

M. R. TREMBOUR.
ELECTRIC FURNACE.
APPLICATION FILED MAR. 24, 1916.

1,333,950.

Patented Mar. 16, 1920.
2 SHEETS—SHEET 1.

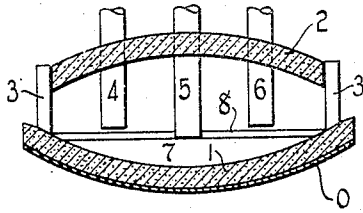


Fig. 2

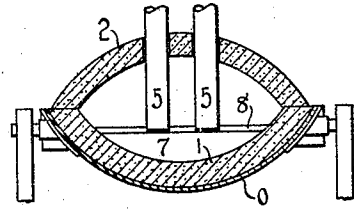


Fig. 3

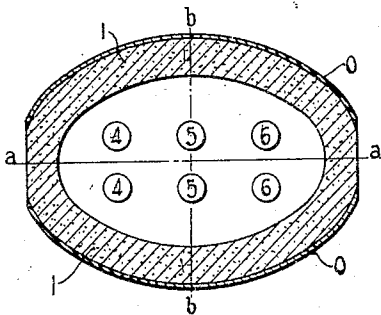


Fig. 1

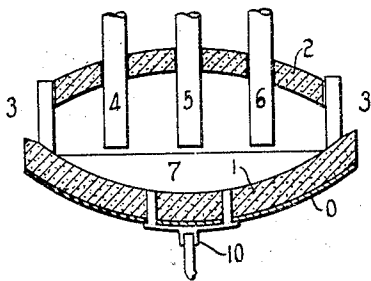


Fig. 5

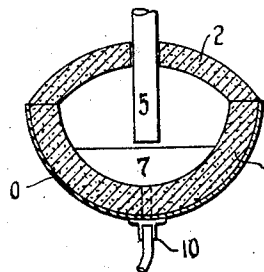


Fig. 6

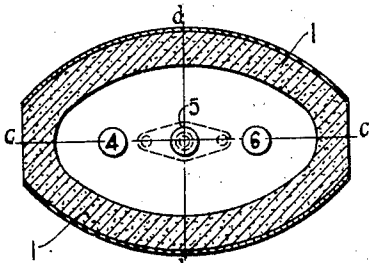


Fig. 4

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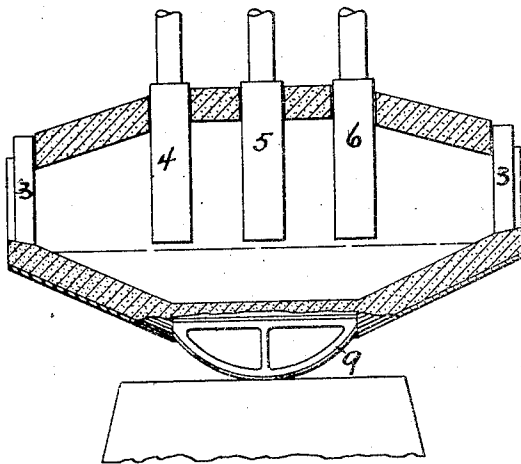


Fig-7

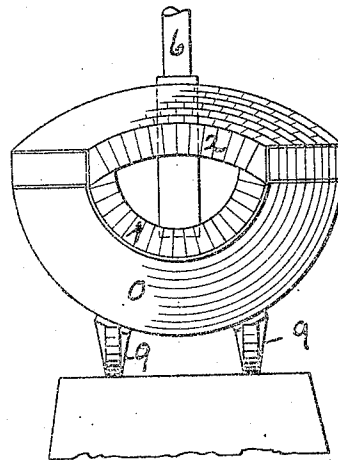


Fig-8

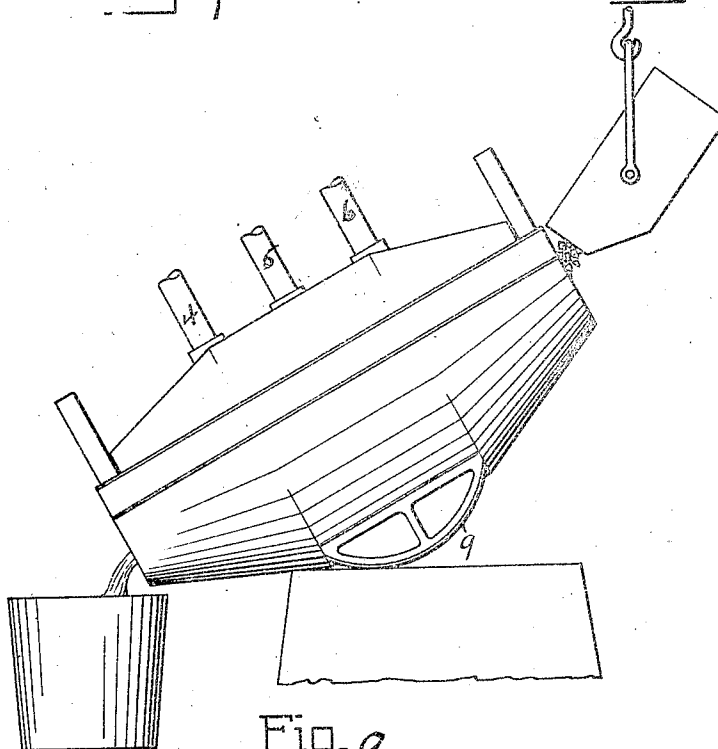


Fig-9

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UNITED STATES PATENT OFFICE.

