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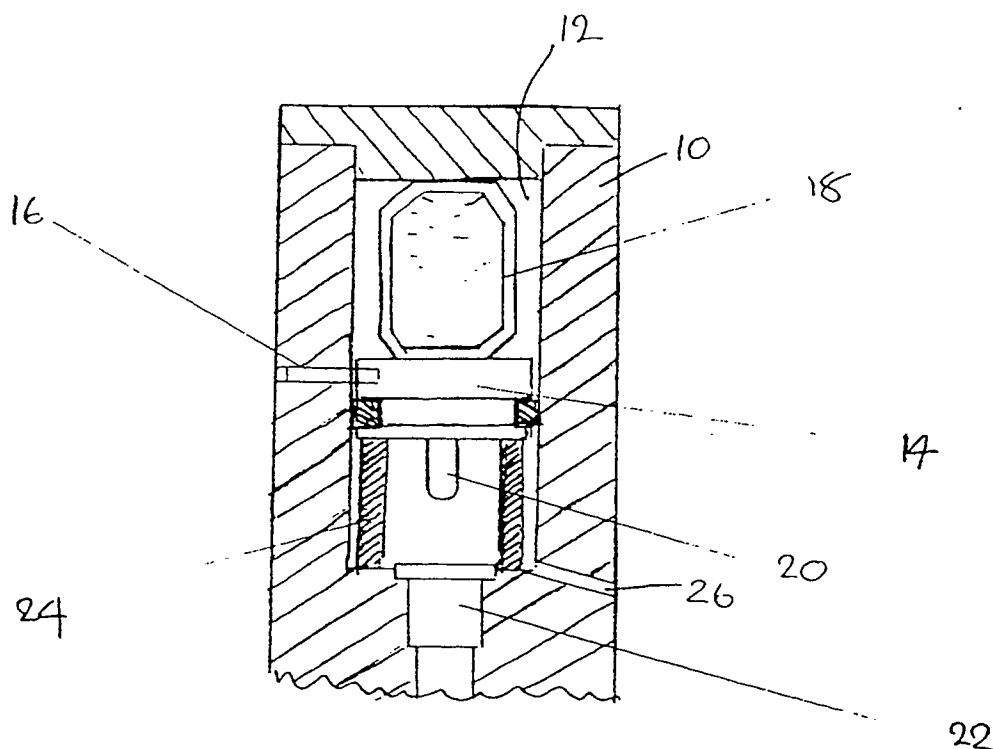
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㉙ **Temperature sensitive device.**

㉚ A temperature sensitive firing device comprising a cylinder 12 having a frangible container 18 of a volatile liquid such as ethyl chloride therein ; a piston 14 mounted in the cylinder 12 having a firing pin 20 mounted thereon and being held in place by releasable securing means 16 such as a shear pin ; and detonator 22 spaced from the firing pin 20 by a fusible member 24 such as a collar made of a eutectic alloy.



EP 0 456 484 A1

The present invention relates to a temperature sensitive device which acts when the ambient temperature exceeds a predetermined level.

Such temperature sensitive devices are found in what are known as "Temperature Sensitive Pyrotechnical Train Interruption Devices" such as are described in US4709637. These devices operate at higher temperatures than would normally be encountered, such as those in a fire, and serve to destroy munitions such as missiles so as to prevent thermal explosion or initiation of an explosive firing train. A significant part of such devices is the mechanism to arrange for firing of the interruption device at a predetermined temperature, and devices utilising low melting eutectic alloys have been proposed. The previously proposed firing devices comprise a spring loaded plunger having a firing pin thereon and held against the spring by one or more retaining members made from a eutectic alloy. When a given temperature is exceeded, the alloys melt so allowing the spring to drive the plunger against the detonator.

The above mentioned firing devices suffer from the problem that once assembled, the spring is always stressed, as are the eutectic retaining members. This could lead to problems if the retaining members creep or fatigue in any way, which could prevent operation or cause firing due to an inadvertent physical shock rather than a temperature effect.

The present invention has arisen in an attempt to provide a firing device which is not stressed until the ambient temperature approaches the operational temperature and in which the possibility of accidental firing is reduced.

