H. F. ROSENCRANS.

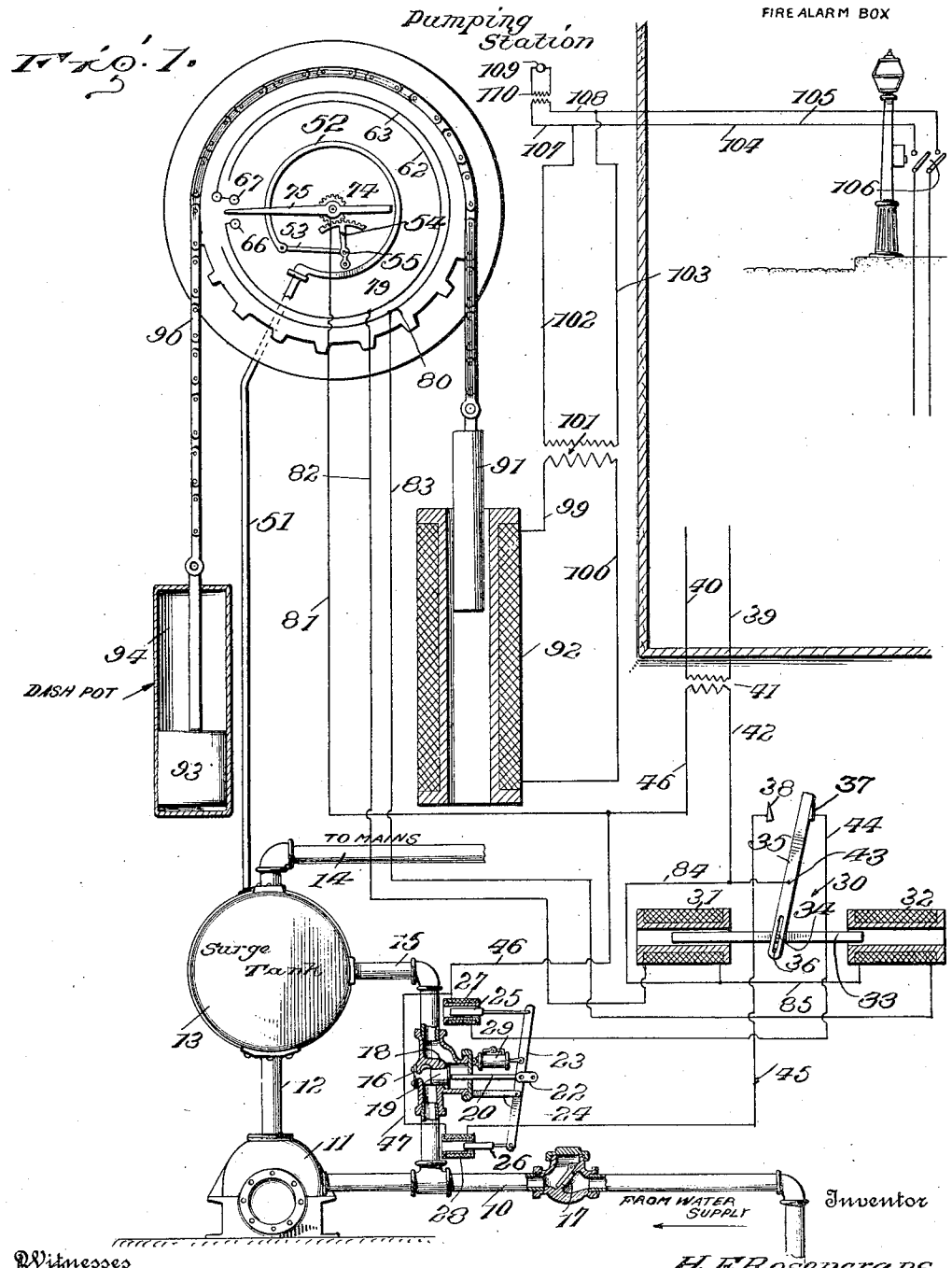
PUMPING SYSTEM.

APPLICATION FILED AUG. 16, 1912.

1,148,054.

Patented July 27, 1915.

