# United States Patent

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[15] **3,667,419**

[45] **June 6, 1972**


## [54] PRECISION TEMPERATURE DETECTION AND ALARM SYSTEM


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[22] Filed: **Sept. 28, 1970**

[21] Appl. No.: **76,017**

[52] **U.S. Cl.** ..... **116/106,** 116/112

[51] **Int. Cl.** ..... **G08b 17/00**

[58] **Field of Search** ..... 116/65, 67, 101, 106, 112, 116/137, 114.5



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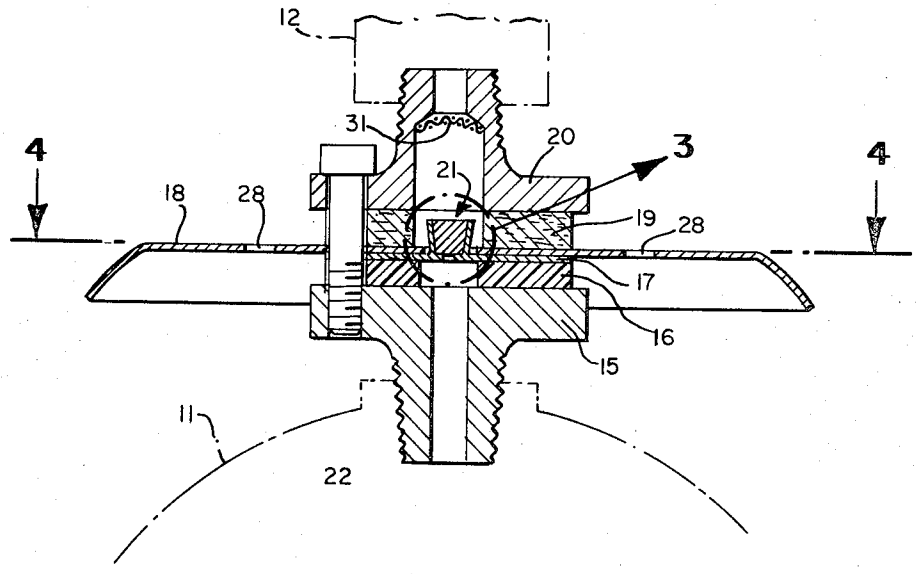
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[57] **ABSTRACT**

A temperature sensing and alarm system for quickly and accurately sensing a sharply defined temperature threshold, comprising a Freon powered horn, the Freon stored in a cylinder and normally blocked from passage to the horn by a eutectic pellet bonded in a brass cup and blocking a Freon release orifice. A heat collector is held in tight contact with an activator disc which contains the aforementioned cup, the cup having angled side walls of a thickness less than the disc portion in contact with the heat collector, thereby providing rapid and uniform heat transfer to the inter-molecular bond between the pellet and the cup, the rapid heat transfer at the eutectic temperature permitting a smaller disc orifice through which sufficient Freon pressure is applied to expel the pellet from the cup at precisely the eutectic temperature.


