Oct. 17, 1967 A. T. BASSETT, JR 3,348,026

RADIANT HEATER UNIT HAVING IMPROVED FILAMENT SUPPORT

Filed Sept. 22, 1965 2 Sheets-Sheet 1

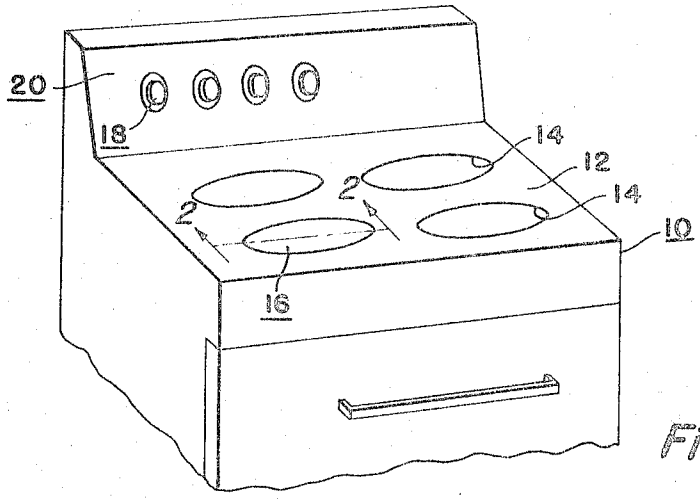


Fig. 1

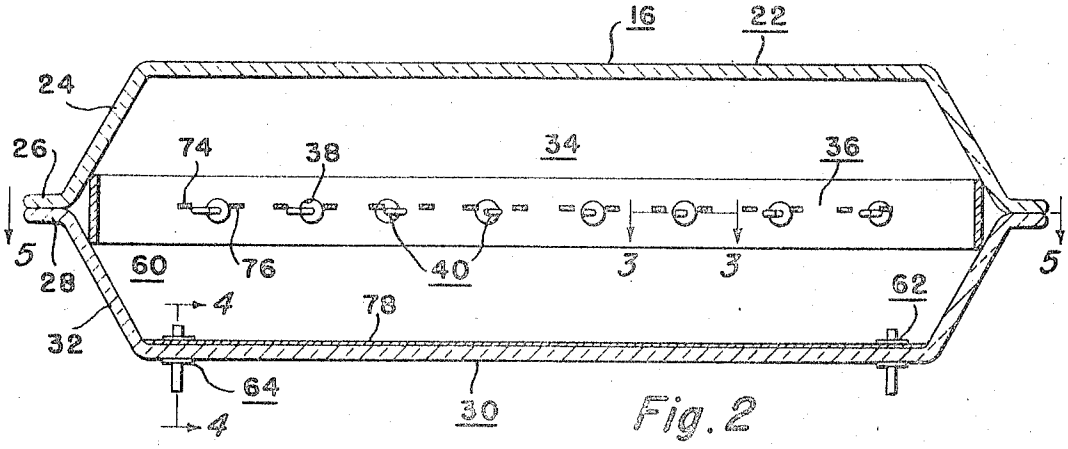


Fig. 2

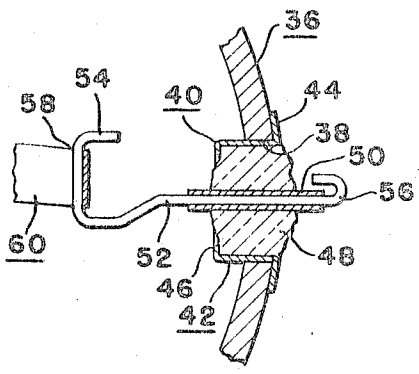


