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(54) SIDE-SUBMERGED COMBUSTION SMELTING APPARATUS FOR SPRAYING OXYGEN-ENRICHED AIR AND PULVERIZED COAL

SEITENTAUCHVERBRENNUNGSSCHMELZVORRICHTUNG ZUM SPRÜHEN VON SAUERSTOFFANGEREICHERTER LUFT UND KOHLENSTAUB

APPAREIL DE FUSION PAR COMBUSTION À IMMERSION LATÉRALE POUR LA PULVÉRISATION D'AIR ENRICHI EN OXYGÈNE ET DE CHARBON PULVÉRISÉ

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- **PUELLENBERG R: "QSL - MODERNE BLEIVERHUETTUNG IN STOLBERG//QSL - MODERN LEAD PRODUCTION IN STOLBERG", ERZMETALL, GMBD - MEDIENVERLAG, CLAUSTHAL-ZELLERFELD, DE, vol. 56, no. 6/07, 1 January 2003 (2003-01-01), pages 340-342, XP001168210, ISSN: 0044-2658**

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Description

FIELD

[0001] The present invention relates to a technical field of metallurgy. To be specific, it involves a side-submerged combustion smelting apparatus for spraying oxygen-enriched air and pulverized coal.

BACKGROUND

[0002] A side-submerged combustion (SSC) smelting process is to inject oxygen-enriched air and gaseous fuel into a molten bath through the tuyeres or lances on both sides of a smelting furnace, and the injected gas stirs the molten bath to accelerate heat and mass transfer and chemical reaction in the molten bath. The SSC smelting process is widely used in the field of non-ferrous metal treatment (such as lead smelting, zinc slag smelting, copper smelting, etc.) and solid waste treatment.

[0003] If the side-submerged combustion smelting apparatus in the related art employs natural gas, coke oven gas, and producer gas as fuels, fuel gas cannot be economically used in fuel gasdeficient regions, which limits the applicability of side-submerged combustion technology.

[0004] If the side-submerged combustion smelting apparatus in the related technology employs pulverized coal as fuel, the pulverized coal and air are mixed within the lance or the tuyere. Therefore, the oxygen concentration in the air cannot be too high to ensure safety, thus causing the hearth area efficiency and thermal efficiency to fail to adapt to the needs of current development of non-ferrous metal smelting industry and fail to achieve large-scale industrial production.

[0005] CN 102011014 discloses a continuous lead-smelting device which comprises a reaction furnace, a side-blown spraying gun for an oxidation zone and a side-blown spraying gun for a reduction zone, wherein, the reaction furnace is internally equipped with a partition wall for dividing a furnace chamber of the reaction furnace into the oxidation zone and the reduction zone, the lower part of the furnace chamber forms a molten pool, the bottom of the partition wall is equipped with a communicating channel for communicating the oxidation zone with the reduction zone, the roof of the oxidation zone is respectively equipped with a feed inlet for the oxidation zone and a flue gas outlet for the oxidation zone respectively, the roof of the reduction zone is equipped with a reductant feed inlet and a flue gas outlet for the reduction zone, and the furnace wall of the furnace chamber is equipped with a siphon lead discharge port and a slag discharge port; the side-blown spraying gun for the oxidation zone is connected with the side wall of the oxidation zone of the reaction furnace so as to laterally blow oxygen into the molten pool of the oxidation zone; and the side-blown spraying gun for the reduction zone is connected with the side wall of the reduction zone of the reaction furnace so as to laterally blow fuel and oxygen into the reduction zone. The continuous lead-smelting device disclosed by the invention has the advantages that oxidation and reduction are realized in single reaction furnace, lead content in slag is low, stability and tightness are good, environmental protection property is high, heat content of the slag is fully utilized and energy consumption is lowered.

[0006] CN 102560119 discloses treating equipment and process of a waste lead-acid accumulator. The treating equipment of the waste lead-acid accumulator comprises a crushing and sorting device, a pressure filtration device, a reacting furnace, a melting zone spray gun and a reducing zone spray gun, wherein the reacting furnace is provided with a furnace chamber the lower part of which forms a melting bath, the furnace chamber is divided into a melting zone and a reducing zone, a passage for communicating the melting zone and the reducing zone is arranged at the bottom of a partition, the furnace chamber is provided with a flue gas outlet and a melting zone feeding port, and the top wall of the reducing zone is provided with a reducing zone feeding port, a slag discharge port, a siphon hard lead discharge port, a siphon soft lead discharge port, a melting zone spray gun port and a reducing zone spray gun port. According to the treating equipment and process of the waste lead-acid accumulator, the energy consumption is low, environmental protection is realized, the thermal efficiency is high, the direct yield of lead is high, the equipment structure is simple, the process is continuous, the process control is simple and easy to realize, and the cost is low.

[0007] R. PUELLENBERG describes in "QSL - Moderne Bleiverhuettung in Stolberg//QSL - modern lead production in Stolberg", ERZMETALL, GMBD - MEDIEN-VERLAG, CLAUSTHAL-ZELLERFELD, DE, vol. 56, no. 6/07, 1 January 2003, pages 340-342, that with the QSL reactor "Berzelius" Stolberg has one of the most modern aggregates for the primary and secondary production of lead. By converting from the shaft furnace process to QSL the two processing steps of roasting and reduction were combined, leading to an increased capacity and a significantly decreased amount of emissions. The emission levels were further reduced by additional engineering measures.

[0008] WO 2011/103132 discloses a method and system for the copper anode refining, in which coherent jet technology is employed to heat the molten blister copper and/or melt scrap copper charges using a melting flame, oxidize the sulfur in the molten blister copper, and reduce the oxygen in the molten blister copper using top-blown coherent jet gas streams from one or more multi-functional, coherent jet lance assemblies. The system and method of the document employs a microprocessor-based controller operatively controlling the flow of an oxygen-containing gas, an inert gas, a reducing agent and a fuel to the coherent jet lance. The disclosed copper anode refining system and method greatly improves copper production while lowering oxidation/reduction cycle

times and minimizing NOx emissions.

