Aug. 14, 1934. P. HÖSEL 1,970,380

PUMP CONTROL

Filed Aug. 8, 1930

FIG. 1

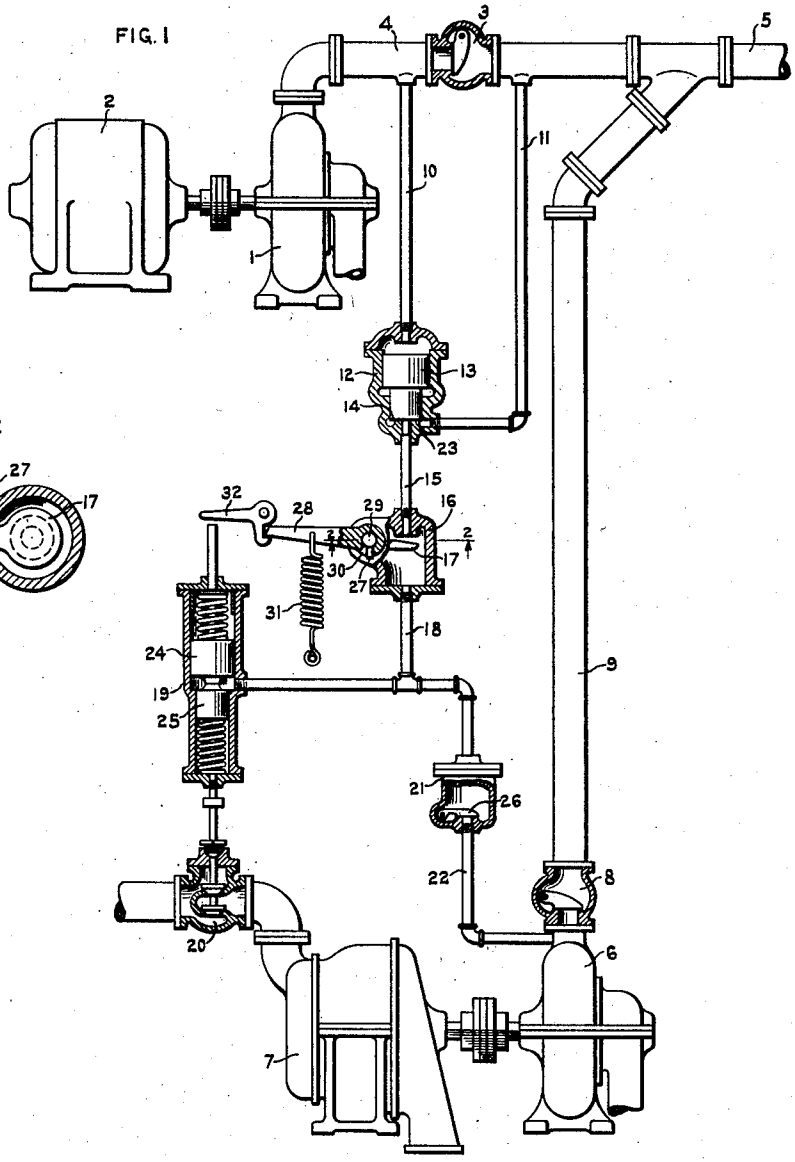
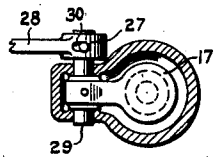


FIG. 2



INVENTOR
Paul Hösel,
BY Charles V. Mullen
ATTORNEY

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PUMP CONTROL

Paul Hösel, Berlin-Charlottenburg, Germany, assignor to General Electric Company, a corporation of New York

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6 Claims. (Cl. 103—11)

This invention relates to the operation of pumps or blowers, and in particular is directed toward insuring the continuity of flow or pressure in the conduit or conduits to which the pumps or blowers discharge.

In the operation of apparatus requiring a supply of fluid under pressure, it is usually important that the pressure of the fluid being supplied to the apparatus be not allowed to fall below a predetermined minimum. In such installations it is advisable to have in addition to the normally operating pump or pumps, a reserve pump or pumps normally inoperative, which when necessary can be operated to insure a supply of pressure or flow of the fluid being fed the apparatus.