**4 Claims, 4 Drawing Figures**



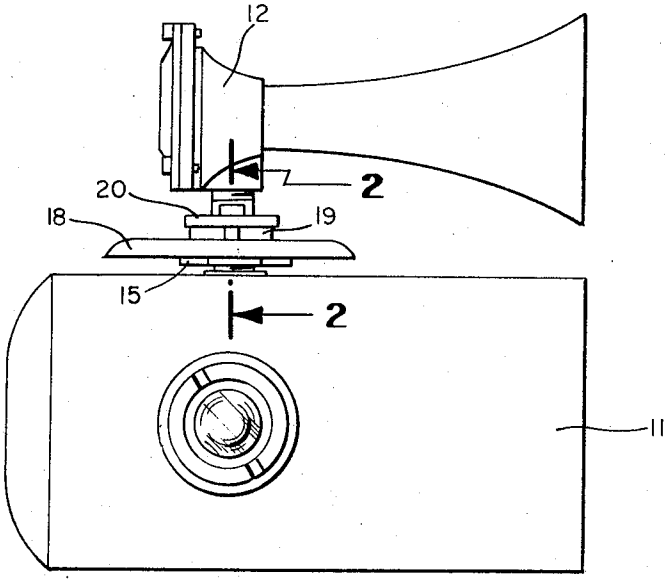



Fig. 1

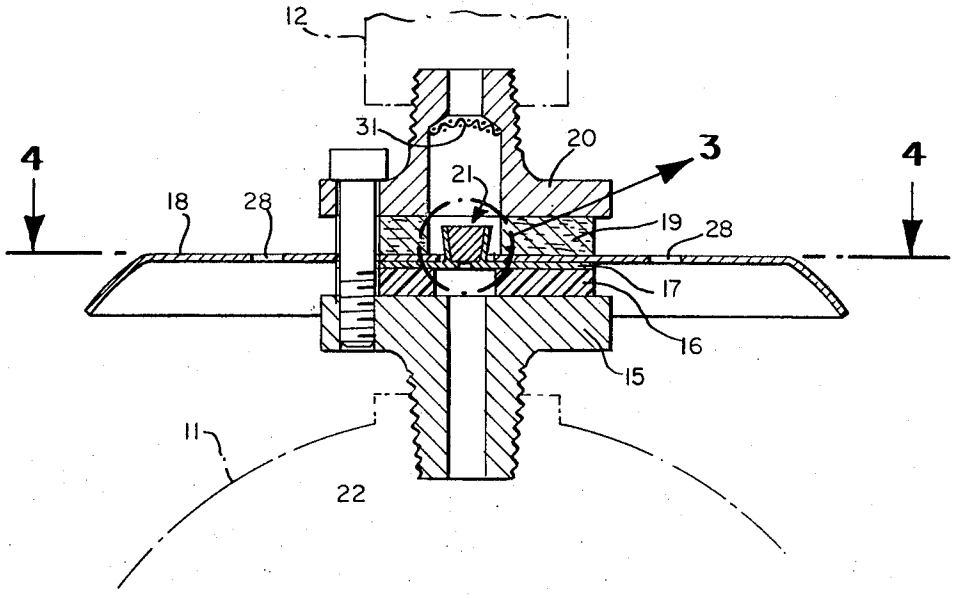



Fig. 2

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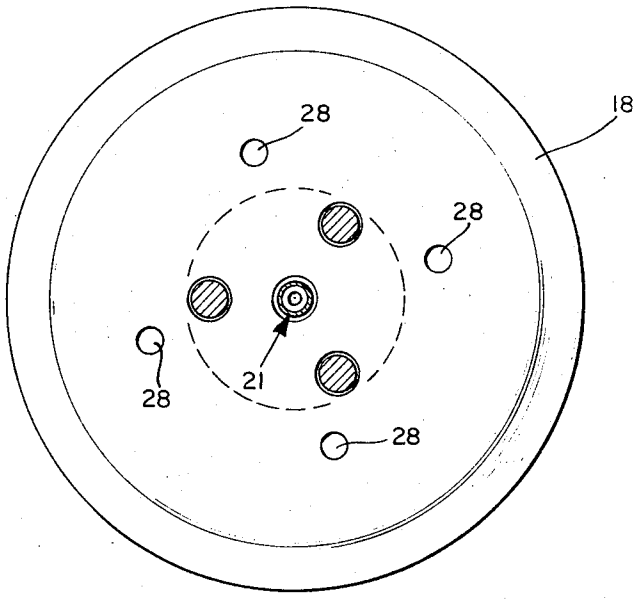



