# United States Patent [19]

**Jamison**

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[54] **FIRE ALARM DEVICE**


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[52] **U.S. Cl.** ..... **340/227.1,** 337/362, 337/381, 339/99 R

[51] **Int. Cl.** ..... **G08b 17/06**

[58] **Field of Search** ..... 340/227.1; 337/362, 337/381, 333, 415; 339/98, 99 R



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| 2,204,237 | 6/1940 | Slack et al. | 337/412 |



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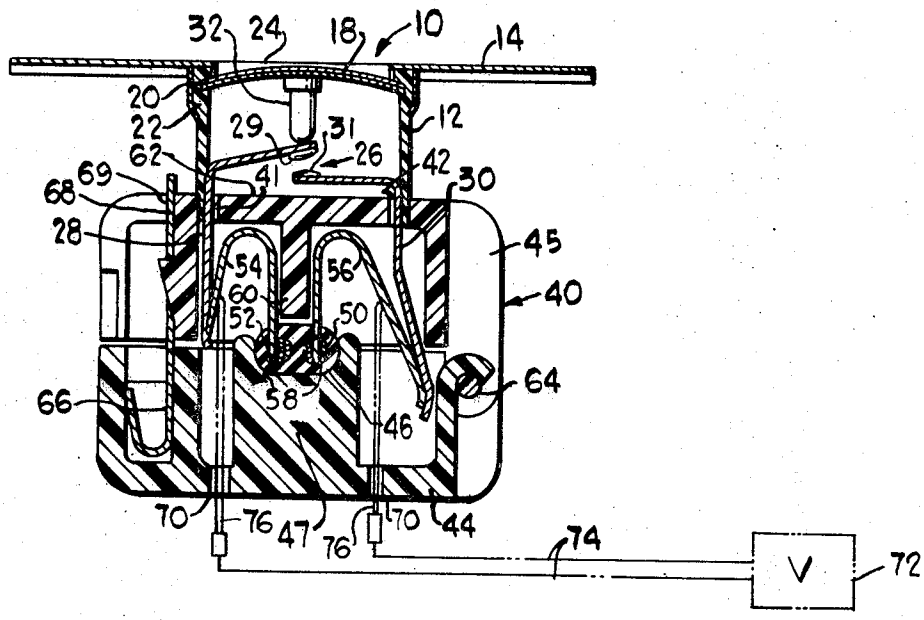
[57] **ABSTRACT**

A fire alarm device including thermostat means operably connected to conductor means whereby a fire condition may activate the thermostat for providing a signal current to activate an alarm in electrical connection with the thermostat. The thermostat includes a normally open switch means having a pair of downwardly depending conducting elements extending therefrom. Each member of the pair of conducting elements is adapted to contact in electrically conducting fashion a member of a pair of current carrying conductors whereby closing of the switch due to exposure to fire may activate an alarm. In a preferred instance the conducting elements are in contact with a pair of barb-bearing electrical contacts in a hinged, channel forming receptacle. Closing of the receptacle about its hinge over a conventional electrical cord including a pair of current carrying wires forces the barbs into mechanical and electrical contact with the wires. In that fashion, the thermostat means is rapidly and efficiently operably contacted with the wires. Each hinged, channel formed receptacle includes means, such as bores, therein through which testing means, such as electrical leads to a voltmeter or the like, may be inserted for testing the connection between a fire alarm device and current carrying wires. Additionally, a fire alarm system is provided including a plurality of the foregoing fire alarm devices connected in parallel along a length of conduit and including appropriate alarm devices therefor.


