United States Patent

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[73] Assignee General Electric Company

[54] SMOOTH SURFACED, HEATED COOKTOP
10 Claims, 5 Drawing Figs.

[52] U.S. Cl. 219/464, 219/445, 219/459, 219/460, 219/463
[51] Int. Cl. H05b 3/68
[50] Field of Search 219/464, 459, 456, 460, 445, 447, 449–450, 465–468, 476–480, 522, 543, 553

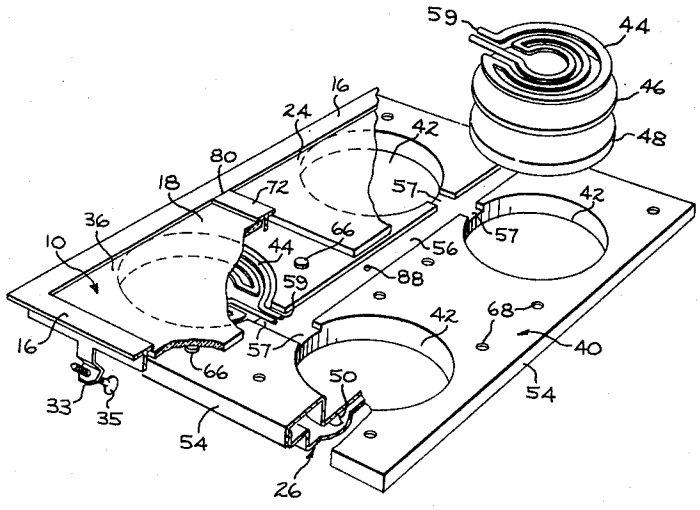
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ABSTRACT: A heated cooktop formed of four individual glass-ceramic plates supported in a plane across the open top of a mounting box. This box is adapted to be suspended in an opening formed in a kitchen counter to provide a flush, cooking surface, there being multiple remote control switches adapted to be mounted on the kitchen wall or on the front of the cabinet which supports the counter. Each plate is furnished with a metal-sheathed resistance heating element bearing against the underside thereof. A high emissivity, ceramic coating is interposed between the metal sheath and the underside of the glass-ceramic plate. A lower layer of thermal insulation supports the heating element up against the plate. Narrow trim strips overlie the peripheral edge of each plate to fasten the plates down. Resilient pads are located adjacent each corner of each plate to help support the plates. Certain of the trim strips are removable so that the cooktop is top-serviceable.



