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[54] DRY-TYPE SPRINKLER

9 Claims, 3 Drawing Figs.

[52] U.S. Cl. **169/17,**
169/38, 239/583
 [51] Int. Cl. **A62c 35/00**
 [50] Field of Search **169/16, 17,**
38; 239/569, 583

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ABSTRACT: A dry-type sprinkler for use in fire protection systems wherein fluid passage through the sprinkler is closed by a valve at the intake end until released by a heat responsive mechanism, characterized by a floating inner tube assembly which automatically compensates for dimensional changes in length of the inner tube with respect to the outer tube when subjected to ordinary thermal effects, and by which loads are isolated within the sprinkler head assembly which includes the heat responsive mechanism, and no loads are transmitted through the inner or outer tubes which might affect the sealing function of the valve.

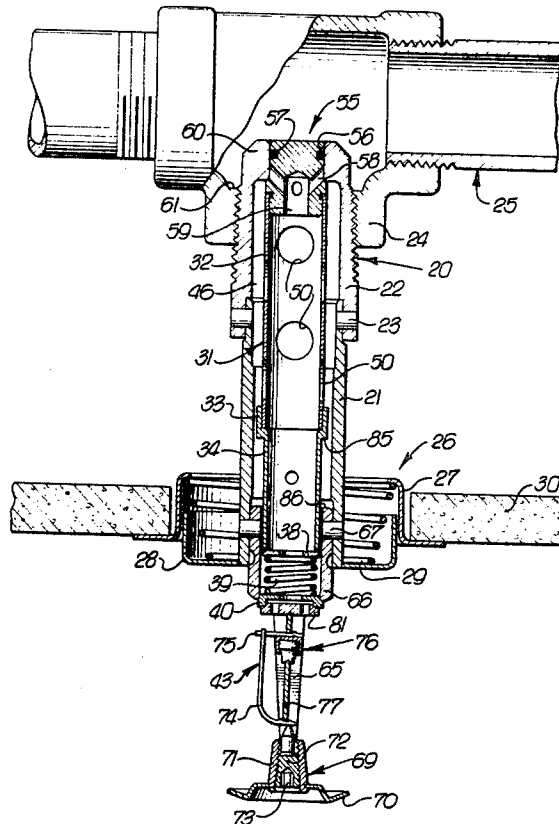
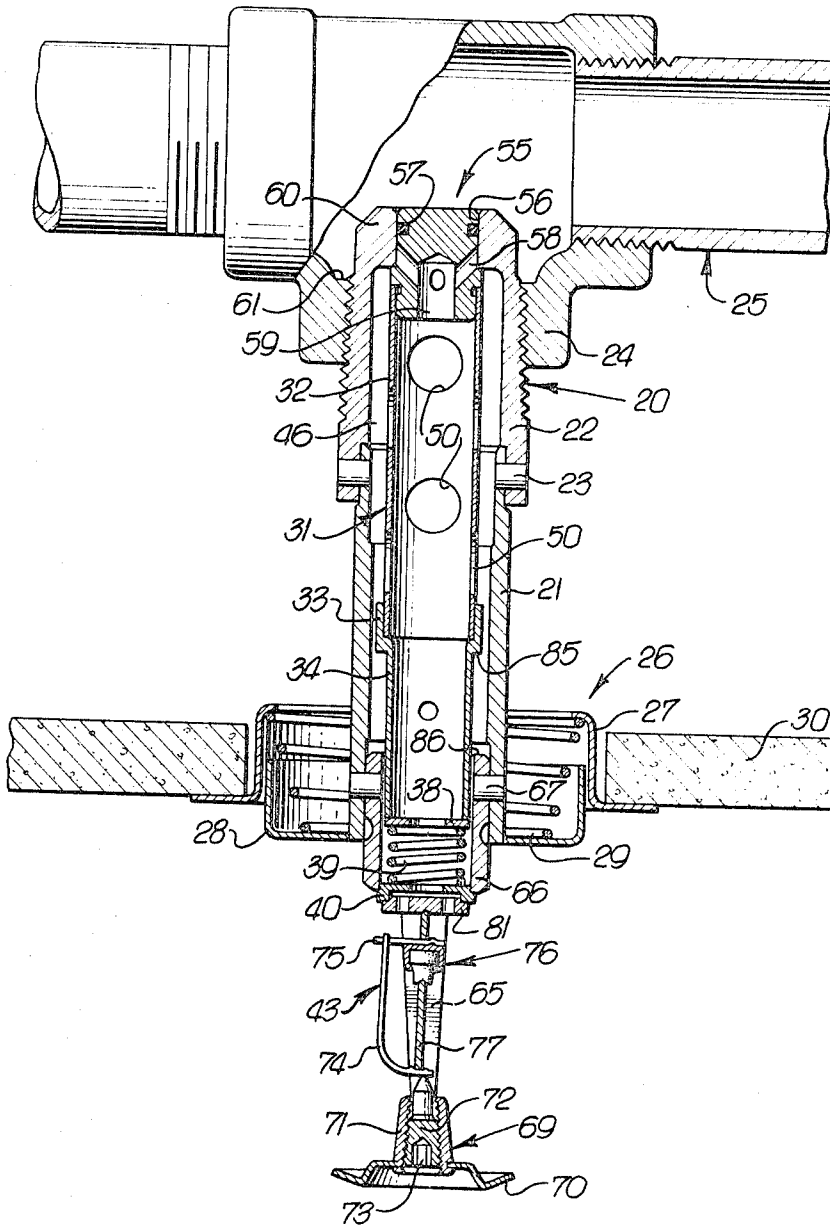


