No. 625,252. Patented May 16, 1899.

H. ELDRIDGE, D. J. CLARK & S. BLUM.

ELECTRICAL FURNACE.

(Application filed Jan. 18, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

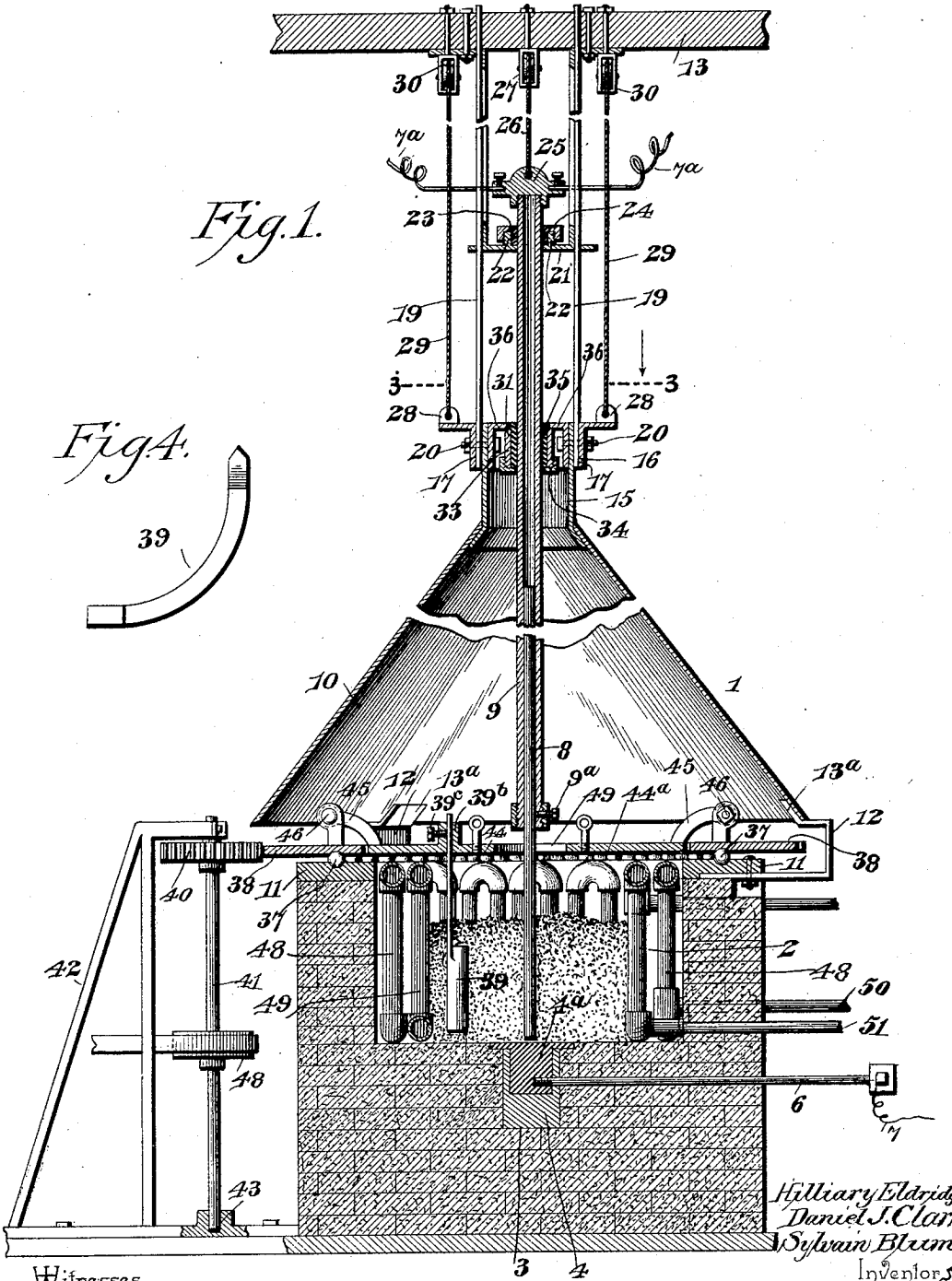


Fig. 4.

Witnesses
Jas. L. McCathran
H. E. Bennett

Hilliary Eldridge
Daniel J. Clark
Sylvain Blum
Inventors

By their Attorneys,
C. A. Snow & Co.

No. 625,252. Patented May 16, 1899.

H. ELDRIDGE, D. J. CLARK & S. BLUM.

ELECTRICAL FURNACE.

(Application filed Jan. 18, 1898.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

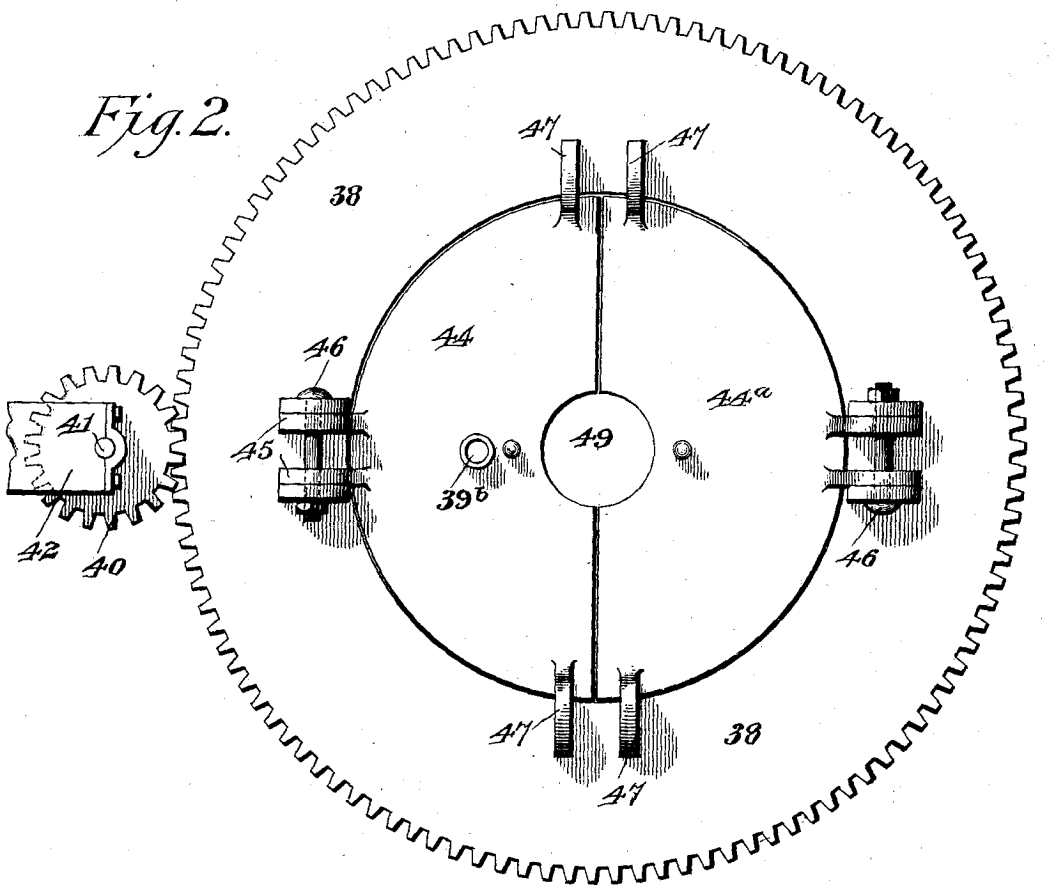
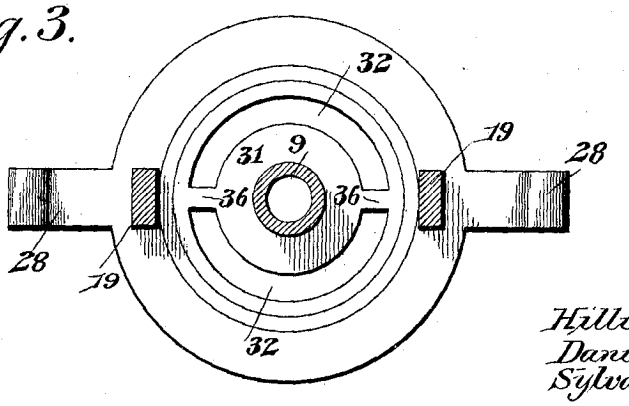


Fig. 3.



