3.2. Function of Linde purging system

3.2.1. Shuttle Valve

When both high pressure lines are without pressure or carry merely boost pressure (for example in zero position of the pump), the two shuttle spools remain in their spring centred neutral position according to fig. 9. High pressure can get to the discharge valve neither from high pressure port A nor from the high pressure port B (see fig. 9).

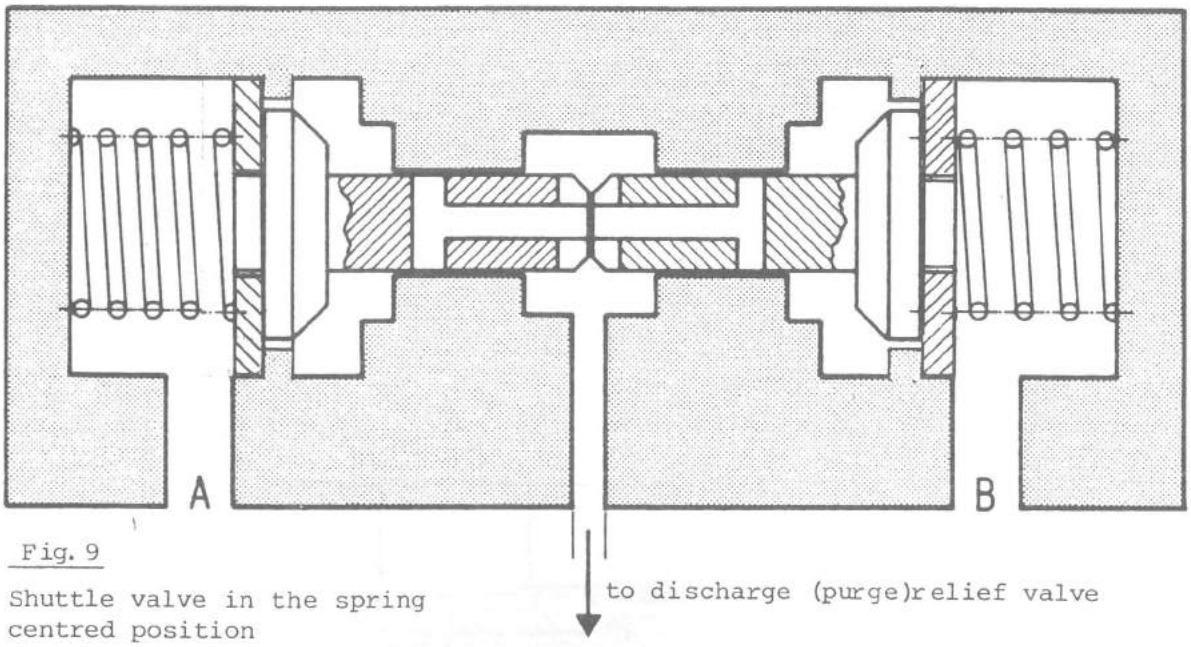

Fig. 9

Shuttle valve in the spring centred position

As soon as high pressure builds up, for example on side A this will push the spool A_1 towards connection port B while taking spool B_1 with it (see fig.10).

