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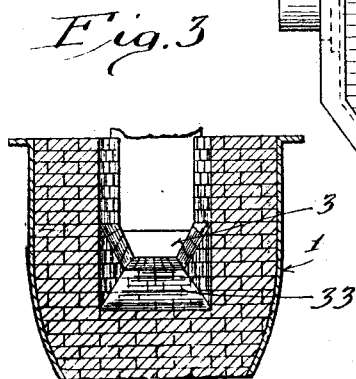
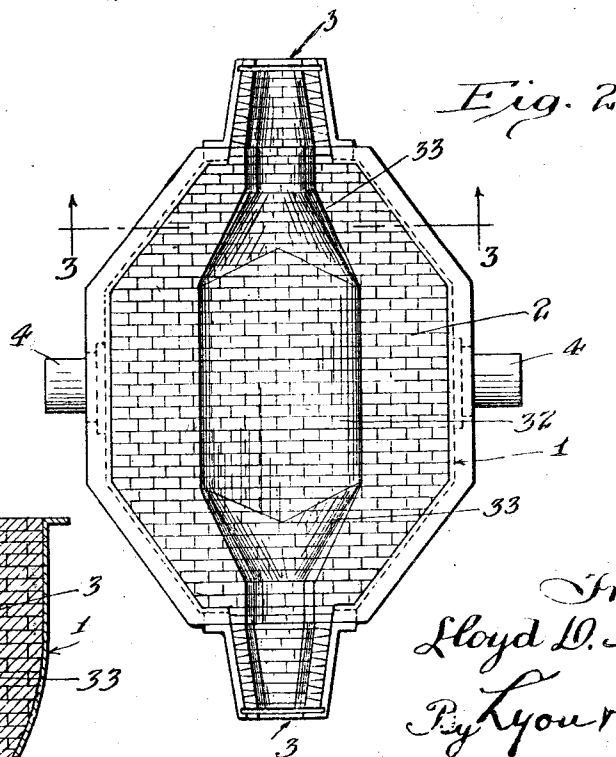
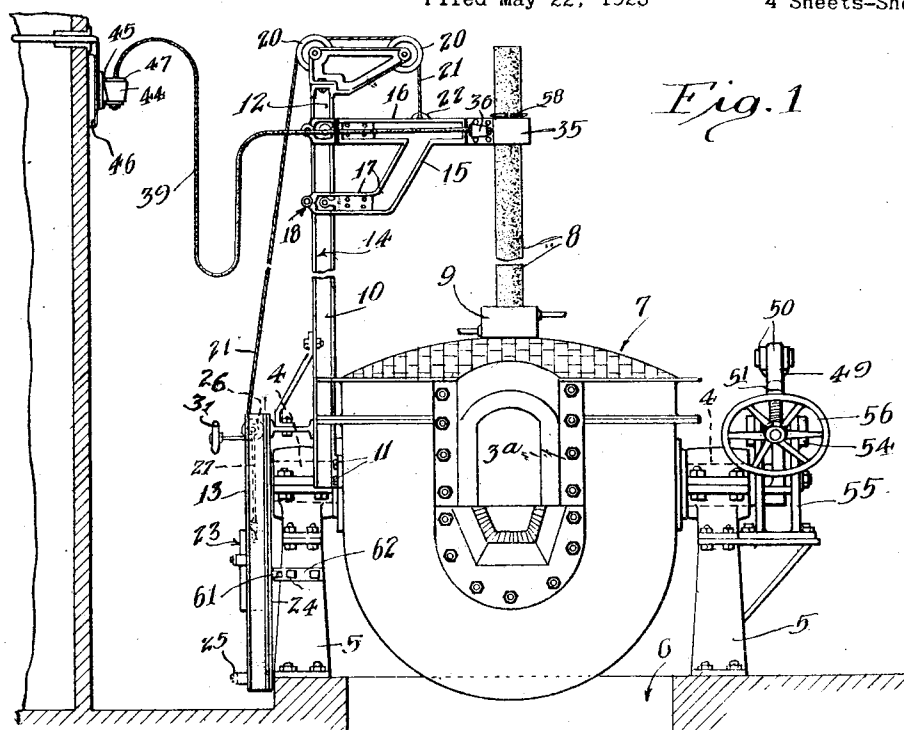
L. D. KAY

1,553,618

ELECTRIC FURNACE

Filed May 22, 1923

4 Sheets-Sheet 1



Inventor
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By Your Honor's City.

