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L. L. SALTON
ELECTRIC FOOD WARMERS
Filed March 31, 1958

2,976,386

FIG. 1.

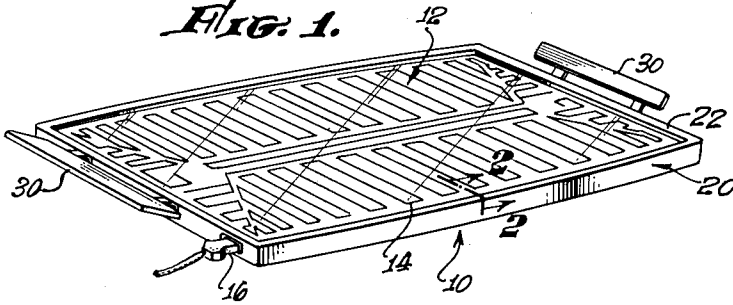


FIG. 2.

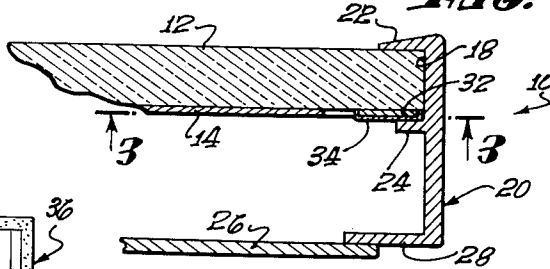


FIG. 5.

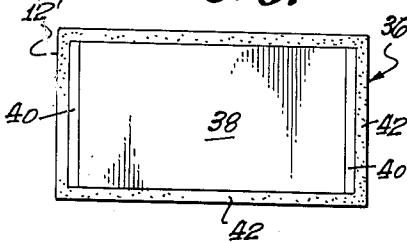


FIG. 3.

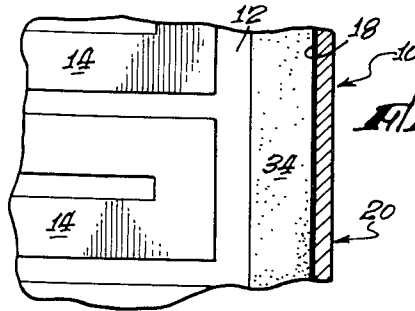
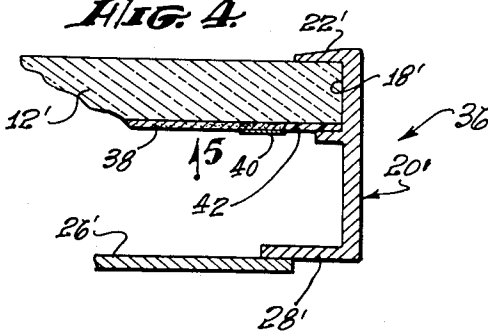


FIG. 4.



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ELECTRIC FOOD WARMERS

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7 Claims. (Cl. 219-19)

This invention relates to new and improved electric heating devices, especially to electric food warmers.

Many electric heating and warming devices are manufactured at the present time in the general form of a glass plate. Such plates are conventionally built so as to include a metal frame which surrounds and holds a shatterproof type of glass plate. The undersurface of the glass plate in this type of electrical food warmer carries an attached electrically conductive layer which often forms a pattern in the form of a ribbon, strip or band of conductive material. In this variety of electric heater appropriate terminal means are electrically connected to the ends of the pattern itself. Electric food warmers of this type generally have the form of a tray whose bearing surface is formed by the glass plate.

With this type of construction when the terminal means employed are connected to an appropriate electrical outlet, current is caused to flow through the electrically conductive pattern. Because of the inherent resistance characteristics of the material from which such a pattern is manufactured, this pattern becomes heated. As the pattern itself is heated most of the heat is transmitted to the glass plate employed and then is radiated from the food warmer by this glass because the glass has a higher emissivity for heat radiation than the surface of the pattern itself. Considerable heat is, however, radiated by the surface of the pattern, and some heat is, of course, transferred by conduction.

Electric heaters and especially food warmers of the type indicated in the preceding paragraphs are widely used for the purpose intended. However, as conventionally constructed, they tend to present somewhat of a shock hazard. When liquid, such as water, is spilled upon the surface of a glass plate, there is a tendency for some of this liquid to flow along the surface of the glass plate so as to electrically connect the conductive pattern employed with the metallic frame used in this type of construction. When this occurs, the frame itself is "charged" and one touching it is apt to receive an electrical shock.

An object of this invention is to provide new and improved electric heating devices and especially food warmers. Another object of this invention is to provide electric heating devices and food warmers which do not provide the shock hazard encountered with prior constructions such as are briefly indicated in the preceding. A more specific object of this invention is to provide electric heating devices and food warmers of the type indicated in which water or liquid repellant means are disposed so as to eliminate danger of electric shock in the event liquid is spilled upon them.

