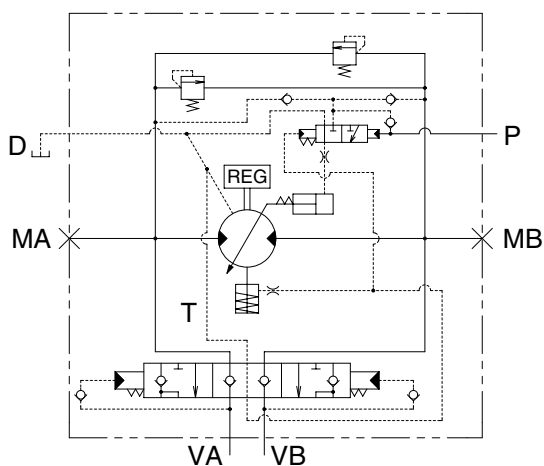
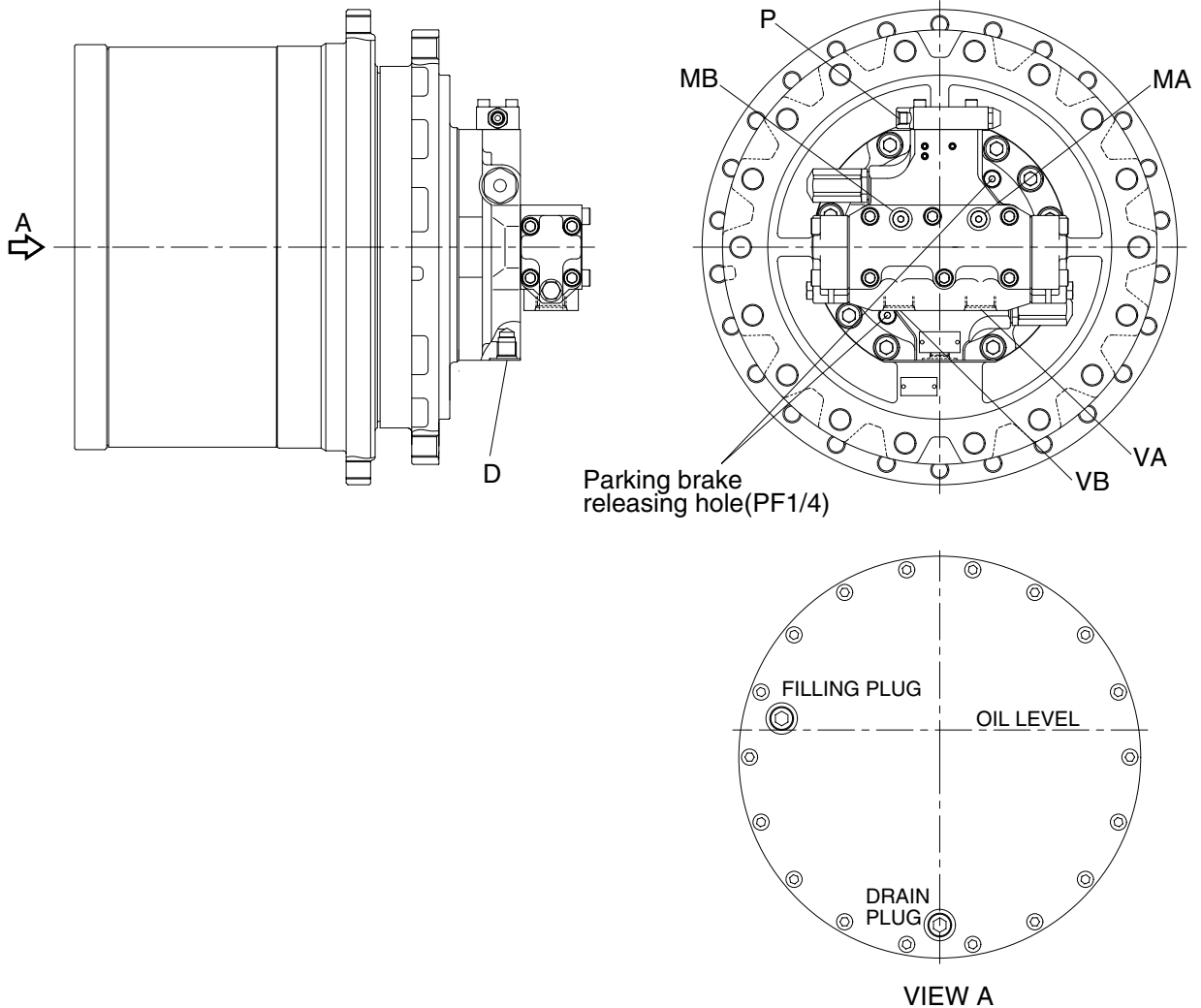


GROUP 4 TRAVEL DEVICE(up to #1455)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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

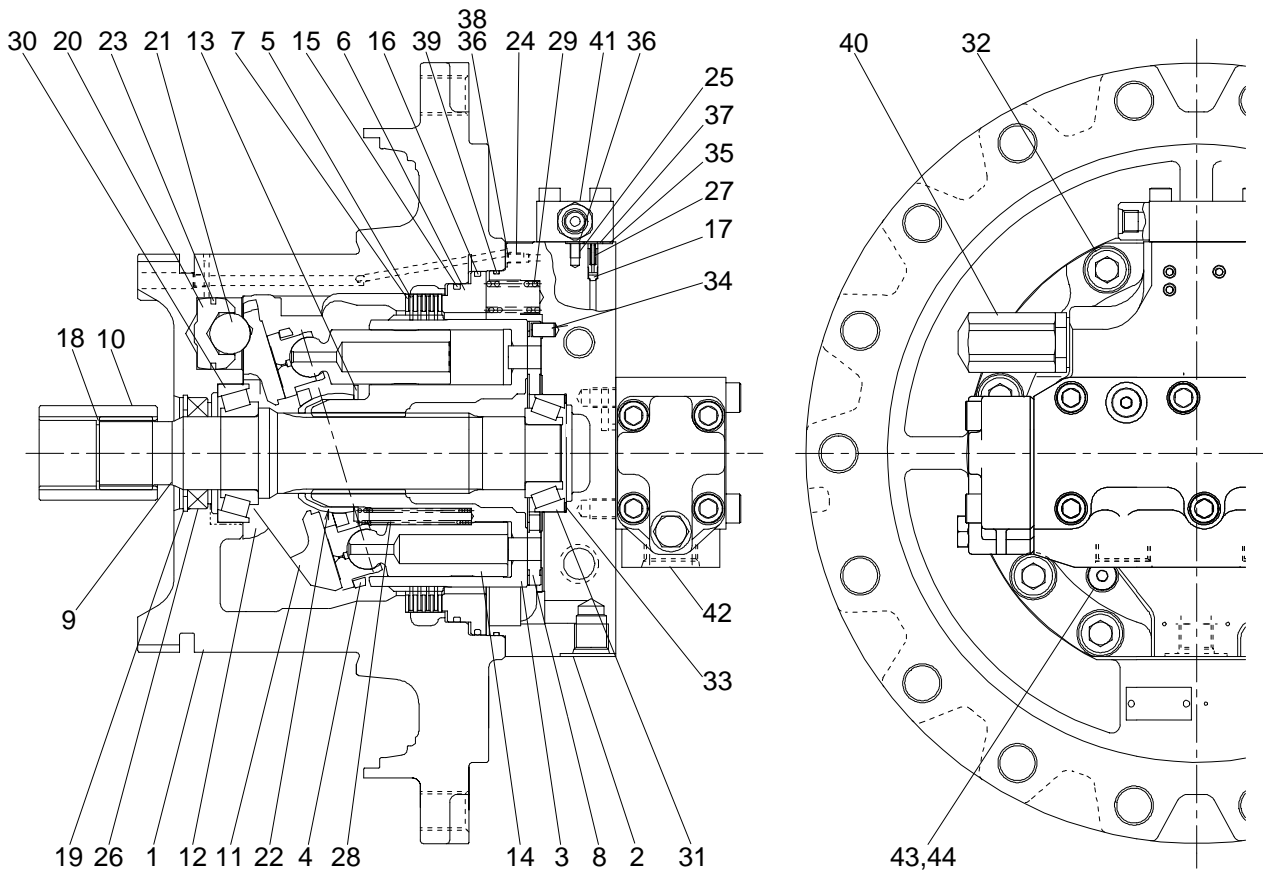


29072TM01

Port	Port name	Port size
VA, VB	Valve port	PF 1
P	Pilot port	PF 1/4
D	Drain port	PF 1/2
MA, MB	Gauge port	PF 1/4

