R. A. BAYARD.

ELECTRIC FURNACE AND METHOD OF OPERATING THE SAME.

APPLICATION FILED MAY 27, 1913.

1,107,478. Patented Aug. 18, 1914.

3 SHEETS—SHEET 1.

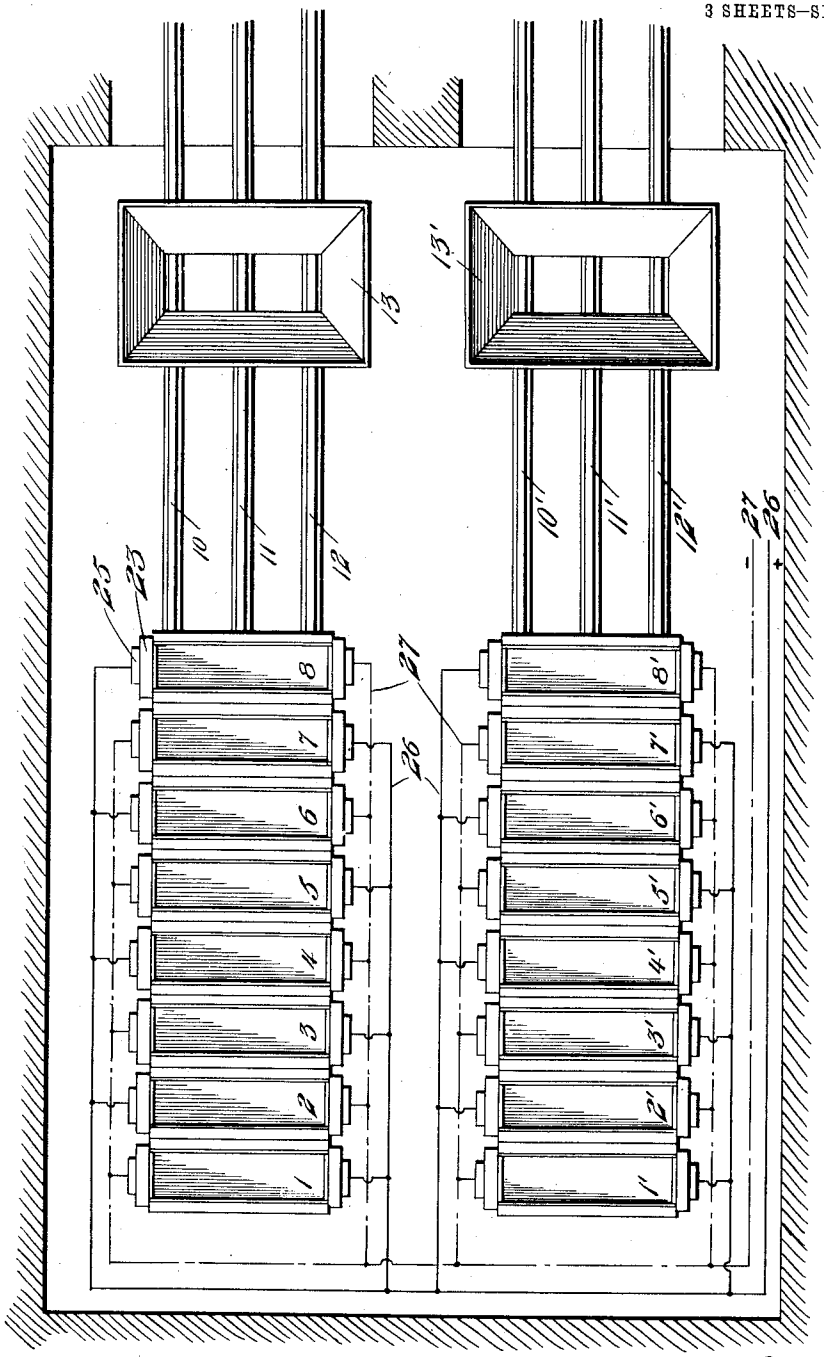


Fig. 1.

