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OVERCURRENT AND UNDERCURRENT INDICATING LAMP

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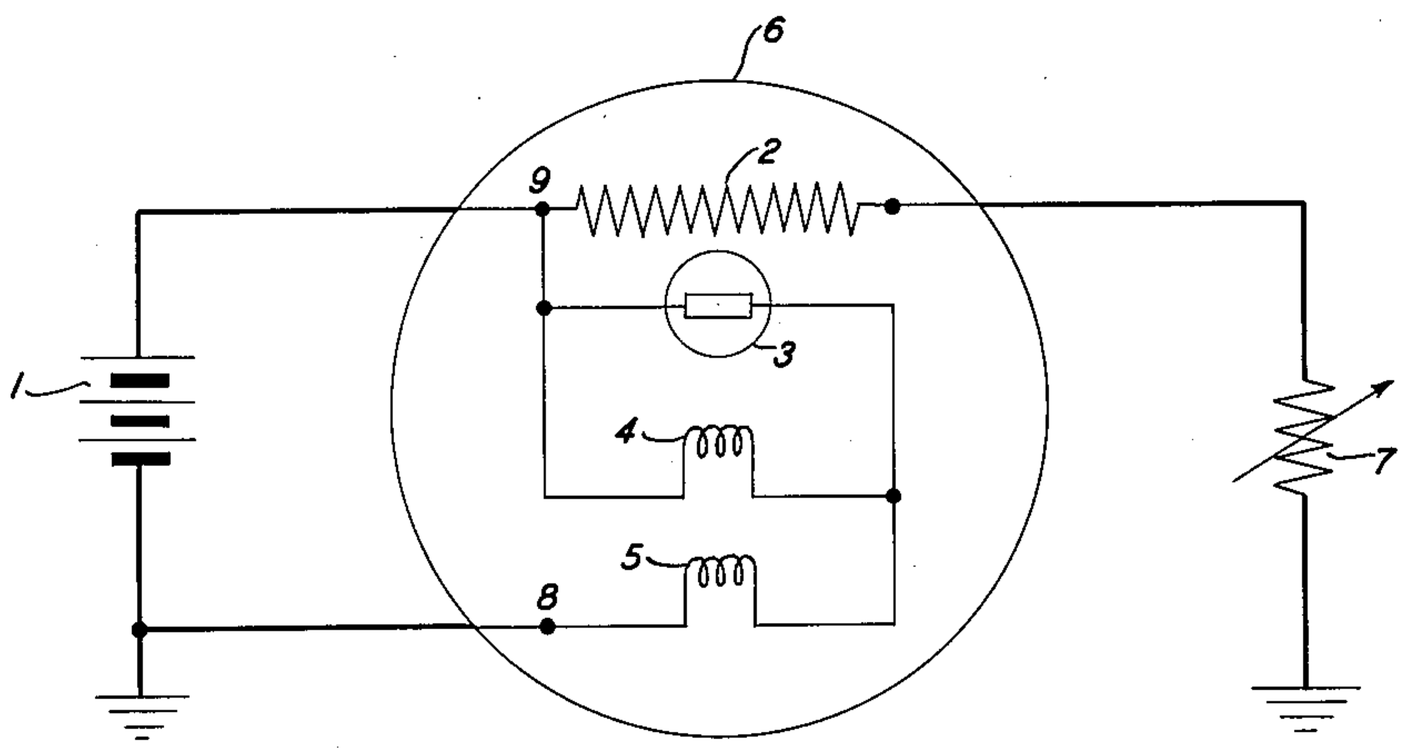

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OVERCURRENT AND UNDERCURRENT INDICATING LAMP

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This invention relates to a current monitoring device and more particularly to a lamp that will indicate an overcurrent condition and an undercurrent condition in a circuit.

An object of the invention is to provide a current monitoring and alarm device that is compact, inexpensive and trouble free in its operation.

Another object of the invention is to use a negative temperature coefficient element in conjunction with two lamp filaments to monitor the current in a circuit.

