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AUTOMATIC WATERFLOW CONTROL FOR AIR COMPRESSORS

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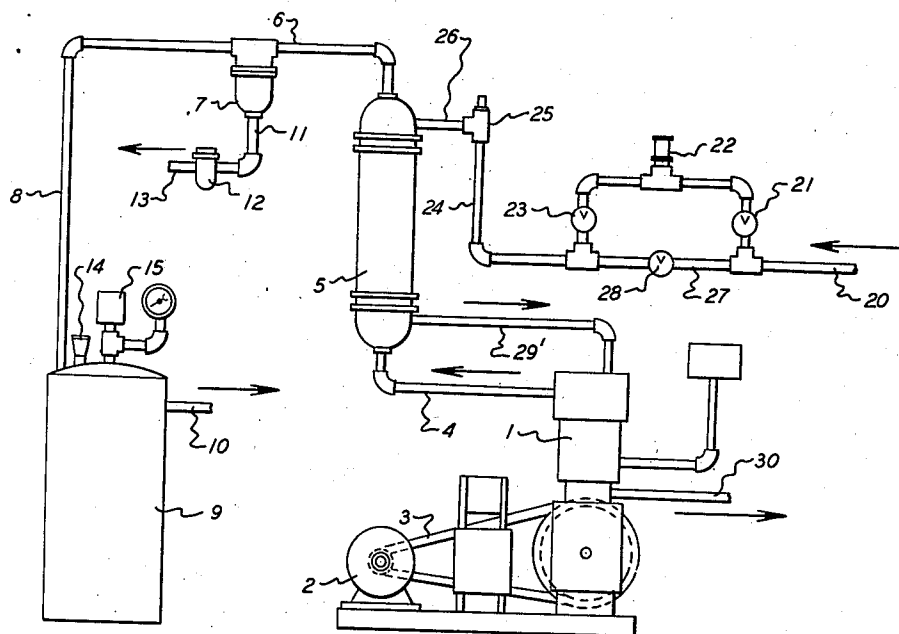


Fig-1-

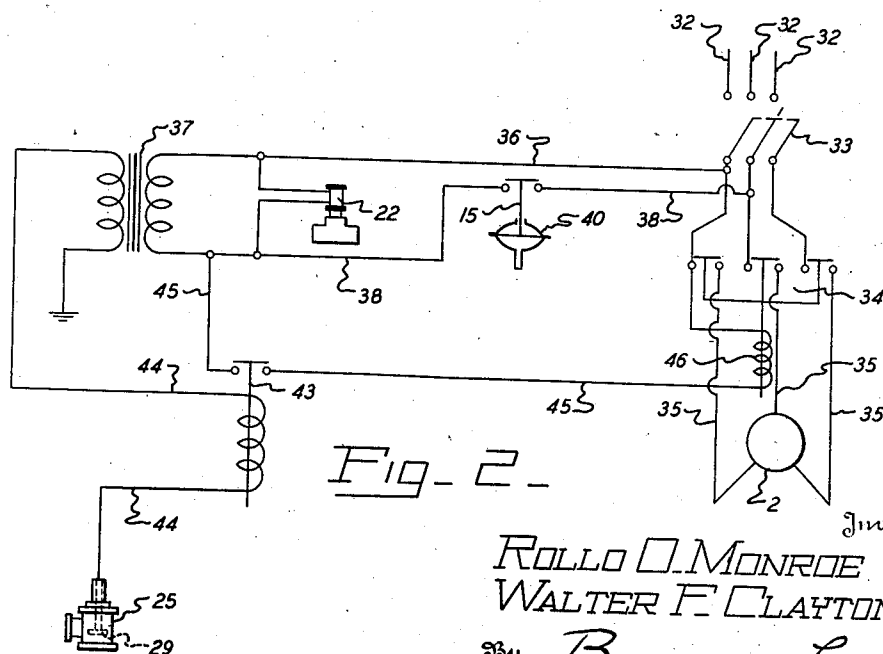


Fig-2-

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AUTOMATIC WATER-FLOW CONTROL FOR
AIR COMPRESSORS

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6 Claims. (Cl. 230—17)

The present invention relates to compressor systems and more particularly to an arrangement for controlling the flow of cooling water for compressors and the like.

