



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

(43) Date of publication:
02.10.2019 Bulletin 2019/40

(51) Int Cl.:
B22D 11/06 (2006.01)

(21) Application number: **16925025.5**

(86) International application number:
PCT/CN2016/112011

(22) Date of filing: **26.12.2016**

(87) International publication number:
WO 2018/119553 (05.07.2018 Gazette 2018/27)

(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

(71) Applicants:
• **Primetals Technologies Japan, Ltd.**
Hiroshima-shi, Hiroshima 733-8553 (JP)
• **Baoshan Iron & Steel Co., Ltd.**
Shanghai 201900 (CN)

(72) Inventors:
• **OKAYASU, Shimpei**
Hiroshima-shi
Hiroshima 733-8553 (JP)

• **TOMINO, Takayoshi**
Hiroshima-shi
Hiroshima 733-8553 (JP)
• **HORII, Kenji**
Hiroshima-shi
Hiroshima 733-8553 (JP)
• **FANG, Yuan**
Shanghai 201900 (CN)
• **CUI, Jian**
Shanghai 201900 (CN)
• **YU, Yan**
Shanghai 201900 (CN)

(74) Representative: **Patent- und Rechtsanwälte**
Dr. Solf & Zapf
Candidplatz 15
81543 München (DE)

(54) **SIDE SEAL PLATE TRANSFER DEVICE**

(57) A side seal plate transfer device comprises: a pair of side seal plate preheating apparatuses (16) for accommodating side seal plates (12) for end surfaces of a pair of cooling rollers (11); a pair of side seal plate pressing and attachment apparatuses (13); a base (110), a melting pool (10), the cooling rollers, the side seal plate pressing and attachment apparatuses and the side seal plate preheating apparatuses being disposed at positions closer to the lower side relative to the base; a pair of guide rails (111) disposed on the base and linearly extending at outer sides relative to the two end surfaces of the cooling rollers; a pair of side seal plate transfer apparatuses (121), travelling on the respective guide rails, and transferring the side seal plates; a first opening (131) formed in the base above the melting pool portion; a pair of second openings (133), serving as paths for transferring side seal plates and formed on the base; and a pair of third openings (132), serving as paths for transferring side seal plates and formed on the base. The side seal plate transfer device allows an operator to easily recognize a safe operation area, and can fast transfer side seal plates from the preheating apparatuses to the

melting pool portion.

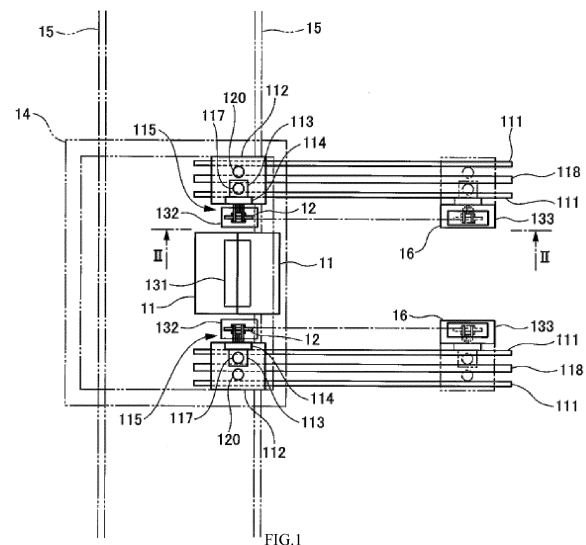


FIG.1

Description

Technical Field

[0001] The present invention relates to a side seal plate transfer device.

Background Art

[0002] In a dual-roller continuous casting apparatus, a pair of cooling rollers are oppositely arranged in parallel at the same height, and side seal plates are respectively disposed on the both axial end sides of the cooling rollers, and molten metal is injected into a space (a melting pool) surrounded by the pair of cooling rollers and said side seal plates while rotating the cooling rollers, so that a cast steel strip can be manufactured between the pair of the cooling rollers toward the lower side.

[0003] In such dual-roller continuous casting apparatus, the side seal plates need to be preheated to be about 900-1300°C before casting is started, therefore, for example, in the following patent document 1, such a side seal plate exchange apparatus is arranged, that is, after being preheated to about 1200°C in a heater, the side seal plates are held and rotated to change the direction through a clamping apparatus, then are driven by a flatbed to travel and move, so as to be arranged on both end sides of the cooling rollers.

Prior art document

Patent document

[0004] Patent document 1: Japanese Patent Application Laid-Open No. H5-329583

Summary Of The Invention

Problems to be solved by the invention

[0005] In the side seal plate exchange apparatus of the dual-roller continuous casting apparatus recorded in the patent document 1, the side seal plates preheated to a high temperature are held and rotated to change the direction through the clamping apparatus, then are driven by the flatbed to travel and move, so as to move on both end sides of the cooling rollers.

[0006] Due to the fact that several operators frequently perform inspection and operation on a certain floor of the cooling roller of the continuous casting apparatus in operation, an operation space is required and safety should be ensured.

[0007] In order to ensure the safety of the operator, it is expected that the operation areas that can be utilized for the maintenance and inspection of major devices, such as the melting pool, side seal plate preheating apparatuses, and side seal plate pressing and attachment apparatuses are clear at a glance. In addition, it is ex-

pected that there are no major devices in the operation area and the operation area is a wider area.

[0008] However, in the patent document 1, the support serving as the arm with the rotating body is relatively large in rotation, the moving range is not clear at a glance before the moving, and thus it is difficult for the operator to judge a safe operation range. Also, it is assumed that, in the case of considering a device used for transferring an object by hanging from the top, it is difficult for the operator operating on a floor to judge a safe operation range without knowing the moving range of the object.

[0009] Moreover, as described in the patent document 1, when the side seal plates are moved, compared with a linear movement, changing the direction of the side seal plates not only requires a relatively complex device, but also consumes the moving time. Due to the fact that even the area capable of being utilized by the operation is increased, the consumed time on the transfer of the side seal plates can also cause the cooling of the heated side seal plates, it is expected to have a configuration of a device that does not consume time on the transfer of the side seal plates.

[0010] In view of this situation, the present invention aims to provide a side seal plate transfer device that allows an operator to easily determine a safe operating area and can fast transfer side seal plates from the preheating apparatuses to the melting pool.

