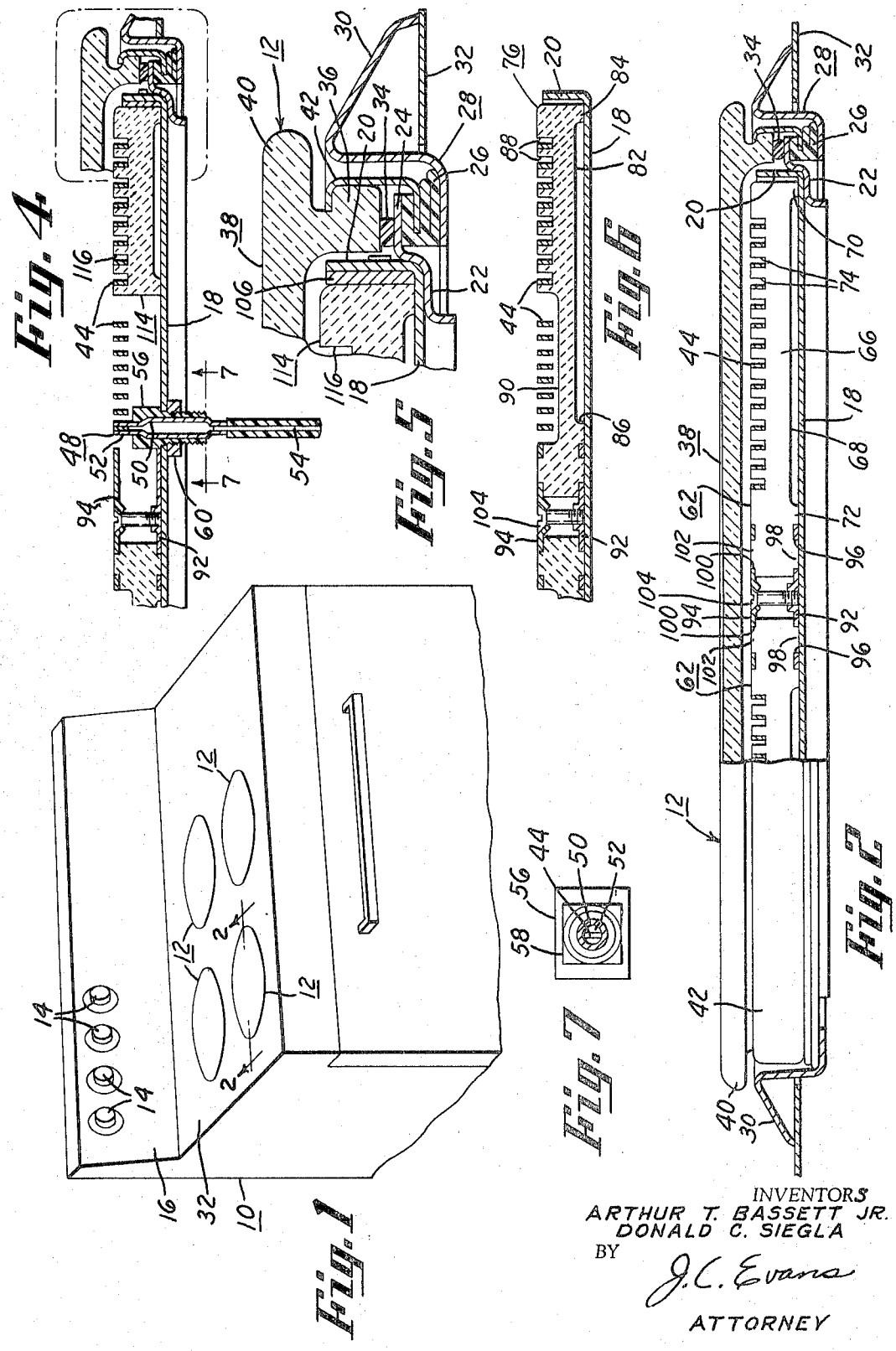
Oct. 17, 1967 A. T. BASSETT, JR., ET AL 3,348,025

