A Fire Suppression System

FIELD

The present invention relates to a fire suppression system, a valve for use in a fire suppression system and a method of providing a fire suppression system. In particular, the techniques disclosed herein relate to a fire suppression system including a multi-directional control valve, a multi-directional control valve for a fire suppression system and a method of simultaneously actuating a first fire suppression supply system and a second fire suppression supply system.

BACKGROUND

A fire extinguishing system generally includes a pressurised cylinder containing an extinguishant. Such fire suppression systems may be installed in fire hazard areas such that the extinguishant is released automatically when a fire is detected. In some fire suppression systems the pressurised cylinder can be connected to a length of detection tubing. The length of the detection tubing comprises an outer wall which is arranged to be ruptured by heat from a nearby fire and the extinguishant is released through the rupture. Accordingly, with such systems, the extinguishant will be automatically and directly released in the proximity of the fire.

The detection tubing is positioned and secured in a fire risk area for which the system is designed to protect. If a fire subsequently starts within this area then the heat will rupture the detection tubing at the hottest area and this will cause the extinguishant to flow through the rupture in order to extinguish, or at least suppress, the original source of the fire. This system is currently available from Firetrace Limited as a direct automatic fire suppression system.

Similar systems are available which are called indirect automatic fire suppression systems. In these systems, the extinguishant is arranged to be discharged through a diffuser head located on a discharge tube. Accordingly, the extinguishant does not flow through the detection tubing and out of the rupture. These indirect systems generally include a valve which is controlled by the pressure in the detection tubing such that the valve is opened when pressure is released from the

detection tubing. On the release of this pressure, the discharge valve opens and the extinguishant flows through the discharge tube and out of the diffuser head.

A user or installer therefore has the option of selecting whether to use a direct fire suppression system or an indirect fire suppression system depending upon the particular circumstances. For example, to protect an area having multiple chambers, an indirect system may be selected in which there is a diffuser head located in each of the chambers. Alternatively, a direct system may be installed where it is preferred to only have the source of the heat directly extinguished without having to guess where to install a diffuser head. A direct system may therefore be more targeted and prevent any components or equipment being unnecessarily covered with an extinguishant.

It is an aim of the techniques disclosed herein to overcome at least one problem associated with the prior art whether referred to herein or otherwise.

SUMMARY

The invention is defined in the independent claims. Further embodiments of the invention are defined in the dependent claims.

According to a first exemplary technique, there is provided a fire suppression system comprising extinguishant supply means, a control valve, a detection tube and a discharge tube wherein rupture of the wall of the detection tube causes a release of pressure from within the detection tube and this release of pressure is arranged to open extinguishant release passageways to both the detection tube and the discharge tube in order for extinguishant to be released through both the detection tube and the discharge tube.

Preferably the release of pressure from the rupture is arranged to simultaneously open extinguishant release passageways to both the detection tube and the

According to a second exemplary technique, there is provided a valve for use in a fire suppression system in accordance with the first aspect of the present invention, the control valve comprising:

a body with an inlet, a first outlet port and a second outlet port; and

a valve member movable within the body for opening and closing extinguishant release passageways between the inlet and both the first outlet port and the second outlet port,

the valve member being movable between;

a first position where the extinguishant release passageways are closed between the inlet and both the first outlet and the second outlet;

a second position where the extinguishant release passageways are open between the inlet and both the first and second outlet ports.

According to a third exemplary technique, there is provided a method of providing a fire suppression system comprising providing extinguishant supply means and a control valve, the method comprising installing a detection tube and a discharge tube within a fire prevention area, wherein rupture of the wall of the detection tube causes a release of pressure from within the detection tube and this release of pressure is arranged to open extinguishant release passageways to both the detection tube and the discharge tube in order for extinguishant to be released through both the detection tube and the discharge tube.

