

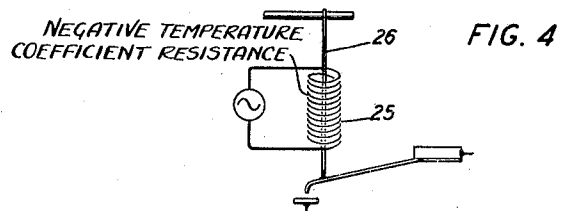
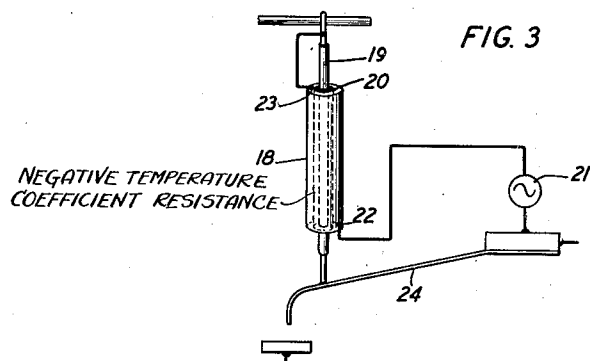
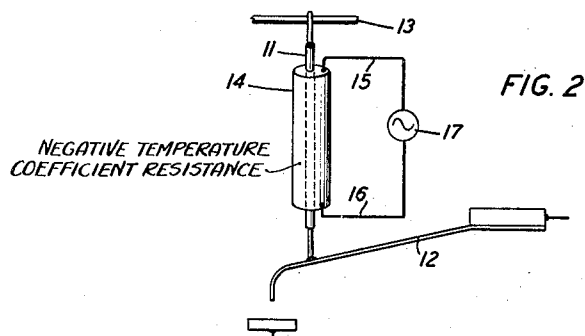
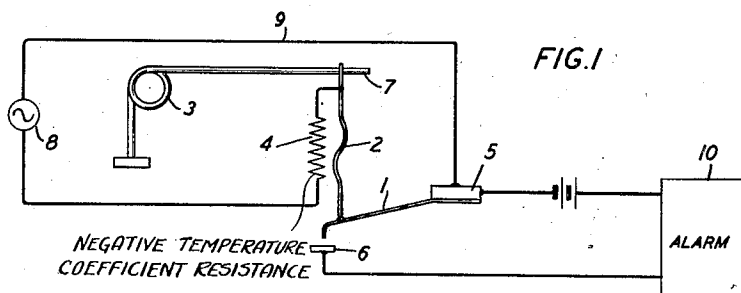
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2,126,530

SIGNALING SYSTEM

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SIGNALING SYSTEM

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This invention relates to signaling systems and particularly to systems for giving fire alarms.

The objects of the invention are to obtain a more positive operation in the performance of devices for detecting the presence of abnormal temperatures; to lessen the likelihood of false operation; and in general to improve and simplify fire alarm systems.

It has been common practice to utilize fusible material, such as lead and lead alloys for detecting the presence of fire. In some cases the fusible material is in the form of wire and constitutes a part of a normally closed electric circuit, which is ruptured when the wire is melted by excessive temperature and causes an alarm to sound. In other cases a spring contact is held out of engagement with a cooperating contact by an element of the fusible material. When the temperature rises and melts the element, the spring contact is allowed to engage its cooperating contact, and the alarm circuit is closed. The reliability of systems of this kind depends entirely upon the fusible material, and the difficulty sometimes encountered is that said material either is so sensitive that it melts in response to normal fluctuations in the ambient temperature, thus giving a false alarm, or is too insensitive to respond to the higher temperatures, thereby delaying the alarm in the event of fire.

A feature of the invention is to obviate these difficulties by a system in which a resistor of some substance having a high negative temperature coefficient of resistance, such as silver sulphide, is utilized to control the flow of electric current through the fusible element. By connecting the resistor in series with the fusible element, the current flowing in the circuit can be made to rise rapidly from a negligible amount to a very high value in response to any predetermined increase in the temperature of the environment.

Another feature of the invention is a system in which the resistor is so located physically and electrically with respect to the fusible element that said resistor serves both to increase the heating current flowing in the element and also to transfer its own heat to the element. By such an arrangement an added certainty is given to the attainment of the melting point of the fusible element when the predetermined abnormal temperature is reached in the surrounding atmosphere.

