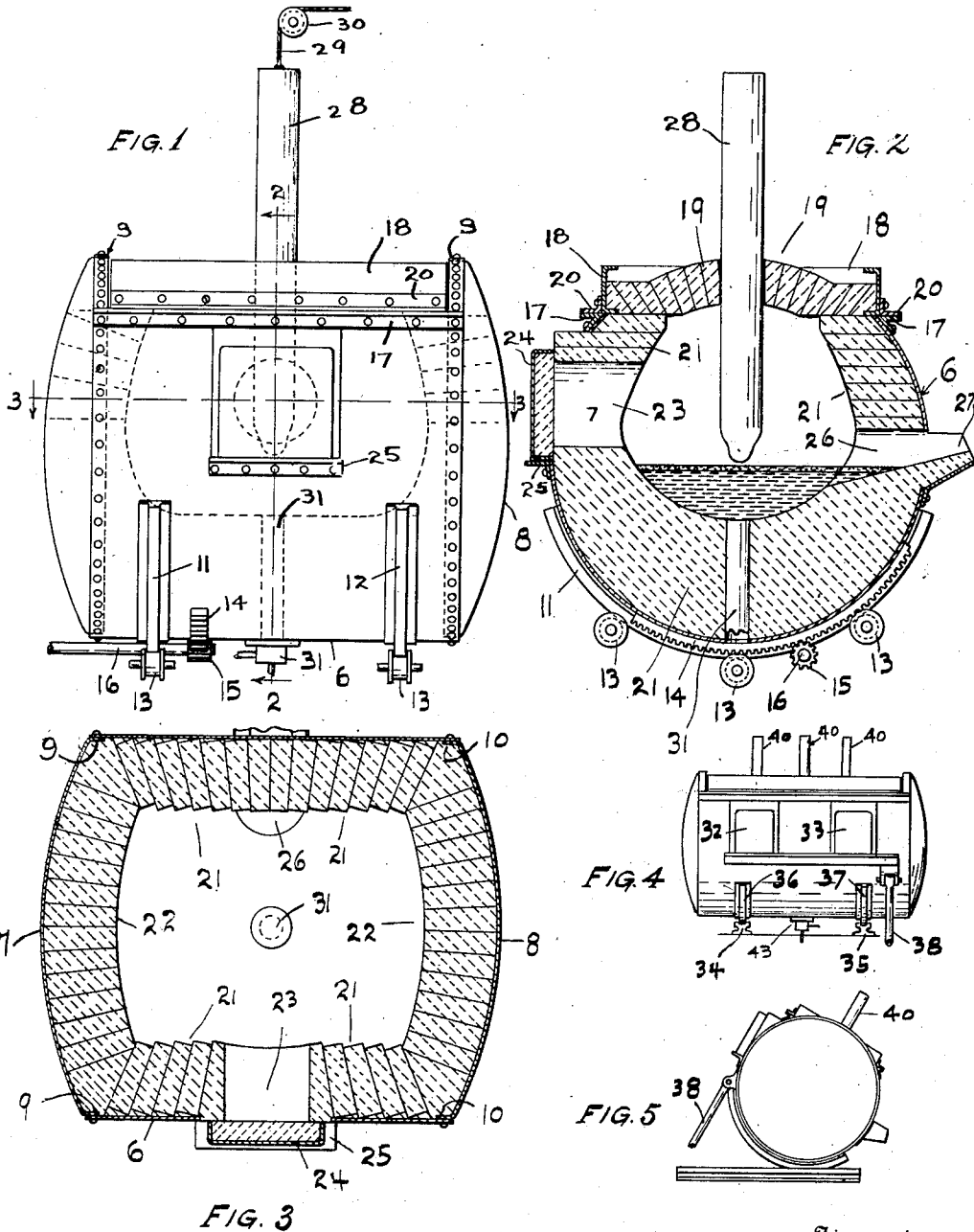


A. E. GREENE.
ELECTRIC FURNACE.

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1,297,149.

