Nov. 24, 1942. E. S. SMITH 2,302,808

ELECTRIC HEATER

Filed July 31, 1941 2 Sheets-Sheet 1

Fig. 1.

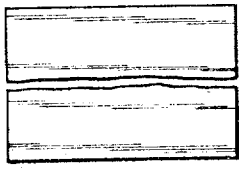


Fig. 2.

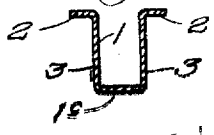


Fig. 3.

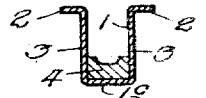


Fig. 4.

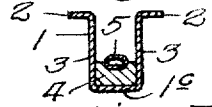


Fig. 5.



Fig. 6.

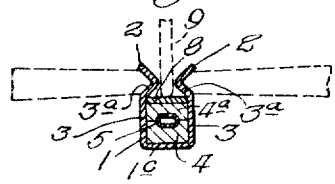


Fig. 7.

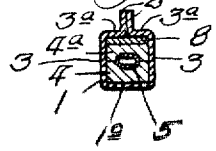
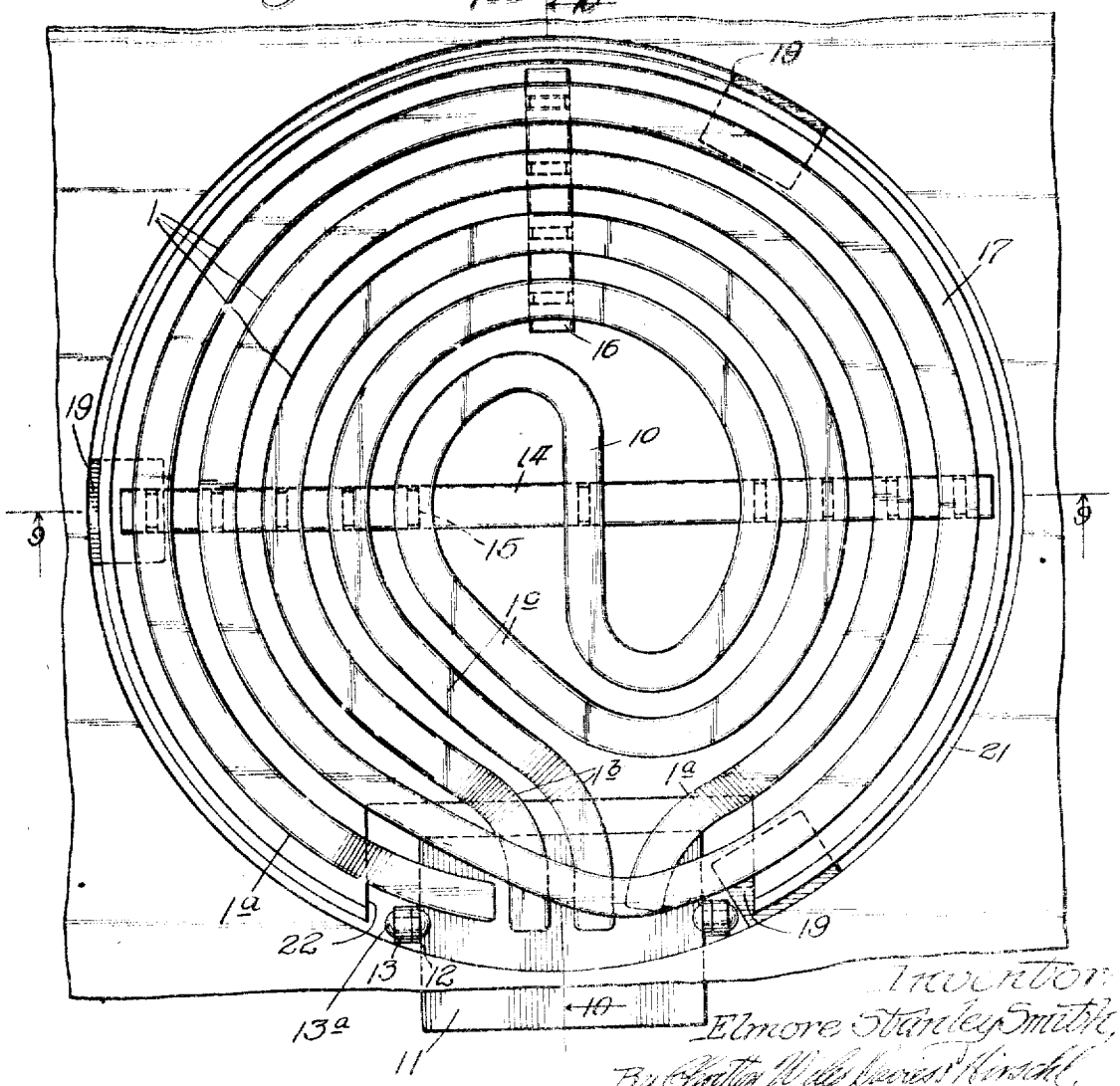


