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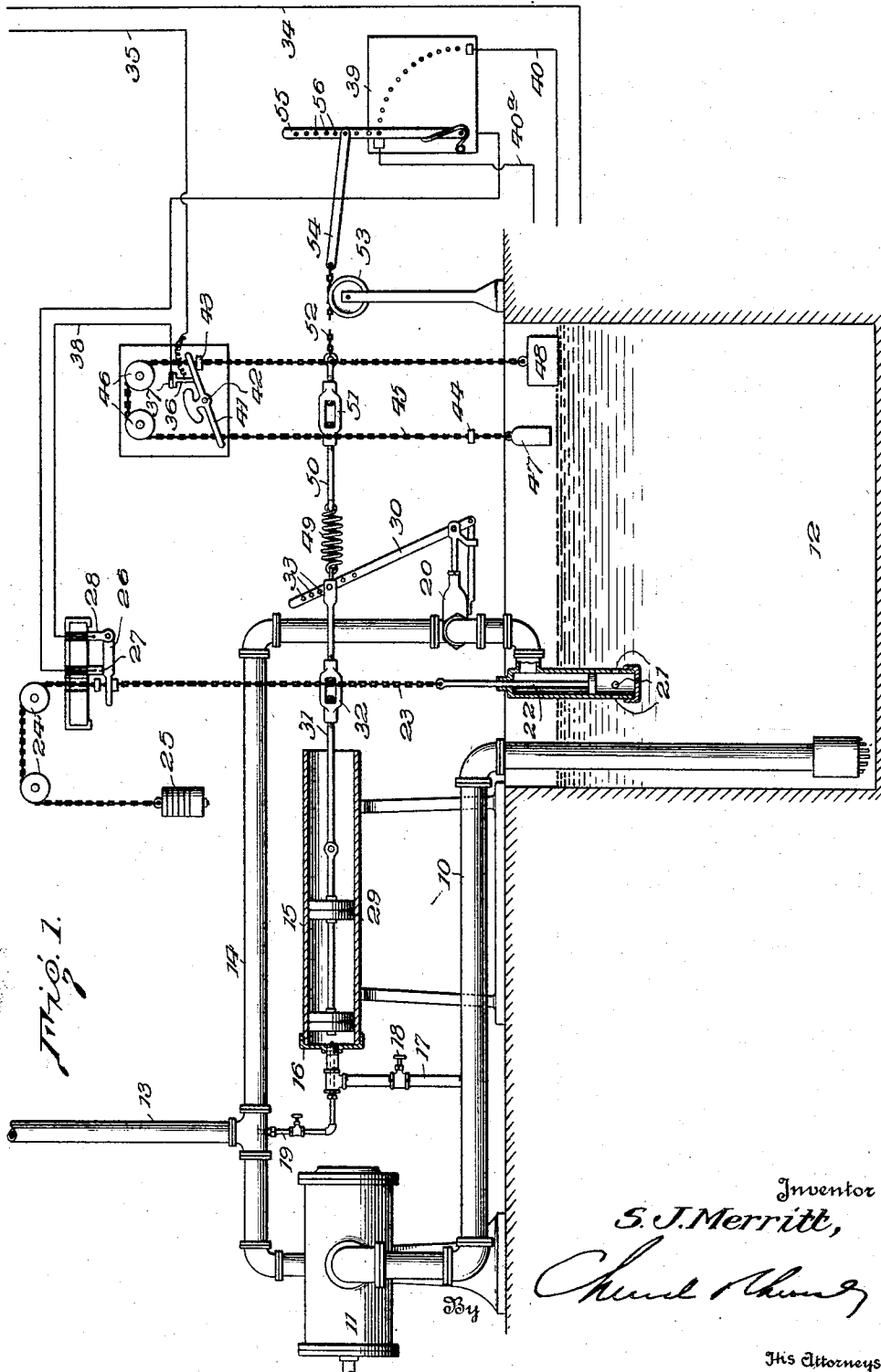
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CONTROL DEVICE FOR PUMPING APPARATUS

