Aug. 10, 1926. 1,595,968

M. UNGER

INDUCTION FURNACE

Original Filed April 18, 1922

Fig. 3.

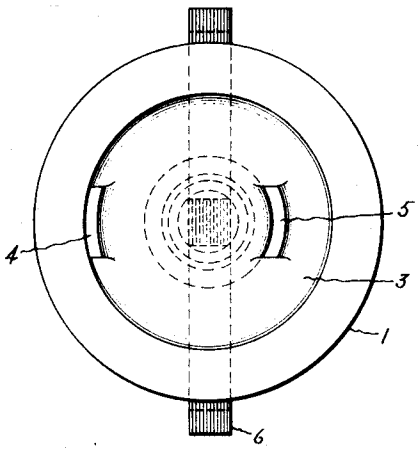


Fig. 1.

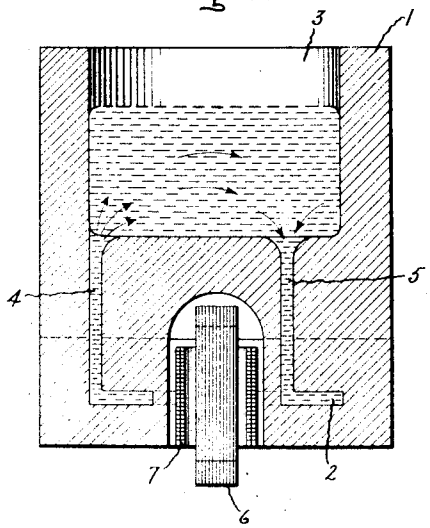
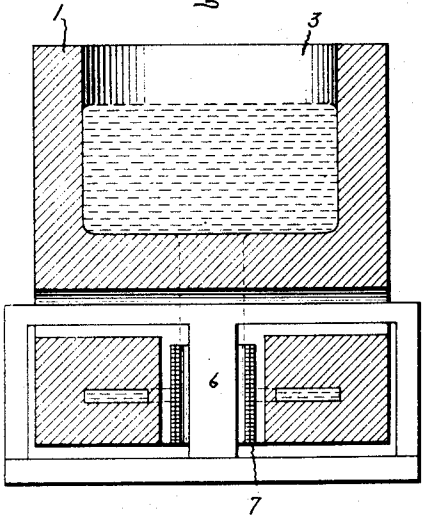


Fig. 2.



Inventor:
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UNITED STATES PATENT OFFICE.

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

INDUCTION FURNACE.

Application filed April 18, 1922, Serial No. 554,576. Renewed June 16, 1926.

The present invention comprises an improved induction furnace and in particular an induction furnace in which the charge which comprises the secondary of the furnace is contained within a channel communicating with a reservoir which increases the capacity of the furnace and affords working space for making additions to and carrying out desired treatment of the charge.

In accordance with my invention I have provided an induction furnace in which a circulation is produced from the channel through a conduit with a return flow through another conduit by electromagnetic forces. In the embodiment of my invention described below, the chamber containing the charge which constitutes the secondary symmetrically surrounds the primary, but the conduits leading to and from the secondary are unsymmetrically spaced with respect to the primary. In a furnace embodying my invention a positive, unidirectional circulation occurs and the operating efficiency is high. The novel features of my invention will be pointed out with greater particularity in the appended claims.

In the accompanying drawings, Figs. 1 and 2 are vertical sections taken at right angles to each other, and Fig. 3 is a plan view of an embodiment of my invention.

The furnace shown in the drawing comprises a refractory furnace body 1, providing a disk or pancake-shaped channel 2, a reservoir 3, and ducts 4, 5, connecting the channel 2 with the reservoir 3. Interlinked with the channel 2 is a magnetic core 6 carrying a primary winding 7. It will be noted that the disk-shaped channel 2 extends substantially at right angles to the main or longitudinal axis of the primary 7. The duct 4 communicates with the channel 2 near the outer periphery of the channel and the duct 5 communicates with the channel near in the inner periphery.

