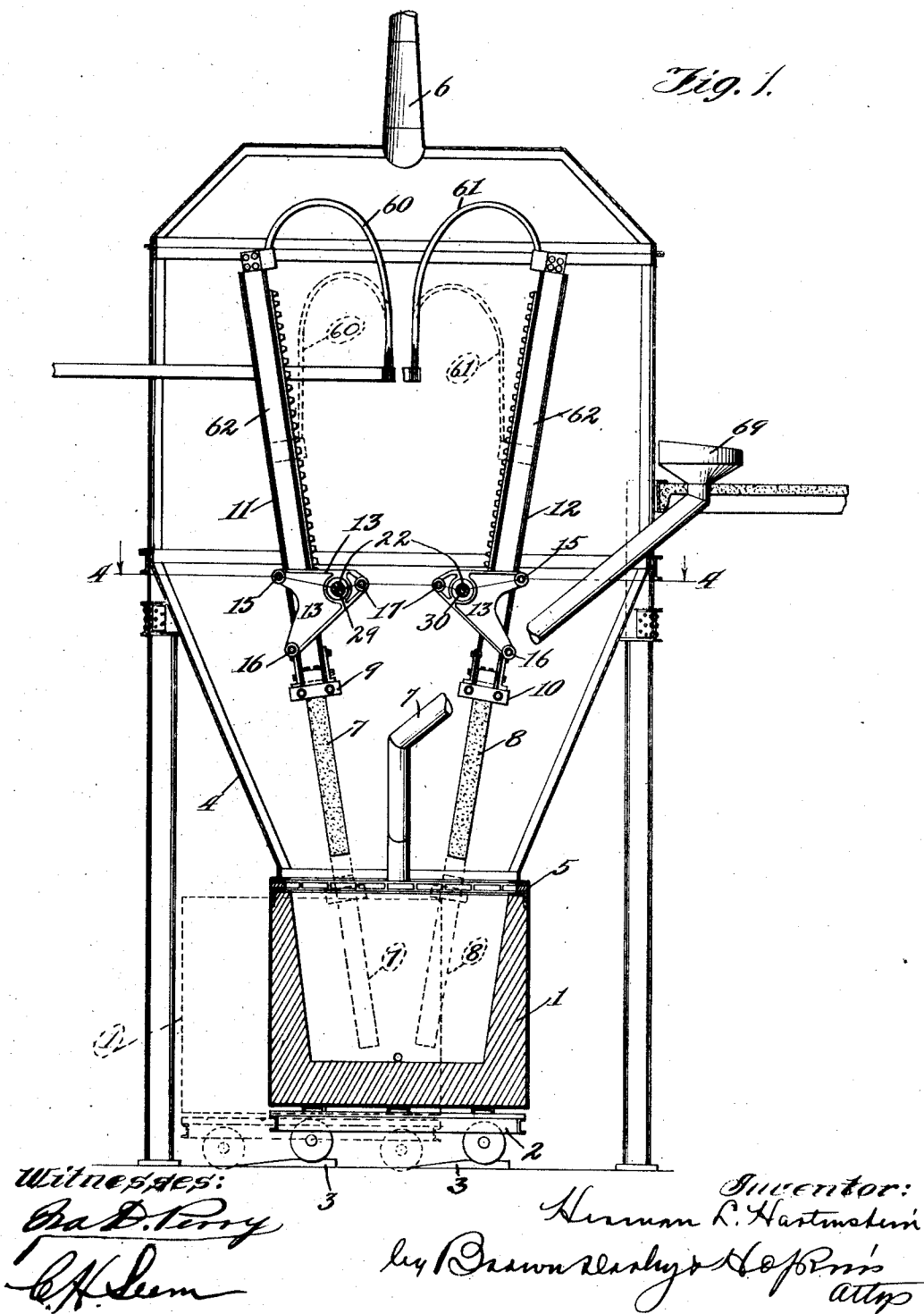


No. 883,110.

