Dec. 7, 1937. W. J. RUSSELL 2,101,098

METHOD OF MAKING ELECTRIC HEATING UNITS AND RESULTANT PRODUCT

Filed Oct. 12, 1934 2 Sheets-Sheet 1

Fig. 1.

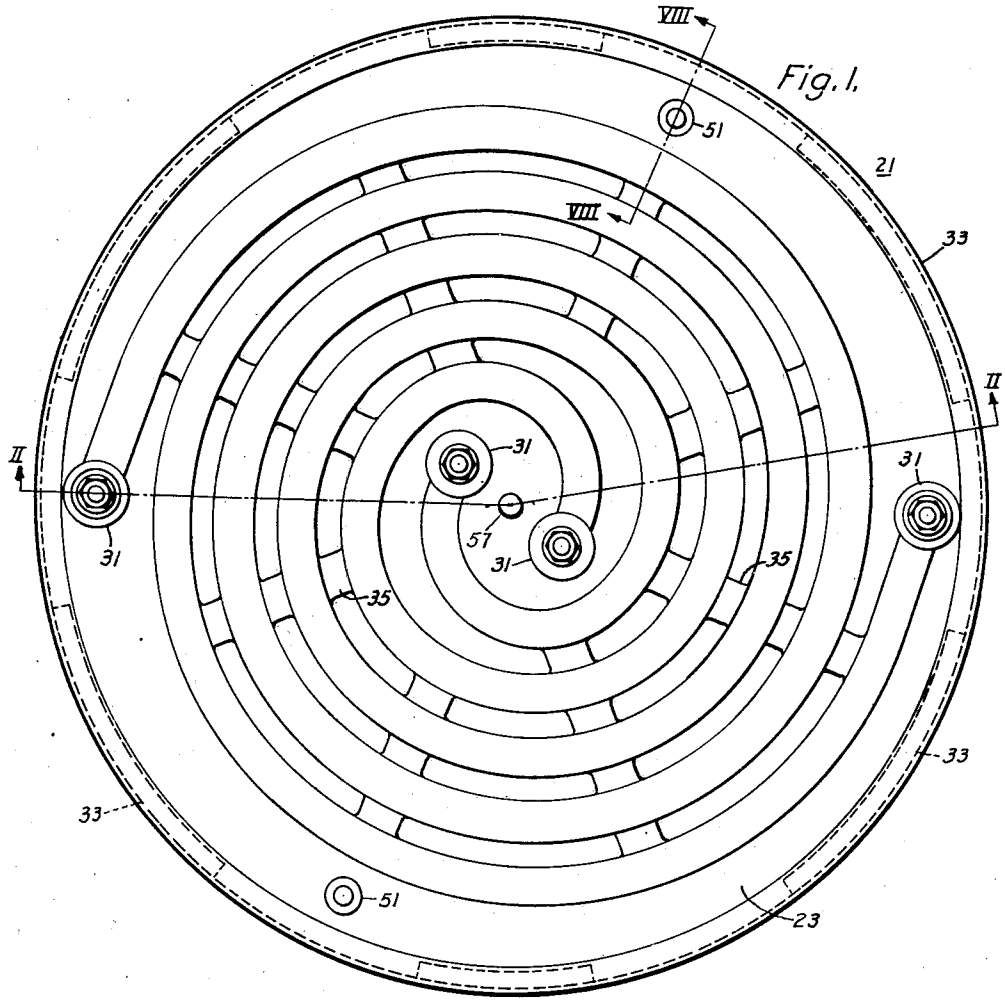
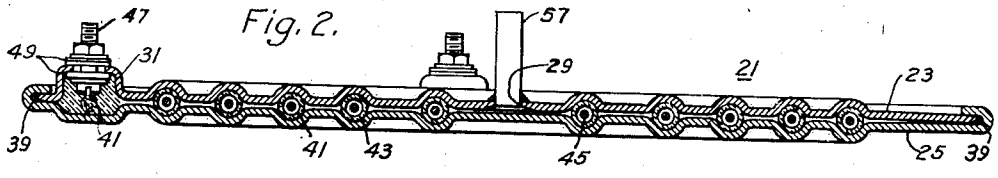


Fig. 2.



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Fig. 3.

