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INFRARED SURFACE HEATING UNIT WITH CORRUGATED RIBBON-SHAPED FILAMENT

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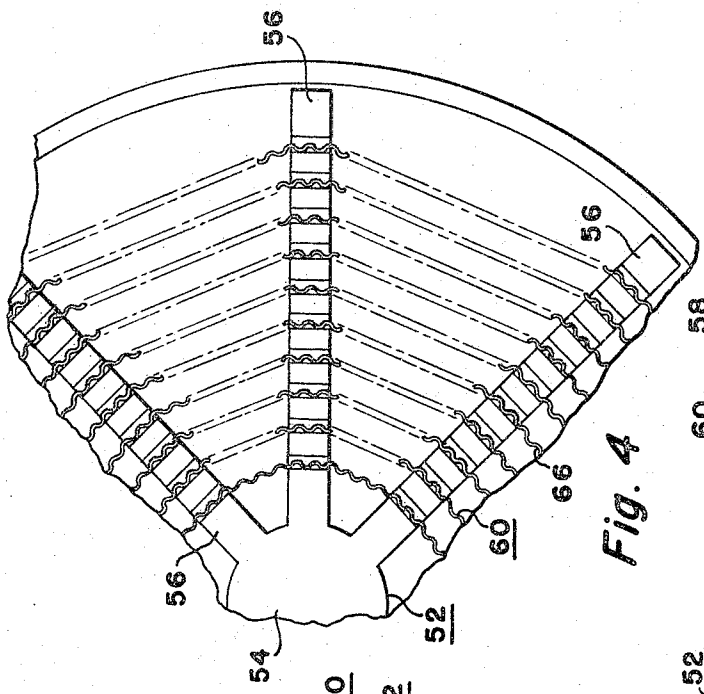


