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THERMAL SAFETY DEVICE

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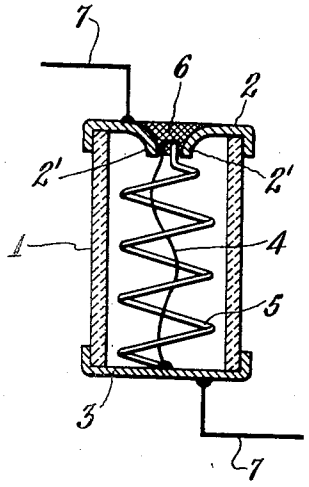


Fig. 1.

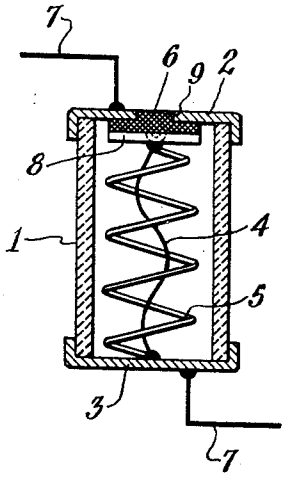


Fig. 2.

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THERMAL SAFETY DEVICE

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3 Claims. (Cl. 200—117)

This invention relates generally to thermal safety devices for interrupting the flow of current in an electrical circuit and, more particularly, to improvements in thermal safety devices adapted for use in low voltage electrical circuits.

Thermal safety devices for use in low voltage circuits, such as for example, electrical circuits for house lighting and domestic electrical appliances, are well known. Such devices generally function to discontinue the flow of current in the circuit by heating of the conductor contained within the device proper causing fusing of the conductor or energizing of a switch element. In addition, they are generally structurally combined with a switch element proper normally adapted by manual or mechanical operation to open the electrical circuit, or such safety devices are adapted to energize mechanically the switch element proper and, by automatically opening the same, effect an interruption of the current flow in the electrical circuit. It will be observed that in each case the functioning of the device is dependent upon internal heating of the conductor as the result of an excess flow of current through the conductor to an external piece of electrical apparatus. Moreover, that form of construction involving mechanical energization of the switch element results in a complicated formation of the whole switching apparatus, wherein insulating intermediate parts and springs are necessary. Both forms of construction moreover have the disadvantage that the restoration of the device to a condition for re-use generally involves a whole series of manipulations, such as opening a casing enclosing the safety device and switch element and involves the resoldering of a part of the circuit or the detaching of a number of parts from the switching apparatus and the re-assembling thereof. A further disadvantage of such devices is that their operation is directly dependent upon the current flow in the circuit in which they form a part. In many cases, before they are actuated, damage to the electrical equipment employed in the circuit is caused due to the generation of heat in such equipment before the safety devices come into operation.

An important object of this invention is to provide a thermal safety device for interrupting the flow of current in a low voltage electrical circuit which is caused to be operated by heat generated externally of the device as distinguished from heat generated internally of the device.

Another object of this invention is to provide a thermal safety device for use in a low voltage electrical circuit adapted to discontinue the flow of current in such circuit as the temperature of the medium surrounding the device reaches a predetermined safe value.

A further object of this invention is to provide a thermal safety device for low voltage electrical circuits adapted to interrupt the flow of current through electrical equipment in such circuits in response to heat radiating from such equipment impinging on the outer surface of such device.

A still further object of this invention is to provide a safety device for low voltage electrical circuits such as are employed, for example, in house installations, which is of minimum dimensions, simple in construction, may be readily and cheaply restored to a condition for re-use and will obviate the above mentioned disadvantages.

Other and further objects of this invention will appear from the following description and the appended claims.

In the accompanying drawing which forms part of the instant specification and in which like numbers refer to like parts throughout the several views:

Fig. 1 is a sectional view in elevation of a safety device forming the subject matter of this invention, and

Fig. 2 is a sectional view in elevation of a modification of the device shown in Fig. 1.

