J. W. BROWN.

ELECTRIC FURNACE.

APPLICATION FILED AUG. 12, 1912.

1,190,856.

Patented July 11, 1916.

4 SHEETS—SHEET 1.

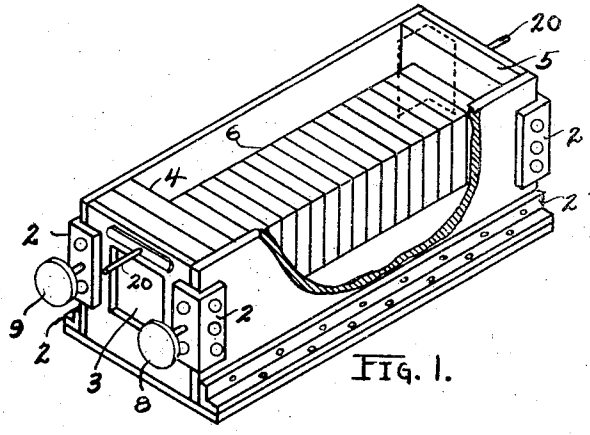
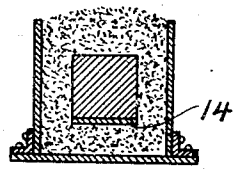


FIG. 1.

FIG. 2.



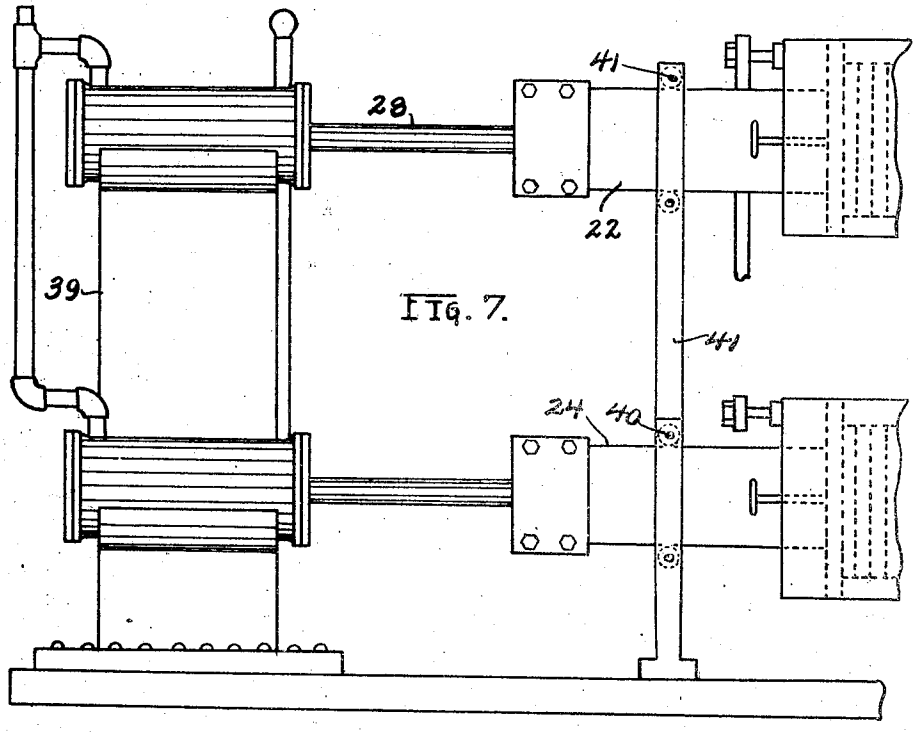


FIG. 7.

