

Nov. 24, 1925.

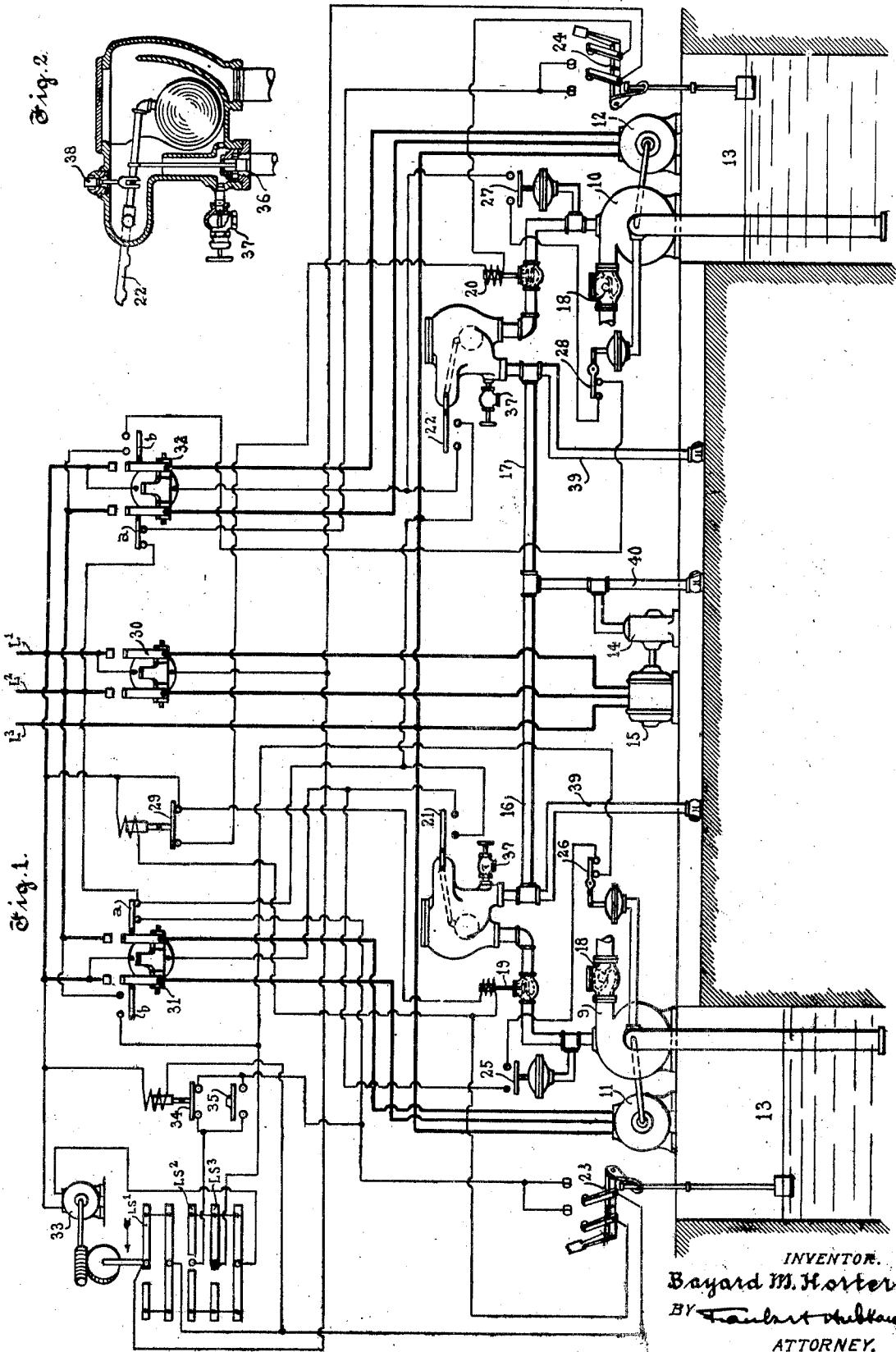
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B. M. HORTER

CONTROLLER FOR POWER DRIVEN PUMPS

Filed Feb. 23, 1923.

