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DRY PIPE VALVE FOR AUTOMATIC SPRINKLER SYSTEMS.

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Fig. 1.

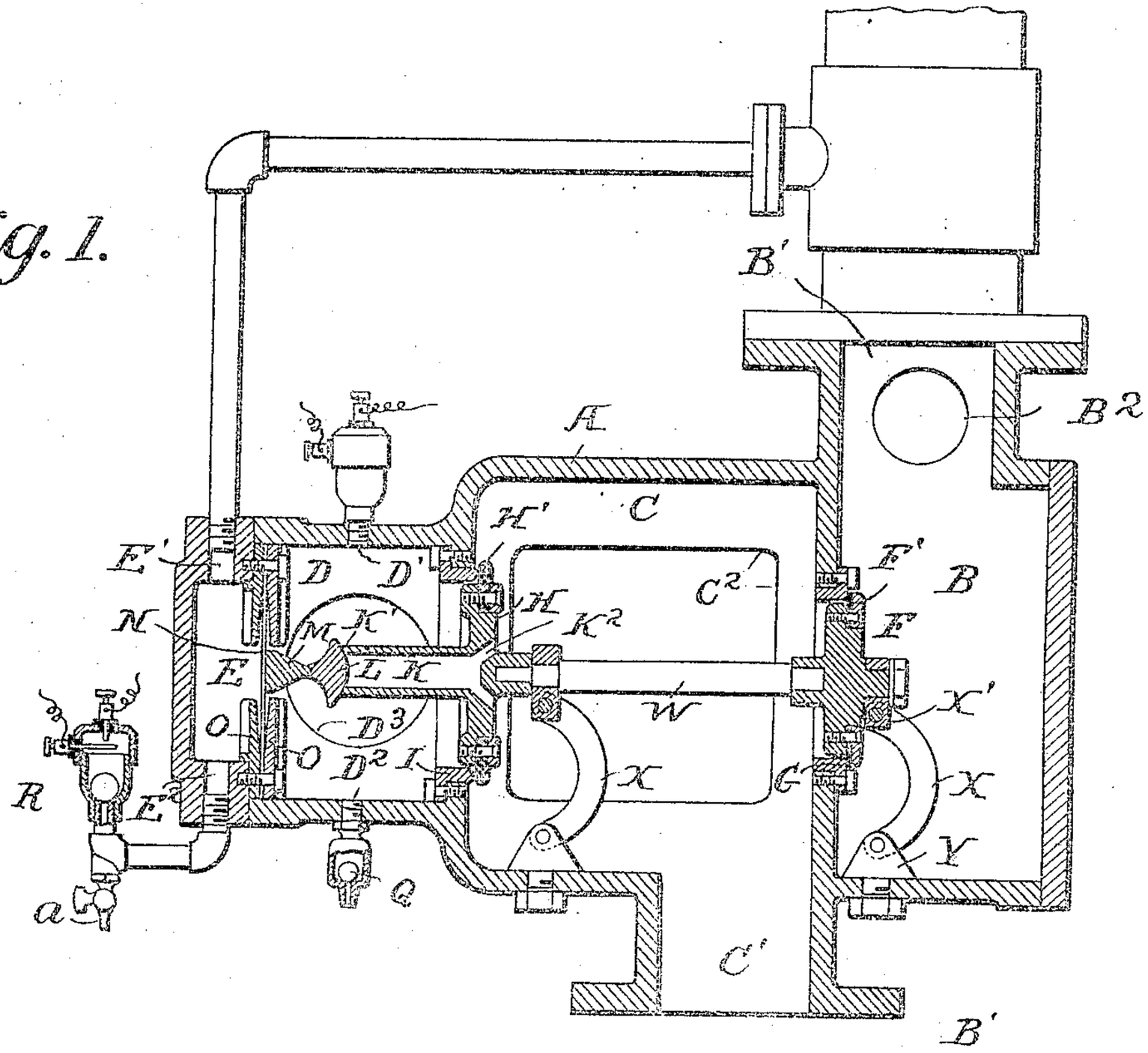
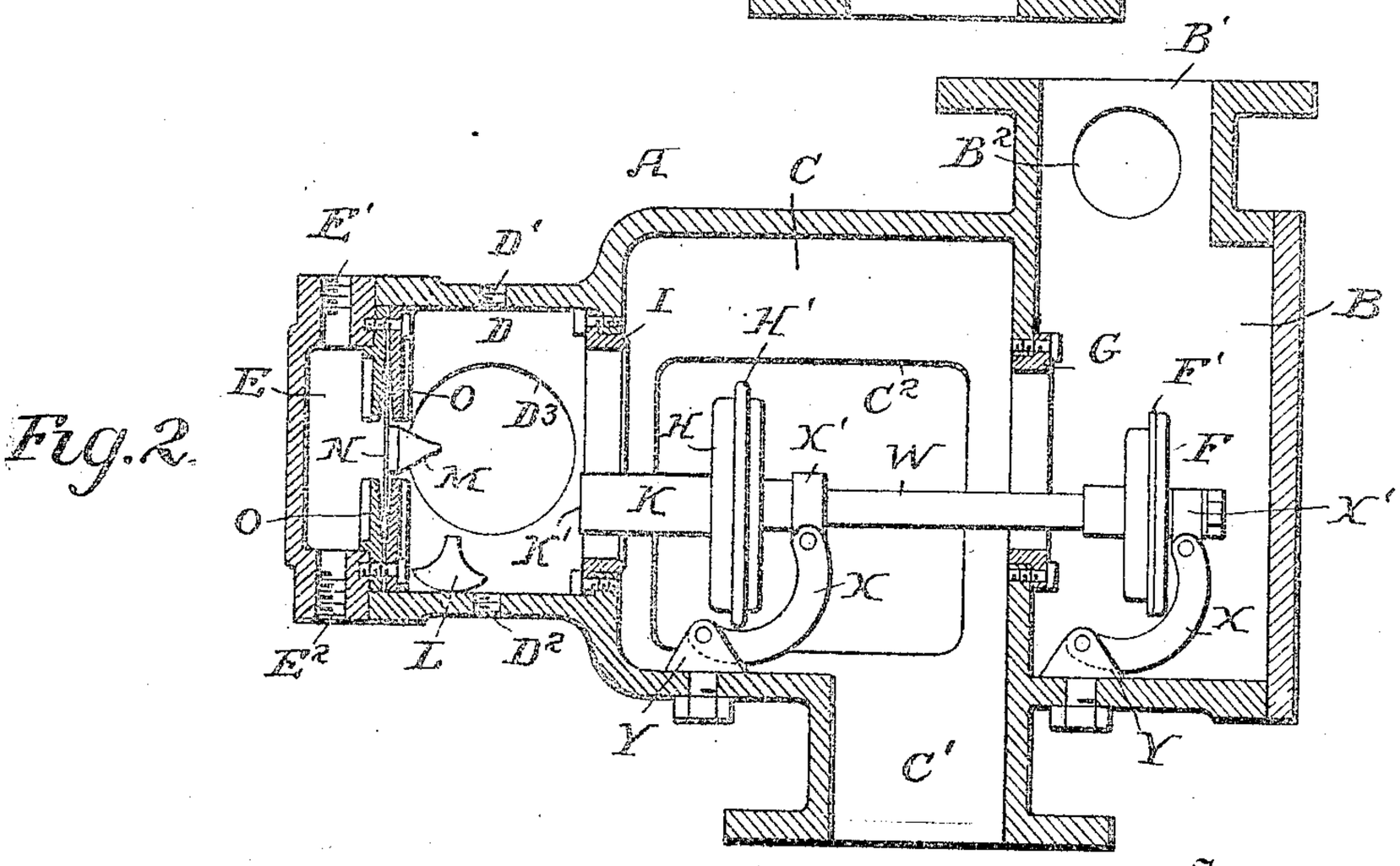


Fig. 2.



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UNITED STATES PATENT OFFICE.

