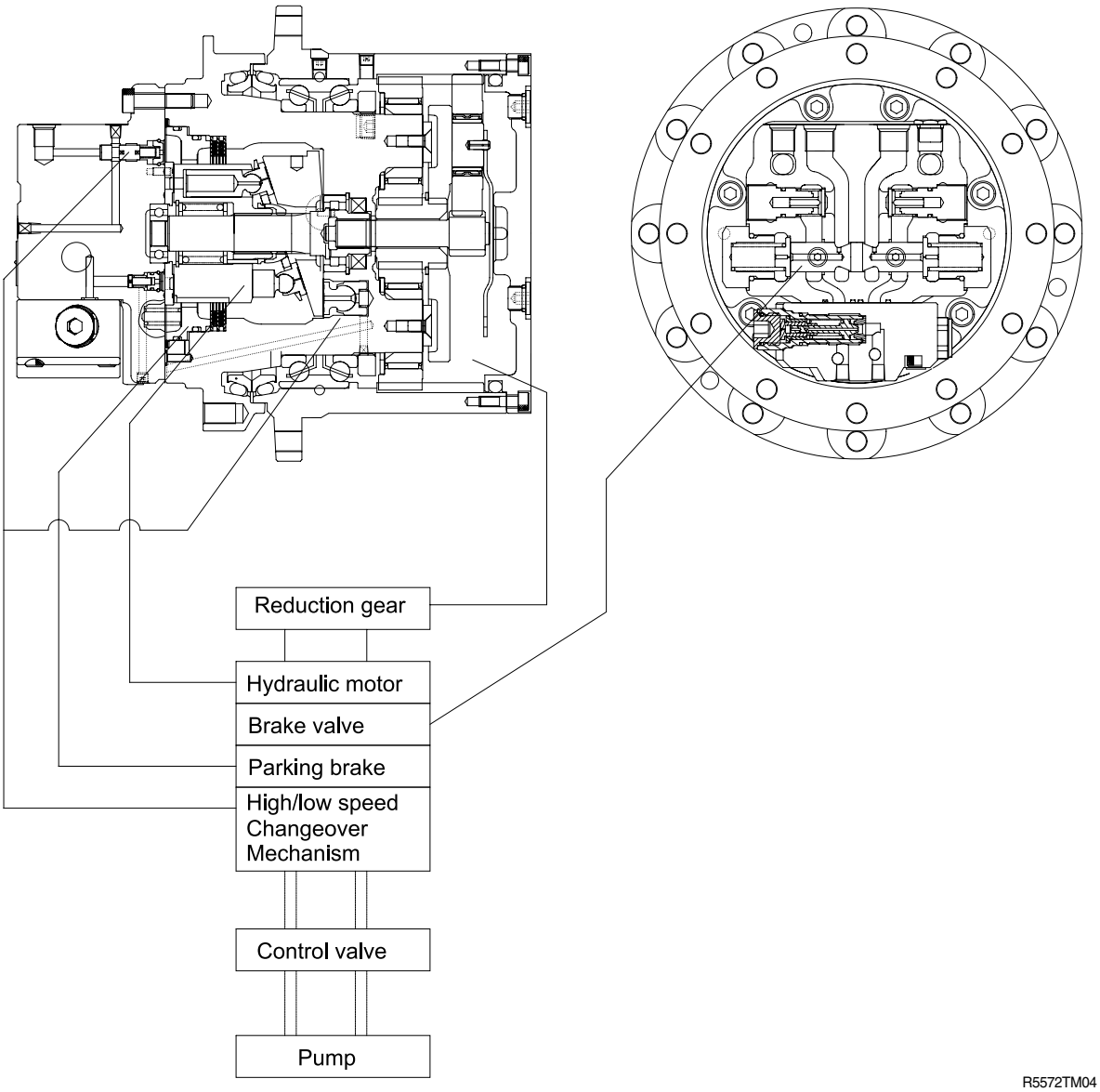
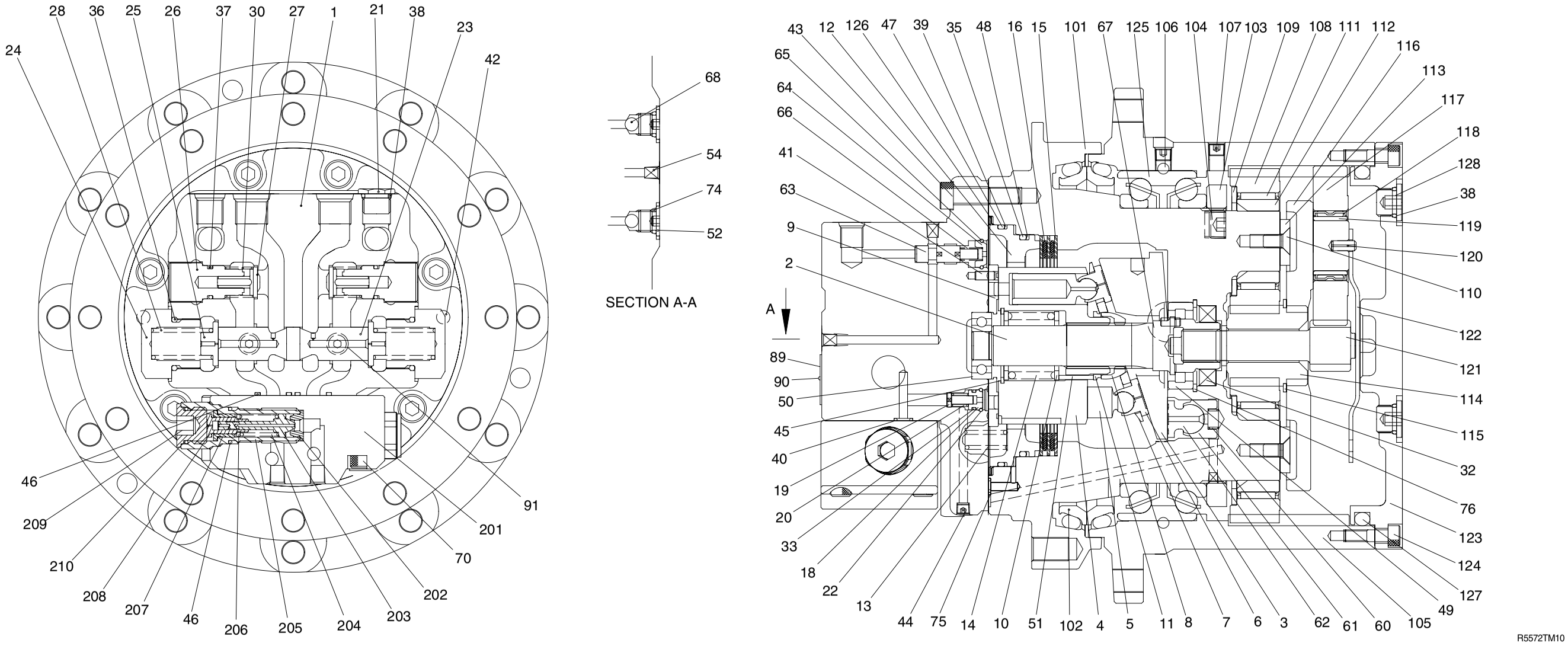
Port	Port name	Port size
P1	Main port	PF 1/2
P2	Main port	PF 1/2
a1,a2	Gauge port	PT 1/4
a3,a4	Gauge port	PT 1/8
T1,T2	Drain port	PF 3/8
Ps	2 speed control port	PF 1/4