2 Sheets-Sheet 1



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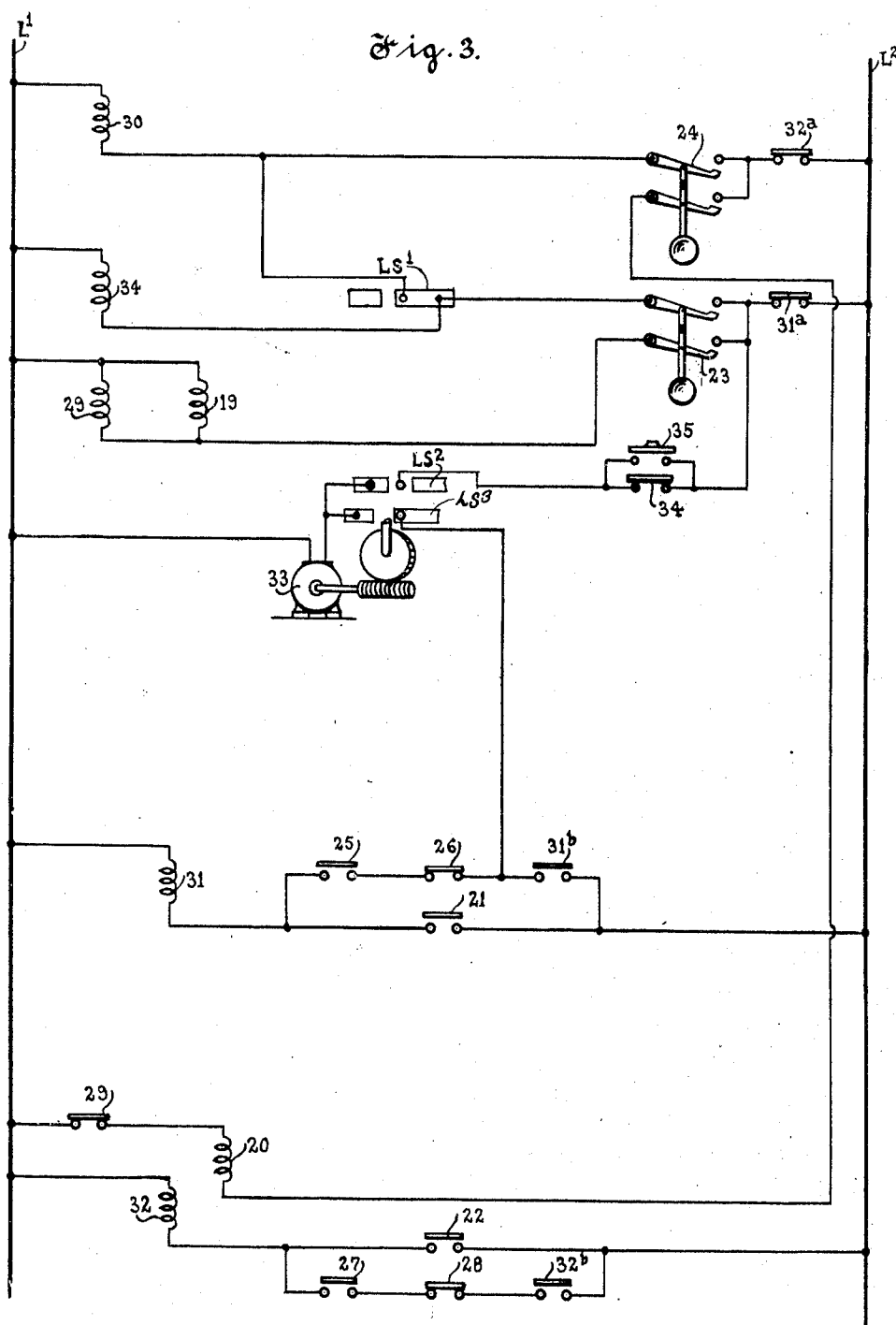
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2 Sheets-Sheet 2



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CONTROLLER FOR POWER-DRIVEN PUMPS.

Application filed February 23, 1923. Serial No. 620,708.

To all whom it may concern:

Be it known that I, BAYARD M. HORTER, a citizen of the United States, residing at Kingston, in the county of Luzerne and State of Pennsylvania, have invented new and useful Improvements in Controllers for Power-Driven Pumps, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

This invention relates to controllers for power driven pumps, particularly centrifugal or other pumps which require priming preparatory to pumping.

Heretofore it has been proposed, as in my copending application, S. N. 607,086, filed December 15, 1922, to provide for automatic control including priming, starting and stopping of such pumps, and the present invention has among its objects that of providing for improved, simplified and also amplified control of pumps of such general character.

Another object is that of providing for automatic control of a plurality of such pumps, such control including provision for priming of all the pumps by means of a single priming device.

Another object is that of providing, in such a control system, for limiting the starting and priming action to a single pump at any one time.

Another object is that of limiting the starting and priming action of the controller under conditions such that all or certain of the controlled pumps are incapable of functioning properly.

