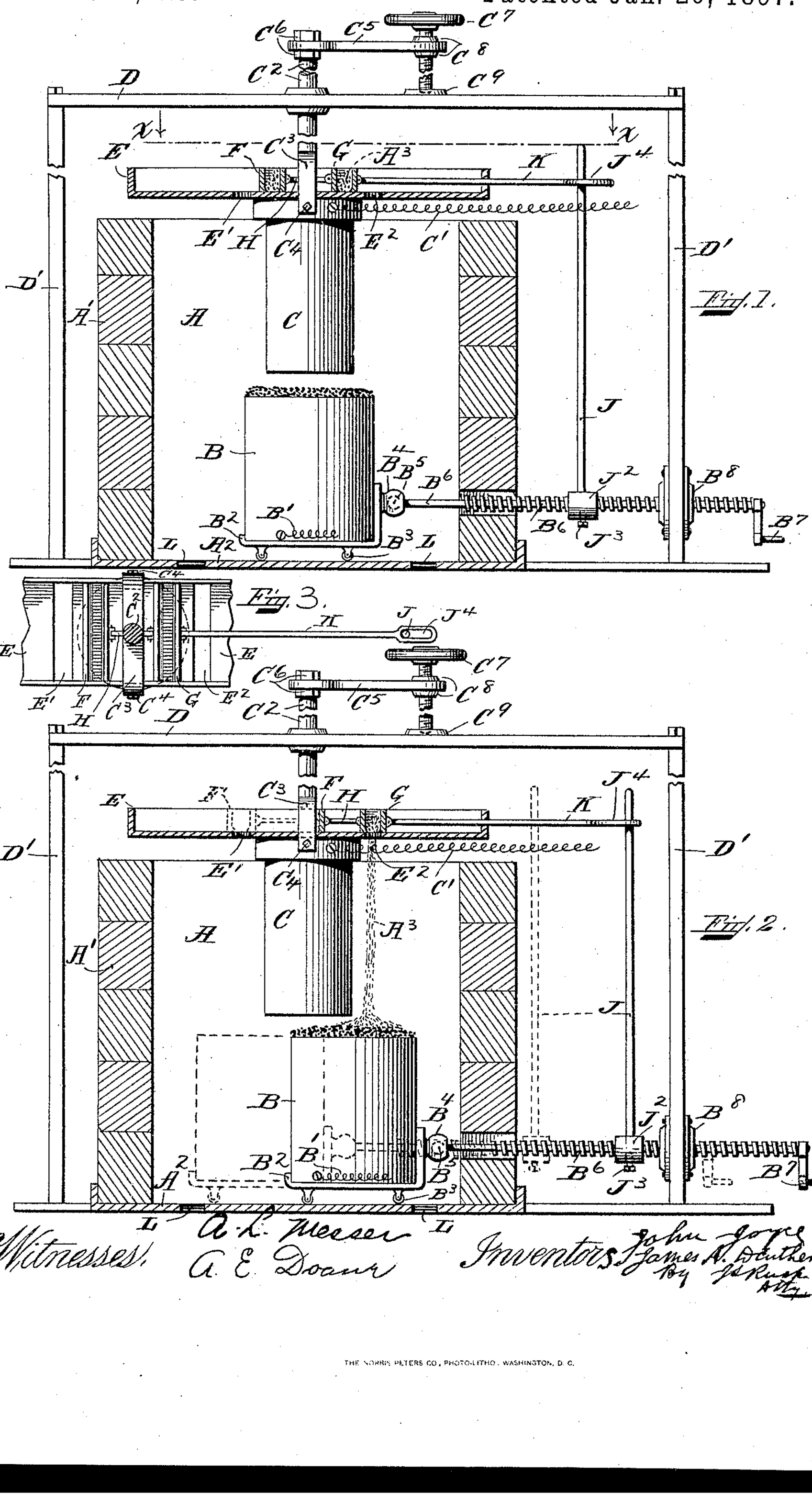
(No Model.)

J. JOYCE & J. A. DEUTHER.

ELECTRIC FURNACE.

No. 575,829. Patented Jan. 26, 1897.



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UNITED STATES PATENT OFFICE.

JOHN JOYCE, OF ANDOVER, AND JAMES A. DEUTHER, OF BOSTON, MASSACHUSETTS.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 575,829, dated January 26, 1897.

Application filed October 12, 1896. Serial No. 608,595. (No model.)

