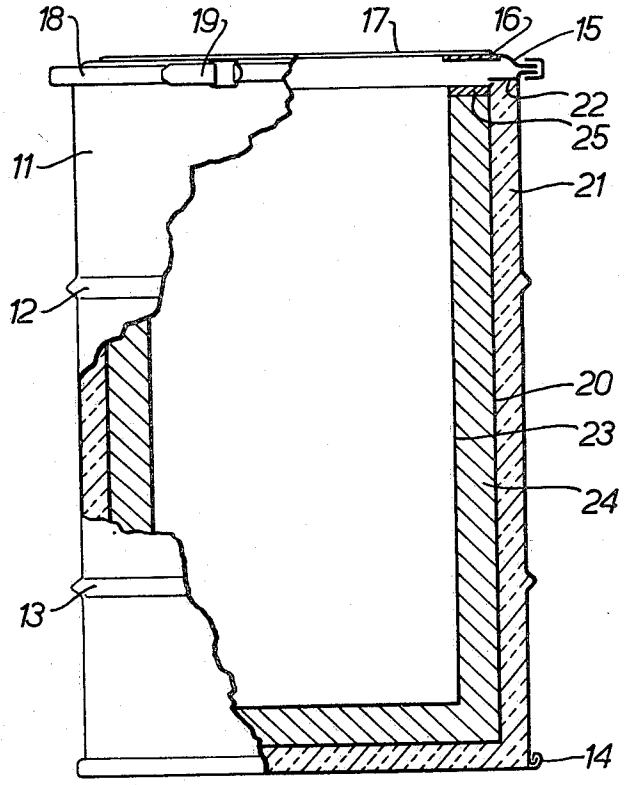
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FIRE-RESISTING CONTAINERS

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FIRE-RESISTING CONTAINERS

George Henry Bulmer, Culcheth, near Warrington, England, assignor to United Kingdom Atomic Energy Authority, London, England

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The storage and conveyance in closed containers of solid pyrophoric materials gives rise to the problem that if by misadventure the contents should ignite the onset of fire may go unnoticed until the integrity of the container is in danger and the release of burning material is imminent.

Containers embodying various inert powdered substances have been used hitherto to afford thermal insulation or fire suppression or both. With powdered substances the occurrence of a fire may leave the powder form unchanged in which case oxygen for supporting the fire can diffuse through the interstices of the powder particles; if temperatures are developed exceeding the melting point of the substance concerned, the powder loses volume by fusion and hence the covering potential is diminished.

According to the present invention, there is provided a container lined with a solid fused layer of a fire extinguishing agent based on a mixture of inorganic salts, such layer being separated from the free interior space of the container by a membrane collapsible by heat. Besides being rendered fire-resisting in this way, such a container is effective inherently to extinguish, or at least suppress, an internal outbreak of fire in that the fire extinguishing agent of the lining layer becomes molten and will spread into contact with the burning material once the separating membrane has broken down. This separating membrane is to be understood in the present context to be susceptible to collapse under the action of heating, it serves to keep the container contents free from contamination by the fire extinguishing agent and also to protect the latter from being rubbed and chipped. During manufacture, the separating membrane may be used to define a mould cavity in which the lining is cast directly within the container.

Low melting point fire extinguishing agents are preferred, such as are quoted in the specifications of co-pending applications Serial Nos. 40,530, now Patent No. 3,095,372, and 176,799, owned by the assignee of the instant invention, where a melting point of less than 640° C. is specified in order, particularly, to meet the needs of a fire involving plutonium which becomes molten at about this point. Mixtures of inorganic chloride and/or fluoride salts of the alkali metals and the alkaline earth metals are given as examples in these specifications.

The solid fused lining of the fire extinguishing agent enables the accommodation in a lining layer of given dimensions of a greater weight of the agent than if the power form were to be used. The following figures in respect of a eutectic mixture of the chlorides of sodium, potassium and barium will illustrate this point:

	Gm./cc.
Apparent density	0.6 to 1.0
Tap or pack density	1.1 to 1.3
Molten density at melting point	1.7
Solid fused density at room temperature	2.2

Those of these measurements which relate to the powder form of the mixture were made on samples having a typical degree of fineness for fire extinguishing purposes; this may be expressed as an area of the order of

1,500 sq. cm. covered by one gm. The solid fused form, being less pervious, is also better adapted to resist absorption of atmospheric moisture which for certain types of fire, notably those involving certain nuclear reactor materials, promotes violent oxidation.

A further preferred feature of the invention, however, is that the lining layer of fire extinguishing agent is sealed permanently from contact with atmospheric air.