1) BASIC STRUCTURE



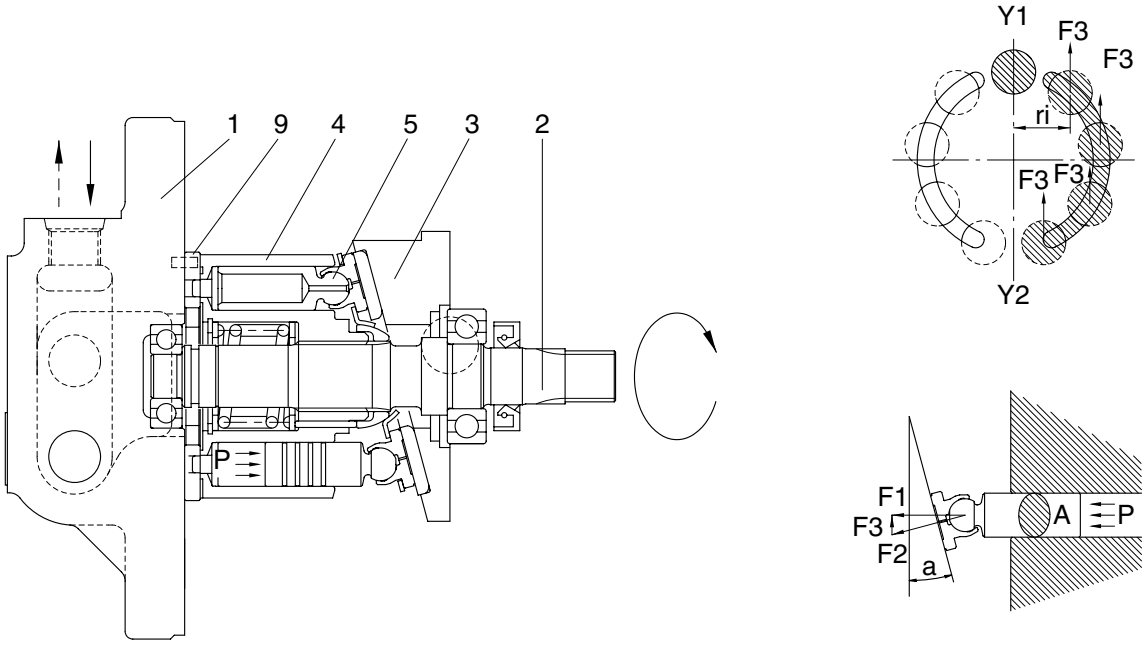
2) STRUCTURE



1	Rear flange	19	Valve	39	O-ring	62	Shoe	104	PT plug	121	Drive gear
2	Main shaft	20	Spring	40	O-ring	63	Valve	105	Housing	122	Thrust plate(R)
3	Swash plate	21	VP plug	41	Paralell pin	64	Stopper	106	Steel ball	123	Cover
4	Cylinder block	22	Ring	42	Parallel pin	65	Ring	107	PT plug	124	Socket bolt
5	Piston	23	Main spool	43	Socket bolt	66	Spring	108	Planetary gear(F)	125	Angular bearing
6	Shoe	24	Plug	44	PT plug	67	Pivot	109	Thrust washer	126	O-ring
7	Retainer plate	25	Spring retainer	45	Snap ring	68	Steel ball	110	Screw	127	O-ring
8	Thrust ball	26	Plug	46	O-ring	70	Socket bolt	111	Needle bearing	201	Valve block
9	Timing plate	27	Valve	47	Back up ring	74	O-ring	112	Collar	202	Seat
10	Washer	28	Spring	48	Back up ring	75	O-ring	113	Thrust plate(F)	203	Plunger
11	Collar washer	30	Spring	49	Roller bearing	76	Snap ring	114	Sun gear	204	Spring
12	Parking piston	32	Oil seal	50	Ball bearing	89	Name plate	115	Snap ring	205	Body
13	Spring	33	O-ring	51	Roller	90	Rivet screw	116	Holder	206	Shim
14	Spring	35	O-ring	52	RO plug	91	PT plug	117	Planetary gear(R)	207	Piston
15	Friction plate	36	O-ring	54	NPTF plug	101	Holder flange	118	Needle bearing	208	Rod
16	Mating plate	37	O-ring	60	Spring	102	Floating seal	119	Inner race	209	Plug
18	Valve seat	38	O-ring	61	Piston	103	Nut ring	120	Spring pin	210	Backup ring

1. FUNCTION

1) HYDRAULIC MOTOR



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The pressurized oil delivered from the hydraulic pump flows to rear flange(1) of the motor, passes through the brake valve mechanism, and is introduced into cylinder block(4) via timing plate(9). This oil constructively introduced only to one side of (Y1)-(Y2) connecting the upper and lower dead points of stroke of piston(5). The pressurized oil fed to one side in cylinder block(4) pushes each piston(5)(four or five) and generates a force F(kgf)= P(kgf/cm^2) × A(cm^2).

