

[72] Inventor **Bohdan Hurko**
Louisville, Ky.
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[73] Assignee **General Electric Company**

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3,406,279 10/1968 Ziver 219/464

Primary Examiner—Volodymyr Y. Mayewsky
Attorneys—Harry F. Manbeck, Jr., Oscar B. Waddell, Frank
L. Neuhauser and Richard L. Caslin

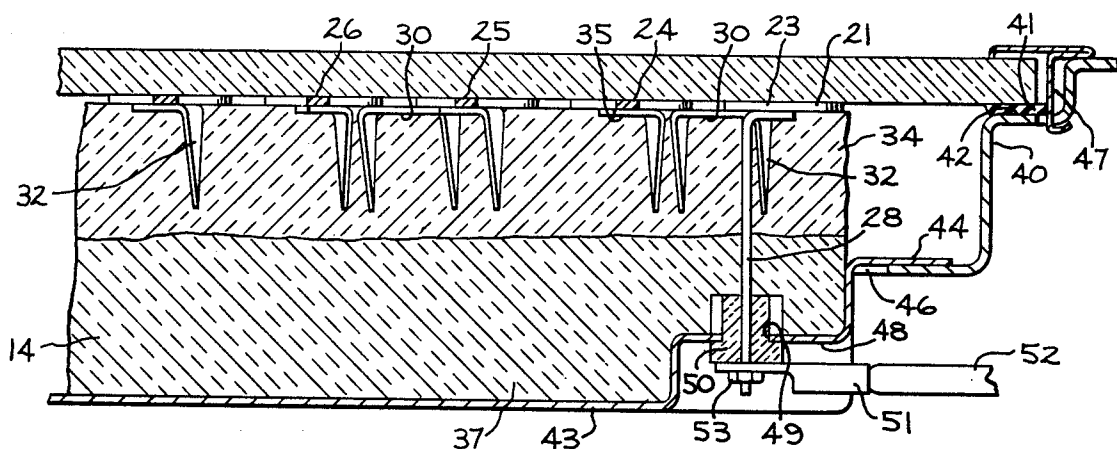
[54] **PLANAR SURFACE HEATER WITH INTEGRAL
FASTENERS FOR HEATING ELEMENT**
4 Claims, 7 Drawing Figs.

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219/467, 219/468, 219/542
[51] Int. Cl. **H05b 3/68,**
H05b 3/06, H05b 3/16
[50] Field of Search 219/464—
3—5, 467—8, 455—9, 345, 542

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ABSTRACT: A heated cooktop having a top glass-ceramic plate with one or more electrical resistance heating units adjacent the underside thereof to form one or more heated areas of the plate upon which a cooking utensil could be positioned for heating or cooking purposes. A heating unit has a base plate upon which are supported a first lower layer of resilient insulation material, a second layer of semirigid insulating board, and a closely wound, sinuous, electrical resistance heating wire of flattened cross section, where the resistance wire is provided on its underside with fastening spikes that are embedded in the top of the insulating board. The top of the resistance wire is in heat transfer relationship with the glass-ceramic plate. The top plate is seated on a supporting surface independently of the heating units. One embodiment incorporates a strip of elastic material under the peripheral edge of the top plate and in contact with the supporting surface to prevent direct contact between the top plate and supporting surface, while sealing the joint therebetween from the accumulation of liquids and soil.