Sept. 15, 1925.

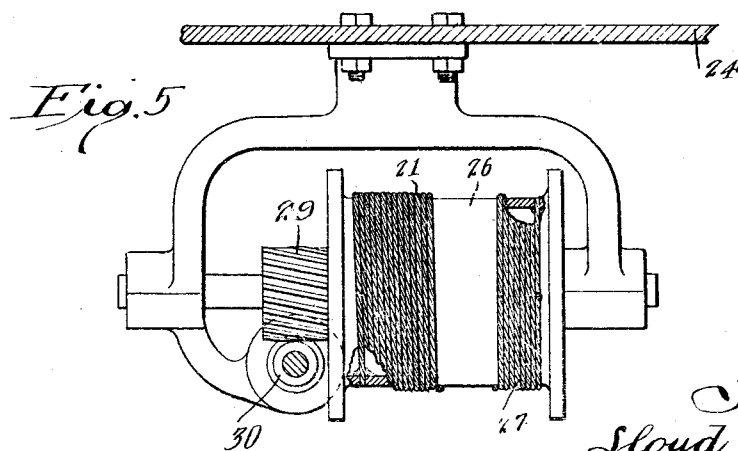
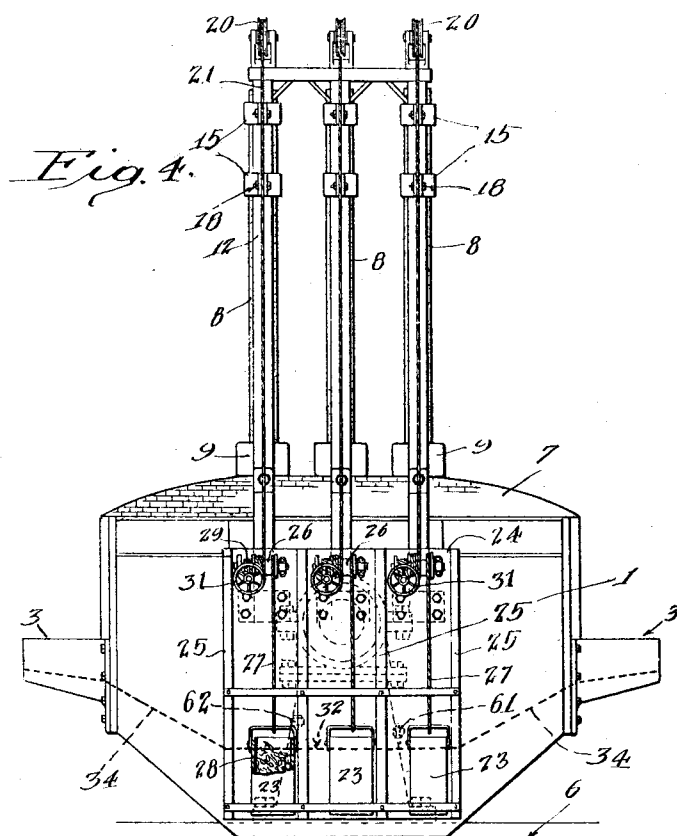
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