H. L. HARTENSTEIN. PATENTED MAR. 24, 1908.
ELECTRIC FURNACE.
APPLICATION FILED NOV. 30, 1906.

4 SHEETS—SHEET 1.

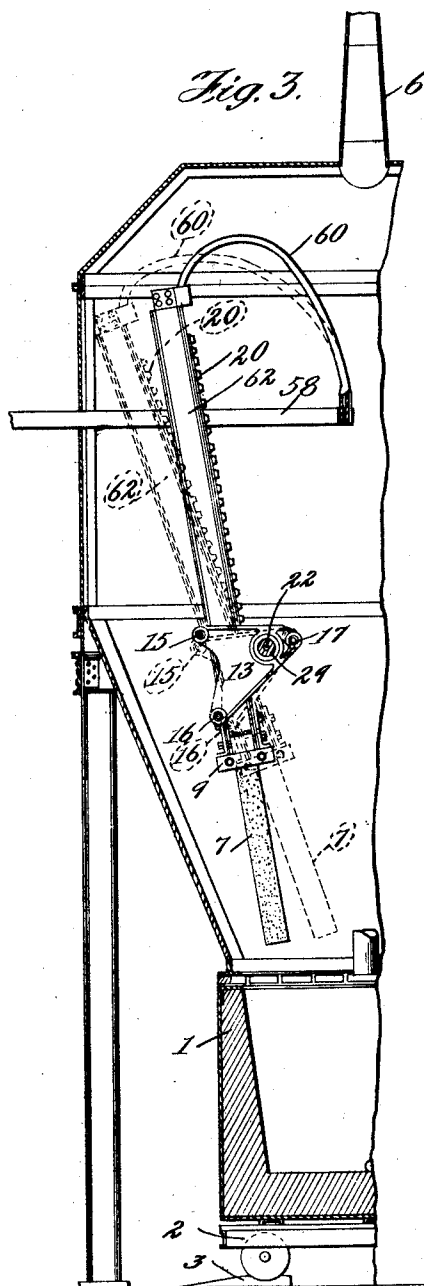
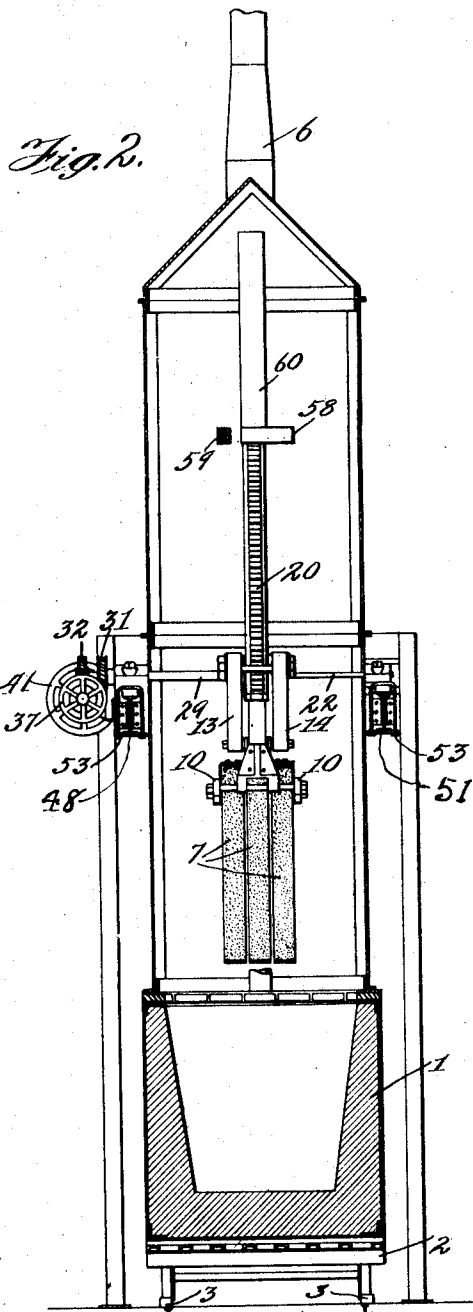


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4 SHEETS—SHEET 2.