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DRY-PIPE VALVE FOR AUTOMATIC SPRINKLER SYSTEMS.

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Application filed March 18, 1905. Serial No. 250,833.

To all whom it may concern:

Be it known that I, ERNEST S. CLAYTON, a citizen of the United States, residing at Newark, in the county of Essex, State of New Jersey, have invented certain new and useful Improvements in Dry-Pipe Valves for Automatic Sprinkler Systems, of which the following is a specification.

My invention relates to dry-pipe valves for use in automatic sprinkler systems, and has for its object to improve and simplify such constructions and to provide an efficient and effective valve and one in which the parts retain their positions until such time as it is desired to have it operate and then when operating shall operate effectively for the purpose intended.

To these ends my invention consists in a dry-pipe valve embodying the various features of construction and arrangement of parts having the general mode of operation and accomplishing the results substantially as hereinafter more particularly set forth.

Referring to the accompanying drawings, Figure 1 is a vertical section of a valve, showing the parts in the closed position; and Fig. 2 is a similar view showing the parts in the open position.

The general purposes and objects of a so-called "dry-pipe" valve for an automatic sprinkler system are understood by those skilled in the art, and need not be set forth herein, and the desirability of providing such a valve which shall operate effectively to control the flow of water until the emergency arises when it shall be used and which shall then quickly and effectively operate to supply the water and not be liable to fail in any respect in doing so has long been recognized. It is the general object of my invention to provide such an apparatus, and I will now proceed to describe the embodiment of my invention disclosed in the drawings, it being understood that the invention is not limited to the precise details of construction and arrangement nor to the particular use that is made of the device.

In the drawings the parts are represented substantially to scale—that is, to the preferred scale—it being understood, of course, that the parts will be properly proportioned and otherwise arranged to meet the requirements of any particular use.

The valve-case A incloses, among other things, four chambers with intermediate connections and appliances, whereby these chambers, through the medium of the water and air pressures, coöperate in producing the desired results. Of these chambers B may be termed the "riser-chamber," it being the chamber connected by means of the outlet B′ with the sprinkler-pipe system, which system under normal conditions contains air under pressure, so that the chamber B may properly be defined as a riser or air-pressure chamber. In actual practice it is preferable that the valve device shall be water-sealed, and under normal conditions this riser-chamber usually contains more or less water, which water may be introduced through the opening B^2, which may be connected to the drain-pipe of the sprinkler system and may have attached to it a valve and funnel to facilitate filling the riser-chamber with the requisite amount of water to form a water seal in setting the valve for operation.

The main or central water-pressure chamber C is provided with an inlet C′ and is connected to the source of water-supply and under normal conditions is filled with said fluid. The valve-case is preferably provided with a suitable hand-hole closed by a suitable cover device C^2, by means of which access can readily be obtained to this portion of the valve.

The auxiliary water-chamber D is provided with an opening D′, communicating with an alarm device, and with an opening D^2, provided with a suitable drainage-cock or suitable automatic drainage valve-check, being, as shown, a check-valve Q, arranged to allow water under practically no pressure, such as would be caused by a slight leak, to pass unobstructed, while any water under pressure or in considerable quantities would close the same and prevent its escape. It will be understood that under normal conditions when the valve is closed there is little or no water in this chamber, and any water that accidentally leaks therein may be drained off through the drainage-cock, or if sufficient water accumulates therein the alarm will be operated, calling attention to the fact, so that the chamber may be relieved of the water. It is also provided with a hand-hole closed by a suitable cover D^3, permitting ready access to the parts.

The diaphragm-chamber E is subjected to air-pressure in any suitable way and is shown as provided with an opening E′ communicating with a pipe leading either directly to the riser-chamber or to some of the pipes of the

sprinkler system, so that the chamber E will be subjected to the same air-pressure as is found in the pipes of the distributing system and in the riser-chamber B. This chamber E is also provided with an opening E^2, communicating with an alarm device R with a petcock *a* to indicate the presence of and discharge any water which might otherwise accumulate therein.