Fig. 3

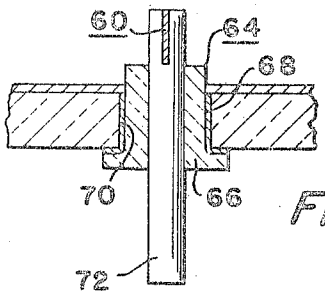


Fig. 4

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RADIANT HEATER UNIT HAVING IMPROVED FILAMENT SUPPORT

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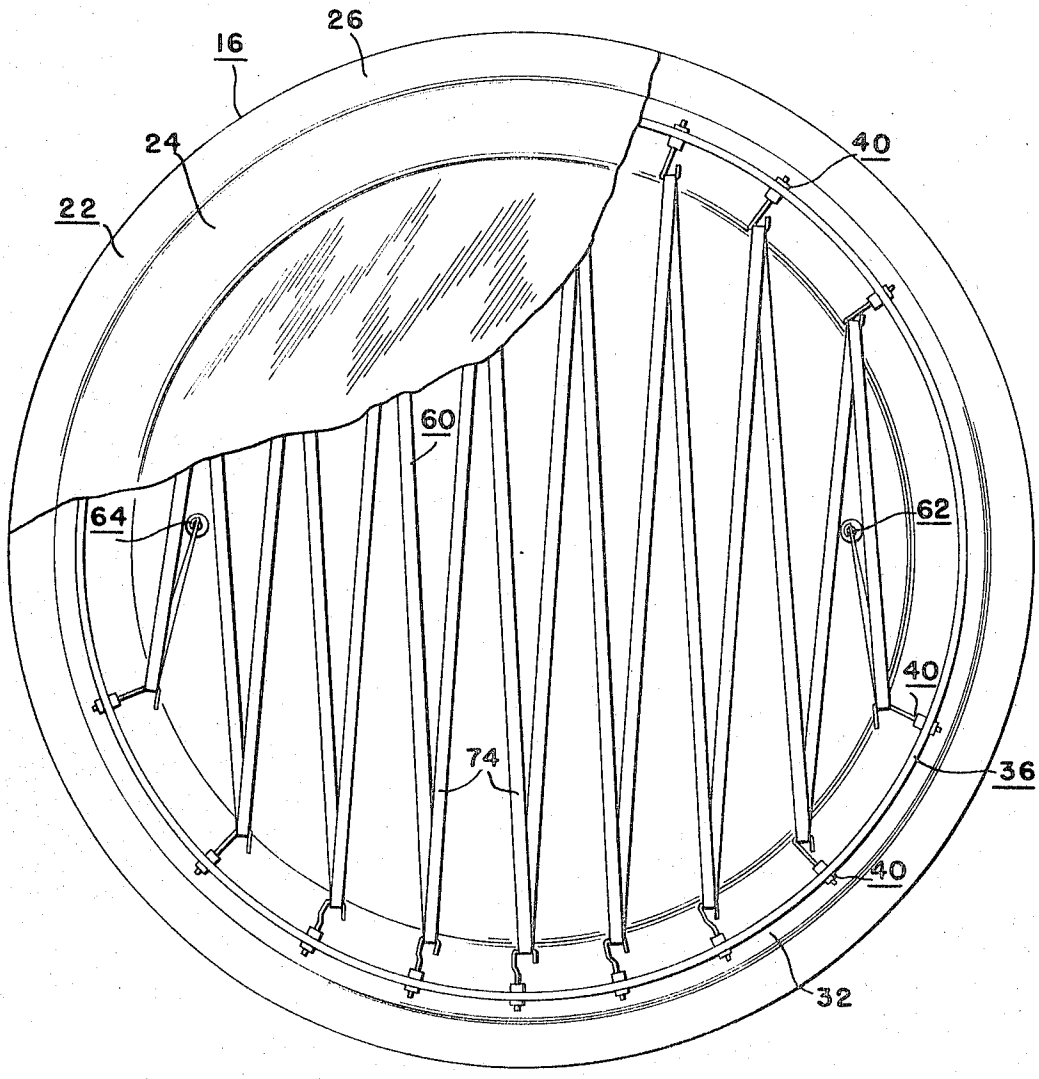


