Sept. 8, 1964 H. GJERKEN 3,148,363

ELECTRIC TEMPERATURE CONTROL AND FIRE ALARM SYSTEM

Filed Oct. 19, 1960 3 Sheets-Sheet 1

FIG. 1

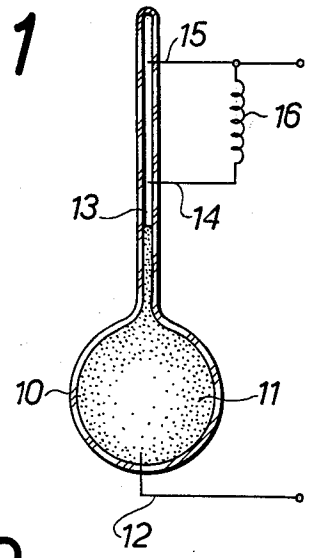
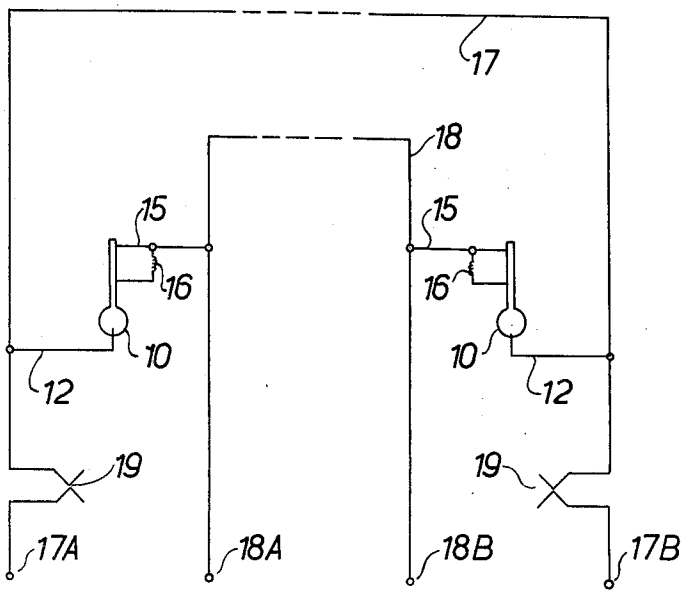


FIG. 2



INVENTOR:
HAAKON GJERKEN.
BY Richards & Geier
ATTORNEYS

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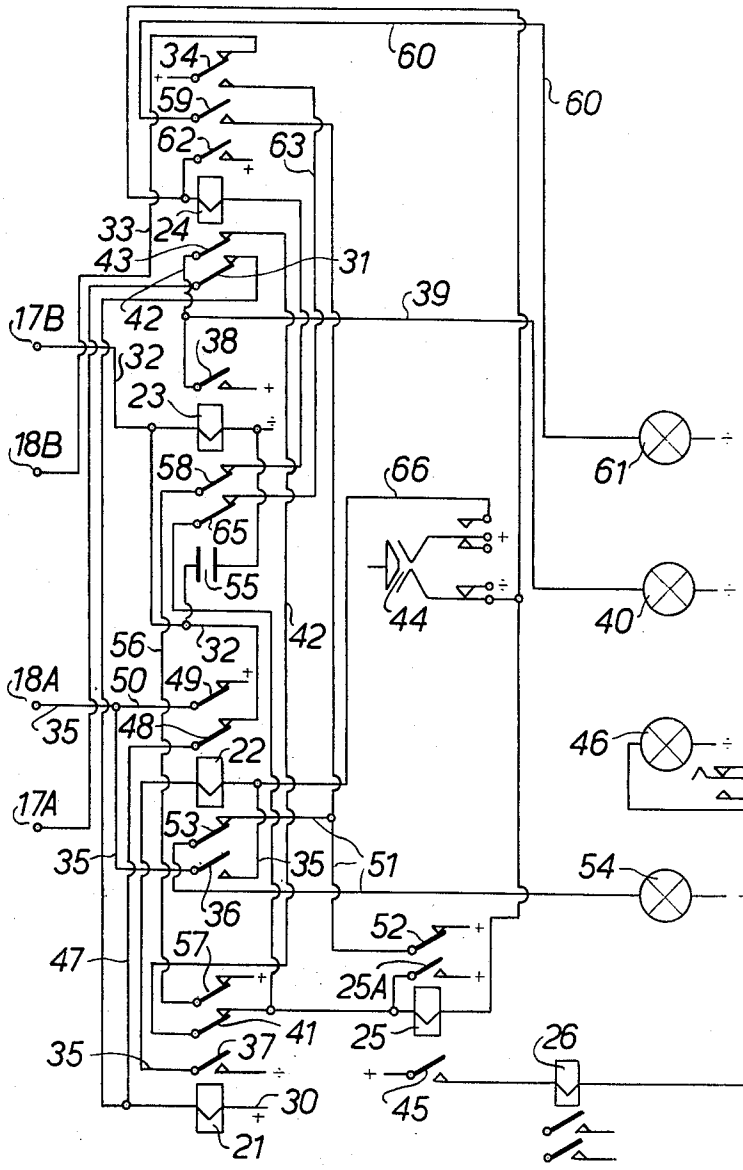
FIG. 3



