

[54] **RADIANT SURFACE-HEATER AND TEMPERATURE SENSING ASSEMBLY**

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[51] Int. Cl. H05b 3/68

[58] Field of Search.....219/443, 449, 458-465, 219/510, 512, 452

[56] **References Cited**

UNITED STATES PATENTS

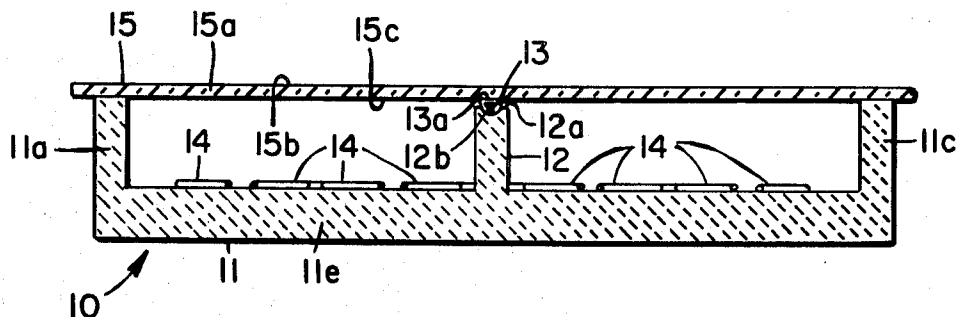
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[57] **ABSTRACT**

An assembly comprising a heater for heating a surface by thermal radiation or infrared transfer and a sensor for sensing the temperature of said surface to provide a control signal for adjusting the heat radiated by said heater in accordance with the value of said signal. An open top container or box-like member of an electrical insulating and low thermal transfer material has secured, to the interior surface of its bottom, an electrical resistance heating element, and the top of the container or member is disposed adjacent the underside of a plate or vitreous material beneath an area of the upper surface of the plate which is to be heated to provide a cooking surface. A divider extends across the interior of the container or box-like member and a temperature sensor having at least one flat side is supported in a channel provided in the upper surface of the divider with the flat side of the sensor in firm physical contact with the underside of the plate in the region of the cooking surface. The sensor is shielded to a substantial degree by the divider but a selected amount of the sensor is left exposed to heat radiated by the heating element to prevent "overshoot" when the assembly is used in an electrical circuit system for controlling the temperature of the cooking surface.

