March 17, 1970 N. J. PANSING ET AL 3,501,621

DUAL RIBBONED SURFACE HEATING ELEMENT

Filed Dec. 22, 1966

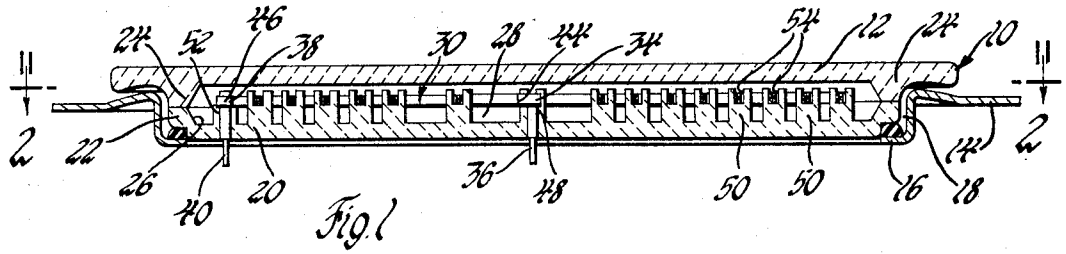

Fig. 1

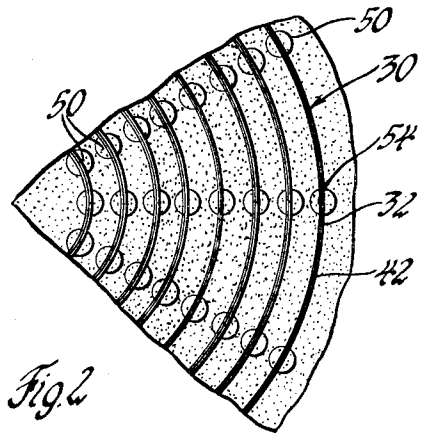

Fig. 2

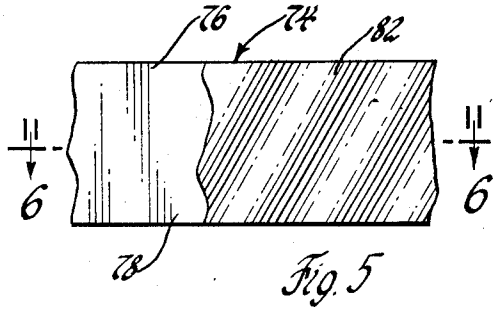

Fig. 5

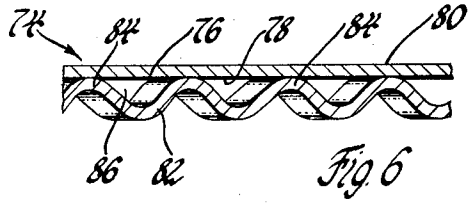

Fig. 6

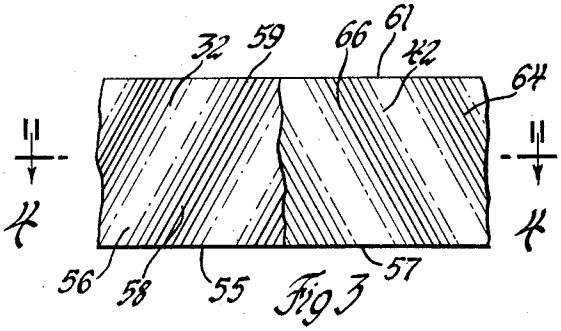

Fig. 3

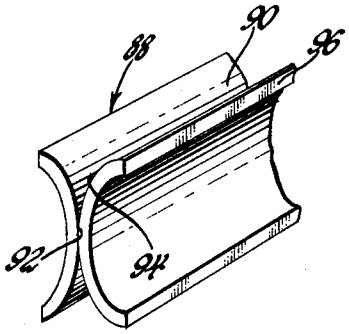

Fig. 7

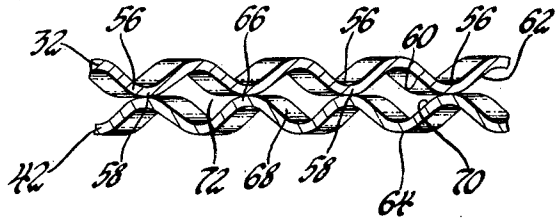

Fig. 4

INVENTORS
Nelson J. Pansing &
BY Robert T. Wones
J. C. Evans
ATTORNEY

United States Patent Office 3,501,621
Patented Mar. 17, 1970

3,501,621

DUAL RIBBONED SURFACE HEATING ELEMENT

Nelson J. Pansing, Clayton, and Robert T. Wones, Piqua, Ohio, assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed Dec. 22, 1966, Ser. No. 603,940
Int. Cl. H05b 3/68
U.S. Cl. 219—443 2 Claims