Fig. 5

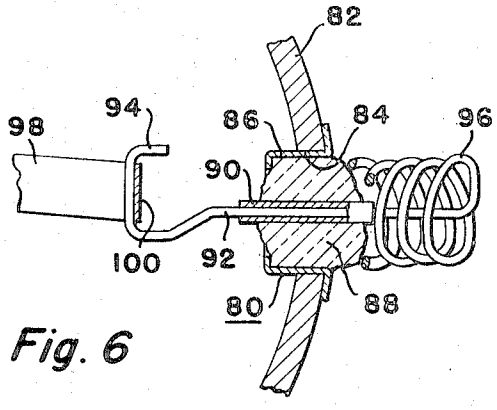


Fig. 6

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RADIANT HEATER UNIT HAVING IMPROVED FILAMENT SUPPORT

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ABSTRACT OF THE DISCLOSURE

In preferred form, an infrared type surface unit including an enclosed region containing a strung electrical resistance filament supported on an annular prestressed ring to compensate for filament sagging and wherein each of the return bends of the strung filament are supported on resilient means for biasing the strung filament from one side to the other of the prestressed support ring.

This invention relates to surface heating units for association with electrical ranges and the like and more particularly to surface heating units of the infrared type.

Present-day surface heating units used on electrical ranges are characterized generally as being direct conductive heating units wherein a spirally wound sheathed tubular electrical resistance heating element is used to raise the temperature of utensils supported thereon.

While such units are suitable for their intended purpose, they often only partially contact the supported utensil in an uneven fashion so as to reduce the conductive heating transfer to the utensil. Furthermore, the units are characterized by substantial thermal lag before the supported utensil receives any appreciable energy from the surface unit.

An object of the present invention, therefore, is to improve surface heating units for association with electrical ranges or the like by the provision of an improved self-contained infrared heating unit including a utensil supporting plate of infrared transmissive material that is associated with a lower reflective plate member to form a filament containing space and wherein an electrically energizable filament is disposed out of direct heat transfer contact with the upper and lower plates and strung on a support ring within the plates between the outer surfaces of the plates to form a radiant energy source throughout the planar extent of the utensil supporting plate.

A further object of the present invention is to improve infrared surface heating units for association with electric ranges or the like wherein the surface heating units are of the type characterized by having a high temperature electrically energizable filament or resistance elements energizable into the infrared range and located out of direct heat transfer contact with any appreciable portion of the remainder of the heating unit by the provision of an annular support ring within the unit that has an electrically energizable high temperature resistance element supported thereon that extends in a looped fashion from one side of the ring to the opposite side of the ring throughout the planar extent of the unit and wherein means are provided to continually compensate for sagging in the looped wire as it is self-heated into an infrared radiating temperature range.

Still another object of the present invention is to improve surface heating units having an infrared emissive filament of the type described in the preceding object by the provision of a wire retainer at each of the return bends of the looped wire that is electrically insulated from the remainder of the surface unit and that include spring compensating means thereon for continuously resiliently biasing the looped wire in a horizontal direction to prevent sagging in the wire resulting from self-heating thereof when the wire is energized; and to improve such units by utilizing a wire having a ribbon configuration to form the loops between the opposite sides of the support ring wherein the greatest dimension of the ribbon is disposed in spaced parallelism to the upper utensil supporting plate.

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

In the drawings:

FIGURE 1 is a view in perspective of a domestic electric range including a surface heating unit of 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 fragmentary vertical sectional view taken along the line 3—3 of FIGURE 2;

FIGURE 4 is an enlarged fragmentary vertical sectional view taken along the line 4—4 of FIGURE 2;

FIGURE 5 is a horizontal sectional view taken along the line 5—5 of FIGURE 2 with a part of the cover plate being shown in elevation thereover; and

FIGURE 6 is an enlarged fragmentary sectional view like that in FIGURE 3 showing another embodiment of an insulated support detail in the present invention.

Referring now to the drawings, in FIGURE 1 an electrical range 10 is illustrated including a top surface 12 thereon having a plurality of openings 14 therein each of which receives an infrared surface heating unit 16 of the present invention. Each of the infrared surface heating units is selectively connected to a suitable power source through a selector switch 18 supported on a rearwardly located control panel 20 on the range 10.

