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SPRINKLER HEAD CORROSION PROTECTOR

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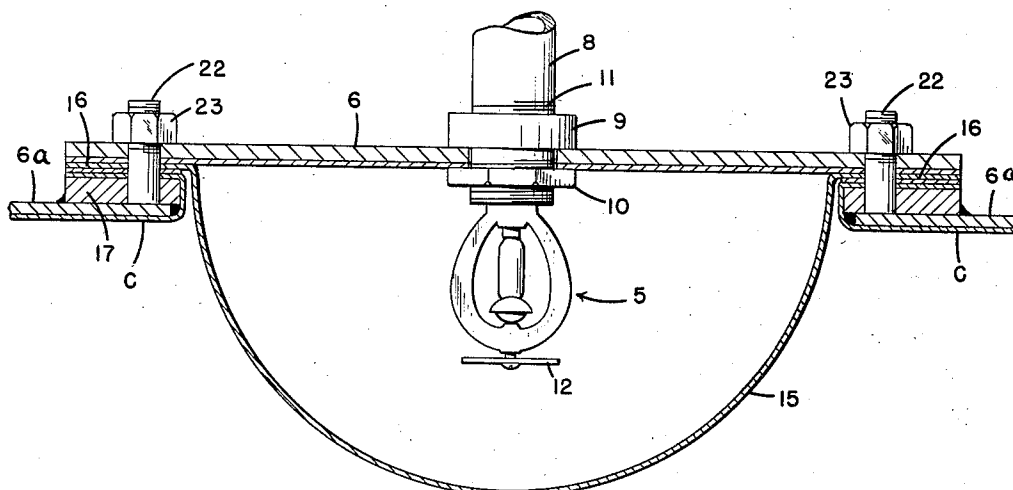


Fig. 1

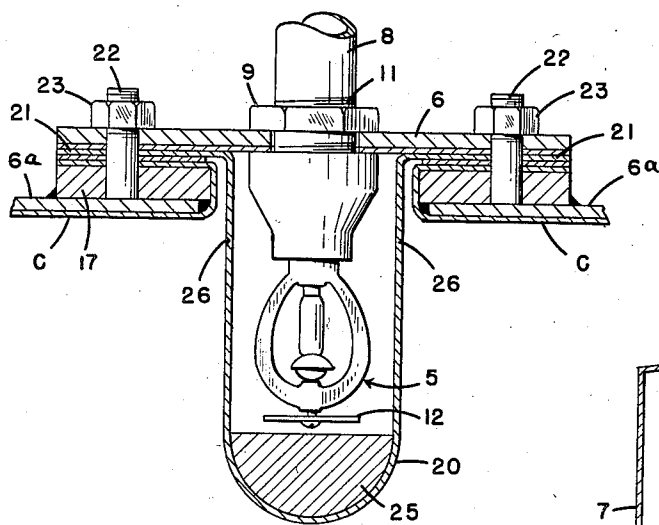


Fig. 2

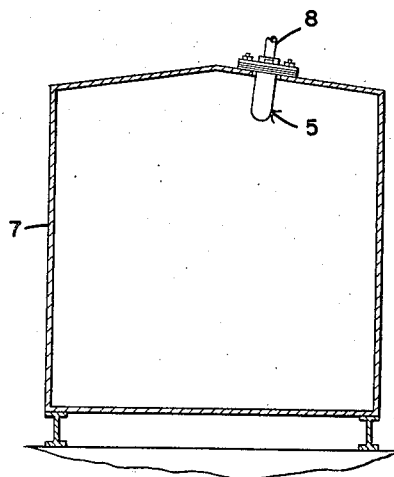


Fig. 3

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SPRINKLER HEAD CORROSION PROTECTOR

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This invention relates to automatic fire extinguishing apparatus, and more particularly to an improved protective cap for automatic sprinkler heads installed under conditions of mechanical stress and chemical corrosion.

Although the prior art shows many varieties of protective caps for automatic sprinkler heads, at least some of which are intended to protect the temperature sensitive element against corrosive action of various fumes, many tests and experiments with all known types of protective devices failed to solve the problem where the sprinkler heads are installed in ducts carrying exhaust fumes under velocities reaching to 100–150 miles per hour and where the fumes comprise mixtures of one or more of the following materials: sulphur dioxide, hydrogen sulphide, sulphuric acid, sodium sulfate, other sulphur compounds, and moisture.

These ducts are customarily fabricated of a synthetic plastic material capable of withstanding the above noted conditions, or from a metal which is coated with such corrosion resistant synthetic material. The necessity for this coating has introduced a serious fire hazard and no previously known automatic fire extinguisher could be used in these ducts.

Glass caps or protectors were not satisfactory because the seal between the cap and the housing could not be made sufficiently tight so that there would be assurance that it would be broken off in the event of a fire. If the cap is retained by an external temperature responsive link or element, this element soon becomes eaten away or so corroded that it either fails prematurely or will not rupture when it should. Experiments proved that various types of paper with or without a coating are ineffective because the penetration of the fumes apparently takes place by a process of osmosis and any coating or covering for the paper sufficiently strong to withstand the air pressure and at the same time protect the sprinkler head against the corrosive action of the fumes, will not burn or otherwise fail in the event of fire. Where a grease type seal was used for a glass cap, it was found that the fumes either seeped through the grease or in some cases hardened the grease to such an extent that the cap could not be forced off by the water pressure.