Other objects and advantages will hereinafter appear.

In the accompanying drawing wherein is illustrated a preferred embodiment of the invention,

Figure 1 is a schematic and diagrammatic view thereof;

Fig. 2 is a sectional view illustrating certain portions of the controller more in detail; while

Fig. 3 is a simplified diagrammatic view illustrating more clearly the control circuit connections of Fig. 1.

Referring first to Fig. 1, of the drawing, the same illustrates centrifugal pumps 9 and

10 provided with individual driving motors 11 and 12 adapted to discharge the contents of a sump 13 or the like, it being, however, understood that the pumps need not necessarily act upon a common sump or the like.

Said pumps are provided with common priming means including a priming pump 14 which may preferably be of the dry vacuum type, a driving motor 15 for the priming pump and suitable connections to be hereinafter more fully described.

Said priming connections may preferably comprise pipes or tubes 16 and 17 connecting the intake of priming pump 14 with the highest points respectively of the chambers of pumps 9 and 10 whereby upon operation of the vacuum pump a reduced pressure is produced within the chamber of the fluid pump and as a result priming liquid is drawn through the pump intake and fills the pump chamber, the discharge passages of the several pumps being of course provided with check valves 18 or the like to enable such reduction of pressure within the pump casing. The tubes 16 and 17 are further provided with electro-responsive valves 19 and 20 respectively adapted to close the connection between the individual fluid pumps and the vacuum pump during normal pumping action of the former.

Float actuated switches 21 and 22 are also connected to the tubes 16 and 17 respectively at regions which are not lower than and are preferably appreciably higher than the highest portion of the individual pump casings, said switches providing for starting of their associated driving motors but only after the water has been so far elevated as to insure that the pump chamber is filled.

Individual sump float switches 23 and 24 are provided for the respective pumps 9 and 10, each float switch being adapted to initiate starting and priming action of the controller upon attainment of a given level of liquid within the sump, whereas preferably said float switches are set to close at different levels of the fluid within the sump.

Each of the liquid pumps is further provided with pressure responsive control means including for pump 9 a switch 25 responsive to variations in the pressure conditions obtaining at the pump discharge and an additional switch 26 responsive to varia-

tions in the reduced pressure at the pump intake and for pump 10 corresponding pressure controlled switches 27 and 28.

The controller is further provided with an interconnection which may comprise a normally closed relay 29 serving to limit the action of the controller, for starting, to a single pump at any one time.

The motors 15, 11 and 12 are supplied from a common source L^1 L^2 L^3 through individual main switches, 30, 31 and 32 respectively, each of switches 31 and 32 being provided with auxiliary contacts, indicated by exponents "a" and "b" respectively, to be respectively open and closed when their associated switches are closed, and vice versa.

The controller is further provided with means for limiting starting operation of the controller under conditions such that all or certain of the pumps are unable to perform their normal functions.

For simplicity the aforementioned control limiting device will be described only as applied to the pump 9, although of course the control of pump 10 may likewise be provided with similar limiting means.

While such limiting apparatus may in practice assume a multiplicity of forms, the same may preferably comprise limit switches LS^1 , LS^2 and LS^3 illustrated in the drawing as combined in a controller drum to be operated at reduced speed by means of a suitable pilot motor 33. A relay 34 having also a push button switch 35 in parallel therewith is also utilized in control of the pilot motor.

The limit switch LS^1 is adapted under suitable conditions to interrupt the closing coil of switch 30 thereby preventing further unsuccessful attempts to start the pump 9 when the latter is incapable of performing its normally intended function.

Limit switches LS^2 and LS^3 serve in conjunction with relay 34 and push button 35 to provide for control of the pilot motor.

Assuming the various parts to be in the relations illustrated and considering only the pump 9 together with its directly associated devices the action of the controller may be described as follows, reference being had also to the simplified diagram of Fig. 3.

Upon a given rise in level of liquid within the sump 13 float actuated switch 23 closes establishing the circuit of the closing coil of main switch 30 of the priming motor. Closure of said float switch 23 also serves to complete the energizing circuits of solenoid valve 19 and of relay 29, said solenoid valve opening communication between pump 9 and vacuum pump 14, and said relay serving to interrupt the energizing circuit of solenoid valve 20 whereby priming of the pump 10 is prevented so long as said relay 29 remains open.

Closure of the float switch also serves to complete the energizing circuit of relay 34 whereby said relay is caused to open temporarily to prevent operation of the pilot motor 33.