This force acts on swash plate(3), and is resolves into components(F2 and F3) because swash plate(3) is fixed at an angle α with the axis of drive shaft(2).

Radial component(F3) generates respective torques (T=F3 × ri) for (T1)-(Y2). This residual of torque (T=S(F3 × ri)) rotates cylinder block(4) via piston(5). Cylinder block(4) is spline coupled with drive shaft(2).

So the drive shaft(2) rotates and the torque is transmitted.

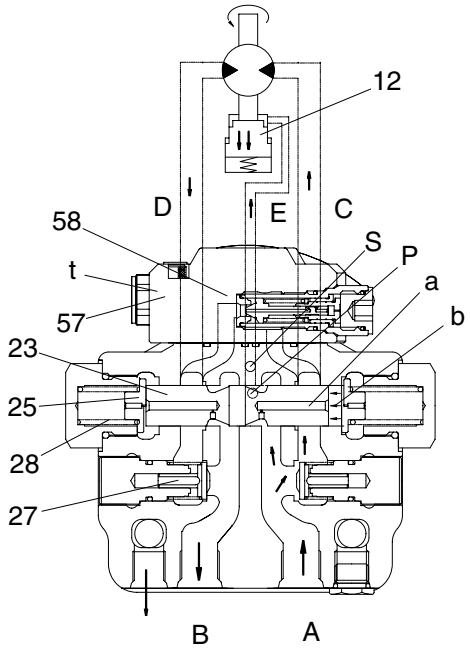
2) BRAKE VALVE

(1) Brake released(starting/running)

When the pressurized oil supplied from port (A) the oil opens valve(27) and flows into port (C) at the suction side of hydraulic motor to rotate motor.

At the same time, the pressurized oil passes through pipe line (a) from a small hole in spool(23) and flow into chamber (b).

The oil acts on the end face of spool(23) which is put in neutral position by the force of spring(28), thus causing spool(23) to slide to the left. When spool(23) slides, port (D) on the passage at the return side of hydraulic motor, which is closed by the spool groove during stoppage, communicates with port (B) at the tank side and the return oil from the hydraulic motor runs into the tank. In consequence, the hydraulic motor rotates. Moreover, sliding of spool(23) causes the pressurized oil to flow into ports (P) and (S).



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The pressurized oil admitted into port (P) activates piston(12) of the parking brake to release the parking brake force (For details, refer to description of the parking brake).

On the other hand, the pressurized oil introduced into port (S) flows into chamber (t) and presses stopper(57) against the inside of body(55) to prevent spool(58) from moving, thus disabling communication at port (C) side of the hydraulic motor (Suction side and return side of hydraulic motor). When the pressurized oil is supplied from port (B) spool(23) and valve(27) move reversely and the hydraulic motor also rotates reversely.

(2) Brake applied(stopping/stalling)

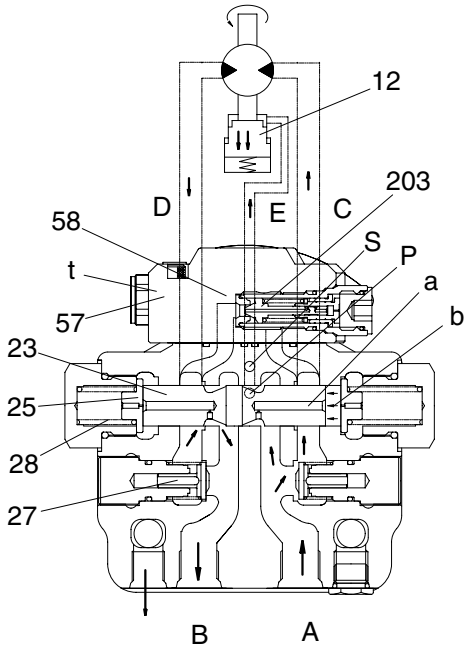
When the pressurized oil supplied from port (A) is stopped during traveling, no hydraulic pressure is applied and spool(23) which has slided to the left will return on the right(neutral) via spring retainer(25) by the force of spring(28).