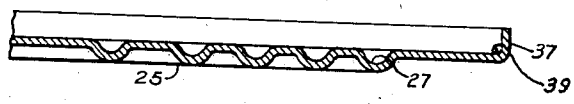


Fig. 4.

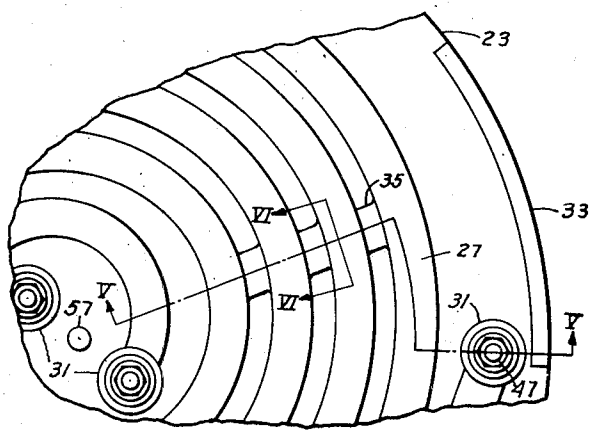


Fig. 5.

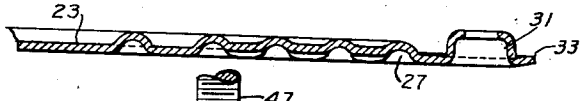


Fig. 6.

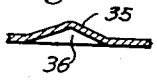


Fig. 7.

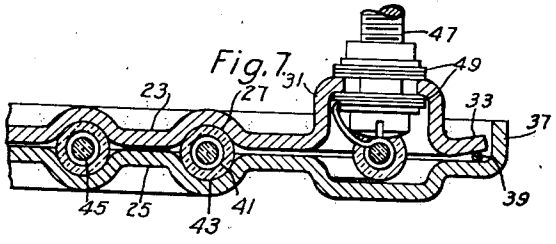


Fig. 8.

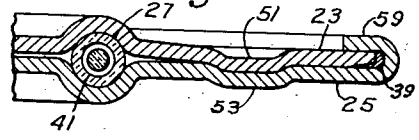
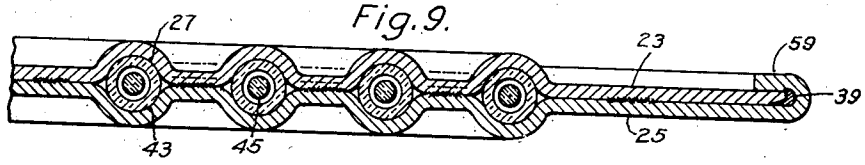


Fig. 9.



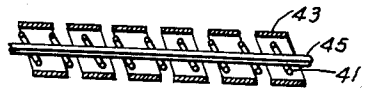


Fig. 10.



Fig. 11.

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UNITED STATES PATENT OFFICE

2,101,098

METHOD OF MAKING ELECTRIC HEATING UNITS AND RESULTANT PRODUCT

William J. Russell, Mansfield, Ohio, assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application October 12, 1934, Serial No. 748,024

9 Claims. (Cl. 219—37)

My invention relates to heating units and particularly to metal encased electric heating units.

An object of my invention is to provide a relatively simple method of making a totally encased heating unit.

Another object of my invention is to provide a totally encased heating unit of light weight and of relatively simple design that shall embody a novel sealing means for the outer periphery of the unit.

Other objects of my invention will either be pointed out specifically hereinafter or will be apparent from a description of a preferred embodiment of my invention.

In practicing my invention, I provide a pair of complementary correspondingly-grooved sheet metal plates, one plate having a laterally bent flange at its outer periphery while the other plate has a plurality of substantially radially-extending depressions in its inner surface between adjacent grooves, locate a soft metal gasket on the inner surface of one of the plates at its periphery, locate a helically wound resistor wire within an open helix of metallic magnesium ribbon and in the groove in one of the plates, locate the plates in face-to-face positions, then spot weld them together, steam treat the unit to convert the metallic magnesium into magnesium hydroxide, dehydrate the same to change the magnesium hydroxide into magnesium oxide, then planish the bulges on the outer side of that plate having the radial grooves on its inside, after which the lateral flange on the one plate is return-bent over and against the other plate to tightly seal the unit.

