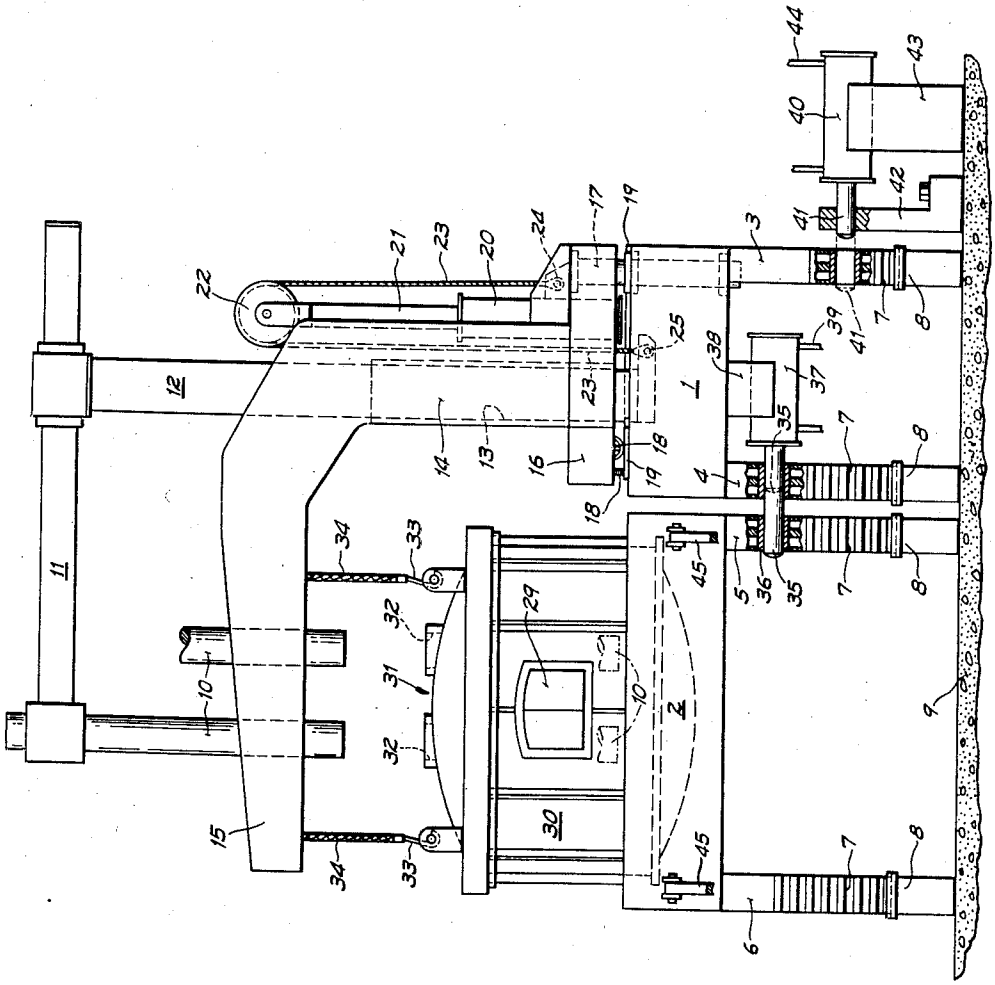
May 12, 1959

W. SORG ET AL

2,886,617

TILTABLE ARC FURNACE

Filed Feb. 4, 1958



INVENTORS.
WILHELM SORG
KARL PFÜTZNER
BY
Ralph G. Hohenfeldt
Attorney

United States Patent Office 2,886,617
Patented May 12, 1959

2,886,617

TILTABLE ARC FURNACE

Wilhelm Sorg and Karl Pfützner, Duisburg, Germany, assignors to Demag-Elektrometallurgie G.m.b.H., Duisburg, Germany, a corporation of Germany

Application February 4, 1958, Serial No. 713,221

Claims priority, application Germany February 4, 1957

4 Claims. (Cl. 13—10)

This invention relates to electric arc furnaces, and more particularly, to furnaces that tilt in one direction, for purpose of pouring a molten charge, and tilt in the opposite direction for facilitating the removal of slag from the charge.

