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Marchner

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[54] **TILTING FURNACE**

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[52] **U.S. Cl.** **13/10**

[51] **Int. Cl.** **F27b 14/02**

[58] **Field of Search** 13/10

[56] **References Cited**

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[57] **ABSTRACT**

A tilting furnace has non-tiltable electrodes through its roof. The bottom portion of the furnace has supporting rolls arranged on both sides of a vertical line through the center of gravity of the furnace when the furnace is in upright position, and cradle beams at the sides of the supporting rolls. For deslagging without moving the electrodes, the furnace may be rotated through small angles around a stationary fulcrum near the roof with the supporting rolls rolling on a base. Beyond these small angles, the electrodes are withdrawn and the furnace may move laterally onto the cradle beams to roll further over on the base.

4 Claims, 3 Drawing Figures

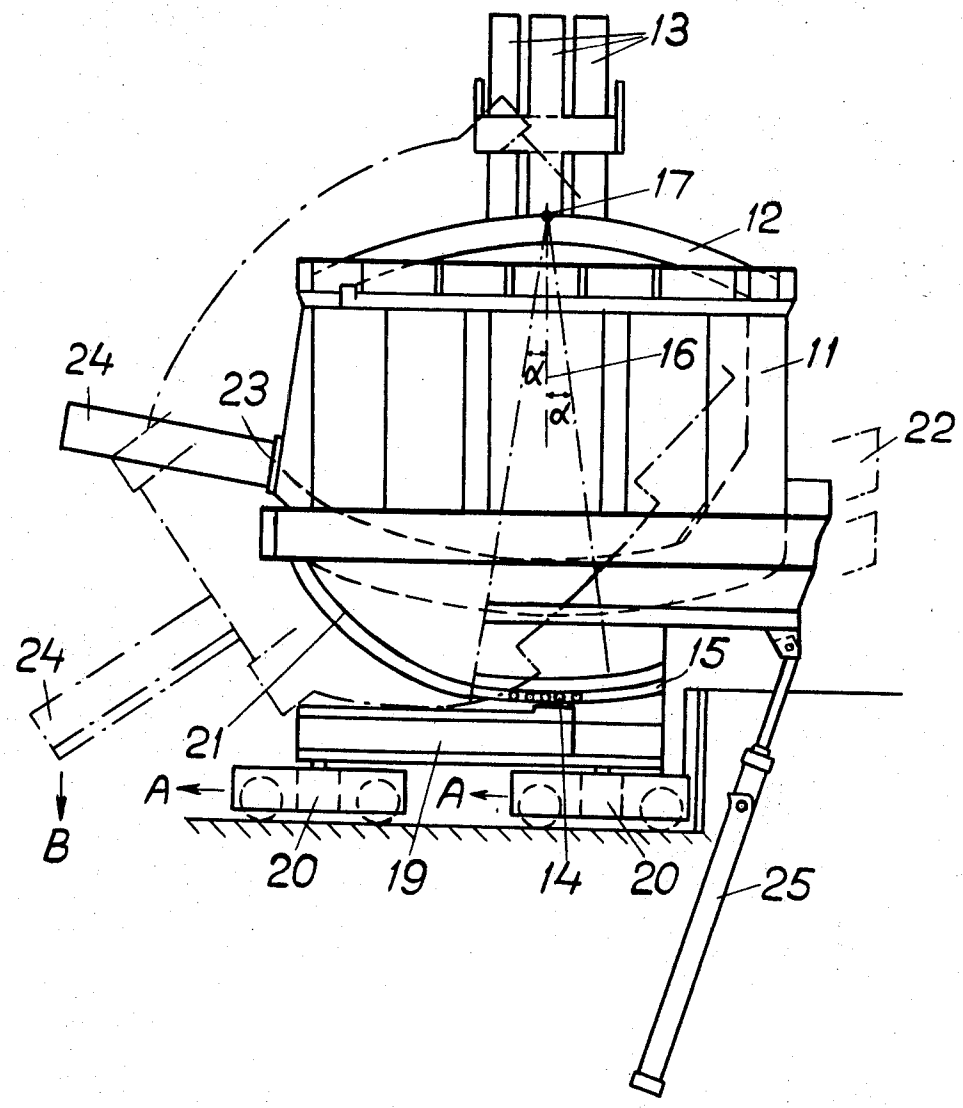


Fig. 1

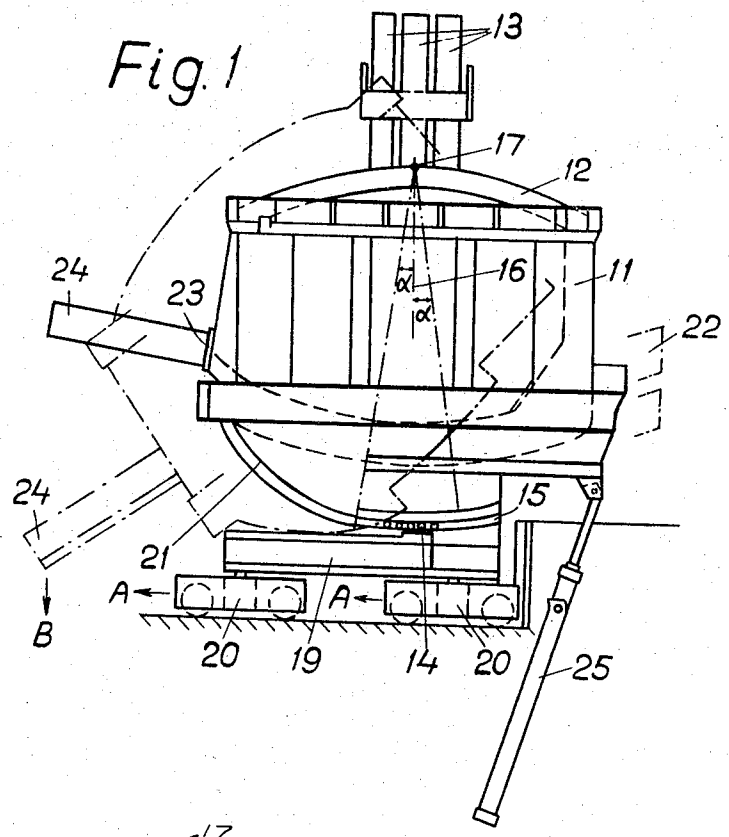


Fig. 3

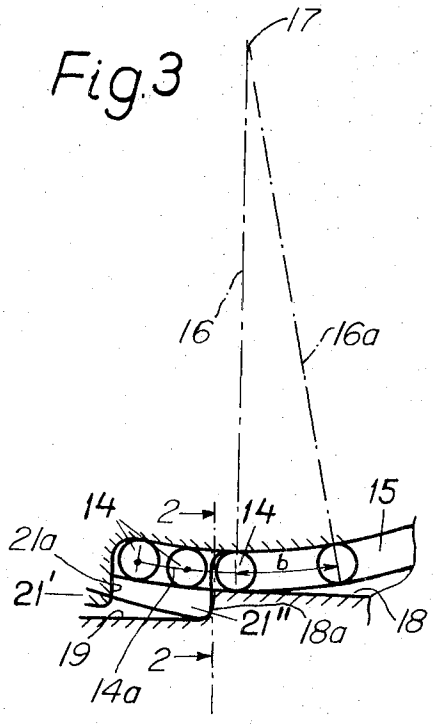
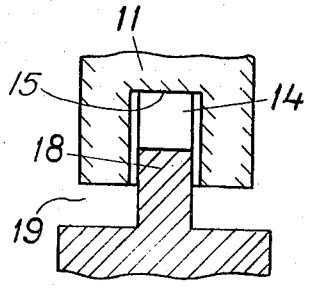


Fig. 2



TILTING FURNACE

BACKGROUND OF THE INVENTION

The present invention relates to a tilting furnace with a vertically adjustable furnace roof and non-tiltable electrodes extending through the roof.

Such furnaces are often constructed with a bottom having two or more arcuate cradle beams, the furnace with its teeming spout being moved laterally by rolling action to a teeming place when the furnace is tilted. This system involves the disadvantage that the electrodes must be lifted out of the roof not only for teeming the melt from the furnace but also when the furnace is insignificantly tilted, for example, to a deslagging postion requiring only slight tilting movements, where the melt surface is at most level with a slag opening or the lower edge of the teeming opening. From a metallurgical point of view it is often necessary to have the heating effect on when the tilting angle of the furnace is small. Also, it is not practical to have to remove the electrodes in connection with such small tilting movements, often below 10°, in relation to the center-of-gravity line when the furnace is in upright position.