Method for solving the problems

[0011] The side seal plate transfer device in the invention for solving the described problems comprises: a pair of side seal plate preheating apparatuses for receiving and heating side seal plates which are used in connection with end surfaces of a pair of cooling rollers constituting a melting pool of a continuous casting apparatus; a pair of side seal plate pressing and attachment apparatuses disposed opposite to the two end surfaces of the cooling rollers respectively and capable of assembling and disassembling the side seal plates, and enabling the side seal plates to be pressed and attached to the end surfaces of the cooling rollers, the side seal plate transfer device is characterized by further comprising: a base, the melting pool, the cooling rollers, the side seal plate pressing and attachment apparatuses and the side seal plate preheating apparatuses being provided at positions closer to the lower side relative to the base; a pair of guide rails provided on the base, when viewed from above, at the outer side of the two end surfaces of the cooling rollers, extending linearly from the side seal plate pressing and attachment apparatuses to the side seal plate preheating apparatuses respectively; a pair of side seal plate transfer apparatuses, travelling on the respective guide rails, supporting the side seal plates in a detachable manner, and transferring the side seal plates between the side seal plate preheating apparatuses and the side seal plate pressing and attachment apparatuses; a first opening formed on the base above the melting

pool; a pair of second openings, serving as paths for transferring the side seal plates from the side seal plate preheating apparatuses to the side seal plate transfer apparatuses and formed on the base at a position where a preset distance is separated from the guide rails towards the cooling roller side; a pair of third openings, serving as paths for transferring the side seal plates from the side seal plates transfer apparatuses to the side seal plate pressing and attachment apparatuses and formed on the base at a position where the preset distance is separated from the guide rails towards the cooling roller side.

[0012] Also, the side seal plate transfer device in the present invention is characterized in that, the third openings are arranged between the first opening and the guide rails, and are located in line with the first opening along the axial direction of the cooling rollers.

[0013] In addition, the side seal plate transfer device in the present invention is characterized in that, a pair of sliding plates are respectively arranged on the pair of the second openings and the pair of the third openings, and perform opening or closing in a manner that horizontally move at the lower face side of the base.

[0014] Moreover, the side seal plate transfer device in the present invention is characterized in that, the respective guide rails are composed of two guide rails, the side seal plate transfer device is provided with a rack which is arranged between the two guide rails and extends parallel to the guide rails, the side seal plate transfer apparatus comprises a clamping apparatus, a reciprocating moving apparatus and a lifting moving apparatus, the clamping apparatus comprises a mechanism for temporarily clamping the side seal plate, the reciprocating moving apparatus comprises a pinion and a motor, the pinion is meshed with the rack and can move along the extension direction of the rack, the motor drives the pinion, the lifting moving apparatus comprises a mechanism for enabling the clamping apparatus to move up and down at a position where the preset distance is separated from the guide rail towards the cooling roller side.

[0015] Further, the side seal plate transfer device in the present invention is characterized in that, the clamping apparatus is lifted by the lifting moving apparatus in a manner that can penetrate through the second opening or the third opening.

Effect of the invention

[0016] According to the side seal plate transfer device in the present invention, due to the fact that a quadrangular area surrounded by the first opening (a certain position of the melting pool) and the pair of linear guide rails exists on the base, and relevant major devices are arranged under the base, the area on the base can be utilized by the operator to perform operation and inspection on the melting pool, the pressing and attachment apparatus and the preheating apparatus. Therefore, the operator naturally walks carefully in the area, taking care

not to place extra object, making it easier to ensure a safe space for operation.

[0017] Further, due to the fact that the relevant major devices are arranged under the base, a larger operation area on the base can be ensured.

[0018] Further, due to the fact that the side seal plate transfer apparatuses are arranged to travel on the linear guide rails at the outer side relative to both end surfaces of the cooling rollers, the operation in the quadrangular area cannot be hindered, so as to form a general target for recognizing the periphery of the area.

[0019] Further, due to the fact that the side seal plate transfer apparatuses travel on the linear guide rails, and both the second openings and the third openings are located at the same distance from the inner side of the linear guide rails, and when viewed from the linear guide rails, the third openings are arranged at one side close to the cooling rollers, so that the transfer distance of the side seal plates can be shortened, and the side seal plates can be rapidly transferred.

[0020] Moreover, due to the fact that the third openings (the second openings) are formed between the first opening and the guide rails, and the third openings and the first opening are located in line with the first opening in the axial direction of the cooling rollers, it can be ensured that the operation area surrounded by the first opening, the pair of the second openings and the pair of the third openings are relatively large, and easy to recognize the range of the operation area.

[0021] Moreover, due to the fact that the second openings and the third openings are openings used only when the side seal plates are transferred, and are not used in other time, a closed state thereof can be realized through the sliding plates when not in use, so as to make it easy to perform the operation safely on the base.

[0022] Moreover, due to the fact that the formation of the quadrangular area surrounded by the first opening and the pair of linear guide rails is added with the rack extending parallel to the linear guide rails, it is easier to recognize the situation that the area appears on the base, so as to easily ensure the space for performing the operation safely.

[0023] Moreover, due to the fact that the distance, separated from the guide rails, of the lifting moving apparatus at the position for clamping the side seal plate at the side seal plate preheating apparatus is the same as that at the position for releasing and transferring the side seal plate at the side seal plate pressing and attachment apparatus, the moving distance can be shortened, and the side seal plates can be moved more rapidly.

[0024] Moreover, due to the fact that the clamping apparatuses are lifted by the lifting moving apparatuses by penetrating through the second openings or the third openings, the side seal plates can be safely and smoothly transferred from the side seal plate preheating apparatuses to the side seal plate pressing and attachment apparatuses.

Description Of The Drawings

[0025]

Fig. 1 is a top view showing a schematic structure of main portions in the major embodiment of the dual-roller continuous casting apparatus using the side seal plate transfer device in the present invention.

Fig. 2 is a view viewed along the arrow line of a section taken along line II-II in Fig. 1.

Fig. 3 is a view viewed along the arrow line of a section taken along line III-III in Fig. 2.

Fig. 4 is an illustration view of the melting pool.

Detailed Description Of The Preferred Embodiments

[0026] Although the embodiments of the side seal plate transfer device and the dual-roller continuous casting apparatus using the same according to the present invention are described with reference to the drawings, the present invention is not limited to the following embodiments described with reference to the drawings.

(Major embodiment)

[0027] The major embodiment of the side seal plate transfer device and the dual-roller continuous casting apparatus using the same according to the present invention are described with reference to Figs. 1-4.

[0028] In Figs. 1-4, 1 is molten metal, 10 is a melting pool, 11 is a cooling roller, 12 is a side seal plate, 13 is a side seal plate pressing and attachment apparatus, 14 is a tundish, 15 is a moving guide rail, and 16 is a side seal plate preheating apparatus.

[0029] The cooling rollers 11 are arranged in pairs opposite to and parallel to each other at the same height in a manner that the axial direction is oriented in the horizontal direction. The side seal plates 12 are arranged in pairs between the pair of the cooling rollers 11 and on the both axial end sides of the cooling rollers 11 respectively, and the melting pool 10 is formed in a space formed between the side seal plates 12 and the cooling rollers 11.

[0030] The side seal plate pressing and attachment apparatuses 13 are arranged in pairs between the pair of the cooling rollers 11 and on the both axial end sides of the cooling rollers 11 respectively. For the side seal plate pressing and attachment apparatus 13, by retracting a hydraulic cylinder 13b, a side seal plate support member 13a that detachably supports the side seal plate 12 deviates away from the end portion of the cooling roller 11, so as to be located at a detachment position P1 at which the side seal plates 12 are detached. In addition, for the side seal plate pressing and attachment apparatus 13, by advancing the hydraulic cylinder 13b, the side seal plate support member 13a can be located at a pressing and attachment position P2, at which the side seal plates 12 are pressed and attached to the end portion of the cooling rollers 11, so as to form the melting pool 10 be-

tween the cooling rollers 11 and the side seal plates 12.

