July 26, 1960 J. A. LOEBER 2,946,989

TEMPERATURE INDICATOR AND FIRE ALARM SYSTEM

Filed Oct. 18, 1954

FIG. 1

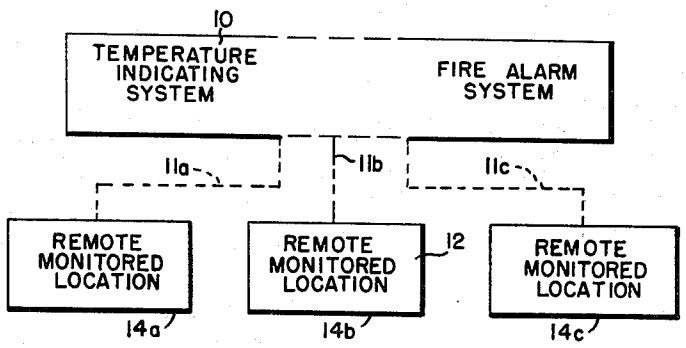
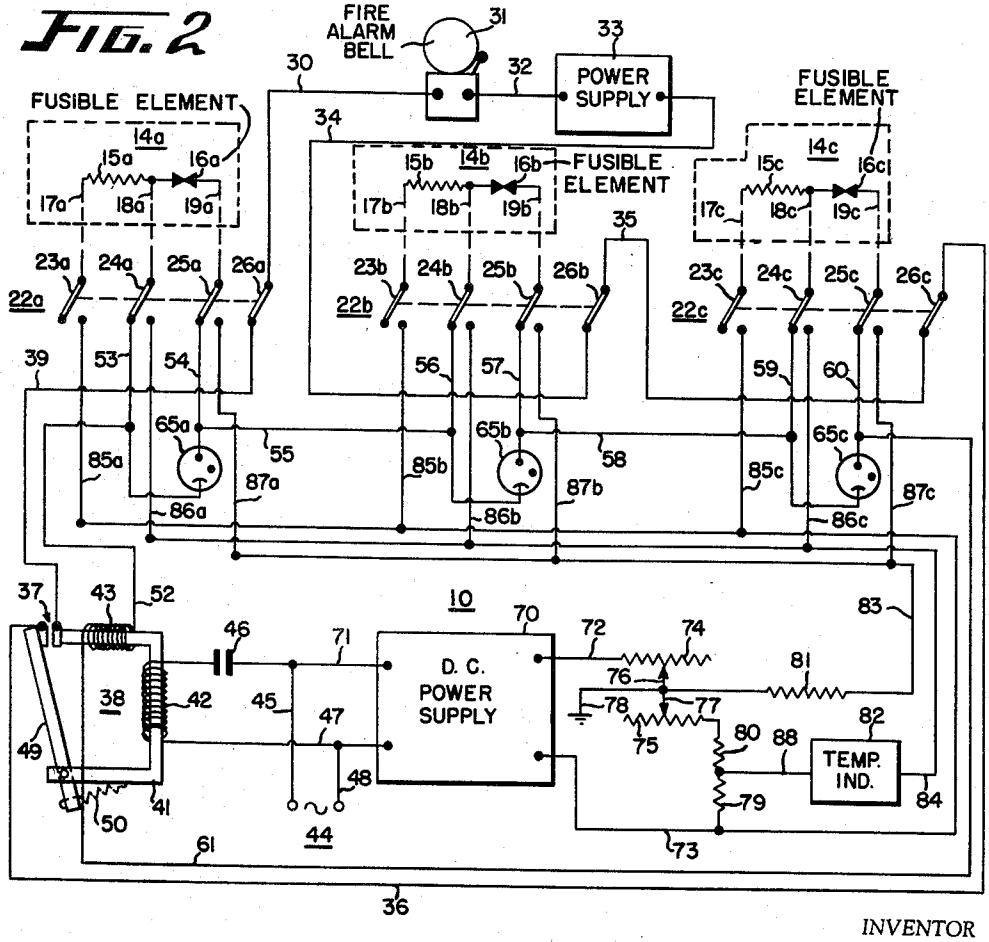


FIG. 2



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TEMPERATURE INDICATOR AND FIRE ALARM SYSTEM

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The present invention is related to the novel combination of two normally independent systems and more particularly relates to the combination of a temperature indicating system and a fire detection and alarm system.

It is an object of this invention to provide a system that is capable of monitoring a plurality of locations from one indicator station so that constant supervision of temperature and other conditions can be maintained.

Another object is to provide a temperature indicating and fire detection and alarm system of an economical nature by the joint use of electrical conductors from the indicator station to the remote temperature sensing and fire detection means.

These and other objects will become apparent from reading the following disclosure when considered with the attached single sheet of drawings.

