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J. A. HAYES

3,520,368

AUTOMATIC FIRE ALARM AND EXTINGUISHER APPARATUS

Filed March 28, 1968

FIG. 1

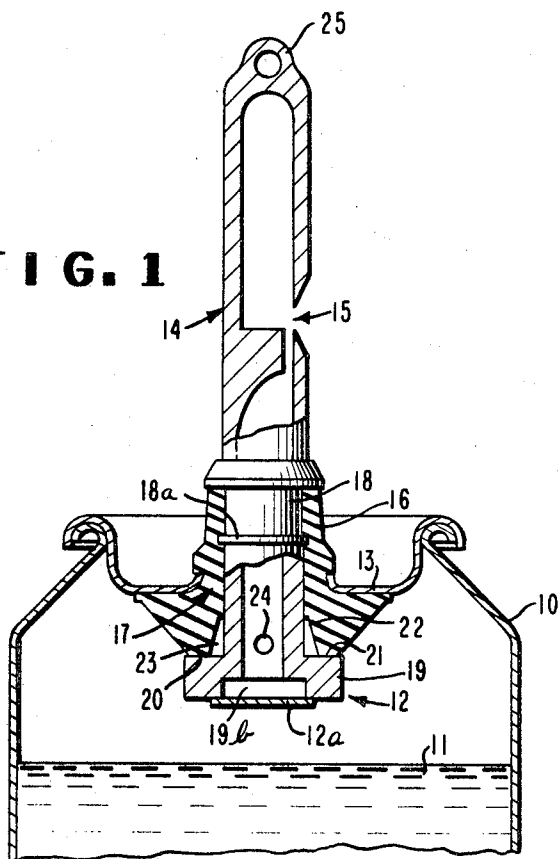


FIG. 3

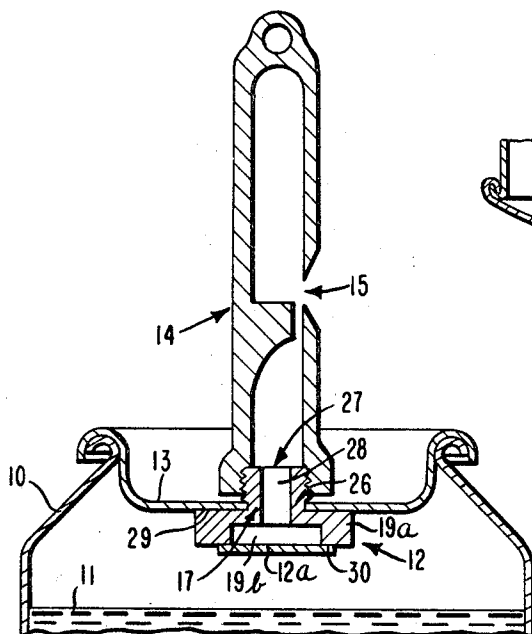


FIG. 2

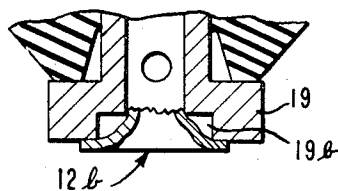


FIG. 4

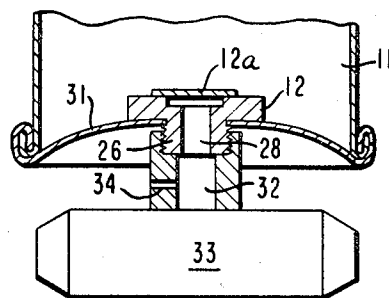


FIG. 5

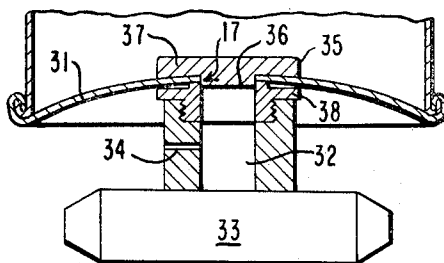
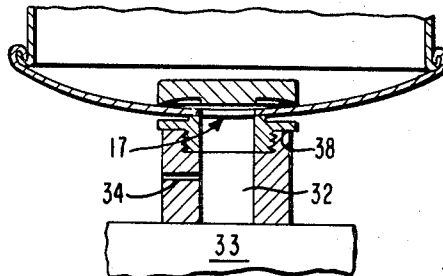


