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(71) Applicant: **Posco**
Pohang-si, Gyeongsangbuk-do 37859 (KR)

(72) Inventor: **KIM, Sung Jool**
Pohang-si
Gyeongsangbuk-do 37881 (KR)

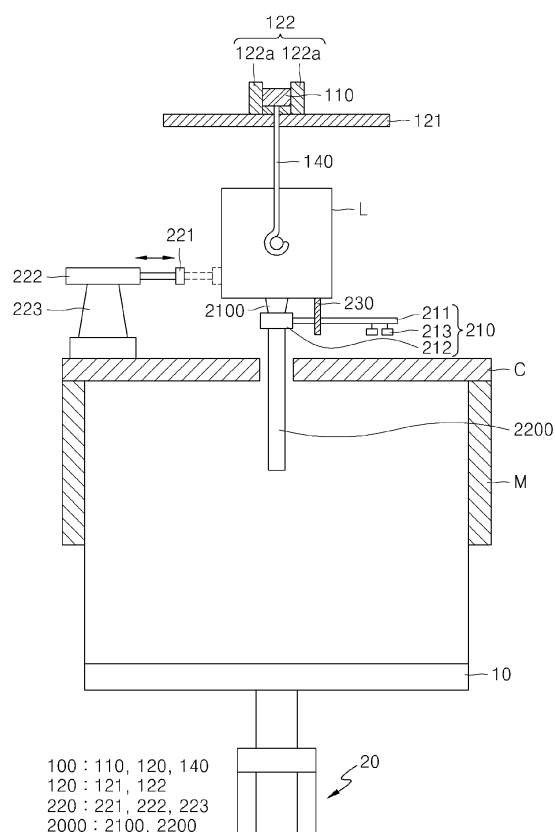
(74) Representative: **Zech, Stefan Markus**
Meissner Bolte Patentanwälte
Rechtsanwälte Partnerschaft mbB
Postfach 86 06 24
81633 München (DE)

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(54) **CASTING EQUIPMENT AND CASTING METHOD**

(57) A casting facility in accordance with the present invention includes a ladle for receiving molten steel, a mold for solidifying the molten steel provided from the ladle to be casted into a cast slab, a hanger extending in one direction, supporting the ladle, and being movable, a ladle gripping means extending in one direction and having one end connected to the hanger and the other end gripping the ladle, a hanger mounting part installed on the upper side of the mold, mounting the hanger for supporting the ladle, and allowing the ladle supported by the hanger to be positioned corresponding to the upper side of the mold, and a nozzle connected to the lower portion of the ladle and discharging the molten steel of the ladle. Therefore, in accordance with an embodiment of the present invention, the ladle may always be stably fixed in the same position by a hanger mounting stand and a stopper. In addition, the ladle and the nozzle may be disposed so as to be perpendicular to the ground without being tilted to any one side by the first and second balance adjustment parts, so that the molten steel may be stably supplied to the mold or the tundish.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a casting facility and a casting method, and more particularly, to a casting facility capable of adjusting balance between a ladle and a nozzle such that the ladle may always be positioned in the same position in positioning the ladle in the casting position, and a casting method.

BACKGROUND ART

[0002] In general, a continuous casting process includes a ladle for receiving the refined molten steel in a steelmaking process, a tundish for temporarily receiving the molten steel provided from the ladle, a shroud nozzle for supplying the molten steel of the ladle to the tundish, a mold for solidifying the molten steel supplied from the tundish into a predetermined shape to be casted into a cast slab, and a plurality of segments aligned and installed in one direction in the lower portion of the mold, and cooling the cast slab drawn from the mold.

[0003] Here, in supplying the molten steel of the ladle to the tundish, a ladle turret as illustrated in Korean Patent Laid-Open Publication No. 2013-0120149 is used. The ladle turret includes a swing tower which is rotationally driven, and ladle cradles installed so as to connected to both sides of the swing tower, and mounting ladles each thereon. In accordance with such a ladle turret, ladles are alternately positioned at the upper portion of the tundish by the rotation of the swing tower and the molten steel of the ladle is discharged into the tundish, so that the casting is continuously performed.

[0004] Such a ladle turret has an advantage in that the ladle may always be stably positioned at the same position at the upper portion of the tundish. However, the ladle turret is expensive and has a disadvantage in that the ladle receiving several hundreds of tons of molten steel is rotated, raised or lowered in order to be positioned at the casting position, so that a power consumption is large in the continuous casting process. Further, in the case of a semi-continuous casting in which the casting is terminated after casting a cast slab having a predetermined length, rather than continuously casting the cast slab, the operation of the ladle turret as described above becomes a more inefficient factor in aspect of a power consumption.

[0005] Meanwhile, in the continuous casting facility, the verticality of shroud nozzle is an important factor in order to prevent molten steel from being re-oxidized by the mixing of the external air when the molten steel of the ladle is supplied to the tundish. Generally, the shroud nozzle includes a ladle nozzle connected to the lower portion of the ladle and, a long nozzle clamped to the lower portion of the ladle nozzle in order to supply the molten steel of the ladle into the tundish. When the long nozzle is clamped to the ladle nozzle, such a shroud nozzle

differs from a clamping position between the ladle nozzle and the long nozzle or a verticality formed by the ladle nozzle and the long nozzle. That is, when the shroud nozzle is clamped to the ladle nozzle, in the case that the shroud nozzle is shifted to any one side and the array is disturbed or the misalignment is occurred, the external air may be invaded between the ladle nozzle and the long nozzle to be mixed into the molten steel. Therefore, when the long nozzle is clamped to the ladle nozzle, it is desired that the verticality is adjusted such that the long nozzle or the ladle nozzle is not shifted to any one side. In order to adjust the verticality, a shroud manipulator as disclosed in Korean Patent Laid-Open Publication No. 2013-0075570 is used. The manipulator of Korean Patent Laid-Open Publication No. 2013-0075570 includes a shroud arm composed so as to be movable forward and backward with respect to the long nozzle; a gripping part positioned in the lower side of the shroud arm, movable forward and backward with respect to the long nozzle, and capable of gripping the long nozzle; and a hydraulic moving means installed in the lower portion of the shroud arm and movable the gripping part forward and backward.

