FIRE PROTECTION SYSTEM


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Field of Search 169/16, 17, 18, 19-22, 169/2 R, 5, 51; 239/208, 209; 181/33 G

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ABSTRACT

A fire protection system for protecting buildings is disclosed. A plurality of conduits having apertures are mounted in a structure. A heat and smoke detector controls the flow of extinguishing agent from a source under pressure to the conduits. Individual heat responsive spray elements are mounted on the conduit to control the release of extinguishing from the apertures. The conduits are a part of a supporting grid for supporting ceiling tiles which form a false ceiling.

17 Claims, 5 Drawing Figures
FIRE PROTECTION SYSTEM
RELATED CASE

This application is a continuation in part of my prior copending application Ser. No. 358,890, filed May 10, 1973, and now abandoned.

FIELD OF THE INVENTION

This invention relates to fire protection systems which release extinguishant in response to the detection of a fire. The term “extinguishant” when used herein means a flowable material which will put out a fire.

Many local fire codes require automatic extinguishant delivery systems in warehouse, office and other public buildings to protect against the spread of fire for the purpose of eliminating or reducing property damage and personal injury and loss of life. In addition, many fire insurance underwriters require such systems to be installed for fire insurance to be obtained or reduce the fire insurance premiums significantly when such systems have been installed.

REPORTED DEVELOPMENTS

Many fire protection systems have been proposed. One such system in common use is comprised of a supply conduit system containing an extinguishant, such as water, under pressure and a plurality of sprinkler heads mounted on and in fluid communication with the supply conduit. The sprinkler heads include a fusible element, which element melts when exposed to the heat of a fire, causing a valve element in the sprinkler head to be displaced thereby allowing the water to be supplied to the sprinkler head. The sprinkler head sprays the water on the surrounding area to extinguish or contain the fire. These systems are costly to install as they require a separate delivery system and a plurality of sprinkler heads in each room. Also, such systems detect heat but not smoke and thus are less able to respond to a fire in its early stages.

Another type of delivery system for extinguishant is the so-called dry system in which air or some other gas under pressure is present in the delivery system so as to maintain a delivery valve for the extinguishant closed and the sprinkler conduits empty of extinguishant. Extinguishant, usually water, may be delivered throughout the system when individual sprinkler heads having fusible elements, cause the pressure in the system to be relieved, thereby opening the delivery valve and supplying extinguishant throughout the system. These systems are usually used in unheated buildings where there is a likelihood that the water left standing in the sprinkler conduits will freeze in cold weather. Such systems are relatively costly to install and maintain, and require the use of a relatively expensive sprinkler head assemblies.

Systems are also known which employ an empty sprinkling system which is supplied with extinguishant when a detector opens the valve between the sprinkling system and a source of extinguishant under pressure. These are commonly known as “deluge systems” and one such system is shown in U.S. Pat. No. 2,365,906 to Rider. Such systems are commonly used in aircraft hangars, factories, and warehouses where volatile agents are present and the danger of conflagration high.

It has also been known to construct storage racks from hollow elements which are provided with sprinkler heads and also, to provide structural beams with integral conduits for delivery extinguishant. Such systems are generally limited to use in warehouses which do not employ false ceilings for concealing services such as heating and ventilating ducts, water pipes, and electrical services.

Of course, grid-layer types of ceilings wherein a grid of supporting elements is affixed to the underside of the true ceiling of the structure and utilized to support a plurality of contiguous, removable ceiling tiles have been in use for many years. One system, utilizing an air diffusing member for ventilation purposes, as a part of such a ceiling structure, is shown in U.S. Pat. No. 2,937,589 to Rachlin.

It is an object of this invention to provide an improved fire protection system having reduced installation and maintenance costs.

It is another object of this invention to provide an improved integral fire protection system and ceiling structure.

These objects and other advantages of the invention will become apparent from a consideration of the preferred embodiment as hereinafter set forth.

SUMMARY OF THE INVENTION

The fire protection system in accordance with the invention herein utilizes a plurality of lightweight conduits which are provided with apertures for releasing extinguishant. The conduits are normally empty of extinguishant and are supplied from a source under pressure by means of a motorized valve which is responsive to a means for detecting heat and/or smoke. The conduits are installed as a part of a support grid for ceiling tiles which form a false ceiling. In one embodiment, heat responsive elements control the release of extinguishant from apertures in the conduit.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a front section view of a spray conduits and tile ceiling installed in a structure.

FIG. 2 is a partial side sectional view showing mounting details of the spray conduit shown in FIG. 1.

FIG. 3 is a schematic representation of the control circuit for supplying extinguishant to the spray conduits.

FIG. 4 is a partial top view of a typical installation of spray conduits in a room and corridor.

