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E. J. BRANNIGAN

ELECTRIC FURNACE

Filed April 29, 1924

Fig. 1.

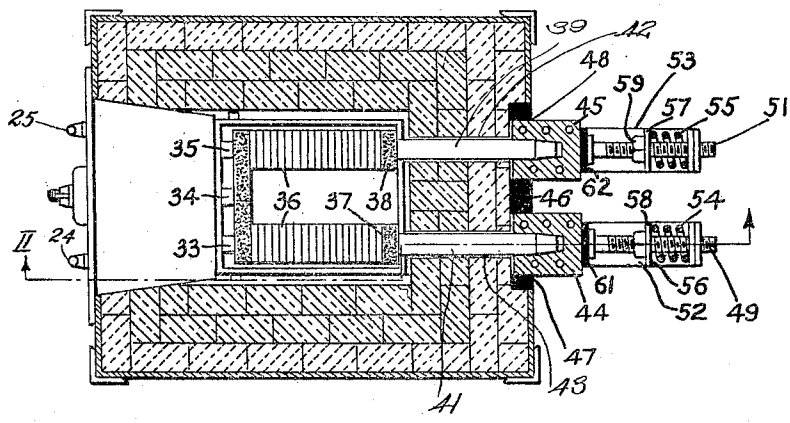
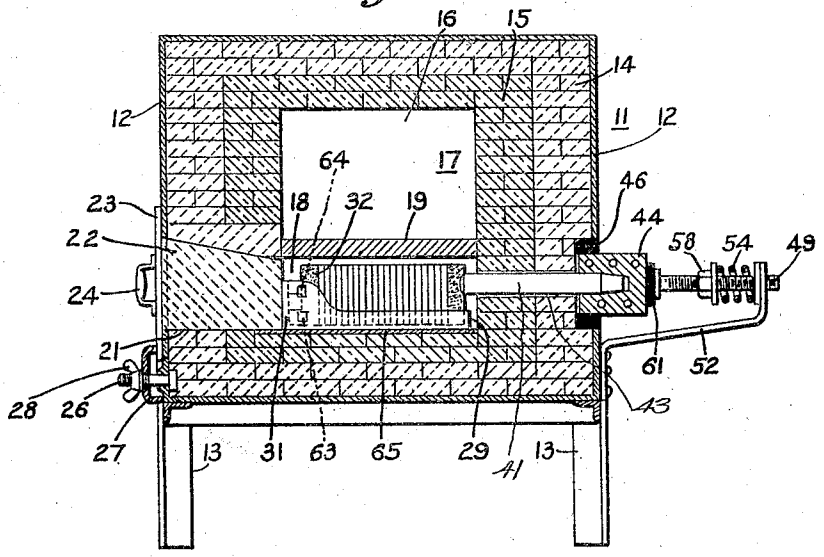


Fig. 2.



WITNESSES:

R. J. Butler.

H. M. Bickel

INVENTOR

Edward J. Brannigan.

BY

Wesley J. Baer

ATTORNEY

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UNITED STATES PATENT OFFICE.

EDWARD J. BRANNIGAN, OF BUFFALO, NEW YORK, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTRIC FURNACE.

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My invention relates to electric furnaces and particularly to electric-resistance furnaces having carbonaceous heating units.

The object of my invention is to provide a quickly removable heating-unit aggregate for a high-temperature furnace.

In practicing my invention, I provide a plurality of refractory walls enclosing a furnace chamber and locate within the furnace chamber a high-back tray having relatively low side and end walls, within which tray is located a refractory heating element. A suitable opening is provided in one of the furnace walls, normally closed by a suitable closure member against which the high-back end of the tray is pressed by suitable elongated terminal electrodes that are resiliently pressed against the outer ends of the built up parts of the plural-resistor member.

It has been found, in actual practice, that the use of refractory resistor members comprising some form of carbonaceous elements is necessary, if it is desired to obtain a relatively high operating temperature within a furnace chamber. A certain amount of oxidation of these resistor members takes place during the operation of the furnace, making it necessary to replace the heating units from time to time. If it is necessary to partially disassemble the furnace structure in order to replace such a heating unit, a relatively large amount of time is lost, and it is highly desirable to provide a furnace structure and a heating unit that will permit of easy and quick removal of a damaged heating unit and of the quick insertion of a new heating unit, whereby the furnace is out of operation only a relatively short time.

In the single sheet of drawings:—

Figure 1 is a view, partially in horizontal section and partially in plan, of an electric-resistance furnace embodying my invention, and

Fig. 2 is a view, in vertical lateral section therethrough, taken on the line II—II of Fig. 1.