[0009] CN105483393A provides a method for treating secondary lead through an improved side-blowing smelting reduction furnace. The method comprises the steps that the secondary lead is put into the improved side-blowing smelting reduction furnace, meanwhile, a smelting agent is added, oxygen-enriched gas, a reduction agent and fuel are sprayed into a smelting pool mixing area of the smelting reduction furnace at the flow speed of 180-280 m/s through multichannel spray guns on the two sides of the smelting reduction furnace, so that materials in the smelting reduction furnace are subjected to a smelting reduction reaction, and wet lead and smelting slag are generated; the wet lead and the smelting slag are included in the smelting pool mixing area at the same time; and the smelting slag is discharged out of a slag outlet of the smelting reduction furnace, and the wet lead is discharged out of a metal discharge opening of the smelting reduction furnace. The method for smelting the secondary lead is compact in procedure, small in fixed number of workers, environment-friendly and low in production cost.

SUMMARY

[0010] The present invention aims to solve at least one of technical problems in the related art to a certain extent. Accordingly, the present disclosure provides a side-submerged combustion smelting apparatus for spraying oxygen-enriched air and pulverized coal. The side-submerged combustion smelting apparatus uses the pulverized coal as a fuel, and thus has advantages of high productivity, low operating cost, and wide applicability.

[0011] The invention is set out in the appended set of claims.

[0012] To achieve above objectives, the embodiments in the present invention provide a side-submerged combustion smelting apparatus for spraying oxygen-enriched air and pulverized coal according to claim 1.

[0013] The side-submerged combustion smelting apparatus in the embodiments of the present invention use the pulverized coal as fuel and thus has advantages of the high productivity, the low operating cost, and the wide applicability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is a schematic view of a side-submerged combustion smelting apparatus for spraying oxygen-enriched air and pulverized coal based on a specific embodiment of the present invention.

Fig. 2 is a schematic view of a side-submerged combustion smelting apparatus for spraying oxygen-enriched air and pulverized coal based on another specific embodiment of the present invention.

Fig. 3 is a sectional view of a pulverized coal lance of a side-submerged combustion smelting apparatus for spraying oxygen-enriched air and pulverized coal based on yet another specific embodiment of the present invention.

Fig. 4 is a sectional view of an air lance of a side-submerged combustion smelting apparatus for spraying oxygen-enriched air and pulverized coal based on still another specific embodiment of the present invention

Reference numerals:

[0015] side-submerged combustion smelting apparatus 1 for spraying oxygen-enriched air and pulverized coal, smelting furnace 100, pulverized coal delivery pipe 200, pulverized coal distributor 210, air delivery pipe 300, coal injection assembly 400, pulverized coal lance 410, inner injection pipe 411, pulverized coal inlet 4111, pulverized coal injection port 4112, pulverized coal clearing port 4113, outer injection pipe 412, cooling chamber 4121, cooling gas inlet 4122, cooling gas injection port 4123, sealing member 413, wear-resistant lining 414, air lance 420, air inlet 4211, air injection port 4212, impurity clearing port 4213.

DETAILED DESCRIPTION

[0016] Embodiments of the present invention 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 invention.

[0017] The embodiments should not be construed to limit the present invention.

[0018] The side-submerged combustion smelting apparatus 1 for spraying oxygen-enriched air and pulverized coal based on embodiments of the present invention will be described below with reference to the drawings.

[0019] As illustrated in Figs. 1-4, the side-submerged combustion smelting apparatus 1 based on embodiments of the present invention includes a smelting furnace 100, a pulverized coal delivery pipe 200, an air delivery pipe 300 and a coal injection assembly 400.

[0020] The pulverized coal delivery pipe 200 is used to deliver the pulverized coal. The air delivery pipe 300 is used to deliver the oxygen-enriched air and is communicated with an air source. A plurality of coal injection assemblies 400 are arranged at intervals on two opposite side walls of the smelting furnace 100. A portion of each coal injection assembly 400 extends into the smelting furnace 100. Each coal injection assembly 400 includes a pulverized coal lance 410 and an air lance 420 which

are adjacent to each other and arranged as a pair. Each pulverized coal lance 410 is in communication with the pulverized coal delivery pipe 200, and each air lance 420 is in communication with the air delivery pipe 300. Each coal injection assembly 400 at least partially extends into the smelting furnace 100. It should be understood herein that "adjacent to each other and arranged as a pair" means that each pulverized coal lance 410 is arranged adjacent to one air lance 420 paired therewith, rather than two pulverized coal lances 410 are arranged adjacent to two air lances 420.

[0021] By providing the plurality of coal injection assemblies 400, the side-submerged combustion smelting apparatus 1 based on embodiments of the present invention can utilize the plurality of coal injection assemblies 400 to inject the pulverized coal and air into the smelting furnace 100, thereby achieving uniform delivery of the pulverized coal and air into the smelting furnace 100. Moreover, since the coal injection assembly 400 includes the pulverized coal lance 410 and the air lance 420 arranged adjacently, each pulverized coal lance 410 being in communication with the pulverized coal delivery pipe 200, and each air lance 420 being in communication with the air delivery pipe 300, the pulverized coal lance 410 and the air lance 420 can be used to spray the pulverized coal and the air respectively. This allows the pulverized coal and the air to be mixed in the smelting furnace 100 to prevent the mixing of the pulverized coal and the air in the coal injection assembly 400. Therefore, the oxygen content in the air delivered by the air lance 420 can be increased, and the hearth area efficiency and thermal efficiency of the side-submerged combustion smelting apparatus 1 can be improved, thereby improving the production efficiency of the side-submerged combustion smelting apparatus 1, and enabling the side-submerged combustion smelting apparatus 1 to carry out large-scale industrial production with the pulverized coal as fuel.

[0022] Furthermore, since the side-submerged combustion smelting apparatus 1 can use the pulverized coal as the fuel, the side-submerged combustion smelting apparatus 1 can not only have a reduced operating cost, but also be applied to regions where gas fuel is scarce, thereby improving the applicability of the side-submerged combustion smelting apparatus 1.

[0023] Additionally, by providing the plurality of coal injection assemblies 400, when a part of pulverized coal lances 410 are worn, the remaining pulverized coal lances 410 can be used to continue delivering the pulverized coal, and the worn pulverized coal lances 410 can be reused after centralized maintenance at an appropriate time. Thus, it is possible to reduce the holding time after the furnace shutdown, avoid frequent interruption of the normal operation of the smelting apparatus 1, and further improve the production efficiency of the smelting apparatus 1.