Fig. 4

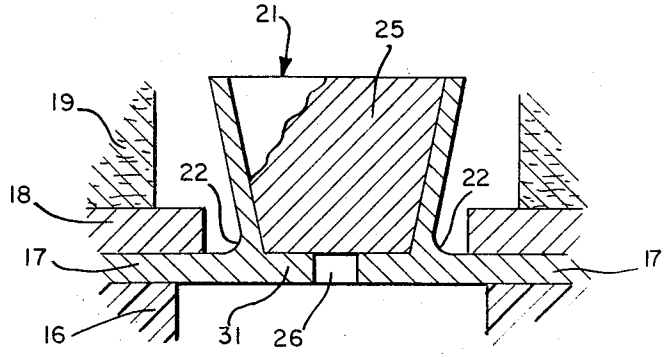



Fig. 3

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# PRECISION TEMPERATURE DETECTION AND ALARM SYSTEM

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to temperature actuated alarm systems and, more particularly, to improvements in gas pressure powered systems permitting more precise detection of a designated temperature and more efficient use of the Freon which powers the horn.

2. Description of the Prior Art

Temperature sensing, or fire alarm systems incorporating pressure powered horns, and activated by a temperature sensing metallic element, have found widespread use in commercial and residential applications. However, the designs of these systems have been relatively crude, resulting in frequent false alarms, early alarms, delayed alarms, and insufficient alarms due to inefficient use of the supply of pressure providing substance. The aforementioned limitations result from a number of structural limitations in the systems employed. For instance, while it is known in the art to use a eutectic metal which has a sharp and precise melting temperature, the means of converting such change in state of the eutectic material into a quick release of Freon to an output horn has been such as to introduce a sluggish response into the system. For example, it is old in the art to contain a eutectic material in blocking position with respect to a passageway which otherwise connects the output of a Freon-containing cylinder with the horn. However, due to inefficient heat transfer to the eutectic material container, a large passageway, or aperture is required, so as to provide sufficient Freon pressure to blast out the eutectic material when the temperature is at the critical point. By so maintaining relatively large pressure upon the pellet, it frequently occurs that the pellet is blasted out prematurely. Also, the large aperture causes subsequent excess flow of Freon gas through the horn, causing inefficient expenditure of the Freon. In other devices of this general design, release of the eutectic material occurs sluggishly and only after the ambient temperature exceeds the predesignated triggering temperature.

There thus remains a need in the area of alarm devices for improved apparatus to precisely detect the attainment of a predesignated temperature, and to provide quick and precise reaction to such temperature, along with efficient use of the supply which powers the alarm.

## SUMMARY OF THE INVENTION

It is an object of this invention to provide temperature sensing and alarm apparatus which overcomes the prior disadvantages of the art and which is reliable and inexpensive.

It is a specific object of this invention to provide alarm apparatus having a minimum reliance upon the activating pressure to trigger the device.

Accordingly, this invention comprises a cylinder for containing Freon or a like substance under pressure, a horn powered by the Freon, and a normally blocked passageway communicating between the cylinder and the horn. A heat collector is held in tight thermal contact with an activator disc having a small hole, or passageway, centrally located thereon, the disc supporting a cup normally filled with a eutectic metal which blocks the passageway. The walls of the cup are angled outward from the passageway so as to provide a large bonding surface between the eutectic metal and the cup in proportion to the volume of the eutectic metal within the cup, thereby insuring that the metal is not disengaged from the cup until attainment of the predesignated temperature, thus preventing false alarms. The walls of the cup are constructed of a lesser thickness than the disc on which the cup is mounted, thereby aiding heat transfer to the bonding surfaces and permitting the use of an extremely small aperture for the Freon passageway.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the alarm system of this invention.



FIG. 2 is a cross sectional view taken along lines 2—2 as shown in FIG. 1.

FIG. 3 is a detail view of the activator disc.

FIG. 4 is a top view of the heat collector.

## DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIGS. 1 and 2, the component parts of the apparatus of this invention are shown. A cylinder 11 is utilized to contain a substance which will create a substantial pressure within the cylinder under temperature conditions in which the system is to operate. An example of such a substance is "Freon," which will be referred to hereinafter to mean any like pressure-providing substance. The cylinder is designed to provide a maximum inner surface of the cylinder which is exposed to the Freon contained therein, in order to maintain a relatively constant temperature and pressure of the Freon during horn operation. When the Freon is released, the conversion of Freon from the liquid to the gas state is accompanied by great absorption of energy, thereby cooling the temperature of the Freon, which in turn tends to reduce the pressure. Similarly, the ambient rise in temperature, as would occur in the presence of a fire in the vicinity where the cylinder is mounted, causes a rise in the Freon pressure. By making the cylinder long with respect to its radius, the inner surface area is maximized with respect to the volume of Freon contained therein. Thus, during operation, the elevated ambient temperature is transmitted quickly through the cylinder to the Freon, maintaining it at a high operating pressure.

A horn 12, of a suitable commercially available type, is mountedly connected to the cylinder through a sensor assembly which comprises, in order proceeding from cylinder 11 to horn 12, a bottom flanged adapter 15, a heat collector washer 16, an activator disc 17, a heat collector 18, an upper head washer 19, and a top flange adapter 20.

Bottom flanged adapter 15 is suitably constructed of aluminum, and has a threaded male portion for engagement in recess 22 of cylinder 11. The head, or flanged portion of adapter 15 is suitably hexagonal and of sufficient surface area to support activator disc 18. Resting on top of adapter 15 is heat collector washer 16, suitably constructed of nylatron, or any equivalent thermal insulator, having a thickness sufficient to thermally insulate adapter 15 and cylinder 11. For example, a thickness of three thirty-seconds inch has been found a suitable thickness. Washer 16 has a surface area equal to that of activator disc 17, to insure proper support for disc 17.

Activator disc 17 which seats upon washer 16, is shown in cross section in FIG. 3. The disc is suitably constructed of brass, and comprises a base portion 31, which seats against washer 16, and a cup portion 21 which defines a truncated cone. The base portion is suitably of a thickness of 0.02 inch, and has a center aperture 26 therein, in the preferred embodiment, with a diameter of 0.026 inch. The cup walls, which are of a smaller thickness than the base, suitably 0.012 inch, taper outward from the base, defining a truncated cone having a smaller diameter suitably of 0.100 inch and a larger outer diameter suitably of 0.150 inch. The outside junction between the base of the disc and the cup walls, is rounded, as shown at 22. This curvature permits a more rapid heat transfer from the disc base to the cup walls, thereby minimizing sluggishness in transferring the ambient temperature to the cup walls. In practice, it is generally found suitable to place a silicone paste on the disc surfaces to provide good thermal transfer from the heat collector to the disc.

The inside space of the cup is filled with a eutectic metal, designated as 25, which is normally in bonded inter-molecular engagement with the brass walls and base 31 of the cup 21. The eutectic material may be of any suitable composition which has the well defined characteristic that the inter-molecular bond between it and the brass cup walls is weakened at a predesignated temperature, corresponding to the temperature at which it is desired to sound the alarm. The claims of this invention do not embrace the composition of the

eutectic metal, such eutectic metals being widely available. It is sufficient for the operation of the system of this invention that the eutectic metal remain bonded to the cup up to the predesignated ambient alarm temperature, and that upon attainment of such alarm temperature, the bonding be weakened sufficiently that the Freon pressure transmitted through aperture **26** dislodges the pellet of metal.

Held in seated engagement with activator disc **17** is heat collector **18**, preferably composed of anodized aluminum. The heat collector is a disc of substantially greater diameter than that of the activator, and has a plurality of holes therethrough, as shown at **28** in FIG. **4**. The holes permit air flow through the collector so that insulating air pockets do not form under the collector. Such air pockets prevent warm air from contacting the collector, and introduce thermal sluggishness into the system.

On top of heat collector **18** is upper head washer **19**, suitably constructed of compressed long fiber asbestos, or an equivalent good thermal insulator. Seated on top of washer **19** is top flange adapter **20**, which has a base portion which seats directly upon washer **19**, and a threaded extending portion which engages horn **12**.

The six elements **15–20** are held in rigid engagement, preferably by three screws, each of which pass through all six elements.