WITNESSES

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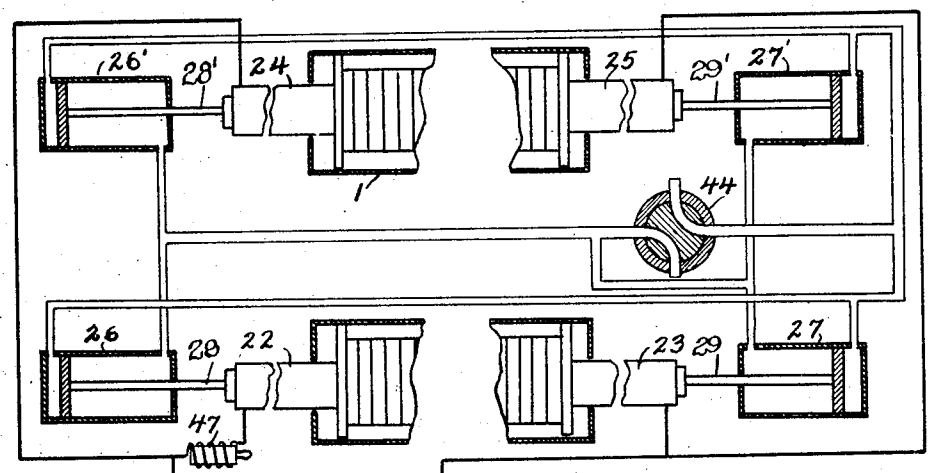


FIG. 11.

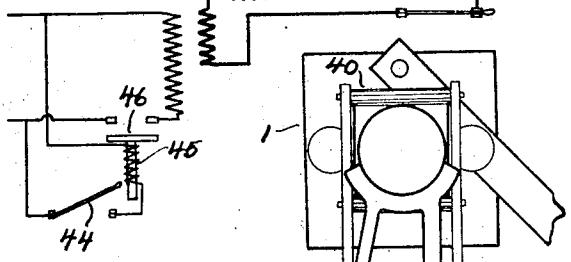


FIG. 8.

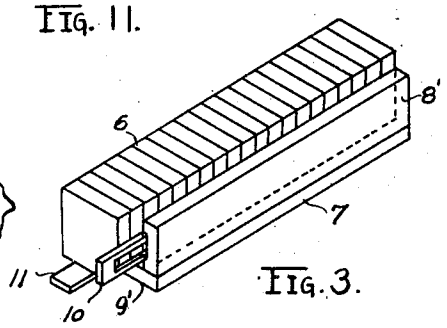


FIG. 3.

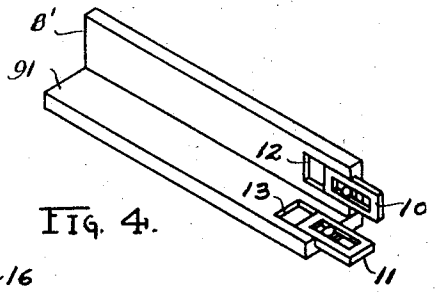


FIG. 4.

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4 SHEETS—SHEET 3.

FIG. 5.