[0024] Further, since the pulverized coal and the air are delivered through the pulverized coal lance 410 and the air lance 420 respectively, once the pulverized coal lance 410 is clogged or damaged, the air delivery in the air lance 420 will not be affected. Compared with a multilayer-channel lance used in the related art, it is possible to ensure the delivery of oxygen-enriched air while clearing the clogged pulverized coal lance 410, and improve the safety and reliability of the smelting apparatus 1. Moreover, in a case where the same amount of pulverized coal is injected and the injection pressure is the same, since the pulverized coal and the air are delivered through the pulverized coal lance 410 and the air lance 420 respectively, the quantity of the pulverized coal lance 410 and the pipeline for delivering the pulverized coal can be reduced, which can further prevent the pulverized coal from clogging the pipeline and the pulverized coal lance 410 on the one hand, and can reduce the cost of the smelting apparatus 1 on the other hand.

[0025] Therefore, the side-submerged combustion smelting apparatus 1 based on embodiments of the present invention is able to use the pulverized coal as the fuel, and has the advantages of high productivity, low operating cost, and wide applicability.

[0026] The side-submerged combustion smelting apparatus 1 according to specific embodiments of the present invention will be described below with reference to the drawings.

[0027] In some specific embodiments of the present invention, as illustrated in Figs. 1-4, the side-submerged combustion smelting apparatus 1 according to embodiments of the present invention includes the smelting furnace 100, the pulverized coal delivery pipe 200, the air delivery pipe 300, and the coal injection assembly 400. The air source can deliver oxygen-enriched air to the air delivery pipe 300.

[0028] Fig. 1 illustrates the side-submerged combustion smelting apparatus 1 according to a specific embodiment of the present invention.

[0029] As illustrated in Fig. 1, the pulverized coal lance 410 in one of two mutually opposite coal injection assemblies 400 is opposite to the pulverized coal lance 410 in the other of two mutually opposite coal injection assemblies 400, and the air lance 420 in the one of two mutually opposite coal injection assemblies 400 is opposite to the air lance 420 in the other of two mutually opposite coal injection assemblies 400. Thus, the pulverized coal and air injected into the smelting furnace 100 can be evenly distributed, so that the pulverized coal can be fully combusted.

[0030] Fig. 2 illustrates the side-submerged combustion smelting apparatus 1 according to another specific embodiment of the present invention.

[0031] As illustrated in Fig. 2, the pulverized coal lance 410 in one of two mutually opposite coal injection assemblies 400 is opposite to the air lance 420 in the other of two mutually opposite coal injection assemblies 400, and the air lance 420 in the one of two mutually opposite coal injection assemblies 400 is opposite to the pulverized coal lance 410 in the other of two mutually opposite coal injection assemblies 400. Likewise, the pulverized coal

and air injected into the smelting furnace 100 can be evenly distributed, so that the pulverized coal can be fully combusted.

[0032] Optionally, as illustrated in Figs. 1 and 2, lengths of respective portions of a plurality of pulverized coal lances 410 that extend into the smelting furnace 100 are equal and are 50-200 mm. By doing so, the pulverized coal can be combusted more fully, and the smelting apparatus 1 can achieve an optimal combustion effect, so as to improve the production efficiency of the side-submerged combustion smelting apparatus 1.

[0033] Further, as illustrated in Figs. 1 and 2, lengths of respective portions of a plurality of air lances 420 that extend into the smelting furnace 100 are equal and are each 50-200 mm. By doing so, the pulverized coal can be combusted more fully, and the smelting apparatus 1 can achieve the optimal combustion effect, so as to improve the production efficiency of the side-submerged combustion smelting apparatus 1.

[0034] According to the invention, Adv, as illustrated in Figs. 1 and 2, a portion of each pulverized coal lance 410 that extends into the smelting furnace 100 and a portion of each air lance 420 that extends into the smelting furnace 100 are equal in length. In this way, the pulverized coal injected into the smelting furnace 100 by the pulverized coal lance 410 can be sufficiently mixed with the air injected from the air lance 420 adjacent to the pulverized coal lance 410, so that the pulverized coal can be sufficiently combusted.

[0035] Specifically, as illustrated in Figs. 1 and 2, a distance between the pulverized coal lance 410 and the air lance 420 in the plurality of coal injection assemblies 400 is equal. In such a way, the combustion in the smelting furnace 1 becomes more sufficient, and the temperature in the smelting furnace 1 is more uniform.

[0036] More specifically, each pulverized coal lance 410 and each air lance 420 are of equal height on the smelting furnace 100, which can facilitate the control over a liquid level in a molten bath of the side-submerged combustion smelting apparatus 1, and be convenient for the injected air to fully stir the molten bath.

[0037] As illustrated in Figs. 1 and 2, the side-submerged combustion smelting apparatus 1 further includes a pulverized coal distributor 210, and the plurality of pulverized coal lances 410 are communicated with the pulverized coal delivery pipe 200 through the pulverized coal distributor 210. Thus, the pulverized coal delivered to each of the pulverized coal lances 410 can be uniform to ensure uniform combustion in the smelting furnace 100.

[0038] Figs. 3 and 4 illustrate the side-submerged combustion smelting apparatus 1 according to some specific embodiments of the present invention.

[0039] As illustrated in Fig. 3, the pulverized coal lance 410 includes an inner injection pipe 411, an outer injection pipe 412, a sealing member 413, and a wear-resistant lining 414. The inner injection pipe 411 is provided with a pulverized coal inlet 4111, a pulverized coal injection port 4112, and a pulverized coal clearing port 4113. The outer injection pipe 412 is fitted over the inner injection pipe 411, and defines a cooling chamber 4121 together with the inner injection pipe 411. The outer injection pipe 412 is provided with a cooling gas inlet 4122 and a cooling gas injection port 4123 both in communication with the cooling chamber 4121. The sealing member 413 is arranged to the inner injection pipe 411 and is movable between a closed position where the pulverized coal clearing port 4113 is blocked and an open position where the pulverized coal clearing port 4113 is open. The wear-resistant lining 414 is provided to an inner circumferential surface of the inner injection pipe 411. Therefore, when the pulverized coal lance 410 is working normally, the pulverized coal clearing port 4113 is blocked off by the sealing member 413, so that the pulverized coal cannot pass through the pulverized coal clearing port 4113; and when the inner injection pipe 411 needs to be cleaned, the sealing member 413 can be moved to the open position to clean the inner injection pipe 411 through the pulverized coal clearing port 4113 to prevent the pulverized coal from clogging the inner injection pipe 411, thereby ensuring the reliability of the delivery of the pulverized coal.