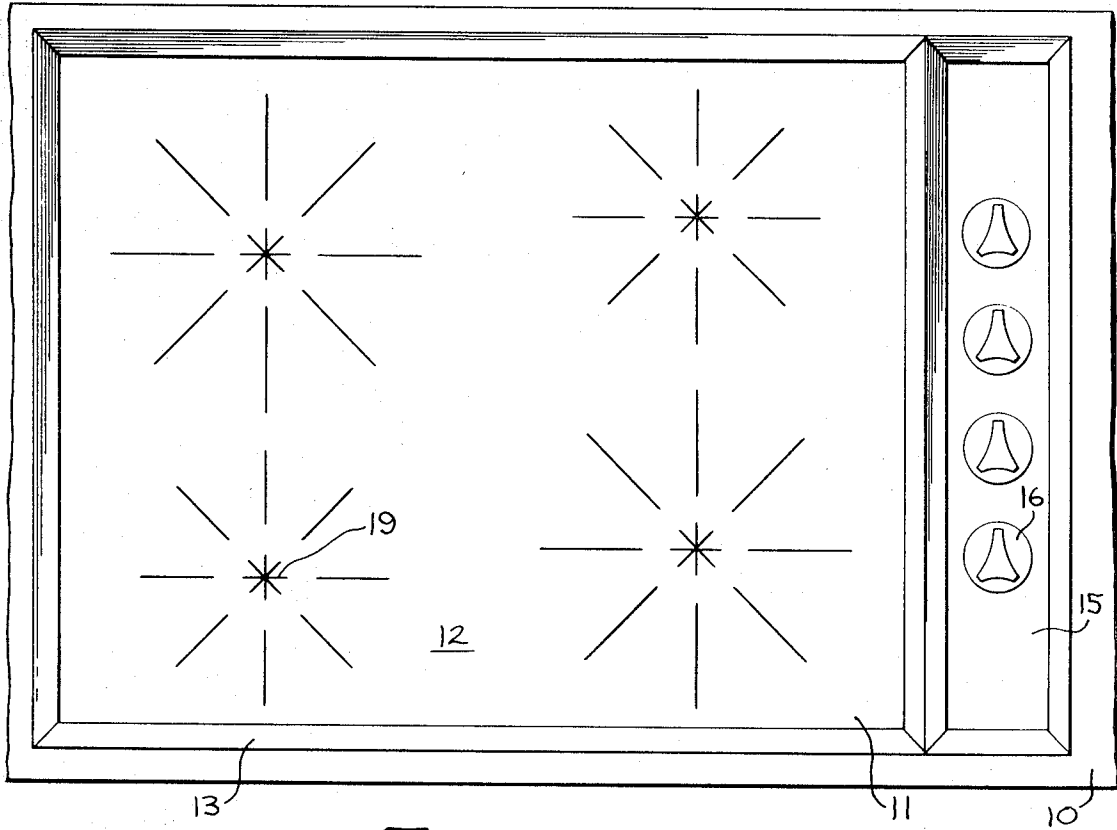


FIG. 1

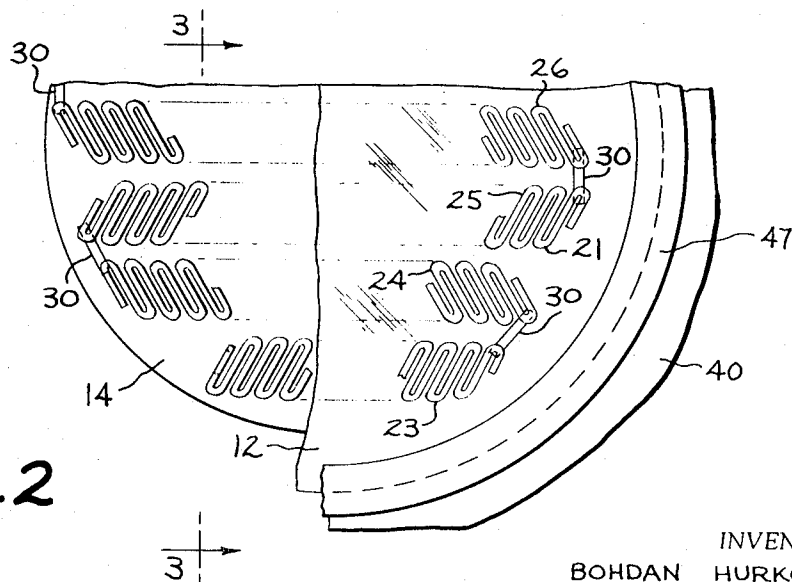


FIG. 2

INVENTOR
BOHDAN HURKO
BY *Richard L. Caslin*
HIS ATTORNEY

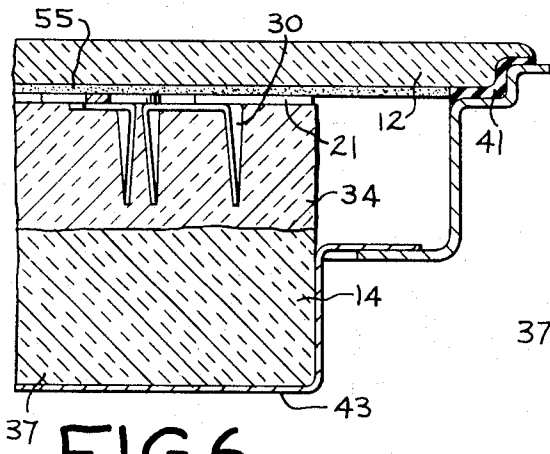


FIG. 6

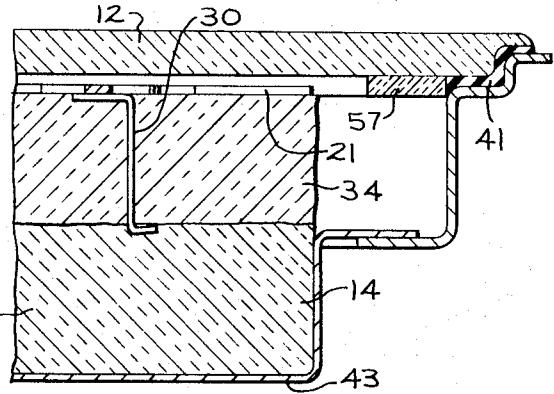


FIG. 7

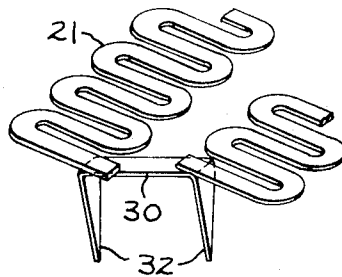


FIG. 4

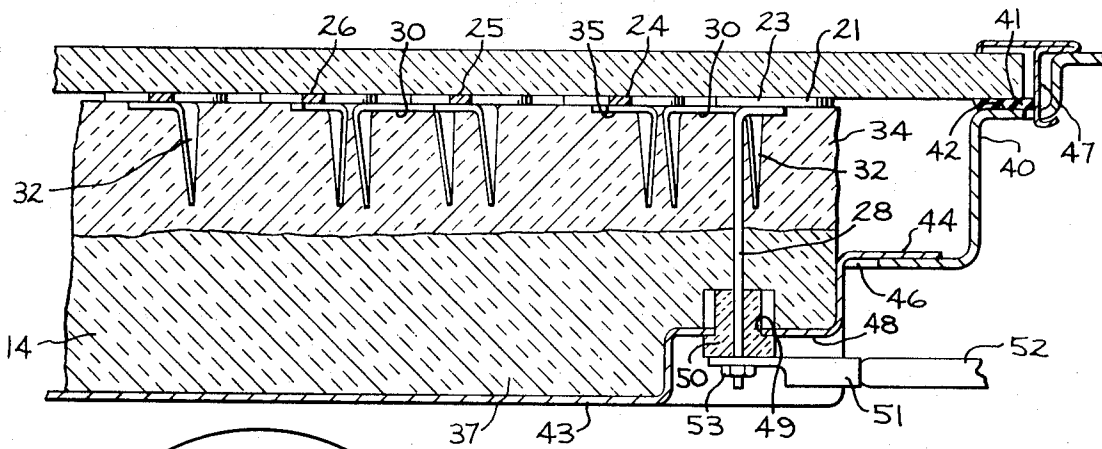


FIG. 3

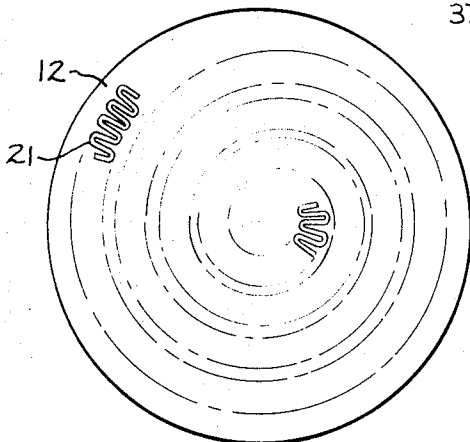


FIG. 5

INVENTOR.
BOHDAN HURKO
BY *Richard L. Caslin*
HIS ATTORNEY

PLANAR SURFACE HEATER WITH INTEGRAL FASTENERS FOR HEATING ELEMENT

BACKGROUND OF THE INVENTION

The average housewife is becoming more interested in having pleasing appearance designs around her home, as well as enjoying the improved ease of cleaning household kitchen appliances. Particular reference is made here to domestic ranges. As to the ease of cleaning the oven of a range, there has been widespread acceptance of the pyrolytic, self-cleaning oven such as is taught in U.S. Pat. No. 3,121,158 of Bohdan Hurko, the present inventor. The solution of the problem of maintaining a clean oven has turned the attention of the housewife to the ease of cleaning the cooktop. A standard electric cooktop is usually provided with a plurality of metal sheathed electrical resistance heating elements which are each wound in the form of a coil and positioned in an opening formed in the cooktop. Each heating element is adapted to support a cooking utensil thereon. These metal sheathed heating elements are self-cleaning of food soil due to the high temperatures they are allowed to reach once they are energized, but it is possible for spillovers to drain through the heating element and accumulate in a collecting pan located beneath the cooktop.

In order to reduce this cleaning problem, cooktops or solid plate surface units have been proposed in which the exposed surface is formed of a glass-ceramic panel. In particular, a generally milk-white, opaque glass-ceramic material has been suggested for this use. Examples of such material are the crystalline glass sold under the trademarks "Pyroceram," "Cer-Vit," and "Hercuvit." The opaque crystalline glass, because of its smooth surface, not only presents a pleasing appearance but it is also readily cleanable. There has been a problem, however, in these glass-ceramic heating units in obtaining satisfactory heating rates as compared with those available from the traditional, exposed, metal sheathed electrical resistance heating units.

An object of the present invention is to provide an improved solid plate surface heating unit which is pleasing in appearance, efficient in operation and competitive with the operation of present day metal sheathed electrical resistance heating elements, as well as resistant to mechanical impact and serviceable over a long period of time.

A further object of the present invention is to provide a solid plate surface heating unit of the class described where the plate is of crystalline glass and the source of heat is a sinuous, flattened, electrical resistance wire with special means for fastening the wire to an insulating base.

A further object of the present invention is to provide a solid plate surface heating unit of the class described with a moisture proof resilient sealing means around the periphery of the plate that serves as a shock absorbing support means therefor.

A further object of the present invention is to provide a solid plate surface unit of the class described where the source of heat energy is supported on a resilient insulating medium which serves to hold the heat source in firm contact with the underside of the plate for good thermal conductivity.

A further object of the present invention is to provide a solid plate surface unit of the class described with insulating means for supporting the plate from a cooktop surface.

SUMMARY OF THE INVENTION

The present invention, in accordance with one form thereof, relates to a solid plate surface heating unit comprising a crystalline glass plate supported at its periphery by a sealing medium. Beneath the plate is a closely wound, sinuous, electrical resistance wire flattened in cross section, and in strip form. There are means for fastening the resistance wire to an insulating base whereby the crystalline plate is protected against mechanical impacts. The glass also has generally uniform temperature gradients due to a large contact surface area relationship between the heating means and the plate.