These and other features and advantages of this invention will be discussed more fully in detail in the following specification. The detailed specification should be considered in con-

nection with the accompanying drawing in which:

Fig. 1 is an abbreviated illustration of a fire alarm system containing a temperature responsive device for controlling the alarm circuit, and

Figs. 2, 3, and 4 show modifications of the temperature responsive device.

It is well known that the substance silver sulphide has an extremely high negative temperature coefficient of resistance. For example, it is possible by raising the temperature of an element of this material to lower its resistance over a range extending from nearly a megohm to values less than 100 ohms. And this range of resistance values is obtainable by the use of temperatures from 0° to 180° C. This sensitiveness of the material to changes in its temperature makes it especially well suited for fire alarm systems. Its temperature may be controlled by heat received from the surrounding medium, indicating the presence of fire and also by the resistance loss resulting from current flowing through the resistance material. These two causes contribute to produce a rapid decrease in the resistance and consequently a rapid and large increase in the current flowing in the circuit containing the resistance element.

Referring now particularly to Fig. 1 of the drawing, the temperature detecting device here shown comprises as its essential elements a circuit closing spring 1, a retaining link 2 of fusible material, a holding spring 3, and a resistor 4. The spring 1 is secured to the base terminal 5 and has sufficient resilience when released to engage the stationary circuit contact 6. Normally, however, the spring 1 is held away from the contact 6 by means of the link 2, which interconnects the spring 1 and the extension arm 7 of the coiled holding spring 3. When properly adjusted, the tension of the spring 3 is just sufficient to hold the contact spring 1 away from its cooperating contact 6. The link 2 may be made of any suitable fusible material having sufficient tensile strength to hold the spring contact 1 out of engagement with the contact 6. It may be in the form of a wire, a flat strip, or in any other desired shape. The fusible temperature of the link 2 may be chosen at any desired value. The resistor 4 is connected in circuit with the fusible element 2 and in circuit with the source of alternating current 8. The resistor 4 may be placed in physical proximity to the element 2, or it may be mounted in any other desired location. The unit 4 may be made of any material having a high negative temperature coefficient of resist-

ance. As above mentioned, however, we have found that silver sulphide can be used to good advantage.

The operation of the system disclosed in Fig. 1 will now be explained. With the temperature responsive device set in its normal condition as seen in this figure, a circuit is traceable from the upper pole of source 8, over conductor 9, terminal block 5, through the spring contact 1, fusible element 2, through the resistor 4, to the other pole of the source 8. The resistance of the resistor 4 is so high at normal ambient temperatures that only a negligible current can flow in the circuit traced. Assume, however, that a fire occurs in the region of the resistor 4. As the temperature increases above the usual variations in the ambient temperature, the resistance of the element 4 decreases correspondingly, allowing more current to flow in the circuit. This additional current produces heat in the element 4, causing its temperature to increase still further, to produce in turn a further reduction in its resistance. This process continues, the current rising rapidly in the circuit including the resistor 4 and the fusible element 2. When the current intensity flowing in the fusible element 2 reaches a predetermined value, as it soon will in response to the rapid decrease in the resistance of the element 4, the fusible element 2 melts and ruptures the mechanical link that has been holding the spring 1. Thereupon the spring 1 engages the contact 6 and closes an obvious circuit for an alarm device 10.

In order to accentuate the heating effect in the fusible element 2, the resistor 4 may be placed physically adjacent the element 2. With such an arrangement the heat generated in the resistor 4 with the increase of current is transferred either by radiation or conduction to the fusible element 2. As the current in the circuit assumes larger and larger values, a considerable amount of heat is generated in the resistor, and this heat transferred to the element 2 contributes to a large extent in raising the temperature of the element to the fusing point.

The modification of the temperature responsive device shown in Fig. 2 may be used instead of the construction illustrated in Fig. 1. In this modified device the fusible element 11, which interconnects the contact spring 12 and the holding spring 13, is surrounded by and is in direct physical contact with the resistor 14. The resistor 14 is formed as a coating of silver sulphide around the fusible element 11 and is connected by terminal conductors 15 and 16 to the source of current 17. In this case an abnormal increase in the ambient temperature causes the resistor 14 to lower its resistance, permitting more and more current to flow from the source 17, in turn raising the temperature of the resistor 14 as the result of the increasing current. The heat thus generated by the resistor 14 is applied directly to the fusible element 11, and when the proper temperature is reached, this element ruptures. The resistor 14 may be so constructed that it does not have sufficient tensile strength to hold the spring 12 after the fusible element 11 is ruptured. One way of accomplishing this result is to apply the silver sulphide resistor 14 in the form of a powder to the exterior of the fusible element 11.

