

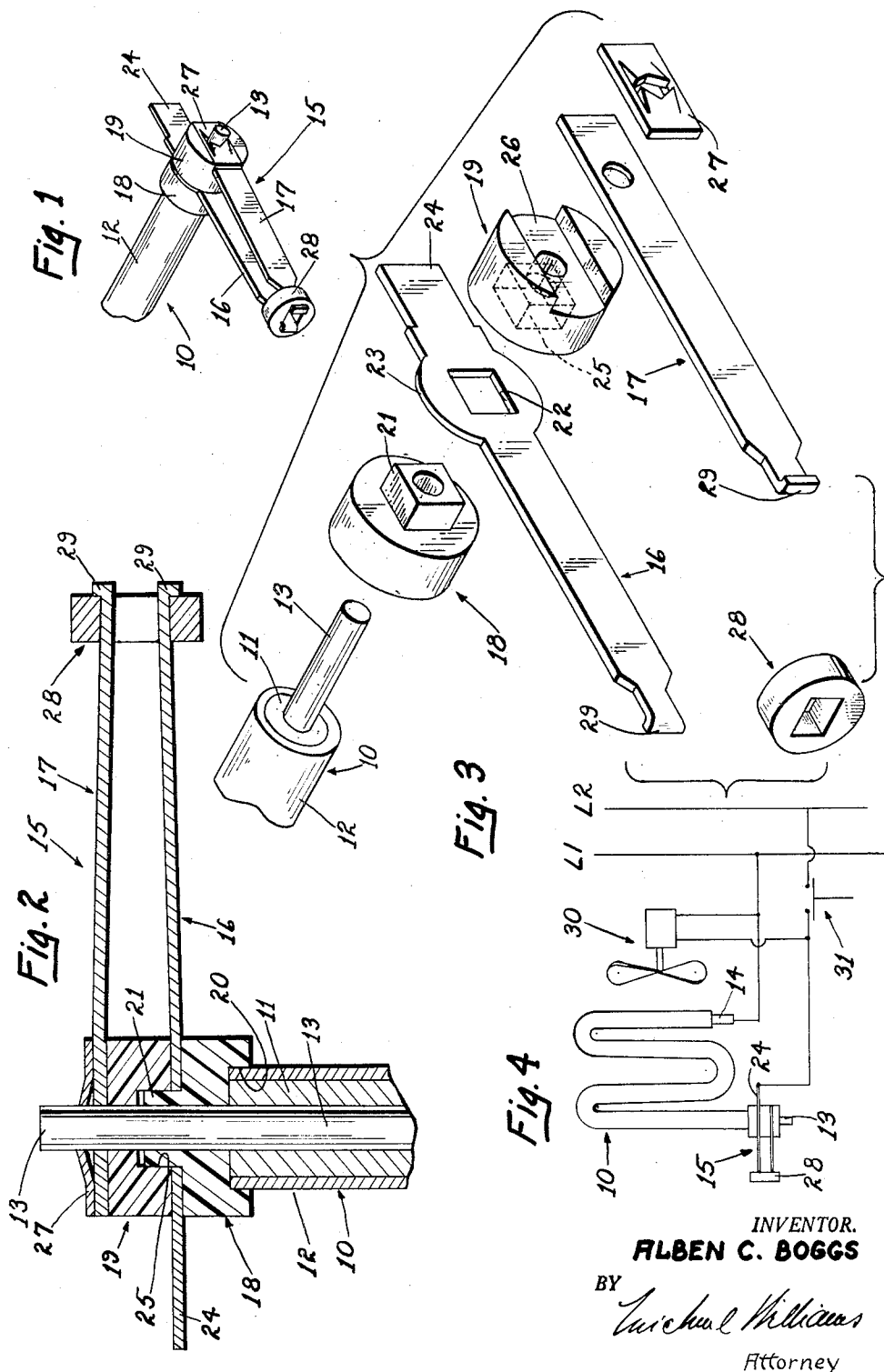
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THERMAL RESPONSIVE DEVICE

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THERMAL RESPONSIVE DEVICE

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The present invention relates to a thermally responsive electric current interrupter, more particularly to an electric heater having associated therewith a protective device for deenergizing the heater under certain conditions, and the principal object of the invention is to provide new and improved articles of such character.