Witnesses
Jas. K. McCathran
W. F. Benedict

Hilliary Eldridge
Daniel J. Clark
Sylvain Blum
Inventors

By their Attorneys,

C. A. Snow & Co.

UNITED STATES PATENT OFFICE.

HILLIARY ELDRIDGE, DANIEL JOHNSON CLARK, AND SYLVAIN BLUM, OF GALVESTON, TEXAS.

ELECTRICAL FURNACE.

SPECIFICATION forming part of Letters Patent No. 625,252, dated May 16, 1899.

Original application filed September 29, 1897, Serial No. 653,450. Divided and this application filed January 18, 1898. Serial No. 667,101. (No model.)

To all whom it may concern:

Be it known that we, HILLIARY ELDRIDGE, DANIEL JOHNSON CLARK, and SYLVAIN BLUM, citizens of the United States, residing at Galveston, in the county of Galveston and State of Texas, have invented a new and useful Electrical Furnace, of which the following is a specification.

Our invention relates to improvements in electrical furnaces or retorts, and it constitutes a division of the prior application filed by us on September 29, 1897, Serial No. 653,450.

The electrical furnace which forms the subject-matter of the present application is especially designed for use in connection with an apparatus for manufacturing calcium carbid and illuminating or heating gas, substantially as disclosed in our prior application to which reference has been made; but it will be understood that we do not restrict ourselves to this specific employment of the electrical furnace or retort, because we are aware that it may be used advantageously in other arts.

One of the objects that we have in view is to provide means arranged to secure easy access to the retort-chamber for the purpose of charging the substance therein to be treated by the heat from the electric arc.

A further object is to so arrange the several working parts of the improved furnace that they may be manipulated or controlled with ease and at the same time to provide for the collection and discharge of the fumes and gases which may arise from the furnace retort or chamber during the treatment of the charge therein.

With these ends in view our invention consists in the combination, with an inclosed furnace-chamber, of a vertically-adjustable fume-collecting hood, a hanger over said hood, insulated guide-boxes carried by the hanger and the hood, and a suspended anode which passes through the said insulated guide-boxes and is adapted to coact with a cathode fixed in the bottom of the furnace-chamber.

The invention further consists in the combination, with the inclosed furnace-chamber, of a revoluble carrier mounted thereon and supporting a closure or head, a stirrer or plow mounted on the carrier and depending therefrom into the inclosed furnace-chamber, and suitable driving means for said carrier; and the invention further consists in the novel construction and arrangement of parts which will be hereinafter fully described and claimed.

To enable others to understand our invention, we have illustrated one embodiment thereof in the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a vertical sectional elevation through the electrical furnace constructed in accordance with our invention. Fig. 2 is a detail plan view illustrating the revoluble carrier and the sectional head or closure which is mounted on said carrier. Fig. 3 is a detail sectional view on the plane indicated by the dotted line 3 3 of Fig. 1, looking in the direction indicated by the arrow. Fig. 4 is a detail fragmentary view in plan of the plow or stirrer which is carried by the rotatable head and carrier of the furnace.

Like numerals of reference indicate like parts in all the figures of the drawings.

The electrical furnace of our invention embodies a structure 1, which is constructed of masonry or fire-brick in any suitable way to provide a chamber 2. We prefer the fire-brick construction of the furnace, because it is better adapted to resist the intense heat generated by the electrical appliances of the furnace. The bottom of the chamber 2 is constructed with a cavity 3, in which is fitted a central sectional cathode 4 4^a. The members of this sectional cathode are preferably made of metal, although other suitable material may be employed, if desired. The lower member of this sectional cathode is permanently fastened or seated in the cavity 3 of the chamber; but the other member of said cathode, which is exposed to the intense heat of the electric arc, in consequence of which it is liable to deteriorate and wear out, is preferably applied to the permanent lower member in a manner to permit its removal in order that said member 4^a may be renewed when worn.

The electrical connection between one of the conductors of the circuit and the cathode

is effected by the employment of a metallic rod 6, which passes through a suitable passage formed in the brickwork of the furnace. The inner end of this rod is screw-threaded to engage with a correspondingly-threaded opening in the members 4 4ª of the cathode; but the outer end of the rod is clamped or otherwise fixed to one of the conductors 7 of the electrical circuit.

The anode 8 extends vertically through the inclosed furnace-chamber in axial relation thereto and to the cathode, and the lower end of said anode is thus adapted to be presented centrally to the removable member 4ª of the cathode. The anode consists, preferably, of a pencil or rod of carbon which is fitted within a tubular carrier 9, suspended above the inclosed furnace-chamber by means which permit of the vertical adjustment of said carrier 9 and the anode 8 therein for the purpose of establishing and regulating the electrical arc between the anode and cathode, as required.

Over the chamber of the furnace is arranged a suspension-beam 13, which may be supported from the roof or in an overhead position by any suitable means. This suspension-beam sustains a hood 10, the means for suspending and adjusting said hood, and the suspending devices for the anode and its tubular carrier. The hood 10 is of conical or funnel shape, substantially as represented by Fig. 1 of the drawings, and it is suspended over the inclosed furnace-chamber in a manner to have its broad lower open end adjacent to the inclosed furnace-chamber in order that it may entirely surround the upper part thereof and collect the fumes and gases arising from the inclosed furnace-chamber during the fusing of the calcium oxid and carbon necessary to produce the calcium carbid.

On the upper edge of the wall surrounding the retort-chamber is rigidly fastened a metallic bearing-plate 11, which serves as a support for a series of angular brackets 12, the latter being bolted rigidly to said bearing-plate, substantially as shown at the right-hand side of Fig. 1. These brackets extend upwardly from the inclosed furnace-chamber and have the inclined extremities 13ª, which form seats for the reception of the lower edge of the fume-collecting hood 10, and the upper end of said fume-collecting hood terminates in a tubular extension 15, to which is fastened a bearing-ring 16. Said bearing-ring is flanged to fit snugly to the tubular extension of the fume-collecting hood, and it is provided with vertical openings or sockets 17 to receive the lower extremities of the vertical guide-rods 19. The bearing-ring, the tubular extension of the fume-collecting hood, and the guide-rods for said hood are all united solidly together by through-bolts 20, which pass through said parts, substantially as shown by Fig. 1.

To the overhead suspension-beam is rigidly bolted the flanged upper end of a hanger 21, which is provided above the electrical appliance of the furnace to form a means which assists in guiding the rods of the fume-collecting hood and also as one of the guides for the tubular carrier of the anode. This hanger 21 has its lower head provided with a guide-box consisting of an upwardly-projecting sleeve 22, a bushing 23, and a gland 24. The sleeve 22 is integral with the lower head of the hanger and it is externally threaded to receive an internal thread on the gland 24. Said bushing 23 is of electrical insulating material, and it is confined within the sleeve and gland of the guide-box, so as to engage directly with the tubular carrier of the movable anode, and this bushing serves to insulate the anode and its tubular carrier electrically from the metallic parts of the guide-box, the hanger, and the other overhead devices of the electrical furnace. The upper extremity of the tubular anode-carrier protrudes above the guide-box of the hanger 21, and to said extremity of the anode-carrier is fastened a head 25, which is socketed to receive the conductor 7ª, which, in connection with the conductor 7, forms a part of the electrical circuit, said conductors being clamped in the head 25 by means of set-screws or other suitable devices. To the eye of the head 25 is connected one end of a suspension cable, rope, or chain 26, which passes upwardly over a guide-sheave 27, the frame of which is bolted or otherwise fastened to the suspension-beam 13, and said suspension cable or chain 26 receives a drop-weight. (Not shown.) This drop-weight serves as a counterpoise for the anode and its carrier to adapt the latter to move easily and freely and to be adjusted vertically, as may be required. The tubular carrier for the anode terminates at its lower end in an enlarged foot, having a clamping-screw 9ª, adapted to bind upon the carbon pencil or rod which forms the anode and to clamp the latter rigidly and adjustably within said tubular carrier 9. The guide-rods for the fume-collecting hood pass through suitable apertures provided in the upper and lower ends of the hanger 21 and the overhead suspension-beam, and these rods thus serve to direct the fume-collecting hood in a straight vertical line and keep it from swaying out of position with relation to the inclosed furnace-chamber and to the angular brackets upon which the lower front end of the hood is adapted to be seated when said hood is lowered into close relation to the inclosed furnace-chamber.

