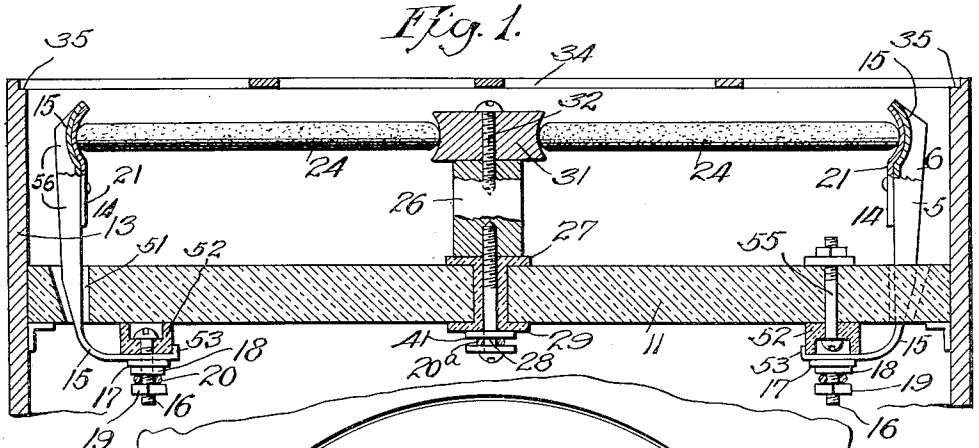
March 15, 1932. H. N. SHAW 1,849,595

ELECTRICAL HEATING APPARATUS

Original Filed Sept. 14, 1928

Fig. 1.



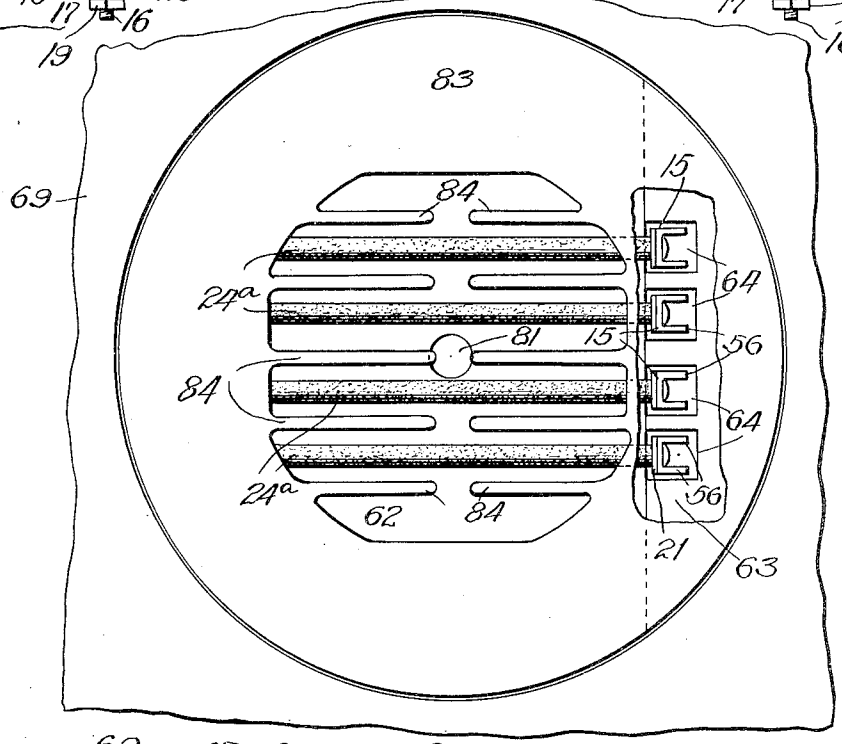


Fig. 2.

