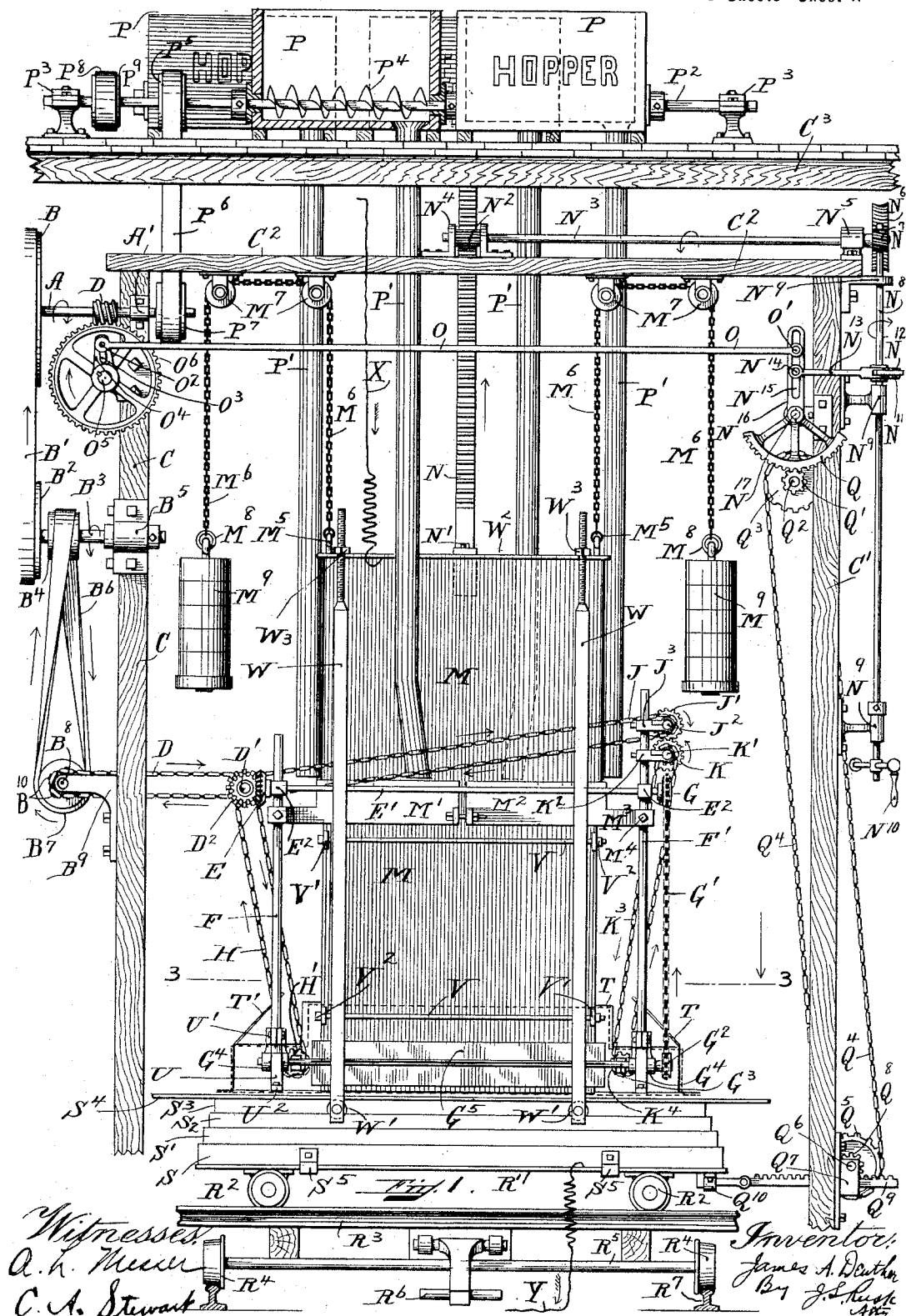


J. A. DEUTHER.
ELECTRIC FURNACE.

(Application filed June 2, 1897.)

(No Model.)

3 Sheets—Sheet 1.



No. 616,906.

