



(11)

EP 3 438 590 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
06.02.2019 Bulletin 2019/06

(51) Int Cl.:
F27D 3/18 (2006.01)

(21) Application number: **17773006.6**

(86) International application number:
PCT/CN2017/075502

(22) Date of filing: **02.03.2017**

(87) International publication number:
WO 2017/166975 (05.10.2017 Gazette 2017/40)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(30) Priority: **01.04.2016 CN 201610203843**
01.04.2016 CN 201620270953 U

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(54) **BLOWTORCH FOR USE IN LATERAL BLOWING OF SUBMERGED BURNING MOLTEN POOL METALLURGICAL FURNACE AND METALLURGICAL FURNACE HAVING BLOWTORCH**

(57) A lance (100) for a side-submerged combustion smelting metallurgical furnace and a metallurgical furnace (1000) having the lance. The lance (100) includes: an outer injection pipe (10), the outer injection pipe (10) internally defining a combustion-supporting gas inlet (11), a combustion-supporting gas outlet (12), and an insertion port (13); an insertion self-locking member (20) having a self-locking and closing function, the insertion self-locking member (20) being mounted at the insertion port (13) of the outer injection pipe; an inner injection pipe (30), the inner injection pipe (30) having a medium inlet (31), a medium injection port (32), and a medium clearing port (33), the inner injection pipe (30) being detachably inserted into the insertion self-locking member (20), an end of the inner injection pipe (30) provided with the medium injection port (32) extending into the outer injection

pipe (10) via the insertion port (13), and the insertion self-locking member (20) being self-locked and closed to block off the insertion port (13) when the inner injection pipe (30) is disengaged from the insertion self-locking member (20); and a blocking member (40), the blocking member (40) being mounted to the inner injection pipe (30) to open or close the medium clearing port (33). The lance not only facilitates clearing of pulverized coal clogging the inner injection pipe (30), thus allowing the inner injection pipe (30) to be unclogged in time, but also obviates the need to lower a liquid level of a molten bath when the inner injection pipe is detached for maintenance, thereby effectively ensuring normal operation of the metallurgical furnace and increasing yield.

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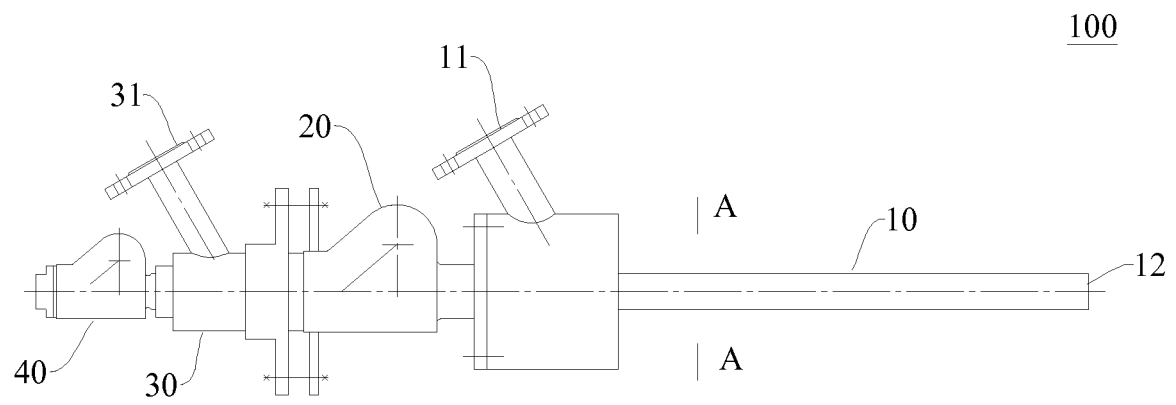


Fig. 1

Description

FIELD

[0001] The present application relates to a technical field of metallurgy, more particularly to a lance for a side-submerged combustion smelting metallurgical furnace, and a metallurgical furnace having the lance.

BACKGROUND

[0002] In the related art, a submerged side-blowing molten bath smelting process is widely used in lead smelting, high lead slag reduction, regenerative lead smelting, slag fuming, and copper smelting. The submerged side-blowing molten bath smelting process is to inject air, oxygen-enriched air and fuel into the molten bath through a tuyere or a lance on both sides of a furnace body, and the injected gas stirs the molten bath to accelerate heat transfer and chemical reaction in the molten bath. For molten bath smelting of exothermic materials, it is only necessary to feed air or oxygen-enriched air from a side-blowing tuyere; for molten bath smelting of non-exothermic materials, oxygen-enriched air and fuel are supplied by the lance for the side-submerged combustion smelting metallurgical furnace, in order to achieve submerged combustion, and the released heat is directly absorbed by the melt, the heating speed is fast, the heat utilization rate is high, and a molten bath temperature can be quickly and effectively adjusted.

