Oct. 25, 1927. 1,646,618

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DRY PIPE VALVE ACCELERATOR

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Fig. 2.

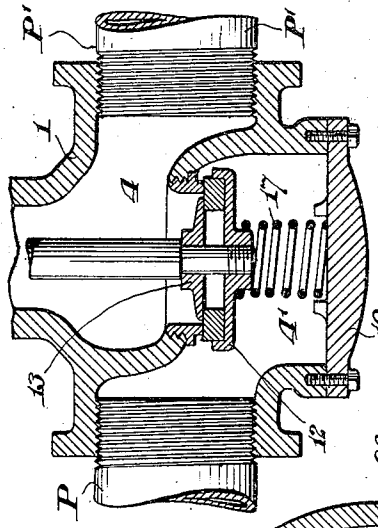

Fig. 1.

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DRY-PIPE-VALVE ACCELERATOR.

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Devices, known as accelerators, for speeding up the opening of dry pipe valves in automatic sprinkler systems are frequently employed and the principal object of my invention is to provide an improved device for that purpose which is sensitive in operation so as to function promptly and positively on a sudden reduction in the pressure in the air line of the system; which will not function upon the occurrence of gradual changes in the pressure in the air line; which is so designed as to prevent accidental functioning due to building up of internal pressure in the accelerator, and which is self setting or, in other words, so constructed that after the accelerator has functioned the parts thereof will automatically return to normal position.

My invention further contemplates general improvements in the design, arrangement and construction of accelerators for use in connection with the dry pipe valves of automatic sprinkler systems, as well as various other objects and advantages to which reference may hereinafter be made or which will be apparent from the following description of a preferred embodiment of the invention as illustrated in the accompanying drawing.

In the said drawing Fig. 1 is a longitudinal vertical section through the accelerator with certain portions thereof shown in elevation and the parts in normal position and Fig. 2 is a vertical section on line 2—2 in Fig. 1 looking in the direction of the arrows but on a somewhat smaller scale. The same symbols are used to designate the same parts in both figures.

As shown, the device comprises a body 1, preferably of cast metal, having a removable cover 2 and arranged to provide a valve chamber in its lower part and a main diaphragm chamber X, preferably of greater diameter than the valve chamber, in its upper part, said chambers being disposed more or less coaxially. The diaphragm chamber may be considered as comprising a lower chamber 3 in the body proper and an upper chamber 3′, the latter being formed in the cover which is, for that purpose, concave on its lower side. The cover is removably secured to the body by bolts 5 passing through flanges with which the parts are provided, and is also provided with a laterally extending boss 2′ through which is extended a passage 6 which opens into the chamber 3′ and the function of which is hereinafter more particularly described.

The valve chamber is divided into upper and lower chambers 4 and 4′ by a transversely extending web 8 which has an opening at its center in which is disposed a removable valve seat 9 the lower face of which extends into the chamber 4′. The lower open end of this chamber is closed by a removable plate 10. The valve seat 9 is cooperative with a valve disk or ring 11, preferably of relatively soft rubber or similar material, disposed in the chamber 4′ and seated between a cup-shaped support 12 and a disk 13 carried at the lower end of a valve stem 14 which projects upwardly within the body, and through a guide bushing 15 disposed therein, to terminate in the diaphragm chamber. Secured to the upper end of the stem is a flexible diaphragm 16 extending across the main chamber, the edges of the diaphragm being clamped between the upper face of the body and the lower face of the cover, so that when the diaphragm is deflected downward from its normal horizontal position, the valve ring 11 will be moved from its seat to establish free communication between the chambers 4 and 4′. Under operative conditions the chamber 4′ is connected by a pipe P with the air line of the sprinkler system in which an air pressure of from 25 to 40 lbs. is ordinarily maintained, while the chamber 4 is ordinarily connected by a pipe P′ with the intermediate chamber of the dry valve (not shown) which is at atmospheric pressure. For urging the valve ring 11 toward its seat a compression spring 17 is disposed between the plate 10 and the valve support 12.

