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F. E. FINLAYSON

2,043,196

ELECTRIC HEATER

Original Filed Nov. 11, 1932

Fig. 1.

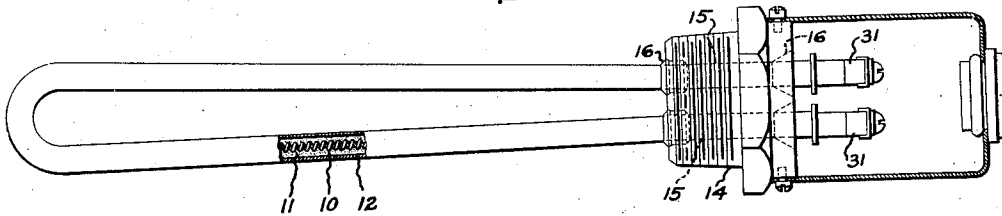


Fig. 2.

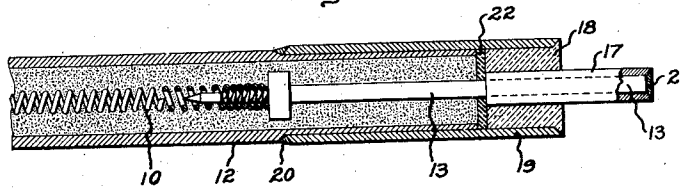
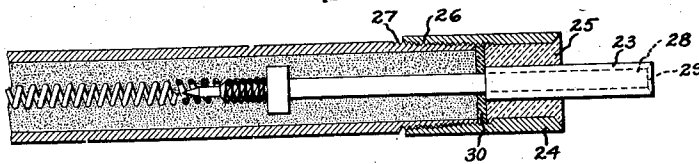


Fig. 3.



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ELECTRIC HEATER

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Original application November 11, 1932, Serial
No. 642,256. Divided and this application Sep-
tember 17, 1935, Serial No. 40,899

3 Claims. (Cl. 201-67)

My invention relates to electric heaters, and it has for its object the provision of an improved method for sealing the terminals of heaters of this type.

Although not limited thereto, my invention has particular application to electric heaters of the incased or sheathed type wherein a resistance conductor embedded in an insulating material is inclosed by an outer metallic protective casing.

In one of its aspects, my invention contemplates the provision of improved means for sealing the terminals of electric heaters of the sheathed type whereby the heaters are rendered impervious to moisture, oil, gas and like fluids.

In accordance with my invention, I place a tubular member, which preferably will be formed of metal, over each terminal of the heater, and provide a fluid impervious joint between the terminal and the tubular member. Surrounding the tubular member is a layer of vitreous material which is arranged to make a fluid impervious joint with it. The vitreous layer is surrounded by a separate casing which has a fluid-impervious joint with the vitreous layer, and also a fluid impervious joint with the sheath provided for the heater.

This application is a division of my copending application, Serial No. 642,256, filed November 11, 1932, and assigned to the same assignee as this invention.

For a more complete understanding of this invention, reference should be had to the accompanying drawing in which Fig. 1 is an elevation of a sheathed electric heater provided with terminal seals arranged in accordance with this invention; Fig. 2 is an enlarged fragmentary sectional view of the electric heater of Fig. 1 illustrating a terminal seal arranged in accordance with this invention and used in the heater of Fig. 1; and Fig. 3 is an enlarged fragmentary sectional view of a heater embodying a modified form of this invention.

Referring to the drawing, this invention has been shown as applied to a helical coil sheathed electrical heating unit of the type described and claimed in United States Patent No. 1,367,341 to C. C. Abbott, dated February 1, 1921, and particularly intended to be used as an immersion heater.

As shown, the heating unit comprises a helical resistance conductor 10 embedded in a compacted mass of powdered heat refractory insulating material 11, the conductor and insulating material being incased by a metallic sheath 12. The insulating material 11 may be any suitable substance, but preferably will be formed of powdered

magnesium oxide. This material may be compacted to a hard dense mass having a good heat conductivity in any suitable manner, such as by reducing the diameter of the sheath after the unit has been assembled and the sheath has been loaded with the magnesium oxide. The sheath may be reduced by swaging or rolling.

