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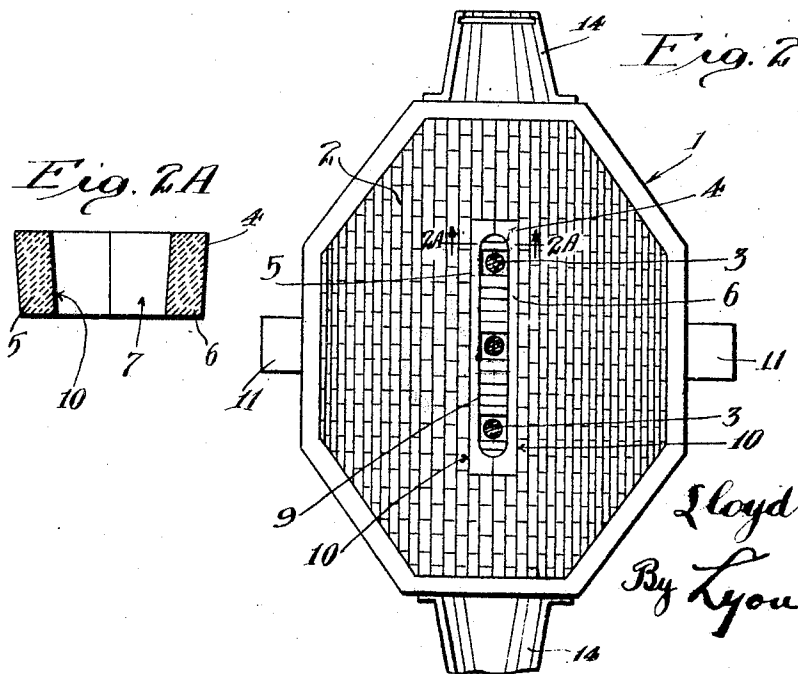
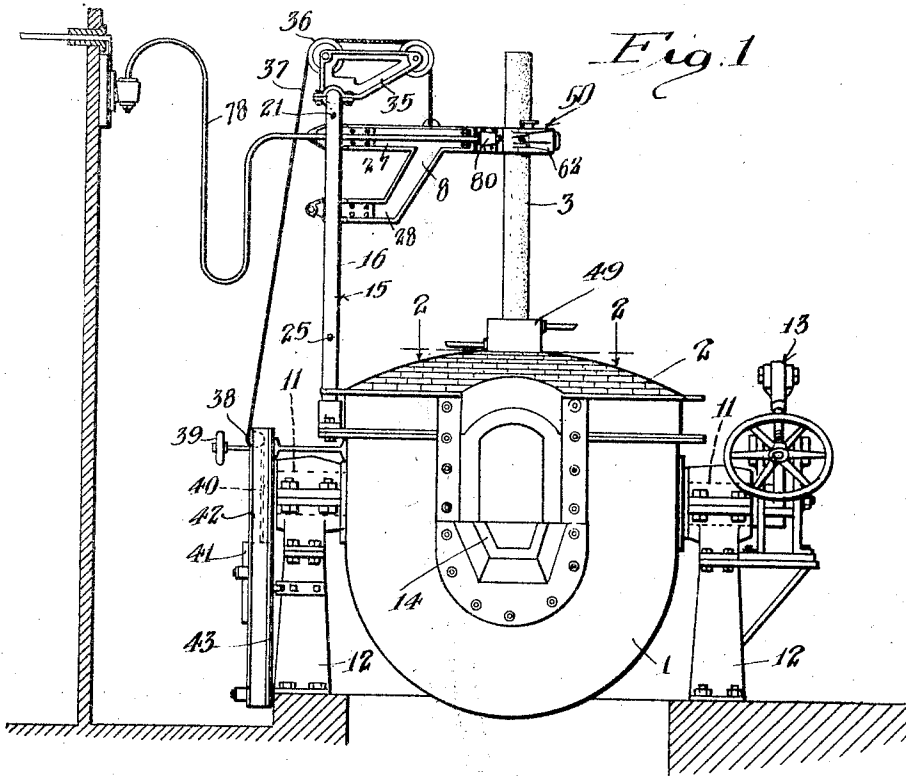
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L. D. KAY

ELECTRIC FURNACE

Filed Aug. 6, 1923

4 Sheets-Sheet 1



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Sept. 15, 1925.

