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R. S. GOLDTHWAITE

2,164,650

HEATING PLATE DEVICE

Filed Jan. 16, 1937

FIG. 1

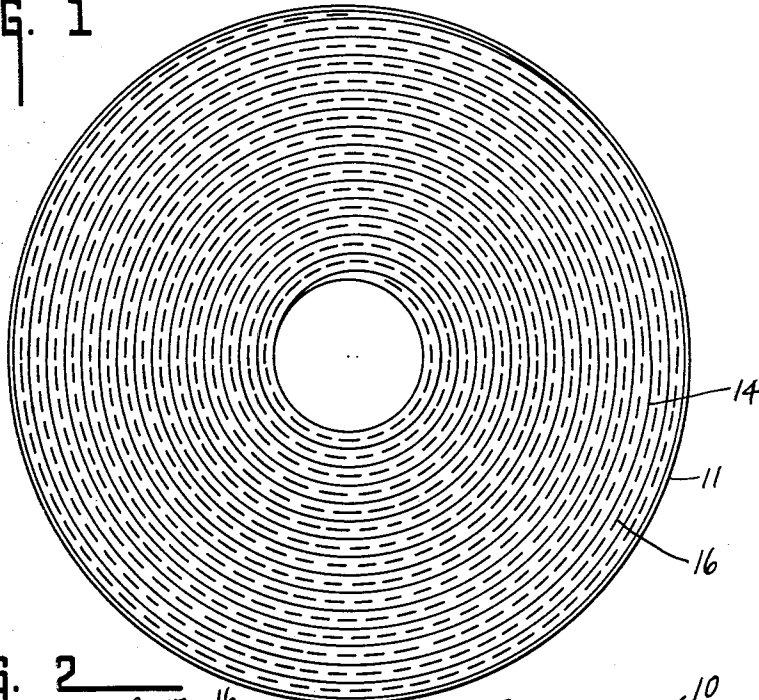


FIG. 2

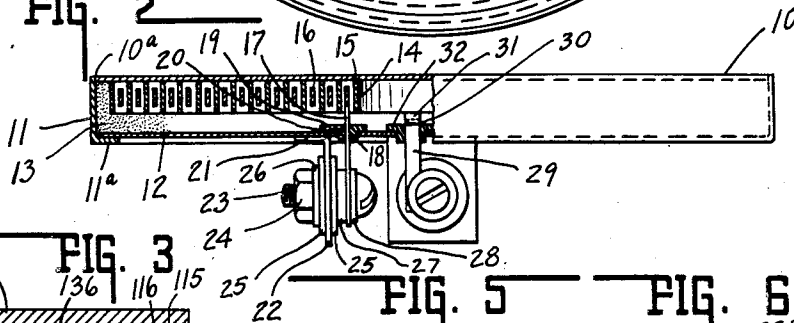


FIG. 3

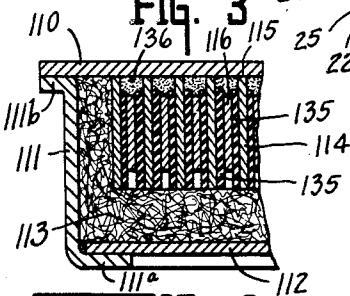


FIG. 4

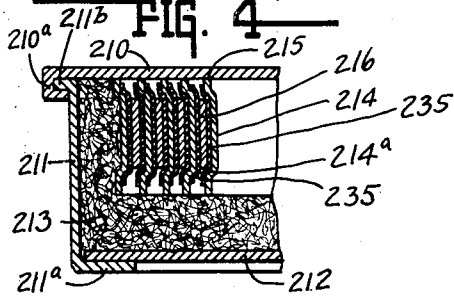


FIG. 5

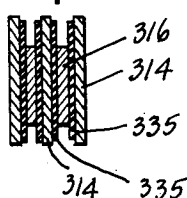
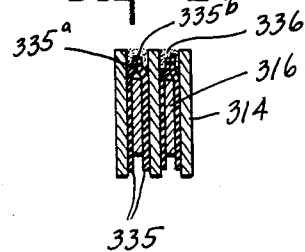


FIG. 6



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HEATING PLATE DEVICE

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1 Claim. (Cl. 219—37)

This invention relates to an electric heating plate.