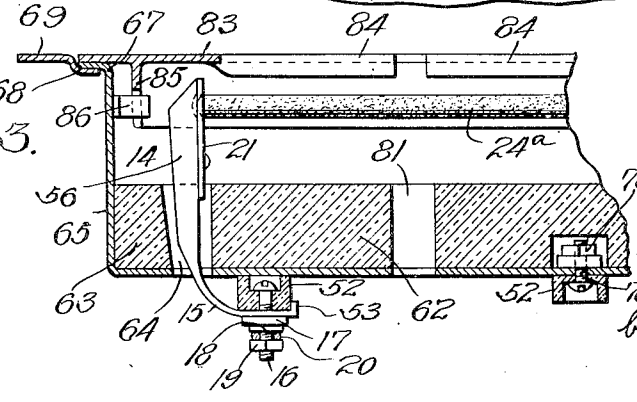


Fig. 3.

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UNITED STATES PATENT OFFICE

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ELECTRICAL HEATING APPARATUS

Application filed September 14, 1928, Serial No. 305,883. Renewed October 19, 1931.

This invention relates in general to electrical heating apparatus, and it has more particular relation to a certain class of such heating apparatus, especially such as is adapted for use as a hot-plate or domestic cooker, embodying or utilizing improved means or devices for electrically and mechanically mounting or maintaining self-sustaining electrical resistance heating elements or units in electrically and mechanically operative position and condition in the apparatus.

In accordance with the present invention, electrical heating apparatus of improved design and construction and particularly adapted for use as hot-plates, cookers or heaters and the like, and wherein the production of medium or relatively high operating temperatures may be desirable, is provided, such apparatus embodying or utilizing self-sustaining resistance heating elements, and being especially adapted for use of such elements as are in the form of molded and heat-hardened bodies produced from a composition containing carbon or a carbide, particularly silicon carbide, as an essential constituent, and the apparatus also embodying improved mounting devices for the heating elements which insure efficient mechanical support for the latter and electrical connection thereof to a supply circuit.

Desirable objects and advantages of the present invention may be attained with electrical heating apparatus, utilizing a combined electrical connection and mechanical support for the resistance heating element, wherein the combined support and terminal is yieldingly urged to abut against the extreme end or ends of the resistance heating element with sufficient pressure to satisfactorily insure the desired resilient mechanical support of and electrical engagement with the heating element, while permitting ready insertion of the heating element to and its removal from operative position. Additional objects and advantages, particularly in the matter of sustained efficient life of the heating elements and terminal mountings therefor, are secured through utilizing a resistance heating element wherein the terminal portions are rendered of appreciably greater conductivity than the body portions, because of a different character or composition of such terminal portions. Further particular objects and advantages are concerned with the utilization of terminal devices of a yielding but still of a strong and durable character and their disposition or mounting in such a manner as to substantially remove the more active resilient portions of the terminal or its support from the region of greatest heat, while retaining the other advantages as to structural simplicity and improved operation; and additional advantages are realized through the use of apparatus of this character embodying, in association with electrical heating apparatus embodying the yielding mounting terminals, a supporting structure or frame along with a base plate thereon, preferably of, or having a surface portion of, refractory insulating material and which may be provided with a good reflecting surface for reflecting heat rays back upon the article or utensil to be heated by the apparatus.

The above and other objects and advantages more apparent from the disclosure hereinafter are attained by the present invention, various novel features of which will be apparent from the description and drawings herein, disclosing several embodiments of the invention, and will be more particularly pointed out in the claims.

In the accompanying drawings showing heating apparatus embodying features of the present invention:

Fig. 1 is a view in sectional elevation of one form of electrical heating apparatus embodying the present invention.

Fig. 2 is a broken plan view showing a further modified form of the present invention.

Fig. 3 is a broken sectional elevation in the plane of a horizontal center line of Fig. 2.