[0003] At present, a side-blowing furnace that uses the lance for the side-submerged combustion smelting metallurgical furnace to feed fuel into the molten bath for submerged combustion has the following defects.

1. When the lance for the side-submerged combustion smelting metallurgical furnace is replaced, it is necessary to interrupt the operation and lower a liquid level in the molten bath to below the lance; after the replacement is completed, the liquid level in the molten bath needs to be raised to a predetermined height. Thus, the production efficiency is reduced.
2. The fuel supplied by the existing high-pressure lance for the side-submerged combustion smelting metallurgical furnace is natural gas, producer gas, coke oven gas, etc. When the existing lance is used to transport pulverized coal, it is easy to cause a pulverized coal channel in the lance to be clogged. In such a case, the lance for the side-submerged combustion smelting metallurgical furnace needs to be pulled out to unclog the pulverized coal channel, which is not convenient for maintenance.
3. The pressure of the lance for transporting the pulverized coal in the side-submerged combustion smelting metallurgical furnace is relatively low, resulting in a poor cooling effect of the lance per se, which not only reduces the service life of the lance for the side-submerged combustion smelting metal-

lurgical furnace, but also makes scouring of a side wall of the furnace body more severe, so that the side wall of the furnace body is seriously burnt.

SUMMARY

[0004] The present disclosure aims to solve at least one of technical problems in the related art to a certain extent. Accordingly, the present disclosure provides a lance for a side-submerged combustion smelting metallurgical furnace. The lance can facilitate in-time unclogging of an inner injection pipe, obviate the need to lower a liquid level of the molten bath during the detachment of the inner injection pipe, and ensure normal operation of the metallurgical furnace.

[0005] The present disclosure further provides a metallurgical furnace having the lance.

[0006] The lance according to embodiments of a first aspect of the present disclosure includes: an outer injection pipe internally defining a combustion-supporting gas inlet, a combustion-supporting gas outlet, and an insertion port; an insertion self-locking member having a self-locking and closing function, and mounted at the insertion port of the outer injection pipe; an inner injection pipe having a medium inlet, a medium injection port, and a medium clearing port, and detachably inserted into the insertion self-locking member, in which an end of the inner injection pipe provided with the medium injection port extends into the outer injection pipe through the insertion port, and when the inner injection pipe is disengaged from the insertion self-locking member, the insertion self-locking member is self-locked and closed to block off the insertion port; and a blocking member mounted to the inner injection pipe to open or close the medium clearing port.

[0007] The lance according to embodiments of the first aspect of the present disclosure not only facilitates clearing of pulverized coal clogging the inner injection pipe, thus allowing the inner injection pipe to be unclogged in time, but also obviates the need to lower the liquid level of the molten bath when the inner injection pipe is detached for maintenance, thereby effectively ensuring normal operation of the metallurgical furnace and increasing yield.

[0008] Optionally, the insertion self-locking member has a first end detachably connected with the inner injection pipe by means of a flange, and a second end welded with the outer injection pipe.

[0009] Optionally, the insertion self-locking member includes: a first body internally defining a connecting channel, through which the inner injection pipe passes and is communicated with the insertion port; and a first self-locking member provided within the first body and movable between a closed position where the connecting channel is closed and an open position where the connecting channel is open.

[0010] Optionally, the first body further defines a sliding slot communicated with the connecting channel; when

the inner injection pipe is inserted into the connecting channel, the first self-locking member is pushed into the sliding slot by the inner injection pipe; when the inner injection pipe is disengaged from the connecting channel, the first self-locking member falls into the connecting channel by gravity.

[0011] Optionally, a lower end of the sliding slot is communicated with the connecting channel, and a length direction of the sliding slot is inclined with respect to a length direction of the connecting channel.

[0012] Optionally, the sliding slot extends obliquely from bottom to top towards the outer injection pipe.

[0013] Optionally, the first self-locking member is a ball.

[0014] Optionally, the blocking member includes: a second body internally defining an unclogging channel communicated with the medium clearing port; a second self-locking member provided within the second body and movable between a closed position where the unclogging channel is closed and an open position where the unclogging channel is open; and a plug, configured to stop the second self-locking member from coming out of the second body, detachably mounted to the second body, and provided with an unclogging port in communication with the unclogging channel.

