No. 881,517. PATENTED MAR. 10, 1908.

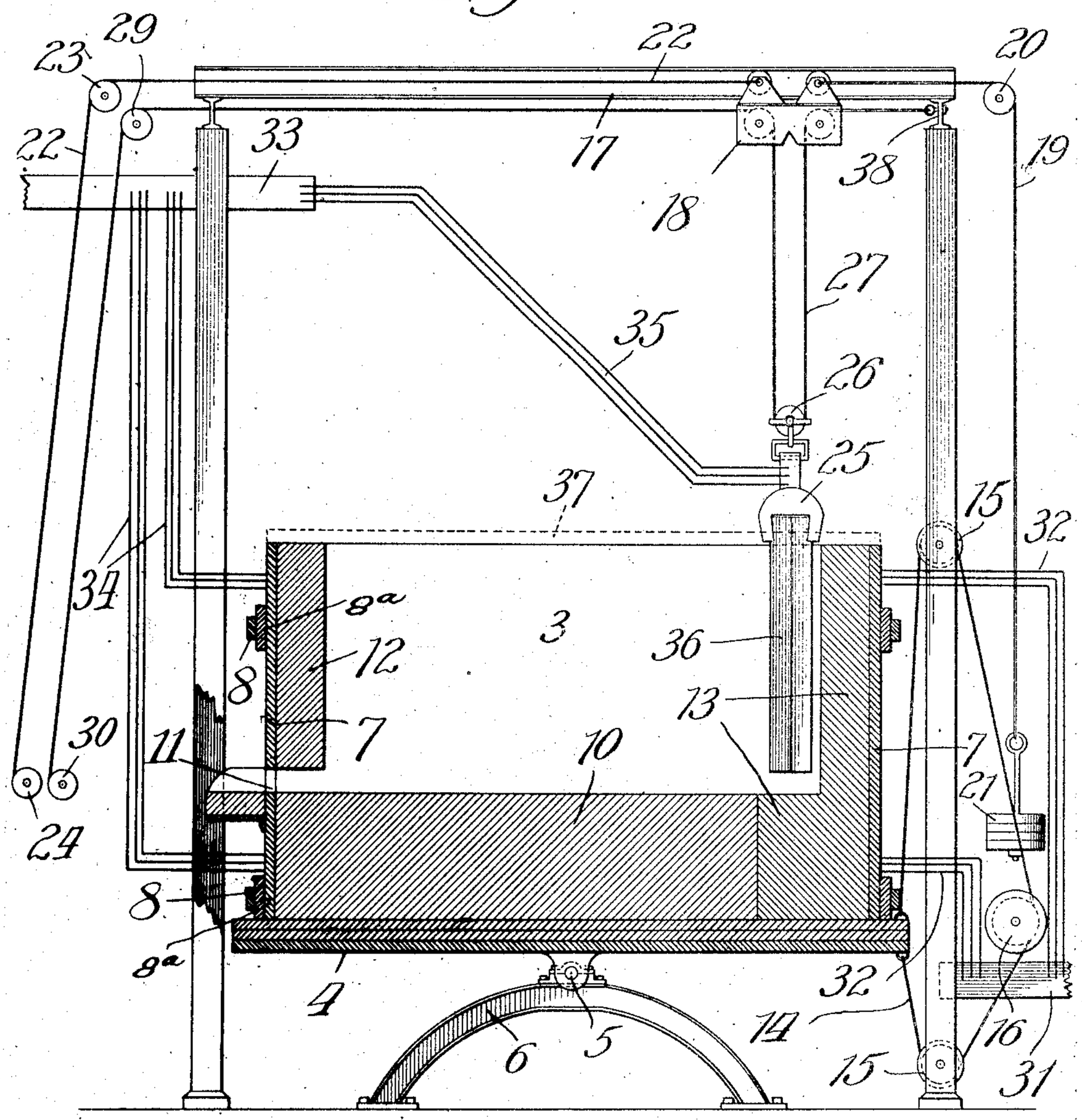
C. E. WILSON.

ELECTRIC FURNACE.

APPLICATION FILED SEPT. 15, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

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Chas. N. Buell.