2. SPECIFICATIONS

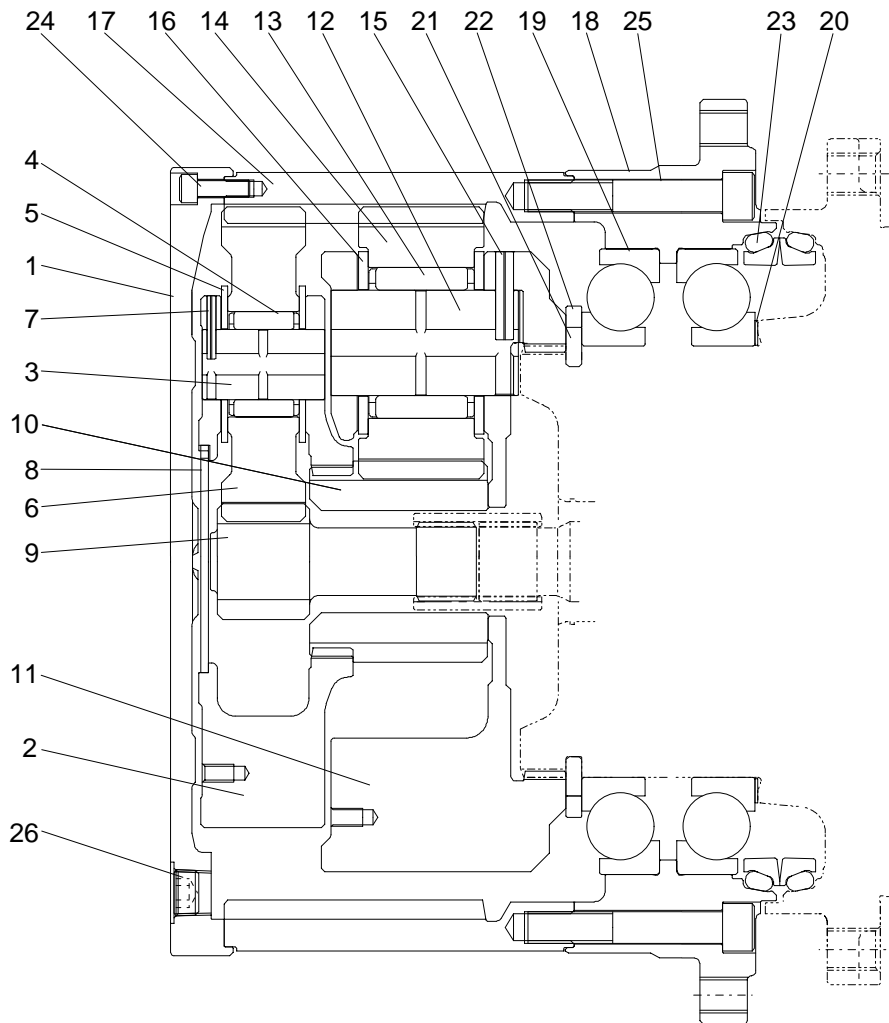
1) TRAVEL MOTOR



29072TM02

1	Casing	16	D-ring(Big)	31	Bearing
2	Rear cover	17	Check valve	32	Hexagon socket bolt
3	Cylinder block	18	C-type retaining ring	33	Shim
4	Shoe retainer	19	Retaining ring	34	Parallel pin
5	Friction plate	20	Inclined piston	35	O-ring
6	Brake piston	21	Steel ball	36	O-ring
7	Separating plate	22	Ball joint	37	O-ring
8	Valve plate	23	Piston seal	38	O-ring
9	Shaft	24	M6 restrictor(0.6)	39	O-ring
10	Coupling	25	M6 restrictor(0.8)	40	Overload relief valve
11	Swash plate	26	Oil seal	41	Pilot valve
12	Pivot	27	Check valve spring	42	Brake valve
13	Spring holder	28	Cylinder spring	43	Plug
14	Piston assy	29	Brake spring	44	O-ring
15	D-ring(Small)	30	Bearing		

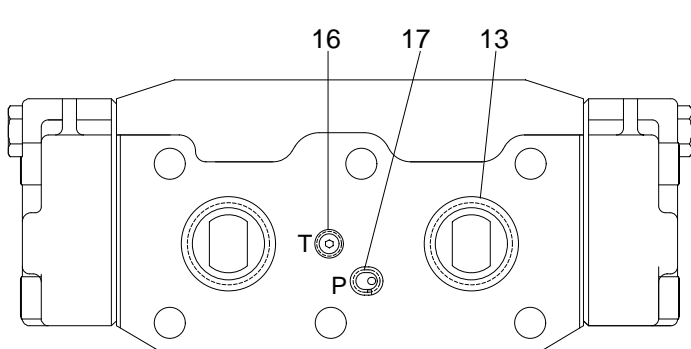
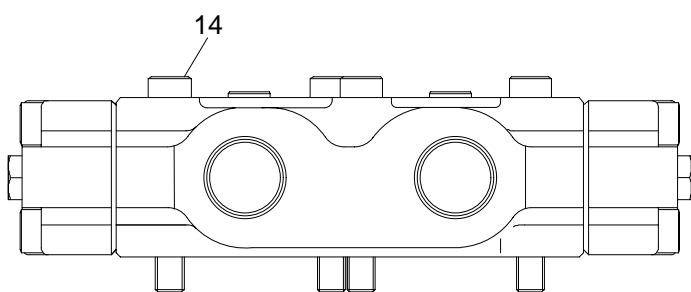
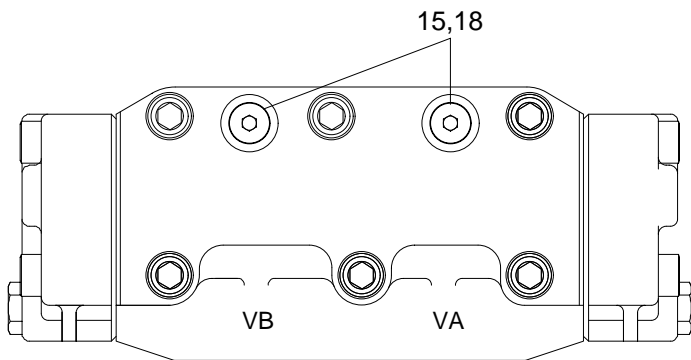
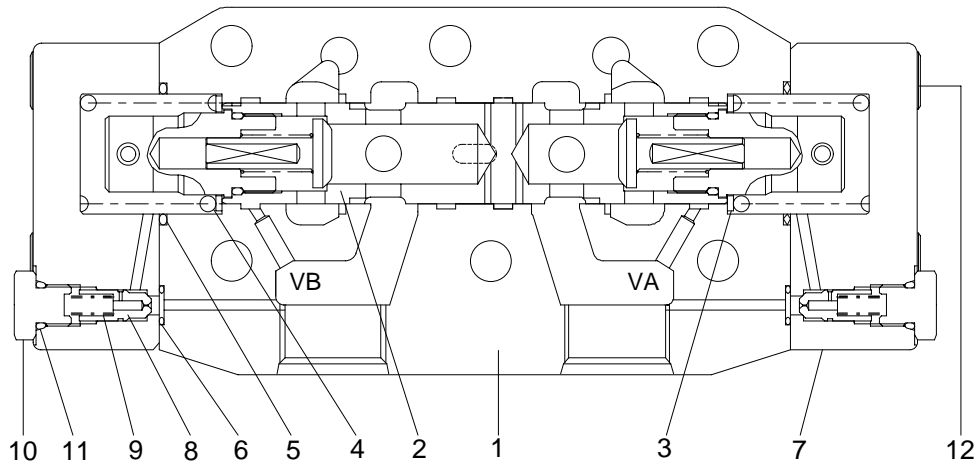
2) REDUCTION GEAR



29072TM03

- | | | | | | |
|---|------------------|----|------------------|----|------------------------|
| 1 | Cover | 10 | Sun gear 2 | 19 | Angular bearing |
| 2 | Carrier 1 | 11 | Carrier 2 | 20 | Shim |
| 3 | Carrier pin 1 | 12 | Carrier pin 2 | 21 | Lock washer |
| 4 | Needle bearing | 13 | Needle bearing | 22 | Support ring |
| 5 | Thrust washer 1 | 14 | Planetary gear 2 | 23 | Floating seal |
| 6 | Planetary gear 1 | 15 | Spring pin | 24 | Hexagon socket bolt |
| 7 | Spring pin | 16 | Thrust washer 2 | 25 | Hexagon socket bolt |
| 8 | Thrust plate | 17 | Ring gear | 26 | Socket head taper plug |
| 9 | Sun gear 1 | 18 | Housing | | |

3) BRAKE VALVE



- 1 Body
- 2 Spool assembly
- 3 Spring follower
- 4 Spring
- 5 O-ring
- 6 O-ring
- 7 Cover
- 8 Restrictor
- 9 Spring
- 10 Plug
- 11 O-ring
- 12 Hexagon socket head bolt
- 13 O-ring
- 14 Hexagon socket head bolt
- 15 Plug
- 16 O-ring
- 17 O-ring
- 18 O-ring

29072TM13

3. FUNCTION

1) BRIEF EXPLANATION OF STRUCTURE

The motor mainly consists of rotary group producing turning force to drive shaft, negative brake preventing host machine from self running during its rest, capacity control parts that changes the motor capacity consequently rotating speed and finally overload relief valve that is attached to the rear cover.

Here is another valve that plays an important role in controlling the hydraulic circuit.

That is called : Brake valve or counter balance valve.

As to this brake valve, refer to page 2-72 for its function.

(1) Rotary group

The cylinder block(3) is inserted into the spline of shaft(9), both ends of which are supported by bearings(30, 31). This cylinder block(3) is pushed toward the rear cover(2) together with valve plate(8) by cylinder spring(28).

Nine pieces of piston assy(14) slide inside the cylinder block(3) along the surface of swash plate (11). Bearings are provided on the end surface of piston assy(14) to reduce the sliding resistance and the ends of piston assy(14) are pushed toward swash plate(11) by cylinder spring(28) through spring holder(13), ball joint(22) and shoe retainer(4).

(2) Negative brake

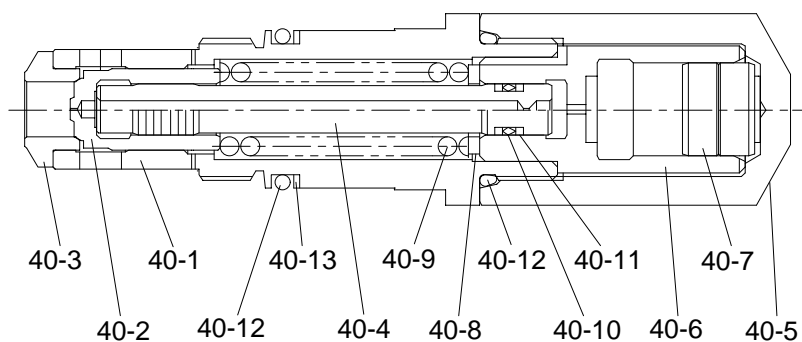
5 separator plates(7) and 4 friction plates(5) are alternately set on the spline of cylinder block(3) and pushed together by 12 brake springs(29) through brake piston(6).

(3) Capacity control parts

They consist of : pivots(12) that support swash plate(11) and slide in two half-spherical recesses in swash plate(11) : Inclined piston(20) that change the angle of swash plate(11) on the pivots(12) : stopper(1-1) of casing that limits the angle of swash plate(11) : pilot valve(41) that leads the oil to inclined piston(20) by external pilot signal : three check valves(17) that select the maximum pressure from the external pilot pressure, inlet pressure and outlet pressure of the motor and send it to pilot valve(41).

(4) Overload relief valve

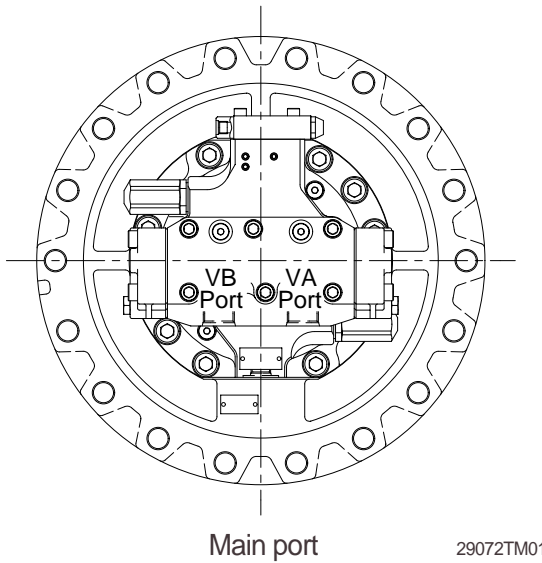
This valve is screwed in the motor rear cover(2) and consists of : socket(40-1) that is screwed and fixed in the rear cover(2) and supports the valve seat(40-3) which metallically seated in the hole of rear cover(2) : valve(40-2) that contact with valve seat(40-3) by adjusting spring(40-9) and fitted in the hole of socket(40-1) : coupling piston(40-4) that fitted in the hole of the valve(40-2) and functions also as an oil passage : piston(40-7) that is inserted in the pilot body(40-6) and : shim (40-8) that adjust the spring force.