In accordance with the present invention, there is provided a temperature sensitive firing device comprising: a container of a volatile liquid; an actuator held in position by releasable securing means; an initiator; and a firing arrangement, the device being such that, above a threshold temperature, expansion of the volatile liquid causes the actuator to move whereby the initiator initiates the firing arrangement.

By employing a device in accordance with the invention, the problems associated with previously known temperature sensitive devices are reduced or eliminated because the device includes no stressed components during normal temperature conditions. Stresses are only introduced when the ambient temperature rises and the device reaches its operating temperature.

The container may be, for example, of a bellows construction of a snap-action type in which a rapid change in volume occurs when the temperature threshold is exceeded. However, it is preferred that the container is frangible. In this embodiment of the invention, the container is arranged to fracture as the internal pressure of the liquid increases when the temperature rises beyond a certain level.

Preferably, the actuator is a piston mounted in a

cylinder which also contains the container. However, the actuator could be some other form of coupling to transmit to the firing arrangement the impulse caused by expansion of the volatile liquid.

In a preferred embodiment of the invention, the firing arrangement is a detonator and the initiator is a firing pin. However, the firing arrangement could be a trip mechanism, for example, involving a train of latches.

It is preferred that the initiator be mounted on the actuator. However, it could be positioned separately from the actuator or mounted on the firing arrangement. The initiator could form an integral part of the actuator or be a separate member fixed to move with it.

Preferably, the initiator is spaced from the firing arrangement by a fusible member, and advantageously the fusible member is a collar which preferably is formed from eutectic alloy. By including the fusible member in the device, the likelihood of accidental firing is further reduced. The material from which the fusible member is formed preferably has a well defined melting point to give operational accuracy.

The releasable securing means is conveniently a shear pin or detent. However, it could be formed simply as a push fit between the actuator and a housing. The releasable securing means is arranged to release the actuator once the pressure due to the action of heat upon the volatile liquid has reached a given level.

It is preferred that the fusible member is arranged to melt before the securing means is released. However, these actions could be reversed or be arranged to be substantially simultaneous.

The liquid is typically ethyl chloride and is arranged to give a pressure of about 20 atmospheres at the required temperature, in this case about 127°C. Obviously, other liquids can be chosen to give the required pressure at other temperatures.

The present invention is now described, by way of example, with reference to the accompanying drawing which shows a diagrammatic cross section view of a device according to one embodiment of the present invention.

Referring now to the drawing, the device comprises a body 10 defining a cylinder 12 therein. A slidable piston 14 is mounted within the cylinder 12 and is retained in position by a shear pin 16. A thin walled, frangible container 18 of ethyl chloride or the like is positioned within the cylinder 12. The piston 14 has a firing pin 20 projecting axially therefrom towards a detonator 22 mounted in the wall of the body 10 opposite said piston. A collar 24 is interposed between said piston 14 and the detonator 22 so as to prevent the firing pin 20 from contacting the detonator. A vent passage 26 is provided in the body 10 to communicate with the outside thereof.

In use, the device described above can form part

of a pyrotechnical train interruption device similar to that described in US4709637. As the ambient temperature rises above normal, for example due to a fire, the collar 24 which is formed from a eutectic alloy melts, the molten alloy draining from the vent 26. As the temperature continues to rise, the container 18 fractures due to the pressure of the ethyl chloride and the pressure within the cylinder 12 builds up until the pin 16 shears and allows the piston 14 to driven down such that the firing pin 20 strikes the detonator 22.

