B for the steering cylinders. An equal flow of oil is also allowed between connections A – B and connection T4 for the tank line. Pressure builds up to the steering cylinders 9, damping cylinder 10, shock valves 20 – 21, anti-cavitation valves 22 – 23 and cross-over valves 17 – 18 – 19. Pressure also builds up via cross-over valves 17 and 26 to the compensator C-connection on pumps 1 – 2 and 12, and the pressure in pumps 1 and 2 increases proportionally. Oil is simultaneously forced out of the steering valve connections A and B to its connection T4 and is returned to the tank via non-return valve 29 against its opening pressure of approx. 12 bar (174 psi).

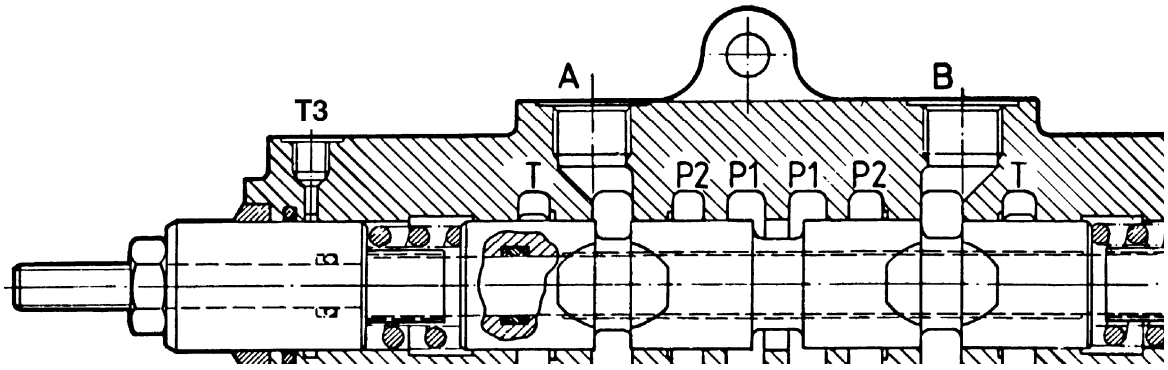

Figure 2
Steering valve

The standby pressure in the sensor line at the compensator C-connection on respective pump is approx. 21 bar (304.5 psi), which is the sum of the pressure of approx. 12 bar (174 psi) (non-return valve 29) and approx. 9 bar (130.5 psi), which arises in the tank line between the steering valve and non-return valve 29.

The standby pressure at the outlet of pumps 1 and 2 is approx. 45 bar (652.5 psi), which is the sum of the sensor pressure 21 bar (304.5 psi) and the spring pressure in the compensator valve 24 bar (348 psi).

P = C + F

P = pressure at pump outlet
C = pressure at sensor line
F = spring pressure in compensator valve

Pressure accumulation, ground dependent pump 12

The engine is running and the machine is moving forward. Sensor pressure is applied at the compensator C-connection. When the pump rotates in the correct direction (machine moving forward), the pressure will build up to the non-return valves 30 in the non-return valve block 8 and to the left side of the sensor 31. Its spring will be unloaded and the circuit is opened. The pump compensator valve is affected via internal passages and the pump will angle down as there is no oil flowing. The same standby pressure now exists at the outlet of pumps 1 – 2 and 12.

Steering function, engine dependent pumps 1 and 2

The steering valve slide is displaced upwards and connection P2 from pumps 2 and 1 are now connected to the steering cylinders via connection A. The pressure builds up in the cylinders' A-connection and the pistons are affected on the plus respective minus sides. Pressure builds up simultaneously via cross-over valves 18 – 19 to damping cylinder 10 and the end surface of the valve slide: The valve slide is stabilized. The same pressure now also exists in the sensor line to the compensator C-connection. The compensator valve is affected and adjusts the flow and pressure from the pump to the current demand.

⚠ CAUTION

There is a pressure-drop between the pumps' outlet and the steering cylinders for as long as there is oil flow. (Concerns resp. restrictions in valves). The pressure difference in this system is approx. 14 bar (203 psi). However, there is a static pressure between connection B in the steering valve and the sensor line to the compensator C-connection when there is no oil flow.

The pressure formula P = C + F always applies, regardless of the current pressure demand.

Steering valve connection B is connected to its T-connection. The return oil from the steering cylinders is returned to the tank via non-return valve 29 against its opening pressure of 12 bar (174 psi).

Steering function, ground dependent pump 12

The ground dependent pump is connected to the drive wheels and the pump operates when the machine is moving forward. If the pressure ceases from the pumps (1 and 2) towards non-return valve 30 in non-return valve block 8, the non-return valve will be opened by the pressure from pump 12. The oil is led towards the steering valve P2 connection. There is now pressure only on the top side of sensor 31 in non-return valve 14, the spring is compressed and the switch closes.

With the controlled flow of oil in the steering valve between its connection P2 and the connections A and B, the pressure to the steering cylinders, valves, damping cylinder and compensator C-connection on pumps 1 – 2 and 12 can be built up again. The pressure in pump 12 increases proportionally. Oil is simultaneously forced out from steering valve connections A and B to connection T and is returned to the tank via non-return valve 29 against its opening pressure of approx. 12 bar (174 psi).

Steering speed will be limited at low pump speeds since the oil flow is supplied from only one pump.

The rotational direction of the pump changes when reversing the machine, and the oil will then flow backwards via the left non-return valve 30 in the non-return valve block 8 and the steering function ceases.