In the particular embodiment of the invention which is illustrated in the accompanying drawing the container has an outer wall constituted by a cylindrical drum **11** of mild steel 0.048 inches thick having twin girth ribs **12** and **13**, the drum having a lapped stitch-welded seam (not appearing in the drawing) and a rolled seal bottom as indicated at **14**. A lid **15** for closure of the open top of the container has a peripheral lip co-operating with a corresponding outwardly directed lip formed at the top of the drum and is reinforced at its inside surface by a flat ring **16** of mild steel 5/16 inch thick and at its outside surface by two spaced-apart parallel cross pieces **17**, also of mild steel of the same thickness, the ring and cross pieces being positioned on the lid by welding.

Securement of the lid is by means of a channel section ring **18** which embraces the engaged lips of the drum and lid in the manner illustrated. The ends of the ring **18** are drawn together by a gagging clasp **19** which it is customary to lock in the clasped position by a turn or so of wire with a seal when the container is charged.

A first liner **20** disposed within the drum **11** is of thin mild steel, say 0.001 inch thick, and leaves between itself and both the side wall and the bottom of the drum a space about one inch wide which is packed with a thermally insulating interlayer **21** of a granular material, such as diatomaceous earth, kieselguhr or exfoliated vermiculite. An annular retaining cover **22** of mild steel extends over the interlayer at the top edge of the liner **21**, the fixture of this cover being preferably by spot welding so as to allow intercommunication between the interlayer and the outside space.

A second liner **23** disposed within the drum **11** leaves between itself and both the side wall and the bottom of the first liner **20** a space about 1½ inches wide. This second liner may be also of a thin metal sheet, such as mild steel, but in order to be more readily collapsible by heat it is preferably of a stiff section of synthetic thermoplastic resin. The space between the two liners is occupied with a solid fused layer **24** of a low melting point fire extinguishing agent based on a eutectic mixture of inorganic salts, the following being two leading examples of the compositions that are suitable:

	Percent
Example 1:	
NaCl	20
KCl	29
$BaCl_2$	51
Example 2:	
LiF	29
NaF	12
KF	59

The percentages quoted above are by weight. The melting point of the first is about 545° C. and of the second about 454° C. Additions to promote free flow, such as talc and metallic soap, are unnecessary in the present application, although for drying purposes a metallic soap addition, for example about 2½% by weight of magnesium stearate, may still be desirable. More positive protection against absorption of atmospheric moisture is afforded by a sealing layer **25** laid over the upper end of the fire extinguishing layer in the gap between the first and second liners, such sealing layer being conveniently of a synthetic resin impervious to moisture such as one

of the epoxy range as used for the encapsulation of components.

Advantageously the fused layer 24 is installed by the following procedure: As a first step there is deposited in the bottom of the container with the first liner 20 and thermally insulating layer 21 already installed, a shallow bed of molten fire extinguishing agent at least to the thickness required at the bottom. During cooling of this bed, and whilst it is still plastic, the second liner 23 is inserted concentrically into the container and pressed down if necessary into the bed to give the requisite thickness of underlying fire extinguishing agent. The two liners now define a mould cavity for casting the further part of the lining layer. Further fire extinguishing agent of the same composition is now introduced in a molten condition to fill this cavity and is allowed to solidify with the second liner remaining in position to act as a contiguous membrane separating the side wall lining of fire extinguishing agent from the free interior space of the container. When the container is in use additional fire extinguishing agent in powder form may be placed over the contents in a bag or sachet.

Typical dimensions for the illustrated container are a height of about 28 inches and an outside diameter of about 18 inches. It will therefore be appreciated that the thickness of the fire extinguishing layer is of the order of one twentieth of the outside diameter.

I claim:

1. A container suitable for the storage and conveyance of solid pyrophoric material, comprising: means forming the outer walls of said container; substantially impervious membrane means spaced inwardly from said first-mentioned means for forming the interior walls of the container and for collapsing under heat generated in the interior of the container; and a solid fused layer of a fire extinguishing agent based on a mixture of inorganic salts disposed in the space defined between said means forming said outer walls and said means forming said interior walls.

2. A container as claimed in claim 1 having an open top closable by a lid, said membrane means being in the form of a cup-shaped liner of a synthetic thermoplastic resin which is contiguous with said fire extinguishing agent lining the sides and bottom of the container.

3. A container as claimed in claim 1, in which said fire extinguishing agent has a melting point below 640° C.

4. A container as claimed in claim 3, in which said salt mixture is of inorganic salts selected from the class consisting of the chlorides and fluorides of the alkali metals and the alkaline earth metals.

5. A container as claimed in claim 1, further comprising means for permanently sealing said solid fused layer from contact with atmospheric air.

6. In a container suitable for the storage and conveyance of solid pyrophoric material and having an open top closable by a lid, the combination comprising two lining layers, the outer being of thermally insulating material in granular form and the inner of a solid fused mass of a fire extinguishing agent which is based on a mixture of inorganic salts and has a melting point below 640° C., a first liner separating the two lining layers, and a second liner contiguous with the inner lining layer and separating it from the free interior space of the container, the second liner being collapsible by heat.

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