[0040] In the related art, during the replacement of the pulverized coal lance, the smelting apparatus has to stop working temporarily, and the liquid level in the molten bath of the smelting apparatus is lowered below the height of the pulverized coal lance, which seriously affects the operating rate. However, for the side-submerged combustion smelting apparatus 1, the pulverized coal lance 410 is cleaned through the pulverized coal clearing port 4113, without need to lower the liquid level in the smelting apparatus 1 or shut down the smelting apparatus 1, such that the production efficiency of the smelting apparatus 1 is ensured, and the large-scale industrial production using pulverized coal as raw material is realized.

[0041] In addition, by providing the cooling chamber 4121, cooling gas can be utilized to cool the outer injection pipe 412 and the inner injection pipe 411 to prevent temperature of the portion, extending into the smelting furnace 100, of the pulverized coal lance 410 from being too high, thus prevent the pulverized coal lance 410 from being damaged due to excessive temperature, and prolong the service life of the pulverized coal lance 410. By providing the wear-resistant lining 414, it is possible to prevent the inner injection pipe 411 from being worn, reduce the wear of the inner injection pipe 411 caused by the pulverized coal scouring an inner wall when the pulverized coal is delivered by the pulverized coal lance 410, and prolong the service life of the pulverized coal lance 410.

[0042] Specifically, when a part of pulverized coal lances 410 are clogged, unclogged pulverized coal lances 410 can be used to continue maintaining the normal operation of the smelting apparatus 1, and the clogged pulverized coal lances 410 can return to work after they are

cleaned through the pulverized coal clearing port 4113 in time. During the cleaning, the pulverized coal lance 410 can be switched from injecting pulverized coal to injecting nitrogen by means of the pulverized coal distributor 210, to facilitate the cleaning of an operator and improve the operating environment of the operator.

[0043] Optionally, the wear-resistant lining 414 can be a ceramic lining, and the cooling gas can be nitrogen.

[0044] Specifically, as illustrated in Fig. 4, the air lance 420 includes an inner injection pipe 411, an outer injection pipe 412 and a sealing member 413. The inner injection pipe 411 is provided with an air inlet 4211, an air injection port 4212, and an impurity clearing port 4213. The outer injection pipe 412 is fitted over the inner injection pipe 411 and defines a cooling chamber 4121 together with the inner injection pipe 411. The outer injection pipe 412 is provided with a cooling gas inlet 4122 and a cooling gas injection port 4123 both in communication with the cooling chamber 4121. The sealing member 413 is arranged to the inner injection pipe 411 and is movable between a closed position where the impurity clearing port 4213 is blocked and an open position where the impurity clearing port 4213 is open. Therefore, when the air lance 420 is working normally, the impurity clearing port 4213 is blocked off by the sealing member 413, so that the air cannot pass through the impurity clearing port 4213; and when the inner injection pipe 411 needs to be cleaned, the sealing member 413 can be moved to the open position to clean the inner injection pipe 411 through the impurity clearing port 4213 to prevent impurities from clogging the inner injection pipe 411, thereby ensuring the reliability of the air delivery. Additionally, by providing the cooling chamber 4121, the cooling gas can be utilized to cool the outer injection pipe 412 and the inner injection pipe 411 to prevent temperature of the portion, extending into the smelting furnace 100, of the air lance 420 from being too high, thus prevent the air lance 420 from being damaged due to excessive temperature, and prolong the service life of the air lance 420.

[0045] 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 particular orientation or be constructed or operated in a particular orientation. Thus, these terms should not be constructed to limit the present disclosure.

[0046] 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, "a plurality of" means two or more than two, unless specified otherwise.

[0047] 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.

[0048] 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.

[0049] 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.

Claims

1. A side-submerged combustion smelting apparatus (1) for spraying oxygen-enriched air and pulverized coal comprising:

   a smelting furnace (100);
   a pulverized coal delivery pipe (200) configured to deliver the pulverized coal;
   an air delivery pipe (300) configured to deliver the oxygen-enriched air, and communicated with an air source; and
   a plurality of coal injection assemblies (400) arranged at intervals on two opposite side walls of the smelting furnace (100), wherein each coal injection assembly (400) at least partially ex-

tends into the smelting furnace (100),
wherein a portion of each pulverized coal lance (410) that extends into the smelting furnace (100) and a portion of each air lance (420) that extends into the smelting furnace (100) are equal in length,
characterized in that each coal injection assembly (400) comprises a pulverized coal lance (410) and an air lance (420) adjacent to each other and arranged as a pair, each pulverized coal lance (410) being in communication with the pulverized coal delivery pipe (200), and each air lance (420) being in communication with the air delivery pipe (300), wherein a portion of each pulverized coal lance (410) that extends into the smelting furnace (100) and a portion of each air lance (420) that extends into the smelting furnace (100) are equal in length,
wherein the pulverized coal lance (410) comprises:

a first inner injection pipe (411) provided with a pulverized coal inlet (4111), a pulverized coal injection port (4112), and a pulverized coal clearing port (4113);
a first outer injection pipe (412) fitted over the first inner injection pipe (411), and defining a first cooling chamber (4121) together with the first inner injection pipe (411), the first outer injection pipe (412) being provided with a first cooling gas inlet (4122) and a first cooling gas injection port (4123) both in communication with the first cooling chamber (4121);
a first sealing member (413) arranged to the first inner injection pipe (411) and movable between a closed position where the pulverized coal clearing port (4113) is blocked and an open position where the pulverized coal clearing port (4113) is open; and
a wear-resistant lining (414) provided to an inner circumferential surface of the first inner injection pipe (411); and
wherein the air lance (420) comprises:

a second inner injection pipe (411) provided with an air inlet (4211), an air injection port (4212), and an impurity clearing port (4213);
a second outer injection pipe (412) fitted over the second inner injection pipe (411), and defining a second cooling chamber (4121) together with the second inner injection pipe (411), the second outer injection pipe (412) being provided with a second cooling gas inlet (4122) and a second cooling gas injection port (4123) both in communication with the second cooling chamber (4121); and
a second sealing member (413) arranged to the second inner injection pipe (411) and movable between a closed position where the impurity clearing port (4213) is blocked and an open position where the impurity clearing port (4213) is open.