ABSTRACT OF THE DISCLOSURE

In preferred form, a surface heating unit having a solid top and bottom reflector plate. A high wattage density resistance element is located between the solid top and the reflector plate to transfer radiant energy directly to utensils on the top cover. The element includes two elongated ribbons supported edgewise between the reflector plate and solid top. At least one of the ribbons is corrugated along its length at an inclination to the longitudinal axis of the ribbons to increase radiant surface. Also, the corrugations include means for spacing the adjacent ribbons and inwardly facing surface that are directed at an inclination into openings between the spaced ribbons to directly radiate through the openings against supported utensils.

This invention is directed to a surface heating unit and more particularly to an electrical resistance element for use with surface heating units and preferably for use with surface heating units of the infrared type.

Surface heating units of the type found on domestic electric ranges, cooking tops or the like utilize an electrically energizable, high temperature resistance element to produce a predetermined level of thermal output from the surface heating unit suitable for carrying out a wide range of cooking operations. In one class of surface heating units, the electrical resistance element is directly radiantly exposed to a utensil or the like on the surface heating unit and is located out of direct heat transfer contact with the utensil whereby the element, when energized, is raised to a temperature whereby a substantial amount of thermal output therefrom is in the form of radiant energy. In such units typically the resistance element has a visually observable glow when energized.

Surface heating units of this type are commonly referred to as infrared surface heating units wherein radiant output from the unit for a given power source is directly proportional to the surface area on the resistance element. In infrared surface heating units of this type that utilize a continuously formed, elongated resistance filament which extends across a substantial planar extent the total amount of wattage output from the unit when connected across a predetermined power source depends upon the amount of surface area in the filament and the manner in which it is exposed in radiant heat transfer relationship with the item being heated. In such units, the operating temperature of the element preferably is held below 1800° F. to control expansion and premature element failure because of oxidation or other conditions that can break the electrical circuit through the resistance element; moreover there is a need to electrically insulate such electrical resistance elements to prevent shorting. The operating temperature limit and other factors has resulted in a fixed wattage density characteristic for units of this type.

An object of the present invention is to improve surface heating units by the provision therein of a resistance element including a polyribbon form having deformed segments thereon to form openings between the ribbons for increasing the radiant energy transfer from a predetermined planar extent of the unit.

Still another object of the present invention is to improve infrared surface heating units of the type including an exposed resistance element by the provision therein of a pair of elongated continuously formed resistance ribbons wherein at least one of said resistance ribbons includes a plurality of deformed segments thereon in engagement with the other of the ribbons to form an opening therebetween for the passage of radiant energy from facing surfaces or plural ribbons thereby to improve the wattage output of the surface heating unit when the resistance element therein is connected across a predetermined power source.

Yet another object of the present invention is to improve the wattage density of a surface heating unit by the provision therein of an improved resistance element comprising a first and second elongated high temperature resistance members located beside one another and wherein at least one of the members includes deformed segments thereon that contact the other member to form a space therebetween for the passage of radiation from oppositely facing inside surfaces on the members; to so improve wattage density by forming the deformed segments to include a plurality of corrugations along the length of said one of the members inclined with respect to the longitudinal axis thereof.

A further object of the present invention is to provide for such improved wattage output from a surface heating unit of the type described above wherein the other of the resistance members has a plurality of corrugations along the length thereof formed at an inclination to the longitudinal axis thereof opposite to the inclination of the corrugations on the other of the resistance members.

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 vertical section through a surface heating unit including the present invention;

FIGURE 2 is a fragmentary view in horizontal section taken along the line **2—2** of FIGURE 1;

FIGURE 3 is an enlarged fragmentary side view of one embodiment of a resistance element in accordance with the present invention;

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

FIGURE 5 is an enlarged fragmentary elevational view of a resistance element according to the present invention;

FIGURE 6 is a view in horizontal section taken along the line **6—6** of FIGURE 5; and

FIGURE 7 is an enlarged view in perspective of still another embodiment of the present invention.