In the drawings,

Figure 1 is an inverted plan view of an assembled encasing heating unit embodying my invention,

Fig. 2 is a view in section therethrough taken on the line II—II of Fig. 1,

Fig. 3 is a fragmentary view in radial section through the upper plate of the unit, shown in unfinished form,

Fig. 4 is a fragmentary top plan view of the lower plate constituting a part of my improved electric heating unit,

Fig. 5 is a view in radial section through the lower plate taken on the line V—V of Fig. 4,

Fig. 6 is a fragmentary sectional view through the plate shown in Fig. 4 and taken on the line VI—VI thereof,

Fig. 7 is a view on an enlarged scale of a portion of an electric heating unit embodying my invention shown in a partially completed condition,

Fig. 8 is a view on an enlarged scale of a portion of an electric heating unit embodying my invention shown in a partially completed condition and taken on the line VIII—VIII of Fig. 1,

Fig. 9 is a fragmentary view in radial section, on an enlarged scale, of a completed heating unit,

Fig. 10 is a fragmentary view in longitudinal section of the resistor element in its early stages of assembly, and

Fig. 11 is a view in end elevation of the parts shown in Fig. 10.

My invention has to do particularly with range heating elements which may be either of square or rectangular shape or of circular shape and I have elected to show a relatively thin light-weight totally-encased electric heating unit particularly adapted to be used in or on the cooking platform of an electric range, which heating unit is adapted to directly support a cooking utensil placed thereon. A heating unit designated generally by the numeral 21 includes a lower thin sheet metal plate 23 and a corresponding upper thin sheet metal plate 25, each of which is preferably made of an alloy steel which is capable of withstanding relatively high temperatures without scaling or oxidizing and which will also withstand occasional subjection to water or other fluids used in cooking or accompanying a cooking operation, without being greatly attacked or acted upon thereby.

Each of the plates 23 and 25 is provided with one or more substantially semi-circular grooves 27 therein, the location of the grooves in the respective plates being such that when they are located in proper operative position relatively to each other, the two grooves will be in register with each other to form a substantially cylindrical groove.

The lower plate 23 is provided with a central aperture 29 therein for a purpose to be hereinafter described and with a plurality of depressed portions 31 adapted to receive terminal members, as will be hereinafter more fully set forth. The outer peripheral edge of plate 23 is made substantially flat except for certain struck-up portions 33, as will be noted by reference to Figs. 4 and 5 of the drawings, also for a purpose to be hereinafter fully set forth. The plate 23 is provided also with a plurality of bent-out portions 35 extending between adjacent grooves, as will be noted more particularly by reference to Fig. 6 of the drawings and also by reference to Figs. 1 and 4 of the drawings, where the top view of such bent-out portions has been indicated by two parallel ex-

tending radial lines between the grooved parts of the plate. The aperture 36 thus provided beneath the bent-out portion I prefer to call a treating vent.

The top plate 25 is initially of a somewhat larger outer diameter than is plate 23 and as one of the steps of manufacture, this extreme outer peripheral portion is bent into a laterally extending flange 37, as is shown more particularly in Fig. 3 of the drawings, in order that it may, in a later step of manufacture of the heating unit, be crimped around or return bent over the peripheral rim or edge portion of plate 23. An annular gasket 39, which is preferably made of a soft copper wire bent to annular shape with its ends welded together, is located against the inner side of plate 25 immediately adjacent to and within the lateral flange 37.

A helically wound resistor wire 41 (see Fig. 10 of the drawings) is made up to the desired design as to resistance and is located within an open helix 43 of a metallic magnesium ribbon, while a core 45 comprising a plurality of rods or wires of metallic magnesium is located within the helix 41 of the resistor wire.

The bottom plate 23, located on a suitable supporting surface with its inner face upwardly, has the structure shown in Figs. 7 and 8 of the drawings, and comprising the helically wound resistor 41, its surrounding open helix of magnesium ribbon 43 and the inner core wires 45 also of magnesium, located in the semi-circular groove 27 in plate 23. Due care is exercised in locating this structure in the half groove 27 to see that the adjacent turns of the helix 41 have been uniformly spaced over the entire length of the groove and the same, of course, applies to the outer helix 43. The ends of the resistor wire 41 are then connected to suitable contact terminals 47 located in and extending through the depressed portions 31, shown more particularly in Figs. 2 and 7 of the drawings, it being understood that the terminal screws 47 are suitably insulated from the plate 23 by electric insulating washers 49, which may be made of mica or of some other suitable electric-insulating material.