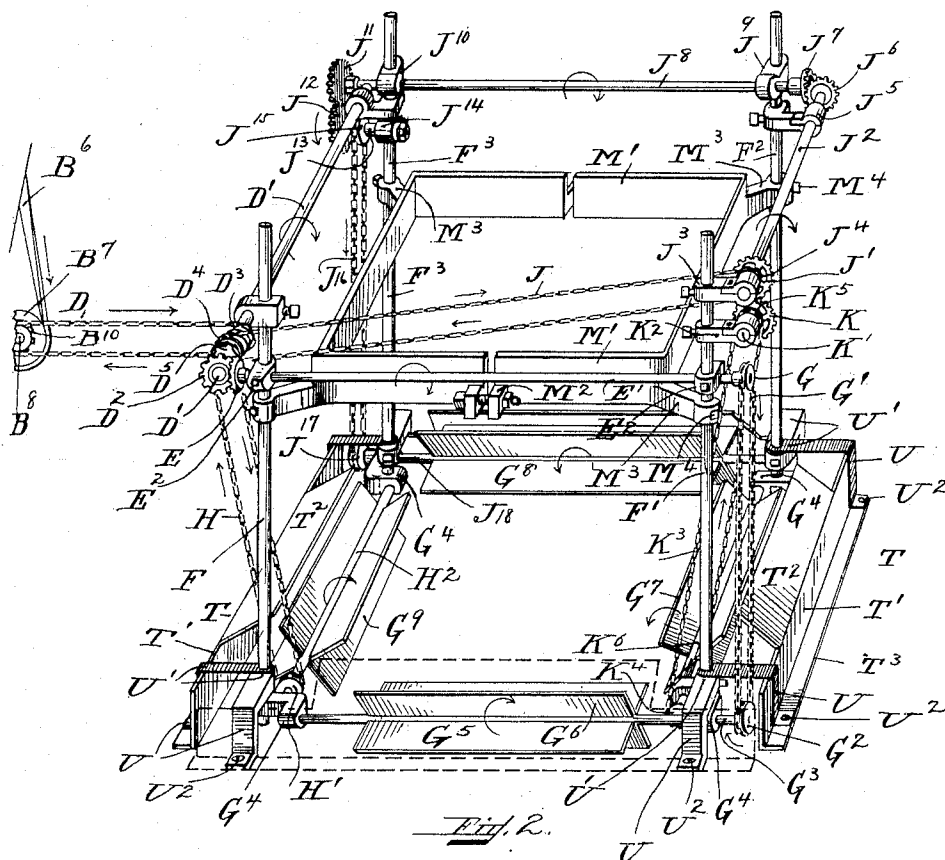
Patented Jan. 3, 1899.

J. A. DEUTHER.
ELECTRIC FURNACE.

(Application filed June 2, 1897.)

(No Model.)

3 Sheets—Sheet 2.



Witnesses:
A. L. Mason
C. A. Stewart.

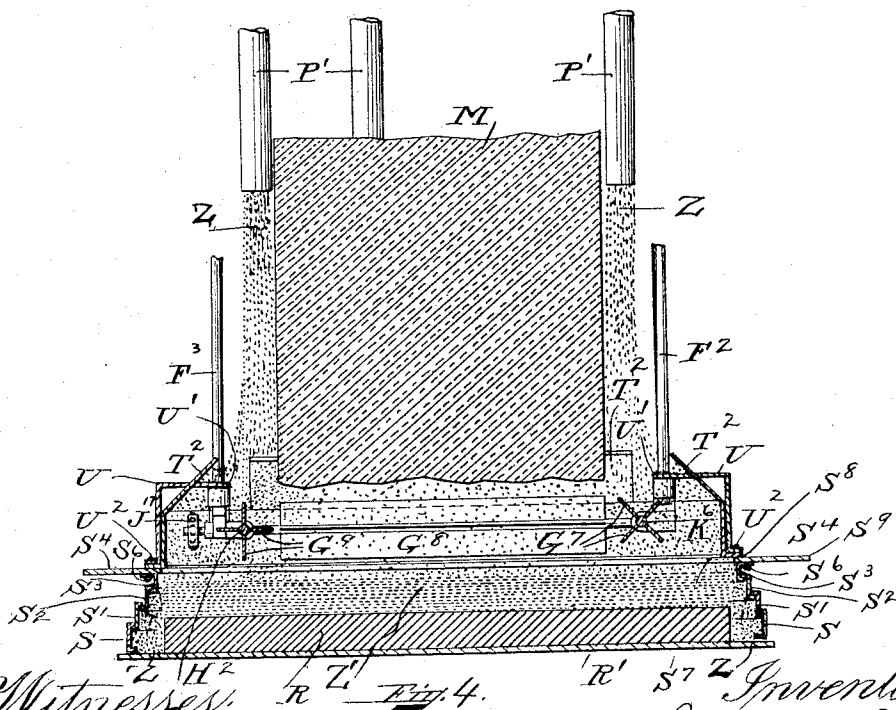
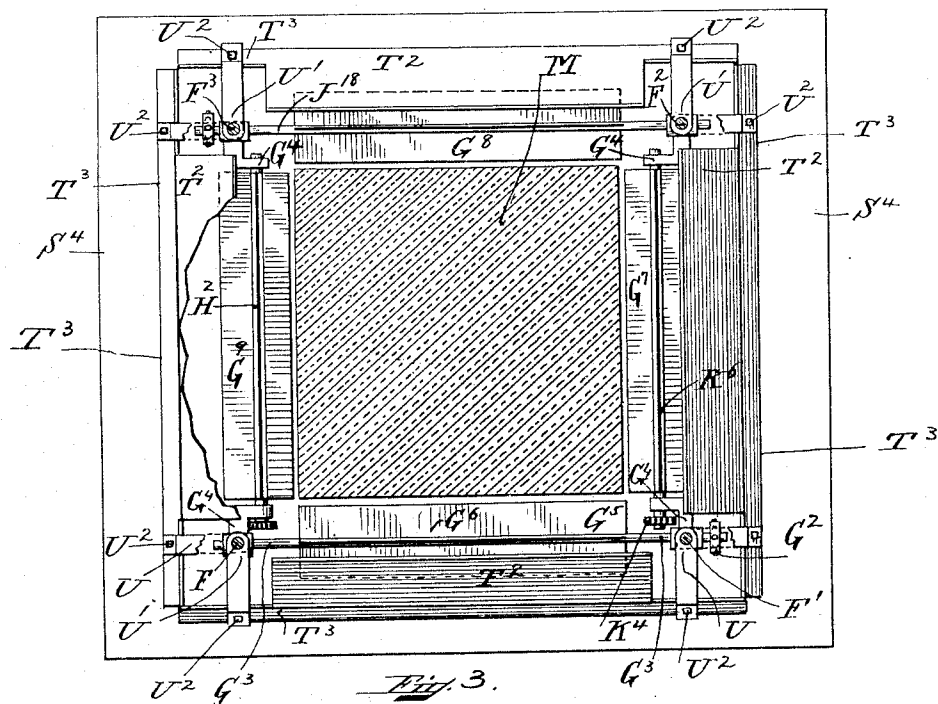
Inventor:
James A. Deuther
By J. S. Rusk
Att'y