SPIDER SUPPORTED ELECTRIC HEATER

Filed June 24, 1965 2 Sheets-Sheet 1



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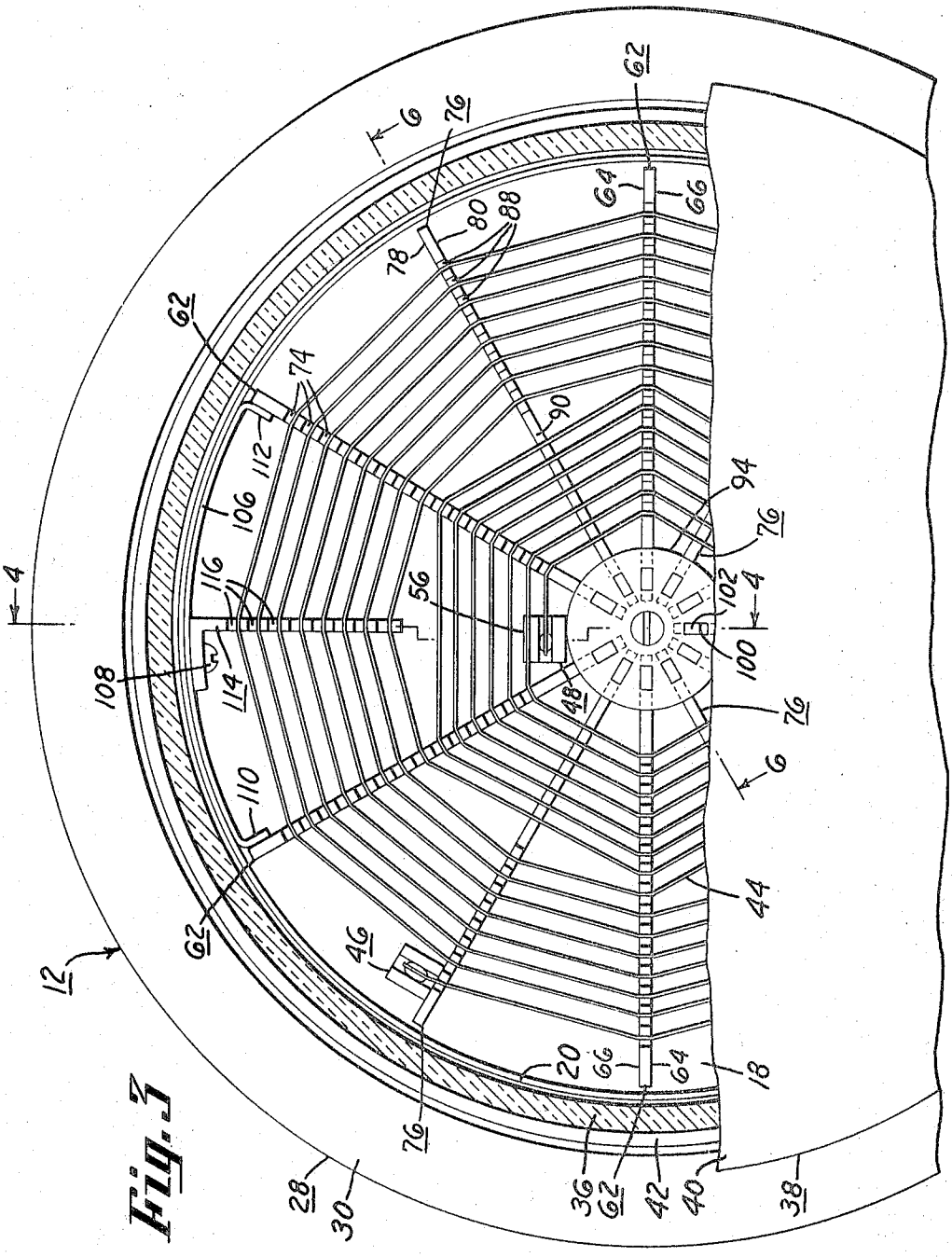


Fig. 1

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SPIDER SUPPORTED ELECTRIC HEATER

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ABSTRACT OF THE DISCLOSURE

In preferred form an infrared surface heating unit having a utensil supporting solid cover and a lower spaced apart reflector plate, a plurality of radially outwardly directed spider arms on the reflector plate including a plurality of up-standing slots receiving a ribbon-formed resistance heating element, the arms being configured to limit heat transfer from the resistance element to the cover and reflector plate.

This invention relates to surface heating units and more particularly to surface heating units of the infrared type.

In surface heating units of the type wherein a resistance element is energized to produce self-heating into the infrared radiation range, one problem is that of preventing heat transfer from the resistance element that reduces the temperature thereof below a predetermined point to carry out effective infrared heating.