Fig. 4

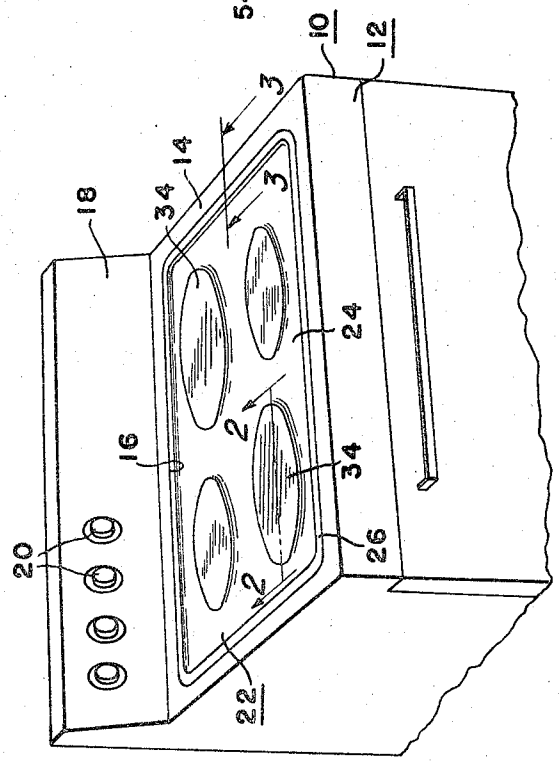


Fig. 1

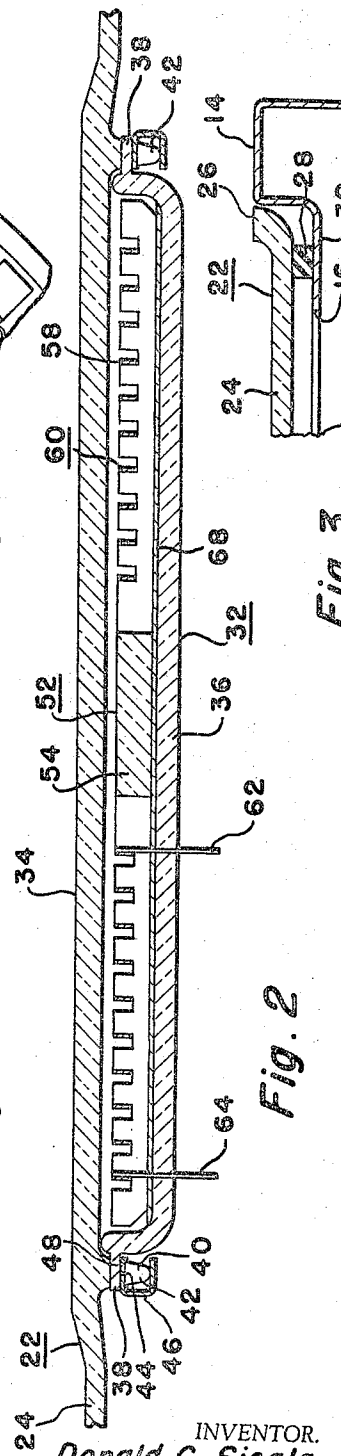


Fig. 2

Fig. 3

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INFRARED SURFACE HEATING UNIT WITH CORRUGATED RIBBON-SHAPED FILAMENT

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ABSTRACT OF THE DISCLOSURE

In preferred form, an infrared type heating unit including a solid cover of infrared transmissive material, an underlying reflector plate spaced below the cover, support means on the reflector plate including a plurality of vertically upwardly facing grooves, a spirally formed, ribbon-shaped resistance element received within the grooves of the support means to be located above the reflector plate within a space between the reflector plate and the cover and freely radially movable within the space, the ribbon shaped resistance element being corrugated along its length for thermal expansion and to reduce surface contact between the element and the support means.

This invention relates to domestic ranges and more particularly to electric ranges having infrared type surface heating units.

One problem with present-day domestic ranges is that of cleaning the surface unit cooking areas thereon. Both in the case of electrical and gas ranges, the cooking top surface area has many cracks or crevices therein, especially around the surface heating units thereon that tend to accumulate spillage that can become baked on so as present an extremely difficult and unpleasant cleaning task.

Accordingly, an object of the present invention is to improve domestic ranges by the provision of a single, continuous, non-metallic top of a relatively low thermal conductivity having an unbroken surface thereon that is easily cleaned.

A further object of the present invention is to improve domestic range units by the provision of a single top having a continuously, unbroken surface thereon in the surface unit cooking area wherein the top is constructed of an infrared transmissive material of relatively low thermal conductivity to minimize conduction of absorbed energy across the top.

A still further object of the present invention is to improve domestic ranges by the provision of a single member that forms the top of the range as a continuous, unbroken surface and wherein the member has a plurality of spaced apart regions thereon associated with infrared heating elements supported beneath the member for heating utensils thereon by radiation through the member.

Still another object of the present invention is to improve domestic ranges by the provision of a single member forming a top therein having a continuously, unbroken upper surface including regions thereon for supporting utensils to be heated and wherein the member is constructed of an infrared transmissive material having a low thermal conductivity and wherein infrared heating elements are located below the member for selectively heating the utensil supporting regions by direct infrared radiation.

Yet another object of the present invention is to improve electrical ranges by the provision of a solid glass or recrystallized glass top which entirely and continuously covers the surface unit cooking area of the range and includes an upper surface configuration that forms

surface utensil supporting portions for trapping spillage from the untensils and further includes infrared heater units disposed beneath the utensil supporting portion thereon to be completely isolated from the top of the range.

A further object of the present invention is to improve domestic ranges by the provision of a non-metallic member forming a range top having an upper surface defining utensil heating regions thereon wherein the range top surface is formed continuously without cracks or crevices through the surface unit cooking area of the range and has a plurality of infrared heating elements located on the underside thereof and supported from the underside thereof to heat utensils supported on the upper surface by direct radiation.

Yet another object of the present invention is to improve domestic ranges by the provision of a single member of non-metallic material that forms the top of the range in the surface unit cooking area and has an unbroken upper surface that is easily cleaned and further includes a plurality of spaced apart regions with infrared heating elements located therebelow for directly heating utensils supported on the spaced apart regions through radiation.