FIG. 6



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3,520,368 AUTOMATIC FIRE ALARM AND EXTINGUISHER APPARATUS

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U.S. Cl. 169—23

2 Claims

ABSTRACT OF THE DISCLOSURE

There is disclosed an apparatus adapted to provide a signal when exposed to fire or other forms of excess heat; the signal, for example, can be an audible sound or the actuation of a means of turning on a fire extinguisher. The apparatus comprises (1) a container of fluid, for example a pressurized nonflammable fluid of suitable vapor pressure, (2) a suitably located valve means (for example a rupture disc or removable plug mounted in a suitable valve assembly) which opens when the pressure in the container reaches a certain excessive level resulting from heating of said fluid and (3) a signal means (for example a whistle, or a switch leading to a fire extinguisher) communicating with the exterior of said valve means and capable of being actuated by the opening of the valve means and resultant flow of pressurized fluid towards the signal means. A secondary valve (for example a tilt-opening valve) can also be present for manual testing of the signal means.

BACKGROUND OF THE INVENTION

This invention relates to an apparatus which automatically provides a signal when exposed to fire or other forms of excess heat.

When the apparatus "provides a signal," it gives notice of the fire or excess heat to some person or thing capable of doing something about it. For example, when the apparatus provides a loud noise (e.g., by means of a whistle or siren), it gives any person in the building or vicinity a warning which will permit him to get out of the danger zone and to call for help in extinguishing the fire. And when the apparatus provides a signal in the form of a sudden flow of pressurized fluid which actuates the turn-on mechanism of a fire-extinguishing system, it notifies a "thing" capable of putting the fire out.

It is well known that many people are killed each year by house fires which start while the people are asleep; they either die without ever knowing there was a fire, or the fire has become so large before they wake up that they are unable to get out of the house alive.

It is also known that millions of dollars' worth of property is damaged each year by fires which start in homes and other buildings when no one is present; often no one becomes aware of such a fire until it is too late to save the building.

And it is known that stoves, furnaces, hot water heaters, and the like sometimes become dangerously overheated (for example by failure of the built-in temperature regulator) when no one is present to take reme-

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dial action. There is a great need for an apparatus which is capable of automatically providing a signal soon enough to permit remedial action in circumstances like these, and which is economical enough to encourage wide-scale use of the apparatus.

SUMMARY OF THE INVENTION

In a broad sense, the present invention may be defined as an apparatus for providing a signal when exposed to fire or other forms of excess heat comprising:

A container adapted for holding a fluid under super-atmospheric pressure,

A fluid in said container which is capable of causing a substantial increase in the pressure within the container when the fluid undergoes a substantial rise in temperature,

A valve means in a wall of said container adapted to open when the pressure in the container reaches a predetermined excessive level below that which would burst the container, and

A signal means communicating with the exterior of said valve means and adapted to be actuated by the opening of the valve means and resultant flow of pressurized fluid towards the signal means.

BRIEF DESCRIPTION OF THE DRAWING

The invention is illustrated in the six figures of the attached drawing.

FIG. 1 shows an embodiment of the novel apparatus in central vertical section and partially broken away; the valve means is in the top wall of the container (a can of the type commonly used in aerosol dispensers). A portion of the tubular stem of the valve means is shown in front view. This embodiment has a tilt-opening secondary valve which permits testing of the signal means (whistle). The rupturable wall portion of the valve means at the bottom end of the tubular stem is closed.

FIG. 2 shows a portion of the apparatus of FIG. 1 in which the rupturable wall has been ruptured by excessive pressure within the container of fluid.

FIG. 3 shows an embodiment of the apparatus in central vertical section wherein the valve means in the top wall of the container again comprises a rupturable wall portion, but it comprises no secondary valve to permit testing of the signal means (whistle).

FIG. 4 shows another embodiment of the apparatus as it appears when the pressure therein is normal; this is a view in central vertical section of the lower portion of a typical aerosol dispenser can in which an orifice and a valve means of the type illustrated in FIG. 3 have been provided in the bottom wall; and a duct attached to the bottom of the valve means leads to a signal means, for example a turn-on switch for a fire extinguisher, horn or siren.

FIG. 5 also shows an embodiment of the apparatus as it appears when the pressure therein is normal; this is a view in central vertical section of the lower portion of a typical aerosol dispenser can in which an orifice and a valve means have been provided in the bottom wall, and a duct leads from the exterior of the valve means to a signal means. The valve means opens in the manner illustrated in FIG. 6.