[0006] However, there is a problem that the shroud manipulator is expensive and has a complicated configuration, and requires a large installation area.

DISCLOSURE OF THE INVENTION

TECHNICAL PROBLEM

[0007] The present invention provides a casting facility capable of always positioning a ladle in the same position and adjusting balance between the ladle and nozzles in positioning the ladle in the casting position, and a casting method.

[0008] The present invention provides a casting facility disposed in the casting position by supporting the ladle with a simple structure and including a ladle support device capable of adjusting balance between the ladle and the nozzle, and a casting method.

TECHNICAL SOLUTION

[0009] A casting facility in accordance with the present invention a ladle for receiving molten steel; a mold for solidifying the molten steel provided from the ladle to be casted into a cast slab; a hanger extending in one direction, supporting the ladle, and being movable; a ladle gripping means extending in a vertical direction, and having one end connected to the hanger and the other end gripping the ladle; a hanger mounting part installed on an upper side of the mold, mounting the hanger for supporting the ladle thereon, and allowing the ladle supported by the hanger to be positioned corresponding to the upper side of the mold; and a nozzle connected to a lower portion of the ladle and discharging the molten steel of the ladle.

[0010] The hanger mounting part includes a pair of first mounting stands extending in a direction crossing the extending direction of the hanger and installed apart from each other such that both edges of the hanger are installed on the upper portion; and a pair of second mounting stands installed so as to respectively extend upward from upper portions of the pair of first mounting stands and having two mounting members installed apart from each other by a distance larger than the width of the hanger.

[0011] The casting facility includes a pair of stoppers installed at lower edges of the hanger, wherein the pair of stoppers are installed apart from each other by a distance shorter than a spaced distance between the pair of first mounting stands from lower portion of the hanger.

[0012] The nozzle includes a first nozzle having the one end connected to the ladle, and a second nozzle capable of clamping to the first nozzle; a first balance adjustment part movable forward and backward, gripping the second nozzle to move in a direction in which the first nozzle is positioned, clamping the second nozzle to the first nozzle, and supporting the second nozzle; and a second balance adjustment part installed at a lower side of the hanger mounting part, movable forward and backward, and advancing to the ladle to which the nozzle clamped by the first and second nozzles is connected, thus supporting the ladle at a position opposite to the first balance adjustment part.

[0013] The first balance adjustment part is movable along the ladle, wherein the first balance adjustment part includes a nozzle gripping member capable of gripping the second nozzle; an arm connected to the nozzle gripping member and movable forward and backward; and a weight installable on the arm at a position opposite to the nozzle gripping member.

[0014] The casting facility includes a support member installed at the lower portion of the ladle, and being able to support the arm.

[0015] The second balance adjustment part includes a horizontal moving part movable forward and backward with respect to a side surface of the ladle at a position opposite to the first balance adjustment part, and supporting the ladle by being in contact with the side surface of the ladle during advancement.

[0016] The casting facility includes a protrusion portion formed in any one of the first and second nozzles; and a clamping part provided on the other nozzle and having a clamping groove being able to receive the protrusion portion.

[0017] When the hanger is supported on the hanger mounting stand and the ladle is positioned on the upper side of the mold, the other end of the second nozzle is installed so as to be inserted into the mold, and the second balance adjustment part is fixed and installed on an upper portion of a mold cover for covering the upper portion of the mold.

[0018] The casting facility draws a cast slab in a direction perpendicular to the ground from the mold.

[0019] The casting facility includes a tundish installed between the hanger mounting stand and the mold, and when the hanger is supported on the hanger mounting stand and the ladle is positioned on the upper side of the mold, the other end of the second nozzle is installed so as to be inserted into the tundish. Also, the second balance adjustment part is fixed and installed on an upper portion of a tundish cover for covering the upper portion of the tundish.

[0020] A casting method includes: supporting a ladle receiving refined molten steel therein to a hanger; clamping a second nozzle to a first nozzle installed at a lower portion of the ladle; moving the hanger and mounting the hanger on a hanger mounting part positioned on an upper side of a mold, such that the ladle is positioned on the upper portion of the mold; moving the molten steel of the ladle through the nozzle to supply the molten steel to the mold; and solidifying the molten steel in the mold and drawing a cast slab from the mold, wherein the moving of the hanger and mounting of the hanger on a hanger mounting part positioned on an upper portion of a mold includes mounting each of one end and the other end of the hanger on upper portions of a pair of first mounting stands installed in a direction corresponding to the extending direction of the hanger.

[0021] The moving of the hanger and mounting of the hanger on a hanger mounting part positioned on an upper portion of a mold is performed such that one end and the other end of the hanger are positioned between two mounting members extending upward from upper portions of the pair of mounting stands and installed apart from in the width direction of the hanger.

[0022] The clamping of the second nozzle to the first nozzle includes gripping the second nozzle to a nozzle gripping member being movable forward and backward; operating an arm connected to the nozzle gripping member and advancing the nozzle gripping member forward and backward, moving the nozzle gripping member to a lower side of the first nozzle, and clamping the second nozzle to the first nozzle; and installing an arm weight at a position opposite to the position of the nozzle gripping member.

[0023] After the clamping of the first nozzle and the second nozzle, the method includes moving the hanger to the upper side of the mold, and then adjusting balance between the ladle and the first and second nozzles, wherein the adjusting of the balance includes operating a horizontal moving part installed in a lower side of the hanger mounting stand to advance a ladle support member connected to the horizontal moving part toward the ladle to allow the ladle support member to support a side surface of the ladle, whereby a force is applied in a direction where the nozzle gripping member is positioned such that the ladle, and the first and second nozzles are adjusted to be perpendicular to the ground.

the operating of the horizontal moving part to allow the ladle support member to support the ladle includes advancing a first moving member connected to the ladle

support member to contact the ladle support member with the outside surface of the ladle; and in a state in which a second moving member connected to the ladle support member and movable forward and backward finely relative to the first moving member is in contact with the ladle, advancing or retracting the second moving member, such that the ladle, and first and second nozzles are adjusted to be perpendicular to the ground without being tilted.