**8 Claims, 3 Drawing Figures**



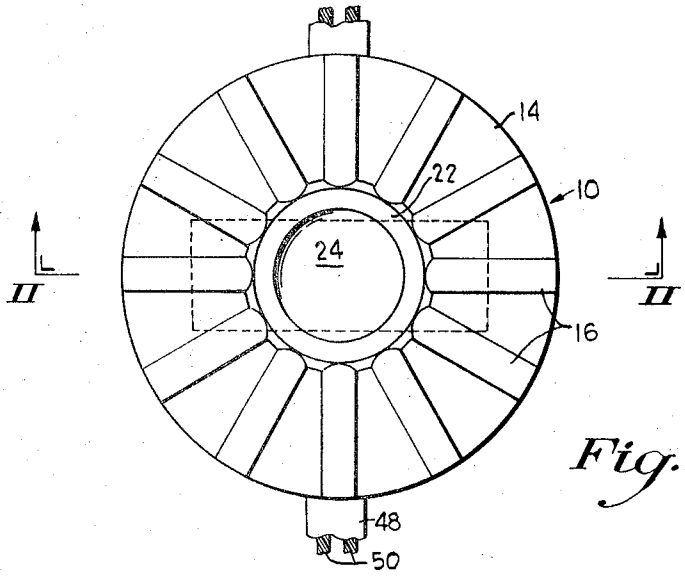



Fig. 1.

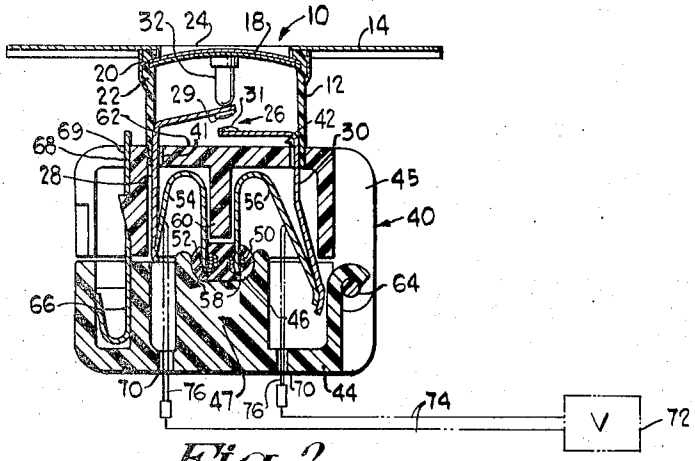



Fig. 2.

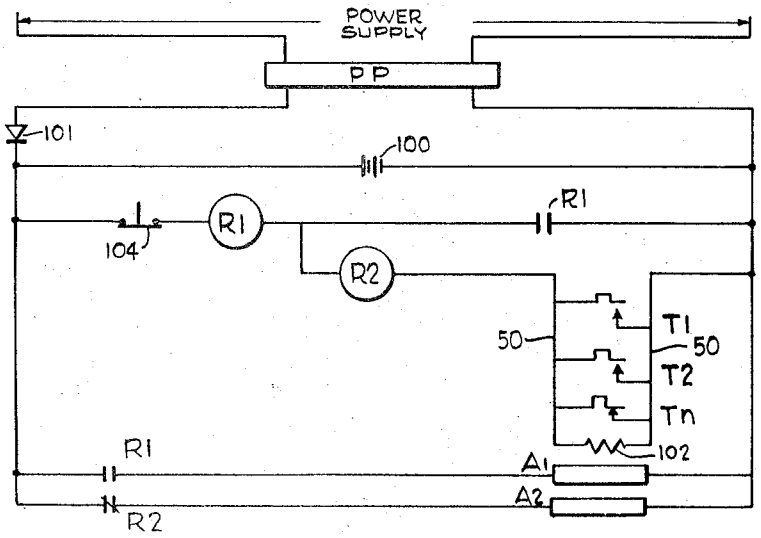



Fig. 3.

# FIRE ALARM DEVICE

## BACKGROUND OF THE INVENTION

This invention relates to a fire alarm device, and more particularly to an improved fire alarm device which may be rapidly and efficiently connected to a pair of current carrying conductors.