[0015] Optionally, the second body further defines a guide slot communicated with the unclogging channel, the guide slot has a lower end communicated with the unclogging channel, and the guide slot extends obliquely from bottom to top towards the outer injection pipe with respect to a length direction of the connecting channel.

[0016] The metallurgical furnace according to embodiments of a second aspect of the present disclosure includes the above lance for the side-submerged combustion smelting metallurgical furnace.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a schematic view of a lance for a side-submerged combustion smelting metallurgical furnace according to an embodiment of the present disclosure.

Fig. 2 is a sectional view taken along line A-A in Fig. 1.

Fig. 3 is a sectional view of a lance for a side-submerged combustion smelting metallurgical furnace according to an embodiment of the present disclosure.

Fig. 4 is a schematic view of a metallurgical furnace according to an embodiment of the present disclosure.

Reference numerals:

[0018]

lance 100, furnace body 200, metallurgical furnace

1000, combustion-supporting gas supply device 2000, medium supply device 3000,

outer injection pipe 10, combustion-supporting gas inlet 11, combustion-supporting gas outlet 12, insertion port 13,

insertion self-locking member 20, first body 21, connecting channel 211, sliding slot 212, first self-locking member 22,

inner injection pipe 30, medium inlet 31, medium injection port 32, medium clearing port 33,

blocking member 40, second body 41, unclogging channel 411, guide slot 412, second self-locking member 42, plug 43, unclogging port 431.

DETAILED DESCRIPTION

[0019] Embodiments of the present disclosure will be described in detail below, and examples of the embodiments are shown in accompanying drawings. The same or similar elements and the elements having same or similar functions are denoted by like reference numerals throughout the descriptions. The embodiments described herein with reference to the drawings are illustrative, and used to generally understand the present disclosure. The embodiments shall not be construed to limit the present disclosure.

[0020] A washing assembly according to embodiments of the present disclosure will be described below with reference to Figs. 1 to 4.

[0021] A lance 100 for a side-submerged combustion smelting metallurgical furnace according to embodiments of the present disclosure, and a metallurgical furnace 1000 having the lance will be described below with reference to Figs. 1 to 4.

[0022] As illustrated in Fig. 1, the lance 100 according to embodiments of a first aspect of the present disclosure includes an outer injection pipe 10, an insertion self-locking member 20, an inner injection pipe 30, and a blocking member 40.

[0023] The outer injection pipe 10 internally has a combustion-supporting gas inlet 11, a combustion-supporting gas outlet 12, and an insertion port 13. The insertion self-locking member has a self-locking and closing function, and the insertion self-locking member 20 is mounted at the insertion port 13 of the outer injection pipe 10. The inner injection pipe 30 has a medium inlet 31, a medium injection port 32, and a medium clearing port 33. The inner injection pipe 30 is detachably inserted into the insertion self-locking member 20, and an end of the inner injection pipe 30 provided with the medium injection port 32 extends into the outer injection pipe 10 through the insertion port 13 (see Fig. 2).

[0024] When the inner injection pipe 30 is disengaged from the insertion self-locking member 20, the insertion self-locking member 20 is self-locked and closed to block off the insertion port 13. The blocking member 40 is mounted to the inner injection pipe 30 to open or close the medium clearing port 33.

[0025] During normal operation, the insertion port 13 for the insertion self-locking member 20 is in an open state, and the medium clearing port 33 for the blocking member 40 is in a closed state. A combustion-supporting gas (e.g. oxygen-enriched air) enters the outer injection pipe 10 from the combustion-supporting gas inlet 11 of the outer injection pipe 10, flows in a gap between the outer injection pipe 10 and the inner injection pipe 30, and finally is discharged via the combustion-supporting gas outlet 12. Pulverized coal and boosting wind enters the inner injection pipe 30 via the medium inlet 31, and the pulverized coal flows in the inner injection pipe 30 under the action of the boosting wind and is finally ejected through the medium injection port 32.

[0026] When the inner injection pipe 30 is clogged and needs to be unclogged, an unclogging tool (such as a drill rod) is inserted from the blocking member 40 to open the medium clearing port 33, and an operator does not need to pull the lance 100 out from a furnace body 200 of the metallurgical furnace 1000. The inner injection pipe 30 can be quickly unclogged to ensure smooth delivery of the pulverized coal, without affecting the normal operation of the metallurgical furnace.