There are also tilting furnaces with a bottom portion containing rolls or several sets of rolls, and in this case the tilting can take place round a fulcrum close to the furnace roof, and when the tilting angles are small the electrodes can be maintained in position. A disadvantage of this type of tiltability is that the furnace teeming spout, when in tilting position, will come too close to the base of the furnace, because no lateral movement is involved by the rotation, and where there is often no place for ladles and the like.

SUMMARY OF THE INVENTION

The invention aims at a solution to the above-mentioned problem and is characterized in that the bottom portion of the furnace partly comprises an arcuate series of supporting rolls rolling against a base and arranged along an arcuate track extending from both sides of a vertical line through the centre of gravity of the furnace when in upright position, and partly has arcuate cradle beams beside the track of the supporting rolls, connected at least on one side to said track, the furnace, when exposed to small movements on both sides of the center-of-gravity line when in upright position, being rotated round a stationary pivoting point located close to the furnace roof, after which outside these rotary motions the furnace rolls on the cradle beams against a preferably plane base. In this way, small rotary motions can be made, for example between + and −10° relative to the center-of-gravity line, round a fulcrum near the roof, and this means that the electrodes can be held stationary, for example, during deslagging. When the furnace is further tilted, the electrodes must be drawn from the roof because the furnace moves laterally and rolls on the arcuate cradles.

THE DRAWINGS

The invention is exemplified in the accompanying figures, of which FIG. 1 shows an arc furnace having tilting machinery, FIG. 2 schematically shows a detail of the supporting rolls in cross-section taken on the line 2—2 in FIG. 3, and FIG. 3 is a schematic sketch of the transition between the two types of movements.

PREFERRED EMBODIMENT

An arc furnace is shown in FIG. 1 with a furnace vessel 11 and a roof 12 with vertically adjustable consumable electrodes 13 through the roof. The bottom portion of the vessel is provided with supporting rolls 14 close to and extending on both sides of a line 16 through the center of gravity when the furnace is in upright position, said supporting rolls being arranged in an arcuate track 15 on the vessel's bottom, either in the form of two transversely interspaced sets of separate rolls, one for each supported part of the furnace, or as one set of longer rolls extending transversely along the whole bottom of the vessel. The track for the supporting rolls extends between the rotational angles $\alpha = +10°$ and $\alpha = -10°$ in relation to the center-of-gravity line 16. The rolls 14 are locked by means of a catch (not shown) when the arcuate cradles take over the rolling-off during the continuous tilting.

At least two arcuate cradle beams 21 are arranged on the bottom of the vessel 11 on one or both sides of the track 15 of the supporting rolls 14, and are connected to it, and on said cradle beams the furnace vessel rolls or is rolled when turned above the shown α-values (+ 10°). The electrodes 13 must, however, first be lifted up from the roof because of the lateral movement taking place when the furnace vessel is rolled. During rotation on the arcuate base of supporting rolls, the vessel is turned round a center 17 close to the roof 12, and the electrodes can be held stationary. In other words, the arcuate series of rolls 14 and their arcuate track 15 are concentric with this center 17. The center of turning lies here at the upper edge of the roof, but slight deviations from this can easily be made.

FIG. 2 shows one supporting roll 14 arranged in a U-formed arcuate track 15 in the bottom portion of the furnace vessel 11. The roll 14 is supported against the base 19 along a horizontal rolling track 18 connected to and elevated above the horizontal base 19 onto which the rocker beam 21 rolls for further tilting of the vessel 11. The base 19 can be supported by cars 20 (FIG. 1) so that the vessel 11 can be movable for casting operations (see arrows A in FIG. 1). The rolls and the cradle beams can of course change places.

It is suitable to arrange two or three separate cradle beams 21 under the vessel in connection with the supporting rolls 14 (suitably one set of supporting rolls for each separate cradle beam).

In FIG. 3 is shown how the supporting rolls 14 are moved to the left in the track 15 during turning to the left, for left-hand rotation of the vessel about the center 17, the vessel's bottom swinging in a right-hand direction to adjust the melting level in the furnace for deslagging through a rear slag opening (see at 22), or at the tapping opening 23. The centerline 16 is here at position 16*a*.