Fire alarm systems comprising a plurality of fire detectors located along a pair of spaced-apart, insulated conductors are well known in the art. Fire detectors in such applications generally are heat responsive whereby the heat from a flame near the fire detector will operate in some fashion to complete a circuit between a power source and an alarm device. For example, U. S. Pat. No. 2,186,112 discloses a fire alarm system wherein a multiplicity of contact fuses are provided along a current carrying line composed of a pair of current carrying wires. There, the fuses are heat-destructable whereby burning of the fuse material may result in a complete electrical curcuit to activate an alarm device. The circuitry disclosed in the above patent cannot be checked for continuity between the contact fuses without closing the circuit by connecting the respective conductors. Further, the activation of the alarm device is dependent upon combustion of the material separating the conductors rather than being activated by an elevated temperature. U. S. Pat. No. 2,204,237 discloses a thermostat connected in parallel between a pair of current carrying wires disposed between a power source and an alarm device such as a bell. The thermostat includes a heat responsive element or elements whereby exposure to heat from a flame may activate the thermostat to close an internal switch for completing the alarm circuit. The preferred means for activating the internal switch comprises the heat destruction of a fusible metal, such as Woods metal, in a spring loaded switch. U. S. Pat. No. 2,204,237 is primarily concerned with the provision of a prefabricated alarm cable wherein the thermostats are built into a current carrying cable system and entails elaborate, rather expensive manufacturing techniques including the splitting of an electrical cord, installation of the thermostat device, and reinsulating the installed device. Also, even after assembly or fabrication, there is no assurance that the pins or barbs of the thermostat are in contact with the metallic conductors in the wires. There are no provisions for determining this without fusing one of the retaining strips in the thermostat and destroying the future effectiveness of the thermostat as a temperature responsive device. U. S. Pat. No. 2,779,842 discloses a fire alarm system wherein a plurality of barb-bearing electrical contacts depending from a conductor encased in a plastic insulator are provided. The barb-bearing devices are adapted to be positioned in overlying fashion upon a current carrying, insulated wire and forced into contact therewith whereby the donducting barbs may penetrate the insulation to come into contact with the wires. Those devices are provided along a length of a pair of insulated current carrying wires in overlapping pairs whereby melting of the plastic insulation thereon may produce a current flow between the current carrying conductors which may be sensed in a conventional fashion and employed as a signal to activate an alarm device. The thermoplastic insulating material there employed has a relatively low melting point, such as 140°F. so that it will melt or soften upon exposure to heat. Thermoplastic materials tend to cold flow over long periods of time and at a much lower temperature than the melting temperature therefor. Thus, such devices are not satisfactory where close and accurate temperature response for a fire alarm device is required. Moreover, the thermoplastic material can melt and cause the device to respond to widely different temperatures depending upon the rate of heating of the device. Again, as in U.S. Pat. No. 2,204,237, barbs or prongs on the thermostatic elements pierce the insulation of the conductors and must contact the metallic wire to be effective. The only way to determine if the device is operable and the barbs are in contact with the metallic conductor is to melt the thermoplastic insulating material. This again destroys the temperature responsive device and prevents future use of that device. Such is also the case with the first mentioned fused device of U. S. Pat. No. 2,186,112.



This invention provides an improved fire alarm device, a multiplicity of which may be placed along a pair of conducting wires in parallel connection therewith, in a rapid and efficient manner. The invention further provides a fire alarm device of the type described which may be readily positioned in a fire alarm circuit, and which may be rapidly and effectively tested without either activating or destroying the fire alarm device. Moreover, the invention provides a fire alarm device which responds accurately and efficiently at its fixed temperature rating with little or no danger of "false" alarms. Additionally, the fire alarm device of the invention is not self-destructable, and may be reused in subsequent applications. And in one aspect, the invention provides a fire alarm system which may not only accurately report fire conditions, but will also signal a system failure, i.e., a power loss, cable break, etc. Other advantages of the invention will become apparent as this specification proceeds.

