

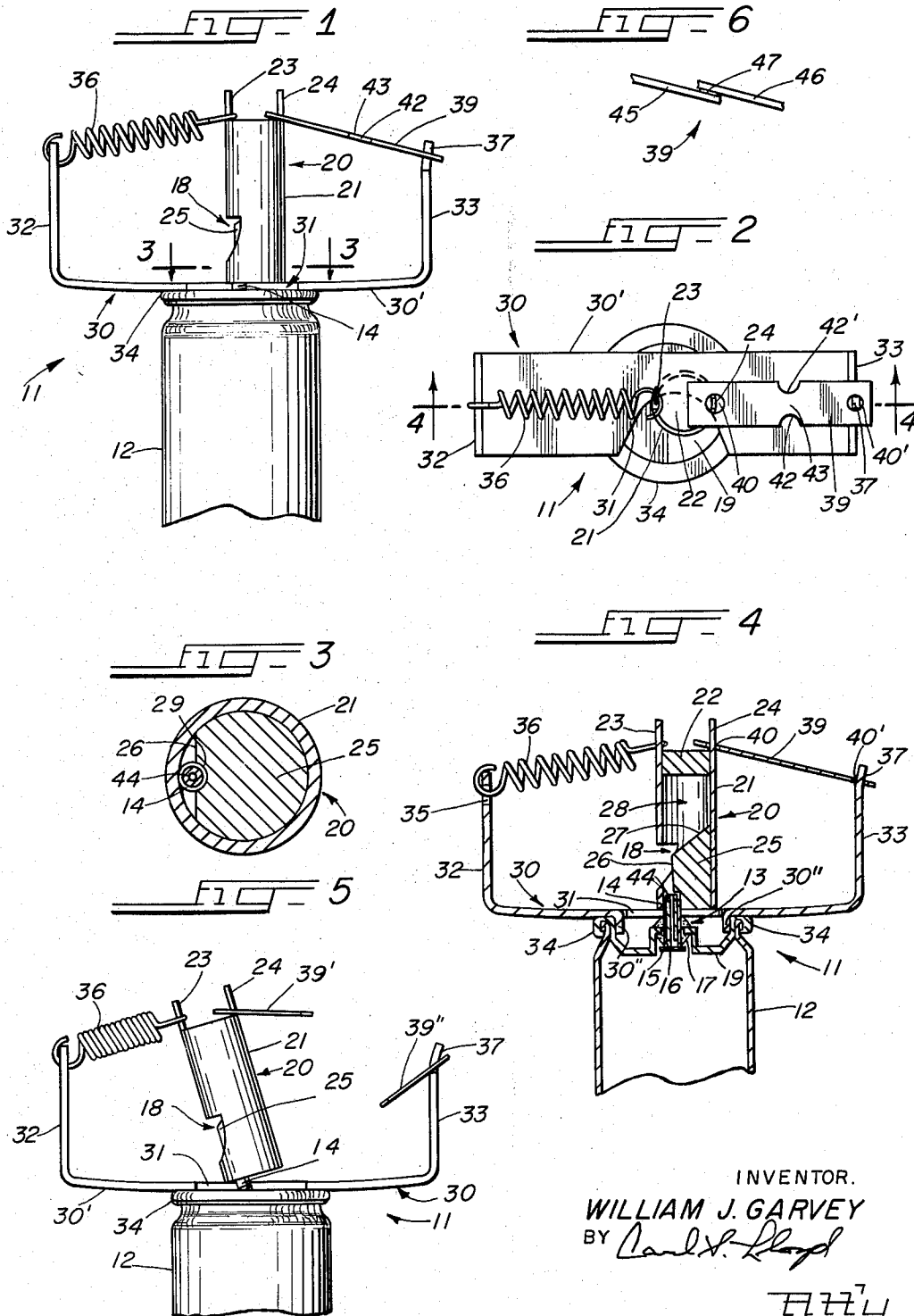
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PNEUMATICALLY ACTUATED FIRE ALARM

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PNEUMATICALLY ACTUATED FIRE ALARM
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This invention relates to fire alarm devices and is concerned primarily with an apparatus which emits an audible warning signal when the ambient temperature reaches a predetermined level.

