Jan. 16, 1962 G. E. AMMERMAN 3,017,491

ELECTRIC HEATER-THERMAL ELEMENT ASSEMBLY

Filed March 30, 1959 2 Sheets-Sheet 1

Fig. 1

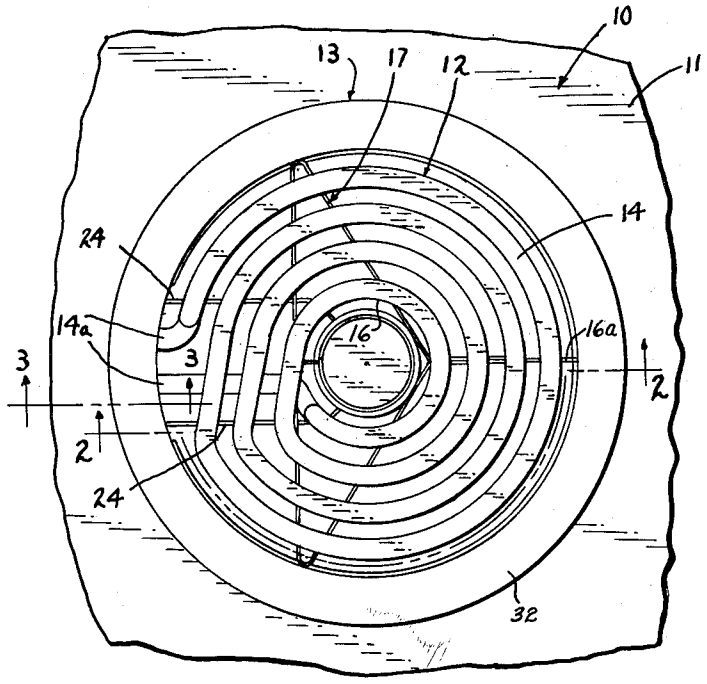
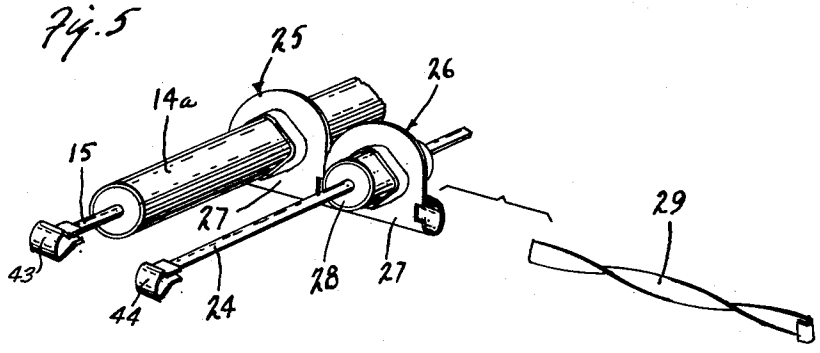


Fig. 5



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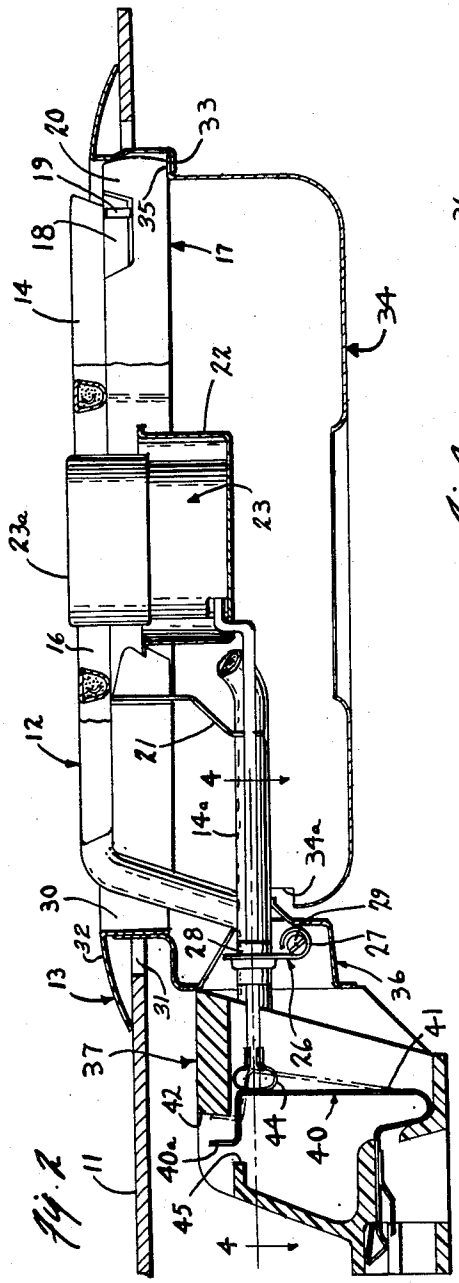