Fig. 8.



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Fig. 9.

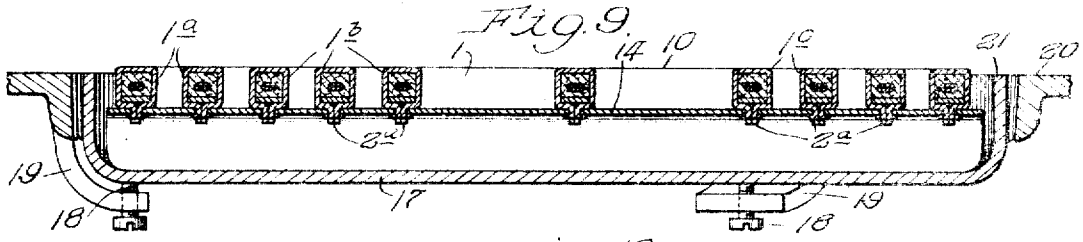


Fig. 10.

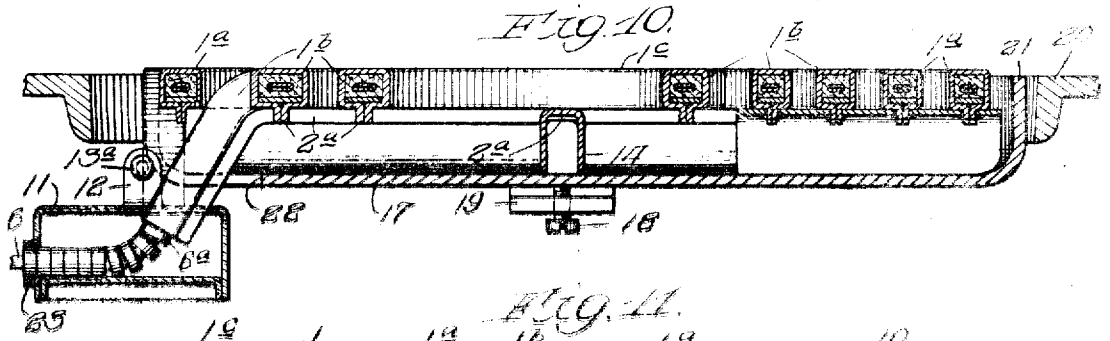


Fig. 11.

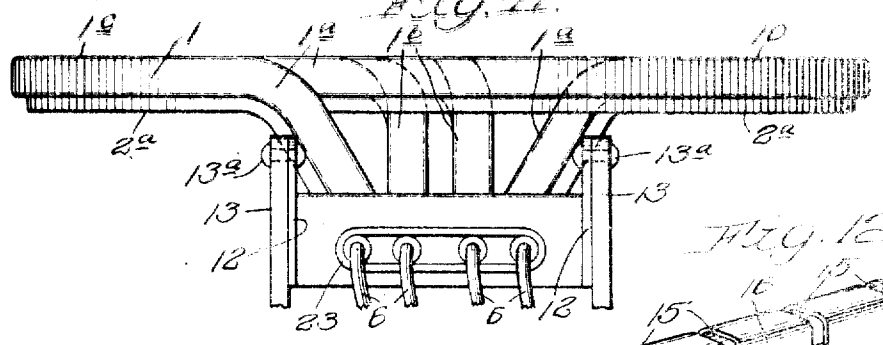


Fig. 12.

