March 2, 1965 G. E. AMMERMAN 3,171,946

ELECTRIC HEATING APPARATUS

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Fig. 1

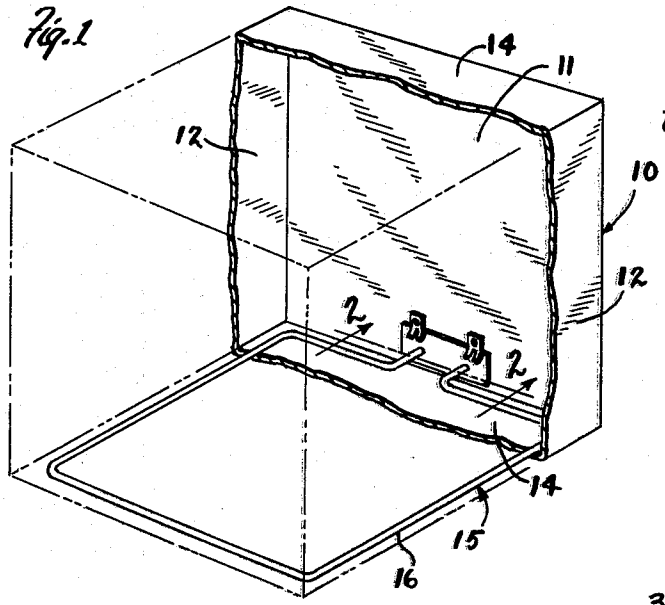


Fig. 4

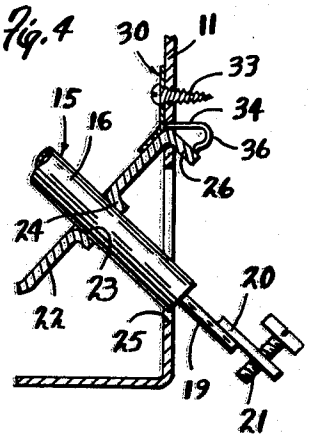


Fig. 2

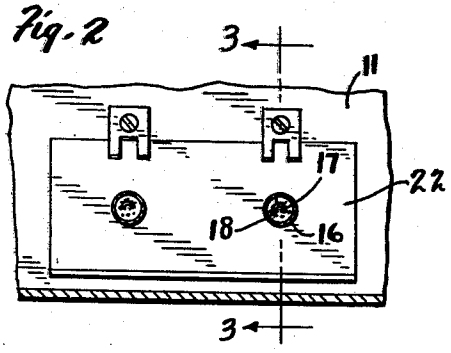


Fig. 3

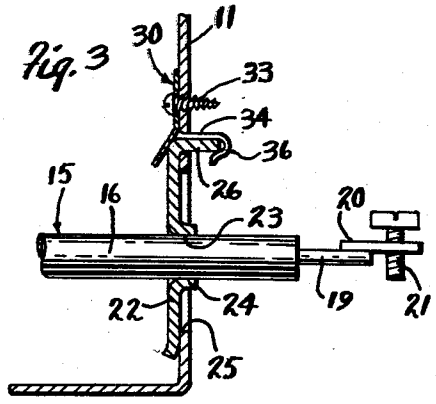


Fig. 5

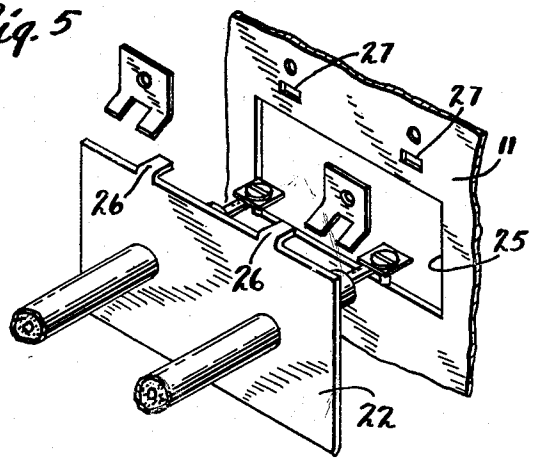
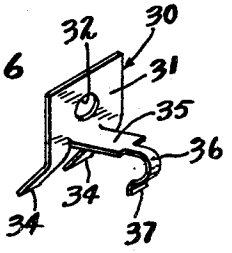


