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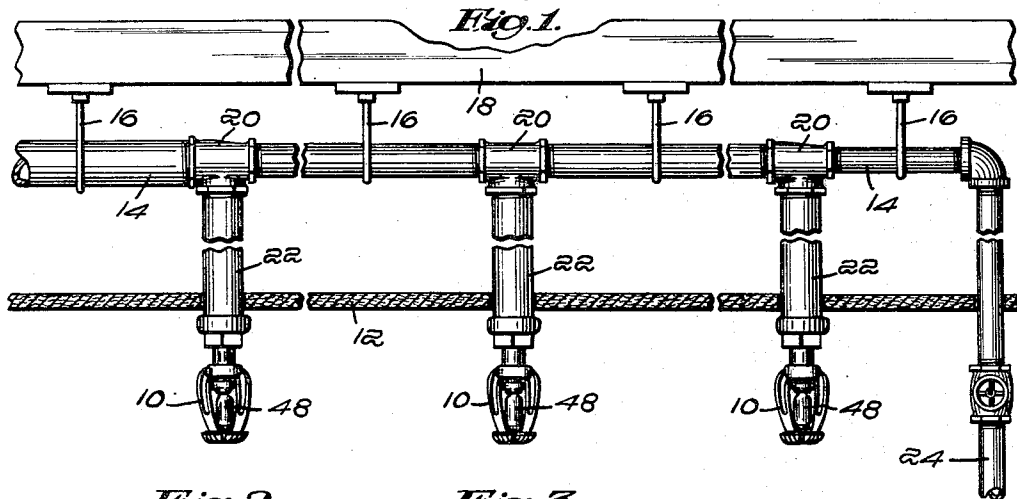
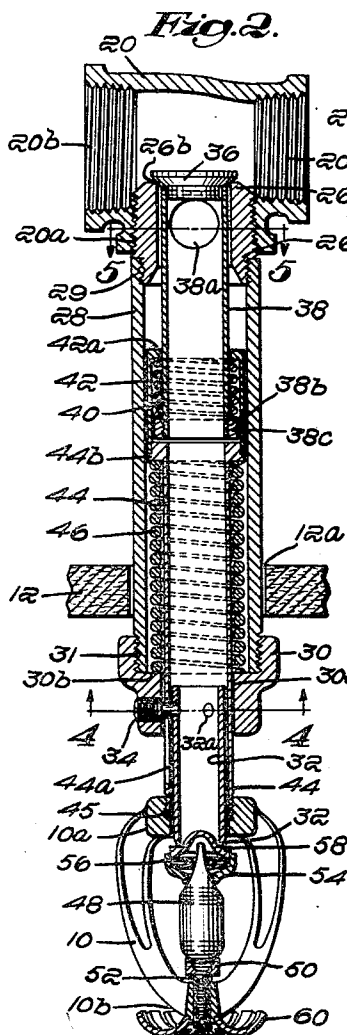
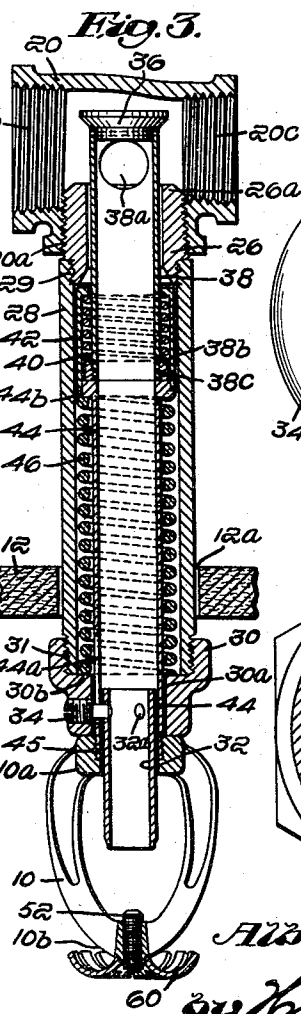
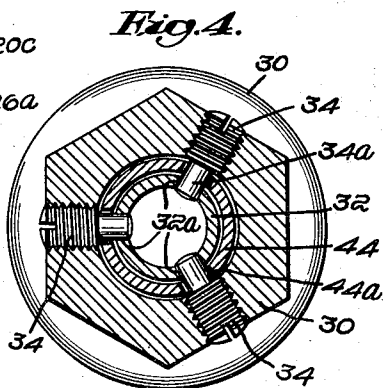
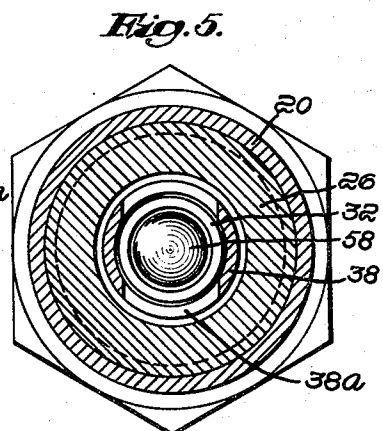
A. J. LOEPSINGER

