(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 915 256 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.05.1999 Bulletin 1999/19

(51) Int Cl.[6]: **F04B 49/03**

(21) Application number: **98500236.9**

(22) Date of filing: **29.10.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **04.11.1997 ES 9702281**

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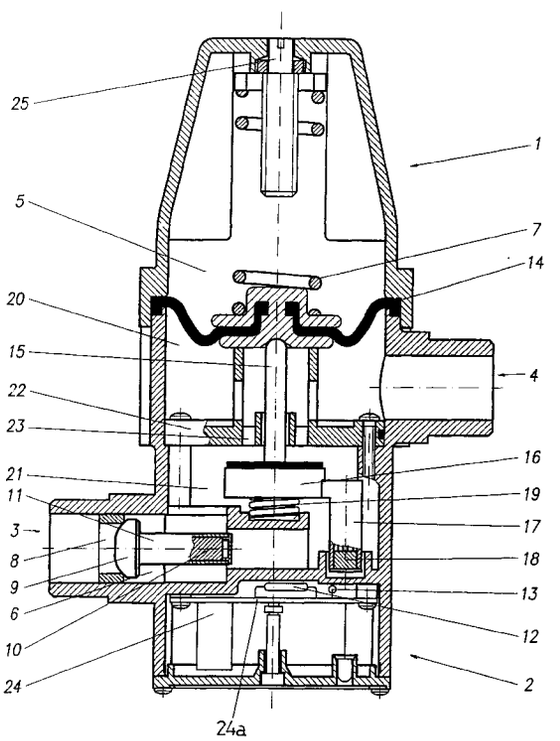
(54) Apparatus for controlling the starting and stopping of a hydraulic pump

(57) It comprises a flow detector (6) which provides a pump-stop signal; a pressure detector (5) which has a moving part associated with a membrane (14) and a fixed part mounted in the housing (2) of the apparatus (1) in the position of displacement of the moving part, the flow detector (6) also being provided with a moving part (9), which functions as a shutoff valve, and a fixed part mounted in the housing (2) of the apparatus (1), said fixed parts being magnetic sensors (12, 13); and means (7) for urging the pressure detector (5).

It includes means for regulating the hydrostatic pressure, mounted inside the apparatus (1), thus allowing the pressure of the supply line to be regulated in function of the flow of water through the apparatus.

Advantageously, the magnetic sensors (12, 13) are connected in such a way that if at least one of said sensors opens the circuit (24a) that supplies signal to the hydraulic pump (1), then the pump will stop. The apparatus takes into account a possible failure of the magnetic sensors.



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Description

[0001] The present invention relates to an apparatus for controlling the starting and stopping of a hydraulic pump that permits regulation of the hydrostatic pressure, while ensuring perfect operation of the hydraulic pump even in the event of failure of any of the sensors.

BACKGROUND OF THE INVENTION

[0002] Known in the art are apparatus for controlling the starting and stopping of a hydraulic pump that include a chamber with an inlet and an outlet. A check valve closes off the outlet and is associated with a sensor, which sends a signal to a control device when the check valve is open. The aforesaid apparatus also include another sensor for capturing the hydraulic pressure inside the apparatus, which also sends a signal to the control device upon reaching a certain value. When there is no water flowing through the circuit the first sensor ceases sending a signal, leading to stoppage of the apparatus.

[0003] Said apparatus present the disadvantage of taking account only of incorrect operation of the pump when there is no water in the circuit, while they take no account of cases of incorrect operation due to defect, wear or breakage of the sensors. It is thus possible for the pump to be operating continuously when it should not be doing so, without the sensors detecting the situation, and this can lead to damage of the pump.

[0004] The aforesaid disadvantage must be considered to be a major disadvantage, since with the passage of time it has been found that 90% of failure in the aforesaid apparatus have been due to faults in the electronics of the control devices.

[0005] Furthermore, said apparatus also present the disadvantage that they only work at the rated pressure of the pump, regulation of hydraulic pressure not being possible.

[0006] Also known are other apparatus for controlling the starting and stopping of a hydraulic pump that include a flow detector which, in the absence of flow, provides a pump-stop signal, a pressure detector which for a predetermined minimum pressure reading provides a pump-start signal, and means for urging the pressure detector.

[0007] Said pressure detector includes a moving part integral with a membrane arranged in a cavity which communicates with the hydraulic circuit, and a fixed part arranged inside the housing of the apparatus in the position of displacement of the moving part.

