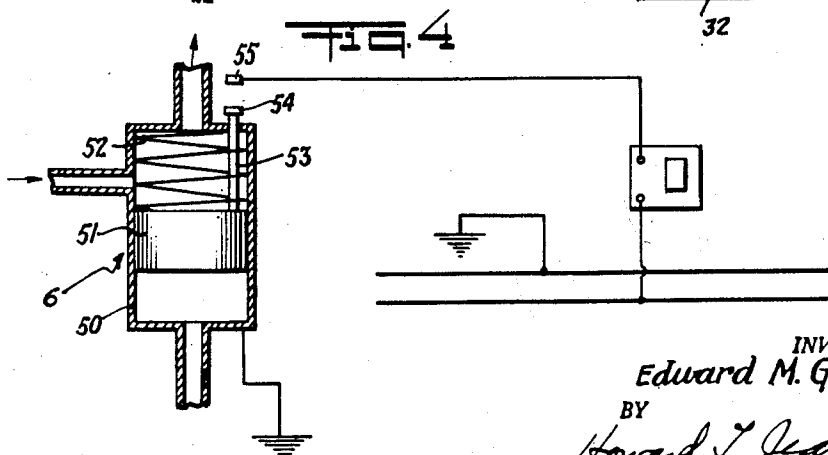
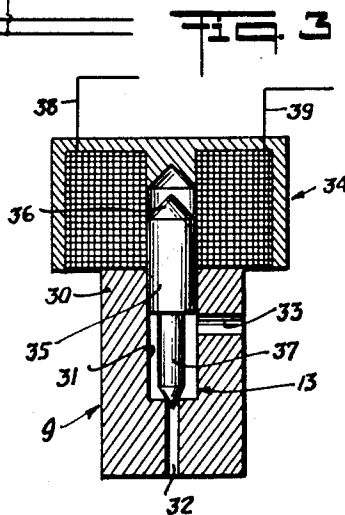


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CLOGGED FILTER SIGNAL DEVICE

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1 Claim. (Cl. 210-62)

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The present invention pertains to electric safety means in hydraulic circuits.

It is an object of the present invention to provide an electrically controlled safety valve which will by-pass any excess pressure which may occur.

According to a feature of the present invention the aforesaid safety valve may be associated with an unloader valve which will relieve the pump effectively as long as the circuit is under pressure.

It is a further object of the present invention to provide an electric signal device which will automatically announce any deficiency in the feed line of a pump or the like included in a hydraulic circuit.

Further features of the present invention will become apparent from the following description of embodiments thereof given by way of example and illustrated in the accompanying drawings.

Fig. 1 is a schematic illustration of a hydraulic circuit according to the present invention.

Fig. 2 is a cross section of the unloader valve included in the circuit according to Fig. 1.

Fig. 3 is a cross section of the electrically controlled valve and its actuating mechanism included in the circuit according to Fig. 1.

Fig. 4 is a cross section of the electric signal device included in the circuit according to Fig. 1.

In the embodiment according to Fig. 1 there is provided a pump 1 which is supplied with fluid from a reservoir 2 through a filter 3.

From pump 1 the fluid passes through an unloader valve 4 and on through conduit 5, past a check valve 12 connected to conduit 5a to a utilization system. When valve 4 is in the open position fluid returns to reservoir 2 through conduit 14.

There is included in the circuit according to Fig. 1 an automatic signal device 6 which will actuate a buzzer 7 or the like whenever the flow of fluid to pump 1 is cut out because of the filter 3 being clogged.

There is further included a pressure switch 8 which will actuate an electrically controlled valve 9. Switch 8 communicates through conduit 10 with conduit 5a and whenever the fluid pressure in the latter exceeds a predetermined value switch 8 will energize valve 9 which communicates with valve 4 through a conduit 13 which will by pass fluid to a return line 11 and cause valve 4 to unload pump 1 until the pressure in conduit 5a drops to the desired minimum value.

Valve 4 includes a casing 15 (Fig. 2) provided

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with a cylinder bore 16 and passages 17a, 17b, 18 and 19. Passage 17a is connected to the pump, passage 17b to conduit 5, passage 18 to return line 14 and passage 19 to conduit 13.

A piston like valve element 20 is slidably mounted in bore 16. Element 20 carries an extension 21 whose head 22 is adapted to cooperate with a valve seat 23 in passage 18 to obstruct the latter.

A passage 24 of relatively small diameter extends through element 20 in the axial direction.

A spring 25 urges element 20 towards seat 23. In this manner element 20 divides bore 16 into two variable volume chambers 26 and 27 between which passage 24 affords restricted communication.

In operation, when passage 19 is closed, pressure arriving through passage 17a will pass through chamber 27 and passage 24 into chamber 26. Since the effective cross sectional area of element 20 is greater in chamber 26 than in chamber 27 head 22 will be firmly applied against seat 23. Pressure fluid supplied by pump 1 will, accordingly, pass on through passage 17b to conduit 5.

But, whenever passage 19 is vented, the pressure in chamber 26 will drop and element 20 will be displaced so as to compress spring 25 and to open passage 18. This will cause the pump to deliver into return line 14 and reduce the load to a pressure corresponding to the strength of spring 25.

Obviously, the diameter of passage 24 governs the speed with which the valve opens.

Referring to Fig. 3 conduit 13 connects passage 19 of valve 4 to valve 9. Valve 9 comprises a casing 30 provided with a cylinder bore 31 and two ports 32, 33. Port 32 communicates with conduit 13 and port 33 with conduit 11.