2,291,818

SPRINKLER SYSTEM

Filed July 24, 1941

2 Sheets-Sheet 1



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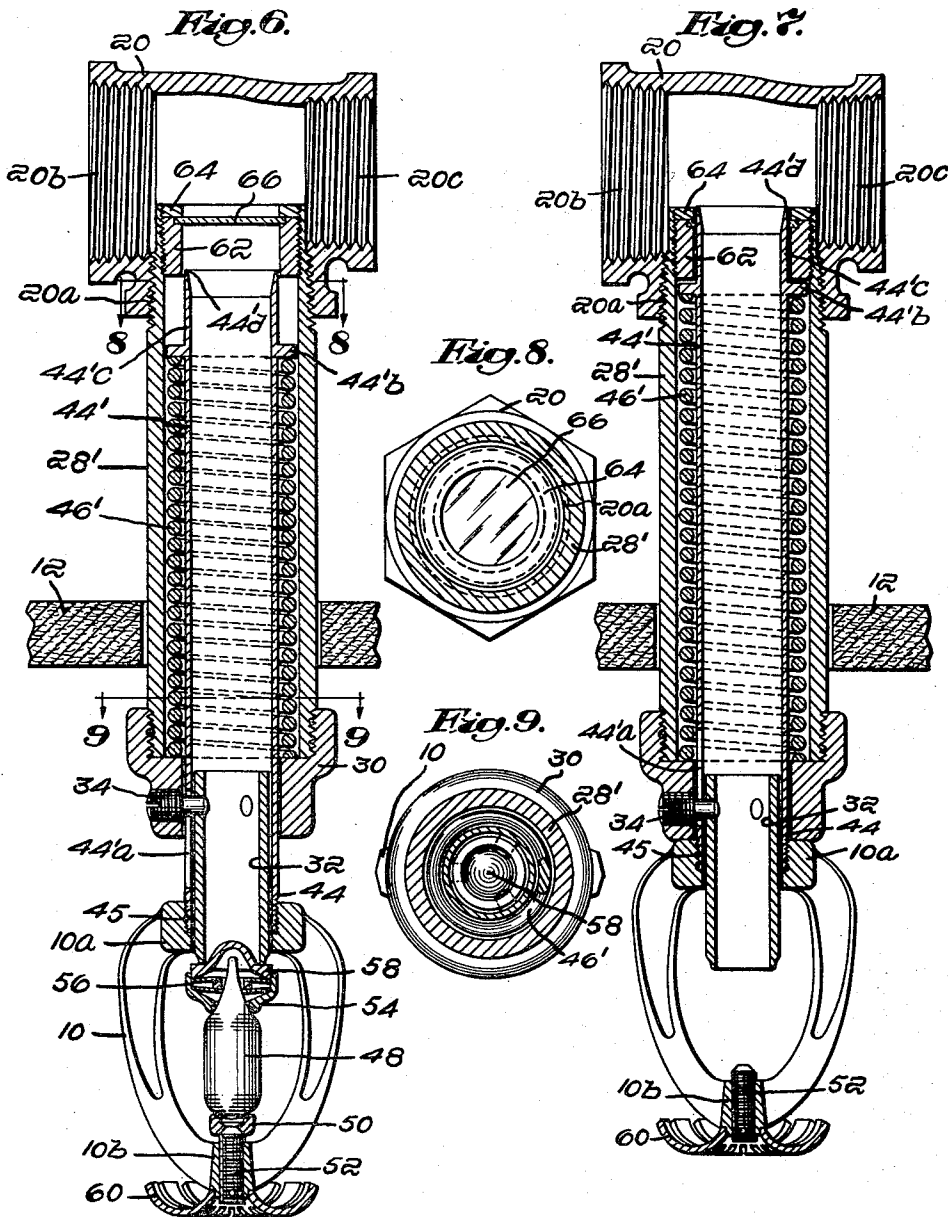
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SPRINKLER SYSTEM