[0031] The tundish 14 is disposed above the melting pool 10 formed by the cooling rollers 11 and the side seal plates 12, and injects molten metal 1 into the melting pool 10. The moving guide rails 15 are disposed above the melting pool 10, and the tundish 14 moves along the axial direction of the cooling rollers 11.

[0032] That is, the tundish 14 is configured to be moved along the moving guide rails 15 to-above the melting pool 10 when injecting the molten metal 1 into the melting pool 10, and is moved along the moving guide rails 15 to a standby position away from upper side of the melting pool 10 in the axial direction of the cooling rollers 11 when implementing the exchange of the side seal plates 12, and the like.

[0033] Therefore, the tundish 14 can be moved on the moving guide rails 15 along the axial direction of the cooling rollers 11 to above the melting pool 10, and then inject the molten metal 1 into the melting pool 10; moreover, the tundish 14 can be moved in the direction perpendicular to the axial direction of the cooling rollers 11 to the standby position when implementing the exchange of the side seal plates 12, and the like.

[0034] The side seal plate preheating apparatuses 16 are disposed at the following positions, that is, the positions away from the side seal plate pressing and attachment apparatuses 13 in the horizontal direction orthogonal to the axial direction of the cooling rollers 11, and the upper part of the side seal plate preheating apparatuses 16 is provided with an inlet/outlet for placing the side seal plates 12 into the inside or taking out the side seal plates 12 from the inside. In addition, preferably, the side seal plate preheating apparatuses 16 are set in such a manner that the height position (see Fig. 2) of the side seal plates 12 placed inside and the position in the axial direction of the cooling rollers 11 (see Fig. 1) are approximately consistent with the position of the side seal plates 12 held by the side seal plate support member 13a at the detachment position P1 of the side seal plate pressing and attachment apparatus 13.

[0035] Moreover, between the upper side of the side seal plate preheating apparatuses 16 and the upper side of the side seal plate pressing and attachment apparatuses 13 disposed in a pairwise manner on both sides in the axial direction of the cooling rollers 11 respectively, guide rails 111, two as one set, are respectively disposed via a base 110 to connect them linearly. On the set of the guide rails 111, moving tables 112 that can slide along the guide rails 111 through a sliding block 112a are respectively disposed across the two guide rails 111.

[0036] On the moving tables 112, columns 113 are vertically arranged respectively in the manner that the guide surface faces the cooling roller 11 side. On the guide surfaces of the columns 113, sliding tables 114 capable of sliding along the guide surfaces of the columns 113 in the vertical direction are respectively mounted. On the surface on the cooling roller 11 side of the sliding table 114, clamping apparatuses, namely a clamping appara-

tus 115, for clamping and holding the side seal plates 12 in a detachable manner are respectively mounted.

[0037] Inside the columns 113, screw shafts 116 are respectively arranged in a rotatable manner, the screw shafts 116 are screwed to the sliding tables 114 in the vertical direction towards the axial direction through the nut block (figure is omitted). Servo motors 117 are respectively mounted on the upper part of the columns 113, and the drive shafts of the servo motors 117 and the upper end of the screw shafts 116 are connected.

[0038] In other words, when enabling the drive shafts of the servo motors 117 to rotate so as to drive the screw shafts 116 to rotate, the sliding tables 114 can slide in the vertical direction on the guide surfaces of the columns 113 by means of the nut blocks, and the clamping apparatuses 115 can be linearly moved up and down.

[0039] Between the set of the two guide rails 111, racks 118 are respectively provided in the length direction along the entire length of the guide rails 111. Servo motors 120 are respectively arranged on the moving tables 112, and the servo motor 120 enables the drive shaft 120a to penetrate through the moving table 112 in the vertical direction in a manner that the end of the drive shaft 120a is disposed on the lower portion of the moving table 112. At the end of the drive shafts 120a of the servo motors 120, pinions 119 meshed with the racks 118 are respectively mounted in the coaxial mode.

[0040] In other words, when enabling the drive shaft 120a of the servo motor 120 to rotate and cause the pinion 119 to rotate, via the pinion 119 rotating and moving in the length direction of the rack 118, the moving table 112 can be moved along the guide rails 111 through the sliding block 112a, so that the clamping apparatus 115 can be switched between the position P3 above the inlet/outlet of the side seal plate preheating apparatuses 16 and the position P4 above the side seal plate support member 13a, wherein, the side seal plate support member 13a is disposed at the detachment position P1 of the side seal plate pressing and attachment apparatus 13.

[0041] In such an embodiment, the guide rails 111, the moving table 112, the rack 118, the pinion 119, the servo motor 120 and the like form the reciprocating moving apparatus 122; the column 113, the sliding table 114, the screw shaft 116, the servo motor 117 and the like form the lifting moving apparatus 123; the reciprocating moving apparatus 122, the lifting moving apparatus 123, and the like form moving apparatus; the clamping apparatus 115, the moving apparatuses 122 and 123 and the like form the side seal plate transfer apparatus 121, and the cooling rollers 11, the side seal plates 12, the side seal plate pressing and attachment apparatuses 13, the side seal plate preheating apparatuses 16, the side seal plate transfer apparatuses 121 and the like form the dual-roller continuous casting apparatus.

[0042] In the dual-roller continuous casting apparatus using the side seal plate transfer apparatuses 121 in the present embodiment, the side seal plates 12 are disposed on the both axial end sides of the cooling rollers

11 to form the melting pool 10.

[0043] Firstly, the hydraulic cylinder 13b is contracted in the manner that the side seal plate support member 13a of the side seal plate pressing and attachment apparatus 13 is arranged at the detachment position P1, and the servo motor 120 is operated so as to position the moving table 112 in the manner that the clamping apparatus 115 is arranged at the position P3 above the side seal plate preheating apparatus 16. Then, the side seal plates 12 are placed inside the side seal plate preheating apparatuses 16, and the side seal plate preheating apparatuses 16 are caused to operate, so as to preheat the side seal plates 12.

[0044] Then, after the side seal plates 12 are preheated to a range, for example, of 900-1300°C, the drive shafts of the servo motors 117 are enabled to rotate and drive the screw shafts 116 to rotate, and the sliding tables 114 are driven to move downwards, so that the clamping apparatuses 115 can linearly descend in the vertical direction, and the clamping apparatuses 115 are placed into the side seal plate preheating apparatuses 16, so as to clamp the side seal plates 12 through the clamping apparatuses 115. Then, the drive shafts of the servo motors 117 are enabled to rotate reversely and drive the screw shafts 116 to rotate reversely, and the sliding tables 114 are driven to move upwards, so that the clamping apparatuses 115 can linearly ascend in the vertical direction, so as to take the side seal plates 12 out of the side seal plate preheating apparatuses 16.