[0027] When the inner injection pipe 30 is worn or damaged and needs to be detached and replaced, the inner injection pipe 30 and the blocking member 40 are integrally removed from the insertion self-locking member 20, and pulled out from the outer injection pipe 10 and the insertion self-locking member 20, the insertion self-locking member 20 is self-locked and closed, and a connecting channel 211 of the insertion self-locking member 20 is blocked to effectively prevent loss of the combustion-supporting gas in the outer injection pipe 10. Meanwhile, the combustion-supporting gas continues to be supplied at the combustion-supporting gas inlet 11, with an increased volume of the combustion-supporting gas, in which case the combustion-supporting gas flows through the entire interior of outer injection pipe 10, a flow space becomes large, and the increased volume of the combustion-supporting gas is able to keep the combustion-supporting gas ejected at a stable speed, thereby effectively preventing the outer injection pipe 10 from being clogged due to a backflow of liquid in a molten bath. During the replacement, the inner injection pipe 30 is inserted into the insertion self-locking member 20 and the outer injection pipe 10, and the inner injection pipe 30 opens the self-locking device and extends into the outer injection pipe 10, in which case the volume of the combustion-supporting gas is reduced, and the supply of the medium (the pulverized coal and the boosting wind) is restored, and the lance returns to a normal operation state. Hence, during the replacement of the inner injection pipe 30, there is no need to stop operation of the metallurgical furnace, and reduce a liquid level of the molten bath.

[0028] In conclusion, the lance 100 according to embodiments of the present disclosure is not only convenient to clear the pulverized coal clogging the inner injection

pipe 30 so as to unclog the inner injection pipe 30 in time, but also enables the inner injection pipe 30 to be independently disassembled and replaced with no need to lower the liquid level of the molten bath, thereby effectively ensuring the normal operation of the metallurgical furnace and increasing yield. In addition, the combustion-supporting gas within the outer injection pipe 10 can cool the inner injection pipe 30 and the like to a certain extent because of its relatively fast flow speed while playing a combustion-supporting role, which not only improves the service life of the lance, but also reduces burning damage of a furnace wall of the metallurgical furnace.

[0029] In some embodiments, referring to Fig. 1, a first end of the insertion self-locking member 20 is detachably connected with a second end of the inner injection pipe 30 by means of a flange, and a second end of the insertion self-locking member 20 is welded with the outer injection pipe 10. A first end of the inner injection pipe 30 is screwed to the blocking member 40 with an elastic gasket therebetween.

[0030] In some embodiments, as illustrated in Fig. 3, the insertion self-locking member 20 includes a first body 21 and a first self-locking member 22. The first body 21 internally defines the connecting channel 211, for the inner injection pipe 30 to pass through and communicated with the insertion port 13. The first self-locking member 22 is provided in the first body 21 and movable between a closed position where the connecting channel 211 is closed and an open position where the connecting channel 211 is open. Thus, when the inner injection pipe 30 extends into the insertion port 13 and passes through the connecting channel 211, the first self-locking member 22 is in the open position to ensure the normal operation of the inner injection pipe 30 and the outer injection pipe 10; when the inner injection pipe 30 is disengaged from the connecting channel 211, the first self-locking member 22 is in the closed position to avoid the loss of the combustion-supporting gas in the outer injection pipe 10.

[0031] Further, the first body 21 also defines a sliding slot 212 communicated with the connecting channel 211. When the inner injection pipe 30 is inserted into the connecting channel 211, the first self-locking member 22 is pushed into the sliding slot 212 by the inner injection pipe 30; when the inner injection pipe 30 is disengaged from the connecting channel 211, the first self-locking member 22 falls into the connecting channel 211 by gravity. Thus, the first self-locking member 22 can be moved and switched between the open position and the closed position, and without external assistance, the first self-locking member 22 can realize the self-locking of the insertion self-locking member 20 by gravity. Additionally, the structure of the insertion self-locking member 20 is simple and compact with relatively low cost.

[0032] According to some embodiments, as illustrated in Fig. 3, a lower end of the sliding slot 212 is communicated with the connecting channel 211, and a length direction of the sliding slot 212 is inclined with respect to a length direction of the connecting channel 211. It should

be noted that "the lower end of the sliding slot 212 being communicated with the connecting channel 211" means that the sliding slot 212 is always above the connecting channel 211 when the lance 100 is applied to the metallurgical furnace 1000. Hence, it is possible to ensure that the first self-locking member 22 can fall into the connecting channel 211 by gravity and block the connecting channel 211 when the outer injection pipe 10 is fixed and the inner injection pipe 30 is pulled out.