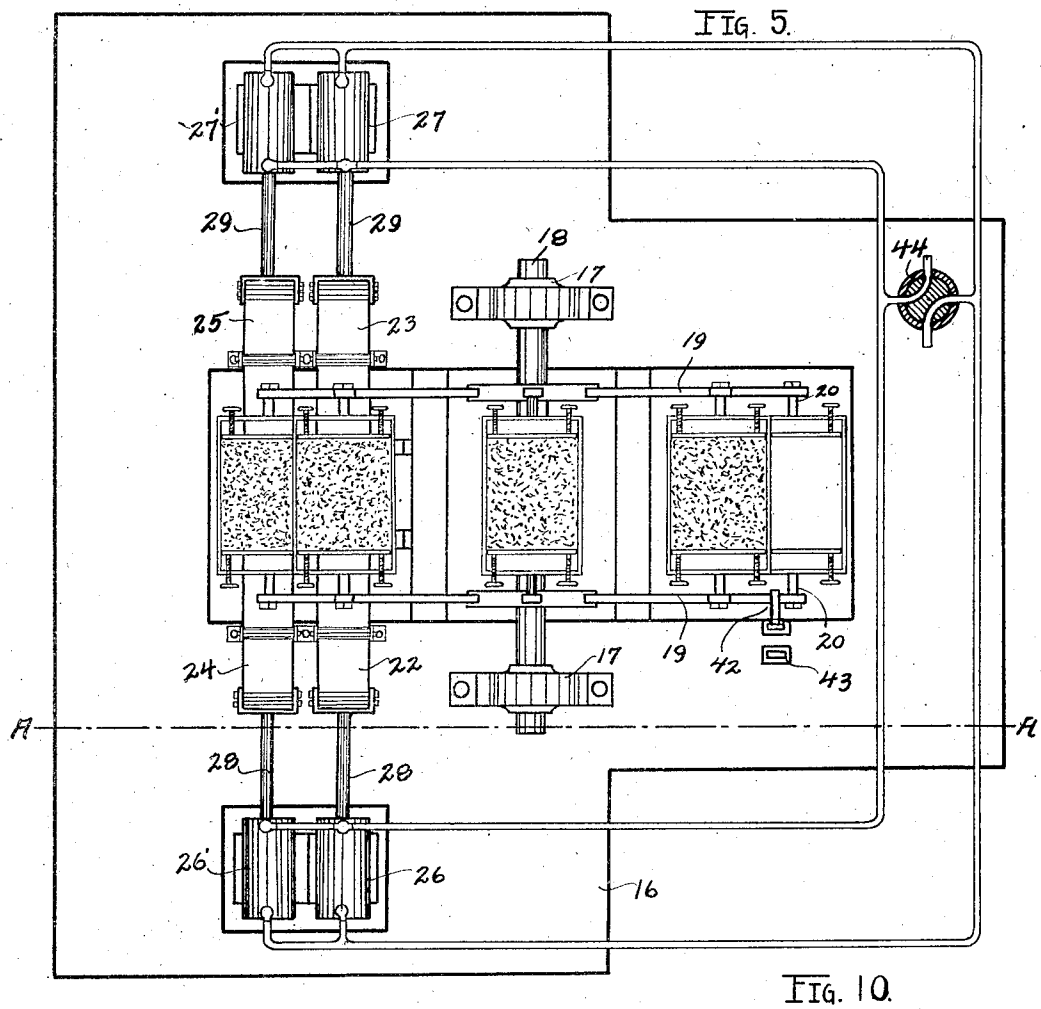
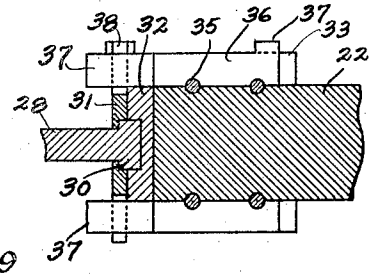


FIG. 10.



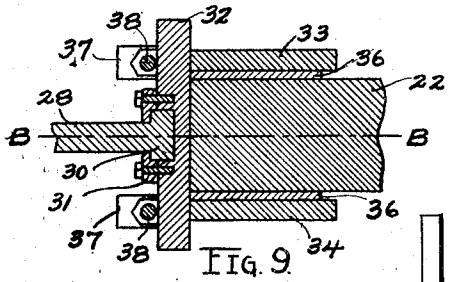


FIG. 9.

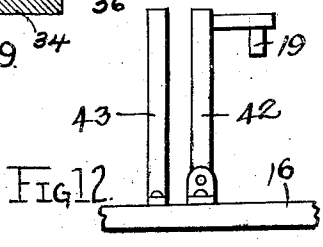


FIG. 12.

WITNESSES

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4 SHEETS—SHEET 4.