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,291,818

SPRINKLER SYSTEM

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Application July 24, 1941, Serial No. 403,845

11 Claims. (Cl. 169—37)

This invention relates to improvements in sprinkler systems having pendent automatic sprinkler heads.

The distributing pipes for conducting a fire extinguishing medium such as water to the heads are usually arranged in a generally horizontal direction and if they are kept filled with the said medium the installation may be entirely conventional with the automatic sprinklers screwed directly into the fittings of the horizontal pipe lines or attached to the lower ends of vertical nipples depending from such fittings. But if the piping is liable to be subjected at any time to freezing temperatures it is necessary to employ a system of the dry pipe type in which the distributing pipes are normally filled with a gas such as air and from which the water is excluded until need for it arises, as when a fire occurs or when the system is tested. After a test or after operation occasioned by a fire the water must be drained off and the system again restored to its normally dry condition.

This presents no difficulties so far as the horizontally disposed pipes are concerned but it is not so simple or easy to remove the water from the pendent heads or from the vertical connections thereto. Accordingly, various closure means have heretofore been proposed for keeping the water out of these heads or connections until the sprinklers have automatically opened in response to a fire occurring in their vicinity. So far as I am aware, all such closure means have been arranged to open in the general direction of flow from the distributing pipe to the head and their opening has depended, after release of the thermally actuated parts of the sprinkler, upon the force of gravity, or the pressure of the fluid in the horizontal pipe, or both. When the system is drained, if any small collection of water remains at the edge of the closure means (and it is almost impossible to avoid it entirely) this may freeze and establish a bond between the closure means and its seat such that gravity alone or combined with whatever pressure is coactive will not be sufficient to overcome the holding force of the ice. The danger of corrosion is ever present and may become a sufficient reality to make a valve stick to its seat or prevent the displacement or movement of certain valve retaining mechanism interposed between the valve and the sprinkler. Such ice or corrosion may prevent, and will at least delay, the opening of the flow passage to the sprinkler. To overcome any such inhibitions and insure that the closure means will be promptly and surely opened upon the

release of the thermally actuated parts of the sprinkler is among the purposes of this invention.

It is an object of my invention to provide closure means which are opened in opposition to the force of gravity and any fluid pressure in the distributing pipes and which in the course of opening moves in a direction against that of the discharge flow. It is another object to employ a powerful spring force which, when released, will at first effect a considerable impact on the closure means to thereby overcome any tendency of such means to remain closed, and which will then cause certain movable parts to shift into positions to establish a clear open waterway to the sprinkler. It is a feature of my improved arrangement that the thermally actuated parts of any customary automatic sprinkler head may be employed in their usual manner to hold the aforesaid spring force in restraint and thus prevent the opening of the closure means until the thermally actuated parts themselves shall have responded to the heat of a fire occurring in their vicinity.

In one form of my invention disclosed herein the closure means comprises a valve which is held against a seat on the inner end of a sleeve screwed into the usual pipe fitting. During normal stand-by conditions and during a test of the system this valve is held tightly closed, but upon the usual response of the thermally actuated parts of the head the valve is forced to move inward of the fitting away from its seat and be held there during fire extinguishing discharge from the sprinkler. In another form shown herein, the closure means comprises a disk-like piece of frangible material which normally affords a positive seal against entry of any water from the distributing pipe to the vertical connection with the sprinkler. When the thermally actuated parts of the head give way this frangible element is completely shattered and the waterway opened for effective sprinkler discharge. In both forms the elements are so arranged and organized that when the spring force is released certain parts will be moved promptly and forcefully to effect a powerful impact which insures positive opening of the closure means.