[0008] The means that urge the moving part of the pressure detector include a spring mounted between said moving part and the housing, while the flow detector includes a moving part which can move vertically that functions as a gravity-operated shutoff valve and a fixed part arranged in the housing.

[0009] Said apparatus present the same disadvantages as the apparatus described above.

DESCRIPTION OF THE INVENTION

[0010] The apparatus of the invention succeeds in resolving the aforesaid disadvantages, while providing other advantages which will be described below.

[0011] The apparatus for controlling the starting and stopping of a hydraulic pump of the invention includes a flow detector which, in the absence of flow, provides a pump-stop signal; a pressure detector which has a moving part associated with a membrane and a fixed part mounted in the housing of the apparatus in the position of displacement of the moving part, the flow detector also being provided with a moving part that functions as a shutoff valve, and a fixed part mounted in the housing of the apparatus, said fixed parts being magnetic sensors; and means for urging the pressure detector; and is characterized in that it includes means for regulating the hydrostatic pressure, mounted inside the apparatus.

[0012] The feed pressure of the hydraulic line can thus be regulated in function of the flow of water through the interior of the apparatus.

[0013] According to an aspect of the invention, the magnetic sensors are connected in such a way that if at least one of said sensors opens the circuit that supplies signal to the hydraulic pump, then the pump will stop.

[0014] This system achieves a remarkable increase in the safety of the apparatus controlling the hydraulic pump, since it takes account of possible faulty operation of one of the magnetic sensors and not only of the non-presence of water in the hydraulic circuit. Thus, if one of the magnetic sensors opens the circuit providing signal to the hydraulic pump then the pump will stop, since said sensors operate in series.

[0015] This system of operation is shown in the following comparative table:

Situation	Status of sensors		Safety	
	A	B	Prior art apparatus	Apparatus invention
1	A0		YES	YES
2	A1		NO	YES
3	B0		YES	YES
4	B1		NO	YES
5	A0	B0	YES	YES
6	A0	B1	NO	YES
7	A1	B0	NO	YES
8	A1	B1	NO	NO

in which A1 is sensor A closed following the fault, A0 is sensor A open following the fault, B1 is sensor B closed following the fault, and B0 is sensor B open following the fault.

[0016] The table above shows that while in the previous apparatus safety in the event of failure of any of the magnetic sensors is low (working in only three of the eight possible cases), the safety of the apparatus of the invention is high, since it works in seven out of the eight cases.

[0017] Preferably, the moving part of the pressure detector and the moving part of the flow detector include a magnet.

[0018] The magnet of the moving part of the pressure detector provides a magnetic signal to its corresponding sensor, while the magnet of the moving part of the flow detector provides a signal to its sensor and to the pressure detecting sensor.

[0019] The sensitivity levels of the sensors and of the magnetic fields generated by the magnets of the moving parts of the detectors have been selected so that the pressure detecting sensor sends signal to the hydraulic pump when the magnetic fields generated by the magnet of the moving part of the pressure device and by the magnet of the moving part of the flow detector are added together, and the flow detector sensor sends signal to the pump by the action of the magnetic field generated solely by the magnet of the moving part of the flow detector.

[0020] Advantageously, the means for regulating the hydrostatic pressure include an element for closing an opening made in a wall separating two cavities present inside the apparatus.

[0021] In function of the external hydraulic demand, the position of the closing element with respect to the opening made in the wall varies, so that if said demand increases the closing element is moved away from the opening, while if on the contrary the external demand is reduced, the closing element moves closer thereto. In this way, it increases or reduces the through-flow and maintains a constant regulated pressure at all times, independently of the external demand originated from the utilization points of the hydraulic line fed by the pump.

[0022] Said closing element is attached to the moving part of the pressure detector.

[0023] The moving part of the pressure detector acts together with the means for regulating the hydrostatic pressure, so that the closing element opens to a greater or less extent depending on the pressure detected by the pressure detector.

[0024] According to one characteristic of the invention, the apparatus includes a timing element associated with a control device, especially a relay or a triac.

[0025] Said timing element serves to keep the pump feed circuit closed when the pump is switched on or off. If no water reaches the apparatus during a preset time (approximately 7 seconds) immediately following switching the pump on or off the control device opens (electronic circuit open) and the pump switches off as a protective measure.

[0026] The means for urging the pressure detector include a spring attached to the membrane.