Fig. 6



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ELECTRIC HEATING APPARATUS

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Fig. 7

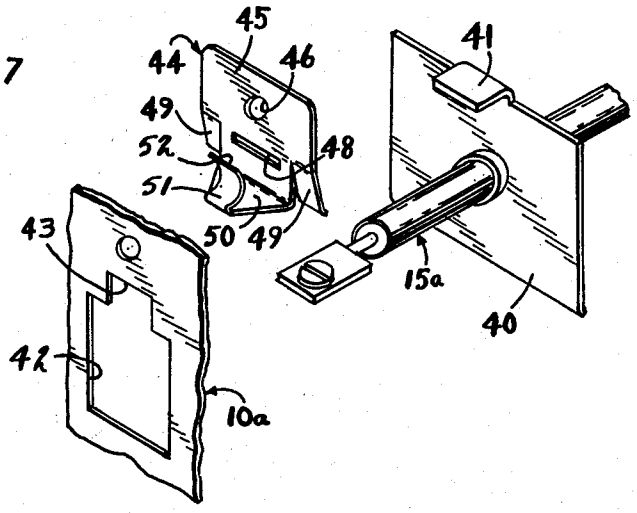


Fig. 8

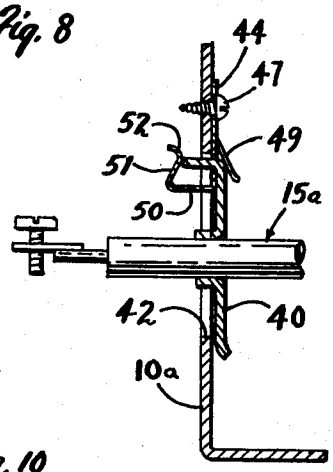


Fig. 9

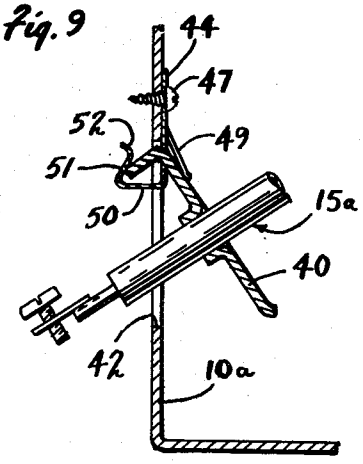
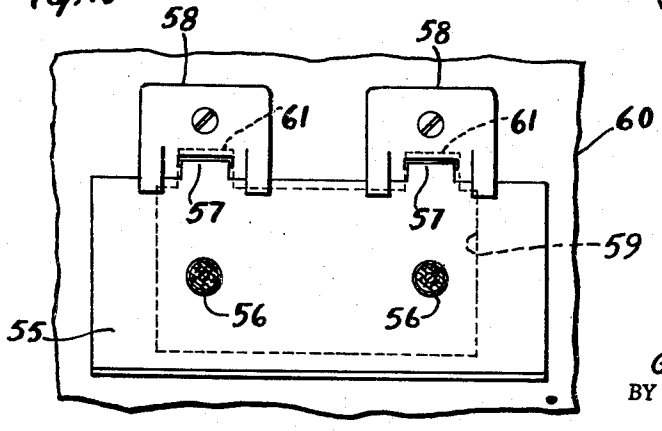


Fig. 10



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ELECTRIC HEATING APPARATUS

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Filed Nov. 27, 1959, Ser. No. 855,584
5 Claims. (Cl. 219—404)

My invention relates to electric heating apparatus, more particularly to such apparatus for use with an oven, and the principal object of my invention is to provide new and improved apparatus of this character.

