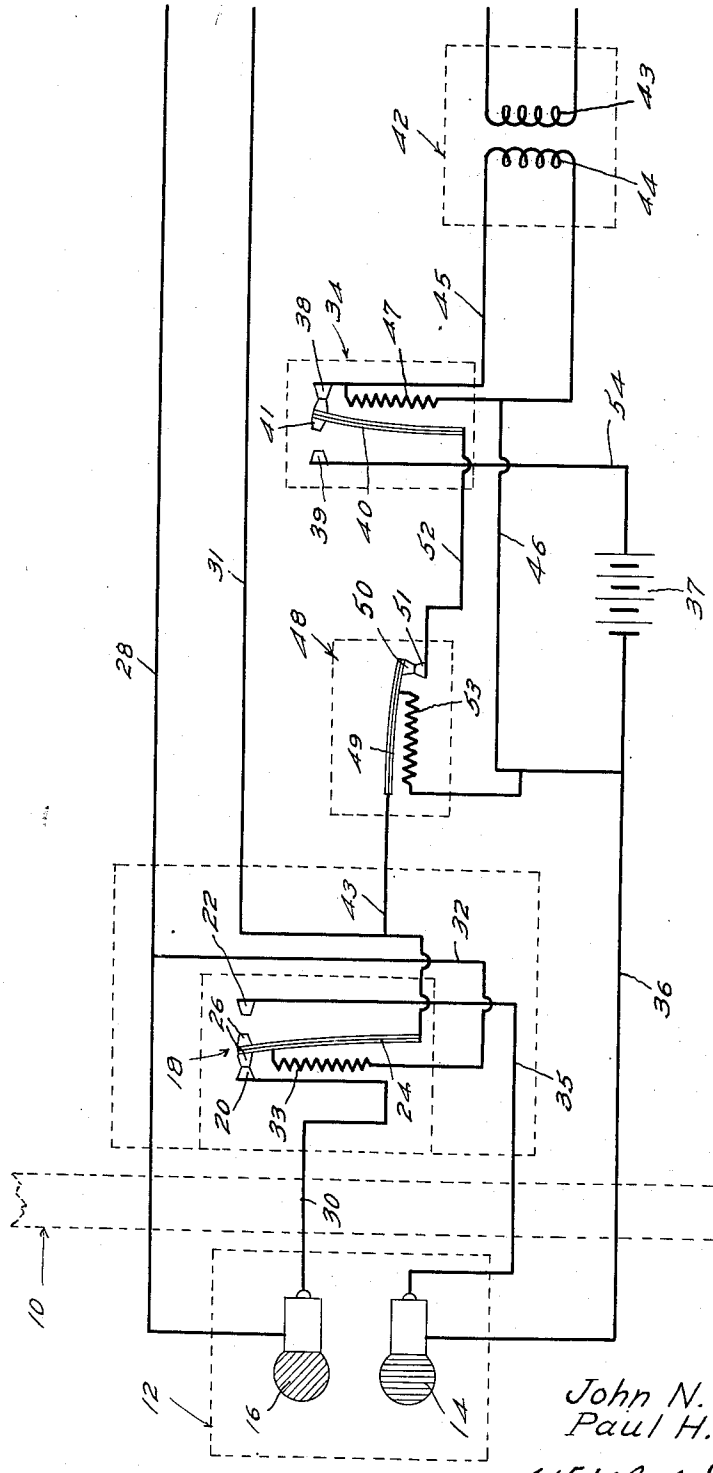
Dec. 22, 1953

J. N. MacINNES ET AL
THERMAL MEANS OF INDICATING TEMPERATURE
AND ELECTRIC FAILURE
Filed Feb. 12, 1951

2,663,860




Inventors
John N. MacInnes
Paul H. Gerard
By Wilfred L. Lawson
Attorney

Patented Dec. 22, 1953

2,663,860

# UNITED STATES PATENT OFFICE

2,663,860

## THERMAL MEANS OF INDICATING TEMPERATURE AND ELECTRIC FAILURE

John N. MacInnes, Newfields, and Paul H. Gerard, Newmarket, N. H.