In general, the safety device comprises a cartridge shaped casing enclosing a tensioned spring whose ends are connected by a flexible current conductor. The spring is held in its tensioned position by means of electrically conducting caps of the casing, the spring being fastened directly to the cap at one end and indirectly to the cap at the other end by means of a fusible material, of which a portion is exposed to the surrounding atmosphere. In its normally operative condition, current flows in the circuit through the cap at one end, through the spring and conductor, through the cap at the other end and thence back into the circuit. As the external air temperature rises, the fusible material melts, the spring is released thereby and in returning to its normal position, draws with it the flexible conductor, thus interrupting the circuit.

Referring now more particularly to Fig. 1, a cylinder 1 formed of glass or any other suitable electrical non-conductive material is closed at the top and bottom by the caps 2 and 3 respectively. The caps 2 and 3 are formed of electrical conducting material such as for example copper, there being fastened to the cap 3 one end of a flexible current conductor 4 such as a copper wire, and one end of a helical spring 5 formed of steel

or other suitable resilient material. The current conductor 4 and the spring 5 are connected together at their ends and are passed through the cylinder 1 so that one connected pair of such ends extends into a funnel-shaped opening in the cap 2, which opening is formed by the lugs 2' on the cap 2. This opening is filled with fusible material 6 which holds on to the cap 2 the corresponding end of the conductor 4, together with that of the spring 5, the latter being under tension. By fusible material it is to be understood, material that melts at comparatively low temperature (about 176° F. to about 212° F.); it may consist of an alloy containing mainly lead, such as for example, the so-called Wood's metal.

The above described safety device is assumed to be connected by means of the caps 2—3 serving as the current conveying parts into the branch 7 of the line of a current consuming apparatus, so that the current is conducted through the fusible material 6 and the current conductor 4. If now excessive heating of the current consuming apparatus takes place, assuming that a switch, for example, which should then open the circuit for any reason does not come into operation, the fusible material 6 melts by the extreme heat, that is, heat which is radiated or transmitted by body contact from the current-consuming apparatus, for example a thermostat, and the spring 5 is released and draws the current conductor 4 down in the cylinder 1, whereby flow of the current in the circuit is discontinued.

Referring now more particularly to Fig. 2, the upper ends of the current conductor 4 and of the spring 5 are connected to an electrically conducting plate 8 and this plate is held by means of the fusible material 6 on the cap 2. In order to apply the fusible material 6, the cap 2 is provided with an opening 9. It will be obvious that the operation of the safety device shown in Fig. 2 is the same as that shown in Fig. 1.

Although the safety device includes a current conductor 4 in addition to the helical spring 5, it is obvious that the conductor 4 may be dispensed with entirely if desired, and the spring 5 relied upon to effect the transfer of current from the cap 2 to the cap 3. However, where the flow of current through the device is relatively great and internal heating would result by reason of the relatively poor conductivity of the coiled steel spring as contrasted with the conductivity of the copper wire current conductor 4, it is preferred that the conductor 4 be employed. The necessity for the non-use of the conductor 4 will be obvious to those skilled in the art in the light of the conditions under which the device is to be employed.

It will be obvious that the objects of this invention have been accomplished and there has been provided a thermal safety device of particular utility in low voltage electrical circuits in securing a current-consuming apparatus against excessive heating and damage resulting therefrom. There has been provided a thermal safety device which has the advantage of great simplicity, minimum dimensions, and easier interchangeability, which can be readily restored to operative condition in the same manner as it was made.

It will be observed that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of the appended claims. It is further obvious that various changes may be made in details within the scope of the appended claims without departing from the spirit of this invention. It is, therefore, to be understood that this invention is not to be limited to the specific details shown and described.

Having thus described this invention, what is claimed is:

1. A thermal safety device for low voltage electrical circuits comprising a pair of metal caps, one of said caps having an opening therein; fusible material filling said opening; a coiled metal spring; a flexible current conductor connecting the ends of said spring; a metal plate bonded to said fusible material; said spring and conductor having one pair of connected ends fastened to said plate and the other pair of connected ends attached to the other of said caps; and non-metallic insulating means spacing said caps from each other whereby said spring is normally maintained under tension.

2. A thermal safety device as claimed in claim 1, said spacing means forming with said caps a cartridge-like jacket enclosing said spring and flexible conductor.

3. A thermal safety device as claimed in claim 1, said fusible material in part engaging a face of the cap having an opening.

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