

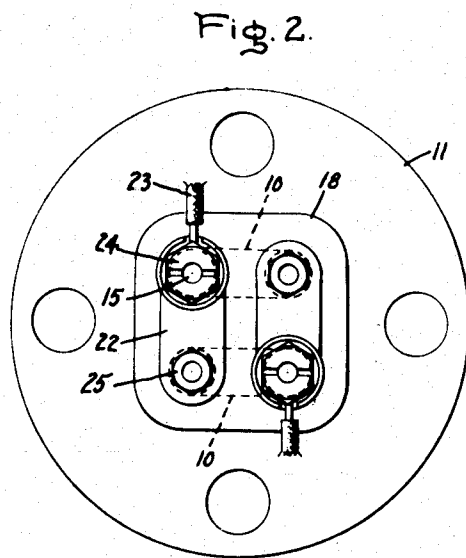
April 18, 1939.

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2,155,239

ELECTRIC HEATER

Filed May 15, 1936



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# UNITED STATES PATENT OFFICE

2,155,239

## ELECTRIC HEATER

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Application May 15, 1936, Serial No. 79,887

### 1 Claim. (Cl. 201—64)

This invention relates to electric heaters, more particularly to electric heaters of the metallicly sheathed type, and it has for its object the provision of an improved terminal structure for heaters of this character which is electrically and mechanically strong and which is impervious to moisture and dirt.

Although this invention has other applications, it is particularly useful in connection with electric immersion heaters of the type having an encased or sheathed heating unit in which an insulated resistance conductor is enclosed in an outer metallic protective casing. One immersion heater of this type is described and claimed in the United States Patent to C. C. Abbott, No. 1,522,992, dated January 13, 1925.

As there described, the heater is formed into the shape of a hair pin so that its terminal ends are adjacent each other. Some difficulty has been experienced with heaters of this type due to electrical break-down of the terminals during severe electrical storms, such as occur, for example, in the southern states of the United States.

It is an object of this invention to increase materially the electrical strength of the terminals of electrical heaters, especially those of the immersion type referred to above. At the same time, this invention contemplates a mechanically strong terminal construction, and one that is moisture and dirt proof.

In accordance with this invention, the ends of the sheath and the terminals projecting therefrom are embedded in a substantially homogeneous mass of electrically insulating and sealing material. It is contemplated that this mass of material have a high electrical resistance and also a relatively great mechanical strength.

For a more complete understanding of this invention, reference should be had to the accompanying drawing in which Fig. 1 is a fragmentary elevation of an electric heater embodying this invention, portions being broken away and portions shown in section so as to illustrate certain details of construction; and Fig. 2 is an end elevation of the electric heater of Fig. 1.

Referring to the drawing, I have shown my invention in one form in connection with an electric immersion heater of the type described and claimed in the above-mentioned Abbott patent. This heater is provided with a pair of sheathed heating units 10 mounted in a suitable supporting member 11. The heating units 10 have substantially the same construction, and each heater, as shown, is of the helical coil sheathed type,

described and claimed in the United States Patent to C. C. Abbott No. 1,367,341, dated February 1, 1921. Briefly, each heater comprises an outer metallic sheath 12 in which a helical, electrical resistance conductor 13 is embedded in a compacted mass of powdered heat refractory, electrically insulating material 14, such as magnesium oxide. The resistance conductor 13 has its ends secured in any suitable manner to electrical terminals 15 which project from the ends of the sheath and which have their inner ends, as shown, embedded in the insulating mass 14. Such units can be bent easily into any desired shape. In the immersion heater shown, each heating unit is bent substantially in the form of a hairpin. Clearly, various other arrangements and configurations of the heating unit may be used.

The ends of each hairpin heating unit 10, as shown, are directed through suitable spaced apertures 16 provided for them in the metallic supporting member 11 so as to pass through from one side to the other of the supporting member, and so as to project somewhat beyond the latter side of the member, as clearly shown in Fig. 1. The passageways 16, as shown, have enlarged portions 16a, in which suitable bushings 17 are wedged to secure the heating unit rigidly to the supporting plate 11.

The projecting ends of the two heaters and the portions of the terminals projecting from these ends adjacent the ends of the heaters are completely embedded in a single, substantially homogeneous, mechanically strong and electrically insulating disc-shaped mass of sealing material 18. This mass of material 18 preferably will be formed of a suitable phenol condensation product.

