

April 22, 1924.

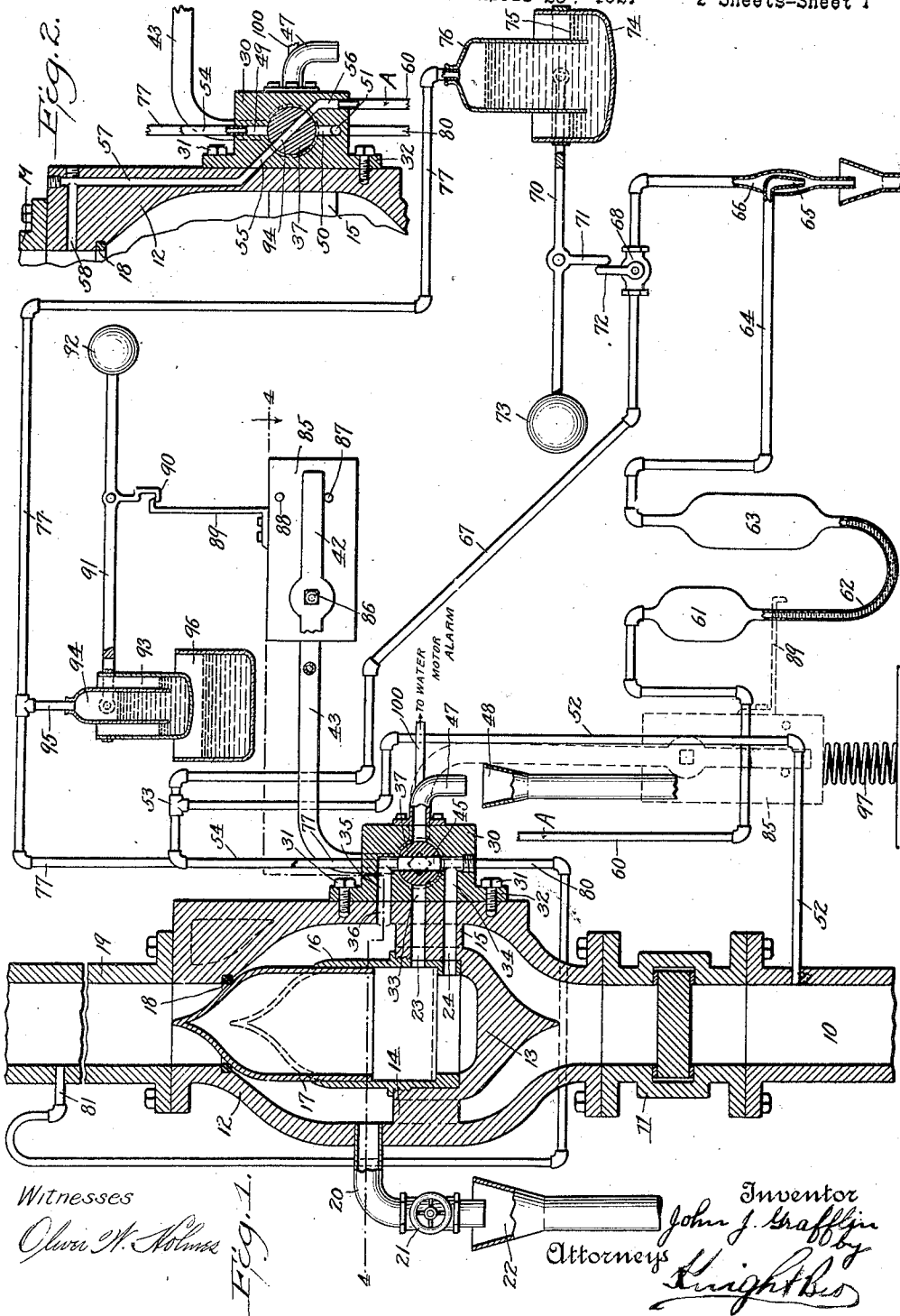
J. J. GRAFFLIN

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AUTOMATIC SPRINKLER SYSTEM CONTROL

Filed April 25, 1921

2 Sheets-Sheet 1



Witnesses

Oliver M. Holmes

Fig. 1.

Inventor
John J. Grafflin
Attorneys
Knight & Co.

