Jan. 27, 1953 A. P. MENDES 2,626,585

PRESSURE-TYPE ALARM DEVICE

Filed Dec. 15, 1950

FIG. 1.

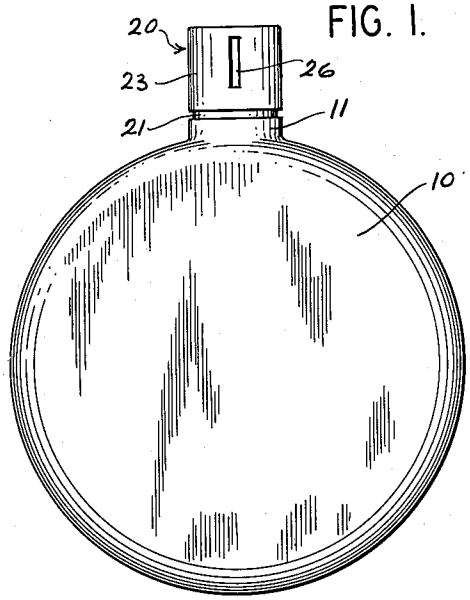


FIG. 4.

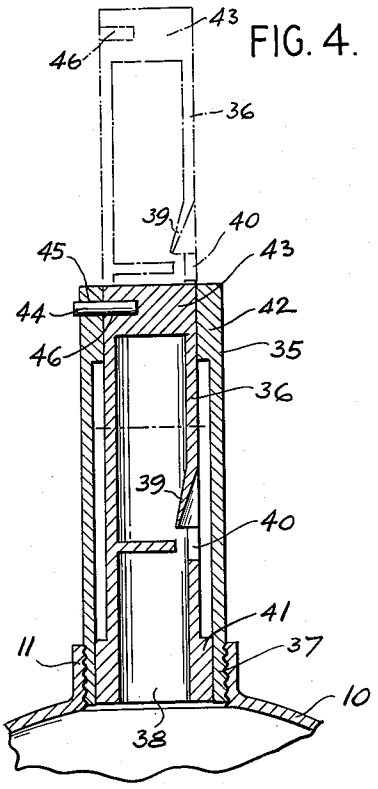


FIG. 2.

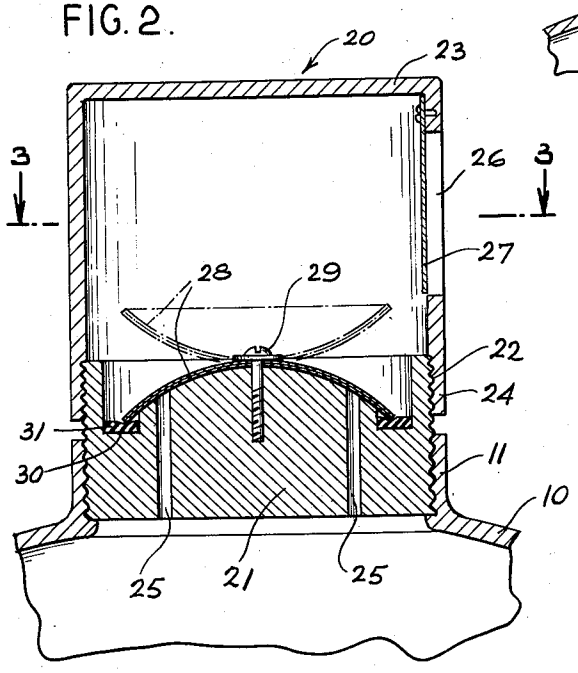
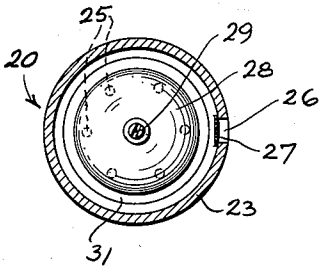


FIG. 3.