FIG. 6 shows the apparatus of FIG. 5 after the can bottom wall has bent outward by excessive pressure in

the container, and the valve means has been opened by the resultant lifting of the lower portion of the valve body from the orifice in the bottom wall.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1, can 10 is a container adapted for holding a fluid under super-atmospheric pressure. Fluid 11 in the can is a fluid which will cause a substantial increase in pressure within the container when heated; the fluid is preferably non-flammable, and still more preferably it is a fluid selected from the group consisting of water-insoluble chlorine and fluorine substituted hydrocarbons having a vapor pressure of about 5–150 p.s.i. (absolute) at 21° C.¹ The fluid can also be a compressed gas, for example, carbon dioxide. The preferred fluids are liquids while in the pressurized container, and they vaporize on passing from the container into the atmosphere. If desired, a substance having a strong characteristic odor can be added to the fluid to provide an additional means of notifying the occupants of a building that the valve means has opened. Valve means 12, which has been installed in the top wall 13 of the can, comprises rupturable wall 12a; and the valve means is adapted to open (by rupture of wall 12a) when the pressure in the can reaches a predetermined level below that which would burst the can. Signal means 14 is a noise-making device in the form of a whistle whose interior communicates with the exterior surface (opposite the can interior) of rupturable wall 12a. The lower interior of the whistle forms a continuation of the duct of stem 18, and thereby forms a fluid inlet means for the whistle. The whistle produces an audible (e.g. loud) sound when wall 12a ruptures and allows pressurized gas or vapor to pass from the container through the sound-producing orifice 15 of the whistle.

The valve means comprises resilient tubular seal 16 fitted sealingly in orifice 17 of top wall 13, and rigid tubular stem 18 fitted co-axially and sealingly in the tubular seal. Stem 18 terminates inside the can in valve head 19, which contains rupturable wall 12a, and has a laterally extending annular shoulder 20. Stem 18 terminates outside the container in whistle 14, and is tiltable about an intermediate pivot point just beneath ring 18a. Tubular seal 16 terminates inside the can in an annular end face 21 that forms a breachable seal type of secondary valve with shoulder 20. The inner wall 22 of the lower portion of seal 16 defines an annular chamber 23 that surrounds stem 18, communicates with whistle 14 through port 24 in the stem wall, and is partitioned by said breachable seal at shoulder 20 from the interior of the can. The interior of the can communicates with chamber 23, and thus with whistle orifice 15, when stem 18 is tilted enough to open the secondary valve by breaching the seal at shoulder 20 and forming a gap between end face 21 and shoulder 20. Thus, the apparatus has a secondary valve which can be opened and closed quickly by hand; this permits a small charge of fluid to be discharged through the whistle to demonstrate that the apparatus functions satisfactorily, or to make a person familiar with the sound of the whistle before mounting the apparatus in an area to be protected by it. The general appearance of the secondary valve in the open or tilted position can be seen in FIG. 2 of U.S. Pat. 3,372,839 issued in my name on Mar. 12, 1968; the disclosure of this patent is incorporated herein by reference.

Tubular stem 18 can be regarded as a duct adapted to convey the pressurized fluid to whistle 14 from the orifice formed by the rupture of wall 12a. (See orifice 12b in the ruptured wall in FIG. 2.) Wall 12a is a rupturable wall of fluid-imperious material which separates the interior of the can from the exterior (atmos-

phere); it is adapted to withstand normal pressures within the can (the pressures which the can is built to withstand); and it is adapted to rupture at a predetermined pressure below that which would cause the can to burst or explode; on rupturing, it provides communication between the interior of the can and the whistle through port 24 and stem 18. The upper end of whistle 14 forms a ring 25 to facilitate the suspension of the apparatus (for example from the ceiling of a furnace room) by means of a suitable fastener, such as a hook or wire which fits in the hole of the ring.

If it is desired to modify a given apparatus of the type illustrated in FIG. 1 so that valve means 12 will open at a higher exposure temperature, this can be done by (a) decreasing the diameter of the cavity 19b in the lower portion of valve head 19, thereby decreasing the effective area of rupturable wall 12a, (b) increasing the thickness of wall 12a, (c) making wall 12a of a stronger or more heat-resistant material, or (d) replacing fluid 11 with a fluid having a lower vapor pressure at elevated temperatures.

