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AUTOMATIC ELECTRIC CONTROL FOR PUMPS

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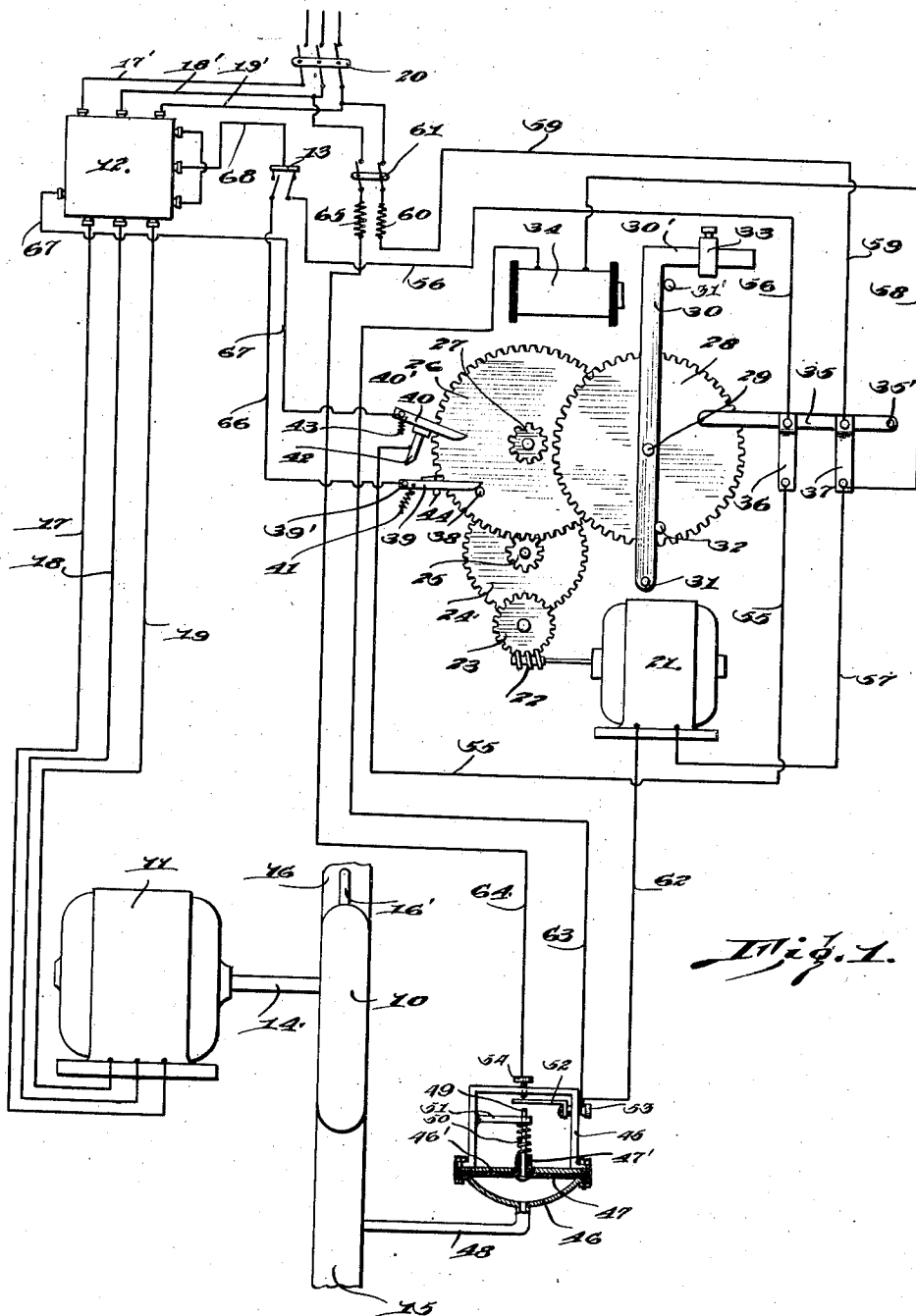


Fig. 1.

WITNESSES

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AUTOMATIC ELECTRIC CONTROL FOR PUMPS

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This invention appertains to improve-  
ments in automatic electric controlled de-  
vices or mechanisms for pumps generally,  
and more particularly to those types of  
5 pumps which are designed to operate contin-  
uously, over long periods of time, with a  
minimum danger or liability to break down  
and without constant attention, such as the  
pump installations usually employed for ir-  
10 rigation purposes and the like.