[0024] The mounting of the hanger on the hanger mounting part positioned on the upper side of the mold to allow the ladle to be positioned on the upper side of the mold includes allowing the lower portion of the second nozzle to be inserted into the mold, wherein the supplying of the molten steel of the ladle to the mold includes supplying the molten steel of the ladle to the mold by the first nozzle and the second nozzle.

[0025] The mounting of the hanger on the hanger mounting part positioned on the upper side of the mold to position the ladle on the upper side of the mold includes allowing the lower portion of the second nozzle to be inserted into the tundish positioned between the hanger mounting stand and the mold, wherein the supplying of the molten steel of the ladle to the mold includes supplying the molten steel of the ladle to the tundish by the first nozzle and the second nozzle.

[0026] The cast slab is drawn from the mold in a direction perpendicular to the ground to be vertical-casted, or the cast slab is curved-casted in a manner in which the cast slab is drawn from the mold in a vertical direction and then is casted in a horizontal direction.

ADVANTAGEOUS EFFECTS

[0027] In accordance with an embodiment of the present invention, a ladle may always be stably fixed in the same position by hanger mounting stands. Further, the ladle and nozzles may be disposed so as to be perpendicular to the ground without being tilted to any one side, so that molten steel may be stably supplied to a mold or a tundish

[0028] The hanger mounting stands in accordance with an embodiment has a simple structure compared to the conventional turret, and consumes less electric power for driving. Further, there is an advantage in that the first and second balance adjustment parts have simple structures compared to the conventional shroud manipulator, thus reducing the installation space and also having a low cost required for the manufacture and operation thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

FIGS 1 and 2 are views illustrating a casting facility in accordance with an embodiment of the present invention.

FIG. 3A is a front view illustrating a first nozzle and a second nozzle in accordance with an embodiment of the present invention. FIG. 3B is a top view, and FIG. 3C is an enlarged view illustrating a clamping part for clamping a first nozzle and a second nozzle. FIG. 4 is a top view illustrating a hanger and hanger mounting stands for mounting the hanger.

FIG. 2 is a top view of a second balance adjustment part in accordance with an embodiment of the present invention as viewed from the upper side.

FIG. 6 is a view for explaining the operation of a ladle support device in accordance with an embodiment of the present invention.

MODE FOR CARRYING OUT THE INVENTION

[0030] Hereinafter, embodiments of the present invention will be described in detail. The present invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present invention to those skilled in the art.

[0031] The present invention relates to a casting facility including a ladle support device for supporting a ladle in which molten steel is received in order to supply the molten steel received in the ladle to a mold or a tundish. More specifically, the present invention relates to a casting facility having an adjustable ladle support device such that the ladle in which the molten steel is received may always be stably positioned in the same position on the upper portion of the mold or the tundish, and a nozzle for discharging the molten steel is perpendicular to the ground without being tilted on the upper portion of the mold or the tundish.

[0032] The ladle support device in accordance with an embodiment draws a cast slab from the mold in a direction perpendicular to the ground, and is applied to a semi-continuous vertical casting facility for casting a cast slab having an ultra-heavy gauge in thickness. In the case of the semi-continuous vertical casting facility in accordance with an embodiment, the molten steel of the ladle is directly supplied to the mold, and the cast slab is casted in vertical. In other words, in a general curved vertical casting facility, the molten steel of the ladle is supplied to the tundish, and the molten steel of the tundish is supplied to the mold to be casted. However, in the vertical casting facility in accordance with an embodiment, the molten steel of the ladle is directly supplied to the mold through the nozzle to be casted into a cast slab.

[0033] In addition, in the case of semi-continuous vertical casting facility, the amount of molten steel required for one charge is small compared to the general curved continuous vertical casting facility. Therefore, the ladle support device in accordance with an embodiment is configured such that one ladle is supported.

[0034] FIGS. 1 and 2 are views illustrating a casting

facility in accordance with an embodiment of the present invention. FIG. 3A is a front view illustrating a first nozzle and a second nozzle in accordance with an embodiment of the present invention, FIG. 3B is a top view, and FIG. 3C is an enlarged view for explaining a clamping part for clamping a first and second nozzles. FIG. 4 is a top view illustrating a hanger and a hanger mounting stand in which the hanger is mounted. FIG. 2 is a top view of a second balance adjustment part in accordance with an embodiment of the present invention as viewed from the upper side. FIG. 6 is a view for explaining the operation of a ladle support device in accordance with an embodiment of the present invention.

[0035] Hereinafter, in the following description of a ladle support device in accordance with an embodiment of the present invention, a vertical casting facility in which the molten steel of a ladle is directly supplied to a mold without a tundish will be described as an example.

[0036] Referring to FIGS. 1 and 2, a casting facility in accordance with an embodiment of the present invention includes a ladle L for receiving refined molten steel; a mold M for solidifying the molten steel provided from the ladle L; a mold cover C for covering the upper side of the mold M; a nozzle 2000 for supplying the molten steel of the ladle L to the mold M; and a ladle support device 1000 supporting the ladle L in which molten steel is received to be positioned corresponding to the upper side of the mold M, and adjusting balance between the ladle L and the nozzle 2000. Further, the casting facility includes a surface plate 10 for drawing a cast slab from the mold M in a direction perpendicular to the ground, and a surface plate moving device 20 for moving the surface plate 10 in a vertical direction to the ground.

[0037] As illustrated in FIGS. 1 and 2, the nozzle 2000 includes a first nozzle 2100 fixed to and installed at the lower portion of the ladle L, and a second nozzle 2200 installed such that one end thereof is clamped to the first nozzle 2100 and the other end is positioned in the mold M in order to supply the molten steel of the ladle L to the mold M.

[0038] As illustrated in FIG. 3, the first nozzle 2100 includes a top nozzle 2110 provided in the bottom of the ladle L and installed corresponding to a flowing outlet through which molten steel flows out; and a bottom nozzle 2120 installed corresponding to the lower side of the top nozzle 2110. Further, a sliding gate 2400 is installed between the top nozzle 2110 and the bottom nozzle 2120, so that the communication between the top nozzle 2110 and the bottom nozzle 2120 is adjusted depending on the operation of the sliding gate 2400.

