Oct. 28, 1969 S. FRANKFURT 3,475,744

FIRE ALARM

Filed June 22, 1966

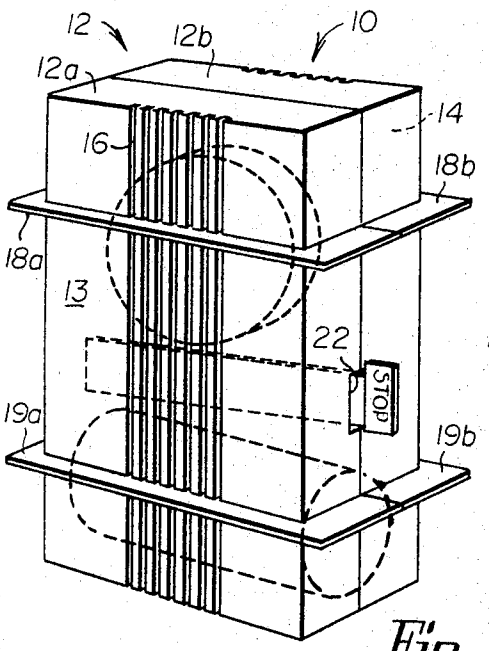

Fig. 1

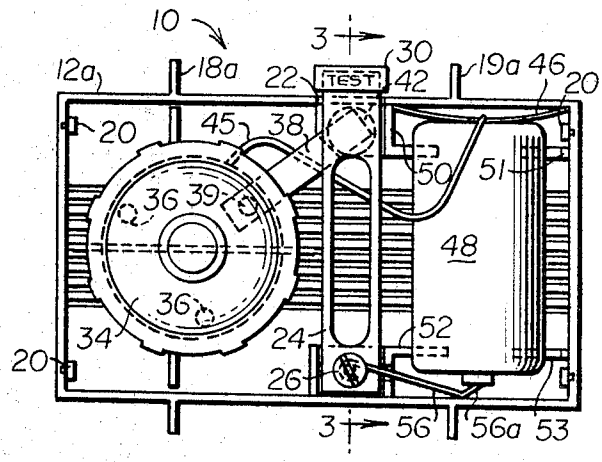

Fig. 2

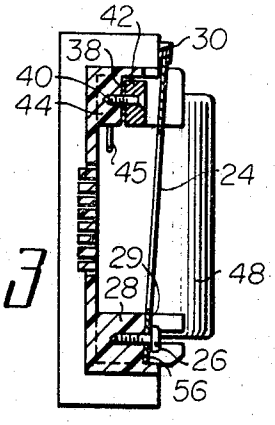

Fig. 3

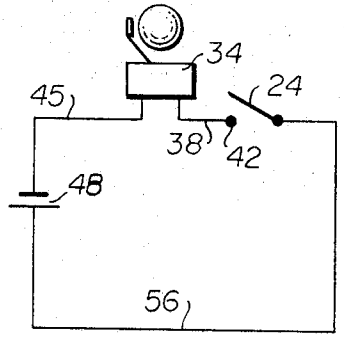

Fig. 4

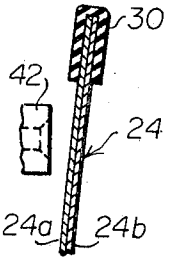

Fig. 5

INVENTOR.
SANDOR FRANKFURT
BY Watts & Fisher, attys.

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FIRE ALARM

Sandor Frankfurt, 13534 Cedar Road, Cleveland, Ohio 44118

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U.S. Cl. 340—227.1 4 Claims

ABSTRACT OF THE DISCLOSURE

An independent signal system responsive to both thermal changes and mechanical actuation, having a thermal responsive and mechanically actuable element that partially extends from a housing, and a permanent magnet capable of holding the thermal responsive element in actuated position independent of changes in temperature. The system is suitable for both fire and burglar alarms and can be manually tested and reset without disassembly.

This invention relates to a fire and burglar alarm or other electrical signal systems using a thermal responsive device that can be mechanically actuated.

Signal systems using thermal responsive devices are especially useful as first alarms. In these systems an audible or visual signal, or both, is actuated in response to a change in temperature, such as an increase in temperature to an abnormally high level, indicating the existence of a fire or other abnormal condition.

Signal systems for burglar alarms are often mechanically actuated. Normally, an audible signal is created when the alarm is tripped, as when a door, window or compartment lid is opened.

For many uses and in many installations it is advantageous to provide a self-contained, independent signal system. Such a system is operable even though there may be a power failure. It is also conveniently used in buildings, vehicles or other areas where central power may not be available.