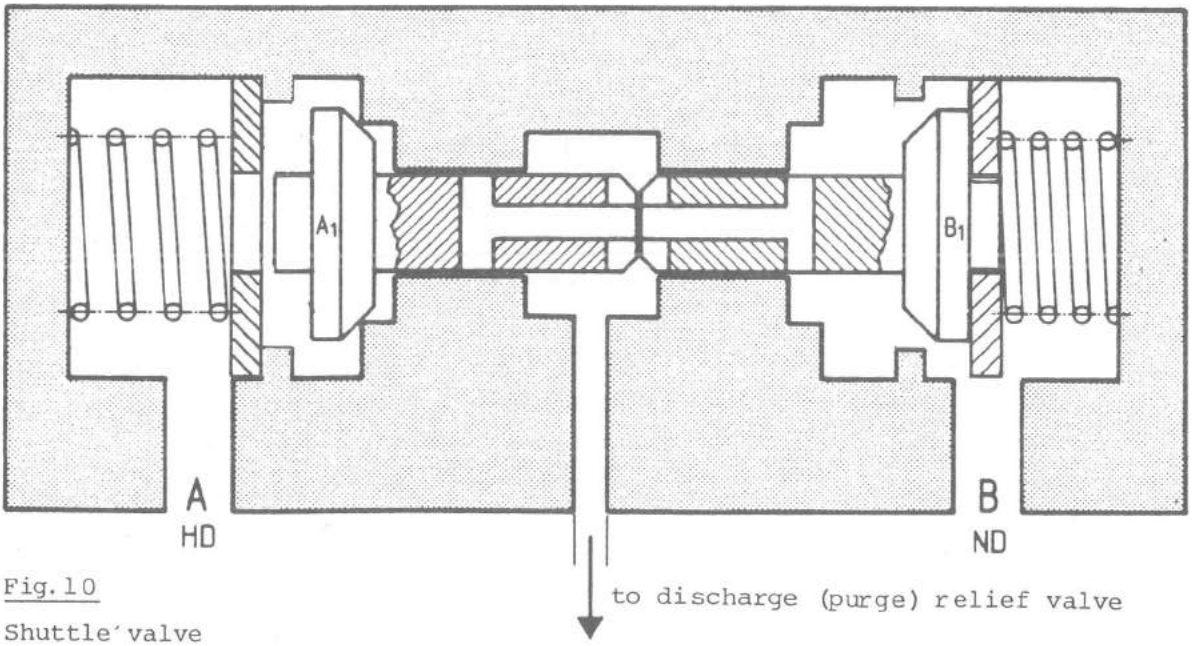

Fig. 10

Shuttle valve
High pressure on side A

The end stop is at the same time the conical seat of spool A_1 which also ensures that high pressure fluid cannot get from spring chamber A_1 to the discharge valve.

3.2.2. Discharge Valve

The choice of a discharge valve has to be made according to the application of the hydraulic motors, i.e. whether they are for the open or closed loop circuit.

3.2.2.1. Discharge valve for open loop

Considerable pressure fluctuations can occur in return lines of open loop circuits due to the directional control valves. These entail discharge flow fluctuations in normal pressure relief valves which may create high back pressure in the leakage lines and, therefore, also in the housing of the hydraulic motors in extreme cases. For this reason it is expedient to use the flow limiting discharge valve according to fig.11.

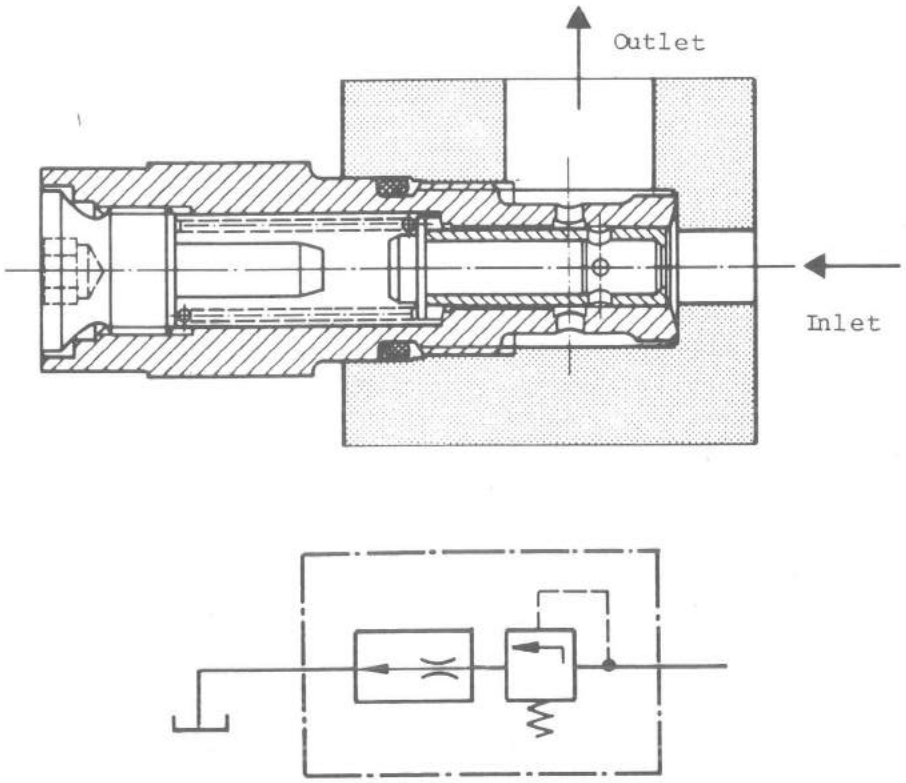

Fig. 11 – Flow limiting discharge valve for open loop

This valve works as a pressure relief valve and keeps the discharge flow constant.