15 Claims, 2 Drawing Figures



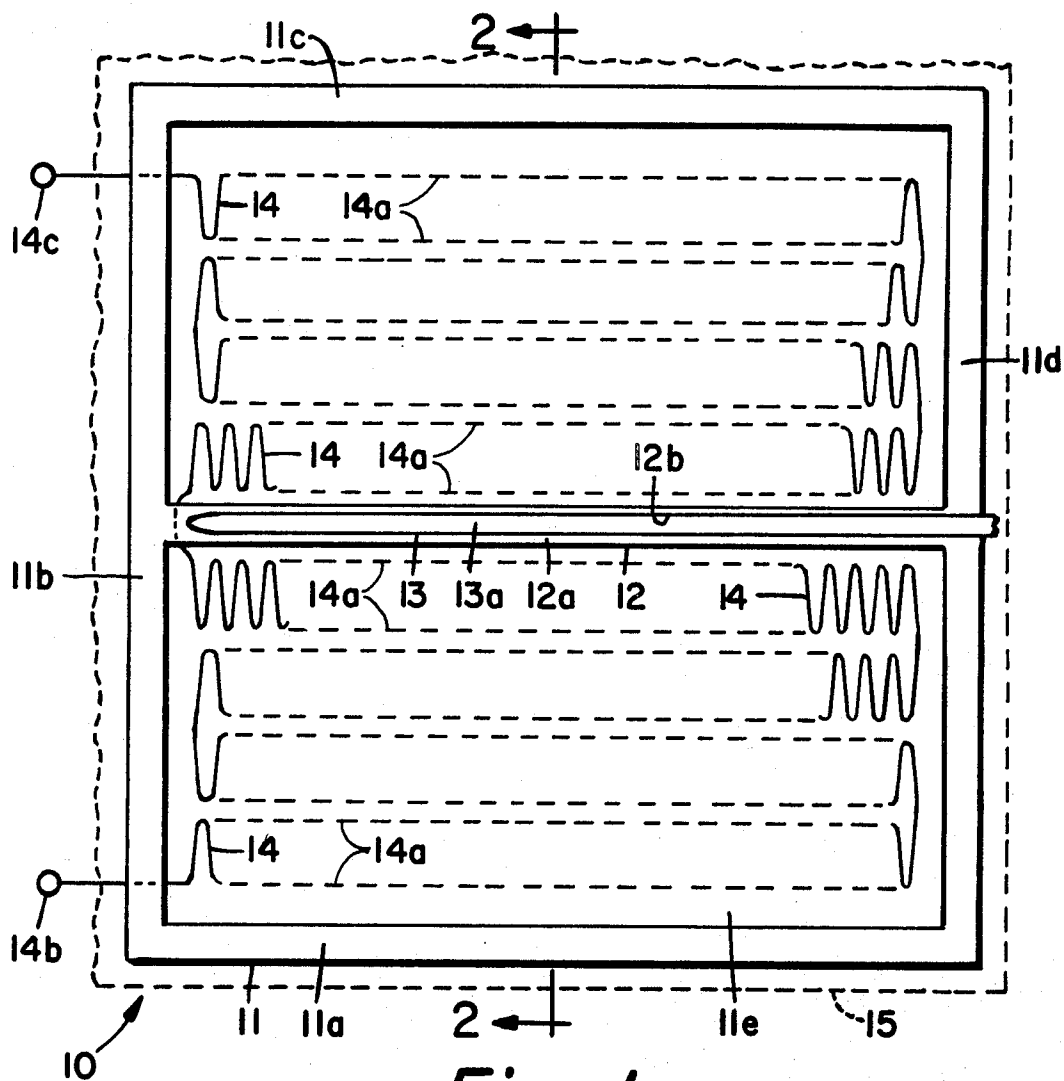


Fig. 1

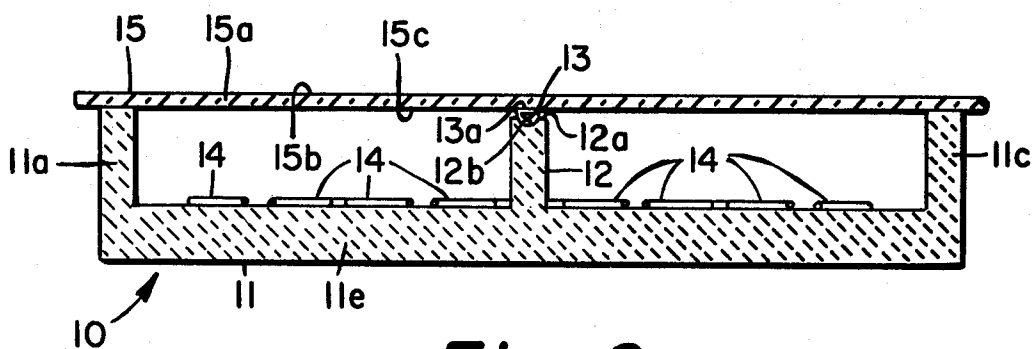


Fig. 2

RADIANT SURFACE-HEATER AND TEMPERATURE SENSING ASSEMBLY

BACKGROUND OF THE INVENTION

There is disclosed in U.S. Pat. Nos. 3,346,721; 3,348,025; 3,355,575, and 3,501,621, for example, surface heating units of the infrared or radiant heat transfer type employing electrical resistance heating elements. The heating units disclosed in said patents are relatively elaborate and, therefore, relatively expensive to make, and the patents do not disclose any use, provision, or manner of providing sensors for detecting or sensing the temperatures of the utensil or vessel-supporting members or plates of the heating units disclosed, nor of the temperatures of the cooking utensils or vessels used on such heating elements. Lower cost radiant surface-heaters for heating cooking surfaces of plates or support members, such as used in the assemblies shown in said patents, are continuously being sought and it has long been recognized that it is desirable, expedient, or even necessary to provide a means for detecting or sensing the temperatures of said plates or support members, or of the utensils or vessels supported thereby during cooking operations.