Small and inexpensive alarm systems are particularly advantageous. A number of such systems can be located unobtrusively in a variety of different places to act independently. With a large number of thermal sensitive systems at various locations, a fire is detected immediately at its source of origin. As is well known, early discovery and control of a fire is often the difference between minor damage and total destruction of a building. Similarly, a separate burglar alarm at each entrance of a building indicates the location of disturbance. A small, self contained alarm can conveniently be used to protect cars, boats, trailers or compartments within such vehicles.

One problem of many fire alarm systems is that they shut off after once actuated if the temperature falls below the triggering temperature. Thus, if a fire should die down or shift, the alarm often shuts off. As a result, the fire may smolder and later flare up in a different location or in the same location with renewed vigor if the initial alarm signal is not observed. It is also desirable that a burglar alarm remain actuated even if the door or window that is opened to trip the alarm is subsequently closed.

One proposed solution to some of the above problems, in connection with a fire alarm system is disclosed and claimed in my U.S. Patent No. 2,762,887. As disclosed in that patent, a thermal responsive device is provided with a hook. When the device is actuated by an increase in temperature, the hook engages a prong, which holds the device actuated.

The present invention provides the advantageous features of my earlier invention, but in an improved manner and in an arrangement that provides an extremely

compact, self-contained signal system that can be used as both a fire alarm and burglar alarm. In addition, the alarm of the present invention can be conveniently tested and reset without disassembly.

Briefly, this invention utilizes a resilient thermally distortable element, such as a bimetallic strip, that is movable between two positions in response to a change in temperature to a predetermined level. Distortion of the thermally responsive element causes the element to complete an electrical circuit that energizes a signal device. A permanent magnet is positioned to retain the thermally distortable element in the position to which it moves in response to the change in temperature. The magnet is of sufficient strength to retain the element in position to maintain the circuit closed, notwithstanding a subsequent change in temperature. As a result, the signal remains energized once the predetermined temperature is reached.

An important feature of this invention resides in the construction and arrangement of the thermally distortable element with respect to the housing for the signal system. A portion of the bimetallic thermal responsive element extends through the housing and moves from a first position to a second position in response to an increase in temperature from below a predetermined temperature level to the predetermined temperature level. At the second position, the bimetallic element completes an electrical circuit and operates the signal. The portion of the bimetallic element that extends through the housing permits the alarm to be mechanically actuated from outside the housing independently of any change in temperature. When the extending portion of the bimetallic element is moved from one position to another, whether mechanically or manually, the electrical circuit is completed. An extending strip from a door or window can be used to mechanically move the element when the protected door or window is opened, causing the alarm to operate. Also, the strip can be manually moved to test whether the alarm is functoning properly. The actuated alarm is turned off and reset by manually moving the extending portion of the bimetallic element away from the permanent magnet.

Accordingly, it is an object of this invention to provide an improved thermal responsive and mechanically actuatable device in the form of an independent signal system that once energized remains energized and that can be conveniently tested and reset.

These and other objects, features and advantages of this invention will become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a diagrammatic, perspective view of a signal system constructed in accordance with the present invention, showing the outer housing and the manner in which the thermal responsive element extends through the housing to facilitate testing and resetting;

FIGURE 2 is a top plan view of the signal system with one half of the housing removed, showing the constructional details and arrangement of the elements of the system;

FIGURE 3 is a sectional view of the system of FIGURE 2, taken along the lines 3—3 and looking in the direction of the arrows;

FIGURE 4 is a wiring diagram of the alarm system; and

FIGURE 5 is a partial enlarged longitudinal sectional view of the bimetallic element and permanent magnet of the alarm system.

Referring now to the drawings, the self-contained signal system is indicated generally at **10**. It includes an outer housing **12** having two portions **12***a*, **12***b* that interconnect to provide a box-like construction in which the oper-

ative elements of the alarm system are contained. A front surface **13** and a rear surface **14** of the housing **12** include slot openings **16** to permit an audible signal from within the housing to be emitted. Fin-like members **18***a* and **19***a* on the housing portion **12***a*, and **18***b* and **19***b* on housing portion **12***b* extend from the housing **12** about the front, back and side surfaces. These members assure that the openings **16** will be spaced from the wall, shelf, or other surrounding environment so that a clear, audible sound will be emitted from the housing **12** no matter how it is oriented. Preferably, the housing is formed of electrically non-conducting material, such as plastic or wood. The two housing portions **12***a*, **12***b* are secured together by detents **20** on opposite ends of housing portion **12***a*. These detents extend into portion **12***b* and are received by indentations (not shown) formed in the inside surface of the end walls of housing **12***b*.