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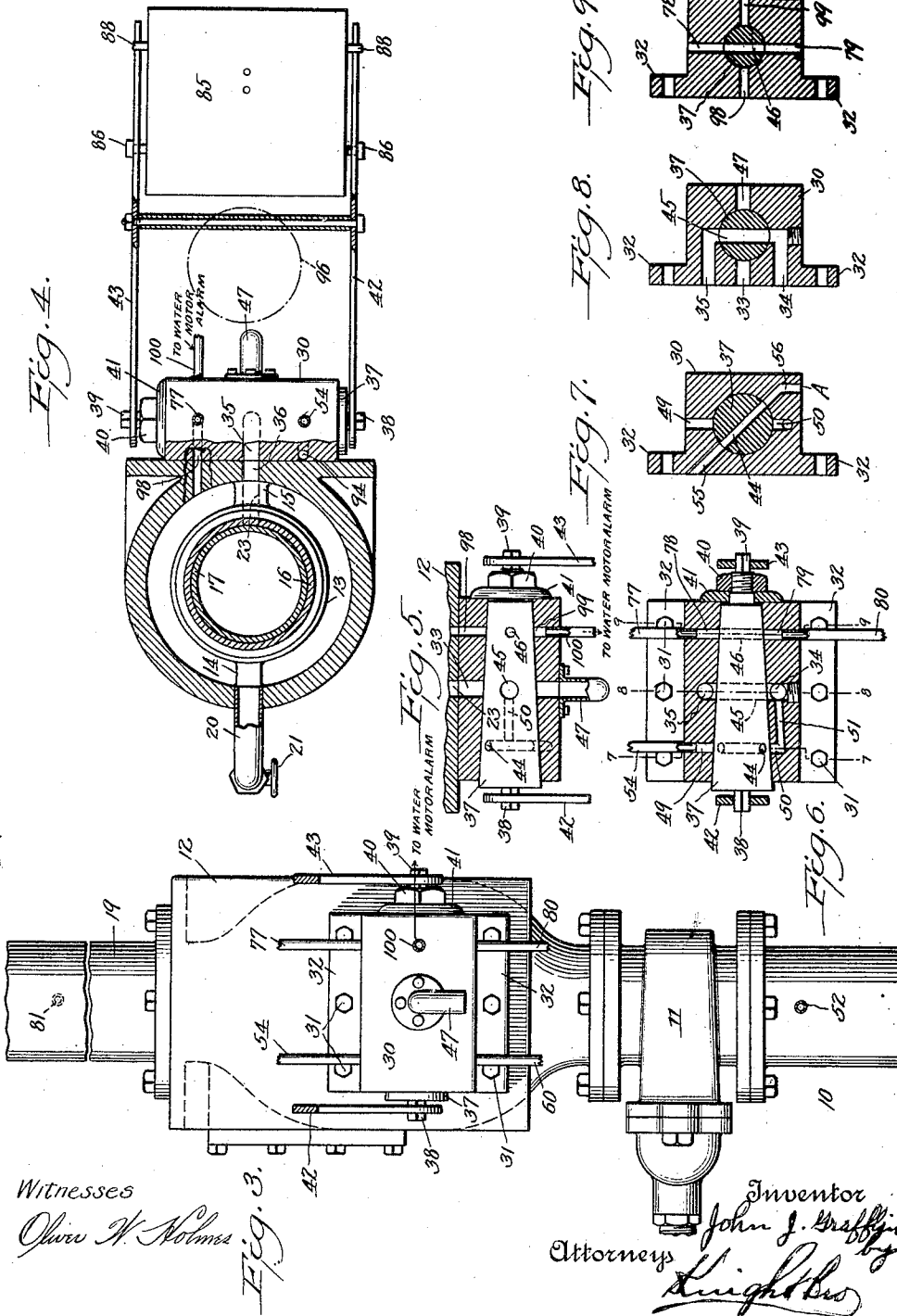
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Inventor
John J. Grafflin
Attorneys
Knight Bros

UNITED STATES PATENT OFFICE.

JOHN J. GRAFFLIN, OF ATLANTA, GEORGIA.

AUTOMATIC-SPRINKLER-SYSTEM CONTROL.

Application filed April 25, 1921. Serial No. 464,280.

To all whom it may concern:

Be it known that I, JOHN J. GRAFFLIN, a citizen of the United States, and a resident of Atlanta, county of Fulton, State of Georgia, have invented certain new and useful improvements in Automatic-Sprinkler-System Controls, of which the following is a specification.