- 40-1 Socket
- 40-2 Valve
- 40-3 Valve seat
- 40-4 Coupling piston
- 40-5 Cap
- 40-6 Pilot body
- 40-7 Piston
- 40-8 Shim
- 40-9 Adjusting spring
- 40-10 O-ring
- 40-11 Back up ring
- 40-12 O-ring
- 40-13 Back up ring

29072TM04

2) FUNCTION

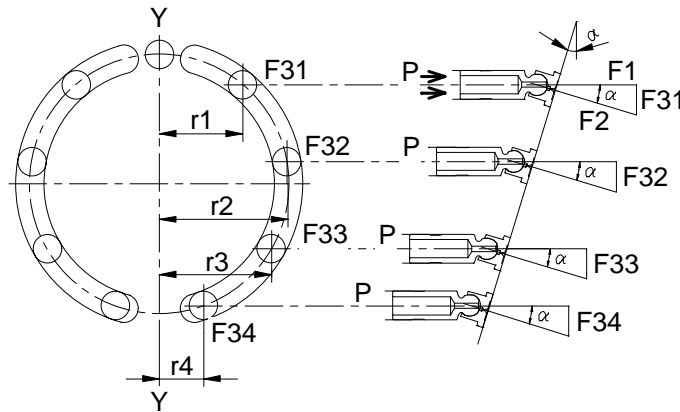


Direction of shaft rotation

Inlet port	Outlet port	Direction of rotation (Viewing from valve side)
VB	VA	Right(Clock wise)
VA	VB	Left(Counterclockwise)

(1) Motor

High pressure oil delivered from hydraulic pump is led to inlet port that is provided in the brake valve(42) and, through the rear cover(2) and valve plate(8), led to cylinder block(3). The oil flow and direction of shaft rotation are indicated in table.



As shown in figure 5(a), high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

$$F1 = P \times A$$

(P : Pressure, A : Area of piston section)

The swash plate(11) with inclined angle of α divides this force F1 into thrust force F2 and radial force F31-F34(or F35)(Figure 5(b)). This radial force is applied to axis Y-Y as turning force and generate drive torque of T

$$T = r1 \cdot F31 + r2 \cdot F32 + r3 \cdot F33 + r4 \cdot F34$$

(In case high pressure oil is applied to five pieces of pistons, $r5 \cdot F35$ should be added.)

This drive torque is transmitted via cylinder block(3) to driving shaft(9).

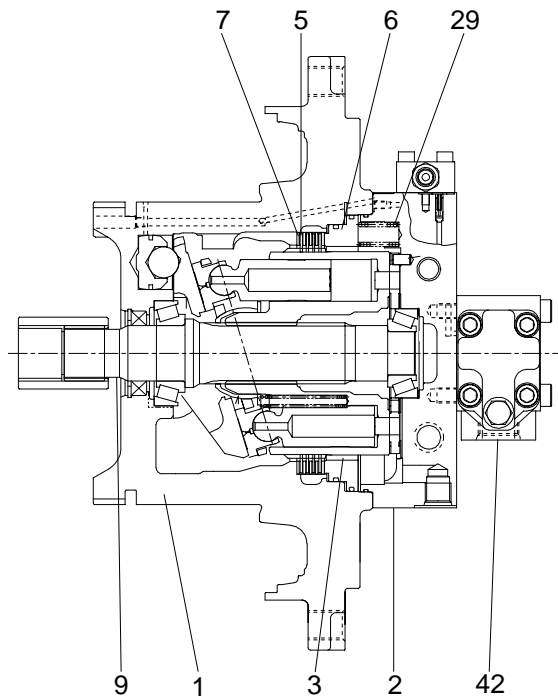
(2) Negative brake

Negative brake is released when high pressure oil, selected by the brake valve(42) that is connected directly to the rear cover(2), is applied to the brake piston(6).

Otherwise the braking torque is always applied.

This braking torque is generated by the friction between the separator plates(7), inserted into the casing(1) and friction plates(5), coupled to cylinder block(3) by the outer splines.

When no pressure is activated on the brake piston(6), it is pushed by the brake spring(29) and it pushes friction plates(5) and separator plates(7) towards casing(1) and generates the friction force which brakes the rotation of cylinder block(3) and hence the shaft(9).



29072TM07

(3) Capacity control mechanism

When high speed pilot line is charged with the pressure PA that overcome the spring(41-7), the spring(41-7) is compressed and spool(41-2) shifts to the right to connect the port P and port C.

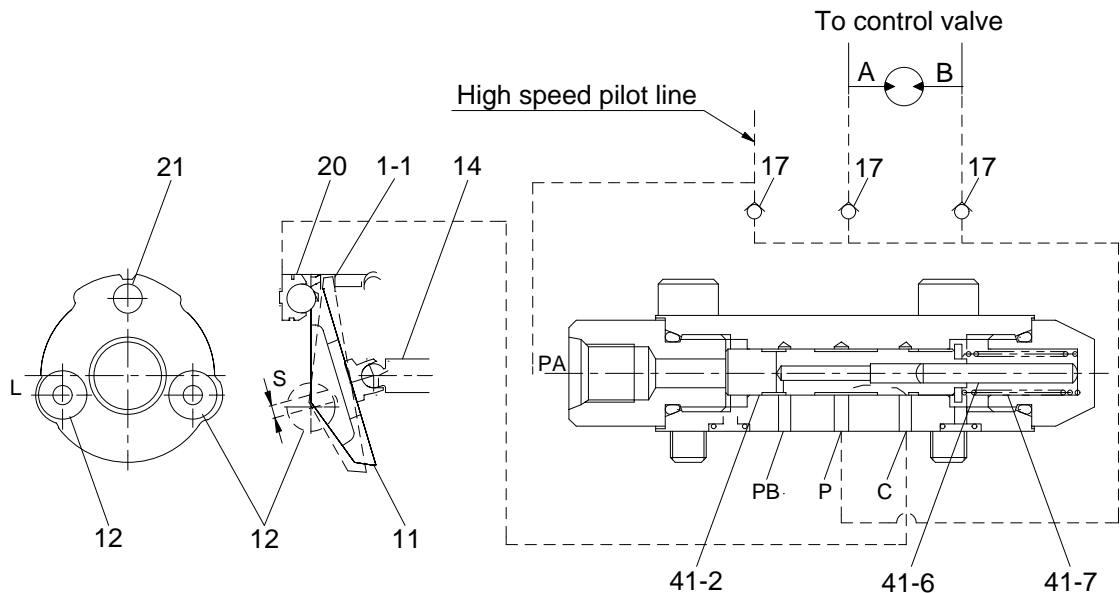
Then, the highest pressure is selected by the check valve(17) from inlet and outlet pressure of the motor and high speed pilot line pressure and pushes inclined piston(20). As a result, swash plate (11) turns around the line L which connect the two pivots(12) as shown by dotted lines. The turn stops at the stopper(1-1) of casing and swash plate(11) keeps the position.

In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.5 times, by the same volume of oil.

When no pressure is in the high speed pilot line PA, spool(41-2) is pushed back by the spring(41-7) and pressure that pressed the inclined piston(20) is released to the hydraulic tank. Here, nine pistons are there and they equally spaced on the swash plate(11). The force that summed up those of pistons comes to almost the center of the swash plate(11) as shown. Since the pivots(12) are off set by S from the center, the rotating force of product S and the force moves swash plate(11) to the former position and the speed returns to low.

When the power demand exceeds the engine power, such as in steep slope climbing or turning at high speed, the system step down to the low speed automatically. The mechanism is that : pump pressure is led to the port PB and this pressure activate on pin(41-6). When the pressure at PB exceeds predetermined value, spool(41-2) returns to the left by the counter pressure against pin (41-6) and the pressure on the piston(21) through port C is released to the tank and the motor comes to low speed.

When PB goes down, the spool(41-2) moves to the right and the speed become high.



29072TM08

(4) Overload relief valve

Two pieces of overload relief valves are located at cross over position in the counterbalance circuit of brake valve and have the following functions.

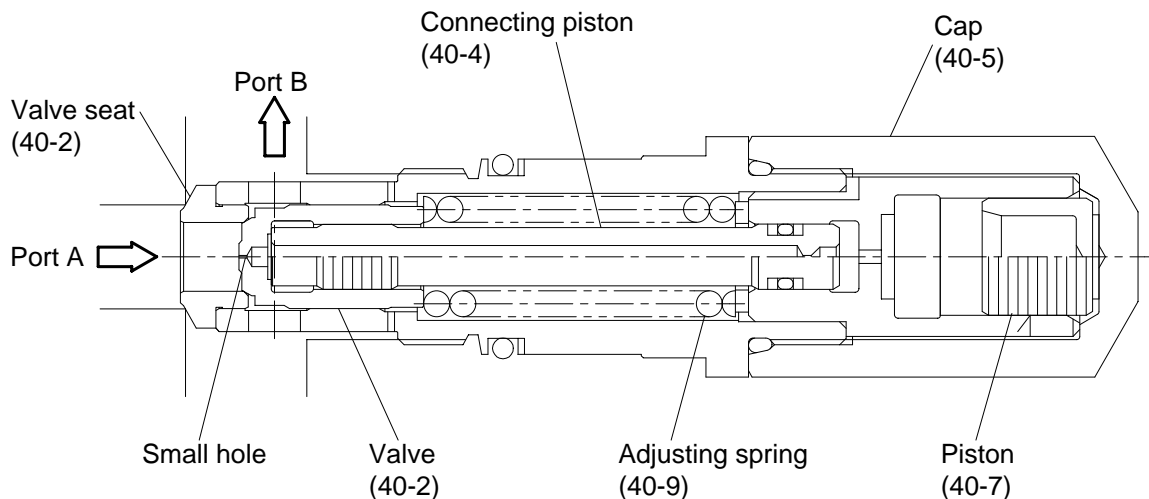
When hydraulic motor starts, keep the driving pressure below predetermined value and while accelerating, bypasses surplus oil to return line.