The bearing-ring, hereinbefore described, is provided with the laterally-extending lugs 28, to which are attached weight-carrying ropes or chains 29, that are reeved through suitable sheaves 30, which are bolted or otherwise fastened to the suspension-beam 13. The weighted cables 29 counterpoise the fume-collecting hood and enable the latter to be raised and lowered easily and quickly, so that access may be obtained to the chamber of the furnace. The flanged bearing-ring being at-

tached rigidly to the fume-collecting hood, provision must be made for the exit of the fumes and gases therefrom, and we attain this object and also provide a guide-box for the anode-carrier by a novel construction of the guide-box itself. This guide-box 31 is arranged centrally within the bearing-ring to provide openings or slots 32, which constitute the exit openings or passages for the gases and fumes from the hood, and said box 31 has a sleeve 33 depending centrally from the bearing-ring, a gland 34, and an insulating-bushing 35. The guide-box sleeve 33 is joined to the bearing-ring by the radial webs 36, and the lower end of said sleeve 33 is threaded to receive the gland 34, which is screwed on the sleeve to confine the bushing 35 within said sleeve and in electrical contact with the anode-carrier 12. This bushing 35 is of electrical insulating material, arranged to have direct contact with the anode-carrier and to insulate the bearing-ring and the hood electrically from said anode-carrier. The insulated guide-box is situated in the bearing-ring and on the hood in vertical alinement with the insulated guide-box on the lower end of the hanger 21, whereby said anode-carrier is adapted to pass through both insulated guide-boxes and to be guided in a straight vertical line thereby.

The bearing-plate on the upper edge of the furnace is provided in its upper surface with a groove, forming a ball-race for the reception of a series of antifriction balls or rolls 37, and upon this ball-bearing rests the rotatable carrier 38. (Shown by Figs. 1 and 2.) Said rotatable carrier consists of a ring or annulus occupying a horizontal position in compact relation to the upper open side of the furnace, and said carrier is adapted for rotation in a horizontal plane on the furnace in order to move the stirrer or plow 39 within the furnace-chamber. In one embodiment of our invention this rotatable carrier 38 is provided with a series of gear-teeth on its peripheral edge, with which teeth meshes a spur-gear pinion 40, which is fastened to the upper end of a shaft 41. This shaft is journaled at its upper end in a suitable bearing of the frame 42, situated exteriorly to the furnace, and the lower end of said shaft is stepped in a bearing 43 on the base of said frame 42, the latter being bolted or otherwise fastened to the base or floor of the furnace.

The rotatable carrier 38 sustains a sectional head or closure 44 44^a, which is of substantially disk-like form and adapted when closed to lie within said ring-like carrier. The sections of the head or closure are provided with lugs or ears 45, which are hinged at 46 to diametrically opposite sides of the carrier 38, and said sections of the closure are provided near their inner free edges with lugs 47, adapted to rest when the sections are closed upon the carrier and limit the folding or closing movement of the sections which form the head or closure. The pivotal connections 46 between the sectional closure and the rotatable carrier occupy positions above the horizontal plane of the carrier, as shown by Fig. 1, and thus the sections of the closure may be drawn upwardly and outwardly to occupy positions when open entirely out of the way of the furnace-chamber. The adjacent inner edges of the hinged sections of the head or closure are recessed at 49 to provide a central opening therein for the passage of the anode and its carrier, thus permitting the free vertical movement or adjustment of said anode when the head is adjusted to close the upper open side of the furnace-chamber.

The plow or stirrer 39 has an offstanding curved foot adjacent to the bed of the furnace-chamber, and the shank of said plow or stirrer passes vertically through a socket 39^b, which is provided in the member 44 of the head or closure, said shank being clamped rigidly in position by a binding-screw 39^c or its equivalent.

The shaft 41 has a pulley 48 or other driving appliance for imparting rotary motion to said shaft, and the shaft is adapted to drive the carrier 38, the sectional closure or head mounted on said carrier, and the plow or stirrer 39, so that the latter is adapted to travel in a horizontal plane within the material contained in the furnace-chamber, thus stirring up said material and feeding fresh material within the zone of the electric arc between the anode and the two-part cathode 4 4^a.

As disclosed by our prior application, of which the present case is a division, the furnace is provided within the closed chamber 2 thereof with two series of heating-coils, one of which is adapted for the purpose of heating air and the other series of coils receive gaseous vapors which circulate through said coils to fix the gases. These two series of coils are arranged concentric one with the other, and both series of coils surround the arc-forming appliances, situated centrally within the inclosed furnace-chamber. In Fig. 1 of the drawings a vertical series of air-heating pipes 48 lie within the furnace-chamber 2, contiguous to the surrounding wall thereof, and within these pipes or coils 48 is another series of heating-pipes 49, which are concentric with the first-named series of pipes. The heating-pipes 48 are arranged to receive or be supplied with air from the inclosed furnace-chamber 2, and to the final pipe of the series of pipes 48 is connected an off-bearing pipe 50, which extends through the furnace and is adapted to be connected with a suitable receiver, such as a carbureter. The other series of pipes 49 has an inlet-pipe 51 connected thereto, and this inlet-pipe extends through the furnace, so as to be properly connected with a source of gas-supply, whereby the inlet-pipe 51 is adapted to convey the gaseous vapors to the series of pipes 49, so as to circulate therethrough and fix the gases. By arranging the two series of pipes one within the other and with said pipes around

the arc-forming appliances within the furnace-chamber the pipes are exposed to the heat generated by the electric arc and the incandescent material which is treated within the furnace, and said pipes are thus adapted to be heated to a high temperature. It is evident, however, that the outer series of pipes 48 will not be heated as highly as the inner series of pipes 49, because they are outside of the pipes 49 and somewhat remote to the source of heat.

The operation of the furnace may be described briefly as follows: The anode-carrier is lowered until the anode comes in contact with the cathode in the bottom of the furnace-chamber, after which the closure 44 44ª is opened and the chamber is filled or charged with the mixture or substance which it is desired to treat. The cover is now closed, and the electric current is turned on through the conductors 7 7ª, said current passing through the anode-holder, the anode, the cathode, and the rod extending outwardly from said cathode. By lifting the anode and its carrier upwardly a suitable distance the electric arc is established between the cathode and the proximal end of the anode thereto, and the heat generated by the electric arc fuses the materials within the furnace-chamber in a well-known manner. The carrier 38 is rotated by the shaft 41 to impart traveling movement to the plow or stirrer in the materials contained within the inclosed furnace-chamber, and as the mixture fuses under the action of the electric arc the plow or stirrer continually throws fresh mixture within the zone of the electric arc. The fumes and gases arising from the chamber of the furnace are collected by the hood and discharged from the upper end thereof. When it is desired to obtain access to the furnace-chamber, it is necessary to raise the hood and open the sectional closure, thus exposing the chamber in the furnace for the removal of the treated charge and for placing therein a fresh charge of material to be treated.

Changes in the form, proportion, and the minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of this invention.

Having thus described our invention, what we claim is—

1. In an electrical furnace, the combination with an inclosed furnace-chamber, and a cathode therein, of a vertically-adjustable hood arranged over the furnace-chamber, and a vertically-adjustable anode-carrier, guided through and insulated from said hood, said hood and anode-carrier being adjustable independently of each other, substantially as described.

2. In an electrical furnace, the combination with an inclosed furnace-chamber, and a cathode therein, of a counterpoised fume-collecting hood suspended over said furnace-chamber, and a counterpoised anode-carrier, guided through said hood and adjustable independently thereof with relation to the cathode, substantially as described.

3. In an electrical furnace, the combination with an inclosed furnace-chamber having a cathode, of a vertically-adjustable fume-collecting hood suspended over said furnace-chamber, and an anode guided through and insulated from said hood, substantially as described.

4. In an electrical furnace, the combination with an inclosed furnace-chamber having a cathode, of a fume-collecting hood, a hanger, insulated guide-boxes carried by the hood and the hanger, and a vertically-adjustable anode passing through said guide-boxes, substantially as and for the purposes described.