INVENTOR:
HAAKON GJERKEN.
BY Richards & Geier
ATTORNEYS

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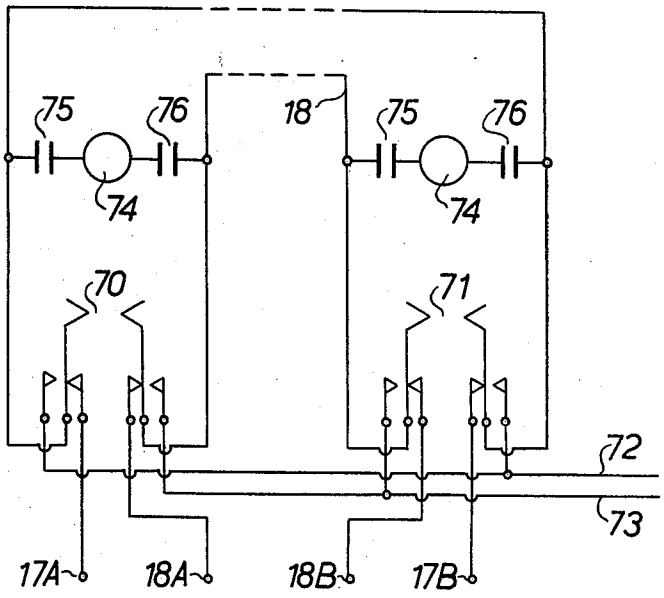
FIG. 4



INVENTOR:
HAAKON GJERKEN.
BY
Richards & Geier
ATTORNEYS

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ELECTRIC TEMPERATURE CONTROL AND FIRE ALARM SYSTEM

Haakon Gjerken, Bergen, Norway, assignor to Gjerken Elektro A/S, Bergen, Norway, a Norwegian company

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2 Claims. (Cl. 340—227)

This invention relates to fire alarm systems for detecting undue temperature increase at locations remote from a central station, and for allowing the transmission of a warning signal indicating the abnormal temperature increase.

A disadvantage in known art alarm systems is that they do not, generally, provide any warning preliminary to the fire alarm being actuated. In many cases, a warning of an increase in temperature of, say twenty degrees centigrade, may enable a watchman to take care of the abnormal conditions by himself, without the necessity of sending out a general warning. However, should the temperature continue to rise, it is desirable to transmit such general warning, because this condition will almost inevitably mean outbreak of fire.

Some systems are known in which the temperature at a distant location may be sensed and transmitted to a central station. However, such temperature sensing systems are complicated and costly, and thus they cannot be used in fire alarm systems in, for instance, factory buildings, on board ship, and the like, where a large number of different locations must be watched.

Furthermore, it is desirable to indicate the presence of a fault in the systems, such as, for example a break in watching circuits, and a short-circuiting of the system. It is also highly desirable that such indication of faults or the presence of such faults does not interfere with the transmission of warnings.

It is an object of the present invention to provide a system in which a first warning is received at the central station upon an increase in temperature to a preselected level, and a second warning is received if the temperature is further increased. A further object of the invention is to provide a system in which such double warning will be received, even when watching circuits of the system are broken or interrupted. A still further object of the invention is to provide a system in which such interruption is distinctly indicated without interfering with the correct receipt and indication of said double warning.

