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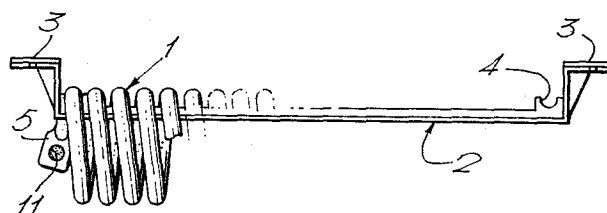
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54 **Fire extinguishing apparatus.**

57 An automatic fire extinguisher comprises a sealed length of PVDF tubing 1 formed into a coil or other convoluted shape, and containing a quantity of BCF or the like vaporisable fire extinguishant under pressure. At normal ambient temperatures the strength of the tube is sufficient to withstand the internal extinguishant pressure. However, when the tube is heated above a specified temperature by exposure to a fire the tube wall softens and the extinguishant pressure rises so that the tube bursts to release the extinguishant over the fire.



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Fire Extinguishing Apparatus

This invention relates to fire extinguishing apparatus. The invention aims to provide inexpensive automatic fire
5 extinguishing apparatus suitable for the protection of a wide variety of risks, and is especially suited to the automatic extinguishment of fires in relatively confined spaces. Apparatus according to the invention may therefore find particular application eg. inside letter (mail) boxes; night
10 deposit safes; storage cabinets for papers, microfilm or other data media; paint or solvent cabinets; office machines, photo booths or other electrical equipment.

In accordance with the invention fire extinguishing apparatus
15 comprises a sealed tube of rigid or semi-rigid plastics material which has been pre-formed into a convoluted shape and contains a fluid fire extinguishant under pressure, the said pressure and the strength of the tube being such that in use the tube resists the pressure of the extinguishant at
20 normal ambient temperatures but softens and bursts to release the extinguishant if heated above a specified temperature. Such apparatus therefore acts as a combined fire detector and extinguisher in the sense that if the tube is heated above a specified temperature as a result of an actual or incipient
25 fire condition the tube will automatically burst and release the stored extinguishant.

In a particularly preferred embodiment of the invention the plastics tube is pre-formed into a helix. This form can be produced by simple and inexpensive winding techniques and the coiled tube can of course store a much greater quantity of
5 extinguishant than a straight length of equivalent tubing extending between the same two end points. In another preferred embodiment likewise designed to maximise the stored extinguishant capacity, but with minimum intrusion of the apparatus into the protected space, the plastics tube is pre-
10 formed into a flat spiral. However, many other convoluted forms, eg serpentine, may be provided and in addition to the above-exemplified regular geometrical forms, which can be regarded as "standard" tube configurations applicable to a range of different risks, the tubes of such apparatus can, by
15 appropriate heat treatment and manipulation, be provided in more complex and specially defined forms tailored to the form of specific risks to be protected and to the corresponding required volume of extinguishant.

20 A particularly preferred material from which to make the tube of a fire extinguishing apparatus according to the invention is polyvinylidene fluoride (PVDF). This material has good mechanical properties and outstanding ageing resistance, is non-flammable and self-extinguishing and, in particular, has
25 excellent long-term chemical resistance and impermeability to bromochlorodifluoromethane (BCF) and the like vaporisable halogenated hydrocarbons, which are the preferred extinguishants in apparatus according to the invention.

30 Certain embodiments of apparatus in accordance with the invention will now be more particularly described, by way of example, and with reference to the accompanying drawings, in which:

Figures 1a and 1b are respectively end and side views of an apparatus based on a helically coiled tube; and

Figures 2a and 2b are respectively a plan view and a vertical
5 section through an apparatus based on a flat spiral tube.

Referring to Figures 1a and 1b, the illustrated apparatus comprises a helix of PVDF tubing 1 sealed at each end and containing a quantity of BCF fire extinguishant. The tube 1
10 is shown mounted to a bracket having feet 3 by which the apparatus can be mounted to a surface in the vicinity of the risk to be protected - eg the top inside surface of a mail box. The tube 1 is attached to the bracket 2 simply by snapping its end coils into grooves 4 in the bracket, the
15 inherent rigidity of the tube being sufficient to maintain the integrity of its pre-formed shape without any firmer means of fixation to the bracket. Alternatively, the bracket 2 could be dispensed with and the coiled tube simply suspended eg by hooks over the risk to be protected.