It is also a feature of my improved structure that any axial expansion or contraction of the parts between the pipe fitting and the sprinkler head will in nowise disturb the tightness of the closure means or in any way modify the action of the various movable elements when the closure means are automatically opened.

The best mode in which I have contemplated applying the principles of my invention is shown in the accompanying drawings but these are to be deemed merely illustrative because it is intended that the patent shall cover by suitable expression in the appended claims whatever features of patentable novelty exist in the invention disclosed.

In the drawings:

Fig. 1 is an elevation of a portion of a sprinkler system embodying my improvements, with a ceiling indicated in section;

Fig. 2 is a vertical section showing a fitting of a horizontal distributing pipe and a vertical connection depending therefrom supporting a pendent sprinkler, the movable parts being shown in their relative positions when the system is inactive;

Fig. 3 is a similar vertical section showing the parts in their relative positions for fire extinguishing discharge;

Figs. 4 and 5 are horizontal sections taken as on lines 4—4 and 5—5 respectively of Fig. 2;

Fig. 6 is another vertical section, somewhat like Fig. 2, of another embodiment of my invention having a modified form of closure means, the movable parts being shown in their relative positions when the system is inactive;

Fig. 7 is a section like Fig. 6, but with the parts shown in their relative positions for fire extinguishing discharge; and

Figs. 8 and 9 are horizontal sections taken as on lines 8—8 and 9—9 respectively of Fig. 6.

Referring to the drawings, and particularly to Fig. 1, there is shown a portion of a sprinkler system employing pendent automatic sprinkler heads 10 located below a ceiling 12 represented in cross-section. Above the ceiling a horizontal distributing pipe 14 is carried by the hangers 16 from some convenient structural support 18. Fittings 20 are provided at suitable intervals along the pipe 14 from each of which a vertical connection 22 extends downward to a sprinkler head. This showing is representative of a system installed in a location subject to freezing temperatures and where the water must normally be held back from the distributing pipes by some suitable form of valve (not shown). When such a dry pipe system is tested by admitting water under pressure to the distributing pipes to determine if they are clear and have no leaks, or after the system has operated to put out a fire, the water can be drained from the horizontal pipes readily enough by a convenient drain connection such as the pipe 24. It is not so easy or practical to drain the numerous vertical connections 22 and thus it is desirable to prevent the entrance of any water into a connection unless its respective sprinkler head has responded to a fire starting within the vicinity of the head.

In Figs. 2 to 5 inclusive are shown the details of one embodiment of my improved structure. In a depending outlet 20a of a pipe fitting 20, is screwed a fixed sleeve 26 which preferably extends sufficiently within the fitting to bring its upper end 26a above the level of the bottom of the inner surface of the horizontal distributing pipe 14 whose sections are screwed into the aligned openings 20b and 20c of the fitting. Thus when the distributing pipes are filled with water, either for test purposes or for fire extinguishing discharge, and then subsequently drained no appreciable quantity will stand in any fitting above the upper end of the sleeve 26 connected thereto, although it is not unlikely that

some small collection of water will remain on the flat uppermost face of the sleeve 26. This is of no concern even if it freezes because, as will presently appear, the apparatus of my improved structure will overcome the holding power of any such ice formation.

A vertical pipe 28 is screwed onto the lower portion of the sleeve 26 and locked thereto by a pin 29. This pipe extends downward through the ceiling 12 to a cap-like member 30 having an axial hole 30a aligned with the axis of the vertical pipe 28. The cap is screwed onto the pipe 28 and locked in place by a pin 31. Extending further downward is another fixed sleeve 32, supported by screw studs 34 which screw into the cap member 30 and have cylindrical stem portions 34a nicely fitting in holes 32a in the wall of the sleeve 32. The elements or parts thus far described are all secured together and remain immovable after the sleeve 26 is screwed into the fitting 20.