My invention relates in particular to the automatic starting of such reserve pumps, and has for one object the automatic starting of a normally inoperative reserve pump in the event that motive power for the normally operating pump fails.

Another object is the starting of the reserve pump in the event that for any reason there is a loss of pressure on the pump side of the non-return valve in the discharge from the normally operating pump.

Still another object is to prevent automatic restarting of the reserve pump in the event of pressure failure on the pump side of the non-return valve in the discharge of the reserve pump, when the reserve pump has been operating.

Other objects of the invention are in part obvious and in part will appear more in detail hereinafter.

I have chosen to illustrate and describe one suitable embodiment of my invention in connection with an electric motor driven boiler feed pump and a steam turbine driven reserve pump for the supply of feed water to a boiler or boilers.

It is understood, of course, that the invention can be employed in connection with other kinds of pumps or blowers besides boiler feed pumps in cases where a reserve pump is to be placed in operation in the event of the failure of an operating pump or of a drop in pressure from the operating pump below a predetermined minimum.

By the term "pumps" used hereinafter in general, I mean reciprocating pumps, centrifugal pumps, blowers or any pumping engines used to create pressure or flow of fluids. By the use of the term "motor" as a means of driving such a pump, I mean this to be interpreted as an electric motor, steam turbine, reciprocating engine, or any suitable prime mover means of operating the pumping engine.

Various conditions may result in a drop in pressure at the discharge of the normally operating pump below a pedetermined minimum, to which the invention is responsive. For instance, if the normally operating pump is being driven by an electric motor, then the motor might burn out or the supply of electricity fail, or in case of a steam turbine or engine the steam pressure might decrease below a value necessary for operation of the turbine or engine, or the steam line might break. The coupling between the motor and the pump might fail, or the pump itself might break. The suction line leading to the pump or the discharge from the pump might fail. Any of the above or various other causes might result in what I would term to be a failure of the normally operating pump to the extent that the pressure at its discharge would drop below a predetermined value and call for the automatic starting of the reserve pump.

The invention is not limited to a single normally operating pump and a single normally inoperative reserve pump, but may be employed with equal advantage in systems where a plurality of pumps supply fluid to apparatus and where one or more normally inoperative reserve pumps are to be placed in operation upon a drop in pressure below a predetermined value at the discharge of one or more of the operating pumps.

In the drawing:

Fig. 1 is diagrammatic of an embodiment of the invention wherein two pumps, one normally operating and one in reserve, feed to a common conduit.

Fig. 2 is a sectional detail of a part of the controlling mechanism.

In the drawing I have indicated at 1 the normally operating feed water pump driven by an electric motor 2 and discharging through a non-return valve 3 from branch conduit 4 to main conduit 5 supplying water to a boiler or boilers (not shown).

At 6 is indicated a normally inoperative reserve pump driven by a steam turbine 7 and discharging through a non-return valve 8 to a branch 9 of the main conduit 5.

The pressure connections 10 and 11 leading from opposite sides of the non-return valve 3 from the branch conduit 4 connect to different points of casing 12 in which there is positioned a differential piston 13 resting upon a seat 14. The piston 13 overlaps its seat 14 to form an annular surface 23 upon which is effective the pressure of the main conduit 5 through the pressure connection 11.

The piston 13 is adapted to close the entrance of conduit connection 15 which joins the casing 12 with a non-return valve casing 16 having a non-return valve 17 disposed across its entrance. From valve casing 16 a conduit connection 18 joins a regulating device 19 for the steam inlet valve 20 of steam turbine 7. The conduit connection 18 further connects the non-return valve casing 16 with a non-return valve casing 21 containing a non-return valve 26 disposed across the entrance of a conduit connection 22 which leads to the discharge of pump 6 on the inlet side of its non-return valve 8.