[0033] Optionally, the sliding slot 212 extends obliquely towards the outer injection pipe 10 from bottom to top. Thus, when the inner injection pipe 30 is inserted, the first self-locking member 22 can be pushed into the sliding slot 212 more smoothly, and the jamming of the first self-locking member 22 when moving from the closed position to the open position is avoided.

[0034] In a specific embodiment, the first self-locking member 22 is a ball. Specifically, a cross section of the sliding slot 212 and a cross section of the connecting channel 211 are both circular, a diameter of the ball is consistent with a diameter of the sliding slot 212, and the diameter of the ball is larger than the diameter of the connecting channel 211. Thus, the movement of the first self-locking member 22 between the closed position and the open position is smoother, and the reliability of the insertion self-locking member 20 is enhanced.

[0035] According to some other embodiments of the present disclosure, as illustrated in Fig. 3, the blocking member 40 includes a second body 41, a second self-locking member 42 and a plug 43.

[0036] The second body 41 internally defines an unclogging channel 411 communicated with the medium clearing port 33, and the second self-locking member 42 is provided within the second body 41 and movable between a closed position where the unclogging channel 411 is closed and an open position where the unclogging channel 411 is open. The plug 43 is used to stop the second self-locking member 42 from coming out of the second body 41, and the plug 43 is detachably mounted to the second body 41 and provided with an unclogging port 431 in communication with the unclogging channel 411.

[0037] Thus, when the inner injection pipe 30 is clogged, the unclogging tool is inserted from the unclogging port 431 in the plug 43, pushes the second self-locking member 42 and enables the second self-locking member 42 to move from the closed position to the open position, and can be smoothly inserted into the inner injection pipe 30 to unclog the inner injection pipe 30. In addition, in a severe clogging situation, the blocking member 40 can be directly removed from the second body, which further improves the convenience of maintenance.

[0038] Further, as illustrated in Fig. 3, the second body 41 further defines a guide slot 412 communicated with the unclogging channel 411. The guide slot 412 has a lower end communicated with the unclogging channel 411, and extends obliquely from bottom to top towards

the outer injection pipe 10 with respect to the length direction of the connecting channel 211. Thus, the unclogging tool can push the second self-locking member 42 into the guide slot 412 more smoothly, and avoid jamming when the second self-locking member 42 is moved from the closed position to the open position.

[0039] The metallurgical furnace 1000 according to embodiments of a second aspect of the present disclosure includes the above lance 100 according to the above embodiments. As illustrated in Fig. 4, specifically, the furnace body 200 of the metallurgical furnace 1000 is provided with a lance insertion port, through which the lance is inserted into the metallurgical furnace. During operation, the inner injection pipe 30 and the outer injection pipe 10 of the lance are both submerged in the molten bath of the furnace body to respectively inject the pulverized coal and the combustion-supporting gas into the molten bath. In the actual production, the combustion-supporting gas is fed to the combustion-supporting gas inlet 11 of the outer injection pipe 10 by means of a combustion-supporting gas supply device 3000, and the pulverized coal and the boosting wind are introduced into the medium inlet 31 of the inner injection pipe 30 by means of a medium supply device 2000.

[0040] By utilizing the lance of the above embodiments, when the pulverized coal injection causes friction wear to the inner injection pipe 30, and the inner injection pipe 30 needs to be repaired and replaced, it is not necessary to lower the liquid level in the molten bath to expose the lance to the outside of the molten bath (i.e. no need to interrupt the production). Rather, the liquid level in the molten bath remains unchanged, and the inner injection pipe 30 is directly removed from the insertion self-locking member 20 and pulled out from the outer injection pipe 10 and the insertion self-locking member 20. Meanwhile, the volume of the combustion-supporting gas into the outer injection pipe 10 is increased, which can maintain the operation of the metallurgical furnace. Afterwards, the inner injection pipe 30 is rapidly replaced and the volume of the combustion-supporting gas is restored to normal, such that the normal operation of the metallurgical furnace can be achieved.

[0041] Therefore, when the inner injection pipe 30 is replaced, the two processes - lowering the liquid level in the molten bath before replacement and raising the liquid level in the molten bath after replacement - are not required, thereby greatly improving the operating rate and yield of the metallurgical furnace.

