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CONTROLLER FOR POWER DRIVEN PUMPS

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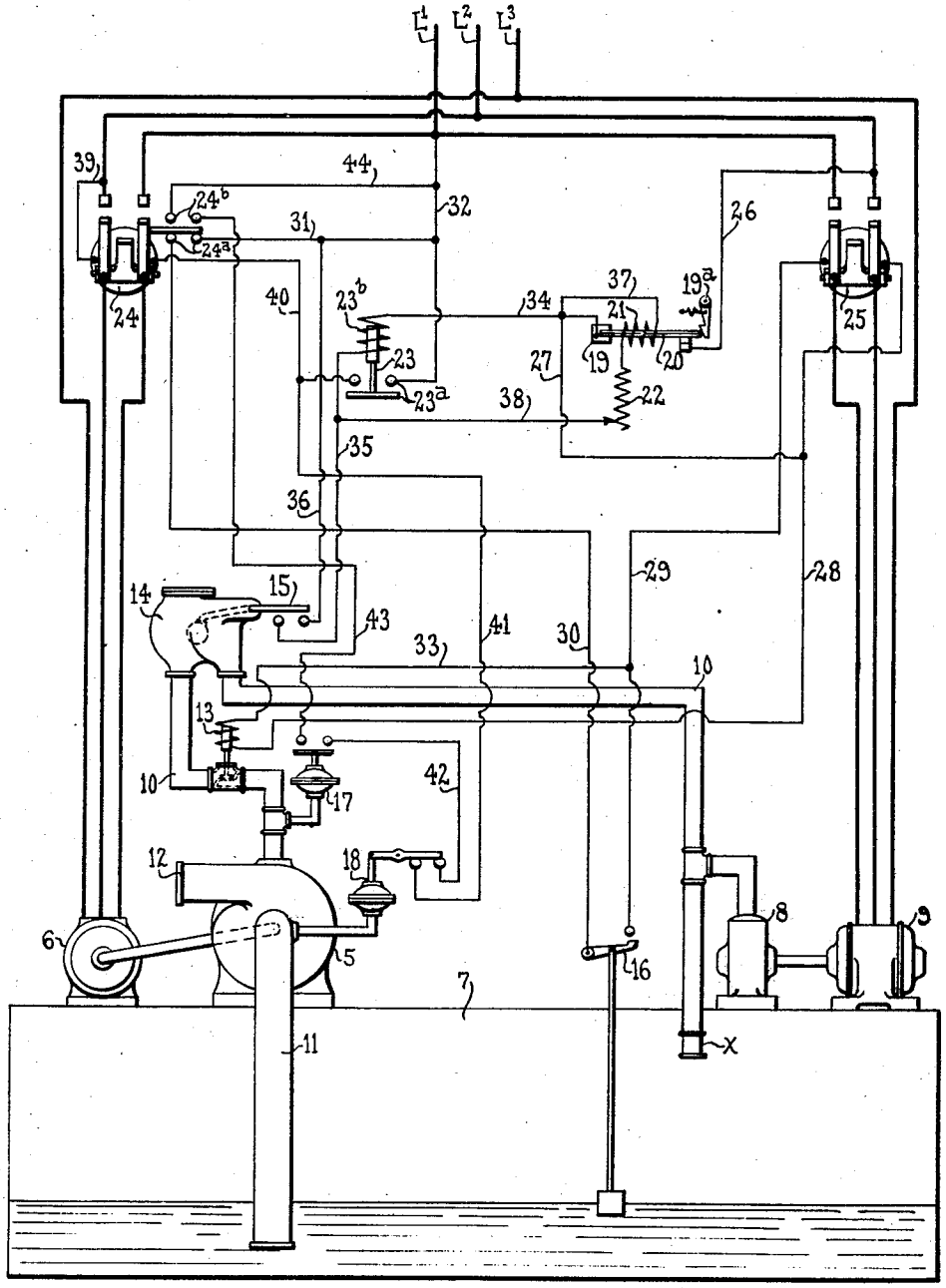

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CONTROLLER FOR POWER-DRIVEN PUMPS

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This invention relates to controllers for power driven pumps and is particularly advantageous for motor driven centrifugal or other pumps which require priming thereof preparatory to pumping.

In the patent of Bayard M. Horter, No. 1,562,561, dated November 24, 1925, is disclosed means to provide for automatically controlling the priming, starting and stopping of such pumps, and the present invention has among its objects that of improving and simplifying the control instrumentalities of the aforementioned character.

Another object is to provide thermo-electric means for controlling the starting and priming action of the controller.

A further object is to provide for adjustment of the aforementioned thermo-electric element of the controller.