The oil in chamber (b) will flow to port (A) side through pipe line (a) in spool(23).

However, a back pressure produced by the restricting effect of pipe line (a) whereby the return speed of spool(23) is controlled.

At the same time, the hydraulic motor will rotate by the force of inertia even if the pressurized oil is stopped.

Accordingly, the return oil will return to port (B) side from port (D) through a passage between the groove in spool(23) and rear flange(1). When spool(23) completely returns to neutral, the above-mentioned passage is fully closed and the hydraulic motor stops.



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As explained above, the hydraulic motor is smoothly braked and stopped by gradually controlling the return oil from the hydraulic motor by the return speed of spool(23), its shape, etc.

However, the hydraulic motor will rotate by the force of inertia. This means that the hydraulic motor will suck oil functioning as a pump.

However, no oil is supplied because the pressurized oil is stopped. In consequence, cavitation occurs on the hydraulic motor, thus adversely affecting it.

At the same time, the passage closed by spool(23), whereby the return oil from the hydraulic motor is enclosed at port (D) side and the pressure is increased.

This pressure slides plunger(203) to the left to short-circuit port (D) and (C) which prevents pressure rise and cavitation (surge cut valve function and anti-cavitation valve function).

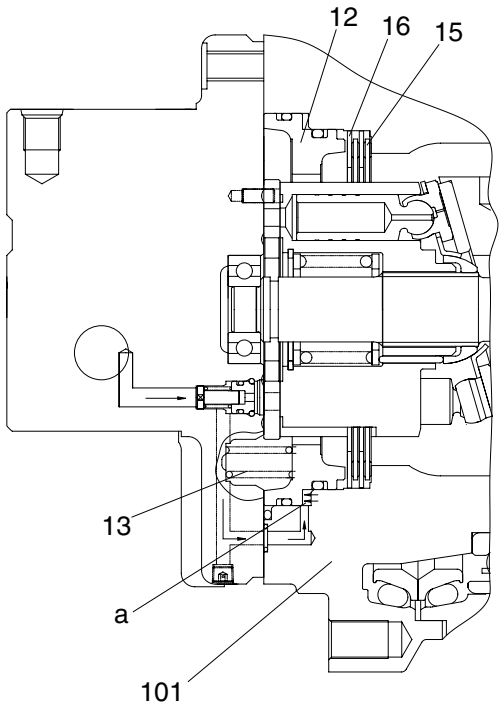
Valve(27) is activated by a slight negative pressure to open the oil passage between the oil line at port (A) side and port (C) at the suction side of motor, thus preventing cavitation of the hydraulic motor.

3) PARKING BRAKE

(1) Running

When the pressurized oil is supplied from the valve, the spool of brake valve in the hydraulic motor assembly actuates to open the passage to the parking brake and the pressurized oil is introduced into cylinder chamber (a) which is composed of the spindle of reduction gear assembly and piston(12).

When the hydraulic pressure reaches 9kgf/cm^2(0.88Mpa) or more, it overcomes the force of spring(13) and shifts piston(12) with shift of piston(12) no pressing force is applied to mating plate(16) and friction plate(15) and the movement of friction plate(15) becomes free, whereby the brake force to the cylinder in the hydraulic motor assembly is released.



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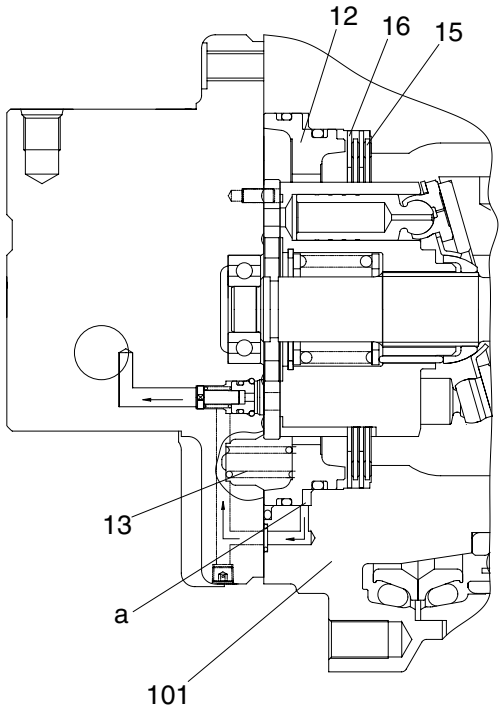
(2) Stopping