My invention relates in general to automatic sprinkler systems for protection of buildings from fire, and more particularly to that type known as the dry pipe system. Such systems are employed in buildings where the temperature is not maintained always above the freezing point so that the pipes leading to the individual sprinkler heads would at times be burst due to freezing of water if they were normally filled with water. In systems of the dry pipe type as now employed, the pipes are filled with compressed air maintained by suitable apparatus. The main control valve which normally holds back the water is located in a suitable protected space usually in the cellar. Upon the opening of a sprinkler head, due to fire at some point controlled by the system, the air pressure drops and thereby automatically opens the main control valve. Systems of this type are subject to certain disadvantages well recognized in practice, such as condensation of water in the pipes which are supposed to be kept dry, and the difficulty of maintaining the system in proper working order.

My invention relates more particularly to dry pipe systems in which a partial vacuum is maintained in the sprinkler pipes.

In applying this principle to practical construction, there are a number of special features of importance such as the automatic maintenance of the vacuum, the method of actuating the main control valve when the vacuum is broken, and the resetting of this valve to re-establish normal conditions in the system. The details of construction and operation, by which these and other desired results are accomplished, may, of course, be quite variable, but, to clearly set forth the principles involved so that those skilled in the art may understand and practice my invention, I shall describe, by way of example, one embodiment thereof which is shown in the accompanying drawings.

In said drawings:

Figure 1 represents, principally in vertical section, the main control valve with its connected and related parts for governing its action.

Figure 2 is a detailed, vertical section through a portion of the main valve housing or chamber showing a vertical section through the stop cock, which controls the ports leading to and from the main control valve.

Figure 3 is an outside elevation of the main valve chamber and its governing stop cock.

Figure 4 is a horizontal section taken on the line 4-4 of Figure 1, showing one method of actuating the governing stop cock.

Figure 5 is a horizontal section through the stop cock showing some of the details of the ports and passages governed thereby.

Figure 6 is a vertical section of the same taken lengthwise of the stop cock.

Figures 7, 8 and 9 are detailed transverse sections of the same on the lines 7-7, 8-8 and 9-9 respectively of Figure 6.

In all the views, the various parts, with the exception of the main gate valve, are indicated as being in their normal positions, with the vacuum on, and the system ready to respond.

The system here shown comprises the main control valve, which is hydraulically opened and closed; the governing stop cock which controls the water passages leading to and from the main control valve and vacuum passages communicating with the sprinkler pipe, an automatic actuating mechanism for the governing stop cock thrown into action upon the definite breaking of the vacuum, and a vacuum pump actuated to maintain the normal vacuum within the system by means of automatic control responsive to small pressure changes within the system.

In Figures 1 and 3, 10 indicates the water main, 11 an ordinary gate valve which may be operated at will to open or close the water main, and 12 indicates the main control valve housing constructed in accordance with my invention. This valve housing constitutes a portion of the pipe leading to the sprinkler system. In construction, it may, for example, comprise in addition to its outer chamber an inner base member 13

preferably of stream line form and cast integral with the outer shell to which it is connected by webs 14 and 15, as shown in Figures 1 and 4. The base member 13 is of sufficiently less diameter than the interior of the shell member to provide ample space for the flow of water to the individual sprinkler pipes when the system is called upon to respond to fire. This base member 13 constitutes the bottom of a hydraulic chamber, which is completed by the cylinder 16 threaded into the base member 13, and a piston-like valve 17 which normally rests in elevated position against a valve seat 18 provided in the main valve housing or shell. The upper end of the piston valve 17 is preferably of stream line form, corresponding with the bottom of the base member 13. This piston valve 17 is slidably positioned within the cylinder 16 with approximately water-tight fit so that it can be driven upward by admission of water into the hydraulic chamber of which it constitutes the top, thus closing the entrance to the pipe 19 which leads to the sprinkler pipes distributed throughout the building. The space outside of the hydraulic chamber, but within the main shell 12 of the control valve, can be drained when desired through waste pipe 20 which is controlled by hand valve 21 and discharges into the drain 22. The hand valve 21 is normally kept closed. Communication with the interior of the hydraulic chamber of the valve is provided by passages 23 and 24, which are formed in the connecting web 15 and the cylinder 16, as clearly shown in Figure 1. These passages are for the admission and discharge of water as will be hereinafter described and explained. They are controlled by the governing stop cock to which reference has already been briefly made and which will now be described in detail.