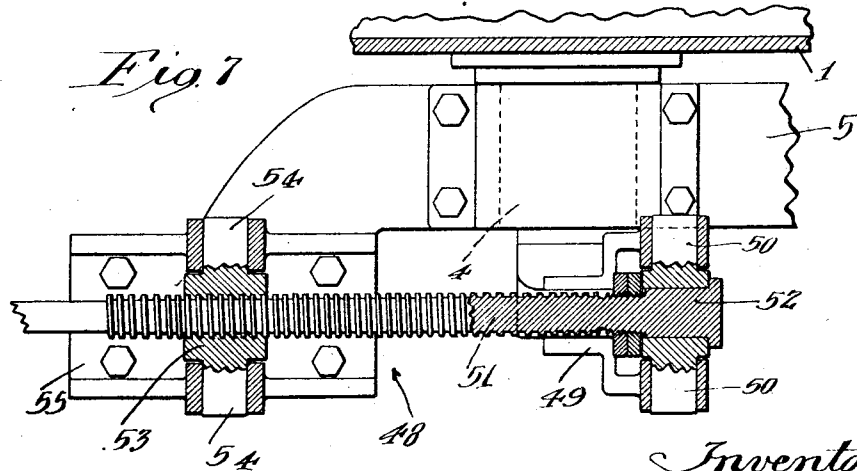
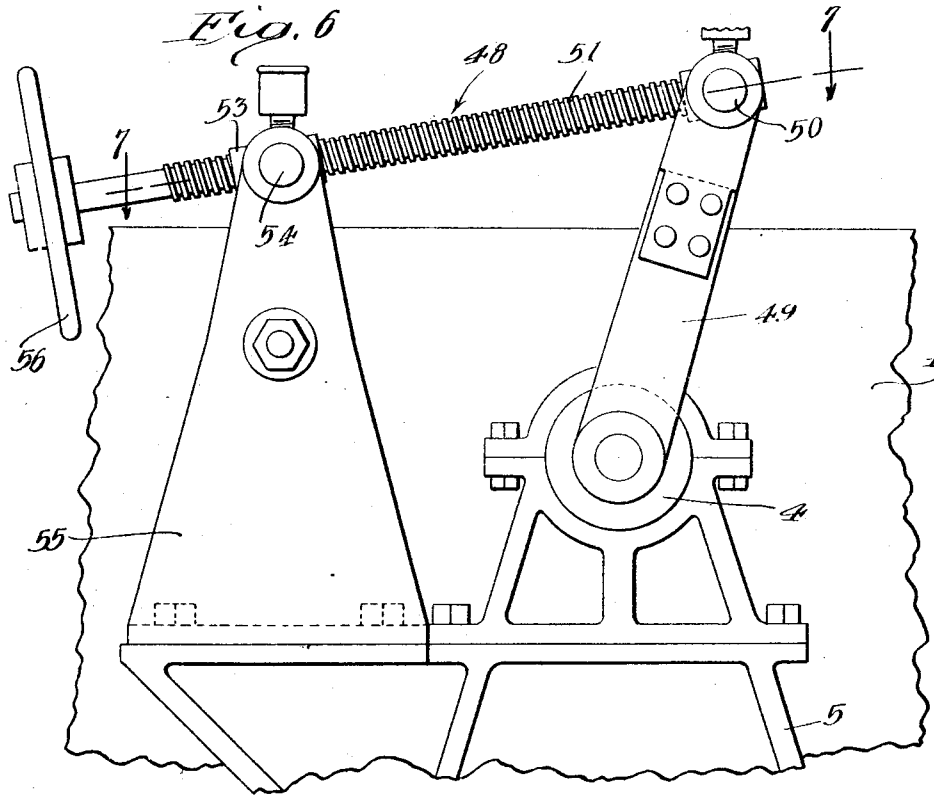
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4 Sheets-Sheet 3