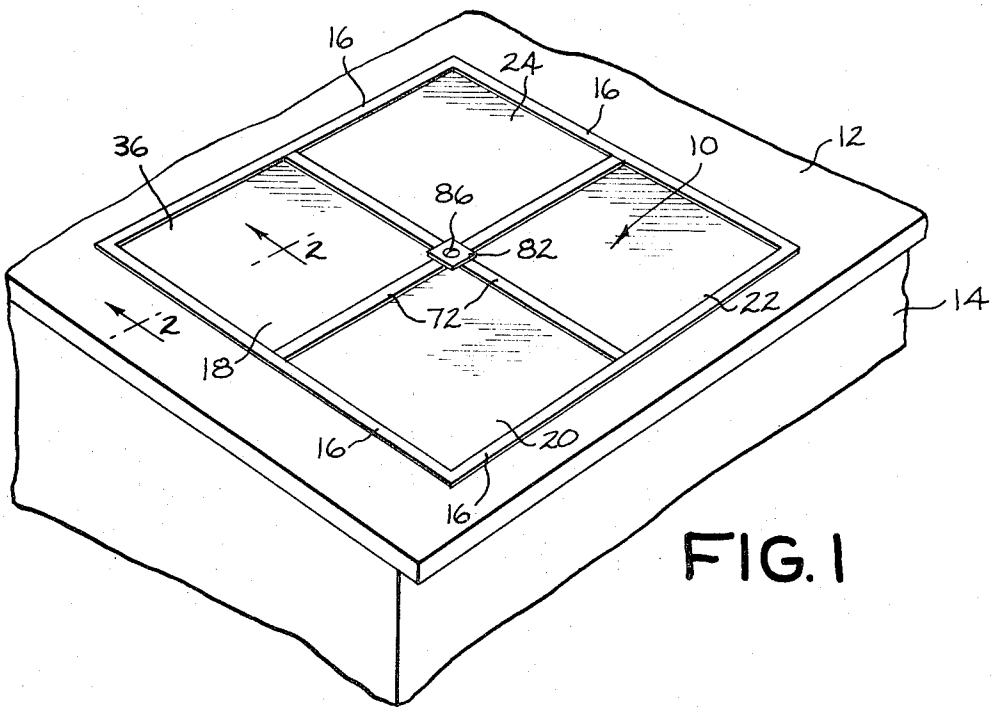


FIG. 1

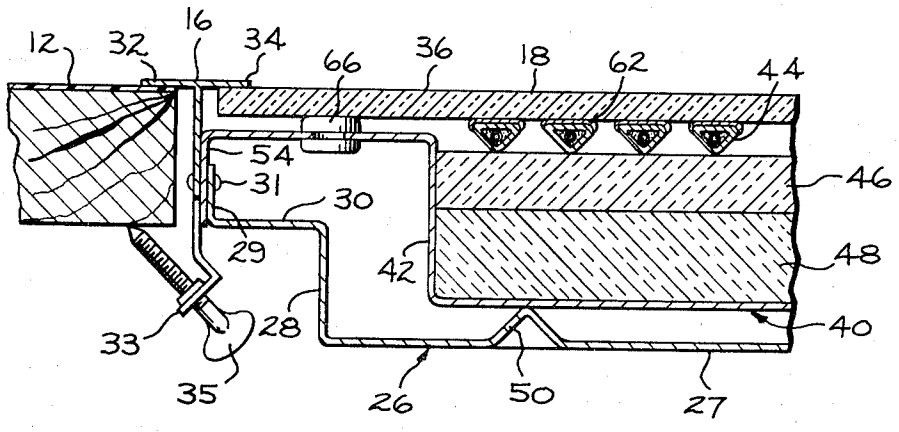


FIG. 2

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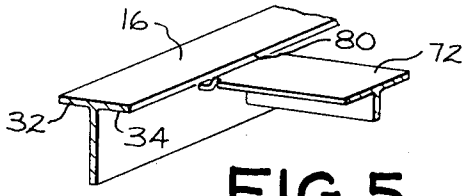