3 SHEETS—SHEET 1.



Witnesses

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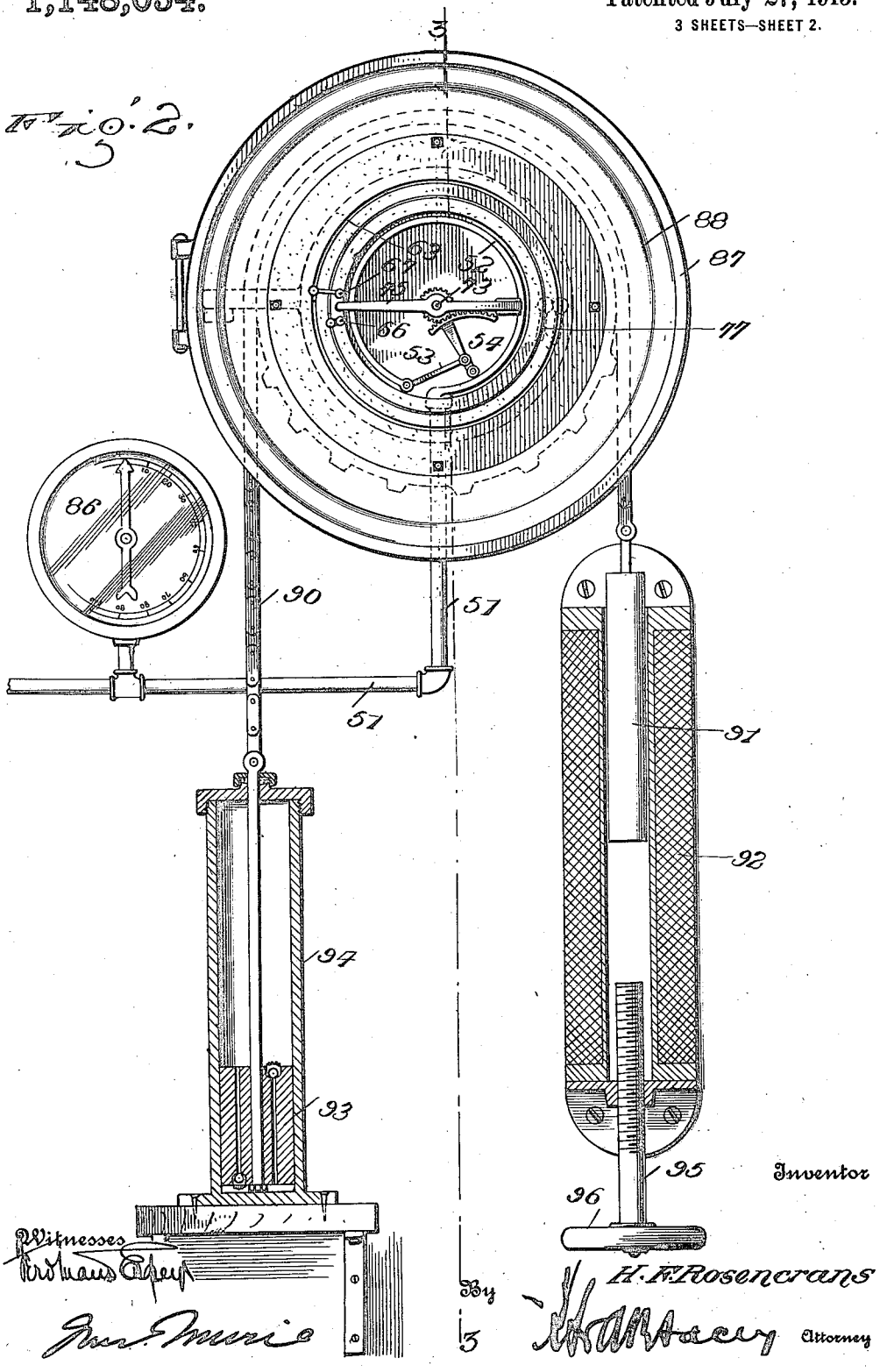
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