The body is also provided with a laterally offset portion 20, either separate from or integral with the main part of the body, providing an auxiliary diaphragm chamber Y preferably having an upwardly converging wall terminating in a neck 20′. The lower open end of this portion 20 is closed, in the assembled device, by a cover 21 concave on its inner face, the chamber Y thus formed being divided into upper and lower chambers 22, 22′ by a normally horizontally extending diaphragm 23 whose edges are clamped between the cover and the portion 20 of the body to which the cover is secured by bolts 24.

This laterally offset portion 20 of the body is connected to the lower part of the latter

by a neck 20'' through which is extended a passage 24 which permits free communication between the chambers 4' and 22 and from which a branch passage 25 is extended downward into a horizontally disposed bore 26 formed in a lug or offset 21' integral with the cover 21. If the diaphragm 23 is arranged to extend across the passage 25 as shown, it will of course be suitably apertured in alignment with the passage so as to permit free communication through the latter.

The bore 26 is preferably arranged to extend from the chamber 22' to the outer end of the lug 21', and between the chamber and the junction of the passage 25 and the bore, a bushing 27 is screwed or otherwise seated in the latter, this bushing being provided with a minute orifice 28 affording communication through the bushing from the bore 26 to the chamber. To prevent clogging of the orifice by particles of dust or dirt a cylindrical screen 29 of fine wire gauze or other suitable material is disposed in the bore, the inner end of the screen being arranged to seat over the reduced outer end of the bushing and the outer end of the screen being soldered or otherwise secured to a plug 30 which is threaded into the enlarged outer end of the bore. Thus by removing the plug and screen as a unit, the screen can be readily cleaned when desired.

Upon the diaphragm 23 for movement therewith is suitably mounted an upwardly projecting stem 31 at whose upper end is disposed a preferably conical valve 32, which may be formed of rubber or other suitable material, arranged to cooperate with a suitable seat 33 disposed in the neck 20'. The neck is provided with a horizontal flange at its upper end and between this flange and the end of the boss 2' of the cover 2 and securely bolted in position, is disposed an elbow 35 having a passage 6' forming a continuation of the passage 6 thus connecting the chamber 3' above the diaphragm 16 with the chamber 22 above diaphragm 23, the valve 32 being effective to interrupt or establish communication therebetween in accordance with its position. For continually urging the valve 32 toward its seat a relatively light compression spring 36 is disposed above the valve and partially within the enlarged lower end of the passage 6'.

The operation of the accelerator when connected in an automatic sprinkler system by the pipes P, P' as heretofore described is as follows: Under normal conditions, that is, when the ordinary air pressure of 25 to 40 lbs. is maintained in the air line of the system, with which line the sprinkler heads are connected, the several parts of the accelerator are maintained substantially in the position shown in the drawing since the pressure in chambers 4', 22 and 22' is equalized and substantially similar to that in the air line with which the chamber 4' is connected, the equalization between chambers 4' and 22 taking place through passage 24 and between these two chambers and 22' through the restricted orifice 28. The diaphragm 23 being thus subjected to equal pressure on both sides will assume a substantially horizontal position thus closing valve 32, while the pressure on the under side of valve support 12 assisted by the spring 17 retains the valve ring 11 closely on its seat with diaphragm 16 in horizontal position. The pressure above and below the diaphragm 16 is also equalized since the chambers 3 and 3' are respectively in communication with the atmosphere, the former by a port 38 through the wall of the body, and the latter by a vent 39 preferably of relatively small diameter extending through the wall of the cover 2; additionally, since the intermediate chamber of the dry valve is at atmospheric pressure and is connected by pipe P' with the chamber 4, the latter is also at atmospheric pressure.

Upon a material and sudden fall in the pressure in the air line due to the opening of one of the sprinkler heads or other cause, a corresponding fall occurs in chambers 4' and 22 by reason of the connection of the former with the air line and the free communication between the two chambers afforded by the relatively large passage 24. This sudden lessening of the pressure against the upper side of the diaphragm 23 in conjunction with the relatively high pressure which still obtains in chamber 22' by reason of the retardation of the escape through orifice 28 of the high pressure air trapped in said chamber, causes the diaphragm to move upward from its normal position thus opening valve 32 against the action of spring 36 and permitting the escape of air through passages 6', 6 to chamber 3' at a pressure substantially corresponding to that within chamber 22, which, while lower than the normal pressure in the air line, is still considerably in excess of the atmospheric pressure in chamber 3. This escaping and relatively high pressure air causes a downward movement or deflection of diaphragm 16 with resultant opening of the valve controlling the passage through web 8 thus placing chamber 4' in communication with chamber 4 so that the air from the air line can exhaust through the latter and thence through pipe P to the intermediate chamber of the dry valve from which it escapes to the atmosphere. The rapid exhaustion of the air in the pipe line which is thus effected materially enhances the rapidity of opening of the dry valve following the opening of a sprinkler head, with corresponding increase in the rapidity with which the water is permitted to enter the air line

