Oct. 11, 1927. 1,645,074

J. A. SEEDE

ELECTRIC FURNACE

Filed June 5, 1926

Fig. 1

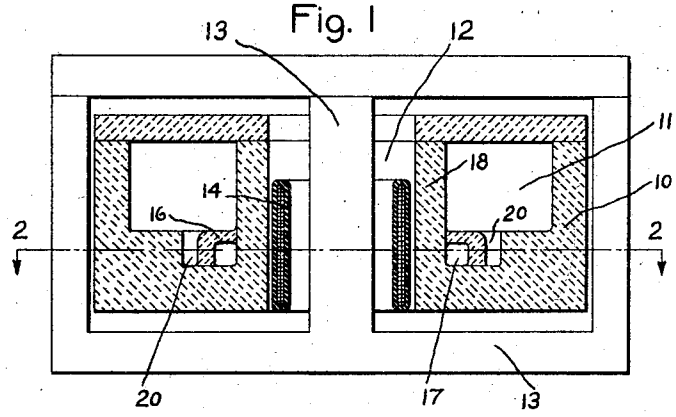


Fig. 2

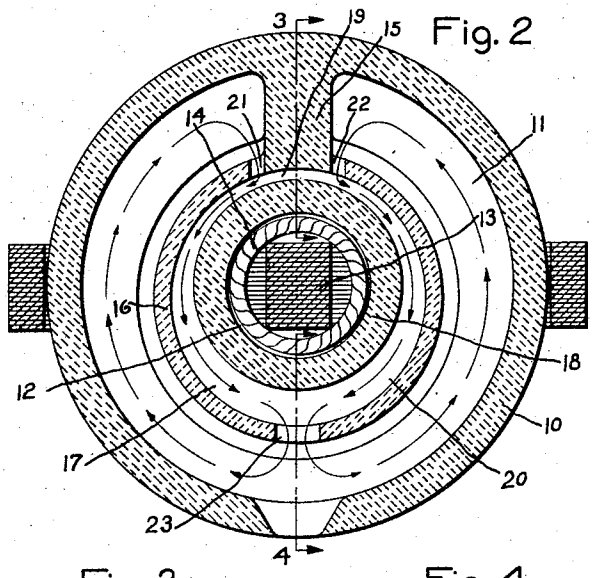


Fig. 3

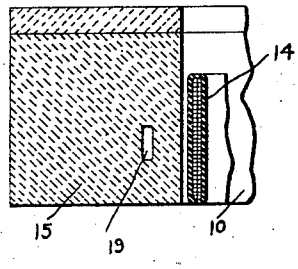
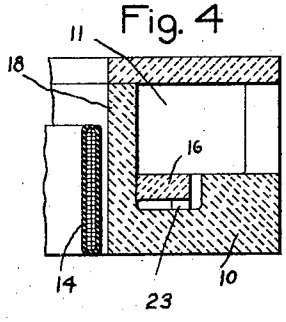


Fig. 4



Inventor:
John A. Seede,
by Alexander S. Lamb
His Attorney.

Patented Oct. 11, 1927. 1,645,074

UNITED STATES PATENT OFFICE.

JOHN A. SEEDE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC FURNACE.

Application filed June 5, 1926. Serial No. 114,009.

My invention relates to electric furnaces, more particularly to electric induction metal melting furnaces, and has for its object the provision of a simple, reliable and efficient furnace providing a load of desirable power factor.

In carrying out my invention in one form, I provide a horizontal annular crucible for the charge having a barrier which prevents the molten charge therein from forming a short circuited secondary of a primary winding associated therewith. In the bottom of this crucible I provide an auxiliary wall by means of which an annular chamber is formed in which a portion of the charge constitutes a closed secondary, this channel communicating with the reservoir at remotely separated points.

For a more complete understanding of my invention reference should be had to the accompanying drawing in which Fig. 1 is a vertical sectional view of an electric furnace embodying my invention; Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1 looking in the direction of the arrows, while Figs. 3 and 4 are fragmentary sectional views showing the shape of the secondary channel.

Referring to the drawing, in carrying out my invention in one form I provide a crucible 10 made of a suitable heat refractory material providing an annular reservoir 11 for the charge. The crucible 10 is provided with a central aperture 12 through which extends a leg of a magnet iron core 13. A primary winding 14, inserted in the aperture 12, surrounds the leg of the core passing through the aperture 12 and is in concentric relation with the reservoir 11.

