Sept. 24, 1957 A. C. BOGGS ET AL 2,807,696

ELECTRIC HEATING DEVICES

Filed Jan. 7, 1953

Fig. 1

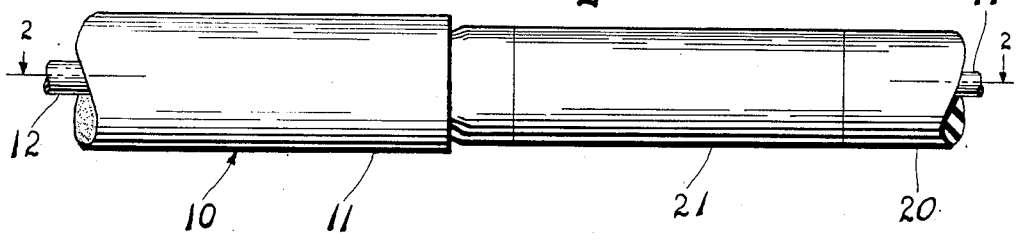


Fig. 2

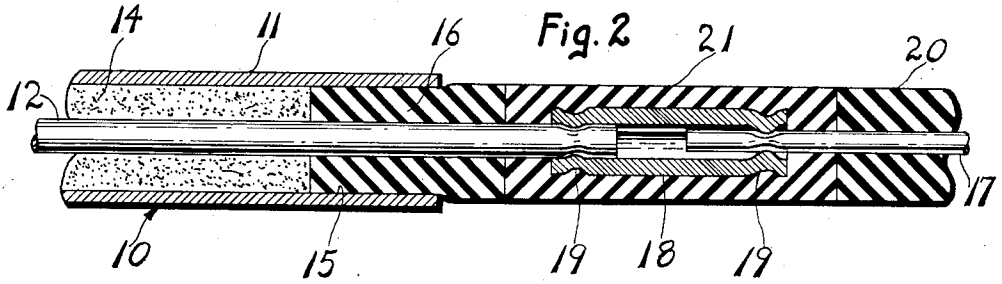


Fig. 3

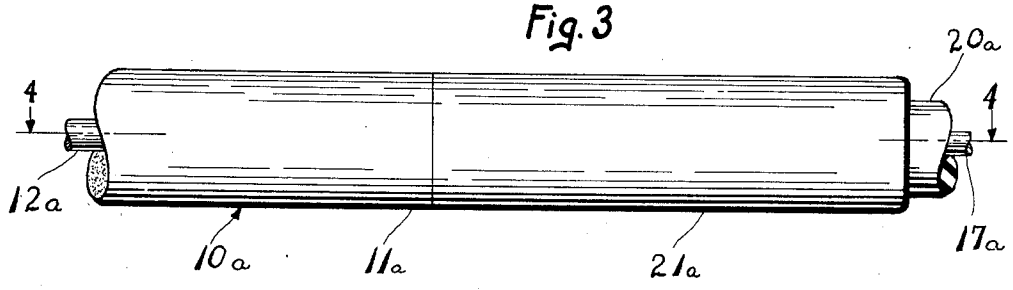
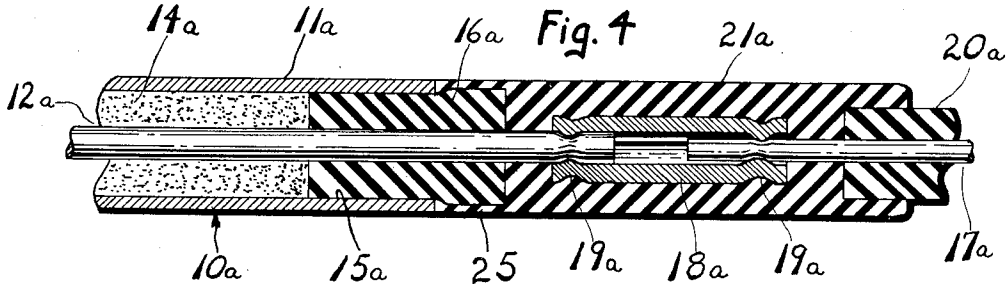


Fig. 4



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ELECTRIC HEATING DEVICES

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1 Claim. (Cl. 201—67)

My invention relates to electric heating devices, particularly to such devices which are sealed against entrance of deleterious matter, and the principal object of my invention is to provide new and improved devices of this character.

My invention is particularly adaptable for use with an electric heating device of the sheathed type comprising a resistor and a sheath enclosing the resistor, the latter being electrically insulated from the sheath by suitable electrical-insulating, heat-conducting means. The invention provides means for sealing the ends of heating devices and also provides means for electrically connecting the heating device to a source of electrical current, the electrical connection between the terminal of the resistor and the conductor wire being adequately protected against shorting and against action of deleterious matter which may be in close relation to the device.

In this respect, the heating device is admirably suited for use where humidity or moisture conditions prevail, such as, for example, for use as a defroster element in refrigeration apparatus.

In the drawing accompanying this specification and forming a part of this application, there are shown, for purposes of illustration, several embodiments which my invention may assume, and in this drawing:

Figure 1 is a broken elevational view of a heating device disclosing one embodiment of my invention,

Figure 2 is a sectional view corresponding generally to the line 2—2 of Figure 1,

Figure 3 is a broken elevational view of a heating device disclosing another embodiment of my invention, and

Figure 4 is a sectional view corresponding generally to the line 4—4 of Figure 2.