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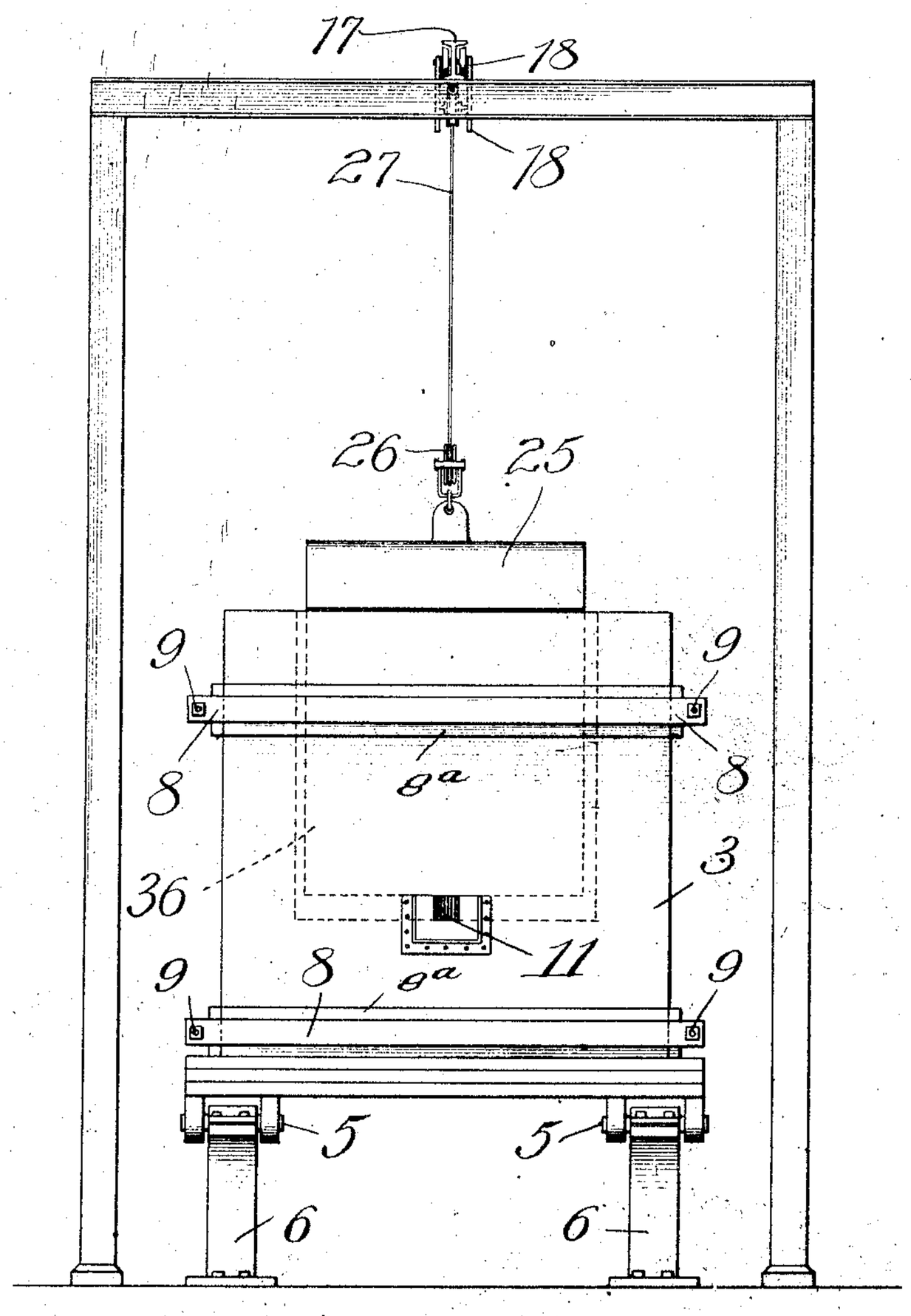
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

CHARLES E. WILSON, OF FERRIS, WEST VIRGINIA.

ELECTRIC FURNACE.

No. 881,517. Specification of Letters Patent. Patented March 10, 1908.

Application filed September 15, 1906. Serial No. 334,749.

To all whom it may concern:

Be it known that I, CHARLES E. WILSON, a citizen of the United States, residing at Ferris, in the county of Fayette and State of West Virginia, have invented a new and useful Improvement in Electric Furnaces, of which the following is a specification.

My invention relates to improvement in electric smelting furnaces generally, and more particularly to such furnaces for the treatment of suitably mixed ore charges for the production of pig-iron, or steel direct.