During the operation of an electric arc furnace the electrodes, usually long carbons, become white hot and thereby lose a considerable amount of their resistance to withstand transverse bending forces. As long as the furnace remains upright, no problem arises in this connection because the electrodes are then only subjected to compressive or tensile forces. However, when the furnace tank is tilted for the purpose of pouring a molten charge, the electrodes become inclined to the vertical plane at an angle of 30 degrees or more and they are thereby subjected to transverse bending stresses, largely due to their own weight, that fractures them occasionally. For this reason it is advisable that in large furnaces particularly, the electrodes be withdrawn while pouring a molten charge. This, of course, brings about the loss of some heat through the openings in the furnace cover from which the electrodes have been withdrawn, but usually no special measures are taken to prevent it.

On the other hand, for the purpose of removing slag, the furnace is generally tilted at an angle of approximately only 15 degrees with respect to the vertical plane in a direction opposite from the direction in which it is tilted during pouring a molten charge and it is generally permissible to tilt the furnace through the smaller angle without endangering the electrodes. It is advantageous to be able to remove slag without withdrawing the electrodes from the furnace tank because heat and time are thereby conserved during preparation of a melt.

Accordingly, it is an object of this invention to provide an electric arc furnace construction that offers a choice of permitting the furnace tank to tilt while the electrodes project into it, or in the alternative, permitting the electrodes to be withdrawn and held vertically stationary while the furnace tilts independently of the electrodes.

Another object is to provide an electric arc furnace which is divided into separate rocking platforms that enable selectively anchoring one platform while the other tilts independently and to provide means for interlocking both platforms for tilting together.

A general object is to improve the efficiency of electric arc furnaces by conserving heat and by reducing time wasted by the replacement of electrodes that may be broken during pouring a molten charge.

In accordance with its broad terms, the present invention is characterized by two platforms or cradles which are separate from each other and supported on individual rockers. Upon one platform there are suitable means for supporting the electrodes and regulating them in response to arc conditions inside a furnace tank. On the other platform there is a furnace tank which has the conventional pouring spout on one side and a slag removal door on the opposite side. Means are provided for interlocking both platforms and further anchoring them

against tilting during normal furnace operation. The platform rocking means are so designed that the furnace operator can choose to unlock the platforms while one remains anchored, and after withdrawal of the electrodes, tilt the furnace tank through a large angle for pouring the melt. Another choice is to permit the platform to remain interlocked and to unlock the electrode supporting platform without withdrawing the electrodes from the furnace, so that the whole structure may tilt bodily through a comparatively small angle for removing slag. By this arrangement, power for tilting the furnace platforms need only be applied to the one platform that supports the furnace tank.

A more detailed description of the invention will now be set forth in reference to the drawing, in which the single figure of the drawing is an elevation view, with parts omitted, of an electric arc furnace construction as it appears when viewed along a line transverse to its tilting axis.

In the drawing, the electric furnace installation comprises a pair of adjacent platforms **1** and **2** which are respectively supported on rockers **3**, **4**, and **5**, **6**. The platforms may be of any suitable metallic construction and the rockers may all be the same and in the nature of gear segments that are provided with teeth **7** which mesh with corresponding teeth on appropriate tracks or beams **8** supported on the foundation floor **9**. It should be evident from the drawing that the platforms **1** and **2**, together with the structure they support, are capable of rocking transversely upon an axis parallel with the view and in a direction toward and away from the observer.

The furnace electrodes **10** are indirectly supported on platform **1** by means of an electrode arm **11** and a vertically movable mast **12**. Usually there are three such electrodes and associated masts, the latter of which lie in the same transverse plane so they are obscured in the drawing. The electrode masts **12** are suitably guided along sliding ways **13** provided on the interior of a column **14** which includes integral beams **15** that extend horizontally over platform **2**. Column **14** is fixed on a swinging table **16** which is adapted to pivot on a heavy pin **17** and roll on a set of rollers **18** which bear upon a suitable arcuate track **19** supported on platform **1**.

