No. 865,608. PATENTED SEPT. 10, 1907.

E. F. PRICE.

PROCESS OF BAKING CARBON ELECTRODES AND HEATING BY ELECTRICITY AND COMBUSTION.

APPLICATION FILED APR. 22, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

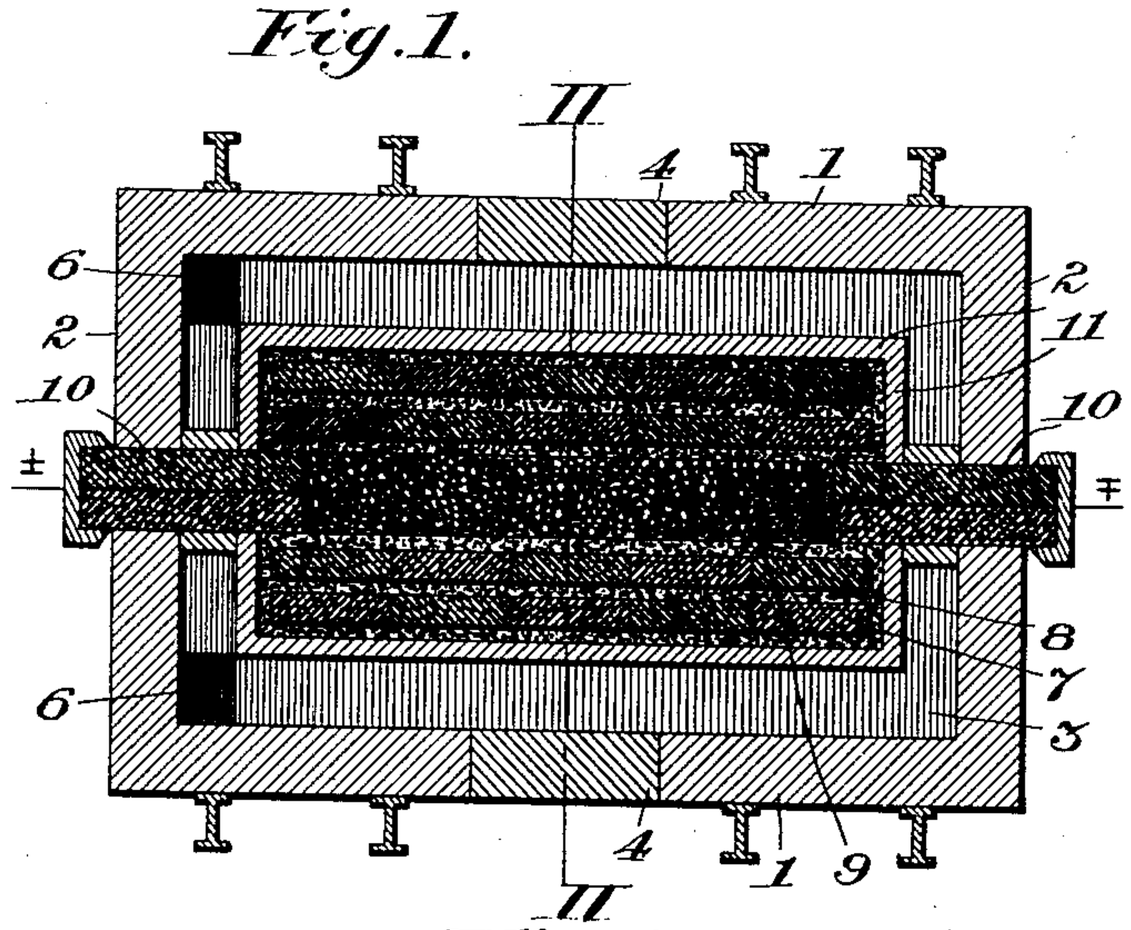
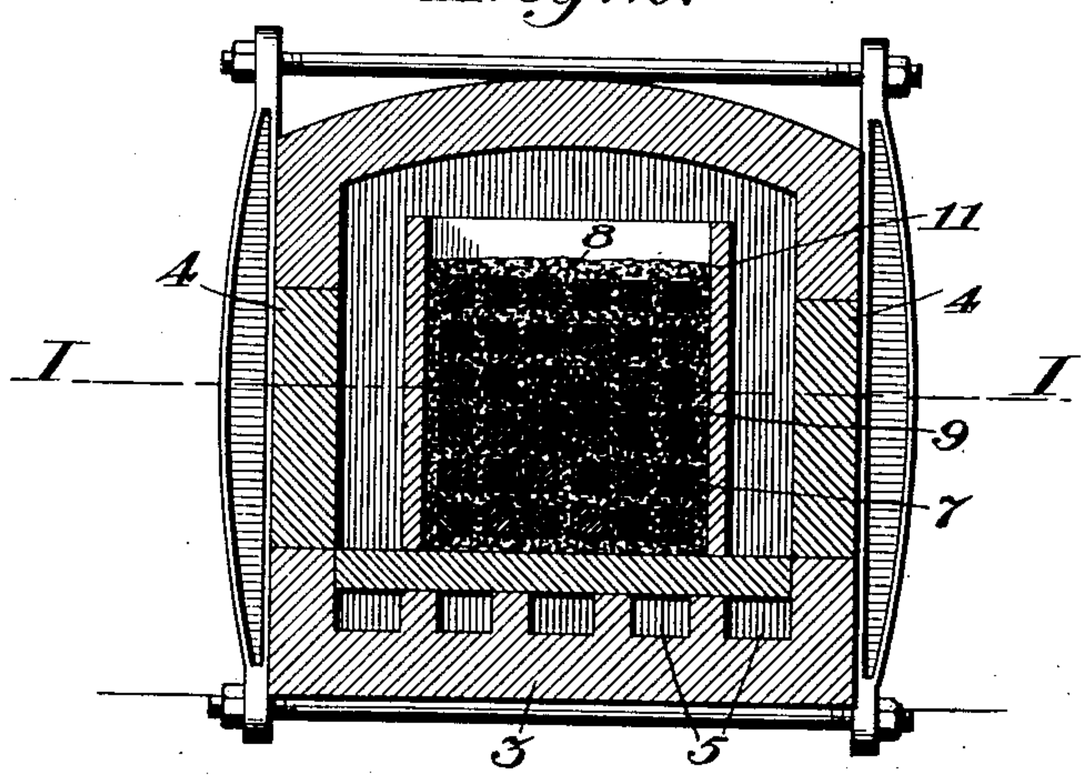