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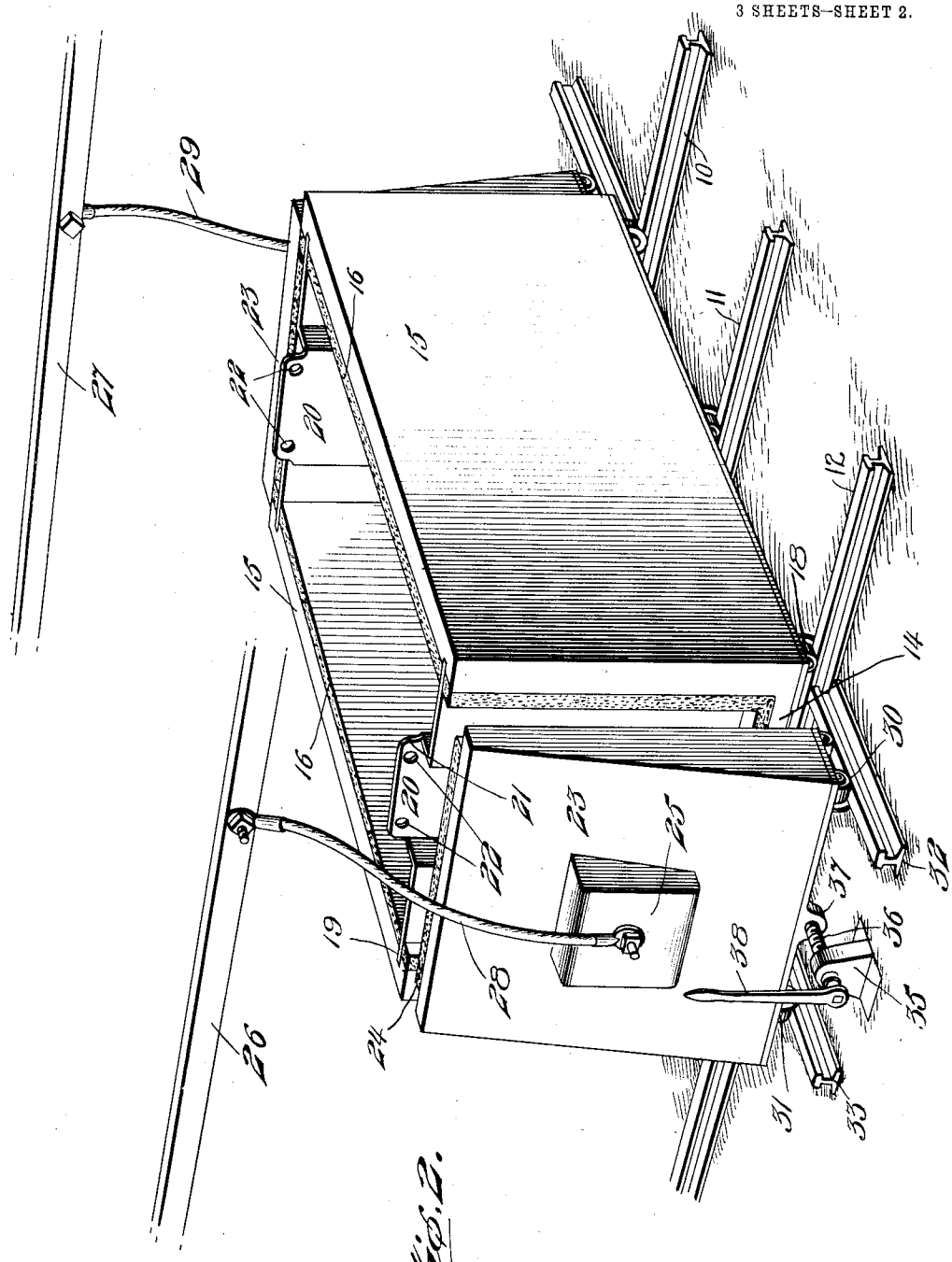


Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 3.