When stopping the motor, keep the brake pressure, that develops on the outlet side of motor, under the predetermined value to stop the inertial force.

To accelerate sharply while starting, and to mitigate the braking shock while stopping. For these purposes, the developed pressure is kept comparatively low for a short period, then keep the line pressure as normal value. While the pressure is low, meshing of reduction gears, crawler and sprocket etc. can be smoothly done and the shock are absorbed.

When starting A port pressure of overload relief valve increases, this pressure is applied to the effective diameter of valve(40-2) which seats on the valve seat(40-3) and at the same time, is delivered, via small hole, to the connecting piston(40-4) located inside the valve(40-2) and the piston bore pressure increases up to A port pressure. The valve(40-2) opposes to adjusting spring(40-9) by the force of the pressure exerted on the area difference between valve seat's effective diameter and piston bore and keep the predetermined pressure.

When hydraulically braking, the piston(40-7) is at the left position by the driving pressure, and when A port pressure increases, the pressure is applied also to the piston(40-7) through the small hole in the valve(40-2) and piston(40-7) moves rightward until it touches the cap(40-5). In this while, the valve(40-2) maintains A port pressure at comparatively low against the adjusting spring(40-9) force and exhaust oil to B port side. After the piston reached to the plug, the valve acts the same as at starting.



29072TM09

3) REDUCTION GEAR

(1) Planetary gear mechanism

Reduction unit slows down the rotating speed of motor and converts motor torque to strong rotating force.

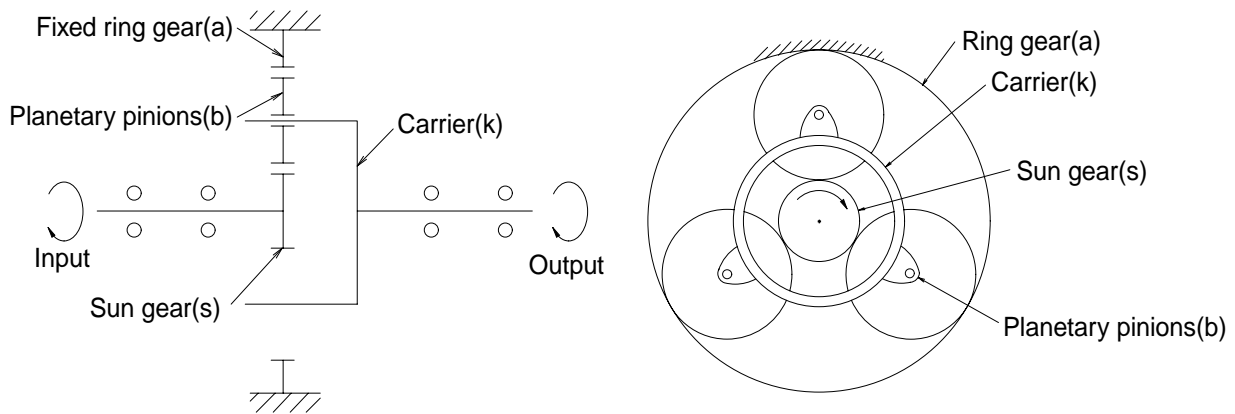
This reduction unit utilizes two stages, planetary reduction system.

Planetary reduction system consists of sun gear, planetary gears, carriers and ring gear.

When the sun gear(s) is driven through input shaft, planetary pinions(b), rotating on their center, also move, meshing with fixed ring gear(a), around sun gears(s).

This movement is transferred to carrier(k) and deliver the torque.

This mechanism is called planetary gear mechanism.



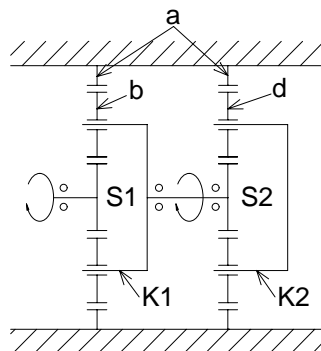
29072TM10

29072TM11

(2) Two stages reduction gear

When the sun gear **S1** is driven by input shaft, planetary action occurs among gears **S1**, **a** and **b** and revolution of gear **b** transfers the rotation of carrier **K1** to second sun gear **S2**, and also evokes planetary action between gear **S2**, **a** and **d**.

This time, because carrier **K2** is fixed to frame, gear **d** drives ring gear **a** and then ring gear **a** rotates to drive sprocket.



29072TM12

4) BRAKE VALVE

(1) Function

Spool

By shifting the spool, the discharged oil from hydraulic motor is automatically shut off or restricted according to the condition and give the effect of holding, accelerating, stopping and counterbalance operations.

Check valve(Built in the spool)

This valve is located in the oil supplying passage to hydraulic motor, and at the same time functions to lock oil displacement. Therefore, this valve serves as not only a suction valve but also a holding valve for hydraulic motor.

Relief valve(Built in hydraulic motor)

When the oil is pressurized either in oil supply or oil discharge passage of hydraulic motor, to the set value, the pressurized oil is relieved to the passage of lower pressure side. Thus this relief valve fulfills the function of a safety valve for the circuit.

(2) Operation

Figures in this chapter show the oil flow and the movement of component parts in each position. The figures are deformed for ease of understanding and the correct formation should be ascertained by page 2-65.

Holding position

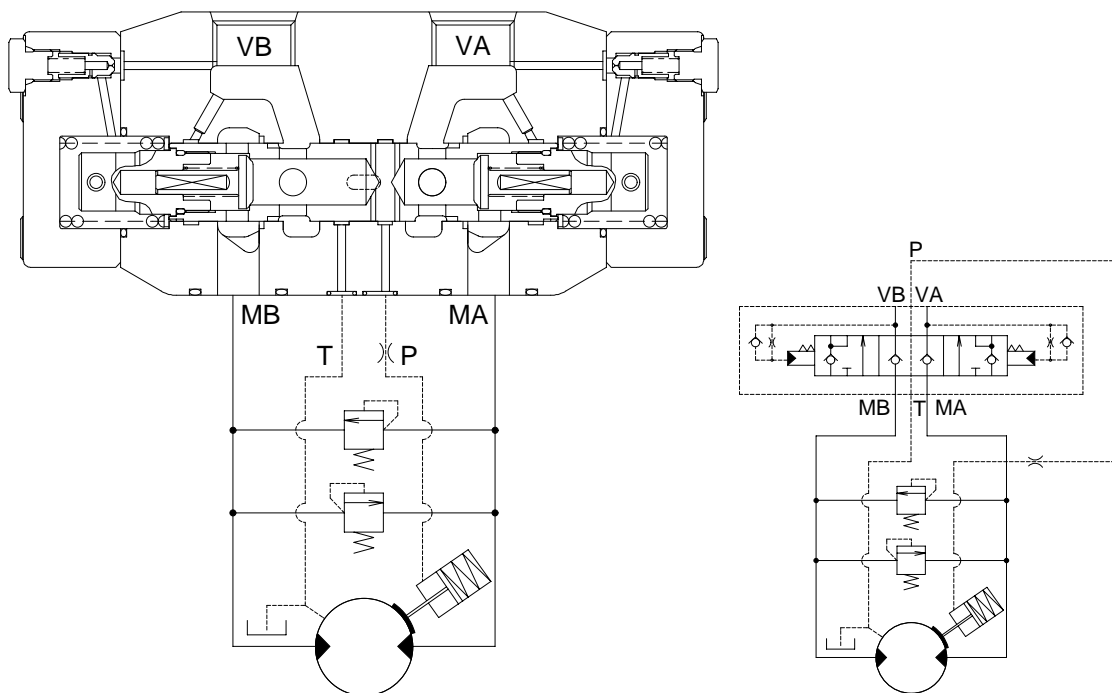
When the control valve is at neutral position, VA and VB ports are connected to the tank, and the spring 4 located on both spool ends holds the spool 2 at central position.

Therefore, the passages from VA to MA and VB to MB are closed, which result in closing MA and MB port connected to hydraulic motor.

Since the passage to parking brake is connected to the tank line, the brake cylinder pressure is equal to the tank pressure and the brake is applied by the springs. Thus, the rotation of the motor is mechanically prevented.

If external torque is exerted on the motor shaft, the motor would not rotate as usual by this negative parking brake.

In case the brake should be released for some reason, pressure is built on MA or MB port. But, due to oil leakage inside hydraulic motor or so, high pressure oil escapes from the closed circuit and motor rotates a bit. So, the cavitation tends to occur in the lower pressure side of the closed circuit. Then, the check valve, built in the spool, operates to avoid the cavitation and opens the passage from VA to MA or from VB to MB. Then the oil equivalent to the leakage is sucked from the tank line to the closed circuit.



29072TM14

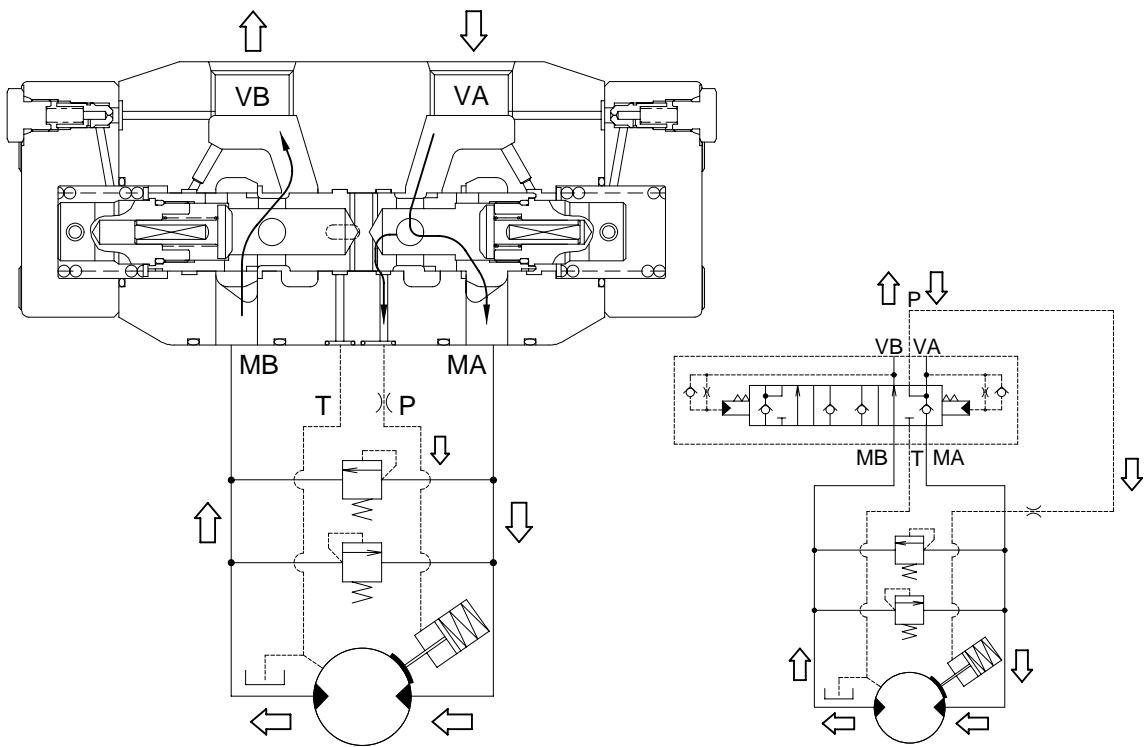
Accelerating operation

When VA and VB ports are connected respectively to pump and tank by operating the control valve, hydraulic oil from pump is forwarded through VA port to push open the check valve provided inside spool, and oil flows to motor via MA port to rotate the motor.