The inner circular edge 26b at the top of the sleeve 26 constitutes a seat for a valve 36 which is normally held downward against such seat and is forcibly moved upward therefrom into the fitting to effect the opening of the flow passage to the sprinkler. This valve has a hollow stem 38 depending therefrom, with suitable openings 38a through its side wall close by the valve 36. This stem has an external shoulder 38b at its lower edge, which may be conveniently provided as shown by a ring 38c secured to the outside wall of the stem. Bottoming on this external shoulder is a spring 40 coiled about the stem 38 with its upper end pressing against an internal shoulder 42a of a movable sleeve 42 interposed between the stem 38 and the vertical pipe 28.

This sleeve 42 is connected with and constitutes an extension of another movable sleeve 44 which extends downward through the pipe 28 and through the hole 30a in the cap-like member 30 between the latter and the fixed sleeve 32. The movable sleeve 44 is provided with suitable slots 44a through which project the cylindrical stems 34a of the screws 34. The base 10a of the sprinkler head is screwed onto the lower end of the movable sleeve 44 and secured thereto by a pin 45. Between an external shoulder 44b at the upper end of sleeve 44 and an internal shoulder 30b of the member 30, is another spring 46 wound about the sleeve 44. This spring 46 is appreciably stronger than the spring 40 first mentioned above and tends to expand and push the sleeve 44 against the adjacent end of the valve stem 38 and thereby force the valve 36 away from its seat in a direction generally against the direction of flow of the water and in opposition to the force of gravity or whatever fluid pressure may be present in the distributing pipe 14.

This arrangement and movement of the passage closing means is radically different from the usual sprinkler practice since without other exception, so far as I know, the closure means for the flow passage through a sprinkler always seats against the direction of flow and is opened by the fluid pressure in the distributing pipes, or by gravity, or by both acting together. In such customary arrangement the closure means is held seated by some form of retaining mechanism which is interposed between the closure and the thermally actuated parts of the sprinkler head. The latter are almost invariably in the form of a strut under compression, and their holding force can be utilized directly to hold the closure means on its seat. It is a distinct feature of

my arrangement that the same thermally actuated parts of a sprinkler may be employed in their usual manner, as a strut under compression, and yet effect the holding of the closure to its seat in direction opposite to that in which the compressive force of the strut is exerted.

Substantially any of the sprinkler heads now available may be employed in my arrangement but for purpose of illustration I show a sprinkler embodying details disclosed in Letters Patent No. 1,996,077 of April 2, 1935. The thermally responsive element is a frangible bulb 48 charged with a highly expansible fluid capable, when heated to a predetermined degree, of completely shattering the bulb. One end of the bulb rests on a seating ring 50 which in turn bears against an adjusting screw 52 in the yoke end 10b of the sprinkler. The other end of the bulb rests on a seating cap 54 which houses spring disks 56 and a portion of a button 58. These several elements represent and in this instance constitute a strut under compression which is adapted to give way in response to a fire occurring in its vicinity.

In my improved arrangement the sprinkler head frame and the movable sleeves 44 and 42 are pulled downward far enough for the thermally actuated parts of the sprinkler to be positioned between the screw 52 and the lower end of the fixed sleeve 32, with the button 58 or other valve element of the sprinkler resting on the bottom edge of this sleeve and closing its opening. The thermally actuated parts hold the sprinkler and sleeve 44 downward, thereby holding the compressed spring 46 in restraint and establishing potential energy which later is transformed into kinetic energy upon the release of the thermally actuated parts. The sleeve 44 and its attached sleeve 42 also compress spring 40 against the ring shoulder 38b at the lower end of the valve stem, causing the latter to be held downward with the valve 36 tightly seated. Thus the strut of the sprinkler is placed under compression as usual and yet holds the closure means seated in a direction opposite to that in which the compressive force of the strut is exerted.