Filed March 19, 1930

3 Sheets-Sheet 1



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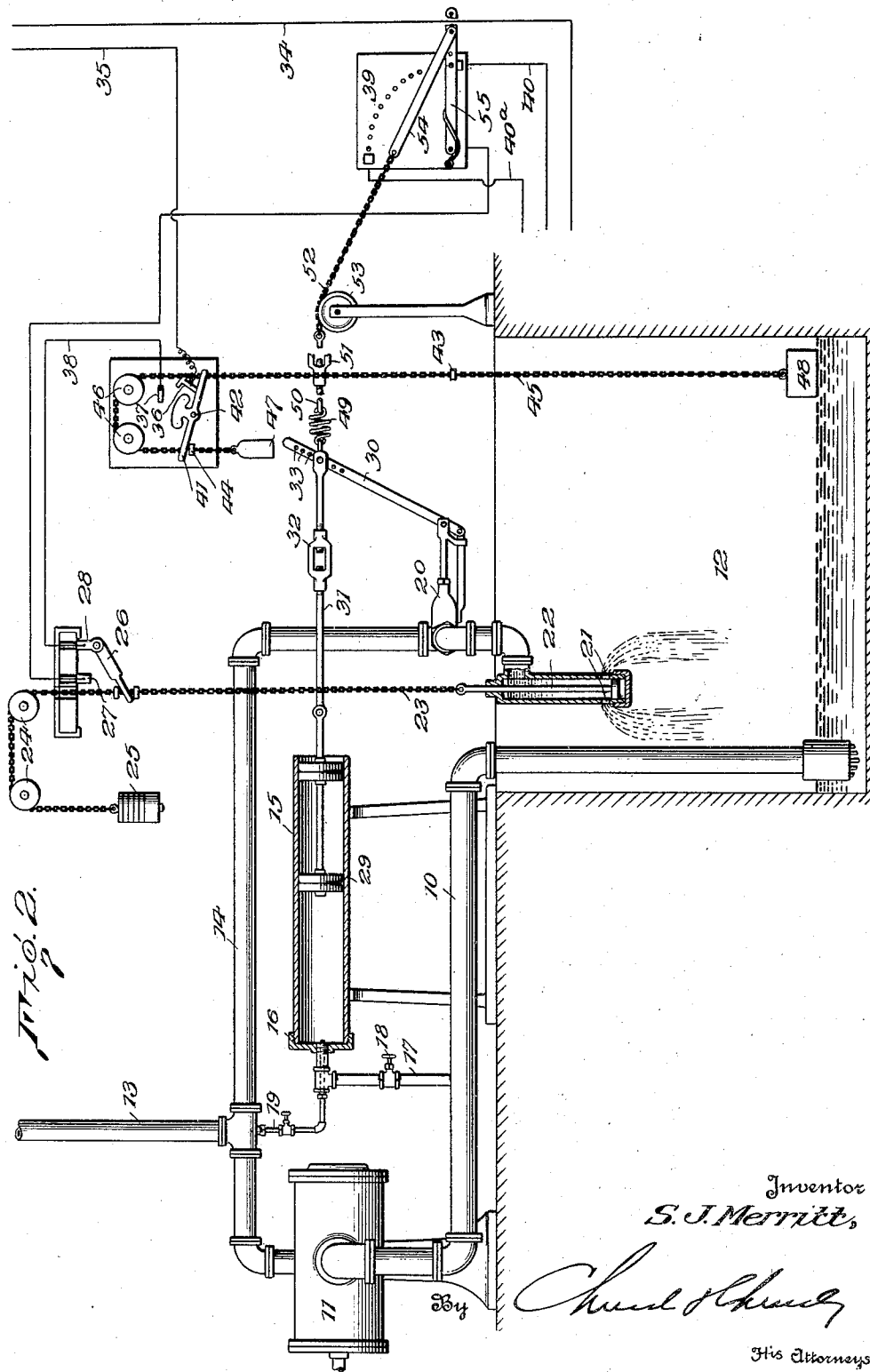
