H. N. POTTER.

ELECTRIC FURNACE WITH MAGNETICALLY ROTATED CHARGE.

APPLICATION FILED JULY 25, 1904.

975,794.

Patented Nov. 15, 1910.

3 SHEETS—SHEET 1.

Fig. 1

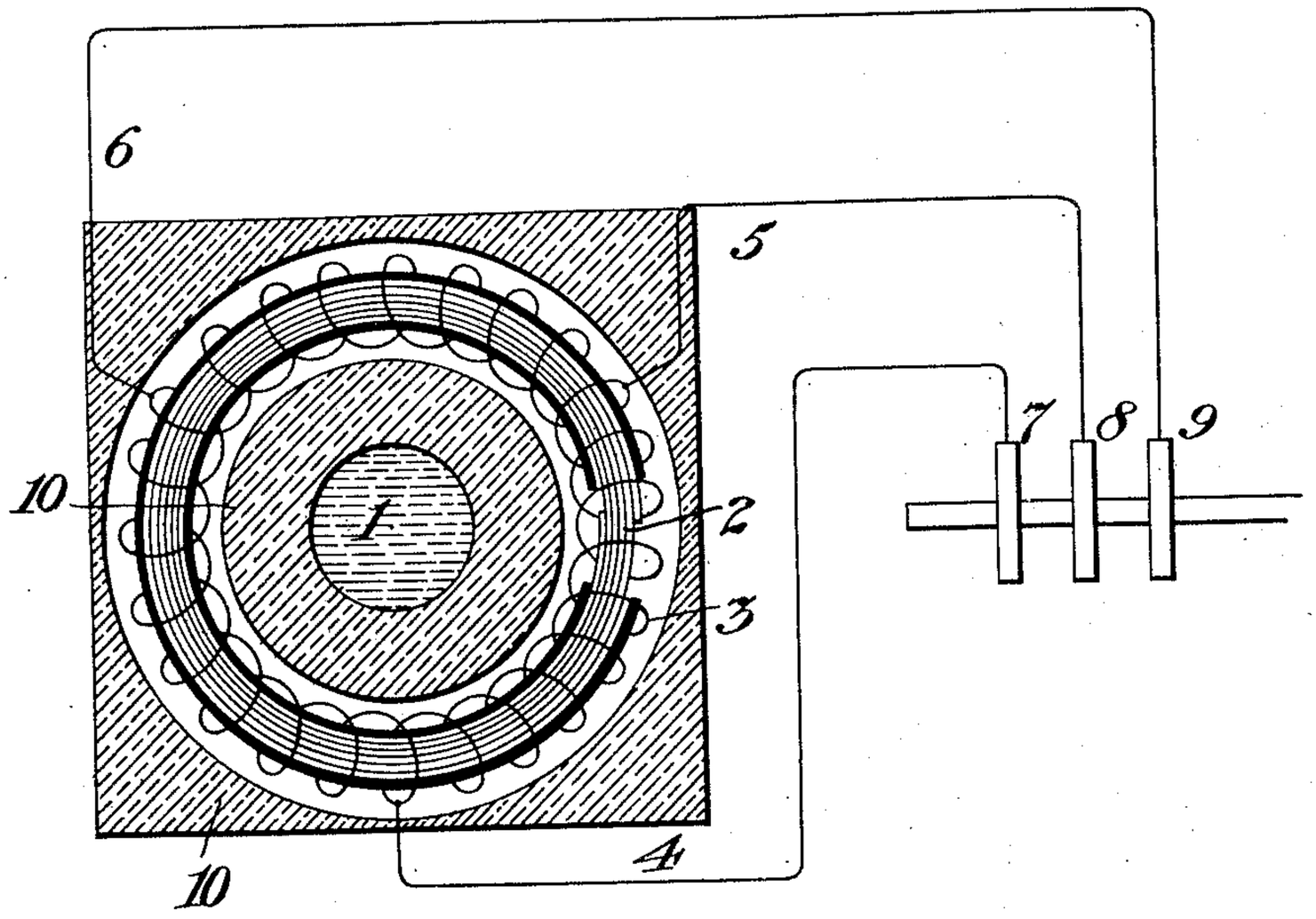
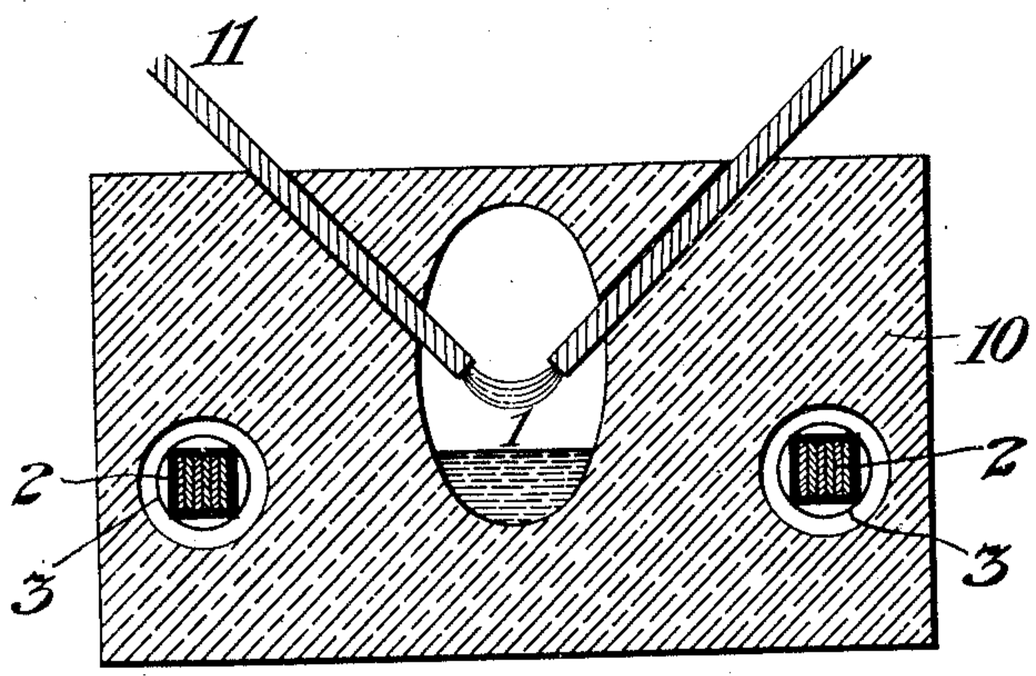