The method comprises moving a valve member between;

a first position where the extinguishant release passageways are closed between an inlet and both a first outlet and a second outlet of the control valve; and

a second position where the extinguishant release passageways are open between the inlet and both the first and second outlet ports.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described, by way of example only, with a reference to the drawings that follow, in which:

Figure 1 is a side cross-section schematic view of a preferred embodiment of a bidirectional control valve with the valve in the closed position.

Figure 2 is a side cross-section schematic view of a preferred embodiment of a bidirectional control valve with the valve in the open and activated (discharging) position.

Figure 3 is a side cross-section schematic view of another embodiment of a bidirectional control valve with the valve in the closed position.

Figure 4 is a side cross-section schematic view of a further embodiment of a bidirectional control valve with the valve in the closed position.

Figure 5 is a top view of a valve member for uses in a bi-directional control valve , according to various embodiments.

Figure 6 is a side view of a valve member for use in a bi-directional control valve, according to various embodiments.

Figure 7 is a bottom view of a valve member for use in a bi-directional control valve, according to various embodiments.

Figure 8 is a schematic view of a preferred embodiment of a fire suppression system.

Figure 9 is a schematic view of another embodiment of a fire suppression system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in Figure 1, a preferred embodiment of a multi-directional control valve comprises a bi-directional control valve 10. In particular, this control valve 10 is specifically for a fire suppression system comprises an inlet 12, a first fluid communication passageway or outlet (port) 14 and a second fluid communication passageway or outlet (port) 16. The first outlet port 14 is arranged to be connected to a detector tube 18 whereas the second outlet port 16 is arranged to be connected to a discharge tube 20. The detector tube 18 comprises a heat sensitive tube which will be ruptured and/or penetrated as a result of exposure to significant heat. As a result of this rupture, the pressure contained within the detector tube 18 will be released and this is then arranged to actuate the control valve 10 such that the fire extinguishant contained within a cylinder 22 is simultaneously released through the detector tube 18 and also through the dedicated discharge tube 20. It should be noted that the discharge tube 20 is separate from the detection tube 18 even though the detection tube 18 actually functions to discharge extinguishant through the heat/fire created rupture. In addition, the detection tube 18 is pressurised whereas the discharge tube 20 is unpressurised.

As explained previously, Firetrace Limited currently provide a direct discharge system using a single outlet port similar to the first outlet port 14 only or an indirect discharge system using a single outlet port similar to the second outlet port 16 only. Accordingly, the techniques disclosed herein now provide a fire suppression system which enables a combination of both a direct extinguishant release and an indirect extinguishant release.

This new function has been enabled through the use of a combination of control valves or a new control valve 10 which provides a first extinguishant release passageway and a second extinguishant release passageway. The valve member 30 has a first part 32 and a second part 34. The first part 32 generally comprises

tube 20 and any discharge heads and/or from the site of the leak. The discharge tube 20 and any discharge heads may actually be unpressurised and/or open to allow any free flow of air into and out of the discharge tube 20. Overall, any release or leak or change of pressure in the detection tube 18 could have significant consequences. For example, a slow release of pressure from the detector tube 18 would eventually cause the system to be falsely activated.

The techniques disclosed herein may provide an equalising function to automatically re-pressurise the detection tube 18 if the detection tube 18 slowly loses pressure. The valve member 30 includes a first part (carrier component) 32 and a second part (sealing component) 34 wherein the second part 34 is effectively carried and mounted to the first part 32.

The valve member 30 includes a re-pressurising or equalising passageway 90 including an internal valve mechanism. In particular, the carrier component 32 includes a passageway 90 defined therethrough. This passageway 90 cooperates with a passageway 94 provided in the sealing member 34. These two passageways connect to provide a continuous passageway from the primed chamber 42 to the detection chamber 40. However, an internal valve mechanism is arranged to selectively restrict the flow through this connecting passageway.