A furnace 11 comprises an outer metallic casing 12 of any suitable or desired contour and dimensions that is supported by a plurality of supporting members 13 which may either be integral with the casing or may be suitably secured thereagainst in any desired manner.

An outer lining 14 comprises a plurality of bricks or blocks of a suitable heat-insulating refractory material. An inner layer 15 comprises a plurality of bricks or blocks of a suitable high-temperature-resisting refractory material usually employed in the art. The bricks or blocks, comprising the inner and the outer linings, respectively, are so located as to provide a furnace chamber 16 of any suitable or desired contour and dimensions.

The furnace chamber 16 may be divided into two compartments, an upper or work-receiving compartment 17 and a lower or heating compartment 18, by a refractory diaphragm 19 that may comprise carbon, graphite or similar material that will withstand the relatively high temperatures encountered in the operation of the furnace without serious deterioration or oxidation thereof.

One of the walls of the furnace is provided with an opening 21, near the bottom of the furnace chamber 16, that may be substantially rectangular in section and that may also be of wedge shape in order to permit of locating therein a closure member 22, of refractory material, that is also of wedge shape, whereby a close engagement between the bricks or blocks of the furnace structure immediately surrounding the opening 21 and the closure member 22 may be obtained.

The closure member 22 may be suitably secured against the inner surface of a metal plate 23 that is provided with a plurality of handles 24 and 25 to permit of an operator handling the same in its removal from, and its insertion into the opening 21.

Means for securing the closure member 22 together with the plate 23 in their proper operative positions comprise a clamping bolt 26 and a clamping member 27, of U-shape that has a turning movement on the bolt 26. One end of the clamping member 27 operatively engages the furnace casing while the other operatively engages a portion of the plate 23, a suitable tightening means 28 operatively engaging the outer screw-threaded end of the bolt 26. The tightening means 28 is here illustrated as a butterfly nut but may, of course, be of any other suitable or desired construction as long as it is effective to tightly hold the closure member 22 and the plate 23 in their proper operative positions, substantially as illustrated in the drawings.

A heating unit for the furnace comprises a tray 29 that has three relatively low side and end portions and a high back 31 and that is composed of a suitable refractory high-temperature-resisting and electric-insulating material. Within the tray 29 I provide an elongated bar 32 of a suitable electric-conducting refractory material that is spaced from the high back 31 by a plurality of blocks 33, 34 and 35, of a suitable electric-insulating refractory material.

A plurality of relatively thin plates 36 are located in adjacent and face-to-face relation at each of the ends of the bar 32 and extend from the inner face thereof to within a short distance of the other end of the tray where a pair of terminal blocks 37 and 38 are located, in operative engagement with the respective end plates of each group of plates 36.

A pair of elongated electric-conducting terminal electrodes 39 and 41 project into the furnace chamber, extending through openings 42 and 43 in that wall of the furnace structure opposite the opening 21. The electrodes 39 and 41 are located a suitable distance apart in order to have the inner ends thereof engage the blocks 37 and 38, respectively.

Water cooled terminal members 44 and 45 operatively engage the outer tapering ends of the respective elongated electrodes and a block 46, of a suitable refractory material, such as asbestos lumber, is located at the surface of the furnace structure and is provided with two openings 47 and 48, respectively, within which the terminal members 44 and 45 are located. The block 46 insures not only the alinement of the electrodes and the terminal members, but also prevents leakage of current therefrom during the operation of the furnace.

Means for resiliently pressing the terminal members and the terminal holders against the several portions of the built-up resistor member comprise screw-threaded rods 49 and 51, the outer ends of which are suitably held in fixed members 52 and 53 that may be of L-shape, as illustrated more particularly in Fig. 2 of the drawing, and have one end thereof suitably secured against the metal casing 12. Helical spring members 54 and 55 surround a portion of the rods 49 and 51, respectively, and press against washers 56 and 57, the outer surfaces of which operatively engage nuts 58 and 59, respectively, that are mounted on the rods 49 and 51.

The inner ends of the respective rods 49 and 51 may be enlarged and may operatively engage plates 61 and 62 of a suitable electric-insulating material, that are located against the outer surface of the respective terminal members 44 and 45.

While I have illustrated a specific embodiment of resilient compressing means, I do not desire to be limited thereto, as the construction described is illustrative only and any construction providing resilient compressing means may be employed.

In assembling the furnace structure and particularly in mounting the heating unit comprising the stacks of plates 36 in the tray 29, the closure member 22 is removed and the tray, together with the resistor member, is inserted in the furnace structure through the opening 21 into substantially the position illustrated more particularly in Fig. 2 of the drawings.

It is assumed that the elongated refractory electrodes are already in position and when the tray, together with the resistor members, is moved into its proper operative position, the terminal blocks 37 and 38 will be caused to operatively engage the inner ends of the electrodes.