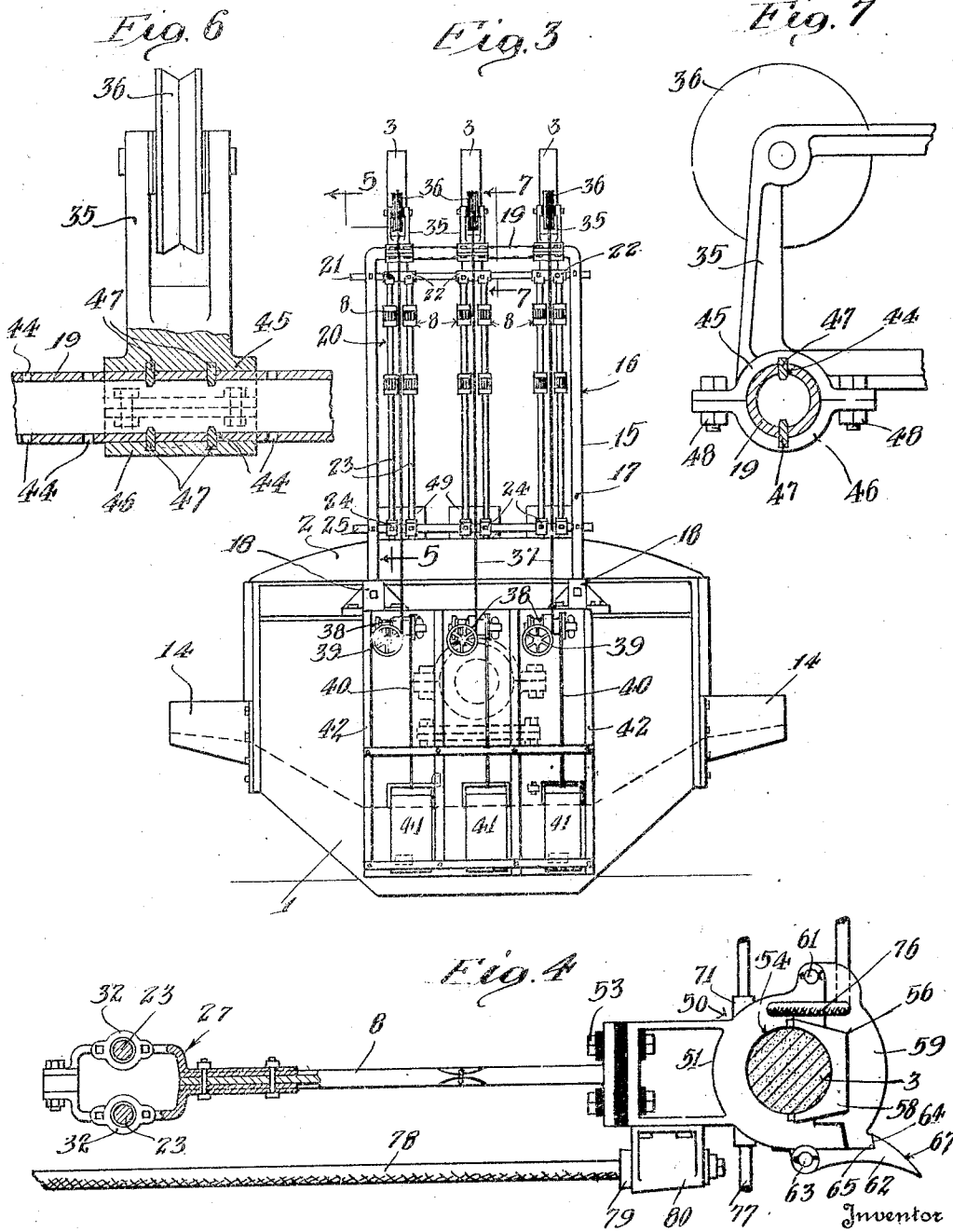
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4 Sheets-Sheet 2