5. In an electrical furnace, the combination with an inclosed furnace-chamber and a suspension-beam, of a hanger depending from said beam and carrying an insulated guide-box, a fume-collecting hood guided by the hanger and the suspension-beam, and provided with an insulated guide-box which is in vertical alinement with the guide-box of the hanger, and a vertically-adjustable anode fitted in the guide-boxes of the hood and the hanger, substantially as described.

6. In an electrical furnace, the combination with an inclosed furnace-chamber and a fume-collecting hood, of a bearing-ring attached to the hood and provided with an insulated guide-box which is arranged therein to form the exit-openings for the fumes and gases arising from said retort, and an anode passing through said guide-box and insulated thereby from the bearing-ring and the hood, substantially as and for the purposes described.

7. In an electrical furnace, the combination with an inclosed furnace-chamber having a cathode, of a fixed overhead hanger, a vertically-adjustable fume-collecting hood provided with guide-rods fitted to said hanger, the vertically-alined insulating guide-boxes carried by the hanger and said hood, and an anode movable in said guide-boxes, substantially as described.

8. In an electrical furnace, the combination with an inclosed furnace-chamber, of a revoluble carrier mounted thereon, a separate closure or head having a hinged connection with said carrier to rotate therewith and adapted to be adjusted independently of the carrier for exposing the furnace-chamber, and a stirrer or plow mounted on the closure or head and depending therefrom within the furnace-chamber, substantially as and for the purposes described.

9. In an electrical furnace, the combination with an inclosed furnace-chamber, of a revoluble carrier mounted on said furnace-chamber, a sectional closure having its members hinged to the carrier to be sustained thereby over the furnace-chamber and adjustable independently of the carrier and of each other to expose the furnace-chamber, a

plow or stirrer mounted on the closure, an anode passing through said closure, and a cathode within the furnace-chamber, substantially as described.

10. In an electrical furnace, the combination with an inclosed furnace-chamber and a cathode therein, of a fume-collecting hood, a suspended anode passing through said hood and insulated therefrom, and independent devices for counterpoising the fume-collecting hood and said anode, substantially as and for the purposes described.

11. In an electrical furnace, the combination with an inclosed furnace-chamber and a cathode therein, of a fume-collecting hood arranged to inclose said furnace-chamber, a counterpoise for said fume-collecting hood, a vertically-movable anode guided in and insulated from said hood, an independent counterpoise connected to said anode, and electrical connections for the anode-carrier and the cathode, substantially as described.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in the presence of two witnesses.

HILLIARY ELDRIDGE.
DANIEL JOHNSON CLARK.
SYLVAIN BLUM.

Witnesses:
E. R. CHEESBOROUGH,
B. I. WILLCOXEN.

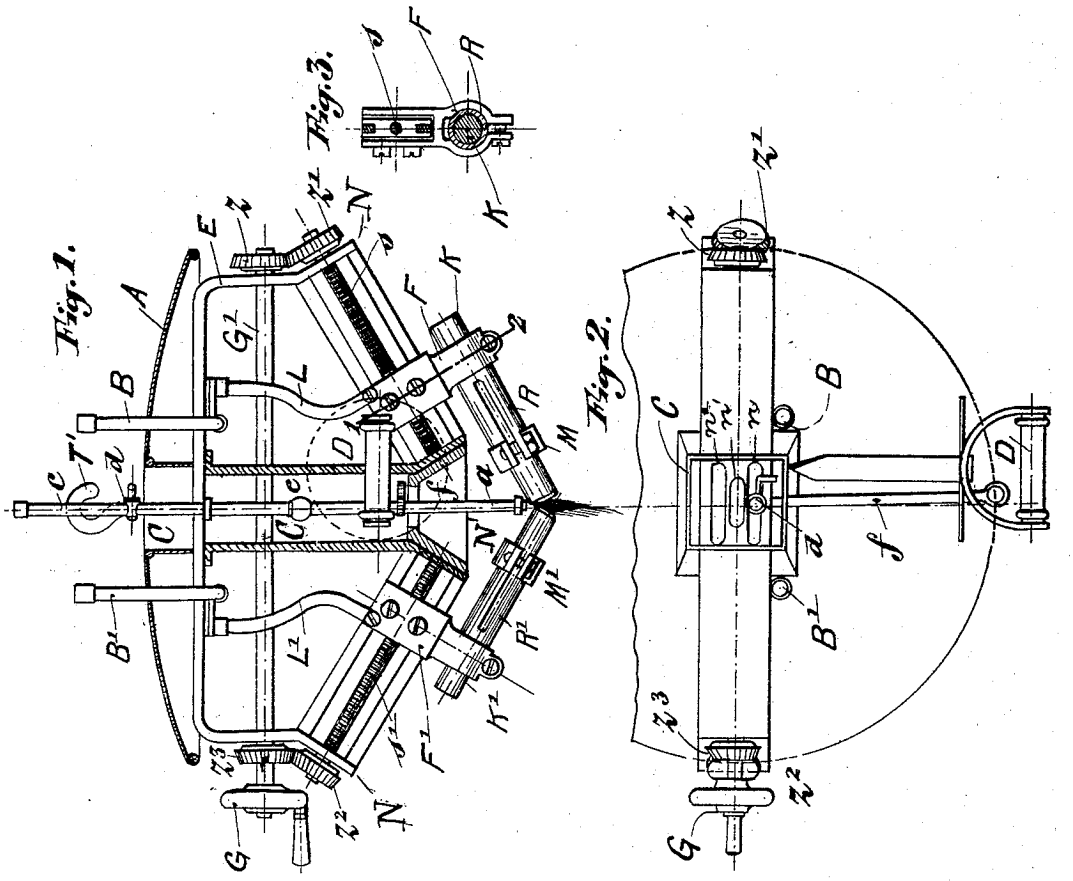
No. 641,767. Patented Jan. 23, 1900.

H. DRÖSSE.

METHOD OF ELECTRIC ARC HEATING AND APPARATUS THEREFOR.

(Application filed Dec. 13, 1898.)

(No Model.)



Witnesses
George N. Richards
G. H. Walmsley

Inventor
Hermann Drösse
by W. H. Babcock Atty

UNITED STATES PATENT OFFICE.

HERMANN DROSSE, OF BERLIN, GERMANY

METHOD OF ELECTRIC-ARC HEATING AND APPARATUS THEREFOR.

SPECIFICATION forming part of Letters Patent No. 641,767, dated January 23, 1900.

Application filed December 13, 1898. Serial No. 699,178. (No model.)

To all whom it may concern:

Be it known that I, HERMANN DROSSE, a citizen of the Empire of Germany, residing at Berlin, Germany, have invented certain new and useful Improvements in Methods of and Devices for Applying a Jet of Air or Gas to an Electric Arc, of which the following is a specification.

Irregularity in the consumption of electric-light carbons naturally causes irregularity in the arc between them. It becomes important to compensate for this irregular action and to remedy the resulting defect. This I accomplish by applying a blast of air or other gas to the arc by means which permit the direction of the blast to be varied at will as becomes necessary for the purpose stated. The said blast is also used to thin and spread the flame of the arc, and its force may be regulated to increase or decrease its action on the latter.

One feature of the new process carried into practice by means of the improved device consists in employing reducing-gas for blowing to do away with the high oxidizing action of the arc, which action is often very objectionable for welding or soldering purposes, and the blast-gas may be atmospheric air combined with burnable and unburnable gas, such as lighting-gas, hydrogen, acetylene, and certain hydrocarbons, which by the high degree of heat of the electric arc are decomposed into their components, carbon and hydrogen, so as to have a high reducing action. In the same way liquids containing carbon or hydrogen—such as petroleum, benzin, and ligroin—are immediately reduced into gas and decomposed by the flame.

The invention consists in the features of construction and combination of parts hereinafter fully described and claimed.

In the accompanying drawings, Figure 1 is a side elevation of the improved apparatus. Fig. 2 is a top plan view of same, the cover A, which is optional, being omitted; and Fig. 3 is a sectional detail view on line 1 2 of Fig. 1.

In the drawings like letters refer to like parts throughout all the figures.

