W. N. CRAFTS.

ELECTRIC FURNACE.

APPLICATION FILED OCT. 15, 1912.

1,069,924. Patented Aug. 12, 1913.

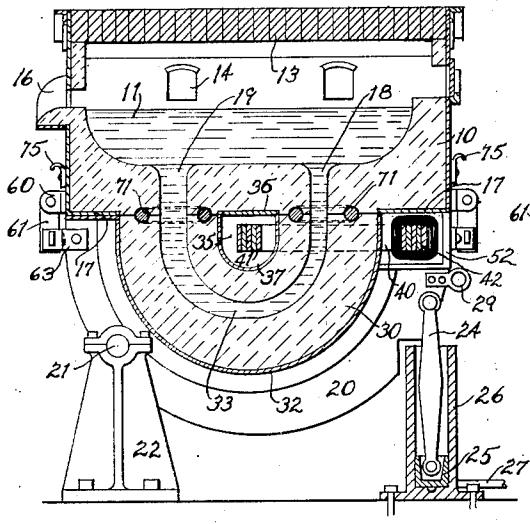


FIG. 2.

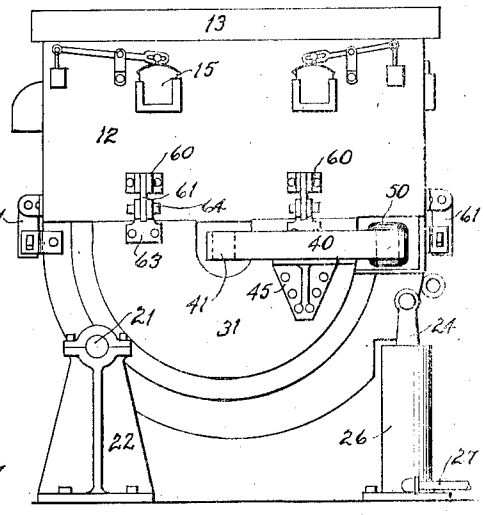


FIG. 1.

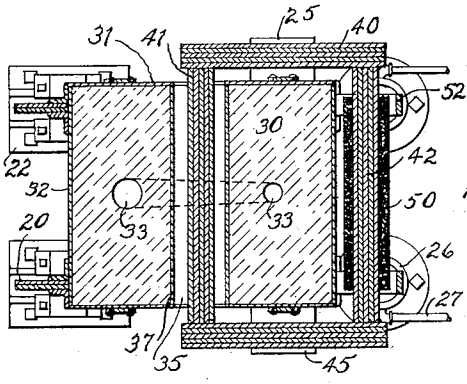


FIG. 4.

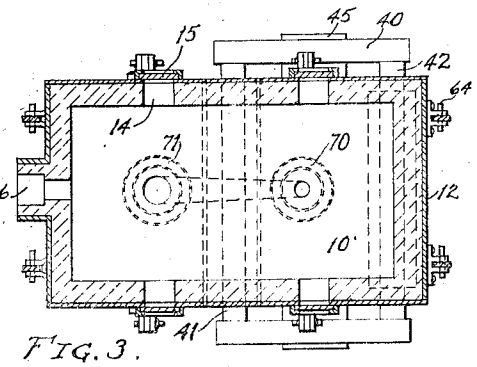


FIG. 3.

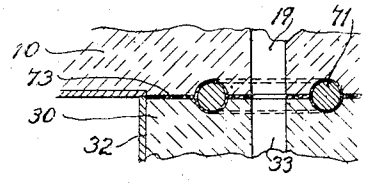


FIG. 5.

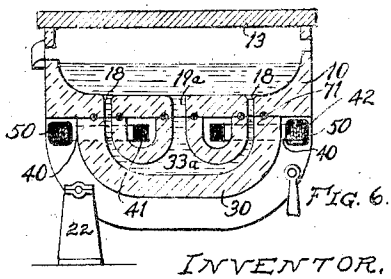


FIG. 6.

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ELECTRIC FURNACE.

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To all whom it may concern:

Be it known that I, WALTER N. CRAFTS, a citizen of the United States, residing at Oberlin, in the county of Lorain and State of Ohio, have invented a certain new and useful Improvement in Electric Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to electric furnaces of the induction type, wherein there is a bath and a U-shaped passageway for molten metal communicating with the bath and constituting with a portion of it an annular secondary surrounding the magnetic core of an induction coil. In such a furnace it is very desirable to provide means enabling the separation of the bath portion of the furnace from the supporting body and the core and primary winding, as this allows the core, primary, and support to be used with another bath portion while the former is being repaired. It also provides for convenient repair of the primary winding. With such separable furnace it is important to provide means preventing leaking from the legs of the U-shaped passageway at the junction planes of the two portions of the body. It is also desirable to so locate the primary winding that it will be preserved from destruction in case of leakage of hot metal when the furnace body wears or cracks.

