Sept. 1, 1931. E. L. WIEGAND 1,821,822

METHOD OF FORMING ELECTRICAL HEATING ELEMENTS

Original Filed Dec. 31, 1928 2 Sheets-Sheet 1

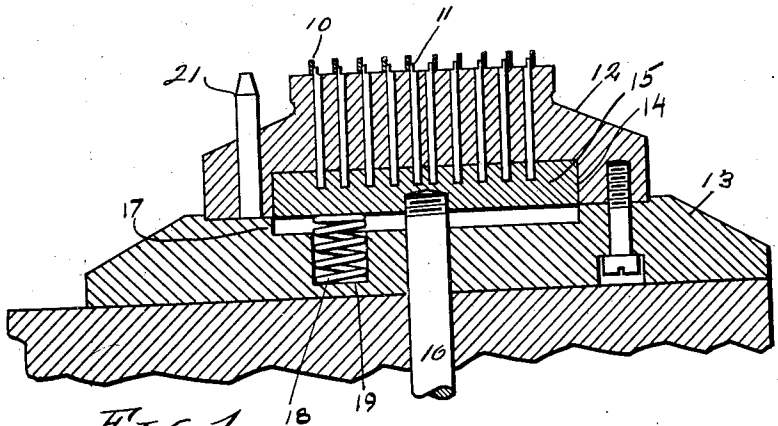


FIG. 1

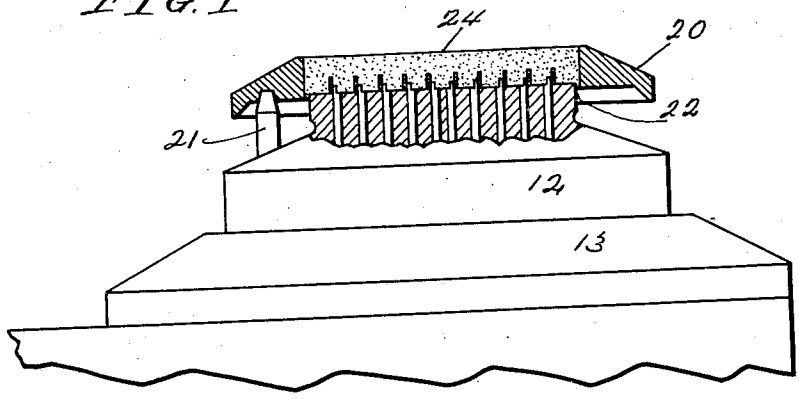


FIG. 2

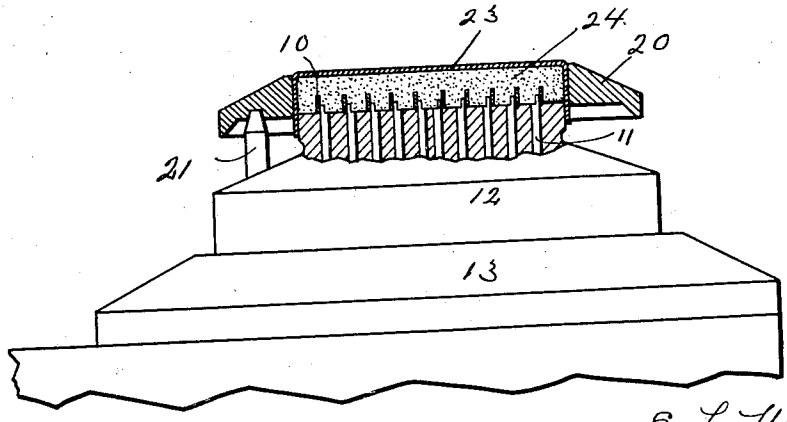


FIG. 3

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METHOD OF FORMING ELECTRICAL HEATING ELEMENTS

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FIG. 4

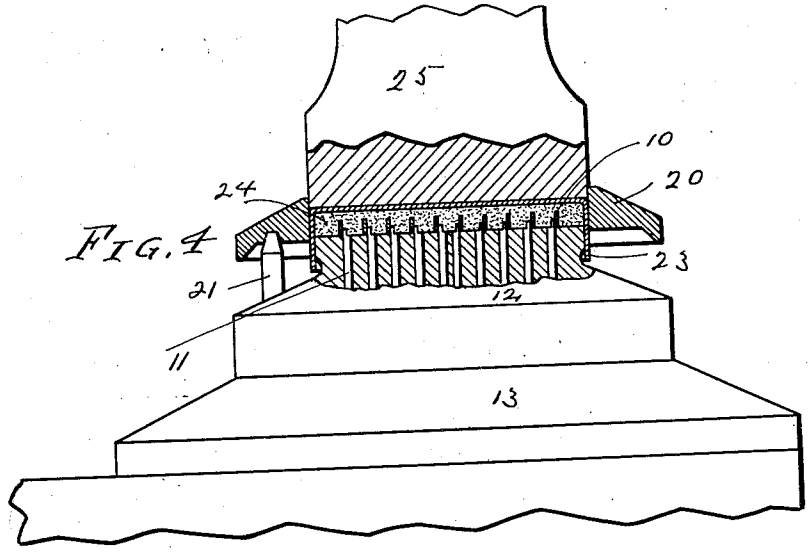


FIG. 5

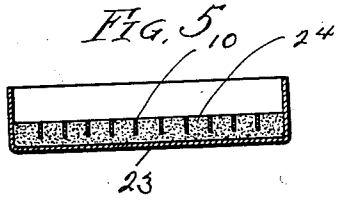


FIG. 8

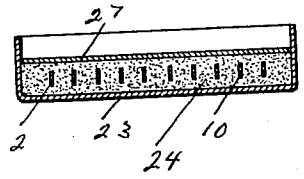


FIG. 6

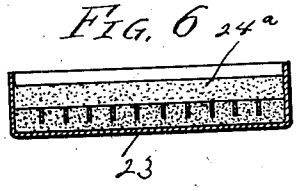


FIG. 9

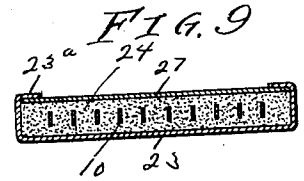


FIG. 10

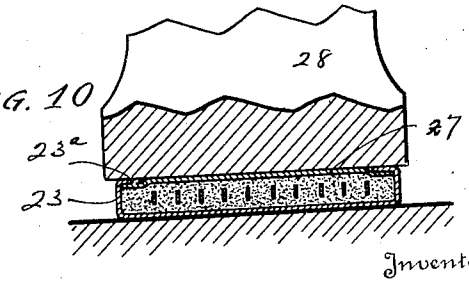
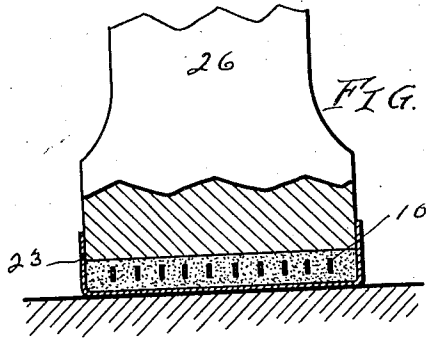


FIG. 7



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Patented Sept. 1, 1931

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UNITED STATES PATENT OFFICE

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METHOD OF FORMING ELECTRICAL HEATING ELEMENTS

Application filed December 31, 1928, Serial No. 329,629. Renewed May 2, 1931.

This invention relates generally to the production of electrical heating elements and more particularly to a method or process of producing a heating unit of the kind disclosed in my Patents Nos. 1,613,426, 1,614,330 and 1,614,331, and embodying a sheath or casing, a resistor, a filling of compacted refractory material enveloping said resistor and a cover plate over which the edges of the shallow casing are turned to securely fasten all the parts together.