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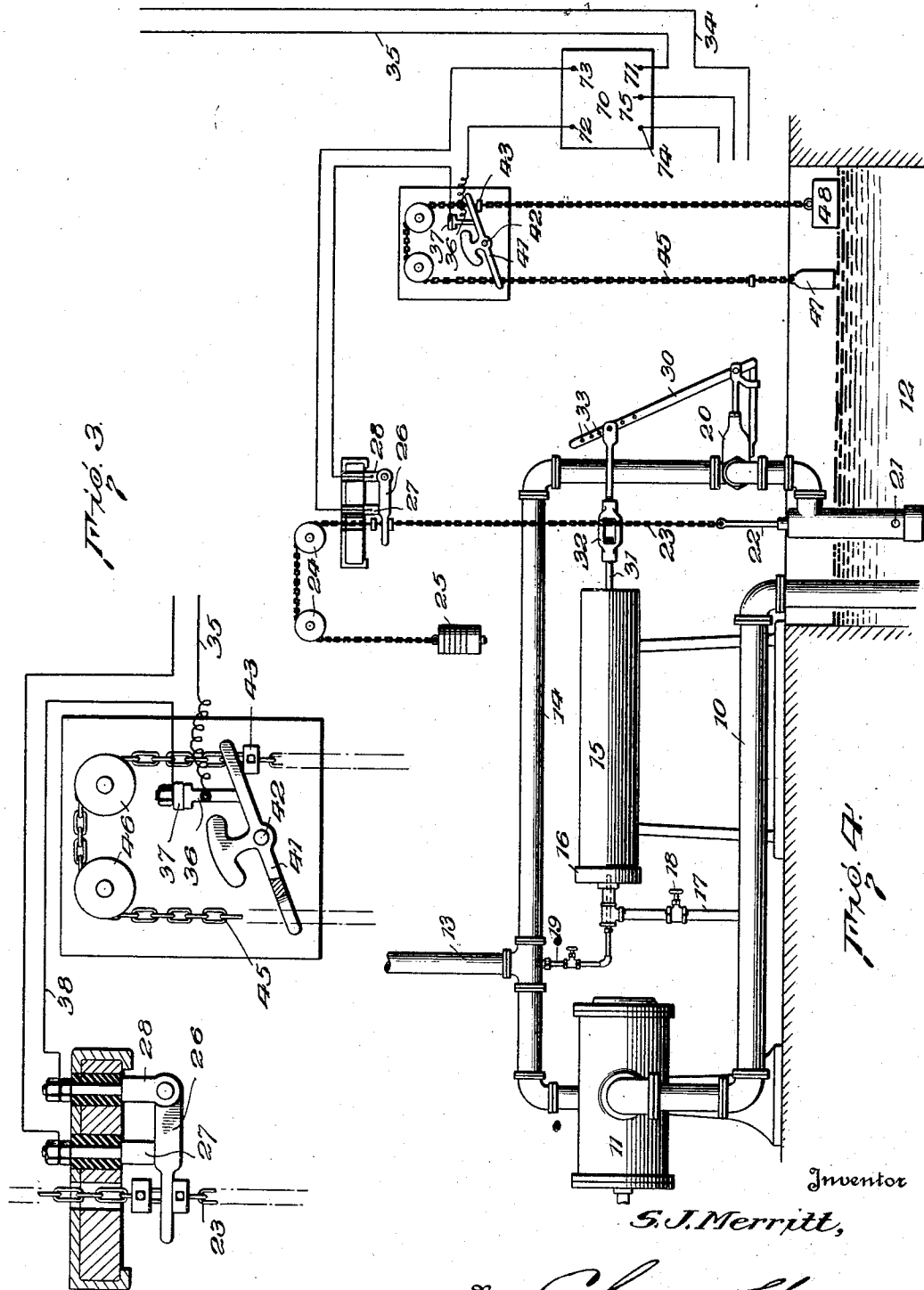
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CONTROL DEVICE FOR PUMPING APPARATUS