Witnesses:

Ed. L. Perry

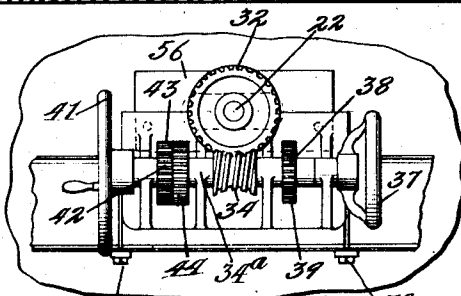
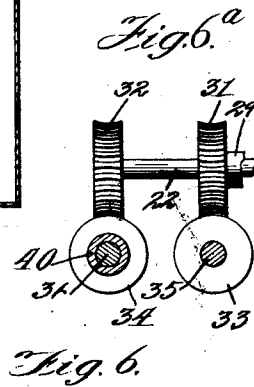
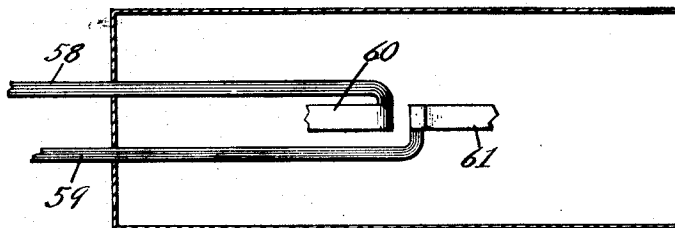
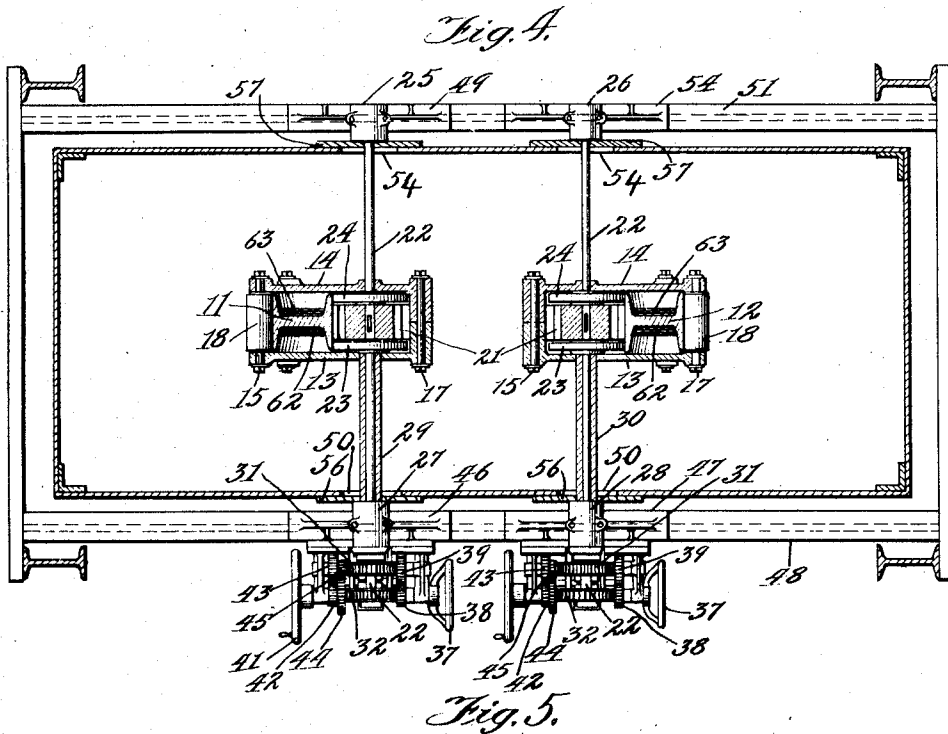
E. H. Seem

Inventor:
Herman R. Hartenstein

by *Brown & Ashby & Hoffmann*
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APPLICATION FILED NOV. 30, 1906.
PATENTED MAR. 24, 1908.
4 SHEETS—SHEET 3.



Witnesses:

Wm. D. Perry
C. H. Seem

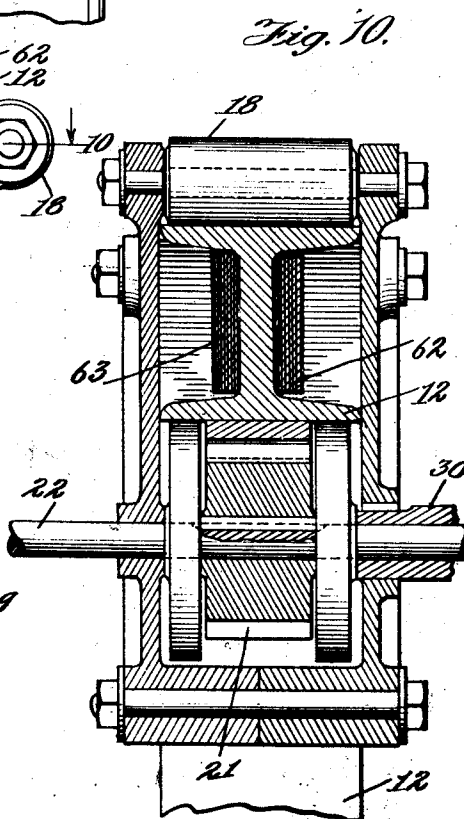
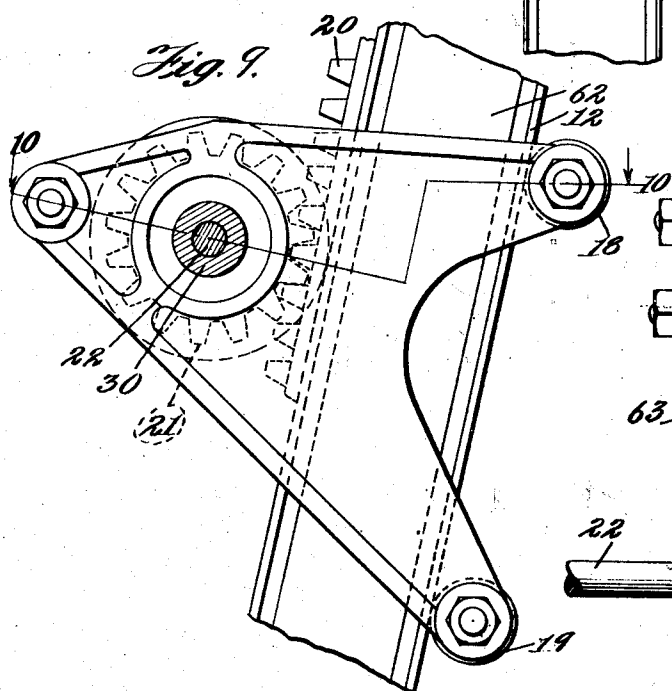
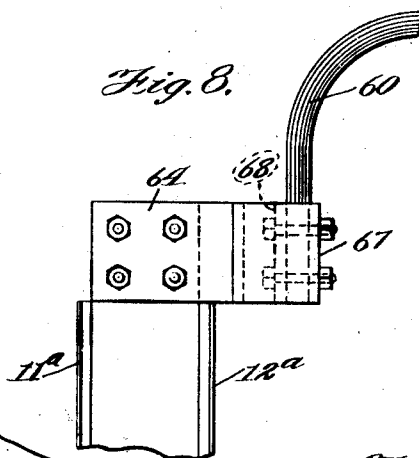
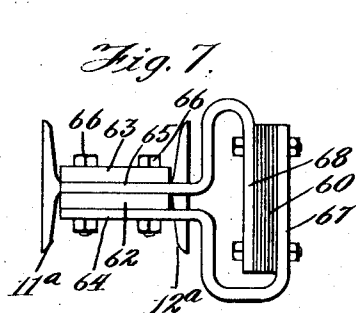
Fig. 6.
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by
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Albany

No. 883,110.

H. L. HARTENSTEIN.
ELECTRIC FURNACE.
APPLICATION FILED NOV. 30, 1908.

PATENTED MAR. 24, 1908.

4 SHEETS—SHEET 4.



Witnesses:

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C. H. Leem

Inventor:

Herman K. Hartenstein

by Brown & Ashby & Hopkin
Attys

UNITED STATES PATENT OFFICE.

HERMAN L. HARTENSTEIN, OF CONSTANTINE, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CONTINENTAL INVESTMENT COMPANY, OF DULUTH, MINNESOTA, A CORPORATION OF MINNESOTA.

ELECTRIC FURNACE.

No. 883,110.

Specification of Letters Patent.

Patented March 24, 1908.

Application filed November 30, 1906. Serial No. 345,752.

To all whom it may concern:

Be it known that I, HERMAN L. HARTENSTEIN, a citizen of the United States, residing at Constantine, in the county of St. Joseph and State of Michigan, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a full, clear, and exact specification.