In operation, the pellet of eutectic material **25** in cup **21** is normally in a solid state, for ambient temperatures below the predetermined alarm temperature. When the alarm temperature is attained, the heat collector, which is an extremely good heat transfer element, quickly assumes the ambient temperature and transmits heat to the base **31** of activator disc **17**. The heat is transferred from the base through the rounded edge **22** to the tapered walls of cup **21**, such that the heat is transferred directly to the bonding layer between the eutectic material and the cup walls. Since the cup walls are thinner than the base of the activator disc, there is very little thermal inertia to overcome in raising the temperature of the cup walls, and the entire bonding surface quickly attains ambient temperature. When the cup walls attain the alarm temperature, the bonding disintegrates, such that the pressure applied through aperture **26** expels the pellet out of the cup. The pellet is caught by a screen within top flange adapter **20**, which prevents it from obstructing the final passageway through adapter **20** into horn **12**. Upon opening of the passage through the cup, Freon contained in cylinder **11** is free to pass uninterrupted into horn **12**, thus exciting same.

From the above discussion, it is now possible to appreciate the advantages incorporated in the novel structure as described. The lengthened walls of cup **21** provide additional bonding surface, thereby helping to prevent premature expulsion of the pellet of eutectic material from the cup. By tapering the walls outward, no extra drag is contributed which would delay expulsion. Additionally, due to the relationship of the base and cup wall thicknesses, thermal transfer to the bonding surfaces is virtually instantaneous, such that as soon as the predesignated alarm temperature is reached, the bond is quickly and thoroughly disintegrated, permitting the expulsion of the pellet of eutectic metal from the cup with minimum pressure applied through aperture **26**. Consequently, aperture **26** can be made considerably smaller than previous designs, since it takes so little force to expel the pellet precisely at the alarm temperature. The smaller aperture has the obvious advantage of permitting a smaller flow of Freon from the cylinder, such that the horn sounds for a greater length of time for a given supply of Freon. Additionally, the two insulating washers hold the heat collector and activator disc in thermal isolation, such that all collected heat is channeled only to the activator, insuring that it quickly follows any changes in ambient temperature.

It is understood that variations of design may be made within the spirit and scope of this invention.

I claim:

**1.** Temperature detection and alarm sounding apparatus for sounding an alarm at a predetermined alarm temperature, comprising:

a. a cylinder containing Freon under pressure;

b. a horn, activated by Freon under pressure;

c. temperature sensitive passage means, isolating said horn from said cylinder when the ambient temperature is below said alarm temperature, and providing a connecting passage between said horn and said cylinder when the ambient temperature attains said alarm temperature;

d. said passage means containing an activator and a heat collector in contiguous heat transfer relationship, and thermally insulated from all other elements of the apparatus;

e. said activator having a base portion in thermal contact with said heat collector, and having a cup portion normally housing a eutectic metal;

f. said cup portion having walls which angle outward from said base portion and combining with said base portion to define a truncated cone, said walls having a thickness less than the thickness of said activator base;

g. said base having a centrally located aperture therein for communicating Freon pressure to the eutectic material in said cup; and,

h. said eutectic material being normally bonded to the inside of said cup at temperatures below said predetermined temperature, said bond disintegrating at said predetermined temperature such that said Freon pressure communicated to said eutectic material expels it from said cup, thereby providing a through passageway from said cylinder to said horn when the ambient temperature attains said alarm temperature.

**2.** The apparatus as described in claim **1** wherein said passage assembly comprises a bottom flange adapter, a heat collector washer, said activator disc, said heat collector, an upper head washer, and a top flange adapter, such elements being connected to each other in the order as stated herein, and secured in place by screws engaging all said elements.

**3.** The apparatus as described in claim **2**, wherein said heat collector comprises a disc of diameter greater than said base portion, and has a plurality of openings therein.

**4.** The apparatus as described in claim **3**, wherein said activator base portion is a disc, and the outside junction between said activator disc and said cup walls is rounded.

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