MAX R. TREMBOUR, OF WATERVLIET, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO LUDLUM ELECTRIC FURNACE CORPORATION, OF ALBANY, NEW YORK, A CORPORATION OF NEW YORK.

ELECTRIC FURNACE.

1,333,950.

Specification of Letters Patent. Patented Mar. 16, 1920.

Application filed March 24, 1916. Serial No. 86,418.

To all whom it may concern:

Be it known that I, MAX R. TREMBOUR, a subject of the German Emperor, residing at the city of Watervliet, in the county of Albany and State of New York, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification.

My invention relates to electric furnaces, and the object of my invention is to provide a furnace adapted for operation at a minimum cost; together with such elements and combinations as are hereinafter more particularly set forth and claimed.

I accomplish these objects by means of the mechanism illustrated in the accompanying drawings, in which:

Figure 1 is a plan.

Fig. 2 is a section along the lines, *a-a*, on Fig. 1.

Fig. 3 is a section along the lines, *b-b*, on Fig. 1.

Fig. 4 is a plan of a modified form of my invention.

Fig. 5 is a section along the lines, *c-c*, on Fig. 4.

Fig. 6 is a section along the lines, *d-d*, on Fig. 4.

Fig. 7 is a vertical section of my furnace showing the rocker for tilting same.

Fig. 8 is an end view of the furnace with the door removed.

Fig. 9 is a side elevation showing the furnace tilted in the act of pouring.

Similar letters refer to similar parts throughout the several views.

The cost of operating an electric furnace depends mainly upon two factors:

(1) The life of the refractory furnace-lining and roof and its accessibility for quick repairs, removal and replacement.

(2) The electric power consumption.

Both of these factors are determined by the design of the furnace-chamber, as well as by the arrangement of the electrodes, upon which depends the position of the electric arcs in the chamber relative to its walls, roof and doors and to the metal charge.

For the design of the furnace-chamber the following rules may be considered fundamental;

Simplicity and strength in construction, avoiding all sharp turns, breaks and open-

ings as far as possible without impairing easy accessibility of all parts of the furnace-chamber, and smallest possible surface of chamber walls, relative to its metal charge, so as to confine the heat and prevent excessive loss by radiation.

Heretofore the chambers of electric arc furnaces have been constructed substantially from rectangular to circular in their horizontal as well as in their vertical sections. The electrodes, wherever more than two were used, were accordingly arranged in triangle or square groups around the center of the furnace. This construction necessitated very large or very numerous doors so as to admit access for observation and repairs to all parts of the chamber. Also, as a rule, a special door or spout was provided to pour off the charge. When tilting a furnace of this construction, the wall opposite the spout must necessarily overhang, which often results in its caving in.

A furnace of spherical design presents admittedly the least possible surface relative to its bulk. It does not do so, however, relative to its melting capacity, there being technical limits to the depths of the metal bath, which in a spherical furnace will form only a small segment of the circle representing the vertical section of the furnace chamber.

I have found that a greater economy in operation results, when the chamber of an arc-furnace is oblong, with the doors used for charging and pouring both at the ends of the longer axis of the furnace and the electrodes arranged substantially on this same axis, the furnace being tilted about its shorter axis.

The accompanying drawings illustrate in principle the construction of the furnace-chamber and the arrangement of the electrodes; also the contours of the metal bath and the position of the arcs relative to the bath and to the chamber walls.

The furnace comprises a steel shell, 0, lined with fire brick or other refractory material, 1, and hung upon trunnions or set upon rockers, 9, upon which it is adapted to be tilted for pouring out the charge of metal. The turtle-back-shaped roof, 2, is provided with openings for admitting the electrodes, 4, 5 and 6. The furnace is provided at each end with the doors, 3, which are used to in-

introduce the charge, to observe the condition of the charge when operating, and to pour out the melted slag and metal.

The drawings also illustrate electrode-adjustments for a variety of melting and refining processes, for which the furnace is suitable. Figs. 1, 2 and 3 illustrate the refining process in accordance with the method described in a co-pending application, and for which this furnace is especially recommended. This furnace, as will be seen from the drawings, is provided with two parallel rows of electrodes, which arrangement would be advisable for furnaces of very large capacity. The electrodes, 4 and 6, are spaced away from the slag, 8, and are arcing, while the central electrodes, 5, are contacting with the metal, 7, without arcing.

