

No. 757,634.

PATENTED APR. 19, 1904.

E. F. PRICE.
ELECTRIC RESISTANCE FURNACE.

APPLICATION FILED APR. 30, 1903.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.

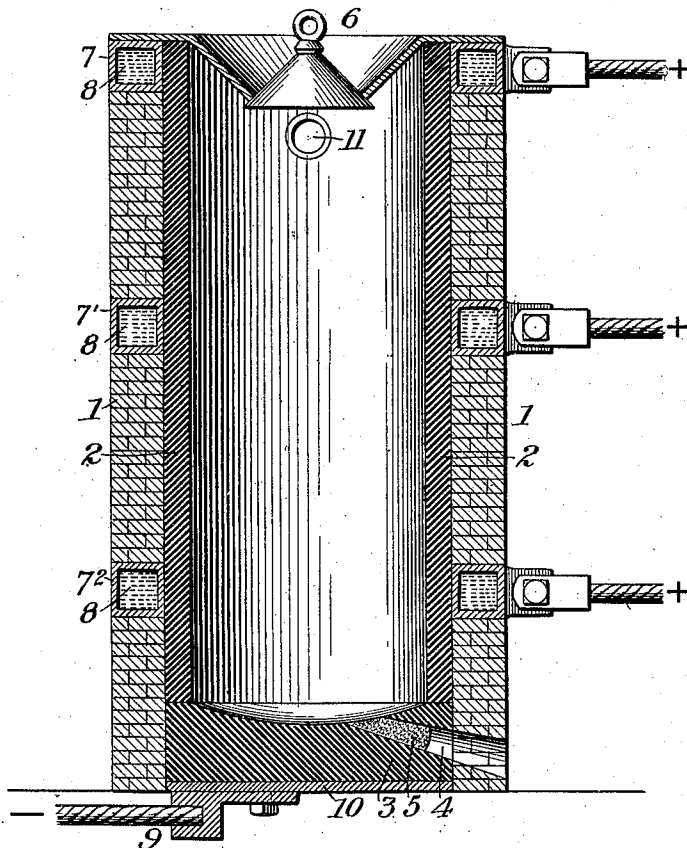
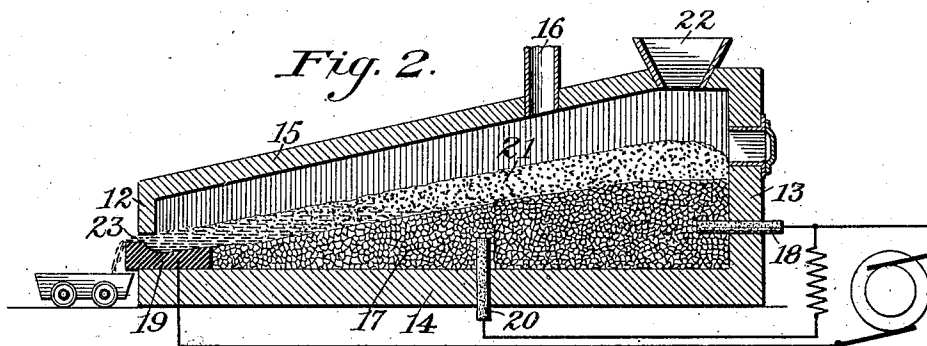


Fig. 2.



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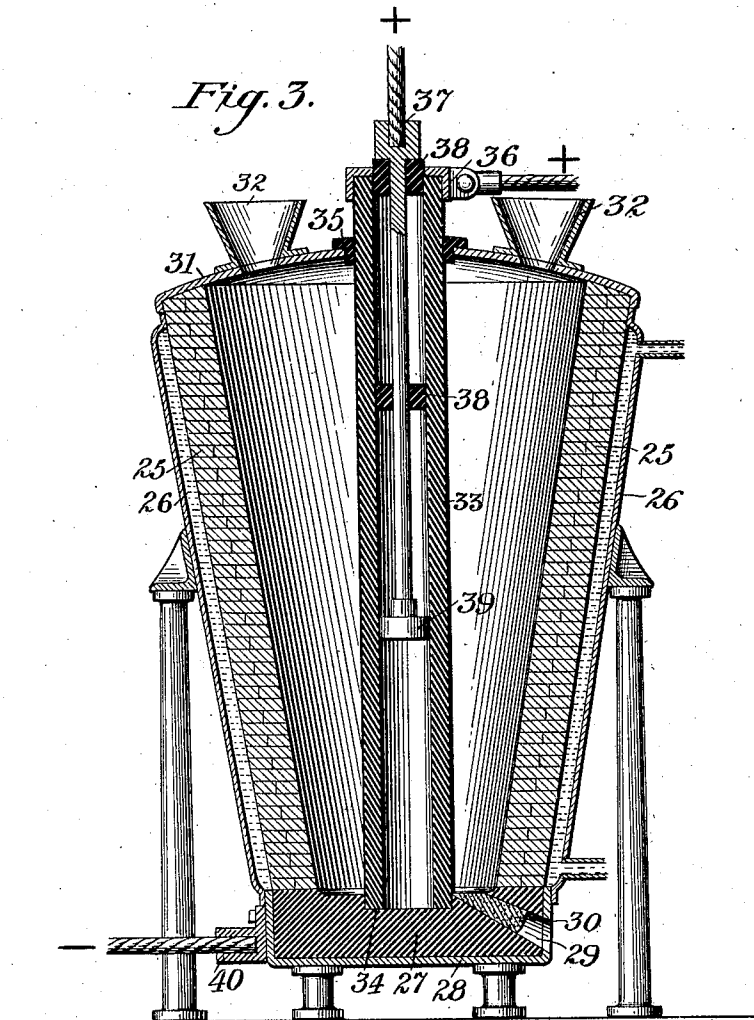
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UNITED STATES PATENT OFFICE.