Application February 12, 1951, Serial No. 210,566

5 Claims. (Cl. 340—227)

1

This invention relates generally to the class of electric signaling and is directed particularly to a system for use in connection with building heating and temperature indicating apparatus.

The object of the present invention is to provide a means of indicating temperature change and electric failure in connection with heating apparatus, such as oil burners, to give notice of the failure of electric current controlling the operation of such apparatus and/or the dropping of the building temperature below a desired level.

Another object of the invention is to provide a signal system of the character stated with means for indicating when a furnace is overheated, but functioning normally, without giving a false alarm.

It is also an object of the invention to provide means for accomplishing the stated results, embodying two signals one of which is active when the heating equipment is operating properly and the temperature is correct, the other signal coming into operation and the first becoming inactive when the reverse conditions prevail.

A still further object is to provide a temperature operated switch in the second or alarm signal circuit which is adapted to effect the intermittent energization of the latter signal when the current fails in the principal circuit.

Still another object of the present invention is to provide means for energizing the alarm signal circuit either by battery or from an A. C. source with thermal switch means controlled by the A. C. for maintaining the latter ready to energize the alarm signal but functioning upon failure of the A. C. supply to put the battery supply in the alarm signal circuit.

The present application is a continuation-in-part of our pending application Serial No. 145,324, filed February 21, 1950.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawing wherein the single figure is a diagrammatic layout of the electrical system constituting the invention.

Referring now more particularly to the drawing the reference character 10 generally designates a portion of an outside wall of a building.

Exteriorly of the building is located, upon the wall or in any suitable location, a suitable receptacle 12, in which are mounted, to be clearly seen, the two signal lights 14 and 16, which are preferably, respectively red and green.

Within the building is a two circuit controlling thermal switch, generally designated 18. This

2

switch comprises the two terminals 20 and 22 belonging respectively to the green and red signal light circuits about to be described.

Between the terminals 20—22 is a bi-metal switch blade 24 carrying opposite terminals 26 for selective contact with the signal circuit terminals.

The numeral 28 designates a conductor forming one side of an electric circuit receiving voltage from the twenty-four volt side of the heating equipment controls. The most convenient source of such low voltage is the stack control of the burner. Such stack control has such low voltage current available as long as the burner is functioning properly and the power supply is not impaired. Since such stack control is standard equipment used on all automatically controlled and fired heating systems, it is not thought that illustration or further description of the same is necessary.

This conductor 28 is connected to one side of the green signal 16 and the opposite side of this light is connected by the conductor 30 to the switch terminal 20.

The conductor 31 forms the other side of the signal circuit and is electrically connected to the switch blade 24.

Connected across the conductors 28 and 31 is the conductor 32 and resistance 33, the latter being located to heat the bi-metal blade 24, thereby causing the element to flex in a direction to engage one of its terminals 26 with terminal 20 thereby keeping the light 16 energized so long as the power remains on.

The value of the resistance 33 is such that should the room temperature drop a predetermined amount below normal, the heat from the resistance will be inadequate to prevent the bi-metal from cooling slightly, allowing the contacts 20—26 to open, breaking the current flow to bulb 16, and causing contacts 22—26 to close and thus complete the circuit for the signal lamp 14 as will be hereinafter apparent.

In the present system use may be made of a battery power source or a transformer connected with the power supply, for energizing the red signal light. Both sources have been illustrated and use is made of a thermal switch or relay, generally designated 34, for the purpose about to be described.

One side of the light 14 is connected by conductor 35 with the terminal 22, while the other side is connected by conductor 36 with one side of a battery 37.

The relay 34 is of the same design as the thermal switch, or relay, 18 in that it comprises

the two spaced terminals 38 and 39 and an interposed bi-metal switch blade 40 carrying the two contacts 41.

The transformer 42 comprises the primary and secondary coils 43 and 44, the primary receiving current from the power line, as will be apparent.

The secondary 44 is electrically connected with the terminal 38 by conductor 45 while the other side is connected by conductor 46 with the conductor 36 as shown.

Across the transformer secondary is connected the heater resistance 47 which, when the power supply is uninterrupted, is heated in the transformer secondary circuit and affects the bi-metal blade 40 to keep the contacts 38—41 closed.

