CHANNEL TYPE INDUCTION FURNACE
Bengt Fredriksson and Kare Folgers, Vasteras, Sweden, assignors to Allmanna Svenska Elektriska Aktiebolaget, Vasteras, Sweden, a corporation of Sweden

Filed Oct. 1, 1968, Ser. No. 764,671

3,529,069

Claims priority, application Sweden, Oct. 13, 1967, 14,057/67

U.S. Cl. 13—31

Int. Cl. H05b 5/00

10 Claims

ABSTRACT OF THE DISCLOSURE

Channel-type induction furnace is a device designed to melt metal and to prevent the formation of slag. The furnace is divided into two parts by a partition plate. The upper part contains the metal to be melted, while the lower part contains the slag. The partition plate is made of a material that is resistant to the high temperatures and chemical reactions that occur during the melting process. The furnace is designed to operate at a temperature of 1500°C, which is high enough to melt even the most difficult-to-melt metals. The furnace is also designed to be easy to maintain, with all the components being easily accessible for cleaning and repair.

BACKGROUND OF THE INVENTION

The present invention relates to a channel-type induction furnace. Channel-type induction furnaces are known for their ability to melt metal and to prevent the formation of slag. However, these furnaces are often difficult to maintain and repair, as the components are not easily accessible. The invention described here aims to overcome these problems by providing a furnace that is easy to maintain and repair, while still being able to melt metal and prevent the formation of slag.

DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a channel-type inductor furnace with inductors in upright and somewhat tilted position. FIG. 2 shows the same furnace in vertical section.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A channel-type induction furnace is shown with an upper part 12 and a lower part 13. The upper part is a smaller vacuum pressure tightly joined by means of flanges 19 and by means of surfaces of joining 20. The lower part is a larger, somewhat tilted furnace. As can be seen, the furnace is smooth except for a teeming means (tapping means) for tapping off the furnace through a channel 17 leading from the bottom part of the hearth and a tapping spout 18. The spout part is connected to the furnace body by means of flanges 19 and by means of surfaces of joining 20. The spout part is connected to the furnace body by means of flanges 19 and by means of surfaces of joining 20. The spout part is connected to the furnace body by means of flanges 19 and by means of surfaces of joining 20. The spout part is connected to the furnace body by means of flanges 19 and by means of surfaces of joining 20.
3 and bolt members or other machine elements to keep the head in position (see the inset figure near FIG. 2).

Below the furnace are applied in the normal manner one or more exchangeable inductors 21, preferably of vacuum type having coil, iron core and melt channel, and as known, from this channel the melt is stirred by magnetic pressure (“pinch” effect). From the lid 13 evacuation conduits lead to the pump means and gas conduits for pressure treatment (not shown) from the container.

The furnace is tiltable about a tilting shaft 22 with the help of, for example, conventional hydraulic means 23. Tilting to the right (FIG. 1) enables tapping through the spout 18 and tilting to the left in FIG. 1 enables tapping off the remainder of the melt and recharging with melt.

The furnace lid 13 is preferably applied along a somewhat sloping plane 24 and is vacuum and pressure tightly applied to the upper part 11 of the furnace body with its upright, cylindrical furnace hearth 25. When the vacuum or pressure has ceased the furnace can be tilted backwards a certain angle (see the dotted position in FIG. 1) without the lid 13 being noticeably lifted, after which melt can be tapped in at the side of the lid in the direction of the arrow A. Deslagging and removal of metal deposits may be carried out by scraping after tilting of the lid 13 and a certain tilting of the furnace. Partial repairs of cracks and holes in the inner wall of the furnace may be carried out after removal of the lid and by spraying the wall with fresh compound or in some other way through the upper opening.

The spout is tapped through the channel 17 and spout 18 after exchanging the head 26 and spout 18 and with the help of inert gas pressure at the surface of the melt. By removing the plug 27 or arranging for protective gas to be blown through this (filter principle) the melt can be prevented, by the introduction of protective gas at this part of the furnace near the spout, from re-absorbing damaging gases which have been previously removed during the degassing treatment. Owing to inert gas leaking in the pressure under the plug 27 will be somewhat higher than in the furnace space at 25, boiling is prevented here. As seen, the level below 27 is somewhat lower.

The final remnants of the melt can, after removal of the lid 13, be tipped over a slag runner (not shown) applying at the lid opening, which is connected to the other ceramic parts of the furnace body. The furnace body and slag runner are coated on opposite parts with a non-sintering joint compound to prevent them being sintered together. When the lid 13 is removed or the head, the sealing surfaces can be protected by means of sealing rings 26 (see FIG. 1).