Practically all present day electric ranges employ heating elements of the type having a resistance conductor embedded in compacted electric-insulating, heat-conducting material, such as granular refractory material, the combination being encased in a metallic sheath. Normally, since the resistance conductor is spaced from the inner wall of the sheath by the refractory material, no current can flow between the resistor and the sheath. However, when the heating elements are not in use, there is a tendency for refractory material to absorb moisture from the atmosphere and become somewhat electrically conductive. Therefore, upon energization of a heating element after it has not been used, a certain amount of current may leak to the sheath from the resistor until such time as the moisture is driven out by the heat of the element.

Leakage of current to the sheath of the heating element causes a dangerous shock hazard and it has been required to ground the sheath to harmlessly carry away any current which might leak to the sheath. The present invention is an improvement of the construction disclosed in Patent No. 2,824,944, issued to me on February 25, 1958, and provides economical, as well as positively and constantly acting, means for grounding an electric heating element, particularly of the type pivotally carried by the wall of an oven.

In the drawings accompanying this specification and forming a part of this application, there are shown, for purposes of illustration, embodiments which my invention may assume, and in these drawings:

FIGURE 1 is a broken perspective view of an enclosure, such as formed by the oven of an electric range, showing an embodiment of my invention,

FIGURE 2 is an enlarged fragmentary sectional view corresponding generally to the line 2—2 of FIGURE 1,

FIGURE 3 is an enlarged fragmentary sectional view corresponding generally to the line 3—3 of FIGURE 2,

FIGURE 4 is a sectional view similar to FIGURE 3 but showing parts in another position,

FIGURE 5 is a separated perspective view of the parts comprising the embodiment herein disclosed,

FIGURE 6 is a perspective view of a detail,

FIGURE 7 is a separated perspective view of another embodiment of my invention,

FIGURES 8 and 9 are vertical sectional views of the embodiment shown in FIGURE 7, with parts in different positions, and

FIGURE 10 is a front elevational view of a slight modification of the embodiment disclosed in FIGURES 7 through 9.

Referring particularly to FIGURE 1, the embodiment herein disclosed is particularly adapted for use with an enclosure, such as an oven 10 of an electric range (not shown). The usual oven has a rear wall 11, side walls 12—12 and top and bottom walls 14—14. A door (not shown) normally closes the front of the oven and may be opened to provide access to the interior thereof.

The electric heating element 15 herein disclosed is of standard construction and of the type having a metal tubular sheath 16 enclosing a resistance conductor 17, the

latter being embedded in compacted granular refractory material 18 to electrically insulate the conductor 17 from the sheath 16. A terminal pin 19 is electrically and mechanically connected to each end of the resistance conductor, each terminal pin extending outwardly of a respective end of the sheath and provided with means, such as the tab 20 welded to the pin and a stud 21 threaded through the tab, for receiving and holding a conductor leading from a source of electrical energy.

An end seal (not shown) is disposed within each end of the sheath to restrict entrance of deleterious material to the sheath interior. Moisture sometimes passes the seal, especially when the heating element has not been used for a length of time, and it is this moisture which may cause current to leak from the resistance conductor to the sheath until it is driven out of the sheath by heat produced by energization of the resistance conductor.

The heating element may be bent to a flat, rectangular configuration, as shown in FIGURE 1, with its terminal ends brought closely together and arranged in parallelism. A metal plate member 22, which may be of the rectangular shape as shown, is provided to rigidly support the heating element and for this purpose the plate member has a pair of transverse openings 23 which closely pass a respective terminal end of the sheath. A boss 24 may surround each opening 23 and may be tightly crimped about the adjoining section of the heating element sheath, or the sheath and plate member may be soldered, brazed or welded at their adjoining surfaces.

As best seen in FIGURE 5, the rear wall 11 of the oven has a relatively large opening 25 therein, the opening preferably being of a configuration to correspond to the plate member 22 and thus in this case is rectangular and of a size somewhat smaller than the plate member.