Heretofore in the operation of such pump  
installations or systems, two elements have  
commonly interfered with the desired con-  
tinuous efficient operation thereof; first, the  
15 temporary break down of the power service  
obtained but momentarily but nevertheless  
sufficiently long enough to allow the main  
control system to open the circuit and stop  
the motor driving the pump until an at-  
20 tendant discovers the trouble and resets the  
switch and motor to operative condition;  
and second, the pump taking in air through  
several possible places in the installation or  
system whereby the water will cease to flow,  
25 even though the motor and pump continue to  
operate and with more or less damage to the  
latter.

An object of the present invention, there-  
fore, is to provide an automatic control de-  
30 vice which will remedy these otherwise se-  
rious objections and disadvantages in such  
pump installations or systems, and which  
will be comparatively inexpensive and eco-  
nomical in construction, installation, main-  
35 tenance and operation.

With the foregoing and other equally im-  
portant objects and advantages in view, the  
invention resides in the certain new and use-  
ful combination, construction and arrange-  
40 ment of parts and circuits as will be herein-  
after more fully described, set forth in the  
appended claims and illustrated in the ac-  
companying drawing, in which:

The single figure is a diagrammatic and  
45 schematical view of the practical embodi-

ment of the invention as it appears when  
incorporated in a conventional pump instal-  
lation or system.

Referring to the drawing, the embodiment  
of the invention, as shown therein by way of  
example, includes the pump 10, the driving  
motor 11 and the automatic control switch  
12, the latter including a starting and stop-  
ping button switch 13.

As shown, the rotors of the pump 10 and  
55 motor 11 are directly connected or coupled  
together by the shaft 14, and water is drawn  
into the pump 10 at the inlet 15 and dis-  
charged therefrom at the outlet 16. The  
motor 11 is connected by connectors 17, 18  
60 and 19 to one side of the usual form of  
momentary contact magnetically operated  
switch, and which is, in turn, connected at  
its other side by conductors 17', 18' and 19'  
to one side of the main line control  
65 switch 20.

The automatic control provided for in the  
present invention, for use in connection with  
the foregoing pump installation, is consti-  
tuted in a small powered motor 21 equipped  
70 with a worm 22 on one end of the armature  
shaft thereof. This worm is disposed in  
mesh with a worm gear 23, which is mount-  
ed on the same shaft with a pinion (not  
shown). This pinion is disposed in mesh  
75 with a large gear 24, which is likewise  
mounted on the same shaft with a second  
pinion 25, the latter being, in turn, disposed  
in mesh with a larger gear 26. Similarly,  
80 this larger gear 26 is mounted on the same  
shaft with the pinion 27, which is arranged  
to be meshed with another gear 28, of sub-  
stantially the same size as the gear 26. The  
gear 28 is mounted for movement to and  
85 from meshing engagement with the pinion  
27 as required and as will be hereinafter  
fully explained. The gear train thus pro-  
vided is preferably ratioed whereby the  
larger gear 26 will operate at substantially  
one revolution per minute.

The gear 28 is mounted on a shaft 29 on which a lever 30 is also pivoted, at a point intermediate its length, the latter having its lower end stationarily pivoted, as at 31. The lever 30 is normally disposed in a vertical position and has its lower intermediate portion abutting against a projection or lug 32 on the adjacent side face of the lower peripheral portion of the gear 28, which projection or lug 32 is disposed at the outer side edge of the lever 30 opposite to that edge of the same facing the pinion 27. The upper end of the lever 30 is formed to provide an outwardly angled offset portion or arm 30', on which a weight 33 is adjustably mounted. The inner side edge of the lever 30, at a point adjacent the upper angled end thereof, is opposed to the pole of an electromagnet 34 which acts, when properly energized, to pull the lever 30 inwardly from its normal vertical position and thereby move the gear 28 into mesh with the pinion 27. A stop 31' is provided to sustain the lever 30 in its normal position aforesaid.

Mounted at the other side of the gear 28 and radially overlapping the same side face thereof that is opposed to the lever 30, and in a manner to lie in the path of movement of the projection or lug 32 is an arm 35 forming a part of the switch blades of a master switch composed of the contacts 36 and 37; the arm 35 being pivoted, as at 35', at its outer end.

Cooperative with the projection or lug 38 on one side of the gear 26 is a starting switch lever 39 and a stopping switch lever 40, which are stationarily pivoted at their outer ends, as at 39' and 40', while their inner ends overlap the adjacent peripheral portion of the gear 26 so as to lie in the path of movement of the projection or lug 38. The starting switch arm 39 is normally tensioned by a coil spring 41 away from a stationary contact 42, located between and common to the same and the stopping switch arm 40, and against the projection or lug 38 on the gear 26, while the stopping switch arm 40 is similarly tensioned by a coil spring 43 against the said contact 42. A stop member 44 is provided at the lower side of the starting switch arm 39 to limit its position of inoperativeness under the action of the spring 41 and to hold the same in position for cooperation with the projection or lug 38 at the proper time.