An opening **22** is provided in the housing portion **12***a* to permit one end of a bimetallic thermal responsive strip **24** to extend from the inside of the housing to the outside. The opening **22** is large enough to permit movement of the bimetallic strip **24** in a direction toward and away from the front surface **13** of the housing **12**.

As best shown in FIGURES 2, 3 and 5, the bimetallic thermal responsive strip **24** in undistorted condition at room temperature (68 degrees Fahrenheit) is essentially flat and straight, and extends at a slight angle with respect to front surface **13**. The strip **24** is anchored at one end by a screw **26** to a support block **28** formed in the housing portion **12***a*. As shown in FIGURE 3, the support block **28** is formed with an inclined upper surface **29** to orient the strip **24** at the desired angle.

The free end of the strip **24** extends through opening **22** and supports a cap **30**. The cap **30** includes indicia on each side. One side says "test," indicating that movement of the strip **24** by manual pressure against the strip on that side of the cap will cause the alarm to operate. The indicia "stop" is imprinted on the opposite side of the cap **30** to indicate that pressure applied manually on this of the cap stops the alarm.

A signal device, such as a buzzer **34** is contained within the housing **12**, being secured by screws **36** to the housing portion **12***a*. An electrically conductive strip **38** extends from a contact **39** of the buzzer **34** to a location beneath the bimetallic thermal responsive strip **24**, adjacent the opening **22** in the housing **12**. A screw **40** secures a permanent magnet **42**, such as an alnico magnet, and the electrically conductive strip **38** together on a support block **44** of the housing **12**. As best shown in FIGURE 3, the magnet **42** is normally spaced from the bimetallic strip **24**.

An insulated wire connector **45** extends from a second terminal of the buzzer **34** to a bowed strip of spring metal **46**, preferably of copper or copper alloy, that forms a base plate for a battery **48**. The strip of metal **46** is located adjacent one corner of the housing **12***a* and held in a bowed condition by a partial partition **50**. The partition **50** and a second partition **51** locate or cradle the bottom end of the battery **48** in position adjacent the bowed strip of metal **46**. As shown in FIGURE 2, the battery **48**, which is a standard type D 1.5 volt dry cell, extends across one end of the housing **12**. Additional contoured partitions **52**, **53** formed in the housing portion **12***a* receive and locate the anode end of the battery **48**.

A spring clip in the form of an electrically conductive wire **56** is fastened to the support block **28** of the housing **12***a* and held in electrical contact with the bimetallic strip **24** by the screw **26**. The spring clip **56** includes an angularly disposed end portion **56***a* position to contact the anode of the battery **48**.

As shown in FIGURE 5, the bimetallic thermal responsive strip **24** is constructed in a conventional manner, with two metals **24***a*, **24***b* that have different coefficients of thermal expansion. By way of example, brass and steel have significantly different coefficients of thermal expansion, brass expanding at a much greater rate than steel for a given rise in temperature. The two metals are laminated to provide the strip **24** with the steel portion **24***a* adjacent the magnet **42** and the brass portion **24***b* away from the magnet. With this arrangement, an increase in ambient temperature causes the strip **24** to bow or deflect toward the magnet **42** due to the increased expansion of the brass portion. Upon sufficient deformation of the strip **24**, the steel portion **24***a* comes into direct contact with the magnet **42** so that the magnet will hold the strip **24** in deformed position even if the temperature subsequently decreases.

The electrical circuitry is diagrammatically shown in FIGURE 4 of the drawings. A series circuit is provided in which the anode of the battery **48** is connected by spring clip **56** to the bimetallic strip **24**, which functions as a switch. The cathode side of the battery **48** is connected by wire **45** to one terminal of the buzzer **34**. The second terminal of the buzzer **34** is connected by strip **38** to the permanent magnet **42**. The magnet **42** and the bimetallic strip **24** act as spaced contacts which, when closed, complete the circuit.

In operation, the bimetallic thermal responsive strip **24** is normally in a straights configuration at room temperature (68 degrees Fahrenheit) and spaced from the permanent magnet **42**. The spacing is sufficient that the attractive force of the magnet **42** will not draw the strip **24** into contact with the magnet. The electrical circuit shown in FIGURE 4 is therefore normally opened and the buzzer **34** is inoperative. When the ambient temperature of the environment in which the bimetallic thermal responsive strip **24** is located increases, the strip **24** bends or deflects in a direction toward the permanent magnet **42**.