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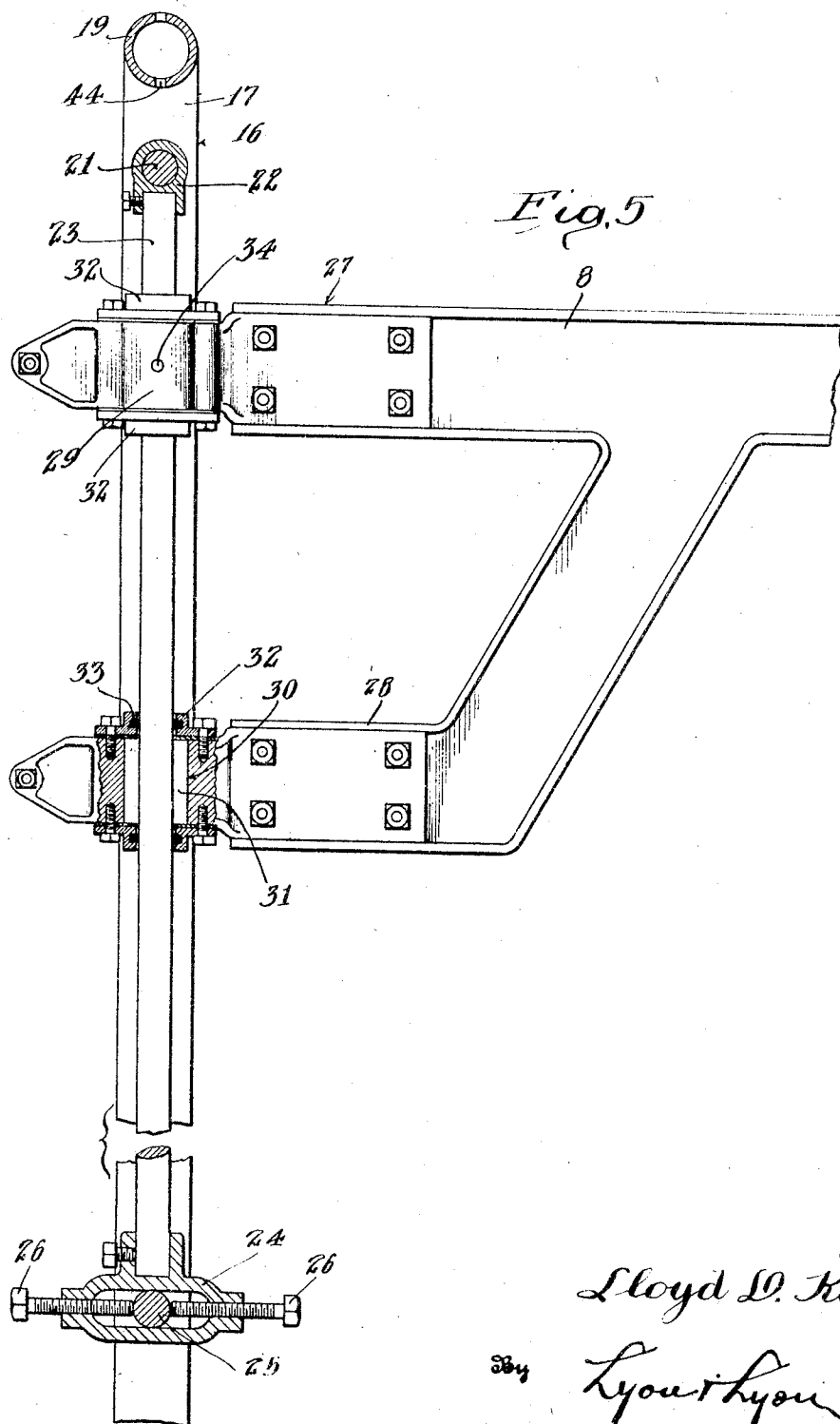
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4 Sheets-Sheet 3



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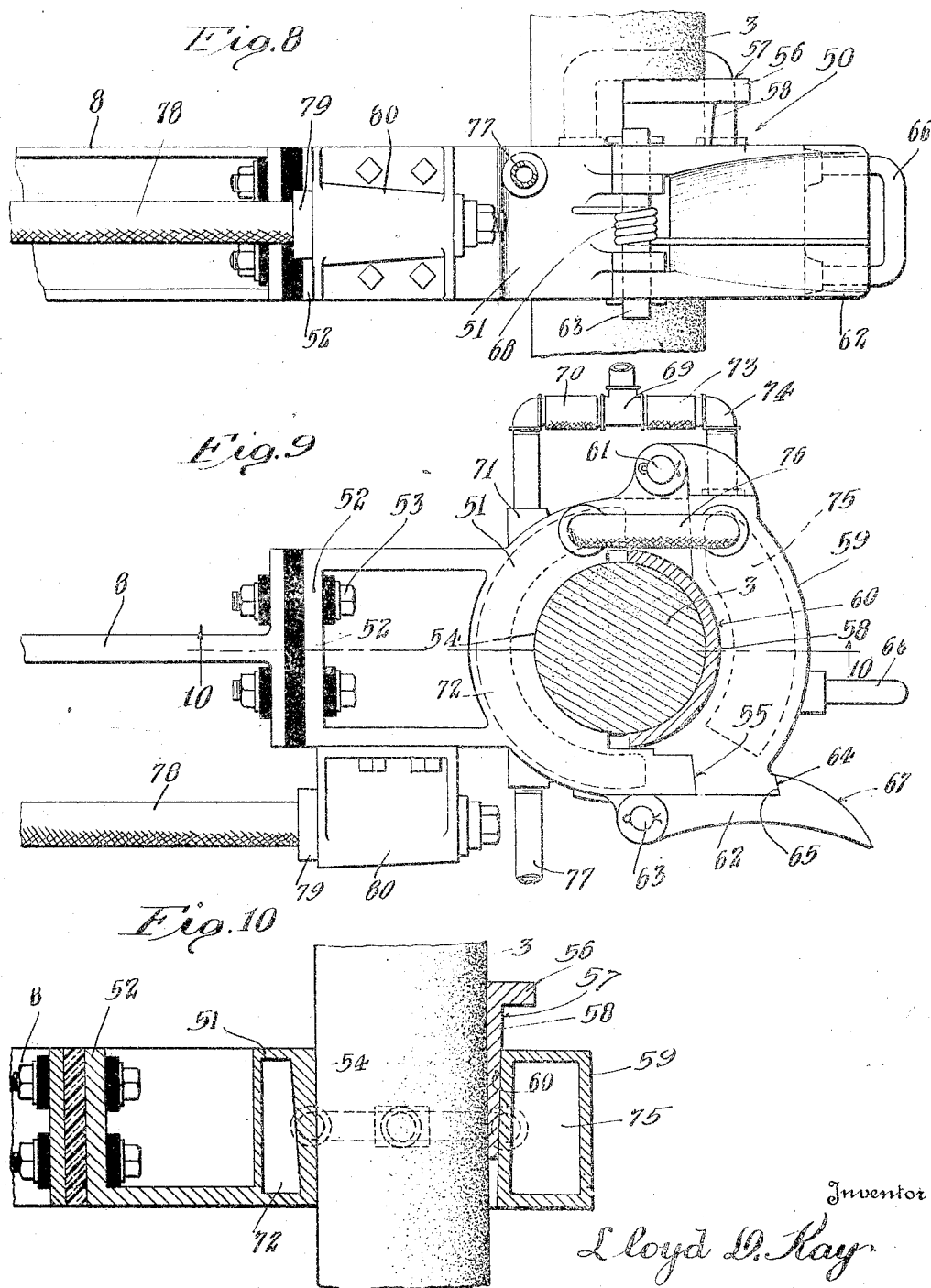
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ELECTRIC FURNACE