It is accordingly an object of the invention to provide a relatively low cost radiant surface-heater assembly of the type including a cooking surface of a support plate or member of vitreous material.

It is another object of the present invention to provide a surface-heater assembly of the type mentioned and including a temperature sensing means or sensor for detecting or sensing the temperatures of said support members or plates or of cooking vessels or utensils used on such support members.

Other objects and characteristic features of the invention will become apparent as the description proceeds.

SUMMARY OF THE INVENTION

It is believed that the invention herein disclosed is adequately summarized in the foregoing abstract and therefore, to avoid redundancy, it is considered expedient to omit a detailed summary of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the Drawings:

FIG. 1 comprises a top plan view of a radiant surface-heater and sensor assembly embodying the invention; and

FIG. 2 is a cross-sectional view of the assembly of FIG. 1, such view being taken generally along line 2—2 of FIG. 1.

Similar reference characters refer to similar parts in each of the Figs. of the drawings.

PREFERRED EMBODIMENT OF THE INVENTION

Referring to the drawings in detail, there is shown an assembly 10 of a type embodying the present invention. Such assembly comprises a relatively shallow box-like member or container 11 of a thermal or relatively high temperature resistant and electrically insulating material, such as an alumino-silicate material for example. Member or container 11 is shown in FIG. 1 as having a square planar configuration including a perimetric wall comprising sides 11a, 11b, 11c and 11d, and a bottom

or bottom portion 11e. However, it will be readily apparent to those skilled in the art that container or member 11 need not necessarily have a square planar configuration but, if considered desirable or expedient, the container or member 11 may have a planar shape of a rectangle other than a square, or, further, a planar shape of any regular polygon, a circle, an ellipse, or a shape comprising a combination of curvilinear and straight lines.

Box-like member or container 11 further includes a divider 12 which preferably extends diametrically across the container or member and divides the container and the interior or hollow thereof into substantially bilaterally symmetric halves. The top or upper surface 12a of divider 12 is slightly below the corresponding surface or surfaces of the aforesaid perimetric wall formed by the sides 11a through 11d of member or container 11. Top surface 12a of divider 12 embodies a longitudinal channel or groove 12b which also extends through the perimetric wall of container or member 11 for purposes discussed hereinafter. Divider 12 may be an integral part of member or container 11 or, alternatively, may be a separately formed part which is secured in any suitable manner to the interior of the perimetric wall of container 11 in the position described.

There is shown attached or secured to the interior bottom surface of container 11, that is, to the upper surface of bottom portion 11e of container 11, a heating element comprising a strip of an undulated, sinuous or serpentine bent or wound electrical resistance heating wire 14. Such strip of wire is further bent into short length strips so that it extends back and forth across the interior bottom surface of container 11 as illustrated by the broken lines such as 14a shown in FIG. 1. Such electrical resistance wire may, for example, be attached or secured to said upper surface of the bottom portion 11e of member 11 by stapling the wire to such surface for example.

It is expedient to point out at this time that the heating element employed in the invention need not necessarily comprise a strip of undulated or sinuously wound wire as discussed above, but such element could, as well, comprise a sinuously or spirally wound ribbon of an electrical resistance heating material, or a helically wound length of electrical heating resistant wire disposed and fastened on the interior bottom surface of container 11 in the form of a spiral or a plurality of loops. With any type of heating element employed the ends of such element extend through the perimetric wall of the container or box-like member 11 and are preferably electrically connected to suitable electrical terminals designated 14a and 14b.