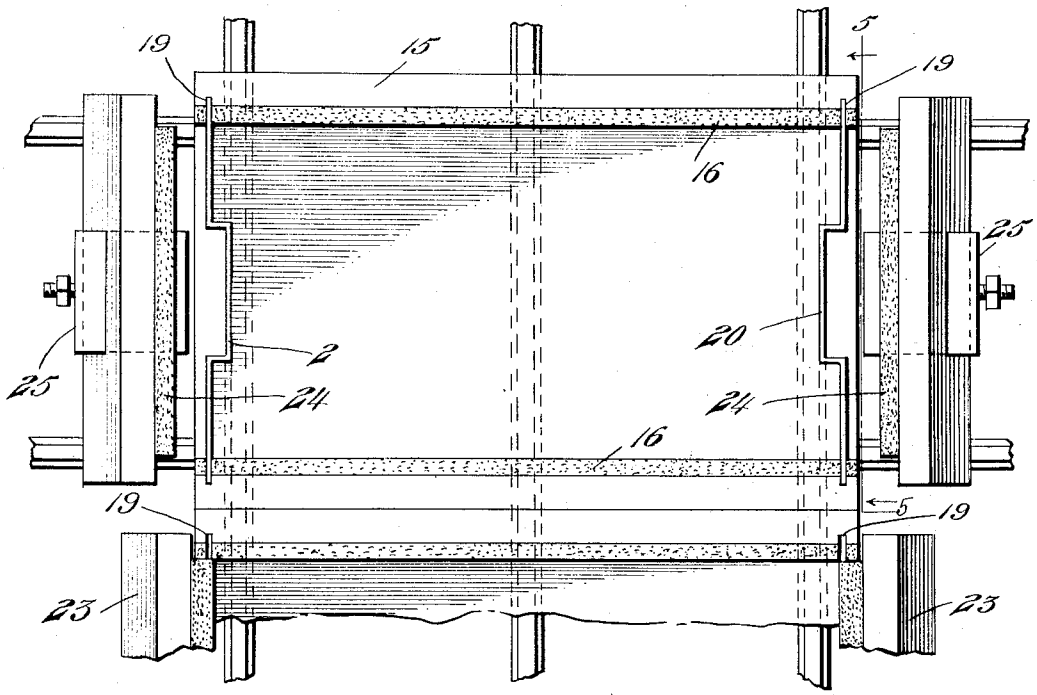


Fig. 4.

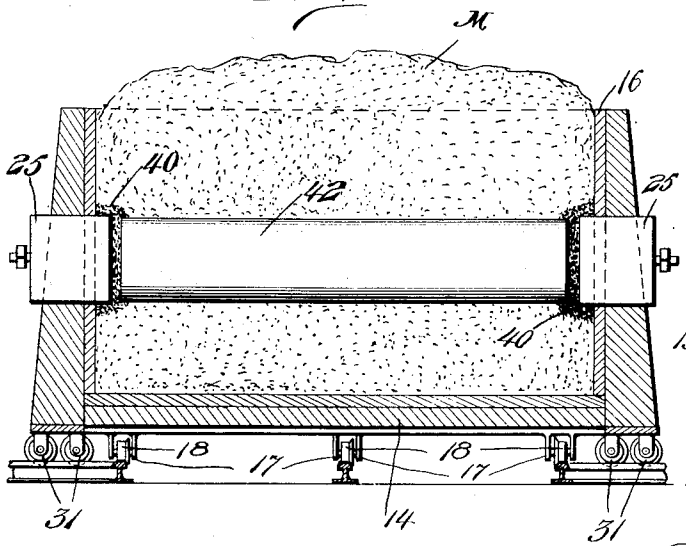
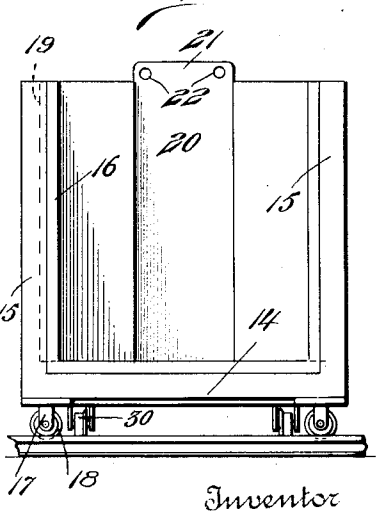


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

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ELECTRIC FURNACE AND METHOD OF OPERATING THE SAME.