With the various parts assembled, as shown in Fig. 2, they may be attached to the distributing pipe 14 by inserting the pipe 28 and sleeve 26 through a hole 12a in the ceiling 12 and screwing the sleeve into the depending opening 20a of the fitting 20. For clearness of disclosure the pipe 28, sleeve 44 and spring 46 are shown in Figs. 2 and 3 without any break to denote variable lengths, but it is to be understood that these three elements can be made in any lengths desired from a few inches up to several feet to accommodate any distance between the distributing pipes 14 and the ceiling 12 as indicated in Fig. 1. Obviously the greater this distance may be, the more likelihood of variable axial expansion or contraction between the several parts, but this is of no consequence because the springs 40 and 46 readily accommodate any unequal changes in length and the valve will continue to be held tightly against its seat. Thus the passageway from the fitting downward through the vertical connection to the sprinkler head 10 is closed against the flow of any fire extinguishing medium from the distributing pipe 14.

The system may be tested at any time without the water passing the valve 36, and in the event of the system going into operation for fire extinguishing discharge through some of the sprinklers there will be no admission of water to the vertical connections leading to any heads

which are sufficiently removed from the fire as not to be affected thereby. After admission of water to the distributing pipes and the subsequent draining therefrom upon the restoration of dry pipe conditions, any water collecting about the edge of valve 36 and freezing there will not prevent the positive opening of the valve in case the strut of the sprinkler gives way because of the impact which follows the release of the spring actuated means.

Upon the occurrence of a fire in the vicinity of a head 10 and the consequent heating of the bulb 48 and its contents to a degree at which the bulb is shattered, the strut is destroyed, with the ring 50, cap 54, spring disks 56 and button 58 being thrown clear of the sprinkler frame. With destruction of the strut the stronger spring 46 immediately expands and pushes the sleeve 44 upward with an appreciable impact against the lower edge of the valve stem 38. The valve is thus somewhat violently unseated, despite any ice which may have formed or any tendency of the valve to stick due to corrosion at the valve seat or elsewhere, thus assuring positive opening of the valve. Thereupon the sleeves 42 and 44, the valve stem 38, the valve 36 and the now open sprinkler 10 move upwardly together, until the base 10a of the latter engages the member 30. The final or fully open position is shown in Fig. 3, with a clear path from the fitting 20 through the holes 38a and the vertical passageway inside the stem 38, the sleeve 44 and the sleeve 32 to the deflector 60.

Regardless of the distance between the distributing pipes and sprinkler heads, there will be no change in the tightness of the valve on its seat due to changes in the lengths of the various parts. There will always be a space between the bottom of the valve stem and the upper end of sleeve 44, so that whenever the thermally actuated parts give way, the sleeve will make impact with the stem and forcibly drive the valve off its seat. Thus my improved arrangement combines unchangeable tightness when such is desired and certainty of opening when a fire extinguishing discharge is needed.

In the modification shown in Figs. 6 to 9 inclusive, certain parts such as the ceiling 12, the fitting 20, the sprinkler head 10, cap member 30, sleeve 32 and screws 34 are identically the same as previously described and are identically numbered in the drawings. In this arrangement the vertical pipe 28' is screwed directly into the bottom opening 20a of the fitting 20, having its upper end somewhat above the bottom portions of the aligned openings 20b and 20c. The pipe is threaded internally to receive a sleeve 62 and a clamping ring 64 between which is secured the edge of a frangible disk 66, preferably made of tempered glass. It constitutes a tight closure of the passageway from the fitting 20 to the sprinkler head 10, and yet it is physically separate from the means controlled by the thermally actuated parts.

Within the pipe 28' is a sleeve 44' having slots 44'a at its lower end to accommodate the screw studs 34 and having near its upper end an external shoulder 44'b between which and the member 30 is compressed a coiled spring 46' wound externally about the sleeve. Above the shoulder, the sleeve has an upstanding portion 44'c which is slidable within the sleeve 62 and terminates in a somewhat sharp edge 44'd. This edge is normally held at an appreciable distance from the frangible disk 66, as shown in Fig. 6, so that upon

the bursting of the heat responsive bulb 48 of the sprinkler and the consequent destruction of the sprinkler strut, the sleeve 44' will be forced rather violently upward so that its top edge 44'd will strike the frangible disk 66 with considerable impact. This results in the disk being completely fractured and destroyed, leaving a clear opening into the sleeve 44' when it comes to rest as the base 10a of the sprinkler brings up against the member 30. This final open position is shown in Fig. 7.