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UNITED STATES PATENT OFFICE

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CONTROL DEVICE FOR PUMPING APPARATUS

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This invention relates to pumping apparatus, and particularly to control devices for electrically operated pumps.

One object of the invention is to provide a pump that is automatically started and stopped, dependent upon the level of the body of water to be removed by the pump, there being means to relieve the discharge head prior to the starting of the pump, whereby the power required to start the pump is exceedingly small compared to that which would be required to start against a full discharge head.

A further object is to provide means whereby the automatically controlled pump can not be placed in operation until the discharge pipe has been drained.

More specifically, the invention consists of an electrically driven pump, the circuit for operating the pump motor having two switches therein, one of which is actuated by a float that is adapted to be raised and lowered by the body of water on which the pump operates, and the other of which is adapted to be opened and closed by means operated by water flowing through a drain pipe which communicates with the discharge pipe of the pump. The pump is primarily designed for use in mines, the float operated switch being actuated by a float that is raised and lowered as the water rises and recedes in the sump from which the water is to be removed. The other switch in the pump motor circuit is operated by a plunger movable in the drain line from the discharge pipe of the pump. The pressure of the water flowing through the drain line moves the plunger in one direction to open the switch, but in the absence of water in the drain line, the plunger is moved in the opposite direction, preferably by a gravity actuated weight, to close the switch. In other words, it is necessary that the pressure on the plunger in the drain line be removed before the switch in the pump motor circuit can be closed. The apparatus also preferably comprises a chamber that communicates by a comparatively large pipe with the low or suction side of the pump, and by a comparatively small line with the high or discharge side of the pump.

Working in this chamber is a plunger that is connected with a valve that controls the flow of water through the drain line of the discharge pipe. The plunger is also connected with the lever of the starting box, said lever normally assuming a position where a minimum amount of current will be delivered to the pump motor upon the closing of the float and plunger actuated switches before referred to. When these switches are closed, the pump is placed in operation at its lowest speed, and by means of the communication between the low side of the pump and said chamber, a vacuum is created in said chamber and the plunger therein reciprocated to close the valve in the drain line of the discharge pipe of the pump, and to actuate the control lever of the starting box to gradually increase the current delivered to the pump motor, whereby the speed of the pump is gradually accelerated. If desired, an automatic starter embodying time control mechanism for increasing the speed of the pump, may be utilized in lieu of the ordinary starting box, in which event the starting box and the connections between the control lever thereof and the plunger in the vacuum chamber may be dispensed with.

With these and other objects in view, the invention consists in certain details of construction and combinations and arrangements of parts, all as will be hereinafter more fully described and the novel features thereof particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is more or less of a diagrammatical illustration of the apparatus embodying the present improvements, the parts being shown in the positions they occupy when the pump is in operation;

Fig. 2 is a similar view, with the parts in the positions they assume upon the pump being rendered inoperative by the motor circuit being broken;

Fig. 3 is a detail view of the float control and plunger control switches of the motor circuit; and

Fig. 4 is a view similar to Figure 1, illustrating the use of an automatic time control

starter, in lieu of the starting box illustrated in Figure 1.

In the form of apparatus shown in Figures 1 to 3, the suction pipe 10 communicating with the low side of pump cylinder 11 is adapted to be submerged in the body of water which accumulates in the sump 12. The discharge pipe 13 of the pump cylinder has a branch or drain line 14 extending therefrom, this drain line terminating preferably above the sump. At a suitable location, there is a vacuum cylinder 15 open at one end and closed at the other by a cap 16. The interior of this cylinder communicates with suction pipe 10 by a pipe 17 extending from the closed end of said cylinder, the passage in this pipe being regulated by a valve 18. Extending also from the closed end of the vacuum cylinder is a pipe 19 considerably smaller than pipe 17. This smaller pipe communicates with the discharge pipe 13.

The passage of water through drain pipe 14 is controlled by a valve 20 and the end of said drain pipe is closed so that water draining therethrough must escape through a plurality of openings 21 in said pipe a short distance above its closed end. Slidable in this perforated portion of the drain 14 is a plunger 22, and connected to said plunger is a chain or other flexible element 23 extending over pulleys 24 and having attached to its free end a weight 25. The chain 23 is adapted to actuate a switch blade 26 so as to make and break the pump motor circuit through the contact 27, 28, as will be more fully described hereinafter. Slidably mounted in the vacuum cylinder 15 is a plunger 29, and said plunger is connected to a lever 30 by sectional rod 31 having a turnbuckle 32 connecting its sections, whereby the throw imparted to lever 30 may be regulated as desired. This lever, which actuates valve 20 in the drain pipe 14, is provided with a series of apertures 33, any one of which is adapted to receive the pin by which said lever is connected to rod 31. This connection affords additional means for regulating the throw imparted to said lever.