FIG. 5 is sectional view of a conduit having a heat responsive control element positioned to block an aperture in the conduit.

DETAILED DESCRIPTION OF THE INVENTION

Many multi-story buildings such as high rise apartments, offices, hospitals, etc., have false ceilings suspended from the underside of the next adjacent floor. These ceilings conceal building services such as heating and ventilating ducts, electrical services and the like. Many of these false ceiling structures incorporate a grid of runners or support elements which support a plurality of removable ceiling tiles. This general construction is illustrated in FIG. 1, and is the environment in which the preferred embodiment of the invention will be described.

Referring to FIG. 1, there is shown a portion of a building structure in section having a first floor slab 10 and a second or upper floor slab 12 spaced above the...
first slab. The slabs 10 and 12 form between them one floor of the building.

Suspended from the upper slab 12 is a false ceiling generally designated as 14. The ceiling is comprised of a plurality of removable ceiling tiles or panels 16. The tiles 16 are usually of a lightweight material and normally are fissured on one surface to provide acoustical properties. Such tiles are usually formed of an asbestos-containing material or fiber glass and thus are noncombustible.

Conventionally, the ceiling tiles 16 are supported by a grid system formed of a first series of runners or support elements extending in a first direction, such as support elements 18 shown in FIG. 1, and a second series of cross runners or support elements 20, which are shown in FIG. 2, and which extend in a direction normal to the direction of support elements 18. The support elements 18 and 20 are usually T-shaped in cross section, with the stem of the T being disposed vertically upward toward the upper slab 12. The support elements 18 are suspended from the lower surface of the slab 12 by means of a plurality of spaced hangars 22, usually formed of wire, secured at one end to the slab 12 and at the other end to the support member or runner 18.

The cross runners 20 are supported by the runners 18 and flanges 32 of conduit 24 and may be clipped or otherwise affixed thereto.

Referring again to FIG. 1, the fire protection system, according to the invention, includes a spray conduit 24 having an elongate hollow body portion 26. The body 26 may be formed of any fire resistant material and may be aluminum or an aluminum alloy extrusion or may be formed of sheet steel or the like fabricated into the desired shape. The body 26 forms a conduit for carrying extinguishing fluid, such as water, and includes a series of spaced apertures 28 which are holes or narrow slots formed in and extending along the bottom wall of the body 26. The ends of the conduits 24 are closed by suitable end plates 37 which are secured in a fluid-tight manner to each end of the conduit 24.

The apertures 28 may be arranged and spaced so that a curtain of extinguishing fluid is sprayed downwardly from the conduit 24. For applications in which greater lateral dispersion of the extinguishing fluid is desirable, deflectors (not shown) may be mounted on the conduit to disperse the extinguishing fluid issuing from one or more apertures 28. Alternatively, the conduit may include a plurality of thermally responsive control elements for controlling the release of extinguishing fluid, as more fully described below with reference to FIG. 5.

The conduit 24 includes a pair of oppositely laterally projecting support means or runners 32, the purpose of which will be hereinafter described.

The spray conduit 24 is supported from the underside of the upper slab 12 by a plurality of hanger rods 34 spaced along the length of the conduit 24. The hanger rods 34 are secured at one end to the underside of slab 12 and at the other end to the spray conduit body 26. The hanger rods are rigid and perform the dual function of supporting the conduits from the upper slab and preventing the conduit from moving toward the upper slab as will hereinafter be described.

The spray conduit 24 also may include a pair of opposite extending fittings 36, the purpose of which will be hereinafter described in the discussion of FIG. 4.
supply conduit 46 which is connected to the inlet of motorized valve 48. The supply conduit 46 includes a manual shut-off valve 47. Conduit 50 is connected at one end to the outlet of motorized valve 48 and at the other end to a fitting 36 of one of the spray conduits 24. Fluid communication between spray conduits 24 is established by intermediate conduits 54 which are joined at each end to fittings 36 of the spray conduits 24. The supply conduit 46 extends along a row of adjacent rooms and a plurality of valves, such a valve 48, one for each room, are disposed therealong, for controlling the supply of extinguishant to each of the individual rooms in a manner as will be hereinafter discussed.

A detector 42 is mounted in the ceiling 14 as shown in FIG. 1 and 4. Of course, it should be realized that a single room R may have a plurality of detectors 42 positioned therein. Of course, a single spray conduit or a group of spray conduits in a room may be controlled by just one of the detectors in a room, with other spray conduits in the room being controlled by detectors placed at other locations in the room. This may be necessary in situations where available extinguishant pressure is low.