FIG. 1.



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FIG. 3.

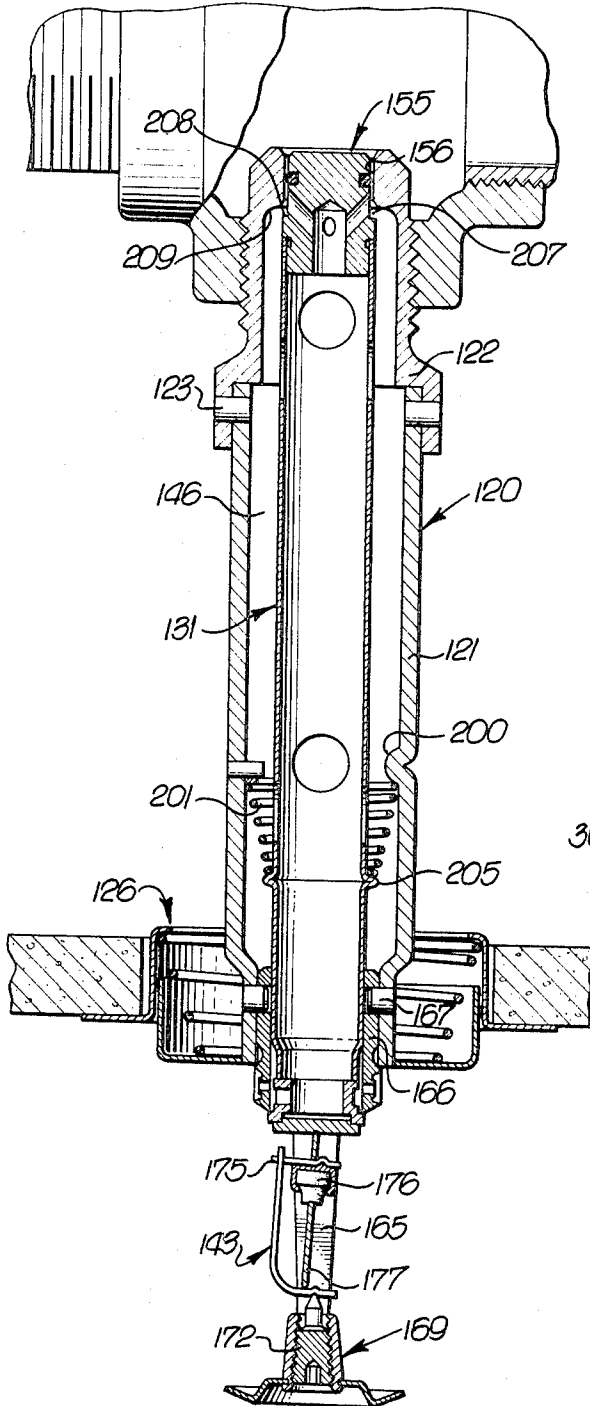
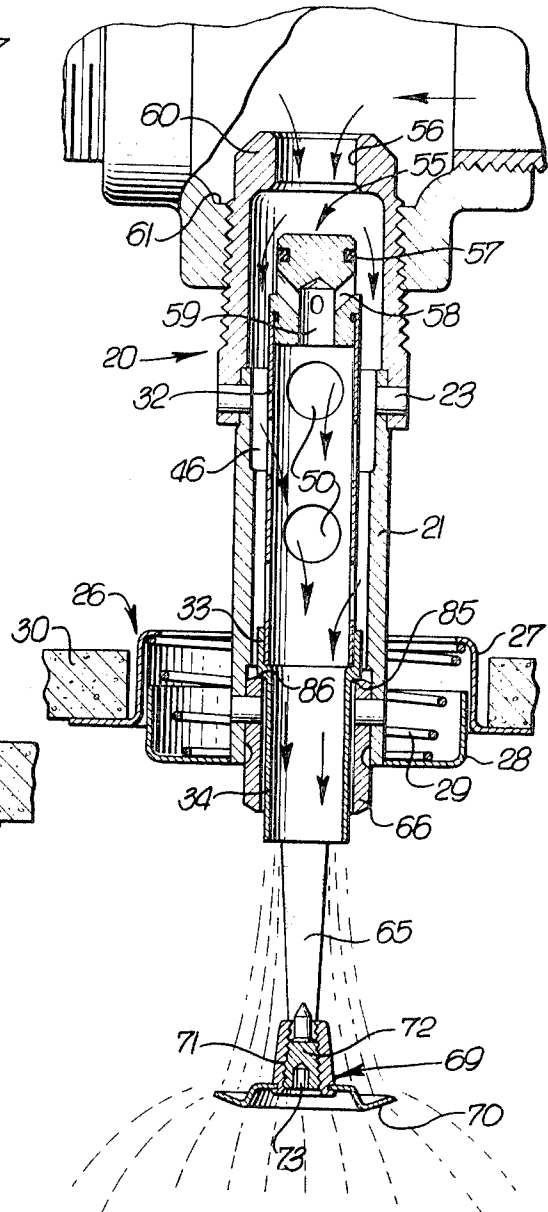


FIG. 2.



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DRY-TYPE SPRINKLER

BACKGROUND OF THE INVENTION

Dry-type sprinklers for fire protection systems have been available. They can be installed in either an upright or pendent position, according to design. The most popular is the pendent form.

Generally speaking they comprise a sprinkler adapted to be installed in a piping system, the sprinkler having a valve at the inlet end to prevent water or other fire extinguishing fluid in the pipe line from entering the sprinkler until the sprinkler is put into operation by collapse of a heat responsive mechanism. The valve end of the sprinkler is screwed into a fitting in the piping.

Usually there is an inner tube, sometimes called a support tube, disposed coaxially within an outer tube, the inner tube being sustained in uppermost (valve closing position) by the heat responsive mechanism.

When heat from a fire actuates the heat responsive mechanism, parts of it collapse, thus opening the valve for discharge of water or other fire extinguishing fluid.

Advantages realized by this type of device are to avoid possible freezing of condensation in a drop line, to eliminate the necessity of removing pendent sprinklers in a dry pipe system for draining after the dry pipe valve has tripped, and in a wet system particularly where sprinklers are required in unheated areas, and freezing of liquid in the sprinklers would prevent operation.