The upper plate 25 is then located in juxtaposition on the lower plate 23 and in order to insure that these plates shall be located in predetermined positions on each other, peripherally thereof, lower plate 23 is provided with projecting portions 51 at two diametrally spaced points adjacent its periphery while the upper plate is provided with depressions 53 corresponding to the projections 51 whereby the projections 51 will cooperate with and fit into the depressions 53.

I then initially tack weld the two plates at a small number of places in order to insure that the two plates will remain in the relative position initially arranged for by the interfitting projections 51 and depressions 53, and then the two plates are spot welded at a relatively large number of spots between the peripheral grooves and between the radially extending treating vents 35 hereinbefore described.

It is obvious that the outer peripheral portion of bottom plate 23 will be sprung slightly away from the adjacent inner face of plate 25 by reason of the sealing gasket 39, but it is also apparent that the portions 33, of which a plurality are provided peripherally of the plate 23, do not engage the gasket 39 so that entry of a fluid into the grooves and treating vents past the gasket 39 is freely permitted.

Any desired number of the partially finished heating units thus far described are now located in an autoclave where they are subjected for a certain length of time to the action of high temperature water and/or steam, which temperature may be up to 1,000° F. This converts the initially metallic magnesium of the members 43 and 45 into magnesium hydroxide having a crystalline structure and occupying also a much greater volume than the initially metallic magnesium. It is evident that the high temperature water or steam may freely traverse the spaces provided by the treating vents 35 which, as shown more particularly in Figs. 1 and 4 of the drawings, extend radially relatively to each other so that the entire length of each of the initially metallic magnesium elements may be subjected to its action, to be thereby completely converted into magnesium hydroxide without the possibility of there remaining any of the metallic magnesium which is an electric conductor and is, therefore, not permissible in the finished product.

The steam treated heating unit is then subjected to a temperature of from 700 to 800° F. in a suitable chamber for several hours to dehydrate the magnesium hydroxide and to change the same into an insulating material, namely magnesium oxide.

If desired, the unit may now be subjected to a treatment with a boiling solution of boric acid in order to increase the electric insulating qualities of the magnesium oxide, but this is mentioned only since it constitutes no part of my invention, but is being disclosed and claimed in an application filed as of even date, Serial No. 748,027, by G. E. Price, which application is assigned to the same assignee as is this application.

If the boric acid treatment is used, the unit is thereafter again subjected to a dehydrating operation at from 700 to 800° F. after which I prefer to planish the portions 35 of the bottom plate 23 in order to make the outer surface of plate 23 more smooth between the grooves as well as to improve the general appearance of the heating unit.

The central opening 29 hereinbefore mentioned was, of course, effective in shortening the length of path which it was necessary for any steam or hot water to traverse to flow from say the outer periphery toward the central portion thereof where, of course, it could flow out through the opening 29. It is obvious that the steam and hot water could also flow into the central opening 29 and from there toward the outer periphery of the unit. A stud 57 is now welded into the opening 29, this stud being of use in securing to the finished unit a dished casing, (not shown in the drawings) or for otherwise securing the heating unit firmly against a supporting means.

As a further step in the assembly, the lateral flange 37 is now bent down over the adjacent outer edge portion of plate 23, after which the bent-over edge is subjected to a relatively high compressive force, such as the action of a drop hammer, whereby the flange 37 is brought into close operative engagement with the outer edge of plate 23, as shown at 59 in Figs. 8 and 9 of the drawings. The gasket 39 is, of course, thereby greatly deformed, and I have shown what I believe to be a fairly accurate representation of its final shape, although I do not desire to be limited thereto, since the main object of providing this soft metal gasket and of locating it adjacent the flange 37 is that it shall completely

seal the outer peripheral edge of the unit, being retained in its sealing position by the portion 37 of plate 25. It is obvious further that the outwardly flared portions 33 will be straightened out so that the periphery of plate 23 will be substantially that shown in Figs. 2, 8, and 9 of the drawings when the units have been completely finished.