Additionally, the preferred configuration of resistance elements for infrared heaters, wherein the resistance element is exposed to atmosphere, is to dispose the resistance element throughout the planar extent of the surface heating unit. As a result, the resistance element has substantial reaches at its outer periphery that must be supported by means to prevent sagging of the element that might otherwise cause the resistance element to contact itself and short out.

Accordingly, an object of the present invention is to improve infrared radiation type surface heating units of the type having a low-profile outer envelope with a base member and an upper utensil supporting plate of infrared transmissive material spaced from the base member wherein a continuous resistance wire is extended between the base member and the support plate across the planar extent of the unit by the provision of a plurality of circumferentially located flat supporting arms of electrical insulating material having low-terminal conductivity wherein the arms are rigidly interconnected to form a unitary framework for holding the spirally wound coil out of electrical contact with itself and wherein the arms locate the wire out of direct heat transfer contact with both the base plate and the upper utensil supporting plate.

A further object of the present invention is to provide an improved surface heating unit of the infrared type including a spirally wound coil by the provision of a framework including a first plurality of separate electrical insulating arms directed radially of the spirally wound coil from the inner to the outer periphery thereof having grooves therein to space the windings of the coil apart from one another and wherein the framework includes a second plurality of separate electrical insulating arms supporting only a predetermined number of the outer winds of the coil to reduce the unsupported length of the wire between adjacent support arms and wherein each of the second plurality of arms has a portion thereof undercut to be out of direct heat transfer contact with the remainder of the windings of the coil supported solely by the first plurality of arms and wherein certain ones of each of the first and second plurality of arms are interconnected by means at the inner periphery of the spirally wound coil to form a unitary wire supporting framework.

A still further object of the present invention is to improve surface heating units of the infrared type by the provision of an improved support frame and resistance wire assembly including a spirally wound ribbon-shaped resistance wire energizable into the infrared range having a first plurality of windings thereon supported by a first plurality of separate support arms extending from the outer periphery of the coil inwardly thereof to a first predetermined point and having all of the turns of the wire supported by a second plurality of separate support arms directed from the outer periphery of the winding inwardly of the inner periphery thereof wherein each of the support arms has an upper edge with a plurality of grooves therein for spacing adjacent turns of the wire out of electrical contact with one another and wherein each of the arms includes a recess formed in the bottom edge thereof to substantially isolate each of the support arms out of direct heat transfer contact with a supporting base member of the infrared heating unit whereby heat transfer from the resistance wire is minimized to improve the effectiveness of the resistance wire as a radiant heat-transfer element.

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 view in perspective of an electrical range including surface heating units constructed in accordance with certain principles of the present invention;

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

FIGURE 3 is a view in top elevation of one of the surfact heating units of FIGURE 1 partially broken away;

FIGURE 4 is a view in vertical section taken along the line 4—4 of FIGURE 3;

FIGURE 5 is an enlarged, fragmentary view in vertical section of region 5 in FIGURE 4;

FIGURE 6 is a fragmentary view in vertical section taken along the line 6—6 of FIGURE 3; and

FIGURE 7 is an enlarged, detail view of an insulating lock member in bottom elevation looking in the direction of the arrows 7—7 of FIGURE 4.

Referring now to the drawings, in FIGURE 1, a domestic electrical range 10 is illustrated having a plurality of surface heating units 12 in the top surface thereof operatively associated with control means shown as including selector knob portions 14 located on a rearwardly located control panel 16 of the range 10.

Each of the surface heating units 12 are more particularly illustrated in FIGURES 2 through 7 as including a base member 18 having an upwardly turned peripheral edge 20 thereon. The base member 18 is supported on a ring member 22 having a peripheral edge 24 supportingly received by an annular cushion member 26 formed of a suitable resilient material. The annular cushion member 26, in turn, is supported by a support ring 28 having an outer peripheral edge 30 turned downwardly to be supportingly received by the upper surface 32 of the range 10.

In the illustrated arrangement, on top of the peripheral edge 24 of the support ring 22 is located an annular seal member 34 preferably constructed of a heat resistant material such as Fiberglas on which is supported an annular depending skirt portion 36 of a utensil supporting upper plate formed of a suitable infrared transmissive material. The plate 38 has an outwardly directed peripheral edge

40 formed continuously therearound that overlies the upper edge of the top engaging support ring 28.

In the illustrated arrangement the upper support plate 38 and the base member 18 are joined together by a continuously formed clamp ring 42 having one edge thereof overlying the upper edge of the skirt portion 36 on the upper plate 38 and the other edge thereof inserted into the cushion member 26 whereby the base support plate 22 is fixedly secured by the ring between the upper surface of the cushion member 26 and the annular seal member 34 as best seen in FIGURE 5.