[0027] The membrane receives hydraulic pressure on its surface and acts on the spring.

[0028] The invention refers also to an apparatus for controlling the starting and stopping of a hydraulic pump, including a flow detector which, in the absence of flow, provides a pump-stop signal; a pressure detector which has a moving part associated with a membrane and a fixed part mounted in the housing of the apparatus in the position of displacement of the moving part, the flow detector also being provided with a moving part, which functions as a shutoff valve, and a fixed part mounted in the housing of the apparatus, said fixed parts being magnetic sensors; and means for urging the pressure detector, characterized in that the magnetic sensors are connected in such a way that if at least one of said sensors opens the circuit that supplies signal to the hydraulic pump, then the pump will stop.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] For a better understanding of all that has been set out, a drawing is attached which, schematically and solely by way of non-restrictive example, shows a practical case of embodiment.

[0030] In said drawing the single figure is a longitudinal section view of an apparatus according to the invention for controlling the starting and stopping of a hydraulic pump.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0031] As can be appreciated from the Figure, the apparatus 1 for controlling the starting and stopping of a hydraulic pump includes a housing 2 which presents an inlet opening 3 and an outlet opening 4, a pressure detector 5, a flow detector 6, and a spring 7 for urging the pressure detector 5.

[0032] In the figure, the apparatus is arranged vertically, but in its working position it has to be placed horizontal, with the inlet opening 3 at the bottom and the outlet opening 4 at the top thereof.

[0033] In the inlet opening 3 there is a seal 8 on which rests a valve 9 which acts as a flow detector 6, the valve having a permanent magnet 10 inside its shaft 11. In a certain position, said permanent magnet 10 excites two magnetic sensors 12, 13.

[0034] The pressure detector 5 includes a membrane 14 on whose surface the hydrostatic pressure acts, and a shaft 15 associated with the membrane 14, which is attached to a valve 16 that acts as hydrostatic pressure regulator. Said valve 16 presents a projecting member 17 that has on its free end a permanent magnet that in a certain position excites one of the magnetic sensors 13 mentioned in the previous paragraph.

[0035] On its side opposite that of the shaft 15, said valve 16 also has a spring 19 for returning the valve 16 to its rest position.

[0036] The apparatus 1 also includes two cavities 20, 21 separated by a wall 22 that has an opening 23 approximately in its central portion. The shaft 15 urged by the membrane 14 travels through the inside of said opening.

[0037] The apparatus 1 further includes a relay 24 and a timing element (not shown).

[0038] The apparatus 1 therefore operates as follows:

[0039] When the apparatus 1 is connected to the mains electricity an initial timing of the relay 24 of some 5 to 7 seconds takes place, which allows the hydraulic circuit to be pressurized. This causes the valve 9 of the flow detector 6 to move in a vertical direction.

[0040] Said valve 9 has the permanent magnet 10 in its shaft 11, so that the generated magnetic field excites the two magnetic sensors 12, 13 of the electronic circuit of the apparatus 1.

[0041] Thus, while there is water flow due to external consumption, the valve 9 of the flow detector 6 continues to send signal to the two magnetic sensors 12, 13 and the pump remains operational.

[0042] Since said sensors operate in series 12, 13, the electronic circuit 24a connects the pump and keeps it in operation as long as both sensors remain closed.

[0043] If for any reason one of the two magnetic sensors 12, 13 opens, the electronic circuit 24a interrupts the power supply to the pump and the pump stops, since said sensors operate in series.

[0044] When external consumption stops because all taps, valves, etc., are closed, the internal pressure of the apparatus 1 increases, the spring 7 yields and the membrane 14 moves to its new position. Said internal pressure of the apparatus 1 is balanced, the spring 19 urges the valve 16 of the pressure regulator, the valve 9 of the flow detector 6 falls under the effect of gravity, engaging the seal 8 and thus isolating the hydraulic circuit of the pump.

[0045] Owing to this new position of the valve 9, the magnetic sensors 12, 13 are no longer excited, which causes the electronic circuit 24a to interrupt the connection and, therefore, the pump to stop after a timing delay of 5 to 7 seconds.

[0046] When a tap is opened, the internal pressure of the apparatus 1 falls, the spring 7 pushes the membrane 14, which in turn pushes the shaft 15 of the valve 16, which on its opposite end has a permanent magnet 18 for closing the sensor 13, once the valve 16 has reached approximately the end of its travel.