In the drawings, Figure 1 sets forth in block diagram a simple system utilizing my invention, wherein, the system shown has a single monitored location. Figure 2 discloses a schematic arrangement of a system having a plurality of remote indicator locations in standby condition and with no fire existing.

In Figure 1 a temperature indicating system and a fire alarm system are shown combined in a single indicator unit **10**. To this unit **10** is connected by a plurality of electrical cables **11***a*, **11***b* and **11***c* remote units **14***a*, **14***b* and **14***c*, respectively each of which contains both a temperature sensing device and a fire detection device. It should be understood that the unit **10** could be separated into two units, a temperature indicating system and a fire alarm system, and that they could be inter-related by the appropriate wiring. If this is done however, a single three circuit cable from each remote unit would still be used so that joint use by both systems of conductive means of the cable would be possible.

A schematic diagram of this disclosure is shown in Figure 2. While three remote monitored locations are shown generally at **14***a*, **14***b*, and **14***c* it is understood that any number may be used and that they would be connected in a manner similar to those shown. Since all of the remote monitored locations **14***a*, **14***b*, and **14***c* are of the same construction the discussion in this disclosure will be limited to the elements of location **14***a*, but similar numbers will indicate identical parts and subletters will be used to diffentiate between remote locations.

The remote monitored location **14***a* is made up, in part, of a temperature sensitive resistor **15***a*. The resistor may be made of a temperature responsive resistance wire such as "Balco" wire wound on a plastic bobbin or support, or in any other manner which is convenient, such methods being well understood by those versed in the art. Resistor **15***a* has one of its ends connected directly to one end of a fusible fire detection element **16***a*. Element **16***a* is composed of a low melting alloy and the selection of the alloy and the configuration of the element is dependent on the temperature to be protected against. It is understood that the proper selection of a fire detection element **16***a* is also well known to those versed in the art.

The free end of resistor **15***a*, the junction of resistor **15***a* and fire detection element **16***a*, and the free end of fire detection element **16***a* are connected to three lead wires **17***a*, **18***a*, and **19***a*. These three lead wires correspond to cable **11** shown in Figure 1 and provide the means of interconnecting the remote monitored location **14***a* (shown generally in Figure 1 as at **12**) and, the system indicator unit (shown generally at **10** in Figure 1).

Lead wires **17***a*, **18***a*, and **19***a* connect to three poles **23***a*, **24***a*, and **25***a* of a four pole switch **22***a* which is part of the combined indicator unit shown generally at **10** and which consists of the remainder of Figure 2. It should be noted that the indicator unit generally shown at **10** in Figure 1 corresponds to indicator unit **10** in Figure 2.

With the switches **22***a*, **22***b*, and **22***c* in the position shown in Figure 2 the indicator system **20** is in standby condition and no fire conditions exist. In this case the fire alarm circuit consists of a series combination of power supply **33**, conductor **34**, switch **26***b*, conductor **35**, switch **26***c*, conductor **36**, relay contacts **37** of a relay generally shown at **38**, conductor **39**, switch **26***a*, conductor **30**, fire alarm bell **31**, and conductor **32**. It is apparent from this circuit that the fire alarm bell **31** will ring when contacts **37** of relay **38** are closed.

Relay **38** consists of a U-shaped core **41** on which a primary coil **42** and a secondary coil **43** are wound. Energization of coil **42** is supplied by an alternating current source **44** through conductor **45**, capacitor **46**, conductor **47**, and conductor **48**. The size of capacitor **46** is selected to resonate the circuit of coil **42** when coil **43** is open circuited. Under the conditions of secondary coil **43** being open circuited and the circuit of primary coil **42** being resonated by capacitor **46**, the armature **49** of relay **38** is pulled in against the bias of spring **50** and contacts **37** close. When coil **43** is short circuited, the change in impedance reflected into the primary circuit of coil **42** by transformer action detunes the resonant conditions existing in the primary circuit and the armature **49** of relay **38** is pulled to the position shown in Figure 2 by the spring **50** and therefore opens contacts **37**. It will be appreciated therefore, that the series standby circuit from coil **43** to conductors **52**, **53**, pole **24***a*, conductor **18***a*, fire detection unit **16***a*, conductor **19***a*, pole **25***a*, conductors **54**, **55**, **56**, pole **24***b*, conductor **18***b*, fire detection element **16***b*, conductor **19***b*, pole **25***b*, conductors **57**, **58**, **59**, pole **24***c*, conductor **18***c*, fire detection element **16***c*, conductor **19***c*, pole **25***c*, conductors **60**, **61** and back to coil **43** form a short circuit for coil **43** of relay **38**. This short circuit causes contacts **37** to be held open by action of spring **50**. If fire occurs at any of the fire detection locations the circuit is opened by melting of one of the fire detection elements **16***a*, **16***b*, or **16***c*. It should be further pointed out that neon glow bulbs (of commercially available design) **65***a*, **65***b*, and **65***c* are connected in parallel with fire detection elements **16***a*, **16***b*, and **16***c*. Upon opening of the circuit at fire detection element **16***a*, for example, neon glow bulb **65***a* is caused to conduct and glows to indicate that fire detection element **16***a*, is open. The glow bulb **65***a*, however, does not pass enough current to hold relay **38** open and the fire alarm bell is sounded. This same action takes place if one or a number of the fire detection locations is open circuited by fire melting a fusable fire detection element.