To all whom it may concern:

Be it known that we, JOHN JOYCE, of Andover, county of Essex, and JAMES A. DEUTHER, of Boston, county of Suffolk, State of Massachusetts, have invented certain new and useful Improvements in Electric Furnaces; and we hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to improvements in electric furnaces for the manufacture of calcium carbid and for the reduction of refractory and other metallic compounds; and its main object is to facilitate the bringing of the material to be treated directly within the influence of the electric arc formed between two separated electrodes, and through which the electric current passes.

In electric furnaces the heat generated between two separated electrodes is sufficiently intense within the field of the arc formed between said electrodes for reduction, while outside of the influence of the arc the heat is not sufficient for such purpose.

For electric furnaces to be economical and practical the heat incident upon the formation of the arc should continuously act upon the material to be treated, and said material should be introduced or brought directly within the influence of the arc, and, further, when such material has been properly affected by the heat incident upon the formation of the arc new material should be supplied for treatment, and no time should be lost in introducing the proper amount of new material required.

To illustrate, in the process of making calcium carbid in electric furnaces this compound, when pure, is composed of metallic calcium and carbon, the metallic calcium required being obtained, preferably, from oxid of calcium and the carbon from coke. Now in order to bring about the chemical formation of calcium carbid from said materials the heat of the arc is necessary, and while it may be of very high temperature at the seat of the arc, yet the temperature a few inches from the seat of the arc is not high enough to produce the product required. This lower temperature, however, at a few inches from the seat of said arc is sufficient to form combustion of the carbon mixed with oxid of calcium and properly volatilize the lime, and before this so-called "burned-out" mixture of oxid of calcium can again be utilized or properly treated by the arc to produce calcium carbid additional carbon must be added to take the place of the carbon burned out. Consequently to avoid the action of burning out of the carbon, as above described, it is necessary that the material to be treated should be introduced or fed directly within the influence of the arc, so as to be acted upon in a comparatively short time.

As is well known, in the practical application of the heat incident upon the formation of the electric arc in the treatment of certain materials, especially refractory compounds in electric furnaces, difficulty is experienced in bringing the materials or compounds to be so treated in said electric furnaces directly and at stated and determined periods of time within the sphere of the influence of the electric arc to be properly acted upon by said electric arc. The sphere of influence of the electric arc in the reduction of certain alkaline earths may be defined as where the heat consequent upon the formation of the electric arc is of sufficiently high temperature to bring about a reduction of the alkaline earths or other compounds under treatment.

Now it is the purpose and object of our invention to facilitate the bringing of the compounds under treatment in the electric furnace within the sphere of influence of the arc, and to bring said compounds in determined quantities at determined periods of time, and to maintain and keep said compounds in determined quantities for determined periods of time within the influence of the electric arc formed between two separated electrodes.

In the accompanying drawings, which illustrate a construction embodying our invention, Figure 1 is a vertical cross-section through the electric furnace and showing the opposite electrodes in full lines. Fig. 2 is a similar view, but showing in full lines the lower electrode moved toward the right and

also showing in dotted lines the lower electrode moved toward the left. Fig. 3 is a detail plan view, hereinafter described, looking down from the line X X, Fig. 1.

The electric furnace A is constructed of fireproof material A′, and located in the bottom of the furnace is the electrode B, of conducting material and connected to one pole of an electric generator by a suitable wire B′, and preferably, but not necessarily, of larger diameter than the upper electrode C, which is connected to the other pole of the electric generator by a suitable wire C′.

The upper electrode C is suspended above the electrode B by means of a rod C^2, which is provided with two forked arms C^3, secured by suitable nuts C^4 to the upper part of the electrode C. The rod C^2 extends upwardly through the cross-beam D, supported by the side beams D′, and the upper end of the rod C^2 projects through the cross-bar C^5, and suitable nuts C^6 hold said rod C^2 connected to the cross-bar C^5. Through the opposite end of the cross-bar C^5 the lifting-screw C^7, working in the nut C^8, is arranged, and its lower end works in the socket C^9 on said cross-beam D, and by means of said lifting-screw C^7 the upper electrode C can be raised and lowered by the mechanism above described.

To the top of the electrode C is firmly secured a rectangular receptacle E, provided on opposite sides of the electrode C with the ports E′ and E^2.

Within the receptacle E are two movable bottomless boxes F and G, connected together by the cross-bar H, and in the normal position of the parts said boxes are in the position shown in Fig. 1, between the ports E′ and E^2.