The cradle beam is moved from position 21′ to 21″ when the vessel is turned 10° to the left (FIG. 3) with its centerline 16 rotated to position 16*a*. A supporting roll has then moved in each instance the distance *b*, and the rolls are farthest to the left in the channel 15. When the furnace changes to supporting by means of the cradle beam and thus rolling, upon further rotation in a left-hand direction, the beam 21 and the track 15 are arranged in such a way that a small change of level is obtained or a shoulder or nib (not shown) must be passed, and this means a little extra tilting resistance

until the rolling is started. After this the supporting rolls release their hold of the base **19** and are kept in position by means of a catch (not shown).

To explain further, note that in FIG. **3** the rolling track **18** ends with a shoulder **18***a* and the cradle beam **21** ends to form a shoulder **21***a*, and that these shoulders abut when the furnace vertical centerline is rotated to the **16***a* position. When these shoulders are separated the furnace tilting mechanism **25** can only cause rotation of the furnace, swinging the line **16** from **16** to **16***a* position about the point **17.** The lower tip of the shoulder **21***a*, due to the arcuate beam shape, contacts the base **19** only when the two ends abut. When forced to abut by continued thrust on the furnace by the mechanism **25,** the furnace is forced to roll over on its cradle beams, lifting the rolls **14** from their rolling track **18** with the shoulder **21** moving arcuately upwardly. Upon reverse rocking, the two shoulders return together while the rolls **14** return to their rolling track **18,** the furnace thereafter rotating about the center **17** adjacent to the electrodes with the shoulders separating again and the cradle beam **21** and the tip **21***a* of its shoulder, free from the base **19.**

As previously noted, there must be two interspaced cradle beams **21** which the furnace's bottom partly has; in other words, these cradle beams provide stability and extend in the desired rolling direction of the furnace, and terminate near to the furnace's vertical centre line **16.** The cradle beams connect with the arcuate track **15,** both being formed by or connected to the furnace's bottom. The arcuate track **15** extends on both sides of this centerline **16** a distance giving the desired extent of rotation about the center **17.** The rolls may each transversely span the distance between the cradle beams or be two series of short rolls each beside one of the cradle beams. In either instance, the arcuate track or tracks **15** should be designed accordingly.

During tilting (rolling) along the cradle beams **12,** the tapping spout **24** is moved laterally and a suitable tapping position is obtained (larger turning then $\alpha = 10°$). See at arrow B in FIG. **1.**

The supporting rolls can be arranged also in other ways than according to FIG. **2** and can possibly be made so as to extend along the whole base. The number of supporting rolls in this case is five, of which only three are represented in FIG. **3,** but the number may vary between three and upwards, but not less than that. The change from supporting by the rolls to rolling on the cradle takes place at the desired small angle α. α may, for example, be chosen to be between 5° and 20°, here 10° has been preferred. Also 8° is feasible. The tilting machinery **25** can be hydraulic, pneumatic or electrical.

The invention can be varied in many ways within the scope of the below claims. For example, the group of rolls **14** can be held together, as indicated at **14***a*, as in the manner of the rolls of roller bearings in general, and, further, may be suitably retained in the track **15.** These engineering details are easily within the skill of any competent furnace designer.

I claim:

1. A tilting furnace which can be tilted far enough for teeming and having a roof in which non-tiltable electrodes are positioned and tilting means; wherein the improvement comprises means for supporting said furnace for rotation about a center at least adjacent to said electrodes and within a limited range of rotative angularities less than permits teeming, and means for supporting said furnace for bodily rolling over when tilted beyond said range, for teeming.

2. The furnace of claim **1** in which said rotative supporting means comprise a series of rolls and a track therefor which is connected to the furnace's bottom and is arcuately concentric with said center and extends from both sides of the furnace's vertical centerline, and said bodily rolling means comprise cradle beams connected to and extending partly around the furnace's said bottom in the direction the furnace is tilted for teeming, and bases on which said rolls and beams are respectively supported.

3. The furnace of claim **2** in which the base for said rolls is at a higher level than the base for said beams and terminates to form a depending shoulder and the ends of said beams adjacent to the rolls' base shoulder terminate to form an upstanding shoulder, the two shoulders being relatively positioned so that they are free from each other during rotation of said furnace within said rotative angularity range and said beams are free from their base, but abut when said range is exceeded in the furnace's teeming tilting direction by operation of said tilting means so that said furnace is forced to roll over on said beams for bodily rolling, said rolls being free to lift from their base when the beams roll over on their base.

4. The furnace of claim **3** in which said rotative angularity range is from 5° to 20° on at least one side of the furnace's centerline.

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