Typical dry-type sprinklers in the prior art with which I am familiar make no provision to relieve tensile or compression loads on the tube assemblies, and make no provision for compensation in the dimensional relation between outer and inner tubes under changes in thermal conditions.

Moreover, when the inner tube extends rigidly from a piston valve to its support at the opposite end of the outer tube, excessive system pressure imposing force on the piston valve or unequal thermal expansion may not only strain the inner tube but overload the support in turn changing the tension in the sprinkler head assembly.

Also such construction provides no internal force for assisting in movement of parts for valve opening action, and the structures are such that upon release of the valve to open the fluid passage, not only the valve but other parts must travel through the tube with attendant possibility of becoming lodged in the water passage and obstructing flow.

SUMMARY OF THE INVENTION

The present invention is characterized by some important improvements over the prior dry-type sprinklers.

Primary elements in my device include an outer tube or nipple assembly attachable to a pipe system, an inner coaxial tube, and a sprinkler head assembly which includes a heat responsive mechanism, this assembly when in set condition, supporting the inner tube in position to seat the valve in closed relation to the bore of an inlet.

My improvements comprise, among other features, a floating inner tube, with a valve permanently mounted at the inlet end of the tube.

This offers several advantages. Dissimilar metals may be used in the several parts without imposing undue load on the heat responsive element due to unequal thermal expansion when subjected to above normal ambient temperatures, or excess load arising from system pressure. Use of dissimilar metals affords design flexibility and cost reduction possibilities. This has not been feasible in prior designs because of the danger of malfunction due to load, i.e., parts might become distorted or dislodged, and excess pressure on the heat responsive element might even cause its premature collapse.

Moreover, the floating tube eliminates load changes during installation, and arising from vibration.

My valve is permanently mounted on the inner tube. Water flows through and around it and through the inner tube. No

loose parts are required to travel through and out of the tube during operation. Thus, potential problems of parts lodging in the water passages are eliminated.

The inner tube floats under the influence of a spring, which in addition to isolating the load between the tube and the sprinkler head assembly, offers an assist in ejecting parts of the latter when the heat responsive mechanism is actuated by temperature equaling the melting point of a fusible element, or substitute tripping device operates.

The foregoing, and other objects and advantages which are achieved will be more fully developed in further description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical section of a sprinkler embodying the invention installed in a piping system. The sprinkler is in set condition.

FIG. 2 is a view similar to FIG. 1 with the parts shown in operating position.

FIG. 3 is a view similar to FIG. 1 of a second form of sprinkler with the parts in set condition.

PREFERRED EMBODIMENT OF THE INVENTION

Referring to FIGS. 1 and 2, the dry-type sprinkler generally designated 20 is in the form of a nipple or outer tube comprising a sleeve 21 and an externally threaded collar 22 interlocked by a plurality of pins 23. For installation, the collar is threaded into a T 24 which is part of a piping system 25. The latter supplies water or other fire extinguishing fluid to the sprinklers upon predetermined conditions.

When installed, as described, the sleeve 21 may extend down through an escutcheon 26 which includes telescoping cups 27 and 28 separated by a compression spring 29, the cup 27 being secured to the lower surface of a ceiling 30.

An inner tube assembly 31 is coaxially disposed within the sleeve 21 and floats therein in a manner to be subsequently described. This assembly 31 includes an upper section 32 nesting in a flanged enlargement 33 of a lower section 34. The lower section 34 rests on an annular washer 38, which in turn is supported upon a compression spring 39. The lower end of the spring abuts against an adapter 40 which is in the form of a flanged washer and is held in place by a heat responsive assembly generally designated 43.

An annular chamber 46 is formed between the inner surface of the nipple 21-22 and the outer surface of the inner tube 31. The upper section 32 is formed with relatively large ports 50 providing fluid communication between the interior of the inner tube 31 and the chamber 46.

At the upper end of the inner tube section 32 is carried a valve 55 in the form of a piston slidably engaged in a reduced bore 56 of the collar 22. An O-ring seal 57 prevents fluid passage when the valve is in its uppermost, closed position. The valve embodies oblique ports 58 to offer supplemental fluid communication through a central countersink 59 from the chamber 46 to the interior of the inner tube 31.