FIG.5

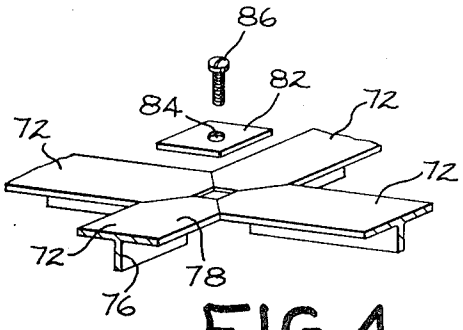


FIG.4

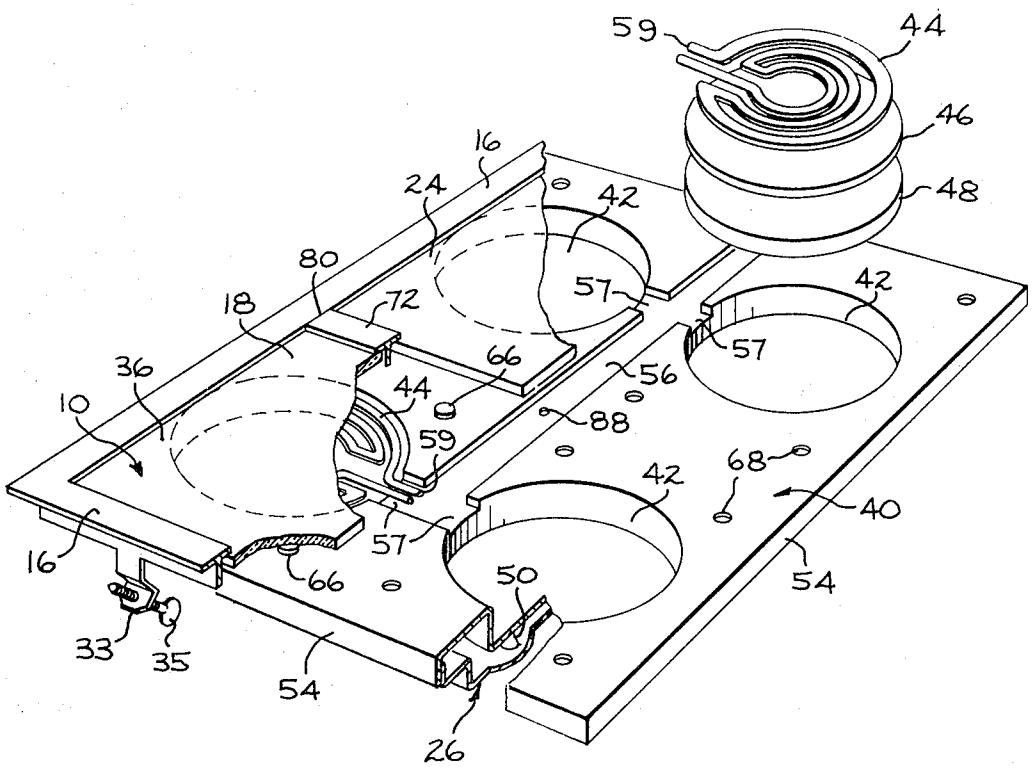


FIG.3

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SMOOTH SURFACED, HEATED COOKTOP

BACKGROUND OF THE INVENTION

The metal-sheathed electrical resistance heating-element of coiled configuration has become a standard design of electrical surface heating units. Such surface heating units have proved to be very efficient and reliable in operation for long periods of time. In most cases these heating units were mounted in an opening in the cooktop in which they are supported. In the event of boilovers, grease spatters or accidental spillage, the soil would pass through the unit opening in the cooktop and accumulate in the drip trays formed therebeneath. These metal-sheathed heating units are self-cleaning in that the sheath temperature operates above about 1,100° F., and any food soil or grease spatter that may accumulate thereon is rapidly decomposed. However, this does not apply to the spillage which flows through the unit openings in the cooktop and accumulates in the drip trays. This requires manual cleaning on a periodic basis to insure cleanliness.

One alternative to the metal-sheathed heating element is the use of a smooth surfaced, heated cooktop of single-plate construction of glass-ceramic material such as is disclosed in the Ziver U.S. Pat. No. 3,406,279. In such a design, an open-coil heating element is located beneath the glass-ceramic plate as is taught in the McLean U.S. Pat. No. 3,391,372. These glass-ceramic plates are of generally opaque, milk-white appearance of lithia-alumina-silicates having a very low coefficient of thermal expansion. Such materials are presently sold under such trademarks as "Pyroceram," "Cer-vit," and "Hercuvit." This opaque, crystalline glass, because of its smooth top surface of almost ground-glass appearance, not only presents a bright, pleasing appearance, but it is also readily cleanable and it does not permit the drainage of liquids and soil therebeneath.

One difficulty with using a single, large glass-ceramic plate for the cooktop having either two or four individual heating elements located therebeneath is that the large sheet of glass is exposed to rather irregular thermal stresses and strains, and it is required to support variable mechanical loads which render it vulnerable to breakage. Some people, especially those who have large families and vegetable gardens, tend to cook large quantities of food at one time; as for example, during the canning season. Another eventuality that does occur, is that children climb up onto the kitchen counter, and they might be tempted to walk on the glass-ceramic plate and thereby overload the glass plate, causing it to fracture.

Another characteristic of this type of smooth surface cooktop is that it tends to become more electrically conductive as it approaches high temperatures. Thus, it is felt that open-coil heaters should not be used, but instead, the metal-sheathed electrical resistance heating elements should be used instead.

The principal object of the present invention is to provide a smooth surfaced, heated cooktop using a plurality of individual glass-ceramic panels which are so mounted that each one may be removed individually from the cooktop, such that it is top-serviceable.

A further object of the present invention is to provide a glass-ceramic cooktop with a metal-sheathed heating means, and a high emissivity, ceramic coating interposed between the heating element and the glass-ceramic plate to protect the plate from reacting at elevated temperatures with the oxides of the metal sheath and also reducing the sheath temperature and hence the cooktop plate temperature and also rendering the heating element electrically safe from current leakage.

A further object of the present invention is to provide a smooth surfaced, heated cooktop of the class described with resilient means for urging the heating element against the underside of the cooktop plate.

A further object of the present invention is to provide a smooth surfaced, heated cooktop of the class described with resilient support means adjacent the corners of each individual glass-ceramic plate to assist in supporting the plate.

A still further object of the present invention is to provide hold-down trim means surrounding the peripheral edge of each plate so that each individual plate and its heating means may be top-serviceable.

SUMMARY OF THE INVENTION

The present invention, in accordance with one form thereof, relates to a glass-ceramic cooktop having a plurality of surface-heating means or stations where each station comprises a metal-sheathed heating element bearing against the underside of a glass-ceramic plate or similar material. Resilient means urge the heating element into contact with the plate. There is a high emissivity, ceramic layer interposed between the heating element and the plate. Trim means surround the peripheral edge of each plate and serve to hold the plates down. Certain of the trim means are removable so that the heating stations may be top-serviceable.