Referring now more particularly to FIGURES 2 through 5, one preferred embodiment of the infrared surface heating unit 16 of the present invention is illustrated as including an upper utensil support plate 22 having a downwardly depending, outwardly inclined peripheral portion 24 thereon with a radially outwardly directed outermost edge 26. The outermost edge 26 is received on a like peripheral edge 28 on a lower support plate 30 that includes an upwardly directed, outwardly inclined peripheral portion 32 which terminates in the edge 28. The peripheral portions 24 and 32 of the plates 22 and 30 separate the plates 22 and 30 throughout substantially their full planar extent to form an open space 34 therebetween.

In one working embodiment of the invention the plates 22 and 30 were formed from an infrared transmissive Pyrex material. Other suitable high strength infrared transmissive materials are equally suitable for the present invention, such as 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 are merely representative of suitable materials that transmit a high percentage of infrared radiation.

Within the space 34 is located an annular ring 36 that is located at the outer periphery of the plates 22, 30 and substantially intermediate the space 34 formed between the plates 22 and 30. In the illustrated arrangement, the ring 36 is formed of stainless steel and is supportingly received by the upwardly directed inclined peripheral portion 32 of the plate 30.

The ring 36 has a plurality of openings 38 formed therein located at circumferentially spaced points therearound. Each of the openings 38 has an electrically insulated hook assembly 40 supported therein. Each of the

insulated hook assemblies 40 includes a tubular jacket 42 having a radially outwardly directed flange 44 on one end thereof that engages the outer surface of the ring about the opening 38 therein and an inwardly turned inner edge portion 46. Within the jacket 42 is located a tubular plug 48 of a suitable electrical insulating material such as fused glass. A support sleeve 50 is directed through the plug 48 to receive a high temperature resistant wire 52 which includes a flexible loop 54 on one end thereof located within the ring 36 and a bent over portion 56 on the opposite end thereof outside the ring 36 to hold the wire 52 in place with respect to the sleeve 50. Each of the insulated hook assemblies 40 has a return bend portion 58 of a continuously formed electrically energized high temperature resistance element or filament 60 passed therearound.

In the embodiment of FIGURES 1 through 5 the filament 60 has one end thereof electrically connected to a terminal assembly 62 from whence the filament 60 extends toward one side of the ring 36 where it loops across one of the hook assemblies 40 from whence it returns to the opposite side of the ring 36 along a predetermined chordal line. The filament 60 then passes about another one of the insulated hook assemblies 40 and thence is directed back to the opposite side of the ring to another one of the hooked insulating assemblies 40. The filament 60 is passed in a like manner between the opposite sides of the ring and looped around like assemblies 40 until it is completely strung in a looped fashion throughout substantially the full planar extent of the upper utensil supporting plate 22 as best seen in FIGURE 5. At this point, the opposite end of the filament 60 is electrically connected to terminal assembly 64 directed through the lower support plate 30 like the assembly 62.

Each of the assemblies 62 and 64 are more specifically set forth in FIGURE 4 as including a tubular insert of electrical insulating material 66 which is inserted through a metal jacket 68 in an opening 70 in the bottom of the lower plate 30. An electrical conductor 72 is passed through the sealed insulating plug 66 so as to electrically connect the filament 60 across a suitable power source.

In the illustrated form the filament 60 is ribbon configured and has its greatest dimension disposed in spaced parallelism with the upper flat surface of the upper support plate 22 as best seen in FIGURES 2 and 5. By virtue of this arrangement, when the filament 60 is energized to a predetermined infrared emissive temperature, the radiation therefrom is directed from a relatively great surface area on the filament directly through the upper support plate 22.

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

By virtue of the above-illustrated arrangement, when the looped, continuously formed ribbon configured filament 60 is connected across a power source, the filament 60 will be self-heated into an elevated temperature range at which a substantial amount of the energy input into the filament 60 is converted to infrared radiation which is directed from a flat surface 74 on the filament 60 directly through the flat top surface of the utensil support plate 22 for raising the temperature thereof. A certain amount of the infrared radiation from the filament 60 will pass from a flat undersurface 76 thereof and be directed against a suitable infrared reflective surface 78 formed on the inside of the lower support plate 30 from whence it is reflected upwardly to also be directed against the utensil supported on the unit for increasing the temperature thereof. The infrared reflective surface 78 may be formed from any suitable reflective material, for example, a deposited gold layer or the like.