Therefore, the pressure increases and negative brake is released by the pressure supplied from pump. At the same time, the pressure of pilot chamber increases to push and move the spool leftwards, overcoming the spring force. Thus, the return line from MB to VB opens to rotate the motor.

In case inertia load is too big to start rotation, accelerating pressure reaches the set pressure of relief valve and high pressure oil is being relieved while the motor gains the rotational speed.

As the rotational speed goes up, the relieved volume decreases, and finally the motor rotates at a fixed speed.

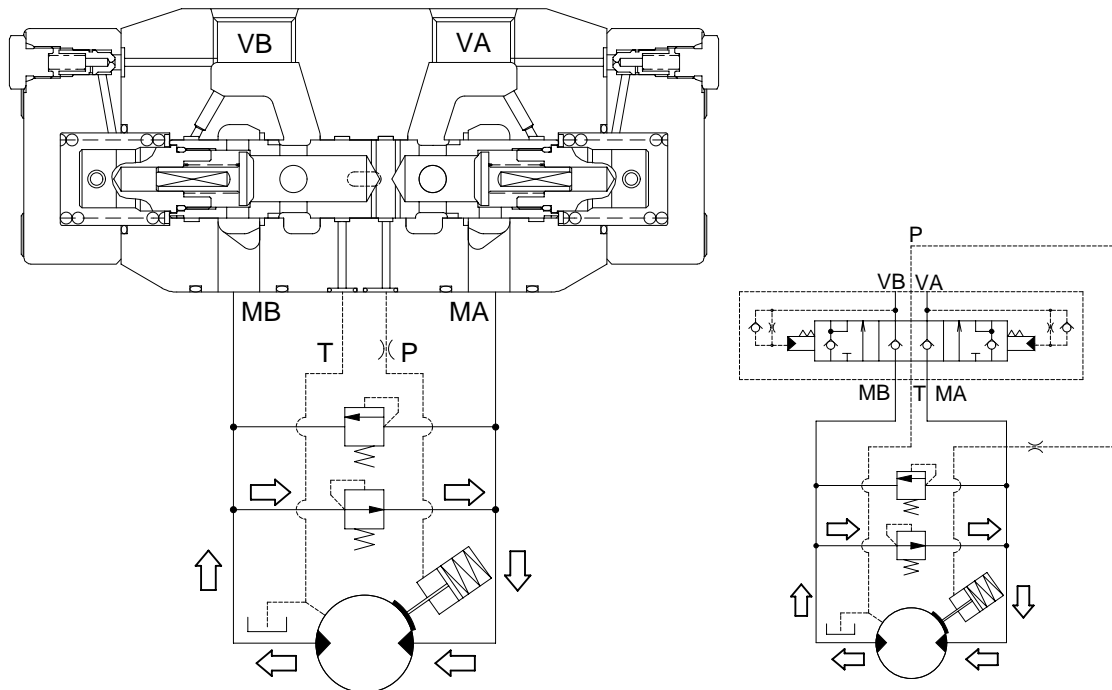


29072TM15

Stopping operation

Returning the control valve to neutral position while running the motor, the oil supply is cut off and VA and VB ports are connected to the tank line. Then the pressure of the pilot chamber located on both spool ends become equal, and the spool returns to the neutral position by spring force. Thus, the passage from MA to VA is closed.

Owing to the inertia force of the load, the hydraulic motor tends to continue the rotation. Here, the motor functions as a pump and forwards the oil to MB port but the passage is blocked and MB port pressure increases. Then the relief valve opens to relieve the pressure and rotational speed decelerates and at last the motor stops. Negative brake release pressure is gradually lowered due to the restrictor and finally the brake works and the motor is mechanically stopped.



29072TM16

Counterbalance operation

Counterbalance operation is required to decelerate slowly the hydraulic motor while absorbing inertia force.

In case the hydraulic oil is gradually decreased from pump to VB port, the drive shaft of hydraulic motor tends to rotate faster than that matched to the volume of oil supply.

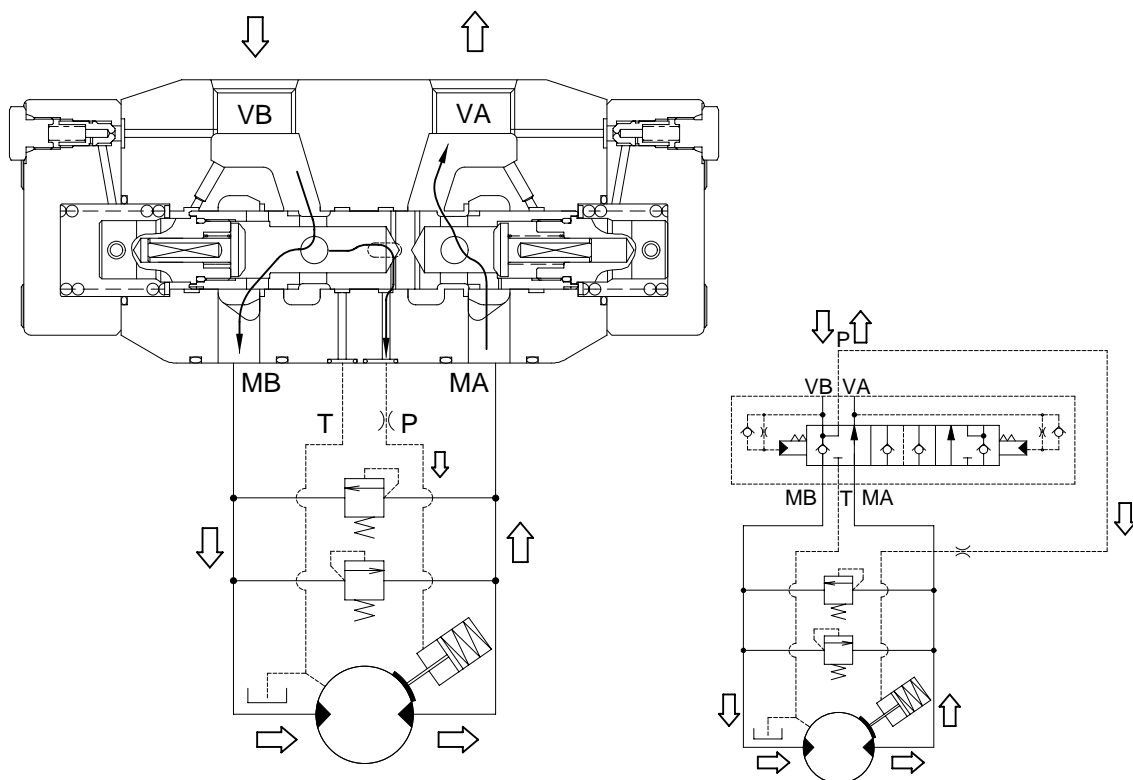
Consequently, the pilot chamber pressure on MB to VB side decreases and the spring force moves the spool leftwards towards neutral position. Therefore, the area of passage from MA to VA becomes smaller and the pressure on MA side rises due to increased resistance in the passage and the motor receives hydraulic braking effect.

If the motor rotates slower than that matched to the volume of supplied oil, the pilot chamber pressure on VB port increases, and spool moves rightwards to enlarge the area of passage from MA to VA.

Therefore the braking effect becomes smaller and the rotational speed of motor is controlled to correspond to the volume of supplied oil.

In order to give stable counterbalance operation, the restrictors are set in the pilot chamber to damp the spool movement.

The negative brake is released during pressure adjusting action of the spool.



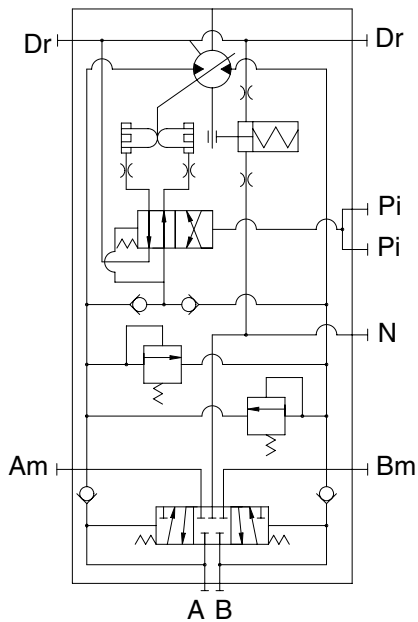
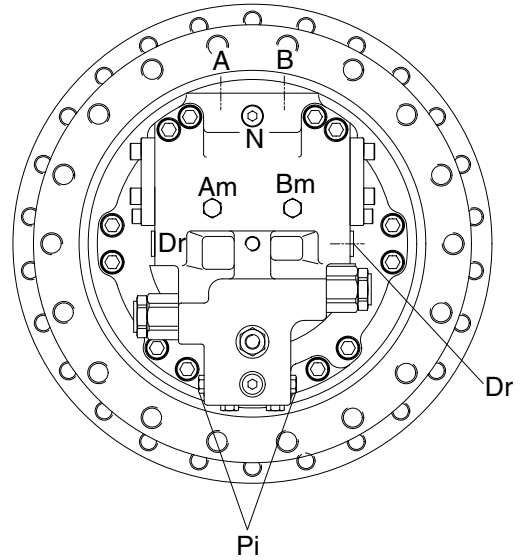
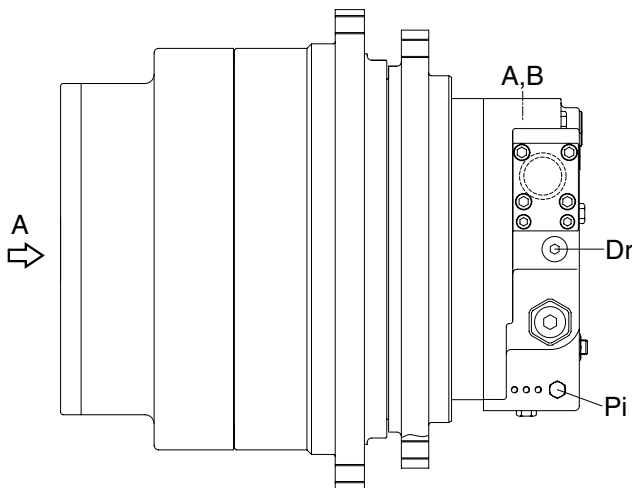
29072TM17