## SUMMARY OF THE INVENTION

This invention provides an improved fire alarm device including thermostat means in operable contact with conductor means whereby a fire condition may activate the thermostat for providing a signal current to an alarm device. The thermostat means includes an integral, normally open switch including a pair of depending conducting elements. Each member of the pair of conducting elements is operably electrically connected with a member of a pair of spaced, insulated current carrying conductors or wires, whereby closing of the switch due to exposure to fire may activate an alarm device. The thermostat means includes a heat sensitive actuator for closing the switch. A preferred actuator comprises a bimetallic strip in operable contact with an insulated switch operator whereby distortion of the bimetallic strip upon exposure to a preselected temperature may activate said operator for closing the switch to complete a circuit for operating an alarm.

In a preferred instance, the depending conducting elements of the thermostat are in contact with a pair of barb-bearing electrical contacts in a hinged, channel forming receptacle adapted to receive a conventional electrical cord including a pair of spaced, insulated current carrying wires. Closing of the channel forming receptacle about the electrical cord forces the barb-bearing electrical contacts into mechanical and electrical contact with the wires. In that fashion, the thermo-

stat means may be rapidly and efficiently contacted with the pair of wires in a fire alarm system. Each hinged, channel forming receptacle includes means by which the fire alarm device may be effectively and rapidly tested without either activating or destroying the fire alarm device. Most preferably, bores are provided in the body thereof through which testing means, such as electrical leads to a voltmeter or the like, may be inserted for testing the connection of the fire alarm device to the conductors.

In a preferred instance, a multiplicity of such fire alarm devices are provided along a desired length of electrical cord. The current carrying conductors therein and the devices are provided in an electrical circuit including both a fire alarm circuit and a current interruption circuit whereby not only fire conditions but also system failure conditions may be effectively signaled. Preferably, a pair of relays through which current in the system flows are provided for selectively activating fire and power failure indicators or alarms.

Other advantages and details of the invention will become apparent by reference to the attached drawings and as the following detailed description thereof proceeds.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a fire alarm device according to the invention.

FIG. 2 is a partial sectional elevation taken along line II—II of FIG. 1.

FIG. 3 is a circuit diagram illustrating a fire alarm system employing the fire alarm devices of the invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference now to FIGS. 1 and 2, a thermostat, designated generally **10**, is provided and includes a hollow cylindrical body portion **12**. Body portion **12** preferably comprises an insulating resinous composition and has mounted thereon, as by fusing or cementing, a circular thin metallic plate **14** including a plurality of rib-like recesses **16** extending radially outwardly therein. Plate **14** comprises a heat transfer plate and will efficiently conduct heat inwardly to thermostat **10**. Thermostat **10** has mounted therein a metallic strip **18** which will, upon exposure to flame or heat, deform in a known fashion. Strip **18** may be of a conventional composition, such as a known heat deformable bimetallic composition. Strip **18** will deform at a known temperature in a predictable fashion. Bimetallic strip **18** is mounted in conventional fashion in thermostat **10**, as within recessed slots **20** provided within the head portion **22** thereof. Head portion **22** of thermostat **10** may comprise various compositions, and may be metallic, such as aluminum, steel, etc. or may be a synthetic resinous composition, such as a phenolic or epoxy resin. A cap **24** is provided in thermostat **10** having a high coefficient of heat transfer whereby heat, as from a flame, may be rapidly transmitted to metallic strip **18**. Suitable cap materials comprise thin sheets of copper or aluminum.

Thermostat **10** additionally includes a normally open switch **26** in body portion **12** thereof. In FIG. **2**, switch **26** includes a pair of electrically conductive strips **28** and **30**. Strips **28** and **30** may comprise common electrically conductive compositions, such as copper or soft beryllium-copper alloy. Strip **28** is bent inwardly at an angle away from the vertical, but less than the horizontal, and includes a contact point **29** at the end thereof. Strip **30** has a contact point **31** at the end thereof and is bent inwardly substantially to the horizontal whereby the normal position of contact points **29** and **31** in body portion **12** of thermostat **10** is somewhat spaced apart. Metallic strip **18** is operably connected to switch **26** whereby distortion of strip **18** upon exposure to a predetermined temperature results in contact of contact points **29** and **31** for closing an electrical circuit. An insulated switch operator, or activator, **32** is operably located between switch **26** and bimetallic strip **18**. In FIG. **2**, switch operator **32** comprises a plastic pin bonded to bimetallic strip **18** and downwardly extending therefrom into contact with metallic strip **28** near contact point **29** at the end thereof. Strips **28** and **30** extend downwardly through the bottom of thermostat **10** into a hinged, channel forming electrical receptacle **40** through appropriate openings **41** and **42** in the top wall thereof.

