Jan. 21, 1969 G. J. SHOMPHE ETAL 3,423,574

ELECTRICAL RESISTANCE HEATING PAD

Filed Oct. 14, 1965

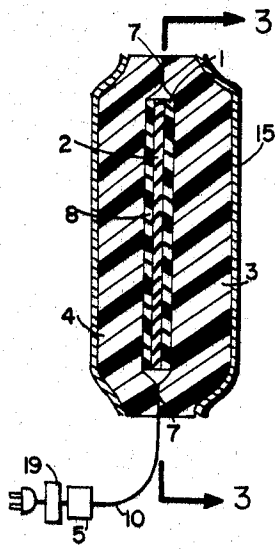

FIG. 1.

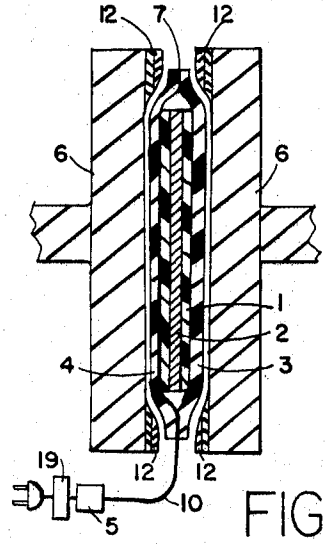

FIG. 2.

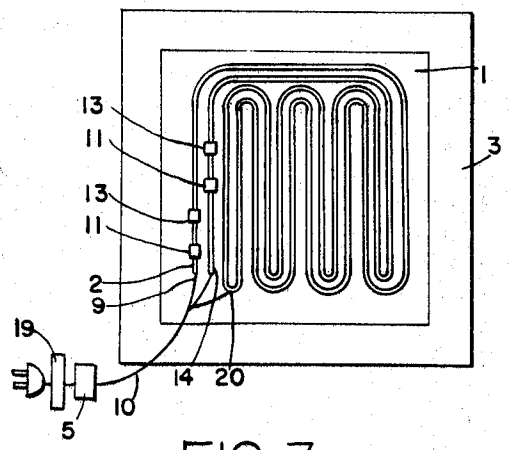

FIG. 3.

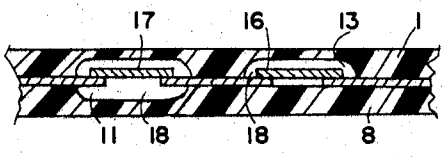

FIG. 4.

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United States Patent Office 3,423,574
Patented Jan. 21, 1969

3,423,574

ELECTRICAL RESISTANCE HEATING PAD

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Filed Oct. 14, 1965, Ser. No. 496,023
U.S. Cl. 219—528 5 Claims
Int. Cl. H05b 3/36

ABSTRACT OF THE DISCLOSURE

Articles are herein provided to form a flexible printed circuit type electrical resistance heating pad. The heating pad is comprised of an etched, resistance steel element encapsulated between flexible, dielectric sheets on both sides of which exists a covering of heat-expandable plastic. The heating element incorporates a thermostat to provide a maximum temperature level, and a thermal fuse which will permanently open the circuit in the event a critical operating temperature is reached. In addition, the power cable for the heating pad incorporates a voltage reduction transformer and a temperature control switch.

This invention relates to electrical resistance heating pads and to the use of a novel combination of printed circuits, heat-expandable vinyl plastics, flame-retardant dielectric insulation and thermal fusing means, whereby the safety, utility and comfort aspects of heating pads are generally improved.

Currently available electrical resistance heating pads employ an elongated electrical resistance wire that is strung back and forth through a padded fabric covering. The resistance wire is commonly covered with electrical insulation and asbestos. Hand assembly of the various components significantly adds to the cost of the finished product. Despite the padding, these prior art heating pads are lumpy and less flexible than desired. Also, constant use causes the asbestos and electrical insulation to crack, thus increasing fire and electrical shock hazards. Furthermore, conventional heating pads are susceptible to damage due to water and exposure to cleaning fluids and the like. Their use is therefore restricted, and considerable care is required in using and maintaining them.

Accordingly, it is a principal object of this invention to provide a new and improved electrical resistance heating pad.