BRIEF DESCRIPTION OF THE DRAWINGS

My invention will be better understood from the following description taken in conjunction with the accompanying drawings and its scope will be pointed out in the appended claims.

FIG. 1 is a top plan view of an electric cooktop embodying the present invention where the cooktop has a single solid glass plate with a series of four heated surface units and a related control panel.

FIG. 2 is an enlarged fragmentary plan view of a single solid plate surface unit with the crystalline glass plate removed to show the closely wound, sinuous, flattened electrical resistance wire in strip form that is supported on layers of insulating material of generally circular form. It will be understood that the heating element would ordinarily not be visible through the opaque glass.

FIG. 3 is a fragmentary cross-sectional elevational view on a slightly larger scale of the solid plate surface heating element taken on the line 3-3 of FIG. 2 and showing the supporting base plate for the surface heating element as well as two layers of insulating medium which carry the resistance wire on the top thereof and press the wire into good thermal contact with the underside of the crystalline plate. Particular attention is directed to the presence of staples fastened to the underside of the resistance wire and embedded in the top layer of the semirigid insulating medium to hold the wire in place.

FIG. 4 is a fragmentary detailed view of the staple method of joining the adjacent ends of two strips of the resistance wire.

FIG. 5 is a second modification of the present invention wherein the closely wound sinuous flattened electrical resistance heating wire is wound in a spiral coil somewhat resembling the configuration of a metal sheathed resistance heating element.