For use in many types of apparatus which require electric heat, there has long been a need for a compact, simple and low cost electric heater assembly which incorporates integrally therewith an efficient, thermally responsive device for de-energizing the heater when its continued operation might present a fire hazard or the like.

Prior art devices, even those which functioned properly, have not been entirely satisfactory since they have been high in cost and since resetting of the thermally responsive device, once it has functioned to de-energize the heater, has been difficult. The present invention possesses none of the disadvantages of prior art constructions while its many advantages will readily become apparent from a study of the following description and from the drawing appended hereto.

In the drawing accompanying this specification and forming a part of this application there is shown, for purpose of illustration, an embodiment which the invention may assume, and in this drawing:

Figure 1 is a perspective view of the invention fragmentarily illustrating an electric heater embodying a preferred form of a thermally responsive protective device,

Figure 2 is an enlarged, fragmentary, longitudinal sectional view of the invention shown in Figure 1,

Figure 3 is an exploded perspective view of the invention shown in Figures 1 and 2, and

Figure 4 is a diagrammatic view illustrating one mode of application of the invention, a suitable electric circuit for effecting operation thereof also being shown.

The present invention employs a conventional, sheathed electric resistance heater 10 which, as is well-known, comprises a resistor conductor (not shown) embedded in compacted, heat-conductive material 11 and encased within a metallic sheath 12. The usual terminal pins 13, 14 are electrically connected to respective ends of the resistor conductor, the latter terminating short of respective ends of the sheath, and each terminal pin protrudes beyond the respective adjoining ends of the sheath to provide for the necessary electrical connections.

A thermally responsive device 15 is adapted to be secured to one of the terminal pins, for example, terminal pin 13, and comprises a pair of elongated members 16, 17 which extend transversely of the terminal pin. For a purpose to become clear, members 16, 17 are formed of a suitable electrically conductive material having certain resilient characteristics; and, member 17 is adapted to be electrically connected to terminal pin 13 while, member 16 is adapted to be electrically insulated from the terminal pin. Members 16, 17 are adapted to be main-

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tained in predetermined assembled relation with each other and with the heater 10 by a pair of dielectric bodies 18, 19.

Body 18 (see Figures 2 and 3) is apertured to slideably fit over terminal pin 13 and the body has one face formed to provide a recess 20 in which the adjoining end of the heater is adapted to seat. If desired, a suitable putty or the like (not shown) may be interposed between body 18 and the end of the heater for sealing purposes. Body 18 is formed to provide a reduced size, shank portion 21 for a purpose to appear, portion 21 having a non-circular cross section and preferably having the generally square cross section herein illustrated.

Member 16 is adapted to abut body 18 and has a square aperture 22 through which a square portion 21 of body 18 is adapted to pass. Member 16 is enlarged at 23 adjacent aperture 22 for strengthening purposes and the member is provided with a lug 24 to which an electrical connection can be made.

Body 19 is also apertured to pass terminal pin 13 and has a square recess 25 at one end for slideably receiving portion 21 of body 18. The other end of body 19 is provided with a transverse slot 26 of sufficient width and depth to receive member 17 and also a retaining clip 27.

Assembly of the device with the heater with the members 16, 17 in side-by-side, generally parallel relation will readily be apparent from the drawing, it being noted that clip 27 tightly grips terminal pin 13 and prevents unintentional disassembly of the device from the heater and also prevents rotation of body 19 about the terminal pin. Since bodies 18, 19 are locked together and since members 16, 17 are locked to the bodies, the entire device 15 will be fixedly secured to the heater 10.

As previously mentioned, member 16 is electrically insulated from terminal pin 13 by means of the bodies 18, 19 while member 17 is electrically connected to the terminal pin through clip 27. Means are provided for establishing electrical connection between the members 16, 17, such means comprising a washer-like, electrically conductive fusible element 28.