Yet another object of the present invention is to improvide infrared surface heating units by the provision of a ribbon-shaped electrical resistance heating element surrounded by a low-profile envelope and located in spaced relationship thereto prevent direct thermal contact therebetween wherein the ribbon-shaped resistance element is continuously convoluted throughout its length to increase the radiating surface area of the heating element.

Still another object of the present invention is to improve infrared surface heating units by the provision of a low-profile outer envelope including an upper plate of infrared transmissive material and a lower plate of low thermal mass located in spaced relationship to the upper plate and an electrically energizable resistance type heating element located therebetween having a ribbon shape supported by a spider-shaped member out of direct heat transfer relationship with both of the plates wherein the spider-shaped member has a plurality of grooves for disposing the ribbon-shaped element through a predetermined planar extent and wherein the ribbon-shaped member is continuously convoluted throughout its length to reduce the surface contact thereof with the spider-shaped element to reduce heat transfer between the element and its supporting spider member.

Still another object of the present invention is to improve domestic ranges by the provision of a cooking surface top of infrared transmissive material having a continuously unbroken surface throughout the surface unit cooking area wherein the single top member includes a plurality of depending members thereon which receive a lower bearing plate of an infrared surface heating unit that is supportingly carried by the depending members through clip members that are carried by the depending members to supportingly engage the lower plate.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a perspective view of a domestic range including the present invention;

FIGURE 2 is an enlarged view in vertical section taken along the line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged view in vertical section taken along the line 3—3 of FIGURE 1; and

FIGURE 4 is a fragmentary view in top elevation of a portion of the surface heating unit of FIGURE 2 with its upper surface removed.

Referring now to the drawings, in FIGURE 1, a domestic range **10** is illustrated having an outer casing **12** which includes a collar **14** around the top edge thereof that forms a top opening **16** in the range unit **10**. The peripheral collar **14** merges with a rearwardly located control panel **18** having a plurality of control knobs **20** thereon for selectively energizing infrared surface heating units to be described.

Within the top opening **16** is located a drop-in top member **22** that defines the complete surface unit cooking area of the range **10**. The top member **22** has a continuous upper surface **24** that extends throughout the planar extent of the opening **16** and includes a raised peripheral edge **26** formed continuously therearound that serves to trap spillage on the top surface **24**. At the raised outer peripheral edge **26** the top **22** is supported by a continuous annular resilient gasket **28** on an inwardly turned edge **30** of the collar **14**, as best seen in FIGURE 3. The gasket **28** serves to take up unevenness in the supporting flange **30** and also serves to isolate the top **22** from the outer casing **12**.

In accordance with certain of the principles of the present invention, the single top member **22** is formed of a solid glass or recrystallized glass material having a relatively low thermal conductivity in the order of 0.5 to 2.5 B.t.u. per hr. ft. ° F. Examples of such materials are quartz, a high silica glass such as Vycor made by Corning Glass or a recrystallized glass ceramic such as Cer-Vit manufactured by Owens-Illinois. These materials also are representative of suitable infrared transmissive materials that have desirable strength properties and are capable of transmitting substantially all of the infrared energy emitted from the heating element of an infrared type surface heating unit.

In the illustrated embodiment of the invention, the source of infrared energy is a plurality of surface heating units **32** located beneath the top member **22**, one of which is illustrated in FIGURE 2.

Each of the infrared surface heating units **32** is located below a raised portion **34** on the upper surface **24** of the top **22** that serves to define a utensil supporting surface raised above the general level of the top surface **24** whereby spillage from a utensil is accumulated on the surface between the raised surface portions **34** making it easily removable during cleaning.

Since the top **22** is continuously formed across the top range opening **16**, the infrared surface heating units **32** are completely isolated from any spillage or the like that might tend to adversely affect the operation thereof.