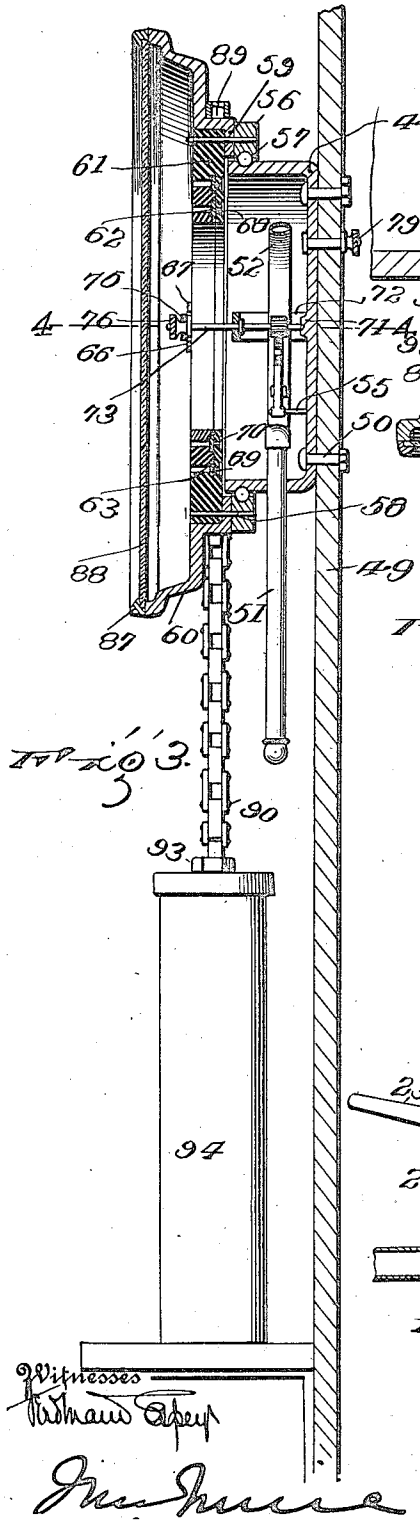


Fig. 3.

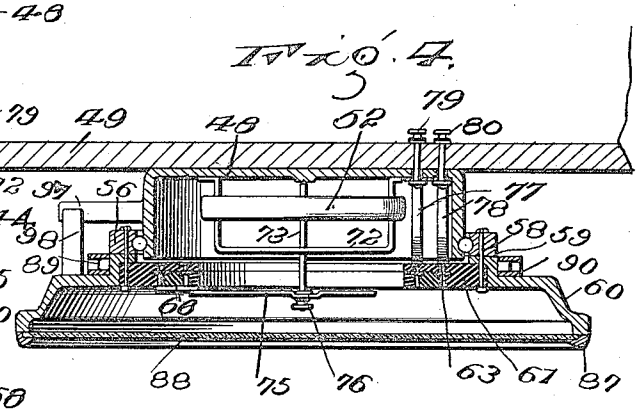


Fig. 4.

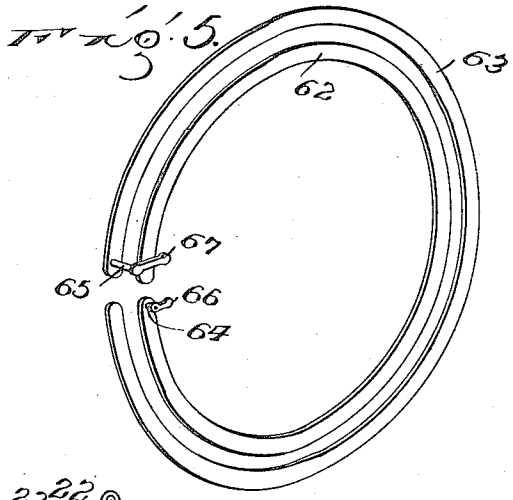


Fig. 5.

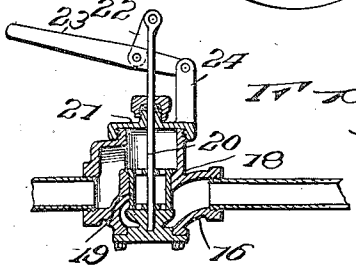


Fig. 6.

Witnesses

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UNITED STATES PATENT OFFICE.

HERMAN F. ROSENCRANS, OF DURAND, MICHIGAN.

PUMPING SYSTEM.

1,148,054. Specification of Letters Patent. Patented July 27, 1915.

Application filed August 16, 1912. Serial No. 715,522.

To all whom it may concern:

Be it known that I, HERMAN F. ROSENCRANS, citizen of the United States, residing at Durand, in the county of Shiawassee and State of Michigan, have invented certain new and useful Improvements in Pumping Systems, of which the following is a specification.

This invention relates to a new and useful system for controlling the pressure in the service mains of municipal water works, and the primary object of my invention is to provide an electrically operated system which will act automatically to constantly maintain the pressure in the mains between certain limits.

A further object of my invention is to provide a system which will accomplish the above object irrespective of the number of pumping stations or pumps or of the speed at which the pumps are driven, always assuming of course, that the pumps are of sufficient capacity to at all times meet the demand.

My invention has for a further object to provide means, in case of fire, for automatically raising the limits of pressure to permit and maintain a greater pressure for fire service.

