PRESSURE ACCUMULATOR AND MOTOR CONTROL

Lawrence F. Jaseph, Memphis, Tenn., assignor to Dover Corporation, a corporation of Delaware

Application November 15, 1951, Serial No. 256,497

5 Claims. (Cl. 60—51)

My invention relates generally to pressure accumulators, and more particularly to an improved pressure accumulator incorporating means for controlling the operation of a pump driving motor to maintain a predetermined pressure in a hydraulic system.

There are many types of apparatus, such as hydraulic lifts and elevators, in which it is desirable to maintain a predetermined pressure in the system, and to provide a pressure accumulator having substantial displacement so as to have available a supply of oil under pressure for sudden demands.

It is therefore an object of my invention to provide an improved pressure accumulator for use in hydraulic systems, which also operates as a control for the energization of the pump driving motor, and which has provisions for relief of the pressure in the system when excessively high pressures are attained.

Other objects will appear from the following description, reference being had to the accompanying drawings, in which—

Fig. 1 is a central vertical sectional view of the pressure accumulator;
Fig. 2 is a left end elevational view thereof; and
Fig. 3 is a diagrammatic view of the pressure accumulator and associated parts of the hydraulic system, together with a schematic circuit diagram of the motor control circuit.

The pressure accumulator comprises a closed end cylinder 10 provided with a head 12 secured to one end thereof by cap screws 14 and defining a passageway into the cylinder. The cylinder 10 is provided with a large bore 16 and a slightly smaller diameter bore 18. The cylinder head 12 may be secured to any suitable support, such as the top of a reservoir 20, by cap screws 22. A piston 24 is provided with an annular end face packing 26 positioned in a suitable groove 28. The piston 24 and cylinder 10 together define an expansible chamber adjacent the head 12. The piston 24 has a long skirt portion 30, the lower portion of which is externally tapered to form a camming surface 32 for cooperation with a roller 34 suitably journaled on the end of a leaf spring actuator 36 for cooperation with the operating plunger 38 of a limit or control switch 40. This switch is mounted within a suitable conduit box 42 which is secured to the cylinder 10, the cylinder 10 having an opening 44 through which the actuating leaf spring projects. The piston 24 has a groove 46 for an O-ring packing 48. An over pressure relief port 47 in the cylinder 10 is connected to the reservoir 20.

The piston 24 is urged to the left by a relatively heavy coil spring 50 which is compressed between the inside of the piston and a spring seat 52, the position of which may be adjusted by means of a screw 54, the seat being held in adjusted position by a lock nut 56.

As best shown in Fig. 3, the apparatus may form part of a hydraulic system comprising the reservoir 20, an inlet pipe 58 for a pump 60, the outlet of which is provided with a check valve and is connected to the normally open control relay contactor CR—1 to the poles of a double pole single throw switch 70 by which the circuit is connected to the power lines L—1 and L—2. The switch 40 is connected in series with the control relay coil C. R. across the poles of the switch 70.

The switch 40 is of a type which is normally closed and which opens with a snap-action upon a predetermined inward movement of the plunger 38, but which does not close until the plunger has moved outwardly a considerable distance beyond the point at which it was effective to close the switch.

In operation, upon closure of the switch 70, the motor 68 will be energized because the switch 49 is closed and relay C. R. will be energized to close contactor CR—1, which forms part of the relay C. R. The pump therefore commences supplying oil from the reservoir 20 to the hydraulic apparatus connected to the pipe 66, and also supplies oil through the head 12 into the bore 16. As the pressure builds up, the piston 24 will move to the right and the camming surface 32 on the skirt of the piston engages the roller 34 and at the predetermined pressure opens the limit switch 40. Opening of the limit switch 40 deenergizes the control relay C. R., which permits the switch CR—1 to open, thereby cutting off the supply of current to the motor 68.

When, due to the operation of the hydraulic apparatus connected to the pipe 66, the pressure in the cylinder 16 is reduced, the spring 50 will force the piston 24 to the left. Considerable travel in this direction is permitted before the switch 40 snaps closed so that a substantial quantity of the hydraulic fluid may escape from the high pressure side of the system before the switch 40 is closed. When this switch is closed, the control relay C. R. is energized and its contactor CR—1 is again closed to complete the motor energizing circuit.

If for some unforeseen reason the pressure within the system should become excessively high, the piston 24 will be moved sufficiently to the right that its sealing packing 26 will uncover the port 47 and permit return of oil to the reservoir 22 through the conduit 49.