BRIEF DESCRIPTION OF THE DRAWINGS

This 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 perspective of a smooth surfaced, heated cooktop embodying the present invention built into the countertop of a kitchen cabinet.

FIG. 2 is a fragmentary cross-sectional elevational view on an enlarged scale through about one-half of one of the surface heating stations of the present invention taken on the line 2—2 of FIG. 1.

FIG. 3 is a top perspective view of the smooth surfaced, heated cooktop of the present invention removed from the countertop of FIG. 1, with some parts broken away and others in cross section so as to be able to see beneath the glass-ceramic plates and understand the method of applying heat to the underside of the plates, as well as the method of supporting the plates. One metal-sheathed heating element and its supporting layers of thermal insulation are illustrated in an exploded relationship to show their dispositions.

FIG. 4 is a fragmentary view on an enlarged scale showing the holddown means used at the very center of the cooktop where four removable trim strips come together and function as fillers between adjacent glass-ceramic panels.

FIG. 5 is another fragmentary view showing a part of the integral trim strip which encircles the mounting box and also the interlocking connection between this trim strip and one of the removable trim strips or fillers between adjacent plates covering the top surface of the cooktop.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to a consideration of the drawings and in particular to FIG. 1, there is shown a top perspective view of a built-in, smooth surfaced, heated cooktop **10** embodying the present invention which is shown built into a counter top **12** of a kitchen cabinet **14**. The countertop **12** is provided with a large rectangular hole cut through the countertop such that the cooktop **10** may be dropped through the hole and supported along its peripheral edge by a rectangular trim strip **16** which encircles the cooktop. A plurality of individual glass-ceramic plates are supported in a single plane across the top of the cooktop in side-by-side relation, and each plate represents a separate surface heating station identified as stations **18**, **20**, **22**, and **24**. While the invention is shown as a built-in cooktop, it could just as well be an integral part of an electric range with an oven therebeneath.

Turning next to FIG. 2 it will be recognized that the four surface-heating stations **18**, **20**, **22**, and **24** are all supported in a shallow mounting box **26**. This box has a bottom wall **27** and a lower, inset sidewall **28** and an upper, outset sidewall **29** which is connected to the lower sidewall **28** by a horizontal ledge **30**. The upper sidewall **29** has a trim strip **16** of generally T-shape in transverse cross section fastened thereto by rivets

31, where the trim strip encircles the upper edge of the mounting box 26. The head of the trim strip 16 has a first outward flange 32 that is adapted to overlie the edge of the countertop 12 surrounding the opening therein, and a second inward flange 34 that is adapted to overlie the adjacent edge of a glass-ceramic plate 36. The lower edge of the trim strip 16 is provided with a plurality of widely spaced tabs 33 which have upwardly and outwardly inclined thumbscrews 35 extending therethrough for engaging beneath the countertop 12, as is best seen in FIG. 2.

In FIG. 3, there is illustrated a filler plate 40 of deep drawn configuration which is adapted to slip down into the shallow mounting box 26 and substantially fill the box except for a series of four cylindrical wells or depressions 42. Each depression 42 is substantially centered with respect to each glass-ceramic plate 36 of the heating stations 18, 20, 22 and 24. A possible modification would be to have the filler plate 40 represent the mounting box thereby eliminating the mounting box 26 therebeneath. Within each depression there is positioned a metal-sheathed electrical resistance heating element 44. Each heating element 44 rests upon a double layer 46 and 48 of thermal insulation. The top layer 46 is of high-temperature semirigid insulating board made for example from molded fibers of silica and alumina which is capable of withstanding temperatures as high as 2,000° F., while the lower layer 48 may be of a lower grade thermal material such as a compressed glass fiber insulation which is compressed from a thickness of about 3½ inches to a thickness of 1¼ inches thereby providing a spring bed for the heating element 44 which tends to bias the heating element upwardly into contact with the underside of the glass-ceramic plate 36. An alternative would be to substitute several sheet metal wave springs to replace the lower layer 48 of resilient insulating material. This type of spring system would bear against the underside of the semirigid insulating board 46. Notice in FIG. 2 that the bottom of the depression 42 is spaced above the bottom wall 27 of the mounting box 26. In order to give the filler plate 40 more support toward the center thereof, upward embossments 50 are formed in the bottom wall 27 of the mounting box 26 to engage the bottom wall of the depression. The peripheral edge of the filler plate 40 is formed with a downturned flange 54, as is best seen in FIG. 2, and this flange is captured between the upper vertical side 29 of the mounting box 26 and the vertical shank portion of the T-shaped trim strip 16 by the rivets 31.