Fig. 2

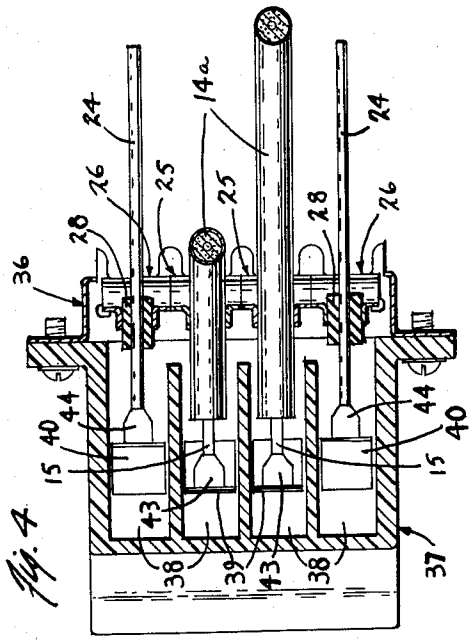


Fig. 4

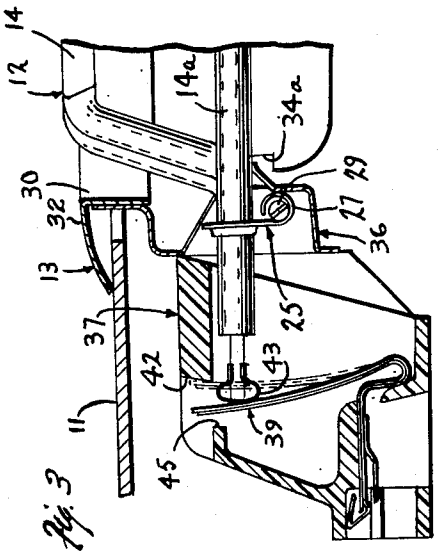


Fig. 3

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3,017,491
ELECTRIC HEATER-THERMAL ELEMENT ASSEMBLY

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Filed Mar. 30, 1959, Ser. No. 802,949
9 Claims. (Cl. 219—37)

The present invention relates to electric heaters, more particularly to thermostatically controlled electric heaters of the type known as range-top heaters, and the principal object of the invention is to provide new and improved electric heaters of the character described.

In the usual type of range-top heater having a heating element which normally remains permanently connected to the range by means of suitable lead wires through which electrical energy is conducted to the element, little difficulty exists when the element is to be thermostatically controlled. In such case, lead wires similar to those which conduct current to the element may be connected to the thermally responsive member which is normally supported for engagement with the underside of the vessel being heated by the heater. When, however, the thermally responsive member is carried by the heating element assembly and in constructions where the latter is of the plug-in type so that it may readily be removed from the range without disconnecting any lead wires, the matter of making electrical connections to the thermally responsive member becomes somewhat of a problem.

It has been suggested that the electrical connections to the thermally responsive member be made in the same manner as the electrical connections to the heating element. However, this presents additional problems. It is to be understood that each range normally employs four separate range-top, or surface, heating units only one of which, in the usual construction, is thermally controlled. Accordingly, some means must be provided to prevent damage in the event an attempt is made to position a thermally controlled element assembly in the place where a non-thermally controlled element assembly belongs or in the event a non-thermally controlled assembly is positioned in the place where the thermally controlled assembly belongs.