and reach the heads, the relatively high pressure air which is discharged into the intermediate chamber of the dry valve probably also assisting to some extent in the opening movement of the air clapper therein.

It will be apparent that so long as pressure in the chamber 22′ is in excess of that in 22 in an amount sufficient to hold valve 32 open against spring 36, the diaphragm 16 will be flexed downward from normal position and the valve controlling the passage between chambers 4 and 4′ held open since by reason of the fact that the area of the diaphragm 16 is very much greater than the area of the latter valve a relatively light pressure on the diaphragm will keep the valve open against the urge of spring 17 supplemented by any excess pressure in chamber 4′ acting in a direction to close the valve. Of course so long as the valve 32 is open the pressures in chambers 3′ and 22 are substantially equal as said chambers are in communication with each other but by reason of friction in the passages or from other causes a slight differential may exist in the pressures in the two chambers even under these conditions.

It will be further apparent that the pressures above and below the diaphragm 23 will slowly equalize through orifice 28 and as this condition is reached spring 36 becomes effective to return valve 32 to its seat and diaphragm 23 to normal position; correspondingly, diaphragm 16 will gradually assume normal position with consequent closing of the valve which it controls, spring 17 assisting in this action. Thus after the accelerator has functioned the parts are gradually returned to normal position automatically.

The small vent 39 from chamber 3′ is provided with a view to preventing the trapping of any high pressure air in the chamber and passages 6, 6′, when the parts return to normal position and which, in the absence of some such means, might otherwise occur; the presence of the vent thereby assures the maintenance of similar pressures above and below the diaphragm except during the functioning of the accelerator during which but little of the high pressure air escapes through the vent owing to the small size of the latter.

It sometimes happens that variations in pressure gradually occur in the air line of a sprinkler system by reason of the action of the air compressor, slow leaks or the like. Such variations, however, are not effective to cause the accelerator to function in the manner hitherto described, since upon the occurrence thereof a corresponding equalization of pressure takes place between chambers 22 and 22′ through the orifice 28 which is of suitable size to slowly permit the passage of sufficient air for this purpose but not of sufficient size to effect such equalization with sufficient rapidity to prevent the functioning of the accelerator upon the occurrence of a material and sudden drop of pressure in the air line due to the opening of a sprinkler head.

While I have herein illustrated and described with considerable particularity a preferred embodiment of my invention in a form adapted for convenient installation in commercial sprinkler systems, I do not thereby desire or intend to specifically limit myself to any precise details of design, construction or arrangement of the various elements of the device as changes and modifications may be made therein if desired without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

1. An accelerator comprising a body having separated diaphragm chambers, a valve chamber having an inlet, a passage establishing communication between the diaphragm chambers, a valve controlling the flow of fluid from the inlet side of said valve chamber to another part thereof and operatively connected with a diaphragm in one of the diaphragm chambers, a valve controlling the passage between the diaphragm chambers and operatively connected with the diaphragm in the other diaphragm chamber and means establishing communication between the inlet side of the valve chamber and said last mentioned diaphragm chamber at points on opposite sides of the diaphragm therein.

2. An accelerator as specified in claim 1, in which said means comprise an unrestricted passage affording communication between the valve chamber and that portion of the diaphragm chamber lying on one side of the diaphragm and another and restricted passage affording communication between the valve chamber and that portion of the diaphragm chamber lying on the other side of the diaphragm.

3. An accelerator as specified in claim 1, in which said means comprise a passage disposed to afford free communication between the valve chamber and that portion of the diaphragm chamber lying on the side of the diaphragm most nearly adjacent the valve controlling the passage between the two diaphragm chambers and a passage having a restricted orifice disposed to afford restricted communication between the valve chamber and that portion of the said diaphragm chamber lying on the opposite side of the diaphragm and remote from said valve.