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By

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UNITED STATES PATENT OFFICE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ALBERT E. GREENE, citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented a certain new and useful Improvement in Electric Furnaces, of which the following is a specification.

My invention relates to improvements in electric furnaces which are employed in the operation of melting and heating metals, and the object of my invention is to provide an electric furnace whose shell shall be of such form as will make it have greater strength and greater capacity in proportion to its weight than the shells of electric furnaces heretofore made, and whose lining shall be so disposed within said shell that any portion of it cannot be loosened and displaced by necessary movements of the furnace to different angular positions in the operations of charging said furnace and discharging molten metal therefrom.

Another object of my invention is to provide a furnace the internal surface of whose lining shall be of such contour that a horizontal section of the interior space of said furnace shall be greatest in area at the normal surface level of the mass of metal contained therein at which level will be the most intense heat of the electric arcs during the operation of said furnace.

A still further object of my invention is to provide an electric furnace which shall embody means which shall be adapted to be operated to impart a rotative movement to its shell to facilitate the operation of extracting portions, or all, of its contents therefrom, or which shall embody modified means for imparting a rocking movement to said shell to facilitate the operation of extracting a desired portion of the molten contents thereof.

I accomplish these objects by devices illustrated in the accompanying drawings, wherein—

Figure 1 is a view in rearward side elevation of one form of an electric furnace embodying my invention;

Fig. 2 is a view of the same in vertical section on broken line 2, 2 of Fig. 1;

Fig. 3 is a view of the same in horizontal section on broken line 3, 3 of Fig. 1;

Fig. 4 is a view, on a reduced scale, in rearward side elevation of a modified form of a furnace embodying my invention; and

Fig. 5 is a view of the same in end elevation as it appears when tilted in the operation of discharging its molten contents.

Referring to Figs. 1, 2 and 3 of the drawings, throughout which drawings like reference numerals indicate like parts, a furnace shell is made of the form of a hollow cylinder comprising a cylindrical wall 6 and two outwardly bulging concavo-convex end walls 7 and 8, the circular edge portions of said end walls 7 and 8 being provided with flanges 9 and 10, respectively, which are riveted to the internal surfaces of the end portions of the cylindrical wall 6, as indicated in Figs. 1 and 3.

The outwardly bulging concavo-convex end walls 7 and 8 are not only of the strongest form but such form gives the greatest area in a horizontal section of the furnace chamber at a point where it is most desired, and is adapted to the arching of the end walls.

The cylindrically formed furnace shell is disposed with its axis in a horizontal line, and fastened to the exterior surface of its lower half portion are two roller-engaging members 11 and 12, of T-shaped cross-section, which extend circumferentially in arcs of circles on said exterior surfaces of said lower half portion, the roller-engaging member 11 being spaced a short distance from the end wall 7 and the roller-engaging member 12 being spaced a like distance from the end wall 8, as shown in Figs. 1 and 2.

The furnace is so disposed that the roller-engaging members 11 and 12 operatively rest upon and engage with a plurality of rollers, as rollers 13, thereby to support said furnace and adapt it to be rotatively moved in the operation of tilting said furnace to discharge its contents, said rollers 13 being pivotally mounted in suitably supported bearings not shown.

Fastened to the outer surface of the cylindrical wall 6 in a position spaced from and parallel with the inner side of the roller-engaging member 11, is a curved toothed rack 14 whose teeth operatively engage with the teeth of a pinion 15 that is fastened on

one end of a shaft 16 which is rotatably mounted in suitably supported bearings not shown, to which shaft 16 rotary motion may be communicated by suitable means, not shown, thereby rotatively to move and tilt the furnace shell in the operation of discharging the contents thereof.