[0047] Once the sensor 13 has been activated, the electronic circuit 24a connects during 5 to 7 seconds, starting the pump. If after that timing period the sensor 13 has not received signal from the valve 9, the pump stops. On the other hand, if after the aforesaid timing period the valve 9 rises due to the flow of water (it gives signal to both sensors 12, 13), the pump continues to operate until either of said sensors ceases to give out a signal. Once the taps have been closed, the pump stops after going through the steps described above.

[0048] The pressure regulator operates as described below.

[0049] When the pump is operating, the water flows through the opening which connects the chambers 20, 21. The opening of the valve 16 depends on the hydrostatic pressure, which by acting upon the membrane 14 regulates the flow through said opening 23. When the maximum regulated pressure is reached, the valve closes.

[0050] Said pressure depends at all times on the force exerted by the spring 7 on the membrane 14, which is a

function of the compression to which the spring is subjected by means of an adjustment bolt 25.

[0051] Despite the fact that references have been made to specific embodiments of the invention, is will be clear to a man skilled in the art that the apparatus described lends itself to many variations and alterations, and that all the details mentioned can be replaced by others which are technically equivalent, without departing from the scope of protection defined by the appended claims.

Claims

1. An apparatus (1) for controlling the starting and stopping of a hydraulic pump, including a flow detector (6) which, in the absence of flow, provides a pump-stop signal; a pressure detector (5) which has a moving part associated with a membrane (14) and a fixed part mounted in the housing (2) of the apparatus (1) in the position of displacement of the moving part, the flow detector (6) also being provided with a moving part that functions as a shutoff valve, and a fixed part mounted in the housing of the apparatus, said fixed parts being magnetic sensors (12, 13); and means (7) for urging the pressure detector (5), **characterized** in that it includes means for regulating the hydrostatic pressure, mounted inside the apparatus (1).

2. An apparatus as claimed in Claim 1, characterized in that the magnetic sensors (12, 13) are connected in such a way that if at least one of said sensors opens the circuit (24a) which supplies signal to the hydraulic pump, then the pump stops.

3. An apparatus as claimed in Claims 1 or 2, characterized in that the moving part of the pressure detector (5) and the moving part of the flow detector (6) include a magnet (10, 18).

4. An apparatus as claimed in Claim 3, characterized in that the magnet (18) of the moving part of the pressure detector (5) provides a magnetic signal to its corresponding sensor (13), while the magnet (10) of the moving part of the flow detector (6) provides a signal to its corresponding sensor (12) and to the sensor (13) of the pressure detector.

5. An apparatus as claimed in Claim 4, characterized in that the sensitivity levels of the sensors (12, 13) and of the magnetic fields generated by the magnets (10, 18) of the moving parts of the detectors (5, 6) have been selected so that the sensor (13) of the pressure detector (5) sends signal to the hydraulic pump when the magnetic fields generated by the magnet (18) of the moving part of the pressure detector (5) and by the magnet (10) of the moving part of the flow detector (6) are added together, and the sensor (12) of the flow detector (6) sends signal to the pump by the action of the magnetic field generated solely by the magnet (10) of the moving part of the flow detector (6).

6. An apparatus as claimed in any of the preceding Claims, characterized in that it includes a timing element associated with a control device (24).

7. An apparatus as claimed in claim 6, characterized in that the control device is a relay (24).

8. An apparatus as claimed in Claim 6, characterized in that the control device is a triac (24).

9. An apparatus as claimed in any of the preceding Claims, characterized in that the means for regulating the hydrostatic pressure include an element (16) for closing an opening (23) formed in a wall (22) separating two cavities (20, 21) present inside the apparatus (1).

