

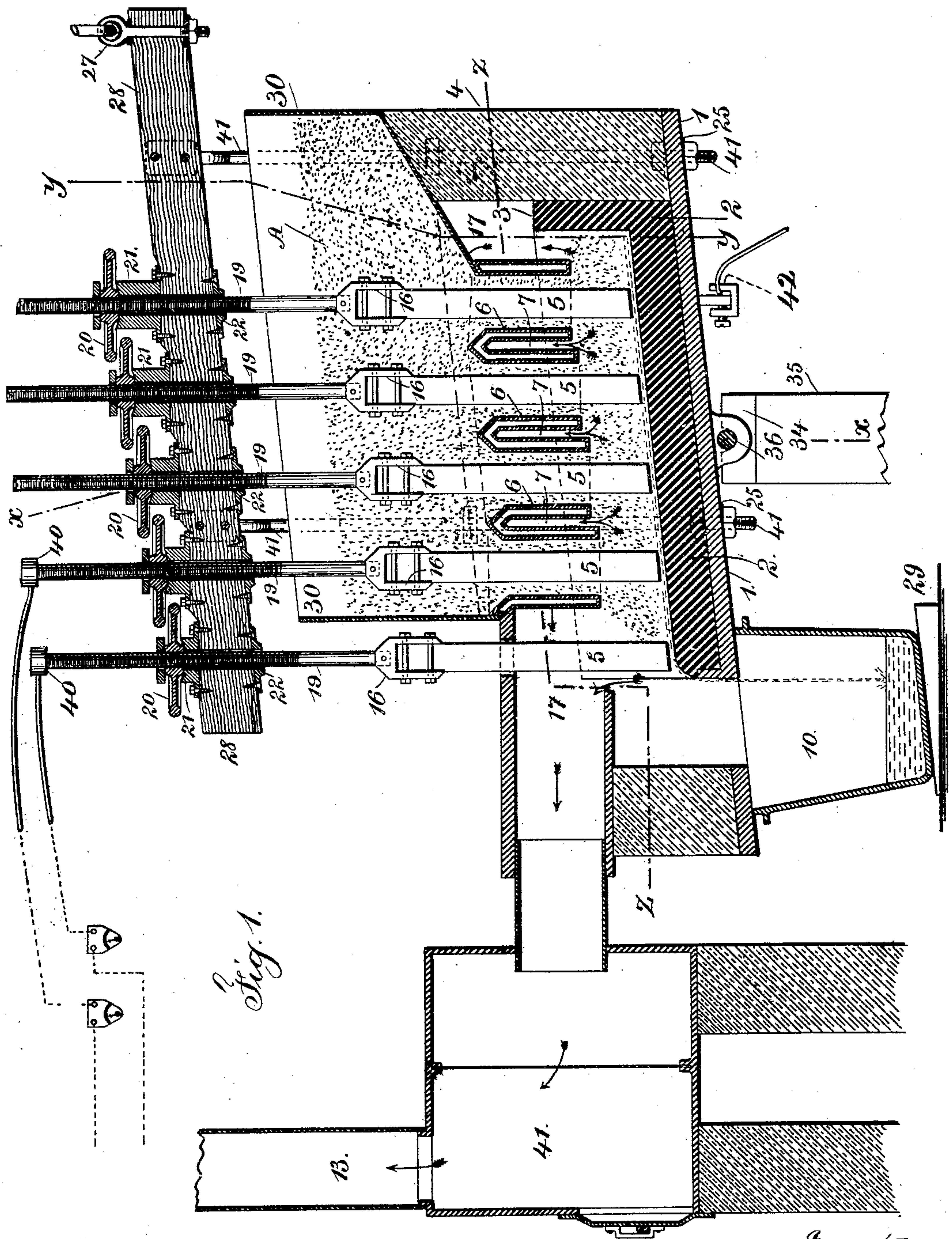
(No Model.)

3 Sheets—Sheet 1.

E. F. PRICE.
ELECTRIC FURNACE.

No. 572,312.

Patented Dec. 1, 1896.



Witnesses

Chas. H. Smith
Geo. T. Pinckney

Inventor

Edgar F. Price
per Lemuel W. Serrell
Att'y.

(No Model.)