The numeral 48 generally designates a thermal control switch comprising a bi-metal switch blade 49 having a contact 50 for coaction with a contact 51.

Contact 51 is connected by conductor 52 with the bi-metal blade 40 of the relay unit 34 while the blade 49 is connected by conductor 43 with the bi-metal blade 24 of the switch 18.

Connected between the bi-metal blade 49 and conductor 46 is a resistance heater 53. This bi-metal element 49 is located on and absorbs heat from convector of the heating equipment and is of such value as to maintain the terminals, or contacts, 50—51 closed when the furnace temperature is not above a selected, or normal, value. When the surrounding temperature rises above such normal value, however, the bi-metal element 49 is affected to cause separation of the contacts 50—51. In such event, resulting from overheating of the heating equipment, the limit controls would shut off the current at the control panel and both lights would then be out, indicating at once the character of the trouble.

The control switch 48 in the present system has an additional function, as will become apparent in the following description of operation.

As previously stated the transformer 42 will normally heat resistance 47 to keep contacts 38—41 closed so that all current demands by light bulb 14 will be met by the transformer 42.

If the line current should fail so that the transformer 42 produces no current, the resistance 47 will cool, thus causing the bi-metal blade element 40 to open contacts 38—41 and close contacts 39—41, so the battery will supply any current demands of bulb 14, the other sde of the battery from conductor 36 being connected by conductor 54 with the terminal, or contact, 39.

When current starts to flow through contacts 50—51, it will flow through heater 53, it being understood that through the current failure the terminals, or contacts, 22—26 would be closed also. The heating of resistance 53 will cause the bi-metal blade 49 to open the contacts 50—51, stopping current flow to the red light 14. Resistance 53 will then cool and the circuit will be reclosed, to light the bulb. Thus the signal light will be flashed on and off.

In the event of the closing of the red signal light circuit, for some reason other than power line failure, such, for example, as the dropping of temperature to a degree which would permit the bi-metal switch blade 24 to close contacts 22—26, the transformer would maintan control and supply current for the red light. The resistance 53, would, however, take off some current from the light circuit and effect the opening and closing of the contacts 50—51, to flash the lght, as before stated.

In the operation of the system, in the event of power failure, overheating, failure to ignite properly, very poor combustion, or any other fault that might cause the stack control to "cut-out," the low voltage current supplied by the circuit conductors 28—31, is shut off. When the supply of low voltage current is shut off, light 16 is extinguished and magnet 18 is deenergized allowing points 26—22 to close thus completing the circuit of lines 35 and 36, causing light 14 to become energized and giving warning of the condition that exists. This action would accomplish all that is desired except for the fact that in the majority of heating installations the radiation is inadequate to take care of the output of the furnace. This brings about an overheating condition which is prevented from becoming dangerous by a limit control, not illustrated, which is a part of the standard oil burner circuit. When such overheating condition occurs the limit control shuts off the burner by cutting off the power supply to the stack control, thus shutting off the low voltage supply. When this latter action occurs the reaction, as far as the present signal device is concerned, will be the same as a burner failure in that the green light 16 will go out and the red light 14 will come on. This, however, is undesirable inasmuch as overheating is a common occurrence and is not considered dangerous and will correct itself as soon as the furnace cools off a predetermined amount.

To eliminate the possibility of "false alarms" which would result from the overheating condition, thermal element 48 is installed on or near a heat convector so that, in the event of overheating, the bimetallic element 49 will open contacts 50—51 and will prevent a complete circuit from becoming established in the circuit 35—36, so that light 14 cannot give a false alarm. Thus in the event of overheating, green light 16 will go out but red light 14 will not light due to the action of thermal element 48. Thus if circuit 35—36 is rendered incomplete by either, or both, the action of thermal element 49 or the bimetal element 24, the light 14 will not be energized.

If the low voltage supply from the stack control on circuit 28—31 is shut off due to the stack control "cutting out," as a result of a faulty burner, or is shut off due to power line failure, the convector which unit 48 is on or near, will be relatively cool and thus the bimetallic element 49 will allow contacts 50—51 to remain closed, thus action of element 24 will complete the circuit to energize light 14, which is proper.