J. A. DEUTHER.
ELECTRIC FURNACE.

(Application filed June 2, 1897.)

(No Model.)

3 Sheets—Sheet 3.



Witnesses:
A. L. Messer
C. A. Stewart

Inventor:
James A. Deuther
By J. S. Rush
Att'y

UNITED STATES PATENT OFFICE.

JAMES A. DEUTHER, OF BOSTON, MASSACHUSETTS.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 616,906, dated January 3, 1899.

Application filed June 2, 1897. Serial No. 639,096. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. DEUTHER, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification.

My invention relates to new and useful improvements in electric furnaces and is in the nature of improvements upon the furnaces described and shown in United States Letters Patent No. 575,826, dated January 26, 1897, issued to me, and No. 575,829, issued to Joyce and myself January 26, 1897.

The object of my invention is to render more economical the operations of electric furnaces and by mechanical devices render more certain and uniform electric smelting processes.

In the accompanying drawings, which illustrate a construction embodying my invention, Figure 1 is a front elevation of my improved electric furnace with the casing entirely removed in order to clearly show the construction and arrangement of the parts and showing four hoppers, one of which is in section to illustrate the construction thereof. Fig. 2 is a perspective view of the mechanism for agitating and delivering the raw material, consisting of carbon and lime, within the influence of the arc. Fig. 3 is a sectional plan view on the line 3-3, Fig. 1, but with the sprocket-chain omitted. Fig. 4 is a longitudinal cross-sectional view through the lower part of Fig. 1.

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

In the operation of my improved automatic furnace power is transmitted from any suitable source by the shaft A, having the bearing A' on one of the side beams C of the furnace, and to said shaft A there is firmly secured the pulley B, over which passes the driving-belt B', also passing around the pulley B², fast on the shaft B³, which has suitable bearings, one of which, B⁵, is secured to the side beam C. On said shaft B³ there is firmly secured the pulley B⁴, and around said pulley B⁴ and also around another pulley B⁷ there is located a driving-belt B⁶. The pulley B⁷ is fast on the shaft B⁸, journaled in the fixed bearing B⁹, and to one side of said pulley B⁷ there is a suitable sprocket-wheel B¹⁰, around

which passes the sprocket-chain D, which at its opposite end passes around a suitable sprocket-wheel D³, fast on the shaft D', (see Figs. 1 and 2,) and to the rear of the bevel-gear D², also fast on said shaft D'. This bevel-gear meshes with the bevel-gear E on the shaft E', which is provided with suitable bearings E², held on the vertical rods F F' by suitable set-screws. On the opposite end of the shaft E' is firmly secured the sprocket-wheel G, over which passes a sprocket-chain G', which also passes over the sprocket-wheel G², fast on the shaft G³, supported at its opposite ends by suitable bearings G⁴ on the lower end of the vertical rods F F', (see Figs. 2 and 4,) and said shaft G³ carries a fan G⁵, having four leaves G⁶, and said fan G⁵ is adapted to be turned in a direction inwardly toward the side of the upper electrode M by the movement communicated by the sprocket-chain G', turned by the shaft E'. Around another sprocket-wheel D³, fast on the shaft D', is a sprocket-chain H, which passes downward and around the sprocket-wheel H', fast on the shaft H², which carries the fan G⁹, having blades similar to the blades G⁶ of the fan G⁵ and supported in suitable bearings G⁴ on the lower ends of the rods F and F³. On said shaft D' there is another sprocket-wheel D⁴, with which the sprocket-chain J works and which at its opposite end passes around a suitable sprocket-wheel J⁴, fast on the shaft J², supported in the bearings J³ and J⁵, secured on the upper ends of the vertical rods F' and F² by suitable set-screws. On said shaft J² there is fast a gear-wheel J', which works with the gear-wheel K, fast on the stud K' and supported in a suitable bearing K², secured to the upper end of said rod F' and secured in place by a suitable set-screw. Fast on the stud K' and in front of the gear-wheel K is a suitable sprocket-wheel K⁵, with which works the sprocket-chain K³, which passes downwardly and around another sprocket-wheel K⁴, which is secured to a shaft K⁶ and carries a fan G⁷, having blades similar to the blades G⁶ of the fan G⁵, and at its opposite ends in the bearings G⁴.