Automatic controls for controlling the flow of cooling water for compressors have been developed, but have not been favorably received by users and manufacturers of compressors for the reasons that in the event of the failure of the automatically controlled valve to function, there has been nothing to stop the compressor. The result has been the continuation of the operation of the compressor without cooling water followed by undesirable consequences.

The present invention overcomes the difficulties of the prior art by providing the controlling system wherein in the event of the failure of water to flow for any reason whatsoever, the compressor is stopped. Furthermore, according to the present invention, the compressor cannot be started without the circulation of cooling water.

An object of the present invention is to provide a control for the cooling water of a compressor, or the like.

Another object of the invention is to coordinate the flow of cooling water with the operation of the compressor.

Still another object of the invention is to provide compressor operating and water controlling electrical circuits and to coordinate the operation of the circuits.

A still further object of the invention is to provide the cooling water itself as a part of a compressor operating circuit.

These and other objects residing in the arrangement, combination and construction of the parts will be apparent from the following specification when taken with the accompanying drawing, in which

Fig. 1 diagrammatically represents a compressor system according to the present invention, and

Fig. 2 is a wiring diagram of the electrical circuit employed in, but not disclosed in, the system of Fig. 1.

Referring particularly to the drawing, the reference character 1 indicates a compressor driven by a motor 2 through a belt 3. Compressed air provided by the compressor is conducted through a conduit 4 to an after cooler 5 and from the after cooler 5 is conducted through a conduit 6, to a separator 7. A conduit 8 conducts the compressed air to an air receiver 9. Compressed air from the air receiver 9 is conducted therefrom by a service conduit 10 to the points of use.

The separator 7 is provided with an outlet conduit 11 in which is disposed a trap 12 having a conduit 13 connected thereto providing a connection with a drain not shown. The air receiver 9 is provided with a relief valve 14, and a pressure responsive switch 15 for controlling the operation of the compressor 1 and the flow of cooling water as will be hereinafter described.

Cooling water for the compressor is conducted from a source, not shown, through a conduit 20, a valve 21, a solenoid valve 22, a valve 23, a conduit 24, a fitting 25 and a conduit 26 to the after cooler 5. The solenoid valve 22 is by-passed by a conduit 27 having a valve 28 therein. An electrode 29 is disposed in the fitting 25 as shown particularly in Fig. 2. Cooling water from the after cooler 5 is conducted by a conduit 29' to the water jacket of the compressor 1 and from the compressor 1 to a drain conduit 30.

The operation of the invention can best be understood by reference to the wiring diagram disclosed in Fig. 2. The electric motor 2 is driven by electric current carried through conductors 32 from a suitable source through a switch 33 and a starter 34. The conductors 32 are connected to the motor 2 through the switch 33 and the starter 34 by conductors 35. A conductor 36 is connected to one of the conductors 32 through the primary of a transformer 37 to a conductor 38 and the conductor 38 is connected to another one of the conductors 32. In series with the conductors 36 and 38 and the primary of the transformer 37 is the pressure responsive switch 15 actuated by a pressure responsive device 40. In parallel with the primary of the transformer 37 across the conductors 36 and 38 is disposed the solenoid actuated valve 22.

The pressure responsive device 40 is arranged so that on low pressure in the receiver 9 the contacts are closed and on high pressure in the receiver 9, the contacts are open. The solenoid valve 22 is so arranged that the valve 22 is normally closed but upon being electrically energized it is opened to permit the flow of cooling water.

The secondary of the transformer 37 has one end thereof grounded and the other end connected in series with the actuating coil of a relay switch 43 and the electrode 29 of the fitting 25, by a conductor 44. The relay switch 43 is arranged in a circuit consisting of the conductor 38 including the pressure responsive switch 15 and a conductor 45 including the relay switch 43, connected at one end to the conductor 38 and at the other end to one end of the solenoid coil 46 of the

motor starter 34. The opposite end of the coil 46 is connected to the conductor 32 which is connected to the conductor 36.