This invention relates to electric furnaces, and more particularly to that class of such furnaces which employ movable or adjustable electrodes capable of being operated from the exterior during the use of the furnace.

One of the objects of the invention is to provide an improved electric furnace having movable or adjustable electrodes capable of being operated from the exterior, and all of whose operating parts will be wholly inclosed within the furnace, thus avoiding the use of stuffing boxes and like elements used where the moving parts pass through the walls of the furnace in the constructions heretofore employed.

Another object of the invention is to provide an improved furnace of the described character which shall be practically air-tight, so that when used for the treatment of materials productive of combustible gases, these gases may be prevented from burning in the furnace and thus damaging the electrodes and their connected parts, and may be conducted away for consumption elsewhere.

With a view to the attainment of the described ends, and the accomplishment of other objects which will hereinafter appear, the invention consists in the features of novelty in the construction, combination and arrangement of parts which will first be described with reference to the accompanying drawings and then more particularly pointed out in the claims.

In the said drawings,—Figure 1 is a vertical sectional view of an electric furnace embodying this invention. Fig. 2 is a similar section taken at right-angles to the plane of the section presented in Fig. 1. Fig. 3 is a section similar to that presented in Fig. 1, showing the parts in a different position. Fig. 4 is a plan section taken on the irregular section line 4—4, Fig. 1. Fig. 5 is a plan section or diagram showing the position of

the horizontal leads of the electrodes with relation to the furnace walls. Fig. 6 is a detail front elevation of one of the electrode operating gears. Fig. 6^a is a detail cross section of a part of the gear mechanism for shifting the electrodes. Fig. 6^b is a detail longitudinal sectional view of the same. Fig. 7 is an enlarged detail plan view of one of the connections used between the horizontal leads and the flexible portions of the electrode conductors. Fig. 8 is a side elevation of the same. Fig. 9 is an enlarged detail side elevation of one of the yokes which support the carbon holders. And Fig. 10 is a plan section thereof on the irregular line 10—10, Fig. 9.

1 is the hearth or melting pot of the furnace, which may be of the usual or any suitable form, but which is preferably supported upon a truck 2, so that it may be readily removed when it is necessary or desirable to replace the lining or otherwise repair or inspect it. When in use this pot or hearth 1 is supported by the horizontal portions of tracks 3, which have inclined ends serving to allow the hearth to be lowered away from the walls 4 of the superstructure of the furnace when the hearth is to be removed, and which also serve to force the upper edge of the pot or hearth into close relation with the lower edges of the walls 4 when it is being replaced. The joint between the walls 4 and the hearth or pot 1 may be rendered practically air-tight by any suitable packing 5, composed of fire-brick or tile laid in some suitable bonding material such as cement or fire-clay. The superstructure or walls of the furnace are practically air-tight, composed preferably of the inclining wall portions 4 and the cover portion 4^a, making a complete inclosure having an outlet flue 6, whereby the evolved gases may be conducted to the point of consumption.

7, 8, are the carbons of the two electrodes which form the heat-producing arc required in the hearth or pot 1, and which, as before mentioned, are required to undergo various movements or assume different positions of adjustment within the furnace, sometimes the requirement being that they be lifted entirely above the upper edge of the pot 1, as shown in full lines, and at other times low-

