

TILTABLE ELECTRIC ARC FURNACE

This invention relates to electric arc furnaces of the kind having a furnace vessel that is tiltable for the purpose of pouring the melt.

In the prior art, it has been known to provide,
5 at the side of the furnace vessel toward which the vessel tilts on pouring, a pour box, sometimes open-topped, which is effectively outside the furnace proper and communicates with it through a runner of often rather restricted cross-section. Examples of such are described in British Patent
10 Specification No.444 758, German Patent Application No.18 04007 and German Patent Specification No. 2944269. This external pour box arrangement can result in quite costly construction and maintenance, slow pouring, and other disadvantages specific to particular designs. Thus, in
15 the two German Specifications aforesaid the pour box is well above the floor of the furnace proper so as to remain substantially empty when the furnace is in its upright orientation; but that results in the pour box tapping hole being so high that an undesirably large angle of furnace
20 tilt must be achieved in order to pour the melt. In the furnace illustrated in Figure 2 of German Specification No.18 04007, for example, the tilting angle is of the order of 30 to 40°. Furthermore, the fact that the tapping hole is uncovered or only thinly covered by molten metal at the
25 commencement of tilting means that some of the slag from

the surface may be run off with the melt during pouring.

The British Patent, on the other hand, shows an arrangement in which the external pour box is at a lower level and is intended to contain a considerable depth of molten metal when the furnace is upright; but here there is the disadvantage that since the pour box is, for practical purposes, outside the furnace proper the furnace must be run inefficiently at an unnecessarily high temperature just to ensure that enough heat can reach the pour box by conduction to maintain the portion of the charge therein molten.

It is therefore an object of the present invention to provide an improved tilting furnace which is simpler in construction, can be poured at a comparatively small angle of tilt and does not suffer from the other disadvantages discussed above.

According to the present invention, there is provided an electric arc furnace which is tiltable for pouring of the melt, wherein the furnace vessel is constructed with an internal extension bay that projects laterally at the side of the furnace vessel toward which the furnace tilts on pouring, which extension bay is closed externally at all sides including the top and has a taphole in its floor that is closable by means of a closure member which is provided externally of the underside of the extension bay and is operable from outside the furnace, the floor of the extension bay being not significantly above the floor of the remainder of the furnace vessel.

By 'not significantly above' the floor of the
10 remainder of the furnace vessel is meant that the internal
floor of the extension bay is low enough in relation to the
internal floor of the remainder of the furnace vessel to
maintain a good depth of molten metal over the tapping hole
in the upright position of the furnace and to achieve entire
15 pouring of the melt within a maximum furnace tilt angle of
20°. Any difference in the levels of the internal floors of
the extension bay and the remainder of the vessel is preferably
such that no part of the latter floor is below any part of the
former after the vessel has been tilted through 10°, and
20 preferably after a tilt of 7.5° has been reached. The furnace
may be constructed to achieve smaller maximum tilt angles
than were previously necessary, 20° being a maximum
and 12° - 15° frequently being sufficient. By locating the
taphole adjacent the outer boundary of the extension bay,
25 a good depth of melt over the taphole can be assured through-
out pouring.

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A further problem in some prior art furnaces is the construction of the closing mechanism for the taphole. The taphole is often closed by a stopper arranged inside the vessel and actuated using an upwardly directed rod. The stopper and rod are thus directly exposed to the molten metal, resulting in considerable wear both to the stopper and to the rod. Maintenance of these parts is difficult, as both the rod and stopper are situated in the vessel. An alternative is the use of a floating plug as disclosed in published German Patent Application No.2944269, which floats on the melt during pouring.

In the arrangement according to the present invention, the taphole is closed by external means. The closure member is preferably a plate, the plate being pivotable about an axis external of the vessel towards and away from the exit end of the taphole. A filler substance may be provided in the taphole, which substance drops out on pouring. The closure mechanism is therefore well protected from the hot melt; and a cooling system may be provided at the outlet of the taphole to provide additional protection.

Thus, no stopper or stopper rod is required which is immersed in the melt. Wear on the closure plate, which is arranged externally, is reduced, and maintenance is simplified. Particularly, the tapping pipe consisting of refractory material can be exchanged from the outside. Further, in the upper, brick-lined part of the furnace vessel more space is available, so that cooling devices can

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be mounted therein, if desired.