[0039] The second nozzle 2200 is clamped to the lower portion of the first nozzle 2100, that is, the lower portion of the bottom nozzle 2120 when molten steel is supplied to the mold M. Here, the second nozzle 2200 may be referred to as a long nozzle or a shroud nozzle.

[0040] In clamping the first nozzle 2100 and the second nozzle 2200, it is required that the first nozzle 2100 and the second nozzle 2200 be perpendicular to the ground

with balance without being tilted to any one side. For this reason, in the present invention, a clamping part 2300 is provided between the lower portion of the first nozzle 2100 and the upper portion of the second nozzle 2200, so that the first nozzle 2100 and the second nozzle 2200 are always clamped at the same position without misalignment, and become perpendicular to the ground.

[0041] The clamping part 2300 includes a protrusion portion 2310 formed on any one of upper portions of the first nozzle 2100 and the second nozzle 2200, and a clamping groove 2320 provided on the other nozzle 2000 and receiving the protrusion portion 2310. For example, in the embodiment, the protrusion portion 2310 is provided so as to protrude upward on the upper portion of the second nozzle 2200, and the clamping groove is provided in the lower portion of the first nozzle 2100. In this case, the protrusion portion 2310 is provided so as to be positioned at one side of a hollow portion of the second nozzle 2200, and the clamping groove 2320 is also provided so as to be positioned at one side of the hollow portion of the first nozzle 2100.

[0042] Of course, the protrusion portion 2310 may be installed in the lower portion of the first nozzle 2100, and the clamping groove 2320 may be provided on the upper portion of the second nozzle 2200.

[0043] Here, when the first nozzle 2100 and the second nozzle 2200 are clamped to the protrusion portion 2310 and the clamping portion 2320, when each of the first nozzle 2100 and the second nozzle 2200 are in a state of maintaining balance without being relatively tilted to any one side while being perpendicular to the ground, the position of the protrusion portion 2310 and the portion of the clamping groove 2310 are determined.

[0044] The ladle support device 1000 includes a ladle support unit 100 for supporting the ladle L such that the ladle L may be positioned corresponding to the upper side of the mold M; balance adjustment unit 200 enabling the ladle L and the nozzle 2000 to be disposed with balance such that the ladle L and the nozzle 2000 are perpendicular to the ground without being tilted to any one side during casting, and a weight measurement means 300 installed in the ladle support unit 100 and measuring the weight of the ladle L.

[0045] The ladle support unit 100 includes a movable hanger 110 such that the ladle L is supported and positioned on the upper portion of the mold M; a stopper 130 installed at both edges of the lower portion of the hanger; a hanger mounting part 120 fixed and installed on the upper portion of the mold cover and supporting the hanger 110 such that the ladle L supported to the hanger 110 may be positioned corresponding to the upper portion of the mold M, and a ladle gripping means 140 having one end connected to the hanger 110 and the other end gripping the ladle L.

[0046] The hanger 110 has a bar shape extending in one direction, and a ring 111 to which a moving means such as a crane may be clamped is installed on the upper portion of the hanger 110. As described above, the stop-

per 130 is installed at both edges of the lower portion of the hanger. The stopper 130 has a block shape, and plays a role such that the hanger is mounted at the same position when mounted on a hanger mounting part 120 described later.

[0047] The hanger mounting part 120 is positioned at the upper side of the mold, and includes a pair of first mounting stands 121 spaced apart from each other in a direction intersecting or orthogonal to the extending direction of the hanger 110; and a pair of second mounting parts 122 installed so as to be spaced apart from each other by a thickness in the width direction of the hanger 110 on upper portions of each of the pair of first mounting stands.

[0048] The first mounting stands 121 extend in a direction intersecting with or orthogonal to the extending direction of the hanger 110, and are provided as a pair. In this case, the pair of first mounting stands 121 are preferably installed apart from each other such that both edges of the hanger 110 may be supported on the pair of first mounting stands 121 when the hanger 110 is positioned on the pair of first mounting stands.

[0049] The second mounting stands 122 are installed on upper portions of each of the pair of first mounting stands 121, and the second mounting stands 122 include a pair of mounting members 122a spaced apart from each other in the extending direction of the first mounting stands 121 and installed so as to face each other. In accordance with such second mounting stands 122, one end and the other end of the hanger 110 are each mounted on the first mounting stands 121 so as to be positioned between the pair of mounting members 122a, so that the hanger 110 is mounted on the hanger mounting part 120. In this case, the stopper 130 is mounted on the lower portion of the hanger 110, and the stopper 130 is mounted so as to be in close contact with inner surfaces of the first mounting stands 121, thereby enabling the hanger 110 to be mounted at the same position all the time.

[0050] The balance adjustment unit 200 includes a first balance adjustment part 210 performing an adjusting operation such that the first nozzle 2100 and the second nozzle 220 is not tilted to any one side; a second balance adjustment part 220 positioned in the lower portion of the hanger mounting part 120, mounted and installed on the upper portion of the mold cover C, and movable forward and backward with respect to the side surface of the ladle L, thus performing an adjusting operation such that the ladle L is not tilted to any one side; and a support member 230 mounted on the lower portion of the ladle L to allow the first balance adjustment part 210 to be supported in a floating state.

[0051] The first balance adjustment part 210 includes an arm 211 movable forward and backward with respect to the second nozzle 2200 positioned at the lower side of the first nozzle 2100; a nozzle gripping member 212 mounted on a front end of the arm 211 and gripping the upper portion of the second nozzle 2200 at the time of advancement; a weight unit 213 installed at the lower

portion of the arm 211 at a position opposite to the nozzle gripping member 212, and having a predetermined weight.

[0052] The arm 211 has a bar shape formed extending in one direction. When the arm 211 is advanced and the nozzle gripping member 212 grips the second nozzle 2200, the arm 211 passes through the support member 230 mounted on the lower portion of the ladle and is supported by the support member 230. Here, one side of the support member 230 has an opened ring shape and is supported in such a manner that the arm 211 is mounted on a ring.

[0053] The arm 211 in accordance with an embodiment is a hydraulic cylinder type, but is not limited thereto, and may be changed into various means movable forward and backward.

[0054] The nozzle gripping member 212 has an opened shape in a direction where the second 2200 nozzle is positioned, for example, a shape of "C" in English alphabet or "ㄷ" in Korean consonant.