Still another object of my invention is to furnish means for adjusting, at will, the pressure limits for either domestic service or fire service. And a still further object I have in view is the provision of a signal automatically actuated by the changing of the system from service pressure to fire pressure to notify the watchman at the pumping station in which the controlling mechanism is located of the change so that he will, if necessary, increase the speed of the pumps or throw other pumps into service to meet the demand.

With these chief and many lesser objects in view, my invention will be more fully described, illustrated in the accompanying drawings, and then specifically pointed out in the appended claims which are attached to and form a part of this application.

In the drawings: Figure 1 is diagrammatic view of my improved system, parts being shown in elevation and still other parts in section to more clearly illustrate the operation of the system; Fig. 2 is a front elevation, partially in section of the control mechanism proper; Fig. 3 is a vertical section on the line 3—3 of Fig. 2, showing further details of construction; Fig. 4 is a transverse section on the line 4—4 of Fig. 3 illustrating certain details not shown in Figs. 2 and 3; Fig. 5 is a perspective view of the movable contact rings employed in the controller and of the contact arms carried thereby and the position of which determines the limits of water pressure in the mains; Fig. 6 is a detail sectional view of the bypass valve.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

My system of controlling the water pressure in the service mains may be employed with all forms of municipal water distributing systems and to fully and clearly explain my system I have shown it employed with one form of water system including a supply pipe 10 leading from the reservoir or other source of supply, not shown, to the intake port of a pump 11. A pipe 12 leads from the outlet of this pump to a surge or compression tank 13 and a pipe 14 leads from this tank to the mains by which the water is distributed throughout the city.

My invention consists primarily in the provision of a valved bypass pipe 15 between the compression tank and supply pipe and means operable to automatically open or close the valve 16 thereof as the pressure becomes too high or too low.

It also consists in the provision of a check valve 17 in the supply pipe at some point between the source of supply and the juncture of the pipe 10 with the bypass pipe 15 to prevent back flow of water through the pipe 10. As long as the bypass valve 16 remains closed and the pump in operation, water will be forced into the tank and thence to the mains. As soon however, as this valve is opened, there being no pressure from the source of supply and back pressure through the bypass and pipe 10 being checked by the valve 17, the pump will merely pass water through the pipe 12, tank, bypass pipe 15 and back to the pump, no water passing through the pipe 14 to the mains. It will therefore be apparent that the pump may be continuously operated at any speed desirable and that the pressure in the mains will never go above a certain point providing the valve 16 is opened at the proper time. Moreover if the capacity of the pump is sufficient to meet the demands made upon it and if the

valve 16 is closed at the proper time, the pressure in the mains will never fall below a certain point.

My invention therefore further consists in providing means governed by the pressure in the surge tank or mains, the pressure in both being equal, for opening and closing the valve 16 at the proper time. In order that this controlling system be of utility, provision must also be made whereby the mechanism controlling the valve may be made to operate at any preferred pressure, at will, to permit the maintenance of any desired pressure in the mains, as a system in which the pressure is unvariable is of course highly unsatisfactory.

Before describing the controlling mechanism, it will be well to clearly understand the manner in which the valve operates. This valve is of the balanced valve type and the details of its construction are clearly set forth in my copending application Serial No. 715,521, filed August 16, 1912. It includes a valve casing divided by a transversely extending web 18 provided with a valve passage, a hollow cylindrical valve 19 movable in this valve passage and engaging by one end upon a valve seat formed in the casing, and a valve stem 20 mounted in spiders carried by the valve and reciprocally movable through a stuffing box carried by the bonnet 21 of the valve casing. Because of this peculiar construction, direct pressure upon the movable parts of the valve is reduced to a minimum and but little force is required to either open the valve or to hold it in open position.

Pivoted to the free end of the valve stem 20, is a link 22 and pivoted by its central portion to the free end of this link is an operating lever 23 which is also pivoted intermediate its length upon an arm 24 extending from the bonnet 21. The free ends of the lever are operatively connected to the plungers 25 and 26 of solenoids 27 and 28 respectively, the connection being such that when the solenoid 27 is energized, its plunger will move the lever to close the valve while, when the solenoid 28 is energized, its plunger will move the lever to open the valve. The controlling means therefore is arranged to energize one or the other of these solenoids when the pressure becomes too high or too low. The valve casing carries a dash pot 29 and the plunger of this dash pot is operatively connected with the lever. This dash pot prevents too rapid opening or closing of the valve and consequent pounding of water in the pipes.