ered to its greatest depth, as shown in dotted lines in Fig. 1, or oscillated laterally as shown in dotted lines in Fig. 3. These carbons, three of which are shown for each electrode, are supported in carbon holders 9, 10, of any suitable construction, the particular form of which being immaterial so far as the present invention is concerned, but which are described in detail in my co-pending application filed on the 19th day of November, 1906, Serial No. 343989, and constitute the subject-matter of the claims thereof. These carbon holders are secured respectively to the lower ends of arms 11, 12, capable of being raised and lowered, or of executing the movements before described. Each arm is embraced by a yoke comprising two plates 13, 14, connected together at both sides of the arm by tie-rods 15, 16, 17. The tie-rods 15, 16, which are located on the same side of the arm, are provided with rollers 18, 19, affording an anti-friction support for the arms, while the opposite side of the arm is provided with a rack-bar 20, which is engaged by a pinion 21 mounted rigidly on a shaft 22 passing across the furnace and journaled in plates 13, 14. Also arranged on this shaft 22 are two anti-friction rollers 23, 24, which engage the arm at both sides of the rack-bar 20, and thus afford an anti-friction bearing for the arm on this side, thus holding the arm firmly between the three points of bearing constituted by the rollers 18, 19, and the two rollers 23, 24. The two shafts 22 are mounted at one side of the furnace in bearings 25, 26, and at the other side in bearings 27, 28, and also mounted in the bearing 27, 28, at one end, are quill shafts 29, 30, whose inner ends are rigidly secured to one of the plates 13 of each of the yokes which support the arms 11, 12. Consequently, it will be seen that by rotation of the shafts 22 the electrodes may be raised and lowered the same or different degrees, and by the rotation of the shafts 29, 30, the yokes will be rotated and the electrodes correspondingly oscillated as on transverse axes. This independent manipulation of the two sets of shafts 22, and 29, 30, may be effected by any suitable mechanism arranged on the exterior of the furnace. In the exemplification of the invention shown in these drawings, this result is accomplished by providing the hollow shafts 29, 30, each with a worm-wheel 31, the inner shafts 22 each with a worm-wheel 32, and these worm-wheels 31, 32, respectively, with intermeshing worms 33, 34. The worm 33 is provided with a hand-operating wheel 37, and the worm 34 with operating wheel 41, so that when wheel 37 is turned the shaft 29 will be rotated, or partially rotated, and the electrode connected therewith correspondingly oscillated, and when wheel 41 is turned the electrode arm will be raised or lowered. Wheel 37 is secured to a short shaft 36, which

is also secured to a pinion 38, meshing with a gear 39 secured to shaft 35.

The wheel 41 is secured to a shaft 36^a, which is also secured to a pinion 42, meshing with a gear 43 loose on shaft 35 but rigidly secured to a pinion 45, which meshes with a gear 44 rigid on a sleeve 34^a that carries worm 34, this back-gearing being resorted to for the sake of greater leverage on the shaft 22, which is required to raise and lower and sustain the great weight of the electrodes and their supporting parts. These shafts 35, 36, as well as the boxes 27, 28, are supported upon suitable carriages 46, 47, mounted to slide upon a track or way 48, while the boxes 25, 26, are mounted in carriages 49, 50, adapted to slide on a way 51. These sliding carriages may be firmly clamped to their respective ways by U-shaped clips 53, and the sides or walls of the furnace are provided with slots 54, 55, to accommodate the movement of the shafts 22, 29, 30, and these slots are closed by slides or valves 56, 57, respectively, so as to keep the furnace practically air-tight.

The upper ends of the electrode supporting arms 11, 12, instead of being projected through the walls of the furnace as heretofore, are arranged wholly within the inclosure, and are connected to the leads shown at 58, 59, in such a way as to permit of their free movement without danger of injuring the leads or parts intermediate the leads and the arms. As indicated in Figs. 1 and 5, the leads 58 and 59 are extended through the wall of the furnace in a horizontal direction, and at their inner ends they are connected to U-shaped or flexible portions 60, 61, respectively, which carry the current to conductors 62, 63, usually employed on each of the arms 11, 12, for placing the carbons in communication with the leads, these conductors 62, 63, being composed of a material—such as copper—of high conductivity, while the arms 11, 12, which are required to be of great rigidity, are formed of a material of greater strength, such as steel.

As indicated more clearly in Figs. 7 and 8, each of the arms 11, 12, is composed of a channeled bar or I-beam having flanges 11^a, 12^a, and between these flanges are situated the conductors 62, 63, which project slightly above the end of the arm, as indicated in Fig. 8. Where they thus extend above the arm, they are connected to two clip-plates having straight portions 64, 65, the latter of which is embraced between the two conductors 62, 63, as indicated in Fig. 7, while the straight portion 64 is clamped to the outer side of the conductor 62 by the same bolts or screws 66 which bind the portion 65 between the conductors 62, 63. These clip-plates are also formed with curved overlapping portions 67, 68, respectively, which embrace one end of the U-shaped conductor 60, 61, of each of the electrodes, these U-shaped conductors

being preferably composed of a plurality of thin strips of copper, or other suitable material possessing the requisite conductivity and flexibility. By the means described, the upper ends of these conductors 60, 61, are secured to their respective conductors 62, 63; the lower ends of these conductors 60, 61, are secured to the leads 58, 59, in any appropriate manner, as by welding, clamping, or otherwise.