By the terminology "plate", the same does not necessarily apply to a plane structure.

5 The chief object of the invention is to simplify the construction of a heating device, commonly known as an electric heating plate, and to strengthen the same.

10 Another object of the invention is to produce a construction of the aforesaid character in a relatively simple, economical and expeditious manner.

15 The chief feature of the invention consists in the formation of a heating plate of the character briefly set forth hereinbefore, and more fully set forth hereinafter and in a manner hereinafter to be more fully described.

20 The full nature of the invention will be more fully understood from the accompanying drawing and the following description and claim:—

In the drawing,

Fig. 1 is a top plan view of an electric heating plate shown circular in outline and parts being diagrammatically indicated therein.

25 Fig. 2 is an end elevation of the plate shown in Fig. 1, parts being broken away to show the same and other parts in central section.

Fig. 3 is an enlarged transverse section through one form of heating plate structure.

30 Fig. 4 is a similar view of a modified form of heating plate structure.

Fig. 5 is an enlarged sectional view through a plurality of adjacent portions of the same strips embodied in the invention, following the winding operation.

Fig. 6 is a similar view of the same parts following the insulating step and previous to the application of the cover or supporting plate thereto.

40 In the drawing 10 indicates a metal heating plate, 11 a shell, and 12 a back plate. As shown in Fig. 2, the back plate rests on the flange 11a of the shell and the adjacent edges of the shell and top or cover plate are suitably secured together by press-fitting, welding, or the like, as indicated at 10a.

45 In Fig. 3 similar numerals increased by one hundred, indicate like or similar parts and in this figure the plate 110 is welded to the flange 111b of the shell 111 having the spaced and inwardly directed flange 111a which supports the back plate 112.

50 In Fig. 4, similar numerals of the two hundred series indicate like parts. In this form, the top plate 210 has a downwardly directed groove forming portion 210a adapted to nest the outwardly

directed flange 211b of the shell 211 having the inwardly directed lower flange 211a, upon which rests the back plate 212. In the chamber thus formed, substantially all of the space not occupied by the members hereinafter to be described, 5 is filled with a suitable heat and electrical insulation, such as mineral wool, indicated in Fig. 2 by the numeral 13 and in Fig. 3 by the numeral 113 and in Fig. 4 by the numeral 213.

10 In Fig. 2 of the drawing, there is illustrated a metallic ribbon 14 which is arranged in scroll formation, as shown diagrammatically in Fig. 1. The same is suitably secured as at 15—that is, its adjacent lateral edge is welded, brazed, or the like, to the cover or vessel supporting plate 10. 15 In the channel formed between adjacent portions 14 is positioned a heating element in the form of a strip of resistance material 16. The width of the strip 16 as shown clearly in Fig. 2, is less than the width of the metal strip 14. In other words, the heating element or strip 16 is nested between adjacent portions of the heat conducting strip 14 which also serves as a reinforcement for the cover or heating plate 10. The strip 14 serves to confine the heat and localize it so that 25 it is imparted to the strip 14 and thence directly conducted to the plate 10, except that portion of the heat which rises directly upwardly toward the plate 10. The heat which is directed downwardly is prevented, to a greater or less degree, 30 from being transmitted to plate 12 by the mineral wool insulation 13, or the like.

35 In one form of the invention portions 14 may be cast integral with the plate 10 and the heating strip 16 when suitably enveloped by electrical insulation, may be nested in the groove or channel formed by the aforesaid.

40 The inner end of the scroll arranged heating strip includes an angular extension 17 which projects through an aperture 18 in an insulating member 19 mounted in the aperture 20 in the plate 12.