As above described, the power communicated through the chain D turns the fans G⁵, G⁷, and G⁹ inwardly toward the sides of the upper electrode, as indicated by the arrows,

and the other fan G⁵ is also turned inwardly toward the other side of the electrode M by the power communicated through the sprocket-chain D, as will appear from the following description. The shaft J² is driven by the sprocket-chain J in the direction indicated by the arrow, and there is secured fast thereon the bevel-gear J⁶, which meshes with the bevel-gear J⁷, fast on the shaft J⁸, supported at one end in the bearing J⁹ on the upper end of the rod F² and near its opposite end in the bearing J¹⁰, near the upper end of the rod F³, and on the extreme end of the shaft J⁸ there is secured fast the gear-wheel J¹¹, which meshes with the gear-wheel J¹², fast on the stud J¹³, supported in the bearing J¹⁴, secured on the rod F³ below the bearing J¹⁰. On said stud there is secured fast the sprocket-wheel J¹⁵, around which is located the sprocket-chain J¹⁶, which passes downwardly around the sprocket-wheel J¹⁷, fast on the shaft J¹⁸, supported in the bearings G⁴ and having blades similar to the blades G⁶ of the fan G⁵. The shaft J², revolving, as indicated by the arrow, outwardly, causes the shaft J⁸ to revolve outwardly, as indicated by the arrow, and with it the gear-wheel J¹¹, and the gear-wheel J¹¹, acting on the wheel J¹², turns the same inwardly, as indicated by the arrow, and this inward movement causes the inner side of the sprocket-chain J¹⁶ to turn the shaft J¹⁸, with the fan G⁵, inwardly toward the side of the electrode M. The rotatable fans form regulating and distributing mechanisms. They are interposed between the feed proper and the anode and serve to regulate and distribute the supply of material to the arc.

From the above it is clear that by the mechanism provided the power that is transmitted from the sprocket-chain D turns all the fans G⁵, G⁶, G⁷, and G⁸ inwardly toward the sides of the upper electrode M. The bearings G⁴, provided for the shafts G³, K⁶, H², and J¹⁸, by which each fan is carried, are secured in any suitable manner on the lower ends of the rods F F' F² F³. On the outside of all the fans there is a frame T, consisting of four plates T', with an inwardly-projecting shelf T², and the object of said frame is to cause the carbon and lime when agitated by the revolving fans to be turned inwardly toward the sides of the electrode and not thrown away from the electrodes by the revolving fans. The plates T' are each supported by arms U, which at their upper ends U' are secured to the rods F, F', F², and F³ and at their lower ends are riveted at U² to suitable flanges T³ on each plate T', and by means of said supports said plates T' of the frame T are supported in their proper positions. The rods F, F', F², and F³ are supported and suspended from lugs M², formed on the plates M', which are located around the center of the upper electrode M, and by means of the bolt and nut M² said plates are firmly secured in place around said electrode. By means of suitable set-screws M⁴ the rods F, F', F², and F³ can be verti-

cally adjusted in their supporting-lugs M². Inasmuch as the plates M' are firmly secured around the electrode M it is obvious that whatever the position of the electrode be the rods F, F', F², and F³ will move with said electrode and carry the operating mechanism of the fans, the fans, and the frame T. Eyes M⁵, secured to the top of the electrode M, on the opposite sides, are connected to chains M⁶, which pass upwardly and over the pulleys M⁷, secured to the under side of the cross-beam C², supported by the side beams C C', and the other ends of said chains are connected to a ring M⁸, supporting the weight M⁹. The electrode is counterbalanced by the weights M⁹ as it changes its vertical position. Secured to the top of the upper electrode by a screw N' is a rack-bar N, which passes upwardly through the floor C², and with said rack-bar N there is adapted to mesh the pinion N² on the shaft N³, supported by the bearings N⁴ and N⁵ on the cross-beam C². Fast on the opposite end of the shaft N³ is a worm-wheel N⁶, which works with the worm N⁷, fast on the upper end of the shaft N⁸, which passes down through the supports N⁹, secured to the side beam C', and at its lower end said shaft N⁸ is provided with a handle N¹⁰, by which it may be operated manually when desired. Fast on the shaft N⁸ and below the worm N⁷ is a ratchet N¹¹, with which works the pawl N¹², having the usual spring to cause the engagement of the pawl and ratchet, and said pawl is carried by the rod N¹³, pivotally mounted on the pin N¹⁴, firmly fixed in its position in the slot N¹⁵ on the arm N¹⁶, secured fast to the shaft N¹⁷. In the upper end of the slot N¹⁵ there is firmly secured a pin O', to which is pivotally secured the shaft O, which at its opposite end is pivotally secured to a pin O², fixed in the slot O³ of the arm O⁴, fast on the shaft O⁵, and to the rear side of said arm O⁴ there is keyed fast the worm-wheel O⁶, with which works the worm D, which is located fast on the shaft A. Secured fast to the shaft N¹⁷ is a gear-segment Q, which is a part of the arm N¹⁶ and which is adapted to mesh with the gear-wheel Q' on the stud Q², which may be supported by any suitable bracket secured on the beam C'. On said shaft Q² is a sprocket-wheel Q³, over which passes the sprocket-chain Q⁴, which at its lower end passes around the sprocket Q⁵, fast on the shaft Q⁶, mounted in a suitable bearing Q⁷, secured to the beam C'. To one side of the sprocket-wheel Q⁵ is a gear-wheel Q⁸, fast on the shaft Q⁶ and adapted to mesh with the rack-bar Q⁹, which is supported and moves in the bearing Q⁷ and at its inner end is connected at Q¹⁰ to the lower plate R' of the lower electrode R, carried by suitable wheels R², which are adapted to move on the rails R³, supported by a truck consisting of the wheels R⁴ on the axle R⁵, and a suitable handle R⁶ is connected to said truck, whereby said lower electrode R may be moved out from below the upper electrode M along the rails R⁷.