A segment of the upper portion of the cylindrical wall 6 is cut away to form an opening that extends lengthwise between the flanges 9 and 10 of the outwardly bulging dished end walls 7 and 8, and adjacent to said opening the opposite longitudinal edge portions of said cylindrical wall 6 are reinforced by bars 17, of angular form in cross-section, which present flat surfaces that are disposed in a horizontal plane, upon which flat surfaces is removably disposed a roof that serves to cover said opening, said roof comprising a rectangular frame 18 of channel iron within which is securely fixed an arch 19 formed of fire brick or other refractory material.

Fastened to the outer side of the lower portion of each of the opposite longer-sides of the frame 18 is a bar 20 of angle iron whose under side surface normally rests on the flat surface of the adjacent bar 17.

The inner surfaces of the cylindrical wall 6 and the concave surfaces of the dished end walls 7 and 8 are provided with linings (as linings 21 and 22, respectively) made of refractory brick which as shown are so formed and relatively disposed that no portions of said linings can be loosened and displaced by tilting movements of the furnace shell.

Extending through the lining 21 and cylindrical wall 6 in the rearward side thereof is an opening 23 which is closed by a removable door 24 that is normally supported by a bar 25 that is fastened in a horizontal position to the cylindrical wall 6 adjacent to the lower edge of said opening 23.

Disposed substantially opposite the opening 23 is an outlet opening 26 that extends through the lining 21 and cylindrical wall 6 with which opening is associated a spout 27 which serves to conduct molten metal from the interior of the furnace in response to the tilting of said furnace by rotative movements thereof, which rotative movements may be effected in an obvious manner by rotating the shaft 16. The top opening of the furnace may be used for charging when desired by lifting off the roof.

Adjustably and slidably disposed to extend downwardly through the removable arched roof 19 into the interior of the furnace is an electrode 28, of well known form, which is maintained in a well known manner in its adjusted position by a cable 29 and pulley 30.

Extending downwardly through the lining 21 and cylindrical wall 6, with its axis in

line with the axis of the electrode 28, is another electrode 31 whose upper end surface registers with the inner surface of the lining 21, said electrode 31 preferably being made of metal suitably water cooled.

The electrodes 28 and 31 are adapted to be connected with a source of electricity in a well known manner not shown whereby an electric arc may be formed between the bottom end of said electrode 28 and the top surface of any metal that may be in contact with the top end surface of the electrode 31, the heat of which electric arc may melt said metal, which metal when melted, may be discharged in required quantities through the spout 27 by turning the shaft 16 thereby to tilt the furnace by a rotative movement thereof.

In Figs. 4 and 5 I have shown a furnace similar to the furnace of Figs. 1, 2 and 3 except that the cylindrical portion of the shell is of greater length so as to provide space inside the furnace chamber for the use of a plurality of electrodes, three in the furnace shown and that it embodies an improved means of tilting. This furnace is designed for large charges. It is adapted for three phase current to enter through the three top electrodes 40, 41 and 42 which may be adjusted and regulated in any well known manner not shown. In the bottom is shown a bottom electrode 43 made of metal and cooled with water. The heating may be carried on in any well known manner, as between the top electrodes and the charge, either with or without the use of the bottom electrode. Two doors are shown on the rearward side of the furnace 32 and 33. The furnace is adapted to be tilted to discharge its contents by means comprising rail tracks 34 and 35 upon which are operatively disposed rail-engaging members 36 and 37, respectively, (which correspond to the roller-engaging members 11 and 12 of Figs. 1 and 2) whereby a rocking movement may be imparted to the furnace to tilt it in response to force exerted on a connecting rod 38 in a manner not shown, one end of which connecting rod 38 is articulated to a bracket 39 fastened to the rearward side of the furnace shell. This type of tilting mechanism has the advantage of simplicity of construction together with the fact that the movement of the end of the spout can be kept almost up and down so that little movement or no movement of the ladle is necessary in order to take the contents of the furnace. The shell may itself roll on the track.

Manifestly, the number of electrodes may be increased to any practicable number and the length of the furnace chamber increased accordingly as well as the diameter.