The stack control, hereinbefore referred to is a standard unit as previously stated which is commonly used on all automatically controlled and fired heating syestems. All of these stack controls embody a 24 volt supply which is derived from a transformer with which said stack controls are normally equipped. In the present inventon the stack control serves only as a source of current supply to actuate the present invention. The invention itself does not in any way affect the operation of the stack control.

The invention has been thus far described in connection with its use with heating equipment employing a stack control unit but it is also designed for use with automatic gas fired heaters and when so employed the circuit wires 28—31 would be connected to the solenoid valve circuit inasmuch as most gas fired heating units are not equipped with stack controls.

We claim:

1. Means for indicating current failure in a principal electric circuit comprising two electric

signals, a separate operating circuit for each, one of said circuits drawing current from said principal circuit, a thermal relay including a terminal for each circuit and a bi-metal switch blade common to the two circuits for the selective closing of said circuits by contact with one or the other of said terminals, a resistance heater connected across the principal circuit, said heater when energized affecting said bi-metal blade to maintain the said one circuit closed, and a source of electric potential for the other one of the circuits, said resistance heater being of such value as to be ineffective to influence the bi-metal element sufficiently to maintain the said one circuit closed upon depression of the temperature of the surrounding atmosphere below a predetermined value.

2. Means for indicating current failure in a principal electric circuit comprising two electric signals, a separate operating circuit for each, one of said circuits drawing current from said principal circuit, a thermal relay including a terminal for each circuit and a bi-metal switch blade common to the two circuits for the selective closing of said circuits by contact with one or the other of said terminals, a resistance heater connected across the principal circuit, said heater when energized affecting said bi-metal blade to maintain the said one circuit closed, a source of electric potential for the other one of the circuits, and a closed thermal switch in the said other one of the circuits, the last mentioned switch having a heat responsive element of a value to effect the opening of the last named switch upon a rise in temperature of the surrounding atmosphere above a predetermined degree.

3. Means for indicating current failure in a principal electric circuit comprising two electric signals, a separate operating circuit for each, one of said circuits drawing current from said principal circuit, a thermal relay including a terminal for each circuit and a bi-metal switch blade common to the two circuits for the selective closing of said circuits by contact with one or the other of said terminals, a resistance heater connected across the principal circuit, said heater when energized affecting said bi-metal blade to maintain the said one circuit closed, a source of electric potential for the other one of the circuits, and a closed thermal switch in the said other one of the circuits and having a heat responsive element maintaining the last named switch closed while the surrounding atmosphere remains below



a predetermined temperature, the last named switch further including a resistance heater connected across the said other circuit and in proximity to the last named heat responsive element to heat the latter when the said other circuit is closed whereby said other circuit will be alternately opened and closed.

4. Means for indicating current failure in a principal electric circuit, comprising an electric signal unit connected in series in said circuit, a thermal switch including a bi-metallic element and two terminals with which the element is adapted to selectively engage, said element and one terminal when in engagement being in series in said circuit, a second electric circuit, a second electric signal unit in series in the second circuit, said bi-metallic element and the other terminal when in engagement being in series in the second circuit, a source of electric potential in the second circuit, a heater element connected across the first circuit adjacent to and for heating the bi-metallic element whereby said element when kept at a predetermined temperature by the heater maintains electric engagement with the said one terminal, said element when below said predetermined temperature opening the principal circuit and electrically engaging the said other terminal to close the second circuit, and a thermal switch in the second circuit functioning to maintain the second circuit closed when the atmospheric temperature around the last named switch is below a predetermined normal.

5. The invention according to claim 4, wherein the last named thermal switch includes a heater element connected across the second circuit and functioning to raise the said atmospheric temperature above said normal when the second circuit is closed and the second signal unit energized whereby the second circuit will be alternately opened and closed.

JOHN N. MACINNES.
PAUL H. GERARD.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,075,314 | Flagg et al. | Oct. 7, 1913 |
| 1,181,419 | Williams | May 2, 1916 |
| 1,653,685 | Whittington | Dec. 13, 1920 |
| 2,439,331 | Bean | Apr. 6, 1948 |
| 2,511,631 | Gordon | June 13, 1950 |