Here again, the pipe 28', the sleeve 44', and the spring 46' may be as long or as short as desired and any unequal axial expansion or contraction between the pipe and sleeve will be readily permitted without any effect on the closure disk 66. The force of the restrained spring when released will readily and surely overcome any sticking due to corrosion and will positively effect destruction of the closure.

In both forms of the structure shown it is a feature that if for any unforeseen reason the valve 36 should leak or the disk 66 become cracked prior to the response of the thermally actuated parts of the sprinkler, there will be no great discharge of water at the lower end of the vertical connection. This follows because the main discharge opening at the end of sleeve 32 is kept closed by the button 58 or other valve element of the sprinkler. With this opening closed the only outlet for the leaking water would be between the cap member 30 and the sleeve 44 or 44', and between the latter sleeve and the inner sleeve 32. Obviously the flow through these rather narrow annular spaces would be greatly restricted. This is particularly a safeguard when the closure means is in the form of the glass disk, because even if the disk should in effect be destroyed, the discharge at the sprinkler end of the connection would not be excessive in any sense, unless of course the thermally actuated parts of the sprinkler had responded and effected the opening of the main flow passage through the sleeve 32.

Although I have particularly shown and described my improvements in their application to a pendent sprinkler head, it is evident that the closure means will remain tightly closed and that the spring actuated means when released will effect positive opening of the closure means regardless of whether the sprinkler head is pendent, upright, or in any other position.

I claim:

1. A sprinkler system comprising a distributing pipe, a tubular connection extending therefrom, closure means normally closing the pipe end of said connection, an automatic sprinkler head at the extended end of said connection having thermally actuated means, and spring actuated means for effecting the opening of said closure means; the spring actuated means being held in restraint by the said thermally actuated means until the latter responds to a predetermined thermal condition and releases the said spring actuated means to effect opening of said closure means for sprinkler discharge.

2. A sprinkler system comprising a distributing pipe, a tubular connection extending therefrom, closure means normally closing the pipe end of said connection, an automatic sprinkler head at the extended end of said connection having thermally actuated means, a sleeve movable toward the closure means and normally held retracted therefrom by the thermally actuated means, and a spring held in restraint by said

sleeve tending to move said sleeve toward said closure means; the said sleeve being released upon response of the thermally actuated means to a predetermined thermal condition to effect impact on said closure means and thereby open said connection for sprinkler discharge.

3. A sprinkler system comprising a distributing pipe, a tubular connection extending therefrom, a closure means normally closing the pipe end of said connection, a sleeve at the other end of said connection movable toward the closure means, an automatic sprinkler head attached to said sleeve having thermally actuated means, and a spring capable of moving said sleeve toward said closure means; the said sleeve and spring being held in restraint by the said thermally actuated means until the latter respond to a predetermined thermal condition whereupon the spring moves said sleeve and opened sprinkler toward said closure means to effect opening thereof for sprinkler discharge.

4. A sprinkler system comprising a distributing pipe, a tubular connection extending therefrom having its extended end fixed, closure means normally closing the pipe end of said connection, a sleeve movable toward said closure means, an automatic sprinkler head attached to said sleeve having thermally releasable parts held in compression against the said fixed extended end to thereby hold said sleeve away from said closure means, and a spring held in restraint by said sleeve tending to move the sleeve toward said closure means; the said sleeve being released upon response of the thermally actuated means to a predetermined thermal condition whereby said spring moves said sleeve to effect the opening of said closure means for sprinkler discharge.

5. A sprinkler system comprising a distributing pipe having a depending outlet, a tubular connection extending downward from said outlet, closure means normally closing the upper end of said connection, an automatic sprinkler head at the lower end of said connection having thermally actuated means, a sleeve movable upward within said connection toward said closure means and normally held retracted therefrom by the thermally actuated means, and a spring held in restraint by said sleeve tending to move said sleeve upward; the said sleeve being released upon response of the thermally actuated means to a predetermined thermal condition whereupon said spring moves said sleeve to effect an impact on said closure means and thereby open said connection for sprinkler discharge.

