Aug. 28, 1928. 1,681,956

R. L. SHRINER

PROCESS OF MAKING ELECTRICAL HEATERS

Original Filed March 6, 1926

FIG. 1.

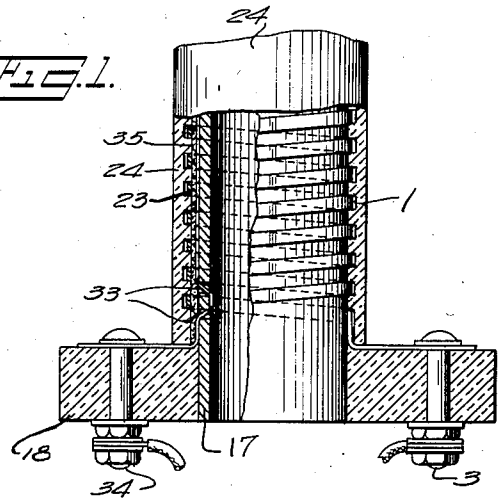


FIG. 2.

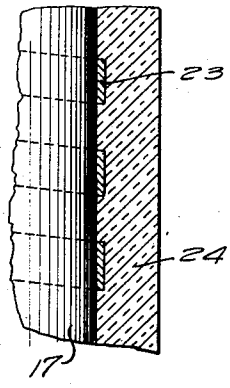


FIG. 3.

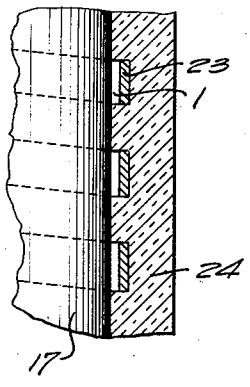
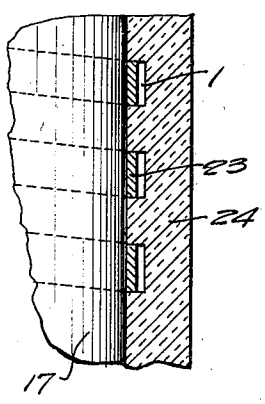


FIG. 4.



INVENTOR

ROBERT L. SHRINER.

BY R. Van Rushmith

ATTORNEY

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UNITED STATES PATENT OFFICE.

ROBERT L. SHRINER, OF WEEHAWKEN, NEW JERSEY, ASSIGNOR TO HUDSON HEATING SYSTEMS, INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PROCESS OF MAKING ELECTRICAL HEATERS.

Original application filed March 6, 1926, Serial No. 92,711. Divided and this application filed December 27, 1926. Serial No. 157,080.

This application constitutes a division of my application Serial No. 92,711, filed March 6th, 1926, and relates to the special form of electrical heating unit therein described and to the process of making same. Generally stated the invention comprises the process of embedding a high resistance electrical conductor, spirally wound on a supporting member, in a surrounding mass of soft, plastic, non-conducting material, then expanding said conductor by passing the maximum amount of current therethrough, and thereby pushing outward the surrounding covering to form a spiral recess in which the conductor may subsequently expand and contract freely when heated or cooled, and, finally, allowing said cover to set or harden, as by baking, or otherwise.

One embodiment of the invention and an illustration of one method of putting it in practice, are illustrated in the accompanying sheet of drawings in which,

Fig. 1 is a detail of a completed heating element shown partly in section and partly broken away.

Fig. 2 is a detail section on a larger scale showing the first step in the process.

Fig. 3 is a similar detail showing a second step, and

Fig. 4 is a similar detail illustrating the last step of the process and showing a fragment of the completed article.

Throughout the drawings like reference characters indicate like parts. 17 is a tube of porcelain or other electrically non-conducting, refractory material, set in any suitable base 18. On this tube is wound spirally a high resistance electric conductor 23, which is to be included in a current supply circuit of suitable voltage and amperage to raise the conductor 23 to the maximum permissible temperature, and employ it as a heat radiating member.

The preferred method of winding coils 23 upon tubes 17 is shown in detail in Fig. 1 where one end of a coil 23 is shown as passing through a pair of holes 33, in tube 17 and anchored to a binding post 34 on a support 18. The conductor is usually formed of a thin ribbon of nichrome alloy and is next laid in a longitudinally extending groove 35 in the exterior of the tube 17, and led therein to the upper end of said tube (not shown). Groove 35 is then filled with cement which covers the portion of ribbon therein, and the remainder of the ribbon is wound spirally around the tube with its free end anchored to a second binding post 3 on support 18. The exterior coating 24 of cement is then applied (as shown in Fig. 2) and the whole baked slowly as by first passing the maximum amount of current through the ribbon, and afterward placing the whole structure in an oven. This gives the ribbon a chance to expand the full amount under the degree of heat to which it will be subjected in use and thereby form a spiral recess 1 in the surrounding, still yielding mass of cement before the latter is subsequently hardened by the final baking, as shown in Figs. 3 and 4. When cooled the ribbon contracts to its original length coiling around tube 17 as shown in Figs. 1 and 4. As a result the ribbon in the completed heating element rests in a spiral conduit having a dimension radially of the coil sufficient to accommodate all subsequent expansions and contractions of the coil and so avoiding possibility of such expansions cracking the cement envelope during operation of the heater. In the same way the initial longitudinal expansion of that portion of the ribbon lying in longitudinal groove 35, frees it from adhesion to the overlying cement, and, after that cement becomes rigid from the completed baking, further expansion or contraction of the ribbon is taken up by free play of the portions thereof forming the loop passing through holes 33, into the tube interior.

The above described method of winding and embedding the conductor in expansion-permitting spaces prevents short circuits and ruptures, and coils thus installed have been kept in continuous operation under commercial conditions without appreciable deterioration for long periods of time.

Various changes could be made in some of the details of construction described above, and some of them could be omitted without entirely departing from the principle of the invention or from its essential novelty, even if the full benefits above indicated were not completely realized after such modifications.

I am aware that it has been heretofore proposed to subject an electrical heating coil embedded in a mass of insulating material

to passage of a heating current while the said mass is still plastic but under pressure. This would cause the plastic material to follow the conducting coil in its radial expansion outward from the coil axis and so fill in any spaces temporarily formed behind it. Consequently, after the mass hardened from such treatment with pressure and heat, the conducting coil could not contract, all the space within the coil having been filled with the hardened conductor forced into it by external pressure. In my invention, on the contrary, plastic material placed about the coil is not subjected to pressure during the expansion of the coil by passage of the current, and consequently the space left inside the coil during its radial outward expansion is not filled by the plastic material, but remains open to permit subsequent radial contractions and expansions of the coil of conducting metal under subsequent coolings and heatings thereof. The same result would follow if the conductor were entirely surrounded by the plastic material.

Having described my invention, I claim:

The herein described method of encasing a metallic conductor in a cavity in a refractory envelope which shall permit free expansion and contraction of said conductor, which comprises the following steps; winding said conductor cold around a suitable support of insulating material, embedding said conductor in a coating of plastic refractory material of considerable thickness applied to said support in mass form, heating said conductor by passing the predetermined amount of current through it while said coating material is still soft and free from exterior pressure, and subsequently hardening said coating as by baking; whereby the expanded conductor will push aside the elastic coating to form an expansion chamber for itself thereon.

ROBERT L. SHRINER.