3 Sheets—Sheet 2.

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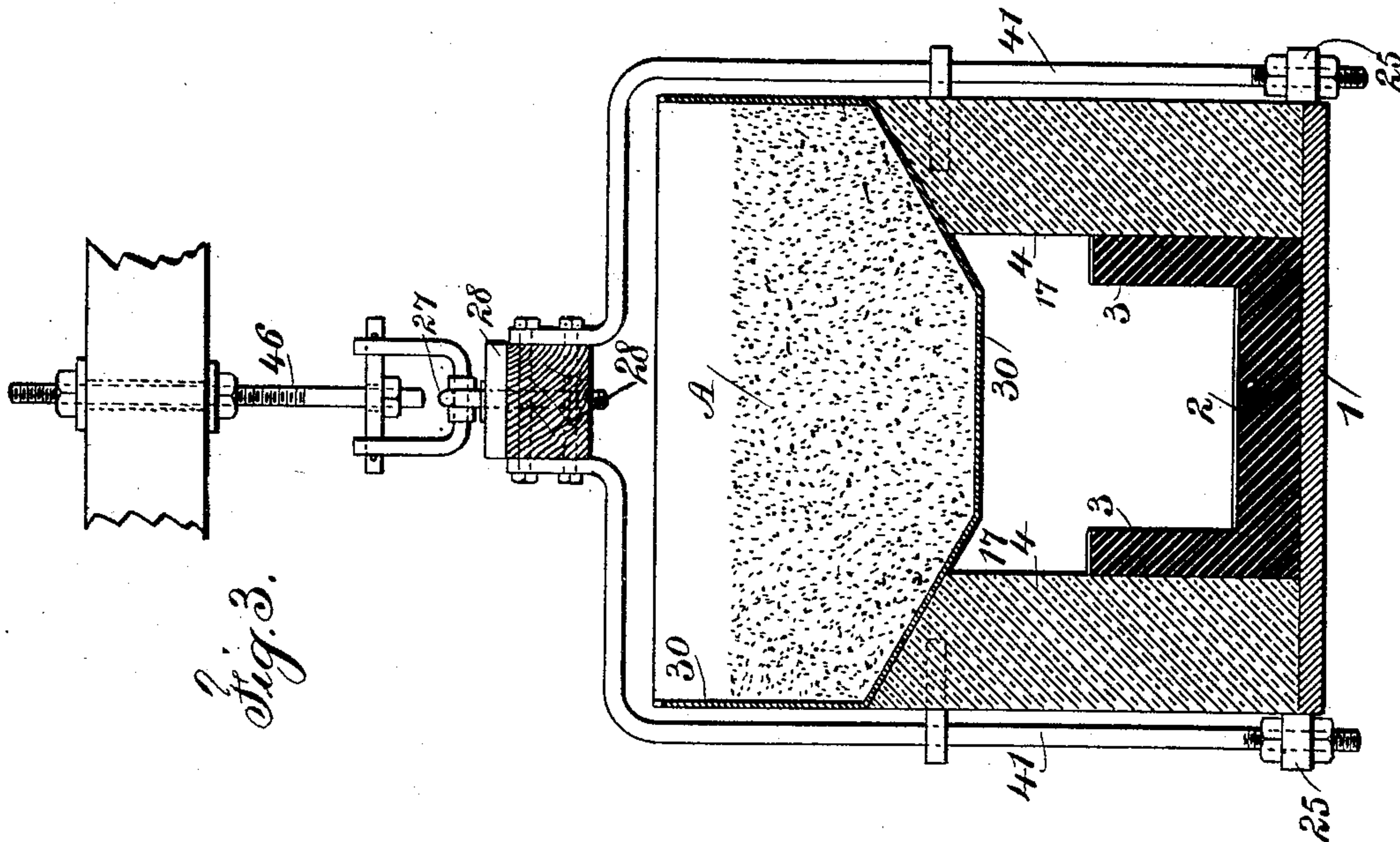


Fig. 3.