Other disadvantages of prior art solutions to the problem have been the necessity of many special parts which unduly increased the costs of units of the type herein contemplated and the inability to quickly service defective units in the field by a replacement only of the parts which are defective rather than the replacement of complete assemblies simply because they are permanently assembled at the factory.

The present invention provides a practical solution to the problems above mentioned and provides other advantages which will readily become apparent from a study of the following description and from the drawings appended hereto.

In the drawings accompanying this specification and forming a part of this application there is shown, for purpose of illustration, an embodiment which the invention may assume, and in these drawings:

FIGURE 1 is a top plan view of the invention,

FIGURE 2 is an enlarged sectional view generally corresponding to the line 2—2 of FIGURE 1 and with portions on the near side broken away to show the underlying structure,

FIGURE 3 is a fragmentary sectional view generally corresponding to the line 3—3 of FIGURE 1,

FIGURE 4 is a fragmentary sectional view generally corresponding to the line 4—4 of FIGURE 2, and

FIGURE 5 is an enlarged, fragmentary, exploded perspective view of a certain detail.

The present invention is similar in many respects to

the heating unit disclosed in the co-pending application of Joseph McOrlly and G. Edward Ammerman for Electric Heaters, filed December 29, 1958, Serial Number 783,579, and assigned to the same assignee as the present application. The principal distinction between the present case and the above mentioned earlier filed case is that the present construction is modified to provide for thermal control of the heating unit.

Briefly, and in common with the construction of application Serial Number 783,579, the present invention comprises a surface-type, electric heater assembly **10** (see especially FIGURES 1 and 2) which is adapted to be carried by the top **11** of a range or the like. As in the previously filed case, assembly **10** presently comprises two major sub-assemblies; i.e., a heating element assembly **12** and a trim ring assembly **13**, the latter of which is supported by the range top **11** and in turn supports the element assembly **12**. In contrast with the construction of the earlier filed case, the present embodiment employs a single tubular sheathed electric heating element **14** instead of a pair of such elements; however, it is to be understood that the single element is shown solely by way of illustration and that a pair of such elements may be employed if desired.

Heating element **14** is of the usual type comprising an elongated tubular metallic sheath filled with compacted electric-insulating, heat-conductive material in which is embedded an electrical resistance member, or resistor. Such resistor normally terminates short of respective sheath ends and each end thereof is electrically connected to respective terminal pins **15** which project beyond respective sheath ends for conducting electrical energy to the resistor.

Heating element **14** has its intermediate portion, specifically that portion which contains the resistor, convoluted to provide a generally flat, heat-generating surface for underlying and supporting a vessel to be heated. As illustrated, an opening **16** is provided at the center of the convolutions for a purpose to appear. The terminal ends of element **14** are bent to provide generally parallel, spaced-apart legs **14*a*** which are spaced below (in the position of parts seen in FIGURES 2 and 3) the heat generating element surface and which extend beyond a margin thereof for a purpose to appear.

Means are provided for supporting the convolutions of element **14** and for this purpose, a support member, or spider **17** is employed. While this spider may take any convenient form, it is preferable to employ one of the type disclosed in detail in Letters Patent 2,877,334, issued to Joseph McOrlly and G. Edward Ammerman on March 10, 1959, for Electric Heaters. In brief, this spider comprises a length of strip material positioned on edge and formed to a triangular configuration (see FIGURE 1). A leg **16*a***, formed by the juxtapositioned ends of the strip, projects from a corner of the triangular configuration and one of the strip ends provides a tongue **18** which passes through a loop **19** which is welded or otherwise secured to and depends from one of the convolutions of element **14**. The other end of the strip has an abutment **20** and such strip end will be bent to dispose abutment **20** in alignment with the end of tongue **18** to prevent unintentional withdrawal of the latter from the loop **19**. As will be clear, the foregoing connects together the spider and that portion of element **14** which is spaced furthest from the element terminal legs **14*a***. Any suitable means may be provided for retaining that portion of the spider which is adjacent the element terminal legs **14*a*** in position beneath the element convolutions and at the present time, a forked bracket **21** may be carried by the spider and may straddle an element leg **14*a*** in a manner similar to the construction disclosed in the previously mentioned co-pending application for Letters Patent.

