R. D. JOHNSON.

AUTOMATIC VALVE.

APPLICATION FILED AUG. 16, 1917.

1,319,154.

Patented Oct. 21, 1919.

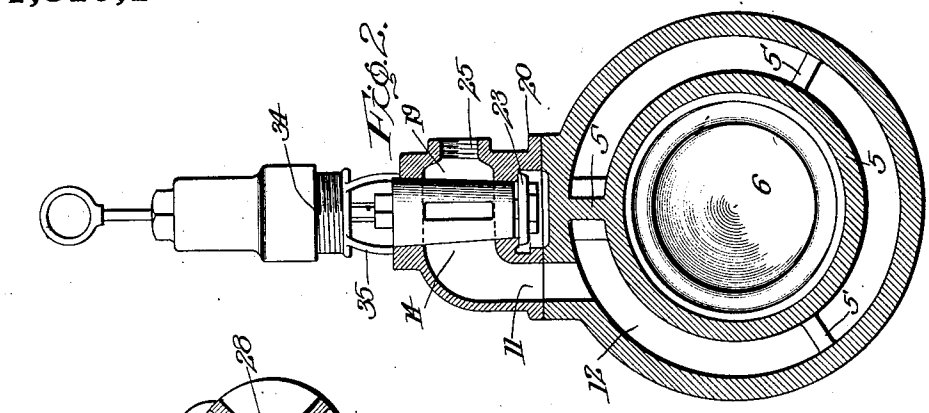

Fig. 2.

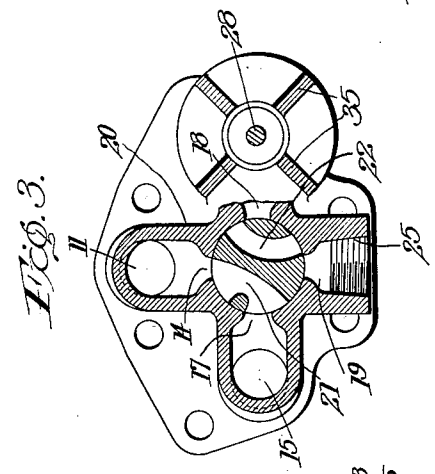

Fig. 3.

Fig. 1.

Fig. 4.

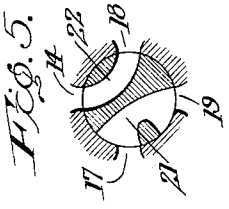

Fig. 5.

Witness

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AUTOMATIC VALVE.

1,319,154. Specification of Letters Patent. Patented Oct. 21, 1919.

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To all whom it may concern:

Be it known that I, RAYMOND D. JOHNSON, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Automatic Valves, of which the following is a specification.

The present invention relates to valves adapted to close automatically when the pressure in the main drops below a predetermined amount.

It often happens, in burning buildings, that the floors fall and sever a main supply pipe of a sprinkler system, and this may well occur at or near the lowest floor, thus cutting off the supply from the building, but opening wide the feeder pipe and discharging, without resistance, into the basement of the building.

In such a case, the free discharge causes such a bleeding of the supply system that the pressure in the street main drops off to such an extent that it is impossible to get sufficient water from adjacent hydrants to fight the fire in the building or adjacent thereto, in case the fire has spread outside of the building containing the automatic sprinklers.

It is the object of the invention to provide a valve system that may, if desired, be operated by hand and also includes mechanism for automatically closing the valve when the pressure in the main drops below a certain critical value. I carry out this object by providing, for hand operation, a valve operative to alternately connect opposite ends of the main valve to a source of pressure and an exhaust respectively and, for automatic operation, an auxiliary valve normally kept in closed position, but responsive to the drop of pressure in the main to open of its own accord, when the pressure in the main decreases below a predetermined point, and thereby allowing the main valve to close.

The valve construction shown is an improvement on or addition to that shown in my prior Patent No. 1,030,890, patented July 2, 1912.