The object of the present invention is to provide for efficiently accomplishing these results, and the invention may be most conveniently summarized as comprising the means by which I attain such object.

The invention is hereinafter more fully described in connection with a convenient embodiment of the invention, as shown in the drawings, and the essential features of the invention are set out in the claims.

In the drawings, Figure 1 is a side elevation of a tilting furnace embodying my invention; Fig. 2 is a vertical central section of such furnace; Figs. 3 and 4 are horizontal sections of the furnace taken just above the bath and through the core respectively; Fig. 5 is an enlarged detail illustrating the means for preventing leakage at the junction of the upper and lower parts of the furnace body; Fig. 6 is a vertical section of a furnace having a multiple U-passage, core and primary.

Referring to the parts by numerals, 10 represents the hearth portion of the furnace body which is formed of magnesite or similar material and has a basin to carry the bath 11.

12 is a suitable metal casing around this portion, and 13 an arch or roof therefor.

14 are the loading openings, closed by doors 15, and 16 represents the pouring spout.

The hearth portion described is adapted to rest on a suitable under portion 30 and tilting frame 20, shown in the drawings. As there shown, the frame is pivotally mounted near its front end on brackets 22, while the rear is supported by tilting rods 24 hereinafter described. The frame work 20 carries the lower furnace-body 30, preferably made of magnesite and protected at the sides and below by the metal shells 31 and 32. On this body 30 the hearth body, heretofore described, rests. The hearth body has a metal shell 17 extending under a portion thereof, but the part which comes over the magnesite 30 is of exposed magnesite, so that the two portions of the furnace may have a cemented, tight connection when they are in place.

To provide for heating the bath I form in the magnesite 10 and 30 one or more U-shaped passageways 33, or 33^a in Fig. 6, adapted to contain molten metal forming one or more annular secondaries with a portion of the molten metal in the basin. The lower portion of the U-shaped passageway is carried in the body 30, while the upper portion of the two legs of the U consists of openings 18 and 19 through the bottom of the body 10, or 18 and the common portion 19^a in Fig. 6. These passageways in the respective magnesite portions of the body are so positioned that when the two parts of the furnace are together, as shown in Figs. 2 and 6, there is a continuous U-shaped passageway connecting with the material in the bath.

The core of the induction coil, of which two are shown in Fig. 6, is designated 40. It is a laminated, preferably rectangular, annular device suitably supported with one leg, as 41, between the arms of the U-shaped passageway. The opposite leg 42 of the core may stand entirely outside of the furnace body, as shown in the drawings. This core may be supported, as shown, by brackets 45

secured to the sides of the lower portion of the furnace.

At a suitable point around the core is provided the primary winding. This is shown at 50 around the leg 42 of the core and thus entirely outside of the furnace body, where it will keep cool and be out of danger should the molten metal break through the bottom of the furnace, which sometimes happens. This winding, moreover, is shown as protected from accident from the outside by straps 52 carried by the frame work 20 near the ends of the winding.

The leg 41 of the core is properly ventilated by passing through an enlarged opening 35 in the body 30, and this opening is covered by a metal protecting roof 36 secured to the body portion 10, and the trough-shaped protector 37 secured to the body portion 30.

The two portions of the furnace are clamped together when in use by suitable clamps, some of which are illustrated in the drawings. Thus, in Figs. 1, 2 and 3, 60 indicates ear-brackets secured to the body portion 10, and 61 are bars pivoted to such brackets. These bars are adapted to extend between the ear-brackets 63 secured to the lower portion of the body and be clamped thereto by wedges or keys 64 driven through the ears and bars. This provides for drawing the two sections of the furnace tightly together.

To prevent leakage of the molten material out of the U-shaped passageway at the junction of the upper and lower parts of the furnace, I provide a special construction illustrated in Figs. 2, 6 and 5, which is an important feature of this invention. Such construction consists of rings 71 of magnesite, or similar material, which surround the legs of the passageway and occupy grooves in the meeting faces of the two portions of the furnace body, being embedded in cement therein, and thus interrupt and cut off any passage existing between these faces. These rings are preferably round in course, and their cross section is preferably circular. They occupy correspondingly placed grooves in the material of 10 and 30, the grooves being somewhat larger than half of the ring, so that there is room for cement about the ring.

The cement between the furnace section is illustrated clearly at 73 in Fig. 5, and may be of material similar to the furnace bodies. It extends about both sides of the rings 71 and along the junction of the two body portions 10 and 30. After being so placed, and before the cement has set, the wedges 64 of the clamps described are driven into place, thus drawing the two portions of the furnace body tightly together and making a tight connection around the U legs.