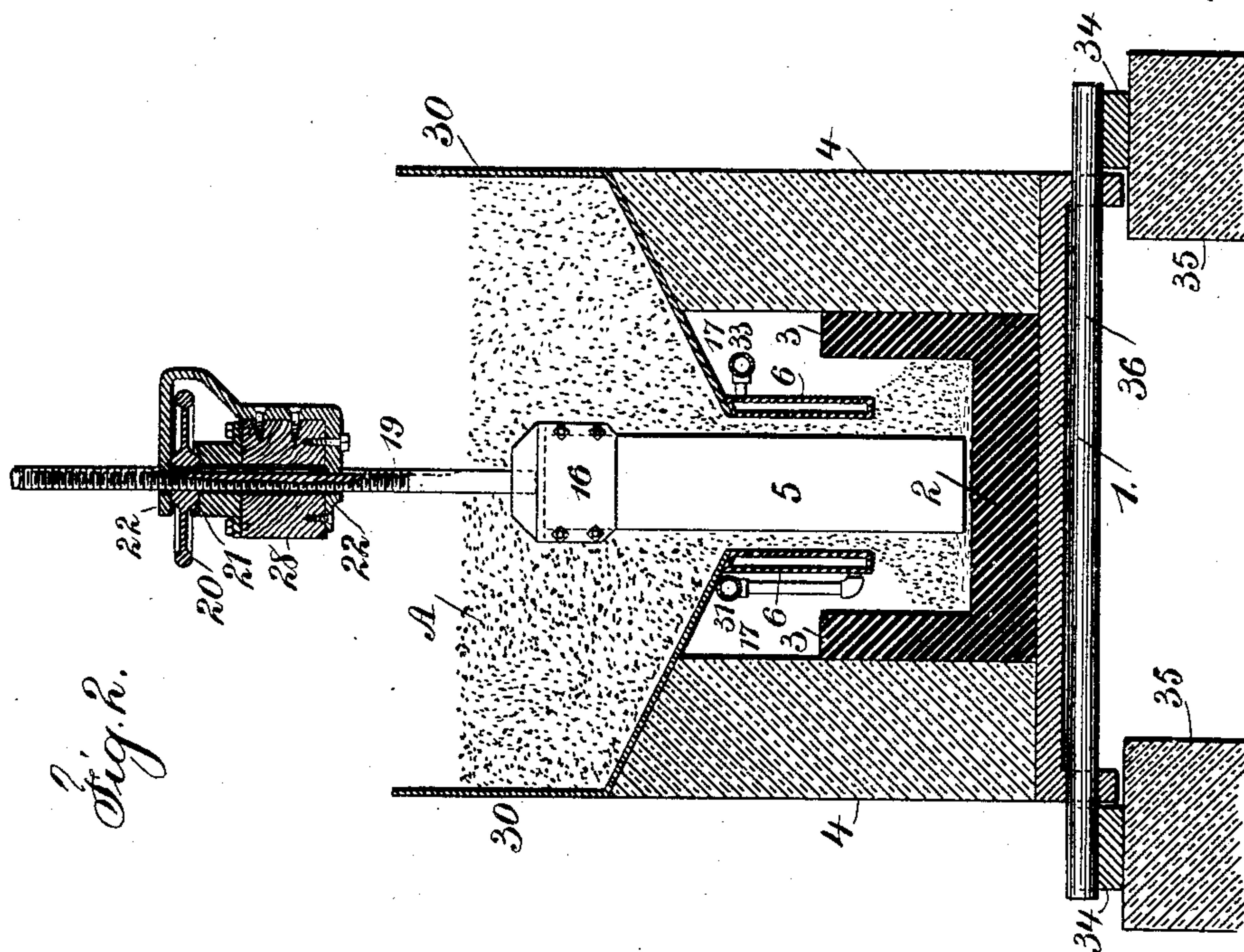


Fig. 4.