[0045] Next, the drive shafts 120a of the servo motors 120 are enabled to rotate and drive the pinions 119 to rotate, and the pinions 119 move along the racks 118, so that the moving tables 112 can linearly move in the horizontal direction along the guide rails 111 through the sliding blocks 112a, and the clamping apparatuses 115 are disposed at the position P4 above the side seal plate support members 13a of the side seal plate pressing and attachment apparatuses 13.

[0046] Then, the drive shafts of the servo motors 117 are enabled to rotate and drive the screw shafts 116 to rotate, and the sliding tables 114 are driven to move downwards, so that the clamping apparatuses 115 can linearly descend in the vertical direction, and the side seal plates 12 are placed on the side seal plate support members 13a of the side seal plate pressing and attachment apparatuses 13, and then, the clamping apparatuses 115 release the side seal plates 12. Then, the drive shafts of the servo motors 117 are enabled to rotate reversely and drive the screw shafts 116 to rotate reversely, and the sliding tables 114 are driven to move upwards, so that the clamping apparatuses 115 can linearly ascend in the vertical direction.

[0047] Next, the side seal plate support members 13a of the side seal plate pressing and attachment apparatuses 13 are enabled to be located at the pressing and attachment position P2 by extending the hydraulic cylinder 13b, namely: the side seal plates 12 are pressed and attached to the end portions of the cooling rollers 11, so

as to form the melting pool 10 between the cooling rollers 11 and the side seal plates 12.

[0048] In other words, in the present embodiment, the side seal plates 12 can be transferred only in a linear moving mode under the condition that the side seal plates 12 are not rotationally moved between the side seal plate preheating apparatuses 16 and the side seal plate pressing and attachment apparatuses 13.

[0049] Therefore, in the present embodiment, due to the fact that the side seal plates 12 can be moved in a state of being toward the same direction as the state of pressing the end portion of the cooling rollers 11, and the moving path of the side seal plates 12 can be shortened, the side seal plates 12 can be moved rapidly, and thus the heat release amount of the side seal plates 12 preheated to the high temperature during the moving can be inhibited.

[0050] Therefore, according to the present embodiment, the heat release amount of the preheated side seal plates 12 disposed at the end portion position of the cooling rollers 11 can be inhibited, so as to reduce the waste of heat.

[0051] In addition, due to the fact that the side seal plates 12 are not rotationally moved between the side seal plate preheating apparatuses 16 and the side seal plate pressing and attachment apparatuses 13, there is no need to ensure the space for rotation, and the space required for exchanging the side seal plates 12 can be reduced.

[0052] More concrete description is as follows. The set of guide rails 111 are linearly arranged on the base 110 between the upper side of the side seal plate preheating apparatuses 16 and the upper side of the side seal plate pressing and attachment apparatuses 13. The lifting moving apparatuses 123 and the clamping apparatuses 115 are arranged on the moving tables 112 moving on the set of the guide rails 111.

[0053] In this state, when the operator walks on the base 110, the set of the guide rails 111 will enter the field of view of the operator, so that the operator can intuitively recognize the moving range of the moving tables 112. Therefore, due to the fact that the operator will avoid a contact accident with the moving tables 112 and the clamping apparatuses 115, the operator will move in a manner close to an unconscious feeling without entering the inner side and vicinity of the set of guide rails 111. Therefore, the safety of the operator can be ensured easily.

[0054] In addition, due to the fact that the side seal plate preheating apparatuses 16 and the side seal plate pressing and attachment apparatuses 13 can be arranged separately from each other by using the set of guide rails 111, the operation space necessary for maintaining the apparatuses can be ensured. Also, the lifting moving apparatuses 123 and the clamping apparatuses 115 can also move along with the moving tables 112, therefore, during the maintenance of the side seal plate pressing and attachment apparatuses 13 and the like,

the moving tables 112 are used to move the clamping apparatuses 115 and the like to a position at which no obstruction will occur, which can also facilitate performing the maintenance operation safely.

[0055] In addition, due to the fact that the side seal plate transfer apparatuses 121 are independently arranged on the axial both end sides of the cooling rollers 11 respectively in pairs, the exchange of the side seal plates 12 at one axial end side of the cooling rollers 11 and of the side seal plates 12 at the other end side can be implemented independently, and the side seal plate transfer apparatuses 121 of the same size can be applied regardless of the axial length of the cooling rollers 11.

[0056] Here, the openings 131-133 formed on the base 110 and the devices around the base 110 will be further described.

[0057] Although the base 110 is arranged at a fixed height, and is further provided with devices, the base 110 is also the space for the operator to move or operate in order to perform the inspection and the like of the devices. At a lower position relative to the base 110, the melting pool 10, the cooling rollers 11, the side seal plate pressing and attachment apparatuses 13 and the side seal plate preheating apparatuses 16 are arranged. A pair of guide rails 111 are disposed on the base 110, when viewed from above, at the outer side of both end surfaces of the cooling rollers 11, the pair of guide rails 111 extend linearly from the side seal plate pressing and attachment apparatuses 13 to the side seal plate preheating apparatuses 16 respectively.

[0058] The side seal plate transfer apparatuses 121 are in one pair, and travel on the pair of guide rails 111 respectively. The side seal plate transfer apparatuses 121 support the side seal plates 12 in a detachable manner, and transfer the side seal plates 12 between the side seal plate preheating apparatuses 16 and the side seal plate pressing and attachment apparatuses 13.

[0059] The first opening 131 is formed on the base 110 above the melting pool 10. The tundish 14 is placed on the moving guide rail 15 (left side in Fig. 1) arranged on the base 110 and the moving guide rail 15 (right side in Fig. 1) arranged on an upper side relative to the base 110 to move, until the position of the first opening 131. During the operation of the continuous casting apparatus, the tundish 14 moves downwards, and injects the molten metal 1 into the melting pool 10 from the lower portion of the tundish 14 through the first opening 131.

[0060] In addition, a pair of the second openings 133 are formed on the base 110. The second openings 133 are located at a preset distance from the guide rails 111 towards the cooling rollers 11 side, and are arranged in a manner corresponding to the respective guide rails 111. The second openings 133 are the paths for the side seal plate transfer apparatuses 121 to receive the side seal plates 12 from the side seal plate preheating apparatuses 16, or to transfer the side seal plates 12 to the side seal plate preheating apparatuses 16.

[0061] In addition, a pair of the third openings 132 are

formed on the base 110. The third openings 132 are located at a preset distance from the guide rails 111 towards the cooling rollers 11 side, and are arranged in a manner corresponding to the respective guide rails 111. The third openings 132 are the paths for the side seal plate transfer apparatuses 121 to receive the side seal plates 12 from the side seal plate pressing and attachment apparatuses 13, or to transfer the side seal plates 12 to the side seal plate pressing and attachment apparatuses 13.