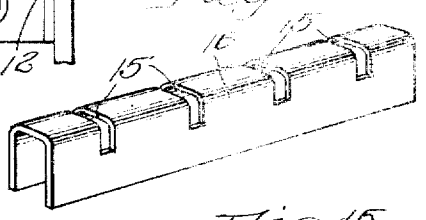


Fig. 13.

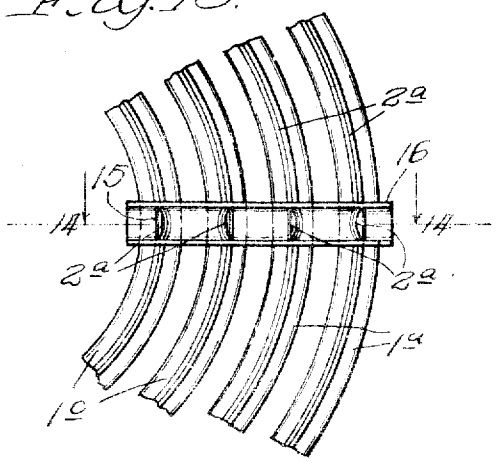


Fig. 15.

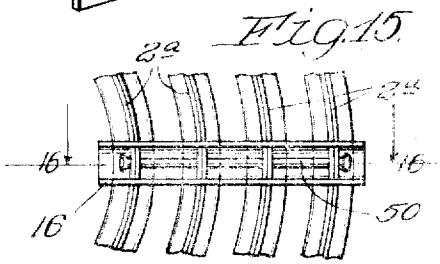


Fig. 16.

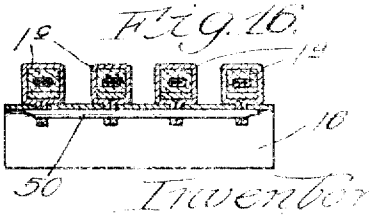
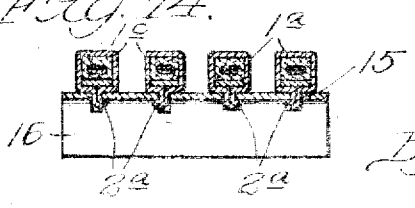


Fig. 14.



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Patented Nov. 24, 1942

2,302,808

UNITED STATES PATENT OFFICE

2,302,808

ELECTRIC HEATER

Elmore Stanley Smith, Weston, Ontario, Canada, assignor to Moffats, Limited, a corporation

Application July 31, 1941, Serial No. 404,943

6 Claims. (Cl. 219—37)

This is a continuation-in-part of my patent application Serial No. 209,438, filed in the United States Patent Office on May 23, 1938, patented February 3, 1942, No. 2,272,136.

This invention relates to electric heaters and particularly to those of the sheathed element type having a casing or sheath formed of sheet metal for enveloping a resistor and my object is to provide a heater of this type which is simple, strong, durable and easily made and which will form a good heat conducting path between the resistor and a cooking vessel placed on the heater whereby quick heating effects are obtained.

A further object is to so construct the sheath that it may be conveniently formed into a grid, the parts or convolutions of which are readily anchored to suitable supporting means to hold said parts in suitable spaced relationship and with their upper surfaces in substantially the same plane.

I attain my object by means of constructions which may be briefly described as follows. The sheath is formed from a flat bottomed channel shaped strip of sheet metal, the channel having its margins directed laterally from the sides thereof. After the channel has been filled with insulating material and a resistor, a flat strip of metal is preferably inserted and the upper parts of the sides of the channel are turned inwardly to close the initially opened top of the channel. The said margins are thus brought into close relationship and project outwardly from the sheath so that they may be conveniently welded or otherwise secured together to seal the sheath and form a continuous rib or flange. The element may be bent to form a grid having the flat underside of the sheath uppermost and the flange depending from the sheath. The grid is anchored by any suitable means connecting together different portions of the flange to hold parts of the grid in spaced relationship to one another and to prevent the grid from twisting. Preferably, parts of the flange are passed through openings in a channel member beneath the grid, and the lower ends of the said flange parts are deformed to secure them to the channel member.