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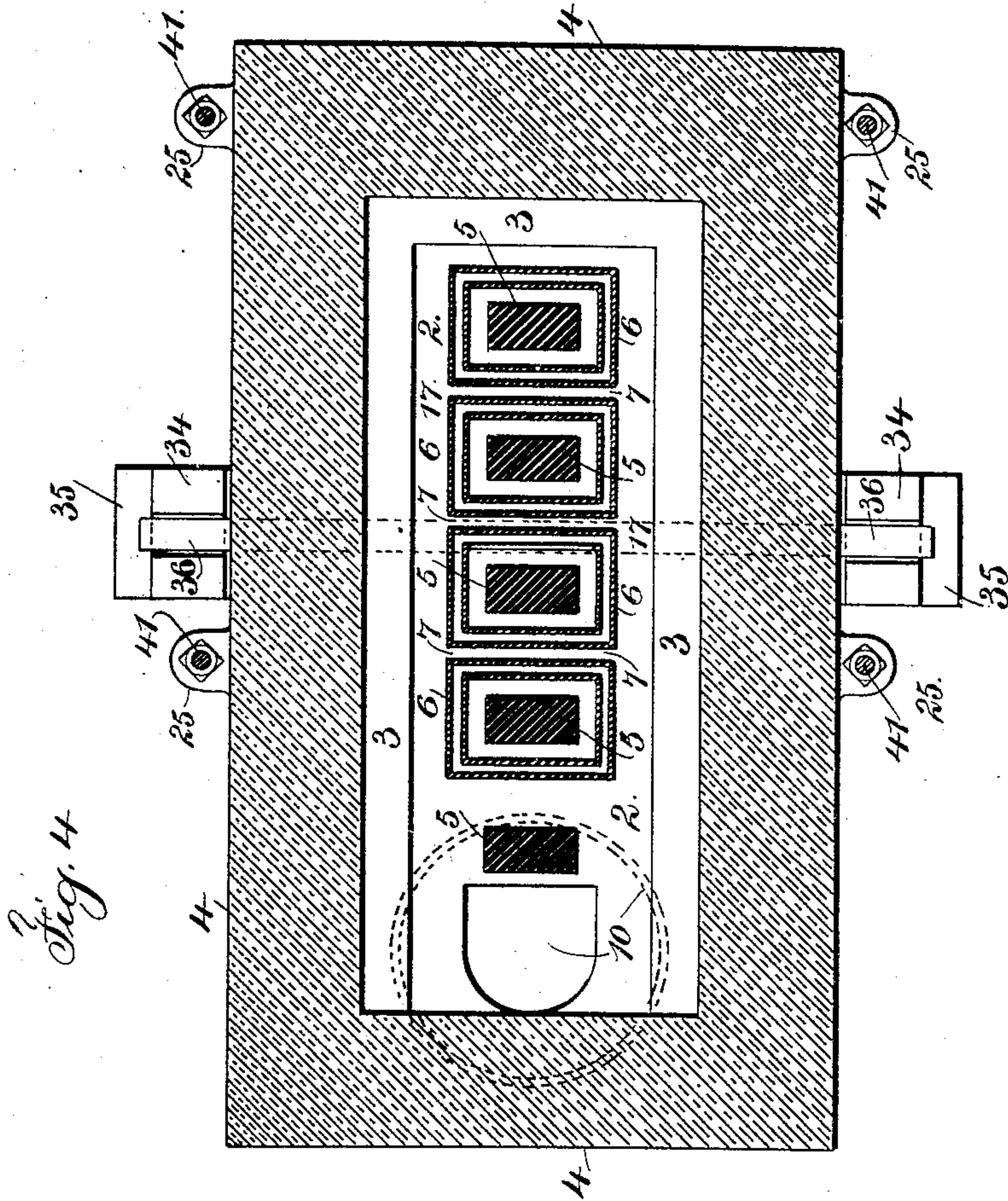
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UNITED STATES PATENT OFFICE.

EDGAR F. PRICE, OF NEWARK, NEW JERSEY.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 572,312, dated December 1, 1896.

Application filed July 22, 1895. Renewed April 11, 1896. Serial No. 587,233. (No model.)

To all whom it may concern:

Be it known that I, EDGAR F. PRICE, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented an Improvement in Electric Furnaces, of which the following is a specification.

The object of this invention is to decompose the ore or other material or melt the same under the electrical operation and to cause the melted or decomposed material to run off the hearth or bottom of the furnace as such materials are melted. Hence the electrodes can be sufficiently near to each other to act to the best advantage and so that such electrodes will not be immersed in the melted or changed material, and I so arrange the parts of this furnace that the operations may be substantially continuous.

I provide the furnace with a straight or nearly straight bottom and with inclosing sides sufficiently deep to hold the required amount of material, and the furnace is pivotally supported and constructed in such a manner that it may be tipped more or less to give greater or less inclination to the bottom of the furnace along which the melted or changed material passes to the place of delivery, and the electrodes, which are preferably of carbon, are surrounded with cases, there being spaces between the electrodes and the cases for the pulverulent material to pass down to the point of fusion and the gases escape around the cases, and it is advantageous to make these cases hollow and to circulate water or similar material through the same, so as to convey away surplus heat and prevent the upper part of the electrodes becoming too highly heated.

In the drawings, Figure 1 is a longitudinal vertical section. Fig. 2 is a cross-section at $x x$, Fig. 1, through the smelting portion of the furnace. Fig. 3 is a cross-section at $y y$, Fig. 1, showing the mechanism for supporting the furnace and varying the inclination of the bottom or hearth; and Fig. 4 is a sectional plan at the line $z z$, Fig. 1.