In the embodiment of the invention disclosed in Fig. 1, a base 11, which may be considered of refractory insulating material, is carried by or forms a part of an enclosing boxlike frame 13. Contact terminals 14 are mounted on the base or support 10 adjacent

the side edges thereof, and include a relatively stiff and resilient leaf spring element 15 of suitable heat-resistant conductive material, constituting a support for the terminal, and a contact strip 21 of suitable conductive material secured, by riveting, welding or otherwise, to the supporting leaf or strap spring 15. The inner side of the contact strips 21 at the upper ends thereof, and, if desired, the corresponding portion of the supporting leaf spring 15, are provided with concavities or recesses, as indicated, for easy or adjustable reception of the ends of self-sustaining resistance heating elements 24 which have butt-end engagement with the walls of the recesses.

At a point intermediate the contact terminals 14, an upright support 26 is secured upon the base 11, this support being shown as of conductive material and suitably insulated by a separator 27, preferably of a slightly yielding character, from the base 11. The upright support 26 may be secured in position by a screw or bolt 28 passing through an aperture in the base 11 and threaded into the lower end of the support, the head and shank of the screw being spaced from the base 11, as by means of a flanged bushing 29, as of somewhat yielding insulating material. There is mounted on the upper end of the support 26 a conductive block 31 of suitably heat-resistant material, the same being provided with a suitable number of recesses intended for the easy or adjustable reception of terminal portions of heating elements 24 which have butt-end engagement with the walls of the recesses, the opposite ends of the heating elements being supported by and in yielding and releasable operative engagement with the terminal mountings 14. The lower end of the bolt or screw 28 may have provided thereon a metallic washer 41, a line connection 20^a being indicated as being held in position between this washer and the upper face of the head of the bolt 28 or a metal washer thereon.

The shank portions 15 of the mounting or supporting terminals 14 pass through openings 51 in the base 11, and are bent at right angles at their lower ends, the bend being preferably along a wide easy curve so as to distribute bending strains; and the horizontal portion at the lower end of the terminal is secured to the under side of a block or strip 52 of insulating, and preferably refractory, material. This supporting block 52 is suitably secured to the under side of the base 11 at spaced points, as by headed bolts 55 passing through both members with securing nuts thereon, as indicated at the right in this figure, near but still substantially spaced from the inner edges of the apertures 51 through the base. Each terminal may be secured in operative position by means of a screw or bolt 16 passing through an aperture in the insulating block 52, and having its head disposed in a counter-bored portion of such aperture, a nut 18, with or without an intermediary washer 17, serving to clamp the terminal in operative position and a bent-over portion 53 at the inner end of the horizontal portion of the terminal bearing against the inner side of the block 52, thus serving to prevent the terminal from displacement through rotation. A nut 19 serves to secure a line terminal 20 in operative connection with the terminal 15. By reason of the fact that the contact supporting block 52 is mounted in position on the base 11 independently of the screws or bolts 16 which secure the terminals 14 in position, it is possible to assemble a group of terminals as a unit, these terminals passing through the apertures 51 in placing the block 52 in operative position.

The outer relatively stiff and resilient supporting strips 15 of the terminals 14 are preferably so formed as to include one or more stiffening ribs 56, here indicated as a pair of spaced ribs provided by turning back at right angles integral side portions of the strip 15, these ribs tapering in width toward the lower part of the strip where it passes through the opening 51 in the base plate. The ribs 56 contribute toward maintaining the strength and resilience of those portions of the strip 15 which are more exposed to the heat produced by the heating elements 24, these desirable effects of the ribs 56 being supplemented or accentuated by reason of the effect of these ribs in greatly assisting in dissipating heat from the body portion of the strip 15 and the contact strip 21 secured thereto.

It will be apparent that the mounting of the terminals 15 is such as permits ready resilient displacement of the upper contact ends thereof from normal operative position, such as may be incident to the removal of a heating element from and its replacement in operative position; and the desired security of electrical and mechanical mounting of the heating element is attained as in the other heretofore described embodiments of the invention; and there is the additional advantage that the actively resilient portions of the terminals are disposed at points which are out of the region of greatest heat and are thus maintained at a relatively low temperature, thus retaining the desired resiliency over a relatively long life, this desired relatively cool condition of the terminal being attained in part through the ventilating effect of upwardly moving cooling drafts passing through the apertures 51. These apertures 51 need be of only such size as to pass the terminals 14 therethrough and permit the desired lateral resilient displacement of the terminals. It will be apparent that the intermediate bridging member 31 and its

support may be omitted and a single heating element substituted for the two heating elements 24.

In accordance with the disclosure of Figs. 2 and 3, a refractory insulating base plate made up of a central portion 62 and two side portions 63, is provided with through passages 64 from the upper to the under side, these through passages being preferably formed by the suitable conformation of one or both of the adjacent edges of the parts 62 and 63 of the base plate. The base plate is removably disposed upon the bottom of a box-shaped frame 65 having an outer flange 67 at its upper edge, the same being adapted to rest upon an inwardly turned flange 68 formed about an aperture in the range top or like support 69, the cooperation between the flange 67 and the flange 68 being such as to insure removable support of the box-like frame 65 in operative position.

The terminal members 14 are of the same general character and are mounted in operative position in the same manner as the corresponding parts of Fig. 1, the bottom of the box or supporting frame 65 being apertured in alinement with the apertures 64 to permit the shank portion 15 of the terminal to pass therethrough. The supporting block 52 is mounted in operative position by means of screws or bolts 76 having their heads disposed in counter-bored portions of through recesses in the block and passing through apertures in the bottom of the supporting frame 65, nuts 78 being applied to the upper ends of said securing bolts and serving to draw said block into and secure the latter in operative position against the under side of the bottom of the frame 65. The under side of the center portion 62 of the base plate is suitably recessed to receive the upwardly projecting portion of the securing screw or bolt 76 and the retaining nut 78 thereon, thus permitting the base plate to rest flush on the bottom plate of the frame 65.

The upper face of the base plate, particularly the center portion 62 thereof, is preferably inclined from all sides toward the center so as to provide a cup-shaped upper surface, a central aperture 81 through the base plate serving to drain the lowest portion of this cup-shaped surface, and the upper surface of the base plate is preferably provided with a high glaze of a heat-resistant character so as to serve as an efficient reflector of heat rays.

It will be apparent that the heating elements 24^a which are disposed relatively close to the reflector on the refractory base plate may be readily removed from and replaced in operative position between the terminals 14, with their strengthening ribs 56, as has been described hereinabove. Likewise, with the heating elements removed from operative position, it will be apparent that the several sections of the base plate may be removed upwardly from operative position, as for purposes of cleaning, these sections of the base plate readily passing by the upwardly extending terminals 15, by reason of the provision of the apertures or recesses 64.

A removable apertured top plate 83 is provided relatively close to the heating elements 24^a, the same preferably being provided with ribs 84 extending toward each other from opposite side portions of the plate and staggered with respect to the heating elements 24^a. This plate 83 serves as a support for a utensil to be heated, and it is preferably supported in operative position by having its edge portions resting upon the flange 67 at the upper edge of the box-like frame 65, the flange 68 of the range top 69 or like support being sufficiently depressed so that the upper surfaces of the range top and the removable top plate 83 are in the same plane. In order to insure that the removable top or cover plate 83 occupies the same position at all times, that is, with the ribs 84 at the opposite sides of and parallel to the heating elements, the top plate may be provided with a depending projection 85 bifurcated at its lower end so as to pass over a projection 86 extending inwardly from the side wall of the box-like frame 65.

The resistance heating elements 24 and 24^a are preferably unitary, self-sustaining, molded and heat-hardened composition products wherein a carbonaceous material, such as silicon carbide, is the principal constituent. Certain heating elements of the preferred character are known in the art, the same being composed of silicon carbide as an essential constituent, with or without one or more modifying substances for altering mechanical or electrical characteristics of the final product. The preferred heating element comprises a heat-producing body portion and integral terminal portions of the same cross-sectional area as the body portion but of such different composition as to be possessed of greater conductivity and less heat-producing effect than the body portion, but still of such a character as not to be possessed of any mechanical or electrical weakness because of these portions of different composition. This presence of more highly conductive terminals insures that portions of the metallic terminal mountings in electrical and mechanical engagement with the ends of the heating element are maintained in satisfactory operating condition during a long life.

As indicated, the conductive terminal mountings described hereinabove include means for resiliently or yieldingly supporting the heating element and maintaining the desired electrical connection from a line circuit to the ends of the heating element, wholly through butt-end engagement between the heating element and the terminal mountings; and this resilient effect may be present in one

or both of the terminal mountings. This desired yielding, but still forcible, butt-end contact relation between the end of the heating element and the contact portion of the terminal mounting is secured through the resilience and normal bias of the mounting element, the contact portion of which is movable about its point of support due to the spring effect of the body portion of the mounting. Satisfactory resilient and heat-resistant materials for producing the desired resilient supporting effects in the terminal mountings are tempered steel, or an iron-chromium alloy, such as hardened "ascoloy", or an aluminum-iron-copper alloy, such as "alcumite" or an iron-nickel chromium alloy such as "calite"; and likewise with these resilient parts of suitable cross-section, they serve efficiently as a portion of the electrical path through the terminal mounting.

Where the operating temperatures of the heating appliance are relatively low, the recessed contact portion of the terminal mounting may be of aluminum, or an alloy thereof, such as aluminum-nickel, which does not oxidize or scale to a distinctive extent under the circumstances. However, where temperatures produced are higher or approach or exceed the melting point of aluminum, nickel or chromium or iron-chromium-nickel alloys, or aluminum-nickel alloys, give desirable results. Aluminum alloy contacts for electrical resistors are described in an application by John A. Boyer, U. S. Serial No. 386,998, filed August 19, 1929.

The present invention is especially concerned with the provision of apparatus capable of commercially satisfactory and efficient operation at temperatures corresponding to a glowing condition of the resistance heating element; and electrical heating appliances embodying features of the present invention relating to the electrical and mechanical mounting of the resistance heating element, as described hereinabove, are capable of giving extremely satisfactory results and efficient operation at temperatures up to as high as and even beyond 2400° F., or as high temperatures as the metal parts of the appliance will withstand.

It should be understood that the invention set forth herein is not limited to the exact details of construction shown and described, for obvious modifications may occur to persons skilled in the art; and it is desired that the claims cover such various modifications within their scope as may occur to those skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. A terminal for an electrical heating appliance of the type wherein a self-sustaining heating element is electrically and mechanically mounted in operative position through yielding butt-end engagement of a contact portion of the terminal with an end of the heating element, comprising a supporting portion of resilient conductive strip material having an edge portion turned back at an angle to provide a strengthening rib and means for conducting an electric current to said terminal.

2. A terminal for an electrical heating appliance of the type wherein a self-sustaining heating element is electrically and mechanically mounted in operative position through yielding butt-end engagement of a contact portion of the terminal with an end of the heating element, comprising a supporting portion of resilient conductive strip material having an edge portion turned at an angle to the original strip to provide a strengthening rib, the ribbed portion of the terminal being carried by a resilient portion.

3. The terminal described in claim 2 in which the resilient portion comprises an extended strip bent through a wide angle from the ribbed portion.

4. A terminal for an electric heating appliance of the type wherein a self-sustaining heating element is electrically and mechanically mounted in operative position through yielding butt-end engagement of a contact portion of the terminal with an end of the heating element, comprising a supporting portion of a conductive strip, a portion of said strip being rigid and another portion of the said strip being resilient, the rigid portion of the said strip being adjacent the terminal portion of the heating element, the resilient portion of the strip being more remote from the end of the heating element than the rigid portion of the strip.

In witness whereof I affix my signature hereto.

HAROLD N. SHAW.