A longitudinal temperature sensor 13 having at least one flat side such as 13a is snugly disposed in channel or groove 12b with said one flat side 13a of the sensor protruding slightly above the top of said channel substantially even with or slightly above said top surface of the perimetric wall of container 11 and is thereby substantially but not completely shielded from the heating element 14 provided on the bottom of container 11. One end of sensor 13 extends through the previously mentioned extension of channel 12b provided in the perimetric wall of container 11 and to the exterior of the container for connections to a control system,

device or apparatus which will be employed to variably control a supply of electrical energy to heating element 11 in accordance with temperatures sensed by sensor 13 as is well known in the art. Such control system, device or apparatus per se forms no part of the present invention and is, therefore, not shown in the drawings for purposes of simplification thereof. It is here pointed out that sensor 13 is preferably of the electrical resistance type disclosed in copending application Ser. No. 227,095, filed on even date herewith and assigned to the same assignee as the present application. However, any of the well-known so-called probe type temperature sensors can be used for sensor 13, the main requirement for such a sensor being that it has at least one flat side for the purpose discussed below.

There is provided a sheet or plate 15 of a thermal resistant vitreous material having an area 15a providing a cooking surface 15b. Member or container 11 is disposed below said cooking surface 15b with said top surface of said perimetric wall of the container disposed adjacent the underside or bottom surface 15c of plate 15, and with the flat side 13a of said sensor contacting and firmly held against the underside or bottom surface 15c of plate 15 and extending diametrically across area 15c of the plate. As will be readily apparent to those skilled in the art, member or container 11 may be supported in its said position adjacent the underside or bottom surface 15c of plate 15 and below area 15a by a suitable high temperature resistant adhesive provided between the top surface of said perimetric wall of member or container 11 and the corresponding areas of the bottom surface or underside 15c of plate 15. Member or container 15 may also be held in its said position adjacent the bottom surface or underside 15c of plate 15 by a suitable support means, not shown, which applies a force to the exterior bottom surface of such member or container and thereby urges the member or container upwardly against surface 15c of the plate. Such a support means can be used as the sole support for member or container 11 or it may be used in conjunction with an adhesive of the type mentioned above.

It is pointed out that sensor 13 is almost entirely shielded from the heat generated by element 14 when such element is energized from a suitable source of electrical current. However, sensor 13 is not entirely shielded from said heat since the sensor is exposed along its longitudinal edges or borders adjacent said surface 13a of the sensor, as illustrated in FIG. 2. Such exposure of said edges or borders of the sensor is to prevent so-called "overshoot" in a temperature control system which is employed to adjust the current supplied to heating element 14 in accordance with temperatures sensed by sensor 13. In other words, sensor 13 must be exposed to a small degree to the heat which radiates from heating element 14 in order to prevent said so-called "overshoot". This will be readily apparent to those skilled in the art and the necessary degree of exposure of sensor 13 to said heat to provide optimum temperature control can be readily ascertained by a minimum amount of experimentation.

Although there is herein shown and discussed in detail only one embodiment of the invention, it will be understood that various changes and modifications may be made therein within the purview of the ap-

pended claims without departing from the spirit and scope thereof.

What is claimed is:

1. A radiant surface-heater and temperature sensing assembly comprising:

A. a plate of a thermal resistant vitreous material having an area providing a cooking surface;

B. a longitudinal temperature sensor having a flat side disposed against the under side of said plate below said cooking surface and extending diametrically across said area of said plate;

C. a relatively shallow box-like member of a relatively high temperature oxidation resistant and electrically insulating material and having an open top disposed and held adjacent the underside of said plate below said cooking surface, such member including a divider extending diametrically across the interior of said member in longitudinal alignment with said sensor and having a height slightly less than the sides of said member, such divider having a width greater than the width of said sensor and embodying in the upper surface thereof a channel in which the sensor is snugly disposed and supported against said underside of said plate while substantially shielded from radiant heat from electrical resistance heating wire disposed on the interior surface of the bottom of said member; and

D. at least one heating element comprising wound electrical resistance heating wire disposed on and secured to the interior surface of the bottom portion of said member, said heating element adapted to be electrically coupled with said temperature sensor for adjustment of the supply of current to said heating element.