When the pressurized oil from the brake valve is shut off and the pressure in cylinder chamber (a) drops 9kgf/cm^2(0.88Mpa) or less, piston(12) will return by the force of spring(13).

Piston(12) is pushed by this force of spring(13), and mating plate(16) and friction plate(15) in free condition are pressed against the holder flange of reduction gear assembly.

The friction force produced by this pressing stops rotation of the cylinder and gives a braking torque(8.4kgf · m(60.8 N · m)) to the hydraulic motor shaft.

Note that oil control through a proper oil passage ensures smooth operation.



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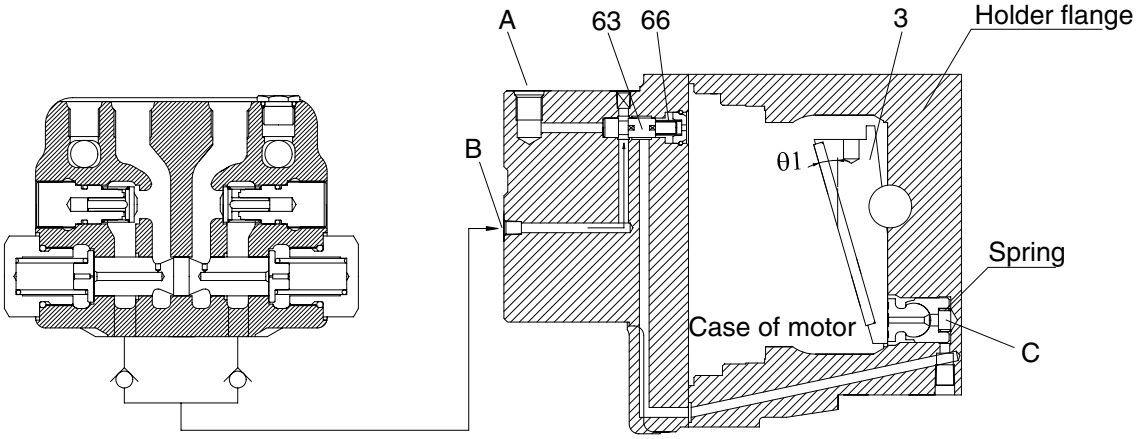
4) HIGH/LOW SPEED CHANGEOVER MECHANISM

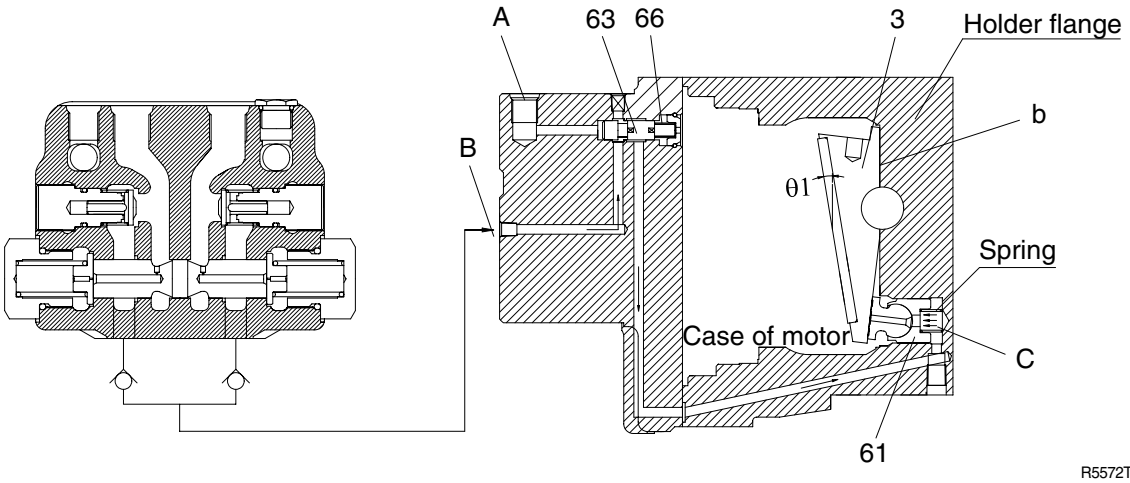
(1) At low speed-at pilot pressure of less than 10kgf/cm²(0.98Mpa)