Fig. 2



Witnesses
Chas. F. Clagett
Wm. A. Capel

Inventor
Henry Noel Potter
By his Attorney
Charles A. Terry.

H. N. POTTER.

ELECTRIC FURNACE WITH MAGNETICALLY ROTATED CHARGE.

APPLICATION FILED JULY 25, 1904.

975,794.

Patented Nov. 15, 1910.

3 SHEETS—SHEET 2.

Fig. 3

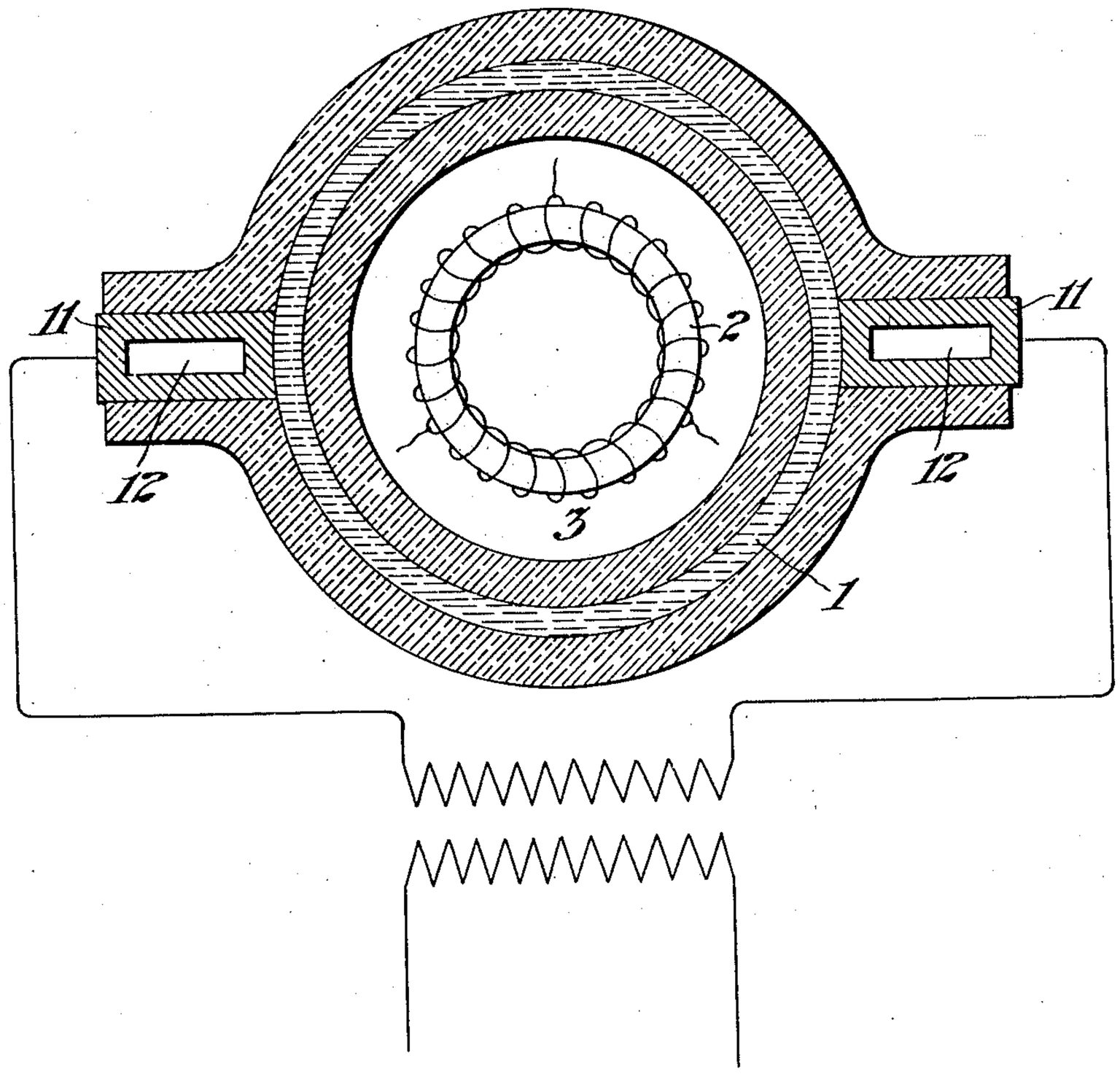
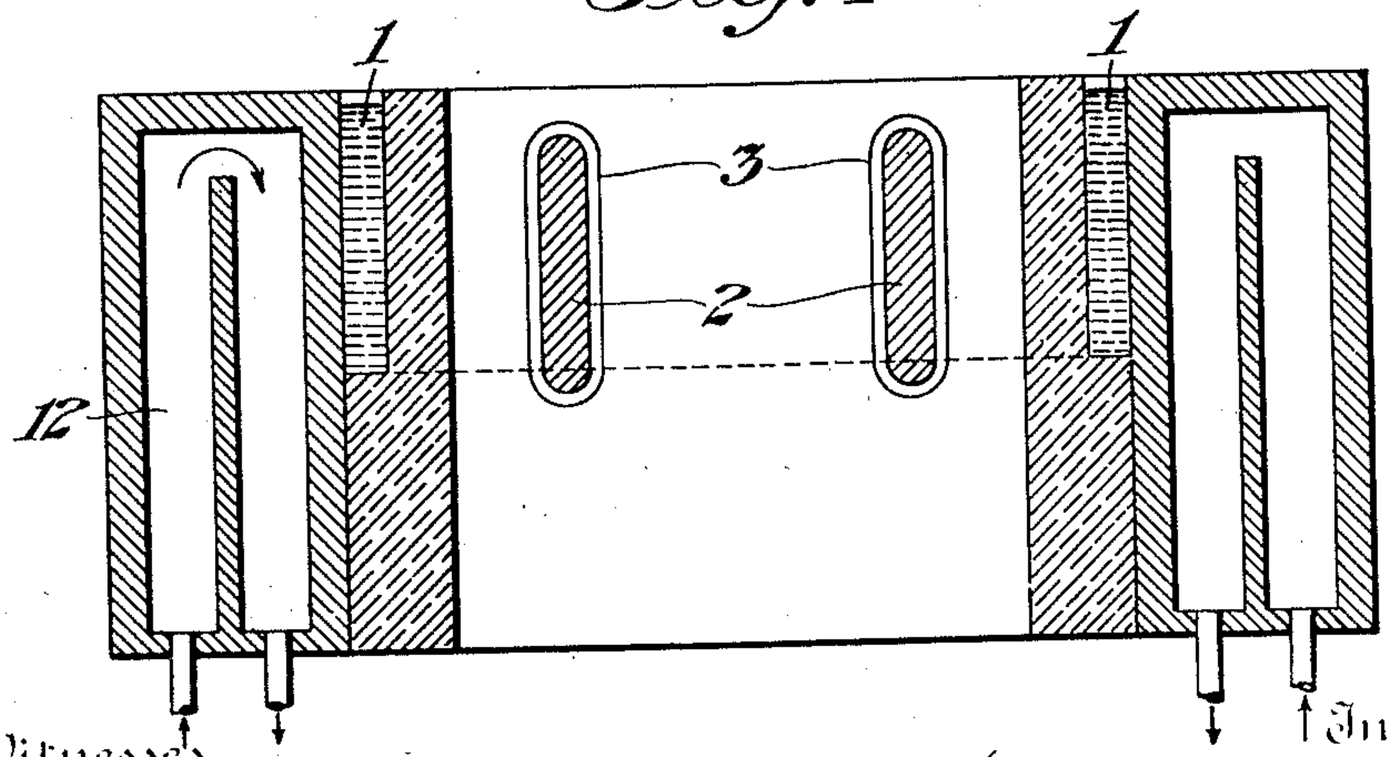