The operation of the electric motor 21, and consequently of the mechanism just described is automatically controlled from a switch device, which, in turn, is controlled by the suction effect at the intake side 13 of the pump 10. This switch device is comprised in a housing 46, preferably concavo-convex in form which is normally open at one end and has such end enclosed by a diaphragm 47 over which is a flat cover 46'

which completes the housing. The arch frame 45 is secured with suitable fastenings to the housing 46 in a manner to clamp the diaphragm 47 and flat cover 46' between the same. The housing 46 is attached to the free end of a pipe section 48 leading to and connecting with the intake 15 of the pump 10.

Projecting outwardly of the housing through the center of the diaphragm 47 and cover 46' is a plunger 49, which is headed at its outer end substantially as shown. The inner side of the diaphragm 47 is preferably provided with a boss 47' surrounding the plunger 49. One end of a coil spring 50, on the plunger; is tensioned by an adjustable collar 51 against the flat cover. The outer free end of the plunger 49 is opposed to a flat spring contact finger 52 supported from the inner end of a binding post 53 secured in the side wall of the arch frame 45. Mounted in the center of the end of the arch frame 45 is an adjustable contact member 54 which has its inner end also opposed to the contact finger 52. In the normal position of operation, the contact finger 52 is free of contact with both the plunger 49 and the adjustable contact 54.

The circuit connections of the motor 21 and the several switch devices aforesaid, are as follows: The contact 36 of the master switch 35 is connected by a conductor 55 to the contact 42 of the automatic starting and stopping switches 39 and 40, and by a conductor 56 to the stop side of the manually controlled button switch 13; while the other contact 37 is connected by a conductor 57 to one terminal of the motor 21, by a second conductor 58 to one terminal of the electromagnet 34 and by a third conductor to a resistance 60, which, in turn, is connected to one terminal of one side of the branch line controlled switch 61, the other terminal of which side of said switch is connected in on the main line conductor 19'. The remaining terminal of the motor 21 is connected by a conductor 62 to the binding post 53 of the diaphragm switch. A conductor 63 leads from the binding post 53 and connects the remaining terminals of the electromagnet 34, while a conductor 64 leads from the adjustable contact 54, of the diaphragm switch, to one terminal of a second resistance 65 which has its remaining terminal connected to one terminal of the other side of the branch line controlled switch 61; the other terminal of the other side of the latter switch 61 being, in turn, connected to the main line conductor 18'. The pivot 39' of the starting switch lever 39 is connected by a conductor 66 to the starting side of the start and stop switch button aforesaid, while the pivot 45 of the stopping switch lever 40 is connected by a conductor 67 to a proper circuit terminal on the automatic momen-

tary contact switch 12, the latter having another of its circuit terminals connected by a conductor 68 to the bridging piece or blade of the button switch 13.

In the operation of the pumping system, as thus arranged and installed, and assuming that the switches 13, 20 and 61 have been closed and that the pump 10 is primed and ready to start a pumping operation, the force of the water on the intake side of the latter is now impressed against the diaphragm 47, so that the same is elevated outwardly of the housing 45, when the plunger 49 presses the spring contact 52 against the adjustable contact 54 and the circuit on the motor 21 is completed from main line conductor 19' to one side of switch 61, resistance 60, conductor 59, motor switch contact 37, conductor 57, motor 21, conductor 62, binding post 53, spring contact finger 52, adjustable contact 54, conductor 64, resistance 65, to the other side of switch 61 and from thence to the main line conductor 18'.

With the motor 21 now connected to line, it will start up and drive the gear train aforesaid in a manner that the gear 26 will turn in a clockwise direction. As the gear 26 rotates, the projection or lug 38 thereon moves against the starting switch arm 39, which completes a circuit between the same and the fixed contact 42, when the motor 11 and pump 10 will be started, and the projection or lug 38 will then take position between the arms or levers 39 and 40. Immediately upon the starting up of the pump 10, the action of the water drawn through the same from the inlet supply pipe 15 creates a vacuum in the pipe connection 48 which relieves the pressure on the diaphragm 47 and allows the circuit to be broken between the spring contact 52 and the adjustable contact 54, when the motor 21 will cease to operate.

In the event that the pump 10 and the motor 11 fail to start up for any reason, upon the attempted closing of the circuit on the motor 11, the electro magnet 34 will be energized and will exert a pull on the arm or lever 30 to swing the same on its pivot 31, when the gear 28 will be moved into mesh with the pinion 27 and rotated therefrom in a counter-clockwise direction. The gearing 28 rotates the projection or lug 32 thereon, which now approaches and strikes the arm or blade 35 of the master switch and opens the circuit at the contacts 36 and 37. This operation, however, only takes place after several efforts, two or three at least, to start the motor 11 and pump 10 from the gear 26 have obtained. During a prolonged absence of power, the pump 10 may have lost its priming or its failure to readily start up may be due to trouble at the compensating switch 12, or the line may be open by the blowing out of a fuse. In

such case, it will, of course, be impossible to start up the pump until such troubles are located and corrected.