On heating, the filament 60 will expand and tend to sag. The sagging of the filament 60 is minimized in the embodiment of the invention illustrated in FIGURES 2 through 5 since the stainless steel ring 36 is heated sufficiently to expand to tend to offset the expansion of the filament 60. If desired, the the ring 36 can be prestressed whereby the filament 60 will be spring loaded prior to heating to further take up any undesirable sagging of the continuously formed loop filament 60 upon heating thereof.

In FIGURE 6, another embodiment of an electrical insulating hook assembly 80 is shown that is located in a ring 82 like 36 in the first embodiment having a plurality of openings 84 therein one of which is shown in FIGURE 5 to have a metal jacket 86 directed therethrough like the jacket 42 in the connector shown in FIGURE 3. A suitable electrical insulating plug 88 is disposed within the jacket 84 in sealing engagement therewith and a sleeve 90 like the sleeve 50 in FIGURE 3 is directed through the plug 88 to slidingly supportingly receive a straight portion of a hook element 92 that includes a large loop 94 on one end thereof and a spring member 96 on the opposite end thereof located exteriorly of the ring 82. In this embodiment an electrically energizable filament 98 has a return bend portion 100 thereof supported within the loop 94 and the spring 96 serves to continuously bias the filament 98 outwardly toward the ring 82 whereby expansion of the filament 98 is continuously compensated to prevent sagging of the filament 98 to prevent adjacent portions of the looped filament from electrically contacting one another.

The advantage of the above-illustrated embodiment of the invention is that a substantial infrared radiating surface is located in good radiant heat transfer relationship with a cooking utensil. The support of the filament is characterized by a minimum of conductive heat transfer contact between the energizable heating element and the remainder of the surface heating unit. The plate portions of the unit have low thermal mass to reduce energy absorption by the unit itself. By virtue of this feature, the energy input to the element is utilized to produce infrared radiation without any substantial loss of heat from the element by conduction that might tend to reduce the temperature of the element in a manner to reduce the effectiveness thereof as an infrared radiation.

Furthermore, the looped configuration and support arrangement enables the continuously formed electrical heater to be continually maintained in a disposition that aligns a substantial portion of the surface thereof in good radiant heat transfer relationship with a utensil supported on the surface unit. Furthermore, the disposition of the filament and the support thereof, by virtue of the improved insulated hook assemblies, prevents sagging in the heated resistance element that might adversely affect the operation thereof by shorting the element against itself. By looping the filament in a strung pattern throughout the planar extent of the upper utensil supporting plate 22, a very uniform heat pattern also is achieved.

While the looped filament configuration and spring support arrangement is illustrated and discussed with respect to a surface heating unit that has an interior space exposed to atmosphere, it will be appreciated that the configuration is equally suitable for use in such units where the space enclosed by the outer envelope is evacuated and filled with an inert gas in which case the illustrated resistance element can be replaced, if desired, by a tungsten heater which is energizable into an incandescent range within the inert atmosphere without undesirable oxidation occurring.

Furthermore, while a ribbon-shaped resistance element is a preferred configuration, other shapes are equally suited for practicing the invention.

While the embodiments of the present invention as

herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In an infrared surface heating unit for association with an electrical range or the like, the combination of, an upper utensil supporting plate of infrared transmissive material, a lower plate having an infrared reflective surface, means on said upper and lower plates for maintaining a predetermined space therebetween, an annular ring located within said space, a continuously formed electrically energizable high temperature resistance element looped between the opposite sides of said ring throughout the planar extent of said upper support plate, and means for suspending said looped electrically energizable element on said ring to maintain said filament in a plane located in spaced parallelism with said upper utensil supporting plate and out of direct heat transfer contact with both said plates, said looped resistance element including return bend portions, said means for connecting said looped filament to said ring including a plug inserted through said ring and a heat resistant member on said plug having a flexible bent end located inside said ring about which one of said return bend portions pass.