My objects are to provide a furnace in which the wearing away of the electrodes will be materially reduced, and to provide a furnace of the type named of generally improved construction for use, more especially, in turning out substantially uniform products of high grade.

In carrying out my invention I provide a melting receptacle or crucible having comparatively large stationary electrodes and provided with means for tilting it to regulate the heat-generating resistance between the electrodes; and I also provide a readily adjustable, as well as removable, exciting electrode for use in starting the smelting operation. I furthermore provide electrically actuated controllers, preferably automatic in operation, for governing the tilting of the crucible and the movement of the exciting electrode, whereby the heat-generating resistance in the crucible may be rendered constantly under substantially perfect control.

In the drawings—Figure 1 is a partly broken, sectional elevation and diagrammatic view of a tilting crucible-furnace constructed with my improvements; and Fig. 2, an end elevation of the same.

The crucible, 3, is preferably rectangular in cross-section. It is formed with a suitably insulated base-plate, 4, pivotally mounted, centrally toward opposite sides, on trunnions, 5, journaled in suitable supports, 6. It has fire-brick side-walls and end-plates, 7, secured together as by means of end bars, 8, and tie-bolts, 9. The bars 8 are insulated from the plates 7 by strips 8^a. The front inner wall is of graphite or other suitable carbonaceous material forming an electrode 12, resting upon the refractory bottom 10; and extending through the front wall just above the bottom 10 is a tap-hole 11 provided with a spout. Extending across the opposite end of the chamber is a clock or mass, 13, of graphite or other carbonaceous material forming part of the bottom at that end, as indicated, and serving as the second permanent electrode.

Connected with the base-plate portion, 4, is means for rocking the crucible on its trunnions consisting of a cable, 14, attached to the base-plate and running over upper and lower pulleys, 15. Between the pulleys the cable is wound around a drum, 16, forming part of a suitable electric-controller device, not shown. Running on a track, 17, centrally above the crucible, is a traveling head or trolley, 18, connected at one side to a cable 19, running over a pulley, 20, and carrying a counter-weight, 21, and connected at its opposite side with a cable, 22, running over a pulley, 23, and connected with a drum, 24, which may be and preferably is a part of a controller device actuated by an electric current.

25 is a carbon holder or head suspended from a pulley, 26, on a raising and lowering cable, 27, extending under the pulley, 26, and over pulleys on the trolley, 18. It is fastened at one end to a bar, 38, and extends at its opposite end over a pulley, 29, to the drum, 30, of another electric-controller device. Extending from a bus-bar, 31, are leads, 32, 32, communicating through the adjacent plate, 7, with the carbon electrode, 13; and extending from a bus-bar, 33, are leads, 34, communicating with the electrode, 12, through the plate, 7, at that end. Lead wires, 35, extend from the bus-bar, 33, to the carbon holder, 25. Suitably fastened at its upper end or edge to the holder, 25, is an exciting electrode in the form of a graphite plate, 36, which may be nearly as wide as the crucible chamber, as indicated in Fig. 2.

In operation the tap-hole 11 is plugged and the crucible caused initially to extend upright, as shown. The exciting electrode, 36, is lowered into the crucible to the electrode 13, the current then turned on and the electrode 36 then raised slightly to produce the initial heat-generating arc between it and the lower portion of the electrode 13. Ore fed into the crucible becomes molten at the said arc, and tends to spread and flow in the direction of the electrode 12. As molten metal accumulates the exciting electrode 36 is moved slowly, toward the electrode 12, to keep it at its lower edge in such relation to the advancing stream of metal as to maintain the necessary heat-generating resistance between them.

When the accumulating molten metal spreads to the lower edge portion of the electrode, 12, the exciting electrode, 36, may be withdrawn to establish the current between the main electrodes, 12, 13, through the molten metal. When the electrode, 36, is withdrawn from the crucible, a heat confining, preferably water-jacketed, insulated cover, indicated by the dotted lines, 37, may be placed upon the crucible, the cover having a suitable opening through which the ore charge may be fed to the crucible.