[0062] According to the structure, due to the fact that a quadrangular area surrounded by the first opening 131 (above a certain position of the melting pool 10) and the pair of linear guide rails 111 exists on the base 110, and relevant major devices are arranged under the base 110, the area on the base 110 can be utilized by the operator to perform operation and inspection on the melting pool 10, the pressing and attachment apparatus 13 and the preheating apparatus 16.

[0063] Therefore, the operator naturally walks carefully in the area, taking care not to place extra object, making it easier to ensure a safe space for operation. For example, due to the fact that under the condition of the following configuration, that is, the second openings 133 and the third openings 132 are formed at the outer side of the area enclosed by the pair of guide rails 111, it is difficult to recognize the range of the operation area, and therefore, it is difficult to ensure the safety if no attention is given to the operator.

[0064] Further, due to the fact that the relevant major devices are arranged under the base 110, a larger operation area on the base 110 can be ensured.

[0065] Further, due to the fact that the side seal plate transfer apparatuses 121 travel on the linear guide rails 111 arranged at the outer side relative to both end surfaces of the cooling rollers 11, the operation in the quadrangular area cannot be hindered, and it can rather be a general indication for recognizing the periphery of the area.

[0066] Further, due to the fact that the side seal plate transfer apparatuses 121 travel on the linear guide rails 111, and both the second openings 133 and the third openings 132 are located at the same distance on the inner side of the linear guide rails 111, also, when viewed from the linear guide rails 111, the third opening 132 is arranged at one side close to the cooling roller 11, so that the transfer distance of the side seal plates 12 can be shortened, and the side seal plates 12 can be rapidly transferred.

[0067] Moreover, due to the fact that the third openings 132 are formed between the first opening 131 and the guide rails 111, and are located in line with the first opening 131 in the axial direction of the cooling rollers 11, it can be ensured that the operation area surrounded by the first opening 131, the pair of the second openings 133 and the pair of the third openings 132 are relatively large, and easier to recognize the safe operation area.

[0068] Also, due to the fact that the area enclosed by

the openings 131-133 is also an area between the pair of guide rails 111, it is also easy to visibly recognize the area from the pair of guide rails 111. In addition, due to the fact that the side seal plate transfer apparatuses 121 travel on the guide rails 111, but do not travel in the area between the pair of guide rails 111, there is no possibility of colliding with the operator.

[0069] A pair of sliding plates 140 are respectively disposed on the pair of the second openings 133 and the pair of the third openings 132, and perform opening or closing in a manner that horizontally move at the lower face side of the base 110. The opening and closing of the sliding plates 140 will take the hydraulic cylinder 141 connected with the sliding plates 140 as a drive unit respectively. As long as the sliding plates 140 are light weighted, an pneumatic cylinder can be used. However, preferably, the sliding plates 140 has rigidity, in this case, due to accompanying weight, preferably, the drive unit is used as the hydraulic cylinder 141.

[0070] According to the structure, due to the fact that the second openings 133 and the third openings 132 are openings used only when the side seal plates 12 are transferred, and are not used in other time, a closed state thereof can be realized through the sliding plates 140 when not in use, so that the operation can be easily and safely performed on the base 110 by the operator.

[0071] In addition, respective guide rails 111 are composed of two guide rails. The rack 118 extending parallel to the guide rails 111 is arranged between the two guide rails 111. The side seal plate transfer apparatus 121 comprises the clamping apparatus 115, the reciprocating moving apparatus 122 and the lifting moving apparatus 123. The clamping apparatus 115 is provided with a mechanism for temporally clamping the side seal plate 12. The reciprocating moving apparatus 122 is provided with a pinion 119 and a motor 120, the pinion 119 are meshed with the rack 118 and can move along the extending direction of the rack 118, and the motor 120 drives the pinion 119. The lifting moving apparatus 123 is a mechanism for enabling the clamping apparatus 115 to move up and down at the position separated from the guide rails 111 towards the cooling roller 11 side by a preset distance.

[0072] According to the structure, due to the fact that the formation of the quadrangular area surrounded by the first opening 131 at which the lower part of the tundish 14 reaches and the pair of guide rails 111 is added with the rack extending parallel to the guide rail 111, it is easier to recognize the situation that the quadrangular area appears on the base 110, so as to easily ensure the safe space for operation.

[0073] In addition, due to the fact that the distance, separated from the guide rails 111, of the lifting moving apparatus 123 at the position for clamping the side seal plates 12 at the side seal plate preheating apparatuses 16 is substantially the same as that at the position for releasing and transferring the side seal plates 12 at the side seal plate pressing and attachment apparatuses 13,

the moving distance of the side seal plates 12 can be shortened, the side seal plates do not rotate, and the side seal plates 12 can be moved more rapidly.

[0074] Moreover, due to the fact that the clamping apparatuses 115 are lifted by the lifting moving apparatuses 123 by penetrating through the second openings 133 or the third openings 132, the side seal plates 12 can be safely and smoothly transferred from the side seal plate preheating apparatuses 16 to the side seal plate pressing and attachment apparatuses 13.

(Alternative embodiments)

[0075] Furthermore, in the embodiments as described above, the moving tables 112 can be arranged in a manner that move relative to the guide rails 111 through the sliding blocks 112a, however, as an alternative embodiment, for example, the following manner can also be used, that is, instead of the sliding blocks 112a, the moving tables 112 can be arranged in a manner that move relative to the guide rails 111 through wheels.

[0076] In addition, in the embodiments as described above, the following manner is used, that is, through the racks 118, the pinions 119 and the like, the moving tables 112 can be sliding moved along the guide rails 111, however, as an alternative embodiment, for example, the following manner can also be used, that is, by means of an actuator such as a retractable hydraulic cylinder or a rotatable screw shaft and the like, the moving tables 112 can be linearly reciprocated along the guide rails 111.

[0077] Further, in the embodiments as described above, the following manner is used, that is, by means of the screw shaft 116 and the like, the moving tables 114 can be sliding moved along the columns 113, however, as an alternative embodiment, for example, the following manner can also be used, that is, by means of the actuator such as a retractable hydraulic cylinder, or the racks and pinions and the like, the moving tables 114 can be moved up and down linearly along the columns 113.

[0078] Further, in the embodiments as described above, the following manner is used, that is, by means of the moving guide rails 15, the tundish 14 is enabled to be moved in a horizontal direction to the standby position deviated from the upper side of the melting pool 10 toward the axial direction of the cooling rollers 11, however, as an alternative embodiment, for example, the following manner can also be used, that is, by means of a lifter, the tundish 14 is enabled to be moved in a vertical direction toward the standby position further deviated upward from the upper side of the melting pool 10.

[0079] In addition, under the condition that even the tundish 14 is arranged above the melting pool 10, the tundish 14 does not interfere with the side seal plate transfer apparatuses 121, when the exchange of the side seal plates 12 is implemented, the content that the tundish 14 moves towards the standby position can also be omitted.