The lower electrode R is composed of any suitable material, as carbon, (see Fig. 4,) and is located on the bottom plate R' and within a telescope consisting of the telescoping sections S, S', S², and S³, which are adapted to work and telescope within one another, and the lower section S is secured to the plate R' by clips S⁵, and to the upper section S³ there is secured at S⁶ a plate S⁴, with an opening S⁷, which is somewhat larger than the top and bottom electrodes, so that the upper electrode and the bottom electrode can be brought into contact to start the arc.

Resting on the top plate S⁴ is the frame T, the front side of which is shown in dotted lines, Figs. 1 and 2, in order to prevent obscuring the other parts of the apparatus. The lower electrode R is reciprocated in the following manner: The worm D on the shaft A meshes with the worm-wheel O⁶ and turns said wheel slowly toward the right, as indicated by the arrow, and in said movement the arm O⁴, fast on the shaft O⁵, moves in the same direction from its normal or starting position, (shown in full lines, Fig. 1,) and said arm pushes the rod O toward the right, which movement causes the upper end of the arm N¹⁶ to move to the right, and this movement of the upper end of the arm N¹⁶ causes the segment-gear Q, of which it is an integral part, to move toward the left, and this left-hand movement of the segment-gear Q, meshing with the gear-wheel Q', causes the gear-wheel Q⁸ to act through the intermediate connections on the rack-bar Q⁹ and moves said rack-bar toward the right, and the rack-bar in said movement pulls said bottom electrode R in the same direction. Now when the arm O⁴ has completed a partial revolution and is in a position at right angles to the position shown in full lines, Fig. 1, it begins its movement toward the left, and in said movement the rod O is pulled toward the left, and with it the upper end of the arm N¹⁶, and this left-hand movement of the arm N¹⁶ causes the segment-gear Q to move toward the right, and this right-hand movement of said gear, acting on the gear-wheel Q' through the intermediate connections, causes the gear-wheel Q⁸ to move the rack-bar Q⁹ inwardly toward the left, and with it the lower electrode R, and as the arm O⁴ makes a partial revolution toward the left and pulls with it the rod O and arm N¹⁶ the segment-gear Q, through the intermediate connections, causes the gear-wheel Q⁸ to move the rack-bar Q⁹ and the lower electrode R to its normal position toward the left. Now as the arm O⁴ begins again a partial turn it pushes the rod O and arm N¹⁶ toward the right, and this movement of the arm N¹⁶ causes the segment-gear Q to move to the left, and this left-hand movement of the segment-gear Q causes the gear-wheel Q⁸, through the intermediate connections, to act on the rack-bar Q⁹ and move it toward the right, and with it the bottom electrode R, which by the partial movement of the arm O⁴ has been

brought to its normal position, as shown in full lines, so that from the above it is obvious that each complete revolution of the wheel O⁶ and arm O⁴ causes the bottom electrode R to move, first, toward the left, and then to be returned to its normal position and continued in its movement toward the left beyond its normal position, and, lastly, pulled to the right to its normal position under the top electrode. As the arm N¹⁶ moves toward the right, it causes the pulley N¹² to turn the ratchet N¹¹, and this movement of the ratchet-wheel is communicated to the shaft N⁸, on which is mounted fast the worm N⁷, working with the worm-wheel N⁶ on the shaft N³, and as the arm N¹⁶ moves toward the left it brings the pawl into engagement with the next tooth, so that each movement of the arm N¹⁶ toward the right communicates movement to the shaft N³ through the shaft N⁸ and worm N⁷ and worm-wheel N⁶.

By adjusting the rod O in the slot O³ of the arm O⁴ the length of the travel of the lower electrode R can be regulated, because the throw of the arm O will be more or less as the pin O² is more or less removed from the center of the shaft O³. The same regulation of movement applies to the adjustment of the pin O' in the slot N¹⁵ of the arm N¹⁶.