This governing stop cock is mounted in a housing block 30 which is secured to the side of the main control valve housing 12 by means of bolts 31 which pass through perforated flanges 32 of the stop cock housing. This housing block 30 is provided with a conical bore from which two passages 33 and 34 connect with the passages 23, 24 of rib 15, above described, and a third passage 35 through a port 36 into the annular space between the outer shell 12 and the inner hydraulic chamber of the main control valve. These ports or passages 33, 34 and 35 are controlled by the governing stop cock, which comprises a tapered plug 37 fitting within the tapered bore of the housing block with a ground joint seat. The plug 37, has, for example, squared projecting ends or studs 38, 39 and, at the smaller end of the plug, a nut 40 presses a tightening washer or ring 41 against the end face of the housing block

in well known manner, to hold the plug in place. Operating lever arms 42, 43 are positioned on the squared ends or studs of the plug 37 to turn the plug, as will be subsequently described.

The plug has three transverse passages or ports 44, 45 and 46, the intermediate one, namely port 45, being in the plane of the three passages 33, 34 and 35, just mentioned. In the normal position of the plug 37, this intermediate port 45 connects passages 34 and 35 with each other, as shown clearly in Figure 8, at the same time closing the port 33. Pressure within and without the hydraulic chamber of the main control valve is thus equalized. When turned 90 degrees, the plug 37 closes the ports 34, 35 and thereupon, this intermediate port 45 permits the water from within the hydraulic chamber to escape through passage 23, 33 into a discharge pipe 47 which empties into a drain 48, as clearly apparent in Figures 1 and 8.

The block 30, as shown in Figures 6 and 7, has an admission port or passage 49 which is in the plane of the transverse passage 44 of the plug 37 but is normally closed by the plug. This passage 49 may be connected through passage 44 with a port 50 which leads through branch passage 51 into the rear of passage 34. Water pipe 52 is led off from the water main 10 below the gate valve 11 and extends upwardly to a T 53 from which one branch 54 leads water into the said admission port or passage 49 of the block 30. By turning the plug 37 45 degrees from the position shown in Figure 7, water is thereby permitted to flow through pipe 52 and the connections stated into the rear of passage 34 and thence through passage 24 into the interior of the hydraulic chamber. In this way, after the main control valve chamber has been opened and drained, the piston-like member 17 is hydraulically lifted into closed position against the valve seat 18. Thereafter, the plug 37, being moved another 45 degrees, or in other words being brought into the normal position shown in all the figures of the drawings, the gate valve 11 may be opened so that water from the main 10 flows up into the annular space surrounding the main valve 17, such annular space being in that position of the stop cock placed in communication through passage 36, 35, 45, 34 and 24 with the interior of the hydraulic chamber so that equilibrium is established. There being no water pressure above the valve piston 17 within the pipe 19, the valve will remain closed on account of the preponderance of upward pressure.

In this same position of the stop cock, the transverse passage 44 registers with diagonal passages 55 and 56 formed in the block 30 (see Figures 2 and 7). The passage

55 leads into a passage 57, 58 formed in the main valve housing 12, as clearly shown in Figure 2, and into the space above the valve seat 18 where normally a vacuum is to be maintained. The passages just described are, in fact, the exhaust passages through which air is withdrawn from the system above the valve seat 18 by means of any suitable form of vacuum pump of which an example will now be described.

From the port or passage 56 above mentioned, the vacuum pipe 60 leads through a container 61, mercury pipe 62, container 63 and pipe 64 into a vacuum pump 65 operated by flow of water through nozzle 66. This water may be led off from pipe 52 at the T 53 and carried through pipe 67 under the control of a spring-returned valve 68 as shown clearly in Figure 1. Upon opening the spring-returned valve 68, the flow of water occurs through nozzle 66, exhausting the vacuum system through the column of mercury in mercury pipe 62. The mercury is, during that operation, drawn into the container 63 in which the air passes through it and from which it drops back into the pipe 62 with the action of a check valve. When the action of the pump 65 ceases or is so reduced as to permit the pressure in chamber 63 to exceed that in the system on the opposite side of the mercury column, the mercury in the left hand side of the pipe 62, which constitutes a U-tube, will stand higher than that in the right hand side, this difference in level between the two sides indicating, of course, the vacuum within the sprinkler system when the pressure in container 63 is substantially atmospheric. The maintenance of this vacuum is, however, automatically controlled under normal conditions by a special actuating means for the spring-returned valve 68.

