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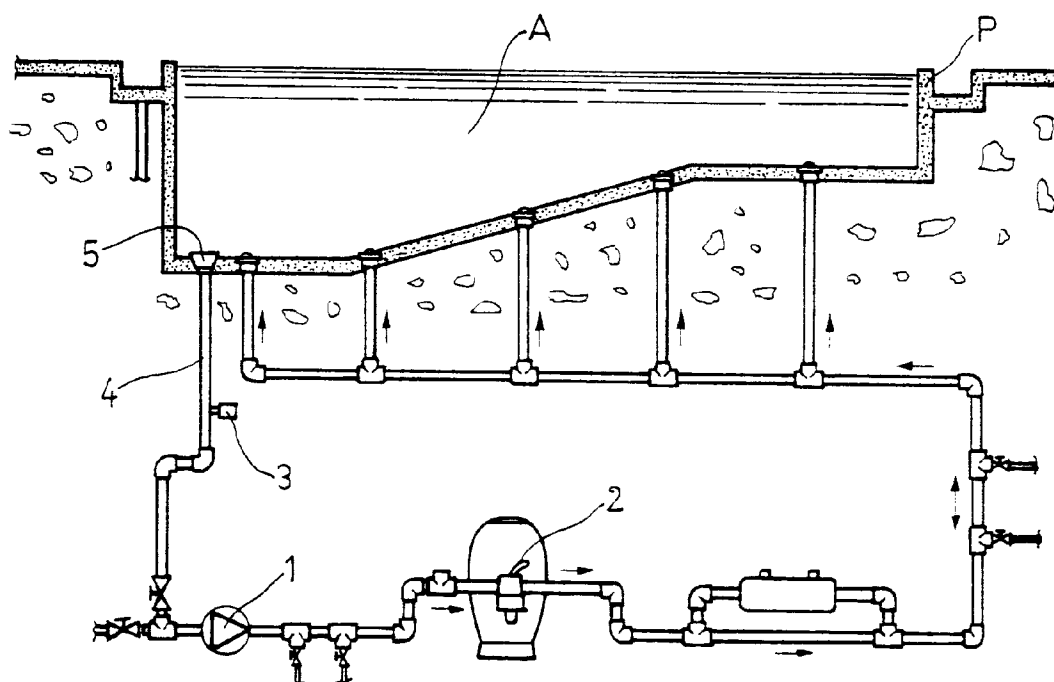
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AL LT LV MK RO SI(30) Priority: **05.03.1997 ES 9700479****05.02.1998 ES 9800220**(71) Applicant: **PLASTERAL, S.A.****08213 Polinya (Barcelona) (ES)**(72) Inventor: **Vila Corts, Francesc Xavier****08213 Polinya (Barcelona) (ES)**(74) Representative: **Pastells Teixido, Manuel****c/o PASTELLS & ARAGONES, S.L.,****Pau Claris, 138****08009 Barcelona (ES)**(54) **System for controlling pump operation**

(57) Characterised by, preferably in the area of fluid suction towards the pump (1), the presence of a detector device (3) for the pressure of the fluid in said area, which device, in the event of a variation in pressure or vacuum in this area, transmits a signal to the pump (1) which will cause same to shut down. This device (3) comprises a

pressure switch-vacuum switch or a pressure gauge which transmits an electrical signal to a relay operating the pump (1). This system comprehends at least one timer which will program pump operation down time. In addition, the system includes at least one signal micro-processing circuit and one system restarting monitoring subsystem.

**Fig. 1****EP 0 863 278 A2**

Description

The invention refers to a system for controlling pump operation.

Purpose of the invention

This system is intended mainly for controlling and ensuring the safe operation of hydraulic pumps of the type installed in swimming-pools, fountains and other places where water is held, in order to suck it and circulate it through hydraulic circuits, such as filter or pumping circuits in aqua-parks (with slides and other complements) the water subsequently being sent towards the original tank or another.