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To form the PVDF tube into a helix it must be heated to a temperature within the approximate range 160-172°C to become workable, and can then be coiled on a simple winding mandrel. The tubing can be wound in its softened state directly as it
25 is led off the extrusion machine by which it is made, or else a manufactured stock of tubing provided on a large diameter drum can be separately wound after being fed through a heated chamber to raise the tubing to workable temperature. The tubing is preferably wound in a continuous length and then
30 cut into sections for filling and sealing, the total number of coils in an extinguisher of course being open to choice in accordance with the desired capacity of extinguishant. After filling with the liquid BCF, the ends of the coil are crushed

flat, as indicated at 5, and sealed eg by heat or radio frequency welding. The extinguishant is preferably dyed a conspicuous colour - green to accord with the generally-accepted colour coding for halon extinguishers - so as to be readily visible through the translucent PVDF tube wall and hence assist in checking for serviceability.

One specific example of an apparatus in accordance with Figures 1a and 1b comprises an approximately 2.5m length of 8mm outside diameter, 1mm wall thickness PVDF tubing wound into 20 coils of 40mm mean diameter, the overall length of the wound helix being approximately 250mm in its relaxed condition. This tube contains 100gm of BCF at a fill ratio of approximately 85%, giving an internal pressure of 2 bar at 15°C.

In use of this apparatus, the tube 1 is mounted so as to be exposed to the heat of any fire which may develop in the risk to be protected. As the tube is heated it begins to soften while at the same time the pressure of the vaporizing extinguishant stored in the tube increases until the tube wall can no longer withstand the pressure loading and the tube bursts with instantaneous release of the pressurised extinguishant. For the example of the apparatus given above, this occurs at a tube temperature of approximately 180°C and an extinguishant pressure of approximately 7 bar. The burst will occur at that location on the tube where the heat input from the fire is the greatest and which accordingly softens first, all points along the tube being equally temperature sensitive.

To demonstrate the effectiveness of this type of extinguisher the following test was performed with a coiled tube made and filled in accordance with the foregoing example. The tube

was suspended adjacent to the top inside surface of a simulated mail box, the latter comprising a square steel cabinet with each side measuring 600mm and having an internal volume of 0.216m^3 ; an opening measuring 200 x 500mm was
5 provided in the top of the cabinet and a vent slot measuring 5 x 550mm was cut at the bottom edge of one side of the cabinet in order to cause a through draught. A quantity of manilla envelopes were placed in the bottom of the cabinet, sprinkled with 50cc of N Heptane and ignited. The tube
10 ruptured within 14 seconds from ignition of the envelopes and the released BCF extinguished the fire. Damage to the envelopes was slight and the contents of the majority would be readable.

15 Turning now to Figures 2a and 2b, these illustrate another form of apparatus in accordance with the invention, comprising a flat spiral of PVDF tubing 6 sealed at each end 7 and containing a quantity of BCF fire extinguishant. The tube is shown held in a mounting frame 8 having feet 9 by
20 which the apparatus can be mounted to a surface in the vicinity of the risk to be protected - eg the top inside surface of a shelf or drawer compartment in a data-storage cabinet. The tube 6 is attached to the frame 7 simply by snapping its coils into grooves 10 provided in the "spokes"
25 of the frame. The operation and performance of this embodiment is similar to that already described in relation to Figures 1a and 1b.

In some applications of fire extinguishing apparatus
30 according to the invention it is desirable to provide electric switching means which are operated automatically when the apparatus responds to the specified temperature condition, eg to initiate an alarm and/or to isolate the risk from its power source in the case where the risk comprises
35 electrical or electronic equipment. One way to achieve this

function is to deposit an electrically-conductive track along the outside of the plastics tube and to monitor the integrity of this track so that breakage of the track on rupture of the tube in response to a fire acts to signal the existence of

5 the fire condition. Preferably there would be a series of parallel tracks extending along the whole length of the tube, or a helical track extending around and along the tube, to ensure breakage of the track wherever the point at which the tube rupture occurred. Alternatively, the internal stresses

10 which are set up in the pre-formed tube when heated could be used to provide a signal. For example, an electrical contact could be deposited upon the flattened end portion of a tube as indicated at 11 in Figure 1b. In use this contact is clamped against fixed contacts to complete an electrical

15 circuit. When the tube is heated in the event of a fire considerable stresses are set up in the tube as a whole - for example in the case of a coiled tube there will be a tendency to unwind - and it is arranged that the anticipated force on the end of the tube resulting from such reaction displaces

20 the tube end from its clamped position thereby opening the associated electrical circuit and signalling the fire condition.