2. In an infrared surface heating unit for association with an electrical range or the like, the combination of, an upper utensil supporting plate of infrared transmissive material, a lower plate having an infrared reflective surface, means on said upper and lower plates for maintaining a predetermined space therebetween, an annular ring located within said space, a continuously formed electrically energizable high temperature resistance element looped between the opposite sides of said ring throughout the planar extent of said upper support plate, and means for suspending said looped electrically energizable element on said ring to maintain said filament in a plane located in spaced parallelism with said upper utensil supporting plate and out of direct heat transfer contact with both said plates, said looped resistance element including return bend portions, said means for connecting said looped filament to said ring including a plug inserted through said ring and a heat resistant member on said plug having a flexible bent end located inside said ring about which one of said return bend portions pass, a tubular sleeve directed through said plug and slidably supportingly receiving said heat resistant element for relative movement with respect to said ring, a spring supported on said heat resistant element exteriorly of said ring for resiliently biasing said heat resistant member exteriorly of said ring whereby said continuously looped filament is maintained tightly strung between the opposite sides of said ring.

3. In an infrared surface heating unit for association with an electrical range or the like, the combination of, an upper utensil supporting plate of infrared transmissive material, a lower reflector plate of low thermal mass, said lower plate having an infrared reflective upper surface, means on said upper and lower plate for forming a space therebetween, an annular ring located in said space adjacent the outer periphery of said space, a continuously formed electrically energizable resistance element looped between the opposite sides of said ring throughout substantially the full planar extent of said upper support plate, said looped continuously formed resistance element including a plurality of return bend portions each being located adjacent said ring, and means for connecting each of said return bend portions of said looped resistance element to said ring for holding said looped resistance element tightly across said ring throughout the energization thereof, said connecting means including means for continuously maintaining said resistance element tightly strung on said ring as said resistance element is heated.

4. In an infrared surface heating unit for association with an electrical range or the like, the combination of, an upper utensil supporting plate of infrared transmissive material, a lower reflector plate of low thermal mass, said lower plate having an infrared reflective upper surface, means on said upper and lower plate for forming a space therebetween, an annular ring located in said space adjacent the outer periphery of said space, a continuously formed electrically energizable resistance element looped between the opposite sides of said ring throughout substantially the full planar extent of said upper support plate, said looped continuously formed resistance element including a plurality of return bend portions each being located adjacent said ring, and means for connecting each of said return bend portions of said looped resistance element to said ring for holding said looped resistance element tightly across said ring throughout the energization thereof, said ring being thermally expandable for continuously maintaining said looped resistance element in a tightly strung relationship with said ring as said resistance element is heated.

5. In an infrared surface heating unit for association with an electrical range or the like, the combination of, an upper utensil supporting plate of infrared transmissive material, a lower reflector plate of low thermal mass, said lower plate having an infrared reflective upper surface, means on said upper and lower plate for forming a space therebetween, an annular ring located in said space adjacent the outer periphery of said space, a continuously formed electrically energizable resistance element looped between the opposite sides of said ring throughout substantially the full planar extent of said upper support plate, said looped continuously formed resistance element including a plurality of return bend portions each being located adjacent said ring, and means for connecting each of said return bend portions of said looped resistance element to said ring for holding said looped resistance element tightly across said ring throughout the energization thereof, said connecting means including a plug in said ring, a tubular sleeve directed through said plug and slidably supportingly receiving said heat resistant element for relative movement with respect to said ring, a spring supported on said heat resistant element exteriorly of said ring for resiliently biasing said heat resistant member exteriorly of said ring whereby said continuously looped filament is maintained tightly strung between the opposite sides of said ring.

References Cited

UNITED STATES PATENTS

459,690	9/1891	Short	338—316
1,499,767	7/1924	Wyzenbeek	219—467
1,568,593	1/1926	Fitzgerald	219—467
2,179,934	11/1939	Jones	338—316

FOREIGN PATENTS

1,028,842	5/1966	Great Britain.

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