In the frame E of the mechanism a shaft G′ is journaled, said shaft being actuated by hand-wheel G and carrying outside of the depending parts of said frame two bevel gear-wheels z and z^2, meshing with gear-wheels z' and z^3, respectively. These latter gear-wheels are mounted on threaded feed-shafts s and s', respectively, the said shafts being journaled near their outer ends in bearings N, forming part of frame E, and at their inner ends in bearings N′, integral with the lower end of outlet-flue C, for the products of combustion. This flue is rigidly attached to frame E and is wider than the latter to allow upward draft. The feed-shafts s and s' are engaged by suitable feed-nuts F and F′, carrying the carbon-holders and constructed as shown in Fig. 3 of the drawings. The feed-nuts are insulated from said feed-shafts. The carbons or electrodes K K′ are inserted into longitudinally-slit tubes R or R′ and secured therein by clamps M M′, said tubes R R′ being held in clamps provided on nuts F and F′. This arrangement of the electrodes prevents the same from being quickly consumed during the welding process, said arrangement providing a larger surface to the passage of the current and leading the latter near the points of the carbons. The air and gas are led to the electric arc produced between the ends of the carbons K and K′ through blast-pipe c, terminating in a nozzle a, pivotally attached to said pipe at e and secured to a handle-rod f, horizontally extending therefrom and serving to give the nozzle a any required position for deviating the flame in any direction. The blast-pipe c has at its upper part a cock d for controlling the pressure of the fluid (gas or liquid) to obtain a more or less greater deviation of the flame.

The current passes through the apparatus as follows: from feed-wire B through the flexible cable L to carbon-holder F and after production of the arc to negative carbon-holder F′ through cable L′ and return-wire B′.

The top part of the frame E may be provided with a hook or its equivalent T′ for suspending the apparatus to a movable carriage, and the apparatus may have a suitable handle D located near handle f and serving to move the apparatus as required. Furthermore, a cover A may be provided on top of the frame, as shown in Fig. 1, having a central passage which forms an upward extension of flue C, making a continuous flue or passage. The central part of frame E is slot-

ted at n, n', and n^2 within the said flue to allow the passage of the blast-tube c and the attachment of the suspending-hook T as well as to facilitate the escape of the products of combustion, and other modifications may be made in the construction and arrangement of the various parts without departing from the scope of the invention.

Having fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In combination with the electric conductors and carbons forming an electric arc, adjusting mechanism for the said carbons, a blast-tube for discharging air or gas against the arc, and adjusting devices for varying at will the direction of the said tube and the blast issuing therefrom, the said tube-adjusting devices being independent of the carbon-adjusting devices, in order that the blast may be applied to the arc at different inclinations, substantially as set forth.

2. In an apparatus of the character described the combination with a suitable frame, of suitable means for holding the electrodes and suitable movement-transmission devices for controlling said electrodes in accordance with the consumption, a chimney arranged at the center of the apparatus and connecting the parts of the frame, a blast-pipe extending through said chimney and having a movable nozzle to permit the deviation of the electric arc in any required direction, substantially as set forth.

3. The method or process of assisting the action of the electric arc on metals and other materials consisting in directing a flow of liquid hydrocarbons or other liquid-reducing agents against and into the electric arc, substantially as set forth.

In witness whereof I have hereunto signed my name, this 29th day of November, 1898, in the presence of two witnesses.

HERMANN DRÖSSE.

Witnesses:
ERWIN L. GOLDSCHMIDT.
HENRY HASPER.

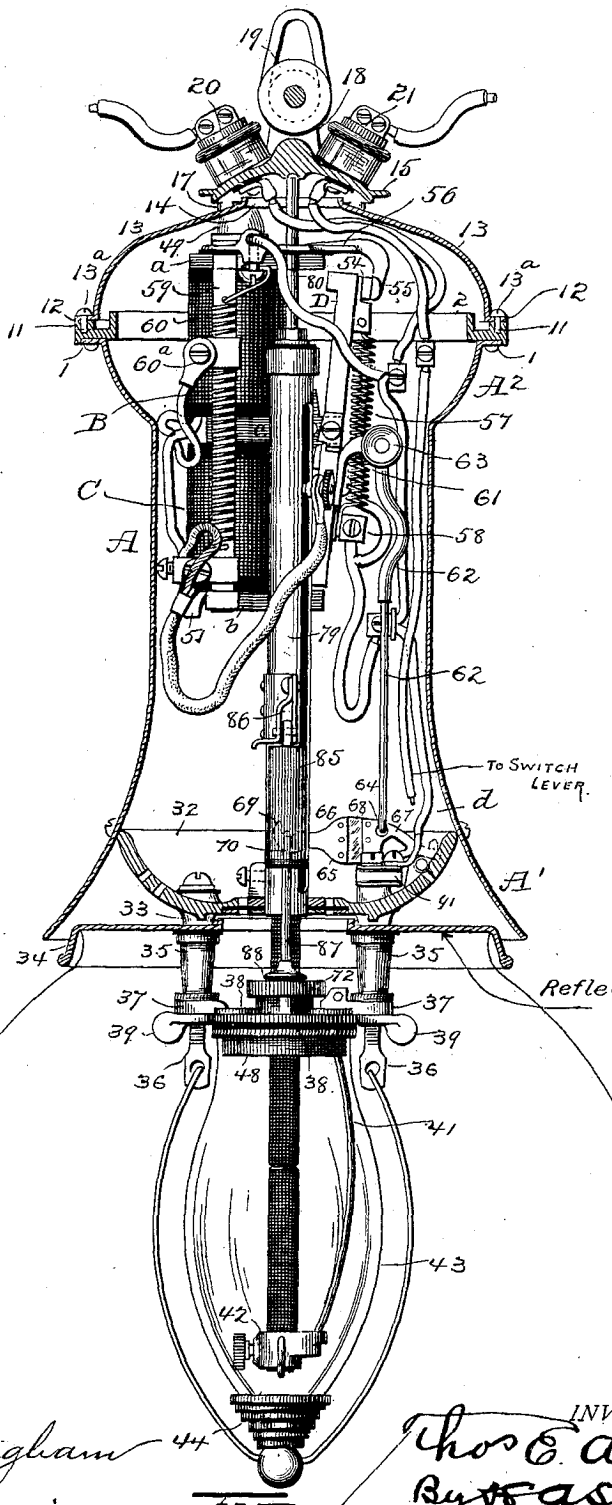
No. 644,563. Patented Mar. 6, 1900.

T. E. ADAMS.

ELECTRIC ARC LAMP.

(Application filed Sept. 20, 1899.)

(No Model.) 4 Sheets—Sheet 1.



WITNESSES

E. J. Nottingham

G. F. Downing.

INVENTOR

Thos E. Adams

By H. A. Seymour

Attorney

Fig. 1

J. H. REID.

MEANS ACTUATED BY ALTERNATING ELECTRIC CURRENT FOR CONTROLLING OR OPERATING ELECTRIC FURNACES OR OTHER MECHANISMS.

APPLICATION FILED DEC. 19, 1914.

1,327,738.

Patented Jan. 13, 1920.