3.2.2.2. Discharge valve for the closed loop

In closed loop circuits there are hardly any pressure fluctuations in the return line. Therefore, a standard pressure relief valve is sufficient to operate as a discharge valve.

Such valves allow for larger discharge flows which may, however, be reduced, if necessary, by inserting throttles or restrictor fittings (see fig. 12).

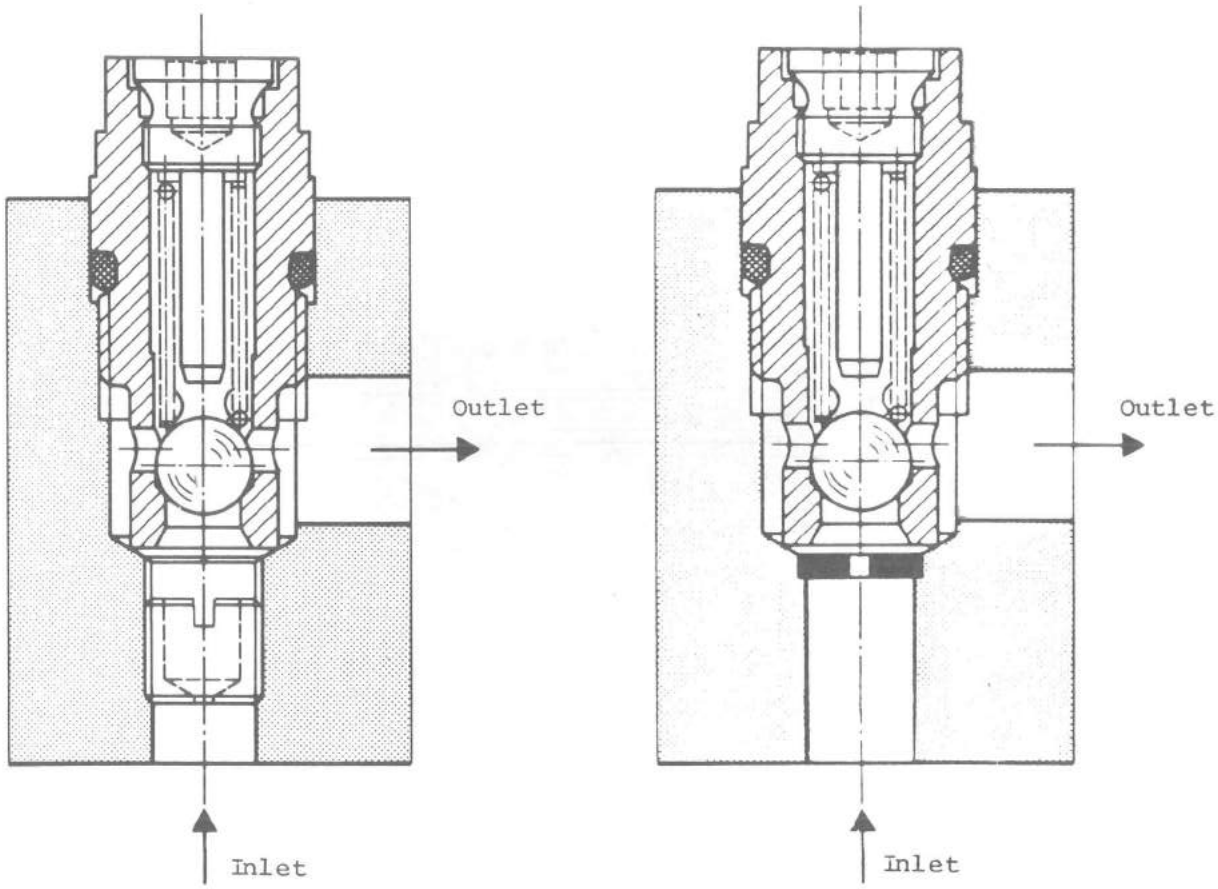

Fig. 12 – Pressure limiting discharge valve for closed loop

The pressure setting of the valve depends on the boost-pressure setting of the corresponding pump and is determined in the engineering stage.