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ELECTRIC FURNACE

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4 Sheets-Sheet 4

Fig. 8

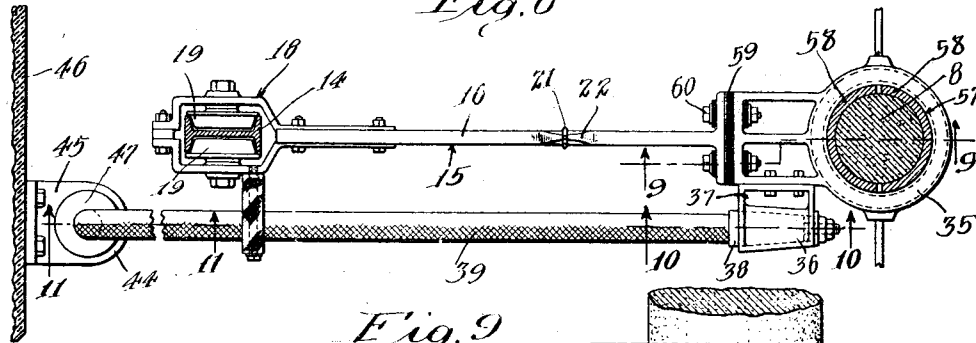


Fig. 9

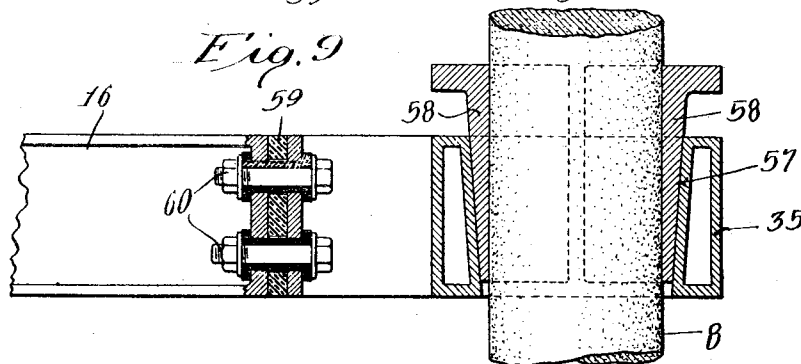


Fig. 10

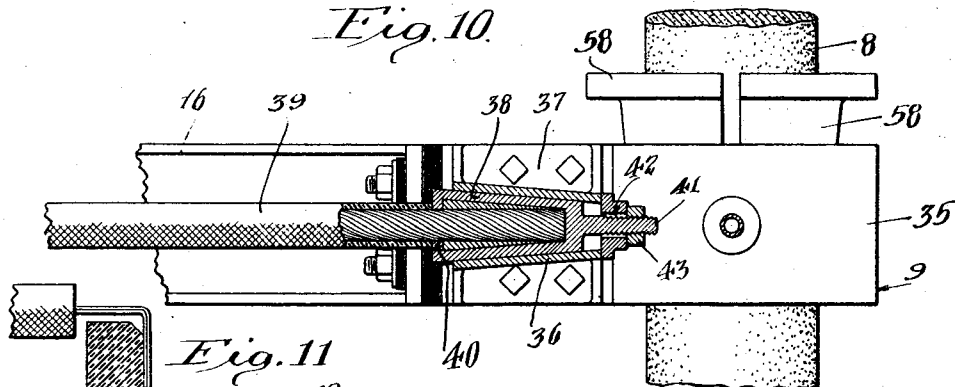
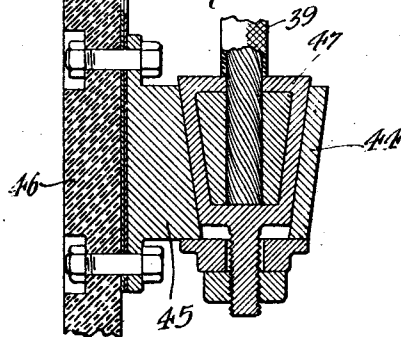


Fig. 11



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UNITED STATES PATENT OFFICE.

LLOYD D. KAY, OF LOS ANGELES, CALIFORNIA.

