

Fig. 1.

Witnesses:

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Inventor:

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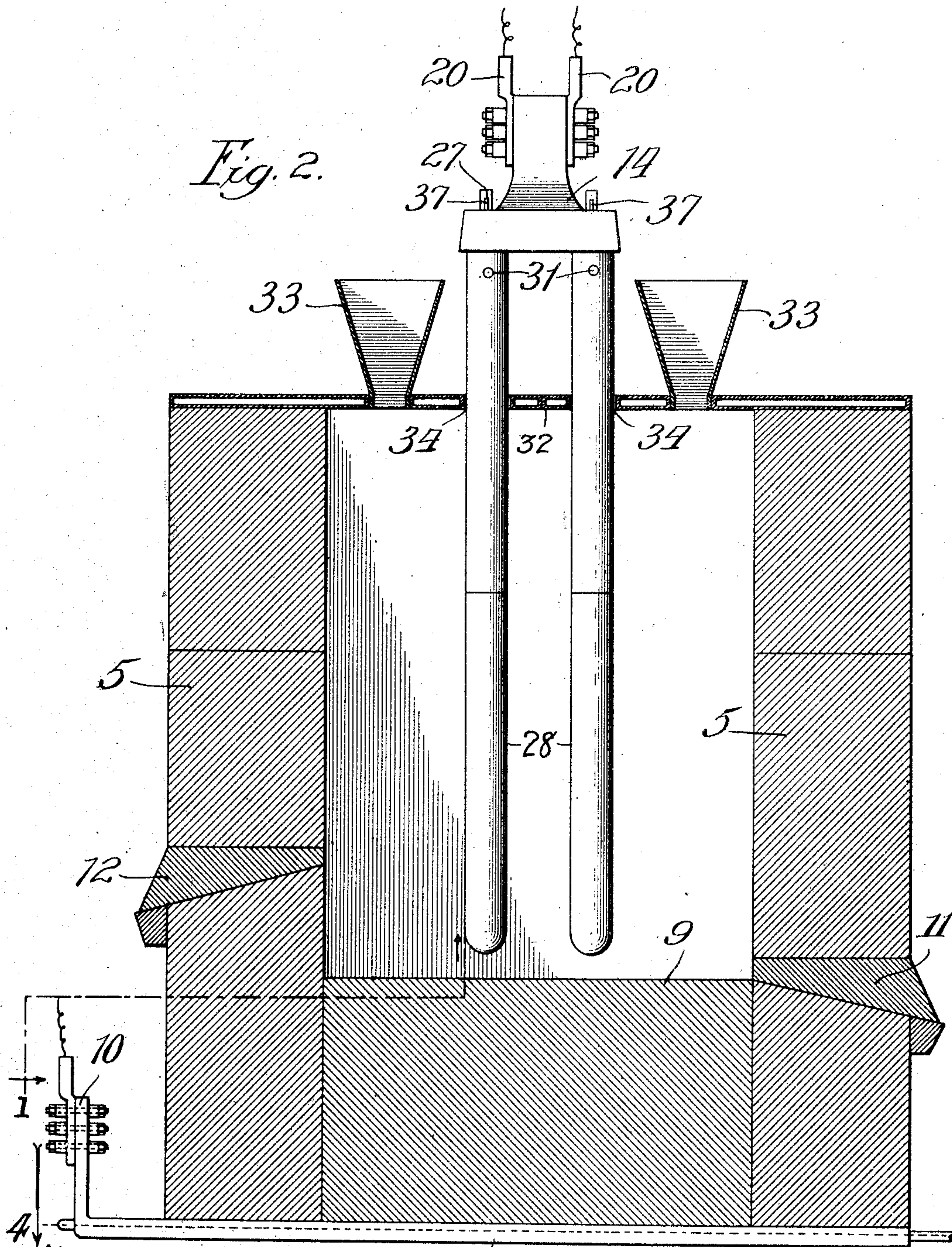
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ELECTRIC FURNACE.

APPLICATION FILED SEPT. 15, 1906.