According to the present invention there is provided an electric temperature control and fire alarm system, comprising an electric D.C. source arranged at a central station, first and second watching conduits forming closed circuits in parallel from one pole of said source via a local watching station and back to the other pole of said source, a thermosensitive means having first, second and third contact wires, said first contact wire being directly connected to said first watching conduit, said second contact wire being connected to said second watching conduit through a resistor, and said third contact wire being directly connected to said second watching conduit, said thermosensitive means being arranged to insulate said first contact wire from said second and third contact wires at normal ambient temperature and to provide a connection between said first and said second contact wires at a temperature increase to a preselected level and further to provide a connection between said first and said third contact wires at a temperature increase a second or higher level, watching relay means arranged on said central station, said watching relay means being arranged to transmit an indication when a connection is provided between said first and second watching conduits through said resistor and to transmit a fire alarm when a direct connection is provided after first having transmitted said indication.

The invention will now be described further, by way of example only, with reference to the accompanying drawings in which:

FIG. 1 is a simplified sectional view of a temperature indicating device incorporated in the system of the present invention.

FIG. 2 is a circuit diagram illustrating the connection of two devices according to FIG. 1 in a system according to the invention.

FIG. 3 is a circuit diagram of the central station in which the desired change-over of the watching circuits is effected. The relays are shown in this figure in current free conditions; and

FIG. 4 is a circuit diagram illustrating an arrangement enabling the connection of telephone equipment into the system.

FIG. 1 shows a thermosensitive device comprising a bulb **10** enclosing a charge **11** of mercury. A first contact wire **12** is melted into the bottom of said bulb whereas a capillary stem **13** protrudes from the upper end of said bulb, a second contact wire **14** being melted into said stem at a first lower level and a third contact wire **15** being melted into the stem at a higher level. A resistor **16** is permanently coupled between said wires **14**, **15**.

Referring now to FIG. 2, the system comprises two permanent watching conduits **17**, **18** connected in parallel into the system, the conduit **17** extending from a first terminal **17A** to an opposite terminal **17B** whereas the conduit **18** extends from a corresponding first terminal **18A** to an opposing terminal **18B**. The thermosensitive devices **10** are connected into the system by having one of the contact wires either **12** or **15**, preferably the bottom wire **12**, connected to the first conduit **17**, whereas the other wire **15** is connected to the second conduit **18**.

It will appear from the preceding that an increase in temperature will cause the mercury to rise in the capillary stem **13** to provide an electric connection between the wires **12** and **14**, whereby the watching conduits **17**, **18** are connected through the resistor **16**. By suitable connection of the terminals **17A**, **17B**, **18A** and **18B** to relays at the central station, an indication may be received, said indication corresponding to an undue temperature increase somewhere in the system. A further increase in temperature will bring the mercury into contact with the contact wire **15**, thereby short-circuiting is effected between the watching conduits. However, such short-circuiting will be preceded by a connection through a resistor **16**, so that a suitable selection of relay equipment may bring about a sequence leading to the transmission of fire alarm only in the event that short-circuiting is preceded by such connection through a resistor **16**, whereas direct short-circuiting of the watching circuits will not effect transmission of fire alarm.

Further, melting contacts **19** are connected in series with the watching conduits.

By means of two closed watching circuits in parallel a disinterruption of one or both circuits may be counteracted by connecting the terminals **17A** and **17B** on one side, and the terminals **18A** and **18B** on the other side, whereby one will have a complete circuit which is open at the thermosensitive devices. This circuit will be closed through any of the resistors **16** at a temperature increase in the associated thermosensitive device, whereas the circuit is short-circuited at the respective thermosensitive device by the contact wire **15**, when this temperature increase is unduly high.

The relay equipment for effecting the desired change-over is shown in FIG. 3. Said relay equipment comprises a first high resistance relay **21** of, for instance, 2000 ohms, a second relay **22** of, say, 830 ohms, and a

third low resistance relay 23 of, for instance, 60 ohms. Furthermore, the said equipment comprises a fourth relay 24 and an indication relay 25 controlling an alarm relay 26. All relays 21 to 26 of the figure are shown in open condition.

In the normal condition, both relays 21 and 22 are closed. The relays 21 and 23 are connected in series into the first watching conduit by a conduit 30 leading from (+) through the winding of the relay 21 to a back contact 31 of the relay 24 and thence to the terminal 17A, whereas a conduit 32 leads from the terminal 17B through the winding of the relay 23 to the plus lead.