Broadly described, the subject invention is a fire alarm device which comprises a pressurized medium, a thermally responsive valve adapted to release the pressurized medium when the ambient temperature reaches a predetermined level, and a pressure-sensitive sound-emitting device adapted to emit a sound whenever the medium is released, whereby a warning signal is produced when the ambient temperature reaches such predetermined level.

Automatic fire alarm devices are known in the art. It is conventional in such devices to employ a container of compressed propellant with a fusible plug which is disposed in an outlet tube so as to function as a thermally responsive valve. When the ambient temperature reaches a predetermined level, the plug melts and the propellant is released and thereafter passed through a sound-emitting device. However, as the propellant escapes, the molten plug is cooled and solidified by the escaping, expanding vapors, thereby wholly or partially blocking the outlet tube. It is, therefore, necessary that the ambient temperature actually reach a temperature in excess of the predetermined melting temperature for the propellant to be effectively released. Furthermore, the fact that the fusible plug must be positioned internally in the outlet tube precludes its direct exposure to the surroundings. Thus, there is always a delay in emission of the warning signal corresponding to the time necessary for heat from the surroundings to be conducted to the fusible plug.

Accordingly, it is an object of the present invention to provide a new and improved fire alarm device employing a valved container which stores pressurized propellant, a sound-emitting member adapted to emit a shrill alarm upon release of the pressurized propellant, and a thermally responsive member adapted to cause the opening of the valve controlling the emission of the pressurized propellant when the ambient temperature reaches a predetermined level.

It is another object of the present invention to provide a fire alarm device of the character described wherein the thermally responsive member is disposed externally of the valved container of pressurized propellant.

It is yet another object of the present invention to provide a fire alarm device of the character described wherein an empty container of pressurized propellant may be replaced with a fresh container whereby the sound-emitting member may be re-utilized.

A further object of the present invention is to provide a fire alarm device of the character described wherein the sound-emitting member is utilized to open the valve, thereby resulting in an alarm device comprising a minimum number of parts.

A still further object of the present invention is to provide a fire alarm device of the character described wherein the thermally responsive member is replaceable for resetting and adjustment of the device.

Still another object of the present invention is to provide a fire alarm device of the character described, which is easily fabricated from inexpensive and readily available parts, which is quickly installable, and which is reliable in operation.

These and other objects, advantages, and features of

the present invention will be apparent from the following description, and by way of illustration, but not of limitation, an exemplary embodiment of the present invention is shown in the accompanying drawing, in which:

FIGURE 1 is a fragmentary side elevation of an embodiment of the present invention;

FIGURE 2 is a top plan view thereof;

FIGURE 3 is an enlarged sectional view taken along line 3—3 in FIGURE 1;

FIGURE 4 is a sectional view taken along line 4—4 in FIGURE 2;

FIGURE 5 is a view corresponding to FIGURE 1, but showing the device emitting its warning signal; and

FIGURE 6 is a fragmentary side elevation of the thermally responsive portion of another embodiment of the present invention.

With reference to the drawing, FIGURES 1 and 2 illustrate a fire alarm device 11 produced in accordance with the present invention. A conventional aerosol container 12, suitable for storing a non-flammable propellant under pressure (hereinafter described), is provided with an outlet valve 13 (see FIGURE 4) adapted to release the propellant when mechanically actuated. While many types of outlet valves may be employed, it is preferred to use the mechanism shown in the drawing (see FIGURE 4). Valve 13 comprises an outlet tube 14 closed at the bottom by a disk 15, which is preferably formed integrally with tube 14. A plurality of openings 16 is provided in the lower portion of tube 14, adjacent disk 15. Each of the openings 16 passes through the wall of tube 14 and communicates with a hollow central portion thereof. A flexible valve seal 17, formed of rubber, neoprene or other similar material, holds outlet tube 14 in position in a top 19 of aerosol container 12. Valve seal 17 normally fits flush against disk 15 (as shown in FIGURE 4), thereby covering all of the openings 16, and effectively preventing the escape of pressurized propellant from the container. Seal 17 is held tightly over the openings 16 by the greater pressure inside the container 12 relative to the external atmospheric pressure.