3 SHEETS—SHEET 2.



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Fig. 3.

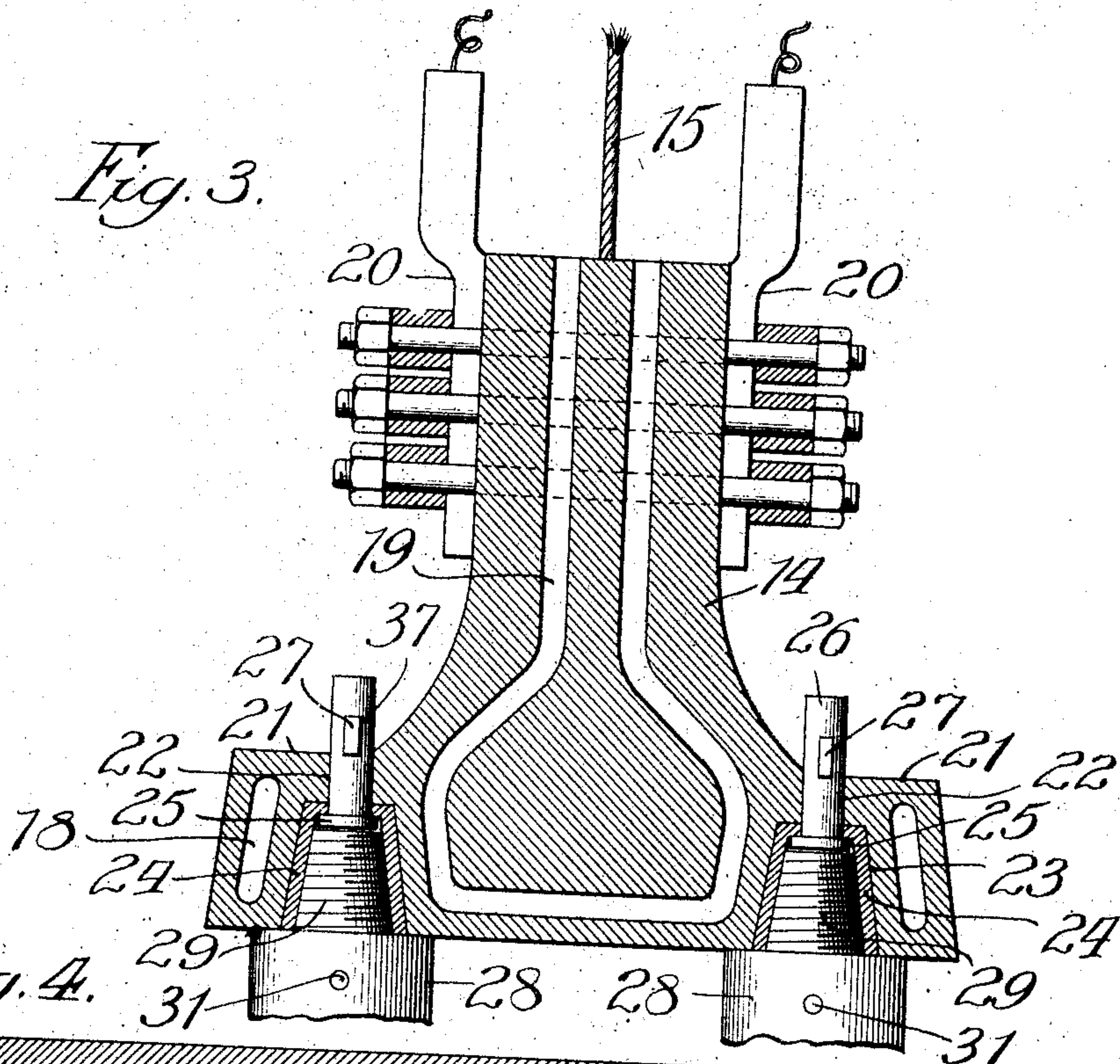
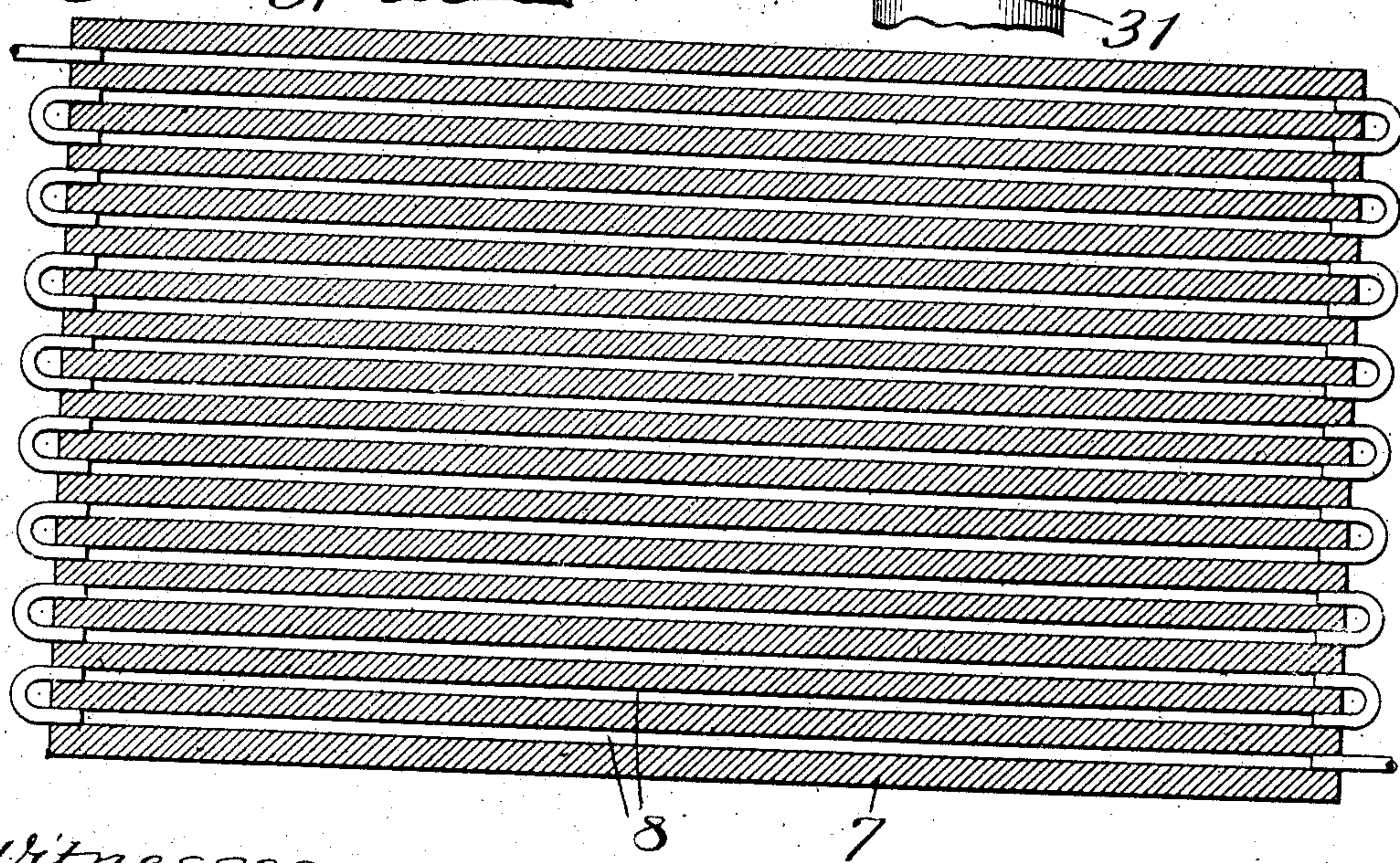


