Oct. 7, 1969 W. FADLER 3,471,139

MELTING CRUCIBLE HAVING EXPANDABLE TOP

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FIG. 1

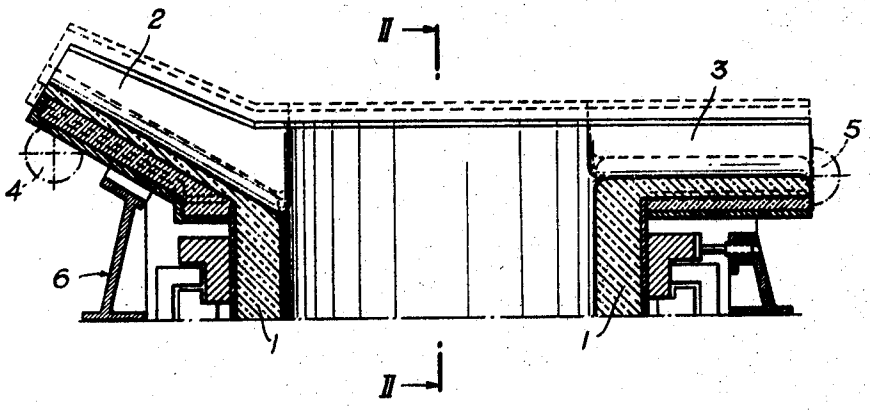

FIG. 2

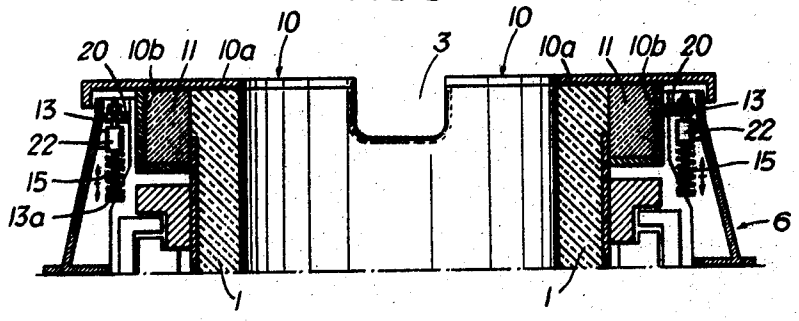

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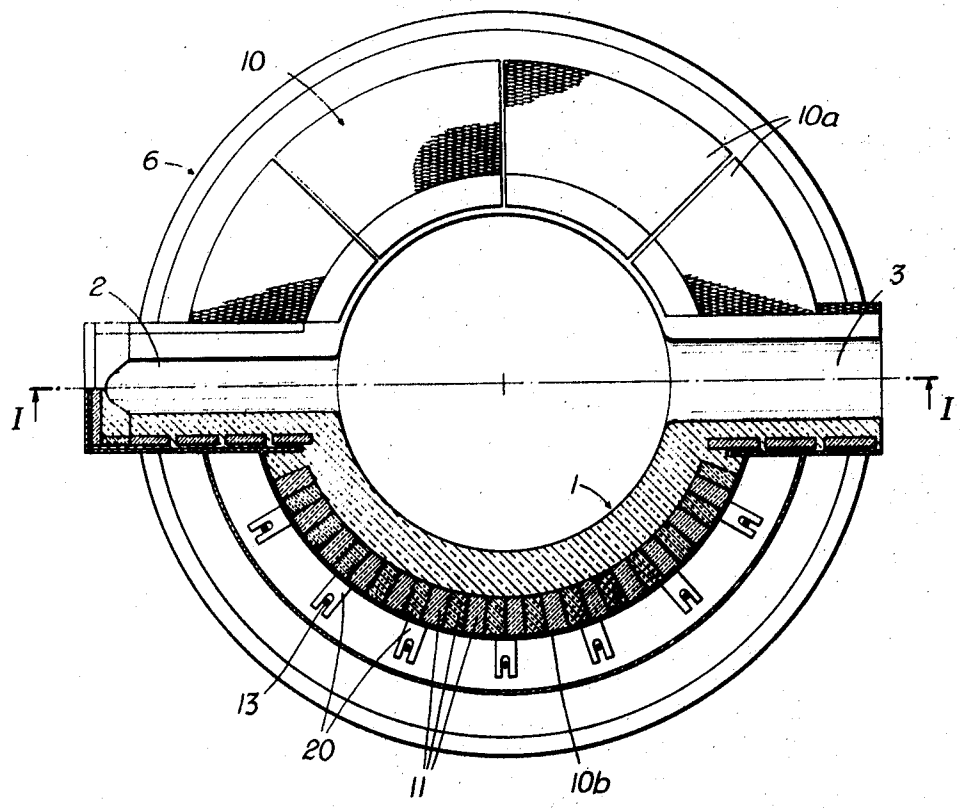
FIG. 3



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United States Patent Office

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MELTING CRUCIBLE HAVING EXPANDABLE TOP

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Int. Cl. F27b *14/06*
U.S. Cl. 226—39 2 Claims

ABSTRACT OF THE DISCLOSURE

The construction of an electric furnace having a crucible which expands under heat stress is disclosed in respect to a single embodiment. The melting crucible includes a pouring lip at one side and a slag trough at an opposite side and it is carried by a furnace frame which includes an upper part or a cover which seals the lower part and which is connected to a lower part in a manner permitting relative movement therebetween to accommodate expansion of the crucible. In the single embodiment indicated, the upper part includes two cover half portions having depending annular pieces which support partial arcuate areas of brickwork and which includes a projecting guide which carries a pin or bolt member which engages in an eyelet secured to the lower part of the furnace frame. The parts are biased together by spring means which engage around the bolt to urge the cover downwardly toward the lower part but to permit upward expansion thereof.