[0042] In the specification, it is to be understood that terms such as "central," "longitudinal," "transverse," "length," "width," "thickness," "upper," "lower," "front," "rear," "left," "right," "vertical," "horizontal," "top," "bottom," "inner," "outer," "clockwise," "counterclockwise," "axial," "radial," and "circumferential" should be construed to refer to the orientation as then described or as shown in the drawings under discussion. These relative terms are for convenience and ease of description, and do not require that the present disclosure have a partic-

ular orientation or be constructed or operated in a particular orientation. Thus, these terms should not be construed to limit the present disclosure.

[0043] In addition, terms such as "first" and "second" are used herein for purposes of description and are not intended to indicate or imply relative importance or significance or to imply the number of indicated technical features. Thus, the feature defined with "first" and "second" may comprise one or more of this feature. In the description of the present disclosure, the term "a plurality of" means two or more than two, unless specified otherwise.

[0044] In the present disclosure, unless specified or limited otherwise, the terms "mounted," "connected," "coupled," "fixed" and the like are used broadly, and may be, for example, fixed connections, detachable connections, or integral connections; may also be mechanical or electrical connections; may also be direct connections or indirect connections via intervening structures; may also be inner communications of two elements, which can be understood by those skilled in the art according to specific situations.

[0045] In the present disclosure, unless specified or limited otherwise, a structure in which a first feature is "on" or "below" a second feature may include an embodiment in which the first feature is in direct contact with the second feature, and may also include an embodiment in which the first feature and the second feature are not in direct contact with each other, but are contacted via an additional feature formed therebetween. Furthermore, a first feature "on," "above," or "on top of" a second feature may include an embodiment in which the first feature is right or obliquely "on," "above," or "on top of" the second feature, or just means that the first feature is at a height higher than that of the second feature; while a first feature "below," "under," or "on bottom of" a second feature may include an embodiment in which the first feature is right or obliquely "below," "under," or "on bottom of" the second feature, or just means that the first feature is at a height lower than that of the second feature.

[0046] Reference throughout this specification to "an embodiment," "some embodiments," "an example," "a specific example," or "some examples," means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the present disclosure. Thus, the appearances of the phrases in various places throughout this specification are not necessarily referring to the same embodiment or example of the present disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples. In addition, those skilled in the art can combine or incorporate different embodiments or examples, as well as features in different embodiments or examples described herein, without any contradiction.

[0047] Although embodiments of the present disclosure have been shown and described, it would be appre-

ciated by those skilled in the art that the above embodiments are explanatory and cannot be construed to limit the present disclosure, and changes, alternatives, modifications and variations can be made to the embodiments without departing from scope of the present disclosure.

Claims

1. A lance for a side-submerged combustion smelting metallurgical furnace, comprising:
 - an outer injection pipe internally defining a combustion-supporting gas inlet, a combustion-supporting gas outlet, and an insertion port;
 - an insertion self-locking member having a self-locking and closing function, and mounted at the insertion port of the outer injection pipe;
 - an inner injection pipe having a medium inlet, a medium injection port, and a medium clearing port, and detachably inserted into the insertion self-locking member, an end of the inner injection pipe provided with the medium injection port extending into the outer injection pipe through the insertion port, and when the inner injection pipe is disengaged from the insertion self-locking member, the insertion self-locking member being self-locked and closed to block off the insertion port; and
 - a blocking member mounted to the inner injection pipe to open or close the medium clearing port.
2. The lance according to claim 1, wherein the insertion self-locking member has a first end detachably connected with the inner injection pipe by means of a flange, and a second end welded with the outer injection pipe.
3. The lance according to claim 1, wherein the insertion self-locking member comprises:
 - a first body internally defining a connecting channel, through which the inner injection pipe passes and is communicated with the insertion port; and
 - a first self-locking member provided within the first body and movable between a closed position where the connecting channel is closed and an open position where the connecting channel is open.
4. The lance according to claim 3, wherein the first body further defines a sliding slot communicated with the connecting channel; when the inner injection pipe is inserted into the connecting channel, the first self-locking member is pushed into the sliding slot by the inner injection pipe; when the inner injection pipe is

disengaged from the connecting channel, the first self-locking member falls into the connecting channel by gravity.