The plate member has a pivot connection with the rear wall 11 so that it may swing flatwise with respect to the wall. As best seen in FIGURES 3 and 4, the terminal ends of the heater sheath extend through the rear wall opening 25 with portions projecting from opposite sides of the rear wall 11. The terminal connectors 20—21 are located outwardly of the oven and to the rear thereof, and are therefore disposed out of the highly heated zone and not subject to heat deterioration. The opening 25 is preferably large enough so that the heater sheath does not engage any marginal surface in its swinging movement.

In the disclosed embodiment the plate member 22 is provided with tab means for cooperation with the marginal surface of an opening in the rear wall 11. Although only one tab may be used it is preferred to use two tabs 26—26 for purposes of stability. Each tab extends transversely from the upper margin of the plate member 22, and rearwardly thereof. The rear wall 11 of the oven is formed with a pair of relatively small openings 27—27 preferably of a configuration (rectangular in this case) to correspond to the cross-sectional configuration of a respective tab, and each opening 27 loosely receives and passes a tab 26, the terminal portion of the tab projecting from the rear wall 11, as seen in FIGURES 3 and 4.

To assemble the pivot connection, it is merely necessary to dispose the terminal ends of the heater sheath through the opening 25 and seat the tabs 26 within respective openings 27. This may all be accomplished from the interior of the oven and therefore no assembly is required from the rear of the oven and this provides a distinct advantage, particularly for service purposes. It will be appreciated that the electrical supply wires (not shown) may be drawn through the opening 25, connected to respective terminal pins 19, and then returned to the rear of the oven when the heater is connected to the rear wall 11.

The assembly thus far described provides for disposi-

tion of the active heating portion (the rectangular portion) in closely spaced position overlying the oven bottom wall 14, and this is the normal heating position. Suitable legs (not shown) may be attached to the heater sheath to engage the bottom wall 14 and maintain the spacing of the heater. It may be desired to raise the heater to clean the bottom wall 14 and this may be easily effected by raising the forward end of the heater to cause it to pivot about the hinge connection formed by the tabs 26 and openings 27.

Safety requirements have necessitated the taking of precautions to eliminate the hazard of electrical shock when a person touches the heater sheath. Heretofore, an angular tab was welded to the rear surface of the plate member 22 and a ground wire was secured to this tab and to a suitable ground, such as a grounded part of the range. Other ground connections were also tried but were found to be expensive and to interfere with the free operation of the hinged assembly.

My invention provides a simple but novel answer to the problem and not only adequately provides for grounding of the heater sheath but also provides means which prevent unintentional removal of the tabs 26 from the openings 27.

As best seen in FIGURES 5 and 6, a spring clip 30 is provided for use with each tab 26. The clip may be produced in great quantity by a stamping operation and therefore its production cost is low. It has been found preferable to form the clip of suitable spring steel, such as spring temper, stainless steel of Rockwell hardness C42–47 for example. In cross-section, the clip is quite thin, for example .0179, and it has a base or body part part 31 formed with an aperture 32 to pass a fastening screw 33 of the self threading type. The body of the clip is slit to provide two aligned and forwardly extending legs 34—34 and a rearwardly extending leg 35 disposed intermediate the legs 34—34 and at an angle thereto.

The clips may be provided with means for holding the heater sheath and plate member assembly in the tilted position shown in FIGURE 4 and for this purpose the leg 35 may have an integral or connected extension 36, preferably of less width as seen in FIGURE 6, and having a downwardly projecting curled extremity 37.