1,107,478. Specification of Letters Patent. Patented Aug. 18, 1914.

Application filed May 27, 1913. Serial No. 770,262.

To all whom it may concern:

Be it known that I, ROBERT A. BAYARD, a citizen of the United States, residing at Niagara Falls, Niagara county, State of New York, have invented certain new and useful Improvements in Electric Furnaces and Methods of Operating the Same, of which the following is a specification.

This invention relates to electric furnaces and has particular reference to general improvements in the construction of furnaces of the resistance type, the method of operating the same and arrangement thereof in the furnace room so as to effect a greater economy in the handling and treatment of the materials and so that the output of a given number of furnaces may be increased. By reason of the present arrangement a smaller floor space will be necessary to accommodate the same number of furnaces that were formerly required for a given output and a great saving in the cost of building, equipment and future operation is effected.

Further objects and the novel features of the invention will be apparent from the following description taken in connection with the drawings, in which:

Figure 1 is a plan view of a furnace room equipped with two batteries of electric furnaces and arranged according to this invention. Fig. 2 is a perspective view of one of the furnaces installed in the room shown in Fig. 1. Fig. 3 is a detail plan view of one of the furnaces and the furnace adjacent thereto, part of the latter being broken away because all of the furnaces are substantially similar in construction. Fig. 4 is a longitudinal sectional view of one of the furnaces filled with raw mixture and showing the resistor embedded therein and the heads and electrodes in place ready for a run. Fig. 5 is an end view of the furnace looking in the direction of the arrows on line 5—5 of Fig. 3 and showing one of the false ends in position.

In carrying out the invention the improvements have been applied to a plant equipped with electric furnaces of the resistance type which are utilized for the production of carborundum, graphite and other compositions. In such plants it has heretofore been necessary to install a battery of four to six separated furnaces to keep some one furnace operating continuously. This has been the practice because after a run is made on a furnace it must be allowed to cool, the walls removed, the product taken away, the walls replaced, and the furnace re-filled with raw mixture, all of which take up considerable time and labor. In such furnaces the walls are built of brick or other refractory material, either laid up without mortar from the floor to the height desired or set up from the floor in iron sectional frames so that a section can be lifted into or out of position. After a run the walls are torn down so that the product may be conveniently removed to the storage shed. The furnace heads which carry the electrodes in such furnaces are of solid masonry and are usually permanently fixed throughout their life and are only removed when a new head is set in place of the old one. In such furnaces the ingredients are mixed at the mixer usually located at some place remote from the furnace. After the walls have been built up the mixture is transported to the furnace and dumped in, the core or resistor and packing at the ends of the same being put in at the proper place, the same being then covered with more mixture. The furnace is then run for the required length of time and after being allowed to cool the walls are taken down and the product is removed to the storage room. The walls are then rebuilt and the operation is repeated.

In the usual arrangement as set forth above it is necessary to have access to the side walls so that they may be taken down and the product removed from the furnace, and afterward, so that the walls may be rebuilt. A single furnace therefore requires much more floor space than its actual floor dimensions and a great amount of heat is lost by radiation on account of the area of the exposed surfaces. Much labor, time and equipment is required to fill this type of furnace and remove the product therefrom, which are among the principal disadvantages overcome in the arrangement according to the present invention.