5. The lance according to claim 4, wherein a lower end of the sliding slot is communicated with the connecting channel, and a length direction of the sliding slot is inclined with respect to a length direction of the connecting channel. 5
- 10
6. The lance according to claim 5, wherein the sliding slot extends obliquely from bottom to top towards the outer injection pipe.
7. The lance according to claim 4, wherein the first self-locking member is a ball. 15
8. The lance according to any one of claims 1-7, wherein the blocking member comprises: 20
 - a second body internally defining an unclogging channel communicated with the medium clearing port;
 - a second self-locking member provided within the second body and movable between a closed position where the unclogging channel is closed and an open position where the unclogging channel is open; and 25
 - a plug, configured to stop the second self-locking member from coming out of the second body, detachably mounted to the second body, and provided with an unclogging port in communication with the unclogging channel. 30
9. The lance according to claim 8, wherein the second body further defines a guide slot communicated with the unclogging channel, the guide slot has a lower end communicated with the unclogging channel, and the guide slot extends obliquely from bottom to top towards the outer injection pipe with respect to a length direction of the connecting channel. 35
- 40
10. A metallurgical furnace, comprising a lance for a side-submerged combustion smelting metallurgical furnace according to any one of claims 1 to 9. 45

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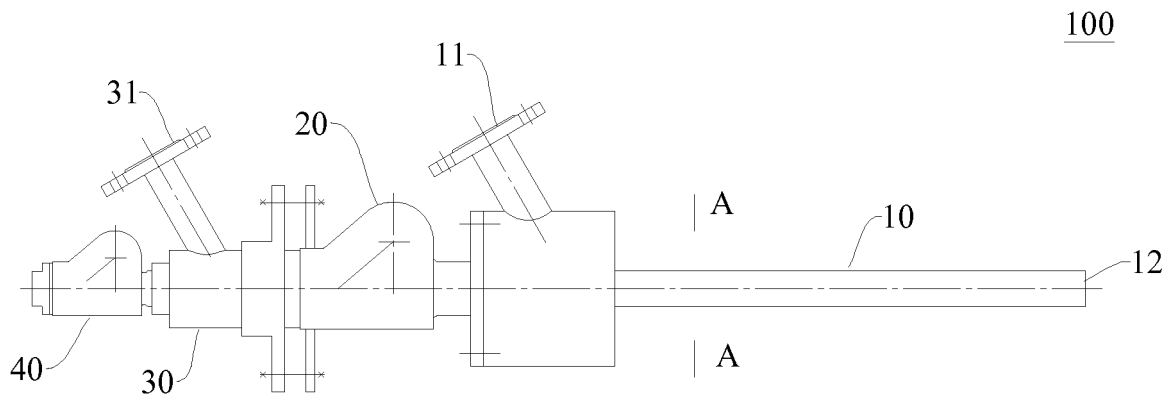