It is another object of this invention to provide an electrical resistance heating pad that is safer and has greater utility than currently available articles.

It is another object of this invention to provide a heating pad which is smooth and flexible.

It is another object of this invention to provide an electrical resistance heating pad having a resistance heating circuit and insulation that will not deteriorate with use.

It is another object of this invention to provide an electrical resistance heating pad heater unit that is impervious to water and other outside agencies and that can be used in any environment and can be cleaned without damage to the electrical circuit and its insulation.

It is another object of this invention to provide an electrical resistance heating pad having a thermostat and a novel thermal fuse within the resistance heater unit.

It is another object of this invention to provide a novel method of fabricating articles of the type described.

These, together with other objects and features of the invention, will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings, in which like elements are given like reference numerals throughout, and in which:

FIG. 1 is a sectional view of a heating pad fabricated in accordance with the principles of the invention;

FIG. 2 is a sectional view illustrating one step in the fabrication of a heating pad comprehended by the invention;

FIG. 3 is a sectional view of FIG. 1 taken at 3—3; and

FIG. 4 is a detail illustrating the thermal fuse and thermostat arrangement comprehended by the invention.

A particularly significant constituent of the electrical resistance heating pad comprehended by the invention is a printed circuit type electrical resistance heater unit that is encapsulated in a flame-retardant or non-inflammable dielectric such as polychlorotrifluoroethylene, fluorinated ethylene propylene copolymer or the like. Such a heater unit is not only impervious to adverse outside environmental conditions but also greatly reduces the possibility of short-circuiting, electrical shocks and fire hazards due to continued flexing and wear. The printed circuit type of heater unit eliminates the problem of a lumpy, uncomfortable surface that is characteristic of the prior art heating pads. Furthermore, the particular type of flame-retardant or non-inflammable dielectric within which the heater unit is embedded is intended to be pliable, thus providing a convenient flexible padding. Another feature of the invention comprehends the inclusion within such a novel electrical resistance heater unit of both thermostat means and a novel thermal fuse. Because of the nature of the construction of the heater unit comprehended by the invention, neither thermostat nor thermal fuse result in undesirable lumps in the surface of the heating pad.

Referring now to FIG. 1, there is illustrated thereby a heating pad fabricated in accordance with the principles of the invention. The heating pad of FIG. 1 includes electrical resistance heating circuit **2** which is encapsulated between flexible dielectric sheets **1** and **8**. Electrical resistance heater circuit **2** may be thin sheet steel or any other appropriate resistive material. Although any appropriate flexible plastic or other material may be used for dielectric sheets **1** and **8**, a presently preferred embodiment comprehends the use of a polyvinyl chloride acetate copolymer. It is also comprehended by the invention that such polyvinyl chloride acetate copolymer include a flame-retardant constituent such as antimony trioxide. The heating pad illustrated in FIG. 1 also includes a covering of heat-expandable plastic, as illustrated by reference numerals **3** and **4**. Such a heat-expandable plastic may be, for instance, the material sold by Plymouth Rubber Company, Canton, Mass., under the trade name of "Elastic Ply Hide." Other resilient materials are of course also comprehended by the invention. Such materials include, but are not limited to, vinyl impregnated cotton fibre and polyurethane foam. Sheets **3** and **4**, which may be heat-expandable plastic or other resilient material as indicated above, are fixed to the electrical resistance heating unit and are also fixed together by an appropriate adhesive **7**. In the illustrative embodiment of FIG. 1 an electrical cable **10** connects the electrical resistance heater circuit **2** to the low-voltage side of transformer **19** through control means **5**. Transformer **19** is used to step the 115-volt house supply voltage down to a safe 24 volts. Controls **5** include a switch which may select either or both of the two heating circuits hereinafter described in relation to FIG. 3. Such selection by the control means provides low, medium or high heat. It is also intended that a decorative covering **15** be applied to the outer surface of the heating pad. In another embodiment of the invention (not illustrated in the drawings) the heating pad utilizes the 115-volt house supply direct.