Background to the invention

Drains are installed at the bottom of, or next to, swimming-pools, fountains, reservoirs and other water tanks through which the water is sucked using a hydraulic pump in order to subject it to a given process and then send it towards the original tank or another.

The electric motor of these pumps is built in such a way that certain parts of it such as the ceramic seal or the electric winding burn out if the motor continues operating without transferring water, such as when a duct is blocked, for example. The most common cause of this blockage is when a foreign object or even a human body obstructs the drain or discharge.

These objects or persons causing the obstruction may be seriously harmed or damaged if the pump does not cease operation.

In order to prevent such blockage and the subsequent damages, grilles or some other type of architectural barrier is placed over these inlets; due to faults in these barriers or negligent maintenance of the swimming-pool or tank, these damages cannot always be avoided.

Summary of the invention

The system described in this invention shuts down pump operation in the event of blockage, thus eliminating the risk of damage to the pump, or to the object or person causing the blockage; it provides for re-starting the pump after a set interval if indefinite shutdown of operation is undesirable, and is equipped with signposting and monitoring elements.

This system is based on the existence of a water pressure detector, preferably located in the suction area, which in the event of any variation in pressure or vacuum present in said area, transmits an electric signal to the pump and causes same to shut down.

This detector device may comprise a pressure switch, vacuum switch or pressure gauge, which can be adjusted to shut down the pump or reduce its suction power by transmitting an electric signal to a relay oper-

ating the pump.

The system should preferably be equipped with at least one electric signal processing microcircuit, at least one pressure gauge, at least one relay, at least one timer, luminous indicators, acoustic or visual alarms, a selector switch to disconnect and re-connect the system and a subsystem to monitor re-start up.

The electric signal processing microcircuit controls the flow of electric signals in accordance with a program designed for the characteristics of the water installation.

The pressure gauge is set so that, in the event of any variation in the pressure beyond a certain limit, it will transmit an electric signal to the microcircuit which, in accordance with the program to be executed, sends another signal to a relay to shut down the pump motor and put the timer into operation.

The timer is programmable and has two functions. One is to cause the microcircuit to send a signal to the relay, after a programmed interval, to restart the pump. The other function is to disable the option of the microcircuit sending a stop signal to the relay due to low pressure, also during a programmable interval. This function is useful, as during the first moments when starting up the pump, there are short fluctuations in the pressure level in the circuit, due to the inertia of a liquid mass that is put into motion; the aim is to prevent any of these fluctuations beyond the permitted pressure limit, from causing the pump to shutdown.

When the pump is restarted, the water pumping process will continue if the cause of the blockage has been removed. If such blockage should continue, the motor will shutdown again, and remain so during the programmed interval until the timer restarts it. If after the second or third interval the blockage persists, the system can be programmed so that the motor does not restart until manual intervention takes place.

The luminous indicators will light up during normal operation of the relevant element, and when said element stops, the indicator will go out, and vice versa. The acoustic and/or visual alarms will activate when the pump motor shuts down. The selector switch allows the user to deactivate the system, so as to empty the swimming-pool, for example, and then re-activate it when the pool is full. As a safety measure, to deactivate the system requires holding the selector switch down for no less than three seconds.

The restart monitoring subsystem controls all system elements and is intended to restore correct operation of each element before, or after, external anomalies, such as automatically restarting the system after a power-cut or de-blocking a blocked element, during a storm for example.

These, and other features will become more apparent from the detailed description below, in addition to two drawings depicting a practical case, given solely as an example of the scope of this invention, not limited to same.

Description of the drawings

Figure 1 shows a layout of a swimming-pool in which this control system is used,
figure 2 shows the electrical diagram of all the safety elements,
figure 3 shows a block diagram of the power source for this control system, and
figure 4 shows the diagram of the flow of electric signals within the system.

Practical case

In accordance with the drawings, this control system of pump 1 operation which sucks water A from swimming-pool P and impels it towards filter 2 for cleaning for subsequent return to the swimming-pool when clean, basically comprises the installation of a pressure switch-vacuum switch or a pressure gauge 3 in water suction tube 4 of the swimming-pool via drain 5 whose mouth is usually protected with a grille.