ELECTRIC FURNACE.

Application filed May 22, 1923. Serial No. 640,711.

To all whom it may concern:

Be it known that I, LLOYD D. KAY, a citizen of the United States, residing at Los Angeles, county of Los Angeles, and State of California, have invented a new and useful Electric Furnace, of which the following is a specification.

This invention relates to furnaces, and, while many features of the invention may be utilized under other circumstances, the invention is expected to be especially useful as applied to an electric furnace. In a certain type of electric furnace, the body of the furnace is mounted on an axis so that it is capable of being tilted when the molten metal is being poured. In order to tilt the furnace, gears have been employed, for example, a worm-wheel and worm, but where a worm-wheel or gear-wheel is employed there is always a slight amount of back-lash present which will permit a slight lost motion in operating the device. The presence of this lost motion is objectionable for many reasons, among which is the fact that the shifting of the molten bath from one side of the furnace to the other side may suddenly take up the back-lash and give the molten metal an impetus toward the low end of the furnace; this is dangerous.

In pouring the metal from such a tilting furnace, it is desirable to have the metal run off at a level as far removed as possible from the slag.

The general object of this invention is to provide a furnace of simple construction having means for overcoming these difficulties and in which the metal in the furnace is counter-balanced; also to provide a construction which will enable the furnace to be tilted without the exertion of great force; also to provide a furnace that is so constructed that the metal poured from it will be drawn off as far as possible from the floating slag.

A further object is to provide simple means for supporting and adjusting the electrodes and to provide simple means for counterbalancing them and compensating in the counterbalancing, for the movement of the electrodes toward the axis of rotation of the furnace as the electrodes become consumed also to provide simple means for connecting the electric cables to the electrodes.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient electric furnace.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawings:

Figure 1 is a front elevation of a furnace embodying my invention.

Figure 2 is a plan of the body of the furnace with the cover removed and showing other parts broken away.

Figure 3 is a cross-section through the furnace body taken on a line 3—3 of Figure 2.

Figure 4 is a side elevation particularly illustrating the counterweight mechanism.

Figure 5 is a plan illustrating the details of the means for adjusting the electrodes and their counterweights.

Figure 6 is a side elevation showing a portion of the body of the furnace and particularly illustrating the device for adjusting the tilt of the furnace.

Figure 7 is a section taken about on the line 7—7 of Figure 6 and particularly illustrating the details of the adjusting screw.

Figure 8 is a plan particularly illustrating the details of the electrode frames and showing the means for connecting the electric cables to them.

Figure 9 is a vertical section taken about on the line 9—9 of Figure 8 illustrating the insulation of the electrode holders and also illustrating details of the means for supporting the electrodes in the holders.

Figure 10 is a vertical section taken about on the line 10—10 of Figure 8 upon an enlarged scale and further illustrating details of the connection for the electric cables.

Figure 11 is a vertical section taken about on the line 11—11 of Figure 8 and showing the connection for the fixed end of the cable.

In practicing the invention, I provide a furnace body which is supported so as to rotate on a substantially horizontal axis. This body is provided with one or more pouring spouts. I provide an adjustable means for positively holding this body against rotation on the axis in either direction. By the term "positively holding" I mean to say that the device I employ is constructed so it is devoid of back-lash, hence it is impossible for

a slight rocking movement of the body to take place on its axis unless that movement is caused by the adjustment of the adjusting means. The body 1 may be formed of a sheet metal shell with fire-brick lining 2 and provided with a pouring spout 3 at each end. This body is preferably of slightly elongated form and supported to rock in its middle plane on a substantially horizontal axis near its center of gravity, for which purpose the opposite sides of the shell are provided with trunnions 4. These trunnions may be supported in pedestal bearings 5 which support the body over an ash pit 6. The furnace may be provided with a cover 7 of any suitable construction through which a plurality of electrodes 8 pass, each electrode being passed through an insulating sleeve 9 which supports it effectively upon the cover.