Preferably, the bushings 17 will be so proportioned that their outer faces will not extend to the outer face of the support 11, but will fall short thereof so as to provide shallow recesses 19. These recesses will be filled with the insulating sealing material 18. These recesses assist in anchoring the insulating mass.

Also, it is preferable that the mass of powdered insulating material 14 in the sheath come substantially close to the ends of the sheath, but not quite to these ends, so that relatively shallow cup-shaped recesses 20 are provided in the ends. These recesses also are filled with the insulating sealing material so that the exposed portions of the insulating material 14 at the sheath ends are completely covered by the

sealing material. This arrangement eliminates air spaces at the surfaces of the insulating material 14, and thereby increases the electrical strength of the heater.

Secured to the outer ends of the terminals 15 are terminal connection members 21 shown to be in the form of nuts threaded to the terminals. The lower ends of these members 21, as shown, are knurled and these knurled portions are embedded in the insulating mass 18 so as to secure the members 21 rigidly to the terminals, and so as to insulate them from each other.

In making the electric heater thus far described, it will be understood that the heating units 10 will be constructed in the form of hair-pins, and their ends will be projected through the apertures 16 provided for them in the support 11 and secured to the support by means of the bushings 17. Previous to this the ends of the sheath will be reamed out to provide the recesses 20. Then the terminal members 21 will be threaded on the terminals. After this, the mass of insulating material 18 will be applied. This insulating material may be applied in any suitable fashion, but preferably will be applied automatically in a suitable molding machine.

As shown in Fig. 2, the corresponding terminals of the two heaters 10 are electrically connected by means of terminal jumpers or strips 22, while the pair of opposite terminals are electrically connected to a source of electrical supply (not shown) by means of leads 23. Relatively large nuts 24 are threaded on the ends of these terminals to secure the leads, while relatively small nuts 25 secure the jumpers to the opposite pair of terminals.

It will be observed that the mass of insulating and sealing material 18 projects for a material distance from the metallic plate 11. Thus, it forms a sealing mass embedding the ends of the sheath and the terminals to remove the terminals electrically from the sheath 12 and the supporting plate 11, as well as from each other.

Moreover, it will be observed that the insulating mass 18 covering the exposed ends of the insulating material 14, and embedding the ends of the sheath and the terminal portions which project from the sheath completely seals the heating unit against the admission of moisture and dirt.

It is also to be noted that the insulating mass 18 is anchored solely by the support 11, the projecting ends of the sheath, the terminals and terminal connector members 21, the adherence of the insulating mass to these members constituting the sole supporting means for the mass.

The connector members 21 are rigidly secured by the insulating mass. This arrangement with those in use heretofore. The electrical superiority is particularly noticeable in those sections of the country where severe electrical storms occur. Previous to this invention, difficulty was experienced by electrical break-down of the terminals. This invention has obviated this difficulty.

It has been found that my terminal seal is superior mechanically and also electrically to those in use heretofore. The electrical superiority is particularly noticeable in those sections of the country where severe electrical storms occur. Previous to this invention, difficulty was experienced by electrical break-down of the terminals. This invention has obviated this difficulty.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claim to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

An electric heater comprising a resistance conductor, a metallic sheath encasing said conductor having its ends adjacent each other, terminals within the end portions of said sheath connected with said resistance conductor and projecting from said ends, a mass of electrically-insulating, heat-conducting material embedding said resistance conductor and the inner ends of said terminals, said mass extending not quite to the ends of said sheath so as to leave shallow cup-shaped recesses in said ends, a metallic support having spaced apertures extending through it through which the ends of said sheath are passed from one side to the other of said support so as to project beyond the latter side of said support, a single, substantially homogeneous disc-like mass of electrically-insulating sealing material molded on said side and projecting therefrom to embed the projecting ends of said sheath and the terminals projecting from said ends and so as to fill said recesses in said sheath, and terminal members having exterior knurled portions secured to said terminals spaced from the ends of said sheath and having said knurled portions embedded in said molded mass of insulating sealing material, the sides and outer surfaces of said mass of insulating material being exposed and the adherence of said mass to said side of said support, and the portions of said sheath, terminals and terminal members embedded thereby constituting the sole supporting means for said mass.

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