Fig. 4



Witnesses
Chas. F. Clagett
Wm. H. Cake

Inventor
Henry Neal Potter
By his Attorney
Charles A. Terry

H. N. POTTER.

ELECTRIC FURNACE WITH MAGNETICALLY ROTATED CHARGE.

APPLICATION FILED JULY 25, 1904.

975,794. Patented Nov. 15, 1910.

3 SHEETS—SHEET 3.

Fig. 5

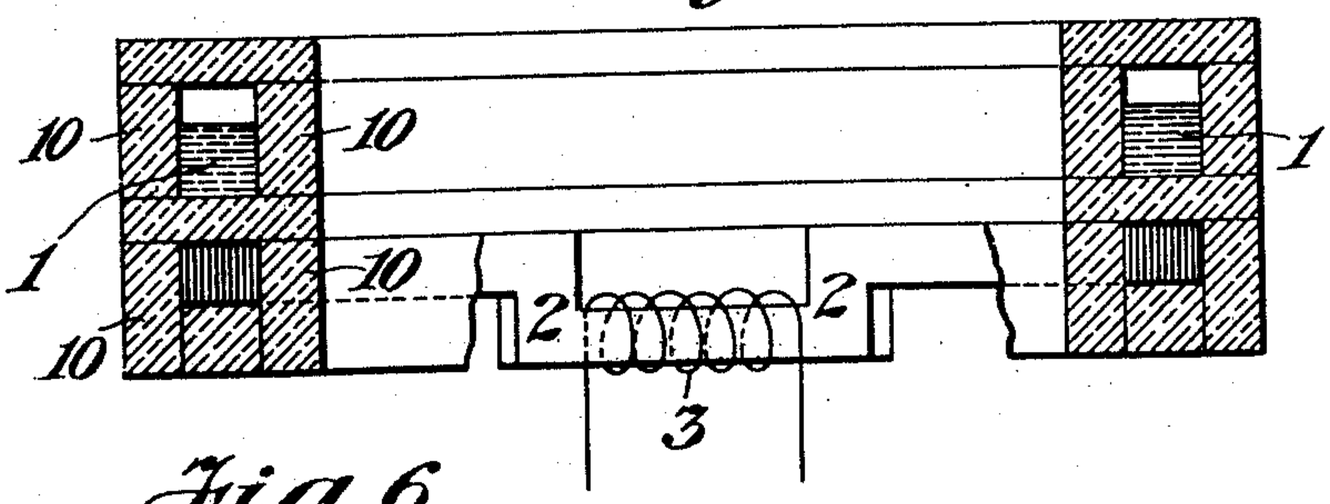


Fig. 6

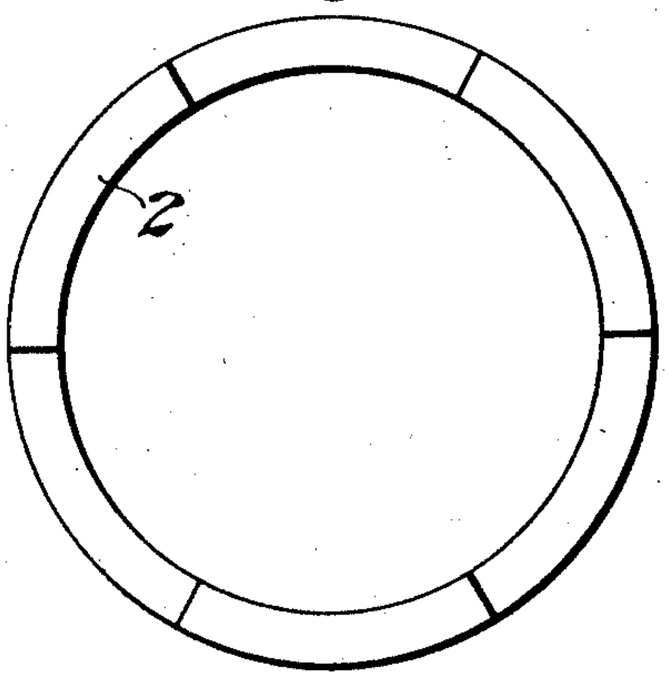


Fig. 7

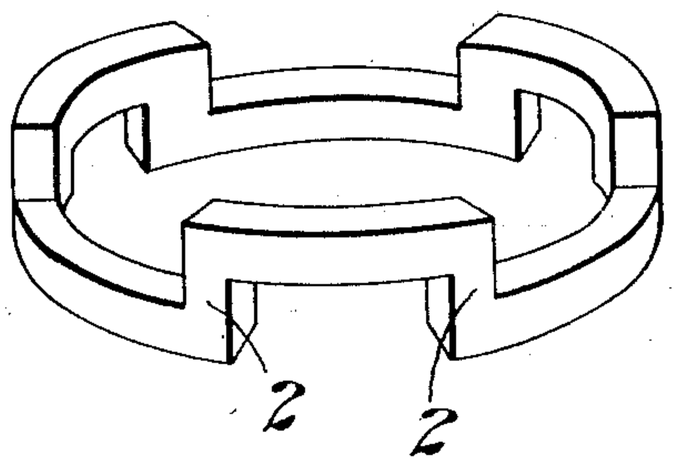
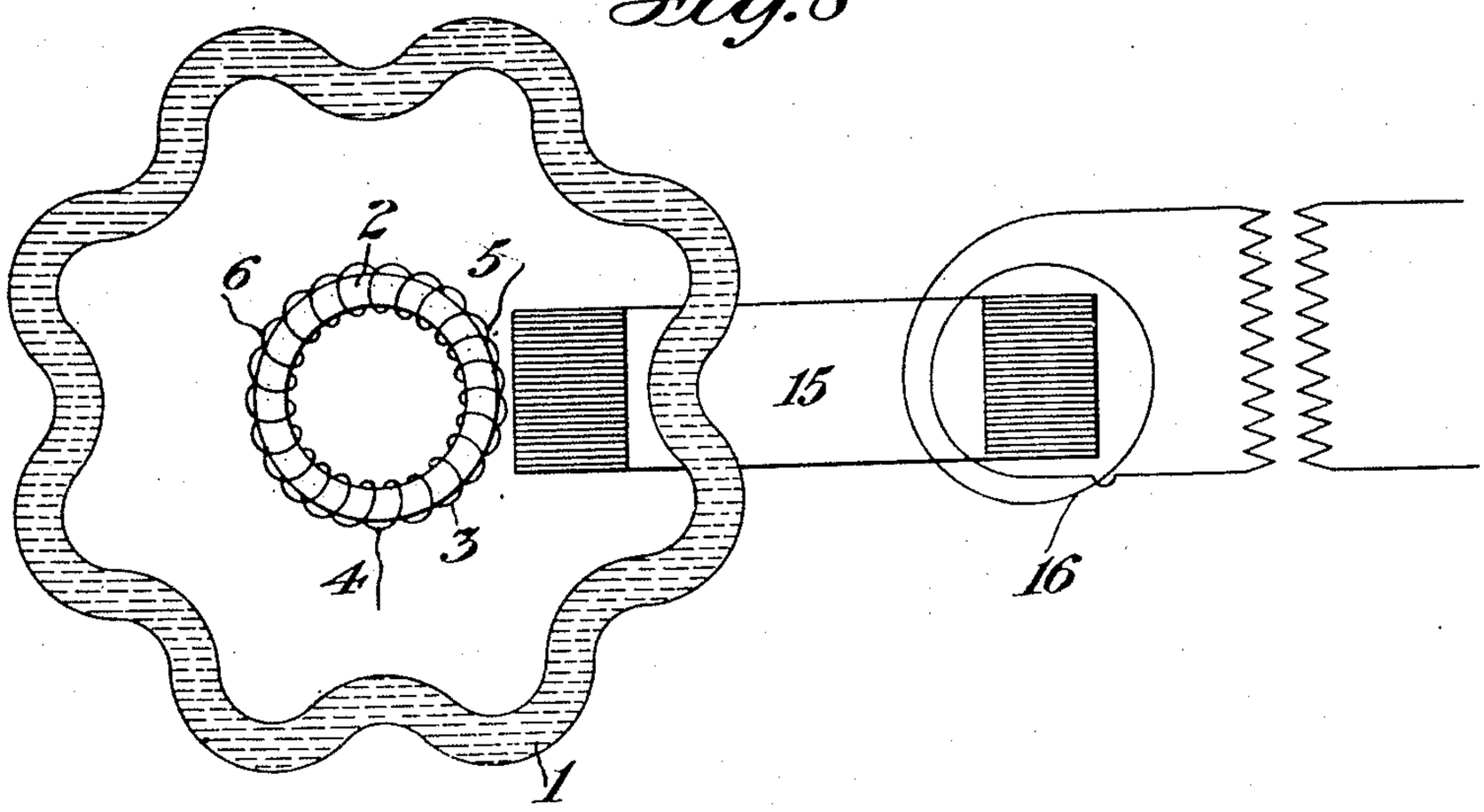


Fig. 8



Witnesses
Chas. F. Clagett
W. H. Capel.