I provide simple means for raising and lowering the electrode and for counterbalancing them in such a way that when the electrode becomes worn and is fed downwardly so that its center of gravity approaches the axis of rotation of the furnace, then there is a corresponding movement of its counterweight toward the axis of rotation. In this way, I not only counterbalance each electrode, but I compensate for the inward feeding movement of the electrode, thereby preventing the weight of the electrodes from interfering in any way with the tilting of the furnace. Furthermore, I mount these electrodes on a frame which is rigid with the body of the furnace and, therefore, moves with the body.

In order to accomplish this, one side of the body 1 is provided with a guide arm 10 (see Fig. 1) the lower portion of which is secured at the point 11 to the side of the body. This frame has an upward extension 12 about in line with the side of the wall of the furnace, and it also has a downward extension 13 which is located on the outer side of the adjacent pedestal bearing 5. The extension 12 operates as a guide for the electrodes for which purpose it is preferably constructed of a plurality of I-beams or double channels 14 (see Fig. 8). Each electrode 8 is supported by a corresponding electrode frame 15 (see Figs. 1 and 8). These electrode frames may be formed with an upper arm 16 and a lower arm 17, each arm being provided with a yoke 18 (see Fig. 8) at its inner end carrying rollers 19 which engage in the channels on opposite sides of the I-beam.

At the upper end of each I-beam guide sheaves or pulleys 20 are provided over which a cord 21 passes which is attached at 22 to its corresponding electrode frame.

The lower end of this cord 21 is attached to a device of special construction which may be operated at will to lower the electrode, and this operation of lowering the

electrode simultaneously lowers a counterweight 23 corresponding to the electrode (see Fig. 4). These counter-weights 23 are guided on the lower extension 13 of the guide frame 10. This extension includes a rectangular back-plate 24 the face of which carries vertical frame bars 25 which divide the space adjacent to the plate 24 into a plurality of guide-ways. At the upper end of each of these guide-ways a drum 26 is provided, about one end of which the cord 21 is wrapped. The other end of the drum is provided with a cord 27 which supports its corresponding counter-weight 23. In order to adapt these counter-weights to use with electrodes of different weights, each counter-weight consists of an open receptacle (see Fig. 4) the interior of which may be filled with scrap-iron 28 or similar material.

The cords 21 and 27 wrap about the drum in opposite directions so that when the upper cord 21 is payed out to permit the electrode 8 to descend, then the corresponding counter-weight will be slightly raised in its guide-way. Any suitable means may be provided for operating the drums 26. In Fig. 5 I illustrate a simple worm wheel 29 rigid with the drum and actuated by a worm 30 with an operating wheel 31 (see Fig. 1).

In order to provide a considerable depth of metal at the pouring spout, I prefer to construct the ends of the basin 32 in the fire-brick lining so that the channel through which the metal flows in going to the spout is very much contracted in width, and this is accomplished simply by providing the ends of the basin with converging sides or side-walls 33. In this way, as the metal flows out into the end of the basin the depth of the metal increases and hence the metal which flows out of the spout will be taken from a considerable depth below the slag floating on the surface of the molten mass. The bottom of the furnace has upwardly inclined end walls indicated by the dotted lines 34 in Fig. 4. The slag is held back by a gate 34.

By reason of the constant raising and lowering of the electrodes, any cable connection is subjected to slight movement. I provide a connection of simple construction which can be readily made and which insures an ample area of contact at the connection as well as insuring a secure connection. In order to accomplish this, I provide an electrode holder 35 for each electrode with a tapered socket 36 which is in metallic connection with the holder. For convenience, this tapered socket may be formed in a small bracket 37 bolted on the side of the electrode holder. The bracket 37 is preferably constructed of copper or brass and the tapered socket 36 is simply a tapered bore. This bore receives a tapered plug 38 which has the same angle of taper