It will be appreciated that by providing the taphole in the floor of an internal extension of the furnace, instead of in a pour box external to the main furnace, the present invention offers a number of important benefits compared to prior art furnaces, by means of relatively simple constructional measures, reducing the required tilting angle of the furnace vessel for pouring and, at the same time, achieving as sharp a separation of the metal from the slag as possible.

In the use of a furnace according to the invention, in the first phase the furnace vessel stands upright. Owing to the small difference in height between the floor of the extension bay of the vessel provided with the taphole and the floor of the remainder of the vessel, a relatively large depth of molten metal is present in the entire vessel, on which floats a layer of slag. The eddies forming in the vicinity of the taphole do not extend upwards through the layer of molten metal to reach the layer of slag.

On pouring therefore, no portions of slag are entrained into the taphole. In the next stage the vessel is tilted so that the relatively large depth of melt also remains over the taphole in this phase.

In the so-called 'swamp method', in which residual melt and slag remain in the furnace during a

subsequent process, the furnace is replaced into the upright position before the end of pouring, and the layer of slag remains behind. The furnace is then charged with material to be melted. In the swamp method it is usual to leave the slag in the furnace through five melting operations. When either or both of the melt and slag are to be discharged, the furnace is tilted in the usual manner toward the taphole.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings wherein:-

Figure 1 is a sectional elevation of an arc furnace vessel embodying the invention; and

Figure 2 shows an enlarged detail from Figure 1 showing the taphole of the furnace vessel and its closure mechanism.

As shown in Figure 1, an electric arc furnace vessel 1 is closed by a cover 13 through which the electrodes 14 pass. The vessel 1 rests on a rocker 7 and can be tilted forward with the aid of an hydraulic cylinder 9 for the pouring of the melt. In so doing the rocker 7 rolls on a plane 8 of the substructure 10. The maximum tilt angle in the embodiment shown is 12° .

A laterally projecting extension bay portion 2 of the vessel is shown at the left hand side of the drawing. In the floor of this lateral bay portion of the

furnace adjacent the outer boundary of the bay portion a taphole 5 is arranged which is closable by means of a hinged sealing plate 6. The sealing plate is mounted to pivot about an axis 6a of its hinge bearing, and is actuated by a drive unit (not shown). The sealing plate 6 and its drive unit are situated on the outer underside of the vessel 1, and the sealing face of the plate 6 is provided with a lining 27 (see Figure 2) of graphite which engages the base of the taphole 5 in the closed position.

10 In the example shown, the melt is to be poured into a ladle 11 which is supported on a ladle carriage 12. The carriage 12 travels beneath the charging floor 15.

Figure 2 shows the taphole 5 in more detail. The aperture in the floor of the vessel providing the tap channel 21 is lined with firebricks 20. The tap channel or tap pipe 21 is filled with a chargeable filler substance 22. During the melting, with the plate 6 closed, the non-sintering filler substance 22 protects the tap pipe 21 from the penetration of the molten metal. On tapping, the sealing plate 6 is swung down away from the taphole 5, the filler substance 22 drops out, and the melt flows into the ladle.

To protect the wall of the projecting bay portion of the vessel, there is provided on the underside of the vessel at the exit of the taphole a graphite liner 23 surrounded by a water-cooling system 25.

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Claims:

1. An electric arc furnace which is tiltable for pouring of the melt, wherein the furnace vessel is constructed with an internal extension bay that projects laterally at the side of the furnace vessel toward which
5 the furnace tilts on pouring, which extension bay is closed externally at all sides including the top and has a taphole in its floor that is closable by means of a closure member which is provided externally at the underside of the extension bay and is operable from outside the furnace, the
10 floor of the extension bay being not significantly above the floor of the remainder of the furnace vessel.
2. An arc furnace according to Claim 1, wherein any difference in the levels of the internal floors of the extension bay and the remainder of the furnace vessel is such that upon
15 tilting of the vessel through 10° there is no part of the latter floor that is below any part of the former.
3. An arc furnace according to Claim 1 or Claim 2, wherein the furnace is tiltable to a maximum angle of 20° .
- 20 4. An arc furnace according to any one of the preceding Claims, wherein the taphole is located adjacent the outer boundary of the extension bay.
5. An arc furnace according to any one of the preceding Claims, including a closure plate for closing the
25 taphole mounted to pivot about an axis external of the



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vessel towards and away from the exit aperture of the tap-hole.

6. An arc furnace according to any one of the preceding Claims, including a filler substance for the
5 taphole, which substance drops out on pouring.

7. An electric arc furnace substantially as described herein with reference to the accompanying drawings.

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