Fig. 2.



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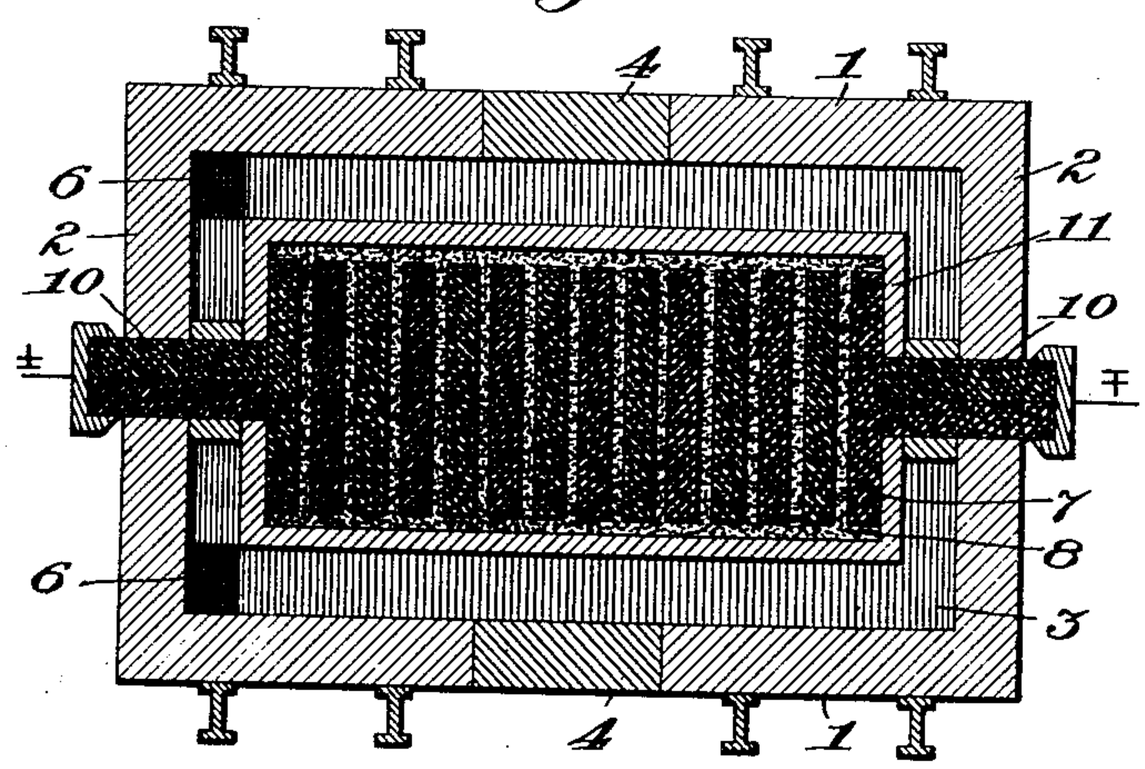
2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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PROCESS OF BAKING CARBON ELECTRODES AND HEATING BY ELECTRICITY AND COMBUSTION.

