June 26, 1928.

1,675,237

M. UNGER

ELECTRIC FURNACE

Filed Dec. 9, 1926

Fig. 1.

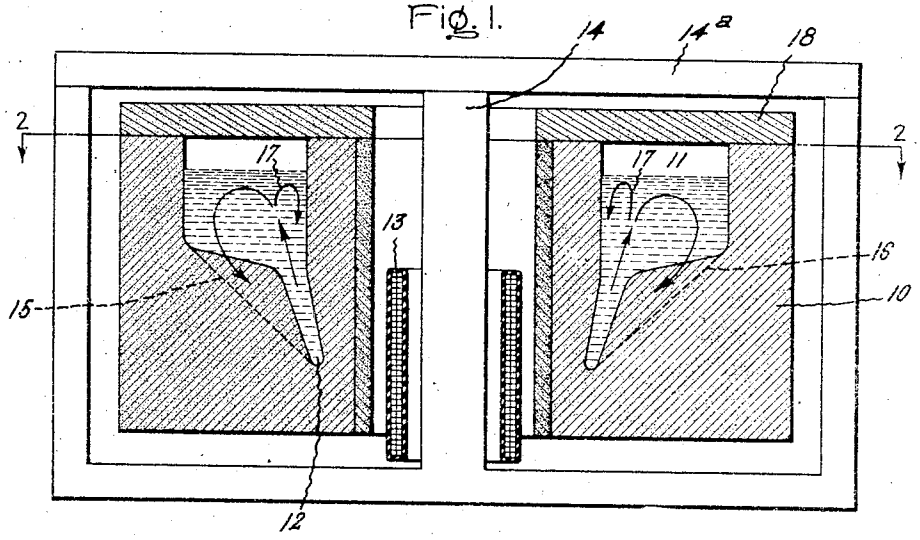
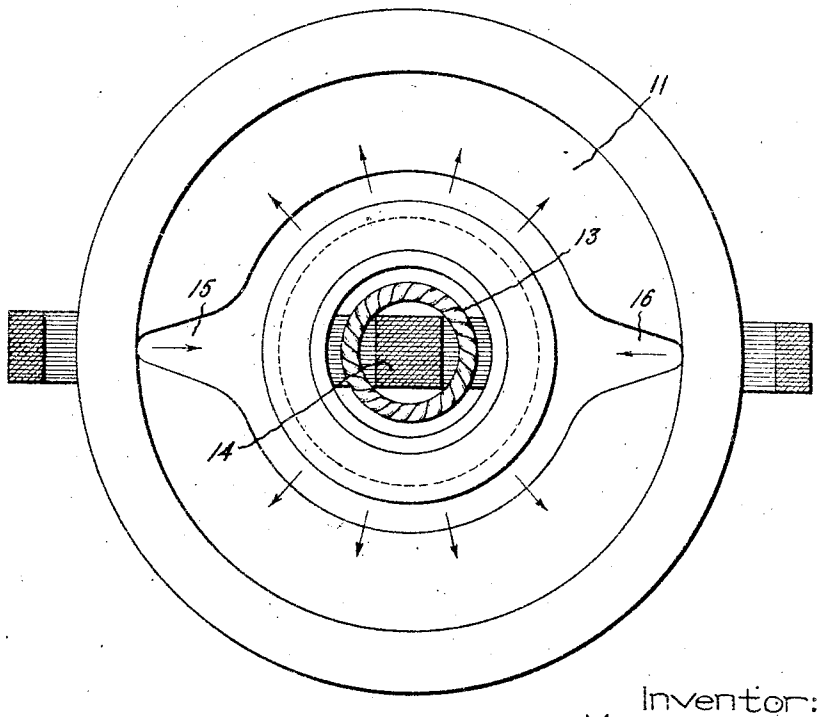


Fig 2.



Inventor:
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UNITED STATES PATENT OFFICE.

MAGNUS UNGER, OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC FURNACE.

Application filed December 9, 1926. Serial No. 153,649.

My invention relates to electric furnaces, more particularly to electric metal melting furnaces, and has for its object the provision of a simple, reliable electric furnace having a satisfactory circulation of molten metal and a desirable power factor.

More particularly my invention relates to electric metal melting furnaces of the induction type, and more especially to ring-type induction furnaces in which the charge is contained in a ring-shaped reservoir or channel with which is associated a primary winding for inducing heating currents in the charge. In such furnaces, it is necessary to make the channel of relatively great width so that the furnace can be charged with pieces of metal of convenient size. Ordinarily, therefore, the ring-shaped channel is relatively wide and shallow. This has the disadvantage that certain portions of the charge are situated in a comparatively remote position with respect to the primary winding so that poor interlinkage of the magnetic flux with these portions necessarily results with a consequent low power factor for the furnace. This limitation as to power factor greatly limits the size of the furnace.

