(No Model.) 2 Sheets—Sheet 1.

J. A. DEUTHER.

ELECTRIC FURNACE.

No. 575,826. Patented Jan. 26, 1897.

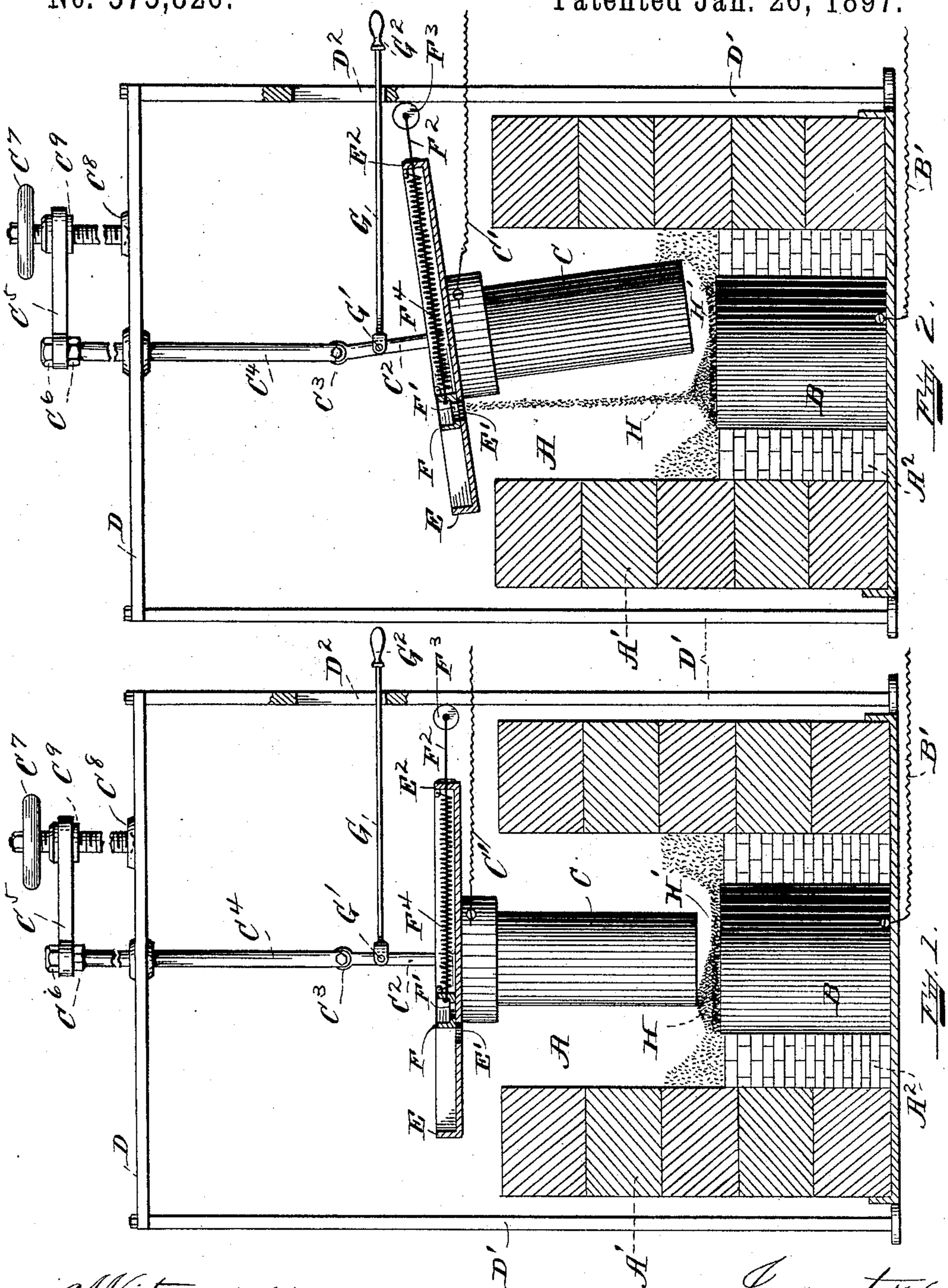

Fig. 1.