45 Suitably secured to the plate 12 as at 21 is a bracket 22 that mounts a screw bolt 23 bearing a nut 24 thereon. The screw bolt 23 is insulated from the bracket by suitable insulation washers 25. One current conducting line may be clamped between the nut 24 and the metal washer 26. The lead wire portion 17 of the heating strip is clamped between the washers 27 and 28. 50

55 A similar type of terminal structure is associated with the opposite end of the heating wire, the lead-in portion being indicated by the numeral 29, with the offset portion thereof by the numeral 30 and the same extends beneath the

plate to the end of the strip 16 in the outer channel or groove, as indicated at 31. The lead-in strip 29 is suitably insulated from the back plate 12 as at 32.

In Fig. 3 of the drawing, the reenforcing and thermal conducting metal strip is indicated by the numeral 114. The adjacent edge of the same is connected as at 115 to the cover or vessel supporting plate 110. Positioned in the groove or channel between adjacent portions of the strip 114, is the electric heating strip 116. The strips 114—116 are of dissimilar width. The two strips are superimposed upon each other with a strip of insulation 135 and another strip of insulation 136. The entire superposed strip arrangement is then wound on a suitable mandrel and thus the electric heating strip is electrically insulated from the reenforcing strip. As shown clearly in Fig. 3, when the strips are associated in wound relation, they are tightly associated together and form a unit with the channel, as it were, between adjacent portions of the strip 114 and above the upper and lateral edge of the heating strip 116.

The electrical insulating strips 135 originally may be metallic magnesium ribbon, subsequently oxidized for use.

Before securing the heat conducting portions 114 to the cover or vessel supporting plate 110, this channel may be filled with magnesium oxide providing insulation 136 between the cover plate and the electric heating strip. The cover plate, as will be apparent, protects the electric heating strip from water, or the like, from a vessel, such as a coffee pot, et cetera, overflowing and shorting out sections of the heating unit. It will be apparent when the portions 114 are secured to the cover 110 that the heating element and the unit as an entirety is rigidly held together by the cover plate.

In Fig. 4 a slightly modified form of the invention is illustrated. In this form of the invention, the strip 214 again is of greater width than the heating strip 216. However, in this instance, the thermal conducting metal strip 214 is provided with a groove or channel 214a adapted to nest, partially or completely, as desired, depending upon the depth of the channel or groove 214a, the electric heating strip 216. Interposed between the electric heating strip 216 and the metal strip 214 are strips of insulating material 235.

The four strips are simultaneously wound upon a mandrel and since the insulation strips are of lesser width than the heat conducting and reenforcing strip, the structure when assembled is such that relative transverse movement of the heating strip with respect to the heat conducting strip is prevented. Thereupon the heating unit may have the lateral and upper edge of the strip 214 suitably secured or united to the cover plate 210 as at 215.

The insulation strips in each of the before mentioned forms of the invention, may be a ribbon of metallic magnesium which upon oxidation forms the electric insulating magnesium oxide facing medium. This oxidation may take place either prior to, subsequent to or simultaneously with the uniting of the thermal conducting strip to the cover or vessel supporting plate.

Reference will now be had to Figs. 5 and 6 wherein the numeral 314 indicates the metal thermal conducting strip, 316 the electric heating strip, 335 the two insulation strips therebetween. The heating strip again is illustrated as being of less width than the thermal conducting strip

and the insulation strips are each illustrated as being of greater width than the heating strip but of less width than the thermal conducting strip.

After being wound into a heating unit, the insulation strips 335 may have their channel exposed portions 335a directed inwardly and have their ends contact as at 335b. This forms a sufficient insulation to prevent the electric heating strip from contacting the cover plate and shorting out. If desired, additional insulation, as indicated at 336, may be supplied, this being in the form of the magnesium oxide or any equivalent material. Following the formation of the unit, as shown in Fig. 6, the heat conducting strip 314 is suitably secured to the cover or support plate.