Description of symbols

[0080]

5	1	Molten metal;
	10	Melting pool;
	11	Cooling roller;
	12	Side seal plate;
	13	Side seal plate pressing and attachment apparatus;
10	13a	Side seal plate support member;
	13b	Hydraulic cylinder;
	14	Tundish;
	15	Moving guide rail;
15	16	Side seal plate preheating apparatus;
	110	Base;
	111	Guide rail;
	112	Moving table;
	112a	Sliding block;
20	113	Column;
	114	Sliding table;
	115	Clamping apparatus;
	116	Screw shaft;
	117	Servo motor;
25	118	Rack;
	119	Pinion;
	120	Servo motor;
	120a	Drive shaft;
	121	Side seal plate transfer device;
30	122	Reciprocating moving apparatus;
	123	Lifting moving apparatus;
	131	First opening;
	132	Third opening;
	133	Second opening;
35	140	Sliding plate;
	141	Hydraulic cylinder.

Claims

1. A side seal plate transfer device, comprising:

a pair of side seal plate preheating apparatuses for receiving and heating side seal plates which are used in connection with end surfaces of a pair of cooling rollers constituting a melting pool of a continuous casting apparatus;
a pair of side seal plate pressing and attachment apparatuses disposed opposite to the two end surfaces of the cooling rollers respectively and capable of assembling and disassembling the side seal plates, and enabling the side seal plates to be pressed and attached to the end surfaces of the cooling rollers,
the side seal plate transfer device **characterized by** further comprising:

a base, the melting pool, the cooling rollers,

the side seal plate pressing and attachment apparatuses and the side seal plate preheating apparatuses being provided at positions closer to the lower side relative to the base;

a pair of guide rails provided on the base, when viewed from above, at the outer side of the two end surfaces of the cooling rollers, extending linearly from the side seal plate pressing and attachment apparatuses to the side seal plate preheating apparatuses respectively;

a pair of side seal plate transfer apparatuses, travelling on the respective guide rails, supporting the side seal plates in a detachable manner, and transferring the side seal plates between the side seal plate preheating apparatuses and the side seal plate pressing and attachment apparatuses;

a first opening formed on the base above the melting pool;

a pair of second openings, serving as paths for transferring the side seal plates from the side seal plate preheating apparatuses to the side seal plate transfer apparatuses, and formed on the base at a position where a preset distance is separated from the guide rails towards the cooling roller side;

a pair of third openings, serving as paths for transferring the side seal plates from the side seal plate transfer apparatuses to the side seal plate pressing and attachment apparatuses, and formed on the base at a position where the preset distance is separated from the guide rails towards the cooling roller side.

2. The side seal plate transfer device of claim 1, **characterized in that**,

the third openings are arranged between the first opening and the guide rails, and are located in line with the first opening in the axial direction of the cooling rollers.

3. The side seal plate transfer device of claim 1 or 2, **characterized in that**,

a pair of sliding plates are respectively disposed on the pair of the second openings and the pair of the third openings, and perform opening or closing in a manner that horizontally move at the lower face side of the base.

4. The side seal plate transfer device of any one of claims 1-3, **characterized in that**,

the respective guide rails are composed of two guide rails,

the side seal plate transfer device is provided with a rack which is arranged between the two guide rails

and extends parallel to the guide rails,

the side seal plate transfer apparatus comprises a clamping apparatus, a reciprocating moving apparatus and a lifting moving apparatus,

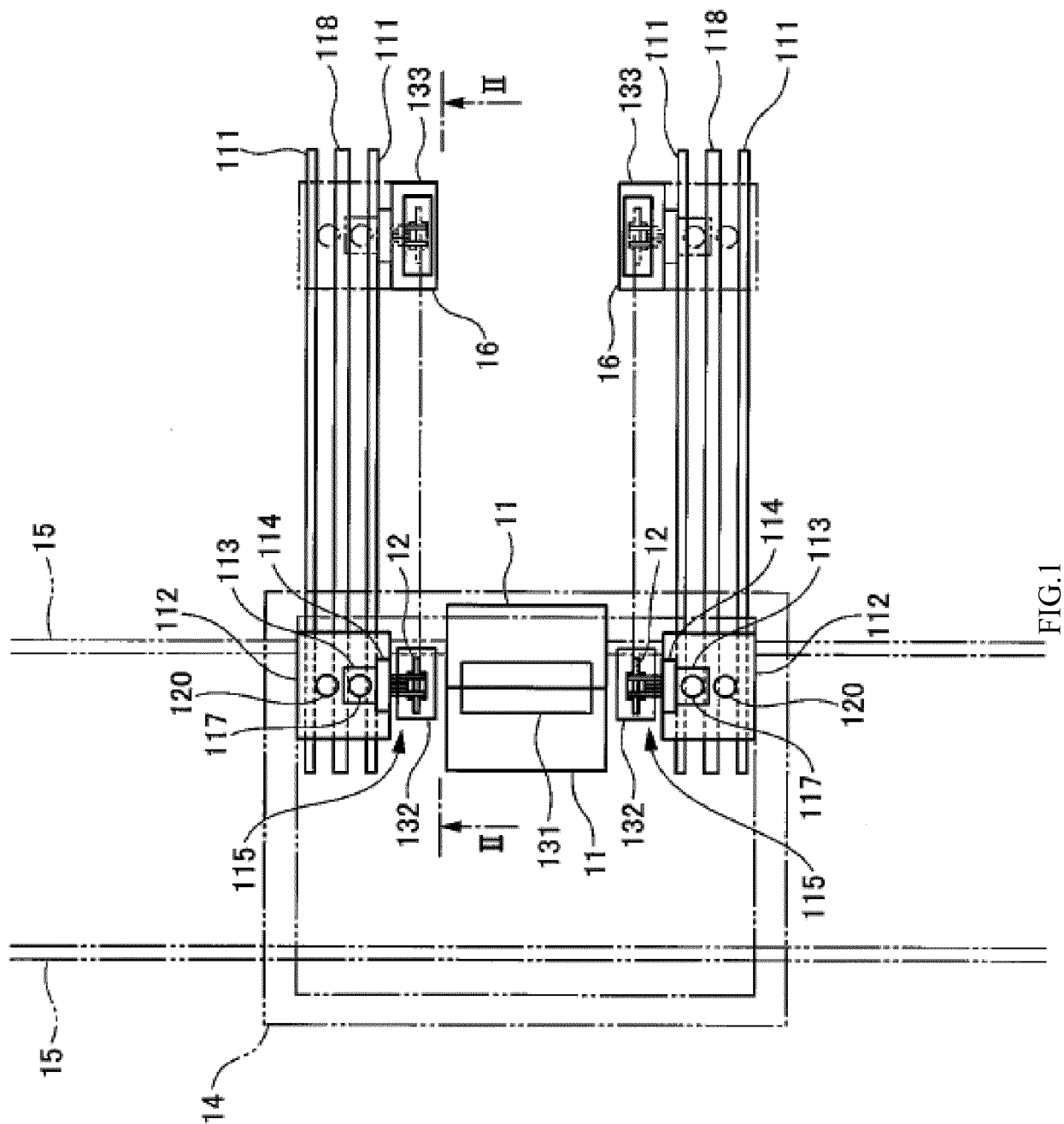
the clamping apparatus comprises a mechanism for temporarily clamping the side seal plate,

the reciprocating moving apparatus comprises a pinion and a motor, the pinion is meshed with the rack and can move along the extension direction of the rack, the motor drives the pinion, and

the lifting moving apparatus comprises a mechanism for enabling the clamping apparatus to move up and down at a position where the preset distance is separated from the guide rails towards the cooling roller side.