The pressure at which the switch 49 is operated may be adjusted by means of the adjustment screw 54 so as to vary the degree of initial compression of the spring 50. By virtue of the difference in positions of the plunger at which it opens and closes switch 40, there will be substantial travel of the piston 24 to the left from the position at which it opens switch 40 to the position at which it closes this switch, and unduly frequent cycles of operation are thereby avoided.

While I have shown and described a preferred embodiment of my invention, it will be apparent that numerous variations and modifications thereof may be made without departing from the underlying principles of the invention. I therefore desire, by the following claims, to include within the scope of the invention all such variations and modifications by which substantially the results of my invention may be obtained through the use of substantially the same or equivalent means.

I claim:
1. In a pressure accumulator and motor control for a hydraulic apparatus, the combination of means forming a cylinder, a piston reciprocable within the cylinder and having a skirt portion, a limit switch having an actuator cooperable with the skirt portion of the piston, a spring compressed between the piston and one end of the cylinder, means connecting the other end of the cylinder to the hydraulic apparatus, an electric motor, a pump operated thereby and having its outlet connected to the hy-
draulic apparatus, and a control circuit including said switch for causing deenergization of the electric motor when the spring has been compressed to a predetermined extent and thereafter to cause reenergization of the motor after said spring has expanded to cause the discharge of a substantial volume of hydraulic fluid from the cylinder to the hydraulic apparatus.

2. A fluid pressure accumulator and over pressure relief apparatus comprising, means forming a cylinder having in its side a relief port and an opening and having an inlet opening at one end thereof, a piston reciprocable in the cylinder, said piston having a tapering skirt portion, a spring compressed between the piston and one end of the cylinder to urge the piston toward the end of the cylinder having the inlet opening, said piston preventing flow of fluid from the inlet opening to the port until a predetermined pressure has been exceeded so that the face of the piston uncovers the port, a limit switch secured to the cylinder means and having an actuator extending through the side opening and engaged by the skirt portion of the piston when a predetermined pressure is exceeded, whereby the limit switch may be used for controlling the energization of a motor driven pump supplying fluid under pressure to the inlet opening of the accumulator cylinder.

3. In a fluid pressure accumulator apparatus, including a cylinder having an opening in its side and an inlet opening at one end thereof, a piston reciprocable in the cylinder, a spring compressed within the cylinder to urge the piston toward the inlet opening, and electrically operated means for supplying fluid under pressure to the inlet opening, the combination comprising a tapering skirt portion integral with the piston, and a limit switch secured adjacent the cylinder and having an actuator extending through the side opening to engage the skirt portion of the piston when a predetermined pressure is exceeded, whereby the limit switch may be used to open the electrical circuit and to stop the supplying of fluid under pressure to the inlet opening of the accumulator cylinder.

4. In fluid pressure accumulator and over pressure relief apparatus, including a cylinder having in its side a port and an opening and having an inlet opening at one end thereof, a piston reciprocable in the cylinder, a spring compressed within the cylinder to urge the piston toward the inlet opening, and means for supplying fluid under pressure to the inlet opening, the combination comprising, valve means formed by said piston for preventing flow of fluid from the inlet opening to the port until a predetermined pressure in the cylinder has been exceeded, a tapering skirt portion integral with the piston, a limit switch secured adjacent the cylinder and having an actuator extending through the side opening, and a roller on the actuator positioned for engagement with the skirt portion of the piston when a predetermined pressure is exceeded, whereby the limit switch may be used to stop the supplying of fluid to the inlet opening of the cylinder.

5. A combined fluid accumulator and control for a pressure fluid system, comprising, in combination, a cylinder, means defining a fluid passageway communicating with said cylinder, a piston slidably mounted within said cylinder and having a tapered rear portion thereon, spring means urging said piston toward said passageway, a snap switch mounted on said cylinder, and an actuator on said switch positioned to be operated by said tapered portion of said piston upon movement of said piston against said spring to a predetermined position.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>611,823</td>
<td>Steier</td>
<td>Oct. 4, 1898</td>
</tr>
<tr>
<td>829,845</td>
<td>Corey</td>
<td>Aug. 28, 1906</td>
</tr>
<tr>
<td>1,543,841</td>
<td>Grigolet</td>
<td>June 4, 1925</td>
</tr>
<tr>
<td>1,895,131</td>
<td>Leonard</td>
<td>Jan. 24, 1933</td>
</tr>
<tr>
<td>2,277,569</td>
<td>Vickers</td>
<td>Mar. 24, 1942</td>
</tr>
<tr>
<td>2,279,176</td>
<td>Pardee</td>
<td>Apr. 7, 1942</td>
</tr>
<tr>
<td>2,356,306</td>
<td>Davis</td>
<td>Aug. 22, 1944</td>
</tr>
</tbody>
</table>