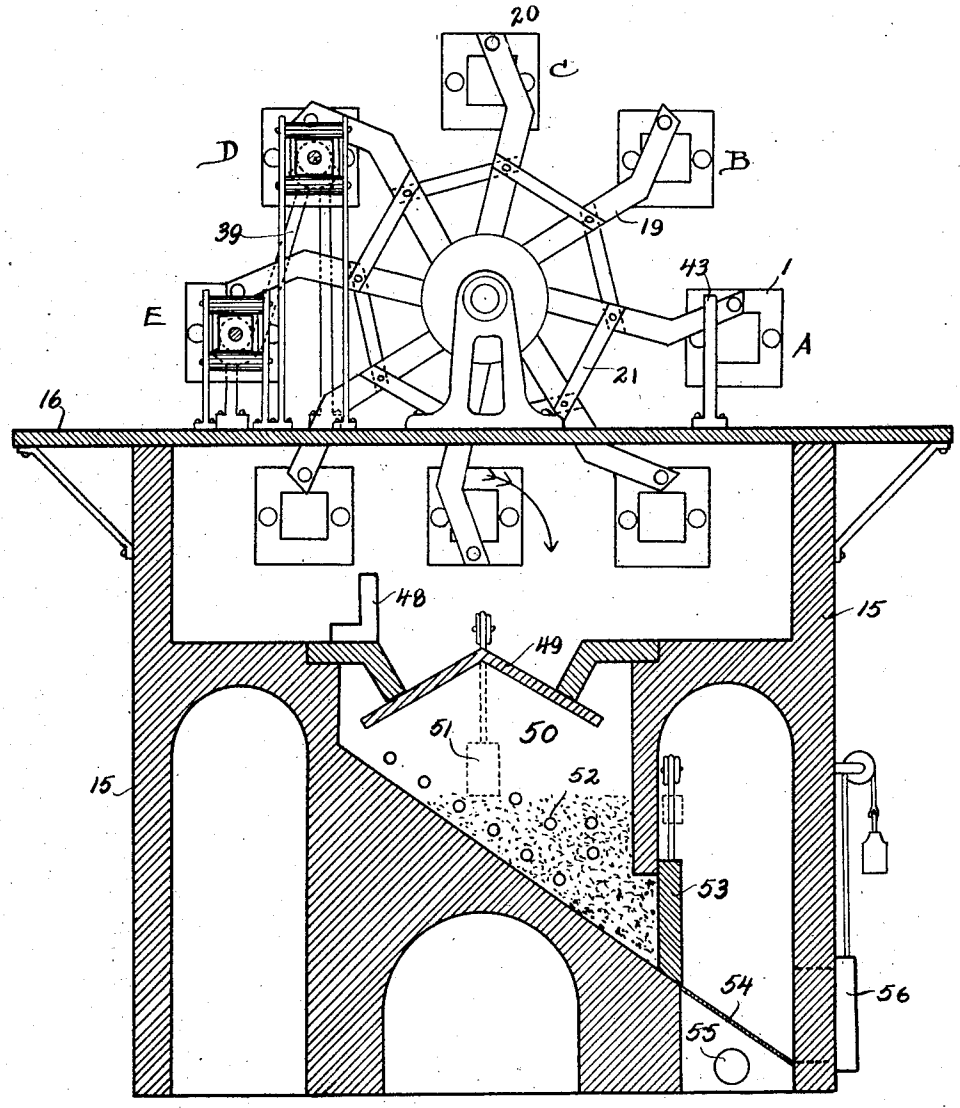


Fig. 6.

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ELECTRIC FURNACE.

1,190,856. Specification of Letters Patent. Patented July 11, 1916.

Application filed August 12, 1912. Serial No. 714,516.

To all whom it may concern:

Be it known that I, JOHN W. BROWN, a resident of Lakewood, in the county of Cuyahoga, in the State of Ohio, have invented new and useful Improvements in Electric Furnaces, of which the following is a clear and exact description.

This invention relates to electric furnaces for heating articles, particularly those made of carbonaceous materials. It is adapted to the graphitization of brushes, carbon plates and other carbon articles, although it can equally as well be used for heating other articles.

In my application Serial No. 702118, June 6, 1912, I have disclosed a method of heating articles in independent units. This application discloses means for carrying out the method set forth in the above identified application.

One object of the invention is to arrange a series of heating units so that an operator can more easily carry out the heating process.

Another object is to heat the articles slowly for a certain time before sending the full heating current through them.

Other objects will appear in the appended description.

In the drawings: Figure 1 is a view of a heating unit with the articles in place. Fig. 2 is a transverse section of the box shown in Fig. 1 after charcoal has been placed around the articles. Fig. 3 is a view of the device used in placing the articles in the box. Fig. 4 is a view of the device shown in Fig. 3 before the articles are placed therein. Fig. 5 is a top view of the complete furnace arrangement. Fig. 6 is a sectional elevation taken on the line A—A of Fig. 5. Fig. 7 is a view of parts of the electrodes and the means for applying pressure thereto. Fig. 8 is an end view of the apparatus shown in Fig. 7. Fig. 9 is a sectional view of the electrode end and the terminal clamp. Fig. 10 is a sectional view taken on the line B—B of Fig. 9. Fig. 11 is a semi-diagrammatic view of the hydraulic system and the electrical circuits. Fig. 12 is a detailed view of the catch and the stop therefor.