The strip **24** is constructed and arranged relative to the magnet **42** so that it bends into contact with the magnet when the ambient temperature reaches a predetermined level, such as 136 degrees Fahrenheit. The temperature level at which contact is made and the buzzer **34** operated may, of course, be varied by adjusting the initial gap between the bimetallic strip **24** and the magnet **42** or by varying the expansion characteristics of the strip itself.

The extending end of the strip **24** is also constructed and arranged to be operable by a tripping mechanism, such as an extending finger (not shown) attached to a movable member such as a window or door. When the window or door is opened, movement of the finger contacts the cap **30** on the end of the bimetallic strip and moves the strip into contact with the magnet **42**.

Once contact is made between the bimetallic strip **24** and the permanent magnet **42**, a circuit is completed from the battery **48** through the buzzer **34**, the magnet **42** and the bimetallic strip **24** to energize the buzzer **34**. The magnet **42** is selected of sufficient attractive force to overcome the resiliency of the strip **24** that tends to return the strip to its initial position, spaced from the magnet, when at room temperature. In this way, the circuit is held closed by the magnet **42**, notwithstanding a subsequent decrease in temperature or a subsequent closing of the door or window if the alarm is mechanically tripped. As a result, the buzzer will provide an indication that a certain temperature level was reached or that a door or window was opened, even if the alarm is not heard immediately and even if the cause of setting off the alarm is eliminated. Moreover, even if the battery should run down before the signal is heard, the position of the strip **24** in contact with the magnet **42** indicates that the alarm was at one time actuated.

To reset the alarm after it has been actuated, the portion of the bimetallic strip **24** extending from the housing **12** is merely lifted away from the magnet **42**. If the temperature is below the tripping temperature of the alarm, the strip will remain out of contact with the magnet **42**, in condition to function again as an alarm. Thus, there is no need to disassemble the device or to replace parts of the mechanism in order to reset the alarm.

Periodically, the signal system is tested to assure that the battery **48** has not lost its power and to determine that other components are properly functioning. This can be conveniently accomplished without opening the housing **12** by pressing the extending portion of the strip **24** into contact with the magnet **42**, causing the buzzer **34** to be energized. If the test is satisfactory, the strip **24** is then lifted from the magnet **42**, and the device is again ready to function. With this construction, a signal system is provided that functions as both a fire and burglar alarm, that is small and self-contained, and that uses a permanent magnet as an inexpensive and convenient means to hold the alarm energized and to facilitate the testing and resetting of the circuit without disassembly.

What is claimed is:

1. An independent signal system comprising:

(a) a signal device for producing a sensible signal when electrically energized,

(b) an electrical circuit for connecting the signal device to a source of electrical current,

(c) two normally spaced electrical contacts forming a part of the electrical circuit, adapted when electrically connected to operate the signal device through the electrical circuit,

(d) thermal responsive means movable mechanically and in response to temperature changes, for electrically connecting said two contacts in response to movement thereof,

(e) means, including a permanent magnet, to maintain the thermal responsive means in a position electrically connecting the two contacts independent of any change in temperature, once it has moved to such a position,

(f) a housing enclosing the signal device, electrical circuit, electrical contacts and thermal responsive means, with an opening through which a portion of said thermal responsive means extends for mechanical or manual engagement and which permits movement of said thermal responsive means between a position in which the said contacts are electrically isolated and a position in which the said contacts are electrically connected by said thermal responsive means,

(g) whereby the signal system functions in response to either a change in temperature or mechanical actuation externally of said housing and can be manually tested and reset without disassembly.

2. The system of claim **1** wherein the thermal responsive means is a bimetallic element that distorts in response to temperature changes.

3. The system of claim **2** wherein the signal device is an audible alarm; a battery contained within the housing act as the source of current; the bimetallic element is essentially straight at ambient room temperature, includes at least one metal that has ferromagnetic properties positioned to contact the magnet when the element is subjected to the predetermined temperature level, and forms one of the normally spaced contacts; and the permanent magnet is fixed relative to the housing, forms the other of the normally spaced contacts, and has sufficient magnetic attraction to hold the bimetallic element in contact with the magnet once contact is made, independent of subsequent changes in temperature.

4. The system of claim **3** wherein the housing includes openings to emit audible sounds and has projections that maintain the openings spaced from any large, flat, adjacent surface.

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JOHN W. CALDWELL, Primary Examiner

D. L. TRAFTON, Assistant Examiner

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337—366; 340—283