As illustrated in the drawings, one side 34 of the power line goes to the pump motor (not shown), and the other side 35 goes to a movable contact 36, adapted to cooperate with fixed contact 37, from which line 38 extends to contact member 28 and from contact 27 of switch 26 to starting box 39. The lines 40, 40a, extending from the starting box 39 to the pump motor, are also only partially shown. The movable contact member 36, just mentioned, is carried by an arm 41 pivoted intermediate its ends at 42 and the ends of said arm are adapted to be engaged by projections 43, 44, on a chain 45, that extends over pulleys 46, said chain having attached to one of its ends a weight 47 and to its other end a float 48, whereby the chain may be caused to travel over pulleys 46 by the float being raised

and lowered, as the water in sump 12 rises and recedes.

Rod 31 of plunger 29 is also connected by a spring 49, rod 50, turnbuckle 51, chain 52 that extends over pulley 53, and an insulated arm 54 to the operating lever 55 of starting box 39, said arm being connected to the lever 55 by a pin that may be inserted in any one of a series of apertures 56 in said lever, whereby the throw imparted to this lever may be regulated. When the pump is idle, operating lever 55 of starting box 39 is on the first contact of the box, as shown in Fig. 2, so that a minimum amount of current will be delivered to the pump motor when contacts 36, 37, are closed, and blade 26 moved into engagement with contact 27. In Fig. 2, the level of the water in the sump is shown at its lower level, and switch blade 26 is shown in open position, and plunger 22 is positioned in the lower end of the drain pipe below the openings 21. With parts in these positions, and it being assumed that valve 20 is open, and water is still draining through the drain pipe 14, the pressure of the water on plunger 22 will hold it down and prevent weight 25 moving blade 26 into engagement with contact 27. After water has ceased to flow through drain pipe 14, plunger 22 is free to rise, whereupon weight 25 will move downwardly by gravity and raise blade 26 into engagement with contact 27. This, of course, only partially closes the pump motor circuit, it being necessary for the water to rise to the level shown in Figure 1, this raising of the water in the sump raising float 48, whereby projection 43 on chain 45 rocks arm 41 and moves contact 36 into engagement with contact 37, thereby closing the circuit of the pump motor. Under the circumstances just described, a minimum quantity of current will be supplied to the pump motor, but this is sufficient to start the motor and pump, due to the fact that the discharge head has been previously totally relieved through the drain line 14. The pump being placed in operation, the connection between the low side of the pump and the vacuum cylinder, i. e., pipe 17, creates a vacuum in the closed end of the cylinder, so that plunger 29 and rod 31 are moved longitudinally of the cylinder. This movement of the plunger and rod actuates lever 30 to close valve 20, and, at the same time, actuates control lever 55 of the starting box to gradually increase the current supplied the pump motor, and consequently, accelerate the speed of the pump until the operating lever has assumed the position shown in Figure 1, at which time the maximum amount of current will be delivered to the motor. Due to the fact that blade 26 can not be moved into engagement with contact 27 until the water pressure on plunger 22 is relieved to the predetermined extent, it will be seen that it is impossible

for the pump to be placed in operation until the discharge head on the pump is relieved to the desired extent.

The vacuum will be maintained in the cylinder 15 during the operation of the pump, but after the level of the water in the sump has fallen to the point shown in Fig. 2, chain 45 will have moved in a reverse direction to an extent sufficient to bring projection 44 into engagement with arm 41, so as to disengage contact 36 from contact 37, thus breaking the circuit to the pump motor. The motor and pump being rendered inoperable, the vacuum in cylinder 15 is relieved so that plunger 29 is retracted and lever 30 actuated to open the valve 20 in the drain pipe 14. At the same time, the control lever 55 of the starting box also returns to its normal position, as shown in Fig. 2. The retractive movement of plunger 29 is facilitated by the pressure in the discharge pipe 13 acting on the plunger through pipe 19.