Referring to Fig. 1, each heating unit (1) consists of a boxlike structure made of asbestos board or any other good heat resisting material that is a nonconductor of electricity. The box may be reinforced at the corners by angle irons (2). Each end has an opening (3) to receive the electrodes, which may be of any shape, depending upon the shape of the electrodes. Carbon blocks (4, 5) fit loosely in the box at each end. The articles (6) are clamped in place between the carbon blocks (4, 5) by means of screws (8 and 9) at one end of the box.

In Figs. 3 and 4 is shown a device (7) for conveniently placing the articles in the box. This consists of two boards (8′ and 9′) fastened together to form an angular arrangement. Two slides (10 and 11) are secured in the ends of the boards (8′ and 9′) so as to slide freely in the slots (12 and 13). The articles (6) are put in the device as shown in Fig. 3, and then it is placed between the carbon blocks (5) in the box with the center line of the articles approximately in line with the center of the blocks. The screws (8 and 9) are then manipulated to force the blocks (4 and 5) together to compress the articles and hold them in place. The slides (10 and 11) are pushed in as the blocks compress the articles and hence the device (7) can be readily removed. With the articles clamped in position there is a space between them and the sides and bottom of the box. Granular charcoal is then poured in the space around the articles as shown in Fig. 2. This is to prevent the undue loss of heat and the combustion of the carbon articles.

The use of the device (7) can be dispensed with if desired and the articles placed in the box a few at a time. In this case a layer of charcoal should first be spread in the bottom of the box and a strip of card board (14) laid on top to present a smooth surface on which the articles can rest. The latter may then be placed on the strip of card board and charcoal placed at the sides and on top of the articles. When the articles are carefully placed in the box in this manner it is not necessary to apply pressure to them to hold them in place, as when the device (7) is used. When the device (7) is used the strip of card board is of course omitted.

Referring to Fig. 5 and Fig. 6, a foundation whose walls (15) may be made of brick, concrete or other material supports

the apparatus for conveying the heating units to the heating means. A floor (16) which may be made of any material, rests on the walls (15). Pillow blocks (17) fastened to the floor (16) carry a shaft (18) of a "Ferris wheel" arrangement, which has a plurality of pairs of arms (19) radiating therefrom, each pair of arms being pivotally jointed to a heating unit (1) by pins (20). The arms (19) on each side may be joined together by braces (21).

At the left of the pillow blocks as shown in Figs. 5 and 6, are arranged the electrodes for heating the articles in the units (1). If carbon articles are heated at a high amperage so as to graphitize them in a very short time they are liable to warp and crack. This tendency is lessened if the articles are heated slowly by a moderate current before sending a heavy current through them. This may be accomplished by regulating the current with only one pair of electrodes, but I have shown two pairs of electrodes. One pair (22, 23) carries a moderate current and serves to preliminarily heat the article while the other pair (24—25) carries a heavy current of from 500 to 5000 amperes to graphitize the articles. The electrodes are adapted to put pressure on the articles in the boxes (1) as described in my application herein referred to.

The pressure may be applied in various ways, but I have shown fluid pressure cylinders (26, 27, 26′, 27′,) having piston rods (28, 29, 28′, 29′) joined to the electrodes (22, 23, 24, 25).

The piston rod 28 (Figs. 9 and 10) has a head (30) that fits in a depression between the plates (31 and 32). Plates 33 and 34 are clamped to the electrode (28) by means of bolts (35). Copper plates (36) are clamped between the plates (33, 34) and the electrode. The electrical conductor may be fastened to one plate at the lug (37). The plates (33, 34) have ears (37) adapted to receive pins 38 which hold the plate (32) against the end of the electrode. The electrode must therefore move forward and backward with the piston rod. All the electrodes are connected to the piston rods in this same manner.