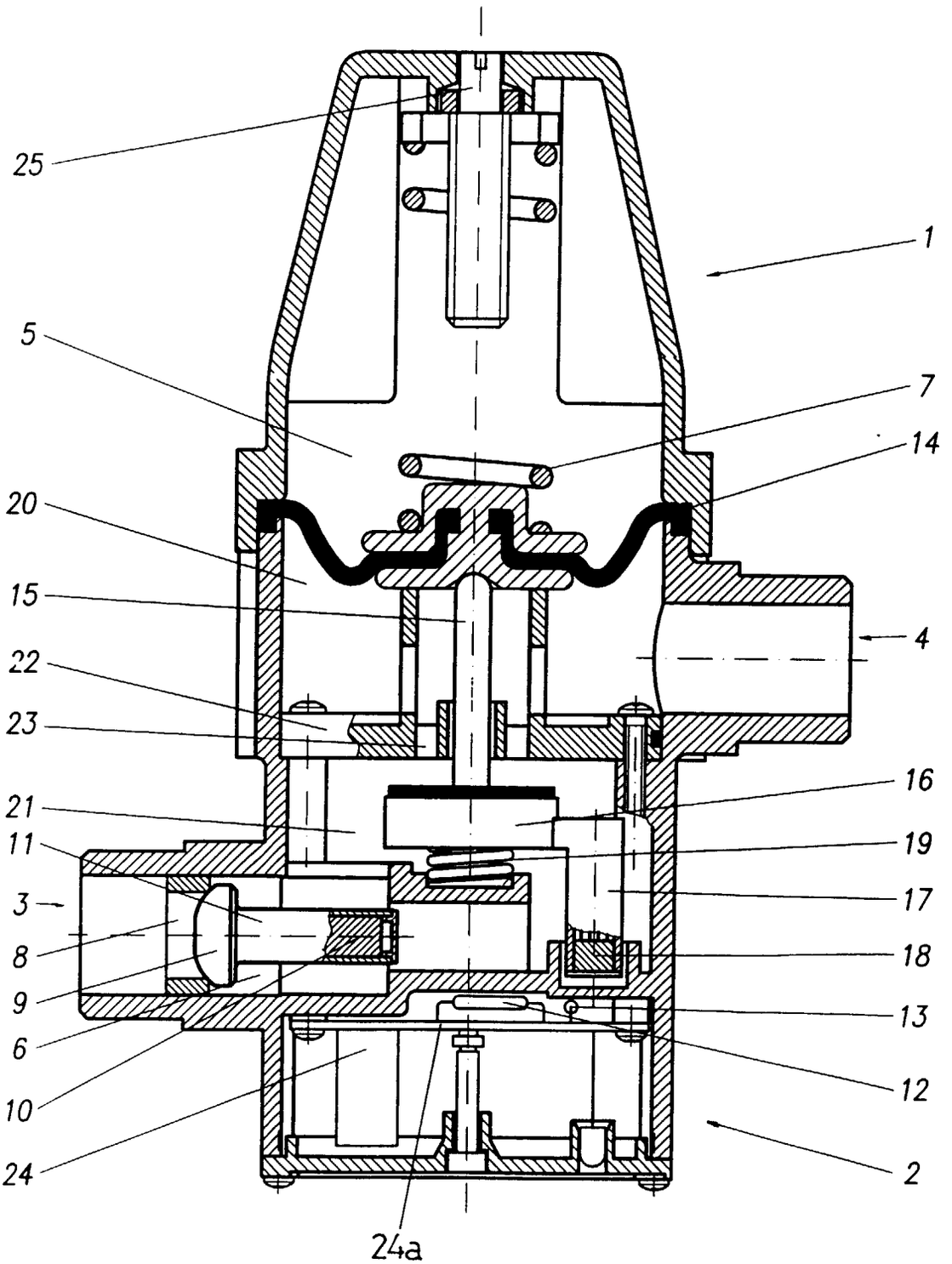
10. An apparatus as claimed in Claim 9, characterized in that the closing element (16) is integral with the moving part of the pressure detector (5).

11. An apparatus as claimed in any of the preceding Claims, characterized in that the means for urging the pressure detector (5) include a spring (7) attached to the membrane (14).

12. An apparatus (1) for controlling the starting and stopping of a hydraulic pump, including a flow detector (6) which, in the absence of flow, provides a pump-stop signal; a pressure detector (6) which has a moving part associated with a membrane (14) and a fixed part mounted in the housing (2) of the apparatus (1) in the position of displacement of the moving part, the flow detector (6) also being provided with a moving part (9), which functions as a shutoff

valve, and a fixed part mounted in the housing (2) of the apparatus (1), said fixed parts being magnetic sensors (12, 13); and means (7) for urging the pressure detector (5), **characterized** in that the magnetic sensors (12, 13) are connected in such a way that if at least one of said sensors opens the circuit (24a) that supplies signal to the hydraulic pump (1), then the pump will stop.

13. An apparatus as claimed in Claim 12, characterized in that it includes means for regulating hydrostatic pressure, mounted inside the apparatus (1).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