Electrical receptacle **40** is substantially as described in U. S. Pat. No. 2,735,078 and illustrated in the Figures thereof. Receptacle **40** comprises hinged interconnected base member **44** and cover member **45**, each formed of a suitable dielectric material, such as an electrically nonconducting plastic such as nylon, phenolic resin, and epoxy resin. Base member **44** of hinged receptacle **40** is formed with a transversely extending U-shaped channel **46** on a central rib **47** adapted to receive an electrical cord including a pair of conductors **50** embedded in an insulation **52**. Cover member **45** of receptacle **40** includes contact springs **54** and **56** each of which comprise a conductive metal such as copper and which are formed of a strip of that metal bent backwardly upon itself. Each contact spring additionally includes a barb or prong **58** at an end thereof. Contact springs **54** and **56** are separated and insulated from one another by a downwardly depending rib **60** extending from the top wall portion **62** of cover member **45**. As can be seen in FIG. **2**, closing hinged receptacle **40** about hinge **64** results in plunging of barbs **58** on the respective contact springs **54** and **56** through insulation **52** and into mechanical and electrical contact with conductors **50**. Conductors **50** may comprise a conventional electrical wire comprising a multiplicity of copper strands.

Receptacle **45** is maintained in closed position with the aid of a latch spring **66** seated in base member **44** of receptacle **40**. Latch spring **60** includes an elongated, vertically extending straight portion **68** adapted to pass through a passageway **69** in closure portion **45** and bear thereagainst for aiding in maintaining receptacle **40** in closed position.

Downwardly depending metallic strips **28** and **30** of thermostat **10** extending into electrical receptacle **40** are adapted to contact contact springs **54** and **56** respectively. Contacting elements **54** and **56** are soldered or welded to thermostat strips **28** and **30** respectively for providing a permanent connection therebetween. In that fashion, thermostat **10** with switch **26** therein is operably electrically connected to conductors **50** whereby closing of switch **26** upon exposure of the fire alarm device to flame may thus complete a circuit and may activate a suitable alarm device.

A pair of spaced-apart bores **70** are provided in base member **44** of receptacle **40** leading from within to

without the receptacle. Bores **70** are provided on either side of rib **47** and are adapted to receive a testing means for testing the electrical connections in the fire alarm device shown in FIG. **2.** Suitable testing means may comprise a voltmeter **72** having a pair of conducting wires **74** operably connected thereto and issuing therefrom. Each member of the pair of wires **74** includes an exposed conducting portion or lead **76** at the end thereof and each is adapted to pass through bores **70** into receptacle **40** into contact with the spring contacts **54** and **56.** In that fashion, the circuitry within the fire alarm device may be rapidly and efficiently tested.