2. The side-submerged combustion smelting apparatus (1) based on claim 1, wherein the pulverized coal lance (410) in one of two mutually opposite coal injection assemblies (400) is opposite to the pulverized coal lance (410) in the other of the two mutually opposite coal injection assemblies (400), and the air lance (420) in the one of the two mutually opposite coal injection assemblies (400) is opposite to the air lance (420) in the other of the two mutually opposite coal injection assemblies (400).

3. The side-submerged combustion smelting apparatus (1) based on claim 1, wherein the pulverized coal lance (410) in one of two mutually opposite coal injection assemblies (400) is opposite to the air lance (420) in the other of the two mutually opposite coal injection assemblies (400), and the air lance (420) in the one of the two mutually opposite coal injection assemblies (400) is opposite to the pulverized coal lance (410) in the other of the two mutually opposite coal injection assemblies (400).

4. The side-submerged combustion smelting apparatus (1) based on claim 1, wherein lengths of respective portions of a plurality of pulverized coal lances (410) extending into the smelting furnace (100) are equal and are each 50-200 mm.

5. The side-submerged combustion smelting apparatus (1) based on claim 1, wherein lengths of respective portions of a plurality of air lances (420) extending into the smelting furnace (100) are equal and are each 50-200 mm.

6. The side-submerged combustion smelting apparatus (1) based on claim 1, wherein a distance between the pulverized coal lance (410) and the air lance (420) in the plurality of coal injection assemblies (400) is equal.

7. The side-submerged combustion smelting apparatus (1) based on claim 1, wherein each pulverized coal lance (410) and each air lance (420) are of equal height on the smelting furnace (100).

8. The side-submerged combustion smelting apparatus (1) based on claim 1, further comprising a pulverized coal distributor (210), a plurality of pulverized

coal lances (410) being communicated with the pulverized coal delivery pipe (200) by means of the pulverized coal distributor (210).

Patentansprüche

1. Eine seitlich eingetauchte Verbrennungsschmelzvorrichtung (1) zum Einsprühen von mit Sauerstoff angereicherter Luft und Kohlenstaub, die folgendes umfaßt:

einen Schmelzofen (100);
ein Kohlenstaubabgaberohr (200), das zur Abgabe des Kohlenstaubs konfiguriert ist;
eine Luftleitung (300), die so konfiguriert ist, dass sie die sauerstoffangereicherte Luft liefert und mit einer Luftquelle verbunden ist; und
eine Vielzahl von Kohleinjektionsanordnungen (400), die in Abständen an zwei gegenüberliegenden Seitenwänden des Schmelzofens (100) angeordnet sind, wobei sich jede Kohleinjektionsanordnung (400) zumindest teilweise in den Schmelzofen (100) hinein erstreckt,
wobei ein Abschnitt jeder Kohlenstaublanze (410), der sich in den Schmelzofen (100) erstreckt, und ein Abschnitt jeder Luftlanze (420), der sich in den Schmelzofen (100) erstreckt, gleich lang sind,
dadurch gekennzeichnet, dass *jede* Kohleinj ektionsanordnung (400) eine Kohlenstaublanze (410) und eine Luftlanze (420) umfasst, die einander benachbart und als Paar angeordnet sind, wobei jede Kohlenstaublanze (410) mit dem Kohlenstaubförderrohr (200) in Verbindung steht, und jede Luftlanze (420) mit dem Luftzufuhrrohr (300) in Verbindung steht, wobei ein Abschnitt jeder Kohlenstaublanze (410), der sich in den Schmelzofen (100) erstreckt, und ein Abschnitt jeder Luftlanze (420), der sich in den Schmelzofen (100) erstreckt, gleich lang sind,
wobei die Kohlenstaublanze (410) umfasst:

ein erstes inneres Einblasrohr (411), das mit einem Kohlenstaubeinlass (4111), einer Kohlenstaubeinblasöffnung (4112) und einer Kohlenstaubauslassöffnung (4113) versehen ist;
ein erstes äußeres Einspritzrohr (412), das über dem ersten inneren Einspritzrohr (411) angebracht ist und zusammen mit dem ersten inneren Einspritzrohr (411) eine erste Kühlkammer (4121) definiert, wobei das erste äußere Einspritzrohr (412) mit einem ersten Kühlgaseinlass (4122) und einer ersten Kühlgaseinspritzöffnung (4123) versehen ist, die beide in Verbindung mit der ersten Kühlkammer (4121) stehen;
ein erstes Dichtungselement (413), das an dem ersten inneren Einblasrohr (411) angeordnet und zwischen einer geschlossenen Position, in der die Kohlenstaub-Räumöffnung (4113) blockiert ist, und einer offenen Position, in der die Kohlenstaub-Räumöffnung (4113) offen ist, beweglich ist; und
eine verschleißfeste Auskleidung (414), die an einer inneren Umfangsfläche des ersten inneren Einspritzrohrs (411) vorgesehen ist; und
wobei die Luftlanze (420) umfasst:

ein zweites inneres Einspritzrohr (411), das mit einem Lufteinlass (4211), einer Lufteinspritzöffnung (4212) und einer Verunreinigungsentfernungsöffnung (4213) versehen ist;
ein zweites äußeres Einspritzrohr (412), das über dem zweiten inneren Einspritzrohr (411) angebracht ist und zusammen mit dem zweiten inneren Einspritzrohr (411) eine zweite Kühlkammer (4121) definiert, wobei das zweite äußere Einspritzrohr (412) mit einem zweiten Kühlgaseinlass (4122) und einer zweiten Kühlgaseinspritzöffnung (4123) versehen ist, die beide in Verbindung mit der zweiten Kühlkammer (4121) stehen; und
ein zweites Dichtungselement (413), das an dem zweiten inneren Einspritzrohr (411) angeordnet und zwischen einer geschlossenen Position, in der die Verunreinigungsfreigabeöffnung (4213) blockiert ist, und einer offenen Position, in der die Verunreinigungsfreigabeöffnung (4213) offen ist, beweglich ist.