As a result of the aforescribed action of the controller the priming pump 14 is operated to reduce the pressure within the pipe 16 and the regions connected therewith and as a result liquid from the sump is caused to rise within the intake of pump 9 to fill the casing of said pump for priming. As operation of the vacuum pump 14 continues the liquid rises above the casing of said pump 9, and within the float chamber of the float actuated switch 21 and when after the aforescribed filling of the pump chamber the liquid has attained such a level as to lift the float, said switch 21 is adapted to close.

Closure of said switch 21 serves to complete the closing circuit of main switch 31 for starting motor 11 to drive the pump 9. Also closure of said switch 31 serves through opening of its auxiliary contacts *a* to interrupt the energizing circuit of main switch 30 of the priming pump motor 15 for terminating the priming action of said pump. Opening of the auxiliary contacts 31^a of switch 31 serves also to interrupt the energizing circuit of solenoid valve 19 and of relay 29. Said valve thereupon immediately closes cutting off communication between pump 9 and vacuum pump 14, whereas relay 29 also closes and subjects the pump 10 to its normal control.

Closure of said main switch 31 also serves through engagement of its auxiliary contacts *b* to prepare but not to complete a maintaining circuit for said switch 31, completion of said circuit being contingent upon closure of the pressure operated switch 25, which closure will occur very speedily as a result of building up of pressure within the casing of the pump 9, it being noted that at this stage the solenoid valve 19 is closed. It should be further noted that as illustrated particularly in Fig. 2 the float controlled switch is of a special type and is provided with means such as a piston valve 36 to be operated by the float for supplementing or rather duplicating the action of electro-responsive valve 19 in cutting off communication with the vacuum pump 14. The float chamber is further provided with a needle valve 37 or the like to permit entrance of atmospheric air and thereby break the vacuum created within the float casing by the vacuum pump 14. A further piston valve 38 may also be provided to break the vacuum suddenly and completely upon attainment of a given maximum height of liquid in the float chamber. As a result of such breaking of the vacuum the liquid within the valve chamber is adapted to drain through the

pipes 39 and 40, thus permitting the float to descend and the switch 21 to open. The needle valve 37 is of course so adjusted or calibrated as to delay such opening of the switch 21 until after the aforescribed closing of the pressure responsive switch 25 whereby energization of the closing circuit of switch 31 is maintained.

Closure of the auxiliary contacts 31^b of said main switch 31 serves also to complete the power circuit of the pilot motor 33 whereupon said pilot motor operates to actuate the various limit switches through approximately a complete cycle or until opening of the limit switch LS³ which action serves to interrupt the circuit of said pilot motor, it being also observed that the limit switch LS¹ is adapted to open and close simultaneously with switch LS³.

So long as the pump 9 performs its functions in the normal manner the main switch 31 is adapted to remain closed. However when by reason of lowering of the level of liquid within the sump, obstruction of the pump intake or other cause, the reduced pressure developed at the pump intake falls below a given value the reduced pressure operated switch 26 is adapted to open thus interrupting the maintaining circuit of switch 31 and stopping the pump. Again if for any reason, the pressure at the discharge of the pump falls below a given value the pressure responsive switch 25 is likewise adapted to open and interrupt said maintaining circuit with similar results.

Opening of the main switch 31 as a result of any of the aforementioned causes results in reclosure of auxiliary contacts 31^a but if the aforescribed stopping of the pump 9 resulted from lowering of the level of the liquid within the sump the float switch 23 will then be open and no action of the controller tending to restart said motor will result.

However, since the opening circuit of relay 34 is now interrupted as a result of the assumed opening of float switch 23, the aforescribed closure of auxiliary contacts 31^a serves to re-establish the power circuit of the pilot motor through limit switch LS² and said relay 34, both of which are now closed, said pilot motor is therefore adapted to operate momentarily for restoring the limit switches to the relation illustrated thereby presetting the same preparatory to subsequent operation in the manner aforescribed. Stopping of the pilot motor under these conditions is of course effected by reason of opening of limit switch LS².

However, assume that while the float switch 23 remains closed, one or the other of the pressure responsive switches 25 and 26 opens and interrupts the maintaining circuit of main switch 31 for stopping motor 11 and pump 9. Under such conditions ob-

viously the auxiliary contacts 31^a and the float switch 23 are both closed and the aforescribed starting and priming action will be repeated, whereas if the condition which caused opening of switch 25 or 26 persists 70 such switch will again act upon closure of the main switch 31 or shortly thereafter to cause reopening of said switch and cause quick stopping of motor 11 and pump 9, whereupon the controller will continue to 75 make repeated efforts to restart the pump.