One object of the present invention is to improve upon the methods heretofore employed in the fabrication of these elements, and provide a series of steps which can be more conveniently and rapidly carried out, thereby reducing the cost of the unit, and the present method also has the advantage of producing a somewhat better or improved article of manufacture.

In its broadest aspects, the invention consists in positioning a resistor upon a support, and within a border; enveloping said resistor with a mass of refractory electrical insulating material, arranging a sheath or casing over said mass and resistor and applying pressure thereto, then reversing said sheath or casing with the refractory and resistor therein, adding more refractory, positioning a cover plate, and applying pressure for compacting the entire mass, and then turning the edges of the sheath or casing over the adjacent portions of the cover plate, and then baking the unit. If a moist binder is employed in the refractory mass, a drying operation may be desirable but where a fusible binder is employed such separate drying will not be required.

The invention also includes certain steps and details hereinafter fully described and set forth in the appended claims.

In the drawings forming a part of this specification and in which is shown one form of apparatus for carrying out my improved method or process, Fig. 1 is a sectional view of a support or form upon which the resistor is positioned and which constitutes the first step of the method or process; Fig. 2 is a similar view illustrating the second step; Fig. 3 a similar view illustrating the third step; Fig. 4 is a view partly in elevation and partly in section showing the fourth step; Fig. 5 is a sectional view of the reversed and partly filled sheath or casing; Fig. 6 is a similar view showing the sheath or casing completely filled with refractory and Fig. 7 is a view showing the second compressing operation; Fig. 8 is a sectional view of the sheath with the resistor, refractory and cover plate arranged in the sheath; Fig. 9 is a view showing the edges of the sheath turned over the adjacent edges of the cover plate and Fig. 10 is a view showing the final pressing operation.

I shall now describe in detail my improved method or process and at the same time, so much of one form of apparatus for carrying it out, as may be necessary for a clear understanding.

The first step consists in positioning a resistor 10 upon a suitable support which in this particular instance consists of a plurality of positioning pins 11 which project upwardly from a form or base 12, which is shaped or contoured according to the nature of the element to be produced, that is to say the base 12 can be round, oblong, triangular or ring shape, and the pins 11 will of course be placed to distribute the resistor properly within the entire shape of the element.

The base 12 is fastened to a suitable support 13, and its lower face is recessed at 14 to receive a block 15 carrying the pins 11, these pins working in vertical holes produced in the base 12.

The block 15 has a rod 16 connected thereto and by means of which it can be drawn down to withdraw the pins 11 below the upper face of the base 12. The support 13 is recessed at 17 to permit this movement of the block 15.

One or more spiral springs 18 keep the blocks 15 normally raised, these springs being located in recesses 19 produced in the support 13.

A wall or border 20 is placed about the base form, as shown in Fig. 2, this wall or

border being supported upon one or more pins 21 and is readily removed therefrom. The inner face of this wall or border conforms to the shape of the base and to the shape of the element to be produced. There is a slight space 22 between the lower inner edge of the wall or border and the upper edge of the base, this space being just sufficient to permit the introduction of the side of a sheath or casing 23 when said sheath or casing is applied in inverted form.

After the resistor has been positioned upon the pins of the form, the wall or border is arranged and the space within the border is filled with a suitable refractory electrical insulating material 24 such as magnesium or aluminum oxide, or zirconium silicate, either singly or in combination, with a binder such as clay, to give the necessary plasticity during fabrication and to effect homogeneity in the final product.

The sheath in inverted position is then made to embrace the mass of refractory material by forcing the sides of the sheath down over the base and within the wall, the sides of the sheath occupying the space 22, and then pressure is applied by a plunger 25, compacting the mass of refractory material firmly about the resistor which is still held upon the base and positioning pins.

As a next step, the pins are withdrawn, by pulling down on rod 16; the wall or border is removed, and the sheath or casing lifted and reversed as shown in Fig. 5.