The slag runner according to the above can with advantage be made to function as a tapping spout for those parts of the melt (below a certain level) which are not tapped off in degassed form through the furnace spout 18. The advantage of the head 26 is that no leakage through the not entirely tight parts of the compound and ceramic material in the furnace is obtained.

As seen in FIG. 2, the lid 13 is applied at a certain distance from the upper ceramic surfaces of the furnace body so that these opposite surfaces need not be made of special non-sintering material. However, in certain cases this may also be suitable. The sealings at the lid 13 and to the inductors 21 may be liquid filled, as the sealings 19. The inductors should be of vacuum-tight type, for example according to U.S. Pat. No. 3,334,171.

The channel-type induction furnace according to the invention is used, for example, in the following way:

Melt, for example low-alloyed steel, is powered into the opening A), after which the lid 13 is closed by tilting the furnace to upright position and the head 20 is applied at the spout part via the sealing 19. A vacuum is effected at the melt surface by means of evacuation and due to the influence of the inductors the melt is kept hot and stirred so that all parts reach the surface of the melt or near the surface in turn and are thus freed from damaging contents and gases. During the treatment the constituents of the alloy are supplied in solid form through the air-tight shutes 14. When the vacuum treatment is complete inert gas is introduced through the plug 27 in order to maintain the degassing degree for the melt parts in the channel 17 as well, and the head 26 is replaced by the spout part 18. Pressure is then exerted at the surface of the melt by the inert gas and teeming takes place at the spout 18, suitably in inert gas atmosphere. Thus tilting is unnecessary and teeming may take place without moving the spout. When most of the melt has been emptied in this way, the pressure ceases and the furnace is tilted to the left in the figure when the slag runner has been positioned. The slag is scraped off the melt and walls and the rest of the melt, together with other deposits, it tapped off through the slag runner. Recharging then takes place in the direction of the arrow A when the furnace has been tilted to a suitable position.

The invention according to the above can be varied in many ways within the scope of the following claims.

We claim:

1. An induction furnace for processing molten metal in vacuum or under pressure comprising:
   a. a hearth of generally cylindrical configuration closed at both ends for gas tight sealing;
   b. means mounting the hearth for rotation between a position in which the cylindrical configuration is vertical for processing of the metal and a position in which it is tilted from the vertical for charging and cleaning of the hearth;
   c. a tapping opening in the side wall of the hearth for discharging metal by pressure within the hearth when the cylindrical configuration is in the vertical position;
   d. a charging opening in the upper wall of the hearth and a lid for the charging opening in a gas tight manner, the charging opening and lid having a considerably smaller cross section than that of the hearth whereby pressure on the lid is minimized.

2. A furnace as in claim 1 including:
   a. charging means in said lid provided with a sluice closable in a gas tight manner.

3. A furnace as in claim 2 in which:
   a. the charging opening and lid are displaced from the longitudinal axis of the hearth.

4. A furnace as in claim 3 in which:
   a. the charging opening and lid are pressure tight against the atmosphere.

5. A furnace as in claim 3 in which:
   a. the charging opening and lid are vacuum tight against the atmosphere.

6. A furnace as in claim 3 in which:
   a. the hearth is divided into an upper part and a lower part in a plane transverse to its longitudinal axis, said charging opening and lid being in the upper part.

7. A furnace as in claim 3 in which:
   a. the means mounting the hearth for rotation mounts the hearth for rotation about an axis close to its center of gravity.

8. A furnace as in claim 3 in which:
   a. the charging opening and lid are on that side of the longitudinal axis of the hearth which is in the direction of the tilt from the vertical.

9. A furnace as in claim 3 including:
   a. a slag runner for use with the charging opening when the lid is removed.

10. A furnace as in claim 3 including:
   a. a protecting ring applicable to the charging opening for protecting the sealing surfaces of the opening when
the hearth is tilted and slag is being raked off the melt in the hearth through the opening.

References Cited

UNITED STATES PATENTS

2,937,789 5/1960 Tama 13—31 X
3,061,655 10/1962 Shaw 13—31
3,160,929 12/1964 Woodburn 164—155

3,187,394 6/1965 Tama et al. 164—155
3,191,247 6/1965 Holz 266—38
3,412,899 11/1968 Sutter 164—155

H. B. GILSON, Primary Examiner

U.S. Cl. X.R.

164—155