P. L. T. HÉROULT.

GRAPHITIZING ELECTRODES.

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Patented June 11, 1912.

1,029,122.

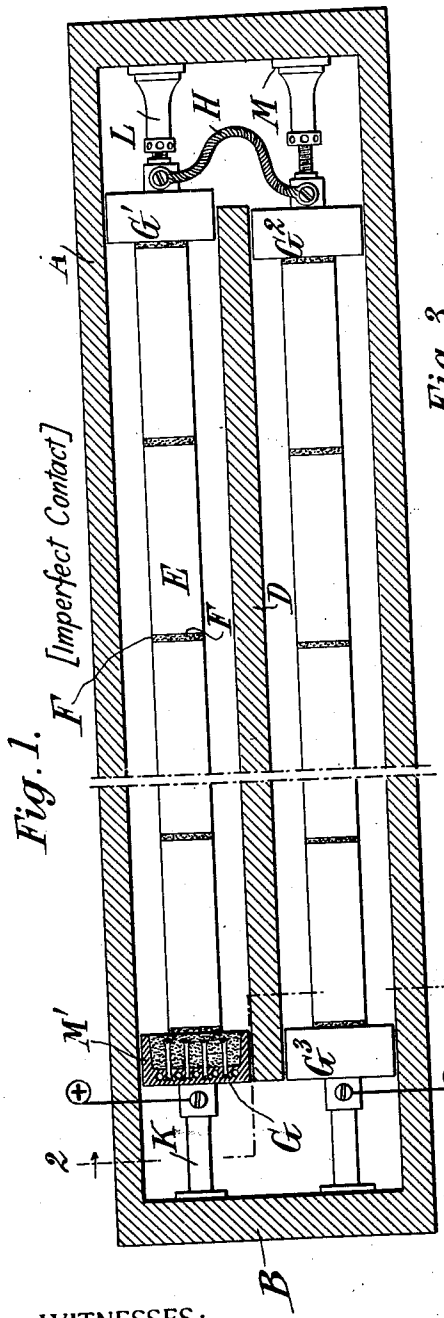


Fig. 1.

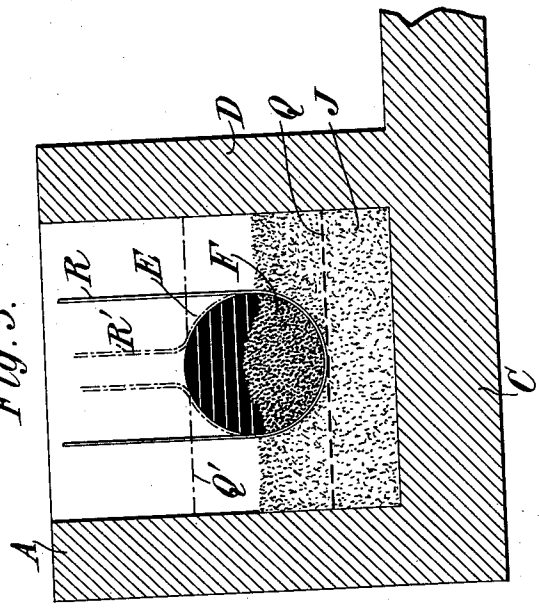


Fig. 3.

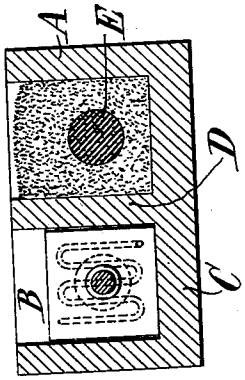


Fig. 2.

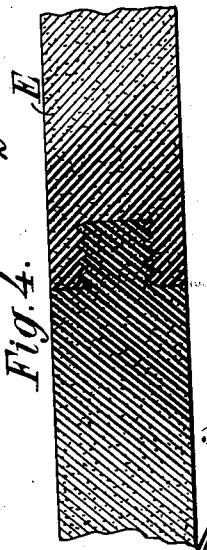


Fig. 4.

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GRAPHITIZING ELECTRODES.

1,029,122. Specification of Letters Patent. Patented June 11, 1912.

Application filed February 10, 1910. Serial No. 543,067.

To all whom it may concern:

Be it known that I, PAUL LOUIS TOUSSAINT HÉROULT, a citizen of the Republic of France, residing in La Praz, Savoy, France, have invented certain new and useful Improvements in Graphitizing Electrodes, of which the following is a specification.

The present invention aims to secure electrodes for electric furnaces and other uses which are of greater efficiency and economy than those heretofore used, and which can be manufactured easily and comparatively cheaply.

The product of the invention is an electrode or a section of an electrode having one or both ends graphitized and having another part which is not graphitized to the same extent as the end, being graphitized to a less degree or not at all according to the circumstances of its use. Such an electrode or section is secured by subjecting the end of it to graphitizing conditions while avoiding the same conditions at another part of the electrode. Preferably this action is secured by arranging the electrodes or sections end to end with imperfect contact and passing a current through them so as to cause the graphitizing of the contacting ends before the rest of the electrode.

It is common practice to make up compound electrodes by screwing together the ends of two sections. With the sections made in accordance with this invention the carbon at the ends by reason of the excessive heat generated there through the imperfect contact is easily machined and is also of high conductivity so as to minimize the tendency to make an imperfect joint at this point by the finished electrode. The middle parts of the sections are not graphitized or at least not to the same extent as the ends. Consequently the heat conductivity of these parts is less than that of the ends and the losses of heat in the furnace in which the electrode is used are diminished.

