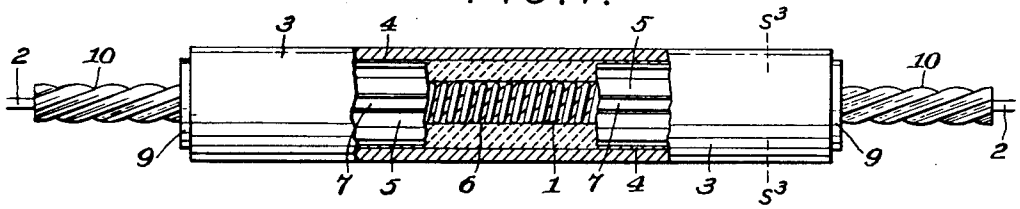
May 19, 1953 I. G. GLENN 2,639,359

ELECTRIC HEATER

Original Filed May 31, 1949

FIG. 1.



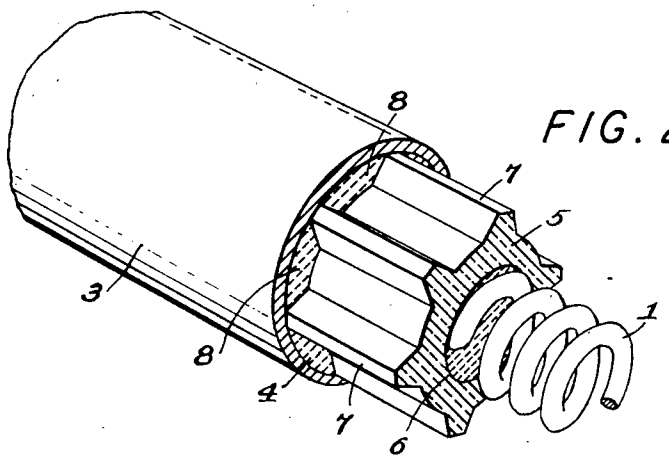


FIG. 2.

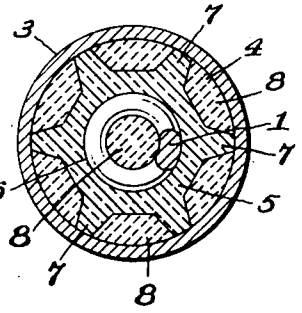


FIG. 3.

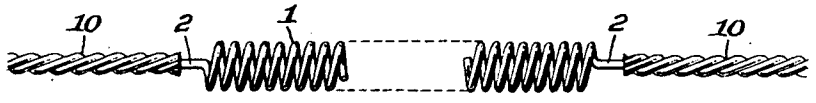


FIG. 4.

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ELECTRIC HEATER

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Original application May 31, 1949, Serial No. 96,185, now Patent No. 2,577,080, dated December 4, 1951. Divided and this application September 25, 1951, Serial No. 248,197

3 Claims. (Cl. 201—67)

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This invention relates to electric heaters and more particularly to certain improved structural features by which production is greatly facilitated and expedited and the heater produced is freed of objectional defects of present-day heaters and possesses important points of superiority over the same. This is a division of my pending application Ser. No. 96,185, filed May 31, 1949, now Patent No. 2,577,080.

The lengthy operation, under present practice, of entering and packing granular insulating material in and around the helically-wound resistor element and in the annular space between it and the surrounding tubular metal jacket, is largely avoided in carrying the invention into effect. This is accomplished by the use of a preformed tube of chalky porcelain or other suitable material, proportioned to snugly receive the resistor element in the bore thereof and fill the greater portion of the space between it and the inner surface of the enclosing metal jacket. This insulating tube is preferably given a ribbed formation externally, the ribs extending lengthwise thereof and radially outward to meet the inner wall of the jacket. Thus constructed and arranged, the tube serves to hold the resistor element accurately and firmly centered in the jacket and against displacement and resulting hot spots and burn-outs. The remaining unoccupied space within the jacket is thus reduced to the bore of the resistor winding and the channels between the ribs of the insulating tube, the filling of which, in the usual manner, with powdered magnesite or like material, is effected in a comparatively short time. The final step of contracting the metal jacket by machine swaging crushes the ribs of the insulating tube and compresses and compacts the body thereof and the filling material solidly in and about the resistor.

A second feature of improvement consists in utilizing integral extensions of the resistor winding as the terminals thereof, to avoid welded or pressed joints or other special construction required for attaching terminals to the same. This is made practically possible by reinforcing the extensions with a winding of Nichrome or nickel wire, which strengthens and renders them durable for all purposes. The extensions are brought out of the jacket through plugs or washers of mica or other material, sealed in the jacket with silicon, closing the ends thereof.

Other features of the invention not specially mentioned above will be brought to attention in the detailed description that follows.

The accompanying drawing will serve to illustrate a construction suitable for carrying the invention into effect, but it is to be understood that no limitations are intended by this showing other than are imposed by the appended claims.

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In the drawings—

Fig. 1 is a view in elevation on an enlarged scale, of the heater with parts broken away to show the internal construction.

Fig. 2 is a detail perspective view, on a greatly enlarged scale, with proportions exaggerated for clearness of illustration, showing the several elements that make up the heater.

Fig. 3 is a cross sectional view on the line s^3—s^3 of Fig. 1, and

Fig. 4 is a detail view showing the integral terminal extensions of the resistor and their reinforcement.

Referring now to the drawings, 1 indicates the resistor element of the heater, which may be of any suitable or well known form but is preferably a helical winding of Nichrome wire, the end portions of which are drawn out and straightened to serve as terminals 2, 2, as hereinafter described.