Another feature of the illustrated arrangement is that each of the heating units **32** are supported by the single top **22** so as to be removable therewith from the rest of the range unit **10** or a like supporting structure such as a built-in countertop. This enables components of the infrared surface heating unit **32** to be readily accessible for repair and further allows the completed unit including the top **22** and surface heating units **32** to be readily installed in place on the range or a like supporting unit.

Referring now more specifically to the heating units **32**, as best seen in FIGURE 2, they each include a lower dish-shaped bearing plate **36** having a plurality of peripheral tabs **38** thereon that are received within grooves **40** formed in depending integrally formed members **42** on the lower surface of the top **22** around the outer periphery of the raised surface portions **34** thereon. The plate **36** is preferably formed of an electrically insulating ceramic material such as alumina, steatite or the like having a low thermal mass. The depending members **42** each also includes a groove **44** therethrough in which is received a spring clip **46** that has an upper surface **48** supportingly receiving one of the tabs **38** whereby the lower bearing plate **36** is effectively hung from the underside

of the top **22**. The bottom of the lower bearing plate **36** is spaced below the top **22** to form a cavity **50** therebetween in which is located a spider-shaped supporting member **52** including a hub portion **54** and a plurality of circumferentially located radially outwardly directed arms **56**. The support member **52** is preferably constructed of a material having good electrical insulating properties and a low thermal conductivity, for example quartz or a high silica glass material. Each of the arms **56** has a plurality of grooves **58** therein in which is located a spirally wound continuous heating element **60** having one end thereof electrically connected to a terminal **62** and the opposite end thereof electrically connected to a terminal **64**. The terminals **62, 64** are directed through the lower plate **36** to be electrically connected across a suitable power source to energize the resistance heating element **60** into the infrared range whereby radiation emitted therefrom is directed upwardly through the infrared transmissive top **22** at the surface portions **34** thereon to raise the temperature of utensils supported thereon.

The heating element **60** preferably is self-heated into the range of 1500° F. to 2000° F. and is constructed of a high-temperature resistance material from a nickel-chromium family or an iron-chromium-aluminum family or the like having desirable strength and electrical characteristics.

By virtue of the illustrated arrangement the heating element **60** is located out of direct heat transfer relationship with both the top member **22** and the base plate **36** whereby the temperature thereof is maintained at an elevated temperature so as to maintain the effectiveness of the radiant effect therefrom.

In accordance with certain of the principles of the present invention the heating element **60** is continuously convoluted throughout its length by a plurality of sinusoidally-formed corrugations **66** that substantially increase the radiant surface heating area of the heating element **60** and, furthermore, reduce the surface contact between the heating element **60** and the arms **56** at the grooves **58** therein so that heat transfer from the element **60** to the arms **56** is minimized.

If desired and as illustrated in FIGURE 2, an infrared reflective layer **68** can be provided on the upper surface of the plate **36** to reflect downwardly directed infrared radiation from the heating element **60** upwardly through the top **22** to supplement the direct radiant heating effect of the heating element **60**.

Another feature of the illustrated arrangement is that by the provision of a glass top **22**, any energy absorbed by the top **22** will pass into a utensil supported by the raised surface portion **34** of the top **22** and because of the low thermal conductivity of the top a relatively small amount of the absorbed energy tends to be conducted away from the heated raised surface portions **34** to the surrounding area of the top **22**.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A cooking assembly comprising, a sheet of infrared transmissive non-metallic material including an upper utensil supporting surface, said sheet of non-metallic material having a thermal conductivity of substantially .5 to 2.5 B.t.u. per hour foot degree F., a plurality of infrared heating units, means for supporting each of said heating units on the underside of said sheet in spaced relationship with one another, each of said heating units including an uninsulated electrical resistance element located in spaced relationship with said sheet, said each of said heating units having a predetermined planar extent and being energizable into the infrared range of 1500° F. to 2000° F. for directly heating utensils supported on said upper surface thereabove through radiation energy absorbed by said cover sheet immediately above said heating units being restricted by the

low thermal conductivity of said cover sheet primarily to passage by conduction directly to a utensil supported by said cover sheet rather than to areas of said cover sheet in radially surrounding relationship to the predetermined planar extent thereof overlying each of said heating units.