2. Seitlich eingetauchte Verbrennungsschmelzvorrichtung (1) gemäß Anspruch 1, wobei die Kohlenstaublanze (410) in einer von zwei einander gegenüberliegenden Kohleinjektionsanordnungen (400) der Kohlenstaublanze (410) in der anderen der beiden einander gegenüberliegenden Kohleinjektionsanordnungen (400) gegenüberliegt und die Luftlanze (420) in der einen der beiden einander gegenüberliegenden Kohleinjektionsanordnungen (400) der Luftlanze (420) in der anderen der beiden einander gegenüberliegenden K Kohleinjektionsanordnungen (400) gegenüberliegt.

3. Seitlich eingetauchte Verbrennungsschmelzvorrichtung (1) gemäß Anspruch 1, wobei die Kohlenstaublanze (410) in einer von zwei einander gegenüberliegenden Kohleinjektionsanordnungen (400) der Luftlanze (420) in der anderen der beiden einander

gegenüberliegenden Kohleinjektionsanordnungen (400) gegenüberliegt und die Luftlanze (420) in der einen der beiden einander gegenüberliegenden Kohleinjektionsanordnungen (400) der Kohlenstaublanze (410) in der anderen der beiden einander gegenüberliegenden Kohleinjektionsanordnungen (400) gegenüberliegt.

4. Seitengetauchte Verbrennungsschmelzvorrichtung (1) gemäß Anspruch 1, wobei die Längen der jeweiligen Abschnitte einer Vielzahl von Kohlenstaublanzen (410), die sich in den Schmelzofen (100) erstrecken, gleich sind und jeweils 50-200 mm betragen.

5. Seitlich eingetauchte Verbrennungsschmelzvorrichtung (1) gemäß Anspruch 1, wobei die Längen der jeweiligen Abschnitte einer Vielzahl von Luftlanzen (420), die sich in den Schmelzofen (100) erstrecken, gleich sind und jeweils 50-200 mm betragen.

6. Seitlich eingetauchte Verbrennungsschmelzvorrichtung (1) gemäß Anspruch 1, wobei ein Abstand zwischen der Kohlenstaublanze (410) und der Luftlanze (420) in der Vielzahl von Kohleinjektionsanordnungen (400) gleich ist.

7. Schmelzvorrichtung mit seitlich eingetauchter Verbrennung (1) gemäß Anspruch 1, wobei jede Kohlenstaublanze (410) und jede Luftlanze (420) am Schmelzofen (100) gleich hoch sind.

8. Seitengetauchte Verbrennungsschmelzvorrichtung (1) gemäß Anspruch 1, ferner mit einem Kohlenstaubverteiler (210), wobei mehrere Kohlenstaublanzen (410) mittels des Kohlenstaubverteilers (210) mit dem Kohlenstaubförderrohr (200) in Verbindung stehen.

Revendications

1. Appareil de fusion par combustion à immersion latérale (1) pour la pulvérisation d'air enrichi en oxygène et de charbon pulvérisé comprenant :

un four de fusion (100) ;
un tuyau de fourniture de charbon pulvérisé (200) configuré pour fournir le charbon pulvérisé ;
un tuyau de fourniture d'air (300) configuré pour fournir l'air enrichi en oxygène, et en communication avec une source d'air ; et
une pluralité d'ensembles d'injection de charbon (400) agencés à des intervalles sur des parois latérales opposées du four de fusion (100), dans lequel chaque ensemble d'injection de charbon (400) s'étend au moins partiellement dans le four de fusion (100),
dans lequel une partie de chaque lance de charbon pulvérisé (410) qui s'étend dans le four de fusion (100) et une partie de chaque lance d'air (420) qui s'étend dans le four de fusion (100) présentent une longueur égale,
caractérisé en ce que chaque ensemble d'injection de charbon (400) comprend une lance de charbon pulvérisé (410) et une lance d'air (420) adjacentes l'une à l'autre et agencées comme une paire, chaque lance de charbon pulvérisé (410) étant en communication avec le tuyau de fourniture de charbon pulvérisé (200), et chaque lance d'air (420) étant en communication avec le tuyau de fourniture d'air (300), dans lequel une partie de chaque lance de charbon pulvérisé (410) qui s'étend dans le four de fusion (100) et une partie de chaque lance d'air (420) qui s'étend dans le four de fusion (100) présentent une longueur égale,
dans lequel la lance de charbon pulvérisé (410) comprend :

un premier tuyau d'injection intérieur (411) doté d'une entrée de charbon pulvérisé (4111), d'un orifice d'injection de charbon pulvérisé (4112) et d'un orifice de dégagement de charbon pulvérisé (4113) ;
un premier tuyau d'injection extérieur (412) monté sur le premier tuyau d'injection intérieur (411), et définissant une première chambre de refroidissement (4121) conjointement avec le premier tuyau d'injection intérieur (411), le premier tuyau d'injection extérieur (412) étant doté d'une première entrée de gaz de refroidissement (4122) et d'un premier orifice d'injection de gaz de refroidissement (4123) à la fois en communication avec la première chambre de refroidissement (4121) ;
un premier élément d'étanchéité (413) agencé sur le premier tuyau d'injection intérieur (411) et mobile entre une position fermée où l'orifice de dégagement de charbon pulvérisé (4113) est bloqué et une position ouverte où l'orifice de dégagement de charbon pulvérisé (4113) est ouvert ; et
un revêtement résistant à l'usure (414) prévu sur une surface circonférentielle intérieure du premier tuyau d'injection intérieur (411) ; et
dans lequel la lance d'air (420) comprend :

un deuxième tuyau d'injection intérieur (411) doté d'une entrée d'air (4211), d'un orifice d'injection d'air (4212), et d'un orifice de dégagement d'impuretés (4213) ;
un deuxième tuyau d'injection extérieur

(412) inséré sur le deuxième tuyau d'injection intérieur (411), et définissant une deuxième chambre de refroidissement (4121) conjointement avec le deuxième tuyau d'injection intérieur (411), le deuxième tuyau d'injection extérieur (412) étant doté d'une deuxième entrée de gaz de refroidissement (4122) et d'un deuxième orifice d'injection de gaz de refroidissement (4123) à la fois en communication avec la deuxième chambre de refroidissement (4121) ; et

un deuxième élément d'étanchéité (413) agencé sur le deuxième tuyau d'injection intérieur (411) et mobile entre une position fermée où l'orifice de dégagement d'impuretés (4213) est bloqué et une position ouverte où l'orifice de dégagement d'impuretés (4213) est ouvert.