Referring now to FIG. 2, there is illustrated thereby means for fabricating the above-described electrical resistance heating pad. Heat-expandable plastic sheets **3** and **4** are illustrated in an unexpanded condition. The sheets may be coated on their adjacent surfaces with a suitable adhesive **7** and applied to the plastic-covered

heating element. A press **6** may be used to apply the proper pressure to create a permanent bond between the heat-expandable plastic and the heater unit. It may be desirable to heat seal the outer edges or outer periphery of the heating pad. This may be accomplished by peripheral heater units **12** used in conjunction with press **6**. When the heat-expandable plastic sheets have been securely adhered to the heater unit as illustrated in FIG. 2, the proper amount of heat may be applied externally to the heat-expandable plastic sheets **3** and **4**. Upon such heating, sheets **3** and **4** expand to the proportions illustrated in FIG. 1. It is another feature of the invention that the heat-expandable plastic may be put into its expanded condition merely by plugging the heater unit into an electrical outlet, thus eliminating the step of externally applying heat referred to above. Alternatively, a high initial voltage may be applied to provide sufficient heat to expand the plastic.

Referring now to FIG. 3, there is illustrated thereby the electrical resistance heater circuit **2**. This circuit is provided by laminating a thin sheet of steel or other appropriate resistive material onto dielectric sheet **1**. Conventional printed circuit techniques are then employed to define the circuit and etch away the unwanted metal. The particular circuit of FIG. 3 includes a first circuit **9** and a second circuit **14** having a common terminal **20**. Circuits **9** and **14** may have different resistance values. Controls **5** are adapted to connect either circuit **9** or **14** or the combination thereof to the 24-volt output of transformer **19**. Also comprehended by the invention are heating pads having any number of discrete circuits of predetermined resistances. Various temperature ranges may be selected by suitable switching means. Such an embodiment is applicable as well to heating pads designed to operate directly on 115-volt house current. After these circuits have been etched, a second dielectric sheet **8** is laminated over the etched circuit to thereby effectively seal such circuits within a plastic container. As illustrated in FIG. 3, each heater circuit includes a thermal fuse **11** and a thermostat **13**.

Referring now to FIG. 4, said thermostat and thermal fuse are illustrated in greater detail. A pocket **18** is provided in dielectric sheets **1** and **8** to accommodate the thermal fuse and thermostat. Thermal fuse **11** consists of a break in the heater circuit element that is bridged by a heat-fusible link **17**. In the present invenion the heat-fusible link **17** comprises an alloy of 48% tin and 52% indium. Such an alloy will fuse at 117° centigrade, which is desirable for most applications. Various other alloys having different fusing temperatures may of course be used for any given application. Heat-fusible link **17** is also coated with a wetting agent such as any resinous material. The purpose of this resinous coating is to cause the fused material of link **17** to coagulate or ball up when the material becomes fluid, thus insuring a rapid and complete break in the electrical circuit. Thermostat **13** may comprise simply a bimetal strip **16** which also bridges a gap in the heater circuit. When a certain temperature is reached, bimetal strip **16** will bend, thus opening the electrical circuit and shutting off the heater circuit.

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

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. An electrical resistance heating pad comprising a first sheet of flexible flame-retardant dielectric material, a thin, flexible sheet steel electrical resistance printed circuit laminated thereto, a second sheet of flexible flame-retardant dielectric material laminated to said resistance circuit and to said first sheet of flexible flame-retardant dielectric material so as to encapsulate said electrical resistance printed circuit, a bimetallic thermostat embedded within said first and second sheets of dielectric material and forming an integral part of said electrical resistance printed circuit, a thermal fuse embedded within said first and second sheets of dielectric material and forming an integral part of said resistance circuit, and a covering of foam-like plastic material surrounding said circuit and said sheets of dielectric material.

2. An electrical resistance heating pad as defined in claim **1** wherein said first and second sheets of flexible flame-retardant dielectric material are fabricated of polyvinyl chloride acetate copolymer and antimony tri-oxide.

3. An electrical resistance heating pad as defined in claim **1** wherein said thermal fuse comprises a heat-fusible link in bridging relationship with a severed portion of said electrical resistance circuit.

4. An electrical resistance heating pad as defined in claim **3** wherein said heat-fusible link comprises an alloy of 48% tin and 52% indium.

5. An electrical resistance heating pad as defined in claim **4** wherein said heat-fusible link is provided with a coating of resinous material.

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U.S. Cl. X.R.

219—543, 517; 338—211; 337—168, 184, 405