It will thus be seen that the valve-casing incloses four chambers, two of which, as B and E, which are on the extremes of the valve-casing, are open to air-pressure, one of the intermediate chambers, as C, being normally open to water-pressure and the other intermediate chamber D being in the nature of an auxiliary, or, so to speak, operating chamber in which the air therein is normally at atmospheric pressure and the chamber being practically free from water; but when the valve is operated this chamber receives the water-pressure in the manner hereinafter set forth.

The flow of water under pressure is controlled by a triple main valve—that is, a valve with three connected elements or gates. As shown, the three valves or gates F H L are on one stem W, and one has a rigid bearing on its seat, and the other two have independent flexible bearings. Mounted on one end of the rigid valve-stem W is the gate F, adapted to control the flow of water from the central water-pressure chamber C to the riser-chamber B and the distributing system connected therewith. This gate F may be variously constructed, but is shown as provided with a rigid bearing-surface F′, coöperating with the valve-seat G, which seat is preferably of nickel, bronze, or other non-corrosive substance. The gate H, also formed with or mounted on the rigid stem W, controls the passage between the central water-pressure chamber C and the auxiliary chamber D, except for a provision hereinafter specified, and this gate is shown as provided with a flexible ring-bearing H′ coöperating with the ring-seat I, which is preferably of metal. The stem W extends beyond the gate H in the form of a tube K, and its open end forms a valve-seat K′, while its other end is normally open into the chamber C through the passage or passages K^2.

The chambers D and E are separated from each other by a flexible metallic diaphragm N, which is shown as supported by a non-corrosive frame O O, and mounted on this diaphragm in the present instance is a button or ball-pointed cone-piece M. Arranged to cooperate with the valve-seat K′ is a gate or valve L, which is made of non-corrosive material and is preferably of substantially the shape shown, so as to present a spherical face to the valve-seat K′, and this valve is supported in position by the button or ball-pointed cone-piece M under normal conditions; but the gate or valve L is free to fall under the influence of gravity or otherwise when the valve is operated. It will be seen that the gate L, supported on the flexible diaphragm coöperating with the seat K′, constitutes an independent flexible valve and valve-seat—that is, the gate L is held against its seat through the medium of the flexible diaphragm N and the button M, and it will thus be seen that it constitutes practically a flexible valve and valve-seat, which is independent of the flexible seating of the gate H and the rigid seating of the gate F.

The gates or valves are shown in Fig. 1 in their normal closed position, where they remain until the valve is operated. I provide some suitable mechanical supporting means for the rigid stem and parts carried thereby, and in the present instance I have shown the arms X X connected to the stem in any suitable manner, as by the collars X′ X′, and mounted in the chambers B and C on the hinged suports Y Y, suitably secured to the walls of the valve. These arms are preferably curved, and when the valve is operated the rigid stem and its connections assume the position indicated in Fig. 2, so that the passages through the valve will tend to remain open.

While the relative proportions of the openings in the valve may vary, I have found that the following dimensions are practicable and desirable. The openings B′ and C′ are each, for instance, four inches in diameter. The opening closed by the gate F is preferably of similar dimension, while the opening closed by the gate H may be assumed to be five inches in diameter. The passage in the extension K is one inch in diameter and the diaphragm has an exposed surface of four inches in diameter. With these relative dimensions and assuming, for instance, that the water-pressure is one hundred pounds per square inch it exerts a pressure upon the gate F, tending to open the same, of 1,256+ pounds and upon the auxiliary-chamber gate H a pressure of 1,963+pounds, less the area of the one-inch opening in the extension K, or 78+pounds, equaling 1,884+pounds pressure, tending to maintain the gate H closed. Thus the excess of water-pressure in the chamber C, tending to hold the gates closed, is 588+pounds. Assuming, then, that the air-pressure in the riser-chamber B and diaphragm-chamber E is fifteen pounds to the square inch, the air-pressure on the face of the gate F, which may be assumed to be four and one-eighth inches in diameter on its face, will be 200+pounds, tending to maintain the gates closed, while the pressure on the diaprhagm N in the chamber E will be 188+ pounds, tending to displace the gate F, and this deducted from the air-pressure on the gate F in the riser-chamber leaves an excess pressure on the same, tending to seal or seat