The electrode masts **12**, and accordingly the electrodes **10**, are adapted to be regulated in a vertical direction by a hydraulic cylinder **20** that is provided with a piston rod **21** which supports a grooved pulley **22**. A cable **23**, attached to swinging table **16** at **24** and to masts **12** at **25**, runs over pulley **22**. It will be evident that fluid pressure variations in cylinder **20**, caused by arc condition responsive means, not shown, will result in raising and lowering of pulley **22** as well as the electrode mast **12**. Because the cable **23** is fixed at one end, any vertical movement of pulley **22** is reflected by twice vertical movement of mast **12**.

A furnace tank **30** of any conventional construction is supported on platform **2**. Tank **30** is provided with a convex refractory cover **31** suitably apertured at **32** for admitting the electrodes **10** into the tank. Cover **31** is engaged by hooks **33** at the ends of short cables **34** that are attached to a cover lifting mechanism, not shown. It is evident that when the electrodes **10** are withdrawn as indicated by their solid line positions in the drawing and the cover **31** is elevated by the cover lifting cables **34**, the cover may swing horizontally while suspended from beams **15** that are carried on swinging table **16**. During normal furnace operation, cover **31** is down on furnace tank **30** as illustrated in the drawing, and the electrodes **10** project into the tank to an approximate position suggested by the broken lines near the bottom of the furnace.

Furnace tank 30 is provided with an access door 29 for removing slag from the molten charge when occasion for that operation arises. On the opposite side of the furnace there is also provided a conventional pouring spout, not visible in the drawing. When slag is to be removed from the furnace tank it is tilted along with platform 2 toward the observer through an angle of approximately 15 degrees with respect to a plane lying parallel with the paper, but when pouring a charge from the spout on the front side of the furnace, the whole construction is tilted 30 degrees or more away from the observer.

As indicated earlier, the invention facilitates slag removal from door 29 without withdrawing electrodes 10 from the furnace. Hence, no heat is lost through electrode openings 32 during slag removal. During this operation, platforms 1 and 2 and electrodes 10 tilt together through the comparatively small angle of approximately 15 degrees. On the other hand, when pouring of a melt is to be carried on, platform 1 is anchored, and platform 2 is released therefrom so that the latter may tilt independently after the electrodes 10 have been withdrawn from the furnace tank 30. At this time, the hooks 33 of cover supporting cables 34 are disengaged from the cover 31.

For carrying on the tilting operations just described, means are provided for selectively interlocking or releasing platforms 1 and 2 with respect to each other and for selectively anchoring platform 1 with respect to a fixed point. For the purpose of interlocking the adjacent platforms, the two inside rockers 45 are provided with a sliding bolt means 35 that is advanceable and retractable between the solid and broken line positions indicated. Each rocker 4 and 5 may be provided with a guide bushing 36 through which bolt means 35 may slide. The bolt means may be actuated longitudinally to a selected position by manual, mechanical, or fluid driven means. In the present case, fluid means are suggested and are seen to comprise a cylinder 37 carried on a bracket 38 that is fixedly attached to platform 1. Suitable flexible tubes 39 are provided for pressurizing or exhausting the cylinder from a remote position as occasion demands. It is immediately evident that when bolt means 35 resides in its solid line position as illustrated, platforms 1 and 2 are locked together as they would be during normal furnace operation or as they would be when the platforms are to be tilted jointly toward the observer. Any number of such bolt means 35, preferably two, may be employed for interlocking the adjacent inside rockers 4 and 5. It is preferable that the bolt means 35 project through the rockers in a region remote from their common tilting axis.