2 SHEETS—SHEET 1.

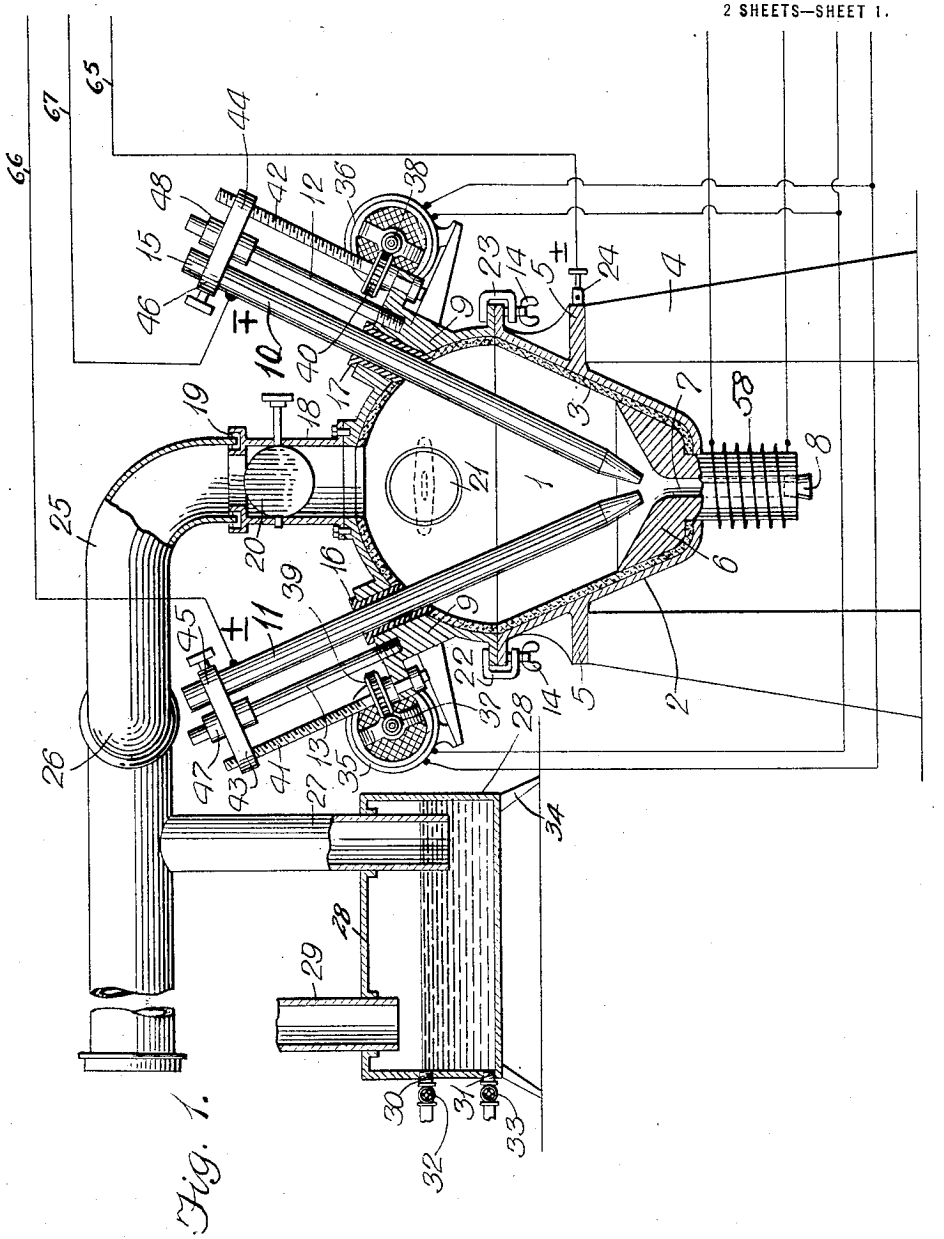


Fig. 1.

Witnesses
Chas. W. Stauffiger
K. G. Finlay

Inventor
James Henry Reid,
By Henry S. Blackmore
Attorney

J. H. REID.

MEANS ACTUATED BY ALTERNATING ELECTRIC CURRENT FOR CONTROLLING OR OPERATING ELECTRIC FURNACES OR OTHER MECHANISMS.

APPLICATION FILED DEC. 19, 1914.

1,327,738.

Patented Jan. 13, 1920.

2 SHEETS—SHEET 2.

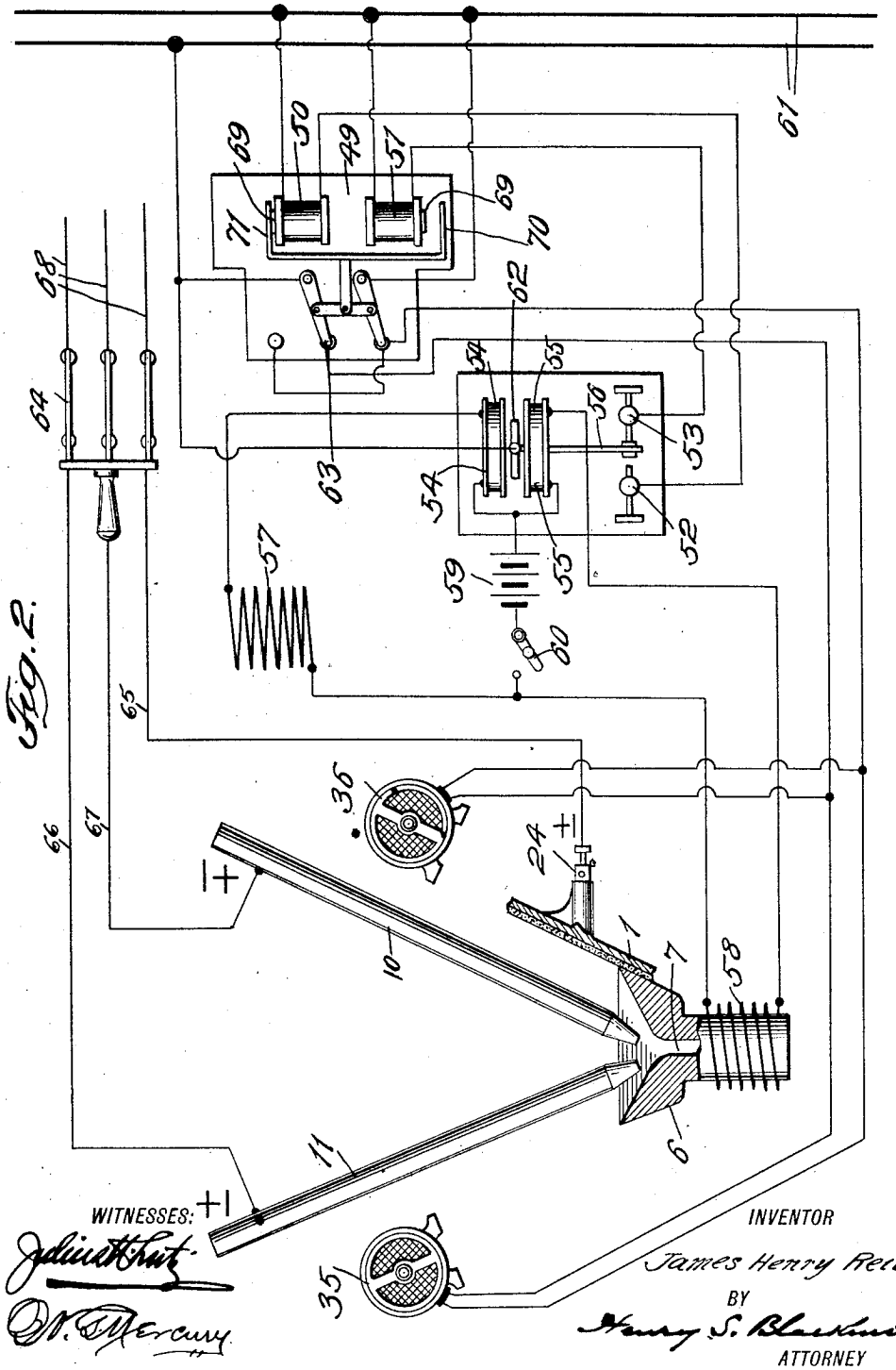


Fig. 2.

WITNESSES:

INVENTOR

James Henry Reid

BY

Henry S. Blackmore

ATTORNEY

UNITED STATES PATENT OFFICE.

JAMES HENRY REID, OF NEWARK, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO INTERNATIONAL NITROGEN CO., A CORPORATION OF DELAWARE.

MEANS ACTUATED BY ALTERNATING ELECTRIC CURRENT FOR CONTROLLING OR OPERATING ELECTRIC FURNACES OR OTHER MECHANISMS.

1,327,738. Specification of Letters Patent. **Patented Jan. 13, 1920.**

Application filed December 19, 1914. Serial No. 878,071.

To all whom it may concern:

Be it known that I, JAMES HENRY REID, a citizen of the United States, residing at 352 Mulberry avenue, in the city of Newark, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Means Actuated by Alternating Electric Current for Controlling or Operating Electric Furnaces or other Mechanisms, of which the following is a specification.

This invention relates to apparatus actuated by electricity, and controlled by devices actuated by repulsion, induced by the action of alternating current on a core acting against a non-magnetic armature, such as aluminium, copper, etc., for the production of distillation or sublimation by direct, fractional, destructive, or other means, of hydrocarbons and production of products from residues. It has for one of its objects the provision of an apparatus for securing products of fractional or destructive distillation of hydrocarbon, such as bituminous coal, coal tar, or other substance capable of yielding carbon by the action of heat and the making of products with what would be the non-volatile carbonaceous residues during the process of operation, such as calcium carbid, which may be obtained by mixing calcium oxycompounds, such as calcium oxid or substances capable of forming the same such as calcium carbonate, with bituminous coal and subjecting the mixture to the action of electricity as hereinafter set forth. The invention further comprises exposing coal of the bituminous variety to the action of electricity of sufficient volume and intensity to operate against the resistance of the substance employed and produce a temperature sufficient to evolve the product desired. It further comprises subjecting a mass of material to the action of electricity of progressively varying character so that varying degrees of temperature may be generated within the charge and various products evolved and secured, such for example as the separate constituents of coal tar viz., benzol, toluol, xylol, etc., instead of coal tar *per se*. Or the whole of the products may be driven off as a composite composition and the constituents recovered thereafter by fractional distillation.