By virtue of the illustrated arrangement, any spillage from utensils supported by the upper support plate 38 is directed generally away from the surface heating unit 12 across the outer edge 40 of the upper plate 38 and the downwardly inclined surface 30 on the support ring 28 and any minor spillage that tends to collect between the clamp ring 42 and the inner surface of the support ring 28 is sealed against entry interiorly of the base member 18 and the upper support plate by the seal ring 34.

In order to obtain effective infrared heating in a surface heating unit having a low-profile envelope of the type illustrated in the illustrated embodiment of the invention, a ribbon-shaped electrical resistance element 44 is disposed between the base member 18 and the upper support plate and continuously spirally wound to extend across substantially the full planar extent of the upper support plate 38 as best seen in FIGURE 3.

The ribbon shape of the resistance element 44 is preferred in order to obtain a substantial radiating surface for emitting infrared energy to heat utensils supported by the upper support plate 38.

In the illustrated embodiment, the resistance element 44 has the outermost end thereof electrically connected to an insulated electrical terminal 46 and the inner end thereof electrically connected to a like, insulated electrical terminal 48 which is more particularly illustrated in FIGURE 4 as including an electrically conductive tubular member 50 that is crimped over at 52 into electrical contact with the inner end of the ribbon-shaped resistance element 44 and having its opposite end crimped over into electrical contact with an insulated conductor 54 adapted to be connected to a suitable source of power. An insulating lock member 56 is directed through the base member 18 to hold the tubular conductor member 50 in place thereon and, as best seen in FIGURE 7, includes a square shank portion 58 for locking the insulating member against rotation with respect to the base member 18. The insulating lock member 56 is held on the base member 18 by a nut 60 threadably received over a depending exteriorly threaded portion on the member 56. The terminal 46 at the outer end of the resistance wire 44 is of a like construction and by virtue of the insulating screw interlocking the terminal conductor piece 50 rigidly and fixedly with respect to the base member 18, the ends of the resistance wire 44 are held against any undesirable movement with respect to the terminal assemblies 46, 48 that might otherwise tend to break the electrical connection therebetween.

The illustrated ribbon-shaped resistance element 44 preferably is constructed of a high-temperature electrical resistance material 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° to 2000° F. When the resistance element 44 is energized to reach such elevated temperatures, the element serves as an effective radiant heat emissive element, the energy of which is directed through the infrared transmissive upper plate 38 to quickly raise the temperature of a utensil supported thereon. One problem with such high-temperature resistance elements is that of maintaining the temperature thereof at the elevated range whereby it is continually effective as an infrared heat source.

Accordingly, it is important to effectively thermally

isolate the resistance element from the remainder of the surface heating unit. Additionally, it is necessary to support the resistance element in its continuous spiral configuration wherein, as the temperature thereof increases, the wire is retained against any movement thereof that might cause adjacent portions of the coil to contact one another to thereby short out the unit.

Thus, in accordance with certain principles of the present invention, a first plurality of support arms 62 are supported on the base member 18 at circumferentially spaced locations thereon to extend from the outer periphery of the spirally-wound coiled resistance wire 44 to the inner periphery thereof. Each of the arms 62 is preferably constructed of a suitable electrical insulating material having a relatively low thermal conductivity, for example, steatite. More particularly, each of the arms 62 is characterized by being relatively elongated and narrow and having flat surfaces 64, 66 on either side thereof. Each of the arms 62 has a bottom edge recessed at 68 throughout substantially the complete length of the arms 62 to form depending legs 70, 72 on either end of the arms 62 that are supported by the upper surface of the base member 18 to locate the members 62 substantially out of direct heat transfer contact with the base member 18.

Additionally, each of the arms 62 has a plurality of spaced apart grooves 74 therein formed between the outer end of the arm 62 to a point adjacent the opposite end of the arm 62 whereby each turn of the spirally wound resistance element 44 is supportingly received within one of the grooves 74 for spacing apart each of the turns at the arms 62.