The constructions are hereinafter more fully described and are illustrated in the accompanying drawings, in which

Fig. 1 is a perspective view of a strip of sheet metal, partly broken away, from which the sheath is formed;

Fig. 2 a cross section of the sheath strip material formed into a channel having its margins laterally directed;

Fig. 3 a view similar to Fig. 2 showing insulating powder inserted in the bottom of the channel;

Fig. 4 a view similar to Figures 2 and 3 showing the resistor inserted;

Fig. 5 a view similar to Figures 2, 3 and 4 showing more insulation and a narrow strip of metal inserted in the channel;

Fig. 6 a cross-sectional view showing diagrammatically how the upper parts of the sides are bent in over the edges of the narrow strip while the latter is held in position;

Fig. 7 a cross-sectional view showing the sheath completely closed;

Fig. 8 a plan view of a heater employing two of the sheathed elements;

Fig. 9 a cross-section on the lines 9—9 in Figure 8;

Fig. 10 a cross-section on the lines 10—10 in Fig. 8;

Fig. 11 a front elevation of the heater;

Fig. 12 a perspective detail of the channel member to which the heater anchoring convolutions are secured;

Fig. 13 a bottom plan view showing more clearly the deformation of the rib for attaching the element to the support;

Fig. 14 a view taken as indicated by the line 14 of Fig. 13;

Fig. 15 a view similar to Fig. 13 showing a modified form; and

Fig. 16 a view taken as indicated by the line 16 of Fig. 15

In the drawings like numerals of reference indicate corresponding parts in the different figures.

Referring to Figures 1 to 7, the heating element comprises a sheath formed of a strip of sheet metal which is first formed into a channel 1 having its margins 2 directed laterally from the sides 3. Insulating powder 4 having good heat conducting properties is deposited in the flat bottom 1c of the channel and pressure is applied to compact it therein and shape it to receive a resistor 5. The latter may be a helical coil of resistance wire flattened out by passing it between rollers.

Each end of the resistor 5 is provided with a terminal or lead-in 6 which may be welded or otherwise secured to the end of the wire 5. The terminals 6 extend beyond the ends of the channel and are insulated therefrom by any suitable means such as a plurality of layers of mica or a

block 6a of other insulating material. The layers or blocks are adapted to be tightly received in the ends of the channel, to prevent the escape of powder therethrough, and preferably extend slightly beyond the ends of the channel. More insulating powder 4a is then deposited in the channel to cover the resistor and this powder is compressed to compact the powder around the resistor. A strip of metal 8 is placed on top of the insulating material 4a which is below the upper parts 3a of the sides of the channel. The said upper parts 3a are then bent in by any suitable means while a tongue 9 holds the strip 8 in place to prevent the insulating material from escaping. When the bent-in parts 3a engage the edges of the strip 8, the tongue 9, which extends the full length of the strip, is withdrawn. The upper parts 3a are then again forced inwardly by any suitable means to their final position in which they overlie the strip 8. The channel is thus closed throughout its length and the terminal insulations 6a are also covered. Referring to Fig. 7, it will be noted that the margins 2 now project outwardly from the body of the channel in close relationship to one another. The next step is to electrically weld these margins to seal the channel and this may be accomplished by a series of closely spaced spot welds or by a continuous weld produced by passing the margins 2 between two rollers in a resistance welding machine. The margins 2 when welded together form a rib or flange 2a which extends the full length of the channel for purposes which will be described later.

Preferably the insulating powder is slightly moist when it is inserted in the channel in which case the channel is placed in a drying oven to remove all traces of moisture from the compressed powder and the interior of the channel before the latter is sealed. In practice, the powder is compressed under a pressure of from 2 to 12 tons per square inch. As a result of this high pressure, the powder becomes a mass of compacted material which forms a good conductor of heat and also a good electrical insulator.