The arrangement for anchoring platform 1 to a fixed point is somewhat similar to the platform interlocking means described in the preceding paragraph. That is, there is provided a fixed fluid cylinder 40 for moving a bolt means 41 along its longitudinal axis for engagement with outside rocker 3 when the bolt projects to its broken line position. Cylinder 40 may be carried on a bracket 43 and it may be provided with fluid tubes 44. It is preferable for bolt means 41 to be further supported and guided by a fixed bracket 42 so that the shear stresses are borne by rocker 3 and bracket 41 rather than cylinder assembly 40. There may be more than one bolt means 41 also.

The arrangement operates as follows during normal furnace operation. Bolt means 35 is advanced to its solid line position so that it extends through both inside rockers 4, 5 thus, interlocking platforms 1 and 2. At this time, electrodes 10 project into the furnace tank to the approximate position indicated by their broken line positions. At the same time, the other bolt means 41 is also advanced into outside rocker 3 so the entire structure is locked to a fixed point.

When it is desired to tilt the furnace backwardly toward the observer for slag removal through door 29, bolt 35 is allowed to remain interlocked with inside rockers 4 and 5 as suggested in the last paragraph, and bolt 41 is retracted from outside rocker 3 so that the platforms 1 and 2 can tilt as a unit along with the furnace tank and the electrode supporting structure.

When it is desired to pour a charge by tilting the furnace tank 30 away from the observer through an angle of around 30 degrees, electrodes 10 are withdrawn to their solid line positions as indicated in the drawing, and bolt means 35 are retracted from inside rocker 5 only. At the same time, cover hooks 33 are detached from cover 31. In order that the electrode supporting platform 1 remain stabilized, bolt 41 should be advanced for engagement with outside rocker 3. Furnace tank 30 may then be inclined any desired amount while electrodes 10 remain in a perfectly vertical position without being subjected to dangerous bending stresses.

Force is applied only to platform 2 for the purpose of tilting either or both platforms. This is achieved by any suitable means capable of exerting an axial stress on bars 45 which are pivotally attached to platform 2. Typically, the furnace is tilted by hydraulic cylinders and pistons or by rack and pinion means which are so well known that showing them is not necessary.

We claim:

1. An arc furnace comprising first and second platform means, electrode means carried on the first platform means, a furnace tank mounted on the second platform means for cooperating with the electrode means, rocker means arranged in parallelism with each other and supporting the platform means individually for tilting transversely to the axis of the rocker means, a fixed locking means selectively engageable and disengageable with said first platform means, and another locking means for selectively locking and unlocking said first and second platform means with respect to each other, whereby said second platform means may be locked or unlocked for tilting jointly with or independently of the first platform means, respectively.

2. The invention according to claim 1 wherein each of said locking means comprise bolt means that are longitudinally movable for mutually engaging the first and second platform means and separately engaging said first platform means, respectively.

3. An arc furnace comprising adjacent platforms, outside and inside rockers supporting each platform for tilting in a direction transverse to the rocker axis, electrode means including elongate electrodes carried on one of said platforms, a furnace tank in respect to which said electrodes may be admitted and withdrawn, bolt means slidably supported from one platform for longitudinal movement to engage and disengage adjacent inside rockers to thereby lock and unlock said platforms with respect to each other, a fixed member, another bolt means slidably supported from said fixed member for engagement and disengagement with one outside rocker, whereby the furnace tank platform may tilt independently when said electrodes are withdrawn and the inside rockers are unlocked while the one outside rocker is locked, and whereby the platforms may tilt jointly when the inside rockers are locked and the outside rocker is unlocked.

4. The invention according to claim 3 including actuating means operatively coupled with said bolt means for advancing and retracting the bolt means

References Cited in the file of this patent

UNITED STATES PATENTS

1,254,308	Buhl	Jan. 22, 1918
1,325,539	Snyder	Dec. 23, 1919
1,552,142	Gray	Sept. 1, 1925
2,236,329	Bryan	Mar. 25, 1941
2,528,571	Babcock et al.	Nov. 7, 1950