In the appended drawings which illustrate my invention—

Figure 1 is a central longitudinal section through the main and the valve system;

Fig. 2 is a transverse section on line 2—2 in Fig. 1;

Fig. 3 is a section on the line 3—3 in Fig. 1; and

Figs. 4 and 5 are diagrammatic representations of the ports of the control valve.

1 represents the main of a supply system or other fluid conduit having an enlargement 2 constituting a valve chamber. At one end of the valve chamber indicated by the numeral 3, the main is contracted in cross-sectional area to form a circular valve seat 4. From the contracted portion 3 the main increases gradually to its normal width. The valve proper comprises a hollow fixed section 5 connected to the main 1 by ribs 5′ and a movable section 6. The movable section 6 has a flange 7 in sliding engagement with the internal wall 8 of the fixed section, and defines in conjunction with the end wall 9 of the cylindrical wall 8 an annular chamber 10. The relation of the flange and the movable section 6 is such that, when the movable section is seated against the valve seat 4, *i. e.*, when the valve is closed, the flange 7 is a definite distance from the end wall 9.

As seen in Figs. 1 and 2, the valve chamber 2 carries at its upper surface the valve operating mechanism. The medium for operating the movable section is the fluid of the main. A duct 11 leads from the upstream portion 12 of the valve chamber 2 to the intake port 14 of a four-way valve 21. Ducts 15 and 16 lead from the opposite ends of the fixed section 5 to ports 17 and 18 respectively. Duct 15 opens into the internal chamber 100 on the up-stream side of the movable section 6, while duct 16 opens into the annular chamber 10. Another port 19 connects to an exhaust 25 to the atmosphere.

The various ducts and ports referred to are united in a single casing 20. The valve or plug 21 is rotatably seated in the space defined by the ports 14, 17, 18 and 19 and has passageways 21 and 22 adapted to establish connection between the various ports for operating the valve. The plug 21 has bearing in casing 20 above and below the ports mentioned and is retained in position by a nut 23 or other suitable means. The casing is removable from the valve chamber 2 as a unit.

As seen in Figs. 3, 4 and 5, the plug 21 may be turned to establish communication between the ducts 11 and 15, 11 and 16, duct 15 and exhaust 25 and duct 16 and exhaust 25.

If it is intended to close the valve by hand, the plug 21 is turned to the position shown in Fig. 4. The duct 11 leading from the main supplies water under pressure through the duct 15 into the internal chamber 100. At the same time the duct 16 is in communication with the exhaust 25. The water pressure acting on the up-stream side of the valve will therefore force the valve to its seat 4, the duct 16 being open to the exhaust 25, (Fig. 1).

In order to open the valve again, the plug 21 is turned into the position shown in Fig. 5. The duct leading from the main supplies water under pressure through the duct 16 into the annular chamber 10, while at the same time the internal chamber 100 is in communication through duct 15, with the exhaust 25. The water pressure acts against the flange 7 and the water contained in the chamber 100 will be forced out through the duct 15 and the exhaust 25.

In order to close the valve automatically I have provided an auxiliary exhaust connection for duct 16 and means for making this connection operative when the pressure in the main on the down-stream side of the valve drops below a critical point. This auxiliary exhaust is shown in the form of a valve needle 26 projecting into an enlarged portion of duct 16. It is supported on a plunger 27. The plunger 27 and plunger rod 28 have sliding movement in a housing 29. A spring 30 surrounds the rod 28 in the housing and tends to move valve 26 away from its seat 31 to open the valve. As seen in Fig. 1 the housing 29 is made adjustable by making it in two parts 32 and 33 interconnected by a screw-threaded engagement indicated by the numeral 34. The tension of the spring 30 may thereby be regulated within a suitable range. The housing is connected to the casing 20 by legs 35 or in any other suitable manner.