By reason of the dish-shaped end walls 7 and 8 being concavo-convex, the interior space of the furnace chamber is more nearly

spherical in form and thus the walls and lining of the furnace presents less volume for the connection of heat and less surface for the radiation of heat, in proportion to its capacity, than do furnaces heretofore made, whereby a greater portion of the heat from the electric arc is usefully employed.

The construction of the furnace shell differs from those heretofore used in that it provides room for a very thick bottom and it furthermore, provides for the use of a brick arch roof at a sufficient distance from the source of heat, namely the electric arc; secondly the roof has a much longer life than in furnaces heretofore made. By reason of the continuity of the circular flanges on the dished and flanged heads, the latter are stronger than plate heads without flanges continuing around the top; furthermore, the dished portions of the heads give maximum strength and also a suitable space for the most desirable contour of the furnace lining in every direction.

While I have shown the lining of the furnace as made of refractory brick, silica brick for example, it is understood that any suitable refractory material may be used and that the lining may be made by suitably mixing the refractories and binding material and disposing it or ramming it into place within the shell to the contour desired, either with the use of a form or without. After ramming in place it may be dried in any well known manner.

It is understood that the door-ways entering the furnace chamber may be lined with arch brick in any suitable way to maintain the arching of the wall so as to maintain the walls in place during the rocking movements of the furnace.

Obviously, changes in dimensions and in arrangement of parts may be made without departing from the novel features of my invention.

What I claim is:—

1. An electric furnace comprising a cylindrical steel shell, a dished and flanged steel head riveted to each end of said shell, an opening in the top of the cylindrical shell, a refractory lining within the shell conforming to the inside thereof and inclosing a furnace chamber, an arched roof covering said chamber and a suitable opening for the charge or discharge of material into or from said chamber, suitable electrodes for forming an arc or arcs within said chamber; a track adapted to support the weight of the furnace and means of rolling the shell over on said track to the desired degree.

2. An electric furnace comprising a cylindrical metal shell of horizontal axis, an outwardly bulging metal head attached to each end thereof, an opening in the top of the cylindrical portion of the shell, a lining of refractory brick within the shell and

inclosing a furnace chamber in the wall portions of which the brick are placed in horizontally-arched relation with each other in such manner as to prevent their dropping into the furnace chamber when in rolled-over position, a roof covering the chamber, suitable openings into the chamber for charging and discharging, electrodes operatively disposed to maintain an arc or arcs within the chamber, and means of rolling the furnace over on a suitable track for the purpose of charging or discharging its contents.

3. An electric furnace comprising a metal shell, said shell consisting of a cylindrical section having horizontal axis together with outwardly dished ends attached to the cylindrical section, a refractory lining within the shell conforming to the inner surface thereof and inclosing a furnace chamber, an opening in the shell above the furnace chamber, an arched roof covering the chamber, suitable openings in the chamber walls for the charging and discharging of material, one or more electrodes entering said furnace chamber, a suitable track-engaging member attached to each end of the shell, said members engaging a track or rail beneath on which the track-engaging members are adapted to roll, and means of imparting movement to the shell whereby it may be made to roll along the track until rotated to the desired degree.

4. An electric furnace comprising a metal shell having a wall of the form of a hollow cylinder whose axis extends horizontally in combination with outwardly-bulging, circular, dished end walls, said cylindrical wall having an opening in the top for a roof and suitable openings in the sides for the charging and discharging of material; a lining of refractory material disposed within said shell to conform to the general shape thereof; a roof of refractory brick covering the top opening of the shell; electrodes adjustably disposed to maintain an arc within the chamber formed by the refractory lining; a suitable track beneath said cylindrical shell wall; suitable track-engaging members attached to the cylindrical wall; and means of imparting a rocking movement to the shell whereby it may be made to roll along the track for the purpose of charging or discharging its contents.