4. Linde variable motor BMV..TF

The rotating assembly of the BMV is identical with that of the BMF. The valve plate of variable motors (fig. 13) with its timing face (1) on which the cylinder barrel runs is identical to that of the fixed displacement motors. The rear side (2) is, however, shaped such that the valve plate can slide on the semi-circular track of the precisely machined matching housing whilst maintaining an effective seal between them.

For switching from minimum to maximum displacement or vice-versa a control piston is generally used. The control piston contains a pin (3) which sits in the hole of the valve plate thus transmitting the control force to the rotating assembly.

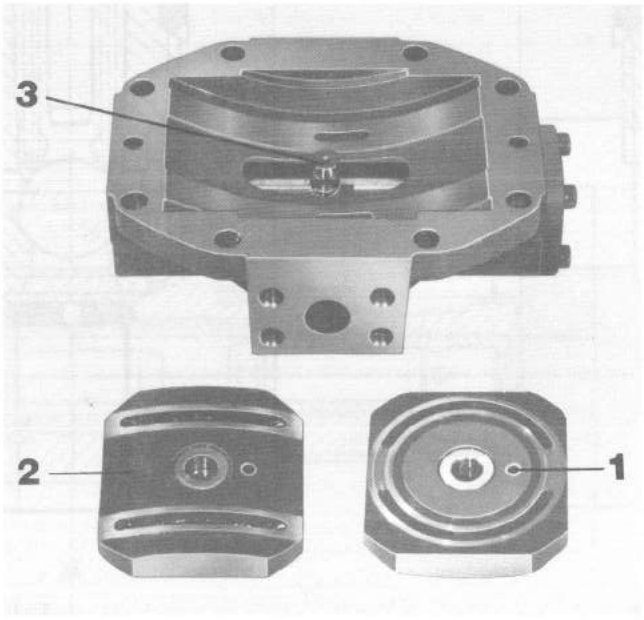

Fig. 13 – Valve plate of the Linde variable motor BMV..TF..

5. Controls for BMV units

5.1. Two position (flip flop) (fig. 14)

By means of a 4/2 way valve a control pressure P_{st} of about 15 bar is alternatively applied to connection port "X" or "Y". One side of the control piston is thus charged by control pressure, while the opposite side is connected to the tank (i.e. unloaded).

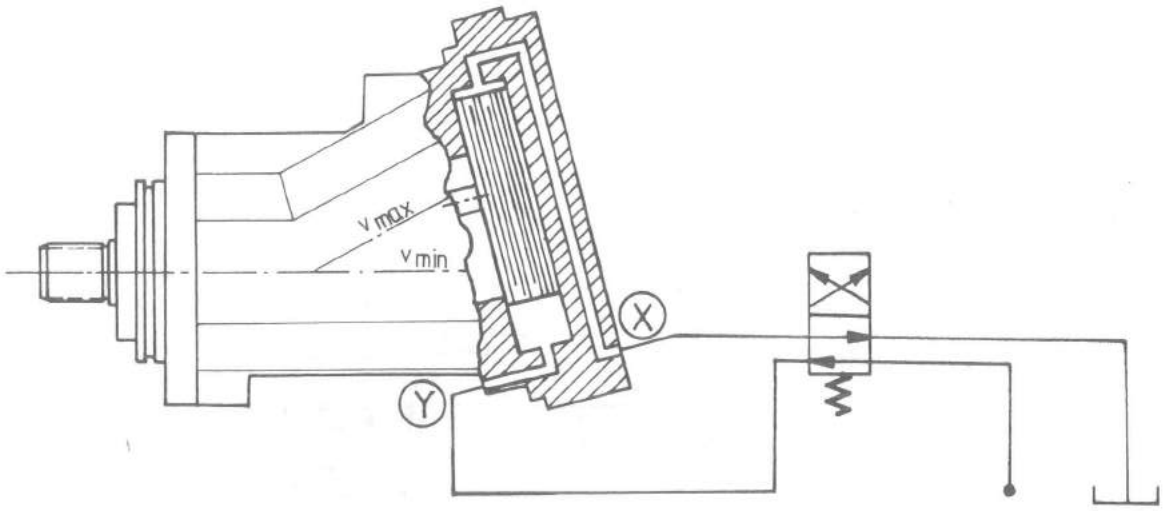

Fig. 14 – Flip-flop motor

Control pressure at port "X" $\hat{=}$ minimum displacement

Control pressure at port "Y" $\hat{=}$ maximum displacement

5.2. Flip-flop motor with electric control (fig. 15)

The 4/2 way valve mentioned under 5.1 is in this case a solenoid valve directly attached to a motor. Connection port (P) must be supplied with control pressure from an auxiliary source (max 20 bar). A return line for this control pressure is not needed, since there is a direct connection in the motor housing to the leakage port (L).