One form of insulating strip is of mica material. The resulting construction, how so ever formed, forms a heating plate in which heat is generated in the ribbon wire or heating strip and by reason of its shape, provides a greater amount of surface per unit of cross section and in this way, the heating strip per unit of length has a greater surface for heat emanation. Likewise, this construction provides that all points of the surface of the heating strip are within a relatively short distance of heat conducting metal so that the heat may be readily conducted away from the source to the cover or vessel supporting plate. This results in the temperature of the heating strip or wire being kept relatively low and this adds to the length of life of the wire. Since the heat generated by the same is concentrated on the cover or vessel supporting plate, the efficiency of this type of heating device is much greater than similar heating devices, heretofore employed in the art.

One suitable form of uniting the thermal conducting strip to the cover or plate is by a copper brazing process which results in a highly efficient thermal bond as well as a mechanical bond. In place of the mineral wool, previously described as useful for filling the chamber of the heating device and designated by numerals 13, 113 and 213 in Figs. 2, 3 and 4, respectively, the same may be of asbestos character or a pulverized form of other suitable material.

One problem inherent in the construction disclosed herein, is that it is desired to position the heating strip as close to the cover or plate as possible. Hence, danger of shorting the electric heating strip by its slippage and contacting the cover plate must be positively prevented by any one of the disclosures set forth herein or one of equivalent character.

Inasmuch as the insulation material filling the chamber of the device has considerable thickness below the heating portion of the device, more especially the heating unit, shorting between the electric heating strip and the back plate is not a problem and hence, no special provision for insulation other than that shown or described is deemed necessary.

As indicated at 136 and 336 in Figs. 3 and 6, respectively, magnesium oxide powder may be placed in these grooves, the cover plate superposed upon the thermal conducting strip and then the two united in any desired and suitable manner.

Increased efficiency of the device is also obtained by making the interior surface of the back plate of non-tarnishing character by either making the plate of non-tarnishing material and mechanically polishing the same or by coating the interior face of the back plate with suitable pro-

5 tective material so that its surface is bright and will remain so. Such a bright or polished surface, therefore, will reflect any and all heat rays directed upon it from the heating strip 116 upwardly and away from it and thus toward the cover plate.

10 The terminology "adjacent non-continuous portions" is intended to refer to portions in the same strip which are adjacent each other and spaced apart as in a spiral or scroll by the distance between adjacent portions in a radial plane as distinguished for adjacent portions in immediate continuity.

15 While the invention has been described in great detail in the foregoing specification, the same is to be considered as illustrative and not restrictive in character. Various modifications have been illustrated and described herein and these modifications as well as others suggested herein and others which will readily suggest themselves to persons skilled in this art, are considered to be within the broad scope of the invention, reference being had to the appended claim.

The invention claimed is:

25 An electric heating device including, a vessel or like supporting heat transmitting plate of comparatively thin section in thickness and of great

area, means supporting said cover plate at its peripheral edge, an elongated continuous electric heating strip beneath the plate and of bare metallic resistance type ribbon of rectangular like section and wound on edge with one of its edges adjacent and substantially parallel to the cover plate, a corresponding heat conducting metal strip in juxtaposition to the heating strip, rigid with the cover for reenforcement thereof against warpage and correspondingly wound and having a corresponding edge in direct thermal contact with the cover for thermal conductivity, means electrically insulating the heating strip from the cover and the juxtapositioned reenforcing strip, the two strips being of scroll outline, the heat conducting strip including a groove in one side face thereof for laterally nesting the heating strip therein for locating purposes, the insulation means being at both sides of the heating strip, the strips and insulation being coiled into a compact mass, the heat conducting strip including a projecting portion at one side of the groove for rigid connection to the cover, and a heat deflecting plate beneath the heating and metal strips and spaced from the heating strip and associated with the cover supporting means.

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