A feature of the invention is the use of a resistance heating element in close association with a thermistor and two lamp filaments to indicate an overcurrent and undercurrent condition in a circuit.

Current monitoring devices are old in the art and include such items as ammeters, fuses, overload relays, circuit brakers and many other types of devices including some complicated embodiments provided for certain usages. Although these devices are well suited for their particular purpose, the present invention fulfills a need for an alarm device that is simple and trouble free in its operation and that can monitor and detect abnormal current conditions in a circuit whose current requirements are relatively constant and unvarying. The present invention fulfills this need by providing a simple device which may be no larger than a small electric light bulb and which will provide a visual warning during an abnormal current condition in a circuit.

The present invention contemplates the use of two lamp filaments connected in series across a power supply with a thermistor connected in parallel with one of the filaments. The current through this series parallel circuit is such that during normal current conditions in the circuit whose current is to be monitored, neither of the two filaments has sufficient current flowing through them to cause them to be illuminated. Closely spaced to the thermistor is a resistance heating element that is connected in series with the current in the circuit that is to be monitored. When the current in this circuit is of a normal magnitude, the temperature of the resistance heating element controls the temperature and the resistance of the thermistor so that neither of the two lamp filaments has sufficient current flowing through them to cause them to be illuminated. When the current in the circuit that is monitored assumes an abnormal value, the change in the temperature of the resistance heating element changes the temperature and resistance of the thermistor so that one of the two lamp filaments passes an increased current and thereby is illuminated. The particular lamp filament that is illuminated during an abnormal condition depends upon whether the current in the external circuit is of an abnormally high or an obnormally low value.

The invention may be more fully understood from the following detailed description of a preferred exemplary embodiment thereof when read with reference to the accompanying drawing.

The current indicator comprises an external envelope

6 which may be made of any transparent or translucent material. Positioned inside the envelope 6 is a resistance heating element 2 which may be made of any suitable material that changes its temperature in response to changes in the amount of current flowing through it. Closely positioned to the heating element 2 is a thermistor 3 whose temperature is controlled by the amount of heat radiated by heating element 2. The thermistor may be of any type that has a high negative temperature coefficient so that the resistance of the thermistor will decrease with an increase in temperature of the heating element and vice versa. Also inside envelope 6 are two lamp filaments 4 and 5 which are connected in series between terminals 8 and 9, which are supplied with an operating potential from battery 1. Thermistor 3 is connected in parallel with lamp filament 4. Resistance heating element 2 is connected at its one end to terminal 9 and at its other end to one side of an external load 7. The external load 7, for the sake of simplicity, is shown only diagrammatically as a variable resistor. In practice, the load 7 could be a piece of telephone equipment, electronic equipment or any other equipment whose proper operation is important enough to warrant its association with a current monitoring and indicating device.

During normal current conditions in the load 7 the current through heating element 2 heats the thermistor to a certain temperature so that its resistance assumes a value sufficiently low to decrease the amount of current flowing through lamp filament 4 so that it does not glow. Lamp filament 5 is chosen to be of the proper resistance so that the current flowing through it is insufficient to cause it to be illuminated during normal circuit conditions. If the current in load 7 decreases by a sufficient amount or ceases entirely, the temperature of resistance heating element 2 decreases which decreases the temperature of the thermistor and increases its resistance. This increased resistance of the thermistor is sufficient so that enough extra current flows through lamp filament 4 to cause it to glow and thereby indicate an open circuit or undercurrent condition in the load 7.

The temperature in heating element 2 increases upon a short circuit or other overcurrent conditions in the load 7. The resulting decrease in the resistance of the thermistor allows a sufficient amount of current to flow through lamp filament 5 to cause it to glow and thereby indicate an overcurrent condition in load 7.

Lamp filaments 4 and 5 are initially chosen to be of proper value so that neither will glow during normal circuit conditions. These filaments are of unequal resistance due to the peculiarities of the circuit with which they are associated. It is not necessary that these filaments be physically located within the envelope 6 nor is it necessary that they be adjacent to the thermistor and the heating element. If desired, each lamp filament can be in its own envelope or both filaments can be within the same envelope. Also these separate lamp filament envelopes can be in an entirely different room from that in which the heater element and the thermistor are located. If desired, filaments 4 and 5 could be replaced by suitable relays or other electroresponsive apparatus that would operate during an abnormal current condition. The operation of the relays could then actuate whatever type of warning signals may be desired.