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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE.

LLOYD D. KAY, OF LOS ANGELES, CALIFORNIA.

ELECTRIC FURNACE.

Application filed August 6, 1923. Serial No. 655,862.

To all whom it may concern:

Be it known that I, LLOYD D. KAY, a citizen of the United States, residing at Los Angeles, in the 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 particularly to electric furnaces. Although features of the invention may be applied to electric furnaces of different types, many of them are especially useful when applied to a tilting furnace; that is to say, a furnace in which the body of the furnace is mounted to rock upon an axis so that the furnace can be tilted to pour the molten metal from it. A preferred construction for this type of furnace involves the use of a supporting frame for the electrodes, extending up at the side of the furnace and carrying movable electrode arms which extend out over the furnace and which carry the electrodes. These electrodes are of considerable weight and by reason of the fact that the electrode arms are held at a relatively high level, it is desirable to provide a rigid support for the arms, that is to say, a support permitting of little or no lost motion that would tend to wrench the electrodes and possibly break them when the furnace is tilted.

In constructing electric furnaces it is the present practice to construct the cover with an electrode opening and if the electrode, when supported in the electrode frame, does not properly align with the opening, the edge of the opening must be chipped out so as to permit the electrode to be passed through. This difficulty arises in the construction of electric furnaces of any type, whether they are tilting furnaces or not.

It is also the present practice to provide a holder for the electrodes with a vertical opening through it, through which the electrode is passed, and tapered bushings are provided inserted through the upper end of the opening to jam against the face of the electrode and clamp it in position. This method is objectionable because the electrode can only be removed with difficulty by prying or driving the bushings upwardly.

In the use of electric furnaces, it frequently happens that the electrode or elec-

trodes will have a very destructive effect on a particular spot in the wall of the furnace, and this necessitates constant repair at this point.

The general object of my invention is to overcome these difficulties and to satisfy the requirements outlined above, that is to say, to provide a furnace in which the position of the electrode or electrodes can be altered with respect to the furnace wall, thereby presenting new paths for the current and preventing the concentration of the destructive effect at a particular point on the wall; also to provide a furnace in which the position of the electrode can be readily adapted to the opening through the cover, and to provide for rigidly supporting the electrodes, at the same time permitting ample adjustments of the same with respect to the furnace body or to the opening in the cover; and to provide improvements in the details of such a furnace facilitating the supporting or adjustment of 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 drawing:

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

Fig. 2 is a plan of the furnace showing the electrodes in section on the line 2—2 of Figure 1.

Fig. 2^A is a vertical section upon an enlarged scale through the cap of the furnace.

Fig. 3 is a rear elevation of the furnace.

Fig. 4 is a horizontal section taken just above one of the electrode arms, certain parts being broken away.

Fig. 5 is a side elevation, particularly illustrating details of the electrode supporting frame and the electrode arm, certain parts being broken away or shown in section; this section is taken substantially on the line 5—5 of Figure 3.