Another object is to provide an adjustable thermo-electric switch for limiting the system to a predetermined number of cycles of starting, priming and stopping of the pump under given abnormal conditions.

Other objects and advantages of the invention will hereinafter appear.

The drawing, consisting of a single figure, illustrates schematically and diagrammatically one of the embodiments which the invention may assume in practice.

Referring to the drawing, the same illustrates a centrifugal pump 5 adapted to be driven by motor 6, said pump being adapted to discharge the contents of a sump 7 or the like.

Pump 5 is provided with priming means including a priming pump 8 which is preferably of the dry vacuum type, a driving motor 9 for the priming pump and suitable connections which will hereinafter be described.

Said priming connections may preferably comprise a pipe 10 connecting the intake of priming pump 8 with the highest point of the chamber of pump 5 whereby upon operation of the vacuum pump a reduced pressure is produced within the chamber of pump 5 whereby priming liquid is drawn through the pump intake 11 to thereby fill the pump chamber to prime the same, the discharge pipe 12 of the pump being of course provided with a check valve (not shown) while pipe 10 is provided with a suitable check valve at one end thereof as indicated by "X", to enable such reduction of pressure within the pump casing. The pipe 10 is further provided with an electro-responsive valve 13 adapted to close the connection between pump 5 and priming pump 8 during normal pumping action of the former.

A vacuum breaker 14 having a float operated switch 15 is also connected in pipe line 10 at a region which is not lower than and preferably higher than the highest portion of the pump casing, said switch 15 providing for starting of motor 6 but only after the liquid has been so far elevated by the vacuum pump as to insure priming of the casing of pump 5.

A float operated switch 16 is adapted to initiate starting and priming action of the controller upon a given rise of the liquid within the sump 7.

Pump 5 has associated therewith a pressure responsive switch 17 responsive to variations of the pressure conditions obtaining at the pump discharge and a reduced pressure responsive switch 18 responsive to variations of the reduced pressure obtaining in the pump intake 11.

The controller is further provided with a thermo-electric device 19 having a bimetallic strip 20 and a heating element 21 and said thermo-electric device is also provided with an adjustable resistance 22. Said device 19 is also preferably provided with a combined latch and contactor 19^a biased by means of spring 19^c out of engagement with contact 19^b, whereby upon movement of the bimetallic strip 20 to a given position contactor 19^a

is permitted to move out of engagement with contact 19^b and into latching engagement with strip 20 to prevent reverse movement of the latter.

A relay 23 having normally open contacts 23^a and an operating winding 23^b is also provided and is adapted in conjunction with the thermo-electric device 19 and the adjustable resistance 22 to limit the number of cycles of starting, priming and stopping of the pump should the latter fail to function properly.

The motors 6 and 9 are supplied from a common source as from lines L^1, L^2, L^3 through the switches 24 and 25 respectively. Switch 24 is provided with normally closed auxiliary contacts 24^a and normally open auxiliary contacts 24^b for a purpose hereinafter described.

Assuming the various parts to be in the relations illustrated in the accompanying drawing, the operation of the controller is as follows:

Upon a given rise in level of the liquid within the sump 7, float switch 16 closes thereby establishing an energizing circuit for the operating winding of switch 25 of the priming motor, said circuit therefor extending from line L^2 by conductor 26 to and through contact 19^b and contactor 19^a, by conductors 26^a, 37, 27 and 28 to and through the operating winding of said switch 25 by conductor 29 to and through float switch 16, by conductor 30 to and through the normally closed contacts 24^a of switch 24, by conductors 31 and 32 to line L^1. Switch 25 thereupon closes to start motor 9 to thereby drive vacuum pump 8. Closure of float switch 16 also establishes the energizing circuit of the electro-responsive valve 13, said circuit extending from line L^2 by conductor 26 to and through contact 19^b and contactor 19^a, by conductors 26^a, 37, 27 and 28 to and through the operating winding of valve 13, by conductors 33 and 29 to and through float switch 16 to line L^1 as aforedescribed. Valve 13 thereupon opens and vacuum pump 8 reduces the pressure in pipe line 10, vacuum breaker 14 and the casing of pump 5, whereupon the liquid in the sump 7 rises in the pump intake 11, the casing of pump 5 and the vacuum breaker 14, thereby insuring priming of the pump.