When the upper portion of outlet tube 14 is laterally displaced (see FIGURE 5), the lower portion of the tube 14 and disk 15 are displaced in an opposite lateral direction as the tube pivots in top 19. The lateral movement of the lower portion of tube 14 pulls one side of disk 15 away from valve seal 17, uncovering at least one of the openings 16 in tube 14. The pressurized propellant then escapes from the aerosol container 12, passing through the exposed opening 16 and out the outlet tube 14. Return of outlet tube 14 to its normal vertical disposition (as in FIGURE 4) stops the release of the propellant, valve seal 17 again fitting flush against disk 15 and thereby covering and blocking all of the openings 16.

A whistle 20 is mounted directly on outlet tube 14 so that propellant escaping through outlet tube 14 passes through whistle 20, thereby causing the emission of an audible warning signal. Whistle 20 (see FIGURE 4) comprises a whistle tube 21 having a generally semi-circular opening 18 cut therein. A solid plug 22 seals the upper portion of tube 21 and thus prevents escape of propellant from the upper end of tube 21. A whistle insert member 25 is adapted to fit flush within the lower portion of tube 21. The flat upper surface 27 of member 25 is inclined (see FIGURE 4) and together with tube 21 and plug 22 forms a whistle sounding chamber 28. One side of member 25 is cut away to form a generally flat surface 26 past which escaping propellant may pass. The flat surface 26 is cut away in the form of a groove 29 (see FIGURES 3 and 4) so as to permit outlet tube 14 to be force-fitted between whistle tube 21 and member 25.

With outlet tube 14 firmly inserted in whistle 20 (as above described), valve 13 may be actuated by lateral movement of whistle 20 (see FIGURE 5). As will hereinafter be apparent, whistle 20 (in addition to functioning as a sound-emitter element of the alarm device) is also a mechanical link utilized in opening outlet valve 13. Thus, it is possible through the utilization of the present invention to provide an alarm device comprising a minimum number of parts.

It should be understood that the present invention is not to be restricted to a whistle of any particular design and that substantially any whistle or other sound-emitting device can be employed so long as the whistle or other device can be mounted directly on outlet tube 14 and is adapted to be actuated by passage therethrough of escaping propellant.

A thermally responsive arrangement is utilized to actuate outlet valve 13 (via whistle 20). Thus, a brace member 30, having a generally flat base portion 30' and a pair of upwardly projecting end members 32, 33, is provided in the alarm device. Base portion 30' has a recess 31 cut in its central portion to permit relatively free movement of outlet tube 14 within the confines of recess 31. Base portion 30' rests flush against the top rim 34 of aerosol container 12 and is preferably fixed to rim 34 by conventional means, such as retaining clips 30'' (see FIGURE 4) which are force-fitted inside rim 34, so as to prevent lateral movement of brace member 30 with respect to aerosol container 12. End member 32 has a hole 35 provided therein, and a spring 36 is hooked through hole 35 and is also hooked about a tab 23 which projects upwardly from whistle tube 21. Spring 36 is biased to urge whistle 20 to the left (as seen in FIGURES 1 and 4) toward its sound-emitting disposition.

End member 33 has a projecting tab 37 extending from its upper edge. A connecting member 39 has holes 40, 40' formed in opposite ends thereof and also has a pair of opposite centrally disposed recesses 42, 42' (defining a narrow central portion 43 formed therebetween). Member 39 connects end member 33 and whistle 20, a tab 24 of whistle 20 and a tab 37 of end member 33 passing respectively through holes 40 and 40'. The length of connecting member 39 is such that whistle 20 is retained (in opposition to the bias of spring 36) in a generally upright non-sound emitting disposition, whereby outlet tube 14 is maintained vertically and valve 13 is closed.