[0055] The first balance adjustment part 210 clamps the second nozzle 2200 to the first nozzle 2100 installed at the lower portion of the ladle L. That is, when the ladle L in which molten steel is received arrives at a casting position, the arm 211 moves forward in a state in which the second nozzle 2200 is gripped or supported by the nozzle gripping member 212 of the first balance adjustment 210, and the upper portion of the second nozzle 220 is positioned corresponding to the lower portion of the first nozzle 2100, so that the first nozzle 2100 and the second nozzle 2200 are clamped to each other.

[0056] When the first nozzle 2100 is thus clamped to the second nozzle 2200, a weight is installed on the arm 211. In this case, a rotation moment causing the arm to continuously rotate is generated due to the weight of the weight, so that a force causing the ladle L and the nozzle 2000 to be tilted in a direction opposite to the first balance adjustment part is generated.

[0057] Therefore, in an embodiment of the present invention, the second balance adjustment part 220 is installed between the hanger mounting part 120 and the mold cover C, and a pushing force is applied from the direction opposite to the first balance adjustment part 210 to the direction in which the first balance adjustment 210 is positioned, so that the ladle L and the nozzle 2000 is adjusted so as to be perpendicular to the ground without being tilted.

[0058] As illustrated in FIG. 5, the second balance adjustment part 220 includes a ladle support member 221 movable forward and backward, and supporting the side surface of the ladle when advancing; a horizontal moving part 222 for horizontally moving the ladle support member 221; and a fixing part 223 mounted on the mold cover C, and supporting the horizontal moving part 222 on the upper portion thereof.

[0059] It is preferable that the ladle support member 221 has such a shape that at least the inner surface thereof coincides with the outer peripheral surface of the ladle

L so as to be easily in contact with and support the side surface of the ladle L. That is, the inner surface of the ladle support member 221 may have a curved or bent shape so as to coincide with the shape of the outer surface of the ladle support member 221. Of course, the embodiment is not limited thereto, and the ladle support member 221 may be in a flat-plate form having no curvature.

[0060] The horizontal moving part 222 includes: a pair of first moving members 222a installed apart from each other in the width direction of the ladle support member 221, and having one end connected to the ladle support member 221; a pair of first driving members 222b for moving the pair of the first moving members 222a forward and backward; a second moving member 222c positioned between the pair of first moving members 222a and having one end connected to the ladle support member 221; and a second driving member 222d for moving the second moving member 222c forward and backward.

[0061] Here, the first moving member 222a may be a roll, and the first driving member 222b may be a roll guide for moving the first moving member 222a forward and backward. The roll guide extends in a direction where the ladle support member 221 is positioned, and the first moving member 222a may move forward and backward along the first driving member 222b. Further, the second moving member 222c and the second driving member 222d in accordance with an embodiment is configured such that advance and retract movement may be finely adjusted compared to the first moving member 222a and the first driving member 222b. Therefore, the second driving member 222d may have a handle shape, and the second driving member 222d may be a means movable forward and backward depending on the rotation direction of the second driving member 222d, and adjusting the forward and backward distances depending on the amount of rotation.

[0062] As described above, when the weight 213 is installed on the arm 211 of the first balance adjustment part 210, the second balance adjustment part 220 prevents the ladle L and the nozzle 2000 from being tilted in the direction opposite to the position of the first balance adjustment part 210 to allow the ladle L and the nozzle 2000 to maintain balance without being tilted or to be perpendicular to the ground. That is, when the weight 213 is installed on the arm 211 of the first balance adjustment 210, or after being installed, when the first and second moving members 222a and 222c of the horizontal moving part 222 of the second balance adjustment 220 move forward to support the ladle L with the ladle support member 221, the ladle L and the nozzle 2000 maintain balance without being tilted due to the pushing force or supporting force of the horizontal moving part 222.

[0063] The embodiment is described as an example in which the ladle support device 1000 is applied to the vertical casting facility, the ladle L is positioned corresponding to the upper side of the mold M, and the molten steel of the ladle L is directly supplied to the mold L. However,

the embodiment is not limited thereto, and a separate tundish may be installed on the upper side of the mold M. In this case, the ladle support device 1000 supports the ladle L to be positioned corresponding to the upper side of the tundish, and thus may allow the molten steel of the ladle L to be supplied to the tundish. Further, as another example, the embodiment may be applied to a conventional curved casting facility in which the cast slab is drawn in a vertical direction and then drawn in a curved direction, rather than to a vertical casting facility. Therefore, the hanger mounting part 120 of the ladle support device 1000 may be positioned on the upper side of the tundish cover C for covering the opening on the upper side of the tundish, and the second balance adjustment part 220 may be positioned on the upper side of the tundish.

[0064] Hereinafter, a casting process in accordance with an embodiment of the present invention will be described with reference to FIGS. 1 to 6.

[0065] In the steel making process, refined molten steel is received in a ladle L, and the ladle L supported by the hanger 110 is transferred to the position of the casting process by a moving means such as a crane (see FIG. 6A). Subsequently, by using the first balance adjustment part 210, the second nozzle 2200 is clamped to the first nozzle as illustrated in FIG. 6B. That is, in a state in which the upper portion of the second nozzle 2200 is gripped and supported by the nozzle gripping member 212 of the first balance adjustment part 210, the arm 211 moves forward toward the first nozzle 2100 installed in the lower position of the ladle L, and the protrusion 2310 of the second nozzle 2200 is inserted into the clamping groove 2320 of the first nozzle 2100, so that the first nozzle 2100 and the second nozzle 2200 are clamped. In this case, when the protrusion portion 2310 provided in the second nozzle 2200 is inserted into the clamping groove 2320 of the first nozzle 2100 so that the first nozzle 2100 and the second nozzle 2200 are clamped, the first nozzle 2100 and the second nozzle 2200 is in a state of maintaining balance without being relatively tilted to any one side. Thereafter, the arm 211 of the first balance adjustment 210 is hung so as to being supported by the support member 230 connected to the lower portion of the ladle L, and the weight 213 is installed on the arm 211.