This actuating means is clearly shown in Figure 1 of the drawings as comprising a pivoted lever 70 provided with an arm 71 for engaging the valve handle or arm 72. One end of the lever 70 may be weighted by a fixed or manually adjusted weight 73. The other end may be weighted by an automatically varied weight comprising, for example, a mercury pan 74 containing a body of mercury 75. The volume of this mercury and its consequent mass effective in weighting the lever 70 is under the control of an inverted bell 76 immersed in, the mercury and communicating at its top through pipe 77, passage 78 (in block 30 of stop cock 37) transverse passage 46 of the stop cock, passage 79, pipe 80 and port 81 with the vacuum space within the pipe 19 of the sprinkler water system. As the degree of vacuum within the system varies, the mercury contained in the inverted bell 76 will rise or fall, thus varying the weight borne by the

end of lever 70 and causing the lever arm 71 to open or permit closing of the spring-returned valve 68. For example, if the vacuum gets below a predetermined normal, the effective weight of mercury admitted into the pan 74 is sufficient to open valve 68 and cause water to flow through the vacuum pump 65, thus further exhausting the space above the valve seat 18.

Upon complete and definite breaking of the vacuum by opening of a sprinkler head, the governing stop cock 37 is turned through 90 degrees to discharge the water from within the piston valve 17, as already mentioned. This operation of the stop cock may be effected by an actuating weight 85 which is carried by arms 42, 43 mounted on the squared studs 38, 39 of the plug 37. This weight 85, may, for example, be pivotally connected with the arms 42, 43 by a bolt or rod 86. The free ends of the arms 42, 43 straddle the weight 85 which latter has free pivotal movement on its pivot 86 to the extent permitted by pins 87, 88, which come into engagement with the said arms. This construction permits lost motion of the weight 85 upon its pivot 86, when tripped, so that it has opportunity of developing some momentum prior to encountering the frictional resistance of turning the stop cock. Normally, the weight may be supported, for example, by a hook 89 engaging a latch 90 whose position is controlled by an automatic lever 91. This lever 91 is generally similar to the lever 70, already described and may, for example, have a fixed or manually adjustable weight 92 counterbalancing a mercury pan weight 93 in which the weight of mercury effective on the lever is under the control of inverted bell 94, the upper portion of which communicates through pipe 95 with the vacuum pipe 77 already described. This mercury pan weight is set to operate on the complete or definite breaking of the vacuum by the opening of one of the sprinkler heads, whereupon the pan 93 depresses its end of the lever 91 to remove latch 90 from the hook 89. A dash pot or liquid cushion 96 may be employed to bring the lever to rest. Upon release of hook 89 from latch 90, the weight 85 first swings on its pivot 86 until the pins 88 engage the free ends of the arms 42, 43, whereupon the stop cock 37 is turned as the weight descends into the position shown in dotted lines in Figure 1. A spring or other cushioning member 97 may be provided to prevent shock at the end of this movement.

The operation of the device may be briefly described as follows. Assuming the parts in their normal positions as shown in the drawings, slight loss of vacuum within the system will open the spring-returned valve 68 to actuate the vacuum pump and restore the vacuum to normal. Definite breaking

of the vacuum will admit atmospheric pressure into the system, whereupon the mercury in the inverted bell 94 empties into pan 93 throwing the latch 90 out of engagement with hook 89. Weight 85 thereupon swings on its pivot 86 until pins 88 engage the outer, free ends of levers 42, 43, and the continued descent of the weight 85 swings the stop cock 37 through an arc of 90 degrees.

10 In this position of the stop cock, the hydraulic space within the valve 17 is thrown open to the outside, thus permitting water to discharge through outlets 23, 33, 45, 47 into drain pipe 48. The piston valve 17

15 thereupon descends and admits the water from the main 10 into the sprinkler system. As the valve 17 descends, it closes the outlet 23 so that it is brought to rest without shock or jar by reason of the trapped water and air within the hydraulic chamber. Passages

20 24, 34 and 35, 36 are already closed by the turning of the stop cock. This same action of the stop cock brought the transverse passage 46 thereof into registry with a passage

25 98, 99 of the block 30 and closed the vacuum passages 78, 79 of the block. It also closed the vacuum passage 55, 56 (see Figures 9 and 7). The passages 98, 99 place the interior of the main valve housing 12 in communication with pipe 100 leading to the

30 usual water motor alarm.

When it is desired to turn off the water and reset the apparatus, the gate valve 11 is closed, the valve 21 opened until all water

35 above this valve has been drained out, valve 21 closed, the weight 85 is lifted through 45 degrees to bring the transverse passage 44 of the stock cock 37 into registry with the water passages 49 and 50, as already described, thereby admitting water into the

40 hydraulic chamber beneath the main valve 17 and causing the latter to be lifted into normal position against its seat. When this has been effected, the weight is further raised

45 into the position shown in the drawings, so that the parts are restored again to their normal positions. The main gate valve may then be opened, and as soon as the vacuum has been restored, the system is ready for the

50 next response.