In the closed position of the valve as illustrated in FIG. 1, water or other fluid in the piping 25 is prevented access to or delivery through the sprinkler. The upper end section 60 of the collar 22 preferably is of a length to extend above the floor 61 of the T coupling to avoid clogging by accumulated sludge or sediment.

The heat responsive device 43 may be of generally known structure and operation. Examples in inverted position on an upright sprinkler head are shown in U.S. Pat. No. 3,161,236 and U.S. Pat. No. 3,336,984. Referring to the present disclosure, a rigid frame 65 includes a hollow boss 66 which is secured by pins 67 to the lower end of the sleeve 21. This frame supports at its lower end a sprinkler head 69 which includes a deflector 70, mounted on an internally threaded extension 71. In this extension is an adjustable compression screw 72 which can be advanced or retracted by a suitable tool inserted into socket 73. Resting upon the point of screw 72 is a spring lever member 74 which is bowed, as illustrated,

its upper end engaged in a key or holding member 75 overlying a fusible element 76. A strut 77 is interposed between the lower end of the lever arm 74 and the under face of an annular cap or holding plate 81.

The heat responsive assembly 43, as described, in conjunction with the rigid frame 65 and the sprinkler head assembly maintains the inner tube in its uppermost position, as shown in FIG. 1, with the valve closed, notwithstanding fluid pressure in the piping system. The compression spring 39 is designed to exert sufficient force to maintain this condition and to accommodate change in the relative lengths of the nipple and the inner tube which may occur by ambient temperature changes and as a result of different coefficient of expansion of different metals employed in the parts. Even if there is a tendency for the pipe line pressure to depress the valve and consequently depress the spring until it is solid, the axial measurements of the valve and bore 56 are of sufficient magnitude to prevent the valve from moving downwardly far enough to open it. The compression spring 39 also keeps the floating inner tube under load making it resistant to vibration during installation and thereafter, while providing additional inherent energy to the operating mechanism.

In operation, if exposure of the sprinkler to a temperature equal to the melting point of the element 76 occurs, the element collapses. The key (holding member) 75 is then free to disengage from the strut 77 and move to the left, as viewed in FIG. 1. Thereupon the strut 77, any remaining part of the fusible element 76, key 75 and lever 74 will fall away permitting the annular cap or holding plate 81 and washer 40 also to fall away. The spring 39 aids in this ejection. The inner tube assembly is thus freed to move down under fluid pressure from the piping system a sufficient distance to open the valve and permit full flow of water or other fluid in the general manner illustrated by the arrows in FIG. 2. The deflector 70 breaks up the discharge into the proper pattern and droplet size for effective distribution. Downward movement of the inner tube is limited by engagement of an annular shoulder 85 with the upper annular surface 86 of the hollow boss 66.

ALTERNATIVE FORM OF THE INVENTION

Referring now to FIG. 3, a structure is shown which employs the basic principle of the floating inner tube, and the advantages derived therefrom, but applies the principle in a somewhat different manner.

Reference numerals where appropriate are comparable to the numerals used in the form first described, increased by 100.

Thus the sprinkler is generally designated 120, and includes a modified nipple or outer tube which includes sleeve 121, a threaded collar 122, and interlocking pins 123. The installation may incorporate an escutcheon 126.

An inner tube assembly 131 is coaxially disposed in the nipple 121, with a chamber 146 between the inner tube and the nipple.

The nipple sleeve 121 is formed with an internal shoulder 200 providing a seat for one end of a compression spring 201. Some other form of spring seat may be substituted as for example, internally projecting pins, or facets.

The sleeve 121 may be reduced in diameter at its lower end, to receive a hollow boss 166 secured by pins 167.

The inner tube assembly 131 may be formed of a single piece, and embodies an external shoulder 205 which is spaced axially away from the shoulder 200 and provides a seat for the spring at its end opposite the seat 200.