Where an automatic time control starter is utilized, as shown in Fig. 4, power line 34 goes to the motor while the power line 35 goes to terminal 71 of starter 70. Terminal 72 of the starter goes to contact 36 of the float control switch, and terminal 73 runs to contact 27 of switch 26, while the other terminals, 74, 75, have leads which run to the motor. Automatic starters of the type mentioned are common in the art, so that a showing or detailed description thereof is unnecessary, and it has, therefore, simply been illustrated diagrammatically. The remaining operating connections for the pump are the same as in the apparatus shown in Figures 1 to 3, except that spring 49, rod 50, turnbuckle 51, chain 52, pulley 53, arm 54, the starting box 39 with its control lever 55, and the leads 40, 40a, are dispensed with. In other words, the automatic time control starter functions to accelerate the speed of the pump in lieu of increasing the speed thereof by gradually decreasing resistance in the motor line, as is done with the automatically moving control lever of the starting box.

What I claim is:

1. In a pump control mechanism, a pump having an intake pipe and a discharge pipe, a motor for said pump, an electrical circuit including said motor, a drain pipe communicating with said discharge pipe, means rendered operative by operation of the pump to close said drain pipe, and means operative by water flowing through said drain pipe for breaking the motor circuit whereby operation of said motor can not be initiated while water is draining through the drain pipe.

2. In a pump control mechanism, the combination of a suction pipe, a pump operatively associated with said pipe, a pump motor, an electrical circuit including said pump motor, a drainage pipe communicating

with the discharge of said pump, a valve for said drain pipe, means for closing said drain pipe when said circuit is closed and opening said pipe when the circuit is open, and means operable by water flowing through said drain pipe valve for holding said motor circuit open.

3. In a pump control mechanism, the combination of a suction pipe, a pump operatively associated with said pipe, a pump motor, an electrical circuit including said pump, a drainage pipe communicating with the discharge of said pump, a valve for said drain pipe, means for closing said drain pipe when said circuit is closed and opening said pipe when the circuit is open, a switch in the motor circuit, a plunger operable by water flowing through said drain pipe, and connections between said plunger and switch for holding said switch open during flow of water through the drain pipe.

4. In a pump control mechanism, the combination of a pump, a motor for the pump, an electrical circuit including the pump, a switch in said circuit, means in the discharge conduit of the pump operable by back pressure in said conduit when the pump is idle to open said switch, a valve in said conduit between the pump and said switch operating means, means for closing said switch in the absence of back pressure in said conduit, and means operable by the pump for closing said valve.

5. In a pump control mechanism, the combination of a pump, a motor, an electrical circuit including said motor, float controlled means for closing said circuit, a drain line for the discharge side of the pump, a valve in said drain line, a vacuum chamber, means for creating a vacuum in said chamber when the pump is in operation, a reciprocatory plunger in said chamber, and connections between said plunger and valve for closing the latter when a vacuum is created in said chamber.

6. In a pump control mechanism, the combination of a pump, a motor, an electrical circuit including said motor, float controlled means for closing said circuit, a drain line for the discharge side of the pump, a valve in said drain line, a vacuum chamber, means for creating a vacuum in said chamber when the pump is in operation, a reciprocatory plunger in said chamber, and connections between said plunger and valve for closing the latter when a vacuum is created in said chamber, and means operable by movement of said plunger for accelerating said pump motor.

7. In a pump control mechanism, the combination of a pump adapted to have its intake pipe submerged in a body of water, a motor for said pump, and electrical circuit including said motor, a pair of switches in said circuit, means operable by back pressure in the discharge conduit of the pump for opening one of said switches, and means for closing said switch in absence of said back

pressure, the other switch being controlled by a float adapted to rise and fall with the level of said body of water.

8. In a pump control mechanism, the combination of a pump, a motor, an electrical circuit including said motor, a drain pipe connected to the discharge conduit of the pump, a valve in said drain, a cylinder open at one end and closed at its opposite end, a pipe connecting said closed end of the cylinder with said discharge conduit, a second pipe connecting said cylinder end with the pump intake, a valve in the last mentioned pipe, a plunger slidable in said cylinder and connections between said plunger and drain pipe valve for closing the latter when the pump is operated and opening the same when said pump is idle.

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