The resistor element is jacketed by an outer metal tube 3, of suitable diameter to provide an annular space 4 between the inner surface thereof and the resistor winding for the reception of refractory insulating material, by which the winding is spaced apart from the jacket wall and held in centered relation therein. The jacket is of greater length than the resistor winding to provide clearance for closing and sealing the open ends thereof, as hereinafter described.

As a filler for the annular space 4, between the jacket and the resistor winding, a preformed tube 5 of suitable refractory insulating material is provided, which is proportioned to receive the winding in snug relation in the bore 6 thereof by being slipped over the same and has an external formation of radially disposed ribs 7, that extend to the inner wall of the jacket and may be slidingly entered therein. While the tube may be made of any of the various well known refractory materials suitable for insulating the winding and serving other necessary purposes, chalky porcelain is preferred, owing to its ready and uniform compressibility under machine swaging to which the assembly is subjected as the final step in the completion of the heater.

It will be seen that the insulator tube forms a complete filler for the main portion of the jacket and leaves only the bore of the resistor winding and the channels between the ribbed formation of the tube to be filled with granular insulating material, which is done with powdered magnesite, as indicated at 8, in the conventional manner and in a comparatively short period of time.

The relative proportions of the ribs and channels may obviously be such that under machine swaging, the crushed ribs will provide sufficient material to fill the channels and avoid the necessity of entering granular material therein as a filler.

Closures are provided for the open ends of the jacket in the form of tightly fitting mica plugs or washers, indicated at 9, which are sealed with silicon against displacement or leakage.

The end closures of the jacket are centrally bored for the passage through the same of the integral extensions of the resistor winding, which, as above stated, serve as the terminals thereof and, in order to give the terminals the required strength to withstand careless or rough handling, they are reinforced with a winding of Nichrome or nickel wire, as indicated at 10. This reinforcement may extend from a point at each end within the jacket and on through the end closures or may be limited to that portion of the terminals that projects beyond the closures, whichever is preferred.

Assembled as above described, the heater is machine-swaged, the effect of which is to reduce the diameter of the enclosing jacket and thereby compress and compact the insulation into a solid body in and around the resistor winding, which secures the same permanently in centered relation in the jacket and against possible displacement.

Prominent among the important advantages of the invention may be mentioned the following:

The instant filling of the greater portion of the heater jacket by the use of a preformed insulator tube, which effects a great saving in time over the conventional method of entering and packing a filler of granular insulating material therein.

The definite and positive centering of the resistor permanently in the jacket and against possible displacement likely to result in hot spots, burn-outs or other shorts.

The use of a preformed insulator tube of chalky porcelain, owing to its ready and uniform compressibility to solid and compact form under machine swaging.

The reduction to a minimum of the jacket space to be filled by the conventional slow method of entering and packing granular insulating material therein.

The closure of the jacket ends air and water-tight by the use of sealed mica plugs.

The avoidance of welded, pressed or other joints or connections, by the use of integral extensions of the resistor winding as terminals thereof.

The reinforcement of the integral resistor terminals to strengthen the same to successfully withstand careless or rough handling.

Finally, increased production at reduced cost, as a result of the above mentioned improvements.

I claim:

1. A flexible electric heater comprising a suitable heating element, a tubular liner of frangible insulating material, preformed externally ribbed of maximum proportions and dimensions attained by the liner, for temporary use of the same in assembling and positioning the elements of the heater and adapted to be thereafter crushed and compacted about the heating element, the said liner as preformed being in a continuous one piece length equaling at least the length of the body of the heating element, the heating element being entered, centered and supported throughout its length in the enclosing bore of the liner by snugly fitting the same, an outer tubular jacket in the bore of which the heating element and liner assembly is entered filling the greater portion of the same, the aforesaid assembly being temporarily centered therein by the ribs of the liner closely and comparatively broadly contacting a substantial area of the wall of the jacket bore and a compacted filling of granular insulating material in the unoccupied space within the jacket, the aforesaid assembly when completed being flexible and permitting cold bending of the heater unit on any radius without displacing the centered heating element.

2. A flexible electric heater comprising a suitable heating element provided with integral projecting terminals from the body thereof, a tubular liner of frangible insulating material, preformed externally ribbed of maximum proportions and dimensions attained by the liner for use as preformed in temporarily assembling and positioning the elements of the heater and adapted to be thereafter crushed and compacted about the heating element, the said liner being in a continuous one piece length equaling at least the length of the body of the heating element, the heating element being entered, centered and supported throughout its length in the enclosing bore of the liner by snugly fitting the same, an outer tubular jacket in the bore of which the heating element and liner assembly is entered filling the greater portion of the same and sealed closures for the open ends of the jacket bore through which the terminals of the heating element project, the aforesaid assembly being temporarily centered in the bore of the jacket by the ribs of the liner closely and comparatively broadly contacting a substantial area of the wall thereof, the aforesaid assembly when completed being flexible and permitting cold bending of the heater on any radius without displacing the centered heating element.

3. An assembly for forming a flexible metal-sheathed electric heating unit preliminary to processing the same by a swaging operation to crush and compact the contained insulating material employed solidly in and about an electric heating element and permanently center the same within the unit, the said assembly comprising a helically-wound open core electric heating element, a preformed tubular liner of frangible insulating material which as preformed acquires its maximum dimensions and through which the heating element of equal length extends snugly fitted therein with the ends projecting substantially axially from opposite end portions of the liner, a tubular metal sheath enclosing the aforesaid assembly of the heating element and liner which is centered therein by the liner with the ends of the heating element projecting beyond the ends of the sheath sealed closed about the same, and a filling of powdered insulating material in the unoccupied space within the tubular sheath, the completed assembly being adapted to be processed as above described which results in rendering it flexible and permitting cold bending of the heating unit on any radius without displacing the heater element from its centered position therein.

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