As seen in Figures 2 and 3, the adjoining ends of members 16, 17 which are spaced from the terminal pin are reduced in width and provide outwardly turned ears 29. Element 28 is apertured to slip over the ends of the members 16, 17 and to seat in the reduced width portions of the members, lugs 29 preventing the element from slipping off the members; however, the members must first be sprung together prior to slipping element 28 in place. As most clearly shown in Figure 2 and with element 28 in place upon the members 16, 17 the members are held together and prevented from springing apart by means of the element.

Member 28 may be formed of any suitable electrically conductive material which has a low melting point. For example, an alloy of bismuth, lead and tin, commonly known as Wood's metal, has been successfully employed. It will be obvious that the material of which fusible element is made will depend upon the temperature at which it is desired that the element soften or melt.

Under normal temperatures, fusible element 28 has sufficient ultimate strength to hold members 16, 17 together against the biasing force which urges them apart. However, when the temperature of the fusible element rises to a predetermined value, its strength at such elevated temperature will be less than that required to hold the members 16, 17 together. Accordingly, members 16, 17 will tear the fusible element apart and thus interrupt the electrical connection between the two members established by the element.

The invention herein disclosed is adapted for use in

air heaters or the like although its use is not limited to such apparatus. As diagrammatically shown in Figure 4, such apparatus normally includes a blower 30 for circulating air over the heating element 10 and, although not shown, the heating element and blower are usually housed in a casing or the like having openings through which cool air is admitted and heated air is expelled.

As illustrated in Figure 4, heating element 10 and blower 30 are connected in parallel to power lines L1 and L2 and the usual switch 31 simultaneously controls flow of current through these circuits. Note that current must pass through members 16, 17 and through fusible element 28 in order to effect energization of heating element 10.

During operation of the apparatus, air is continually circulated through the casing by the blower and thus the temperature within the casing and the casing itself will remain at a safe level. However, in the event circulation of air is cut off, as by blockage of the openings in the casing through which the air flows or by failure of the blower to operate, the temperature of the air within the casing will rise to a dangerously high level. Under such conditions and since fusible element 28 is immersed in and subject to the temperature modifying effects of the air within the casing, element 28 will soften and permit members 16, 17 to spring apart in the manner heretofore described and deenergize the heating element.

When it is desired to restore the apparatus to operation and preferably after locating and eliminating the trouble which caused the protective device to operate, it is only necessary to position another fusible element 28 upon the members 16, 17 in the manner hereinbefore disclosed.

In view of the foregoing it will be apparent to those skilled in the art that I have accomplished at least the principal object of my invention and it will also be apparent to those skilled in the art that the embodiment herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described, hence it will be appreciated that the herein disclosed embodiment is illustrative only, and that my invention is not limited thereto.

I claim:

1. In combination, an electric heating element adapted to be subjected to the temperature modifying effects of a heat absorbing medium and a protective device for interrupting current flow to said heating element when the temperature of the medium rises to a predetermined value, said heating element comprising a sheathed embedded element having a current carrying terminal pin extending therefrom and said protective device comprising a pair of members carried by and extending transversely of the exposed portion of said terminal pin, said members being resiliently biased away from each other to electrically insulated relation and one of said members being electrically insulated from said terminal pin and being adapted to be connected to a source of electrical energy and the other of said members being electrically connected to said terminal pin, said protective device further comprising a fusible element extending between and maintaining said members in juxtaposition against the biasing force and providing for electrical contact between said members, said fusible element being apertured to receive said members when the latter are shifted to juxtaposition against the biasing force and said fusible element possessing sufficient ultimate strength at normal temperatures to maintain said members in juxtaposition, said fusible element losing sufficient strength when its temperature rises to a predetermined value that the biasing force exceeds the ultimate strength of said fusible element and such biasing force thereupon interrupting electrical contact between said members by tearing said fusible element apart and shifting said members away from each other to electrically insulated

relation to thereby interrupt current flow to said heating element.