Fig. 6 is a vertical section taken through the upper part of the electrode supporting frame and showing a portion of the pulley bracket partly in elevation and partly in section.

Fig. 7 is a vertical section taken about on the line 7—7 of Figure 3, and passing through the upper part of the electrode supporting frame. This view shows a portion of the pulley bracket, the same being broken away and shown partly in section.

Fig. 8 is a side elevation of one of the electrode holders.

Fig. 9 is a plan of the electrode holder shown in Figure 8, but showing the electrode and bushing in cross section.

Fig. 10 is a section taken substantially on the line 10—10 of Figure 9.

The furnace illustrated includes a body 1 and the cover 2 through which electrode 3 pass into the interior of the furnace.

It is usual to construct a furnace cover such as the cover 2 with an opening or openings for the electrodes, and the electrodes are supported in a fixed frame so that they project down through the opening. In constructing a furnace cover in that way, the opening for the electrode is not very accurately located and it frequently happens that it is not in good alinement with the electrode. This necessitates the chipping out of the side of the opening to permit the electrode to pass down. Furthermore there is usually no provision for effecting a shifting or alteration in the position of the electrode with respect to the furnace wall.

According to my invention I construct the furnace cover and the support for the electrode in such a way that the electrode can readily be positioned to adapt it to pass through the electrode opening, and I also construct the furnace cover in such a way as to permit adjustments of the electrode to alter its position with respect to the furnace wall.

In order to accomplish this I provide the cover with an electrode opening which is larger than the electrode and I support the electrode in such a way as to permit the adjustment of the electrode with respect to the opening. In order to accomplish this I prefer to provide the cover with a cap 4 which is in the form of an elongated block of refractory material divided longitudinally into two cap members or side members 5 and 6. This cap member is preferably located on the longitudinal axis of the body and has an elongated opening 7 which extends longitudinally in it.

I provide a plurality of electrodes 3, for example, three of them, and these electrodes are supported each by an electrode arm 8 so that they extend down into the furnace.

After the electrodes have been properly positioned in the opening 7, I then close

the opening through the cap 4 with a filler preferably composed of a plurality of filler blocks 9 of suitable refractory material. These blocks are slightly tapered like the inner face 10 of the cap member, see Figure 2^A; this taper enables them to be set in place from above. They are used to fill the space between the electrodes and also close the opening between the end of the slot 7 and the outermost electrodes. These blocks may be given any desired form, but preferably those adjacent the electrodes have concave faces to fit to the sides of the electrodes.

The furnace illustrated is of the tilting type, for which purpose the body 1 is provided with oppositely disposed trunnions 11 which are supported in pillow blocks 12, and at one side one of the trunnions 11 is provided with a tilting mechanism 13 by means of which the furnace can be tilted in order to enable the molten material to be poured from a spout 14 at either end of the furnace.

Rigid with the furnace I provide an electrode supporting frame 15 which extends upwardly at the side of the furnace, and this frame 15 supports the electrode arms 8. The construction of this frame is such as to permit the electrode arms 8 to be raised or lowered and is also constructed so as to enable the electrode arms to be adjusted laterally in a direction substantially parallel with the axis of the body, and also in such a way as to enable the electrode arms to be tilted, that is to say, to be swung or adjusted in a vertical plane transverse to the axis of the furnace. In order to accomplish this the supporting frame 15 comprises a substantially rectangular main frame 16 comprising vertical side members 17 received in sockets 18 mounted on the furnace body. The side members 17 are connected integrally by an upper bar 19. The supporting frame operates to support a plurality of upright guides 20, one corresponding to each electrode and these guides are movably mounted in the present instance on the main frame 16. Their mounting is such as to permit their being adjusted laterally and in a direction substantially parallel with the axis of the furnace. They are also mounted so that they can be tilted in a vertical plane. For this purpose, in the main frame 16 I provide an upper horizontal bar 21 which operates as a pivot bar for the guides. Each guide has a sleeve 22 loosely mounted on the bar 21, and each guide is preferably constructed of a pair of substantially vertical bars 23 which are parallel and disposed apart. The lower ends of these bars 23 are provided with means for adjusting them with respect to the axis of the pivot bar 21, see Figure 5. This means is in the form of a yoke 24 secured to the lower end of each guide bar 23 and through which a lower

horizontal bar 25 passes. The ends of the yoke 24 are provided with set screws 26 which engage opposite sides of the bar 25. see Figure 5. By screwing up on one of the set screws 26 and unscrewing the other set screw, it will be evident that the lower end of the guide bars 23 can be adjusted outwardly or away from the furnace, or inwardly toward the furnace.