Fig. 4.



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# UNITED STATES PATENT OFFICE.

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## ELECTRIC FURNACE.

No. 881,518.

Specification of Letters Patent.

Patented March 10, 1908.

Application filed September 15, 1906. Serial No. 334,750.

*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 object is to provide an electric ore-smelting furnace of an improved construction adapting it for the introduction of large units of electric energy, say ten or more thousand horse-power, and so arranged that electrodes may be renewed without disturbing the operation of the furnace.

In carrying out my invention I prefer to provide a melting-chamber in the form of a crucible, having separate tap-holes for slag and metal, at different elevations. The crucible is mounted upon a cast-iron base of water-jacketed construction and has a surrounding wall of fire-clay, or the like. In the base of the crucible, resting in intimate contact with the base-plate, is a layer or block of suitable carbonaceous material forming one electrode-terminal of the source of electric-current supply. The other terminal consists of a plurality of independently controlled and independently adjustable electrodes, each preferably in the form of a battery of pencils of carbonaceous material, and each suspended from an independent conductor-head of improved construction. The pencils are each formed in sections, the sections having means at their ends for attachment to the sustaining head, and to each other, whereby as one battery of pencils becomes shortened to a degree requiring the insertion of new sections, the current leading to that battery or electrode may be shut off, without disturbing the current leading to the other battery or batteries if there are more than two, while the pencil renewals are taking place. The electrodes are preferably so constructed that when the current through one of them is shut off, the other or others will carry the entire load for a time sufficient to permit renewal to be made of the pencils of the electrode from which the current is shut off. Owing to this arrangement the furnace may be caused to operate continu-

ously, or practically so, and nearly all the time at full capacity.

Referring to the drawings,—Figure 1 is a broken, longitudinal section on irregular line 1—1 in Fig. 2, partly in elevation and partly diagrammatic, illustrating the crucible and electrodes as I prefer to provide them; Fig. 2, a section taken on line 2 in Fig. 1; Fig. 3, a still further enlarged, broken section taken on line 3, in Fig. 1; and Fig. 4, a broken, plan section of a base-plate, the section being taken on line 4 in Fig. 2.

The crucible is formed with side-walls, 5, and end-walls, 6, both of refractory material and resting at their lower ends upon a preferably cast-iron base-plate, 7. The base-plate may be in sections, each section being formed, for example, as indicated most plainly in Fig. 4, wherein it is shown provided with a convoluted passage, 8, for water to prevent its overheating. The bottom of the crucible is formed of a block or mass, 9, of suitable carbonaceous material, constituting one electrode and resting at its lower surface in intimate contact with the base-plate, 7. On each section of the base-plate are suitable attaching terminals, 10, for electric current lead-wires. In one side, 5, close to the base line is a tap opening, 11, and in the opposite wall, 5, at a higher elevation, is a tap opening, 12. 13, 14 are independent heads suspended from cables, 15, running over pulleys, 16, and carrying counter-weights, 17. Each head is constructed with cored passages, 18, 19, properly disposed and suitably connected with water supplying means, whereby the heads are water-jacketed to prevent their being overheated. Each head has lead-wire connections, 20, by which it is independently connected with a source of electric current supply. In the shoulder portions, 21, of the heads, at opposite sides, are openings, 22, terminating in downwardly-flaring sockets, 23, in the under sides of the heads. Fitting the said flaring sockets are removable, flaring bushings, 24, internally threaded and provided in their upper ends with openings, 25, through which pass headed pins, 26, provided with key openings, 27. Each carbon



pencil, 28, is provided on its upper end with a threaded projection, 29, adapted to screw into a bushing, 24.

In the construction shown there are two rows of socketed bushings on each head, 13, 14, whereby each is adapted to carry 18 carbon pencils, all of which are fastened in place by screwing them at their projections, 29, into the removable bushings, 24, then passing the bushings into sockets, 23, and fastening them in place by driving keys, 37, through the slots, 27, which are just above the plane of the shoulders, 21. The pencils are in sections of comparatively short length, each section having a threaded extension, 29, at its upper end and a tapering threaded socket, 30, at its lower end to receive the projection, 29, of the next lower section. Extending through the upper parts of the pencil sections are small openings, 31. Resting on the top of the crucible is a water-jacketed covering-plate, 32, carrying ore-feed funnels, 33, in suitable locations, and having openings, 34, through it for the passage of the carbon pencils. The function of the plate, 32, is to form a heat-confining cover for the crucible.