An additional quantity of refractory 24^a is then placed in the sheath or casing to completely fill the same, and then additional pressure is applied by a suitable plunger 26, thereby compressing the entire mass within the sheath or casing. Instead of applying a refractory mass any other suitable insulating material may be applied as a complementary covering of insulating material.

If the mass contains a moist binder it will be necessary to dry the compacted mass, but if a fusible binder is employed such drying will not be necessary.

A cover plate 27 is then placed in the sheath or casing, this plate being shaped to fit snugly therein as shown in Fig. 8 and then the edges 23^a of the sheath or casing are turned over the adjacent edges of the cover plate as shown in Fig. 9.

The final compression is then made by plunger 28 forcing the edges 23^a over the cover plate 27, compressing the entire mass finally and giving the unit or element its final compression preparatory to baking which operations complete the fabrication of the electrical heating element with the exception of the attachment of terminals which has not been referred to as that is done as heretofore. It will, of course, be understood that the final compression can be utilized to give the final cross sectional shape to the heating elements.

For some types of work a wholly sheathed element is not absolutely necessary, as for instance, where the unit is properly protected when mounted in certain types of appliances, such as percolators, waffle irons and other devices where the exposed refractory is not too likely to become polluted. In these types of units the cover plate 27 may be omitted and the edges of the sheath or casing 23 rolled over and pressed down in the manner shown in my copending application Serial No. 329,628, filed December 31, 1928.

From the foregoing, it will be seen that I provide a novel method of making a completely sheathed electrical heating element and one in which the steps are quickly, conveniently and efficiently carried out.

Having thus described my invention, what I claim is:—

1. The herein described method of making an electrical heating unit which consists in compacting into a shallow metal sheath a mass of refractory insulating material which in turn envelops a resistor wound upon a form, then removing the form and reversing said sheath with refractory and resistor therein, adding more refractory material and applying a cover plate and then turning over the edges of the sheath upon the adjacent edges of said cover plate.

2. The herein described method of making an electrical heating unit which consists in compacting into a shallow metal sheath a mass of refractory insulating material which in turn envelops a resistor wound upon a form, then removing the form and reversing said sheath with refractory and resistor therein, adding more refractory material and applying a cover plate and then turning over the edges of the sheath upon the adjacent edges of said cover plate and then baking the same.

3. The herein described method of making an electrical heating unit which consists in enveloping a definitely positioned resistor wound upon a form with a mass of refractory material, covering the same within a shallow metal sheath, applying pressure thereto, removing the form, adding more refractory material, arranging a cover plate within the sheath, and turning the edges of the sheath over the adjacent edges of the cover plate.

4. The herein described method of making an electrical heating unit which consists in enveloping a definitely positioned resistor wound upon a form with a mass of refractory material, covering the same within a shallow metal sheath, removing the form, adding more refractory material and applying pressure thereto, arranging a cover plate within the sheath, turning the edges

of the sheath over the adjacent edges of the cover plate and then baking the unit.

5. The herein described method of making an electrical heating unit which consists in arranging a metal sheath in inverted form over a mass of refractory material containing a resistor wound upon a form, applying pressure and reversing the sheath with refractory and resistor therein, removing the form, adding more refractory material, arranging a cover plate within the sheath, applying pressure, drying and baking.

6. The herein described method of forming electrical heating units which consists in positioning a resistor upon a form and covering the same with refractory material, placing thereover in inverted form a metal sheath, compressing the mass of refractory material about the resistor and form, reversing the sheath with refractory and resistor therein, removing the form, adding more refractory material, arranging a cover plate within the sheath and then compressing and turning in the edges of the sheath.

7. The herein described method of forming electrical heating units which consists in positioning a resistor upon a form and covering the same with refractory material, placing thereover in inverted form a metal sheath, withdrawing the positioning means and reversing the sheath with refractory and resistor therein, adding more refractory material, arranging a cover plate within the sheath and then drying and compressing and turning in the edges of the sheath and finally baking the unit so made.