In carrying out my invention I provide a deep narrow channel at the bottom of the ring-shaped reservoir in which a portion of the charge forms a closed secondary circuit for a primary coil associated therewith.

For a more complete understanding of my invention reference should be had to the accompanying drawing, in which Fig. 1 is a sectional view of an electric metal melting furnace embodying my invention, while Fig. 2 is a sectional view along the line 2—2 of Fig. 1 looking in the direction of the arrows.

Referring to the drawing, my invention in one form embodies an annular furnace crucible 10 made of a suitable heat refractory material, such as fire clay, which may be molded or otherwise shaped. This crucible is provided with a horizontal ring-shaped reservoir 11 for the charge and with an annular channel 12 situated below the reservoir 11 and communicating at its top with the bottom of the reservoir. In other words, the channel 12 forms a deep annular recess connecting with the bottom of the reservoir.

As shown in Fig. 1, this channel 12 communicates with the inner periphery of the reservoir so as to closely surround a primary winding 13 inserted in the channel and mounted on a suitable magnet core 14. The primary winding is preferably displaced axially in a downward direction with respect to the channel 12. As shown in Fig. 1, it will be observed that the top of the primary coil and the top of the channel are substantially even, while substantially one half the length of the primary winding extends below the bottom of the channel.

This axial displacement of the primary winding produces an electromagnetic repulsive force in an axial direction between the primary winding and the charge contained in the channel and with the primary winding displaced in the downward direction this force is directed upwardly on the charge whereby the metal is forced upward as indicated by the arrows. There will also be a certain amount of radial force due to electromagnetic repulsion acting on the metal in the channel and in order to facilitate the circulation, the annular channel preferably is made with a smaller diameter at the bottom so that it extends obliquely upward substantially along the line of the resultant of the radial and axial repulsive forces. This arrangement of the channel tends to promote circulation of the charge. In order to provide for the return of charge from the reservoir back to the channel two oppositely disposed grooves or channels 15 and 16 are provided in the crucible through which the charge returns in a downward direction, as indicated by the arrows. These channels connect the outer periphery of the reservoir with the bottom of the channel and provide a return path for the molten charge through a region which is remotely situated from the primary winding. A portion of the charge may also return by flowing downward along the inner periphery of the reservoir and channel, as indicated by the arrows 17. This will depend upon the arrangement of the primary winding and other details of construction.

An annular cover 18 is provided for the crucible, the upper cross bar 14^a of the core being removable to permit the cover to be removed.

While I have described my invention as embodied in concrete form and as operating in a specific manner in accordance with the

provisions of the patent statutes, it should be understood that I do not limit my invention thereto since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric furnace comprising a crucible providing a ring-shaped reservoir and an annular channel depending from the bottom of said reservoir and communicating with said reservoir at the inner periphery thereof, and a primary winding inductively associated with said channel.

2. An electric furnace comprising a crucible providing a ring-shaped reservoir and an annular channel depending from said reservoir, and a primary winding inductively associated with said channel so as to induce heating currents in the portion of the charge contained therein, said primary winding being axially displaced with respect to said channel to produce a circulation of charge between the channel and reservoir by electromagnetic repulsion.

3. An electric furnace comprising a crucible providing a horizontal ring-shaped reservoir and a horizontal annular channel depending from the reservoir and communicating with the reservoir at the inner periphery thereof, a primary winding concentrically located with respect to said channel for inducing heating currents in a portion of the charge contained therein, said primary winding being displaced in a downward direction with respect to said channel so as to produce a circulation of charge between said channel and said reservoir.

4. An electric furnace comprising a crucible providing a horizontal ring-shaped reservoir for the charge and a relatively deep narrow annular channel depending from the bottom of said reservoir and communicating therewith at the inner periphery thereof, and a primary winding associated with said channel so as to produce a flow of charge in said channel in an upward direction into said reservoir, said crucible being provided with a return path for the molten charge through a region remote from said primary winding.

5. An electric furnace comprising a crucible providing a horizontal ring-shaped reservoir for the charge and a relatively deep narrow ring-shaped channel depending from the bottom of said reservoir and communicating therewith at the inner periphery thereof, and a primary winding inductively associated with said channel and axially displaced in a downward direction with respect to said channel so as to produce a circulation of charge in an upward direction in said channel by electromagnetic repulsion, said crucible being provided with a return path for the charge connecting the outer periphery of said reservoir with the bottom of said channel.

In witness whereof, I have hereunto set my hand this seventh day of December, 1926.

MAGNUS UNGER.