This pressure switch-vacuum switch or pressure gauge 3 is responsible for transmitting the electric signal to a safety-cabinet 6 where the first timer 7, a relay 8, a second timer 9 and a switch 10, whose safety-box will be connected to the relevant pump switchgear cabinet (not shown).

This system is designed so that in the event the pressure switch-vacuum switch or pressure gauge 3 interrupts pump 1 operation, the latter (or the set of pumps) will shut down for the time programmed on the first timer 7, after which time the pump will automatically resume operation for another, shorter time, programmed by the second timer 9. If the initial problem continues to exist, it will again shut down the pump, repeatedly, until the pump is shut down definitively.

In said safety-cabinet 6, several luminous, "LED" type indicators in different colours are located, in order to specify the different operating conditions of the system.

Thus, for example, green will indicate current and operation; red, the timer action that stops the pump; yellow, second timer operation, and the fourth colour that the pressure switch-vacuum switch is open.

Switch 10 will select connection or disconnection of the system, for example for draining the swimming-pool with nobody present.

The last component of the system is the installation of independent alarms which will operate acoustic/visual signals to indicate any anomaly in system operation.

Figure 3 shows the electric diagram of the power source represented in blocks, indicating 11, inlet of the pressure switch-vacuum switch or pressure gauge, 12, the main safety timer, 13, the secondary timer, 14, the operating and signalling relays, 15, the indicator "LED's" and 16, the external connections.

Should the hydraulic circuit lack a filter or any another element which could cause a variation in the pres-

sure within said circuit, the pressure switch-vacuum switch or pressure gauge may be installed in any part of the circuit.

In accordance with figure 4, when pressure gauge records a pressure below the set value, it transmits an electric signal to microcircuit 17. On receiving the signal, the microcircuit sends a signal to relay 18 which cuts off the power supply to motor 19 of pump 1, thus shutting it down, and also sends a signal to timer 20 to commence count down of the time to elapse before the pump restarts.

After the set time, timer 20 sends to microcircuit 17 the signal to operate the relay to start up motor 19 of pump 1, while at the same time blocking said microcircuit 17 so that during a time which can be set between 0 and 10 seconds, it should not respond to any low pressure signals received from pressure gauge 3.

If the cause of the drop in pressure disappears, the water pumping process continues in normal operation. If the cause should persist, pressure gauge 3 will again record a pressure lower to that programmed, will again transmit a signal to microcircuit 17 which will again operate relay 18, stopping motor 19 of pump 1, and will start timer 21 (which depending on electronic technology could also be timer 20 itself). After another set time, the timer repeats the above function.

If the cause of the drop in pressure disappears, the water pumping process continues in normal operation. If the cause should persist, pressure gauge 3 will again record a pressure lower to that programmed, will again transmit a signal to microcircuit 17, and this will cause relay 18 to interrupt pump 1 operation. The timer will not start up the pump again.

While the safety system is activated, there will be a green light on 23, on the outside of assembly 22, which may be located inside a safety cabinet. If the system is deactivated, the green light goes out and a red light 23' blinks. A lit yellow light 23" indicates that the pump is shut down. A blue light 23''' indicates that the pressure gauge shows a pressure lower than programmed. A continuous red light 23^{iv} will light during the first few seconds when the pump is started up during which, due to the pressure fluctuation typical of the inertia of the fluid, microcircuit 17 does not send relay 18 the stop signal to the electric motor.

Selector switch 24 enables to deactivate the system and re-activate it. The monitoring subsystem 25 is responsible for restoring correct operation after anomalies due to external causes.

In places visible from the swimming-pool or from an eventual control center, there shall be visual and/or acoustic alarms 23^v which will energise when the pump stops.

In the flow diagram of the electric signals, pressure gauge 3 sends its signal to the microcircuit of electric signals 17, which can send a signal to relay 18 to stop motor 19 of pump 1 and starts timer 20 or timer 21 according to what has been envisaged or pro-

grammed. Signal leave the timer for microcircuit 17 which cause it to operate relay 18 while at the same time, during 10 seconds, they prevent any signals received from pressure gauge 3 from being transformed in signals to relay 18.

