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SYSTEM OF CONTROL

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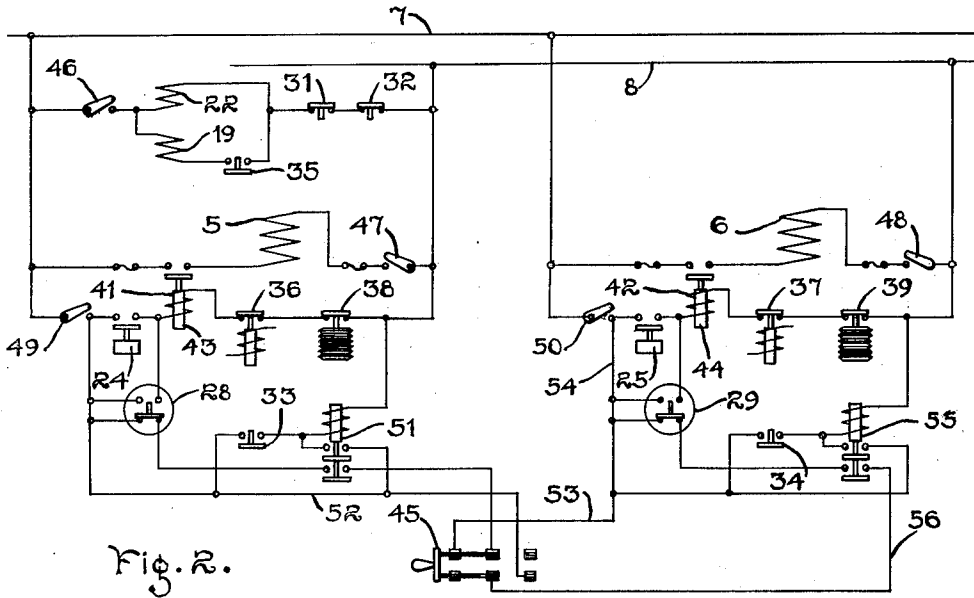


Fig. 2.

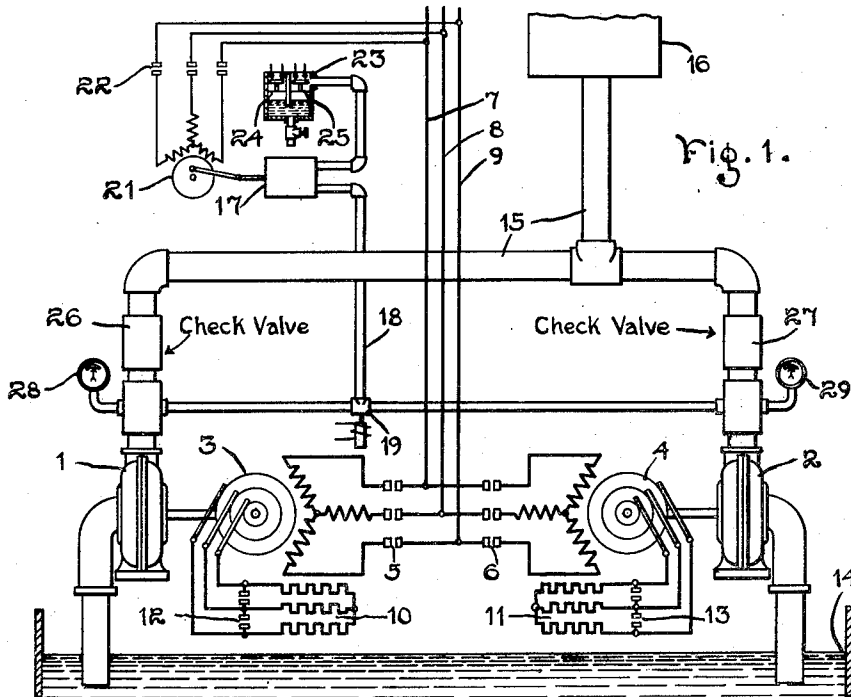


Fig. 1.

WITNESSES:

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SYSTEM OF CONTROL.

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To all whom it may concern:

Be it known that I, JAMES CAPUTO, a citizen of the United States, and a resident of Girard, in the county of Trumbull and State of Ohio, have invented a new and useful Improvement in Systems of Control, of which the following is a specification.

My invention relates to systems of control and it has particular relation to systems employed in connection with electrically operated pumps.

One object of my invention is to provide for the automatic transfer of the pumping load from one to another of similar motor-operated pumps.

Another object is to provide for starting either pump selectively, after which there may be an automatic transfer of load in case of failure of the pump that is initially started.

A further object is to provide automatic means for priming each pump and to prevent either pump from starting until it has been primed.

Other objects of my invention will appear in the following specification and appended claims.