The utility of the device as thus far described in a fire alarm system according to the invention may best be understood by reference to circuit diagram shown in FIG. **3.** There a battery **100** is charged by a power supply, such as an ordinary AC voltage, through a conventional power processing unit PP, such as a rectifier, to provide a regulated constant DC voltage to the fire alarm circuit. Discharge of battery **100** through the power processing unit is prevented by diode **101.** The circuit includes a pair of conductors **50** extending through the area to be fire protected. Conductors **50** have a plurality of switch-bearing thermostats $T_1$, $T_2$, $T_n$ in parallel connection therewith. It should be appreciated here that conductors **50** may comprise an ordinary two-wire electrical cord. The thermostats are placed in the circuit by simply closing over the cord a thermostat-bearing receptacle **40,** as hereinabove described. A pair of relays $R_1$ and $R_2$ are connected in series in the circuit. Alarms $A_1$ and $A_2$ are activated by switches $R_1$ and $R_2$, respectively. Alarms $A_1$ and $A_2$ may comprise bells, warning lights, etc. as in ordinary fire alarm systems. Relays $R_1$ and $R_2$ and resistor **102** are chosen such that under normal conditions a small signal current passes through both relays, and the small current operates relay $R_2$ but not relay $R_1$. That is, the signal current is sufficient to energize only relay $R_2$. In the case where the signal current is interrupted, for example due to a cable break, relay $R_2$ is de-energized and alarm $A_2$ is activated to signal a system failure. In the case of a fire near any one of the plurality of switch-bearing thermostats, the switch **26** therein will close to thereby "short out" resistor **102** and increase the current to relay $R_1$. Relay $R_1$ is thus energized to seal itself across conductors **50** and thus activate fire alarm $A_1$ to signal a fire condition. Preferably, a manual reset switch **104** is provided to return the circuit to a normal condition after the thermostats have cooled.

The foregoing has described the invention and certain preferred embodiments thereof. It is to be expressly understood, however, that the invention is not necessarily limited to the specifc embodiments disclosed therein, but may be variously practiced within the scope of the following claims.

According to the provisions of the patent statutes, I have explained the principle, preferred construction and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiments. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

**1.** A fire alarm switch adapted to be electrically connected in parallel between a pair of electrical conductors in a two-conductor wire comprising,

a thermostat operably connected to an electrical receptacle,

said thermostat having a normally open electrical switch operably connected to heat sensitive means whereby exposure of said thermostat to a predetermined temperature will close said switch,

said electrical switch including a pair of electrically conductive elements extending therefrom into said electrical receptacle,

said electrical receptacle having a channel forming receptacle including base and closure members adapted to be fitted together for forming a transverse channel therethrough for receiving and holding a two-conductor wire,

said electrical receptacle including a pair of barb-bearing electrically conductive contacts, each one of said pair of barb-bearing contacts adapted to mechanically and electrically contact one of said conductors in said two-conductor wire when said base and closure members are fitted together over a two-conductor wire positioned in said transverse channel therebetween,

said electrically conductive elements extending from said electrical switch in electrical contact with said barb-bearing contacts, and

said fire alarm switch including a pair of spaced openings in said electrical receptacle positioned on the opposite side of said electrical receptacle from said thermostat for receiving separate portions of a testing device for testing the electrical connections between said electrically conductive elements extending from said switch, said barb-bearing contacts, and the connection between said barb-bearing contacts and said conductors.

**2.** The fire alarm switch as set forth in claim **1** wherein said heat sensitive means includes a heat distortable metallic composition.

**3.** The first alarm switch as set forth in claim **1** wherein said electrical switch includes a pair of electrically conductive metallic strips extending from within to without said thermostat, and wherein the portions of said metallic strips within said thermostat are bent inwardly toward each other whereby said strips are normally spaced apart and whereby exposure of said thermostat to said predetermined temperature results in contact of said portions of said strips within said thermostat.

**4.** The fire alarm switch as set forth in claim **1** wherein said electrically conductive elements extending from said electrical switch are permanently affixed to said barb-bearing contacts.

**5.** The fire alarm switch as set forth in claim **4** wherein said electrically conductive elements are welded to said barb-bearing contacts.

**6.** The fire alarm switch as set forth in claim **1** wherein said pair of openings extend into said electrical receptacle on opposite sides of said transverse channel for receiving and holding a two-conductor wire.

**7.** The fire alarm switch as set forth in claim **2** including an electrically nonconductive pin disposed between said heat distortable metallic composition and said electrical switch.

**8.** The fire alarm switch as set forth in claim **1** including a thin metallic plate operably mounted on said thermostat whereby heat on said plate may be efficiently conducted to said thermostat.

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