4. An accelerator comprising a body having a valve chamber divided by an apertured web, a main diaphragm chamber disposed above the valve chamber and an auxiliary diaphragm chamber, said diaphragm chambers being connected by a passage, a valve controlling the flow of fluid through

said web and connected to a diaphragm in the main diaphragm chamber, a valve controlling said passage and connected to a diaphragm in the auxiliary chamber, a passage affording free communication between that part of the auxiliary chamber lying above the diaphragm with that part of the valve chamber lying below the valve therein and another passage affording restricted communication between the same portion of the valve chamber and that part of the auxiliary chamber lying below the diaphragm therein.

5. An accelerator as specified in claim 4 in which the valve in the valve chamber is arranged to be opened by a downward movement of the diaphragm in the main diaphragm chamber and the valve controlling the passage connecting the diaphragm chambers is arranged to be opened by an upward movement of the diaphragm in the auxiliary diaphragm chamber.

6. An accelerator as specified in claim 4 in which the valve in the valve chamber is closed when the diaphragm in the main diaphragm chamber is in a substantially horizontal position and the valve controlling the passage between the diaphragm chambers is closed when the diaphragm in the auxiliary diaphragm chamber is in a substantially similar position.

7. An accelerator comprising a body having a valve chamber divided into upper and lower portions by an apertured web, a main diaphragm chamber disposed above the valve chamber and vented to the external atmosphere and an auxiliary diaphragm chamber laterally offset with respect thereto, a valve controlling communication from the lower part of the valve chamber to the upper part thereof, a diaphragm in the main diaphragm chamber adapted to operate said valve, a passage extending from above said diaphragm to the upper part of the auxiliary chamber, a diaphragm extending across said auxiliary chamber, a valve operatively connected to said diaphragm and controlling said passage, means tending to maintain said valve closed, a passage extending from the lower part of the valve chamber to the upper part of the auxiliary chamber above the diaphragm therein and affording free communication therebetween, another passage affording restricted communication between the valve chamber and the lower part of the auxiliary chamber beneath the diaphragm therein, means for establishing communication between the lower part of the valve chamber and the air line of a dry pipe sprinkler system, and means for establishing communication between the upper part of said valve chamber and the intermediate chamber of the dry valve, whereby under normal conditions a substantially balanced pressure is maintained on both sides of the diaphragm in the auxiliary chamber but on a reduction of pressure in the lower part of the valve chamber the diaphragm in the auxiliary chamber is flexed to open the valve with which it is operatively connected thereby establishing communication between the two diaphragm chambers and creating an unbalanced pressure on opposite sides of the other diaphragm to open the valve in the valve chamber.

8. An accelerator as specified in claim 7 and embodying means tending to urge the valve in the valve chamber against its seat and maintain it in closed position.

9. An accelerator as specified in claim 7 in which the effective area of the diaphragm in the main diaphragm chamber is in excess of the effective area of the valve in the valve chamber whereby a given pressure acting against the diaphragm is operative to open the valve against a relatively higher pressure acting against the valve in the opposite direction.

10. An accelerator comprising a body having a plurality of chambers and a valve chamber having an inlet, means establishing communication between the first mentioned chambers, a valve operative to control communication from the inlet side of the valve chamber to another part thereof, a movable element disposed in each of said first mentioned chambers, means connecting the valve with one of said elements, passages respectively extending from the inlet side of the valve chamber to points on opposite sides of the movable element in the other of said first mentioned chambers and a valve operable in conformity with the movement of the other movable element and adapted to open and close said means by which communication is established between said first mentioned chambers

11. An accelerator comprising a body having main and auxiliary diaphragm chambers, a valve chamber having an inlet, means establishing communication between the diaphragm chambers, a diaphragm in each diaphragm chamber, a valve in the valve chamber controlling the flow of fluid from the inlet side of said chamber to another part thereof and operatively connected with the diaphragm in the main chamber, a plurality of passages establishing communication between the inlet side of the valve chamber and the auxiliary chamber upon opposite sides of the diaphragm therein and means operable in conformity with the movements of said diaphragm to control communication between the diaphragm chambers.

In witness whereof, I have hereunto set my hand this 22nd day of April, 1925.

LEROY M. LEWIS.