5. An electric furnace comprising a cylindrical metal shell, a dished and flanged metal head secured to one end of said shell and a like head secured to the other end of said shell, said shell having an opening in the upper portion thereof, a refractory lining within said shell conforming to the inside thereof and inclosing a furnace chamber, an arched roof covering said chamber by fitting on said opening in said shell, suitable electrodes for forming an arc or arcs within said chamber, and mechanism

carried by said shell to provide for the charging and discharging of material into and from said furnace chamber.

6. An electric furnace comprising a cylindrical metal shell on a horizontal axis, an outwardly bulging metal head attached to each end of said metal shell, a lining of refractory material within said shell and inclosing a furnace chamber, a removable roof for said chamber, means for permitting the charging and discharging of material into and from said chamber, electrodes operatively disposed in said chamber to maintain an arc or arcs therein, and means for moving the furnace into position to discharge refined material therefrom.

7. An electric furnace comprising a metal shell having outwardly dished ends, a refractory lining in the shell conforming to the inner surface thereof and inclosing a furnace chamber, an arched roof fitting an opening in said shell above the furnace chamber, means having openings in said chamber for permitting the charging of material into said chamber and the discharge of refined material therefrom, one or more electrodes extending into said furnace chamber, and mechanism for tilting the furnace to effect discharge of refined material therefrom.

8. An electric furnace comprising a cylindrical plate portion having a horizontal axis, two outwardly dished plate heads respectively riveted to the ends of said cylindrical portion to form a shell having an opening at the upper side of said cylindrical portion between said heads, a refractory lining for the shell composed of said cylindrical portion and said heads, and a cover for said opening, said cover comprising a brick arch adapted to rest on the refractory lining of the furnace shell.

9. An electric furnace comprising a cylindrical shell having concavo-convex ends, a refractory lining to form a chamber having spherical-shaped end walls and a cylindrically-shaped bottom, and a discharge spout extending radially and laterally from said cylindrical shell with the discharge end of said spout normally in a plane extending horizontally through the axis of said shell a short distance above the surface of the bath on the cylindrically-shaped bottom of said chamber.

10. An electric furnace comprising a cylindrical shell having concavo-convex ends, a refractory lining to form cylindrically-

shaped side walls, a cylindrically-shaped bottom and spherically-shaped ends, a cover for an opening in said shell, and a refractory lining for said cover forming an arch-shaped roof for said chamber.

11. An electric furnace comprising a cylindrical shell and closed ends, a refractory lining, a removable cover for an opening in said shell, and a refractory lining for said cover to form an arch-shaped roof for the chamber within said refractory lining.

12. An electric furnace comprising a cylindrical shell having closed ends, a refractory lining forming a chamber, a flat door for a charging opening extending into said chamber, and an extension from such refractory lining at such opening to form surfaces for the said door to fit against to close said charging opening.

13. An electric furnace comprising a shell and a refractory lining, a removable door for a charging opening extending through said lining into the chamber of the furnace, means for supporting said door in closed position, and extensions for such refractory lining at said charging opening to form surfaces cooperating with said door to close said charging opening.

14. In an electric furnace, the combination with a cylindrical shell of metal having concavo-convex ends, an upper longitudinal opening, a lateral charging opening, and a radial discharging opening; of a refractory lining to form cylindrically-shaped lateral walls, a cylindrically-shaped bottom, and spherically-shaped ends of an interior chamber; a cover for the upper longitudinal opening in said shell; a refractory lining for said cover to form an arch-shaped roof for said chamber; a door for said charging opening; a spout at said discharging opening; an electrode extending through said cover and said arch-shaped lining into said chamber; an electrode extending through the bottom of said lining; mechanism for supporting the aforesaid parts for combined rotary movement; and mechanism for transmitting rotary movement to said furnace to effect discharge of refined material from said chamber out of said spout.

In witness whereof, I hereunto subscribe my name this 1st day of October A. D. 1917.

ALBERT E. GREENE.

Witnesses:

GERTRUDE E. GREENE,
T. D. EVERTS.