As an illustration of the invention and the manner in which it may be employed the production of tar and other ingredients or substances evolved by the destructive and other distillation of bituminous coal together with the production of carbid, such as calcium carbid, will be taken, reference being directed to the accompanying drawing in which:

Figure 1 shows a longitudinal vertical section of a furnace partly in elevation illustrating the electrodes, control device, and condenser, and,

Fig. 2 shows a diagrammatic view illustrating the control mechanism and electrical connections therefor, and illustrating the method of operation.

Similar numerals of reference represent corresponding parts in the various views.

Referring to the drawings the numeral 1 indicates an electric furnace in which substances are treated or converted by heat or electrical action, comprising the receptacle 2 provided with the lining 3 and supported by the supports 4 by means of the bearing extensions 5.

The receptacle 2 is provided with a top or cover 9 through which pass the electrodes 10 and 11, which are held or supported by the supports or devices 12 and 13 by means of the insulation guides 43 and 44. The said electrodes pass through the cover 9 and are provided with the insulation sleeves 16 and 17. From the cover extends the outlet 18 provided with the fluid seal 19 and the revolving or movable damper or valve control 20.

The upper section of the cover 9 is also provided with a sealed feed inlet 21, the removable seal of which may be removed and replaced for supplying ingredients to the apparatus and closing the apparatus during the operation thereof.

The lower section 2 and the upper section 9 are secured together by the clamps 22 and 23 actuated by the thumb screws 14. The lower section 2 of the converter is provided with a means 24 for making an electrical connection to the converter of a character opposite to that of the electrodes 10 and 11, and which means includes a securing and releasing member for the electrical conductor. The outlet 18 with its seal 19 communicates with a removable conduit 25 oper-

ating through the swinging joint 26. This conduit communicates with an outlet 27 leading to the reservoir 28 and through which the condensed volatile or volatilized products pass to the same, the reservoir 28 being provided with an outlet 29 for the permanent gases whereby said gases are conveyed to a reservoir (not shown).

The reservoir 28 for the distillate is provided with the outlet 31 controlled by the valve 33 at the lower part thereof, and the outlet 30 controlled by the valve 32 at a higher point for the removal of lighter products when the reservoir contains water.

The reservoir 28 is also provided with the legs or supports 34.

The receptacle 2 with its lining 3 is provided with the outlet or tap-hole 7 and the plug or closure 8 therefor, and the carbon contact base or hearth 6. The wall of the discharge opening or tap-hole is also provided exteriorly with a spirally wound wire 58 of such character that its electrical resistance increases rapidly when heated and which is employed to actuate and control the electrodes in order to maintain a substantially uniform temperature in the furnace and automatically adjust the electrodes for current control for this purpose as hereinmore fully set forth.

The cover 9 is also provided with the electrode feed and regulating motors or devices 35 and 36 which are in circuit with the reversing switch 49 (Fig. 2), the shaft of each motor or electrode regulating device is provided with the spiral thread or worm 37 and 38, which engage the cog wheels 39 and 40, thereby revolving the screw bearing rods 41 and 42 which causes the guides 43 and 44 to travel in an upward or downward direction, according to the direction of the revolution of the rod and simultaneously carry the electrodes 10 and 11 in like direction for feed or withdrawal to or from the furnace the guides being supported by the carrying rods 13 and 12 passing through the sleeves 47 and 48. The electrodes 10 and 11 being attached or secured to the guides 43 and 44 by the binding screws 45 and 46.

In describing the furnace control mechanism operated through the automatic actuation of the electrodes reference is directed more particularly to Fig. 2 where parts of the electric furnace are shown connected with the control device in which the numeral 68 represents electrical conductors leading from a source of supply (not shown) and controlled by the switch 64. The wires 66 and 67 are leads to the electrodes 10 and 11 and the wire 65 to the pot or receptacle 1 of the furnace and its carbon electrode, hearth or base 6 by means of the terminal contact 24.

The electrode control motors 35 and 36 are in circuit with a reversing switch 49 provided with the repulsion devices 50 and 51 actuated by alternating current acting on non-magnetic armatures such as aluminium, copper, etc., which are in electrical connection with the contacts 52 and 53 respectively of the balance coils 54 and 55, said coils having an armature between them with a contacting arm 56 extending to and adapted to contact with the terminals 52 and 53.

Each of the coils 54 and 55 is in series with the resistance coil 57 or 58 respectively and the battery 59 and switch 60 when operating.

The power circuit 61 supplies current for operating the reversing switch and motors for controlling the electrodes.

These two circuits constitute an electrical balance so that when both are energized and the resistance coils are maintained at the same temperature, the magnetic effect on the armature 62 is *nil* and the arm 56 remains in the adjusted position shown in the drawing.

The furnace being cold the electrodes 10 and 11 are lowered into contact with the hearth 6 thus establishing an electric current upon the closing of the switch in the circuit 68 and simultaneously the switch 60.

The resistance of the electrodes and hearth to the current raise their temperature and consequently the resistance of the coil 58 thereby producing a greater flow of current in the resistance coil 57 and consequently disturbing the equilibrium of the armature 62 and causing the arm 56 to contact with the terminal 52 and a flow of current through the repulsion device 50 reversing the switch 49 and changing the direction of the motors 35 and 36 thereby drawing the electrodes slowly apart and away from the hearth.

The separating of said electrodes decreases the flow of current and consequently less heating effect and drop in temperature results which decreases the resistance of the coil 58 and permits a balance in the coils 54 and 55 thereby bringing the arm 56 into contact with the terminal 53 at which time the current in the repulsion device 51 brings the reversing switch to its normal position. The above action reverses the motors and draws the electrodes together thus increasing the current flow and a consequent rise in temperature. This cycle obtains so long as the furnace is in use.

The terminals 52 and 53 are provided with adjusting screws for regulation of the balance.

As an example of the process the production of calcium carbid from bituminous coal and lime or calcium oxid and the recovery of the tar or volatile products evolved during the action of electricity on the composition will be taken.

A mixture of pulverized bituminous coal

and calcium oxid in proportion of one hundred pounds of bituminous coal to 150 pounds of calcium oxid (pulverized) is thoroughly mixed and introduced into the receptacle 2 through the opening 21, it is advisable to mix with this composition about 5% of powdered coke in order to reduce the initial resistance and provide a means for starting the passage of the electric current through the mass at a comparatively low voltage and also provide a means for initially heating the mass through the agency of electricity and also provide a means for rendering the mass more or less porous so that the volatile products produced by the action of heat may be more readily evolved and discharged from the mixture. When the mixture has been introduced into the apparatus the supply opening 21 is sealed and a current of electricity passed through the mixture from the electrodes 10 and 11 through the receptacle 2 by means of said electrodes and the contact 24 of the apparatus. As the current passes through the mixture of bituminous coal and lime the heat generated by the resistance of the ingredients causes the evolution and distillation of various volatile products which condense and accumulate in reservoir 28 from which they may be recovered and the different ingredients afterward secured by fractional distillation. Or the electric current may be so regulated that each individual volatile ingredient produced by the destructive distillation of the hydrocarbon in the converter 2 may be individually and separately secured during the process of destructive distillation, the temperature being regulated by moving the electrodes through the insulating sleeves 16 and 17. When all the volatile products have been distilled off the residual non-volatile carbonaceous matter associated with the lime is heated to a high degree through the passage of electricity and thereby converted into calcium carbid which is finally removed from the receptacle 2 by removing the taphole plug 8, whereby the carbid is discharged while maintained in a molten condition by the heat induced by the induction current passing through the induction coil 58. The outlet 18 is provided with a damper 20 which may be regulated by revolution to suitably check the outflow of the volatile products evolved during the process of operation, the conduit 25 may be raised and disconnected from the fluid seal device 19 which seal is preferably maintained by means of a low fusible metal.