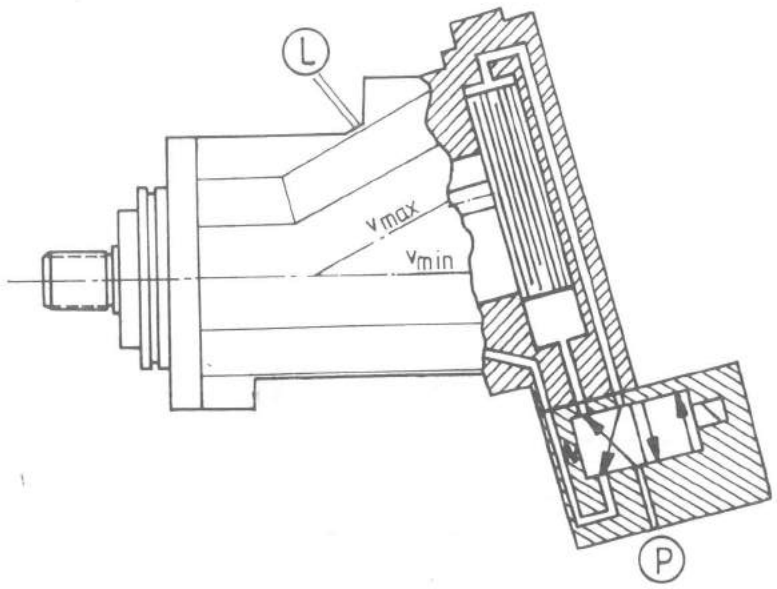

Fig. 15 – Flip-flop motor
with electric control

Magnet unenergised $\hat{=}$ maximum displacement

Magnet energised $\hat{=}$ minimum displacement

5.3. Motor with stepless hydraulic control

5.3.1. Function (circuit diagram fig. 16)

The control device receives pressurised fluid of minimum 15 bar from the servo circuit through port "P". When the pilot valve (1) is in its normal position, the servo pressure is conducted to one side of the control piston, i.e. to that side which corresponds to the maximum displacement position of the motor. The opposite piston side is discharged via the pilot valve into the inside of the motor housing.

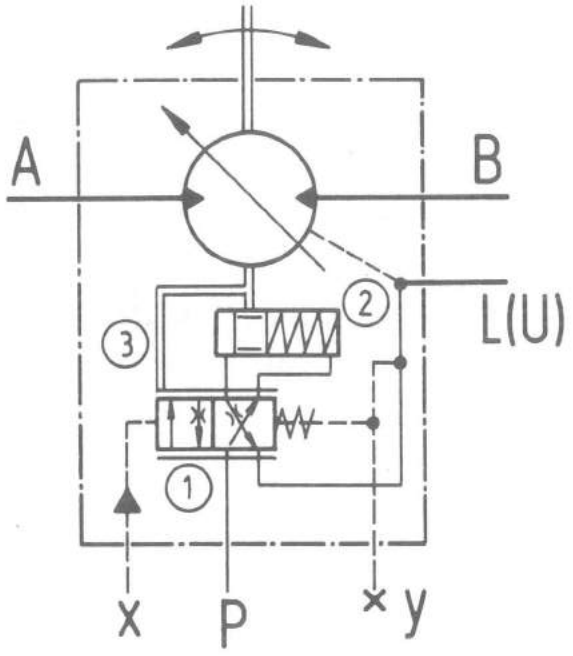

Fig. 16 - Motor with stepless hydraulic control

On sending a defined control pressure through port "X" a pilot valve is shifted against the force of the spring and the control system is charged with servo pressure which induces the control piston to switch the motor from maximum to minimum displacement. The feed back system (3) allows it to run precisely at any intermediate position between minimum and maximum displacement depending on the control pressure at port "X". The variation from V_{max} to V_{min} is a function proportional to a control pressure (normally 8 to 15 bar) according to diagram fig.17.