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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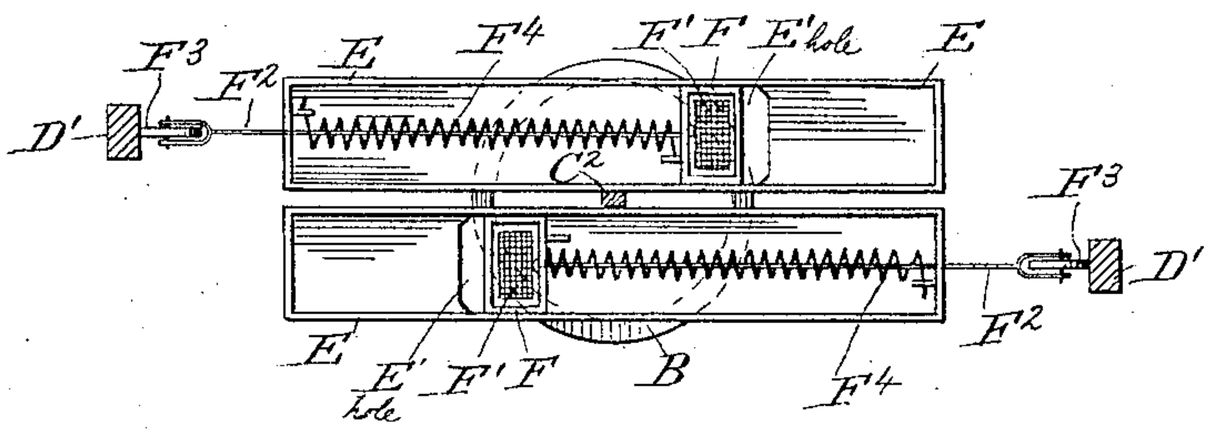
Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES A. DEUTHER, OF BOSTON, MASSACHUSETTS.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 575,826, dated January 26, 1897.

Application filed August 21, 1896. Serial No. 603,471. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. DEUTHER, of Boston, county of Suffolk, and State of Massachusetts, have invented certain new and useful Improvements in Electric Furnaces; and I 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.

My 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 acted upon directly within the influence of the electric arc formed between two separated electrodes, 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 smelting, while outside 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 fed 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. Now, while it is useful to surround the electrodes when in action with some material to prevent the heat incident upon the arc from affecting the walls and other parts of the furnace, yet it is at the same time wasteful to have more material than is necessary to prevent excessive radiation of heat from the arc. For instance, 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 said arc is not high enough to produce a comparatively pure product. This lower temperature, however, at a few inches from the seat of said arc is sufficient to cause combustion of the carbon mixed with the oxid of calcium, and probably 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 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.

Now it is the purpose and object of my invention to introduce or feed directly within the influence of the arc the material to be treated, and thus prevent said material having the carbon burned out in the manner above described.

In the accompanying drawings, which illustrate a construction embodying my invention, Figure 1 is a vertical cross-section through an electric furnace, and showing the opposite electrodes in full lines. Fig. 2 is a similar view, but showing the upper electrode moved to a different position from that shown in Fig. 1. Fig. 3 is a plan view, partly in section, showing the double feed mechanism.

Like letters of reference refer to like parts throughout the several views.

The electric furnace A is constructed of fireproof material A′, and in practice may have a suitable outlet through which the product can be removed. Located at the bottom of the furnace and surrounded by the brick A^2 is the electrode B, of conducting material, and connected to one pole of an electric generator by a suitable wire B′. Located above the lower electrode B is a movable and oscillatory electrode C, preferably of less diameter than the electrode B, and which is connected to the other pole of the electric generator by a suitable wire C′. This upper electrode C is suspended above the electrode B,

and is supported in its suspended position by means of the rod C^2, connected to the top of the electrode C, and to said rod C^2 there is pivotally connected at C^3 another rod C^4, which extends upwardly through the cross-beam D, supported by the side beams D′, and the upper end of said rod C^4 projects through the cross-bar C^5, and a suitable nut C^6 holds said rod C^4 connected to the cross-bar C^5. Through the opposite end of the cross-bar C^5 a lifting-screw C^7, working in the nut C^9, is arranged, and its lower end works in a socket C^8 on said cross-beam D, and by means of said lifting-screw C^7 the electrode C is raised and lowered by means of the connections above described.

Secured to the top of the electrode C is a rectangular receptacle E, provided with an opening E′ in its bottom and located near the edge of the top of the electrode C. Within said receptacle C there is arranged a box F of suitable size with the opening F′ in its bottom, and said box F is adapted to reciprocate within the receptacle E. Connected to one side of the box F is a rod F^2, and said rod extends out through the end E^2 of the receptacle E, and on its outer end there is provided a roller F^3, which bears against one of the side beams D′, and around that portion F^2 within the receptacle E there is arranged a spiral spring F^4, which is connected at one end to the box F, and the opposite end is connected to the end B^2 of the receptacle E.