2. A protective device for an electrical heating element of the type having a tubular metal sheath and a terminal pin extending outwardly from at least one end of said sheath, comprising a pair of juxtaposed metallic electrical conductive members extending from said terminal pin, at least one of which is formed of springy sheet metal, one of said conductive members being electrically connected to said terminal pin and the other being insulated from said terminal pin, and a fusible member clamping the ends of said conductive members together to establish a spring force urging said ends in a direction away from each other, said fusible member establishing electrical connection between said conductive members and fusing at a predetermined temperature to permit said spring force to move said ends apart and forcibly interrupt the electrical connection afforded by said fusible member.

3. A protective device for an electric heating element of the type having a tubular metal sheath and a terminal pin extending outwardly from at least one end of said sheath, comprising a first dielectric bushing having an aperture to pass said terminal pin so that one end surface of said bushing may be directed toward said one end of the sheath, an opposite end surface of said first bushing having a boss surrounding the bushing aperture, a first sheet metal conductive member having a transverse aperture to pass said bushing boss and a side surface bearing against said opposite end surface of said first bushing whereby said first metal member is insulated from said terminal pin, a second dielectric bushing having an aperture to pass said terminal pin and having one end surface positioned against the opposite side surface of said first metal member, a second sheet metal conductive member having an aperture to pass said terminal pin and having a side surface positioned against the opposite end surface of said second bushing, said second metal member having a portion in spaced juxtaposed relation with respect to a portion of said first metal member, means for holding the aforementioned assembly together and for holding said second metal member in electrical connection with said terminal pin, and a fusible loop extending about said spaced portions of said first and second metal members to establish electrical connection therebetween and to mechanically stress said spaced portions to establish a spring force tending to separate the same, said fusible loop weakening at a predetermined temperature whereby said spring force severs said loop to quickly break mechanical and electrical connection between said spaced portions.

4. A protective device for an electric heating element of the type having a tubular metal sheath and a terminal pin extending outwardly from at least one end of said sheath, comprising a first dielectric bushing having an aperture to pass said terminal pin and a recess in one end surface to receive said one end of the sheath, an opposite end surface of said bushing having a non-circular boss surrounding the bushing aperture, a first sheet metal conductive member having a non-circular transverse aperture complementary to and passing said bushing boss and a side surface bearing against said opposite end surface of said first bushing whereby said first metal member is insulated from said terminal pin, a second dielectric bushing having an aperture to pass said terminal pin and having a non-circular opening in one end surface complementary to and receiving the boss of said first bushing said one end surface of said second bushing being positioned against the opposite side surface of said first metal member, said second bushing having a slot in its opposite end surface extending cross-wise and intersecting the bushing aperture, a second sheet metal conductive member having an aperture to pass said terminal pin, a part of said second metal member being non-rotatably seated in the slot of said second bushing, said second

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metal member having a portion in juxtaposed spaced relation with respect to a portion of said first sheet metal member, a speed nut engaged on said terminal pin and non-rotatably seated in the slot of second bushing, said speed nut being forced against said second metal member to maintain assembly of the parts comprising the protective device and to hold said second metal member in electrical connection with said terminal pin, and a fusible loop extending about said spaced portions of said first and second metal members to establish electrical connection therebetween and to mechanically stress said spaced portions to establish a spring force tending to separate the same, said fusible loop weakening at a predetermined temperature whereby said spring force severs said loop to quickly break mechanical and electrical connection between said spaced portions.

5. A protective device for an electrical heating element of the type having a tubular sheath and a terminal pin extending outwardly from an open end of said sheath, comprising a pair of metallic electrically conductive members carried by said element, one member being electrically connected to said terminal pin and the other being electrically insulated therefrom, and a fusible member connected to said conductive members for passage of

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electrical current from one to the other and at a predetermined temperature holding portions of said conductive members in spaced relation against a biasing force tending to spring said portions apart, said fusible member weakening under predetermined higher temperature so that said biasing force severs it to interrupt passage of electrical current between said conductive members.

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