5. The twin-roller continuous casting device of claim 4, **characterized in that**,

the clamping apparatus is lifted by the lifting moving apparatus in a manner that can penetrate through the second opening or the third opening.



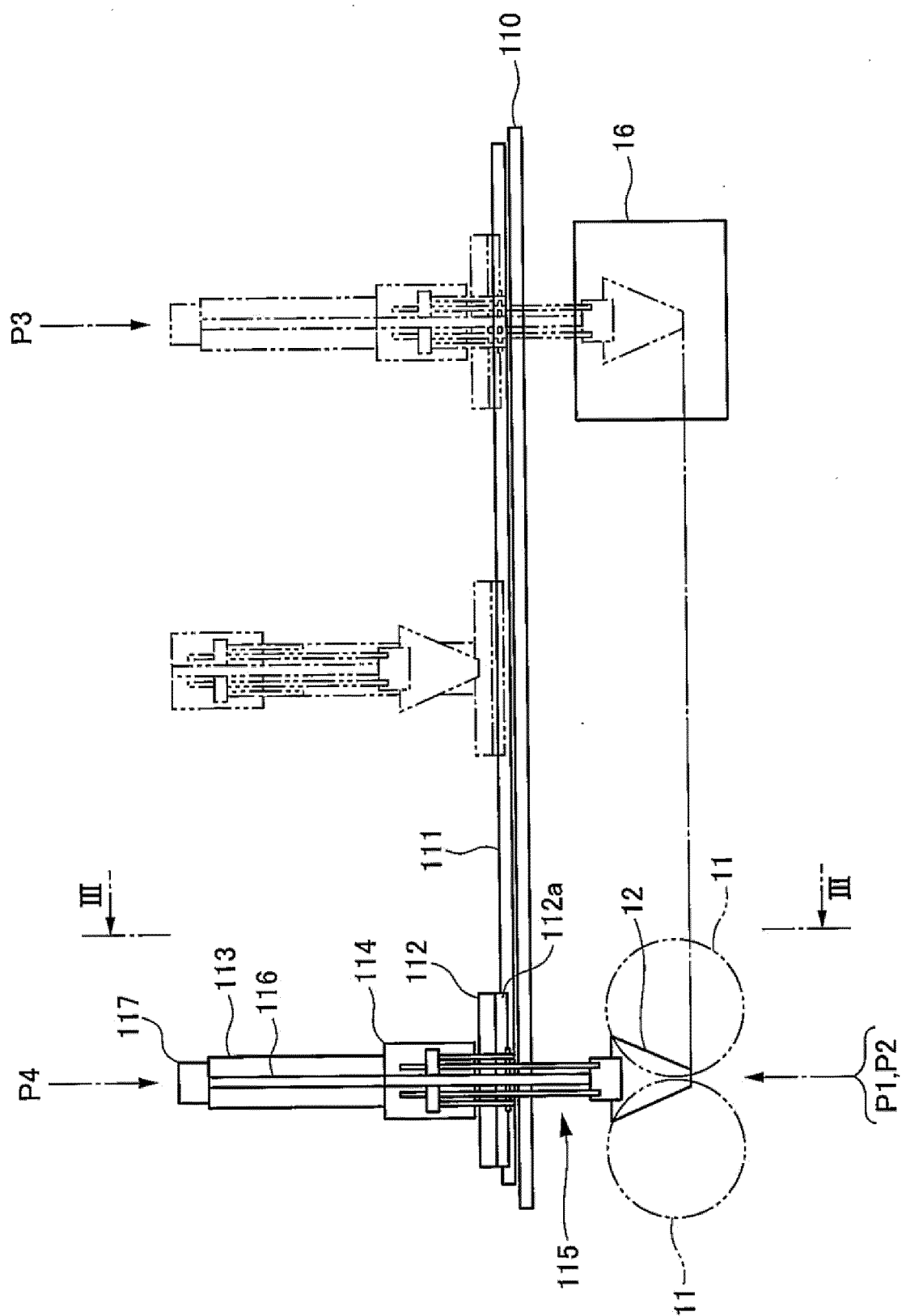


FIG. 2

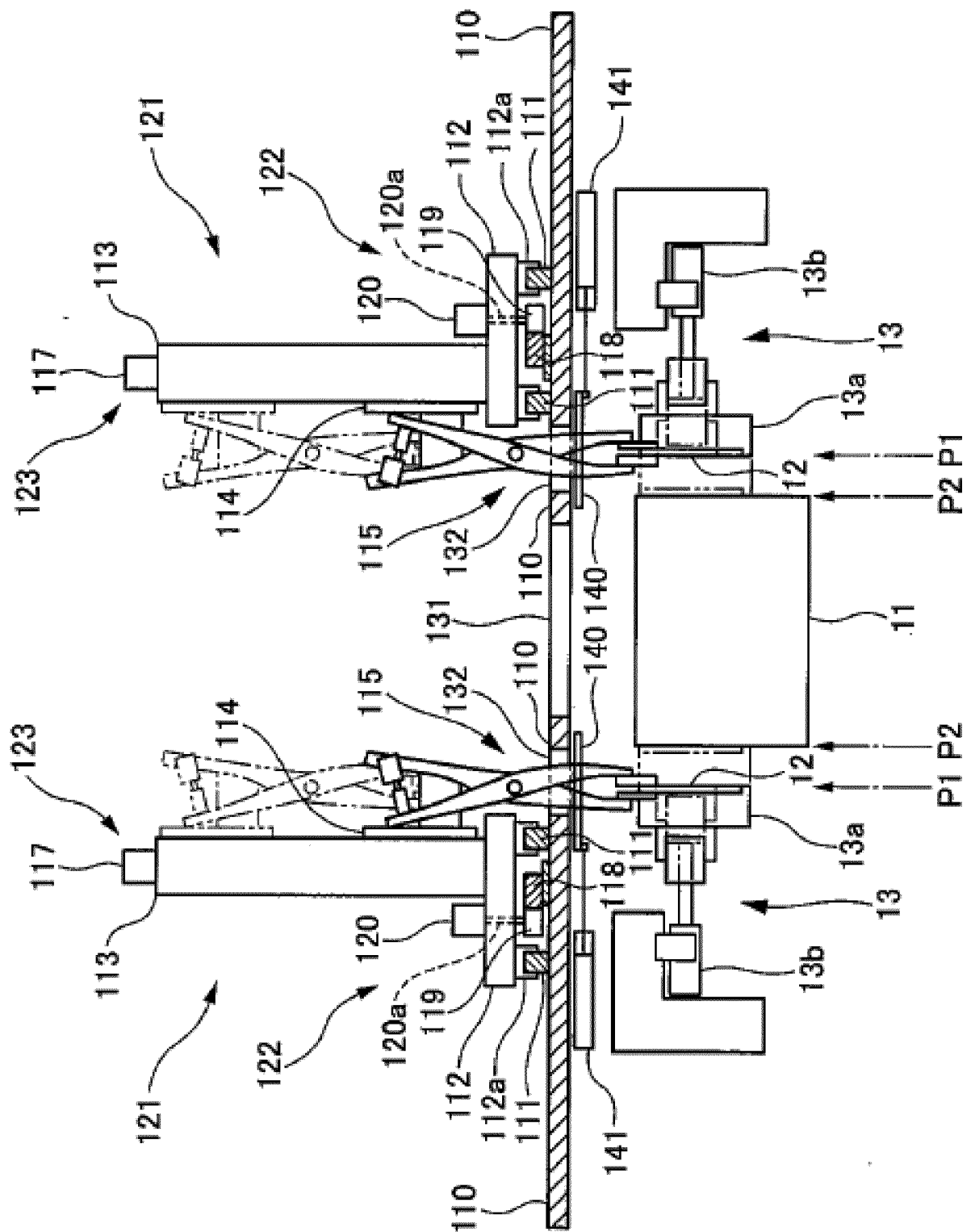


FIG. 3

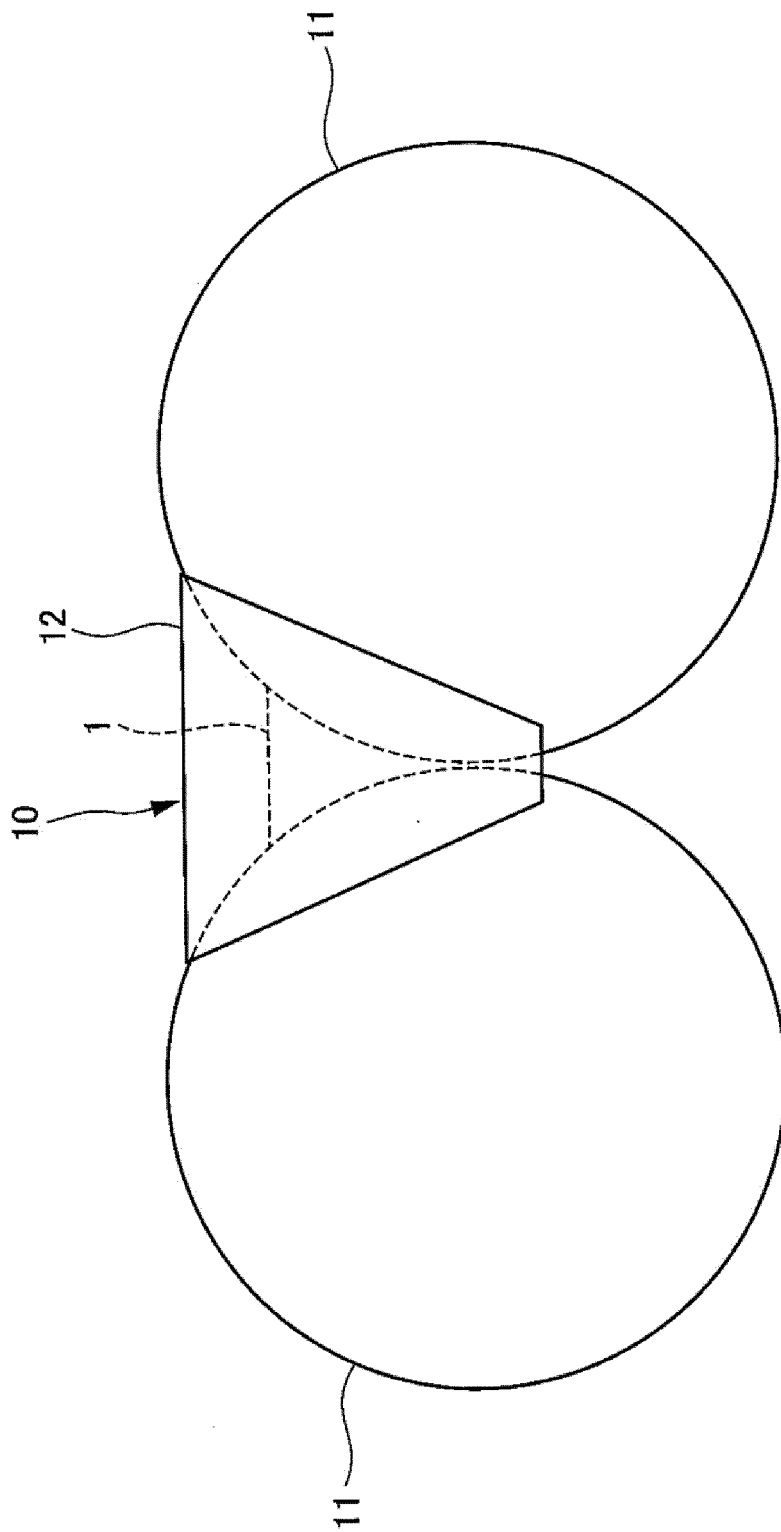


FIG.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/112011

A. CLASSIFICATION OF SUBJECT MATTER

B22D 11/06 (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)

B22D

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)

CNABS; CNKI, DWPI, SIPOABS, VEN: 侧封板, 导轨, 预热, 辊, 连铸; side, seal, continuous, cast, roller

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 201543794 U (BAOSTEEL GROUP CORP.; SHANGHAI BAOSTEEL ENGINEERING & TECHNOLOGY COMPANY LIMITED), 11 August 2010 (11.08.2010), description, pages 2-3, and figures 1-4	1-5
A	CN 103100674 A (CFHI DALIAN DESIGN AND RESEARCH INSTITUTE; CHINA FIRST HEAVY INDUSTRIES), 15 May 2013 (15.05.2013), entire document	1-5
A	CN 102198495 A (BAOSTEEL GROUP CORP.; SHANGHAI BAOSTEEL ENGINEERING & TECHNOLOGY COMPANY LIMITED), 28 September 2011 (28.09.2011), entire document	1-5
A	CN 104972081 A (YANSHAN UNIVERSITY), 14 October 2015 (14.10.2015), entire document	1-5
A	JP 0755357 B2 (MITSUBISHI HEAVY IND CO., LTD.), 14 June 1995 (14.06.1995), entire document	1-5

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search

15 February 2017

Date of mailing of the international search report

10 April 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

YING, Yiming

Telephone No. (86-10) 62085090

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family membersInternational application No.
PCT/CN2016/112011

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 201543794 U	11 August 2010	None	
CN 103100674 A	15 May 2013	None	
CN 102198495 A	28 September 2011	CN 102198495 B	29 May 2013
CN 104972081 A	14 October 2015	None	
JP 0755357 B2	14 June 1995	JP H05329583 A	14 December 1993
		JP H0755357 B2	14 June 1995

Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP H5329583 B [0004]