When no fire is present and it is desired to determine the temperature at any of the locations **14***a*, **14***b*, or **14***c* the switch **22***a*, **22***b*, or **22***c* corresponding to the location is pushed to the right. Switches **22***a*, **22***b*, and **22***c* are

spring biased to the left (the means for biasing them is not shown) and they return to this position except when moved to obtain a temperature reading. For example, if the temperature at **14***a* is desired, switch **22***a* is moved to the right. This disables the fire alarm system by opening **26***a*. It also switches the conductors **17***a*, **18***a*, and **19***a* of the connecting means from the fire alarm circuit to a three wire bridge type temperature indicating system. The three wire bridge type temperature indicating system is of a well known type and could be similar to that disclosed in Patent 1,097,651. In this type of bridge system two conductors are connected together to form one connection to the sensing element while a third wire is connected to the other side of the sensing element. This is done to provide for temperature compensation in the connection means and allows the sensing element to be located at any convenient distance from the bridge without concern for errors due to changes of temperature in the areas the conductors pass through. The bridge system consists of a direct current power supply **70** which derives its input power from alternating current source **44** and conductors **45**, **71**, **47**, and **48**. The direct current output is supplied to conductors **72** and **73**. Conductor **72** in turn is connected to one end of balancing potentiometer **74** and is adjusted by changing the position of slider **76** which is grounded at **78**. The conductor **73** is connected through resistors **79** and **80**, balancing potentiometer **75**, and slider **77** to ground **78**. The actual resistances that form the bridge of the indicating system are resistors **81**, the part of potentiometer **75** connected between resistor **81** and resistor **80**, resistor **80** itself, resistor **79**, and the resistor in the remote monitored location that is selected by switch **22***a*, **22***b*, or **22***c*. The reading of the temperature at the selected remote location is obtained by the unbalance of a bridge and is indicated on a direct current meter movement calibrated as a temperature indicator **82**. Conductors **73**, **83**, and **84** in combination with lead wires **85***a*, **85***b*, **85***c*, **86***a*, **86***b*, **86***c*, **87***a*, **87***b*, and **87***c* provide the necessary intercommunication between the main bridge elements and the switches **22***a*, **22***b*, and **22***c* to the remote monitor locations. When switch **22***a* is moved to the right the complete bridge circuit can be traced from slider **77** to resistor **81**, conductors **83**, **87***a*, switch **25***a* conductor **19***a*, element **16***a*, resistor **15***a*, conductor **17***a*, switch **23***a*, conductors **85***a*, **73**, resisor **79**, resistor **80**, and potentiometer **75**. The temperature indicator **82** determines the unbalance of the bridge and is connected across the bridge from the junction of resistor **79** and **80** by conductor **88**, and by conductors **84**, **86***a*, switch **24***a*, conductor **18***a*, to the junction of the resistance sensitive element **15***a* and the fire detection element **16***a*. It is apparent from the above discussion that it is possible to determine the temperature at any of the remote locations by depressing the proper selector switch and then reading the temperature directly from the temperature indicator. This novel unit also provides for almost constant supervision of the remote locations for possible fire and indicates by neon glow bulb, the location or locations of any fires that do exist.

The disclosure above has been cited as an example only of one possible means of carrying out my invention and I do not wish to be limited to it alone. I limit my invention only to the scope of the appended claims.

I claim as my invention:

1. In a combined temperature indicating and fire alarm system, a plurality of remotely located temperature responsive units each including a temperature sensitive resistance indicative of temperature and a temperature responsive switch element actuated when the temperature of said switch element exceeds a predetermined temperature, a selectively operable switching means for each of said temperature responsive units and having a first normal position and a second position, a central electrical energy responsive temperature indicating means, a central alarm means, a plurality of first conductors each connected to one terminal of a different one of said switch elements and to the associated switching means, a similar plurality of second conductors each connected to the opposite terminal of a different one of said switch elements and to the associated switching means, a control circuit for said alarm means including said plurality of switching means and effective when said switching means are all in their first normal position to connect said plurality of first and second conductors and the temperature responsive switching elements to said alarm means, said control circuit being operative to render said alarm effective upon any of said temperature sensitive switch elements being actuated upon its temperature exceeding said predetermined value, a plurality of third conductors each connected to one terminal of a different one of said resistances and to the associated switching means, each of said second conductors being connected to the other terminal of a different one of said resistances, and circuit means controlled by said switching means operable upon any one of said switching means being moved to its second position to connect the second and third conductors connected to the associated resistance to said temperature indicating means to cause the latter to indicate the temperature at the area in which said resistance unit is located and to cause said third conductor of the associated temperature responsive switch element to be connected to said temperature indicating means in such a manner as to oppose the effect of the resistance of said first conductor.