The method of making totally encased electric heating units hereinbefore described and the resulting product provides a relatively simple method for making a highly efficient, lightweight, substantially flat electric heating unit that shall combine relatively high strength with extreme lightness and, therefore, will permit of quick heating up when put into operation.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claims.

I claim as my invention:

1. The method of making an enclosed electric heating unit embodying similarly grooved metal plates which includes the steps of locating a resistor in the grooves, disposing the plates in face-to-face position, locating a yieldable gasket between the outer peripheral portions of the plates, securing the plates together at a plurality of spaced points within the periphery of the plates and sealing said peripheral portions by lapping one over the other to tightly compress the gasket between them.

2. The method of making an enclosed electric heating unit embodying similarly grooved metal plates of different diameters, which includes the steps of locating a resistor in the grooves, disposing the plates in face-to-face relation, locating a yieldable gasket between the outer peripheral edges of the plates, welding the plates together at a plurality of points between the grooves and by crimping the outer edge of the larger-diameter plate tightly over the other and said gasket.

3. A totally encased electric heating unit comprising a pair of complementary metal plates located in face-to-face position, an electric resistor between said plates, a yieldable gasket between the outer peripheral edge portions of said plates, an outer edge portion of one of said plates being return-bent into close operative engagement against the gasket and the outer face of the other plate.

4. A totally enclosed electric heating unit comprising a pair of complementary metal plates located in face-to-face position, an electric resistor between the plates and means to hermetically seal the outer periphery of the unit, said means including an annular gasket of soft metal compressed into sealing engagement with the outer peripheral edge portions of the two plates, one of said portions being disposed around the other and said gasket.

5. A totally enclosed electric heating unit comprising a pair of similarly grooved metal plates in face-to-face position, a resistor in the groove, a gasket of copper wire between the outer peripheral edge portions of the plates, an outer edge portion of one of the plates being crimped tightly over the outer edge portion of the other plates to press the gasket into close operative engagement with the plates.

6. The method of making an encased electric heating unit which includes forming a pair of cooperating sheet metal plates with complementary grooves and with a flat outer peripheral edge portion on one plate and with a laterally-extending peripheral flange on the second plate, securing a soft metal gasket to the second plate within the flange thereon, locating a resistor in the groove in one of the plates, locating the other plate in cooperative position thereagainst, securing the two plates together within the outer periphery thereof and then sealing the unit at the outer periphery thereof by bending the lateral flange on the second plate over against the peripheral edge of the first plate and subjecting the outer peripheral edge portion of the unit to a relatively high compressive force.

7. The method of making an encased electric heating element which includes the steps of forming a grooved bottom plate having a flat outer edge and a cooperatively grooved top plate having a laterally-extending peripheral flange, securing an annular copper gasket to the top plate, deforming the bottom plate to provide treating vents, locating a resistor helix loosely surrounded by metallic magnesium in the groove in the bottom plate, connecting the ends of the resistor to terminals on the bottom plate, locating the two plates in cooperative positions relatively to each other, securing the two plates together intermediate the grooves, steam treating the unit to convert the metallic magnesium into magnesium hydroxide, dehydrating the hydroxide, planishing the treating vents in the bottom plate and then sealing the unit at the outer periphery thereof by bending the peripheral lateral flange on the top plate against the peripheral edge of the bottom plate and subjecting the outer peripheral edge portion of the plates to a relatively high compressive force to deform the gasket and force it into sealing engagement with the adjacent faces of the two plates.

8. A totally enclosed electric heating unit comprising a pair of similarly grooved metal plates in face-to-face position, a resistor in the groove, a soft-metal gasket between the outer edge portions of the plates, an outer edge portion of one of the plates tightly surrounding the outer edge portion of the other plate to press the gasket into sealing relation with the plates.

9. A totally enclosed electric heating unit comprising a pair of registering metal plates, at least one having a recess therein, a resistor in the recess, an outer edge portion of one of the plates being tightly flanged over the outer edge portion of the other plate, and a soft-metal gasket disposed between said edge portions at the periphery of one edge portion and in intimate contact with both edge portions.

WILLIAM J. RUSSELL.