In addition to the circumferentially spaced arms 62, the illustrated unit includes a second plurality of support arms 76 located between certain pairs of the arms 62 as best seen in FIGURE 3. Each of the arms 76 is formed of a suitable electrically insulating and low heat conductive material such as steatite and like the arms 62 extend from a point radially outwardly of the outer turn of the coil 44 to a point radially inwardly of the inner periphery of the coil. Each of the arms is relatively narrow and includes flat side surfaces 78, 80 and a bottom edge recessed at 82 to form an outer depending leg 84 and an inner depending leg 86 supported by the base member 18 to locate substantially all of the arm 76 out of heat transfer contact therewith. The upper edge of the member 76 includes a plurality of spaced apart grooves 88 therein that are formed in the illustrated embodiment through half of the length of the member 76 and radially inwardly of the grooves 88 is located a recess 90 in the member 76 that underlies a predetermined number of the windings of the resistance element 44 so as to locate the element 44 at this location out of direct heat transfer contact with the arm 76.

The grooves 88 in the arms 76 supportingly receive portions of the outer turns of the coil 44 as seen in FIGURE 3, whereby the arms 76 serve to reduce the unsupported reaches of the element 44 so that when the element 44 is heated, the outer turns thereof as they expand are supported against extreme movements that might otherwise cause the adjacent turns at the outer part of the coil to contact one another and electrically short out the heating unit.

Another feature of the illustrated arrangement is that the individual support arms 62, 76 are interconnected as a unitary framework by a pair of discs 92, 94 located centrally of the interior space of the heater unit 12 as best seen in FIGURE 2. The disc 92 is supportingly received by the lower bearing member 18 and includes a plurality of openings 96 therein in which are fitted tabs 98 on each of the radially inner ends of the support arms 62, 76. The other disc 94 also includes a plurality of openings 100 located at circumferentially spaced points therein to receive tabs 102 on the radially inner ends of each of the arms 62, 76 at the upper edge thereof. The discs 92, 94 are securely held against the radially inwardly located

ends of the arms **62**, **76** by a screw member **104** that is directed through the upper disc member **94** into threaded engagement with the lower disc member **92** whereby each of the arms that are fitted into the discs are fixedly held together as a unitary framework having the spiral coil resistance element **44** supported thereon. The framework and element **44** thereby constitute a unit that is easily located within the surface unit **12** during its assembly and that is quickly removable therefrom as a unit for quick service.

A still further feature of the illustrated embodiment of the invention is that the unitary framework and resistance coil within the surface heating unit **12** is located therein against rotation with respect to the base member **18** so as to prevent undesirable stressing of the resistance wire **44**. In the illustrated arrangement this is accomplished by the location of a spring retainer member **106** of arcuate shape that is located against the inner peripheral surface of a part of the edge **20** of the base member **18** by a screw **108**, as best seen in FIGURE 3, whereby radially inwardly bent ends **110**, **112** of the spring retainer **106** are located in abutting engagement with a pair of the spaced apart support arms **76** to positively locate the remainder of the support arms against rotational movement with respect to the base member **18**.

The screw **108** also secures a stub support arm **114** on the outer peripheral edge **20** of the base member **18**. The stub support arm **114** is similar to the support arm **76** but instead of being undercut has the radially innermost terminus point thereof located radially outwardly of the terminal assembly **48**, as best seen in FIGURE 3. The support arm **114** includes spaced apart openings **116** in the upper edge thereof for supportingly receiving the reaches of wire in the element **44** that pass thereover whereby the support member **114** serves like the support arm **76** to reduce the unsupported length of the reaches of wire at the larger diameter turns of the element **44**.

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. In an infrared electrical surface heating unit, the combination of, an outer envelope including a base member and an upper utensil supporting plate for transmitting infrared energy, said base member and upper support plate being located in spaced relationship with one another, an infrared emissive resistance element located in the space between said base member and said support plate, support means for supporting said infrared emissive resistance element throughout the planar extent of said upper support plate out of direct heat transfer contact with both said base member and said upper support plate, said support means including a first plurality of separate support arms having depending portions on the opposite ends thereof supportingly received by said base member to locate the remainder of each of said arms out of direct heat transfer contact with said base member and a plurality of spaced apart grooves in the upper edge thereof throughout the length of each of said arms between the opposite ends thereof, said support means including a second plurality of separate support arms, each of said second plurality of arms being located between a pair of said first plurality of arms and including depending portions on the opposite ends thereof supported by said base member for locating the remainder of each of said second plurality of arms out of direct heat transfer contact with said base member and said upper utensil supporting plate, each of said second plurality of arms having a plurality of spaced apart grooves formed throughout only a portion of the length between the ends of each of said second plurality of arms, said arms having an undercut portion therein located between the grooved portion thereof and the opposite end thereof, and means for connecting each of said arms together as a unit including a disc located centrally of said base member and coacting means on said disc and the inner end of each of said first and second plurality of arms for fixedly securing each of said arms to said disc.