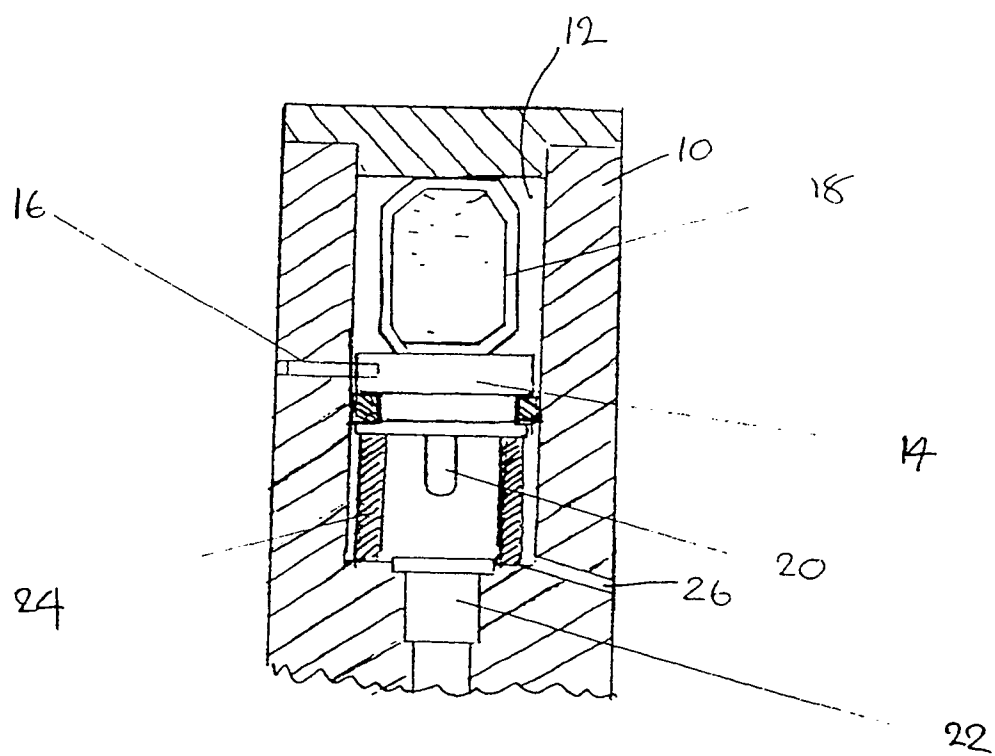
The invention described has the advantage that its components do not become stressed until the container 18 fractures so reducing any problems of fatigue or due to physical damage or errors in production.

Claims

1. A temperature sensitive firing device comprising: a container (18) of a volatile liquid; an actuator (14) held in position by releasable securing means (16); an initiator (20); and a firing arrangement (22), the device being such that, above a threshold temperature, expansion of the volatile liquid causes the actuator (14) to move whereby the initiator (20) initiates the firing arrangement (22).
2. A device as claimed in claim 1 wherein the container (18) is frangible.
3. A device as claimed in claim 1 or 2 wherein the actuator is a piston (14) mounted in a cylinder (12) which also contains the container (18).
4. A device as claimed in claim 1, 2 or 3 wherein the firing arrangement is a detonator (22) and the initiator is a firing pin (20).
5. A device as claimed in any preceding claim wherein the initiator (20) is mounted on the actuator (14).
6. A device as claimed in any preceding claim wherein the initiator (20) is spaced from the firing arrangement (22) by a fusible member (24).
7. A device as claimed in claim 6 wherein the fusible member is a collar (24).
8. A device as claimed in claim 6 or 7 wherein the fusible member (24) is formed from eutectic alloy.
9. A device as claimed in claim 6, 7 or 8 wherein the fusible member (24) is arranged to melt before the securing means (16) is released.
10. A device as claimed in any preceding claim whe-

rein the releasable securing means comprises a shear pin (16) or detent.

11. A device as claimed in any preceding claim wherein the volatile liquid is ethyl chloride.
12. A device as claimed in any preceding claim wherein the volatile liquid gives a pressure of about 20 atmospheres at the desired temperature of operation.
13. A temperature sensitive firing device comprising a cylinder (12) having a frangible container (18) of a volatile liquid therein; a piston (14) mounted in said cylinder (12) and having a firing pin (20) mounted thereon and being held in place by releasable securing means (16); and a detonator (22) spaced from said firing pin (20) by a fusible member (24).





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EUROPEAN SEARCH REPORT

Application Number

EP 91 30 4158

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.5)
D,A	US-A-4 709 637 (BOGGERO) * Column 2, line 34 - column 3, line 16; figures 2,3 *	1,4-9, 13	F 42 C 15/36
A	US-A-2 843 042 (LAZARI) * Column 1, lines 47-62; column 2, lines 1-38; figure *	1-5,10	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F 42 B F 42 C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19-08-1991	Examiner DOUSKAS K.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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 I : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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