When the liquid reaches a predetermined level in vacuum breaker 14, float operated switch 15 associated therewith closes thereby completing the energizing circuit of relay 23, the circuit therefor extending from line L^2 by conductor 26 to and through contact 19^b and contactor 19^a, by conductors 26^a, 37 and 34 to and through winding 23^b, by conductor 35 to and through float switch 15 of vacuum breaker 14, by conductors 36, 31 and 32 to line L^1. Relay 23 thereupon closes for a purpose hereinafter described. The circuit of the heating element 21 is also completed by the closure of float switch 15, the circuit thereof extending from line L^2 by conductor 26 to and through contact 19^b and contactor 19^a, by conductor 26^a through said heating element 21 and the variable resistance 22 by conductors 38 and 35 to and through float switch 15 and thence to line L^1 as already traced. Thus the bimetallic strip 20 will be heated by the heating element 21 but not sufficiently to permit disengagement of contactor 19^a from contact 19^b.

Upon closure of relay 23, switch 24 is closed to establish the circuit for motor 6 to drive pump 5, the circuit for the operating winding of switch 24 extending from line L^2 by conductor 39 to and through said operating winding by conductor 40 through contacts 23^a of relay 23 and by conductor 32 to line L^1. Also upon closure of switch 24 the energizing circuit for switch 25 and electro-responsive valve 13 is interrupted through opening of contacts 24^a thus shutting down motor 9 and the vacuum pump 8 and effecting closure of valve 13.

Upon closure of valve 13 and the operation of pump 5, pressure will build up in the pump casing and pipe 10 to thereby close the pressure responsive switch 17. A maintaining circuit for the winding of switch 24 is established upon closure of switch 17 said circuit extending from line L^2 by conductor 39 through said winding, by conductors 40 and 41 through reduced pressure responsive switch 18 by conductor 42 through pressure responsive switch 17 by conductor 43 through contacts 24^b by conductors 44 and 32 to line L^1.

Upon closure of valve 13 and stopping of vacuum pump 8 the vacuum breaker 14 is drained through pipe 10 to sump 7. Upon draining of vacuum breaker 14 float switch 15 associated therewith opens, thereby interrupting the energizing circuit of relay 23 and the circuit of heating element 21, thereby opening relay 23.

If pump 5 should fail to build up sufficient pressure to close switch 17 or should the pump intake become stopped so that no water enters and switch 18 opens, switch 24 will open and thereby shut down motor 6 and pump 5.

In the event that the level of the liquid in sump 7 has not been lowered sufficiently, float switch 16 remains closed, the cycle of starting, priming and stopping will be repeated a number of times as aforedescribed and the bimetallic strip 21 will consequently be heated repeatedly. Obviously the heating effect upon said strip will be cumulative, so that upon repetition of the aforementioned cycle a given number of times, the bimetallic strip will become heated to such a degree as to permit contactor 19^a, acting under its bias, to disengage contact 19^b. The bimetallic strip 20 will thereupon become latched in

its raised position, thereby preventing further operation of pumps 5 and 8 and rendering the entire system inoperative pending manual resetting of the thermo-electric device 19. By varying the value of resistance 22 in circuit with heating element 21 the heating effect of the latter may be varied so that the number of cycles of starting, priming and stopping may be changed as desired. Also if desired a suitable alarm or indicating device may be provided, to be controlled by operation of bimetallic strip 20.

Under normal conditions, the pumping system will function automatically to lower the level of the liquid in sump 7. When the liquid in sump 7 has been lowered to such a level that sufficient liquid does not enter the pump, the reduced pressure developed at the pump intake will fall below a given value and the reduced pressure operated switch 18 will thereupon open to shut down the pump. When the liquid reaches this level, float switch 16 will have opened thereby restoring the various parts to the positions illustrated and presetting the same for the next cycle of operation.

What I claim as new and desire to secure by Letters Patent is:

1. In a controller for power driven pumps, the combination with automatic starting means, of electro-thermally responsive means subject to control by said starting means and operable automatically to terminate the action of said starting means following a predetermined number of operations of the latter wherein the pump fails to perform its normal functions.

2. In a controller for electric motor driven pumps, the combination with automatic starting means, of electro-thermally responsive means subject to control by said starting means and operable automatically to terminate the action of said starting means following a predetermined number of operations of the latter wherein the pump fails to perform its normal functions, and means for varying the thermal effect on said electro-thermally responsive means of each operation of said starting means to thereby vary the number of operations of the latter prior to operation of the former.

3. In a controller for electric motor driven pumps, the combination with an electric motor, a pump to be driven thereby, and automatic starting means for said motor, of control means for said starting means comprising an electro-thermal device and an electro-responsive device, said electro-thermal device comprising a heating element, a variable resistance in circuit with said heating element for varying the heating effect of the latter, a bimetallic element responsive to the cumulative heating effect of said heating element, energization of said electro-responsive device being subject to control by said bimetallic element to terminate the action of said starting means following a given number of starting operations of the latter as predetermined by the cumulative heating effect of said heating element during a period wherein the pump fails to perform its normal functions.

In witness whereof, I have hereunto subscribed my name.

EDWIN W. SEEGER.