The molten charge in the reservoir 11, however, does not constitute a short circuited secondary for the primary winding 14 since the electric circuit through the charge is interrupted by means of a barrier 15 extending across the reservoir, whereby the reservoir constitutes an open loop. This barrier may be formed of the same heat refractory electrically insulating material as the crucible 10, and it is preferably molded as an integral part of the crucible. In the bottom of the reservoir an annular partition wall 16 is provided whereby an auxiliary channel 17 having a uniform cross-sectional area is formed. This channel provides a closed secondary loop for the primary winding 14 in which a portion of the charge is heated by currents induced therein. As shown, the wall 16 is provided with a horizontal top portion and a vertical side portion, and it is of such size as to be slipped easily over the inner annular wall 18 of the crucible. It is cemented in place to the wall of the crucible. The barrier 15 is provided with an aperture 19 which forms a part of the channel 17, the ends of the auxiliary wall 16 being cemented to the barrier. As shown, the wall 16 is mounted in a narrow annular depression 20 in the bottom of the crucible. Communication is had between the channel 17 and the reservoir 11 through apertures 21 and 22 in the wall 16 on opposite sides of the barrier 15 and through a diametrically opposite aperture 23 in the wall 16. The aperture 23 is much larger than the apertures 21 and 22 which are of equal size, and in fact should be equal to or larger than the two apertures 21 and 22 together.

For the purpose of providing for a pronounced circulation of charge in the channel 17, the channel has an elongated transverse section in the region adjacent the apertures 21 and 22, being formed at this point by the aperture 19, with its greatest transverse dimension extending vertically, as indicated in Fig. 3, while on the side adjacent the aperture 23 its greatest transverse dimension is horizontal, as indicated in Fig. 4. The change in the shape of the channel takes place gradually from one side to the other. For example, at the two diametrically opposite sides between the outlet openings the channel is substantially square in transverse section, as indicated in Fig. 1.

By reason of the radial magnetic repulsion between the primary winding and the molten charge in the channel 17 a force is exerted on the molten charge in the channel tending to throw it outward radially. This force acting outward on successive radially disposed elements of the molten charge is transmitted from one element to the other outward radially and consequently a higher fluid pressure exists in the molten metal at the outer periphery of the channel than at the inner periphery. Adjacent the outlet opening 23 much higher fluid pressures are produced at the outer periphery of the channel than in the region adjacent the openings 21 and 22, due to the greater radial width

of the channel adjacent the opening 23. This is due to the fact that the greater radial dimension in this region results in the accumulated pressures of a greater number of radially disposed elements so that greater fluid pressures are built up. This increased pressure causes the molten charge in the channel to be forced out at the opening 23 into the reservoir, the metal returning from the reservoir to the channel through the openings 21 and 22 as indicated by the arrows in Fig. 2. An effective unidirectional circulation of the charge is thereby produced. The rapidity of circulation can be increased if desired by increasing the horizontal elongation of the channel adjacent the opening 23.

It will be observed that by means of this construction the secondary channel 17 is brought very close to the primary winding whereby magnetic leakage is reduced and consequently a high power factor obtained.

It will be noted that the two halves of the reservoir form parallel electric circuits with the halves of the channel situated between the openings 21 and 22 and the opening 23, and consequently the charge in the reservoir will carry a small amount of current. The great predominance of the induced current, however, will be in the portion of the charge in the channel 17 by reason of its close proximity to the primary winding. In starting the furnace a small amount of molten charge sufficient to establish a closed heating circuit in the channel 17 will be introduced into the reservoir, after which the reservoir may be charged with solid pieces.

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 induction furnace comprising heat refractory walls providing an open loop reservoir for the charge and a closed loop heating channel communicating with said reservoir at remotely separated regions, and an electrical winding for inducing a heating current in a conductive charge in said channel.

2. An electric induction furnace comprising a crucible providing an annular reservoir for the charge, a barrier in said reservoir, and walls forming a horizontal annular channel in the bottom of said reservoir, said walls being provided with ports on opposite sides connecting said channel with said reservoir, and a primary winding arranged to induce heating currents in a conductive charge in said channel.

3. An electric induction furnace comprising heat refractory walls providing a horizontal annular reservoir, a barrier extending across said reservoir, a wall made of refractory heat conducting material forming an annular channel in the bottom of said reservoir communicating with said reservoir at remotely separated regions and in which a portion of the charge forms a closed secondary, a magnetic core interlinking with said reservoir and channel, and a primary winding on said core.

In witness whereof, I have hereunto set my hand this 4th day of June, 1926.

JOHN A. SEEDE.