The fluid pressure cylinders are supported by heavy brackets (39) so as to be rigidly connected to the floor (16). The electrodes rest on rollers (40) journaled in brackets (41).

The operation will now be described. The operator stands at the right hand side of the "Ferris" wheel as shown in Fig. 1, and fills the box in position A as previously described. The catch (42) which is pivoted to the floor (16) is then swung back against the stop (43) and the "Ferris" wheel rotated till the filled box reaches position B. The boxes or units will be filled in succession till one reaches position D. The valve (44) (Fig. 11) is manipulated to admit pressure to the cylinders (26, 27) to force the electrodes (22, 23) against the carbon blocks (4, 5). The current is then switched on by closing hand switch (44) which energizes the electromagnet (45), and causes the switch (46) to be closed. The current can be regulated to any amount by any means such as the variable inductance (47) in circuit with the auxiliary heating electrodes (22, 23). The operator then fills another box while the box in position D is being heated. The auxiliary heating may be accomplished by using various current densities depending upon the character of the article to be heated. The desire is to use a current density that will heat the article slowly and prepare it for the final heating which will take place in position E. The auxiliary current should preferably be turned on the same length of time as the main heating current. The reason for this is that one switch in the primary of the transformers will then be sufficient to open and close the circuit for both heating circuits. However, if desired, the auxiliary current may be switched on for a time different than that of the main current.

After a certain time the operator opens switch 44 and causes the main switch (46) to open. The valve (44) is turned to admit pressure to cylinders 26 and 27 so that the electrodes 22 and 23 are withdrawn. The wheel is then revolved till the box first filled moves to position E. The valve (44) is then turned back to admit pressure to the cylinders to force the electrodes 22, 23, 24 and 25 against the articles in the two boxes, and the main switch (46) is closed. The articles in the box at position E have been preliminarily heated and a heavy heating current is now sent through them. The value of the main heating current may be any value desired. By using a current of 3000 to 5000 amperes per sq. inch, I have graphitized carbon in 20 seconds. For most articles, however, a less current density is preferable, as articles are liable to become porous when such high current densities are used. It is therefore, preferable to heat most articles by means of current of less density such that they will be graphitized in about 10 or more minutes. When a sufficient time has elapsed the circuit is broken and the electrodes are withdrawn as before. The next box having been filled by the operator the apparatus is turned so that the fully heated box is in position F. The box in position D is then preliminarily heated and the box in position E is fully heated as before. Finally on the next movement the box is turned by the trip (48) and the contents dumped on the cover (49). The weight of the articles

causes the cover to descend and they slide into the bin (50). The counter weight (51) causes the cover to rise into its former position. The heated articles as well as carbon blocks (4 and 5) being covered by charcoal and having insufficient air supply in the bin (50) will not burn. Water pipes (52) may be used to cool the articles off so that they may be taken out through the door (53) sooner than they otherwise could.

When the cooled articles are removed through the door (53) the granular charcoal will fall through the grating (54) and may be removed by any means such as a conveyer (55). The articles may be removed through door (56).

It is not necessary to use two sets of electrodes. The same result can be accomplished with only one set with regulating means in circuit so that the current at first can be kept at lower values to heat the articles slowly. Then by means of the regulator the current can be increased to a high value. The electrodes (24 and 25) can therefore be omitted and the regulator (47) or any other regulating means can be used to grade the current to accomplish both the preheating and the final heating. The use of only one set of electrodes, however, will require a longer time to treat the articles, as the total time is the sum of the time of the preheating and the time of the final heating.

Having described my invention, what I claim is:

1. In electric furnaces, a plurality of independent furnace units containing charges to be heated, a support for said units, electrodes for heating the charges and means for causing relative movement between said support and the electrodes to place said electrodes adjacent different units on the support.

2. In electric furnaces, a plurality of furnace units, means whereby charges contained in said units may be heated and a conveyer for moving the units into position to be acted upon by said first mentioned means.