the gate F, of 11+pounds. From this it will be seen that with a valve of the dimensions assumed the excess of pressure tending to seat the gates over the pressure tending to open the gates is 11+pounds excess air-pressure added to 548+pounds excess water-pressure, or a total of 560+pounds. It is further evident that any increase in water-pressure in the chamber C, due, for instance, to water-hammer or other cause, will further tend to seat the gates or hold them on their seats until perchance a water-pressure of two hundred and forty pounds is reached, which would balance the pressure exerted by the air on the diaphragm N and transmitted through the button M to the spherical gate L on the one-inch opening in the tubular extension K. Should it be necessary to provide for water-pressure in excess of this limit, (two hundred and forty pounds,) it will of course be necessary to increase the air-pressure to withstand the same. In this way it will be seen that the valve furnishes an effective construction, wherein the valve-gates will remain seated under relatively great changes in water-pressure, and at the same time it involves a relatively low air-pressure in the distributing system, and the parts are so arranged and coöperate together that when this air-pressure is released the valve will open quickly and completely and remain open without danger of being accidentally closed.

The operation of the valve in cases of emergency or necessity is exceedingly simple. Upon the unsealing of the air-pressure—as, for instance, by the operation of an automatic sprinkler-head or otherwise—the air-pressure is released in the riser-chamber B and diaphragm-chamber E, and as soon as this air-pressure is reduced to, say, 6+ pounds the water-pressure in the chamber C equalizes the air-pressure on the spherical gate L, which is held against the seat K′, and upon a further reduction of air-pressure water passes through the tube K into the intermediate auxiliary chamber D, and the spherical gate L drops by gravity or otherwise to the bottom of the chamber. As soon as this chamber D fills with water the pressure on both sides of the gate H becomes approximately equalized and the entire water-pressure of 1,336+pounds is exerted upon the riser-chamber gate F, and the gates are opened by the stem W swinging upon the arms X. If for any reason the gates should be swung back upon their seats, the pressure due to the column of water upon the riser-gate F and the pressure of the water in the water-chamber C against the gate H would not reseat or seal the valve, because the intermediate or auxiliary chamber D now being open to the water-chamber C through the one-inch tube or passage K will equalize the pressure in said chamber, and the gate L, having moved from the diaphragm by dropping or otherwise, cannot again close the passage K, so that the water-pressure in the auxiliary chamber D would be equal to that in the water-chamber C and the gate F would immediately be reopened. After the valve has once operated automatically in the manner set forth it cannot again be set until the movable gate L is manually placed in position, the various gates seated in any suitable way, and the air-pressure supplied to the riser and diaphragm chambers, In resetting the valve the supply of water to the chamber C should be cut off and sufficient water be introduced into the riser-chamber B to form a seal which will tend to temporarily hold the parts in position before the air-pressure is applied to the system.

It will thus be seen that by varying the relative dimensions of the different parts of the valve it can be made operative under different pressures of water and air and be so arranged that it is inoperative under relatively great changes of water-pressure, due to water-hammer or otherwise, and that it will only operate by changes in the air-pressure, and when such changes occur it will quickly operate to supply water to the distributing system and to continue said supply without liability of interrupting the same until the desired results are accomplished.

While I have described the valve L as loose, so as to fall completely out of position by gravity, it may be pivoted to swing downward or may be otherwise automatically movable out of its position or movable from its seat.

What I claim is—

1. In an apparatus of the character described, a casing containing four chambers, two in communication with distributing-pipes and both containing air under pressure, one in communication with a source of water-supply under pressure, and the other under atmospheric pressure, a valve closing the communication between the water-supply chamber and that under atmospheric pressure, and arranged to seat under the water-pressure, a second valve fitted to a port of less diameter than the first seating against the water-pressure and closing the communication between the water-chamber and one of those under air-pressure, and means whereby a reduction of pressure in the air-pressure chambers causes said valves to be opened, substantially as set forth.