In any case, the action of the projection or lug 32 is so synchronized with gear 26 that the master switch is actuated whenever the gear 28 is meshed with gear 26, by reason of the action of the magnet 34, and is rotated sufficiently to cause the projection or lug 32 to strike the arm 35. In this emergency, everything will become inoperative and will remain so until the trouble is located by an attendant and the system restored to an operative condition.

Now, if the pump 10 should take in air, while in operation, and as a consequence thereof ceases to continue to pump water, the vacuum in the pipe connection 48 will be broken and the diaphragm 47 moved to position to again close the circuit between the spring contact 52 and the adjustable contact 54. Immediately upon the completion of the circuit, in this instance, the motor 21 and magnet 34 will again come into operation, when the lug 38 on gear 26, regularly between the start lever 39 and the stop lever 40, will operate the latter lever and cause the circuit on the pump motor 11 to be opened at the line controlled switch 12, when the pump 10 will be stopped. While the pump 10 is inactive, and the lug 38 is traversing the circumference between the stop lever 40 and the start lever 39 the air in the pump 10 will have the opportunity to escape through the bleeder pipe 16' and into the water discharge pipe 16. In lieu of the bleeder pipe 16' a small petcock or the like may be substituted therefor to vent the air from the pipe 12 to atmosphere. As soon as the lug 38 reaches the start lever 39, it will actuate the same to cause the circuit on the pump motor 11 to be closed at the line switch 12. As soon as the pump 10 starts up again, the circuit on the magnet 34 will be opened at the diaphragm switch 52.

Ordinarily, the pump 10 will be placed in operation by the motor 11 upon the first period of operation of the mechanism, in which case, the lever 30 is returned to normal position and disengages the gear 28 from the pinion 27; the lug 32 being of a sufficient weight as to cause the gear 28 to resume its starting position each time the lever 30 is actuated. Upon actuation by the projection or lug 38 on the gear 26 of the starting lever, or the stop lever 40, the latter are returned to normal position by the action of the springs 41 and 43 just as soon as the lug 38 clears the same.

Without further description, it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction

may be resorted to, without departing from the spirit of the invention or its scope as claimed.

I claim:

5 1. In combination, an electric motor driven pump including a main control switch for the said motor, starting and stop-  
ping switches in circuit with said main con-  
10 trol switch, motor operated means for actuating said starting and stopping switches, and means governed by the pres-  
sure at the intake side of the said pump for controlling the operation of said motor  
operated means.

15 2. In combination, an electric motor-driven pump including a main control switch for the said motor, starting and stop-  
ping switches in circuit with said main control switch, mechanical means for actu-  
20 ating said starting and stopping switches, electrically operated means for operating said mechanical means, and means governed  
by the pressure at the intake side of the said pump for controlling the operation of said  
25 electrically operated means.

3. In combination, an electric motor driven pump including a main control  
switch for the said motor, starting and stop-  
ping switches in circuit with said main  
30 control switch, a gear train for actuating said starting and stopping switches, an elec-  
tric motor for actuating said gear train, and means governed by the pressure at the intake  
side of the said pump for controlling the  
35 operation of said last named motor.

4. In combination, an electric motor driven pump, including a main control  
switch for the said motor, starting and stop-  
ping switches in circuit with said main  
40 control switch, a gear train for actuating said starting and stopping switches, an elec-  
tric motor for actuating said gear train, and a diaphragm switch governed by the pres-  
sure at the intake side of the said pump for  
45 controlling the operation of said last named motor.

5. In combination, an electric motor driven pump, including a magnetically actu-  
ated main control switch, starting and  
50 stopping switches in circuit with said main switch, mechanical means for actuating said  
starting and stopping switches, an electric motor for actuating said mechanical means,  
means governed by the pressure at the intake  
55 side of the said pump for controlling the operation of said last named motor, a master  
switch, and means for actuating said master switch to open the main line circuit upon  
the failure of the said first named motor to  
60 start the pump after several operations of the said starting switch.

6. In combination, an electric motor driven pump, including a magnetically actu-  
ated main control switch, starting and  
65 stopping switches in circuit with said main

switch, mechanical means for actuating said starting and stopping switches, an electric motor for actuating said mechanical means, means governed by the pressure at the intake side of the said pump for controlling the operation of said last named motor, a master switch and electromagnetically operated means for actuating said master switch to open the main line circuit upon the failure of the said first named motor to start the pump after several operations of the said starting switch.

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