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Patented Jan. 27, 1953 2,626,585

UNITED STATES PATENT OFFICE

2,626,585

PRESSURE-TYPE ALARM DEVICE

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Application December 15, 1950, Serial No. 200,893

3 Claims. (Cl. 116—102)

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My invention relates to improvements in alarm devices and has particular reference to an alarm device which will automatically emit a loud and prolonged warning sound when the surrounding air temperature is raised beyond a predetermined limit. Such an alarm device is especially applicable for use as a fire alarm, and it may also be used to give warning of conditions conducive to the initiation of combustion, as in places where grain and paint are stored. The device is intended to be used generally to indicate any undesirable elevation of temperature, as in the case of an overloaded motor or faultily-lubricated bearing, or malfunction of a cooling or refrigerating mechanism.

I am aware of several alarm devices in the prior art which utilize containers of compressed air or carbon dioxide to actuate a whistle or similar sound device. In these alarm devices, the containers are generally sealed, the seal being designed to melt at the temperature at which it is desired that the device operate, the compressed gas then escaping through the sound device to produce a warning noise.

In order to operate a whistle or siren long enough and loud enough to give a warning that would be of practical value, a considerable quantity of gas must be available for a considerable length of time. The gas is therefore best stored in the container in a liquified state. However, the pressures developed by air and by carbon dioxide so stored, at normal room temperatures and more so at temperatures at which fire alarms are operated are so high that extremely strong and therefore heavy containers are required for the required quantity of gas.

Unless regulating means were introduced into the device it would be virtually inoperative because no ordinary whistle or siren will operate throughout the range of pressures, from the maximum at opening to the minimum as the container empties. Further, as everyone knows who has used a carbon dioxide cartridge to inflate a life belt or charge a soft drink siphon charger, the cartridge empties in a moment so that the period, if any, during which such a prior art device as described would emit a sound would be very brief.

Because of the aforementioned considerations, I utilize in my alarm devices substances which boil, under pressure of one atmosphere, at temperatures near that at which the alarm is intended to operate. Thus, the vapor pressure of these substances at all temperatures at which the device is to be used is low enough for the substance

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to be safely retained by a container having thin, light walls.

The principal object of my invention is the provision of an alarm device which has a container for storing a substance which boils at or near the temperature at which it is desired that the device emit a warning signal, together with sound-producing means adapted to be operated by the gas emitted by the boiling substance.

Another object of the invention is the provision of an alarm device of the character described in which the sound-producing means is associated with a seal which normally seals off the container so that the substance therein can not evaporate, but which is adapted to open automatically when the temperature rises to the operative level of the alarm device.

Still another object of the invention is the provision of an alarm device of the character described in which the substance in the container has a vapor pressure which is moderate at all temperatures within the probable range of use of the device below its boiling point, so that the container may be made with thin, light walls, affording economy in manufacture.

Other objects and advantages of the invention will be readily apparent in the course of the following specification when taken in connection with the accompanying drawings, in which:

Fig. 1 is an elevational view of the container utilized in the alarm device, with a sound producing unit connected to the mouth thereof;

Fig. 2 is an enlarged central vertical section of the sound-producing unit of Fig. 1, showing the closure means therefor;

Fig. 3 is a horizontal section taken along lines 3—3 of Fig. 2; and,

Fig. 4 is a central vertical section showing another type of sound-producing unit connected to the mouth of the container, said unit having a modified closure means.

Referring in detail to the drawings and in particular to Fig. 1, I provide a hollow container 10 whose walls are made from a heat-conductive material, preferably metal. The container 10 has a relatively high surface area in proportion to its internal cubic volume, on the principle of a flash boiler, so that changes in the surrounding air temperature are quickly and effectively transmitted through its heat-conductive walls to the substance contained therein. Thus, the container 10 may have the shape of a flat circular flask, as shown in Fig. 1.

The container is intended to hold substances which at ordinary temperatures exert a rela-

tively moderate pressure, as compared to compressed air or carbon dioxide when held in part in liquid phase at the same temperatures. For this reason, the container 10 may be made simple and economically, having thin walls and an internally-threaded neck 11 for the reception of a seal and a sound-producing unit.