The sheet metal of which the channel or sheath 1 is formed is an alloy of suitable metals adapted to withstand high temperatures for a long period of time. This alloy is well known in the art and the heating element comprising the sheath 1, the compacted powder 4, 4a and the resistor 5 may be bent or curved to any desired shape of grid. After the element is bent it will be necessary to use the underside 1c of the channel as the top of the element, in which case the flange 2a will extend downwardly from the underside of the element. The flat top 1c provides a maximum contacting surface, extending from side to side of the sheath, for engagement with the bottom of a cooking vessel.

In Figures 8 to 11, is shown a heater of the hot plate type comprising two sheathed heating elements 1a, 1b each of which was formed of a predetermined length of channel and subsequently bent or curved so that it will cooperate with the other element to form a grid 10. The ends of the elements are passed through openings in the top of a terminal box 11 and secured therein in any suitable manner to form greaseproof joints between the edges of the openings and the ends of the elements. The box 11 is provided with upwardly extending lugs 12 which are pivoted at 13a on any suitable stationary part 13 of a stove so that the heating grid may be swung upwardly relative to the cooking top 20 of the stove.

The convolutions of the grid are secured together and the grid is supported as follows. A channel member 14 extending across the underside of the convolutions of the grid 10 is provided with spaced apart openings 15 for receiving the portions of the flanges 2a overlying the member 14. The depth of the flanges 2a is greater than the thickness of the material of which the channel member 14 is formed so that portions of the flanges will extend through the openings 15 into the groove of the channel member. The protruding portions are burred or deformed to secure the flanges in the openings. When the grid is spiral the channel member 14 will extend diametrically across it and be arranged substantially parallel to the axis of the pivotal connection for the terminal box 11. A second channel member 16 extends substantially at right angles to the member 14 across the underside of the portion of the grid remote from the pivotal connection 13a. The member 16 is also provided with spaced apart openings 15 for receiving the portions of the flanges 2a overlying the member 16. The inner ends of the portions of the flanges received in the openings in the member 16 are also deformed to secure the flanges thereto. With this construction the convolutions of the grid are firmly secured in spaced relationship to one another and yet they are free to expand and contract between the points of connection with the members 14, 16 and the box 11.

The channel members 14 and 16 rest on a reflector 17 which is removably carried on a plurality of adjustable supports 18 which may be set screws threaded in lugs 19 formed on or secured to the underside of the cooking top 20. The lugs project inwardly from the wall of the usual opening in the cooking top to receive the hot plate and are so located relative to the upper surface of the cooking top 20 that the top of the grid will be positioned slightly above the upper surface of the cooking top. The reflector is provided with a rim 21 which extends upwardly around the outer convolutions of the grid 10 to a point adjacent the underside of a vessel resting on the grid. The rim and the bottom of the reflector are cut away at 22 to clear the ends of the sheathed elements which pass downwardly from the convolutions to the terminal box 11 located below the reflector.

By swinging the grid on its pivots 13a to raise it clear of the reflector, the latter may be readily removed from its supports 18 for cleaning and polishing purposes. The terminals or lead-ins 6 are flexible, are insulated from one another and from the terminal box 11 in any suitable manner, and are directed through insulated openings 23 therein to stationary contacts or direct to a switch (not shown).

The spiral grid type of hot plate enables a considerable length of heating element or elements to be confined in a relatively small area such as would be covered by ordinary cooking vessels. To obtain the best heating results it is not only necessary that the top surfaces 1c of the elements be flat to provide the maximum width of contact area (relative to the width of each element) between the elements and a vessel supported thereon but that the flat top surfaces 1c be flush so that the maximum contact area throughout the total length of the convolutions will be obtained. After each element is curved or bent to the desired shape, it is subjected to a high pres-

sure to ensure that the tops 1c of the convolutions are level. The rigidity of the continuous ribs or flanges 2a on the undersides of the elements tends to retain the convolutions as set because the flanges resist any bending of the convolutions in a vertical direction.

The convolutions are firmly held from shifting or twisting relative to one another by the channel members 14, 16 which are anchored firmly to the flanges 2a.