At about the center of the rod C^2 there is pivotally connected at G′ the rod G, which passes through and is supported in the slot D^2 in the side beam D′ and is provided at its outer end with the electrically-insulated handle G^2, and by means of said handle G^2 the upper electrode C can be moved from its vertical position, as shown in Fig. 2. Now, assuming that the rod G has been operated to move the upper electrode C to the position shown in Fig. 2, it will be noted in said movement that the rod F^2 moves the box F to the position shown, so that the opening F′ in said box F registers with the opening E′ in the receptacle E. Consequently the material to be treated, when it is placed in the box F, by hand or by any suitable mechanism, drops onto the top of the lower electrode B, and is designated in the drawings by the letter H, and it is thus within the influence and in the path of the heat consequent upon the formation of the arc between B and C when the electrode C recovers its vertical position, as shown in Fig. 1, or is pushed in an opposite direction, and by this pendulum or oscillatory movement the material is dropped down upon the lower electrode B and brought at will within the influence of the arc. As the spring F^4 is connected at one end to the box F and at the other end is connected to the end E^2 of the receptacle E, it is obvious, as the rod F^2 pushes the box F to the position shown in Fig. 2, and thereby puts the spring F^4 under tension, that said electrode C resumes its vertical position the spring F^4 by reason of said tension will move the box F to the position shown in Fig. 1, when fresh material can be placed in said box F for the next operation.

The movement given to the upper electrode C, as shown in Fig. 2, causes the arc to move, as required, from left to right, or vice versa, across the electrode B and induces a smelting process. Consequently it is possible to have the arc formed act continuously and positively on the fresh material, and as the smelted product, which is designated by the letter H′, is a conductor it is therefore clear that the material dropped onto the electrode B from the box F is within the influence of the arc, and it is further clear that there is no breaking of the electric current in the feeding of the material to be treated, as the electric current between the two electrodes is not broken by the oscillatory movements given to the upper electrode.

The amount of material placed in the box F being known, it is obvious that a determined quantity 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, so an amount can be admitted proportionate to the heat generated by the arc. As the material is reduced between the electrodes the same can be separated and provide room for more material by operating the lifting-screw C^7 and the connecting mechanism to raise the electrode C, which, while increasing the length of the arc between the electrodes, does not break the circuit.

While the drawings have shown mechanism arranged for feeding the material when the electrode is pulled toward the right hand, as shown in full lines, Fig. 2, it is clearly obvious that another receptacle similar to that indicated by the letter E, but reversed in position, so that its roller corresponding to the roller F^3 would bear against the other side beam D′, can, if desired, be placed alongside of the receptacle E and would be operated in a similar manner to that described for the receptacle E, and would drop the material to be treated down the right-hand side of the electrode C instead of the left-hand side, as is the case in the apparatus shown in the drawings and described in the specification, and by providing two such receptacles the material to be treated can be dropped down both the left-hand and right-hand sides of the electrode C, and, further, it will be noted that the movements of the electrode C leave a clear passage for the dropping of the fresh material H onto the electrode B or the fused product H′ formed on top of said electrode B.

From the above it is clear that the new material to be treated is dropped on the lower electrode or on the material previously smelted and located on said electrode B, and can be brought within the influence of the arc formed between the electrodes. Consequently, as the

material is introduced or fed directly within the influence and in the path of the moving arc, the heat is fully utilized and a great saving is accomplished over furnaces where the material is not so introduced or fed directly and positively 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 electric current is not consumed merely in forming the arc.

I do not limit myself to the arrangement and construction shown, as the same may be varied without departing from the spirit of my invention.

Having thus ascertained the nature of my invention, what I claim as new is—

1. In an electric-arc furnace, a suspended electrode, a mechanism for vibrating said electrode, and a feed mechanism for feeding the material to be treated within the path of the electric arc during the interval between a back and a forth movement of said electrode.

2. In an electric-arc furnace, a suspended electrode, a mechanism for vibrating said electrode, and a feed mechanism connected with said electrode and adapted to be operated by the movement of the same to feed the material to be treated within the path of the electric arc.

3. In an electric-arc furnace, a suspended electrode, a mechanism for vibrating said electrode, and a feed mechanism connected with the said electrode and adapted to be operated by the movement of the same to intermittently feed the material to be treated within the path of the electric arc.

4. In an electric-arc furnace, a lower electrode, an upper electrode, mechanism for vibrating said upper electrode to expose the lower electrode to receive the material to be treated, mechanism for increasing the distance between said electrodes to accommodate the material to be treated, and a feed mechanism operated by the movement of said upper electrode for feeding the material to be treated onto the lower electrode and within the path of the electric arc.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 20th day of August, A. D. 1896.

JAMES A. DEUTHER.

Witnesses:
J. KREBS RUSK, JR.,
ELIZABETH G. KELLEHER.