No. 865,608. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed April 22, 1905. Serial No. 256,888.

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 Processes of Baking Carbon Electrodes and Heating by Electricity and Combustion, of which the following is a specification.

In United States Letters Patent Numbers 752 357 and 752,358, granted to me February 16, 1904, I have described and claimed certain processes of electrically baking the carbon electrodes which are used in carbid and other electric furnaces. In these processes the green or partially baked electrodes are placed around a resistance-core and within a suitable packing and an electric current is then passed through the core and in some cases through the packing and electrodes, which are thereby heated to the required temperature. If the electrodes are taken directly from the molds or press to the electric furnace and the baking is effected entirely by electricity, the expense is greater than when a combustion furnace is employed. If the electrodes have been initially baked by combustion, they are ordinarily allowed to cool and the heat stored in them is dissipated and lost before they are placed in the electric furnace.

According to the present process, the electrodes are initially heated by products of combustion and while hot are electrically heated to the required temperature. The electrodes to be baked are preferably embedded in a nonoxidizing, refractory packing, supported on the hearth of a combustion furnace. The final heating may be effected by an electric current passed through a resistance core, around and in proximity to which the electrodes are arranged. If an electrically-conductive packing is employed, a portion of the electric current will shunt from the core through the packing and electrodes, the resistance of which will increase the supply of heat. The required temperature may also be produced without employing a core, by arranging the electrodes transversely in a conductive packing and passing the electric current directly through the electrodes and interposed layers of packing, as described in U. S. Patent 749,418, granted January 12, 1904, to E. G. Acheson.

In the electric furnaces now employed for the production of graphite, carborundum and calcium carbid, a considerable portion of the heat is conducted through the charge and furnace walls and lost, thereby materially decreasing the efficiency of the furnace and increasing the cost of the product. This loss may be prevented by surrounding the electric furnace with a combustion furnace or heating flues, and thus maintaining around the electric furnace a heat buffer or stratum of products of combustion having substantially the same temperature as the outer surface of the electric furnace walls. While the loss of heat from the outer surfaces of the walls of the combustion chamber or flues may then be equal to that normally dissipated from the electric furnace, the lost heat will be supplied by the direct combustion of fuel and a considerable economy will thus be effected. For this reason, in the specific process of baking carbons heretofore referred to, heating gases of the proper temperature are preferably passed around the charge both before and during the period of electric heating, the initial heating being thus effected solely by the combustion of fuel and the final heating jointly by combustion and electricity.

Referring to the accompanying drawings—Figure 1 is a horizontal section through a furnace for baking electrodes, with the electrodes, packing and resistance core in place, on the line I—I of Fig. 2; Fig. 2 is a transverse vertical section on the line II—II of Fig. 1; and Fig. 3 is a horizontal section through a similar furnace in which the electrodes are placed transverse to the path of the electric current.

The combustion furnace may be of any usual or preferred type, that shown comprising side walls 1, end walls 2 and a hearth 3. The side walls contain door openings 4 which are bricked up during the operation of the furnace. The hearth contains longitudinal, parallel flues 5, which receive and carry hot products of combustion and deliver them into the furnace chamber through openings 6 at one end. The products thence pass longitudinally through the furnace and escape from the other end through a stack, not shown.