Each electrode arm is bifurcated at its inner end so as to present an upper fork 27 and a lower fork 28 and these forks are provided with means for engaging the guides to enable the guides to support the arms and permit the arms to be raised or lowered on the guides. In the present instance each of the forks 27 and 28 is forked, each fork being provided with a sleeve 29 which surrounds and slides on the bar. Each of these sleeves has a bore 30 much larger in diameter than the guide bar and forming a chamber filled with grease 31. At each end of the sleeve 29 a collar 32 is attached having an internal groove to receive a washer 33 of hard felt or similar material. These sleeves 29 are provided with lubricating openings 34 and enable the arms to slide very freely up and down on the bars.

I provide means for counterweighting the electrodes and their arms 3 individually, and for this purpose I provide the upper bar 19 of the frame 16 with a pulley bracket 35 corresponding to each arm. These pulley brackets have means such as the pulleys 36 for guiding wire cables 37, each cable being secured to its corresponding arm and passing down at the rear of the furnace where it is attached to a drum 38 which may be rotated at will by a hand wheel 39. These drums also carry cables 40 which support counterweights 41 respectively, which are mounted to slide up and down in guides 42 on the outer face of a back plate 43, said back plate being rigidly attached to the adjacent trunnion 11 of the furnace so that it swings with the furnace when the furnace is tilted.

The pulley brackets 35 are mounted on the frame 16 in such a way as to enable them to be adjusted along the upper bar 19 to maintain substantial alignment with the arms 8, if they should be adjusted. In order to accomplish this I provide the upper bar or cross bar 19 with a plurality of openings 44, there being a row of these openings on the upper side and another row on the lower side. Each bracket has at its base a split sleeve 45 including a removable cap 46, and the body of this sleeve and also the cap are provided with pintles 47 which are received in these openings 44. By loosening up the nuts 48 these sleeves can be opened up and the brackets moved to any point desired on the bar 19.

Each electrode 3 is carried in a collar 49

which seats upon the upper face of the cover 2, see Figure 1; and each electrode is supported in a holder 50 carried on the end of its corresponding arm 8.

These holders each comprise a rigid body 70 with a socket which is open on the side of the body, and the body of each holder is provided with a cap movably mounted on the body so as to close the open side of the socket. By swinging this cap open the electrode can be inserted in the socket by a lateral movement. I also provide means for securing the cap in its closed position. The body 51 of each holder is constructed in the form of a block with a laterally projecting foot 52 which enables it to be attached by means of insulated bolts 53 to the end of its arm 8. The outer portion of the body 51 is formed into a socket with a concave inner face 54, and opening out on the side of the body. I also provide a bushing. The bushing illustrated consists of a bushing segment or section 57 having a semi-cylindrical inner face to fit against the electrode, and an outer conical face 58. The concave face 54 is preferably of cylindrical form, see Figure 10 so as to fit against the side of the electrode, while the outer face is tapered or conical to fit the inner face of a cap 59.

On the outer side of the body the cap 59 is provided which has a concave inner face 60 opposite to the concave face 54 and this cap is pivotally supported on the body on a pivot 61. I provide a snap catch or spring latch for holding the cap closed, and this is preferably in the form of a simple latch 62 pivoted at 63 on the side of the body and having a keeper shoulder 64 at its outer portion which engages over a seat 65 formed on the outer side of the cap. In placing the electrode in the holder the bushing 57 is placed in position against the concave face 54 while the cap 59 is in its open position. The electrode is then introduced by a lateral movement. The handle 66 of the cap is then seized and the cap is swung shut. As the cap swings shut its outer portion strikes against a cam face 67 on the latch and pushes the latch back out of the way so as to permit the cap to close against the outer face 55 of the body. The bushing 57 is then dropped into position.

The pivot pin 63 of the latch 62 is provided with a coil spring 68, one end of the spring being extended so that its outer end rests against the latch near its tip or outer end.

In the construction of the latch I prefer to construct it so that the keeper face or shoulder 64 is substantially at right angles to the radial line drawn to it from the axis of the pin 63, and preferably this keeper shoulder and the seat 65 are curved surfaces struck on a radius from the axis of this pin.

The holder may be cooled by circulating

water through it in the usual way. As illustrated, this water will be received through a T 69 having a hose 70 connecting to a boss 71 on the side of the body in such a way that the water will be admitted to a water chamber 72 formed in the body. The T 69 is also connected by a flexible hose 73 with an elbow 74 attached to the outer side of the cap near the hinge pin 61. Through this elbow the water flows into a water chamber 75, see Figure 10, and the water finds outlet from this water chamber through a loop of hose 76 which passes up through the upper wall of the water chamber, and is connected to the water chamber 72, see Figure 9.

The circulating water passes out from the body through a discharge pipe 77.

The electric current is carried to the holders by means of flexible cables 78, each cable having a conical head 79 secured in a socket 80 bolted to the side of the foot 52.