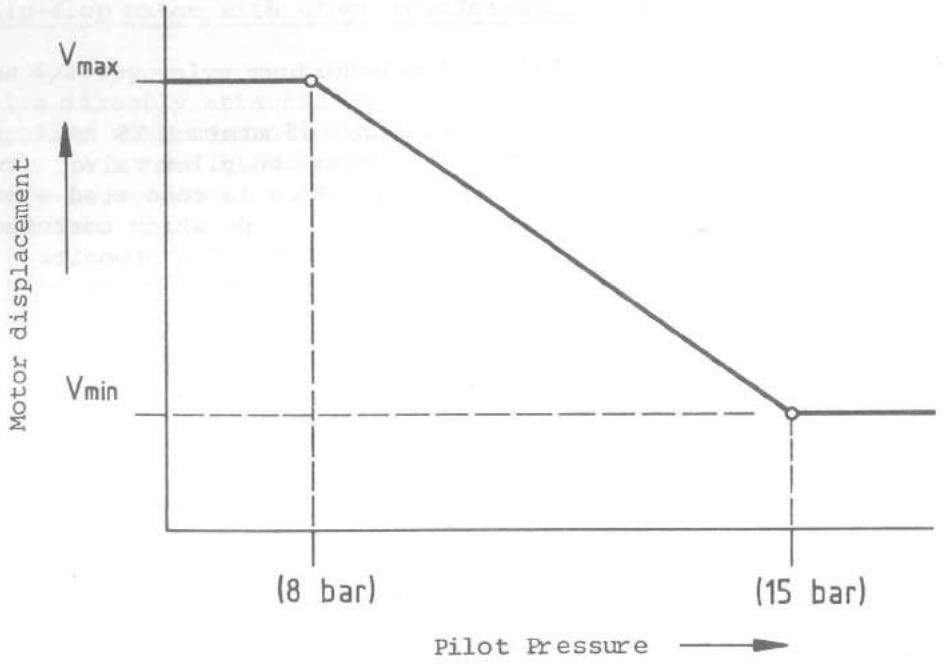

Fig.17 – Variation from V_{max} to V_{min} as a function of the control pressure. Values stated in parantheses are standard pilot pressures.

The 8 to 15 bar line can be adjusted slightly by means of the setting screw (8) shown in fig.18.

Counter clockwise $\hat{=}$ spring (6) compressed

Clockwise $\hat{=}$ spring (6) relieved

In exceptional cases an override pressure signal can be sent to the normally closed port "Y" towards the upper side of the pilot valve (1). This pressure signal is in support of the forces of springs (6) and (7). To achieve this, however, a plug (9) must be fitted in the connection to channel (L).