[0066] In addition, as illustrated in FIG. 6C, a hanger 110 in which a ladle L is supported moves by using a moving means, and is mounted on a hanger mounting part 120. That is, one end and the other end of the hanger 110 are mounted so as to be positioned between a pair of mounting members 122a of a second mounting stand 122 on an upper portion of a first mounting stand 121. In this case, a stopper 130 is installed at the lower portion of the hanger 110, and the stopper 130 may not move to the outside of the first mounting stand 121, so that the hanger 110 is always mounted and installed on the constant position of the hanger mounting part 120. Also, as the hanger 110 is mounted on the hanger mounting part

120, the lower portion of the second nozzle 2200 passes through the opening of the mold cover C to be installed so as to be positioned in the mold M.

[0067] When the hanger 110 is mounted on the hanger mounting part 120, the first driving member 222b of the second balance adjustment part 220 is operated and the pair of first moving members 222a move forward, so that the ladle support member 221 is in contact with and supported by the side surface of the ladle L. Thereafter, the second driving member 222d is operated as needed to finely advance or retract the second moving member 222c, so that the ladle L is finely adjusted so as to be perpendicular without being tilted to any one side. Accordingly, even when a force is generated which is tilted to a position opposite to or facing the position of the first balance adjustment 210 by the weight of the weight part 213 of the first balance adjustment part 210, by applying a force in which the second balance adjustment pushes the ladle L 220 in the direction in which the first balance adjustment 210 is positioned, the ladle L and the nozzle 2000 are prevented from being tilted, and each of which may be perpendicular to the ground.

[0068] When the ladle L and the nozzle 2000 are thus positioned corresponding to the upper portion of the mold M and the balance is adjusted, the casting is started. That is, when a sliding gate 2400 positioned between a top nozzle 2110 and a bottom nozzle 2120 of the first nozzle 2100 is operated to communicate the top nozzle 2110 and the bottom nozzle 2120, the molten steel of the ladle L is supplied to the mold M through the top nozzle 2110, the bottom nozzle 2120 and the second nozzle 2200. The lower portion of the mold M is sealed by a surface plate 10 before the molten steel is supplied to the mold M, so that the molten steel supplied to the mold M is solidified in the mold M. Thereafter, the surface plate 10 continuously descends in a direction perpendicular to the ground to draw the cast slab from the mold M. In this case, the molten steel is supplied to the mold M until a cast slab having a targeted length is casted, and the surface plate 10 descends. When the cast slab having the targeted length is casted, the sliding gate 2400 is closed, the supply of molten steel to the mold M is stopped, the cast slab is completely drawn from the mold M, and then the descending is stopped to terminate the casting.

[0069] Thus, the ladle L may always be stably fixed in the same position by the hanger mounting part 120 and the stopper 130 in accordance with an embodiment of the present invention. Further, the ladle L and the nozzle 2000 may be disposed so as to be perpendicular to the ground without being tilted to any one side by the first and second balance adjustment parts 210 and 220, so that molten steel may be stably supplied to the mold M or the tundish. In addition, the hanger mounting stand 120 in accordance with an embodiment has a simple structure as compared with the conventional turret, and consumes less electric power for driving. Also, the first and second balance adjustment parts 210 and 220 have simpler structures than the conventional shroud manip-

ulate, and thus provides advantages of a less installation space and low cost.

INDUSTRIAL APPLICABILITY

[0070] In accordance with the casting facility and the casting method disclosed in the present invention, the ladle may always be stably fixed at the same position by hanger mounting stands. Further, the ladle and the nozzle may be disposed so as to be perpendicular to the ground without being tilted to any one side by the first and second balance adjustment parts, so that molten steel may be stably supplied to the mold or the tundish.

Claims

1. A casting facility, comprising:

a ladle for receiving molten steel;
a mold for solidifying the molten steel provided from the ladle to be casted into a cast slab;
a hanger extending in one direction, supporting the ladle, and being movable;
a ladle gripping means extending in a vertical direction, and having one end connected to the hanger and the other end gripping the ladle;
a hanger mounting part installed on an upper side of the mold, mounting the hanger supporting the ladle thereon, and allowing the ladle supported by the hanger to be positioned corresponding to the upper side of the mold; and
a nozzle connected to a lower portion of the ladle and discharging the molten steel of the ladle.

2. The casting facility of claim 1, wherein the hanger mounting part comprises:

a pair of first mounting stands extending in a direction crossing the extending direction of the hanger and installed apart from each other such that both edges of the hanger are installed on the upper portion; and
a pair of second mounting stands installed so as to extend upward from upper portion of each of the pair of first mounting stands, and having two mounting members installed apart from each other by a distance larger than the width of the hanger.

3. The casting facility of claim 2, comprising:

a pair of stoppers installed at lower edges of the hanger,
wherein the pair of stoppers are installed apart from each other by a distance shorter than a spaced distance between the pair of first mounting stands from lower portion of the hanger.

4. The casting facility of any one of claims 1 to 3, wherein the nozzle comprises:

a first nozzle having the one end connected to the ladle, and a second nozzle capable of clamping to the first nozzle;

a first balance adjustment part movable forward and backward, gripping the second nozzle to move in a direction in which the first nozzle is positioned, clamping the second nozzle to the first nozzle, and supporting the second nozzle; and

a second balance adjustment part installed at a lower side of the hanger mounting part, movable forward and backward, and advancing to the ladle to which the nozzle in which the first and second nozzles are clamped is connected, thus supporting the ladle at a position opposite to the first balance adjustment part.

5. The casting facility of claim 4, wherein the first balance adjustment part is movable along the ladle, wherein the first balance adjustment part comprises:

a nozzle gripping member capable of gripping the second nozzle;

an arm connected to the nozzle gripping member and movable forward and backward; and
a weight installable on the arm at a position opposite to the nozzle gripping member.

6. The casting facility of claim 5, comprising:
a support member installed at the lower portion of the ladle and being able to support the arm.

7. The casting facility of claim 6, wherein the second balance adjustment part comprises:
a horizontal moving part movable forward and backward with respect to a side surface of the ladle at a position opposite to the first balance adjustment part, and supporting the ladle by being in contact with the side surface of the ladle during advancement.