EDGAR F. PRICE, OF NIAGARA FALLS, NEW YORK, ASSIGNOR TO UNION CARBIDE COMPANY, OF NIAGARA FALLS, NEW YORK, A CORPORATION OF VIRGINIA.

ELECTRIC-RESISTANCE FURNACE.

SPECIFICATION forming part of Letters Patent No. 757,634, dated April 19, 1904.

Application filed April 30, 1903. Serial No. 155,024. (No model.)

To all whom it may concern:

Be it known that I, EDGAR F. PRICE, a citizen of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Electric-Resistance Furnaces, of which the following is a specification.

This invention is an electric-resistance furnace for heating materials, especially mixtures of a metallic compound and a reducing agent, and specifically lime and carbon for the production of calcium carbid. The furnace is designed to effect reactions at high temperatures, and the construction is such as to facilitate the withdrawal of any molten products through a tap-hole.

The furnace comprises a resistance-conductor in position to heat the charge and means for passing through the conductor a plurality of electric currents which are superposed in such order that the current density increases through a portion of the conductor in proximity to the charge, heating it ununiformly. The outlet for the molten product, if any, is preferably placed adjacent to the region of maximum current density in the resistance-conductor, so that the product may be heated to a high temperature, and thereby brought into a highly-fluid condition. This feature is of especial importance in the production of calcium carbid, which attains a fluidity sufficient to permit it to be tapped from a furnace only at very high temperatures.

The invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a vertical axial section of a stack-furnace. Fig. 2 is a vertical longitudinal section of a hearth-furnace, and Fig. 3 is a vertical section of a furnace employing a central resistance-conductor.

The furnace shown in Fig. 1 comprises a vertical stack 1 of refractory non-conducting material, such as magnesia fire-brick, within which is a continuous tubular lining 2 of refractory conducting material, such as carbon. The hearth 3 of the furnace is also of refractory conducting material, such as carbon, and

has a tap-hole 4, which may be closed by a plug 5. The top of the furnace is provided with a bell and hopper charging mechanism 6. A plurality of metal rings 7 7' 7² (shown as three in number) surround the carbon lining 2 and are connected to one terminal or several terminals of like sign of the source or sources of electric current. Each of these metal rings preferably has a central passage 8 for water or other cooling medium. The other terminal or terminals 9 of the source or sources of electric current are connected to an iron plate 10, which underlies and makes good electrical contact with the carbon hearth 3. The metal rings 7 7' 7² are built into the brick shell 1 of the furnace and are so arranged and spaced upon the carbon lining 2 that the current flowing through this lining acting as a resistance-conductor from the intermediate ring 7' to the hearth 3 is superposed upon the current flowing from the upper ring 7 through the resistance-conductor to the hearth 3. Similarly, the current flowing from the lower ring 7² to the hearth is superposed upon both of the currents flowing from the upper ring 7 and the intermediate ring 7' to the hearth. It will thus be seen that the density of the total current flowing through the resistance-conductor increases by steps from the upper to the lower end of the conductor, so that it is heated ununiformly. When the furnace is filled with a charge, such as a mixture of lime and carbon in proper proportion to form calcium carbid, the temperature of the charge will be gradually raised as it descends within the furnace by the heat radiated from the resistance-conductor and by the hot gases rising from the zone of reduction until the materials reach a point where they react to form calcium carbid. This carbid may be allowed to accumulate as a pool in the hearth and drawn off from time to time through the tap-hole or may be allowed to run out continuously as produced. Fresh material is fed in at the top as the charge is reduced and descends within the furnace. The waste gases escape from the top of the furnace through an outlet 11.