Referring now to FIGURES 1 and 2, a surface heating unit **10** is illustrated including a solid top **12** of infrared transmissive material that serves to support a utensil on the upper surface **14** of a domestic range or the like. In the illustrated arrangement, the upper surface **14** of the range has a depending flange **16** thereon forming a recess **18** in the upper surface **14** in which is seated a base **20** of the unit **10** that has an annular upwardly directed peripheral lip **22** thereon which supportingly receives a lower rim **24** on the cover **12** whereby a reflective surface **26** inside of the base **20** is spaced from the under side of the cover **12** to form an opening **28** in which is located an electrical resistance element **30** constructed in accordance with certain principles of the present invention.

The surface heating unit **10** is representative of infrared surface units that are improved by the present invention. For a more detailed description of units of this type

reference may be had to copending U.S. application Ser. No. 429,305, filed Feb. 1, 1965 which discloses a low profile, surface heating unit of the type that incorporates an exposed resistance element that is of a high temperature resistance material energizable into the infrared range for directing energy through an infrared transmissive, continuous solid top **12** for carrying out predetermined cooking operations. The low profile configuration per se and the concept of infrared radiant heating form no part of the present invention but such surface heating units have an improved operation by virtue of the present invention.

One problem with surface heating units of the type is that the resistance element has an upper operating temperature limit. Where the resistance element extends across a predetermined planar extent defining a heated region on the top surface of a domestic range or the like the wattage output from the surface heating unit depends upon the area of the heated region.

In the illustrated arrangement, the resistance element **30** is configured to increase the wattage output of the surface heating unit **10** without increasing the operating temperature of the element **30** above a predetermined point. Thus, the resistance element **30** includes a first elongated ribbon formed resistance member **32** that has one end **34** thereof electrically connected to a terminal **36** directed through the base member **20** and an opposite end **38** electrically connected to an end terminal **40** also directed through the plate **20**.

The resistance element **30** also includes an elongated ribbon formed resistance member **42** having one end **44** thereof electrically connected to the terminal **36** and the opposite end **46** thereof electrically connected to the terminal **40**. In the illustrated arrangement, the resistance members **32, 42** are spirally wound from a centrally located post **48** upstanding from the base plate **20** and are passed over a plurality of spaced apart support pins **50** to a terminal post **52** thereby to form a heating pattern underlying substantially the full planar extent of the under side of the solid top cover **12**.

In FIGURE 2, a segment of the spiral winding is illustrated, clearly showing the radial spacing of segments of the ribbon formed resistance members **32, 42** through an arcuate segment of the spiral winding. Where the resistance elements **32, 42** pass over each pin **50** they are secured thereto by being fit into a slot **54** formed across the top of each of the support pins **50**. The members **32, 42** each stand edgewise in the slot **54** so that bottom edges **55, 57** on the members **32, 42** respectively are supported by the pins **50**. The members **32, 42** also include a top edge **59, 61** respectively.

To obtain a higher wattage density for a unit of heated surface area, in accordance with certain principles of the present invention, the illustrated dual ribbon formed resistance element **30** has a plurality of corrugations **56** formed at spaced apart points along the length of member **32**. The corrugations **56** in a preferred embodiment of the present invention are formed to extend between the edges **55, 59** of member **32** at an inclination of approximately 45°. The corrugations **56** are inclined in a like manner with respect to the longitudinal axis of the member **32**; each of the corrugations **56** include a ridge **58** thereon with an exposed surface **60** on one side thereof and another exposed surface **62** on the other side thereof. The outside surface of the element **32**, as best seen in FIGURE 4, defines a continuously undulating, sinuously formed surface from whence, when the resistance element **30** is energized across the terminals **36, 40**, radiant energy will pass directly therefrom for heating a utensil or the like on the top cover **12**.