When, as stated, the molten metal has accumulated to an extent sufficient to spread entirely across the refractory base 10 from the edge of the electrode 13 to the lower edge of the electrode 12, the consequent free passage of the current and lowering of the resistance causes the electric-controller to turn the drum 16 and tilt the crucible to the left, in Fig. 1, until the molten metal recedes from the electrode 13 far enough to reëstablish the resistance which the controller is intended to maintain. Thus as the quantity of molten metal increases the crucible becomes tilted more and more until the metal extends in in a plane, from close to the lower edge of the electrode 13 more or less nearly to the top of the electrode, 12. The plug is then removed from the tap-hole 11, and first the metal which has separated by gravity from the slag flows through the tap-hole and then the slag. As the pouring off progresses the bath of metal tends to recede from the lower edge of the electrode 13. This causes the controller to reverse its former operation, in its endeavor to maintain the proper resistance, and to turn the crucible in the direction of its upright position shown. When the surface of the metal sinks below the top of the tap-hole, molten slag overlying the metal will pour off.

The controllers, 16, 24 and 30, are not specifically shown and described in the present application, and may be dispensed with if desired and the operation of tilting the crucible and moving and raising and lowering the exciting electrode performed by hand or other means. The controllers I prefer to employ may be of known construction and electrically actuated and governed in their operations by the resistance to the current passing through the furnace. As the molten mass accumulates and resistance diminishes between the molten metal and electrode 13, the controller, 16, would turn to tilt the crucible forward. The controllers, 24 and 30, would operate to raise the exciting electrode during the initial starting of the operation and move it toward the electrode, 12. In this way approximately constant, uniform resistance and heat-generation may be maintained, which would aid materially in the production of a uniform metal product.

If desired plugged tap-holes at different elevations for slag and metal may be provided in place of the one pouring opening, 11, at that end, whereby at the end of a run the slag and metal may be tapped off separately in a well known manner.

The exciting electrode, 36, need be employed only for a comparatively short time at the beginning of a run after a complete shut down and the wear thereon would thus be comparatively little. The electrodes, 12, 13, being comparatively large bodies of carbonaceous material, will permit large units of electric current to be employed and the wear thereon will also be comparatively little.

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

1. In an electric furnace, the combination of a melting-receptacle provided with main electrodes, and an exciting electrode movable between the main electrodes, toward one and away from the other, for the purpose set forth.

2. In an electric furnace, the combination of a melting-receptacle provided with main electrodes, and an insertible and withdrawable exciting electrode with means for moving it between the main electrodes, toward one and away from the other, for the purpose set forth.

3. In an electric furnace, the combination of a melting-receptacle provided with main electrodes, an insertible and withdrawable exciting electrode and an electric controller device operatively connected with the exciting electrode for moving the same between the main electrodes, toward one and away from the other, for the purpose set forth.

4. In an ore-smelting electric furnace, the combination of a tiltable melting-receptacle provided with electrodes toward opposite sides, and means for tilting the receptacle to prevent accumulating molten metal from contacting with one electrode and to maintain the desired resistance through the heat-generating material overlying the metal.

5. In an ore-smelting electric furnace, the combination of a tiltable melting-receptacle provided with electrodes toward opposite sides, and an electrically actuated controller device operatively connected with the receptacle for tilting the same, to prevent accumulating molten metal from contacting with one electrode and to maintain the desired-resistance through the heat-generating material overlying the metal.

6. In an ore-smelting electric furnace, the combination of a tiltable melting-receptacle provided with main electrodes toward opposite sides, an exciting electrode, means for moving the exciting electrode toward one of the said main electrodes and away from the other, and means for tilting the receptacle

to prevent accumulating metal from contacting with one electrode and to maintain the desired resistance through the heat-generating material overlying the metal.

7. In an ore-smelting electric furnace, the combination of a tiltable melting-receptacle provided with main electrodes toward opposite sides, an exciting electrode, means for moving the said exciting electrode toward one of the said main electrodes and away from the other, means for raising and lowering said exciting electrode, and means for tilting the receptacle as molten metal accumulates therein, for the purpose set forth.

8. In an ore-smelting electric furnace, the combination of a tiltable melting-receptacle provided in one side with a pouring opening and in opposite sides with electrodes, means for tilting the receptacle in one direction to prevent accumulating molten metal from contacting with one electrode and to maintain the desired resistance through the heat-generating material overlying the metal, the receptacle being tiltable in the opposite direction to retain the desired resistance as the molten contents discharge through the said pouring opening.

CHARLES E. WILSON.

In the presence of—
H. M. GIBBES,
T. R. RAGLAND.