FIG. 6 is a fragmentary cross-sectional elevational view of a third modification of the present invention showing a ceramic layer formed on the underside of the glass plate where the ceramic layer has a high electrical resistivity.

FIG. 7 is a fragmentary cross-sectional elevational view similar to that of FIG. 6 of a fourth modification of the present invention where the heating wire is shown spaced away from the underside of the glass plate.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to a consideration of the drawings, and in particular to FIG. 1 there is shown a plan view of a kitchen counter 10 having built therein an electric cooktop 11 comprising a solid glass plate heating surface 12 surrounded by a metal trim frame 13 and having an adjoining control panel 15 that includes a multiple position switch 16 for each one of the four plate surface heating elements for obtaining various rates of heat energy. The solid glass plate heating surface 12 is of crystalline glass which has a milk-white opaque appearance with generally a starlight design or target 19 centered over each one of the four individual surface heating elements for assistance in locating the proper position of the cooking utensils. It will be understood by those skilled in this art that the present cooktop invention could also be used as the cooktop of an electric range with an underlying oven, or it could be built as a single solid plate surface unit.

FIG. 2 is an enlarged plan view of a fragment of a single solid plate surface unit. It shows a source of heat 21; namely, an electrical resistance heating wire of closely wound sinuous configuration that is flattened and made in strip form so that it can be cut in varying lengths. The lengths are arranged in a parallel pattern to form a generally circular heated area; for example, the smallest lengths 23 lie the opposite sides of the unit and gradually increasing lengths 24, 25 and 26 are used as the center of the heating element is approached.

Attention is now directed to the slightly enlarged fragmentary view of FIG. 3 taken on the line 3-3 of FIG. 2. The nearest end of the short strip 23 of the heating wire 21 is formed with a vertical elongated terminal 28 which extends

downwardly for over several inches in the drawing. A similar terminal arrangement would be made on the opposite end of the heating wire 21. The opposite end of strip 23 is adapted to be joined to the adjacent end of the strip 24 by means of a relatively large staple 30. A similar connection is made at the opposite end of the strip 24 for joining it with the adjacent end of the strip 24 by means of another staple 30.

The enlarged fragmentary view of FIG. 4 shows the relative size of the staple 30 and the length of its two spikes 32. These staples 30 are welded or otherwise fastened to the underside of the heating wire 21 and are adapted to be embedded in a high temperature semirigid insulating board 34, as is best seen in FIG. 3. Single spikes 35 are also fastened beneath the heating wire adjacent the midportion of each strip 23, 24, 25 and 26 so as to hold the heating wire onto the board 34 and prevent its movement and possible damage during manufacture, assembly and shipment.

A second layer of resilient lower temperature insulating material 37 such as fiberglass or the like is positioned beneath the insulating board 34. The upper semirigid insulating board or pad 34 is a high temperature insulating material such as is made from molded fibers of silica and alumina to withstand temperatures as high as 2000° F., and it provides a positive support for the heating wire 21. The lower insulating pad 37 has lower insulating properties and it is slightly compressed to exert a lifting force on the upper board and press the heating wire 21 into good thermal contact with the underside of the glass-ceramic plate 18.

The heater wire is preferably made of a resistance element known as Kanthal A-1 sold by the Kanthal Corp. of Stamford, Conn., having about 5.5 percent of aluminum, 2.2 percent of chromium, 0.5 percent of cobalt and the balance iron. The aluminum oxidizes and a layer of Al_2O_3 is formed on the surface of the heater and this serves to prevent current leakage when the heater wire is in direct contact with the hot crystalline glass plate.

As for the means of supporting the surface heating element 14, attention is directed to the cross-sectional elevational view of FIG. 3. The glass-ceramic plate 12 is first adapted to be positioned over a shallow metal pan 40. The metal pan 40 may be either circular or of generally rectangular form and it is adapted to be seated in a cooperating opening cut in the countertop 10. The peripheral edge of the glass-ceramic plate 12 is adapted to be seated on a short step or ledge 42 that encircles the pan. It is well to seal the peripheral edge of the glass-ceramic plate 12 with respect to the supporting step or ledge 42 of the pan 40, and this is accomplished by means of a continuous strip of adhesive material 41 which is a nonhardening plastic material such as silicone rubber which retains its elasticity and resilience as well as forms a waterproof seal. It is also a thermal insulator and a shock absorbing medium to prevent damage of the glass-ceramic plate due to mechanical impact. A trim strip 47 may be used around the periphery of the glass 12 to make a more permanent installation.