In operation the furnace is initially started by lowering the suspended electrodes into contact with the stationary electrode to establish the current and then raising them slightly to produce arcs. Each head forms a common distributor for the current to all the pencils it carries, and any ore mixture placed on the stationary electrode may form a resistant material which, as is well known, is soon raised to a temperature producing the desired smelting heat. More or less finely divided ore to be treated, with any fluxing and carbonaceous material for a suitably mixed charge, is fed in desired quantity into the crucible at the funnels, 33. Under the generated heat the constituents of the ore are melted and the proper reactions effected. The reduced metal separates by gravity from the lighter slag-making constituents and as the metal rises the upper electrodes are raised to prevent contact therewith and maintain the proper heat-generating resistance. When the metal reaches the height, or nearly the height of the tap-opening, 12, the plug may be withdrawn from this hole to tap off the slag. The plug at the tap-hole, 11, may then be withdrawn to tap off the metal. As the metal descends the upper electrode may be caused to descend with it, so that there need be no material cessation at any time of the smelting operation.

The pencils forming the members of each upper electrode naturally wear away at their lower ends, requiring more or less frequent lengthening, the lengthening being performed by the insertion of new upper pencil sections. When one of the electrodes or

batteries of pencils, therefore, becomes too short, the current leading thereto may be cut off while the other battery continues in operation. To insert new sections, sustaining pins are passed through the openings, 31, of the then upper sections, which are then disconnected from the head by knocking out the keys, 37, from the slots, 27. The head is then raised and the upper pencil sections rest suspended upon the pins which engage the sides of the openings, 34, and sustain the pencils with the socket pieces and studs, or pins, 22. The socket pieces, 24, are then unscrewed from the sections with which they have been in engagement and new sections or lengths are screwed at their sockets, 30, upon the upper ends, 29, of the suspended sections. The replacing sections are then screwed into the socket pieces, 24, and all fastened into the head in the manner explained. While these carbon renewals are taking place in one battery, the other battery continues the smelting operation, being capable, as aforesaid, of carrying the entire current, or load, for a limited time.

If desired the cables, 15, may be operatively connected with suitable electric controller devices, 35, which, governed by the resistance of the currents through the furnace, will automatically raise and lower the upper electrodes to maintain the desired heat-generating resistance.

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

1. In an electric furnace, the combination of a melting chamber, an electrode in the base of the chamber forming a lower terminal of the electric-current supply, a plurality of suspended and independently-adjustable heads above the said chamber independently connected with said supply, and a suspended electrode removably mounted in each of the said heads, the suspended electrodes forming together an upper terminal, in the chamber, of the electric-current supply, whereby the electrode at one head may be renewed while the current passes through the other suspended electrode, for the purpose set forth.

2. In an electric furnace, the combination of a melting chamber, an electrode in the base of the chamber forming a lower terminal of the electric-current supply, a plurality of suspended and independently-adjustable heads, above the said chamber, independently connected with said supply, and a battery of pencils removably mounted in each of the said heads and forming together an upper terminal, in the chamber, of the electric-current supply, whereby pencil renewals may be made at one suspended electrode while the current passes through the other suspended electrode, for the purpose set forth.



3. In an electric furnace, the combination of a melting-chamber, a lower electrode in the chamber, a pencil holding head independently connected with the source of current-supply, a plurality of pencils for said head independently mounted therein at their upper ends and forming an upper electrode, and a cover for the melting-chamber having openings through it for the passage of the

pencils, each pencil comprising a plurality of 10 readily applied sections joined together at their ends and provided, near their upper ends, with perforations to receive sustaining pins, for the purpose set forth.

CHARLES E. WILSON.

In the presence of—

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