The clips 30 may also be disposed in position from the front of the oven (through the oven interior) and in the case where the extensions 36 are omitted, the leg 35 is inserted between the upper surface of the respective tab 26 and the adjoining surface defining the corresponding recess 27. The legs 34—34 will overlie the forward face of the plate member 22 at the rounded corner which joins with the tab 26, as seen in FIGURE 3. The legs 34–35 are preferably undersprung sufficiently so that when the screw 33 is tightened, the legs 34, 35 will be further angularly displaced by engagement with their corresponding surfaces so that one or the other, or both, of the legs will always be pressed into good electrical contact with adjoining surfaces of the plate member and rear wall 11, to thereby provide for transference of any electrical current from the heater sheath 16, through the plate 22 with which it has good metal-to-metal contact, and to the rear wall 11 which is normally grounded as part of the range. The rather close fit between the legs 35 and the tabs 26 and corresponding openings 27 will hold the clips 30 in place while the screws 33 are inserted, or prior thereto, while the holes for the screws are located and drilled in the case of a service replacement in an old range.

When the extensions 36 are used, each clip may be assembled with its tab, the curled portion 37 at least in part holding the clip in place. Holes for the screws 33 may be located and drilled, if not already in the rear wall 11, and the screws 33 may then be inserted and driven home. The clip in this case will provide the grounding feature as before described and additionally will provide a holding action with the tabs 26, as seen in FIGURE 4, to releasably hold the heater assembly in upwardly tilted position. The metal-to-metal scraping action between the tabs 26 and their respective extensions, as the parts are moved between the two positions shown in FIGURES 3 and 4, will maintain a clean electrical contact therebetween.

Referring to FIGURES 7 through 9, the embodiment therein shown is particularly designed for use where the terminal ends of the heater are disposed farther apart than shown in FIGURE 1 and thus where a plate 22 spanning the terminal ends is not too practical.

In the embodiment of FIGURES 7 and 9, each terminal end of the heating element 15*a* passes through and is securely fixed to a small metal plate member 40 having a single tab 41 extending laterally from its upper margin. The plate 40 is preferably quite flat and of a size to close an opening 42 in the rear wall of the oven 10*a* when the plate is in position to overlie the opening. The opening 42 has a small rectangular notch 43 in its upper margin for a purpose to appear later.

A spring clip 44 is provided for use with the tab 41 to provide the necessary ground and to also provide a latch for holding the oven element in elevated position, and the clip comprises a body 45 having an aperture 46 to pass a sheet metal screw 47 for securing the body to the wall of the oven 10*a* in flatwise condition, as shown in FIGURES 8 and 9.

The clip 44 may be formed of spring steel, as previously disclosed, and has a rectangular opening 48 therein which receives and passes the tab 41. The clip is lanced to provide side marginal legs 49 which are bent from the plane of the body of the clip to overlie and resiliently bear against the forward face of the plate member 40 at the rounded corner which joins with the tab 41, as seen in FIGURE 8, or against the forward plate face as shown in FIGURE 9.

The central lower portion of the clip 45 is displaced laterally rearwardly to provide the right angular rearwardly displaced leg 50 which tapers to an upwardly disposed extension 51. The extension is inclined toward the body of the clip 45 and terminates in a curled portion 52. The inclination of the extension, and its curled portion, are such that there is spring engagement between these parts and the end of the tab 41 in any position of the plate member 45. The rubbing action between the parts will insure that good electrical contact is maintained to conduct any electrical current from the sheath of the oven element to the oven wall and to ground.

FIGURE 10 discloses the embodiment of FIGURES 7 through 9 as used in the case where the terminal portions of the oven element are brought together in the close relationship shown in FIGURE 1. In the construction of FIGURE 10, a single, generally flat, sheet metal plate member 55 spans the two terminal portions 56 of the oven element and is rigidly affixed thereto. The plate member has a pair of rearwardly displaced tabs 57, 57 and a separate spring clip 58 (like spring clip 45) cooperable with each tab. The opening 59 in the oven wall 60 is rectangular, as seen in dotted lines, and has a pair of upwardly extending rectangular notches 61 to pass, and providing working space for, respective tabs 57.