8. The casting facility of claim 5, comprising:

a protrusion portion formed in any one of the first nozzle and the second nozzle; and
a clamping part provided on the other nozzle and having a clamping groove being able to receive the protrusion portion.

9. The casting facility of claim 7, wherein when the hanger is supported on the hanger mounting stand and the ladle is positioned on the upper side of the mold, the other end of the second nozzle is installed so as to be inserted into the mold, wherein the second balance adjustment part is fixed and installed on an upper portion of a mold cover for

covering the upper portion of the mold.

10. The casting facility of claim 9, drawing a cast slab in a direction perpendicular to the ground from the mold.

11. The casting facility of claim 7, comprising a tundish installed between the hanger mounting stand and the mold, wherein when the hanger is supported on the hanger mounting stand and the ladle is positioned on the upper side of the mold, the other end of the second nozzle is installed so as to be inserted into the tundish, wherein the second balance adjustment part is fixed and installed on an upper portion of a tundish cover for covering the upper portion of the tundish.

12. A casting method comprising:

supporting a ladle receiving refined molten steel therein to a hanger;

clamping a second nozzle to a first nozzle installed at a lower portion of the ladle;

moving the hanger and mounting the hanger on a hanger mounting part positioned on an upper side of a mold, such the ladle is positioned on the upper side of the mold;

moving the molten steel of the ladle through the nozzle to supply the molten steel to the mold; and

solidifying the molten steel in the mold and drawing a cast slab from the mold,

wherein the moving of the hanger and mounting of the hanger on a hanger mounting part positioned on an upper portion of a mold comprises: mounting each of one end and the other end of the hanger on upper portions of a pair of first mounting stands installed in a direction corresponding to the extending direction of the hanger.

13. The method of claim 12, wherein the moving of the hanger and mounting of the hanger on a hanger mounting part positioned on an upper portion of a mold is performed such that one end and the other end of the hanger are positioned between two mounting members extending upward from upper portions of the pair of mounting stands and installed apart from in the width direction of the hanger.

14. The method of claim 13, wherein the clamping of the second nozzle to the first nozzle comprises:

gripping the second nozzle to a nozzle gripping member being movable forward and backward; operating an arm connected to the nozzle gripping member and advancing the nozzle gripping

member forward and backward, moving the nozzle gripping member to a lower side of the first nozzle, and clamping the second nozzle to the first nozzle; and

installing an arm weight at a position opposite to the position of the nozzle gripping member. 5

15. The method of claim 14, after the clamping of the first nozzle and the second nozzle, comprising moving the hanger to the upper side of the mold, and then adjusting balance between the ladle and the first and second nozzles, wherein the adjusting of the balance comprises: operating a horizontal moving part installed in a lower side of the hanger mounting stand to advance a ladle support member connected to the horizontal moving part toward the ladle to allow the ladle support member to support a side surface of the ladle, whereby a force is applied in a direction where the nozzle gripping member is positioned such that the ladle, and the first and second nozzles are adjustable to be perpendicular to the ground. 10 15 20

16. The method of claim 15, wherein the operating of the horizontal moving part to allow the ladle support member to support the ladle comprises: 25

advancing a first moving member connected to the ladle support member to contact the ladle support member with the outside surface of the ladle; and 30

in a state in which a second moving member connected to the ladle support member and movable forward and backward finely relative to the first moving member is in contact with the ladle, advancing or retracting the second moving member, such that the ladle, and first and second nozzles are adjusted to be perpendicular to the ground without being tilted. 35 40

17. The method of claim 16, wherein the mounting of the hanger on the hanger mounting part positioned on the upper side of the mold to allow the ladle to be positioned on the upper side of the mold comprises: 45

allowing the lower portion of the second nozzle to be inserted into the mold, wherein the supplying to the mold of the ladle comprises: supplying the molten steel of the ladle to the mold by the first nozzle and the second nozzle. 50

18. The method of claim 16, wherein the mounting of the hanger on the hanger mounting part positioned on the upper side of the mold to allow the ladle to be positioned on the upper side of the mold comprises: 55

allowing the lower portion of the second nozzle

to be inserted into the tundish positioned between the hanger mounting part and the mold, wherein the supplying to the mold of the ladle comprises:

supplying the molten steel of the ladle to the tundish by the first nozzle and the second nozzle.

19. The method of claim 17 or claim 18, wherein the cast slab is drawn from the mold in a direction perpendicular to the ground to be vertical-casted, or the cast slab is curved-casted in a manner in which the cast slab is drawn from the mold in a vertical direction and then is casted in a horizontal direction.