The furnace is made with side walls 4, resting upon a bottom plate 1, and there is a hearth or bottom 2, preferably of carbon, in the form of a slab, and it is usually advantageous to employ slabs of carbon at the sides

of the furnace, as shown at 3, and upon the upper portions of the walls 4 a suitable bin or hopper 30 is provided, and I remark that the size and shape of the furnace-walls and the hopper may vary according to the character of the material to be operated upon, and the number of the electrodes may also vary according to the size of the furnace.

I have shown electrodes 5, which are advantageously of carbon and placed vertically, and each electrode is provided with a holder or clip 16, that permanently connects the carbon electrode to the conductor, which is advantageously formed of a rod 19, screw-threaded and passing through the supports 21 upon a beam 28, there being a hand-wheel and nut 20 by which to raise or lower the electrode to bring the lower end of such electrode into proper proximity to the hearth or floor 2 of the furnace, and I remark that the conductors from the dynamo are to be connected to the heads 40 of the rods 19 in any desired manner, and by channeling the rods 19 longitudinally and providing the guides 22 with projecting keys entering such slots the screws 19 are held from rotating by the action of the hand-wheels and nuts 20.

The furnace bottom plate 1 is pivoted to a suitable support. I have represented the pivotal bar 36 as passing through lugs upon the bottom plate 1, such bar 36 resting upon suitable bearings 34 upon a foundation or supports 35, and the beam 28 should be connected with the furnace by the slings or rods 41, that pass through the lugs 25, that project from the bottom plate 1, and are connected thereto by suitable nuts, and these rods 41 pass up in the form of a yoke to the beam 28, and by means of an eye 27, yoke, and screw-rod 46, through a beam or permanent support, the back end of the furnace can be raised or lowered bodily by the nuts on the screw-rod 46, so as to incline the bottom of the furnace to a greater or less extent to cause the melted material to flow with sufficient freedom to run off the hearth or bottom of the furnace into a suitable receptacle 10, which receptacle 10 can be pressed tightly up against the under side of the plate 1 by a wedge 29 or other suitable device, so as to exclude atmosphere as far as possible.

It will be understood that the material to

be acted upon, as shown at A, is introduced in a pulverulent condition into the hopper 30, and it settles down around the electrodes 5 and rests upon the hearth or bottom 2 of the furnace, and I find it advantageous to make use of the hollow cases 6, which surround the electrodes adjacent to the bottom and inner edges of the hopper, and these hollow cases 6 are advantageously kept cool by water circulating through the same from the pipe 31, the discharge being through the pipes 33, and between these cases 6 and electrodes 5 there are spaces sufficient for the pulverulent material to subside around the electrodes, and the upper parts of the cases 6 are connected together, as shown in Fig. 1, so that there are spaces 7 between one case and the next, which spaces form flues for the gases or other volatile materials to pass away, and these spaces 7 open into longitudinal flues 17, leading to any suitable chamber in which useful by-products may be condensed, or such vapors may pass to a chimney 13. It will now be understood that the pulverulent materials will be subject to the action of the electric arc between the electrodes 5 and the hearth or bottom 2 of the furnace, and such materials will be melted or decomposed by the electric action or recombined, according to the character of the materials under treatment, and that the metal or other material that is fused or reduced upon the hearth 2 will run along such hearth in consequence of the inclination until it finally escapes from the end of the hearth into the receptacle 10, and there is ample opportunity for gases to escape by the flues 7, and the materials within the hopper are kept in a comparatively cool condition until they pass by the cases 6. Hence but a small quantity of the material is under treatment at one time, but the furnace is capable of extension substantially indefinitely, so that its capacity may be increased, and the electric arcs are constantly acting upon fresh untreated material as the changed material passes off the hearth. Either electrode can be replaced when so desired without necessarily arresting the action of the others.

This furnace is adapted to the reduction of refractory metallic and non-metallic oxides and alloys of the same and for the production of metallic and alkaline earthy carbids by electric smelting and for other purposes in electric smelting, and by keeping the casings full of the material to be acted upon the atmosphere is excluded as much as possible from the electrodes to prevent them from burning away, and at the same time the gases resulting from the reduction of the materials under treatment, together with such portions of the compounds as may escape, pass by the flues to the condensing or depositing chamber 41 for the collection or condensation, or both, of such materials, and the vent-pipe or chimney allows for the escape of surplus gases.