As a means for selectively energizing the solenoids 27 and 28, I have provided a double point, solenoid actuated, automatic switch designated as a whole by the numeral 30. This switch includes a pair of oppositely disposed alined solenoids 31 and 32 having a common plunger 33 provided centrally with a laterally directed pin 34. Pivoted intermediate its length and opposite the central portion of the plunger, is a switch blade 35, one end of which is slotted to receive the pin, as shown at 36, said end being insulated from the plunger in any suitable manner, not shown. Spaced contacts 37 and 38 are positioned to be engaged by the switch blade as the latter is moved by the solenoids 31 and 32, respectively.

Line wires 39 and 40 lead from any suitable source of electrical supply to a transformer 41. A conductor wire 42 leads from this transformer to the pivot pin 43 of the switch blade 35 and so to the switch blade, while wires 44 and 45 lead from the contacts 37 and 38 to the solenoids 27 and 28, respectively. A return wire 46 connects the free terminal of the solenoid 27 and transformer 41, while a wire 47 connects the free terminal of the solenoid 28 with the wire 46. It will therefore be seen that when the solenoid 31 is energized, the circuit is completed through the wire 42, switch blade, switch contact 37, wire 44, solenoid 27 and wire 46 to energize the solenoid 27 and keep the valve 16 closed, this being the normal position of the valve. On the other hand, when the solenoid 32 is energized, the circuit is completed through the wire 42, switch blade, switch contact 38, wire 45, solenoid 28 and wires 47 and 46 to energize the solenoid 28 to open the valve and hold it open until the solenoid 27 is again energized.

The controlling device proper of my invention consists of a mechanism governed by the pressure in the surge tank or main and adapted to close circuits to energize the solenoids 31 and 32 as the pressure becomes too low or too high. This mechanism is so constructed that it may be set to operate at any desired pressure limits and is also so arranged that the closing of a fire switch will automatically raise these pressure limits any desired, predetermined amount. For a more specific explanation of this mechanism, reference will be had to Figs. 2 to 5 inclusive of the drawings in which the details of its construction are illustrated.

The preferred embodiment of my circuit closer includes a fixed casing member 48 in the form of a cylinder open at its front and closed at its back, the back wall of the casing being secured to any suitable support 49, such as a wall of the pumping room, by bolts 50.

Connected at one end to the surge tank 13, is a pipe 51, the other end of which passes through the wall of the casing and is connected to a pressure gage tube 52, the closed end of which is pivotally connected to a link 53, the opposite end of which is pivoted to a sector gear 54 swingingly mounted on a pin 55 carried by the casing. The

outer face of the casing is grooved peripherally to co-act with the interiorly grooved two-part ring 56 to form a race for ball bearings 57. Bolts 58 pass through this ring at spaced intervals, through the inwardly directed flange 59 of an annular movable casing member 60 and through an annular contact carrying ring 61 of insulating material.

The ring 61 is provided with a pair of spaced apart, concentrically formed grooves in its outer face, the inner portions of which are undercut to provide seats for the open contact rings 62 and 63. These contact rings are slidable in their seats and are adapted for counterclockwise and clockwise movement, respectively, and are provided at their rear ends with pins 64 and 65 which extend through the grooves and upon the outer ends of which are radially directed contact arms 66 and 67 which terminate flush with the inner edge of the supporting member 61. The supporting member is made up of a plurality of separable parts to permit the positioning of the rings and these parts are secured together in any preferred manner after the rings are in place.

Seated in or otherwise secured to the back of the supporting member 61, are contact rings 68 and 69 which are in constant electrical connection with the rings 62 and 63, respectively, through a plurality of spaced pins 70 carried by the rings 68 and 69 and bearing by their ends against the rings 62 and 63.

Journaled by one end in a bearing 71 centrally formed in the back wall of the casing 48 and intermediate its length, in a yoke 72 carried by said wall, is a shaft 73 carrying a gear 74 meshing with the sector gear 54. Mounted upon the free end of this shaft and insulated therefrom, is a switch blade 75, this blade being secured in place by a nut 76 also insulated from the shaft and forming a means for electrically connecting a wire to the switch blade. The switch blade is of such length that when swung by the pressure of water in the pressure tube, it will engage against one or the other of the contact arms 66 and 67.

Spring brushes 77 and 78 are insulated from the casing 48, to which they are secured by bolts which, with their nuts, form binding posts 79 and 80, respectively, and bear by the free ends against the contact rings 68 and 69, respectively.