Two additional problems were encountered as a result of our work. It was found that if the cap contained any sort of a seam or joint, the seam failed first, thus permitting the sprinkler head to open. The cap, however, did not fall away from the sprinkler head and, as a result, the spray pattern was completely destroyed. In addition, it was found that even using a cap formed of nitrocellulose material, if the cap shape was such that only part of the cap was removed upon the application of elevated temperature, the remaining part also destroyed the spray pattern, thus eliminating the effectiveness of the sprinkler head. Peculiarly enough, the very properties of nitrocellulose which are employed to enhance the present invention may operate to defeat the purpose thereof unless the cap is constructed in accordance with the present invention. For example it has been found that if the nitro-

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cellulose cap is made of relatively small diameter so that it closely fits the sprinkler head, the heat generated when the bottom of the cap ignites, very quickly sets off the sprinkler and this action is so fast that only a small portion of the cap around the tip has an opportunity to burn before the sprinkler valve opens and puts out the fire on the remainder of the cap. This very effective and fast operation of the head proved to be a disadvantage because the unburned portion of the cap destroyed the spray pattern and in effect acted as a shield to direct all the water directly downward in a highly localized area. This of course is very undesirable from the standpoint of efficient operation of an automatic sprinkler system. Our experiments indicated that a synthetic plastic cap of nitrocellulose or similar material could be made sufficiently strong to withstand the pressure and corrosion present in such ducts, and further, when properly designed, these caps can be made to operate satisfactorily under the most severe conditions.

Therefore, in one embodiment of the invention, it is proposed to use a relatively small diameter cap of nitrocellulose or other synthetic material in which the wall of the cap, well above the path of the spray pattern, is formed with portions of reduced thickness, as by scoring. The bottom of the cap is weighted with lead or similar material so that the cap, upon being subjected to an elevated temperature, always parts at the portions of reduced thickness, with the lead weight completely removing all portions of the cap which might otherwise interfere with the spray pattern. Another embodiment of the invention eliminates the need of cap scoring and weight simply by increasing the diameter of the cap to provide a desired inside clearance between the cap and the sprinkler head. With this construction, if the bottom portion of the cap starts to burn, the fire will not immediately actuate the sprinkler head and thus there is sufficient time for the cap to burn away around the edges before the sprinkler valve opens. This has been found effective in removing all portions of the cap which would otherwise interfere with the spray pattern after the sprinkler has been set off. It has been found as a practical matter that it is desirable, if not necessary, to use a weight with any material except nitrocellulose. A further advantage of this material resides in the fact that the heat released by the burning of the nitrocellulose cap is sufficient in itself to accelerate the opening of the sprinkler head. It will be noted that the characteristics of nitrocellulose which are considered to be disadvantageous in conventional sprinkler head cap structures, as mentioned above, are taken advantage of in the present invention and contribute in providing a more efficient device. A relatively large cap of nitrocellulose which is molded or drawn was found to completely solve the problem and it is believed that we are the first to mold this material in comparable shapes and sizes.

The primary object of the invention therefore, is to provide an improved protective cap for automatic sprinkler heads.

A further object of the invention is to provide a protective cap for automatic sprinkler heads capable of withstanding the effects of corrosive fumes for an extended period of time.

A further object of the invention is to provide a protective cap and installation for sprinkler heads capable of withstanding pressures incident to extremely high fluid velocities.

A still further object of the invention is to provide an improved protective cap for automatic sprinkler heads which will not destroy the spray pattern of the sprinkler when the cap is partially burned away.

A still further object of the invention is to provide an improved protective cap for automatic sprinkler heads

having means for removing a large portion of the cap under elevated temperature conditions.

A further object of the invention is to provide a protective cap for automatic sprinkler heads so constructed that the cap will substantially burn away before the sprinkler head is released.

A still further object is to provide an improved automatic sprinkler head assembly capable of withstanding high velocity corrosive fumes.

Further objects will be apparent from the drawings and specification in which

Fig. 1 is a view illustrating a sprinkler head equipped with a preferred form of our improved protective cap which is shown in section,

Fig. 2 is a vertical section showing a modified form of our improved protective cap, and

Fig. 3 is a transverse section through an exhaust duct showing the manner in which the improved sprinkler head assembly is mounted.

The invention comprises essentially the provision of a drawn synthetic plastic cap securely mounted and covering the individual sprinkler head nozzle. The preferred form of cap is hemispherical in shape and provides substantial clearance between the sprinkler head and the inside of the cap. Another embodiment uses a cylindrical cap more closely fitting the sprinkler head and provided with portions of reduced thickness, as by scoring, and a weight which together cooperate to completely remove the lower portion of the cap when the portions of reduced thickness give way under elevated temperature conditions. The material found to be highly satisfactory for making such caps is a nitrocellulose composition.