The container 10 is filled with a substance which has a boiling point not far below the temperature at which the alarm device is desired to emit its warning signal. For this purpose, I have found that such substances as methylene chloride, trichlorethylene, and several of the fluorinated hydrocarbon derivatives of the short chain and small ring aliphatic series of organic compounds (known commercially as "Freons") possess the physical characteristics necessary for the successful operation of the alarm device in its several different applications. The "Freon" substances have boiling points ranging from −198.3° F. to +199.0° F., so that they may be used to indicate the presence of excessive heat (as in a fire alarm) or to indicate the failure of refrigerating apparatus. In addition, these substances also possess the desirable characteristics of being non-flammable, non-toxic, non-explosive, extremely stable, and generally non-corrosive.

Although other substances may suggest themselves, it may be noted that the following substances are especially suitable since they boil at one atmosphere of pressure at temperatures ranging from 199° F. to −41° F. The boiling point of tetrachlorodifluoroethane ($CCl_2F—CCl_2F$) or Freon 112 is 199.0° F.; that of trichlorethylene ($CHCl:CCl_2$) is 188.6° F.; that of trichlorotrifluoroethane ($CCl_2F—CClF_2$) or Freon 113 is 117.6° F.; that of trichloromonofluoromethane (CCl_3F) or Freon 11 is 74.7° F.; that of dichlorotetrafluoroethane

($CClF_2—CClF_2$)

or Freon 114 is 38.4° F.; that of dichlorodifluoromethane (CCl_2F_2) or Freon 12 is −21.6° F.; and that of monochlorodifluoromethane ($CHClF_2$) or Freon 22 is −41.4° F.

When the container is filled with such a substance, elevation of the surrounding air temperature causes the temperature of the substance to rise correspondingly due to the transmission of heat through the walls of the container 10. When the temperature reaches the level at which it is desired that the device operate, the seal between the container and the sound device opens, as will be presently described. At this time the contained substance will be actively boiling, and because of the flash boiler construction of the container, will continue to supply a sufficient amount of vapor to operate the alarm to produce a loud warning signal for an adequate length of time.

Fig. 2 illustrates one type of seal and sound-producing unit 20 which may be associated with the container 10 in order to provide a complete alarm device.

The unit 20 comprises a cylindrical block 21 which bears external threading 22 for attachment respectively to the internally threaded neck 11 of container 10 at one end, and at the other end to a hollow whistle casing 23 which has an open, internally threaded end 24. The block 21 has one or more bores or air passages 25 which permit gas from container 10 to pass into whistle casing 23 and thence to the atmosphere through an aperture 26 in whistle casing 23. The aperture 26 is covered by the usual type of reed 27, which vibrates as the gas escapes through aperture 26, sounding a signal which lasts as long as the gas continues to flow.

The bores 25 of block 21 are sealed liquid-tight and gas-tight by a bi-metallic unit 28 which is secured to the outer surface of block 21 by any suitable means such as a screw 29. While the unit 28 may be of any type of bi-metallic thermostatic element, I prefer to use a conventional thermostatic circular disc which is shown in Fig. 3. Such devices have a critical temperature below which they are curved or dished in one direction, as shown in full line in Fig. 2, and above which they snap suddenly in an oppositely curved position as shown in broken line in Fig. 2.

The outer surface of the block 21 may be shaped approximately to follow the curve of the disc 28 in its normal curved position. The block 21 may contain a circular recess 30 which surrounds the bores 25 and which contains an annular washer or resilient gasket 31. In the normal curved position of the disc 28, the outer edge of said disc presses into said washer 21, providing a tight seal over the bores 25. It is evident that the lower the surrounding temperature, the greater will be the pressure with which the disc 28 presses into the washer 31.

Thermostats of the type described are marketed in various forms to operate at selected temperatures. A thermostat may be chosen to operate at a temperature at which the alarm device is desired to sound, which temperature is therefore higher than the boiling point of the substance in the container 10. When the surrounding air temperature reaches the boiling point of the substance, said substance will begin to boil and to be converted to gas. When the temperature reaches the operative level of the thermostatic disc 28, the disc 28 snaps to its oppositely-curved position, permitting the gas to flow through the bores 25, to the interior of the whistle casing 23, and past the reed 27, out the aperture 26. As the substance in the container continues to boil, gas continues to flow through the whistle aperture 26 so that a loud and prolonged warning signal is emitted until all of the substance in the container 10 has boiled away.