In the casing of the regulating device 19 of the steam turbine inlet valve 20 are positioned plungers 24 and 25 impacted one on the other, of different diameters and both under pressure from the conduit connection 18. Plunger 25 is the regulating plunger proper for the valve 20. The upper plunger 24 of greater diameter serves as a quick-closing device for the valve 20 if the pressure in conduit connection 18 falls below a minimum.

In Fig. 2 is shown an enlarged sectional view of a part of the non-return valve comprising casing 16. A shaft 29 is positioned in an extension of casing 16, extending from the casing and bearing a projecting pin 27. Fixed to shaft 29 is the movable valve 17 normally free to move to or away from the seat surrounding the entrance of conduit connection 15. An arm 28 is loosely fitted to the shaft 29 and is held in a normal position through the media of latch 32 and a spring 31. The arm 28 has in its hub partly encircling shaft 29 a slot 30 in which the pin 27 moves within certain limits of travel.

In the normal position shown, the spring 31 holds the arm 28 against the latch member 32 with the slot 30 of the arm 28 in a position such that rotary movement of shaft 29 as limited by the travel of the pin 27 in the slot 30 allows the valve 17 to move freely toward or away from the seat surrounding the entrance of conduit 15.

Upon the admission of pressure through conduit 18 to the regulating device 19 above a predetermined value, the plunger 24, spring-backed, moves upwardly, freeing the plunger 25 from restraint in a manner such that it becomes a regulator of the steam inlet valve 20 controlling the admission of steam to the turbine 7 in accordance with the pressure of water in the conduit connection 18.

In its upward motion, the stem of the plunger 24 comes in contact with the latch 32, freeing it from engagement with the arm 28. The spring 31 then effective upon the arm 28 pulls this arm downwardly, pivoting around its shaft 29 in a manner such that one end of the slot 30 engages pin 27, causing a movement of the valve 17 upwardly to seat against and close off the entrance passage to the conduit connection 15.

In operation, the motor driven pump 1 discharges through conduit 4 and non-return valve 3 to the main conduit 5. Pressure in the connecting conduits 10 and 11 is approximately equal, and no motion of plunger 13 in the casing 12 takes place, the plunger resting against the seat 14, closing off entrance to the conduit connection 15.

If for some reason the pressure in conduit 4 falls below that in conduit 5, the pressure in conduit 10 becomes lower than that in conduit 11, and upon the occurrence of a predetermined difference, the pressure in conduit 11 moves plunger 13 upward.

The entrance to connection 15 is thus open for the admission of fluid pressure from main conduit 5 through the intermediary of conduit connection 11. Pivoted valve 17 being free to move toward or away from its seat, the pressure existing in connection 15 becomes effective in connection 18 and upon the controlling mechanism 19 of the steam inlet valve 20 to turbine 7.

Admission of pressure through connection 18 causes a sudden upward motion of plunger 24, releasing for regulation of the steam inlet valve 20 the spring-backed plunger 25.

Simultaneously the upward motion of plunger 24 trips latch 32, allowing spring 31 to pull the arm 28 downwardly and cause a seating of the valve 17 against the entrance from connection 15 in a manner to shut off said connection from pressure through conduit connection 11 from main conduit 5.

Starting of the steam turbine 7 and correspondingly of the reserve pump 6 results in the building up of pressure at the outlet of the pump, sufficient to overcome the resistance of the pivoted non-return valve 8, and feed fluid, in this case water, flows through the conduit 9 to the main conduit 5. At the same time pressure from the discharge of the pump 6 is admitted through connection 22 past pivoted valve 26 to the conduit connection 18 and effects regulation of the mechanism 19 to the end that the steam inlet valve 20 is regulated in accordance with the discharge pressure from the pump 6.

If now for some reason the pressure at the discharge of the pump 6 and correspondingly at the entrance to the non-return valve 8 falls to a value insufficient to support the plunger 24, then the quick-acting plunger 24 operates to shut off the steam supply valve 20. Such a decrease in pressure at the discharge pump 6 might result from a failure of steam turbine 7 or of the pump 6 or from some other reason. It might be caused by the shutting off of a stop valve in the line supplying steam to the regulating valve 20 through the desire to shut down the turbine 7.