In operating the furnace, when the same is tilted by the tilting mechanism 13 so that it rocks on its trunnion 11, the bars 23 of the guide 20 operate to hold the arms 8 securely, and this construction prevents the relatively heavy weight of the electrode on the outer ends of the arms from producing any undue swinging movement at the ends of the arms 8, which would effect the alinement of the electrodes.

In building the cover, it may be built upon an arched form in the usual way, the cap 4 being set in position like the keystone of an arch.

In placing the electrodes in position through the cover, if their alinement is not such as to permit them to enter the electrode opening, their alinement can be altered as desired, by adjusting the guides 20 along the bars 21 and 25, or by adjusting the set screws 26.

After the electrodes have been properly located, the opening 7 through the cap 4 should be closed by means of the filler bricks which are of course of refractory material.

The pulley brackets 35 can then be adjusted into line with the arms.

By operating the hand wheels 39 the drum 38 can be rotated so as to raise or lower the electrodes at will. During this movement the sleeves 29 slide freely on the guide bars 23.

The electrodes can be readily attached to their holders 50 by swinging open the caps 59.

By reason of the fact that there is no tapered bushing used on the inner side of the socket it will be evident that the electrode holder holds the electrode in fixed alinement with respect to the axis of the holder.

The flange 56 of the bushing 57 may be cut away as shown so as to provide clearance for the hose connection 76.

It is understood that the embodiment of the invention described herein is only one of the 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 an electrode, a cover having an opening therethrough larger than the electrode and receiving the same so as to permit lateral movement of the electrode in adjusting the same within the furnace, a support for the electrode, and means for adjusting the electrode in a horizontal direction within the opening, to alter the relation of the electrode to the side walls of the furnace.

2. In an electric furnace, the combination of a cover having an opening therethrough for the electrode, said opening being larger than the electrode, a support for the electrode to hold the same in the opening, means for adjusting the electrode in a horizontal direction, to aline the same in the opening, and a filler of refractory material disposed at the side of the electrode for closing the opening after the electrode is in place.

3. In an electric furnace, a cover having an elongated opening for the electrode, means for supporting the electrode in the opening, and means for adjusting the electrode longitudinally of the opening, or laterally with respect to the opening to aline the same therein.

4. In an electric furnace, a cover having an elongated opening therein, a plurality of electrodes disposed in the said opening, means for supporting the electrodes, and means for adjusting the electrodes in a horizontal direction longitudinally of the said opening and relatively to said cover.

5. In an electric furnace, a cover having a cap of refractory material with a horizontally elongated opening therethrough, means for supporting an electrode in the opening, and a filler in the form of a plurality of separate blocks of refractory material received in the opening between its edge and the side of the electrode, and operating to hold the electrode positioned in the opening.

6. In an electric furnace, a cover having a cap member with an elongated opening therein, means for supporting a plurality of electrodes disposed in the opening, and a filler in the form of separate blocks of refractory material received in the opening between the electrodes operating to close the opening.

7. In an electric furnace, a cover having a cap member disposed over the middle axis of the cover, said cap member being divided longitudinally into cap-sections, and having an elongated opening therein, a plurality of

electrodes disposed in the opening, and means for supporting and adjusting the electrodes to aline them in the opening.

8. In an electric furnace, a cover having
5 an elongated cap member divided longitudinally into two side members and extending over the furnace body, said cap member having an elongated opening therein, a plurality of electrodes mounted in the opening, and
10 refractory filler blocks disposed in the ends of the opening beyond the outermost electrodes and in the space between the electrodes.

9. In an electric furnace, a cover having
15 an electrode opening therethrough, a supporting frame extending up at the side of the furnace, an electrode arm carried on the supporting frame, means for adjusting the electrode arm in a direction substantially
20 parallel with a horizontal axis of the furnace, and means for adjusting the electrode arm to tilt the same and alter the direction of the axis of the electrode.

10. In an electric furnace, an electrode
25 supporting frame extending up at the side of the furnace, and comprising a pair of upright bars disposed apart, an electrode arm having sleeves guided on said upright bars, means for holding the electrode arm at different levels on the said upright bars, and
30 means for effecting a lateral adjustment of the bars.

11. In an electric furnace, an electrode supporting frame comprising an upright
35 guide, an electrode arm movably mounted on the guide, and means for adjusting the guide toward or from the horizontal longitudinal axis of the furnace.

12. In an electric furnace, an electrode
40 supporting frame extending up at the side of the furnace and including an upright guide pivotally mounted to swing on a horizontal axis on the supporting frame, and means for effecting adjustment of the guide
45 with respect to said axis to tilt the electrode and thereby move the lower end of the electrode laterally with respect to the furnace.