Fig. 4 illustrates another embodiment of the sound-producing unit which comprises a hollow casing 35 in which a whistle 36 is slidably mounted. The casing 35 is open at both ends, one of said ends having external threading 37 for attachment to the internal threading 11 of container 10, and the other end having an internal flange 42. The whistle 36 is of the conventional type having an air-inlet opening 38, and a reed 39 positioned adjacent an outlet opening 40 which is located centrally intermediate the ends of the whistle 36. The whistle also has a projecting peripheral flange 41 which slidably abuts the inner surface of the casing 35 and is positioned to abut the internal flange 42 of casing 35. The solid closed end 43 of the whistle 36 extends slidably through the flange 42 of casing 35. A bar of fusible metal 44 extending through a bore 45 of the casing 35 and into a slot 46 in the solid closed end of the whistle 36, normally locks the whistle 36 in an inoperative sealed position shown in full line in Fig. 3. In this position, the outlet opening 40 of the whistle 36 is located within the casing 35 whose outer end is closed off by the solid closed end 43 of the whistle 36.

The metal bar 44 is made of a metal or alloy which melts at a temperature such as that pro-

duced by the approach of fire or by conditions conducive to the outbreak of fire, and the substance in the container 10 is selected to have a boiling point close to or the same as the melting temperature of the bar 44.

When the surrounding air temperature rises to the boiling point of the substance in the container 10, the pressure of the gas generated within the container 10 urges the whistle 36 outwardly relative to the container 10. The rise in temperature causes the bar 44 to melt, releasing the whistle 36 and enabling the whistle to be slid outwardly by the pressure of said generated gas to its operative position shown in broken line in Fig. 4. In the aforementioned operative position, the outlet opening 40 of the whistle 36 is located externally of the casing 35, and the flange 41 is in contact with the flange 42, preventing further outward movement of the whistle 36. The gas generated in the container 10 may now pass freely through the inlet opening 38 and out of the outlet opening 40, producing a warning sound.

While preferred embodiments of my invention have been shown and described herein, it is obvious that numerous additions, changes, and omissions may be made in the invention without departing from the spirit and scope thereof.

I claim:

1. An alarm device comprising in combination a container having a large surface area in proportion to its cubic content and having heat-permeable walls, said container containing a liquid which boils at a selected temperature, a gas-operable sound device having a liquid-tight and gas-tight connection with said container and communicating with the interior of said container, and closure means normally held in an operative position in which it seals off the sound device from the passage of gas therethrough, said closure means having a heat-sensitive member which normally maintains said closure means in its operative position, said heat-sensitive member being responsive to a rise in the surrounding temperature to a selected level above the boiling point of said liquid, thereby moving closure means out of its operative position, whereby gas from the boiling liquid may flow through said sound device to produce a warning signal.

2. An alarm device comprising in combination a container having a large surface area in proportion to its cubic content and having heat-permeable walls, said container containing a liquid which boils at a selected temperature, a gas-operable sound device, a connecting member between said sound device and the interior of said container, said connecting member having a through-and-through air opening, and a bimetallic thermostatic element secured adjacent said air opening and having a normal curved shape in which it closes said opening to the passage of gas therethrough, said thermostatic element being adapted to snap to out of its normal curved shape and to an oppositely curved shape in which it uncovers said opening when the surrounding temperature rises to a selected level above the boiling point of said liquid.

3. An alarm device comprising in combination a container having a large surface area in proportion to its cubic content and having heat-permeable walls, said container containing a liquid which boils at a selected temperature, a gas-operable sound device, a hollow tube communicating with the interior of said container, said sound device comprising a whistle slidably mounted in said sound device, said whistle having an air inlet at its inner end and an outlet, said air inlet communicating with the interior of said container through said tube, said outlet being located intermediate the ends of said whistle, and a metal plug normally locking said whistle in a contained position in said tube in which the outer end of said whistle closes off the outer end of said tube, said metal plug having a melting point slightly higher than the boiling point of said liquid.

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