as the socket, and this plug is secured to the end of the flexible cable 39 which carries the current to or from the electrode. Plug 38 is simply in the form of a hollow cone with an opening 40 at its large end. In securing the plug to the end of the cable, the end of the cable is bared of insulation and the plug is held in a vertical position and filled with molten metal such as lead. The bare end of the cable is then thrust through the opening 40 and jammed down to the bottom or small end of the plug. This will displace a considerable amount of lead, but leaves the inner chamber of the plug completely filled with lead, which operates as a good conductor connecting all sides of the end of the cable with the adjacent wall of the plug. The plug may be held in the socket by means of a threaded stem 41 at its small end which passes loosely through an opening 42 at the inner end of the socket and is secured in place by a nut 43. The fixed end of the cable 39 is preferably provided with a similar plug and socket connection (see Fig. 11) in which the socket 44 is constructed as part of a fixed bracket 45 which is mounted on an insulating support 46. This socket receives a tapered plug 47 secured to the cable in the same way as described in connection with the plug 38. In order to allow for the tilting of the furnace and the raising or lowering of the electrodes the cable 39 preferably is permitted to hang in a loop (see Fig. 1). In order to tilt the furnace at will, I provide an adjusting device which is preferably in the form of a nut-and-screw device 48 (see Fig. 6). This device is associated with an arm 49 which is rigidly connected with the body of the furnace. For this purpose, the arm 49 may be secured directly to the outermost trunnion 4. The outer end of this arm is bifurcated to receive a loose pin 50 and in this pin a feed-screw 51 has a swivel head 52. The outer end of the adjusting screw 51 carries a nut 53, the sides of which are formed into pins or pintles 54 which rock in the upper end of the pedestal bracket 55. This nut 53 is threaded preferably with a square thread to fit the square thread on the screw 51, and the end of the screw is provided with a hand-wheel 56 for rotating it. With this organization of parts, it will be noted that the device 48 will hold the body positively against a slight movement in either direction on its axis. At the same time, the hand-wheel 56 and the threads on the screw 51 give sufficient leverage to enable the molder to tilt the furnace at will. In order to hold the electrodes 8 in position, each holder 35 is formed with a tapered bore 57, the large end of which is disposed upwardly (see Fig. 9), and in this bore I place a pair of tapered bushings 58 which have flanges at their upper ends, and are in-

serted from above. These bushings are bored to the diameter of the electrode so that when they are pressed downwardly they act as wedges in the conical bore 57 and clamp the electrode in place. There is nothing connected to them; they are freely movable upwards with their path unobstructed so that they can be instantly dislodged by a blow under the flange.

Each electrode holder 35 is effectively insulated from the electrode frame which supports it by means of an insulating plate 59 to which the holder is secured by means of insulated bolts 60 (see Figs. 8 and 9).

The counterweights 23 are placed at such a level that when cooperating with the electrodes, the weights may project below the lower edge of the guide plate 24. When the furnace is to be tilted, the electrodes should be lowered, and the counterweights raised to any point desired to enable the weights to operate as an effective counterbalance for the metal as the furnace tilts. As the furnace tilts, of course the weights rest against the sides of the frame bars, 25, and so they swing away from the vertical plane of the furnace. In this way their "lever arm" as a counter-balance increases, the further the furnace is tilted.

In order to guide the back-plate 24 as the furnace is tilted, I provide two rollers 61, which are carried respectively in brackets 62. One of these brackets is attached to the pedestal 5 at one side and the other at the other side (see Figs. 1 and 4).

It is understood that the embodiment of the invention described herein is only one of many embodiments this invention may take and I do not wish to be limited in the practice of my invention nor in my claims to the particular embodiment set forth.