Through the top plate W² of the upper electrode extend opposite vertical rods W, secured in place by suitable nuts W³, and said rods extend downwardly and are provided on their lower ends with rollers W', which in the operation of this particular design of furnace are adapted to be placed under the plate S⁴, so that as the upper electrode in the operation of the furnace moves upwardly said rods W will lift the plate S⁴ and cause the telescopic furnace-walls to rise, and thus confine within the telescopic walls and frame T the calcium carbid Z', formed by the electric arc, and the raw material Z being fed to supply the arc. These rods are not rigid in their upper supports, but are allowed some lateral movement, so that when the operation is complete the lower ends may be knocked away from beneath the plate S⁴ when the telescope closes, and the lower electrode R may be removed by means of the truck previously described. When the furnace is about to start, the top electrode is brought down into contact with the bottom electrode R in order to start the arc, in which position the telescopic sections S, S', S², and S³ are closed and the rollers W' are placed under the edges of the plate S⁴, and as the operation continues and the upper electrode moves upwardly the rods W move said plate S⁴ and cause the telescope to open, as shown in Fig. 1. By means of this lower telescopic electrode the calcium carbid is confined within the chamber where it is made, as is also the raw material being fed, as previously stated.

The carbon and lime are admitted in any suitable manner into the hoppers P, and from each hopper there extends downwardly the

tube P', one on each side of the upper electrode M, and through said tubes the carbon and lime pass from each hopper to the fans G⁵, G⁷, G⁸, and G⁹, which, revolving rapidly and turning inwardly toward all four sides of the electrode M, agitate said carbon and lime and throw it inwardly toward the electrodes and mechanically supply or feed to the arc the necessary amount of raw material for the arc's most economical operation, the frame T preventing the dispersion of the raw material to an undue extent.

Through the two front hoppers passes the shaft P², having bearings P³ at its opposite ends, located on the upper floor C³, and that portion of the shaft within each hopper is constructed with an endless screw P⁴, which in revolving conveys the material toward the end where the tube P' enters. The construction of each hopper and its mechanism is the same. Fast on the shaft P² there is fixed the pulley P⁵, around which passes the driving-belt P⁶, also located around the pulley P⁷, fast on the shaft A, and said shaft P² is driven by said belt P⁶. The two rear hoppers are provided with a shaft similar to the shaft P², which receives its power from the belt P⁸ passing around the pulley P⁹, and a similar pulley is located on the shaft of the other two hoppers, whereby the shaft of said hoppers is operated to feed the material down the tubes which lead therefrom. The binding-plates V', located on the sides of the electrode, are securely held in place by the cross-bars V and suitable nuts V², and the object thereof is to hold the electrodes firmly together.

The power communicated to the gearing is so arranged as to rotate the fans rapidly, sufficiently so to perform the function of keeping the raw material fed into the furnace from the hoppers close against the electrodes and mechanically feed the arc, so that the arc formed during the process of working is always supplied with raw material to keep on producing the essential product, and the raw material is thus mechanically fed to the arc. The worm-gear is designed to operate the segment-gear at a rate of speed and reciprocates the lower electrode at a speed proportionate to the formation of the essential product. In other words, the reciprocation is very slow, the reduction of the speed takes place through the various gears, and the speed is calculated to keep proportional to the more or less rapid formation of the essential product formed by the arc. The fans are calculated to move at a rate of speed sufficient to keep the arc thoroughly fed, and should more material be fed in than is required to keep the arc supplied, the frame surrounding the fans being only of such dimensions as is requisite to hold sufficient raw material for carrying on the operation, the excess of raw material falls to the floor and is not burned out or otherwise injuriously affected by being in close proximity with the heat incident upon or radiated from the arc. Thus the frame

surrounding the upper electrode prevents the undue dispersion of the raw material by the mechanical devices employed to feed the arc, so that the arc is at all times insured a most economical operation by supplying only such a quantity of raw material as is sufficient to keep the arc at all times thoroughly fed, and so should an excess of material be fed from the hoppers this excess of material falls over the sides of said frame before said excess of raw material can be injuriously affected by the heat incident upon the formation of the arc and can again be utilized for the fabrication of the ultimate product. In other words, the frame prevents an excessive dispersion of the raw material and helps to keep the arc supplied with sufficient raw material and no more than is found to be economical. The reciprocating movement of the lower electrode is automatically regulated to permit of the raw material being fed onto the ultimate product formed and to cause said raw material to be brought directly within the path of the electric arc.