GROUP 4 TRAVEL DEVICE(#1456 and up)

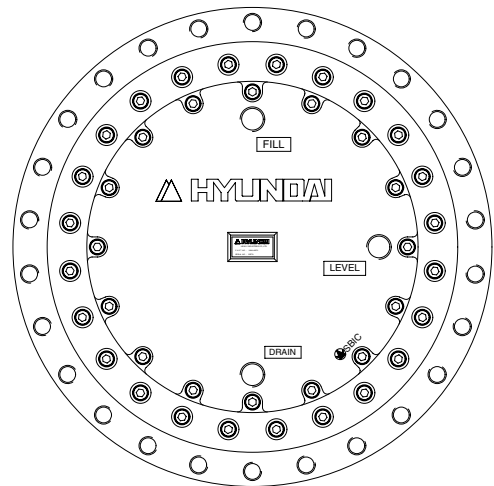
1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



CIRCUIT DIAGRAM



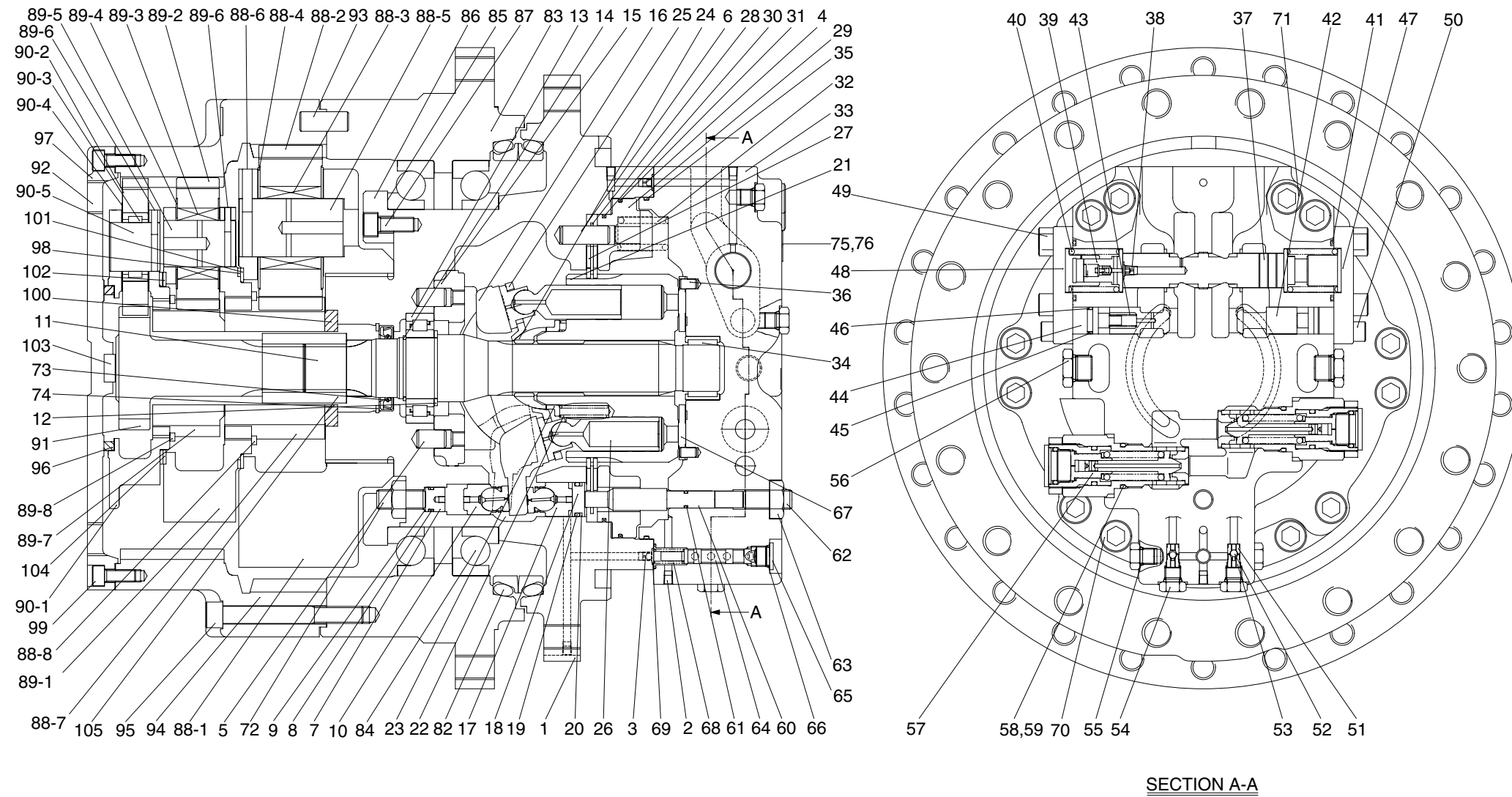
VIEW A

300072TM01A

Port	Port name	Port size
A, B	Valve port	SAE 6000psi 1"
Pi	Pilot port	PF 1/4
Dr	Drain port	PF 1/2
Am, Bm	Gage port	PF 1/4
N	Parking release port	PF 1/4

2. SPECIFICATION

1) TRAVEL MOTOR



2907A2TM01

1 Casing	16 Plate	31 Ring	46 Back up ring	61 O-ring	83 Housing	89-1 Carrier No.2	92 Plug
2 Plug	17 Piston	32 Spring	47 Cap	62 Lock screw	84 Bearing	89-2 Planetary gear No.2	93 Lock pin
3 Screw	18 Stopper	33 Valve casing	48 Cap	63 Nut	85 Shim	89-3 Needle No.2	94 Ring gear
4 Screw	19 O-ring	34 Needle bearing	49 Bolt	64 Spool	86 Retainer	89-4 Thrust washer No.2	95 Bolt
5 Pin	20 Back up ring	35 O-ring	50 Socket bolt	65 Plug	87 Bolt	89-5 Pin No.2	96 Thrust ring No.1
6 Pin	21 Cylinder block	36 Pin	51 Seat	66 O-ring	88 Carrier No.3	89-6 Spring pin No.2	97 Cover
7 Stopper	22 Cylinder spring	37 Spool	52 Steel ball	67 Valve plate	88-1 Carrier No.3	89-7 Sun gear No.2	98 Thrust ring No.2
8 O-ring	23 Spacer	38 Screw	53 Stopper	68 Spring	88-2 Planetary gear No.3	89-8 Snap ring No.2	99 Bolt
9 Back up ring	24 Guide	39 Damping check	54 Plug	69 O-ring	88-3 Needle No.3	90 Carrier No.1	100 Motor ring
10 Piston	25 Plate	40 Spring	55 O-ring	70 Socket bolt	88-4 Thrust washer No.3	90-1 Carrier No.1	101 Thrust ring No.3
11 Shaft	26 Piston & Shoe assy	41 O-ring	56 Plug	71 Socket bolt	88-5 Pin No.3	90-2 Planetary gear No.1	102 Thrust ring No.1
12 Spacer	27 Plate	42 Plunger	57 Relief valve	72 Lock screw	88-6 Spring pin No.3	90-3 Needle bearing No.1	103 Pad
13 Roller bearing	28 Plate	43 Spring	58 O-ring	73 Oil seal	88-7 Sun gear No.3	90-4 Thrust washer No.1	104 Thrust ring No.2
14 Stop ring	29 Brake	44 Stopper	59 Back up ring	74 Lock ring	88-8 Snap ring No.3	90-5 Pin No.1	105 Coupling
15 Support	30 Ring	45 O-ring	60 Rod	82 Floating Seal	89 Carrier No.2	91 Sun gear No.1	

3. PRINCIPLE OF DRIVING

1) WORKING OF ROTARY GROUP

The high pressurized hydraulic oil which is supplied from a hydraulic pump is flows into a cylinder(21) through the valve casing(33) of motor, and valve plate(67).

The rotary group has a construction that the above high pressurized hydraulic oil is flow only one side of the line Y-Y which connect the upper and lower dead point of the piston(26).

This high pressurized hydraulic oil works on the piston and generating the force $F1$, $F1 = P * A$ (P : supplied pressure, A : pressure receiving area), like following pictures.

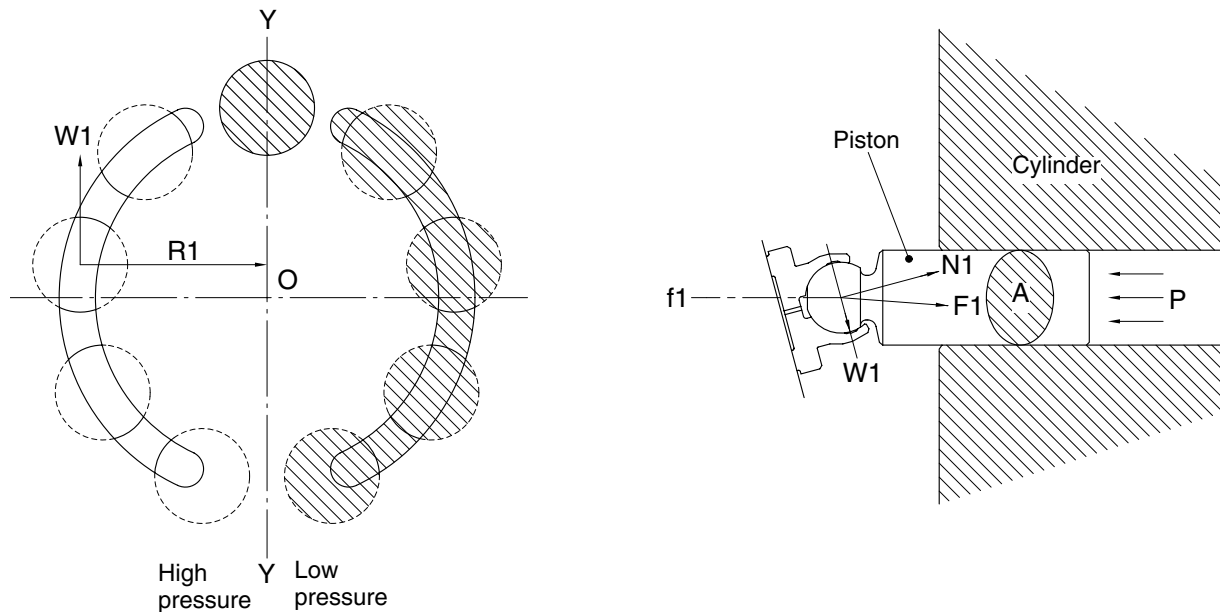
This force, $F1$, is devided by the swash plate(16) having a tilting angle α into the thrust component $N1$ and radial component $W1$.