Inventor
Henry Noel Potter
By his Attorney
Charles A. Perry.

UNITED STATES PATENT OFFICE.

HENRY NOEL POTTER, OF NEW ROCHELLE, NEW YORK, ASSIGNOR TO GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

ELECTRIC FURNACE WITH MAGNETICALLY-ROTATED CHARGE.

975,794. Specification of Letters Patent. Patented Nov. 15, 1910.

Application filed July 25, 1904. Serial No. 217,954.

To all whom it may concern:

Be it known that I, HENRY NOEL POTTER, a citizen of the United States, and resident of New Rochelle, county of Westchester, State of New York, have invented certain new and useful Improvements in Electric Furnaces with Magnetically-Rotated Charges, of which the following is a specification.

In certain electric furnace operations it is desirable to stir a bath of fluid metal while it is maintained at a very high degree of temperature. Ordinary mechanical stirring processes cannot readily be practiced under such conditions of operation and it becomes necessary to resort to other means for accomplishing the stirring of the fluid.

I propose to impress upon the mass of fluid metal the effects of a rotating magnetic field, making the fluid the closed secondary of an induction motor. Under these circumstances a rotation or revolution of the fluid will be caused and this revolution of the fluid can be effected in one direction or the other by an appropriate manipulation of the electric currents producing the rotary field. The stirring action can be assisted by giving to the vessel which contains the fused metal an irregular configuration either on the bottom or sides or both, so that the general rotation of the mass will be accompanied by eddies which assist in stirring the fluid.

The idea is applicable either to a resistance furnace where the melted metal is itself the resistance or to furnaces either of the arc or resistance type in which the melted metal is heated from a source exterior to itself. The molten metal may fill a circular trough, or it may lie on a base in the general form of a disk, or it may constitute an annulus surrounding the lower carbon of an arc furnace, in which the carbons are co-axial and vertical.

The present invention is of wide application, inasmuch as most of the materials produced in electric furnaces are conductors of electricity.

I have illustrated my invention in the accompanying drawings, in which—

Figures 1 and 2 are, respectively, horizontal and a vertical section of a furnace adapted to perform the functions of the present invention; Figs. 3 and 4 are, respectively, a horizontal and a vertical section of a modified form of furnace; Fig. 5 is a vertical section of still another modified form of furnace; Figs. 6 and 7 are detail views illustrating parts of the furnace shown in Fig. 5; and Fig. 8 is a diagram of another modification.

In general, it may be stated that the figures are mainly diagrammatic, inasmuch as the invention relates to a broadly conceived invention wherein specific details are of comparative unimportance.

Referring to Figs. 1 and 2, the character 1 indicates a pool of molten metal surrounded by a container, 10, which may be composed of the mixture from which the molten or fluid metal 1 is produced by the action of the furnace. Around the pool 1, at a suitable distance therefrom, such that the temperature conditions do not interfere with the operation, is located a ring, 2, of laminated iron surrounded by a conducting coil, 3, from which, at intervals of 120°, conductors 4 and 5, branch off and are connected to the collector rings, 7, 8 and 9, of a three-phase generator, or to the terminals of a three-phase transformer.

Fig. 3 illustrates the same general idea as applied to a resistance furnace in which the molten metal 1 is itself the resistance. The current for melting the metal is applied through terminals, 11, 11, which are supplied with means for water cooling as shown at 12, 12. Within or without or underneath the ring 1 is arranged a ring 2 of laminated iron surrounded by a coil 3, as before.

In Figs. 3 and 4, the ring of laminated iron is shown as being located within the ring 1 of molten metal.