The external circuit, which consists of elements 7 and 2, could be deleted so that the remaining equipment would constitute a new and highly useful heat responsive alarm which would provide a warning indication whenever the operating temperature of an associated piece of equipment deviates from a predetermined range of temperature extremes. In an application of this type the thermistor would be positioned adjacent the device whose temperature is to be monitored while the indicator lamps would

be physically remote therefrom and would be positioned so as to be visible to an operator or an attendant. For example, the thermistor could be placed inside a freezer whose temperature, for some reason or other, must be kept at a relatively constant level so as to provide an alarm in the event that the temperature in the freezer becomes too hot or too cold. This invention also could be used in a similar manner when it is desired to check that an oven or the like operates at a relatively constant temperature.

It is to be understood that the above-described arrangements are but illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. In an overcurrent and undercurrent indicating device, a source of potential, a first filament, a second filament, said filaments being of unequal resistance and connected in series across said source of potential, a negative temperature coefficient element connected in parallel with said first-mentioned filament, and means responsive to the magnitude of current in an external circuit to vary the temperature of said negative temperature coefficient element, thereby to cause one of said filaments to be illuminated during an overcurrent condition in said external circuit and the other of said filaments to be illuminated during an undercurrent condition in said external circuit.

2. In an overcurrent and undercurrent indicating device, a source of potential, a first lamp filament, a second lamp filament, said filaments being of unequal resistance and connected in series across said source of potential, a thermistor connected in parallel with said first-mentioned lamp filament, and means responsive to the magnitude of current in an external circuit to vary the temperature of said thermistor thereby to cause one of said filaments to be illuminated during an overcurrent condition in said external circuit and the other of said filaments to be illuminated during an undercurrent condition in said external circuit.

3. In an overcurrent and undercurrent indicating device, a source of potential, a first lamp filament, a second lamp filament, said filaments being of unequal resistance and connected in series across said source of potential, a thermistor connected in parallel with said first-mentioned lamp filament, and a resistance heating element connected in series with an external circuit, said resistance heating element being responsive to the magnitude of current in said external circuit to vary the temperature of said thermistor thereby to cause one of said filaments to be illuminated during an overcurrent condition in said external circuit and the other said filament to be illuminated during an undercurent condition in said external circuit.

4. In a temperature responsive alarm indicating device, a source of potential, a first filament, a second filament, said filaments being of unequal resistance and connected in series across said source of potential, a negative temperature coefficient element connected in parallel with said first-mentioned filament, said element being responsive to variations in the temperature thereof, thereby to cause one of said filaments to be illuminated during a high temperature condition of said element and the other of said filaments to be illuminated during a low temperature condition of said element.

5. In an alarm indicating device, a source of potential, a first electroresponsive device, a second electroresponsive device, said two electroresponsive devices being of unequal resistance as connected in series across said source of potential, a negative temperature coefficient element connected in parallel with said first electroresponsive device, and means responsive to the magnitude of the current in an external circuit to vary the temperature of said negative temperature coefficient element, thereby to cause one of said electroresponsive devices to be operated during an overcurrent condition in said external circuit and the other of said electroresponsive devices to be operated during an undercurrent condition in said external circuit.

6. In an overcurrent an undercurrent indicating device, a source of potential, a first filament, a second filament, said filaments being of unequal resistance and connected in series across said source of potential, a negative temperature coefficient element connected in parallel with said first-mentioned filament, a resistance heating element and an external load connected in series across said source of potential, said resistance heating element being responsive to the magnitude of current in said external load to vary the temperature of said negative temperature coefficient element thereby to cause one of said filaments to be illuminated during an overcurrent condition in said load and the other of said filaments to be illuminated during an undercurrent condition in said load.

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