The bottom electrode B is mounted on a suitable casting B^2, provided with rollers B^3 to facilitate the movement of said lower electrode along the bottom plate A^2. Said casting B^2 is provided on one side with a socket B^4, in which is held a ball B^5 on the inner end of the shaft B^6, having a worm-gear throughout the greater part of its length, and which extends out through the side wall A′ and the side beam D′ and at its outer end is provided with a suitable handle B^7. Firmly secured in the side beam D′ is a nut B^8, in which the worm-gear on the shaft B^6 works. At about the center of the shaft B^6 there is located a vertical rod J, having a sleeve J^2 surrounding the shaft B^6, and a pin J^3 projects through said sleeve into the groove of the worm-gear, so that in the operation of said shaft B^6 the movement thereof operates the vertical rod J. The upper end of said rod J extends through an eye J^4 on the end of the rod K, which passes through the receptacle E and is connected at its outer end with the box G.

It is obvious that by turning the handle B^7 the lower electrode B can be moved toward the right, as shown in Fig. 2, and in the same movement the rod J acts on the rod K and moves the boxes F and G to the positions shown, so that the material contained in the box G passes from said box G, through the port E^2 down onto the top of the bottom electrode B. By turning the handle B^7 the lower electrode B can be moved to the position shown in dotted lines, Fig. 2, and in said movement the rod J, acting on the rod K, will move the boxes F and G so that the box F will register with the port E′, as shown in dotted lines, Fig. 2, and the material will drop down onto the top of the lower electrode B.

The amount of material placed in the boxes F and G being known, it is obvious that a determined amount of material to be treated can be brought within the influence of the heat incident upon the formation of the arc between the opposite electrodes, and an amount can thus be added proportional to the heat generated by the arc.

As the material is reduced between the electrodes the same may be separated, and thus provide room for more material by operating the lifting-screw C^7 and connecting mechanism to raise the electrode C, which, while increasing the length of the arc between the electrodes, does not break the circuit, as the reduced material is a conductor and forms then a part of the lower electrode.

From the above it is clear that the new material A^3 to be treated is dropped onto the lower electrode or onto the material previously smelted. Consequently as the electrode is moved toward its original position the material is brought directly within the influence and in the path of the electric arc, the heat is fully utilized, and a great saving is accomplished over furnaces where the material is not so directly and positively brought within the influence of the arc, because, as previously stated, the heat necessary for smelting is of sufficient intensity only within the influence of the arc formed between the opposite electrodes, and the current is not consumed merely in forming the arc.

The movement of the lower electrode B, it will be understood, does not break the circuit, but the arc moves correspondingly with the movement of the lower electrode, as it is well known that the electric arc between two electrodes will follow the path of least resistance, and consequently will be formed in those portions of the two electrodes which are nearest to each other.

When the electrode B is in the position shown in full lines, Fig. 2, to receive new material on the right side, the material on the other half of the electrode is within the influence of the arc, and as the electrode B is moved toward the left to receive the material on the left side of the electrode the material which has been fed on the right side of the electrode B is being acted upon by the electric arc. Consequently it is clear that while the electrode B is receiving new material the electric arc is acting on the material pre-

viously received, so that the material is brought directly in the path of the moving arc, and consequently within the direct influence of the heat incident upon the formation of said arc.

Suitable openings L are provided in the bottom plate A^2 through which the raw material not acted upon by the arc may be withdrawn.

We do not limit ourselves to the arrangement and construction shown, as the same may be varied without departing from the spirit of our invention.

Having thus ascertained the nature of our invention, what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an electric-arc furnace, an upper electrode, a lower electrode, a mechanism for moving said electrode from its normal position to expose the same to receive the material to be treated, a mechanism for returning said lower electrode to its normal position, and a feed mechanism for feeding the material to be treated onto said lower electrode during the interval between the movements of the lower electrode from and to its normal position.

2. In an electric-arc furnace, an upper electrode, a lower electrode, mechanism for moving said lower electrode from its normal position to expose the same to receive the material to be treated, and a feed mechanism operated by the said movement of said lower electrode for feeding the material to be treated onto said lower electrode.

3. In an electric-arc furnace, an upper electrode, a lower electrode, mechanism for moving said lower electrode from its normal position to expose the same to receive the material to be treated, and an intermittent feed mechanism connected to the upper electrode and adapted to be operated by the said movement of the lower electrode to intermittently feed the material to be treated onto said lower electrode.

4. In an electric-arc furnace, an upper electrode, a lower electrode, mechanism for varying the distance between said electrodes, mechanism for moving said lower electrode from its normal position to expose the same to receive the material to be treated, and a feed mechanism connected to said upper electrode and adapted to be operated by the movement of the said lower electrode to intermittently feed the material to be treated onto said lower electrode.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, on this 2d day of October, A. D. 1896.

JOHN JOYCE.
JAMES A. DEUTHER.

Witnesses:
A. L. MESSER,
A. E. DOANE.