Looking at the filler plate 40 in FIG. 3, there is a longitudinal channel or wiring raceway 56 which is centered between the four depressions 42. In addition there are connecting raceways 57 which join the depressions 42 to the main raceway 56, such that the terminal ends 59 of each metal-sheathed heating element 44 may be positioned therein and the lead wires (not shown) for connecting the heating elements to a power circuit may be positioned within the raceway 56 and fed down beneath the filler plate where an electrical wiring box (not shown) would be located for joining the lead wires to the leads of a power cable for the heated cooktop 10.

Turning back to FIG. 2, the top surface of the metal-sheathed heating element 44 is provided with a high emissivity, ceramic coating or layer 62 to separate the metal sheath from the glass-ceramic plate 36 so as to protect the glass-ceramic material from the oxides of the metal sheath. This will serve to protect the glass-ceramic plate from a devastating chemical reaction caused by the oxides of nickel, chromium, steel and the like etching the glass. A suitable coating may be porcelain enamel or other inert materials which will not react with either metal or glass-ceramic material. As an alternative the ceramic layer 62 could be applied to the undersurface of the glass plate 36. In any event, the metal sheath is spaced from the glass-ceramic plate by a ceramic layer 62. This ceramic or porcelain enamel coating increases the emissivity from 0.66 for the standard Inconel sheath to 0.92 for the ceramic-coated sheath of this invention when operating at 1,200° F. This means that the heating element sheath temperature is reduced when it is coated with a ceramic layer. For example, the sheath temperature of a standard metal-sheathed heating element of 1,000 watts is equal to about 1,390° F., while the sheath temperature of the coated sheath of the present invention for a 1,000 watt unit is about 1,095° F. Hence, this ceramic layer helps to protect the glass from being overheated since the sheath is able to operate at a given wattage at a lower temperature. To gain maximum surface unit efficiency, the heating element should touch the glass.

Preferably the metal sheath of the heating element 44 will be of smaller diameter than in standard units of the same wattage in order to improve efficiency by reducing the thermal mass of the heating element. However, the electrical leakage from the sheath is directly proportional to the spacing between the helical resistance wire within the sheath and the internal diameter of the sheath. Hence, the reduction in the diameter of the sheath tends to increase the likelihood of current leakage. This is offset however when using the ceramic layer 62 which is an electrical insulator that reduces the likelihood of electric leakage so as to render the sheath safe without sacrificing performance or life.

Since the glass-ceramic plate 36 is generally square and much larger in size than the spiral heating element 44, it is preferable to provide some resilient supporting means adjacent each corner of the plate. This may be done by installing rubber pads or cushions 66 which may each be pressed through a suitable hole 68 in the filler plate 40. Accordingly, the four plates 36 may be installed one at a time by resting each glass plate on one of the heating elements 44 and then pressing down against the resilient insulation 48 and the four resilient pads 66, before sliding the glass plate sidewise until its outer edges underlie the inward flange 34 of the peripheral trim strip 16. When all four glass plates 36 are in place there is a cross-shaped gap or space 70 separating the four plates. This space 70 is adapted to be closed by a series of four, short, removable trim strips 72, as is best seen in FIG. 4. Each trim strip 72 is generally T-shape in transverse cross section with a vertical shank 76 and a horizontal crown 78. Looking at FIG. 5, the outermost end of each removable trim strip 72 is adapted to telescope into a slot 80 in the inward flange 34 of the peripheral trim strip 16. This leaves the innermost ends of the removable trim strip 72 unattached. Looking at FIG. 4, the innermost ends all converge at the center of the cooktop 10 where they are held down by a decorative washer 82 which is provided with a central hole 84 for receiving a fastening screw 86 therethrough that threads into a companion hole 88 in the center of the filler plate 40. Thus if it were necessary to replace or remove any one of the glass-ceramic plates 36 it would merely be necessary to remove the central screw 86 and slide out the two closest removable trim strips 72 thereby allowing some sidewise freedom of movement of the glass-ceramic panel 36 so that it can be shifted horizontally until it moves free of the inward flange 34 of the peripheral trim strip 16 at which time it may simply be lifted from the cooktop.