A two-part furnace constructed as described is readily adapted for tilting to pour out the finished material. To that end the frame work 20, heretofore referred to, may conveniently be pivoted at 21 to the standards 22 supporting one side, while the other side may be connected with connecting rods 24, whose pistons 25 occupy stationary cylinders 26. When fluid is admitted to these cylinders by the pipes 27 beneath the pistons, the pistons are raised thereby to tilt the furnace structure about the pivots 21, thus pouring the molten metal out of the tap 16. At the end of the campaign, the material in the U-shaped passageways may be drained therefrom, if desired, by tilting the furnace over farther. This may be done by connecting a suitable hoist with the eye 29.

When it is desired to separate the furnace for purposes of repair, or otherwise, it is simply necessary to drive out the keys 64 and attach a suitable hoist to the upper section of the furnace. For purposes of such attachment, suitable hooks may be secured to the furnace body, as, for example, the hooks 75 shown in Fig. 2.

It will be noted that the leg of the passageway 33 which communicates with the passageway 19 is larger in cross section than the other leg. The purpose of this unequal cross section of the two legs is to cause the material to become hotter in one leg than in the other, whereby the resulting tendency to rise causes a continuous circulation of the material through the legs and a portion of the bath, thereby continuously agitating and circulating the material in the bath. Similarly, in Fig. 6 the common leg 19^a is preferably of different cross sectional area than the sum of the areas across the individual legs.

It will be seen that, in practice, my furnace operates as if it were one solid unitary structure, while, whenever separation of the parts, or access to the induction coil, is desired it may be very easily obtained. To repair the primary winding, for example, or the lower portion of the furnace, it is only necessary to disconnect the clamps and set aside the upper part of the furnace. This provides access to the lower part and enables the core and primary winding to be entirely removed and repaired most conveniently. As the greatest wear comes on the hearth portion of the furnace, it is feasible to have two or more such portions to go with one lower portion, and, as soon as the upper portion is worn, to remove it and substitute a new portion, thus entailing no delay while the hearth portion is being repaired. By having the primary winding entirely outside of the furnace body it is not only perfectly ventilated and keeps cool, but it is protected from damage by any

leakage of the molten material. The possibility of such leakage is further reduced by the ring surrounding the legs of the U-shaped passageway, as heretofore explained.

Having thus described my invention, what I claim is:

1. In a separable two part electric induction furnace, the combination of a body having a basin with openings communicating therewith through the bottom of said body, a base portion having a U-shaped passageway, the legs of which are adapted to communicate with the openings referred to, means for clamping the two portions of the furnace together for use and releasing the two portions for repairs and replacement, and a core and primary winding adapted to cause the material in the passageway and a portion of that in the bath to become an annular secondary.

2. The combination of a separable two-part induction furnace having a conjoint passageway for molten metal, and means for making a non-fusible liquid-tight joint between the two parts of the furnace.

3. The combination of a separable two part furnace having a basin and a U-shaped passageway communicating therewith, the bent portion of the U-shaped passageway being in one member of the furnace, and portions of the legs of the U being in the other part of the furnace, and means surrounding a leg of the U and embedded in the adjoining faces of the two parts of the furnace.

4. In an electric furnace, the combination of an upper portion having openings through the bottom thereof, a lower portion having a U-shaped passageway, the legs of which are adapted to communicate with the openings referred to, and a ring embedded in the adjoining faces of the upper and lower portions of the furnace and surrounding the junction of one of said openings with a leg of the passageway.

5. In an electric furnace, the combination of a hearth portion having a basin and provided with openings through its bottom communicating with the basin, a base portion having a U-shaped passageway, the legs of which are adapted to communicate with the openings refered to, rings embedded in the adjoining faces of the two portions of the furnace around the respective legs of the U, and clamps for drawing the two parts of the furnace snugly together.

6. The combination of a base portion having one or more vertical U-shaped passageways therein, a hearth portion adapted to surmount the base portion and having openings through its bottom adapted to communicate with the legs of said passageway, the openings communicating at their upper ends with a basin in the hearth portion, and rings at the junction of the two portions of the furnace surrounding the conduits provided by the passageways and openings described.

7. The combination of a base portion having one or more vertical U-shaped passageways therein, a hearth portion adapted to surmount the base portion and having openings adapted to communicate with the legs of said passageway, the openings communicating at their upper ends with a basin in the hearth portion, and rings surrounding the conduits provided by the openings and passageway, said rings being embedded in cement occupying grooves in the adjacent top and bottom faces of the base and hearth portions of the furnace respectively.