The automatic device for feeding the raw material is preferable to that of any operation by hand for performing the same function, as mechanical devices permit of feeding regularly and steadily and also feeding the proper amount of raw material to insure the most economical operation. When the furnace is in operation and the product is being formed, the electrodes are maintained in such relative positions as to maintain the desired electrical resistance. Now taking the fabrication of calcium carbide as an illustration of one of the products produced in my electric furnace we find that the raw material entering into its composition is practically a non-conductor of electricity, and as the electric arc is used for its production it is plain that should an excess of raw material be fed to the arc or between the electrodes an excessive electrical resistance will result, and only such an amount should be thus fed to the arc as the arc is capable of acting upon in a determined period of time, and thus a regulated quantity of raw material can be fed to the arc constantly. The fans by their rotation agitate and feed to the arc a constant supply of raw material at regulated quantities supplied from the hoppers. Without mechanical devices for feeding it is found to be practically impossible in practical operation on a commercial scale to keep the arc constantly supplied with the raw material, as the arc at one moment may cause a space between the electrodes and the raw material now on one side and a moment after on the other side, whereas by the devices shown all sides of the electrode are kept in practically constant contact with the raw material, and thus at all times and on all sides the arc is supplied with the necessary amount of raw material, and the process of thus making carbide is rendered more economical in having the arc always at work producing the essential

product. The fans are so located with reference to the arc as to insure the arc being continually supplied with the necessary raw material.

5 Apart from mechanically feeding the raw material into what may be termed the "path of the arc" it is also desirable to continually surround both electrodes at the point where the arc is located with the raw material, so that from all sides of the electrodes the raw material can be mechanically supplied to the arc. As the lower electrode reciprocates under the top electrode the calcium carbid formed by the arc on that end of the electrode which is moving from under the top electrode receives the raw material directly on top and brings said raw material directly within the influence of the arc and under the top electrode as it returns to its normal position, and the same operation takes place when the bottom electrode reciprocates in the opposite direction from its normal position under the top electrode, so that in the right and left reciprocations of the electrode R raw material is dropped directly on the right and left hand ends of the bottom electrode and then brought directly within the influence of the arc by the return movement of said electrode.

30 In the manufacture of calcium carbid by my electric furnace the electric arc is employed. It is known that the very high temperature of the arc rapidly disintegrates most substances brought within its influence. Consequently in commercial practice it is found essential to keep the walls or sides composing the electric furnace out of contact with or removed from the arc, so that they may not be injuriously affected by the heat consequent upon the operation. It is found that the raw material entering into the fabrication of calcium carbid is an excellent non-conductor of both heat and electricity and that the interposition of the raw material between the electrodes and the walls of the furnace effectually protects the latter from the heat incident upon the fabrication of calcium carbid. The heat is naturally greater where the arc is located. Consequently a necessary quantity of this raw material is desirably interposed between the furnace-walls and the electrodes and around the location of the arc. As described, the plate S⁴ moves with relation to the frame T from the points S⁸ to S⁹, and at all times there is interposed at the seat of the arc, which is relatively on a plane near to the top plate S⁴, an amount of raw material between the electrode M and the sides of the frame T which is greater than that required between the electrodes and the newly-formed carbid and the sides of the telescopic furnace. As the operation is carried on and the newly-formed carbid Z' grows higher, with it the telescopic walls of the furnace rise and permit the carbid Z' and the original electrode to be surrounded by the raw material Z between the carbid Z' and the walls of the tele-

scopic furnace, whereby the walls of the telescopic furnace proper are effectually protected with a minimum amount of raw material, which, as above stated, forms an excellent non-conductor of both heat and electricity; but said material becomes a good conductor of electricity when converted into calcium carbid.

75 Instead of raising the upper electrode the lower electrode may be lowered as the calcium carbid is formed on the top thereof, and the upper electrode may be reciprocated over the lower electrode, thereby insuring the same result, as previously described.

80 The power required to carry on the different mechanical movements as described may be derived from the same or independent sources, it being only necessary, as hereinbefore set forth, to have said mechanical movements travel at a designated speed with relation to each other and to the essential product formed.

85 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.

90 Having thus ascertained the nature of my invention and set forth a construction embodying the same, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an electric-arc furnace, two opposite electrodes, a feed mechanism, a regulator operating independently of said feed mechanism and located adjacent to the anode for receiving the material to be treated from said feed mechanism and for supplying the same to the arc, and means for operating said regulator.

2. In an electric-arc furnace, two opposite electrodes, a mechanism for moving one of said electrodes relatively to the other, a feed mechanism, a regulator operating independently of said feed mechanism and located adjacent to the anode for receiving the material to be treated from said feed mechanism and for supplying the same to the arc, and means for operating said regulator.

3. In an electric-arc furnace, two opposite electrodes, mechanism for moving one of said electrodes relative to the other, a feed mechanism, and a regulator independent of said feed mechanism and carried by said movable electrode intermediate of said feed mechanism and the anode for receiving the material to be treated from said feed mechanism and supplying the same to the arc.

4. In an electric-arc furnace, two opposite electrodes, a feed mechanism, a rotatable fan operating independently of said feed mechanism and located adjacent to the anode for receiving the material to be treated from said feed mechanism and to regulate the supply of the same to the arc, and means for rotating said fan.

5. In an electric-arc furnace, two opposite electrodes, mechanism for moving one of said

electrodes, a feed mechanism, and a rotatable fan located intermediate of said feed mechanism and the anode for distributing and regulating the supply of material to the arc.