The conjunction of these devices is shown in reference 22 whose parts send the signals to pilot lights and alarms 23 to 23', or receive it from selector switch 24, or send them and receive them from the monitoring subsystem 25.

Claims

1. System for controlling pump operation, characterised by having, preferably in the area of fluid suction towards the pump, a device detecting the pressure of the fluid in said area, which device, in the event of a variation in pressure or vacuum in this area, transmits a signal to the pump which will cause same to shut down.
2. System for controlling pump operation in accordance with claim 1, characterised by the detector device comprehending a pressure switch which transmits an electrical signal to a relay acting on the pump.
3. System for controlling pump operation in accordance with claim 1, characterised by the detector device comprehending a vacuum switch which transmits an electrical signal to a relay acting on the pump.
4. System for controlling pump operation in accordance with claim 1, characterised by including at least one timer to program the down time of pump operation.
5. System for controlling pump operation in accordance with claim 1, characterised by including several visual indicators that identify the different phases and situations that may arise in system operation.
6. System for controlling pump operation in accordance with claim 1, characterised by including acoustic and/or visual alarms to indicate any anomalies in system operation.
7. System for controlling pump operation in accordance with claim 1, characterised by including a selector switch to determine connection or disconnection of the control system.
8. System for controlling pump operation in accordance with claim 1, characterised by including at least one electric signal microprocessing circuit and

one of a monitoring subsystem for system re-start.

9. System for controlling pump operation in accordance with claim 8, characterised by the electric signals microprocessing circuit controlling the signals generated in the different system elements, and generates its own signals which act on the element which generated the processed signal, or another.
10. System for controlling pump operation, in accordance with claims 1 and 8, characterised by the detector device being equipped with a pressure gauge which, when the measured pressure exceeds a preset value, it sends a signal to the microcircuit which is transformed into two signals, one which operates the relay which then stops the hydraulic pump motor and another which starts the timer.
11. System for controlling pump operation, in accordance with claims 4 and 8 characterised by at least one programmable timer sending a signal to the microprocessor circuit after elapsing the time programmed since the stoppage of the pump motor and by the interval to be programmed ranging from one minute to twelve hours.
12. System for controlling pump operation, in accordance with claim 4, characterised by the timer, after a set number of restarts, each involving less than a minute's pump motor operation, ceases to restart the pump.
13. System for controlling pump operation, in accordance with the above claims, characterised by the timer, on restarting pump operation, prevents the microprocessor circuit from sending the relay a motor shut down signal due to lack of pressure on the pressure gauge during a maximum of ten seconds.
14. System for controlling pump operation, in accordance with claim 7, characterised by the selector switch deactivating or activating system operation when it is held pressed down continuously for no less than three seconds.
15. System for controlling pump operation, in accordance with claim 8, characterised by the subsystem for monitoring system restart uses an electrical signal processing microcircuit which receives signals from each element in the system and automatically restarts any element(s) which may have been shut down for some cause - except if the stoppage has been manually operated or a loss of pressure has occurred- once the cause has disappeared.