In both the forms of furnace hereinbefore described it is possible to set up currents in molten metal which will cause a rotation of the metal or a revolution thereof such as will produce the desired stirring of the metal while it is in a molten state. Such effects are produced by causing currents to flow through the rotary field constituted by the laminated core, 2 and the conductor, 3. Taking Fig. 3 as an example, the molten metal being kept in circulation, no portion of it remains very long in close proximity to the electrodes, which is in itself an advantage in addition to the stirring action.

Coming now to the Figs. 5, 6 and 7, we have a similar arrangement in which, however, the magnetic circuit is arranged under-

neath the fluid material and is depressed at intervals to receive coils, as shown at 3, which coils take the place of the continuous coils shown in the earlier figures of the drawing. In connection with this furnace it may be remarked that it is novel to send current into a ring of fused metal so that the current splits into two parallel currents, one in each half of the ring.

Referring to Fig. 8, this shows a conduction furnace in which the melted metal 1 is shown in a trough having the shape of a waved ring. The current induced in the ring 1 by a transformer having an iron core, 15, and a primary core, 16. The ring 1 constitutes the secondary and the current induced within it maintains it in fusion. In addition to this transformer there is a three-phase transformer to effect the rotation. This is a ring 2 of laminated iron surrounded by coils 3 and provided with terminels 4, 5 and 6, as explained in connection with the earlier figures of the drawing. The directions of the eddy current in the fused metal 1, induced by the three-phase ring, are in general at right angles to the fusing current induced by the transformer 15—16, for which reason, the two do not interfere with each other.

It is obvious that in addition to the alternating current devices shown in the drawings, it is possible to produce a direct current analogy in the form of a motor, the commutator brushes being represented by water cooled or infusible contacts projecting into the fused mass and serving to transmit therethrough a direct current, preferably of low voltage and extremely heavy amperage. If this current be now cut by a constant magnetic field, the entire liquid will rotate or revolve.

In a divisional application filed July 1, 1905, Serial Number 267,914, claims are made upon certain methods of operation disclosed herein.

I claim as my invention:—

1. In a furnace, means for producing a rotatory magnetic field within a chamber for containing the molten metal, the molten metal chamber being traversed by induced electric current.

2. In a furnace, an alternating induction stator having a space within which molten metal adapted to serve as a rotor therefor may be located.

3. In an electric furnace, a stator having a space within which molten conducting material may be placed in operative relation thereto, the said stator acting inductively through said space through a constantly varying magnetic field.

4. In an electric furnace, the combination with a receptacle for fused conducting material, of means for producing an alternating inductive field arranged in operative proximity thereto and means for causing a magnetization progressive in space of the said field.

5. An electric furnace comprising a space for receiving a bath of molten material and means for producing a rotating alternating magnetic field through the space within which the molten material is to be located.

6. An electric furnace for containing a body of conducting molten material, together with means for utilizing polyphase currents for producing a rotating magnetic field within said molten material.

7. A furnace having in combination a receptacle for molten metal together with means inductively disposed in relation thereto for moving said molten metal.

8. A furnace having in combination a receptacle for molten metal together with means inductively disposed in relation thereto for rotating said molten metal.

9. A furnace having in combination a receptacle for the material to be treated; electrical means for heating said material and means other than said heating means inductively disposed in relation to said material for producing a moving magnetic field.

10. A furnace having in combination a receptacle for the material to be treated together with means for inductively heating and separate means for inductively mixing said material.

11. A furnace having in combination a receptacle for the material under treatment, a source of heat for supplying the bulk of heat necessary for the treatment of the material together with means other than said source of heat for inductively mixing said material and thereby at the same time imparting thereto a certain amount of additional heat.

Signed at New York, in the county of New York, and State of New York, this 18th day of July, A. D. 1904.

HENRY NOEL POTTER.

Witnesses:

WM. H. CAPEL,

GEORGE H. STOCKBRIDGE.