Referring now more particularly to the drawings, a plurality of sprinkler heads 5, 5 are mounted in the upper ceiling structure 6 of an exhaust duct assembly 7 or in any other suitable location where an automatic sprinkler system is to be used. The sprinkler heads are connected to the main 8, and are secured thereto by means of a brass fitting 9, lock nut 10, and nipple 11. Each sprinkler 5 is provided with the usual thermally responsive element and a deflector 12 which is so designed to direct the water in the most effective spray pattern. In exhaust ducts of the type referred to above, the metal duct structure 6a is lined with a synthetic plastic coating indicated at various places by the letter C. This coating is desirably a sheet of plasticized polyvinyl chloride. The preferred form of protector cap 15 is generally hemispherical in shape and is provided with an integral annular flange 16 which can be bolted between the upper plate 6 and an annular plate or collar 17. This method of attachment is found to provide a seal around the rim of the protective cap thus preventing the admission of any corrosive fumes to the inside of the cap. By making the radius of the cap shown in Fig. 1 on the order of 4 to 5 inches, it has been found that ample clearance between the heat responsive element in the sprinkler head and the cap itself can be provided and maintained. This dimension has been found to be critical when used with the standard sprinkler head which extends 3 inches below the ceiling. Preferably the cap itself is made of nitrocellulose which is highly flammable and a quick burning material. When the bottom of the cap 15 ignites, it has been found that the sprinkler head will not open until the cap has burned away to a point well above the path of the spray as it leaves deflector 12.

The modified cap 20 shown in Fig. 2 is substantially cylindrical in shape and has a rounded lower end. Likewise this cap may have a horizontal annular flange 21 which is securely sealed and clamped to the ceiling structure 6 by means of bolts 22, 22 and nuts 23, 23. Due to the fact that there is much less clearance between the sprinkler head 5 and the cap 20, it has been found that the high concentration of heat so close to the sprinkler head may release the spray before the cap has been burned away sufficiently far above the deflector 12 to

clear the spray pattern. This disadvantage is overcome by installing a weighting element 25 of lead or other heavy material in the bottom of the cap 20. To make sure that the entire lower portion is removed, the cap is scored or otherwise formed with reduced thickness portions at 26, 26 well above any possible path of the spray pattern. This feature is essential in using a nitrocellulose material for the cover unless the form of Fig. 1 is employed, in which case the scoring and the weights can be eliminated.

The thickness of the cap may be made to withstand any stress imposed upon it by external forces such as the fluid velocity in the duct. The shape of the caps and particularly that of Fig. 1 lends itself readily to a pressure molding or drawing operation. Furthermore, it is possible to completely and effectively seal the cap so that corrosive fumes or materials cannot penetrate to the sprinkler head.

While the invention has been described as being of particular importance where sprinkler heads are used in exhaust fume ducts, it must be also noted that other applications are indicated; for example, in wooden cooling towers which very often have liquids containing highly corrosive materials running thereover.

Having thus described our invention, we claim:

1. A combination including a supporting structure, a sprinkler head mounted on said supporting structure, a unitary sprinkler head protective cap cooperating with said supporting structure to completely encompass said sprinkler head, and means for securing said cap to said supporting structure, said cap being formed of thermoplastic material and including a seamless portion extending in spaced relation with and enclosing said sprinkler head and an integral annular flange engaged by said securing means.

2. The combination as defined in claim 1 wherein said cap further includes means for effecting the removal of a section of said enclosing portion of said cap under elevated temperature conditions.

3. The combination as defined in claim 1 wherein said seamless enclosing portion of said cap is hemispherical in shape.

4. A unitary protector cap for heat responsive sprinkler heads, said cap being formed of thermoplastic material and including a seamless sprinkler head enclosing portion having an open end, and a securing flange formed integrally with said seamless portion and extending along the open end thereof.

5. A protector cap as defined in claim 4 wherein said cap further includes means for effecting removal of a section of said sprinkler head enclosing portion under elevated temperature conditions.

6. A protector cap as defined in claim 4 wherein said seamless enclosing portion of said cap is hemispherical in shape.

7. A seamless protector cap for automatic sprinkler heads and the like formed of synthetic thermoplastic material, said cap having an annular flange extending along an edge thereof and forming the base of the cap, and a weight disposed within said cap for completely removing a portion of the cap remote from its base when the cap is subjected to elevated temperature conditions.

8. A combination including a supporting structure, a sprinkler head mounted on said supporting structure, a sprinkler head protective cap cooperating with said supporting structure to completely encompass said sprinkler head, and means for securing said cap to said supporting structure, said cap being formed of thermoplastic material and including a seamless portion extending in spaced relation with and enclosing said sprinkler head, an integral annular flange engaged by said securing means, and a weight disposed within said cap for completely removing a portion of the cap remote from said flange under elevated temperature conditions.

9. A protective cap in accordance with claim 7 in

which the cap is formed with portions of reduced thickness which are located between said annular flange and weight.

10. The combination of claim 8 in which the cap is formed with portions of reduced thickness which are located between said annular flange and weight. 5

11. The combination of claim 10 wherein said sprinkler head includes a spray deflector and wherein said cap portions of reduced thickness are disposed substantially above said deflector.

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