The $W1$ generates torque, $T = W1 * R1$, in respect to the line Y-Y.

This torque generated by each piston on the high pressurized hydraulic oil side is summed up onto a resultant torque $\Sigma(W1 * R1)$, which prodeces torque for rotation.

This torque transfers the rotation force to the cylinder(21) through the pistons.

Since the cylinder block is spline-coupled with the shaft, the rotation force is transmitted to the shaft accordingly.



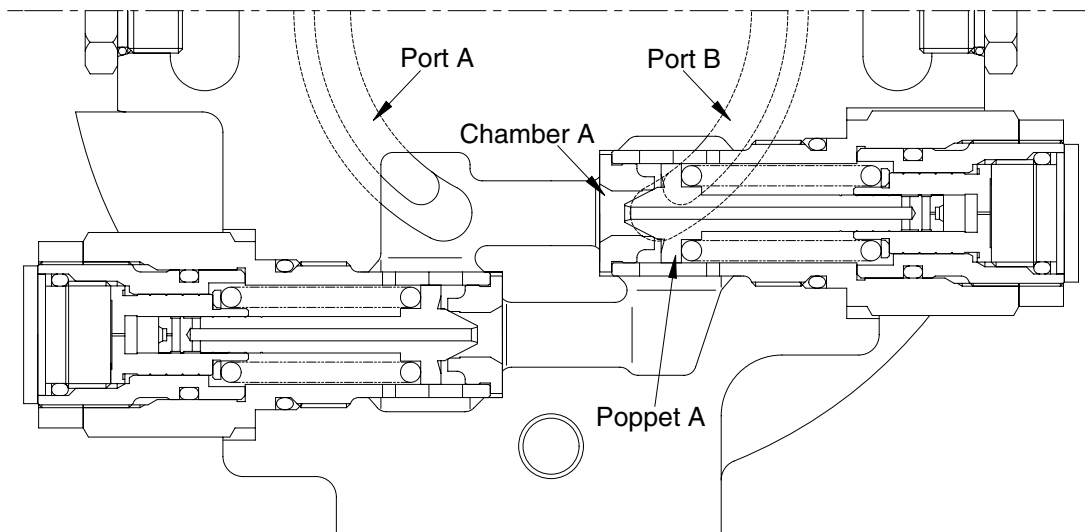
2907A2TM07

2) WORKING OF RELIEF VALVE

Relief valve carries on two function of following.

- (1) Relief valve is 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 inertia object.
- (2) In case of an inertia object stopped, relief valve is generating a break pressure at the outlet and stop it forcedly.

The chamber A is always connect with port A of a motor. When the pressure at port A increase and the force pushing poppet A is higher than the 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.



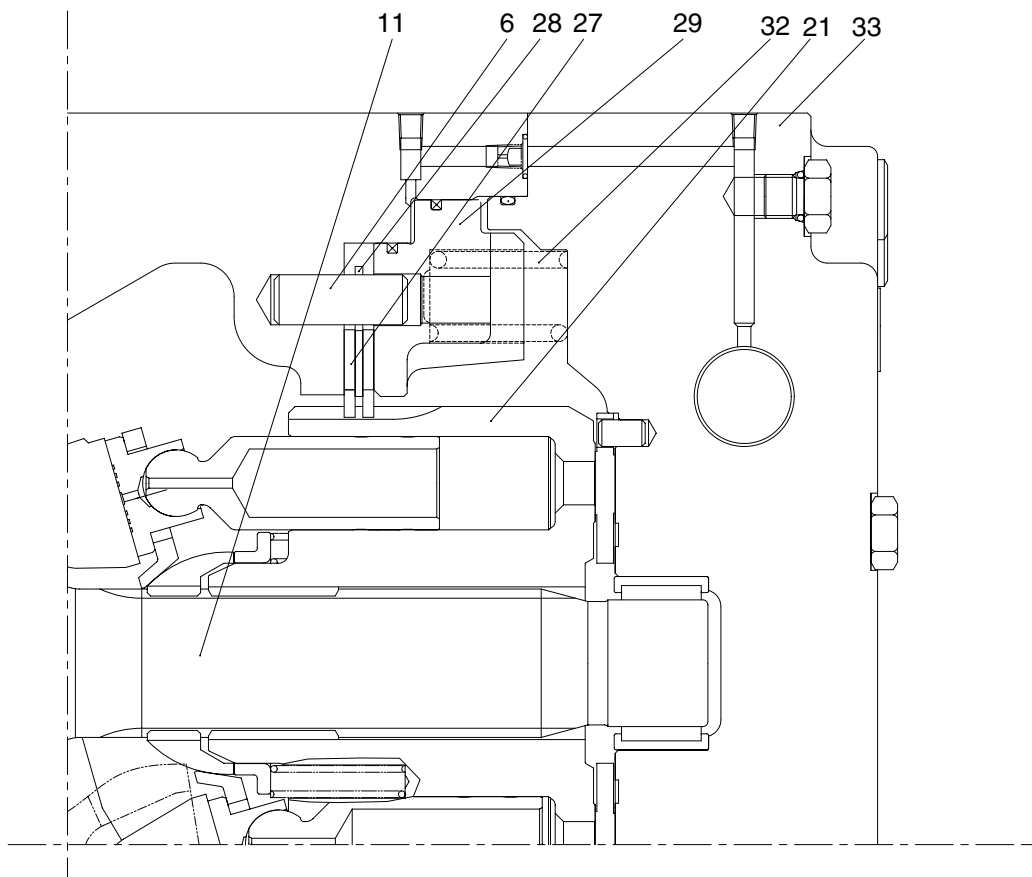
2907A2TM04

3) WORKING OF NEGATIVE BRAKE

The negative brake is released applying to the brake piston(29) the pressure led through built in the valve casing(33) spool. With no pressure working, the brake force is always ensured.

The brake force is generated by the frictional force among a plate(28) fixed by pin(6) and shaft casing, brake piston(29) and a frictional plate(27) connected through spline outside the cylinder block(21).

Without pressure being applied to the brake piston, the brake piston is pushed by ten brake springs(32) and the friction plate and separator plate are held between the brake piston and casing. This friction force restrains the shaft(11) spline-coupled with the cylinder block, and thus functions the brake.



300075TM05

4) COUNTERBALANCE VALVE

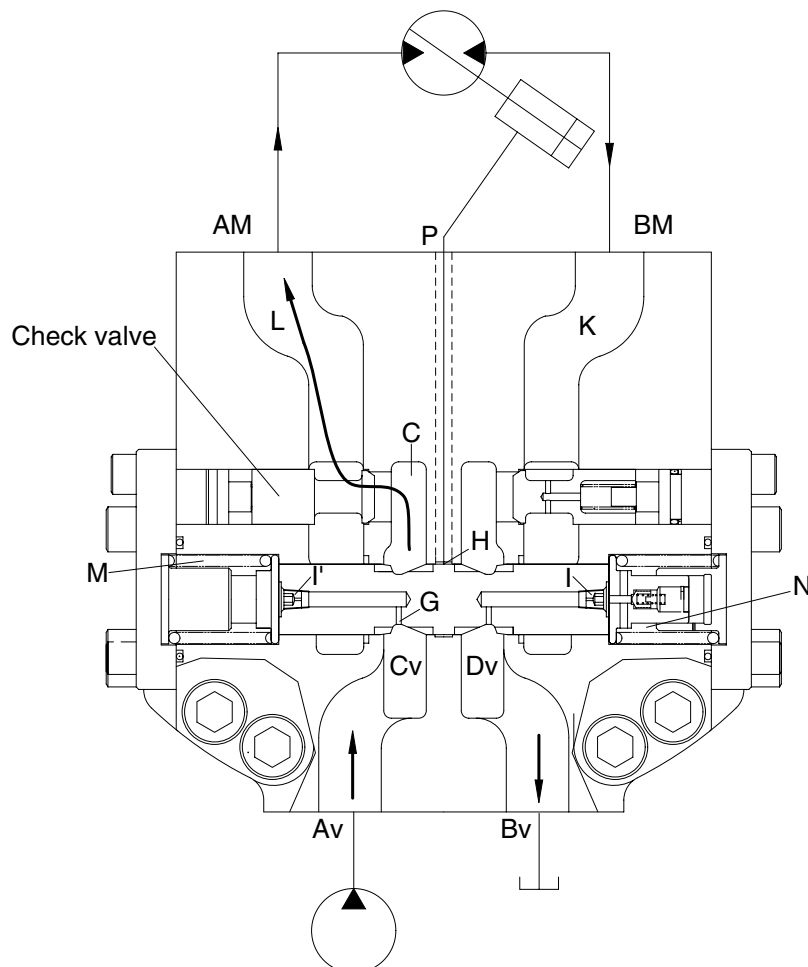
Av port is connected to a hydraulic pump : Bv port is connected to a tank.

The oil supplied from the hydraulic pump passed through Av → Cv → C sequence, pushed up the poppet of the check valve, passed through L to port AM, and is supplied to the hydraulic motor to turn it. But the brake is operated. Therefore, the pump discharge oil pressure is increases. And the pressure is led via passage G to spring room M. When the pressure in room M exceed the value equivalent to the force of the spring which holds the spool at its neutral position, the spool begins to move right.

The oil in room N is sent to room Dv by orifice I and discharged from Bv port to a tank. So spool moves to the right. The oil flows as the way of K → Dv → Bv sequence. Also according to the oil path as composed way Cv → H → P sequence, the pressure of Av pump is provided to the port P. An working oil in room N is discharged through orifice and a gap. Therefore the switching operation of spool is driving slowly.