In the furnace room shown in Fig. 1 two batteries of furnaces, eight in each battery,

are installed. Arranged as shown, they only occupy about the same floor space ordinarily occupied by nine furnaces of the same size as the individual furnace shown, and this consequently results in a saving of floor space equivalent to that taken by seven furnaces. Longitudinally of the furnace room there are two trackways or sets of tracks 10, 11, 12 and 10′, 11′ and 12′ which are connected to a track system outside of the furnace room and by means of which the individual furnaces of the batteries may be bodily moved out into the yard to cool the finished product more quickly and then to the storage shed to discharge the product. The said furnaces may also be wheeled to the mixers 13 or 13′ to receive the mixed ingredients, the mixers being located at some distant or convenient place along the track where they can discharge into the open top of the receptacle formed by the false ends and body part of the furnace. After being filled with raw mixture the furnaces are returned to where the fixed heads and electrodes are positioned and the heads and electrodes are moved in and the run is made. The furnaces 1 to 8 and 1′ to 8′, shown arranged in batteries of eight each in Fig. 1, are separate individual furnaces, the side walls of which fit close beside or flush against one another. The end furnaces 1 and 8 and 1′ and 8′ of the two batteries are the only ones which have exposed walls that radiate heat, consequently a large quantity of energy usually lost by radiation is saved.

The separate furnaces of the batteries are substantially similar in construction, accordingly only one will be described, a perspective view of the same being shown in Fig. 2. The furnace proper comprises a bin-like portion open at the top and made in the form of a structural frame having a bottom 14 and side walls 15 which are lined with suitable refractory material 16. The bottom is provided with three pairs of lugs 17 which form bearings for the wheels 18 that support the furnace body on the tracks 10, 11 and 12. Near the ends the side walls and refractory material of the bin have the vertical recesses 19 which form guide slots for the false ends 20, preferably made of sheet steel. The false ends 20 are substitutes for true ends to be described and are provided with central offset portions 21 and eyes 22. With the use of a suitable device engaging the eyes 22, the ends 20 may be lowered into and raised out of the slots 19. A suitable receptacle is thus formed of the body portion of the furnace to move the material to and from the place where it is operated upon. For each of the furnace bodies 1 to 8 and 1′ to 8′ there is a pair of end walls or heads 23 mounted on movable platforms and provided with suitable lining of refractory material 24. Each head is formed to fit into the end of the bin part and the edges may cover the slots when the false ends are withdrawn. Each head carries an electrode 25 suitably insulated from the head 23. The electrodes at opposite ends of the furnace are permanently connected to the bus bars 26 and 27 by means of the cables 28 and 29. At the bottom each head 23 carries pairs of wheels 30 and 31 which support the same for movement laterally from the furnace proper. The wheels may roll in suitable guideways, as grooves, or along the rails 32, 33 extending laterally for a short distance from the main rails 10 and 12. When the furnace proper is moved for charging or discharging the true ends 23 are always left at the operating position and connected with the bus bars. In order to readily move the ends to and from the ends of the bin or furnace proper a suitable device is provided. In the construction shown, a lug 35 is permanently fastened to the floor and screw-threaded to receive a threaded pin 36 which engages a lug 37 on the head 23, and is rotated by means of a lever 38 to move the said head.

It will be understood that the individual furnaces shown in Fig. 1 are equipped in the same manner as the furnace shown in Fig. 2, and when it is desired to fill these furnaces with raw material or move them from their operating position for discharging, the ends are moved away from the ends of the furnace, as the product is usually solid and firm, and then the false ends 20 are inserted in the grooves 19 and substituted for the ends 23. A bin is thus formed which is then transported to the mixer 13 or 13′, as the case may be, and filled with the mixture M, the core or resistor 42 being inserted at the proper time. It will be observed that in either case the end walls are only temporarily a part of the furnace, the operating ends carrying the electrodes being the ends while the furnace is operating and the false ends being the ends of the furnace while the same is moving the material to and from the operating position. After all or as many of the furnaces as it is desired to run have been charged they are returned to the heads 23 or permanent ends, which latter are moved up into contact with the bin, whereupon the false ends may be withdrawn. The offset portion 21 of the false end leaves sufficient space so that a slight amount of suitable conducting packing 40 may be packed about the ends of the resistor 42 and electrodes 25 which extend into the recess left by the offset portion 21. As soon as the material has been treated the false ends may be re-inserted in the grooves 19 and the permanent ends or heads 23 moved back slightly so that the furnace and the product therein can be moved out into the yard where it will cool rapidly and after which the product may be

taken to the storage sheds. The furnace is then re-filled at the mixer, moved to its operating position and the operation repeated. In the meanwhile the other battery or batteries of furnaces are operating. The energy consumption is kept practically constant and the time between operations and labor involved is greatly reduced which materially increases the output of the plant.