BRIEF SUMMARY OF THE INVENTION

The invention relates, in general, to the construction of metallurgical furnaces and, in particular, to the construction of a melting crucible for an electric furnace which includes a top cover part which is movable in respect to a lower frame part of the furnace.

Melting crucibles of electric furnaces are made from a ramming compound consisting of quartzite. The thermal stresses which result in the operation of such furnaces cause a progressive transformation of the grain structure of the quartzite so that the crucible grows steadily in size. Conventional crucibles are designed so that they expand in a vertical direction so that a gap is formed at the top end of the crucible between the crucible and the frame of the furnace. Such a gap is undesirable, particularly, at the pouring lip and the slag spout because the molten material enters the gaps between the melting crucible and the frame during the pouring operation and during removal of the slag from the bath surface to result in undesirable contamination of the furnace top portion. The amount of expansion of the melting crucible relative to the frame varies with the height of the melting crucible and may be anywhere from 20 to 70 mm. depending on the size of the furnace.

In accordance with the present invention, there is provided a melting crucible furnace construction for a crucible having a pouring lip and a slag spout wherein the top portion, including the cover, is secured to the bottom portion by means which permit relative expansion of these two parts but which also ensures a tight fit of the top portion relative to the bottom portion. The construction is such that no gaps will apppear between the melting crucible frame parts as a result of an expansion of the melting crucible.

In the preferred form of the invention, the frame surrounding the melting crucible advantageously comprises a lower part which is secured to a top part or cover element by a resilient connection which permits relative expansion of these two parts without disturbing the tight enclosure of the upper portion of the melting crucible. The connection includes a bolt member which slides in an eyelet and is resiliently biased in order to maintain the two parts in close engagement.

Accordingly, it is an object of the invention to provide an improved furnace construction which includes a crucible made of a material which has a tendency to expand such as quartzite and which includes a lower frame part and a top frame part or cover which is connected to the lower frame part in a manner ensuring the tight sealing therewith but permitting relative expansion of the two parts.

A further object of the invention is to provide a furnace construction which includes a crucible having a pouring spout and a slag spout mounted in a frame structure which includes a top cover part which is resiliently connected to a bottom part in a manner such that the cover tightly engages with the bottom part but is permitted to move relatively thereto to accommodate for any expansion of these parts or the crucible.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a section taken on the line I—I of FIG. 3 of a melting crucible constructed in accordance with the invention;

FIG. 2 is a section taken on the line II—II of FIG. 1; and

FIG. 3 is a top plan view with a portion thereof indicating the top part removed.

DETAILED DESCRIPTION

Referring to the drawings, in particular the invention as embodied therein comprises a metallurgical induction furnace including a melting crucible generally designated **1** which is made of a material such as quartzite which will expand when subjected to thermal stress under the conditions of furnace operation. The melting crucible **1** is provided with a pouring lip **2** at one end and a slag trough **3** at its opposite end. The crucible is arranged so that it might be pivoted about an axis **4** during the pouring operation and about an axis **5** for removing a slag. For clarity of illustration purposes various stationary parts of the furnace are not shown.

In accordance with the invention, the melting crucible **1** is carried by a frame having a lower part or parts generally designated **6** and an upper part or parts generally designated **10** which is relatively movable in respect to the lower part **6**. As indicated in FIG. 1, during the operation of the furnace, the crucible **1** is likely to expand to the dotted line position indicated in FIG. 1. In order to avoid an occurrence of gaps between the melting crucible and the surrounding frame which includes the upper part **10** and the lower part **6**, the upper part **10** is connected to the lower part through means biasing these two parts together but permitting the expansible movement of the part **10** relative to the lower part **6**.

As shown in the drawings, the upper part generally designated **10** includes two semi-annular cover members **10***a*, **10***a*, which carry arcuate depending flange portions **10***b* providing a chamber for refractory or brick material **11**. Each depending flange **10***b* carries one or more pro-

jecting flanges or brackets **20** which carry headed bolt member **13** which extend through openings therein and through a guiding eyelet **22** carried on the lower part **6**. The bolt member **13** includes a flanged lower portion **13***a* and a compression spring **15** which is confined between the flange portion **13***a* and the eyelet **22** and biases the bolt member **13** together with the flange **10***b* and the cover **10***a* downwardly to ensure a tight enclosing of the crucible around the pouring lip and slag trough.

The connection of the upper part **10** or lower part **6** is such that expansion or upward movement of the upper parts in respect to the lower parts may be easily accomplished. Upon expansion of the melting crucible **1**, the entire top part **10** is upwardly displaced. Because of the springs **15**, the top part also follows any contraction movement of the melting crucible **1** when the crucible is cooling. The guide means which include the bolts **13** and the eyelets **22** prevent any slipping of the top brickwork **11** toward the lip during tilting movement of the crucible and ensure a tight seal around the crucible so that there will be no contamination of the parts around the pouring lip and slag trough.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. An induction furnace comprising a melting crucible of a material which is likely to expand and a framework surrounding said crucible including a lower portion and a top portion, means interconnecting said lower portion and said top portion urging said top portion into sealing engagement over said lower portion and said crucible but permitting expansible movement of said top portion relative to said lower portion including guiding eyelet means on one of said upper and lower portions and a bolt slidable in said eyelet carried by the other of said portions and spring means biasing said bolt in a direction to cause said upper portion to be urged into sealing engagement with said lower portion, having an outwardly extending pouring lip on one side of said crucible, and a slag trough extending outwardly at a substantially diametrically opposite location on the opposite side of said crucible.

2. An induction furnace according to claim **1** wherein said top part includes cover portions on each side of said slag trough and said pouring lip, each of said cover portions having an annular depending flange portion surrounding said crucible, and brickwork disposed between said flange portion and said crucible.

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