6. A sprinkler system comprising a distributing pipe arranged in a generally horizontal direction having a depending outlet, a tubular connection extending vertically downward from said outlet having a fixed sleeve at its lower end, closure means normally closing the upper end of said connection, a sleeve movable within said connection toward said closure means, an automatic sprinkler head attached to said movable sleeve having thermally releasable parts held in compression against the said fixed sleeve to thereby hold said movable sleeve away from said closure means, and a spring held in restraint by said movable sleeve tending to move the movable sleeve upward toward said closure means; the said movable sleeve being released upon response of the thermally actuated means to a predetermined thermal condition whereby said spring moves said movable sleeve upward to

effect the opening of said closure means for sprinkler discharge.

7. A sprinkler system comprising a distributing pipe, a tubular connection extending therefrom, a valve at the pipe end of said connection seating in the direction of flow from said pipe through said connection and normally closing said connection against such flow, an automatic sprinkler head at the extended end of said connection having thermally actuated means, and spring actuated means for moving said valve from its seat; the spring actuated means being held in restraint by said thermally actuated means until the latter respond to a predetermined thermal condition and releases the spring actuated means to effect movement of said valve from its seat and thereby permit flow from said pipe through the connection and opened sprinkler head.

8. A sprinkler system comprising a distributing pipe, a tubular connection extending therefrom, a valve at the pipe end of said connection normally closing said connection, a spring acting to hold said valve closed, a second spring tending to open said valve, an automatic sprinkler head at the extended end of said connection having thermally actuated means, and means associated with said head and said second spring holding the latter in restraint until the thermally actuated means responds to a predetermined thermal condition and thereby releases said second spring to overcome the force of said first mentioned spring and effect opening of said valve for sprinkler discharge.

9. A sprinkler system comprising a distributing pipe, a tubular connection extending therefrom having a sleeve fixed in said pipe with its inner end constituting a valve seat, a pipe connected to the other end of said fixed sleeve, a valve seating on said seat having a hollow stem extending through said fixed sleeve with spring seating means on the extended end of said stem, a movable sleeve extending within said pipe having a portion enveloping a portion of said valve stem with spring seating means at the end of said enveloping portion, a spring interposed between said spring seating means capable of imposing a force on said valve stem to hold said valve on its seat, a second spring in said pipe tending to move said movable sleeve toward said

valve stem, an automatic sprinkler head mounted on said movable sleeve having thermally actuated means, and a second fixed sleeve at the extended end of said pipe constituting a seat for said thermally actuated means; the said thermally actuated means when seated on said second fixed sleeve holding said movable sleeve and said second spring in restraint and causing said first spring to impose a closing force on said valve stem to keep said valve seated, and the said movable sleeve and said second spring being released upon response of the thermally actuated means to a predetermined thermal condition whereby said second spring moves said movable sleeve, said first spring and said valve stem to unseat said valve for sprinkler discharge.

10. A sprinkler system comprising a distributing pipe, a tubular connection extending therefrom, a frangible closure element normally sealing the pipe end of said connection, an automatic sprinkler head at the extended end of said connection having thermally actuated means, and spring actuated means for effecting the destruction of said closure element; the spring actuated means being held in restraint by the said thermally actuated means until the latter responds to a predetermined thermal condition and releases said spring actuated means to effect destruction of said closure element and opening of said connection for sprinkler discharge.

11. A sprinkler system comprising a distributing pipe, a second pipe extending therefrom, a frangible closure element normally sealing the inlet end of said second pipe, a sleeve within said second pipe having a portion extending outside thereof, an automatic sprinkler head mounted on said extended portion having thermally actuated means resting on the extended end of said second pipe, and a spring within said second pipe tending to move said sleeve toward said closure element; the said sleeve and spring being held in restraint by said thermally actuated means until the latter responds to a predetermined thermal condition, whereupon said sleeve is released and moved by said spring to effect destruction of the closure element and opening of the passageway through said second pipe for sprinkler discharge.

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