2. In a combined temperature indicating and fire alarm system, a plurality of remotely located temperature responsive units each including a temperature sensitive resistance indicative of temperature and a temperature responsive switch element providing an open circuit when the temperature of said switch element exceeds a predetermined temperature, a selectively operable switching means for each of said temperature responsive units and having a first normal position and a second position, a central temperature indicating means, a central alarm means, a plurality of first conductors each connected to one terminal of a different one of said switch elements and to the associated switching means, a similar plurality of second conductors each connected to the opposite terminal of a different one of said switch elements and to the associated switching means, a control circuit for said alarm means including said plurality of switching means and effective when said switching means are all in their first normal position to connect said plurality of first and second conductors and the temperature responsive switching elements all in series with each other and to said alarm means, said control circuit being operative to render said alarm effective upon said circuit being interrupted by the opening of any of said temperature sensitive switch elements, a plurality of third conductors each connected to one terminal of a different one of said resistances and to the associated switching means, each of said second conductors being connected to the other terminal of a different one of said resistance elements, and circuit means controlled by said switching means operable upon any one of said switching means being moved to its second position to render said alarm means ineffective while said switching means is in said second position and to connect the second and third conductors connected to the associated resistance to said temperature indicating means to cause the latter to indicate the temperature at the area in which said resistance unit is located.

3. In a combined temperature indicating and fire alarm system, a plurality of remotely located temperature responsive units each including a temperature sensitive resistance indicative of temperature and a temperature responsive switch element providing an open circuit when the temperature of said switch element exceeds a predetermined temperature, a like plurality of selectively oper-

able switching means located together at a central point remote from said units, there being one of said switching means for each of said temperature responsive units and each switching means having a first normal position and a second position, a temperature measuring bridge also remotely located from said temperature responsive unit and having a central temperature indicating means between the output terminals of the bridge and in proximity to said switching means, a central alarm means, a plurality of first conductors each connected to one terminal of a different one of said switch elements and to the associated switching means, a similar plurality of second conductors each connected to the opposite terminal of a different one of said switch elements and to the associated switching means, a control circuit for said alarm means including said plurality of switching means and effective when said switching means are all in their first normal position to connect said plurality of first and second conductors and the temperature responsive switching elements all in series with each other and to said alarm means, said control circuit being operative to render said alarm effective upon said circuit being interrupted by the opening of any of said temperature sensitive switch elements, a plurality of third conductors each connected to one terminal of a different one of said resistances and to the associated switching means, each of said second conductors being connected to the other terminal of a different one of said resistances, and circuit means controlled by said switching means operable upon any one of said switching means being moved to its second position to render said alarm means ineffective while said switching means is in said second position and to connect the second and third conductors connected to the associated resistance to said bridge to form one arm thereof and to connect the first conductor connected to the associated temperature responsive switch element into an opposing arm of said bridge whereby the resistance of said first conductor compensates for the resistance of said third conductor to enable said bridge to accurately indicate the temperature sensed by said temperature sensing resistance.

4. In a combined temperature indicating and fire alarm system, a temperature responsive unit including a temperature sensitive resistance indicative of temperature and a temperature responsive switch element providing

an open circuit when the temperature of said switch element exceeds a predetermined temperature, a selectively operable switching means remotely located from said temperature responsive unit having a first normal position and a second position, a temperature measuring resistance bridge also remotely located from said temperature responsive unit and having a temperature indicating means between the ouput terminals of the bridge, an alarm means, first and second conductors connected to opposite terminals of said switch elements and to said switching means, said second conductor being connected to one terminal of said temperature sensitive resistance, a third conductor connected to the opposite terminal of said temperature sensitive resistance and to said switching means, a control circuit for said alarm means including said switching means and effective when said switching means is in its first normal position to connect said first and second conductors and the temperature responsive switching element in a closed circuit to said alarm means, said control circuit being operative to render said alarm effective upon said circuit being interrupted by the opening of said temperature sensitive switch element, and circuit means controlled by said switching means operable upon any one of said switching means being moved to its second position to render said alarm means ineffective while said switching means is in said second position and to connect the second and third conductors connected to the associated resistance to said bridge to form one arm thereof and to connect said first conductor through said temperature responsive switch element into an opposing arm of said bridge whereby the resistance of said first conductor compensates for the resistance of said third conductor to enable said bridge to accurately indicate the temperature sensed by said temperature sensitive resistance.

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