5 6. In an electric-arc furnace, two opposite electrodes, mechanism for moving one of said electrodes, a feed mechanism, and a rotatable fan carried by said movable electrode intermediate of said feed mechanism and the anode for distributing and regulating the supply of material to the arc.

7. In an electric-arc furnace, two opposite electrodes, mechanism for moving one of said electrodes horizontally, a mechanism for moving the other of said electrodes vertically, a feed mechanism, and a rotatable fan carried by said vertically-movable electrode intermediate of said feed mechanism and the anode for distributing and regulating the supply of material to the arc.

8. In an electric-arc furnace, two opposite electrodes, mechanism for moving one of said electrodes, a feed mechanism, a plurality of fans carried by said movable electrode intermediate of said feed mechanism and the anode for regulating and distributing the supply of material to the arc, and means for rotating said fans.

9. In an electric-arc furnace, two opposite electrodes, a feed mechanism, a regulating mechanism operating independently of said feed mechanism and located adjacent to the anode for receiving the material to be treated from said feed mechanism and for supplying the same to the arc, means for operating said regulating mechanism, and a wall surrounding said regulating mechanism.

10. In an electric-arc furnace, two opposite electrodes, mechanism for moving one of said electrodes, a feed mechanism, a distributing and regulating mechanism located intermediate of said feed mechanism and the anode, and a telescopic wall surrounding said distributing and regulating mechanism.

11. In an electric-arc furnace, two opposite electrodes, a mechanism for moving one of said electrodes, a feed mechanism, a rotatable fan located intermediate of said feed mechanism and the anode for distributing and regulating the supply of material to the arc, and a telescopic wall surrounding said fan.

12. In an electric-arc furnace, two opposite electrodes, mechanism for moving one of said electrodes, a feed mechanism, a rotatable fan carried by said movable electrode intermediate of said feed mechanism and the anode for distributing and regulating the supply of material to the arc, and a telescopic wall surrounding said fan.

13. In an electric furnace, two opposite electrodes, mechanism for moving one of said electrodes relative to the other, a feed mechanism, a regulator operating independently of said feed mechanism and located adjacent to the anode for receiving the material to be treated from said feed mechanism and for supplying the same to the arc, and means for

moving said regulator simultaneously with said movable electrode.

14. In an electric-arc furnace, two opposite electrodes, mechanism for moving one of said electrodes, a feed mechanism, a distributing and regulating mechanism movable simultaneously with said movable electrode and located intermediate of said feed mechanism and the anode, and a telescopic wall surrounding said distributing and regulating mechanism.

15. In an electric-arc furnace, two opposite electrodes, mechanism for moving one of said electrodes, a feed mechanism, a rotatable fan movable simultaneously with said movable electrode and located intermediate of said feed mechanism and the anode for distributing and regulating the supply of material to the arc.

16. In an electric-arc furnace, two opposite electrodes, a mechanism for moving one of said electrodes, a feed mechanism, a rotatable fan movable simultaneously with said movable electrode and located intermediate of said feed mechanism and the anode for distributing and regulating the supply of material to the arc, and a telescopic wall surrounding said fan.

17. In an electric-arc furnace, two opposite electrodes, mechanism for separating said electrodes, and a wall consisting of telescopic sections around the lower electrode and adapted to extend and inclose the lower electrode and newly-formed carbid as the electrodes separate.

18. In an electric-arc furnace, two opposite electrodes, mechanism for separating said electrodes, mechanism for feeding the material to be treated to the path of the electric arc, a wall consisting of telescopic sections around the lower electrode and adapted to extend and inclose the lower electrode and newly-formed carbid as the electrodes separate, and a frame located around said feeding mechanism for keeping the raw material in contact with said feeding mechanism to keep the arc constantly supplied and adapted with the telescopic furnace-wall to inclose the lower end of the upper electrode and the newly-formed carbid on the top of the lower electrode as the electrodes separate.

19. In an electric-arc furnace, two opposite electrodes, mechanism for separating said electrodes, mechanism for feeding the material to be treated to the path of the electric arc, a wall consisting of telescopic sections around the lower electrode and adapted to extend and inclose the lower electrode and newly-formed carbid as the electrodes separate, and a frame located around said feeding mechanism for keeping the raw material in contact with said feeding mechanism to keep the arc constantly supplied and for removing the excess of raw material from proximity to the arc whereby said excess is not injuriously affected by the heat of the arc and adapted with the telescopic furnace-wall

to inclose the lower end of the upper electrode and the newly-formed carbid on the top of the lower electrode as the electrodes separate.

5 20. In an electric furnace, two opposite electrodes, mechanism for moving one of said electrodes relatively to the other, mechanism for separating said electrodes, feed mechanism, regulating mechanism operating independently of said feed mechanism and located
10 adjacent to the anode for receiving the material to be treated from said feed mechanism

and for supplying the same to the arc, and means for simultaneously operating all said mechanisms.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 1st day of June, A. D. 1897.

15

JAMES A. DEUTHER.

Witnesses:

C. A. STEWART,

A. L. MESSER.