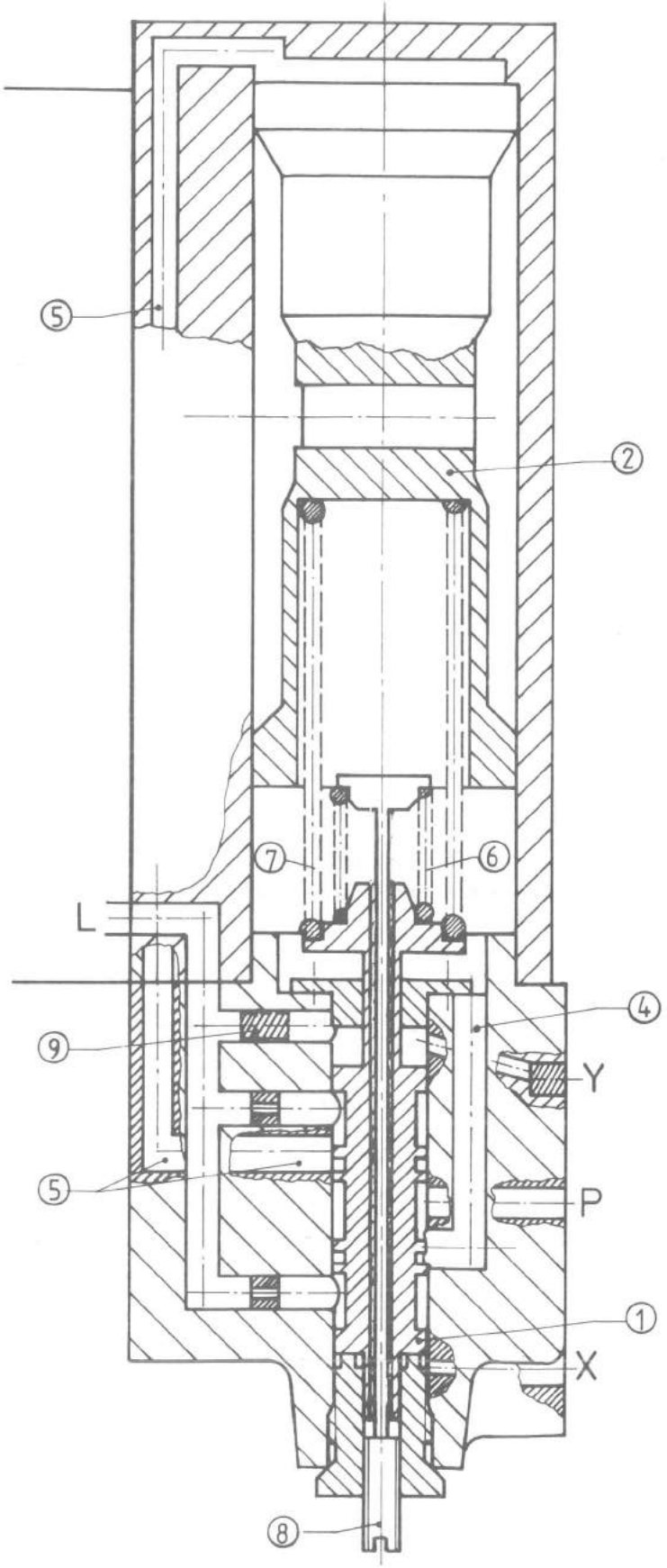

Fig. 18 – Motor with stepless hydraulic control (construction)

5.4. "Regulating motor" BMR with high pressure sensing control

5.4.1. Function (see circuit diagram fig.19)

In this regulating system the motor is normally fixed in its minimum displacement position. Upon reaching a pre-selected pressure the motor switches steplessly towards its maximum displacement.

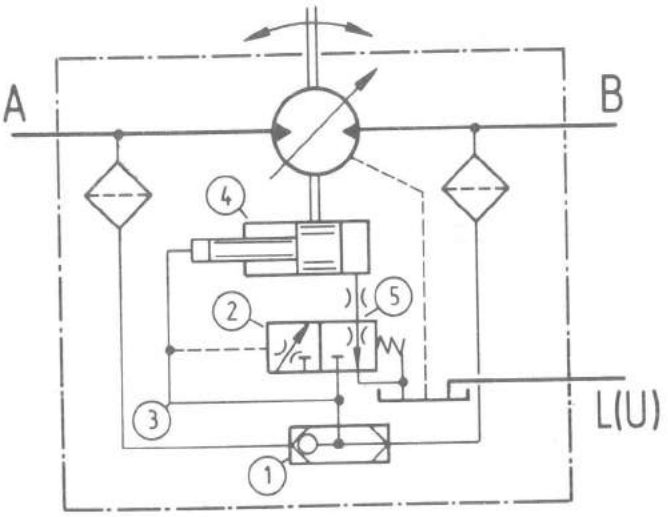

Fig.19 - "Regulating motor" BMR with high pressure sensing control

The shuttle valve (1) will always connect the pressure control device (2) with that high pressure port A or B carrying the higher pressure level (the shuttle valve feed line is equipped with a filter, in order to protect the entire regulating device against contamination). Therefore, there is always high pressure in front of the pressure regulator (2) and via channel (3) also on the small face of the control piston (4). The small area of the control piston being pressurised and the large area being unloaded via the pressure regulator the motor is always kept in its minimum displacement position.

The pressure setting of the regulator defines the regulation begin, i.e. that pressure at which the motor will start to shift towards maximum displacement. As soon as the pressure controller (2) moves against the spring force, high pressure will be released upon the large area of the control piston through channel (5). Due to the pressure forces resulting from the area differential the motor is moved. The adaptation to the required torque is effected steplessly and the motor maintains positively any position between V_{min} and V_{max} depending on the high pressure. The control characteristic is shown in diagram fig.20.