The accompanying drawings illustrate an embodiment of the invention:—

Figure 1 is a plan partly in section of a furnace at work, omitting the blanketing material. Fig. 2 is a cross section on the line 2—2 of Fig. 1. Fig. 3 is a cross section, on a larger scale than Figs. 1 and 2 of parts of the furnace. Fig. 4 is a longitudinal sectional view of the joint connecting the ends of two sections of a compound electrode.

The furnace used is of a type similar to that covered in my application No. 523,194 for patent for graphitizing large electrodes. This furnace has side walls A, end walls B and a bottom C of brick work with a central longitudinal partition D also of brick work for retaining the granular material which is used as a blanket to keep the heat in. The central partition D divides the furnace into two longitudinal compartments in which the process is carried on.

In executing the process there is arranged in each of the compartments a long line of electrodes E placed end to end with a packing F of graphite between them of such a nature and construction as to form an imperfect electrical connection between them. A current is passed through the line of electrodes of sufficient volume and intensity to create a high temperature at the end portions of the electrodes where the contact is imperfect, with a lower temperature at the other points; the conditions being calculated so that the end of the electrodes will be graphitized to the desired extent while the other parts are graphitized to a less extent or not at all.

Before passing the current through the line of electrodes each of the chambers of the furnace is closed at its ends by terminal blocks approximately fitting the rectangular cross section of the chamber. These terminal blocks are indicated at G G′ G^2 and G^3.

The terminal G is connected to the positive cable and the terminal G^3 to the negative cable. The terminals G′ and G^2 are connected to each other by means of a flexible cable H.

The column of electrodes is surrounded by a heat retaining blanket J which may be for example of pulverized charcoal. It is retained at the sides by longitudinal walls A and the partition D and at the ends by terminal blocks G G′ G^2 and G^3. Preferably these blocks are arranged to make an imperfect electrical connection with the adjacent ends of the electrodes. The blocks G and G^3 are supported by struts K bearing against the adjacent end wall of the furnace. The opposite blocks G′ and G^2, between which is the flexible connection H, are

backed by jacks L of any suitable type such as screw jacks or hydraulic jacks with which a constant pressure may be maintained against the ends of the electrodes. Blocks M of wood or other yielding material are arranged behind the jacks so as to automatically provide for the expansion which occurs when the current is first turned on and for the shrinkage which subsequently follows.

The construction of one of the blocks is shown in the section view at G, Fig. 1. A cup-shaped shell M of cast iron is cast with an encircling pipe therein for cooling it with water, and with prongs of wrought iron embedded in the bottom of the shell and projecting therefrom to unite the shell firmly to the filling of carbon within the shell. For securing a connection of exactly the desired degree of conductivity or resistivity between the ends of the electrodes E I preferably use powdered graphite and introduce it between the ends of the electrodes, pressing the electrodes together during the graphitizing process by means of the jacks L. The method of introducing the graphite is indicated in Fig. 3. The powdered charcoal J is first introduced to the level Q and the electrode E laid thereon, with a strip R of paper, sheet metal or other flexible material passed around under the joint. The ends of the strip are brought upward as shown in full lines after which the powdered charcoal is introduced to the level indicated in full lines, and the powdered graphite introduced from the top and tamped sufficiently to secure the desired degree of compactness. The paper is then brought together in the manner indicated in dotted lines at R′, and the powdered charcoal raised to the level Q′ and the graphite introduced to the same level; and so on until the graphite is introduced throughout the joint. The ends of the strip R are then removed and the charcoal filled in upon the top of the electrode to the desired height. The jacks are then used to compress the joints to the desired degree of compactness and the current is applied.

Fig. 4 shows the connecting ends of two of the electrodes E, the heavier shading indicating the greater degree of graphitization at the ends. The connection is made in this case by turning an external thread on one section and an internal thread on the other and screwing the two parts firmly together. Other known or suitable styles of connection may be used. The invention may be applied to the making of one-piece electrodes, large or small, as well as to the making of the electrodes or electrode sections shown which are intended for the subsequent manufacture of compound electrodes.

In a specific example of the process the electrodes may be of about twenty inches diameter or equivalent cross section. A current of 20,000 amperes may be used. The contact between the adjacent ends of electrodes may be roughly about ten times as resistant as are the solid electrodes, and the desired degree of resistivity may be secured by using crushed graphite of suitable fineness.

What I claim is:—

1. The method of graphitizing an electrode which consists in subjecting an end of the electrode to imperfect contact with a resistant conductor, and passing a sufficient current through the electrode and such resistant conductor, whereby such end of the electrode is heated to graphitizing temperature while the remainder of the electrode is heated to a lower temperature.

2. The method of graphitizing electrodes which consists in arranging them end to end with imperfect contact, subjecting them to longitudinal pressure and passing a current through them to graphitize their contacting ends.

3. The method of graphitizing electrodes which consists in arranging them end to end with an intervening resistant packing affording imperfect contact, subjecting them to longitudinal pressure and passing a current through them to graphitize their contacting ends.

4. An electrode made up of sections jointed together, the joined ends of which are graphitized and other parts of which are not graphitized to the same extent.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

PAUL LOUIS TOUSSAINT HÉROULT.

Witnesses:

D. ANTHONY USINA,

FRED WHITE.