The furnace shown in Fig. 2 comprises end walls 12 13, floor 14, and roof 15 of refractory non-conducting materials, such as fire-brick. A feed-hopper 22 and waste-gas pipe 16 pass through the roof. On the floor of the furnace lies a resistance-conductor 17, which may be of loose material, such as broken coke. The upper surface of this conductor slopes downwardly from a point beneath the hopper to the discharge end of the furnace. An electrode 18, such as a carbon rod, extends into the resistance-conductor at some point remote from the discharge end of the furnace and is connected to one terminal of a source of current. Another electrode 19—for example, a carbon slab—is placed in contact with the resistance-conductor at the discharge end of the furnace and connected to the other terminal of the dynamo. A third electrode 20, connected to electrode 18, leads into an intermediate part of the resistance-conductor. The material to be heated 21 is fed into the furnace through hopper 22 and distributed in a layer upon the resistance-conductor. Electric currents are thereupon passed from electrodes 18 20 to electrode 19. It will be seen that the electric current flowing through the resistance-conductor between the electrodes 20 and 19 is superposed upon the current flowing between the electrodes 18 and 19, thus heating the conductor ununiformly, the density of the current in the conductor increasing toward the discharge end of the furnace. That portion of the charge 21—for example, lime and coke—near the electrode 19 will soon be brought to a temperature sufficient to cause the materials to react to form carbid and the carbid to be brought into a molten condition, whereupon it will flow out from the furnace through tap-hole 23. The charge 21 is then moved downward upon the conductor and fresh material introduced. If desired, the tap-hole may be temporarily closed by a plug of refractory material and the carbid drawn off intermittently.

The furnace shown in Fig. 3 is a vertical annular stack having a body or shell 25 of refractory material, such as magnesia fire-brick, surrounded by a water-jacket 26, and a hearth 27 of refractory conducting material, such as carbon, supported in an iron casing 28. The hearth has a tap-hole 29, which may be closed by a plug 30. The top of the furnace is closed by a metal dome 31, having charging-hoppers 32. A vertical column 33 of refractory conducting material, here shown as a tube of carbon, is arranged centrally within the furnace and serves as a resistance-conductor. The lower end of this conductor is seated in a recess 34 in the carbon hearth, and the upper end of the conductor passes through an insulating-bushing 35, seated in a central opening in the metal dome 31. One terminal, 36, of a source of electric current is connected to the upper end of the resistance-conductor

33, and a second terminal 37 of similar polarity extends down within the tubular conductor, being insulated from its upper portion by rings 38, and is put in electrical contact with the conductor at a point 39 intermediate its upper and lower ends. The other terminal or terminals, 40, of the source or sources of electric current are connected to the metallic casing of the carbon hearth. It will be seen that the electric current flowing from the terminal 37 through the lower portion of the resistance-conductor to the hearth is superposed upon the current flowing from the terminal 36 through the conductor to the hearth, thereby heating it ununiformly. The charge fed in through hoppers 32 and lying around the resistance-conductor is thus gradually raised in temperature as it descends within the furnace, and the temperature in the region of the hearth may be carried to a point sufficient to effect reduction and enable any molten product to be withdrawn through the tap-hole which is adjacent to the region of maximum current density.

While in the operation of the furnaces shown and described the molten product flows out through a tap-hole and is therefore specified in the claims as withdrawn by gravity, it will be understood that in some cases the movement of the molten material may be assisted by mechanical means. For example, the tap-hole must be kept clear from obstructions and the flow of the carbid under the action of gravity may be suitably facilitated or assisted.

I claim—

1. An electric-resistance furnace, comprising a stable resistance-conductor in position to heat the charge, and means for passing different quantities of electric current through different portions of said conductor, thereby producing a varying current density through the conductor and heating it ununiformly, as set forth.

2. An electric-resistance furnace, comprising a stable resistance-conductor in position to heat the charge, means for passing different quantities of electric current through different portions of said conductor, thereby producing a varying current density through the conductor and heating it ununiformly, and means adjacent to the region of maximum current density for withdrawing a product by gravity, as set forth.

3. An electric-resistance furnace, comprising a stable resistance-conductor in position to heat the charge, and means for passing through said conductor a plurality of electric currents superposed in such order that the current density increases through the conductor, thereby heating it ununiformly, as set forth.

4. An electric-resistance furnace, comprising a stable resistance-conductor in position to heat the charge, means for passing through said conductor a plurality of electric currents superposed in such order that the current

density increases through the conductor, thereby heating it ununiformly, and means adjacent to the region of maximum current density for withdrawing a product by gravity, as set forth.

5 5. An electric-resistance furnace, comprising a stable resistance-conductor in position to heat the charge, and means for passing through said conductor a plurality of electric currents superposed in such order that the current
10 density increases along the path of the current through the conductor, thereby heating it ununiformly, as set forth.

6. An electric-resistance furnace, comprising a stable resistance-conductor in position to
15 heat the charge, means for passing through said conductor a plurality of electric currents superposed in such order that the current density increases along the path of the current through the conductor, thereby heating it un-

uniformly, and means adjacent to the region of 20 maximum current density for withdrawing a product by gravity, as set forth.

7. An electric-resistance furnace for the production of carbids, comprising a stable resistance-conductor in proximity to the charge 25 of carbid-forming materials, and means for passing through said conductor a plurality of electric currents superposed in such order that the current density increases through the conductor to a point where the heat generated by 30 the resistance of the conductor will cause the materials to react to form carbid, as set forth.

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

EDGAR F. PRICE.

Witnesses:

GEO. H. DANFORTH,
F. B. O'CONNOR.