CLAIMS

1. Fire extinguishing apparatus comprising a sealed tube of rigid or semi-rigid plastics material which has been pre-
5 formed into a convoluted shape and contains a fluid fire extinguishant under pressure, the said pressure and the strength of the tube being such that in use the tube resists the pressure of the extinguishant at normal ambient temperatures but softens and bursts to release the
10 extinguishant if heated above a specified temperature.
2. Apparatus according to claim 1 wherein the tube is pre-formed into a helix.
- 15 3. Apparatus according to claim 1 wherein the tube is pre-formed into a flat spiral
4. Apparatus according to any preceding claim wherein said plastics material is polyvinylidene fluoride.
- 20 5. Apparatus according to any preceding claim wherein said fire extinguishant is bromochlorodifluoromethane.
6. Apparatus according to any preceding claim wherein the
25 tube includes means for use in providing a detectable signal when the tube is heated to a said specified temperature.
7. Apparatus according to claim 6 wherein at least one electrically-conductive track is provided along the length of
30 the tube, which track is adapted to be broken by the bursting of the tube.

8. Apparatus according to claim 6 wherein a portion of the tube bears an electrical contact and said portion of the tube is adapted to be displaced by a change of shape of the tube in response to a said specified temperature.

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9. Fire extinguishing apparatus comprising a sealed tube of polyvinylidene fluoride containing a fluid fire extinguishant under pressure, the said pressure and the strength of the tube being such that in use the tube resists
10 the pressure of the extinguishant at normal ambient temperatures but softens and bursts to release the extinguishant if heated above a specified temperature.

10. Fire extinguishing apparatus substantially as
15 hereinbefore described with reference to Figures 1a and 1b or Figures 2a and 2b of the accompanying drawings.

Fig. 1b.

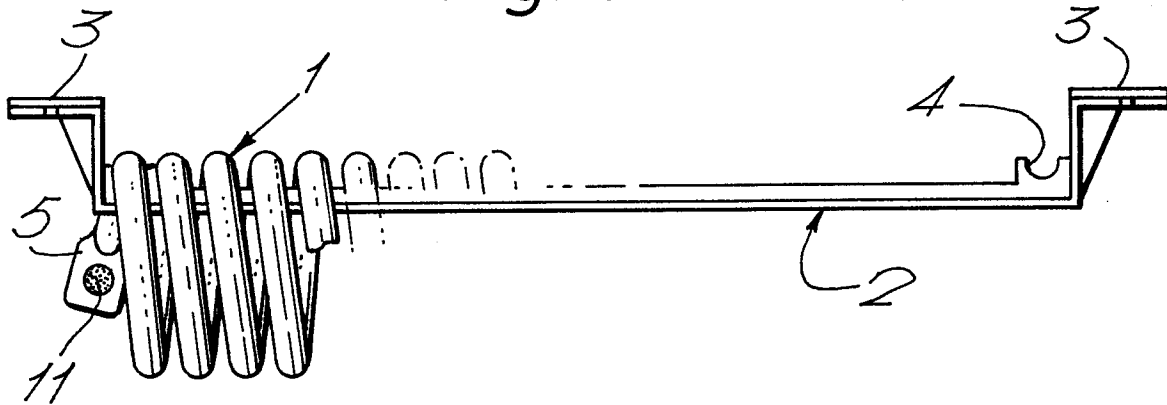


Fig. 1a.

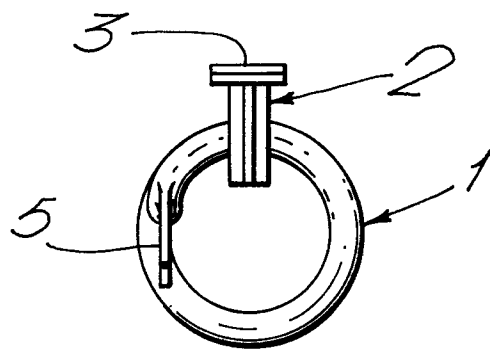


Fig. 2a.