In one embodiment of the FIG. 1 type of apparatus, can 10 is constructed to withstand an internal pressure of at least 270 p.s.i.; stem 18, valve head 19 and wall 12a are molded as a composite single piece of plastic from high-density polyethylene; cavity 19b has a diameter of $\frac{5}{16}$ inch; wall 12a has a thickness of 4.5 mils, and will rupture when the pressure within the can reaches 225 p.s.i.; fluid 11, introduced into the can at a temperature of -25° C., is a 40/60 mixture of dichlorodifluoromethane and symmetrical dichlorotetrafluoroethane; and the pressure in the can at 21° C. is 45 p.s.i.

In FIG. 3, valve means 12 comprises outer plug portion 26, which is sealingly fitted in orifice 17 of top wall 13 of can 10, and which has an exit port 27 and duct 28 communicating with whistle 14 through the lower tubular portion of the whistle. Valve means 12 also comprises inner washer-like portion 19a, which is integrally united to plug portion 26, and which has its hollow interior in communication with duct 28. Portion 19a has an outer face 29 which forms a fluid-tight seal with the inner surface of can wall 13 in an area surrounding orifice 17, and an inner face 30 to which is sealingly attached rupturable wall 12a. It will be apparent that when wall 12a ruptures to form an orifice 12b as illustrated in FIG. 2, the vapor from liquid 11 will flow through duct 28, port 27, and the sound-producing orifice 15 of the whistle.

One embodiment of the FIG. 3 apparatus is prepared by (1) using a can which will burst (in the absence of valve means 12) when the pressure in the can reaches 240 p.s.i., (2) using a washer-like portion whose cavity 19b has a diameter of $\frac{1}{4}$ inch, and (3) using a laminated wall 12a made by bonding a top layer of 0.5 inch thick polyethylene terephthalate film to a 1.5 inch thick film of medium density polyethylene, wall 12a having the capacity to rupture when the pressure in the can reaches about 195 p.s.i., measured at 22° C.

In FIG. 4, valve means 12 has the same structure as in FIG. 3, but here it is fitted in an orifice in the bottom wall 31 of the can. Duct 32 has its upper end sealingly attached to plug portion 26, and its lower end sealingly attached to the pressure-responsive turn-on member (not shown) of signal means 33, for example any suitable known electrical or mechanical switch capable of turning on an alarm device (e.g. a horn, bell, or siren, or a flashing light, inside or outside the building, or at a fire station), or a fire extinguisher (e.g. a spray of dry or wet fire extinguishing fluid). One skilled in the art will have no difficulty in selecting a suitable switch. Duct 32 has a vent means 34 in the form of one or more small holes through which pressurized fluid can pass to avoid a pressure build-up that would burst the can. Another means of insuring that the can will not burst is to provide a valve means in the top wall of the can having the same structure as shown in FIG. 3 or in FIG. 1, and

¹ Among the more useful fluids are those which are known to be adapted for use as propellants in aerosol dispensers.

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having a rupturable wall that will rupture at a predetermined pressure below that which would burst the can but above that which would open the valve means in the bottom of the can. It will be apparent that when wall 12a ruptures, the pressurized fluid 11 will flow through ducts 28 and 32, and turn on signal means 33. The valve and signal arrangement shown in FIG. 4 can also be installed in the top wall or side wall of the can. When installed in the top wall, signal means 33 can be a switch device of the general type commonly used to turn on sump pumps wherein the upward movement of a stem member turns on a switch attached to a motor.

In FIG. 5, bottom wall 31 of the can is a bendable wall adapted to bend outward at a predetermined pressure below that which would burst the can. Valve means 35 comprises outer plug portion 36 sealingly fitted in the orifice 17 in the center of wall 31. Duct 32 and signal means 33 are as described for FIG. 4. Fitting 38 is sealingly attached to the bottom surface of wall 31 around orifice 17, and the upper end of duct 32 is sealingly attached to fitting 38. Valve means 35 also comprises an inner washer-like portion 37 which (a) is integrally united to portion 36, (b) forms a fluid-tight seal with the inner surface of wall 31 in an area surrounding orifice 17 when the pressure in the can is normal, (c) is rigid enough to resist any undue deformation under pressures which cause outward bending of wall 31, and (d) is adapted to pull plug portion 36 from orifice 17 when wall 31 bends outward (see FIG. 6) so that there is communication between the interior of the can and signal means 33 through orifice 17 and duct 32. There can be a resilient washer (not shown), for example a rubber O-ring, between the lower face of portion 37 and wall 31 to enhance the seal in this area. One or more vertical holes can be provided in portion 37 to enhance the flow of fluid when the valve opens.