The operations performed in this furnace may be substantially continuous to avoid the expense of stopping and starting the furnace, because the materials can be supplied and the hopper kept sufficiently full for such materials to descend by gravity, and it is advantageous to employ an ammeter in the circuit to each of the electrodes, so that a uniform or nearly uniform current can be passed through each electrode, the regulation of the current being effected by raising or lowering the electrode and thereby increasing or decreasing the resistance, and the furnace can be kept in operation until the electrodes are consumed or nearly so.

It will be apparent that in order to avail of gravity in feeding the materials from the hopper the electrodes should be substantially vertical; but the entire furnace can be swung upon its pivot to any desired inclination, or constructed with the electrodes at any desired inclination, or even horizontal or nearly so, according to the material acted upon, without substantially departing from the subject-matter of the present invention. The conductors of opposite polarity to those that are connected to the electrodes 5 are connected to the bottom plate 1, as at 42.

It will be seen in Fig. 1 that the end electrode in the range is closely adjacent to the edge of the hearth over which the material is delivered, and there is not any material fed around such electrode. Hence the material passing from around the other electrodes cannot escape from the edge of the inclined hearth without passing closely adjacent to this electrode, so as to be acted upon and brought into the proper condition before running off to the receptacle 10.

I claim as my invention—

1. The combination in a furnace of a conducting-hearth forming one electrode, a range of electrodes substantially perpendicular to the hearth and means for adjusting the electrodes and regulating the currents, a supply-hopper for the material to pass down around the electrodes, and means for varying the inclination of the hearth and the movement of the material thereon as it passes from one electrode to another substantially as specified.

2. The combination with a furnace having an inclined bottom or hearth, of a range of electrodes substantially perpendicular to such bottom, means for supporting and adjusting the electrodes toward or from the hearth and means for supplying the material to be acted upon around such electrodes, and casings around the electrodes, there being spaces between such casing and the electrodes for the passage of the material acted upon, substantially as set forth.

3. The combination with a furnace having an inclined bottom or hearth, of a range of electrodes substantially perpendicular to such bottom, means for supporting and adjusting the electrodes toward or from the hearth, means for supplying the material to

be acted upon around such electrodes, a hollow casing around each electrode and means for supplying a circulating fluid through such hollow casings to regulate the temperature thereof, there being spaces between the electrodes and the casings for the passage of the material to be acted upon, substantially as set forth.

4. The combination with an inclined hearth of a range of electrodes over such hearth and electric connections to the hearth and to the electrodes and means for supplying the material to be treated around the electrodes in the range, except the one adjacent to the place of delivery from the hearth, so that the materials cannot pass off the hearth without being subjected to the electric operation, substantially as specified.

5. The combination in an electric furnace, of a hearth or bottom forming one electrode, a range of electrodes substantially perpendicular to the bottom, casings around the respective electrodes and a hopper with which such casings are connected, there being spaces between the casings and the electrodes for the passage of the material acted upon, substantially as specified.

6. The combination in an electric furnace, of a hearth or bottom forming one electrode, a range of electrodes substantially perpendicular to the bottom, casings around the respective electrodes and a hopper with which such casings are connected, there being spaces between the casings and the electrodes for the passage of the material acted upon, the casings being provided with openings forming flues, and flues into which the escaping gases or other materials pass and a chamber to which they are led, substantially as set forth.

7. The combination in an electric furnace,

of a hearth or bottom forming one electrode, a range of electrodes substantially perpendicular to the bottom, casings around the respective electrodes and a hopper with which such casings are connected, there being spaces between the casings and the electrodes for the passage of the material acted upon, a pivotal support for the furnace and means for adjusting the inclination of the bottom or hearth, substantially as set forth.

8. The combination in an electric furnace, of a bottom or hearth, a pivoted plate for supporting the same, side walls and a hopper for the material to be acted upon, an electrode and means for adjusting the proximity of the end of the same to the bottom of the hearth, a casing surrounding the electrode, there being a space between the casing and the electrode for the material in the hopper to pass down to the hearth, supporting-rods and a screw for adjusting the furnace upon its pivotal support and varying the inclination of the hearth, and a removable pot for receiving the product from the furnace, substantially as set forth.

9. The combination in an electric furnace with a conductor forming the furnace-hearth from which the changed material is allowed to pass off by gravity, of an adjustable electrode above the hearth, a supply-hopper from which the material to be treated descends around the upper electrode and a lateral escape for the gases to prevent them ascending through the material under treatment, substantially as specified.

Signed by me this 17th day of July, 1895.

EDGAR F. PRICE.

Witnesses:

GEO. T. PINCKNEY,
S. T. HAVILAND.