Normally, the relay 21 will be closed while the relay 23 is opened, because the relay 21 is a high resistance relay whereas the relay 23 is a low resistance relay, the voltage drop across the first one being sufficiently high to keep the latter one opened.

In this normal condition, the relay 22 is connected into the watching conduit 18 by a conduit 33 extending from (+) through a back contact 34 of the relaly 24 and direct to the terminal 18B, whereas a conduit 35 extends from the terminal 18A through a stick contact of the relay 22, through the winding of said relay and from here to a front contact 37 of the relay 21, and then to (÷).

In the normal condition, an increase in temperature will be indicated by closing the relay 23, the connection between the watching circuits through the resistor 16 effecting a voltage increase of sufficient magnitude to close said relay. Thus, a front contact 38 of said relay 23 will be closed to supply current through a conduit 39 to a temperature increase indicator 40 from (+) to (÷).

At a further increase in temperature, a short-circuiting connection is set up between the watching conduits. Because a positive potential is applied to the watching conduit 18 from the back contact 34 of the relay 24 via the watching conduit 17, the relay 21 will be opened. Said relay 21 comprises a back contact 41 connected to a conduit 42 extending from the front contact 38 of the relay 23 via a back contact 43 of the relay 24, through the winding of the indicating relay 25 and therefrom to (+) through a switch 44 serving as restoring switch. In usual manner, this relay 25 comprises a front contact 45 for supply of current to the alarm relay 26 and to a fire indicator 46, said relay further comprising a stick contact 25A connected to (+) in order to keep the relay 25 picked up until restoring the system manually by means of the switch 44.

The preceding represents the mode of operation in a normal condition, in which both watching circuits are undisturbed.

When either of the watching circuits 17 or 18 is broken, the relay 22 will open, due to said relay 22 being connected in series with the watching conduit 18 and being charged with current from the front contact 37 of the relay 21, which is connected in series with the watching conduit 17.

However, a conduit 47 extends from the conduit 30 through the winding of the relay 21, through a back contact 28 of the relay 22 to the conduit 32, which then leads through the winding of the relay 23. Said conduit provides a connection between the relays 21 and 23, in other words between the terminals 17A and 17B outside of the watching circuit 17, wherefore said relays 21 and 23 are closed again as in the normal condition, that is, with the relay 21 normally closed and the relay 23 normally opened. Further, the relay 22 comprises a back contact 49 applying a positive potential to the terminal 18A through a branch conduit 50.

Because the conditions of indicating an increase in temperature are that the relay 23 is closed while the relay 21 is kept in closed condition, one will in this event receive an indication of temperature increase by the watching conduit 17 being connected to the watching conduit 18 through any one of the resistors 16. As both ends of the watching conduit 18 are charged with positive potential, any thermosensitive device will give such connection regardless of the location of the interruption if such interruption is present in the watching conduit 18, whereas the cross connection via the conduit 47 of the central station will apply this potential to both relays 21 and 23 through the resistor 16, regardless of the location of an interruption in the watching conduit 17.

When short-circuiting as a consequence of a temperature increase leading to contact of the mercury with the contact wire 15, one will in the same manner as described above receive a fire alarm, by the relay 21 being opened and the relay 23 being closed.

For the indication of such interruption a conduit 51 is charged with positive potential through a back contact 52 of the indicating relay 25, said conduit passing through a back contact 53 of the relay 22 and herefrom to an interruption indicator 54 and therefrom to (÷). It should be understood that said indicator will be illuminated at an interruption, as the relays 21 and possibly the relay 23 are picked up while the relay 22 is dropped away when interuption is present. When fire alarm is indicated, the interruption indicator is disconnected.

When the system is short-circuited, the relays 23 and 24 will be closed and the relay 21 will open. It will appear from the preceding that a first step in normal operation will involve that the relay 23 is closed while the relay 21 is still open, whereupon the relay 21 will open after a short period, depending upon the rate to increase of the temperature. When short-circuiting the system, the 21 will open, too, while the relay 23 is closed, but this relay 21 will proceed substantially at the same time. By a suitable modification of the relay 23, for instance by shunting a condenser in parallel to its winding, one may ensure that the relay 21 is opened for a moment before closing up the relay 23. A conduit 56 extends from (+) via a back contact 57 of the relay 21, a back contact 58 of the relay 23, through the winding of the relay 24 and herefrom to (÷). In other words, the relay 24 will also be closed when short-circuiting; from a front contact 59 of said relay a conduit 60 extends to an indicator lamp 61 for the indication of short-circuited conditions by lighting said lamp.