The closure member 22, together with the plate 23, is then placed in its proper operative position and clamped therein by the clamping bolt 26 and the co-operating tightening means 28. The nuts 58 and 59 are now tightened against the springs 54 and 55, respectively, thereby causing the elongated electrodes to be resiliently pressed against the portions of the resistor member. The resistor member may be energized by suitable supply-circuit conductors (not shown) that are electrically connected to the terminal members 44 and 45 in the usual manner.

When the oxidation of some or all of the resistors has proceeded to such extent as to make it impossible to use them any longer, and it is desired to remove the heating unit, it is only necessary to discontinue energization of the resistor member and to slacken the nuts 58 and 59. The closure member 22 is then removed and the tray 29, together with the resistor, as hereinbefore described, located therein, is then removed, a pair of spaced projections 63 and 64 being provided on each side of the tray 29 at the high-back end thereof to permit of a suitable pulling tool being employed to move the tray outwardly through the opening 21. If desired, a layer 65 of granular material or a plate 65 of a suitable electric-insulating refractory material, may be located at the bottom of the heating compartment 18 in order to permit of the easy insertion and removal of the tray, as hereinbefore described.

Whereas, in furnaces employing other types of heating units, it was necessary to disassemble at least a portion thereof before a damaged heating unit could be removed and a new one substituted therefor, which required that the furnace structure be permitted to cool. It is not necessary to do this in the device embodying my invention, wherein it is only necessary to remove

the closure member after which the heating unit may be easily and quickly removed and another one inserted within a very short time, which may then be energized after completing the reassembly of the furnace structure, as hereinbefore described.

Various modifications and changes may be made without departing from the spirit and scope of the invention. I desire therefore that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:—

1. In an electric resistance furnace, the combination with a plurality of refractory walls enclosing a furnace chamber and having an opening in one wall thereof and a removable, refractory closure member for said opening, of a refractory tray, movable into and out of said chamber, through said opening, and a refractory resistor member located in said tray.

2. In an electric resistance furnace, the combination with a plurality of refractory walls enclosing a furnace chamber, and a resiliently-mounted electrode in one of said walls, of a relatively shallow tray in said chamber and a resistor member in said tray having one end thereof in operative engagement with said electrode.

3. In an electric resistance furnace, the combination with a plurality of refractory walls enclosing a furnace chamber having an opening in one wall thereof at the bottom of the chamber, a movable refractory closure member for said opening, and a resiliently mounted terminal electrode in one of said walls opposite said opening, of a refractory tray, and a refractory resistor member in said tray, movable into and out of said chamber through said opening and the resistor member held in operative engagement with said electrode by said closure member.

4. In an electric resistance furnace, the combination with a plurality of refractory walls enclosing a furnace chamber having an opening in one wall thereof, a removable refractory closure member for said opening, and a plurality of resiliently-mounted elongated terminal electrodes projecting into the furnace chamber, of a high-back tray of refractory electric-insulating material movable into and out of said chamber through said opening, a plurality of spaced parallel-extending resistor members located in said tray and having one end of each operatively engaging the high-back of the tray and having the other end of each held in operative engagement with the inner ends of the electrodes.

5. In an electric resistance furnace, the combination with a plurality of refractory walls enclosing a furnace chamber and having an opening in one wall thereof, of a removable heating unit aggregate movable into and out of said chamber through said opening, said aggregate comprising a relatively shallow tray of refractory electric-insulating material, and a two-part refractory resistor member located in said tray, a refractory closure member for said opening abutting one end of said tray, and a pair of elongated terminal electrodes projecting into the furnace chamber opposite to said opening and operatively engaging the resistor member.

6. In an electric resistance furnace, the combination with a plurality of refractory walls enclosing a furnace chamber and having an opening in one wall thereof, of a quickly removable heating unit aggregate normally located in said chamber, and comprising a shallow tray of refractory electric-insulating material and a plurality of refractory electric conducting plates located on edge in said tray and projecting above the upper edges thereof.

7. In an electric resistance furnace, the combination with a plurality of refractory walls enclosing a furnace chamber having an opening in one wall thereof, and a refractory closure member for said opening, of a quickly removable heating unit aggregate movable into and out of said chamber through said opening and comprising a high-back shallow tray of refractory electric-insulating material, and a pair of resistor elements located therein and comprising a plurality of electric-conducting refractory plates standing on edge and projecting above the top of said tray, and a pair of terminal electrodes projecting into said chamber and resiliently pressed against the ends of the resistor elements.

In testimony whereof, I have hereunto subscribed my name this 16th day of April 1924.

EDWARD J. BRANNIGAN