13. In an electric furnace, an electrode supporting frame comprising a substantially
50 horizontal pivot bar extending longitudinally with an axis of the furnace, a plurality of guides mounted to swing on said bar, means for adjusting the guides with respect to the axis of the pivot bar, and electrode
55 arms movably mounted on the guides, and extending over the furnace.

14. In an electric furnace, an electrode supporting frame extending up at the side
60 of the furnace and comprising an upright guide, an electrode arm movably mounted on the guide, means for effecting an adjustment of the guide in a direction substantially parallel with an axis of the furnace to change the position of the electrode in the furnace, a
65 pulley bracket carried by the supporting

frame capable of adjustment on the frame to maintain substantial alinement with the electrode arm, a counterweight with cables connecting the same to the arm, and means on the bracket for guiding the cable.

15. In an electric furnace, an electrode supporting frame comprising a substantially rectangular main frame extending up at the side of the furnace, a pair of substantially horizontal bars mounted in the main frame,
70 a plurality of guides supported on said horizontal bars, an electrode frame carried by each guide, and means for enabling the guides to be shifted longitudinally along the bars to alter the position of the electrodes in
75 the furnace.

16. In an electric furnace, an electric supporting frame comprising a substantially rectangular main frame extending up at the side of the furnace, a pair of substantially
80 horizontal bars mounted in the main frame, a plurality of guides supported on said horizontal bars, an electrode frame carried by each guide, and means for enabling the guides to be shifted longitudinally along the bars to alter the position of the electrodes in the furnace, said main frame having an upper bar, brackets mounted on the upper bar, a counterweight with cables connecting the same to its corresponding electrode frame,
85 and means on the brackets for guiding the cables.

17. In an electric furnace, an electrode supporting frame comprising an upright
90 guide pivotally supported at one end, said supporting frame including a substantially horizontal bar, yoke means carried by the guide and disposed adjacent said horizontal bar, and adjusting means carried by the yoke means for engaging the side of the bar to
95 tilt the guide, and an electrode arm, carried on the guide.

18. An electric furnace comprising a body supported to rock on a transverse axis to tilt the body in pouring from the furnace, an
100 electrode supporting frame rigidly connected with the body and extending up at the side of the furnace, said supporting frame including a pair of upright guide bars disposed apart, an electrode frame having
105 sleeves to slide on said guide bars when the electrode frame is raised or lowered, said supporting frame including a pivotal support for said guide bars, means for effecting lateral adjustment of the guide bars in a
110 direction substantially parallel with an axis of the furnace and means for effecting an adjustment of the guide bars with respect to the axis to tilt the guide bars in a substantially vertical plane transverse to the
115 said axis of the furnace.

19. In an electric furnace, an electrode holder comprising a rigid body with a socket, said socket being open on the side of the body so as to permit the electrode to be
120

5 moved laterally into the socket, a cap pivotally mounted on the body to swing over and close the open side of the socket, and means for securing the cap in its closed position.

10 20. In an electric furnace, an electrode holder having a body rigid with a socket, said socket being open on the side of the body and having a concave inner face, a cap pivotally mounted on said body and having a concave inner face opposite the concave face of the body, said cap and body cooperating to permit the electrode to be placed in the socket by a lateral movement, said concave faces cooperating to hold the electrode in the socket, and a movable latch for holding the cap in its closed position.

15 21. In an electric furnace, an electrode holder comprising a body with a socket having a substantially cylindrical face, said socket being open on the side of the body opposite the said inner face, a cap pivotally mounted on the body to swing over and close the open side of the socket, and having a substantially conical inner face cooperating with the first named inner face to hold the electrode, means for latching the cap to the body in its closed position, and a bushing section held in the socket between the body and the cap for clamping the side of the electrode.

20 22. In an electric furnace, an electrode holder comprising a body with a socket, said

socket being open on its side, a cap pivotally mounted on the body to swing over and close the open side of the socket, and a latch having a pivotal connection with the body and having a keeper shoulder for engaging the cap, said cap having a seat for the keeper shoulder, said seat and the face of said keeper shoulder being disposed substantially at right angles to a radial line drawn from the axis of the pivotal connection of the latch.

23. In an electric furnace, an electrode holder comprising a body with a socket, said socket being open on its side, a cap pivotally mounted on the body to swing over and close the open side of the socket, and a latch having a pivotal connection with the body and having a keeper shoulder for engaging the cap, said cap having a seat for the keeper shoulder, said seat and the face of said keeper shoulder being disposed substantially at right angles to a radial line drawn from the axis of the pivotal connection of the latch, said latch having a spring for moving the same toward the cap and having a cam face cooperating with the cap when it swings shut to displace the latch and permit the cap to move to its closed position, so that the latch snaps over the seat.

Signed at Los Angeles, California, this 27th day of July 1923.

LLOYD D. KAY.