Conductors carrying current in opposite directions repel each other, due to electromagnetic forces. When one of the conductors is in a liquid state, a repelling force acts upon each current carrying element and this force is cumulative so that while the active force as measured on the side of the conductor facing the other conductor is substantially zero, the force on the opposite side is the entire integrated force of the elements making up the liquid conductor. Applying this fact to the furnace which is the subject of this application, it will be apparent that the metal in the annular disk-shaped ring will be repelled radially in a horizontal plane. This repelling force has also been termed the centrifugal force as it is similar to the force obtained if the furnace were rotated on its vertical axis. This repulsive force sets up a pressure causing a flow of the charge through the duct 4 into the reservoir 3, a replacement flow occurring in the opposite direction from reservoir to the channel 2 through the duct 5, which communicates with the region of lesser pressure adjacent to the inner surface, thus causing a unidirectional flow of the charge.

An imaginary cylindrical surface could be passed concentric with the axis of the primary and parallel to the direction of flow of the secondary current which will subdivide the charge in the channel 2 into complete current-carrying elements connected respectively to the reservoir by the conduits 4 and 5, and being radially located different distances from the primary. The difference in pressure between the inner and the outer periphery of the annular secondary may be said to be due to the difference in density of primary flux traversing the inner and outer annular elements of the secondary. The charge in the ducts 4 and 5 carries no current and therefore is not subjected to the pinch effect, which tends to compress and rupture liquid conductors carrying currents of high density.

This particular construction of furnace lends itself particularly well to melting of such metals as aluminum and magnesium, and alloys having low specific gravity and high electrical conductivity. Melting of such metals is well-known types of induction furnaces is very much restricted, due to difficulties from the pinch effect as well as low power factor. In the furnace which is here described, the current carrying part of the charge, i. e. the horizontal ring, is readily held under considerable hydraulic pressure which is uniformly distributed, thus greatly reducing difficulties from the pinch effect, so that a furnace made to this construction can operate at a high power input and at a greatly improved power factor. This type of furnace also lends itself very well to the use of preformed linings.

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

1. An induction furnace comprising the combination of a primary winding and refractory walls constituting a reservoir, a container having a major extension at right angles to the main axis of said winding inductively related to said primary, and ducts connecting said reservoir and container at regions between which may pass an imaginary surface parallel to the direction of flow of secondary current sub-dividing a charge in said channel into complete current-carrying sections, one of which is in closer inductive relationship to the primary winding than the other.

2. An induction furnace comprising the combination of a primary, a furnace body shaped to constitute a reservoir and a secondary channel of uniform cross sectional area symmetrically surrounding said primary and communicating with said reservoir at regions radially spaced different distances from said primary, thereby causing a unidirectional flow of charge between said channel and reservoir.

3. An induction furnace comprising the combination of a magnetic core, a primary winding thereon, a refractory furnace body surrounding a leg of said core and providing both an annular container interlinked with said core, and having a materially greater extension at any angle to said core than parallel thereto, and a reservoir communicating with said annular container at regions radially displaced different distances from said core.

4. An induction furnace comprising the combination of a magnetic core, a primary winding thereon, and a refractory crucible comprising a reservoir for a fluid charge, a container interlinked with said core and ducts connecting said reservoir with said container at regions of said container relatively displaced radially with respect to said core.

5. An induction furnace comprising a magnetic core, a primary winding thereon, and a refractory wall enclosing an annular channel surrounding said primary winding, a reservoir located above said channel and a plurality of conduits connecting said channel and reservoir, one of said conduits communicating with said channel adjacent the outer rim of the channel, and another conduit remote from said first conduit communicating with said channel adjacent the inner rim thereof.

6. An induction furnace comprising the combination of a core having vertical members, a primary winding on one of said vertical members, a furnace body providing a channel surrounding a vertical member of said core and having a major extension in a horizontal direction, a reservoir located above said core, a vertical conduit passing from the inner rim of said channel to said reservoir and another conduit passing from the outer rim of said channel to said reservoir on the opposite side of said core.

In witness whereof, I have hereunto set my hand this 17th day of April, 1922.

MAGNUS UNGER.