With particular reference to Figures 1 and 2 of the drawing, the embodiment of the invention therein disclosed comprises an electric resistance heater **10** having a sheath **11**, preferably of metal, and a resistor (not shown) electrically connected to a terminal pin **12**.

Suitable refractory material **14** embeds the resistor and the inner end of the terminal pin **12** and serves both to electrically insulate the resistor and the pin and also to conduct heat from the resistor to the sheath. The refractory material stops short of, or is routed out from, an end of the sheath to form an opening **15**, and the resistor terminal extends through such opening and outwardly of the sheath.

An apertured plug **16** is disposed about the terminal **12** and within the opening **15**, and the plug may have a portion extending outwardly of the opening. As presently preferred, the sheath **11** is of a transverse size, at least adjacent the opening **15**, so that the plug **16** may be inserted into the opening without requiring a great amount of force. Thereafter, the sheath, at least adjacent the opening **15**, is subjected to a swaging operation so as to reduce its transverse size and thereby compress the plug **16** into sealing engagement with adjacent surfaces of the opening **15** and the terminal **12**.

In some cases the sheath is subjected to a swaging operation throughout its active length in order to compress and adequately compact the refractory material, and in such cases the end of the sheath may be simultaneously swaged to effect sealing of the plug **16**. It has been found that the swaged plug provides an adequate seal for the sheath not only effective for subsequent forming operations on the sheath but also effective generally throughout the life of the heating device, and that the plug prevents entrance of moisture and other deleterious matter which otherwise would impair the usefulness of the heating device.

The plug **16** may be formed of any suitable material which lends itself to the compressive sealing action caused by swaging, and at present it is preferred to form the plug of a suitable rubber material. As seen in Figure 2, an end of the terminal **12** extends beyond the outer end of the plug **16**, for a purpose to appear.

An electrical conductor **17**, securable in any suitable manner to a source of electrical current, is electrically connected to the terminal **12**, and as herein disclosed, a tubular member **18**, of electrical conducting material, is formed to generally closely receive, in its opposite ends, the terminal **12** and the conductor **17**, and the opposite ends of the member **18** are swaged or suitably indented, as shown at **19**, to electrically and mechanically bond the terminal and conductor to the member.

The conductor is provided with electrical insulation **20** and in the present embodiment such insulation is preferably a rubber material.

Electrical insulation **21** is disposed about the electrical connection formed by the member **18** and such insulation is connected to the plug **16** and the insulating covering **20** in sealing relation to protect the electrical connection. In the present embodiment, it is preferred to form the insulation of rubber material and to mold it about the electrical connection and vulcanize it to the plug **16** and to the insulating covering **20**.

As best seen in Figure 2, the insulation **21** spans the space between the opposed faces of the plug **16** and insulating covering **20** and is vulcanized to such faces. It is preferred that the transverse sizes of the plug **16**, the insulating covering **20**, and the insulation **21** do not materially exceed the transverse size of the sheath **11** and in the embodiment shown in Figure 2 the plug, insulating covering and the insulation are of a diameter equal to, or slightly less than the diameter of the sheath so that the protective insulation at the end of the sheath will in effect be a continuation of the sheath. Thus, bulky protective and insulating means are eliminated and the heating device may be used in constructions having space limitations.

It will be further appreciated that the lead from the sheath possesses flexibility and may be flexed to suit space limitations without subjecting the heating device to deleterious infiltration of harmful matter. This is an important feature of the invention since devices used in cases such as for refrigeration defrosting must be absolutely sealed to guarantee against harmful shorting of the electrical connection to a part of the refrigerator.

The embodiment of the invention shown in Figures 3 and 4 is similar to that shown in Figures 1 and 2, and like parts are designated by like reference numerals supplemented by the suffix "*a*." In this embodiment, the insulation **21***a* is molded about the plug **16***a* to provide a tubular portion **25** which is also vulcanized to the plug. Further, in this embodiment, the transverse size of the insulating covering **20***a* is less than the transverse size of the insulation **21***a* and the latter is molded about and vulcanized to the covering **20***a* to enhance the sealing effect.

It will be appreciated that the material forming the

plug, insulation and insulating covering may be of a rubber to suit requirements, and that natural or synthetic rubber, or rubber-like plastics, may be used where conditions dictate.

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 embodiments 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.

We claim:

An electric heating device, comprising an electric resistance heater including a tubular metallic sheath enclosing a resistor terminal pin extending axially thereof and embedded in a surrounding heat conducting refractory material, said refractory material terminating short of an end of said sheath and partially defining an opening in said sheath through which said terminal pin projects axially outwardly therefrom, a cylindrical deformable compressible plug of rubber material having its inner end disposed in said sheath opening and surrounding the projecting end of said terminal pin, the end wall of said sheath surrounding said opening being of contracted reduced diameter to exert pressure laterally inwardly against the outer cylindrical wall of said plug to radially compress the plug and hold it in fixed sealing position against the inner surface of said sheath wall and to hold the plug material in sealing engagement with the outer surface of said terminal pin, a conductor wire having an electrically insulating covering, said wire having electrical connection with said terminal pin, and insulating means disposed around said electrical connection, opposite ends of said insulating means being sealed to and respectively abutting against the outer end wall of said plug and the inner end of said insulating covering of said conductor wire, said insulating means being of a transverse size not materially exceeding the transverse size of said sheath.

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