A conductor wire 81 leads from the wire 46 and is connected by its end to the switch blade 75, while wires 82 and 83 lead from the binding posts 79 and 80 to terminals of the solenoids 31 and 32, respectively. A wire 84 leads from the wire 42 to the free terminal of the solenoid 31, while a wire 85 leads from the wire 84 to the free terminal of the solenoid 32.

From the foregoing description, it will be apparent that when the pressure in the surge tank 13 falls below a certain point, the contraction of the pressure tube 52 will swing the switch blade into engagement with the contact arm 66. A circuit is then closed through the wire 42, wire 84, solenoid 31, wire 82, ring contacts 62 and 68, switch blade 75 and wire 81 back to the line wire 46 to energize the solenoid 31 and throw the switch 30 to close the circuit through the solenoid 27 and close the valve 16, causing the pump to force water into the tank. If, on the other hand, the pressure in the surge tank becomes too high, the expansion of the pressure tube 52 will move the switch blade 75 into engagement with the contact arm 67. A circuit is then closed from the line wire 42, through the wires 84 and 85, solenoid 32, wire 83, contact rings 63 and 69, switch blade 75 and wire 81 back to the line wire 46, energizing the solenoid 32 to throw the switch 30 to close the circuit through the solenoid 28 and open the valve 16 and hold the same until the pressure again becomes normal.

By sliding the ring contacts 62 and 63 to move their contact arms 66 and 67 to various positions with respect to the switch blade 75, the controlling device, above described, can be made to automatically open and close the valve 16 at any desired pressure.

The pipe 51 is preferably provided intermediate its length with a pressure gage 86 from which the pressure may be read to assist in adjusting the contact rings 62 and 63. The movable casing member 60 is preferably provided with a hinged closure 87 which may include a transparent wall 88 through which the position of the rings can be noted.

In order to provide means for automatically advancing the contact arms 66 and 67 to raise the pressure in case of fire, I have provided the movable casing member 60 with a plurality of spaced apart, peripherally formed sprocket teeth 89 over which is trained a sprocket chain 90. One end of this chain is attached to the plunger 91 of a vertically disposed solenoid 92, while its other end is secured to the movable member 93 of a dash-pot 94. The amount of movement of the plunger 91 and consequently the angle through which the movable casing member and its contact rings will be turned is governed by means of a screw 95 adjustably threaded through the frame of the solenoid and extending upwardly in the same to act as a stop for the plunger, this screw being provided with a hand wheel 96 by means of which it may be readily manipulated.

The weight of the movable member 93 of the dash-pot is sufficient to overcome the friction between the casing members 48 and 60 and to outbalance the plunger 91. It

therefore holds the plunger in raised position under normal conditions. The casing members 48 and 60 are provided with lugs 97 and 98, respectively, which co-act to form a stop for limiting the reverse movement of the casing 60. Wires 99 and 100 connect the terminals of the solenoid 92 with a transformer 101 and wires 102 and 103 connect the transformer with line wires 104 and 105. The line comprising the wires 104 and 105 is run to various sections of the city and provided with a plurality of switches 106. These switches are preferably located in the fire alarm boxes and may be so arranged that they will be closed by the ringing of the alarm.

Upon the closing of one of the switches, the solenoid 92 is energized to turn the casing member 60 and consequently the contact rings 62 and 63 in a clockwise direction through a predetermined angle dependent upon the adjustment of the screw 95 to advance both the high and low pressure contacts to provide for and maintain a higher pressure than usual in the mains. As soon as the switch is opened, the parts return to normal condition. It will be apparent that if the valve 16 is not already closed it will be closed by the advancement of the contact arms, as above described as the contact arm 66 will momentarily engage the switch blade during its forward movement. The pump will therefore force water directly to the surge tank. It follows that during the return of the parts to normal position upon the opening of the switch, the valve 16, if not already open, will be opened by the momentary engagement of the contact arm 67 by the switch blade 75 and that said valve will therefore be held open until the pressure in the surge tank becomes normal.

Branch wires 107 and 108 are preferably run from the line wires 104 and 105 within the pumping station to a pilot light 109, a suitable transformer 110 being interposed between the line wires and light. This light warns the operator that the pressure has been raised and he can therefore throw an additional pump into service, if necessary, to maintain this pressure.

The system and its operation will be readily understood from the foregoing description in which the operation of each of the principal mechanisms and divisions of the system has been explained in connection with its corresponding structure and the bearing of each in relation to the others pointed out. A further description of the operation is therefore deemed unnecessary.

The entire controlling system is not only effective but certain in its operation, consisting of but few mechanical parts all simple in construction and arrangement.