2. In the combination of claim **1**, means on the outer periphery of said disc member contacting at least one of said arms to prevent relative movement between said arms and said base member.

3. In an infrared electrical surface heating unit, the combination of, a low-profile outer envelope including a base member and an upper utensil supporting plate for transmitting infrared radiation, said base member and upper support plate being located in spaced relationship with one another, a first plurality of arms located between said base member and said upper utensil supporting plate, each of said support arms being an electrical insulator and having a low-thermal conductivity, each of said plurality of support arms having one end thereof located adjacent the outer periphery of said base member and the opposite end thereof located centrally of said base member, said ends of each of said first plurality of support arms having depending portions thereon supported by said base member, said depending portions locating the remainder of each of said first plurality of support arms out of direct heat transfer contact with said base member and said upper support plate, said first plurality of support arms having spaced apart grooves formed therein throughout the length of said arms between the opposite ends thereof, a second plurality of support arms located in the space between said base member and said upper utensil supporting plate, each of said second plurality of support arms being located between a pair of said first plurality of support arms and including a first end portion located adjacent the outer periphery of said base member and an opposite end member located centrally of said base member, depending portions on the ends of each of said second plurality of support members supported by said base member for locating each of said second plurality of said support members out of direct heat transfer contact with said base member and said upper support plate, said second plurality of said support members including a plurality of spaced apart grooves formed only through a part of the length of each of said arms between the ends thereof, certain ones of said second plurality of arms being undercut below said grooves adjacent the end thereof located centrally of said base member, an infrared emissive resistance element located between said base member and said upper supporting plate extending throughout substantially the full planar extent of said upper utensil supporting plate, a predetermined number of turns of said resistance element being supportingly received by said first and by said second plurality of support arms at the grooves therein for locating said resistance element out of direct heat transfer contact with both said base member and said upper support plate, a second predetermined number of turns of said resistance element being supported only by said first plurality of support arms at the grooves therein for locating said resistance element out of direct heat transfer relationship with said base member and said upper support plate, said second predetermined number of turns of said resistance element being located out of direct heat transfer contact with said second plurality of said support arms by the undercut portion in each of said second plurality of said support arms.

4. In an infrared electrical surface heating unit, the combination of, a low-profile outer envelope including a base member and an upper utensil supporting plate for transmitting infrared radiation, said base member and upper support plate being located in spaced relationship with one another, a first plurality of separate support arms located between said base member and said upper utensil supporting plate, each of said support arms being an electrical insulator and having a low-thermal conductivity, each of said plurality of support arms having one end thereof located adjacent the outer periphery of said base member and the opposite end thereof located cen-

trally of said base member, said ends of each of said first plurality of support arms having depending portions thereon supported by said base member, said depending portions locating the remainder of each of said first plurality of support arms out of direct heat transfer contact with said base member and said upper support plate, said first plurality of support arms having spaced apart grooves formed therein throughout the length of said arms between the opposite ends thereof, a second plurality of separate support arms located in the space between said base member and said upper utensil supporting plate, each of said second plurality of support arms being located between a pair of said first plurality of support arms and including a first end portion located adjacent the outer periphery of said base member and an opposite end member located centrally of said base member, depending portions on the ends of each of said second plurality of support members supported by said base member for locating each of said second plurality of said support members out of direct heat transfer contact with said base member and said upper support plate, said second plurality of said support members including a plurality of spaced apart grooves formed only through a part of the length of each of said arms between the ends thereof, certain ones of said second plurality of arms being undercut below said grooves adjacent the end thereof located centrally of said base member, an infrared emissive resistance element of a ribbon configuration located between said base member and said upper supporting plate extending as a spiral

throughout substantially the full planar extent of said upper utensil supporting plate, a predetermined number of turns of said spiral resistance element being supportingly received by said first and by said second plurality of support arms at the grooves therein for locating said resistance element out of direct heat transfer contact with both said base member and said upper support plate, a second predetermined number of turns of said spiral resistance element being supported only by said first plurality of support arms at the grooves therein for locating said resistance element out of direct heat transfer relationship with said base member and said upper support plate, said second predetermined number of turns of said resistance element being located out of direct heat transfer contact with said second plurality of said support arms by the undercut portion in each of said second plurality of said support arms, and means for connecting each of said arms together as a unit including a disc located centrally of said base member.

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