The resistance conductor 10 extends through a considerable portion of the length of the sheath 12 and has its two ends connected to terminal members 13 which project from the ends of the sheath. While the conductor may be connected to its terminals 13 in any suitable manner, I prefer to connect them in the fashion described and claimed in United States Patent No. 1,494,938 to C. C. Abbott, dated May 20, 1924. As there described, the terminal members 13 have their inner ends threaded and are electrically and mechanically connected with the resistance conductor by screwing a number of the end turns of the conductor onto the threaded ends of the terminals. In this arrangement the terminals may have a diameter slightly larger than the diameter of the helix of the conductor 10. As shown (Figs. 1 and 2), each terminal 13 projects somewhat from its end of the sheath and is supported at its inner end by the compacted insulating material 11.

Heating units of this type can be bent easily into any desired shape. In the immersion heater shown, the heating element is bent substantially in the form of a hairpin. The adjacent ends of the heating element are received by a suitable supporting member 14 which may be in the form of a plate, or which may be in the form of a threaded plug (as shown) arranged to be received in a threaded aperture provided for it in a wall or supporting plate of a receptacle or other device.

A pair of spaced apertures 15 are provided in the supporting member 14 for receiving the two ends of the heating element. As shown, the ends of the heating element are inserted within the passageways 15 so as to project somewhat beyond the plate on the opposite side thereof.

As pointed out in detail in my above-mentioned copending application, suitable fluid impervious joints are effected between the heating elements and its supporting plug 14. As shown, at the points where the ends of the heater enter and emerge from the plug 14, fluid-tight seals are provided which may be formed by brazed joints 16 between the sheath and the plug. For this purpose, the apertures or holes 15 in the plug 14 are provided at their ends with recesses which

serve to receive suitable brazing material providing the fluid-tight joints between the sheath ends and the plug.

In order to render the terminals absolutely impervious to the leakage of fluids into the sheath, I surround each terminal 13 with a tubular member 17 which has an internal diameter slightly larger than the diameter of the terminal so as to leave a relatively small annular space between these members. Surrounding this tubular member 17 is a substantially homogeneous mass of vitreous material 18, such as a high temperature glass arranged to adhere to the tubular member to form a fluid impervious joint with the member. Surrounding the mass of glass 18 is a metallic casing 19 which in turn surrounds the terminal end portion of the sheath, and which is secured to the sheath by a fluid-impervious joint 20. The glass 18, the tubular member 17 and casing 19 will have such coefficients of expansion that the glass will have fluid impervious joints with the tubular member and casing.

Between the end of each terminal 13 and its surrounding tubular member 17 is a suitable fluid-impervious joint 21.

Interposed between the glass seal 18 and the end of the sheath 12 and the insulating material 16 is an insulating washer 22 formed of any suitable electrically insulating material, such as mica. This material increases the insulation between the terminal 13 and sleeve 17 and the sheath 12. Preferably, the centrally arranged aperture in the washer will have a diameter substantially equal to the diameter of the terminal 13.

It will be understood that in making the terminal seal, each terminal sleeve or tubular member 17 is arranged in substantially concentric relation with its casing 19. The terminal sleeve 17 is assembled with the tubular member 19 and with a tube (not shown) formed of the glass sealing material 18 in substantially the same positions relative to each other that they will occupy in the finished heater, shown in Fig. 2.

Then the assembly is heated to a temperature at which the glass becomes soft. The glass is then compressed until it completely fills the space between the tubular members 17 and 19 so that upon subsequent cooling it will adhere to these members to make fluid impervious joints with them. Preferably, the tubular members 17 and 19 will be cleansed before the glass 18 is applied, as by means of sand blasting or suitable machining operations.

The unitary structure comprising the tubular members 17 and 19 and the glass 18 adhering to them is then assembled with the heater so that the terminal 13 of the heater is received in the tubular member 17 and so that the tubular member 19 embraces the terminal end of the sheath. The outside diameter of that portion of the sheath which is received by the member 19 may be reduced somewhat, as indicated in Fig. 2, the internal diameter of the member 19 being substantially the same as the diameter of the sheath portion to which it is fitted. The tubular member 19 is sealed to the sheath 12 by means of a brazed, soldered or welded fluid impervious joint 20. The end of the tubular member 17 is brazed or otherwise connected with the end of the terminal 13 so as to form the fluid-tight joint 21. As shown, the outer end of the tube 17 is counter-sunk so as to provide a well or cup in which the brazing or soldering material is received.

When the washers 22 are used, they will be threaded over the terminals 13 before the seals are assembled with the heater.