What I claim is:—

1. In an electric furnace, the combination of a body having a fire-brick lining, trunnions supporting the body to rotate on a substantially horizontal axis, a pouring spout carried by the body at its end, a pin loosely mounted in the arm, an adjusting screw having a swivel connection with the pin, a nut mounted to rock on a fixed axis, and having a thread connection with the screw, and a hand wheel attached directly to the screw for rotating the screw to rock the arm and tilt the furnace body on its axis.
2. In an electric furnace, the combination of a fire-brick lined body, means for supporting the same to rotate on a substantially horizontal axis, an electrode guiding frame carried by the body and extending upwardly above the same, an electrode guided on the guide frame and extending down into the furnace, a counterweight for the electrode supported so as to move about the said horizontal axis when the body is tilted, and carried below the said axis of

rotation, means for raising and lowering the electrode, and means for tilting the body on its axis of rotation.

3. In an electric furnace, the combination of a fire-brick lined body, means for supporting the same to rotate on a substantially horizontal axis, an electrode guiding frame carried by the body and extending upwardly above the same, an electrode guided on the guide frame and extending down into the furnace, a counterweight for the electrode carried in the guiding frame below the said axis of rotation, means connected with the electrode and the counterweight operating to lower the electrode and raise the counterweight, and means for tilting the body on its axis of rotation.

4. In an electric furnace, the combination of a fire-brick lined body, means for supporting the same to rotate on a substantially horizontal axis, a guide frame carried by the body and having an upward extension for guiding an electrode and a downward extension for guiding a counterweight, an electrode frame guided on the guide-frame and having means for holding an electrode, a counterweight guided in the lower portion of the guide frame below the axis of rotation of the body, means for raising and lowering the electrode frame and the counterweight, and means for tilting the body on its axis of rotation.

5. In an electric furnace, the combination of a fire-brick lined body, means for supporting the same to rotate on a substantially horizontal axis, a guide-frame carried by the body and having an upward extension for guiding an electrode and a downward extension for guiding a counterweight, an electrode frame guided on the guide-frame and having means for holding an electrode, a counterweight guided in the lower portion of the guide-frame below the axis of rotation of the body, means for raising and lowering the electrode frame and the counterweight, means for tilting the body on its axis of rotation, and a flexible electric cable held fixed at one end and connected at its other end with the electrode.

6. In an electric furnace, the combination of a fire-brick lined body, means for supporting the same to rotate on a substantially horizontal axis, a guide-frame rigid with

the body and having an upward extension including upright guide channels, said guide-frame also having a downward extension with guide channels, a plurality of electrode frames guided in the upper guide channels, electrodes carried respectively thereby, a plurality of counterweights corresponding to the electrodes and guided in the guide channels of the downward extension, means for raising and lowering each electrode and its corresponding counterweight, and means for tilting the body on its axis of rotation.

7. In an electric furnace, the combination of a body, means for supporting the same to rotate on a substantially horizontal axis, and a spout carried by the body at its ends, a fire-brick lining forming a basin within the body and having sides converging toward the said spout, whereby when the furnace is tilted the depth of metal is increased in the vicinity of the pouring spout, thereby facilitating the pouring of the metal from a depth below the slag.

8. In an electric furnace, the combination of an electrode holder having a tapered socket metallically connected therewith, an insulated cable, a tapered plug receiving the end of the said cable, a packing of conductive material surrounding the end of the cable within the plug, and providing metal between the side of the cable and the wall of the plug, and means for securing the plug in the tapered socket.

9. In an electric furnace, the combination of a body having a fire-brick lining, means for supporting the body to rock on a fixed substantially horizontal axis passing transversely through the body, a pouring spout carried by the body at its end, an arm rigid with the body, a nut-and-screw device associated with the arm for swinging the arm in either direction to tilt the furnace body on its axis and having a swivel support for the screw at the arm and another swivel support for the screw at a fixed point, and a hand wheel connected directly to the nut-and-screw device for rotating the screw in unison with the hand wheel.

Signed at Los Angeles, California, this 8th day of May, 1923.

LLOYD D. KAY.