3. In electric furnaces, a plurality of furnace units adapted to contain charges to be heated, electrodes for heating the charges, a conveyer for moving the units successively between the electrodes and means for supporting said units on the conveyer.

4. In electric furnaces, a plurality of furnace units, means whereby charges contained in said units may be heated, supporting means for the units, means for moving said supporting means and said heating means relative to each other to place the heating means successively adjacent different units on the support.

5. In electric furnaces a plurality of furnace units adapted to contain charges to be heated, a supporting frame for said units, electrodes for heating the charges, and means for moving said frame to place the units successively between the electrodes.

6. In electric furnaces, electrodes, a heating unit having conducting end walls, means for producing relative movement between the electrodes and the heating unit, and means for moving said electrodes against said conducting end walls.

7. In electric furnaces, electrodes, a heating unit having conducting end walls, means for producing relative movement between the electrodes and the heating unit, means for moving the end walls to engage a charge and means for moving said electrodes against said conducting end walls.

8. In electric furnaces, a plurality of furnace units, electrodes for treating charges contained in said units, a chamber receiving the charges when heated and means for moving the units to the electrodes to be heated and away from them to be deposited in said chamber.

9. In electric furnaces, a furnace unit adapted to contain charges to be heated, heating electrodes spaced apart, means for moving the electrodes toward and from each other, means for moving said unit between the electrodes and controlling means to cause said first mentioned means to move the electrodes against the charges in said unit to apply pressure thereto.

10. In electric furnaces, a furnace unit adapted to contain charges to be heated, a pair of electrodes, a second pair of electrodes, means for conveying said unit between such pairs of electrodes, means for causing the first pair of electrodes to engage the charges in said unit to preheat them and means for causing the second pair of electrodes to heat said charges after they have been preheated.

11. In an electric furnace, a plurality of independent units adapted to contain charges to be heated, a pair of electrodes, supporting means for moving said units successively between the electrodes and means for removing the treated charges from the units.

12. In an electric furnace, a plurality of independent units adapted to contain charges to be treated, a pair of electrodes, supporting means for moving said units successively between the electrodes, means for moving the electrodes against the charges and means for removing the treated charges from the units.

13. In an electric furnace, a plurality of independent units adapted to contain charges to be treated, supporting means for said units, a pair of electrodes, a second pair of electrodes, means for causing the first pair of electrodes to engage the charge to preheat it and means for causing the second pair to engage the charge to complete the heating.

14. In electric furnaces, a furnace unit containing a charge to be heated, a revoluble frame supporting said unit, heating electrodes spaced apart, hydraulic pistons connected to said electrodes and means to control the admission of fluid on each side of such pistons whereby the electrodes can be moved toward or away from said unit.

15. In electric furnaces a revoluble frame, a plurality of furnace units secured to said frame, heating electrodes spaced apart, means for moving the electrodes toward or from the units and a stop to hold the said frame with a furnace unit in position between the electrodes.

16. In electric furnaces, a revoluble frame, a plurality of furnace units pivoted to said frame, and a trip projecting into the path of the units to cause them to discharge their contents when moved adjacent thereto.

17. In electric furnaces, a revoluble frame, a plurality of furnace units pivoted thereto, a pair of electrodes spaced apart, means for moving the electrodes toward or from said units, a trip projecting into the path of the said units adapted to cause them to revolve on their pivots to discharge their contents and a bin to receive said contents.

18. In electric furnaces, a plurality of furnace units containing charges to be heated, a pair of electrodes spaced apart, a source of E. M. F. applied to said electrodes, a second pair of electrodes spaced apart, a source of E. M. F. applied to said second pair of electrodes, said second source having greater voltage than the first source, and means for moving said furnace units between the first pair of electrodes to be preliminarily heated, and then between the second pair of electrodes to be completely heated.

19. In an electric furnace installation, the combination of a plurality of furnaces arranged side by side, electrodes therefor at the operating position of the furnace, and means whereby a part of each of the furnaces may be moved from the operating position and electrodes to receive and discharge material.

In testimony whereof I have hereunto signed my name.

JOHN W. BROWN.

Witnesses:
RALPH H. ATKINSON,
GEORGE H. BROWN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."