In a system where it is necessary to maintain a continuous water supply and in which two or more main pumps are provided, it is customary to manually prime the idle pump occasionally to facilitate starting the same in an emergency. It is also customary to provide manual control for starting and stopping the auxiliary pump.

In my system of control, I propose to omit many of the manual operations. The automatic features hereinafter described obviate the necessity for continuous attention on the part of an attendant to insure uninterrupted water supply.

My invention will be described with reference to the accompanying drawing in which, Figure 1 is a diagrammatic representation of circuits and apparatus embodying my invention,

Fig. 2 is a diagrammatic view of control circuits employed in connection with the system that is shown in Fig. 1.

With reference to Fig. 1, a pair of centrifugal pumps 1 and 2, are operated by means of induction motors 3 and 4, these motors being connected, through suitable three-pole primary switches 5 and 6, to a source of sup-

ply comprising line conductors 7, 8 and 9. The motors 3 and 4 are, preferably, of the wound-rotor type employing external secondary resistors 10 and 11, which may be automatically short-circuited in the usual manner by double-pole switches 12 and 13, respectively, when the motors are operating at full speed.

The pumps 1 and 2 draw water from a reservoir 14 and supply a system comprising water mains 15 and a tank or stand-pipe 16. A reciprocating vacuum pump 17 is provided with suitable piping connections 18 for priming the pumps 1 and 2. A normally-closed three-way magnet valve 19 is located in the piping system that connects the three pumps. A small motor 21 for driving the priming pump 17 is connected, through a three-pole primary switch 22, to line conductors 7, 8 and 9. A tank 23, containing float switches 24 and 25, receives water discharged from pump 17. Check valves 26 and 27 are suitably disposed in the main piping system near the respective main pumps, and pressure gauges 28 and 29, each having a pair of normally closed and normally open contact members, as illustrated in Fig. 2, are provided.

In Fig. 2, I have illustrated certain coils that are employed for operating the switches shown in Fig. 1. For convenience, I have designated the coils by the same reference numerals that were assigned to the corresponding switches in Fig. 1. Pairs of interlocks 31, 33 and 32, 34 are mechanically connected to secondary switches 12 and 13, respectively, and interlock 35 is mechanically connected to the switch 22, in accordance with a well-known construction. Overload relays 36 and 37 and thermal relays 38 and 39, of any well-known type, are connected in circuit with the operating coils 41 and 42 of no-voltage relays 43 and 44. A double-pole, double-throw transfer knife switch 45 interconnects the control circuits for a purpose to be hereinafter described. Control switches 46, 47 and 48 are manually operable. Control switches 49 and 50 may be manually or automatically operated as described.

Assuming the apparatus to be in its illustrated inoperative positions, the system is started by initially closing switch 46 to energize the switch 22 for starting the prim-

ing pump 17. Interlock 35 is actuated by switch 22 to effect the opening of magnet valve 19. The priming pump 17 now starts, drawing water through main pumps 1 and 2, valve 19 and piping 18 into tank 23. Float switches 24 and 25 are actuated, in accordance with the level of the water in tank 23, to close the control circuits of no-voltage relays 43 and 44.

If it is desired to operate the pump 1, switch 45 remains in its illustrated position, and control switch 49 is closed manually, switch 50 remaining open. Switch 47 must also be closed, and, together with switch 46, may remain normally closed. No-voltage relay 43 completes a circuit for primary switch 5 to connect the motor 3 to line conductors 7, 8 and 9. When motor 3 attains full speed, switch 12 is closed, as previously described, and interlock 31 is opened. Switch 22 thereupon opens to interrupt the circuit of the motor 21. The magnet valve 19 next closes, by reason of the opening of interlock 31, to prevent circulation of the water from pump 1 through the priming piping 18 into pump 2.

As soon as pump 1 is operating normally, the pressure gauge 28 completes a holding circuit for the no-voltage relay 43, including the upper contact members of the pressure gauge. The pump 1 supplies the main system comprising piping 15 and stand-pipe 16.

The interlock 33, which is closed by means of secondary switch 12, provides a circuit for the operating coil of a self-holding relay 51 which maintains a circuit for emergency operation of pump 2 in the event of failure of pump 1. The holding circuit for relay 51 comprises line conductor 7, switch 49, conductor 52, the operating coil of relay 51 and line conductor 8.

If, for any reason, pump 1 is rendered inoperative, the lower contact members of pressure gauge 28 are again closed, whereby a circuit is established from line conductor 7 through switch 49, pressure gauge 28, relay 51, switch 45, conductors 53 and 54, float switch 25, coil 42 and relays 37 and 39 to line conductor 8. No-voltage relay 44 now closes to effect the closure of primary switch 6 to start motor 4. It may be assumed that float switch 25 has previously been closed by the automatic operation of the priming pump 17, as hereinbefore described. It is, however, necessary for the priming pump 17 to be again operated after the operation of pump 1 was completed and prior to the starting of pump 2. The reason is that the tank 23 is allowed to drain itself after each priming operation, thereby opening the float switch contacts and insuring a priming operation prior to the re-starting of either of the pumps 1 or 2. The necessity for insuring priming of the pumps will be understood by those familiar with

the art. It may also be noted that, during emergency operation of pump 2, switch 50 remains open. The motor 4 continues to operate until the self-holding relay 51 is opened by means of switch 49.