Above casing 30 there is mounted a solenoid 34 whose opening is concentric with and of the same diameter as bore 31.

A piston like valve element 35 is slidably mounted in bore 31. Head 36 of element 35 projects into solenoid 34. Element 35 has a reduced portion 37 whose dimension in the actual direction exceeds that of port 32.

Normally, element 35 is in the position shown and port 32 is obstructed. But, when solenoid 34 is energized, element 36 will be attracted and raised so that ports 32 and 33 communicate with each other about the reduced portion 37. Thus, when solenoid 34 is energized chamber 26 of valve 4 (Fig. 2) is vented.

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Solenoid 34 is connected by cables 38, 39 to a source of electric energy 40 and switch 8.

Switch 8 includes a cylinder 41 communicating through conduit 10 with conduit 5a. A spring 45 holds a piston 42 slidably engaged to a cylinder 41 and carries a rod 43 projecting to the outside.

Cable 38 is connected to cylinder 41 and cable 39 ends at a contact 44 facing rod 43. Switch 8 is, of course, made of a material which is a good conductor of electricity.

With this structure, when the pressure in conduit 5a overcomes the strength of spring 45 which acts on piston 42, rod 43 will approach and, eventually, engage contact 44 whereby solenoid 34 will be energized.

For the sake of clarity, the drawings show valve 9 and switch 8 on a much larger scale than valve 4. It will be appreciated that valve 9 and switch 8 are merely pilot means controlling valve 4 and the amount of fluid which circulates through the pilot means need be no more than a small fraction of that circulating through the unloader valve. Accordingly, the dimensions of the pilot means may be very small with respect to those of the associated unloader valve. The resulting economy of bulk and weight is a particular advantage on vehicles or aircraft.

It is also evident that fluid pressure is delivered by the pump into conduit 5a and the utilization system until spring 45 is fully compressed. Then, as soon as the pressure in passage 17b of valve 4 begins to drop, check valve 12 closes and separates the utilization system from the pump while the latter is unloaded.

This arrangement affords the further advantage that except for the negligible amount corresponding to the displacement of the ball or poppet in valve 12—no fluid is withdrawn from the utilization system so that the same is maintained at the desired maximum value of pressure—governed by the strength of spring 45—while the pump is being unloaded.

With the unloader valves known heretofore a certain amount of fluid is generally required to be supplied by the utilization system (accumulator) to assist in the unloading operation. This withdrawal makes it impossible to maintain the system at the desired maximum pressure while the pump is idling.

Of course, as soon as the pressure in conduit 5a drops below the desired maximum pressure, spring 45 will push piston 42 back, the electric current is interrupted, element 35 of valve 9 drops back into closed position, pressure can build up in chamber 26 of valve 4, head 22 obstructs passage 18 and the pump starts reloading the system.

If it is uncertain that element 35 can always be returned into closed position by gravity, then, it is advantageous to add a spring to the structure of valve 9 in order to return element 35 into the position shown when the current is shut off.

Signal device 6 (Fig. 4) includes a cylinder 50 in the feed line of pump 1. Inside cylinder 50 there is provided a piston 51 urged by a spring 52 in a direction opposed to the normal flow of fluid.

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Piston 51 carries a rod 53 projecting to the outside of cylinder 50.

Rod 53 ends in a contact plate 54 facing another contact plate 55. Both contact plates are wired to a suitable source of electricity and to a bell buzzer or the like.

When the suction pressure in cylinder 50 rises above a predetermined value—due to non-delivery of fluid through 8, the filter piston 51 will be drawn by the suction against spring 52 so as to compress the same whereby rod 53 will be displaced and contact 54 will approach and eventually engage contact 55. Accordingly, the buzzer or the like will sound warning the operator to stop the pump until the deficiency in the supply of fluid can be removed. The cylinder, piston, spring and rod formulates a switch mechanism.

The foregoing description is not intended to limit the present invention which extends to all changes, modifications and equivalents within the scope of the appended claim.

What is claimed is:

The combination of a fluid filter, a normally open negative fluid pressure switch mechanism, a remote indicator and a pump, said switch closed by a negative fluid pressure, means to draw fluid from said fluid filter in a hydraulic system, means to pass said fluid through the negative fluid pressure operated switch mechanism, means to actuate said remote indicator when the fluid pressure in said switch is below a predetermined value, and means to deliver the fluid to a pump while operating, said fluid switch mechanism including resilient means to retain it open normally, means to close said fluid switch mechanism when said filter becomes clogged and a negative pressure is attained in said fluid switch to overcome the normal resilient holding means.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
556,008	Harris	Mar. 10, 1896
757,901	Fairhurst	Apr. 19, 1904
777,677	Kettering	Dec. 20, 1904
844,923	Cridge	Feb. 19, 1907
895,426	Cable	Aug. 11, 1908
1,148,054	Rosencrans	July 27, 1915
1,240,664	Brown	Sept. 18, 1917
1,307,207	Mitchell	June 17, 1919
1,408,221	Pendergast	Feb. 28, 1922
1,411,802	Mosher	Apr. 4, 1922
1,507,193	May et al.	Sept. 2, 1924
1,798,973	Cordier	Mar. 31, 1931
1,938,711	McMurray	Dec. 12, 1933
2,236,087	Detwiler	Mar. 25, 1941
2,264,024	Glashan	Nov. 25, 1941
2,319,578	Beckley	May 18, 1943
2,320,763	Trautman	June 1, 1943
2,345,213	O'Shei	Mar. 28, 1944
2,402,885	Gilfillan	June 25, 1946
2,426,411	Petersen	Aug. 26, 1947