In the modification shown in Fig. 3 the resistor 18 surrounds the fusible element 19 in somewhat the same manner as that illustrated in Fig. 2. The resistor 18, however, is electrically insulated from the metallic fusible element 19 by

means of a layer of electrical insulation 20 interposed between the element 19 and the resistor 18. This insulation makes it possible to include the resistor and the fusible element in series relation in the electrical circuit. The circuit may be traced from the upper pole of the source 21, terminal 22, through the resistor 18, terminal 23, thence to the upper end of the fusible element 19, through said element to the spring contact 24 and returning to the other pole of the source 21. By this construction it is possible to obtain a more efficient heating relation between the resistor 18 and the fusible element 19 and at the same time to include the element 19 in circuit with the resistor. As explained in connection with Fig. 2, the tensile strength of the resistor 18 and the insulation 20 is insufficient to interfere with the restoration of the spring 24 when the fusible link 19 melts. For example, the insulator 20, as well as the resistor 18, may be made of material in amorphous form having low tensile strength.

A further modification is illustrated in Fig. 4. Here the resistor 25 is made in the form of a spiral conductor within which the fusible element 26 is located. As shown, the fusible element 26 is raised to the fusing temperature entirely by the heat transferred thereto from the resistor 25. If desirable, however, the resistor 25 may also be connected in series with fusible link 26 as shown in Figs. 1 and 3.

It is obvious that the location of these temperature detector devices within the building to be protected may be made in accordance with a wide variety of arrangements. The elements may be constructed in any suitable form and it should be understood that the structures described herein are merely illustrative and do not limit the scope of the invention. Also the alternating current generators shown herein for supplying current to the resistance elements may be replaced by any suitable type of current source.

What is claimed is:

1. The combination in a signaling system of a fusible element, a circuit including said element, a source of potential connected to said circuit, a resistor having a high negative temperature coefficient of resistance and responsive to other than normal ambient changes of temperature in the surrounding medium for controlling the flow of current in said circuit, and a signal device actuated upon fusion of said fusible element.

2. In a signaling system, a current carrying fusible element, a circuit including said element, a resistor having a high negative temperature coefficient of resistance also included in said circuit and arranged to transfer its heat to said current carrying element, means for applying a voltage across said resistor, and signaling means actuated upon fusion of said current carrying element.

3. In a signaling system, a fusible element, a resistor having a high negative temperature coefficient of resistance and arranged to transfer its heat to said element, a circuit including said element and resistor, means for applying a voltage across said resistor, and means rendered effective by the fusing of said fusible element.

4. In combination, a source of heating current and a circuit therefor, a resistor which responds to a change in temperature to cause an increase in the flow of current of said circuit, an element in said circuit which fuses in response to a predetermined current increase caused by said resistor,

and means responsive to the fusing of said element.

5 5. The combination in a signaling system of a circuit having a source of current connected thereto, a resistor in said circuit which lowers its resistance and allows more current to flow to produce more heat therein in response to an increase in the ambient temperature, a fusible element arranged in proximity to said resistor to receive
10 transferred heat from said resistor, and signal means actuated upon fusion of said fusible element.

15 6. The combination in a signaling system of a circuit having a source of current therein, a resistor of negative temperature coefficient material in said circuit which responds to other than normal changes in the ambient temperature to cause an increased flow of current in said circuit

and to produce heat, and a fusible control element arranged to be heated by the increasing current flowing in said circuit and also to receive transferred heat from said resistor.

7. In a signaling system, a fusible element and a circuit therefor, a source of current connected to said circuit, a resistor in said circuit which changes its resistance in response to changes in the ambient temperature to allow an increased current to flow in said circuit and through said fusible element, a circuit making contact, a movable contact normally held out of engagement with said first-mentioned contact by said fusible element, and signal means rendered effective when said fusible element fuses and allows said contacts to close.

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