In order now to avoid an automatic restarting of the reserve pump 6 under the influence of a pressure acting back through conduits 5, 11 and 15, the pivoted valve 17 is held against its seat through the intermediary of the pin 27 cooperating in the slot 30 of the arm 28 and through the force of spring 31.

It is therefore necessary after a stopping of the turbine 7 and pump 6, to reset by hand the latch 32 under the arm 28 when it is desired to make available the automatic means for starting the reserve pump. After the latch mechanism 32 has been reset to support the spring loaded arm 28, then the movable valve 17 is free to travel toward or away from its seat within the limits of travel of the pin 27 in the slot 30. The mechanism is then available to function automatically as before.

It is to be understood that while I have illustrated and described my invention in connection with an electrically driven feed water pump and a turbine-driven reserve pump for the supply of water to a boiler or boilers, this is only a preferred embodiment, and the invention may be utilized in connection with other types of pumps or blowers for services other than the supply of feed water to a boiler or boilers.

While I have described the principle of operation of my invention together with the apparatus which I now consider to represent a preferred embodiment thereof, I desire to have it under-

stood that the apparatus shown is only illustrative, and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a pump having a discharge conduit, a motor for driving the pump, a non-return valve in said conduit, a second pump having a discharge conduit connected in parallel with the discharge conduit of the first-named pump, a motor for driving the second pump, said second pump being normally inoperative, means controlled by the pressure in said first-named conduit on opposite sides of said non-return valve for starting automatically said second-named motor in case the pressure on the inlet side of said non-return valve falls below a predetermined minimum, means controlled by the pressure at the discharge of said second-named pump for stopping automatically the second-named motor in case said pressure falls below a predetermined minimum, means preventing the automatic restarting of the second-named motor after it has been stopped, and hand-operable means for making ineffective said last-named means.

2. In combination, a pump having a discharge conduit, a motor for driving the pump, a non-return valve in said conduit, a second pump having a discharge conduit connected in parallel with the discharge conduit of the first-named pump, a motor for driving the second pump, said second pump being normally inoperative, means controlled by the pressure in said first-named conduit on opposite sides of said non-return valve for starting automatically said second-named motor in case the pressure on the inlet side of said non-return valve falls below a predetermined minimum, means controlled by the pressure at the discharge of said second-named pump for stopping automatically the second-named motor in case said pressure falls below a predetermined minimum, and means preventing the automatic restarting of the second-named motor after it has been stopped.

3. In combination with a plurality of pumps for feeding a common header and each having a non-return valve in the line to the header, of means rendered operative by a change in pressure differential across one of said non-return valves beyond a predetermined value for automatically bringing into operation another of said plurality of pumps, and means preventing the automatic restarting of the second-named pump after it has been stopped.

4. In combination with a plurality of pumps for feeding a common header and each having a nonreturn valve in the line to the header, of means rendered operative by a change in pressure differential across one of said non-return valves beyond a predetermined value for automatically bringing into operation another of said plurality of pumps, means preventing the automatic restarting of the second-named pump after it has been stopped, and hand operable means for making ineffective said last-named means.

5. The combination with a plurality of pumps adapted to feed a common header and each having a non-return valve in the line to the header, of means rendered operative by a change in pressure differential across one of said non-return valves beyond a predetermined value for automatically bringing into operation another of said plurality of pumps, means controlled by the pressure at the discharge of the last-named pump for stopping automatically the last-named pump in case said pressure falls below a predetermined minimum, means preventing the automatic restarting of the last-named pump after it has been stopped, and hand operable means for making ineffective said last-named means.

6. In combination, a pump having a discharge conduit, a motor for driving the pump, a differential pressure producing medium in said conduit, a second pump having a discharge conduit connected in parallel with the discharge conduit of the first-named pump, a motor for driving the second-named pump, said second pump being normally inoperative, means controlled by the differential pressure produced by said medium for starting automatically said second-named motor, means controlled by the pressure at the discharge of said second-named pump for stopping automatically said second-named motor, and means preventing the automatic restarting of the second-named motor after it has been stopped.

PAUL HÖSEL.