The stranded wire inlead 6 is preferably made of similar heat resisting alloy as the resistor 5 and is welded thereto as stated. This stranded wire 6 is of greater cross-section than the wire of which the coil is wound so that it will offer very little resistance to the passage of current. This prevents the formation of objectionable heat in the leads and at the ends of the sheath. This is important because it is advisable to use vitreous material at the ends of the sheath in order to make it non-absorbent and proof against crumbling. The inlead 6 extends through a block 6a of vitreous insulating material which is used to close the end of the sheath. This block is made to have intimate contact with the inner surface of the end of the sheath and also the inlead by means of a fusion process.

As shown more particularly in Figs. 13 and 14 the rib or flange 2a can be bent over or otherwise deformed where it projects into the groove of the channel member 16 to secure the element to the channel member. If desired, the attachment can be made in another manner still utilizing the rib 2a. This modified form is shown in Figs. 15 and 16 and consists in providing holes in the flanges 2a where they extend over the openings 15 in the channel 16 and then inserting the pin 50 through said holes to fasten the convolutions of the element to the channel 16.

It is obvious that various modifications of my invention may be made without departing from the spirit of the invention as defined by the accompanying claims.

What I claim as new, and desire to secure by Letters Patent, is:

1. A sheathed electric heating element formed as a grid, the sheath of the element being formed of sheet metal having a flange depending therefrom; and a channel member having spaced apart openings for receiving the portions of the flange overlying the member, the said portions protruding into the groove of the channel member and deformed to secure them to the member.

2. An electric heating element having a sheet metal sheath provided with a flange, the element being formed as a grid with the flange extending downwardly from the convlutions of the sheath; and a channel member extending across the underside of the grid and having spaced apart openings in its upper wall to receive the portions of the flange overlying the said wall, the said flange being deeper than the thickness of the said wall so that the portions in the openings will protrude into the groove of the channel member and be deformed therein to secure the grid to the member.

3. An electric heating element having a sheet metal sheath provided with a flange, the element being formed as a spiral grid with the flange extending downwardly from the convolutions of the sheath; and a channel member extending across the underside of the grid and having spaced apart openings in its upper wall to receive the portions of the flange overlying the said wall, a second channel member extending substantially at right angles to the first channel member across the underside of a portion of the grid, the second channel member also having openings in its upper wall to receive the portions of the flange overlying the last mentioned wall, the said flange being deeper than the thickness of said walls so that the portions of the flange in the openings will protrude into the grooves of the channel members and be deformed therein to secure the grid to the members.

4. An electric heater having a plurality of sheathed heating elements formed as a grid, each element having two ends and each end having a terminal projecting therefrom for connection with an electrical supply circuit; a terminal box having openings for receiving the ends of the elements, the said ends being secured in said openings, the sheath of each element being provided with a depending flange; and means for connecting the flanges of adjacent convolutions together to hold parts of the convolutions in spaced relationship to one another, said means including a channel member with slots in the web embracing portions of the flange.

5. An electric heater having a plurality of sheathed heating elements formed as a grid, each element having two ends and each end having a terminal projecting therefrom for connection with an electrical supply circuit; a terminal box having openings for receiving the ends of the elements, the said ends being secured in said openings, the sheath of each element being formed of sheet metal having a flange depending therefrom; a channel member extending across the underside of the grid and having spaced apart openings in its upper wall to receive the portions of the flanges overlying the said wall; a second channel member extending substantially at right angles to the first mentioned channel member across the underside of a portion of the grid remote from the box, the second channel member also having openings in its upper wall to receive the portions of the flanges overlying the last mentioned wall, the said flanges being deeper than the thickness of the said walls so that the portions of the flanges in the openings will protrude into the grooves of the channel member and be deformed therein to secure the grid to the members.

6. A heater constructed as set forth in claim 4 in which the terminal box is pivoted on a suitable stationary part; a reflector removably supported on a stationary part beneath the grid and provided with a rim spaced from the outer periphery of the grid, the channel member being supported on said reflector, the reflector having an opening in its periphery to permit it to be readily removed from and replaced on its support.

ELMORE STANLEY SMITH.