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Fire Detectors and Fire Protection Systems
Incorporating Such Detectors

The present invention relates to fire detectors and to
5 fire protection systems incorporating fire detectors.

There is disclosed in United Kingdom patent specification
no. 2060376 a fire protection system comprising one or
more fire extinguishers with pneumatically operable
10 actuation means. The actuation means is connected by a
conduit to a detector comprising an elongate tube
containing a solid, temperature-responsive, gas-evolving
substance. When a predetermined temperature is sensed at
any point along the tube, the substance reacts
15 explosively, and generates gas which travels along the
conduit in order to trigger the actuation means of the
fire extinguisher. Although this previously proposed
system operates well, a difficulty arises in that after
use, the tube and the associated conduit and actuation
20 means will contain the combustion products of the gas-
evolving substance and also some unburnt residue and the
entire system must be cleaned before it can be
recommissioned for use, which may be very time-consuming
especially when the detector tube is many metres in length
25 and when the conduit is branched in order to serve several
extinguishers or other pneumatically operated devices
incorporated in the system.

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- According to the present invention, there is provided a fire detector comprising a tube of heat-conductive material normally closed at one end, and a temperature-responsive element housed within the tube, said element
- 5 comprising a length of a gas-evolving substance effective when a predetermined critical temperature is reached at any point along the length of the element to generate explosively a volume of gas for activating pneumatic actuation means connectable to the other end of the tube,
- 10 and a mesh sheath surrounding said length of gas-evolving substance, said sheath defining a filter to retain combustion products and unburnt residue of said substance; and said tube being adapted to be openable at at least one end thereof to facilitate the removal from
- 15 the tube of said sheath with retained combustion products and unburnt residue after combustion of said temperature-responsive element, and the insertion of a fresh said element.
- 20 Further according to the invention, there is provided a fire protection system comprising at least one fire extinguisher; pneumatic actuation means for said fire extinguisher; and a fire detector as defined above for generating gas for activating said pneumatic actuation
- 25 means connected thereto by conduit means.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

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Figure 1 is a schematic view of a fire protection system incorporating a detector in accordance with the preferred embodiment of the invention;

5 Figure 2 is a fragmentary section showing pneumatic actuation means of a fire extinguisher of the system; and

Figure 3 is a section through the detector.

10 The fire protection system shown in the drawings comprises a fire extinguisher 2, pneumatically-operable actuation means 4 for the fire extinguisher 2, a fire detector 6 containing a solid, gas-evolving, temperature-responsive substance, and a conduit 8 connecting the detector 6 to
15 the actuation means 4. The conduit 8 may be branched to transmit gas pressure to other pneumatically-operable devices, such as a pneumatically-operated electrical switch 10, or a pneumatic ram 12 associated with machinery under protection. As shown in Figure 2, purely by way of
20 example, the fire extinguisher 2 comprises a head portion in the form of a body which defines a passage 18 and port 32 leading from the outlet 20 of the extinguisher 2. The extinguisher outlet 20 is normally closed by a closure plate 22 seated on an O-ring 24 and held against the force
25 of pressurised extinguishant fluid within the extinguisher by a pivotal catch 26 which engages a pivoted arm 28 by which the closure plate 22 is carried. The actuation means 4 comprises a piston 30 which is movable to the right (as viewed in Figure 2) by gas pressure generated by
30 the gas-evolving substance; such movement pivots the catch 26 clockwise (as viewed in Figure 2) and this releases the restraint on the arm 28 whereby the closure plate 22 is moved away from the extinguisher outlet 20 by the pressure

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of the extinguishant fluid and the fluid is discharged from the head portion via the outlet port 32 to associated ducting (not shown) which is threadedly connected to the port 32.

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The system so far described is substantially identical to that disclosed in the above-numbered United Kingdom patent specification further details of which are herein incorporated by reference. The illustrated construction
10 of the pneumatically-operated actuation means is given by way of example only and other forms of actuation means such as described in the aforementioned specification may alternatively be used.

15 As shown in Figure 3, the fire detector 6 comprises a tube 34 which may be between a few centimetres and 25 metres or more in length, the tube being of a heat conductive material such as copper-plated, hot-tinned steel. The tube 34 is initially straight, but can be bent during
20 installation in order to follow a desired path. When installed, the tube extends through a zone to be protected, for example the tube may be positioned on the wall or ceiling of a room so as to extend throughout the length of the room, or along machinery.

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The interior of the tube 34 contains a temperature-responsive element 36 comprising a length of a gas-evolving temperature-responsive substance which extends substantially throughout the length of the tube 34, the
30 element being flexible so that it can be bent with the tube 34. The substance may consist of a cotton wick impregnated with blackpowder and dried nitrocellulose solution. Alternatively, the substance may consist of a

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plastic igniter cord. A typical plastic igniter cord (fast) may comprise central paper strings coated with mealed blackpowder composition and held together with cotton counterwinding; these are enclosed in an extruded layer of plastic incendiary composition and finished with an outer plastics covering. The substance reacts suddenly and explosively when a critical temperature of, say, between about 175° and 185°C is attained at any point along its length, the explosive reaction generating a large volume of gas at a pressure which may be within the range of 150 to 3000 psi or more, the pressure being controllable for each particular installation by using tubing of different diameters.