I claim:

1. A valve mechanism for sprinkler systems comprising in combination a water pipe, a main control valve for controlling

55 the flow of water thru said pipe, means for applying water pressure to said valve to close the same and hold it closed, means for normally maintaining a vacuum in said pipe beyond said main control valve, and means

60 for relieving the water pressure from said control valve to cause the opening of the same upon definite breaking of the vacuum.

2. A valve mechanism for sprinkler systems comprising in combination a water pipe,

65 a hydraulically operated main control valve

for controlling the supply of water thru said pipe, a conduit connecting said valve with the water supply, a conduit connecting said valve with the atmosphere and means for opening the first mentioned conduit and simultaneously closing the second mentioned conduit to cause the closure of the valve.

70

3. A valve mechanism for dry pipe sprinkler systems comprising in combination a water pipe, a main control valve

75 therein, means for hydraulically closing said control valve, means for normally maintaining a vacuum in said water pipe beyond said control valve, and means governed by the definite breaking of said vacuum for opening said hydraulically actuated valve.

80

4. A valve mechanism for dry pipe sprinkler systems comprising in combination a water pipe, a main control valve

85 therein, means for producing a vacuum in said water pipe beyond said control valve, means responsive to small changes of pressure in said vacuum for controlling the operation of said vacuum producing means, and means responsive to a definite breaking of said vacuum, for opening said main control valve.

90

5. A valve mechanism for dry pipe sprinkler systems comprising in combination a water pipe, a main control valve

95 therein, means for producing a vacuum in said water pipe beyond said control valve, means responsive to small changes of pressure in said vacuum for controlling the operation of said vacuum producing means, and means responsive to a definite breaking of said vacuum, but not responsive to small changes of pressure in said vacuum, for opening said main control valve.

100

6. A valve mechanism for dry pipe sprinkler systems comprising in combination a main control valve, a water pipe in which the supply of water is under the control of said main control valve, means for

105 normally maintaining a vacuum in said water pipe beyond said main control valve, and a mercury check valve through which said vacuum producing means withdraws air from said water pipe in producing said

110 vacuum.

115

7. A valve mechanism for dry pipe sprinkler systems comprising in combination a water pipe, a main control valve

120 therefor, means normally connected with said pipe beyond the control valve for maintaining a vacuum therein, and means for simultaneously opening said control valve and disconnecting said vacuum producing means.

125

8. A valve mechanism for dry pipe sprinkler systems comprising in combination a water pipe, a main control valve

130 therefor, means normally connected with said pipe beyond the control valve for main-

5 taining a vacuum therein, and means controlled by the vacuum for opening said control valve and disconnecting said vacuum producing means when the vacuum is broken.

10 9. A valve mechanism for dry pipe sprinkler systems, comprising in combination a water pipe, a main control valve therefor, means normally connected with said pipe beyond the control valve for maintaining a vacuum therein, and means controlled by the vacuum for opening said control valve and disconnecting said vacuum producing means and also said vacuum control means when the vacuum is broken.

15 10. A valve mechanism for dry pipe sprinkler systems, comprising in combination a water pipe, a main control valve therefor, means normally connected with said pipe beyond the control valve for maintaining a vacuum therein and means controlled by the vacuum comprising a balanced tripping device having a liquid receptacle the weight of which is affected by changes in the vacuum to unbalance said tripping device and open said control valve when the vacuum is broken.

11. A valve mechanism for dry pipe

sprinkler systems, comprising a piston main control valve designed to be held closed by the hydraulic pressure and to open when said pressure is removed, a cylinder in which said valve moves, an auxiliary valve controlled by the air pressure in the dry pipe, a passage leading from the said cylinder to said auxiliary valve, a passage leading from said auxiliary valve to the water supply and the atmosphere to allow the water pressure to enter the cylinder when the control valve is to be closed and to leave the cylinder when the control valve is to be opened.

12. A valve mechanism for dry pipe sprinkler systems, comprising in combination a water pipe, a main control valve therein, means for producing a vacuum in said water pipe beyond said control valve, an auxiliary valve controlling the flow of water to and from said main control valve, restraining means for holding said auxiliary valve in position to keep the main control valve closed and means actuated by a break in the vacuum to trip said restraining means.

JOHN J. GRAFFLIN.