However, during each of such attempted starts the pilot motor is energized and acts to operate the limit switches through an appreciable range whereby after a number 80 of unsuccessful attempts at starting, such number being determined by the design of the limit switches and specifically in the construction illustrated by the length of the drum segments or the speed of the pilot 85 motor, said drum arrives at a position such that both limit switches LS¹ and LS³ are open, the former permanently interrupting the closing circuit of main switch 30 and preventing further attempts at restarting 90 whereas the limit switch LS³ in its open position serves to prevent further energization of the circuit of the pilot motor. In this manner the number of unsuccessful attempts to start the pump may be limited 95 as desired.

With the limit switches in the relation last described obviously subsequent automatic starting action of the controller as regards the pump 9 is prevented. However, 100 upon closure of push button 35 the power circuit of the pilot motor is re-established for shifting the limit switches into the relation illustrated in which relation the conditions are suitable for automatic restarting. 105 It is of course assumed that the automatic functions of the controller are not to be so re-established except following investigation and removal of the cause of inoperation of the pump 9.

The operation of the pump 10 is in all respects similar to that of the pump 9 just described except for the absence of the special limiting apparatus and hence further description is deemed unnecessary, the similarity of the general control features being quite obvious from the drawing. 110

It is, however, to be understood that the aforescribed limiting instrumentalities may be and preferably are applied to the 120 controller of pump 10 in precisely the same manner as aforescribed in conjunction with pump 9, such features, however, being omitted herein merely for purpose of simplicity. 125

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

1. In a controller for a plurality of individually driven pumps, the combination with common priming means for the pumps, 130

of automatic means limiting the effect of the priming means to the pumps singly.

2. In a controller for power driven pumps, the combination with automatic starting means, of means to terminate the action of said former means automatically following a predetermined number of operations of said former means wherein the pump fails to perform its normal functions.

3. In a controller for a plurality of independently operable pumps, the combination with common priming means for the pumps, of means restricting the priming action to the pumps singly, individual starting means for the several pumps and means rendering the action of said starting means with reference to any given pump contingent upon prior entry into the casing of such pump of a quantity of priming liquid in excess of that which said casing is capable of containing when the pump is fully primed.

4. In a controller for power driven pumps, the combination with a plurality of pumps, priming and starting means therefor comprising elements to act upon the pumps in common, of interconnecting means providing against action of said elements with reference to any plurality of said pumps simultaneously.

5. In a controller for power driven pumps, the combination with a plurality of pumps, priming and starting means therefor comprising elements to act upon the pumps in common, of interconnecting means providing against action of said elements with reference to any plurality of said pumps simultaneously, said interlocking means comprising a relay adapted to respond upon action of said elements with reference to one pump for temporarily limiting action of such elements to said pump.

6. In a controller for power driven pumps, the combination with means providing for starting the pump automatically, of means providing for automatically rendering said former means inactive under given conditions of inoperation of the pump.

7. In a controller for power driven pumps, the combination with means providing for starting the pump automatically, of means providing for automatically limiting the number of times said former means is permitted to perform its starting action

prior to inception and continuance of normal operation of the pump.

8. In a controller for power driven pumps, the combination with means providing for starting the pump automatically, of means providing for stopping of the pump under given abnormal conditions and means for terminating repetition of the action of said first mentioned means during continuance of such abnormal conditions.

9. In a controller for power driven pumps, the combination with means providing for automatic starting of the pump and means providing for automatic stopping of the pump under given conditions, of limiting means for said starting means and means subjecting said limiting means to control by both said starting and said stopping means.

10. In a controller for power driven pumps, the combination with means providing for automatic starting of the pump and means providing for automatic stopping of the pump under given conditions, of control means for said starting means comprising a limit switch adapted when in a given position to prevent action of the starting means, and means to act within each cycle of operation of said starting means for advancing said limit switch toward such position.

11. In a controller for power driven pumps, the combination with means providing for automatic starting of the pump and means providing for automatic stopping of the pump under given conditions, of control means for said starting means comprising a limit switch adapted when in a given position to prevent action of the starting means, means to act within each cycle of operation of said starting means for advancing said limit switch toward such position, associated means to act during stopping of the pump under normal conditions to prevent said switch temporarily from thereafter remaining in such position and associated means providing for stopping and maintaining said limit switch in such position following a predetermined number of cycles of operation of the starting means wherein the pump fails to start and continue pumping.

In witness whereof, I have hereunto subscribed my name.

BAYARD M. HORTER.