In the furnace shown in Figs. 1, 2, the carbon electrode bars 7 are placed end to end within a refractory non-oxidizing packing 8, which may consist either of granular coke, anthracite coal or other material which is electrically conductive or will be converted into a conductor when heated, or of a nonconductor, such as magnesia or sand. The electrodes are grouped around a central resistance conductor 9, which may be of broken coke, the ends of which are in contact with electric terminals 10, preferably carbon bars, extending through the end walls of the furnace. The electrodes, packing and core are supported on the furnace hearth between side and end walls 11, preferably of tile, which are spaced away from the side and end walls of the furnace. In employing this furnace to carry out the process, the molded electrodes, packing and core are placed in position and hot products of combustion are passed through the hearth-flues and furnace chamber, thereby initially heating the electrodes, packing and resistance conductor and increasing the electrical conductivity of each. An electric current is then passed through the heated core, between the terminals 10, and the partially baked electrodes are thereby heated to the required temperature, both

by the heat radiated from the core and by the current shunted through the packing and electrodes, if a conductive packing be employed. It is preferable to simultaneously supply hot products of combustion to the furnace and pass electric current through the core, the baking being thereby quickly and economically effected. The maximum economy is generally effected by supplying heating gases during the second stage of the process at a temperature at least equal to that of the surfaces from which the electrically-generated heat would otherwise be dissipated. If the gases are below this temperature, electric heat is lost, and if they are above it the transfer and loss of heat through the outer furnace-walls is unnecessarily increased.

The furnace shown in Fig. 3 is identical with that previously described, but the resistance core is omitted and the electrodes 7 are placed transversely within an electrically-conductive packing 8. The end electrodes are in contact with the terminals 10 and the electric heating is effected by the resistance of the electrodes and packing, only.

Carbon electrodes can be baked at a much lower cost by the present process than by those described in my previous patents, since the initial heating is effected at a relatively low cost by combustion of fuel while the final high temperature is obtained by electricity, the heat supplied by combustion nevertheless being retained. The initial heating is also advantageous in that it increases the electrical conductivity of the electrode-bars, packing and core, if used, thereby enabling the electric current to be supplied at a lower potential. The electrodes to be baked may themselves constitute the resistance conductors specified in claim 1.

I claim:—

1. The process of baking carbon electrodes, which consists in initially heating the electrodes and a resistance conductor or conductors by combustion, and heating the hot electrodes to a higher temperature by passing an electric current through said conductor or conductors, as set forth.

2. The process of baking carbon electrodes, which consists in placing the electrodes in proximity to a resistance conductor, initially heating the electrodes by combustion, and heating the hot electrodes to a higher temperature by passing an electric current through said resistance conductor, as set forth.

3. The process of baking carbon electrodes, which consists in initially heating the electrodes by combustion, and heating the hot electrodes to a higher temperature by passing an electric current through them, as set forth.

4. The process of baking carbon electrodes, which consists in placing the electrodes in proximity to a resistance conductor, initially heating the electrodes and resistance conductor by combustion, and heating the hot electrodes to a higher temperature by passing an electric current through said resistance conductor and electrodes, as set forth.

5. The process of baking carbon electrodes, which consists in placing the electrodes transverse to the path of current-flow, with intermediate layers of an electrically-conductive packing, initially heating the electrodes by combustion, and heating the hot electrodes to a higher temperature by passing an electric current through said electrodes and packing, as set forth.

6. The process of baking carbon electrodes, which consists in embedding the electrodes transverse to the path of current-flow in an electrically-conductive packing, initially heating the electrodes by combustion, and heating the hot electrodes to a higher temperature by passing an electric current through said electrodes and packing, as set forth.

7. The process of baking carbon electrodes, which consists in initially heating the electrodes by combustion, heating the hot electrodes to a higher temperature by electricity, and preventing the escape of electrically-generated heat by a gaseous medium heated by combustion, as set forth.

8. The process of baking carbon electrodes, which consists in initially heating the electrodes by combustion, heating the hot electrodes to a higher temperature by passing an electric current through a resistance conductor, and preventing the escape of electrically-generated heat by maintaining hot products of combustion around the zone of electric heating, as set forth.

9. The process of baking carbon electrodes, which consists in initially heating the electrodes by combustion, heating the hot electrodes to a higher temperature by passing an electric current through a resistance conductor, and maintaining in contact with the surfaces which tend to dissipate electrically-generated heat, products of combustion having a temperature substantially equal to that of said surfaces, as set forth.

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

EDGAR F. PRICE.

Witnesses:
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D. BURGESS.