The tubular member 17 performs an important function when the tube 19 is being brazed to the sheath 12. During this process the sheath 12 and tube 19 are heated which causes the air in the sheath to expand. The tubular member 17 provides a path through which this air can escape, the seal 21, of course, not being formed at this time. Unless the air were thus permitted to escape, it would tend to bubble out through the brazing material forming the joint 20 which is objectionable.

Instead of being sealed to the sheath by brazing, soldering, etc., the tubular member surrounding the glass may have a threaded connection with the sheath so as to provide a fluid-tight joint, as shown in Fig. 3. In this arrangement, the terminal sleeve 23, the surrounding tubular member 24 and the glass sealing material 25 between these members are arranged in substantially the same fashion as are the corresponding elements 17, 19 and 18 of Fig. 2. In Fig. 3, however, the tubular member 24 is provided with an internal threaded portion 26 arranged to be screwed on a corresponding threaded portion 27 provided on the terminal end of the sheath. A suitable sealing compound may be placed on the cooperating threads between the casing 24 and the sheath.

It will be understood that here again the terminal sleeve 23 will be connected or joined with the terminal 23 by means of a brazed joint 29.

And here also it is preferable to thread a mica washer 30 over the terminal before the seal is assembled with the heater.

In this heater it is not necessary to vent the sheath when the tube 24 is applied to it, and for this reason, the member 23 need not be in the form of a tube. It may be a solid member having a hole in it for receiving the terminal, and having its outer end closed. This arrangement obviates the necessity of the brazed joint 29.

After the tubular members of either form have been brazed to the terminals, suitable terminal connector members 31 (Fig. 1) may be attached to the sleeves which are of such a length that they project outwardly somewhat beyond the glass sealing material, as shown. These connectors may be secured to the sleeves in any suitable manner.

It is to be understood that it is not necessary to use glass for the sealing material 18, 25, but that any other suitable material such as vitreous enamel may be used. It is important, however, that the glass or other sealing material have a high electrical resistance at the operating temperatures of the terminals.

It will be observed that I have provided a terminal seal which comprises a tubular member 17, 23 surrounding the terminal of the heater, this member in turn being surrounded by a substantially homogeneous layer 18, 25, of glass which makes fluid impervious joints both with this tubular member and with the surrounding casing 22, 24. The tubular member 17, 23 surrounding the terminal is joined with it by means of a fluid impervious joint 21, 29.

The terminal seals of my invention effectively prevent the admission of fluids into the sheath. It is to be understood, however, that they may be used just as effectively to retain a selected atmosphere in the sheath, such as an atmosphere for preserving the life of the resistance heating

element. Thus, for example, the seals may be used to retain a non-oxidizing or reducing atmosphere in the sheath to protect the heating element.

5 While I have shown particular embodiments 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 claims to cover
10 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:—

1. The method of sealing the terminal end of
15 an electric heater provided with a resistance conductor, a terminal and a metallic sheath incasing said conductor which comprises placing a metallic tubular member within a second tubular member of larger diameter in substantially
20 concentric relation therewith, filling the space between said tubular members with a vitreous sealing material, heating said vitreous material to soften it and applying pressure to cause it to adhere to said tubular members, assembling said
25 tubular members to said heater so that said terminal is received within the inner tubular member, and then effecting a fluid impervious joint between the outer tubular member and said sheath.

30 2. The method of sealing the terminal end of an electric heater provided with a resistance

conductor, a terminal and a metallic sheath incasing said conductor which comprises placing a metallic tubular member within a second tubular member of larger diameter in substantially concentric relation therewith, filling the
5 space between said tubular members with glass, heating said glass to soften it and applying pressure to cause it to adhere to said tubular members, assembling said tubular members to said
10 heater so that said terminal is received within the inner tubular member, and then brazing said outer tubular member to said sheath and said inner tubular member to said terminal.

3. The method of sealing the terminal end of
15 an electric heater provided with a resistance conductor, a terminal and a metallic sheath incasing said conductor which comprises placing a metallic tubular member within a second tubular member of larger diameter in substantially concentric relation therewith, filling the space be-
20 tween said tubular members with glass, heating said glass to soften it and applying pressure to cause it to adhere to said tubular members, assembling said tubular members to said heater so
25 that said terminal is received within the inner tubular member, threading said outer tubular member on said sheath so as to effect a fluid-tight joint between said members and then brazing said inner tubular member to said terminal.

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