2. An assembly in accordance with claim 1 and in which said temperature sensor is of a type including a coil of wire of a material having a relatively high coefficient of electrical resistance as an electrically responsive temperature element.

3. An assembly in accordance with claim 1 and in which said temperature sensor is of a type comprising a pair of elongate members having different coefficients of thermal expansion.

4. An assembly in accordance with claim 1 and in which said vitreous material is a glass-ceramic.

5. An assembly in accordance with claim 2 and in which said vitreous material is a glass-ceramic.

6. An assembly in accordance with claim 3 and in which said vitreous material is a glass-ceramic.

7. A radiant surface-heater and temperature sensing assembly comprising:

A. a relatively shallow open topped container of a relatively high temperature oxidation resistant and electrical insulating material, such container including a divider extending generally diametrically across the interior of said container with the top surface of the divider slightly below the top surface of the perimetric wall of the container, such divider embodying in its top surface a relatively elongate channel for snugly receiving and substantially shielding a temperature sensor;

B. at least one electrical resistance heating element secured to the interior bottom surface of said container on both sides of said divider;

C. an elongate temperature sensor having at least one flat side and snugly disposed in said channel in said divider with said one flat side of the sensor protruding slightly above the top of said channel at least substantially even with said top surface of said perimetric wall of said container, and at least one end of said sensor protruding through said perimetric wall of the container for electric coupling with said heating element for adjustment of the supply of current to said heating element; and

D. a plate of a thermal resistant vitreous material having an area providing a cooking surface, said container disposed below said cooking surface of said plate with said top surface of said perimetric wall of the container disposed adjacent the underside of the plate and with said flat side of said sensor contacting and held against the underside of said plate diametrically across said area of the plate.

8. An assembly in accordance with claim 7 and in which said temperature sensor is of a type including a coil of wire of a material having a relatively high coefficient of electrical resistance as an electrically responsive temperature element.

9. An assembly in accordance with claim 7 and in which said temperature sensor is of a type comprising a pair of elongate members having different coefficients of thermal expansion.

10. An assembly in accordance with claim 7 and in which said vitreous material is a glass-ceramic.

11. An assembly in accordance with claim 8 and in which said vitreous material is a glass-ceramic.

12. An assembly in accordance with claim 9 and in which said vitreous material is a glass-ceramic.

13. In combination, an assembly comprising:

A. a radiant heater including,

I. a relatively shallow open top container of a ther-

mal resistant and electrical insulating material;

II. a longitudinal divider of a thermal resistant material and extending diametrically across the hollow of said container with its top surface slightly below the upper surface of the peripheral wall of the container and embodying in its said top surface an open top channel extending linearly along the length of said top surface of said divider, and

III. an electrical heating element secured to the interior bottom wall of said container on both sides of said divider;

B. a plate of a thermal resistant vitreous material including a cooking surface defined by an area of the upper surface of said plate, said container being securely supported beneath such plate with said upper surface of said peripheral wall of the container disposed adjacent the lower surface of the plate below said cooking surface; and

C. a longitudinal temperature sensor including one flat side and snugly disposed in said groove with said flat side firmly physically contacting said lower surface of said plate directly below said area of said upper surface of said plate and diametrically in alignment with a diameter of said cooking surface, said sensor being slightly less than completely shielded by said divider from radiation from said heating elements and adapted to be electrically coupled to said heating element for adjustment of the supply of current to said heating element.

14. An assembly as in claim 13 and in which said vitreous material of said plate is a glass-ceramic material.

15. An assembly as in claim 13 and in which said sensor is of a type including a wire of a material having a relatively high coefficient of electrical resistance as an electrically responsive temperature element.

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