The constructions illustrated in FIGURES 7 through 10 are also adapted for assembly from the oven side of the rear oven wall and a clip member may be initially assembled with a corresponding plate member and its tab by disposing the latter through the rectangular opening in the former whereby the tab is interposed between the upright extension 51 and the legs 49. This assembly of the clip and tab is secure enough to enable the installer to properly position the assembled parts with the oven wall opening by grasping and manipulating the terminal portion of the oven element, thus leaving clear a suitable working space for positioning the fastening screw and driving it home.

The constructions shown in FIGURES 7 through 10

indicate that my invention may be used with a separate plate member for each terminal portion of the oven element, as seen in FIGURES 7 through 9, or with a single plate member spanning, and rigidly secured to, the adjoining oven element terminal portions. The embodiment of my invention shown in FIGURES 1 through 6 may likewise be used in alternative oven element constructions and the disclosed embodiment illustrates the plate member **22** spanning the adjoining terminal portions of the oven element. In the event the terminal portions are more widely spaced, a plate member may be secured to each terminal portion and provided with a single tab, as is the case shown in FIGURES 7 through 9. The rear wall **11** of the oven may then be formed with a pair of openings, such as the opening **25**, but smaller to correspond to the smaller size of the plate member, and a small rectangular opening may be disposed adjacent each larger opening to receive the plate member tab. Spring clips identical to the clips **30** may be used for cooperation with a respective plate member.

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 embodiments 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 embodiments are illustrative only, and that my invention is not limited thereto.

I claim:

1. In an electric heating apparatus, the combination of an apertured wall and an assembly including a plate member and an electric heating element supported by said plate member, said plate member having a marginal tab passing through the wall aperture and cooperating with the marginal surface of the latter to provide a pivot connection about which said assembly may swing, a metal spring clip connected to said wall and having a pair of angularly disposed legs, one leg extending through said wall aperture for engagement with said tab and the other leg overlying said plate member and preventing unintentional withdrawal of said tab from said wall aperture, and a catch formed on one of said legs and cooperable with said tab for holding said assembly in one of its pivoted positions.

2. In an electric heating apparatus, the combination comprising an apertured metal wall adapted to be electrically grounded, and an assembly including a metal plate member and a metal-sheathed electric heating element extending through an opening in said plate member and connected to the latter for support and for transference of electric current therebetween, said plate member having a marginal tab loosely passing through the wall aperture and cooperating with the marginal surface of the latter to provide a pivot connection about which said assembly may swing, and a metal spring clip connected to said wall and having a pair of angularly disposed legs, one leg extending through said wall aperture and interposed between a marginal surface thereof and said tab, and the other leg overlying said plate member and preventing unintentional withdrawal of said tab from said aperture, said legs being resiliently sprung by connection of said spring clip with said wall to resiliently bear against said tab and said plate member in any pivoted position of said assembly and thus provide for transference of electric current from said heating element sheath and said plate member to said wall and thereby to ground.

3. The construction according to claim 2 and further including a spring catch formed as a terminal extension of said one leg, said spring catch being cooperable with said tab for holding said assembly in one of its pivoted positions.

4. An electric heating assembly for connection to an electrically grounded wall, comprising a metal plate member and a metal-sheathed electric heating element extending through an opening in said plate member and rigidly connected to the latter in metal-to-metal engagement, said plate member having a marginal integral tab extending angularly therefrom, a clip formed of spring metal and having a flat body portion provided with an opening to receive and pass said tab and to form a hinge joint therewith whereby said heating element may be pivoted to and from a normal heating position, said clip being adapted for mechanical and electrical connection with said grounded wall and having legs extending from opposite sides thereof, one of said legs resiliently bearing against a surface of said plate member adjoining said tab and the other of said legs having a portion spring pressed against said tab to provide for conduction of electrical current from the metal sheath of said heating element through said plate member and clip member and to said grounded wall.

5. The construction according to claim 4 wherein said other leg of said clip cooperates with said tab for yieldably holding said heating element in one of its pivoted positions.

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