As seen in FIGURE 2, a bracket 22 is carried by the spider in any suitable manner; however, it is preferable at the present time to secure the bracket to the spider in the same manner as the medallion which is disclosed in the previously mentioned Patent 2,877,334. Carried by bracket 22 is a suitable, commercially available thermally responsive device 23 of the electrical type having an upper portion 23*a* which engages the bottom of a vessel placed upon the heating surface provided by the element 14. Extending from device 23 are a pair of generally rigid, exposed electrical conductors 24 (see also FIGURE 1) which extend in side by side relation with the element legs 14*a*. At the present time, one conductor 24 is disposed on one side of the juxtaposed legs 14*a* while the other is disposed on the opposite side of such legs.

Means are provided for removably connecting together terminal leg portions 14*a* and conductors 24 and as best seen in FIGURES 2, 3, 4 and 5, a flange member 25 is secured to each terminal leg portion 14*a* in spaced relation with its free end and an identical flange member 26 is secured to each conductor 24. These flange members may be identical to the flange members disclosed in application Serial Number 783,579 and each will have a tubular portion 27. With respect to flange members 25, the latter may be crimped to respective legs 14*a* as disclosed in the above mentioned application with their tubular portions 27 in axial alignment. With respect to flange members 26, a bushing 28, formed of rubber or other dielectric material, will be interposed between such members and respective electrical conductors 24 for insulation purposes. Flange members 26 may be crimped about respective bushing 28 to insure against disassembly and when such bushings are made of rubber or other readily deformable material, they will be deformed by the flange members into gripping engagement with respective conductors. Obviously, the tubular portions 27 of flange members 26 will be aligned with the tubular portions of flange members 25 and such members will be removably secured together by a spiraled strip 29 all as disclosed in the previously mentioned application.

Turning now to the previously mentioned assembly 13, the latter is similar to that disclosed in application Serial Number 783,579 and is herein illustrated as comprising a trim ring having a tubular portion 30 (see FIGURE 2) fitting within an aperture 31 formed in the range top 11 and an upper, radially outwardly extending flange portion 32 which rests upon the range top adjacent the range top aperture. Although not shown, the trim ring may carry any suitable clips or the like for resiliently retaining the ring in position within the range top aperture. As best seen in FIGURE 2, the lower end of the tubular ring portion 30 is provided with a radially inwardly turned flange 33. A reflector pan 34, having a radially outwardly turned flange 35, rests upon and is supported by the ring flange 33 and a portion of the pan wall is cut away at 34*a* to pass the element legs 14*a*. As will be understood, pan flange 35 provides an annular ledge upon which rests the previously described spider 17 when the parts are assembled in the normal heating position best illustrated in FIGURE 2.

Also as disclosed in the previously mentioned application, the trim ring presently carried means arranged to provide for movement of the heating element assembly 12 toward and away from its normal heating position and further ararnged to provide for automatic connection and disconnection of the heating element 14 and the thermally responsive member 23 of such assembly 12 with respective electrical circuits. Briefly, such means may comprise a bracket 36 secured to and depending from the tubular trim ring portion 30 and a hollow terminal block 37 carried by such bracket. Since bracket 36 and block 37 are similar to these disclosed in detail in application Serial Number 783,579, it is believed that a repetition of this detail here would unduly complicate the present case.

As disclosed in the above-mentioned application, the interior of block 37 is divided into four compartments 38. As will appear, the two intermediate compartments are, in the present invention, adapted to respectively receive the free end of an element terminal leg 14*a* while the end compartments are adapted to respectively receive the free end of an element terminal leg 14*a* while the end compartments are adapted to respectively receive the free end of a conductor 24. As best seen in FIGURE 3, each of the intermediate compartments carries an electrical contact member 39 which may be identical to the electrical contact members disclosed in the previously mentioned application. The end compartments 38 also carry electrical contact members 40; however, members 40 differ in certain important respects from members 39.

