

July 20, 1954.

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2,684,431

ELECTRIC HEATER

Filed Sept. 5, 1951

2 Sheets-Sheet 1

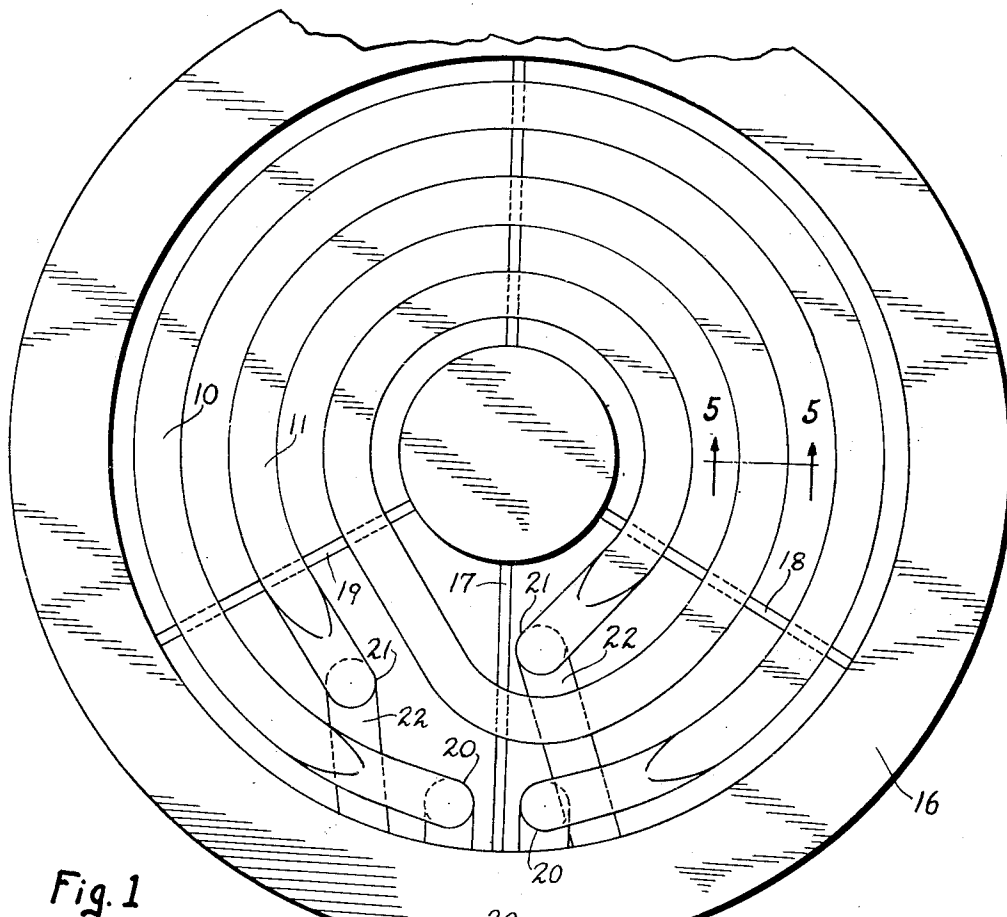


Fig. 1

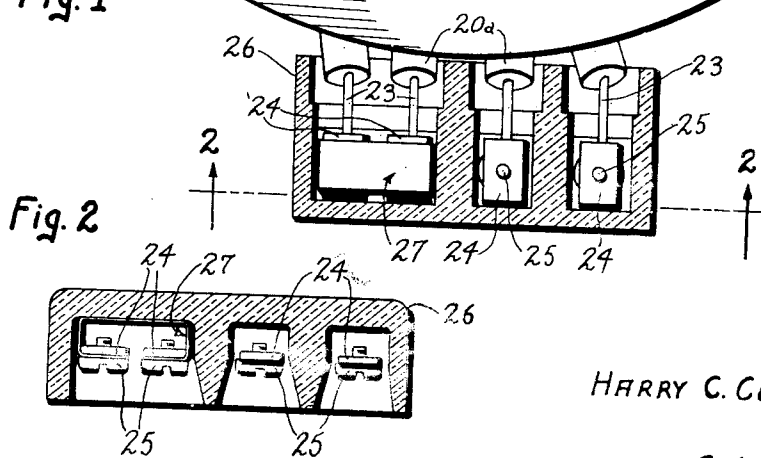


Fig. 2

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Fig. 3

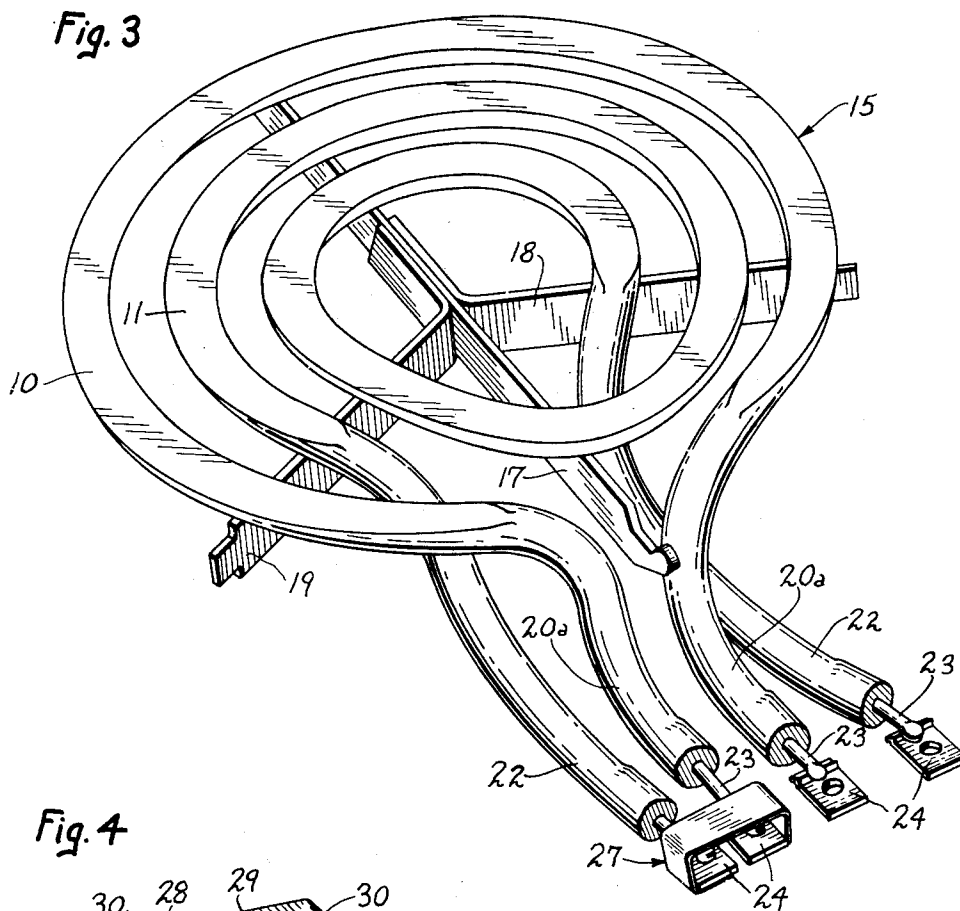


Fig. 4

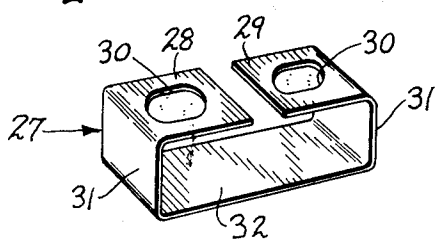
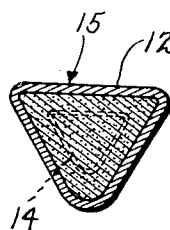


Fig. 5



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ELECTRIC HEATER

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3 Claims. (Cl. 219—37)

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This invention relates to an electric heater and, particularly, to an electric heater including tubular electric heating elements having their active portions conformed into a pattern defining a flat planar surface, and mounted on a support, together with a connector for the terminal ends of the tubular heating elements of a nature to electrically connect the terminal ends of at least two of the heating elements in a manner to compensate for disalignment of the terminal ends caused by the shaping of the heating elements, or produced by expansion and contraction of the heating elements.