The operation of the device is as follows: Assume that the compressor 1 has operated and built up a pressure in the air receiver 9 and then has stopped. At this stage there will be no flow of cooling water. Assume then that the pressure in the air receiver 9 drops due to use so that the pressure responsive device 40 is actuated to close the switch 15. A circuit is then closed including the conductor 36, the solenoid valve 22, the conductor 38 and the switch 15. The closing of this circuit opens the solenoid valve 22 to start the flow of cooling water. As soon as the cooling water passing through the conduit 24 strikes the electrode 29, a circuit is closed through the ground including the secondary of the transformer 37, the conductor 44 and the coil of the relay switch 43. The closing of the relay switch 43 closes the circuit including the conductor 38 which includes the previously closed pressure responsive switch 15, the conductor 45 and the coil 46 of the motor starter 34. The closing of this circuit closes the motor starter to start the compressor motor 2 and thus the compressor 1. Should the pressure in the air receiver 9 rise to such a point that the pressure responsive switch 15 is opened, the solenoid valve 22 is closed by the opening of its circuit and also the motor starter 34 circuit including the conductors 38, 45, the relay switch 43 and the coil 46 is opened to stop the motor and thus the compressor.

In analyzing the operation of the system according to the present invention, it will be clear that the motor 2 for the compressor 1 cannot operate until the cooling water starts to flow and completes the circuit of the motor starter 34 through the relay switch 43. Thus, it is the flow of cooling water that is responsible for the starting of the motor 2. The fitting 25 is placed at a high point of the water system so that should the flow of cooling water fail, due to some accidental, purposeful, or other cause, the water will gravitate away from the electrode 29, opening the relay switch 43 circuit and the relay switch 43, to open the motor starter 34 circuit which includes the conductor 38, the conductor 45, and the coil 46. The operation which the present invention provides has a very definite safety feature in that the compressor cannot operate until the cooling water is flowing and has an economy feature that the cooling water does not flow when the compressor is not operating.

While the invention has been described particularly with respect to a compressor for storing compressed air, it will be understood that the invention has other applications as for instance in compressors for refrigerating units or other installation where the flow of a conducting liquid is required. In the control of the cooling water for compressors for refrigerating units it will be understood that it is not necessary that a pressure actuate the switch for controlling the solenoid valve operation as some other varying condition may be employed to close this circuit. Furthermore in compressor systems the use of an after cooler and separator for the compressed air are not a part of the invention and may be omitted. In the claims it is contemplated that "water" include other conducting liquids of an equivalent nature.

Having thus described our invention, what we desire to secure by Letters Patent and claim is:

1. A device for controlling the flow of a liquid for a liquid cooled compressor, which comprises a liquid conduit system for conducting said liquid from a source to said apparatus, a valve in said conduit system, pressure means responsive to pressure built up by said compressor for opening said valve to provide a flow of said liquid, starting means for said compressor, and means responsive to said flow of water for actuating said starting means.

2. A device for controlling the flow of cooling water for a compressor which comprises a water conduit system for conducting water from a source to said compressor, a valve in said conduit system, a reservoir for compressed air provided by said compressor, means responsive to a predetermined minimum pressure in said reservoir for opening said valve to provide a flow of said water, starting means for said compressor, and means responsive to said flow of water for actuating said starting means.

3. A device for controlling the flow of cooling water for a compressor which comprises a water conduit system for conducting water from a source to said compressor, an electrically actuated valve in said conduit system, said valve being normally closed, a reservoir for compressed air provided by said compressor, a circuit having means responsive to a predetermined low pressure in said reservoir to close said circuit to open said valve upon said reservoir reaching a predetermined low pressure and for closing said valve upon said reservoir reaching a predetermined high pressure, and a second circuit having means to close the same upon the flowing of said water, to start said compressor and to open the same to stop said compressor upon the stopping of the flow of said water.

4. The invention as defined in claim 3 wherein the means to close the second circuit includes a third circuit closable through said water to the ground.

5. The invention as defined in claim 3 wherein the pressure responsive circuit closing means is in both the first and second circuits.

6. A device for controlling the flow of cooling water for a compressor which comprises a water conduit system for conducting water from a source to said compressor, an electrically controlled valve in said conduit system, an electric circuit for controlling the operation of said valve, a switch for opening and closing said circuit, a reservoir for storing compressed air provided by said compressor, means responsive to a predetermined low pressure in said reservoir to close said switch and responsive to a predetermined high pressure in said reservoir to open said switch, closing said circuit to open said valve to provide a flow of said water and the opening of said switch opening said circuit to close said valve to stop the flow of said water, an electrically controlled starting means for said apparatus, an electric circuit including the first named switch for controlling said starting means, a second switch in said last named circuit, a third circuit for closing said second named switch, and means responsive to the flow of water in said conduit system for closing said third circuit for closing said second circuit for actuating said starting means to start said compressor, whereby either the opening of said third circuit or of said pressure responsive switch will stop said compressor.

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