Firstly, and as seen in FIGURE 2, members 40 may be made of a single thickness of material since much less contact pressure is required because of the relatively small amounts of current which passes through such members. Secondly, these members are so arranged that when the element assembly is in its normal heating position seen in FIGURE 2, the contact engaging faces 41 of these members are spaced closer to the heating element than are the corresponding faces of contact members 39 (see especially FIGURE 4) for a purpose to be seen.

As disclosed in the previously mentioned application, contact members 39 are normally biased to the phantom line position seen in FIGURE 3 (when, of course, the element assembly is removed from the normal position shown) wherein such members are engaged with an abutment 42 formed in the terminal block. In the same manner, contact members 40 are also biased to the phantom line position seen in FIGURE 2 wherein an offset portion 40*a* thereof engages with the abutment 42 to thus limit contact member movement. As will later be disclosed, offset portion 40*a* serves yet another function.

Means are provided for establishing a low electrical resistance connection between the terminal pins 15 of element 14 and respective contact members 39 and between conductors 24 and contact members 40. At the present time, it is preferable to employ for this purpose contact buttons 43 carried by the free ends of terminal pins 15 and contact buttons 44 carried by the free ends of conductors 24. Since these contact buttons are described in detail in the previously mentioned application, it is believed that repetition herein is unnecessary. It is important to note, however, that the contact buttons 43 are spaced a greater distance from the heating element than are the contact buttons 44 as best may be seen in FIGURE 4 and from a comparison of FIGURES 2 and 3, and for a purpose to appear.

In its normal heating position, the element assembly 12 will be positioned as seen in FIGURES 2 and 3 wherein contact buttons 43 are engaged with respective contact members 39 and wherein contact buttons 44 are engaged with contact members 40. With the parts so disposed, electrical energy may pass to the element 14 from the contact members 39 for heating the element and a control current may pass to the thermally responsive member 23 through the contact members 40 for controlling flow of electrical energy to the element 14 in accordance with the temperature of member 23 which is engaged with and thus senses the temperature of a vessel (not shown) supported by the element.

As disclosed in the previously mentioned application, element assembly 12 may be tilted to an inclined position to permit removal of reflector pan 34 and, when the element is so inclined, contact members 39 and 40 will be biased to the respective phantom line positions seen in FIGURES 3 and 2 to resiliently retain the element assembly in such position. The element assembly may also be completely withdrawn from the assembly 13 as dis-

closed in the above mentioned application to provide greater accessibility for cleaning.

As previously mentioned, contact buttons **44** on the free ends of conductors **24** project beyond the heating surface provided by element **14** a lesser distance than the contact buttons **43** carried by the free ends of terminal pins **15**. Accordingly, in the event an element assembly of the type herein disclosed is installed by mistake in a trim ring assembly of the type disclosed in the previously mentioned application, no damage will result, even though the element assembly fits perfectly into place, since the contact buttons on the terminal ends of conductors **24** do not extend far enough for engagement with those contact members designed to engage the outermost element terminal ends and thus there will not be a complete electrical circuit to pass current to the heating element.

Conversely, if an attempt is made to install an element assembly of the type disclosed in the previously mentioned application with the trim ring assembly herein disclosed, it will be impossible to seat the element assembly in the normal heating position seen in FIGURES 2 and 3. This will result for reason that when such an attempt is made, the outermost element terminal ends will engage respective contact members **40** and will deflect them to the left (in the position of parts viewed in FIGURE 2) from their phantom line position. Since, however, the outermost element terminal ends project further than do the terminal ends of conductors **24** which are designed to engage these members, the latter would have to deflect considerably beyond the full line position seen in FIGURE 2 in order to permit seating of the element assembly. Such excess deflection of contact members **40** beyond their full line positions is, however, prevented by engagement of offset **40***a* of a contact members with an abutment **45** of the block. Accordingly, an element of the type disclosed in the application cannot be seated in the presently disclosed trim ring assembly.

It is to be understood that while bracket **36** is herein disclosed as being secured to a trim ring which is separable from the range, it is contemplated that this bracket could be secured directly to the range top with the attendant elimination, if desired, of the trim ring.