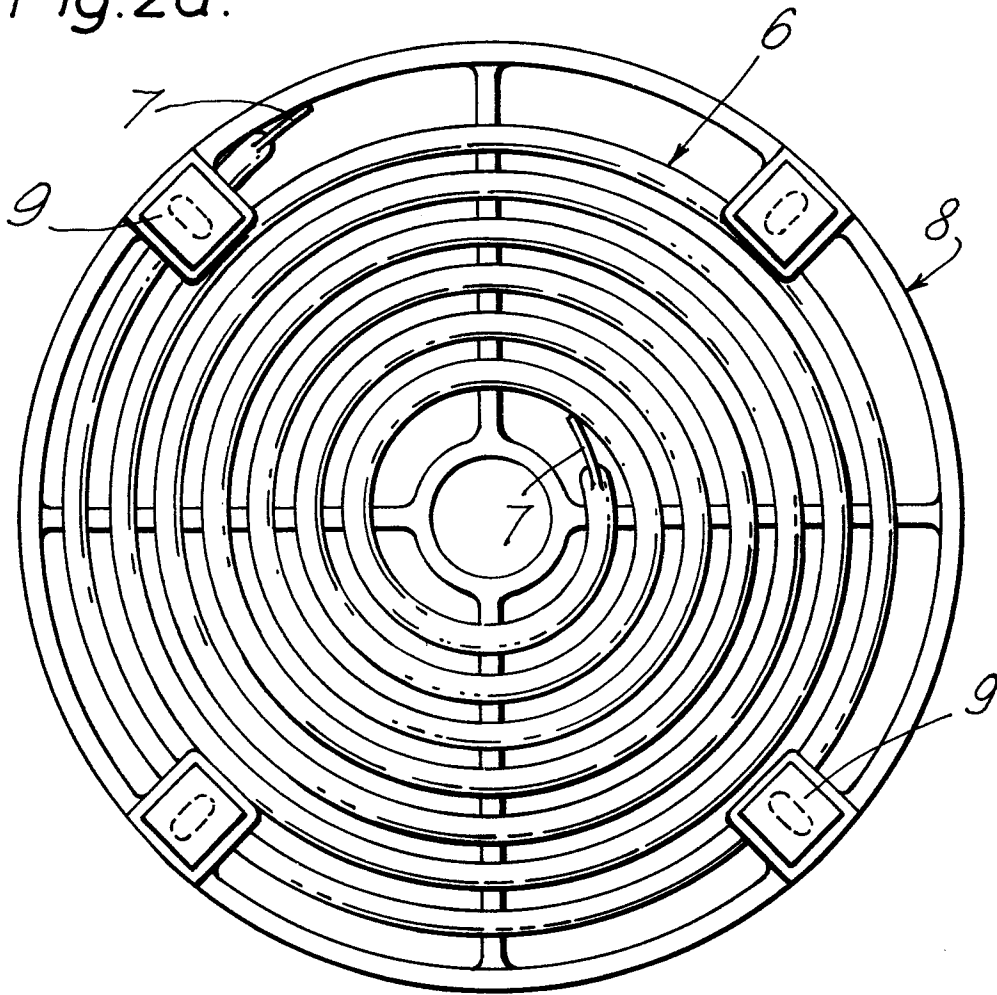
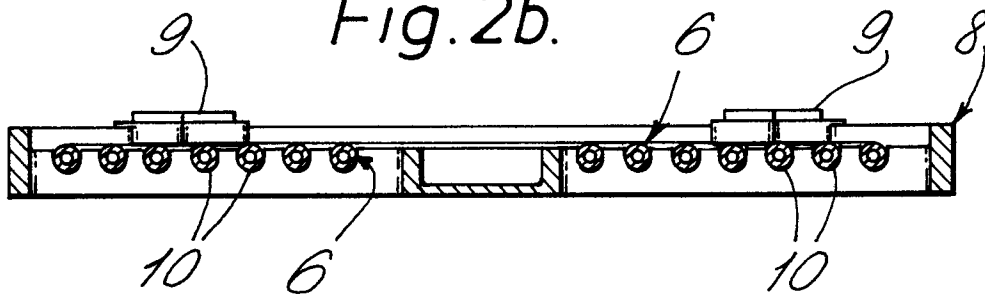


Fig. 2b.





European Patent
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EUROPEAN SEARCH REPORT

0094192

Application number

EP 83 30 2499

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
X, A	GB-A-1 357 010 (CHUBB FIRE SECURITY LTD.) * Whole document *	1, 5, 6, 9	A 62 C 35/10
A	WO-A-8 001 987 (SPERLING)		
A	US-A-2 857 971 (FERRIS)		
A	US-A-2 917 116 (WYANT)		
A	US-A-3 113 624 (HAGGOTT et al.)		
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			A 62 C 1/00 A 62 C 35/00
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 27-07-1983	Examiner KANAL P K
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	