The operation of this automatic valve is as follows:

When the main valve is in normal *i. e.* open position, the plug 21 is in the position shown in Fig. 3, and section 6 of the main valve is in the dotted line position, and kept open by the pressure on its down-stream face, this pressure also tending to cause leakage around the section 6 to keep the chamber 10 full of pressure water. The water from the up-stream side of the main has direct access to the internal chamber 100 through the small port 36, while the water in the annular chamber 10 and duct 16 is confined, the plug 21 and valve 26 closing the only outlets from the said chamber. When the pressure in the main at the downstream side of section 6 decreases below a predetermined point, the difference of pressure between the water in the annular chamber 10 and the main at that point causes sufficient leakage from chamber 10 around section 6 where it passes through the end wall 9, to allow spring 30 to slightly open the valve 26. This action will continue until the chamber 10 is in full communication with the exhaust. The pressure of the water in the internal cylinder will then force the movable section toward and against seat 4 and the water in annular chamber 10 will flow out past valve 26. This position is indicated in Fig. 1.

It is to be noted that normally *i. e.* when the pressure at the down-stream side of the valve is sufficiently high, no leakage can take place from the annular chamber 10 around the movable section 6, because there is not sufficient difference of pressure between the water in the annular chamber and the water at downstream side of the valve. However, when the pressure in the main decreases a predetermined amount the resulting difference of pressure produces a leakage sufficient to allow valve 26 to slightly open and once the breach is made the valve 26 will rapidly open completely and the difference in pressure between the water at the up-stream side of the movable section 6 in the internal chamber 100 and the water at the down-stream side of the section 6 is sufficient to force the section 6 against its seat 4.

It is to be observed that the effective area of pressure at the up-stream side of the section 6 is proportional to the cross sectional area of the internal chamber 100, while the effective area of pressure at the down-stream side of the section 6 outside the wall 9 is proportional to the cross sectional area of the section 6. Moreover, the pressure is reduced at the down-stream side through the contraction of the main. When chamber 10 is exhausted through the opening of valve 26, the difference of pressure between the water in the internal chamber 100 and the water acting on the valve in opposite direction is such as to insure the closing of the valve section 6.

When the internal chamber 100 is connected to the exhaust and the chamber 10 to the supply, the difference in pressure is likewise such as to promptly open the valve section 6.

When the system is in normal condition, the water in the annular chamber 10 surrounding the flange 7 is absolutely confined, as previously stated, and the pressure at the up-stream end of the section 6 cannot act until the pressure in chamber 10 is partly destroyed.

To reset the valve system again, after the pressure is recovered, it is only necessary

to turn the plug 21 in the position shown in Fig. 5 to open the valve, as previously described, and when it is entirely open to turn the plug to the position shown in Fig. 3 which is the neutral position.

While I have shown and described various specific details, my invention may be carried out in other ways and other forms, and what is shown is for purposes of illustration only.

I claim:

1. In a valve of the type recited the combination of a casing, a cylindrical section spaced from the casing to form a fluid way, a plunger section forming with the cylindrical section an internal chamber and an annular chamber having communication with the fluid way, means for maintaining restricted communication between the internal chamber and the fluid way in the open position of the valve, and an automatic exhaust valve normally closing the exhaust from the annular chamber under balanced pressure in the fluid way and in both chambers and in open position of the plunger and adapted to automatically open in response to a predetermined drop in pressure communicated to the annular chamber from the outlet side of the plunger thereby unbalancing the pressure and closing the valve, substantially as described.

2. In a valve of the type recited the combination of a casing, a cylindrical section spaced from the casing to form a fluid way, a plunger section forming with the cylindrical section an internal chamber and an annular chamber having communication with the fluid way, a controlling valve for admission and exhaust of each of said chambers to open and close the plunger and including means for maintaining restricted communication between the internal chamber and the fluid way and for closing the exhaust of the annular chamber in open position of the plunger, an exhaust duct arranged on the outlet side of the controlling valve and communicating with the annular chamber, and an automatic valve normally closing the duct in open position of the plunger and adapted to open in response to drop in pressure on the outlet side of the plunger and permit the plunger to close, substantially as described.

In testimony whereof I affix my signature.

RAYMOND D. JOHNSON.