2. Appareil de fusion par combustion à immersion latérale (1) selon la revendication 1, dans lequel la lance de charbon pulvérisé (410) dans un des deux ensembles d'injection de charbon opposés mutuellement (400) est opposée à la lance de charbon pulvérisé (410) dans l'autre des deux ensembles d'injection de charbon opposés mutuellement (400), et la lance d'air (420) dans l'un des deux ensembles d'injection de charbon opposés mutuellement (400) est opposée à la lance d'air (420) dans l'autre des deux ensembles d'injection de charbon opposés mutuellement (400).

3. Appareil de fusion par combustion à immersion latérale (1) selon la revendication 1, dans lequel la lance de charbon pulvérisé (410) dans un des deux ensembles d'injection de charbon opposés mutuellement (400) est opposée à la lance d'air (420) dans l'autre des deux ensembles d'injection de charbon opposés mutuellement (400), et la lance d'air (420) dans l'un des deux ensembles d'injection de charbon opposés mutuellement (400) est opposée à la lance de charbon pulvérisé (410) dans l'autre des deux ensembles d'injection de charbon opposés mutuellement (400).

4. Appareil de fusion par combustion à immersion latérale (1) selon la revendication 1, dans lequel des longueurs de parties respectives d'une pluralité de lances de charbon pulvérisé (410) s'étendant dans le four de fusion (100) sont égales et mesurent chacune de 50 à 200 mm.

5. Appareil de fusion par combustion à immersion latérale (1) selon la revendication 1, dans lequel des longueurs de parties respectives d'une pluralité de lances d'air (420) s'étendant dans le four de fusion (100) sont égales et mesurent chacune de 50 à 200 mm.

6. Appareil de fusion par combustion à immersion latérale (1) selon la revendication 1, dans lequel une distance entre la lance de charbon pulvérisé (410) et la lance d'air (420) dans la pluralité d'ensembles d'injection de charbon (400) est égale.

7. Appareil de fusion par combustion à immersion latérale (1) selon la revendication 1, dans lequel chaque lance de charbon pulvérisé (410) et chaque lance d'air (420) sont de hauteur égale sur le four de fusion (100).

8. Appareil de fusion par combustion à immersion latérale (1) selon la revendication 1, comprenant en outre un distributeur de charbon pulvérisé (210), une pluralité de lances de charbon pulvérisé (410) étant en communication avec le tuyau de fourniture de charbon pulvérisé (200) au moyen du distributeur de charbon pulvérisé (210).