The chief value of my controlling system however, is because of its extreme flexibility, the pressure being absolutely controlled between any desired points as long as the demand made upon the pump or pumps does not exceed their capacity. One controlling system may be installed to operate and control any number of pumps so long as all the pumps are connected with the system or so long as the capacity of the single pump to which the system is connected is relatively such that all the other pumps will not equal the minimum demand, while all the pumps together will exceed the maximum demand.

On the same principle one controlling system working in connection with one of a plurality of co-acting sub-pumping stations will control the entire pumping system so long as the other stations together do not exceed the minimum demand. This permits the pumping of water from out-of-town stations directly into the distributing mains. The system can also be employed with equally as good results with a stand pipe.

With this system a number of pumps may be employed and each thrown into or out of service as occasion demands, while, because of the extreme range of adjustment, the pressure may be constantly maintained, at all times, within any desired limit, the throwing into service, at any time, of an extra pump of a certain capacity, under this system, not necessarily meaning that that amount of water is forced into the mains regardless of the pressure therein, as in other systems.

Although I have illustrated and described a specific form of controlling mechanism proper, it will be understood that I do not wish to limit myself to the specific details thereof as various changes within the scope of the appended claims may be made, if desired, without in any way departing from the spirit of my invention.

The above described system may be used with any water system and is much cheaper to install and maintain than the usual steam pumping system of the same capacity, also being automatic in its action it requires practically no attention.

Having thus described the invention, what is claimed as new is:

1. A water supply system including a surge tank, a spring tube pressure gage, a pipe communicating between the tank and tube, a rotatable shaft, means co-acting between the tube and shaft for rotating the latter, a switch blade carried by the shaft, a contact carrying member positioned concentrically about the shaft, contacts movable about said member and adapted for engagement by the switch blade, a valve controlling the pressure in the system, solenoids adapted to open and close the valve, circuits including said solenoids and normally open through the switch blade and contacts, and

means for revolving the contact carrying member to simultaneously move the contacts with respect to the switch blade.

2. A water supply system including a surge tank, a spring tube pressure gage, a pipe communicating between the tank and tube, a rotatable shaft, means co-acting between the tube and shaft for rotating the latter, a switch blade carried by the shaft, a contact carrying member positioned concentrically about the shaft, contacts movable about said member and adapted for engagement by the switch blade, a valve controlling the pressure in the system, solenoids adapted to open and close the valve, circuits including said solenoids and normally open through the switch blade and contacts, and means for revolving the contact carrying member to simultaneously move the contacts with respect to the switch blade, said means including a solenoid connected in a normally open circuit and a switch for closing said circuit.

3. A water supply system including a pump, a supply pipe leading to the pump and provided with a check valve, a surge tank, a pipe communicating between the pump and surge tank, a bypass pipe communicating between the surge tank and supply pipe at a point between the pump and check valve, means for opening and closing said valve, said means including a switch blade movable in one direction or the other by pressure in the surge tank, contacts normally positioned one upon either side of the blade and movable toward and away from each other and from the blade, and circuits normally open through said contacts and blade, said contacts being further arranged for simultaneous movement in one direction upon the closing of an auxiliary circuit and for return movement to original position upon the opening of said auxiliary circuit.

4. A water supply system including a revoluble switch blade movable by pressure in the system, a concentrically grooved contact carrying member positioned concentrically with respect to the blade, contact rings mounted in the grooves of said member and slidable therein, contact arms carried by said rings and adapted for engagement by the switch blade, fixed contact rings carried by said member and electrically connected with the slidable contact rings, means for revolving said contact member together with its contact rings, brushes engaging against the fixed contact rings, a valve controlling the pressure in the system, solenoids for opening and closing said valve, normally open circuits for solenoids, circuits normally open through the switch blade and contact arms, and means operable by the closing of either of said latter circuits for automatically closing the corresponding of the first mentioned circuits.

5. A water supply system including a tank, a pump discharging into the tank, means for maintaining the pressure in the tank between predetermined limits, means for varying said limits, and electrically operated manually controlled means for simultaneously raising said limits independent of pump speed.

6. A water supply system including a tank, a pump discharging in the tank, spaced contacts independently adjustable toward and away from each other, a switch blade movable between said contacts and controlled by the pressure in the tank, and means for simultaneously moving the contacts with respect to the switch blade, said means including a manually operable switch in circuit with a solenoid, the solenoid having operative connection with the contacts.