The corridor C includes a centrally located spray conduit 55 which can be comprised of a plurality of conduit sections joined in end to end relationship with suitable sealing means (not shown) joining the sections. The spray conduit 55 is essentially the same as spray conduits 46 heretofore described. A lateral supply conduit 58 in fluid communication with the conduit 46 supplies extinguishant to a motorized valve 56 to supply extinguishant under pressure to conduit 55.

It should be realized that when the protection system is quiescent, the conduit 50, the spray conduits 24, and the connecting conduits 54 are all empty of extinguishant. The spray conduits 24 are open to the atmosphere at all times through the apertures 28. When a detector 42 detects a fire or similar occurrence, by sensing heat/or smoke, it provides a control signal which is supplied to a control element 44 by a line 43. This causes the motor M to be energized and the motor M in turn opens the valve 48. When the valve 48 is open, extinguishant flows from the riser 52, through the line 46, through the valve 48 and through the conduit 50 to the spray conduits 24 which, it will be recalled, are joined together by the connecting conduits 54 and the fittings 36. Thus the conduits 24 are supplied with extinguishant which is directed downwardly through the apertures 28 as shown in FIG. 1. If the apertures 28 are closely spaced, the extinguishant issues from the spray conduit 24 as a curtain of extinguishant which tends to prevent the spread of the fire laterally across the room.

The system is shut off by closing manual shut off valve 47 which stops the flow of extinguishant to the conduits 24.

In addition, the detector 42 can be connected in controlling relationship to the valve 46 for supplying spray conduits 55 in the corridor C with extinguishant. The spray conduit 55 forms a protective curtain throughout the length of the corridor and protects people in the corridor who must use the corridor to gain access to fire escapes and protected stairwells.

If FIG. 5, there is illustrated another embodiment of the invention herein described. In this embodiment, the number of apertures in the bottom wall of the conduit 60 is reduced, as compared with conduit 24 in the FIG. 1 embodiment. In addition, the release of extinguishant from the conduit 60 is controlled by a plurality of heat responsive control members 61 spaced along, and which may depend from, the bottom wall of the conduit 60. There is a control element 61 for each aperture 62 in the conduit. This system is utilized in situations where it is desirable to release water only in the immediate locality of the fire and not in a curtain, as in the FIG. 1 embodiment.

As above mentioned, in the conduit illustrated in FIG. 5 embodiment, a plurality of apertures 62, drilled or otherwise formed, are spaced longitudinally along the bottom wall of the conduit 60. There is disposed in each aperture 60 a seat or sealing member 63, which can be comprised of a flexible resilient grommet made, for example, of Neoprene.

The control element 61 includes a frame 64, which can be comprised of a U-shaped rod, which is affixed, by suitable means, to the conduit. As illustrated in FIG. 5, the frame 64 is mounted on the flanges 65 by means of threaded fasteners 66. Control element 61 also includes a conical valve member 67, normally held in a fluid sealing position against grommet 63 by a heat fusible line 68. The link 68 is of a type employing a tubular barrel containing a fusible material and a glass ball 71 disposed on top of the solid fusible material so that when the fusible material melts, the glass ball drops into the barrel of the element. Such fusible links are known in the art and the particular construction of this link is not the subject matter of the invention herein disclosed. The valve element 67 includes a portion 69, having a radiused surface for rotating the element 71 of the fusible element 68. The element 68 and valve member 67 are held in position by suitable means, such as an adjustment screw 70, which is mounted on the frame 64 and which urges the valve member 67 by a link 68 against the sealing element 63. The control element 61 also includes suitable deflecting means, such as deflector plates 72, which may be mounted on the frame 64 to disperse extinguishant issuing from the aperture 62, as will hereinafter be described.

Conduit 60 can be mounted in a manner previously described with respect to conduit 24 of the FIG. 1 embodiment. It should also be noted that the conduit 60 includes flanges 65 for supporting conduit 60, as in the FIG. 1 embodiment. Thus the conduit 60 functions as the support for ceiling tiles as a part of a grid type ceiling structure.

The supply of extinguishant to conduit 60 is achieved in the manner as heretofore described with respect to the conduit 24. The conduit 60 is normally empty of extinguishant and is supplied with extinguishant in response to a signal generated by a suitable detector, such as detector 42. However, in this embodiment, extinguishant does not flow from all the apertures in the conduit supplied with extinguishant, but only from those apertures where the control element 61 has been actuated. In this regard, the control element 61 functions as follows. When sufficient heat has been developed to raise the fusible material in the link 68 about its melting point, the glass ball of the fusible element 68 drops inside the barrel of the element 68, thereby releasing the valve element 67. Thus the valve element 67 and fusible element 68 are free to fall away from the conduit 60. When this occurs, extinguishant issues through the aperture 62 and impinges upon the deflector plate 72 and is diffused into a spray which falls upon the fire.
It should be realized that the system disclosed herein provides many economies in that the fire protection system can be installed at the same time that the suspended ceiling is being installed and that it eliminates the need for a separate delivery system. This reduces the amount of time required for installation and also reduces material costs. Also, the spray conduits 24 or 60 can be formed of lightweight materials because the conduits are not required to hold the extinguishing agent under pressure or hold gas under pressure for extended periods of time. The conduits 24 and 60 are empty of extinguishing agent until such time as the detector element 42 causes extinguishing agent to be supplied to the conduits. Thus, very significant savings in overall cost and maintenance can be realized, particularly in high rise buildings in which each floor must have its own protection system.