The element 36 is retained within a mesh sheath 38 which acts as a filter to retain solid combustion products and unburnt residue from the explosive reaction while permitting passage of gas through the mesh of the sheath. The sheath 38 is formed of metal wire for example of stainless steel or nickel steel so as to be heat resistant and to withstand the explosive reaction; preferably, the sheath 38 is formed from a braided wire mesh. At each end, the sheath 38 is closed by being crimped into a tubular end fitting 40a, 40b. The end fitting 40a at the end of the tube 34 remote from the conduit 8 is internally threaded for connection to an inwardly-projecting threaded spigot of a threaded blanking plug 42 which closes the remote end of the tube 34 and which is screwed into a gland nut 44 held captive at that end of the tube. The proximate end of the tube 34, that is the end of the tube 34 which is closer to the conduit 8, is likewise provided with a captive gland nut 44 and this receives a tubular, externally-threaded, connector 46 by which the tube 34 can

be connected to a further length of detector tube or to the conduit 8 which leads to the actuation means. The crimped end fitting 40b for the sheath 38 at the proximate end of the tube 34 is externally threaded and of a size to
5 mate with the internal thread of an end fitting 40a similar to that used at the remote end of the tube 34. If the tube 34 is connected to a further length of detector tube, the externally-threaded end fitting 40b will be screwed into the internally threaded end fitting at the
10 adjacent end of the temperature-responsive element associated with that other tube; if, however, the detector tube is connected directly to the conduit 8 at its proximate end, the end fitting 40b is simply left free (as shown).

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In use, when the temperature-responsive substance actuates explosively at the critical temperature, a large volume of gas is generated which passes through the wire mesh sheath 38 into the tube 34 and thence into the conduit 8 in order
20 to trigger the actuation means. However, the solid combustion products and unburnt residue are retained within the sheath 38 and do not enter the tube. In order to recommission the system after use, the blanking plug 42 is removed from the remote end of the tube 34 and the
25 proximate end of the tube 34 is disconnected from the threaded connector 46 by unscrewing the gland nut 44 at that end of the tube. A new temperature-responsive element, complete with an outer wire sheath 38 and end fittings 40a, 40b is connected to the proximate end of the
30 spent element by screwing the end fitting 40a of the new element onto the end fitting 40b of the spent element. The spent element is then withdrawn from the tube 34 through the open, remote, end of the tube, thus drawing

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the new element into the tube 34. When the spent element is fully withdrawn, it is disconnected from the new element, and the tube 34 is re-closed by screwing the plug 42 onto the end fitting 40a of the new element and
5 screwing the gland nut 44 onto the plug 42. At the proximate end of the tube 34, the gland nut 44 is screwed onto the threaded connector 46.

It will be apparent that the use of the wire sheath avoids
10 the need to clean the system after use as solid combustion products and any unburnt residue will be removed when the element is removed. The end fittings at each end of the sheath enable the element to be easily replaced in the manner described above, even if the tube 34 (or tubes 34)
15 follow a tortuous path in the installation.



CLAIMS

1. A fire detector comprising a tube of heat-conductive material normally closed at one end, and a temperature-responsive element housed within the tube, said element comprising a length of a gas-evolving substance effective when a predetermined critical temperature is reached at any point along the length of the element to generate explosively a volume of gas for activating pneumatic actuation means connectable to the other end of the tube, and a mesh sheath surrounding said length of gas-evolving substance, said sheath defining a filter to retain combustion products and unburnt residue of said substance; and said tube being adapted to be openable at at least one end thereof to facilitate the removal from the tube of said sheath with retained combustion products and unburnt residue after combustion of said temperature-responsive element, and the insertion of a fresh said element.
2. A fire detector according to claim 1, wherein the sheath comprises a wire mesh.
3. A fire detector according to claim 2, wherein the mesh is a braided mesh.
4. A fire detector according to any preceding claim wherein the temperature-responsive element further comprises an end fitting at each end of the sheath, the end fitting at one end of the sheath being externally threaded and the end fitting at the other end of the sheath being internally threaded, the internal and external threads being complementary whereby two similar such temperature-responsive elements can be coupled by engaging the externally-threaded end fitting of one of said elements with the internally-threaded end fitting of the other of said elements.

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5. A fire detector according to claim 4, further comprising removable plug means closing one end of the tube, said plug means including a threaded portion for connection with the threaded end fitting at the adjacent
5 end of the temperature-responsive element.

6. A fire detector according to any preceding claim, wherein the tube is bendable and the element extends along substantially the entire length of the tube.

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7. A fire detector according to claim 1 and substantially as hereinbefore described with reference to the accompanying drawings.

15 8. A fire protection system comprising at least one fire extinguisher; pneumatic actuation means for said fire extinguisher; a fire detector comprising a tube of heat-conductive material normally closed at one end, and a temperature-responsive element housed within said tube;
20 said temperature-responsive element comprising a length of a gas-evolving substance effective, when a predetermined critical temperature is reached, to generate explosively a volume of gas for activating said pneumatic actuation means and a mesh sheath surrounding said length of gas-evolving substance, said sheath forming a filter to retain
25 combustion products and unburnt residue of said substance; conduit means connecting the other end of said tube to said actuation means; and said tube being adapted to be openable at at least one end thereof to facilitate the
30 removal from the tube of said sheath with retained combustion products and unburnt residue after combustion of said temperature-responsive element, and the insertion of a fresh said element.

35 9. A fire protection system according to claim 8, wherein said detector is made in accordance with any one of claims 2-7.