By exposing the solid hydrocarbon, such as bituminous coal to the action of controlled electric currents, the internal resistance will produce intense heat so that the substance will be transformed throughout in a regular and complete manner and will yield a larger percentage of products of more uniform character than in processes devised heretofore, so that the lighter hydrocarbons are not disrupted or "cracked" and such compounds as ammonia are more largely produced and secured without decomposition.

The nonvolatile carbonaceous residue remaining after the evolution of the more volatile and less carbon-containing products produced comprises very heavy hydrocarbon which reacts with a metal oxycompound, such as calcium carbonate or oxid, at elevated temperatures and produces calcium carbid directly from the coked lime which is bonded with and by the heavy nonvolatile hydrocarbon.

Other metal oxycompounds may be employed instead of calcium, such as barium, or other metal a carbid of which is desired, or any nonmetal oxycompound a carbid of which is desired, such as silica for producing silicon carbid, or so called carborundum may be produced.

The metal oxycompound may be a metal oxid, such as calcium oxid, or substance capable of forming or yielding the same by the action of heat, such as calcium carbonate.

The hydrocarbon employed is of the solid variety under ordinary atmosphere conditions and preferably of the mineral species, or substances derived therefrom, such as bituminous coal, lignite, cannel coal, asphalt, or other solid mineral of organic origin.

The various volatile products produced by the action of electricity through the electrical resistance of the carbon-yielding substances operated on may be produced and collected as a composite composition and separated from each other by subsequent fractional distillation or each may be secured as it is produced by maintaining the electrical condition necessary and capable of producing such independently until each has been evolved and the character of electricity supplied altered to yield a next progressively higher carbon-containing product, whereby the products may be directly obtained separate from each other.

Silicon carbid may also be made by mixing silica or silicates with the mineral hydrocarbon or carbon-yielding substance instead of metal carbid or any mixture of metal and nonmetal carbid may be produced.

The term "carbid" employed herein is intended to include and does include broadly any nonvolatile carbid of a metal or nonmetal which may be produced by the action of a solid hydrocarbon and electricity on a compound of such metal or nonmetal a carbid of which is desired, as herein set forth.

The transformation of ingredients may also be induced and maintained by the action of electricity or an electric current on

an inert electrical resistor as a source of heat, such as silicon carbid, associated or communicating with the ingredient to be acted upon, as well as carbon, such as coke, added or produced in the process, without departing from the spirit of the invention.

By inducing internal heat by electrical action, a more perfect and controlled transformation of the material acted upon into the product desired may be accomplished, and the character of the product uniformly maintained without contamination, and also the yield of any individual product desired increased over that secured by any of the means of the prior art, which depends upon the application or employment of externally applied heat for bringing about the destructive distillation and fractional separation of similar carbonaceous substances, and the production of similar products.

As the conductivity of the mass acted upon increases by reason of the increasing non-volatile carbon residue, the electrical current is correspondingly regulated to maintain a uniform and desired temperature. The conductivity of the initial charge may be augmented by associating the carbonaceous substances to facilitate the starting of the operation by inducing internal heat, throughout the mass, whereby the transformation and evolution of volatile products may be obtained in the interior in an outward direction, thereby enhancing the porosity of the material and discharge of volatile products without decomposition.

The control actuating device or operating member of the present invention is based upon a fact that many metals such as aluminium are repelled when subjected to the action of alternating electric currents energizing a core, and when such non-magnetic metals as aluminium are employed as armatures they are repelled with a force corresponding to the character of alternating current actuating the core of the device, and hence it will be seen that the aluminium armatures 70 and 71 will be repelled oppositely in accordance with the energizing of the coils 51 or 50 by means of alternating current and the repulsion of the aluminium armature on either side actuates the switch 63 whereby the regulation of the electrodes in the furnace is automatically maintained by the motors 35 and 36.

Any or all substances capable of being repelled or acted upon in a manner like aluminium are intended to be included in the scope of the present invention which includes as a member for actuating the control of electric furnaces a means or member actuated by repulsion action on the armatures induced by coils energized by alternating current, in contradistinction to and from magnetic action direct or through the medium of a helix actuated by direct current.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. An apparatus for making and securing products electrically, which comprises the combination of a receptacle, electrodes therein, means for bringing the electrodes and receptacle into an electrical circuit, means including an armature of non-magnetic nature adapted to be acted upon by an alternating current for repelling the same, temperature-governed means for regulating the movement of said armature, said armature controlling the operative distance of the electrodes when in use, and means for reversing the movement of the electrodes while communicating with the controlling member.

2. An apparatus for making and securing products electrically, which comprises the combination of a closed receptacle, electrodes therein, means for bringing the electrodes and the receptacle into an electrical circuit, means including an armature of non-magnetic nature adapted to be acted upon by an alternating current for repelling the same, temperature-governed means for regulating the movement of said armature, said armature controlling the operative distance of the electrodes when in use, and means for moving the electrodes communicating with the controlling member.

3. An apparatus for making and securing products electrically, which comprises the combination of a closed receptacle provided with a condenser, electrodes in said receptacle, means for bringing the electrodes and the receptacle into an electrical circuit, means including an armature of non-magnetic nature adapted to be acted upon by an alternating current for repelling the same, temperature-governed means for regulating the movement of said armature, said armature controlling the operative distance of the electrodes when in use, and means for moving the electrodes forward and backward while in communication with the controlling member.

4. An apparatus for making and securing products electrically which comprises the combination of a closed receptacle provided with a condenser, electrodes in said receptacle, means for bringing the electrodes and the receptacle into an electrical circuit, means including an armature of non-magnetic nature adapted to be acted upon by an alternating current for repelling the same, temperature-governed means for regulating the movement of said armature, said armature controlling the operative distance of the electrodes when in use, and means for reversing the movement of the electrodes while communicating with the controlling member.

5. An apparatus for making and securing

products electrically, which comprises the combination of a closed receptacle, electrodes therein, means for bringing the electrodes and the receptacle into an electrical circuit, means including an armature of aluminium adapted to be acted upon by an alternating current for repelling the same, temperature-governed means for regulating the movement of said armature, said armature controlling the operative distance of the electrodes when in use, and means for moving the electrodes communicating with the controlling member.

6. An apparatus for making and securing products electrically, which comprises the combination of a closed receptacle provided with a condenser, electrodes in said receptacle, means for bringing the electrodes and the receptacle into an electrical circuit, means including an armature of aluminium adapted to be acted upon by an alternating current for repelling the same, temperature-governed means for regulating the movement of said armature, said armature controlling the operative distance of the electrodes when in use, and means for moving the electrodes forward and backward while in communication with the controlling member.

7. In an electric furnace, the combination of an electrode moving mechanism with means for controlling such movement including a device for actuating the operative mechanism of an electric furnace, which comprises the combination of a non-magnetic armature with means for repelling the same, actuated by energy induced by an alternating current.

8. In an electric furnace, the combination of an electrode moving mechanism with means for controlling such movement including a device for actuating the operative mechanism of an electric furnace, which comprises the combination of a non-magnetic armature with means for repelling the same, actuated by energy induced by an alternating current, and means communicating with the mechanism to be actuated and the armature for accomplishing the same.

9. In an electric furnace, the combination of an electrode moving mechanism with means for controlling such movement including a device for actuating the operative mechanism of an electric furnace, which comprises the combination of an aluminum armature with means for repelling the same actuated by energy induced by an alternating current.

10. In an electric furnace, the combination of an electrode moving mechanism with means for controlling such movement including a device for actuating the operative mechanism of an electric furnace, which comprises the combination of an aluminum armature with means for repelling the same actuated by energy induced by an alternating current, and means communicating with the mechanism to be actuated and the armature for accomplishing the same.

11. An electric furnace, comprising a receptacle, electrodes therein, means for supplying an alternating current thereto, and means for altering the distance between electrodes including a switch actuated by repulsion to lines of force induced by the alternating current.

12. An electric furnace, comprising a receptacle, electrodes therein, means for supplying an alternating current thereto, and means for altering the distance between electrodes including a switch actuated by repulsion to lines of force induced by the alternating current acting upon an aluminum armature.

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

JAMES HENRY REID. [L. S.]

Witnesses:

JOHN BITTNER,

PHILIP ZEFF.