Usually in operating electric resistance furnaces in order to keep the loss due to induction at a minimum it has been the practice to carry return buses directly back under the furnace. This necessitates water cooling the buses under the furnace which has a cooling effect on the bottom of the furnace and decreases its yield. In the present invention the connections to the buses 26 and 27 are arranged so that no return bars are required beneath or around the furnace and therefore it is not necessary to provide cooling water and the harmful effect of the latter is not experienced.

Referring to Fig. 1 it will be noted that the positive bus bar is connected to one end of the furnaces 2, 4, 6 and 8; and 2′, 4′, 6′ and 8′ and to the opposite ends of the adjacent furnaces. A positive and a negative current supply main runs along both of the ends of the group of furnaces. Alternate adjacent ends being connected to the positive and negative main, respectively, the flow of current through a furnace adjacent a given furnace will be in a direction opposite to the flow of current in the latter. In other words the permanent heads of the furnaces on corresponding ends are alternately connected to the positive and negative bus bars so that there is always and at all parts an interlacing of the conductors, and consequently the inductive loss is practically negligible. The arrangement of the bus bars and conductors as disclosed effects a great saving in the amount of copper required to carry the very heavy currents used in electric furnaces of this type. The close proximity of the furnaces and the connection of the heads as explained above makes it possible to very materially reduce this heavy expense of an installation.

The operation of the plant and treatment and handling of the material will be apparent from the foregoing description. It will be clear that by the arrangement herein set forth a great saving in first cost and further operation is effected.

Various modifications will suggest themselves to those skilled in the art and it is therefore not intended to limit the invention to the exact details shown and described.

Having thus described the invention what is claimed as new is:

1. In combination, an electric furnace comprising a part adapted to hold the material treated and having a temporary wall, and means whereby the said part may be moved to charge and discharge material.

2. In an electric furnace, the combination of electrodes, means supporting the electrodes and permanently located at the operating position, and a container for the material to be treated movable to and from said operating position, said electrodes and the supporting means therefor fitting the ends of said container when the latter is in operating position.

3. In an electric furnace, the combination with a part of a furnace comprising a bottom and side walls, of other walls associated with said part of the furnace when the same is in operation, means whereby said part may be moved to receive and discharge material, and temporary walls adapted to be substituted for said other walls when the furnace is in transit receiving and discharging material.

4. In an electric furnace, the combination of a member constructed to hold the material which is treated and having an opening in the wall thereof, a separable part fitting the opening in the wall and carrying an electrode and a part adapted to be substituted for the separable part to close the opening.

5. In an electric furnace, the combination of a body comprising a bottom and side walls, end walls for the body and separable therefrom, electrodes mounted in said end walls, and false ends adapted to be substituted for said separable ends carrying the electrodes.

6. In an electric furnace, a movable receptacle for the material to be treated having a temporary or false wall.

7. In an electric furnace, the combination of electrodes located at the operating position, a body portion movable to and from said operating position, and means whereby said body portion may be converted into a receptacle for transporting material to and from the operating positions.

8. In a furnace, the combination of a movable receptacle for the material to be treated, said receptacle having open ends and forming a portion of said furnace, parts for said receptacle which temporarily close the ends when the receptacle is receiving, discharging and moving material, said parts being detachable when the receptacle is charged and in operative position, and means adapted to fit the receptacle and close the ends thereof when the same is in operative position.

9. In an electric furnace, the combination of a movable receptacle for the material to be treated and forming a portion of said furnace, parts temporarily fitting said receptacle when the same is receiving, discharging and moving material, said parts being de-

tached when the receptacle is charged and in operative position, and means carrying electrodes adapted to fit the receptacle when the same is in operative position.

10. In an electric furnace, the combination of a body portion comprising a bottom and side walls, a track, means whereby said body portion may travel along said track, and detachable parts fitting between the side walls to form temporary ends for the receptacle while the same is moved along said track to receive, discharge and move the material which is treated.

