THERMAL CIRCUIT PROTECTOR

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ABSTRACT
A thermal circuit protector for automatically opening a circuit when the ambient temperature becomes too high. The protector comprises a fusible pellet disposed inside a conductive case. A first conductor electrically contacts the case while a second conductor is electrically insulated from the case. Contact is made from the first conductor to the second by three electrically conductive balls which contact the case and the second conductor. A first spring maintains the electrical contact between the case, the balls and the second conductor. A second spring acts to break the contact between the case, the balls and the second conductor when the fusible pellet melts.

3 Claims, 4 Drawing Figures
THERMAL CIRCUIT PROTECTOR

This invention relates generally to circuit breaking devices and pertains more particularly to a thermal fuse which interrupts or opens an electric circuit when a predetermined ambient temperature is reached.

Many instances exist when it is desirable to protect electrical devices from excessive heat. Electric motors can be damaged if they overheat. Thus it is desirable to protect them from overheating. As a further illustration, thermal protectors are useful in shutting off flammable liquid and gas sources when a fire has occurred.

Accordingly, it is an object of this invention to provide a thermal protector for electrical circuits which has a precise operating temperature and which automatically interrupts the current flow in an electric circuit.

This invention relates to a thermal circuit protector having a cylindrical, tubular, electrically and thermally conductive case with an integral closure at one end and an electrically nonconductive closure at the other end. A first conductor makes electrical contact to the case while a second conductor extends through the insulating end closure. A fusible pellet which melts at a prescribed temperature is held in place by a spring assembly. The spring assembly also maintains three electrically conductive balls in conductive engagement with the case and the second conductor while the pellet is solid. When the ambient temperature reaches the proper level, the fusible pellet melts and the spring assembly acts to move the three conductive balls out of engagement with the second conductor to break the circuit.

Other features and advantages of the invention will be apparent from this description, the accompanying drawings, and the appended claims in which:

FIG. 1 is a longitudinal cross section of a thermal circuit protector constructed in accordance with the present invention;

FIG. 2 is a cross section along line 2-2 of FIG. 1;

FIG. 3 is a longitudinal cross sectional view of a second embodiment of the invention; and

FIG. 4 is a longitudinal cross sectional view of a third embodiment of the invention.

In the FIG. 1 a thermal protector, generally indicated by reference numeral 10, comprises a cylindrical, tubular, electrically and thermally conductive case 11 having closures 12 and 13 at each end. The closure or plug 13 is held in the case 11 by an inwardly extending flange 17 which is formed after the device has been assembled. A sealing compound 29 may seal the closure 13.

A first conductor 18 electrically contacts the case 11 at closure 12. A second conductor 19 extends through the bore 16 of plug 13 and is insulated from the case 11 by the plug 13. A collar 20 prevents second conductor 19 from being extracted from the thermal protector 10. The end of second conductor 19 is beveled as shown at reference numeral 21.

A temperature sensitive fusible pellet 22 may be of any suitable type now well known in the art and which may be purchased on the market by specifying the desired collapsing temperature. These pellets have a rigid body which can withstand any pressures exerted on them by the thermal protector assembly while the ambient temperature is below the collapsing temperature.

When the ambient temperature exceeds the collapsing temperature, however, the pellet melts.

A plate 23 having a slightly smaller surface area than that of the pellet 22 acts to distribute the force exerted by pressure spring 24 over the area of pellet 22. The outer diameter of the plate 23 is smaller than the inner diameter of the case 11 providing a pathway 25 for the molten fusible material when the pellet 22 melts.

Pressure spring 24 forces three balls 26 into conductive engagement with case 11 and the bevel end 21 of conductor 19. The balls 26 and the end of conductor 19 may be made of copper or other conductive material and may be coated with silver to increase conductivity. A second spring or release spring 27 exerts a force on conductive balls 26 opposing that of pressure spring 24. The pressure spring 24 and release spring 27 are chosen so that when the pellet 22 is solid and uncollapsed, pressure spring 24 exerts a greater force on balls 26 than release spring 27 to maintain contact between case 11, balls 26, and the beveled end 21 of conductor 19. The release spring 27 sits on plug extension 14 and is provided with an end turn 28 which is smaller than the other turns.

When the ambient temperature reaches the collapsing temperature of the pellet 22, the pellet will melt and molten material will flow through the areas 25. Pressure spring 24 will therefore be allowed to expand, exerting less pressure on balls 26. When pressure spring 24 has expanded sufficiently, the force exerted on balls 26 by release spring 27 will be greater than that exerted by pressure spring 24. Thus, release spring 27 will move the balls 26 out of engagement with conductor 19 opening any circuit connected to conductors 18 and 19.

The embodiment shown in FIG. 3 is similar in operation to that shown in FIG. 1 and the same reference numerals are used to indicate the same features in both FIGS. 1 and 3. In FIG. 3 plate 30 has been added and is located between pressure spring 24 and conductive balls 26. Plate 30 is identical to plate 23 and acts to distribute the force of pressure spring 24 exerted on balls 26.

The embodiment shown in FIG. 3 operates in the same manner as the embodiment shown in FIG. 1. Thus, when the pellet 22 collapses the pressure spring 24 will be allowed to expand. After pressure spring 24 has expanded sufficiently, release spring 27 will exert a greater force on balls 26 than does pressure spring 24 moving balls 26 out of engagement with conductor 19.

In the embodiment shown in FIG. 4 electrical contact is made to the thermal circuit protector by conductor 18 which electrically contacts the case 11 at integral closure 12. Insulating plug 13 having plug extensions 14 and 15 and bore 16 occupies the end of case 11. An inwardly extending flange 17 holds plug 13 within the case 11. The end closure may be sealed by electrically insulating sealing compound 29.

Fusible pellet 22 occupies the inside of case 11. Plate 23 acts to distribute the force exerted by pressure spring 24 evenly over pellet 22. Pathway 25 provides a path for molten fusible material.

Electrical contact is made from conductor 19 to the case 11 by three electrically conductive balls 26. Plate 31 has a raised portion 32 which prevents the balls 32 from rolling to the center.

Finally, release spring 33 exerts a force on an insulator 34. Insulator 34 has a bore 35 through which con-
ductor 19 extends. Balls 26 rest in an indented area 36 of insulator 34.

In operation the embodiment shown in Fig. 4 is similar to the previous two embodiments. However, the release spring 33 does not directly exert a force on balls 26. Instead release spring 33 exerts a pressure on balls 26 indirectly through insulator 34.

Numerous modifications and changes can be made from the disclosed embodiments without departing from the true spirit of the invention as defined in the claims.

What is claimed is:

1. A thermal circuit protector which comprises:
   a tubular, electrically and thermally conductive case;
   a normally solid fusible pellet occupying one end of said case;
   an insulating plug occupying the other end of said case having a bore extending therethrough;
   a first conductor electrically contacting said case;
   a second conductor extending through the bore of said insulating plug;
   electrically conductive balls normally in electrical contact with the inside of said case and said second conductor; and
   spring means for maintaining said balls in electrical contact with said case and said second conductor when said pellet is solid and for breaking said electrical contact when said pellet melts.

2. The thermal circuit protector as claimed in claim 1, wherein said spring means comprises:
   a pressure spring exerting a first force on said conductive balls; and
   a release spring exerting a second force on said conductive balls, said second force opposing said first force, said second force being smaller than said first force when said pellet is solid, said second force being larger than said first force after said pellet melts to disengage said conductive balls and said second conductor.

3. The thermal circuit protector as claimed in claim 2, wherein an insulating member is disposed between said conductive balls and said release spring.