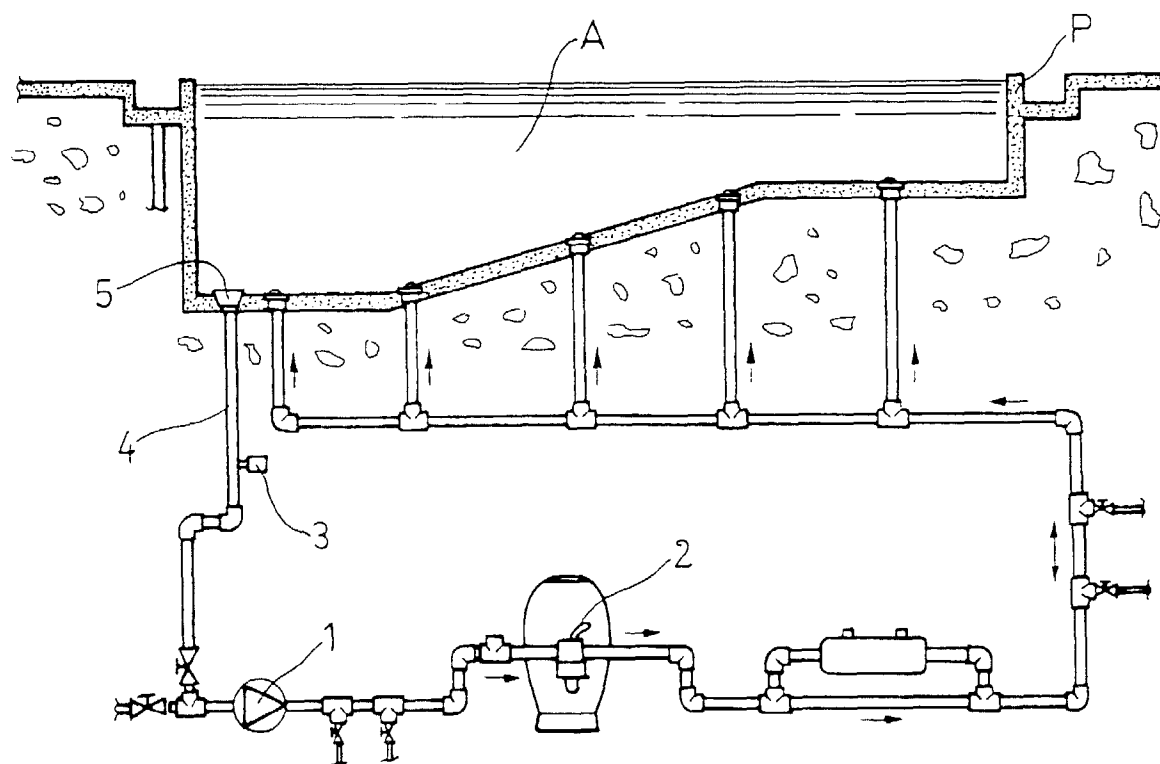


Fig. 1

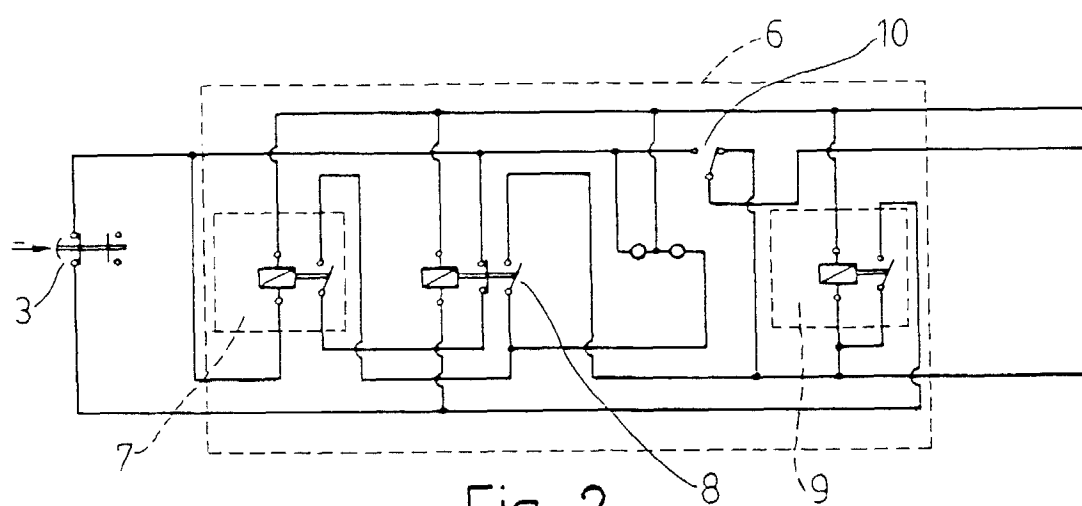


Fig. 2