Connecting member 39 is formed of a fusible material which melts at a predetermined temperature. When the ambient temperature reaches the said predetermined temperature, connecting member 39 melts and pulls apart at its central portion 43, and thus whistle 20 is pulled to the left by spring 36 (as shown in FIGURE 5). Preferably, the connecting member 39 is formed of a metal alloy having a relatively low melting point. While the precise alloy to be employed depends on the exact use for which the alarm device 11 is to be put (i.e., upon the temperature at which it is desired that a warning signal be sounded), a preferred metal alloy is "Wood's metal," which comprises 50% bismuth, 25% lead, 12.5% tin and 12.5% cadmium. "Wood's metal" has a melting range of 158-165° F., a Brinell No. of 9.2, has 6000 p.s.i. tensile strength, and undergoes 2-inch elongation at 200 pounds slow pull.

The non-flammable propellant utilized in the alarm device 11 should be stable, nontoxic, and non-corrosive and should be of a type that will produce a substantial pressure inside the aerosol container 12 at the temperature at which it is desired that the alarm device 11 emit its warning signal. A preferred propellant is dichlorodifluoromethane, which is commonly known as "Freon-12." However, as will be apparent to one skilled in the art, many other propellants having the proper physical and chemical characteristics are available and can successfully be employed.

The operation of the alarm device 11 may be summarized as follows. Normally, the device 11 is disposed in the position shown in FIGURE 1. When the ambient temperature reaches the predetermined melting range of the fusible connecting member 39, the member 39 separates (as at central portion 43) into a left portion 39' and a right portion 39'' (see FIGURE 5). Spring 36 pulls whistle 20 to the left, and outlet tube 14 is thereby moved to the left. Movement of outlet tube 14 to the left separates disk 15 from valve seal 17, thereby uncovering at least one of the openings 16. The pressurized propellant then escapes through the exposed opening 16, outlet tube 14 and whistle 20, and a shrill warning sound is then emitted, so as to signal that the ambient temperature has reached the predetermined level.

Performance of the alarm device is improved if a capillary tube 44 is inserted in outlet tube 14 (see FIGURE 4). The smaller diameter of the capillary tube results in a smaller quantity of the propellant escaping during a given length of time, thus adding to the length of time during which the warning signal is emitted.

It will be apparent to one skilled in the art that other thermally responsive means may be utilized to actuate the valve 13 of the aerosol container 12. Thus, the connecting member 39 may be provided in the form of two partially overlapping parts 45, 46 interconnected by a fusible strip 47 of metal alloy, such as "Wood's metal" (see FIGURE 6). Or, a bimetallic strip (not shown) adapted to flex at a predetermined temperature may be connected to whistle 20, whereby flexing of the strip causes lateral movement of whistle 20 in order to open valve 13 (as hereinbefore described). Similarly, whistle 20 may be biased by a compressed spring (not shown) adapted to shift whistle 20 laterally upon melting of a fusible retaining member.

One of the many advantages of the subject invention is the interchangeability of its parts. It will be apparent to one skilled in the art that the aerosol container 12 can easily be separated from brace member 30 and whistle 20, after its propellant supply is exhausted, and a fresh aerosol container can be mounted in its place. Furthermore, in the illustrated embodiment, it is quite simple to replace a separated connecting member 39, simply by maintaining whistle 20 in a generally upright disposition and slipping the holes 40, 40' in the replacement connecting member 39 over tab 23 on whistle tube 21 and over tab 24 on end member 33. Not only does this arrangement permit rapid resetting of the alarm device, it also permits easy adjustment of the predetermined temperature at which the alarm device emits its signal. By merely selecting and installing a connecting member 39 having the desired melting temperature, the alarm device 11 can be adjusted to signal various predetermined temperature levels.

Another advantage of the present invention is that it can be manually tested. This is accomplished merely by removing connecting member 39 from the device, since upon removal thereof spring 36 opens valve 13 and a warning signal is emitted. Thus, it is possible to quickly, yet reliably, check the operability of the device. In this respect, the subject invention is a marked improvement over conventional devices which cannot be manually tested because they are dependent on internal fusible plugs for their actuation.