In order to keep the relay 24 closed also after closing the relay 23, same comprises a stick contact 62 applying a positive potential thereto.

The melting contacts 19 referred to previously serve for the indication of fire alarm in the event of short-circuiting, said contacts being arranged to melt at a temperature exceeding that which will give short-circuit by the wire 15. Then, the relay 23 will open, too, a conduit 63 supplying current to the relay 25 through a front contact 34 of the relay 24 and a back contact 65 of the relay 23.

Because the conduit 60 is charged with current from the back contact 52 of the indicator relay 25, the short-circuiting indicator lamp will be disconnected at such fire alarm.

It will appear from the preceding that the system will indicate short-circuiting as well as interruption, but that such indication will not disturb a fire alarm. When interruption is present in the system, one will also receive information of a temperature increase which may form a warning, but which is too low to necessitate the transmission of a fire alarm.

For the restoration of the system, it will be necessary to close the relay 22 and to disconnect the fire alarm relay 25 and the relay 24. In order to obtain the reconnection of the relay 22, a reconnecting conduit 66 extends from the restoring switch 44 to the winding of said relay 22, whereby the stick circuit of said relay is restored. As the circuit connections of the last-mentioned relays extend to the restoring switch, one may by the latter disconnect the relays 24 and 25.

Another advantage in the system described above is

that auxiliary equipment may be incorporated to use the system for simple telephone calls. Such auxiliary equipment is illustrated in FIG. 4.

Herein, the terminals 17A, 17B, 18A and 18B of the watching conduits are shown. The terminals are connected to two change-over switches 70 and 71, arranged to change over the watching conduits 17 and 18 to connect same to a respective one of two conduits 72, 73, connected to an amplifier, not shown. At different locations in the circuits, loudspeakers 74 are connected between the conduits 17, 18, insulated from same by condensers 75, 76. Thus, the loudspeakers 74 may form integral parts of a sound transmitting system of a well known kind. The condensers 75, 76 prevent the permanently connected loudspeakers from having any detrimental effiect on the first alarm system.

What I claim is:

1. An electric temperature control and fire alarm system, comprising an electric D.C. source arranged at a central station, first and second watching conduits forming closed circuits in parallel from one pole of said electric source via a local watching station and back to the other pole of said source, a thermosensitive means having first, second and third contact wires, a resistor, said first contact wire being directly connected to said first watching conduit, said second contact wire being connected to said second watching conduit through said resistor, and said third contact wire being directly connected to said second watching conduit, said thermosensitive means being adapted to insulate said first contact wire from said second and third contact wires at normal ambient temperature and to provide a connection between said first and said second contact wires upon a temperature increase to a first pre-selected level in said thermosensitive means and further to provide a connection between said first and said third contact wires upon a temperature increase to a second higher pre-selected level in said thermosensitive means, a high resistance relay, and a low resistance relay, said relays being connected in series with said first watching circuit to provide that the first-mentioned relay closes and the second-mentioned relay opens when the temperature in the local watching station is at a normal ambient level, and to provide that the second-mentioned relay closes if the temperature in said station increases to the first-mentioned pre-selected level, and to provide that the first-mentioned relay opens if the temperature in said station increases to the second-mentioned pre-selected level, said system further comprising a third relay connected in series with said second watching conduit, said third relay being charged with current through a back contact of said first relay and comprising back contacts for closing said first relay at an interruption of said first watching conduit and to effect an interconnection of said watching conduits at an interruption in each of said watching conduits whereby a single watching circuit is set up which is interrupted at the thermosensitive means at normal ambient temperature and is closed thereby at a temperature increase to said first and second order preselected levels.

2. A system according to claim 1, wherein said first and second relays are connected to said single watching circuit with a connection whereby closure at the temperature of said first preselected level will close said second relay while keeping said first relay closed while closure at the temperature of said second preselected level will open said first relay.

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