7. A water supply system including a tank, a pump discharging into the tank and having a suction pipe, a by-pass between the tank and suction pipe, electric circuits controlling discharge of water through the by-pass, switch common to said circuits, and means operable by pressure in the tank for actuating the switch, said means including an indicator having a switch blade, the movement of which is controlled by the pressure in the tank, a ring mounted for turning movement and carrying contacts engageable by the switch blade, and electrically controlled means for rotating the ring in one direction to advance the contacts.

8. A water supply system including a tank, a pump discharging into the tank and having a suction pipe, a by-pass between the tank and suction pipe, electric circuits controlling discharge of water through the by-pass, a switch common to said circuits, and means operable by pressure in the tank for actuating the switch, said means including an indicator having a switch blade, the movement of which is controlled by the pressure in the tank, a ring mounted for turning movement and carrying contacts engageable by the switch blade, means operable by the closing of the electric circuit for turning the ring in one direction, and means operable by subsequent opening of the circuit to automatically return the ring to original position.

9. A water supply system including a tank, a pump discharging into the tank and having a suction pipe, a bypass between the tank and suction pipe, means including electric circuits controlling the discharge of water through the by-pass; a switch common to both circuits, and electrically controlled means including a switch blade controlled by pressure in the tank for throwing the first mentioned switch, said means including a ring positioned about the switch blade, contacts carried by the ring and movable

about the same independently, and electrically actuated means for simultaneously moving the ring and its contacts.

10. A water supply system including a tank, a pump discharging into the tank and having a suction pipe, a bypass between the tank and suction pipe, means including electric circuits controlling the discharge of water through the by-pass, a switch common to both circuits, and electrically controlled means including a switch blade controlled by pressure in the tank for throwing the first mentioned switch, said means including a ring positioned about the switch blade, contacts carried by the ring and movable about the same independently, electrically controlled means for moving the ring and its contacts, and means for subsequently returning the ring and its contacts to original position.

11. A water supply system including a tank, a pump discharging into the tank and having a suction pipe, a by-pass between the tank and suction pipe, electric circuits controlling discharge of fluid through the by-pass, a switch common to said circuits, and means operable by pressure in the tank for actuating the switch, said means including an indicator having a switch blade, contacts adapted for engagement by the switch blade, a contact carrying ring upon which such contacts are adjustably mounted, said ring being mounted for turning movement and provided with sprocket teeth, a chain trained over the teeth of the ring, a counterweight carried by one end of the chain, a solenoid plunger carried by the other end of the chain, and a solenoid co-acting with the plunger and in a normally open circuit.

12. A water supply system including a tank, a pump discharging into the tank and having a suction pipe, a by-pass between the tank and suction pipe, electric circuits controlling discharge of fluid through the by-pass, a switch common to said circuits, and means operable by pressure in the tank for actuating the switch, said means including an indicator having a switch blade, contacts adapted for engagement by the switch blade, a contact carrying ring upon which such contacts are adjustably mounted, said ring being mounted for turning movement and provided with sprocket teeth, a chain trained over the teeth of the ring, a counterweight carried by one end of the chain, a solenoid plunger carried by the other end of the chain, a solenoid co-acting with the plunger and in a normally open circuit, and means for adjustably limiting the movement of the plunger.

13. A water supply system including a tank, a pump discharging into the tank, spaced contacts, a switch blade movable between said contacts and controlled by the pressure in the tank, means for simultaneously moving the contacts with respect to the switch blade, said means including a solenoid having operative connection with the contacts, and means for limiting the movement of the contacts.

14. A water supply system including a tank, a pump discharging into the tank, spaced contacts, a switch blade movable between said contacts and controlled by the pressure in the tank, means for simultaneously moving the contacts with respect to the switch blade, said means including a solenoid having operative connection with the contacts, and means for returning the contacts to normal position.

15. A water supply system including a tank, a pump discharging into the tank, spaced contacts, a switch blade movable between said contacts and controlled by the pressure in the tank, means for simultaneously moving the contacts with respect to the switch blade, said means including a solenoid having operative connection with the contacts, means for limiting the movement of the contacts, and means for returning the contacts to normal position.

16. A water supply system including a tank, a pump discharging into the tank, means for maintaining the pressure in the tank between predetermined limits, means for separately varying said limits, and electrically controlled means including a switch for simultaneously raising said limits.

In testimony whereof I affix my signature in presence of two witnesses.

HERMAN F. ROSENCRANS. [L. S.]

Witnesses:

J. DOWNER,

M. E. HOUGHTON.