The bottom of the recessed pan 40 is shown with a circular hole 46 formed therein into which one of the heating elements 14 is seated. The bottom of the heating element 14 is furnished with a circular metal pan 43 as a supporting base which is seated within the hole 46 of the recessed framework and supported by a peripheral flange 44 from the edge of the hole. This pan 43 receives the insulating layers 37 and 34 which carry the heating wire 21 on the top thereof. A small hole 49 is shown formed in the bottom of the pan for receiving an insulating bushing 50 that is a hollow bushing for receiving one of the terminals 28 of the heating wire 21 therethrough. This terminal 28 is threaded at its lower end and it first receives a connector 51 of a lead wire 52 thereover and they are joined together by means of a fastening nut 53.

A second modification of the present invention is depicted in FIG. 5 where the glass-ceramic plate 12 is a round disc and it cooperates with a closely wound sinuous flattened resistance wire 21 that is of continuous form and it is wound in a coil starting as a small circle at the center and increasing in size as

it nears the outer limit of the coil. Thus, instead of cutting the resistance wire into varying lengths and joining the lengths together in a parallel arrangement to form a source of heat energy of relatively large surface area, a similar result could be accomplished by this spiral coil arrangement. A similar fastening means to the staples 30 would be used for holding the heating wire 21 to the underlying semirigid insulating board 34.

The third modification of the present invention is shown in FIG. 6 wherein the underside of the glass plate is coated with a ceramic layer 55 of high electrical resistivity such as silica or silicone dioxide or alumina so as to reduce the possibility of current leakage through the glass plate when it is being operated at high temperatures.

The fourth modification of the present invention is shown in FIG. 7 showing the heater wire 21 spaced away from the underside of the glass plate 12 by an insulating ring 57 positioned around the periphery of the heating element 14. Moreover the tips of the spikes of the staples 30 are folded over against the underside of the block 34 to prevent the heater wire from touching the glass.

Modifications of this invention will occur to those skilled in this art, therefore it is to be understood that this invention is not limited to the particular embodiments disclosed but that it is intended to cover all modifications which are within the true spirit and scope of this invention as claimed.

I claim:

1. A surface heater comprising a heated panel of glass-ceramic material, thermal insulating means in strip form for supporting the periphery of the panel from a metal base, at least one heating unit mounted beneath the panel and comprising a bottom supporting plate attached to said metal base, a first lower layer of resilient insulating material carried by the bottom plate, a second upper layer of semirigid insulating board carried by the said resilient layer, and an electrical resistance heating element supported on the top surface of the insulating board and having terminal portions for making electrical connection thereto, means for fastening the heating element to the insulating board, said heating element comprising a series of bands of sinuous flattened resistance wire, and means for connecting together each end of adjacent bands to form a continuous circuit from terminal to terminal, the lower layer of resilient insulating material being slightly compressed to bias the heating element into good contact with the underside of the glass-ceramic panel.

2. A surface heater as recited in claim 1 wherein the said fastening means for the heating element includes spikes integral with the underside of the element which penetrate the insulating board.

3. A surface heater as recited in claim 1 wherein the said connecting means between the ends of adjacent bands of the heating element comprise staples that are permanently attached between adjacent bands of the heating element and have spikes embedded into the insulating board.

4. A surface heater comprising a heated panel of glass-ceramic material, thermal insulating means in strip form adapted to support the periphery of the panel from a metal base, at least one heating unit mounted beneath the panel and comprising a bottom supporting plate attached to said metal base, a layer of semirigid insulating board carried by said bottom plate, an electrical resistance heating element supported on the top surface of the insulating board and having terminal portions for making electrical connections thereto, means for fastening the heating element to the insulating board including spikes integral with the underside of the heating element which penetrate the insulating board, said heating element comprising a series of bands of sinuous flattened resistance wire, and means for connecting together each end of adjacent bands to form a continuous circuit between said terminal portions, and resilient means carried by said bottom supporting plate for biasing the insulating board and its supported heating element upward into good thermal contact with the underside of the glass-ceramic panel.