Also, the resistance member **42** includes a plurality of spaced apart corrugations **64** therein which form a plurality of ridges **66** inclined with respect to the edges **57, 61** of member **42** and the longitudinal axis of the resistance member **42** and, as seen in FIGURE 3, are directed oppositely to the inclination of the ridges **58**. The ridges **58** and **66** thereby cross intersect one another at a plurality of point contacts, as best seen in FIGURE 4, so as to space the inwardly facing surfaces **60, 62** from like surfaces **68, 70** on either side of each ridge **66** across openings **72** formed between the ribbon members **32, 42** along the length thereof. Again, as best seen in FIGURE 4, the surfaces **60, 62, 68, 70**, because of their inclination to the longitudinal axis of ribbon members **32, 42**, face in a direction to directly pass radiant energy to an object located thereabove. The openings **72** serve as a passage for radiant energy from the surfaces **68, 70** and surfaces **62, 60** on the resistance members **42, 32**. Thus, the side by side arrangement of ribbon formed resistances having deformed surfaces therein for producing a spacing between adjacent inside surfaces of the arrangement materially increases the transfer of radiant energy from the arrangement through an infrared transmissive solid top member **12** or the like.

In the embodiment of the present invention shown in FIGURES 5 and 6 is a segment **74** of a resistance element of the type set forth in the embodiment of the FIGURES 2 through 4. The segment **74** includes a first resistance element **76** corresponding to one of the side by side ribbon formed resistance members in the element **30**. In this arrangement, the resistance element **76** is of a flat ribbon form having a smooth continuous inside surface **78** and a smooth flat continuous exterior surface **80**. Additionally, the segment **74** includes a second resistance element **82** that is located beside the resistance element **76** throughout the length thereof. The resistance element **82** has a plurality of corrugations along the length thereof forming a plurality of inwardly directly inclined ridges **84** on the strip that engage the inside surface **78** of the resistance element **76** to define in cooperation therewith a plurality of inclined spaces **86** through which radiant energy can be directed from the inside surfaces of the resistance elements **76, 82** thereby to increase the wattage density of a surface heating unit or the like.

Yet another embodiment of the invention is illustrated in FIGURE 7 wherein a segment **88** of a resistance element like that shown in the first embodiment has a first resistance element **90** that is curved about its longitudinal axis to form a convexly shaped elongated ribbon having an inwardly directed edge **92** thereon that engages a convexly formed surface **94** of a second elongated resistance ribbon **96**. The back to back location of the two convexly formed ribbons **90, 96** produces a substantial exposure of the inside surfaces of the ribbons to increase the wattage density of a surface heating unit of the type shown in the first embodiment or a like arrangement.

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 surface heating unit electrical resistance element for increasing wattage density in a surface heating unit or the like comprising a first elongated ribbon, a second continuously formed ribbon located in side-by-side relationship to said first ribbon, said second continuously formed ribbon having a top edge and a bottom edge, a plurality of corrugations formed in said second ribbon extending at an inclination to said second ribbon, each of said corrugations including a ridge contacting said first ribbon for forming an opening between said ribbons at each of said ridges, each of said corrugations including a surface thereon on each side of each of said ridges facing inwardly toward said first ribbon, each of said inwardly facing surfaces being inclined from said top edge to said bottom edge of said second ribbon to face upwardly in said openings for increasing direct radiant transfer from said ribbons through said openings.

2. A surface heating unit electrical resistance element for increasing the wattage density in a surface heating unit or the like comprising a first elongated

continously formed ribbon, a second continuously formed ribbon, said first and second ribbons being located side-by-side throughout their length, one of said ribbons having a first plurality of corrugations formed along the length thereof, each of said first and second ribbons having a top edge and a bottom edge, each of said first plurality of corrugations extending at an inclination from said top edge to said bottom edge of said one ribbon, each of said first corrugations including a ridge facing toward said second ribbon, said second ribbon having a second plurality of corrugations formed along the length thereof, each of said second plurality of corrugations extending at an inclination from said top edge to said bottom edge of said second ribbon, each of said second corrugations including a ridge facing toward said first ribbon, said ridges on said first ribbon cross intersecting said ridges on said second ribbon and engaging them at a point contact to space said first and second ribbons and to define a plurality of openings between said first and

second ribbons for the passage of radiant energy from said ribbons, each of said corrugations having an inwardly facing surface on either side of said ridge, said inwardly facing surfaces being inclined into said openings for increasing direct radiant transfer through the openings.

References Cited

UNITED STATES PATENTS

1,890,339	12/1932	Römhild	313—343
3,032,635	5/1962	Kraft	219—553
3,346,720	10/1967	Siegla	219—445
3,056,846	10/1962	Glaser	13—20 X

BERNARD A. GILHEANY, Primary Examiner

F. E. BELL, Assistant Examiner

U.S. Cl. X.R.

219—468; 338—279