8. The herein described method of forming electrical heating units which consists in positioning a resistor upon a form, arranging a border about said form, covering the resistor within the border with refractory material, placing thereon in inverted form a sheath, applying pressure, separating the sheath with embedded resistor from the form and reversing the sheath with the refractory and resistor therein, supplying additional refractory material, arranging a cover plate within the sheath, drying and turning in the edges of the sheath over the edges of the cover plate under pressure and then baking the unit.

9. The herein described method of forming electrical heating units which consists in positioning a resistor upon a form, arranging a border about said form, covering the resistor within the border with refractory material, placing thereon in inverted form a sheath, applying pressure, withdrawing the positioning means and removing the sheath with the refractory and resistor therein, supplying additional refractory material, arranging a cover plate within the sheath, turning in the edges of the sheath over the edges of the cover plate.

10. The herein described method of making electrical heating elements which consists in positioning a resistor upon a form, surrounding said form by a border, enveloping the resistor with a mass of refractory material, placing over said refractory with the resistor enveloped therein a sheath in inverted form and applying pressure thereto, withdrawing the form and removing the sheath with refractory and resistor contained therein, adding more refractory material, applying additional pressure, arranging a cover plate within the casing and upon the refractory, turning the edges of the sheath over the edges of the cover plate and drying and baking.

11. The herein described method of making an electrical heating unit which consists in positioning a resistor upon a form, providing a mold surrounding said resistor and applying refractory insulating material to said mold and enveloping said resistor, applying a sheath in inverted form to the said refractory and resistor, applying pressure thereto, withdrawing the form, inverting the sheath, applying additional refractory, arranging a cover plate, turning over the edges of the sheath, and finally applying additional pressure to compact the whole.

12. The herein described method of making electrical heating units which consists in first positioning a resistor upon a form, then enveloping said resistor with refractory insulating material suitably confined as to lateral escape, applying a sheath in inverted position upon the refractory and resistor, applying pressure, separating the sheath with embedded resistor from the form and inverting said sheath with refractory and resistor therewithin, applying additional refractory material and compressing, adding a cover plate and finally pressing over the edges of the sheath, and finally drying and baking the unit.

13. The herein described method of making electrical heating units which consists in placing a sheath over a mass of refractory insulating material which in turn envelops a resistor, said resistor being positioned and the refractory mass being held against lateral escape, applying pressure to the casing with the refractory and resistor therein, separating the sheath and embedded resistor from the resistor positioning means, arranging a cover plate within the casing, turning the edges of the sheath inwardly over the edges of the cover, and repressing and baking.

14. The herein described method of making electrical heating units which consists in placing an inverted sheath over a refractory insulating material which in turn envelops a resistor, said resistor being positioned and the refractory mass being held against lateral escape, applying pressure to

the sheath with the refractory and resistor therein, withdrawing the resistor form and inverting the sheath with the refractory and resistor therein, arranging a cover plate within the sheath, turning the edges of the sheath over the edges of the cover, repressing and finally drying and baking.

15. The method of making an electrical resistance heating unit which consists in enveloping a definitely positioned resistor mounted upon a form with a mass of refractory material, covering the same with a metal sheath, applying pressure thereto, removing the resistor positioning means, adding more refractory material and turning over the edges of the sheath to form a holder for the unit.

16. The method of making an electrical resistance heating unit which consists in definitely positioning a resistor upon a form and enveloping the same with a mass of refractory insulating material, covering the same with a metal sheath, applying pressure thereto, removing the form, adding more refractory material and turning over the edges of the sheath to form a holder for the unit and drying and baking.

17. The method of making an electrical resistance heating unit which consists in arranging a metal sheath in inverted form over a mass of refractory material containing a resistor definitely positioned upon a form, applying pressure and then removing the resistor positioning means, reversing the sheath with the refractory and resistor therein, adding more refractory material, applying additional pressure and turning over the edges of the sheath to form a holder for the unit.

In testimony whereof, I hereunto affix my signature.

EDWIN L. WIEGAND.