The apparatus of the present invention can of course be mounted in a decorative grille or screen enclosure to render it inconspicuous without rendering it inoperable. Useful embodiments of the apparatus can be made to sell for a very reasonable price—a price that substantially everyone can afford.

The apparatus is very useful for automatically giving early notice of fire or excess heat to a person or device capable of taking some prompt action with respect to the fire or excess heat. If a person is asleep in a home where a fire starts in the furnace room, the apparatus can enable him to avoid death or serious injury by warning him of the fire in time to escape while the fire is still small, or by extinguishing the fire automatically, or both. At the same time, the apparatus can enable him to avoid serious damage to his property. If the person is away from home when the fire starts, the apparatus can put the fire out, or warn others who can put the fire out, before there is any extensive damage to the property.

I claim:

1. An apparatus for providing a signal when exposed to fire or other forms of excess heat comprising:

a container adapted for holding a fluid under super-atmospheric pressure, and having a wall provided with an orifice in which a valve can be fastened, said wall being adapted to bend outward at a predetermined excessive pressure,

a fluid in said container which is capable of causing a substantial increase in the pressure within the container when the fluid undergoes a substantial rise in temperature,

a valve means sealingly fastened in said orifice and adapted to open when the pressure in the container reaches a predetermined excessive level below that which would burst the container,

a signal means communicating with the exterior of said valve means and adapted to be actuated by the opening of the valve means and resultant flow of pressurized fluid towards the signal means, and

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a duct adapted to convey the pressurized fluid from said valve means to said signal means, one end of the duct being sealingly attached to the exterior of the valve means, and another end of the duct being sealingly attached to the signal means, said valve means being comprised of:

an outer plug portion sealingly fitted in the container orifice, and

an inner washer-like portion integrally united to said plug portion which: (1) forms a fluid-tight seal with the inner surface of said wall in an area surrounding said orifice when the pressure in the container is normal, (2) is rigid enough to resist any undue deformation under pressures which cause outward bending of said wall, and (3) is adapted to pull said plug portion from said orifice when said wall bends outward so that there is communication between the interior of the container and said signal means through said duct.

2. An apparatus for providing a signal when exposed to fire or other forms of excess heat comprising:

a container adapted for holding a fluid under super-atmospheric pressure,

a fluid in said container which is capable of causing a substantial increase in the pressure within the container when the fluid undergoes a substantial rise in temperature,

a valve means which is sealingly fastened in an orifice in the top wall of said container, comprises a rupturable wall as described below, and is adapted to open when the pressure in the container reaches a predetermined excessive level below that which would burst the container,

a signal means communicating with the exterior of said valve means and adapted to be actuated by the opening of the valve means and resultant flow of pressurized fluid towards the signal means, said signal means: being a noise-making device adapted to make an audible sound when a pressurized gas or vapor passes through it, and having a fluid inlet means which communicates with the exterior of said rupturable wall, and

a duct adapted to convey the pressurized fluid from said valve means to said signal means, one end of the duct being sealingly attached to the exterior of the valve means, and another end of the duct being sealingly attached to the signal means,

said valve means comprising (1) a rupturable wall of fluid-impervious material which (a) separates the interior of the container from its exterior, (b) is adapted to withstand normal pressures within the container, and (c) is adapted to rupture at a predetermined pressure below that which would burst the container and thereby provide communication between the interior of the container and said signal means through said duct, (2) a secondary valve adapted to be opened and closed quickly by hand and constructed so that when it is open the interior of the container is in communication with said noise-making device, and (3) a resilient tubular seal fitted sealingly in the container orifice, and a rigid tubular stem fitted coaxially and sealingly in the tubular seal, said stem terminating inside the container in a valve head which contains said rupturable wall, and has a laterally extending annular shoulder, said stem terminating outside the container in said noise-making device, and being tiltable about an intermediate pivot point;

said tubular seal having a lower portion which terminates inside the container in an annular end face that forms a breachable seal type of secondary valve with the laterally extending annular shoulder of the valve head, and has an annular shoulder of the valve

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head, and has an inner wall defining an annular chamber that surrounds said tubular stem, communicates with said noise-making device through a port in the stem wall, and is partitioned by said breachable seal from the interior of the container, the interior of the container being in communication with the annular chamber and thus with said noise-making device when said tubular stem is tilted enough to open the secondary valve by breaching the seal and forming a gap between said end face and said annular shoulder.

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EVERETT W. KIRBY, Primary Examiner

U.S. Cl. X.R.

116—106; 222—407.21; 239—72