The inner tube 131 carries at its upper end a piston valve 155 operating in bore 156 of the nipple. In this form, however, when the sprinkler is in the set condition, there normally remains a space 207 between a flange 208 on the valve and an annular shoulder 209 at the lower end of the bore 156.

The heat responsive mechanism 143 and its cooperating parts for retention of the inner tube are either identical or generally similar to the mechanism and parts previously shown

and described, and part numbers (increased by 100) identify corresponding elements.

It is intended that the inner tube 131 be in a floating condition. This is achieved by the spring 201 and its operatively associated parts.

When the heat responsive mechanism is coupled in the frame 165 and the screw 172 tightened to the desired setting, the lower end of the inner tube is supported in its predetermined lowermost position. This support is effected against the force of partial compression of the spring 201, and in such position there is room in the space 207 for longitudinal expansion of the inner tube which may occur due to changes in ambient temperature.

In the event of fire, the heat responsive mechanism collapses in the manner previously described.

In this form, the force of the spring will cause not only ejection of the parts of the heat responsive mechanism to be discarded, but also full release and travel of the inner tube and valve without the assist of any external hydrostatic or pneumatic pressure acting upon the piston. Thus, the sprinkler will operate at 0 p.s.i. gauge pressure regardless of installation attitude, whether it can be in the pendent or upright position.

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention.

What I claim is:

1. A dry-type sprinkler adapted for mounting on a piping system in a fire protection installation, which sprinkler comprises an outer tube having an inlet end and an outlet end, means at the inlet end for connecting it into a pipe, and a fluid passage presenting a radially disposed valve seat, an inner tube disposed concentrically within the outer tube and adapted for a reciprocal movement therein, a piston-type valve member mounted on the inner tube adjacent the inlet end of the outer tube adapted in a first position to seal off communication between the piping and the tubes and in second position to open such communication; said valve member presenting a cylindrical surface movable into and out of engagement with said valve seat and susceptible of limited movement in engagement with said valve seat without opening said fluid passage, a sprinkler head assembly including a heat responsive mechanism mounted adjacent the outlet end of the outer tube, said assembly embodying fixed support means limiting reciprocal travel of the inner tube, and means to float the inner tube relative to the outer tube permitting relative axial movement therebetween without opening said fluid passage to compensate for longitudinal dimensional changes between the inner and outer tubes and isolate the inner tube from loads generated in the support means.

2. A dry-type sprinkler as defined in claim 1 in which the resilient means to float the inner tube is a compression spring disposed with one end acting against the support means and the other end acting against the adjacent end of the inner tube.

3. A dry-type sprinkler as defined in claim 1 in which there is a first internal spring seat in the outer tube, a second external spring seat on the inner tube axially spaced from the first spring seat in the direction of the support means, and a spring encircling the inner tube is disposed between the spring seats.

4. A dry-type sprinkler as defined in claim 1 in which the valve in the first position fits in the inlet end portion of the outer tube, the said end portion embodies a shoulder, and the valve embodies a flange one face of which opposes the shoulder and limits axial movement of the valve in the direction of the shoulder.

5. A dry-type sprinkler as defined in claim 4 in which the valve flange has a second face which mounts the valve on the inner tube.

6. A dry-type sprinkler as defined in claim 1 in which the respective diametrical dimensions of the outer and inner tubes provide a fluid chamber therebetween, ports are formed through the inner tube for fluid communication from the chamber into the inner tube, the valve is permanently

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mounted on the inner tube, and the valve in its second position is axially spaced away from its first position a sufficient distance to afford free flow of fluid into the fluid chamber.

7. A dry-type sprinkler as defined in claim 6 in which the valve includes bores providing fluid passages communicating between the fluid chamber and the interior of the inner tube.

8. A dry-type sprinkler according to claim 1 in which said valve and valve seat are relatively disposed so as to permit said

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inner tube to float in either direction with respect to said outer tube.

9. A dry-type sprinkler according to claim 3 in which means including said spring are provided for actuating said valve member to open said fluid passage in the absence of fluid pressure at the inlet end of said outer tube.

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