8. In a furnace, the combination of a base portion having a U-shaped passageway therein arranged in a substantially vertical plane, said base portion consisting of heat resisting material and a suitable frame work, said material being exposed at its upper face, a top portion for the furnace, having a heat resisting body carrying a basin with walls and a roof, openings through the body from the basin adapted to communicate with the legs of the U in the base portion, the under portion of said top part being exposed about the legs so that such top portion may have its heat resisting material come into coaction with the heat resisting material of the base portion, cement between the two portions, and rings located at the junction of the two portions and embedded in grooves therein and extending around the legs of the U-shaped passageway and said openings, combined with a core and primary of an induction coil coacting with material in the basin and U-shaped passageway to make of the same an annular molten secondary.

9. In an electric furnace, the combination, with a basin, of a U-shaped passageway for molten metal located in a vertical plane and communicating with the bottom of the basin, an annular horizontal core lying beneath the basin and surrounding one of the legs of the U, and a primary winding for said core located entirely outside of the furnace body.

10. The combination, with the base portion of a furnace, means arranged to tilt the same, of a surmounting portion, means to clamp it on the base portion, a U-shaped passageway in the base portion, and communicating openings through the bottom of the surmounting portion adapted to continue the legs of the U-shaped passageway into communication with material in the basin, a closed magnetic core extending around one or more of said legs, and a primary winding for said core.

11. In an electric furnace, the combination of a base portion, means adapted to support and tilt the same, a surmounting portion

having a basin, a U-shaped passageway lying partly in the base portion and partly in the surmounting portion, a ring embedded in the two portions and surrounding the legs of such passageway, means for clamping the two portions together, a core surrounding one or more of said legs, and one or more primary windings for said core.

12. In an electric furnace, the combination of a base portion, means adapted to support and tilt the same, a surmounting portion having a basin, a U-shaped passageway lying partly in the base portion and partly in the surmounting portion, a core surrounding a leg of said passageway, a primary winding for said core, said core occupying an opening in the base portion near the top thereof, which opening is exposed when the top portion of the furnace is removed.

13. In an electric furnace, the combination of a base portion, a removable top portion carrying a basin, a U-shaped passageway contained partly in the base portion and partly in the top portion, and a core and primary winding of an induction coil, of which material in the passageway and in the basin may constitute the secondary.

14. In an electric furnace, the combination of a base portion, a removable top portion carrying a basin, a U-shaped passageway contained partly in the base portion and partly in the top portion, rings individually surrounding the legs of the U-shaped passageway at the junction of the top and bottom portions of the furnace, a core and primary winding of an induction coil, of which material in the passageway and in the basin may constitute the secondary, external means for clamping the two portions of the furnace together, and means for supporting and tilting the lower portion of the furnace and with it the upper portion when clamped thereto.

15. In an electric furnace, the combination of a base portion, means for supporting and tilting it, a top portion adapted to rest thereon, means for clamping it to the base portion, said top portion having a basin with a roof, loading openings and a pouring spout, there being a U-shaped passageway communicating with the basin and contained partly in the top portion and partly in the base portion, individual rings surrounding the legs of such passageway and embedded in the two portions where they join, a closed magnetic core lying in a horizontal plane and occupying a recess in the base portion covered by the top portion but exposed when the top portion is removed, and a winding for said core outside of the base portion.

16. The combination of a separable two-part induction furnace having a passageway for molten metal, means for making a liquid tight joint between the two parts of the furnace around said passageway, a core extending around the passageway and occupying a recess in the furnace body which, when the two portions are separated, is uncovered sufficiently to allow the removal of the core intact.

17. The combination in a separable two-part induction furnace of a base portion, a top portion removably mounted thereon, one or more U-shaped passageways in the base portion and extending through the bottom of the top portion to a basin formed in the top portion, means for forming a liquid-tight joint around the legs of the U between the junction of the two portions, a core surrounding the leg of the U and occupying a recess between the two portions of the furnace normally closed above and below but uncovered when the top portion is removed, a primary winding for such core, and clamps for holding the two parts of the furnace together in use.

18. In an electric furnace, the combination of two portions, one surmounting the other, the upper portion having a basin, a U-shaped passageway for molten metal located in a vertical plane in the two portions and communicating with the bottom of the basin, an annular horizontal core lying beneath the basin and surrounding one of the legs of the U and having its inner leg in the recess in the furnace body located at the junction of the portions and uncovered when the top portions are moved, and a primary winding on said core located entirely outside of the furnace body.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

WALTER N. CRAFTS.

Witnesses:
ALBERT H. BATES,
GERTRUDE K. SMITH.