When the pump discharge pressure fall, spool moves to the left side by a spring at the side of room N. Also spool moves to the left, the hydraulic oil in room M is sent to Cv room through orifice I' and discharged to the Av port.

When the pressure at port Av fall down to the tank pressure, the pressure of room M is as the same as that the tank pressure and becomes equal to that in room N, and so the spool returns to its neutral position.



300072TM06

5) WORKING OF DISPLACEMENT CHANGEOVER

The capacity of the travel motor is changed by changing the tilting angle of this swash plate(16).
The tilting angle changes by displacement changeover valve.

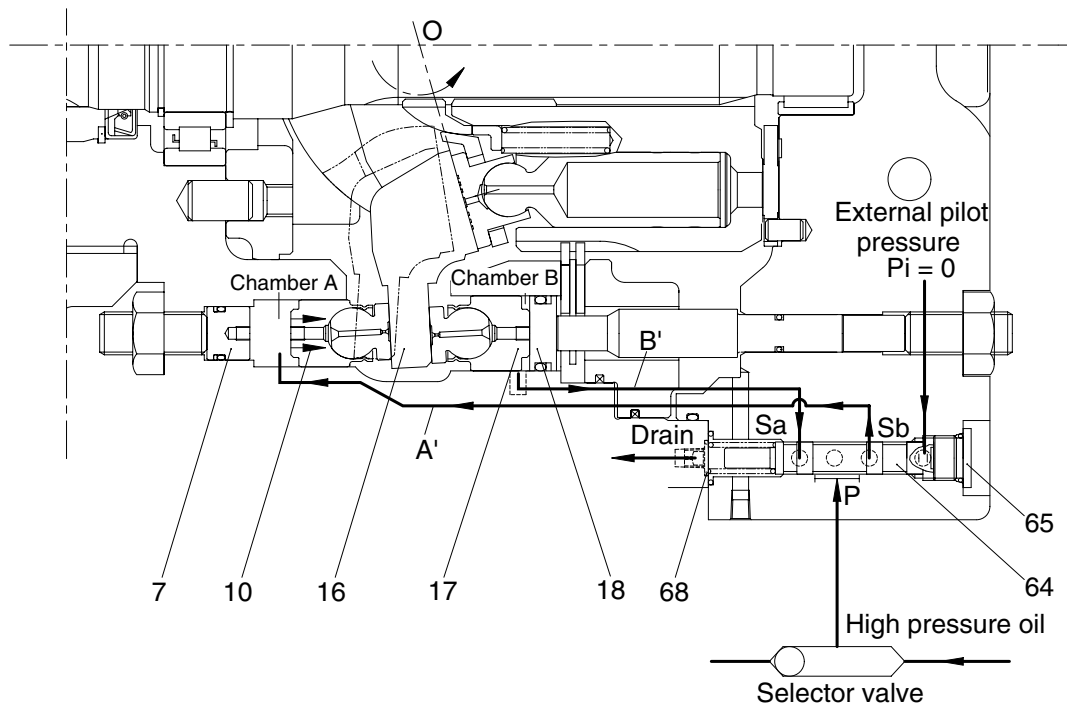
(1) External pilot pressure : $P_i = 0$ (Large displacement)

By means of the built-in high pressure selector mechanism in the valve casing(33), the high pressure oil working on the motor function to port P of the displacement-changeover valve.

A the spool(64) assembled in the displacement changeover valve is pressed to plug(65) by the spring(68), the high pressure oil at port P flows to port Sb.

This high pressure oil flows through oil passage(passage A') of valve casing(33) and shaft casing works to chamber A.

This oil in chamber B flows through passage B' and port Sa into the drain line. The displacement changeover piston(17) is pushed right and the swash plate(16) moves in the arrowed direction around rotation center 'O'. The swash plate moves until it touched stopper(18), and then is fixed there.



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(2) External pilot pressure : $P_i \geq 20\text{kgf/cm}^2$ (small displacement)

If the force operating on spool(64) of the displacement changeover valve is stronger than the spring(68), and the spool moves to the left side.

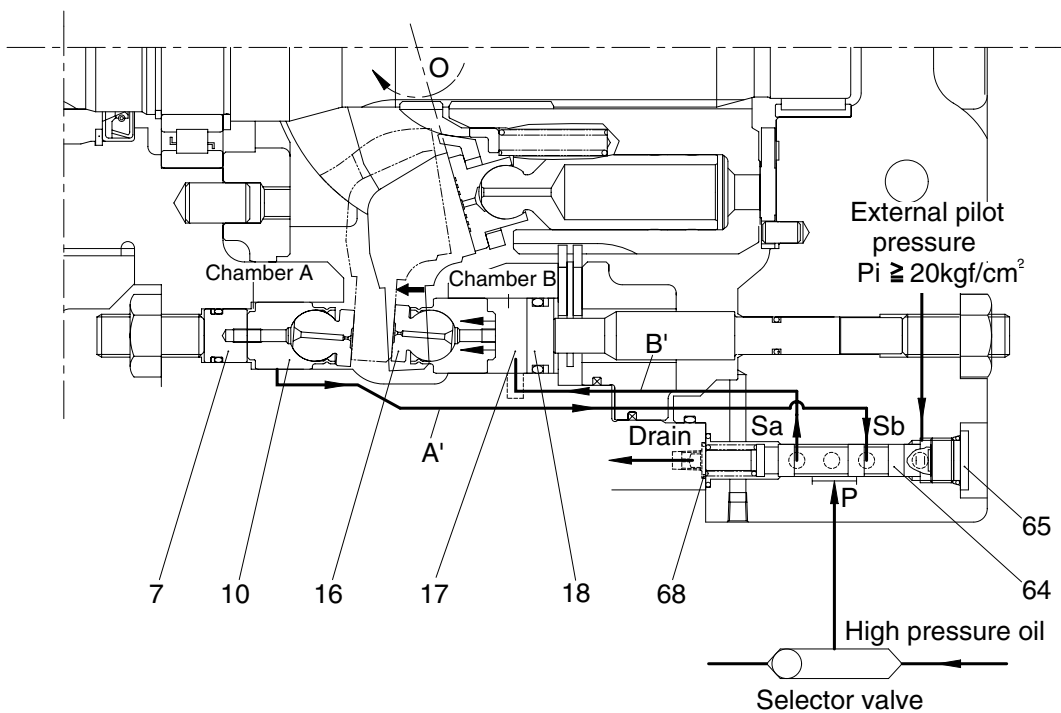
The high pressure oil works on room B through passage Sa → B' from port P.

The oil in chamber A flows into the drain line through the passage A' → Sb.

The displacement changeover piston(17) is pushed left and the swash plate(16) moves in the arrowed direction around rotation center 'O'. The swash plate moves until it touches stopper(7), and then is fixed there.

If the load increase while the motor is working with its small displacement($P_i \geq 20\text{kgf/cm}^2$, 2nd speed) until the motor inlet port pressure reaches the preset value, the motor increase its displacement in response to the load, while maintaining the pressure at the preset value (automatic 2 -speed function). As motor inlet port pressure reaches the preset value and then spool(64) moves right side, inlet pressure oil flows into chamber A through port Sb and the swash plate moves until it touches stopper(17). If the load further increase until the displacement of the motor reaches the maximum value, the inlet port pressure increase further.

If the load decreases under this condition, the motor continues reducing its displacement in the reverse sequence. As the load and inlet port pressure decreases and reaches the preset value, spool(64) moves left side by the pilot pressure(P_i). Therefore inlet port pressure flow into chamber B through port Sa and the swash plate moves until it touches stopper(10).



2907A2TM06

6) REDUCTION GEAR

(1) Planetary gear mechanism

Reduction unit slows down the rotating speed of motor and converts motor torque to strong rotating force.

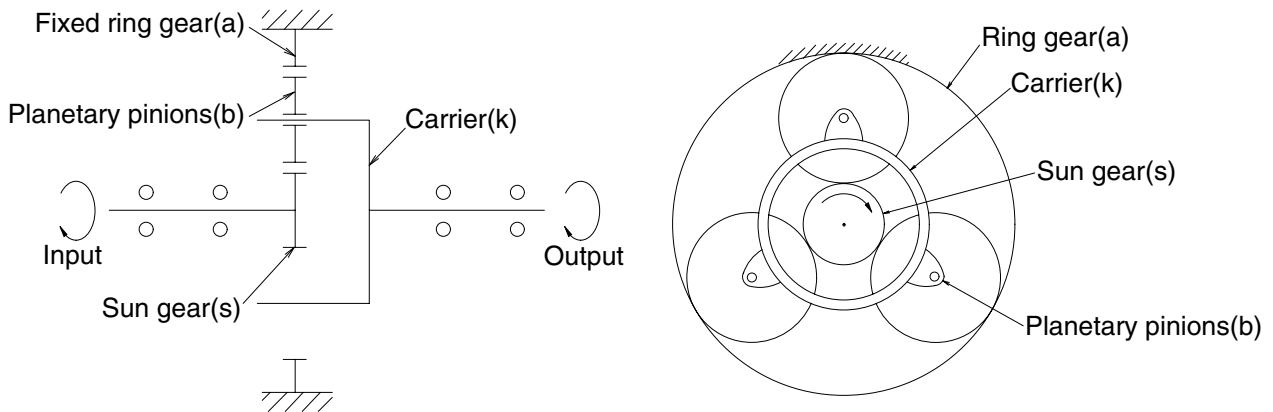
This reduction unit utilizes two stages, planetary reduction system.

Planetary reduction system consists of sun gear, planetary gears, carriers and ring gear.

When the sun gear(s) is driven through input shaft, planetary pinions(b), rotating on their center, also move, meshing with fixed ring gear(a), around sun gears(s).

This movement is transferred to carrier(k) and deliver the torque.

This mechanism is called planetary gear mechanism.



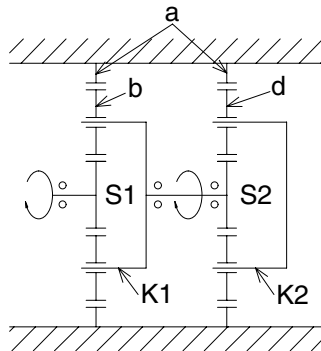
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(2) Two stages reduction gear

When the sun gear **S1** is driven by input shaft, planetary action occurs among gears **S1**, **a** and **b** and revolution of gear **b** transfers the rotation of carrier **K1** to second sun gear **S2**, and also evokes planetary action between gear **S2**, **a** and **d**.

This time, because carrier **K2** is fixed to frame, gear **d** drives ring gear **a** and then ring gear **a** rotates to drive sprocket.



29072TM12