It has heretofore been customary to connect the terminal end of one heating element to the terminal end of another heating element by means of a solid bar. Such type of connection not only requires accurate shaping and alignment of the tubular elements in such manner that the elements will lie flat on the support and not disrupt the flat planar surface due to stress on the terminal ends, but such type of connection does not provide for possible disruption of the planar surface by reason of unequal expansion and contraction of the elements.

It is one object of this invention to provide a heater including tubular electric heating elements having terminal ends connected together, and to provide a connection for such terminal ends which will compensate for disalignment of the terminal ends, or will provide for relative disalignment of the terminal ends in response to expansion and contraction of the heating elements.

It is another object of this invention to provide an electrical connector for the terminal ends of heating elements as herein disclosed which will provide for the greatest degree of flexibility of the terminal ends with respect to their position, one to the other.

Various other objects and advantageous features of the invention may be had from the following description, and one embodiment thereof may be seen in the accompanying drawings wherein similar characters of reference designate corresponding parts, and wherein:

Figure 1 is a fragmentary top plan view, partly in elevation and partly in section, showing an electric heater embodying the idea disclosed by this invention.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a perspective view showing the heater elements and support therefor.

Figure 4 is a perspective view of the electrical

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connector for connecting the terminal ends of the heating elements.

Figure 5 is a sectional view of the heating elements taken on the line 5—5 of Figure 1.

Referring to Figure 1 of the drawings, there is shown an electric heater consisting of tubular electric heating elements 10 and 11 which are normally formed from straight tubes into the configuration shown in Figure 1, or other desired configuration, by bending. The tubular heating elements generally comprise a tubular metallic sheath 12 through which extends a spirally or other shaped resistance element 14, the resistance element 14 being embedded in a refractory material contained within the sheath 12 which acts as a heating conductor and an electric insulator. The tubular sheaths 12, at least for their active portions on which a receptacle or article to be heated rests, are here shown as being generally triangular in shape with the base of the triangle forming the top planar surface, and the apex of the triangle resting upon a reticulated support which is, in turn, supported in a ring 16 that is adapted to fit within an opening in the top of a stove or hot plate.

The reticulated support consists of a bar 17 extending diametrically across the ring 16, and two arms 18 and 19 secured to and extending substantially radially outwardly from the bar 17 to the inner circumference of the ring 16. The active portions of the heating elements rest upon the bar 17 and the arms 18 and 19, and are preferably secured to the bar 17 in a manner to retain the heating elements on the bar 17 but permit some horizontal movement of the heating elements due to expansion and contraction of the elements.

As shown in Figures 1 and 3, the terminal ends of the tubular heating element 10 are bent first downwardly as at 20 and then horizontally and outwardly from the active portion of the heating element as at 20a. The terminal ends of the tubular heating element 11 are bent first downwardly as at 21 and then horizontally outwardly as at 22, the arrangement here shown being such that the horizontally extending terminal ends 22 of the heating element are disposed outwardly of and on each side of the horizontally extending ends 20a of the heating element 10.

As shown in Figure 1, the resistance elements 15 have terminal rods 23 connected to their protruding ends, and each terminal rod 23 is provided with a connecting element 29 embodying a plate and a screw 25 for connection of the wires of an electric supply circuit thereto. An insulat-

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ing block 26, having appropriate grooves and spaces therein, is adapted to loosely receive the terminal ends of the heating elements and protect the electrical connections against contact with metal and resultant short-circuiting.