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.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A heated cooktop comprising a plurality of individual plates of high resistivity, dielectric material such as crystalline glass, a shallow mounting box adapted to have the plates supported across the top open surface of the box, an inner filler plate fitted into the box and including for each plate a well, each well supporting a layer of thermal insulation, a metal-sheathed electrical resistance heating element supported on the insulation, and one of said crystalline glass plates being supported on each heating element, and a trim strip surrounding the top edge of the mounting box and overlying the adjacent edges of the plates, and trim means overlying the mounting box and disposed between adjacent plates for holding down the remaining edges of the glass plates.

2. A heated cooktop as recited in claim 1 with resilient means for urging each heating element into engagement with the underside of the related glass plate, and resilient support means adjacent each corner of each plate for supporting the glass plate near the extremities thereof.

3. A crystalline glass cooktop comprising a mounting box, and supporting a plurality of glass plate heating units where each heating unit comprises a layer of thermal insulation, a metal-sheathed resistance heating element supported on the insulation, and a crystalline glass plate supported on the heating element, a trim strip surrounding the top edge of the mounting box and overlying the adjacent edges of the said plate heating units, and removable trim strips disposed between adjacent glass plates, and fastening means for holding the removable trim strips in place.

4. A glass-ceramic cooktop including a mounting box, a plurality of glass plate surface heating units supported in the box, each surface unit comprising a layer of thermal insulation, a metal-sheathed resistance heating element supported on the insulation, and a glass-ceramic plate supported on the heating element, a trim strip surrounding the top edge of the mounting box and overlying the adjacent edge of the glass plates, removable trim strips disposed between adjacent glass plates, and fastening means for holding the removable trim strips in place.

5. A heated crystalline glass cooktop comprising four plates of glass and a shallow mounting box where the glass plates are adapted to be supported across the top open surface of the box, each glass plate resting on a metal-sheathed resistance heating element, and resilient means for urging each heating element into engagement with the underside of the related glass plate, trim means surrounding the peripheral edge of the box and overlying the adjacent edges of the glass plates, and removable trim strips positioned between adjacent edges of the glass plate, and fastening means for holding the removable trim strips in place.

6. A heated crystalline glass cooktop as recited in claim 5 with an inner filler plate supported in the mounting box, said filler plate including restraining means to prevent side movement of the heating elements, and resilient means adjacent the corners of each glass plate to seal the glass plates against the trim strips.

7. A heated crystalline glass cooktop as recited in claim 5 wherein at least the top surface of each heating element is spaced from the glass plate by a high emissivity ceramic coating to protect the crystalline glass from the oxidation of the metal sheath of the heating element.

8. A glass-ceramic cooktop having a plurality of surface heating units, where each unit comprises a metal-sheathed resistance heating element and a glass-ceramic plate seated on the heating element, and resilient means for urging the heating element into contact with the underside of the glass-ceramic plate, wherein the top surface of the heating element is spaced from the glass-ceramic plate by a high emissivity ceramic coating to protect the glass-ceramic plate from the oxidation of the metal sheath of the heating elements by reducing the maximum temperature of the sheath as compared with standard metal-sheathed heating elements of similar wattage, as well as providing faster heat-up and cool-down rates, and making the heating unit electrically safe from current leakage.

9. A glass-ceramic cooktop as recited in claim 8 wherein there are four surface heating units with rectangular glass-ceramic plates of substantially equal size, a mounting box for supporting the heating units therein in a rectangular formation, said resilient means being a layer of thermal insulation, and second resilient means positioned adjacent each corner of each glass-ceramic plate to bear upwardly against the said plate, a trim strip surrounding the peripheral edge of the box and extending inwardly thereof to overlie the adjacent edges of the glass-ceramic plate, and removable trim strips positioned between abutting edges of the glass-ceramic plate, and fastening means for holding the trim strips in place.

10. A heated cooktop comprising a plurality of individual plates of high resistivity, dielectric material such as crystalline glass, a shallow mounting box adapted to have the plates supported across the top open surface of the box, the box having a well furnished for each plate, each well supporting a layer of thermal insulation, a metal-sheathed electrical resistance heating element supported on the insulation, and one of said crystalline glass plates being supported on each heating element, and a trim strip surrounding the top edge of the mounting box and overlying the adjacent edges of the plates, and trim means supported from the mounting box and disposed between adjacent plates for holding down the remaining edges of the glass plates.

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