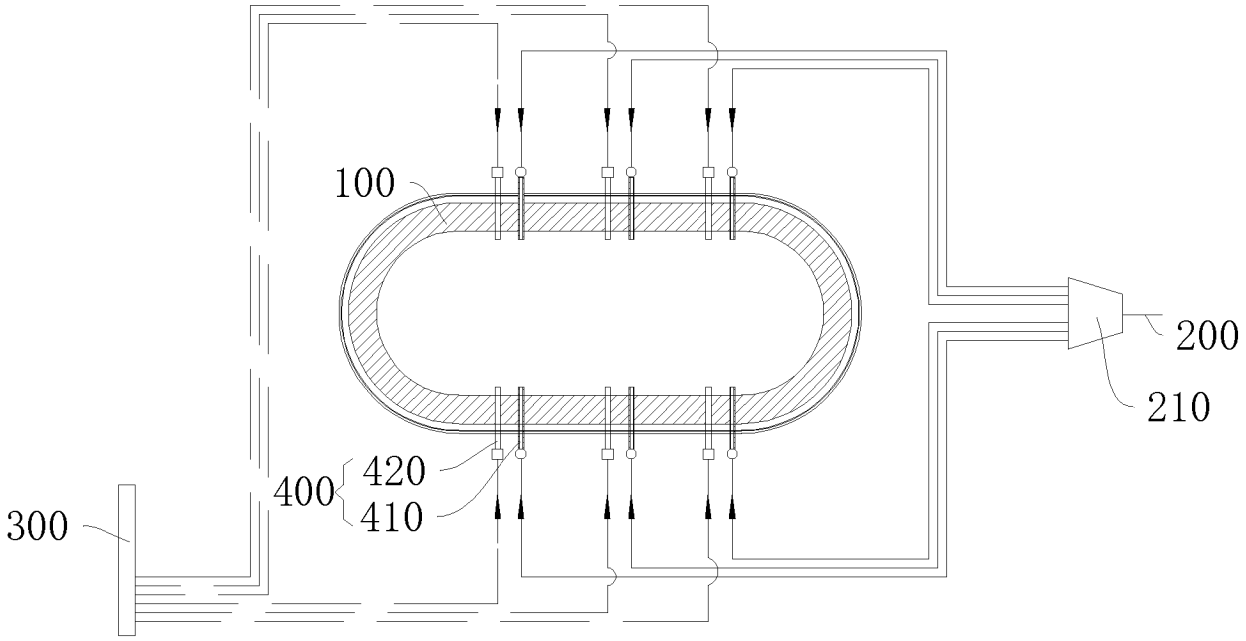


Fig. 1

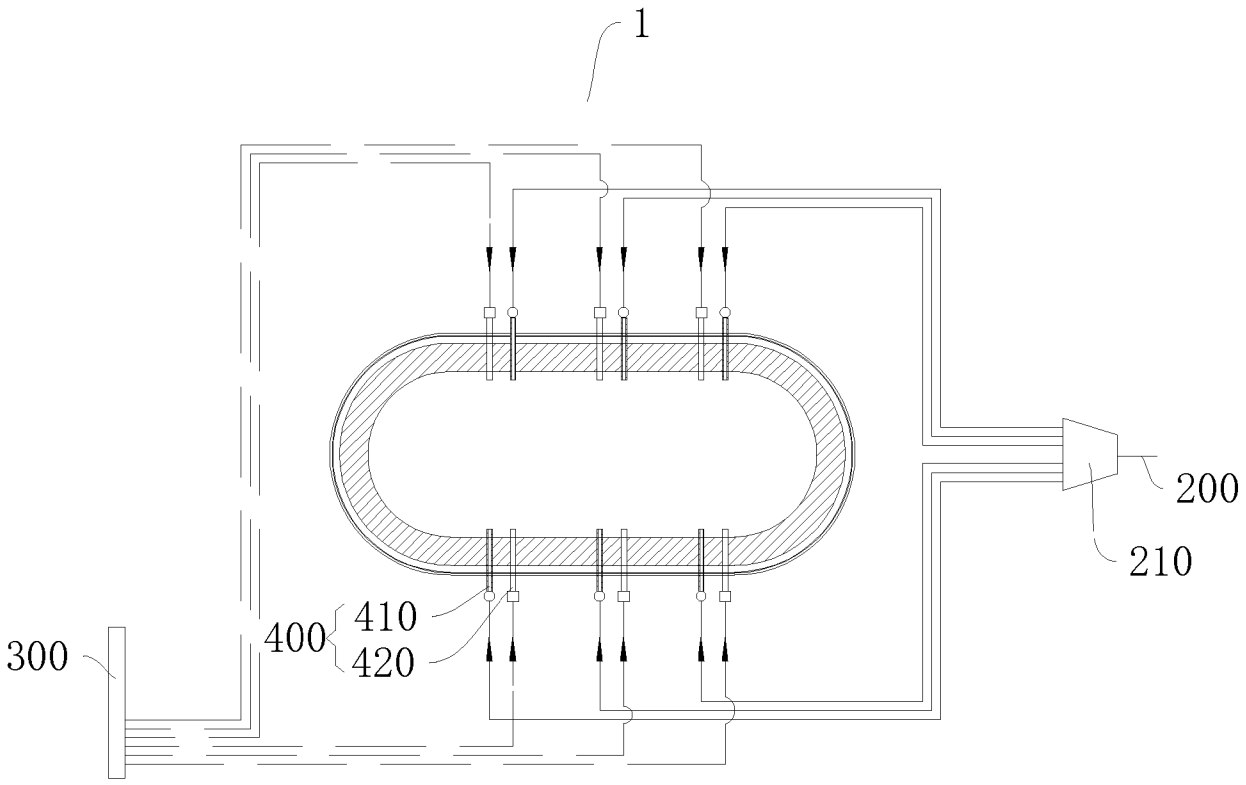


Fig. 2

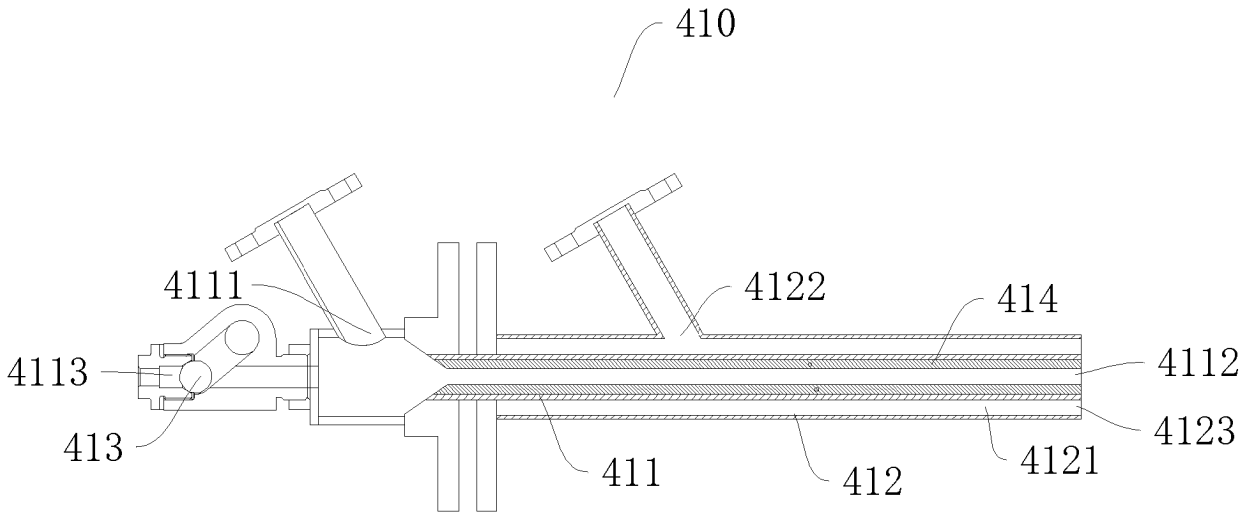


Fig. 3

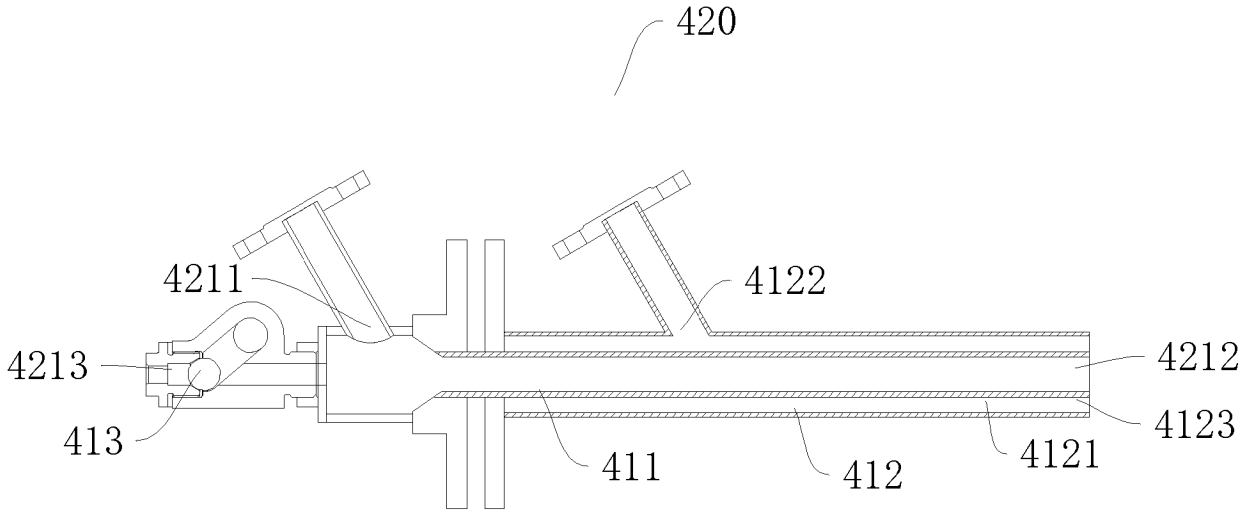


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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