It is a usual practice, particularly where the well-known three-wire electrical circuit is used, to connect the terminal end of one heating element with the adjacent terminal end of the other heating element, the remaining terminal ends of the heating elements remaining free for connection to separate lines of the three-wire circuit, and it has been found that it is extremely difficult to so shape the downwardly and horizontally extending portions of the heating elements as to avoid discrepancies in alignment between the terminal ends of a magnitude which will cause the heater element to lie above and not contact the support. It has further been found that expansion and contraction of the heating elements will, in itself, produce disalignment of the adjacent terminal ends of the heating elements, and such disalignment may well reach a magnitude which will cause the tubular heating elements to move upwardly away from, for example, the support arm 19 and thus disrupt the planar surface on which the receptacle or article to be heated rests and thereby materially affect the heat transfer capacity of at least those portions of the heating elements above which the receptacle or article is resting, and with which the receptacle or article is out of contact.

In accordance with this invention, there is provided an electric connector for at least two adjacent ends of the respective heating elements which consists of a preferably metallic strip-like conductor, generally indicated at 27, which is bent upon itself to provide two in-turned ends 28 and 29 having openings 30 therein to receive the screws 25, end portions 31 extending substantially normal to the in-turned ends and a portion 32 spaced from and extending substantially parallel to the in-turned ends and across the two adjacent terminals of the tubular heating elements from the outside edge of one to the outside edge of the other. The openings 30 are preferably oblong in contour to permit a minor lateral adjustment of the terminal ends with respect to the connector, or to accommodate screws of different sizes.

With the construction herein described, it will be seen that the adjacent connected terminal ends of the respective heating elements 10 and 11 need not be necessarily in substantially accurate alignment, since disalignment will be compensated for by the flexibility of the connector 27, and that this same flexibility will permit at least relative movement of the terminal ends of the heating elements due to expansion and contraction of the heating elements without placing such stress on the heating elements that they will tend to rise above the support and thereby destroy the planar surface on which the receptacle or article to be heated rests.

What is claimed is:

1. An electric heating unit, comprising tubular electric heating elements having approximately their active portions conformed into a pattern defining an article receiving surface, a support

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for the heating elements, constructed and arranged to have said pattern portion of the heating elements engaged thereagainst on one face of said pattern portion, terminal ends on said tubular heating elements extending laterally of said pattern portion, at least one terminal end of one heating element extending in substantially side by side relation with a terminal end of another heating element, and a unitary connector for electrically connecting the terminal end of the one heating element to the terminal end of the other heating element, including a flexible strip-like member bent upon itself to provide free ends for rigid connection to the terminal ends of said heating elements and a portion spaced from and spanning the said terminal ends from the outside lateral edge of one terminal end to the outside lateral edge of the other terminal end and in spaced relation to said terminal ends.

2. An electric heating unit, comprising tubular electric heating elements having approximately their active portions conformed into a pattern defining an article receiving surface, a support for the heating elements, constructed and arranged to have said pattern portion of the heating elements engaged thereagainst on one face of said pattern portion, terminal ends on said tubular heating elements extending laterally of said pattern portion, at least one terminal end of one heating element extending in substantially side by side relation with a terminal end of another heating element, and a unitary connector for electrically connecting the terminal end of the one heating element to the terminal end of the other heating element, including a flexible strip-like member bent upon itself to provide free ends for connection to the terminal ends of said heating elements, portions normal to said free ends, and a portion generally parallel to said free ends spanning the said terminal ends from the outside lateral edge of one terminal end to the outside lateral edge of the other terminal end and in spaced relation to said terminal ends.

3. An electric heating unit comprising a pair of sheathed resistor elements having juxtaposed terminal ends, and a connector for said terminal ends comprising a thin freely flexible channel-shaped strip of current conductive material, opposite ends of said channel-shaped strip having feet turned transversely relative to the adjacent channel wall, and said feet being rigidly connected to said terminal ends respectively, the flexibility of said strip providing for twisting of the channel walls to compensate for minor misalignment of said terminal ends and for relative movement thereof resulting from expansion and contraction of said resistor elements.

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