By the means described it will be seen that the furnace is practically air-tight, or sufficiently so to prevent the combustion of the evolved gases, while permitting ample freedom of movement of all of the internal parts, which may be operated at will from the exterior, the hearth or melting pot being supplied with the material to be treated, without permitting the gases to escape, through a suitable chute 69.

In order that the invention may be understood by those skilled in the art, the details of this embodiment thereof have been thus specifically described, but

What I claim as new therein and desire to secure by Letters Patent is:

1. In an electric furnace, the combination of an inclosure constituting a furnace chamber, movable electrodes situated within said chamber, conductors leading into said chamber, and yielding connections between the electrodes and said conductors.

2. In an electric furnace, the combination of movable electrodes, movable means for supporting and operating the electrodes, and a furnace chamber completely inclosing the said electrodes and their said supporting and operating means.

3. In an electric furnace, the combination of a furnace chamber, stationary electric lead extending through the wall of the chamber, electrodes situated within the chamber, and movable means for supporting and operating the electrodes situated wholly within the chamber and electrically connected with said leads.

4. In an electric furnace, the combination of an inclosure forming a furnace chamber, electric leads extending into said chamber, electrodes situated within the chamber, and means for supporting and operating the electrodes situated wholly within the chamber and movable with respect to said leads and electrically connected therewith.

5. In an electric furnace, the combination of an inclosure forming a furnace chamber, electric leads extending into said chamber, electrodes situated within the chamber, means for supporting and operating the electrodes, comprising members movable transversely of the wall of the furnace chamber, and an electrical connection between the electrodes and said leads, all of the said parts of the electrode supporting and operating means which move transversely of the wall of

the chamber being situated wholly within the chamber.

6. In an electric furnace, the combination of a furnace chamber; electrodes therein, electrode supporting means comprising rigid arms situated within the chamber, and flexible connections between said arms and leads respectively, located within the chamber.

7. In an electric furnace, the combination of a furnace chamber, electrodes situated therein, arms for supporting said electrodes situated wholly within the chamber, pivots for the arms extending through the wall of the chamber and supporting the same, electric leads extending into the chamber, and electrical connections between the electrodes and said leads, situated within the chamber.

8. In an electric furnace, the combination of a furnace chamber, electrodes situated therein, electrode supporting arms mounted wholly within the chamber and movable therein longitudinally and on transverse axes, and electric leads extending into the chamber and connected with the electrodes.

9. In an electric furnace, the combination of a furnace chamber, electrodes situated therein, electrode supporting arms, conductors arranged longitudinally of said arms and connected with the electrodes, electric leads having flexible terminals, clip-plates clamped to the conductors of each of said arms and overlapping and clamped to the flexible terminal of each of said leads, and means for supporting and operating said arms.

10. In an electric furnace, the combination of a furnace chamber, electrodes situated therein, electrode supporting arms having the form of channel-bars, electric conductors arranged in the channels in said bars and connected with the electrodes and extending above the upper extremities of the arms, electric leads provided with flexible terminals, clip-plates, one of which is provided with a flat portion clamped between said conductors where they extend above the arm, and the other of which is clamped to the outer side of the other of said conductors, both of said clip-plates for each of said arms having overlapping curved extremities between which the flexible extremity of the lead belonging to that arm is clamped, and means for supporting and operating the arms.

11. In an electric furnace, the combination of a portable hearth or melting pot, a furnace chamber situated above said melting pot, and means whereby the melting pot may be raised to form a tight joint with the lower edges of said chamber or lowered away from said chamber at will, with means within the said chamber for supporting and operating the electrodes.

12. In an electric furnace, the combination of a portable melting pot or hearth, a truck on which the same is supported, inclined tracks on which the truck rolls, a furnace

chamber situated above the pot or hearth,
and into contact with the lower edge of
which the hearth is adapted to be forced
when the truck rides up said inclines, with
5 electrodes, and means within said chamber
for supporting and operating the electrodes.
In testimony whereof I have signed my

name to this specification, in the presence of
two subscribing witnesses, on this 23rd day
of November A. D. 1906.

HERMAN L. HARTENSTEIN.

Witnesses:

FRANCIS A. HOPKINS,
CHAS. H. LEEM.