2. In an apparatus of the character described, the combination with a casing having two chambers communicating independently with distributing-pipes normally containing air under pressure, a water-chamber communicating with a source of water-supply under pressure, a chamber under atmospheric pressure, a port between the latter chamber and the water-chamber, a port of less diameter between the water-chamber and

one of the air-pressure chambers, connected valves fitted to said ports, the smaller closing under air-pressure against the water-pressure, and the larger under the water-pressure, and means for equalizing the water-pressure on both sides of the larger valve on the reduction of pressure in the distributing-pipes and air-pressure chambers, substantially as set forth.

3. In an apparatus of the character described, the combination with a valve-casing having four chambers, one of the chambers being connected to be normally under water-pressure, of passages connecting said chamber to two other chambers, one under atmospheric pressure and the other under air-pressure in excess of atmospheric pressure, a diaphragm interposed between the air-pressure and atmospheric-pressure chambers, a valve-stem supporting valves controlling the passage between the water, air and atmospheric chambers, and a valve controlling the passages between the water and atmospheric chambers and seated under air-pressure, substantially as set forth.

4. In an apparatus of the character described, the combination with a valve-casing having a chamber connected to be normally under water-pressure, a riser-chamber normally under air-pressure, and an auxiliary chamber under atmospheric pressure, of passages between the water-chamber and both the riser and auxiliary chambers, a valve having gates closing both said passages under water-pressure, and a third valve seated against the water-pressure by air-pressure, substantially as described.

5. In an apparatus of the character described, the combination with a valve-casing having a chamber connected to be normally under water-pressure, a riser-chamber normally under air-pressure, and an auxiliary chamber under atmospheric pressure, of passages between the water-chamber and both the riser and auxiliary chambers, a valve having gates closing both said passages under water-pressure, a third valve, and diaphragm connected therewith whereby to seat said valve by air-pressure against the water-pressure, substantially as described.

6. The combination with the valve F controlling the port between the air and water chambers of an automatic fire-extinguisher, and seated under air-pressure, of a connected valve H seated under water-pressure to hold the air-pressure valve to its seat, and means whereby to admit the water-pressure to both sides of the valve H on a reduction of the air-pressure, substantially as set forth.

7. The combination of the casing having a chamber communicating with a water-supply, a chamber under air-pressure, and one under atmospheric pressure, with a port between the water-chamber and each of the other chambers, a valve having two connected heads closing said ports under water-pressure, a second port between the chamber under atmospheric pressure and the water-chamber, a valve closing said port, and a diaphragm maintained on said latter valve by air-pressure, substantially as set forth.

8. In an apparatus of the character described, the combination with a valve having a water-chamber connected to be normally under water-pressure, an auxiliary chamber under atmospheric pressure, and a diaphragm-chamber under air-pressure, of a valve having a tubular extension, a gate for the passage between the water-chamber and auxiliary chamber, and a movable gate controlling the opening of the tubular extension and controlled by the diaphragm, substantially as described.

9. In an apparatus of the character described, the combination with a valve-casing having a chamber, of a gate closing the chamber at one side, a tubular extension through the gate, a diaphragm closing the chamber at the other side, and an independent loose gate normally closing the tubular extension under the influence of the diaphragm and supported to fall from normal position when the diaphragm is moved, substantially as described.

10. In an apparatus of the character described, the combination with a valve having a water-chamber connected to be normally under water-pressure, a riser-chamber under air-pressure, an auxiliary chamber under atmospheric pressure, a diaphragm-chamber under air-pressure, and a diaphragm between the diaphragm-chamber and auxiliary chamber, of a triple-seated valve having gates controlling the passages between the water-chamber and riser-chamber and water-chamber and auxiliary chamber and a tubular extension into the auxiliary chamber, and an independent gate controlling said tubular extension and controlled by the diaphragm, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERNEST S. CLAYTON

Witnesses:
C. A. GAULWAITE,
G. F. HUTCHINGS