R5572TM16

When no pilot pressure is supplied from port (A) at a pressure of 10kgf/cm²(0.98Mpa) or less, valve(63) is pressed toward the left by the force of spring(166), the pressurized oil supply port B is shut off, and oil in chamber (C) is released into the motor case via valve(63).
Consequently, swash plate(3) is tilted at a maximum angle(θ1°) and the piston displacement of hydraulic motor becomes maximum, thus leading to low-speed rotation.

(2) At high speed-at pilot pressure of 20kgf/cm²(1.96Mpa) or more



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When a pilot pressure is supplied from port (A) at a pressure of 20kgf/cm²(1.96Mpa) or more, the pressure overcomes the force of spring(66) and valve(63) is pressed toward the right. The pressurized oil at supply port (B) is then introduced into chamber (C) via valve(63).
Piston(61) pushes up swash plate(3) until it touches side (b) of the holder flange.
At this time, swash plate(3) is tilted at a minimum angle(θ2°) and the piston displacement of hydraulic motor becomes maximum, thus leading to high-speed rotation.

2. REDUCTION GEAR

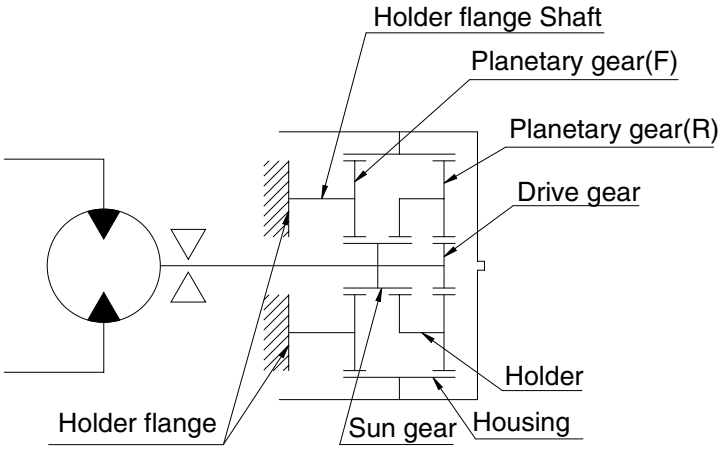
1) FUNCTION

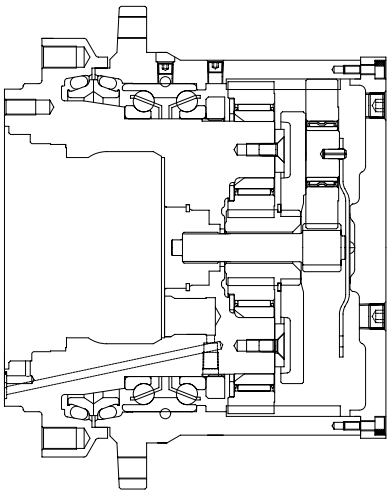
The reduction gear unit consists of a combination of simple planetaly gear mechanism.

This mechanism reduce the high speed rotation from the hydraulic motor and convert it into low speed, high torque to rotate the hub(or case), which in turn rotates the sprocket.

2) OPERATING PRINCIPLE

Shaft → Drive gear → Planetary Gear R → Housing
→ Holder → Sun gear → Planetary Gear F →Rotation of Housing





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Reduction ratio=(Housing Teeth/Drive Gear Teeth + 1)
× (Housing Teeth/Sun Gear Teeth + 1) - 1.