The internal valve mechanism comprises a ball 94 or spherical valve member which is arranged to seal the connecting passageway 90 on the detection of a fire. In a normal inoperative condition, the ball 90 is contained within the passageway 90 but there is an equalising passageway extending from the detection chamber 40 to the primed chamber 42 such that the pressures will be equalised. As shown in Figure 1, a greater pressure within the detection chamber 40 would only force the ball member 94 away from the tapered or flared sealing surface of the passageway 90. A slight decrease or gradual decrease in the pressure within the detection chamber 40 would not produce a sufficient force or move the ball 94 into engagement with the sealing surface of the passageway 90. Accordingly, a small or gradual decrease in the pressure within the detection chamber 40 will be

normally be adjacent to the periphery of the sealing disc 34.

The seat 38 may be normally spaced from the sealing disc 34 by a certain amount (or a predetermined distance) and the edge or periphery of the disc 34 may be spaced from or flexed or deformed such that pressurised fluid (gas) can escape and flow around the edge of the sealing disc 34. This therefore enables gas from within the primed chamber 42 to flow into the detection chamber 40 in a restricted flow. This flow of pressurised gas will tend to maintain substantially equal pressures in the detection chamber 40 and the primed chamber 42. Accordingly, this maintains the integrity of the overall system.

An alternative embodiment is shown in Figure 4. The valve essentially works and operates in the same way as the embodiments described above. However, in this alternative version, the detection chamber 40 includes an abutment stop 82 which holds an end of the carrier component 32 in a spaced position from the end of the detection chamber 40. The first outlet 14 then provides exit regions 81, 83 on this stop component 82. Accordingly, in the open, discharging position, the extinguishant flows through the grooves 70 and past the O-ring 60 and then into an annular void 84 surrounding the central stop portion 82. The pressurised extinguishant can then flow from through the exit regions 81, 83 and into the detection tube 18 in order to flow out of the rupture.

A preferred embodiment of a fire suppression system is shown schematically in Figure 8. The fire suppression system comprises a single pressurised cylinder 22 containing an extinguishant. The fire suppression system further comprises a bidirectional valve 10, a pressurised detection tube 18 and an unpressurised discharge tube having discharge heads 21 provided thereon. The discharge heads 21 may be mounted or installed in separate chambers 96, 98 or (partially) concealed locations which may not necessarily receive a release of the extinguishant from the detection tube 18. The discharge heads 21 may be directed towards any essential, critical or expensive components. In this embodiment, a rupture of the detection tube 18 causes the activation of the bi-

1. A fire suppression system, comprising:
a cylinder configured to contain a fire extinguishant material;
a control valve connected to the cylinder and configured to controllably seal the cylinder under a first pressure, wherein the control valve comprises:
an inlet fluidly linked to the cylinder;
a first outlet port open to a second pressure;
a second outlet port;
a valve member movable between a closed position and an open position within the control valve for opening and closing:
a first extinguishant release passageway between the inlet and the first outlet port; and
a second extinguishant release passageway between the inlet and the second outlet port;
a detector tube connected on a first end to the first outlet port, wherein:
the detector tube is configured to be held at the second pressure; and
a loss of the second pressure from the detector tube due to a rupture causes the valve member to move from the closed position to the open position to unseal the cylinder and release the fire extinguishant material through both the first and second extinguishant passageways; and
a discharge tube connected to the second outlet port.

2. A fire suppression system according to claim 1, wherein the control valve further comprises an equalizing passageway to enable pressurized fluid to flow therethrough when the valve member is in the closed position.

3. A fire suppression system according to claim 2, wherein the equalizing passageway:
is open when the detection tube is pressurized; and
is closed when the detection tube is ruptured.

4. A fire suppression system according to claim 2, wherein the equalizing passageway is configured to maintain the second pressure in the detector tube.

5. A fire suppression system according to claim 2, wherein the equalizing passageway:
is open when the valve member is in the closed position; and
is closed when the valve member is in the open position.

6. A fire suppression system according to claim 1, wherein:
the closed position of the valve member closes off the first and second extinguishant release passageways to prevent the release of the fire extinguishant material; and
the open position of the valve member opens the first and second extinguishant release passageways to allow the simultaneous release of the fire extinguishant material from the first and second outlet ports.