In view of the foregoing it will be apparent to those skilled in the art that I have accomplished at least the principal object of my invention and it will also be apparent to those skilled in the art that the embodiment herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described, hence it will be appreciated that the herein disclosed embodiment is illustrative only, and that my invention is not limited thereto.

I claim:

1. A range-top heating unit comprising a heating element shiftably carried by the range and providing a heating surface for underlying and supporting a vessel to be heated and having a leg whose end terminates a predetermined distance beyond said heating surface for conducting electrical energy to said element, a temperature responsive member carried by said element for engagement with a vessel supported by the latter and having a current conductor extending therefrom in side-by-side relation with said element leg whose end terminates short of the end of said leg, means carried by the range providing a first electrical contact engageable with the end of said element leg and a second electrical contact engageable with the end of said current conductor, said contacts connecting said element and said temperature responsive member in respective electrical circuits and said first contact deflecting to a position spaced a predetermined distance from said heating surface and said second contact deflecting to a position less than said predetermined distance upon disposition of said heating element in a normal heating position with said leg thereof and said current conductor respectively engaged with said contacts, and means preventing deflection of said second contact to a position spaced said predetermined distance from said heating surface to prevent disposition of a heating element in said normal heating position in the event a leg thereof rather than said current conductor is engaged with said second contact.

2. The construction of claim 1 wherein said electrical contacts are carried by a dielectric body and wherein said deflection preventing means comprises an abutment carried by said body for engagement with said second contact upon deflection of the latter.

3. A range top heating unit, comprising an elongated sheathed electric heating element having an intermediate convoluted heat generating portion disposed in a plane and providing a heating surface upon which a vessel to be heated is supported, said element having a pair of terminal portions integral with said heat generating portion and disposed below the latter and extending in side-by-side relation radially outwardly thereof, a temperature responsive member carried by said heating element and disposed within the center of the convoluted heat generating portion and adapted to engage the undersurface of the vessel supported on the heat generating portion, said temperature responsive member having a pair of rod-like conductors rigidly extending therefrom in side-by-side relation with said terminal portions, a terminal block of dielectric material disposed stationary with respect to said heating element and having elongated stalls for locating said terminal portions and conductors during movement of said heating element to normal heating position and for receiving and transversely separating respective terminal portions and conductors, and a spring contact in each stall for resilient but separable engagement with the contact end of a respective terminal portion and conductor, the spring contacts and respective contacts on said terminal portions having effective circuit making engagement at a different distance radially of said heating element than the spring contacts and contacts on said conductors, whereby said terminal portions and said conductors must be disposed in their proper stalls to effect predetermined operation of said heating element.

4. The construction according to claim 3 wherein the effective engagement between the spring contacts and contacts on said terminal portions are spaced a greater distance radially of said heating element than the effective engagement of said spring contacts and contacts on said conductors.

5. The construction according to claim 3 wherein said terminal portions and said conductors are held in horizontally aligned relation.

6. The construction according to claim 3 wherein all spring contacts are flat springs and have portions abutting said terminal block to limit spring movement in one direction.

7. The construction according to claim 6 wherein said portions on the spring contacts for said conductors also abut a spaced part of said terminal block to limit spring movement in the opposite direction.

8. An electric heating assembly, comprising a sheathed electric heating element having an intermediate convoluted heating portion disposed in a plane to support a vessel to be heated and having a pair of terminal portions disposed beneath said heating portion and extending radially thereof, said terminal portions being disposed in predetermined aligned side-by-side relation but being capable of moving to and from such relation, a temperature responsive member disposed within the center of the convoluted heating portion and having a pair of conductors disposed beneath said heating portion and extending radially thereof and adapted to be aligned in side-by-side relation with said terminal portions, a radially extending flange secured to each terminal portion and conductor, each flange having a looped part the axis of which is normal to and vertically spaced from the axis of the respective terminal portion and conductor, all looped parts being turned in the same direction and movable

with the respective flange so that the openings of said looped parts may be axially aligned, and a metal strip extending through the aligned openings of said looped parts and tying together the latter in end-to-end abutting relation by having its opposite ends headed over the opposite free end of the looped parts.

9. The construction according to claim 8 wherein a dielectric bushing is disposed between each conductor and its looped part.

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