If it is desired to first operate pump 2, instead of pump 1, the switch 45 is actuated to the right initially and remains in that position. The priming pump 17 is started in the manner previously described. Switch 49, controlling pump 1, remains open and switch 50 is closed. The motor 4 starts upon the operation of the float switch 25 which closes relay 44 to complete the operating circuit for the primary switch 6. The priming pump 17 is stopped by means of interlock 32, which is controlled by the secondary switch 13 in a manner similar to that described in connection with the operation of pump 1. The interlock 34, which is also actuated by switch 13, effects the closure of a self-holding relay 55, which is disposed similarly to relay 51, so that, when pump 2 stops for any reason, pump 1 may be automatically started by means of a control circuit comprising conductor 7, switch 50, conductor 54, lower contact members of pressure gauge 29, relay 55, conductor 56, switch 45, conductor 52, float switch 24, coil 41, relays 36 and 38 and line conductor 8. No-voltage relay 43 now closes to effect the starting of pump 1 in the manner previously described. During the operation of pump 2 and the emergency operation of pump 1, control switch 50 remains closed and switch 49 open. It will be evident that check valves 26 and 27 prevent the return of water to the reservoir 14 in the event of shutting down either of the main pumps.

I have described a system which is completely automatic in operation with the exception of manual control incident to initially starting either of the main pumps. The value of a system of this character is at once apparent in that it lessens the attention required and permits the attendant to otherwise employ his time. Also, the necessity of manually priming the idle pump from time to time to insure that it is in operating condition is obviated.

I claim as my invention:

1. The combination with a plurality of main pumps and a priming pump therefor, of means rendered operative by the priming pump for controlling one of the main pumps, and means controlled by said main pump for controlling another of said main pumps.

2. The combination with a plurality of main pumps and a priming pump therefor, of means rendered operative by the priming pump for controlling the main pumps and means rendered effective upon the failure of one of said main pumps for operating another of said main pumps.

3. The combination with a plurality of main pumps and a priming pump therefor, of means rendered operative by the priming pump for controlling one of the main pumps, means controlled by said main pump for controlling another of said main pumps and additional means for controlling one of said main pumps and said priming pump.
4. The combination with a plurality of main pumps and a priming pump therefor, of fluid operable means operated by the priming pump for controlling the main pumps and a regulator controlled by one of said main pumps for controlling another of said main pumps when said means is effective.
5. The combination with a plurality of main pumps and a priming pump therefor, of means rendered operative by the priming pump for controlling the main pumps, and a regulator that is effective when one of said main pumps stops for starting another of said main pumps.
6. The combination with a pair of main pumps and electrical operating means therefor, of a priming pump, a switch rendered effective by the priming pump for starting one of the main pumps, and a regulator that is effective when said main pump stops for controlling said operating means.
7. The combination with a pair of motor-operated pumps and starting switches therefor, of a self-holding relay controlled initially by one of the starting switches, a transfer switch, a float-switch, and a pressure-gauge for interrupting a circuit through one of the motors and for completing a circuit comprising the relay, the transfer-switch and the float-switch for starting the other of said motors.
8. The combination with a pair of motor-operated pumps and a pressure-system supplied thereby, of means for selectively rendering one of the pumps operative and, thereafter, upon failure of said pump, automatically starting the other pump.
9. The combination with a pair of main motor-operated pumps and a priming pump therefor, of means for starting the priming pump, and fluid operable means for insuring the proper functioning of said priming pump prior to the starting of either of the main pumps.
10. The combination with a pair of main motor-operated pumps and a priming pump therefor, of automatic means for starting and stopping the priming pump, and fluid operable means for insuring the proper functioning of said priming pump prior to the starting of either of the main pumps.
11. The combination with a pair of motor-operated pumps and a pressure system supplied thereby, of manual means for selectively rendering one of the pumps operative and means, effective after failure of said pump, for automatically starting the other pump.
12. The combination with a pair of motor-operated pumps and a pressure system supplied thereby, of means for selectively rendering one of the pumps operative, means effective after failure of said pump for automatically priming the other pump and for thereafter rendering said other pump operative.
13. The combination with a pair of main motor-operated pumps and a pressure system supplied thereby, of means for priming said main pumps, manual means for selectively rendering one of the main motors operative, and means comprising said priming means and effective, in the event of failure of said main pump, for automatically rendering the other main pump operative.
- In testimony whereof, I have hereunto subscribed my name this seventh day of October, 1922.
- JAMES CAPUTO.