7. A fire suppression system according to claim 1, wherein the control valve further comprises:
a primed chamber disposed between the inlet and a first side of the valve member, wherein the first side comprises a first surface area exposed to the first pressure; and
a detector chamber disposed between the first outlet port and a second side of the valve member, wherein:
the second side comprises a second surface area exposed to the second pressure; and
the second surface area is larger than the first surface area.

8. A fire suppression system according to claim 1, further comprising:
a second cylinder connected to a second end of the detector tube, wherein the second cylinder is configured to contain a second fire extinguishant material; and
a second control valve disposed between the second cylinder and the second end of the detector tube, wherein the second control valve is configured to controllably seal

the second cylinder and release the second fire extinguishant material in response to the loss of the second pressure from the detector tube.

9. A fire suppression system according to claim 1, wherein the discharge tube further comprises a discharge head configured to release the released fire extinguishant material.

10. A pneumatically actuated valve for a pressurized cylinder containing a fire extinguishant material, comprising:

a body, comprising:

an inlet configured to connect to and be fluidly linked to the cylinder;

a first outlet port open to a first pressure; and

a second outlet port; and

a valve member movable and disposed within the body, wherein the valve member is configured to:

controllably seal the cylinder under a second pressure;

open and close a first extinguishant release passageway extending between the inlet and the first outlet port;

open and close a second extinguishant release passageway extending between the inlet and the second outlet port;

move between:

a closed position, wherein the first and second extinguishant release passageways are closed off to prevent the release of the fire extinguishant material;

an open position, wherein the first and second extinguishant release passageways are opened to allow the simultaneous release of the fire extinguishant material from the first and second outlet ports; and

move from the closed position to the open position in response to a loss of the first pressure.

11. A pneumatically actuated valve according to claim 10, wherein the control valve further comprises:

a primed chamber disposed between the inlet and a first side of the valve member, wherein the first side comprises a first surface area exposed to the second pressure; and

a detector chamber disposed between the first outlet port and a second side of the valve member, wherein:

the second side comprises a second surface area exposed to the first pressure; and

the second surface area is larger than the first surface area.

12. A pneumatically actuated valve according to claim 11, wherein the valve member further comprises an equalizing passageway to enable pressurized fluid to flow from the primed chamber to the detector chamber when the valve member is in the closed position.

13. A pneumatically actuated valve according to claim 12, wherein the valve member is configured to close the equalizing passageway when the valve member is in the open position.

14. A method of providing a fire suppression system, comprising:

installing a detector tube within a fire prevention area, wherein the detector tube is configured to be pressurized to a first pressure;

installing a discharge tube within the fire prevention area;

coupling an inlet of a control valve to a cylinder configured to contain a fire extinguishant material under a second pressure;

coupling a first end of the detector tube to a first outlet port of the control valve; and

coupling a first end of the discharge tube to a second outlet port of the control valve, wherein the control valve is configured to:

open a first extinguishant release passageway between the inlet and the first outlet port in response to a loss of the first pressure; and

open a second extinguishant release passageway between the inlet and the second outlet port in response to the loss of the first pressure; and

allow the fire extinguishant material to be simultaneously released through both the first and second outlet ports.

15. A method of providing a fire suppression system according to claim 14, further comprising maintaining the first pressure in the detector tube by allowing a pressurized fluid to flow from the cylinder through an equalizing passageway formed into a valve member disposed within the control valve.

16. A method of providing a fire suppression system according to claim 15, wherein:

the equalizing passageway is open when the valve member is in a closed position; and

the equalizing passageway is closed when the valve member is in an open position.

17. A method of providing a fire suppression system according to claim 14, further comprising:

connecting a second cylinder containing a second fire extinguishant material to a second end of the detector tube; and

connecting a second control valve between the second cylinder and the second end of the detector tube, wherein the second control valve is configured to controllably seal the second cylinder and release the second fire extinguishant material into the detector tube in response to the loss of the first pressure from the detector tube.