Many modifications and variations of the particular arrangement described herein will be apparent to one skilled in the art, and it should be understood that the invention is not limited in its application to the details of construction and arrangement of parts specifically described or illustrated herein. It should further be understood that various changes, modifications, and alterations may be effected in the parts and elements of the described embodiment, without departing from the spirit and scope of the present invention, as described in the

What is claimed is:

1. A fire alarm device comprising:
 container means for holding a pressurized propellant;
 valve means for releasing the pressurized propellant
 from the container means;
 signal means adapted to emit a warning signal upon
 release of the pressurized propellant by the valve
 means, the signal means being operatively connected
 to the valve means such that movement of the signal
 means opens the valve means, thereby releasing the
 pressurized propellant; and
 thermally responsive valve control means adapted to
 effect the movement of the signal means and thereby
 to open the valve means whenever the ambient tem-
 perature reaches a predetermined level,
 whereby the alarm device emits a warning sound when-
 ever the ambient temperature reaches the said pre-
 determined level.
2. A fire alarm device comprising:
 container means for holding a pressurized propellant;
 valve means for releasing the pressurized propellant
 from the container means;
 signal means adapted to emit a warning signal upon
 release of the pressurized propellant, the signal means
 being operatively connected to the valve means such
 that movement of the signal means opens the valve
 means, thereby releasing the pressurized propellant;
 biasing means urging the signal means to its valve
 opening position; and
 thermally responsive retaining means adapted to pre-
 vent movement of the signal means to its valve open-
 ing position so long as the ambient temperature is
 less than a predetermined temperature, the retaining
 means being adapted to permit movement of the
 signal means to its valve opening position whenever
 the ambient temperature reaches the said predeter-
 mined level,
 whereby the alarm device emits a warning sound when-
 ever the ambient temperature reaches the said pre-
 determined level.
3. A fire alarm device comprising:
 an aerosol container adapted to hold a volatile propel-
 lant under pressure;
 valve means on the aerosol container movable between
 a closed position wherein propellant is held within
 the aerosol container and an open position wherein
 propellant is released therefrom;
 whistle means operatively connected to the valve means
 and providing a passage for released propellant there-
 through, the whistle means being movable with the
 valve means between the closed and open positions
 thereof, such that movement of the whistle means
 opens and closes the valve means;
 biasing means normally urging the whistle means to-
 ward a position wherein the valve means is opened;
 and

thermally responsive retaining means adapted to hold
 the whistle means in the position wherein the valve
 means is closed, the retaining means being adapted
 to release the whistle means when the ambient tem-
 perature reaches a predetermined level,

whereby a warning signal is emitted when the ambient
 temperature rises to the said predetermined level.

4. A fire alarm device as claimed in claim 3, wherein
 the biasing means comprises a spring mounted between
 the container and the whistle means.

5. A fire alarm device as claimed in claim 3, wherein
 the thermally responsive retaining means comprises a
 fusible metal member mounted between the container and
 the whistle means.

6. A fire alarm device comprising:
 an aerosol container adapted to hold a volatile propel-
 lant under pressure;

valve means on the aerosol container movable between
 a closed position wherein propellant is held within
 the aerosol container and on open position wherein
 propellant is released therefrom;

whistle means operatively connected to the valve means
 and providing a passage for released propellant
 therethrough, the whistle means being movable with
 the valve means between the closed and open posi-
 tions thereof, such that movement of the whistle
 means opens and closes the valve means;

a spring member mounted between the container and
 the whistle means, the spring member being biased to
 urge the whistle means toward a position wherein
 the valve means is opened; and

a fusible metal retaining member mounted in opposi-
 tion to the bias of the spring member between the
 container and the whistle means, the retaining mem-
 ber being adapted to hold the whistle means in the
 position wherein the valve means is closed, and the
 retaining member being adapted to release the whis-
 tle means when the ambient temperature reaches a
 predetermined level,

whereby a warning signal is emitted whenever the
 ambient temperature rises to the said predetermined
 level.

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