11. In an electric furnace, the combination of a body portion comprising a bottom and side walls, temporary or false end walls for said body portion, a main track, wheels mounted on said bottom and supporting said body portion of the furnace on said main track, other tracks extending laterally from said main track, operating end walls movably mounted on said lateral tracks and fitting the ends of said body portion, and electrodes mounted on said operating ends.

12. In an electric furnace, the combination of a bin-like part comprising a bottom, permanent side walls connected to said bottom and temporary or false ends fitting between said permanent side walls, said bin-like part with the false ends forming a receptacle for transporting the material to be treated to and from the operative position of the furnace, and means at the operating position adapted to be substituted for said false ends and to conduct the current to and from the material to be treated.

13. In an electric furnace of the resistance type, the combination of a movable part of the furnace comprising a bottom and side walls, heads fitting the ends of said part and being laterally movable and forming the complete furnace, electrodes carried by said heads, and false ends adapted to be substituted for said laterally movable heads so that the movable part of the furnace may receive, discharge and move the material treated.

14. In an electric furnace, the combination of a movable container for the material to be treated, electrodes, means for suitably supporting the electrodes and arranged to close the ends of said container when the electrodes are in operative position, and means whereby said container may be removed from the operating position to transport the material treated.

15. In an electric furnace installation, the combination of a plurality of furnaces arranged side by side when in operative position, electrodes carried by parts of each furnace for conducting electric energy to each of the furnaces, and means whereby parts of said furnaces other than those carrying the electrodes may be removed from the operative position to receive and discharge material.

16. In a furnace installation, the combination of a plurality of furnaces arranged in groups when in operative position, each furnace comprising fixed and movable parts, and means whereby the movable parts of the furnaces may be moved from their operating positions and fixed parts to receive and discharge material.

17. In an electric furnace installation, the combination of a plurality of furnaces of the resistance type having their side walls abutting one another, each furnace being equipped with an electrode at each of its ends, and means whereby the furnaces may be moved apart, substantially as and for the purposes described.

18. In an electric furnace installation, the combination of two electric furnaces arranged adjacent each other, each furnace being equipped with an electrode at each of its ends, and positive and negative current supply mains located at the ends of the furnaces and connected to the electrodes so that current will flow in a given direction in one furnace and in an opposite direction in the other.

19. In an electric furnace installation, the combination of a plurality of electric furnaces arranged side by side, oppositely disposed electrodes mounted on each furnace, a positive current supply main connected to alternate corresponding ends of the furnaces, a negative current supply main connected to the ends between those to which the positive main is connected, the electrodes at the opposite ends of the furnaces being of opposite polarity, whereby current will flow in opposite directions through adjoining furnaces.

20. A method of operating electric furnaces of the resistance type to reduce the induction therein which comprises arranging the furnaces side by side, connecting current supply mains of opposite polarities to adjoining electrodes and reversing the connections of the current supply mains at the electrodes opposite the first-mentioned electrodes so that currents will flow in opposite directions and parallel paths through adjoining furnaces.

21. A method of decreasing the loss due to the induction in electric furnaces of the resistance type which comprises arranging a plurality of furnaces side by side and connecting the current supply mains at opposite ends of the furnaces so that the flow of current through any given furnace is in an opposite direction to that of the current flow in the adjacent furnace.

22. A method of operating electric furnaces of the resistance type having its electrodes permanently located at the operating

position which comprises moving a part of the furnace to a distant point to charge the same, returning the said part of the furnace and its charge to the electrodes and operating on the material, allowing the product formed to cool and moving said part of the furnace and product to discharge the latter.

23. In an electric furnace installation, the combination of a plurality of furnaces arranged side by side and on a common level, each furnace comprising a movable portion having an electrode situated at each end, means for arranging said movable portion to form a bin-like receptacle of the same, and means whereby said receptacle may be moved, as and for the purposes described.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT A. BAYARD.

Witnesses:
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M. L. VAN WAGNEN.