Figs. 4, 5 and 6 illustrate a furnace with one row of three electrodes, all of which are spaced away and arc to the melted bath, 7.

I have shown in Fig. 5 a furnace equipped with the water-cooled metal electrodes, 10, introduced through the bottom of the furnace and contacting with the metal, although I may use this arrangement of the electrodes in the furnace illustrated in Figs. 1, 2 and 3, which is without the water-cooled metal electrodes.

As will be seen from these drawings, the form of the furnace chamber is in general ovoid, or ellipsoidal, all its walls being curved. There are no perpendicular side-walls, no exposed sharp corners and breaks in the lining. The surface of the chamber-walls relative to the charging tonnage (melting capacity) is small, all vertical sections of the chamber, longitudinal as well as lateral, approaching the elliptic form instead of the square or circular. The chamber tapering from its widest lateral cross-sections near both ends, leads to the natural location of the doors at these ends, insuring easy accessibility to each part of the chamber. The position of the doors at each end of the furnace and parallel to the tilting axis is a decided advantage in charging as well as in pouring the metal, as either door can be used for pouring and can at once be brought into the most convenient position for charging. There being no walls parallel to the tilting axis, no part of the lining can overhang and cave in when the furnace is tilted. (See Fig. 9.)

As the electrodes are arranged along the longer axis, the heat will be generated as far away as possible from the refractory lining and roof of the furnace and at the same time along a line, below which the metal bath reaches its greatest depth. In other words, the heat will be applied to the metal instead of to the refractory lining.

What I claim as my invention and desire to secure by Letters Patent is:

1. An electric furnace having a melting

hearth of general ovoid shape in plan with dished bottom constricted toward the opposite ends of its major axis, doors at the opposite ends of said major axis for charging and discharging the furnace and through which access to the interior may be had for repairs, a removable low arched roof of general like outline as the hearth and having at the opposite ends of its major axis arches completing the door openings of the furnace, together with vertically adjustable electrodes piercing the roof and arranged along the major axis of the furnace, the contour of the hearth being predetermined with relation to the location of the electrodes to afford the least practical surface compared to the melting capacity of the furnace and to confine heat, prevent radiation loss and insure an even distribution of heat throughout the entire hearth area, the greatest heat being generated at the point of greatest depth of the melt on the hearth.

2. In a construction such as specified in claim 1, a hearth bottom having an inclination of less than 45° from its mid area to the door openings to permit the free discharge of the melt when the furnace is rocked through a relatively small arc.

3. An electric furnace having a hearth of general ovoid shape and dished bottom with doors at the opposite ends of its major axis, a low arched roof meeting the sides of said hearth and conforming in general outline to the outline of the hearth and having at its opposite ends a fire-brick lining comprising a series of transverse parallel arches of different radii, the terminal arches of least radius cooperating with the hearth ends to complete the ends of door openings of the furnace, substantially as described.

4. An electric furnace having a melting hearth of general ovoid shape in plan with dished bottom constricted toward the opposite ends of its major axis and flattened in longitudinal section through its mid area, a removable roof therefor conforming in general outline to the outline of the hearth and having a similarly flattened mid area vertically registering with that of the hearth, in combination with vertically adjustable electrodes piercing the flattened mid area of the roof and overlying the corresponding area of the hearth, said area of the hearth supporting the molten charge at its deepest point and therewith insuring the generation of the greatest heat at the point at which the metal bath is of the greatest depth.

5. An electric-arc furnace comprising an elongated hearth lined with refractory material, forming at each end of the longitudinal axis of the hearth, the sill and sides of a charging or discharging opening, the inner side of said hearth tapering in opposite directions in general ovoid form toward said openings respectively; and an arched-

roof detachably mounted upon said hearth, and having a lining of refractory brick forming roof-arches for said openings respectively; and means whereby said furnace can be tilted upon an axis at right angles to its longitudinal axis.

6. An electric-arc furnace comprising an elongated hearth lined with refractory material, forming at each end of the longitudinal axis of the hearth the sill and sides of a charging or discharging opening, the inner side of said hearth tapering in opposite directions in general ovoid form toward said openings respectively; an arched-roof detachably mounted upon said hearth, and

having a lining of refractory brick forming roof-arches for said openings respectively; means whereby said furnace can be tilted upon an axis at right angles to its longitudinal axis; doors for closing said openings respectively; and a plurality of electrodes inserted through said detachable roof along the longer axis of the furnace.

In testimony whereof I have affixed my signature in presence of two witnesses.

MAX R. TREMBOUR.

Witnesses:

EDWIN CONNIFE,
CLARENCE B. BOTNE.