In addition, with respect to the embodiment shown in FIG. 5, because the conduits 60 do not retain extinguishing agent under pressure for extended periods of time, the control elements 61 are not required to be precision manufactured, but rather, can be less expensive, and relatively uncomplicated assemblies, as shown.

I claim:
1. An integral fire protection system and ceiling structure comprising a plurality of discrete ceiling tiles, a supporting grid for supporting the ceiling tiles, a hollow, elongate conduit incorporated into said supporting grid for carrying extinguishing agent under pressure, a source of extinguishing agent under pressure, valve means for maintaining the conduit empty of extinguishing agent when the system is in an inactive state, detector means for detecting a fire, said valve means being responsive to the detecting means for causing the valve means to supply extinguishing agent to the conduit upon the detection of a fire by said detecting means, and the conduit including means for spraying extinguishing agent outwardly of the conduit.

2. A structure as in claim 1, wherein the spraying means comprises a series of discrete, spaced apertures formed in a bottom wall of the conduit and the conduit includes heat responsive control element for controlling the flow of extinguishing agent through each of the apertures.

3. A structure as in claim 2, wherein the control element comprises a sealing element associated with each aperture, a valve element for preventing flow of extinguishing agent through the sealing element, and heat responsive means for holding the valve member in fluid sealing relationship with the sealing element when the temperature of the heat responsive is below a predetermined temperature and for releasing the valve element when the temperature of the heat responsive means is above a predetermined temperature.

4. A structure as in claim 1, and further including support means for supporting the conduit comprising means engaging a top portion of the conduit.

5. A structure as in claim 1, wherein the conduit includes means for supporting edges of ceiling tiles adjacent the conduit.

6. A structure as in claim 5, wherein the supporting means comprises a longitudinally extending flange mounted on the conduit.

7. A structure in accordance with claim 1, wherein the means responsive to the fire detector means comprises a valve positioned between the source of extinguishing agent and the conduit.

8. A ceiling assembly, comprising a plurality of ceiling tiles, a grid type support system for holding said ceiling tiles in position, including an elongate conduit having a hollow interior for carrying extinguishing agent under pressure, the conduit including spray means communicating with said hollow interior for spraying extinguishing agent from the hollow interior outwardly of the conduit, the conduit including means for engaging an edge of at least some of the tiles.

9. A ceiling assembly in accordance with claim 5, wherein the support means comprises a first series of spaced support members and a second series of spaced support members oriented in a direction different from the first series.

10. A ceiling assembly according to claim 6, wherein alternate ones of the support members are conduits.

11. A combined ceiling tile support member and conduit comprising an elongate hollow body for carrying extinguishing agent under pressure, spray means carried by the conduit for spraying extinguishing agent outwardly of the conduit, and support means on the conduit for engaging an edge of a ceiling tile.

12. A member according to claim 11 wherein the support means comprises at least one laterally projecting flange positioned adjacent a bottom wall of the conduit.

13. A member according to claim 11, wherein the spray means comprises at least one aperture formed in a wall of the body and heat responsive control element associated with the aperture for preventing the flow of extinguishing agent from an aperture below a predetermined temperature and for permitting the flow of extinguishing agent from the aperture when said predetermined temperature is reached.

14. A member according to claim 13 wherein the heat responsive control element includes a sealing member disposed about the aperture, a valve member for engaging the sealing member to prevent the flow of extinguishing agent from the conduit, a heat responsive link for holding the valve member in sealing relationship with the sealing means when the link is below a predetermined temperature and for permitting the valve member to move out of sealing relationship with the sealing member when the temperature of the link is above the predetermined temperature.

15. A member as in claim 14, wherein the control element includes a frame mounted on the member and wherein the link is coactive between the frame and valve member for holding the valve member in sealing relationship with the sealing member.

16. A member as in claim 15, wherein a deflector means is mounted on the frame in the path of extinguishing issuing from the aperture.

17. A member as in claim 15, wherein the frame includes a movable means for engaging heat responsive link and urging the valve member into sealing relationship with the sealing member.