2. A cooking surface assembly comprising, an upper plate of infrared transmissive non-metallic material having an upper utensil supporting surface, a lower plate disposed below said upper plate having an upwardly facing infrared reflective surface, means for supporting said lower plate on said upper plate, an electrically energizable uninsulated resistance element located between said upper and lower plates, means for supporting said resistance element out of direct heat transfer relationship with said plates including means defining a plurality of vertically directed grooves located above said reflective surface and below said upper plate, said resistance element being spirally wound and supported within said grooves for free radial expansion above said reflective surface, said spirally wound heating element also being ribbon-shaped and having a plurality of transverse corrugations along the length thereof for increasing the radiation emissions therefrom and for reducing surface contact between said resistance element and said support means during free radial expansion of said resistance element within said grooves.

3. A cooking surface assembly comprising, an upper plate of infrared transmissive material, a lower plate located below said upper plate in spaced relationship thereto having a low thermal mass, coacting means on said upper and lower plates for interconnecting said plates one to the other and forming an open space therebetween, a heating element electrically energizable into the infrared range disposed between said plates, supporting means on said lower plate, said supporting means having a plurality of spaced apart radially and circumferentially located vertically formed grooves therein. said heating element being spirally wound through said grooves whereby said supporting means serves to locate said heating element out of direct heat transfer contact with said upper and lower plates and for free radial thermal expansion between said upper and lower plates, said heating element having a ribbon shape located edgewise within said groove and including a plurality of generally transverse convolutions along the length of said heating element for reducing the contact between the sides of said heating element and said supporting means at the grooves therein.

4. A surface unit cooking assembly comprising, an upper sheet of infrared transmissive non-metallic material having a raised peripheral edge for trapping spillage and an upper surface, said surface having a raised portion therein, a plurality of depending members on the undersurface of said sheet around the outer periphery of said raised portion, a lower plate disposed below said sheet beneath said raised portion, said depending members having grooves formed therein, tabs on the outer periphery of said plate received by said grooves, and spring clip means insertable through said grooved depending members supportingly engaging said lower plate tabs for supporting said plate on said sheet, an electrical resistance heating element disposed between said plates and energizable into the infrared range for directly heating utensils supported by said raised surface portion through radiation, and means for supporting said heating element out of direct heat contact relationship with said sheet and said lower plate.

5. A cooking surface assembly comprising an upper utensil supporting plate of glass infrared transmissive material having a thermal conductivity of substantially .5 to 2.5 B.t.u. per hour foot degree F., a reflector plate located below said upper utensil supporting plate, means for connecting said reflector plate to said upper plate to form an open space therebetween, support means on said reflector plate including a plurality of radially and circumferentially spaced vertically directed, upwardly facing grooves therein above said reflector plate and below said upper plate, an elongated, ribbon shaped electrically energizable uninsulated high temperature resistance element supportingly received by said supporting means within said grooves and having the lower edges thereon engaging the bottom of each of said grooves, said ribbon shaped resistance element having a width less than that of each of said grooves thereby being free upon electrical energization of said resistance element to move radially within said grooves between said plates, said resistance element being corrugated along its length to form sinuous side surfaces thereon to space said resistance element from said supporting means and to reduce direct thermal contact therebetween and said sinuous side surfaces along the length of said resistance element increasing the radiation surface on said resistance element for improving transfer of energy by radiation from said resistance element through said upper utensil supporting plate.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,346,720 October 10, 1967

Donald C. Siegla

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 60, for "therein" read -- thereon --; column 2, lines 26 and 27, for "improvide" read -- improve --; line 29, after "thereto" insert -- to --; column 4, line 60, after "cooking" insert -- surface --; line 74, after "radiation" insert a comma; column 5, line 38, after "therein" insert a comma.

Signed and sealed this 12th day of November 1968.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents