Dec. 2, 1941. W. ROTH 2,264,716

ELECTRIC FURNACE

Filed Feb. 21, 1940

Fig.1.

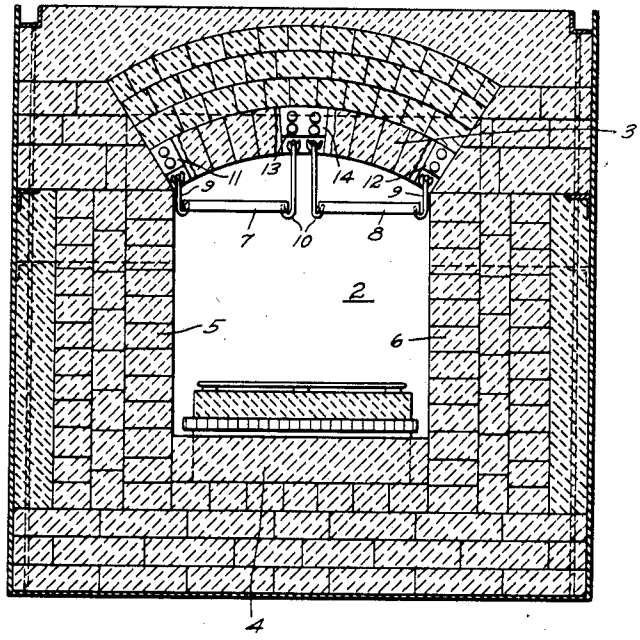



Fig.2.

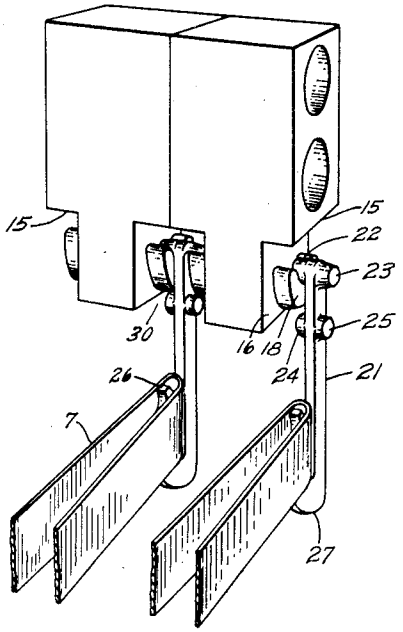



Fig.3.

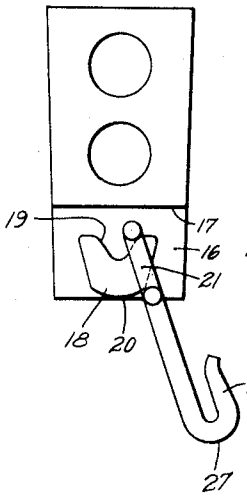
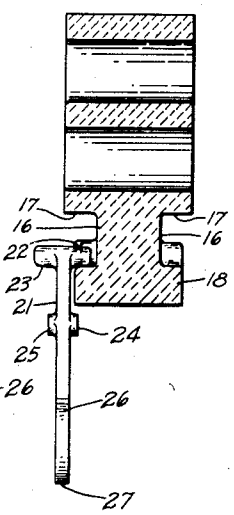



Fig.4.




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Patented Dec. 2, 1941

2,264,716

# UNITED STATES PATENT OFFICE

2,264,716

## ELECTRIC FURNACE

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Application February 21, 1940, Serial No. 320,065

6 Claims. (Cl. 13—25)

My invention relates generally to electric furnaces, and to the electrical heating units therefor with means for supporting them, and more specifically relates to preformed electrical resistor ribbons with repeating convolutions and means for supporting them in spaced relation to the roof or top wall of the furnace.

An object of my invention is to provide an improved supporting means for an electric resistor heating unit in an electric furnace.

Another object of my invention is to provide means for supporting a sinuous electrical heating unit in such a manner that both the supporting means and the unit can freely expand and contract.

Still another object of my invention is to provide a substantial supporting means for a sinuous electric heating unit, which will sustain the unit in spaced relation with respect to the top wall of the furnace, the means comprising a plurality of pins, each having a hook, the pins being removably held in the wall.

A primary object of my invention is to provide swingable pins in the top wall of a furnace, as a supporting means for a sinuous, ribbon heating unit so that the heating unit can be readily and easily inserted into place or removed from the supporting means without the necessity of tearing down all or any part of the top wall.

A further object of my invention is to provide a plurality of pins or hook members for supporting a sinuous resistor unit substantially at its turns or bends, and with the hooks which support one side of the resistor unit turned toward or away from those supporting the other side.

A particular object of my invention is to so support a sinuous resistor unit by pins such as aforesaid so that both the pins and the unit can be easily and readily removed or replaced without disturbing the top wall from which the pins are suspended.

Further objects, features and advantages of my invention will be uncovered in the following detailed description of a preferred embodiment, this description to be taken in connection with the following drawing, in which:

Figure 1 is a view in vertical, transverse section on a reduced scale of a furnace embodying my invention;

Fig. 2 is a perspective view of a pair of adjacent tile forming part of the top wall of the furnace, showing the manner in which the tile is formed, and the manner in which the heating unit supporting pins are supported thereby;

Fig. 3 is a front elevational view of one of the tile of Fig. 2 and showing a supporting pin being placed in position, and

Fig. 4 is a view showing the tile of Fig. 3 in transverse vertical section, and showing in elevation transverse to Fig. 3, the position of the hook member with respect to the tile.

Referring to Fig. 1, the furnace 1 includes a heating chamber 2 defined by a top wall 3, a bottom wall 4 and side walls 5 and 6. The heating chamber is adapted to be heated by any suitable means including top wall heating units 7 and 8 held in spaced relation with respect to the top wall 3 by means of a plurality of pins or hook members 9 near the side walls of the furnace, and pins or hook members 10 in proximity to the center line of the furnace. The pins are preferably of heat-resistant metal.

The walls of the furnace, except for the special tile used to support the pins, may be built in any customary manner of refractory and insulating brick, and the top wall may be either flat or arched. In the furnace shown, special tile of non-metallic refractory form part of the top wall, and four rows are required for the specific embodiment, two rows 11 and 12 being in proximity to the side walls of the furnace and two rows 13 and 14 along the center line of the furnace.

Each row comprises a plurality of separate bricks or tile shown more particularly in Figs. 2, 3 and 4. The tile are all similar, and each has the general form of ordinary bricks except that they are provided with shoulders 15 at each of its sides which abuts another adjacent tile in the formation of the top wall. These shoulders are toward the bottom part of the tile on each side of a bottom narrowed extension of the brick, the extension and shoulders cooperating to form substantially parallel nooks bounded by vertical surfaces 16 and substantially horizontal surfaces 17. Each tile is formed with a protuberance 18 which projects into each nook. Each protuberance 18 is formed as shown, and has a dimension inward of the tile which is less than the width of the horizontal surface 17, and a depth which is less than the depth of the vertical surface 16. Furthermore, the maximum length of the protuberance is also less than the length of the surfaces 16 and 17.

The periphery or contour of each protuberance follows that of a U with thick walls, and in the actual embodiment is shown as comprising an upper surface 19 concave upwardly, and with

shorter radii of curvature than the lower surface 20 which is convex downward.

The general form of the pins or hook members which cooperate with the shoulders and protuberances of the tile is also shown in Figs. 2, 3 and 4. Generally, each pin comprises a shank 21 of any desired length and two journals 22 and 23 extending from each side of the shank at its top. Below these journals two further projections 24 and 25 extend out from the body of the shank substantially parallel to the journals 22 and 23. The bottom of each of the pins is provided with an upwardly turned end 26 to provide a hook 27 which straddles the part of the heating unit that it supports. The hook may take any desired form, but I prefer to so design the upstanding end 26 of the hook so that the lower space between it and the main body of the shank is fairly uniform in width, but so that the upper part of the space diverges for better reception of the heating unit ribbon which is to be supported by the hook.

For a furnace such as shown in Fig. 1, in which the top wall is slightly arched, I prefer to have the brick or tile slightly tapered, that is, wedge-shaped, and since it is desired that the heating units 7 and 8 be supported substantially in a horizontal plane, the hook members cooperating with the row of tile adjacent the side walls of the furnace have shanks shorter than the shanks of the hook members cooperating with the center rows of the roof.

In constructing the top wall of the furnace, the specially-formed tile is arranged one adjacent the other so that adjacent nooks on adjacent bricks form recesses 30 in the top wall, these recesses occurring at spaced intervals along the length of the furnace, the number depending upon the width of the tile or brick. In the assembled wall, a protuberance 18 of one brick will be substantially horizontally aligned with and will face a protuberance of the adjacent brick, but the two vertical edge surfaces of the two protuberances will be slightly spaced from each other for the reception of a shank 21.

The pins, both 9 and 10, are inserted in position by a combined translatory and rotary motion. For insertion, a pin is moved upward along the sides of the protuberances in a recess until the journals 22 and 23 are just above the tops of the protuberances. The upper part of the shank between the journals and projections can then pass between the two protuberances of each recess, and the journals can be slid over to seat in the bottom of the concave upper surfaces 19 of the protuberances in the recess. The lower projections on each pin are suitably placed to engage the bottom surfaces of the protuberances while the journals are just above the top surfaces. Consequently, further insertion of the pin requires a slight turning of the pin either slightly before or after the journals reach their seats, depending on the clearance between the lower projections of the pin and the bottom surfaces of the protuberances. Fig. 3 shows one position a pin may assume during its insertion or removal.

After the journals are seated in place, the pin may be released and will automatically swing into a vertical position regardless of the angle of the tile with respect to the vertical. Each pin, of course, can be removed by a series of movements substantially reverse to those described for the insertion of a pin.

It may be observed that a pin in its supporting position is free to swing on both sides of a vertical plane through the journal members 22 and 23, and, consequently, it is possible to dispose the pins with the hooks in an end row facing toward, or away from, the pins of a center row; and, in the same way, the hooks of the pins in the center rows can be faced in either direction, depending on how the hook is turned before its insertion in the top wall. I consider this feature to be a distinct advantage since the hook members can be placed either with the shanks within the bends of the heating unit, or with the shanks outside the bends of the heating unit, as desired. In actual practice, I prefer to place the shanks outside the different convolutions of the heating unit, as more particularly shown in Fig. 2.

Because of the freedom of movement of the hook members in suspended position, it requires but simple manipulations to place a sinuous heating unit in its proper position in the furnace. All that is necessary is to support one side of the heating unit in the hooks of a row of pins, which freely swing to enable this to be easily done.

The other side of the unit can then readily be placed on the hooks of the cooperating row of pins by swinging them slightly out of place and raising the unit above the hook ends 26. The sides of the heating unit can then be dropped into the hooks and released, whereupon the supporting pins will swing into a substantially vertical position. One advantage of this free movement of the hook members lies in the automatic compensation for irregularities in the forming of the heating unit, because the hook members need not be exactly vertical while supporting the unit. By this I mean that if one or more of the side lengths of a convolution are either shorter or longer, the pins automatically adjust themselves thereto, and it is equally obvious that the pins will automatically adjust themselves to changes in the size of the heating unit with expansion and contraction due to temperature changes.

As a further improvement in my invention, I prefer to have the distance between a journal 22 or 23 and a projection 24 or 25 only slightly greater than the depth of the protuberance from the bottom of its upper concave surface to the bottom of its lower convex surface. This limits the vertical displacement of the hook to some extent and by providing only sufficient clearance above the protuberance with respect to the upper surface 17 of a shoulder, it will be extremely difficult to dislodge any of the hook members except by the movements previously described for its insertion or removal. Nevertheless the hook member is free to expand and contract, and adjust itself to the size of the heating unit or to irregularities in the spacings of the row of special tile in the top wall, or other discrepancies that usually occur in apparatus of the type described.

While I have described my invention in a preferred embodiment, it is quite obvious that many modifications can be made embodying the teachings of my invention without departing from the spirit or scope thereof.

I claim as my invention:

1. An electric furnace comprising, a heating chamber provided with a top wall formed of heat refractory material, said wall being provided with downwardly opening recesses, a pair of substantially-aligned protuberances extending from opposite sides into said recess, but spaced slightly

from each other, said protuberances being generally U-shaped with finite thickness between its inner and outer surfaces, a pin having journals adapted to rest on said protuberances and a shank suspended between them, lower projections on said shank below said protuberances, the thickness of said protuberances at their center being greater than the distance between the top of said protuberances and the upper boundary of said recess, the distance between said journals and said projections being slightly greater than the said thickness.

2. An electric furnace comprising a top wall, said top wall being provided with a downwardly directed recess, said wall having a pair of horizontally separated but substantially aligned protuberances in said recess, a heating-unit-supporting pin having a shank and a pair of journals at the top of said shank, said shank being disposed between said protuberances, with said journals supported by said protuberances, the distance between the ends of said journals being greater than the space between said protuberances, said protuberances being spaced from the top of said recess and a side of said recess which generally parallels said journals, said shank having an enlarged portion slightly below one of said protuberances.

3. In a furnace, the combination with a top wall and an extended heating unit; of means for supporting said unit substantially parallel to, but spaced from, said wall, said means comprising a plurality of pin members each pivoted along a substantially horizontal axis in said wall and suspended therefrom, said pin members and said wall being constructed and arranged with cooperative provisions so that said pin members are capable of swinging movement in a vertical plane substantially transverse to said axis, and on both sides of a vertical plane through said axis, said provisions comprising a plurality of recesses in said wall opening downwardly, protuberances projecting into said recesses, and projections on said pin members resting on said protuberances and providing said horizontal axis for each pin member, there being two horizontally-spaced protuberances in each recess and each said pin member having two projections one for each protuberance, each said pin member having a suspended shank portion between the last said two protuberances, the bottoms of said protuberances being convex downward and said shank portions having projections somewhat below said bottoms.

4. An electrical furnace comprising, a heating chamber provided with a top wall including non-metallic refractory material comprising bricks, said bricks being formed with nooks at the edges of a pair of sides juxtaposed to adjacent bricks, each of said bricks further comprising a protuberance for each nook projecting into said nook, said protuberance extending toward an adjacent brick but of less depth than the last said nook, the tops of said protuberances having depressions between a pair of opposite edges of said protuberances, and a pin member suspended between a pair of adjacent protuberances on adjacent bricks, said pin member having projecting journals resting in said depressions.

5. The structure of claim 4 characterized by the bottoms of said protuberances being convex downward and said pin member being provided with additional projections slightly below the said convex bottoms, a pair of adjacent protuberances being narrower than the width of the space formed with two adjacent nooks of adjacent bricks, whereby said pin member is removably suspended.

6. A non-metallic refractory brick for suspending a hook for supporting a heating unit in an electric furnace, said brick having at least one vertically directed side and provided with a nook at the bottom thereof, said brick having a protuberance projecting sidewise into the said nook, said protuberance being of less depth than said nook, and having a top surface which is concave upward in a direction lengthwise of the nook, and having a bottom surface which is convex downward in a direction lengthwise of the nook.

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