Fig. 1

A-A

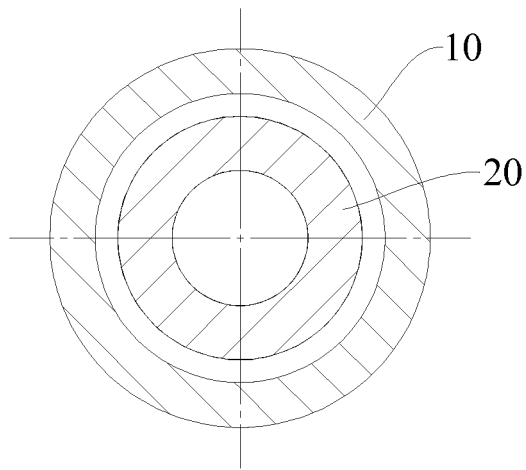


Fig. 2

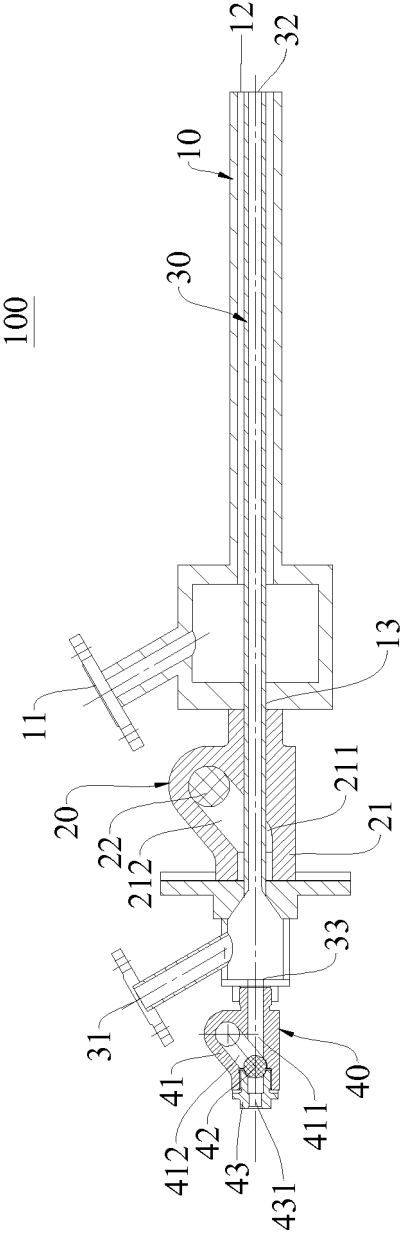


Fig. 3

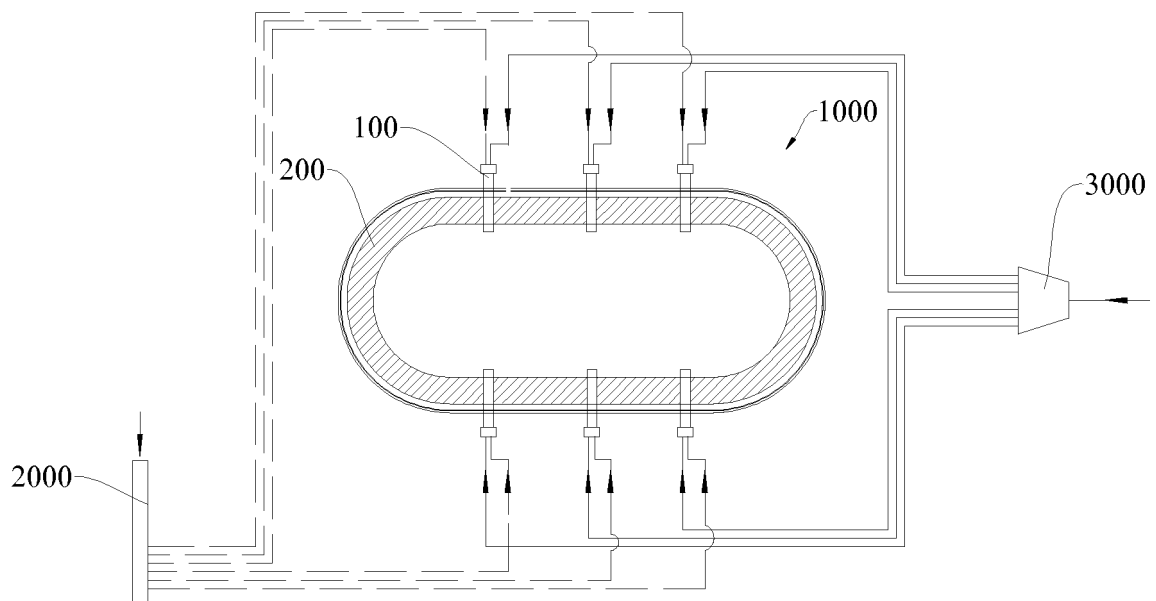


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/075502

A. CLASSIFICATION OF SUBJECT MATTER

F27D 3/18(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F27D3, C22B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT, CNKI, CNPAT, WPI, EPODOC: ejection gun, nozzle, lance, lock, air+, coal, chang+, gravity, clean+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 105737614 A (CHINA ENFI ENGINEERING CORPORATION) 06 July 2016 (06.07.2016) claims 1-10	1-10
PX	CN 205642013 U (CHINA ENFI ENGINEERING CORPORATION) 12 October 2016 (12.10.2016) claims 1-10	1-10
Y	CN 201561656 U (BAOSTEEL ENGINEERING & TECHNOLOGY GROUP CO., LTD.) 25 August 2010 (25.08.2010) description, paragraphs [0027]-[0033], and figures 1-3	1-10
Y	CN 203741387 U (CHANGSHA ENGINEERING & RESEARCH INSTITUTE OF NONFERROUS METALLURGY CO., LTD.) 30 July 2014 (30.07.2014) description, paragraphs [0018]-[0024], and figures 1-5	1-10
A	CN 204261366 U (HUNAN RESHINE NEW MATERIAL CO., LTD.) 15 April 2015 (15.04.2015) the whole document	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search 18 May 2017	Date of mailing of the international search report 01 June 2017
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer LIU, Liyan Telephone No. (86-10) 62084874

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/075502

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 105737614 A	06 July 2016	None	
CN 205642013 U	12 October 2016	None	
CN 201561656 U	25 August 2010	None	
CN 203741387 U	30 July 2014	None	
CN 204261366 U	15 April 2015	None	