Because of the nature of this invention it is not considered necessary to set forth in this specification a further list of various objects and advantages of the invention itself. Such other objects and advantages of the invention will be fully apparent to those skilled in the art to which this invention pertains from a detailed consideration of the remainder of this description including the appended claims and the accompanying drawing in which:

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Fig. 1 is a perspective view of an electrical food warmer of this invention;

Fig. 2 is a partial cross-sectional view taken at line 2-2 of Fig. 1;

Fig. 3 is a partial cross-sectional view taken at line 3-3 of Fig. 2;

Fig. 4 is a partial cross-sectional view corresponding to Fig. 2 of a modified electric food warmer of this invention; and

Fig. 5 is a bottom view of the glass plate employed in the modified food warmer indicated in Fig. 4, this view being taken in the direction of the arrow 5 in Fig. 4.

Wherever convenient for purposes of illustration and explanation like numerals have been used to designate like parts in the accompanying drawing. It is to be understood that this invention is not limited to electric food warmers constructed precisely as shown inasmuch as a number of differently appearing electrical food warmers and other electric heating devices incorporating the inventive features herein shown and described may be easily designed. The accompanying drawing is, however, primarily intended to illustrate a presently preferred embodiment of the invention.

As an aid to understanding this invention it may be stated in essentially summary form that it concerns electrical food warmers each of which is built so as to include a conductive metal frame holding a glass plate. Upon the lower surface of such a plate an electrically conductive coating is located so that this coating is spaced from the side edges of this lower surface. This coating may be in the form of a continuous ribbon of conductive material having appreciable electrical resistance. Around the outside of the electrical conductive pattern employed a water or liquid repellant material is located so as to form a frame or border on the lower surface of this plate. This border serves to provide an area surrounding the electrical conductive coating which prevents water or other liquid from wetting the lower surface of the glass plate, and, hence, protects against current being conveyed by such liquid from the electrically conductive pattern to the frame during various circumstances such as, for example, when water or other liquid is spilled upon the upper surface of the glass plate.

In order to explain this invention more fully it is considered advisable to refer directly to the accompanying drawing. In Fig. 1 there is shown a complete electric food warmer 10 of the present invention which is built so as to include a glass plate 12 having on its lower surface an electrically conductive coating in the form of a pattern 14. This pattern conveniently may take the form of a continuous ribbon of electrically conductive material applied to a tempered glass plate as described in the Long U.S. Patent No. 2,119,680 although a number of other equivalent electrically conductive patterns may be employed with the invention.

The material from which the pattern 14 is created preferably possesses sufficient electrical resistance so that when current is applied to it through the use of a terminal 16 this pattern is heated in accordance with the well known laws of electricity. The terminal 16 is attached to the ends of the ribbon comprising the pattern 14 by appropriate connections (not shown) of the general variety described in the aforesaid long patent.

The glass plate 12 is held in the food warmer 10 by means of a U-shaped channel 18 in a metal frame 20 which extends completely around this plate 12. Thus, the frame 20 is a conducting support for the plate 12. As indicated in Fig. 2 of the drawings the sides 22 and 24 of the channel 18 resiliently engage the glass plate so as to prevent its movement within the complete frame 20. An appropriate bottom plate 26 may be attached by screws or the equivalent to a projecting flange 28 located

at the bottom of the frame so as to cover the complete bottom of the warmer 10. In the embodiment of the invention shown in Fig. 1 conventional handles 30 are attached to opposed ends of the frame 20 for use in moving the food warmer 10.

As can be seen from an examination of Fig. 2 of the drawing the construction of the channel 18 within the frame 20 is such that a comparatively "loose" connection is made between the glass plate 12 and this frame. Because of the nature of the contact between the frame 20 and this plate 12 when liquid, such as water, is spilled upon the exposed surface of the plate 12, this liquid will tend to adhere to the surface of this plate and to flow around the end or side of the plate 12 located within the channel 18 so as to contact the surface of this plate 12 to which the pattern 14 is attached. If this occurs, it is considered obvious that the frame 20 will be electrically connected to the pattern 14 and that anyone touching this frame will receive an electric shock.

In order to prevent this difficulty with the embodiment of the food warmer 10 shown a small conductive metal border 32 coated by a strip of hydrophobic material 34 which is not wetted by water or other similar liquid is located completely around the pattern 14 so as to be spaced from this pattern. The border 32 is not connected with the pattern 14 and serves as a region separating this region from the conductive support or frame 20. With this construction the material 34 prevents liquid from adhering to the glass plate 12 and flowing by what may be termed surface tension so as to be in contact with the pattern 14. As a result this pattern 14 is effectively insulated against any shock danger which may arise from water or the like being spilled upon the food warmer 10 itself.

The material 34 may be easily applied in the form of a border by any of a variety of known techniques. Thus, for example, a conventional type of silicone enamel or the like can be applied to the border 32 by various known processes. Similarly other materials, such as polytetrafluoroethylene can be applied to this border 32 by placing a suspension or dispersion of particles of this material upon the border 32 and then heating in accordance with known procedures. Other materials which are hydrophobic in nature can be of course used in this manner. The border 32 is advantageous in this type of construction inasmuch as it adds to the decorative attractive appearance of the complete warmer 10, and inasmuch as many hydrophobic materials, such as are capable of being used with the invention adhere more easily to this type of border than to glass.

A particularly advantage of this type of construction is that it is most readily adapted to the conventional method of manufacturing this type of conductive pattern. In this method one surface of the glass is first completely covered with a layer of the conductive material then a protective pattern of a chemically resistant material is applied unto it and finally that part of the conducting layer which is not thus protected is removed by chemical means. This method of production is described in more detail in U.S. Patent No. 2,673,142, T. W. Glynn. It is easily seen therefore that border 32 may be produced without any additional steps in the manufacture by appropriately designing the protective pattern and by choosing the protective material so that it has the desired water repellant characteristics.

It is possible to define the nature of the various materials which may be used as the material 34 indicated in Fig. 2 of the drawing in a number of ways. The term "hydrophobic" used in this specification is employed to designate materials which are repellant to water and aqueous solutions such as coffee, tea, milk and the like. Another method of defining this material is with reference to the angle of contact between this material and water. Preferably the material used as the material 34 illustrated should be of such a nature that an angle of contact

between water and this material is at least 90°; and preferably this angle is greater than this value. In other words, the material 34 should be incapable of being "wetted" by water or other common household liquids or solutions.

In the food warmer 10 the conductive metal border or strip 32 is advantageous in that it helps to distribute heat more rapidly than uncoated glass serves to distribute heat. Thus, this conductive metal border 32 serves to reduce stresses and to aid in preventing breakage along the unheated edge of the plate 12 during the use of the food warmer 10.

In practicing the teachings of the invention it is possible to provide a modified construction 36 as indicated in Fig. 4 of the drawing. In this modified food warmer 36 a frame 20' of the type as previously indicated serves to hold a glass plate 12' substantially as previously indicated. This modified construction differs from the food warmer 10 in that the bottom surface of the plate 12' is covered with an elongated electrically conductive coating 38, as shown in the Fig. 5 of the drawing. Appropriate conventional terminals 40 are attached to the opposed ends of this block-like coating 38 in accordance with known practice. The terminals 40 are adapted to be connected to another terminal (not shown) such as the terminal 16 previously described used in connecting the food warmer 36 into an electrical circuit. Located around the outside edge of the coating 38 and the terminals 40 is a strip-like border or region 42 having the same properties as the material 34 previously indicated. A suitable border 42 may be created by applying to the plate 12' any of a number of various known long chain cationic compounds such as long chain amines or quaternary ammonium compounds containing 12 to 24 carbon atoms. One compound which may be advantageously used is trimethyloctadecyl ammoniumchloride. The method of treating a glass surface with such compounds is known at the present time, and preferably involves simply wetting the glass with a highly dilute solution of this material. The border 42 may also be created from various other known materials such as polytetrafluoroethylene as indicated above or from halosilanes or halosilicones.

The various hydrophobic borders which may be employed with this invention may be used in addition to various insulating materials, some of which may be water repellant, which are at times placed upon a pattern such as the pattern 14, in order to insulate this pattern. It has been found that many of the coatings applied to a conductive pattern, such as the pattern 14, may tend to be somewhat porous and, hence, will not exercise sufficient protection against undesired shock when liquid is spilled upon a food warmer of the type to which invention pertains.

Those skilled in the art to which this invention pertains will realize that the use of a hydrophobic border as herein described is efficient in eliminating a shock hazard. They will further realize that if desired several different borders of the type described in this specification may be used around an electrically conductive pattern in order to provide protection against shorting of this pattern. All of the various borders of a hydrophobic variety coming within the scope of this application may be easily and conveniently applied to a glass plate with a minimum of difficulty and, hence, contribute to effective, safe structures which may be created at a comparatively low cost.

I claim:

1. A heating device which includes a conductive metal support; a glass plate held by said support, said plate having an upper and a lower surface; an electrically conductive layer attached directly to the lower surface of said plate, said layer being spaced from the edges of said lower surface; a conductive material strip located on said lower surface of said plate so as to surround said conductive layer and spaced therefrom; said conductive ma-

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terial strip being coated by a hydrophobic material and serving as a liquid repellant border around said layer.

2. A heating device as defined in claim 1 wherein said hydrophobic material is composed of a silicone enamel.

3. A heating device as defined in claim 1 wherein said hydrophobic material is composed of polytetrafluoroethylene.

4. A heating device which includes: a conductive metal support; a glass plate loosely held by said support, said plate having an upper and a lower surface; an electrically conductive layer attached directly to the lower surface of said plate, said layer being spaced from the edges of said lower surface; a hydrophobic strip located on said lower surface of said plate so as to surround said conductive layer and so as to be spaced therefrom, said strip serving as a liquid repellant border around said layer.

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5. A heating device as defined in claim 4 wherein said hydrophobic strip is formed of cationic compounds.

6. A heating device as defined in claim 4 wherein said hydrophobic strip is composed of polytetrafluoroethylene.

7. A heating device as defined in claim 4 wherein said hydrophobic strip is formed of organo silicon compounds.

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