FIG. 1

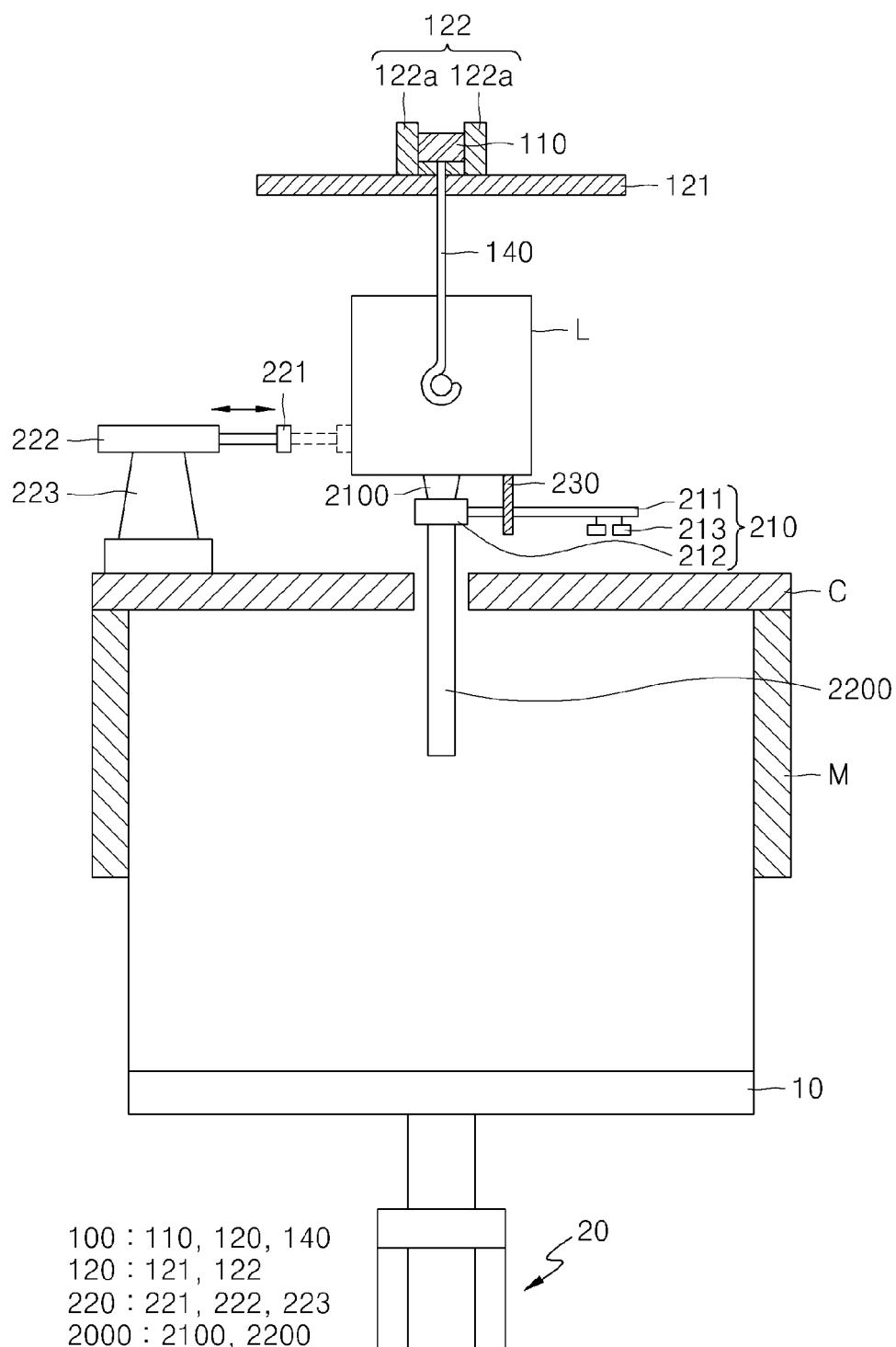


FIG. 2

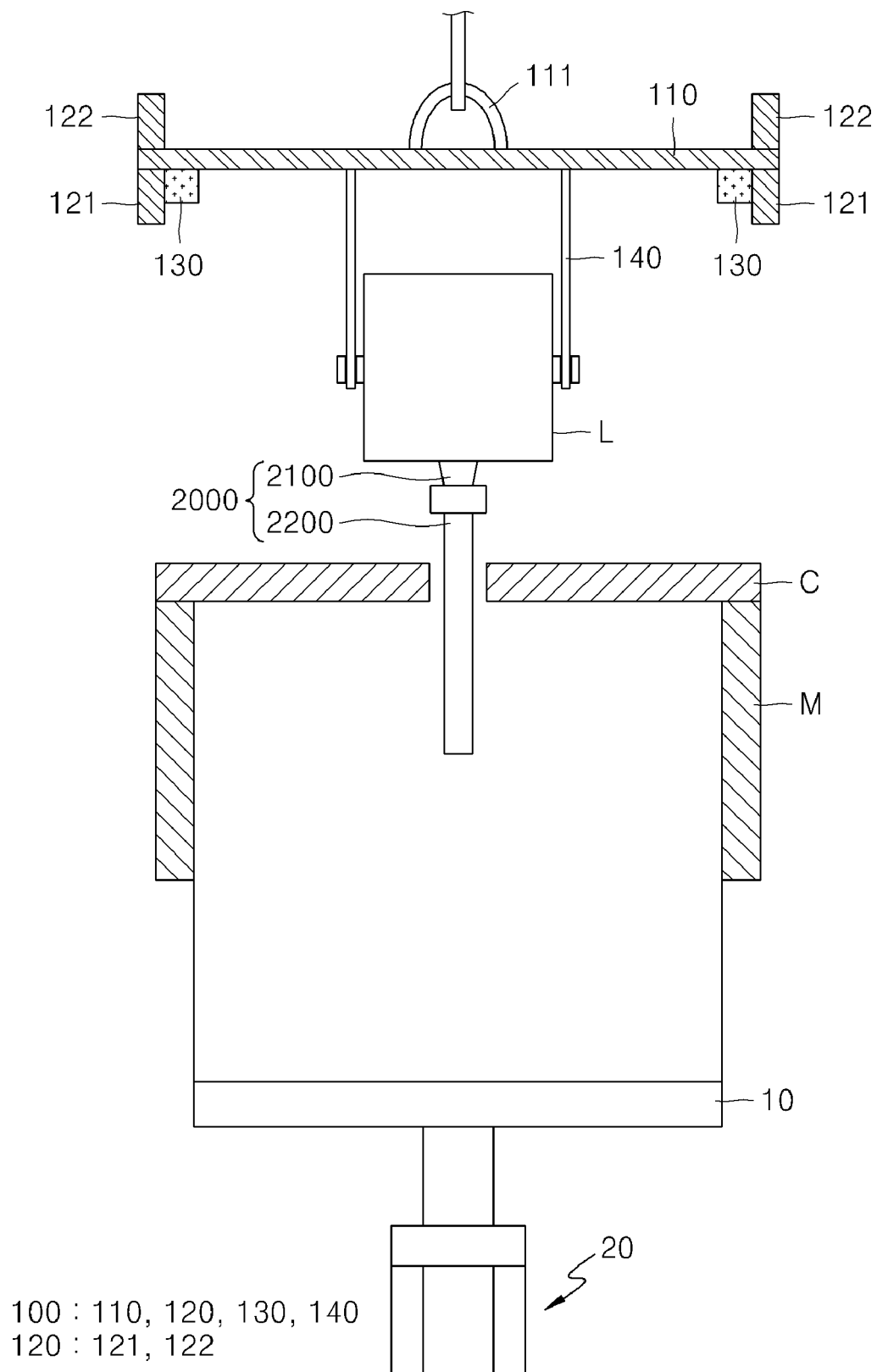


FIG. 3

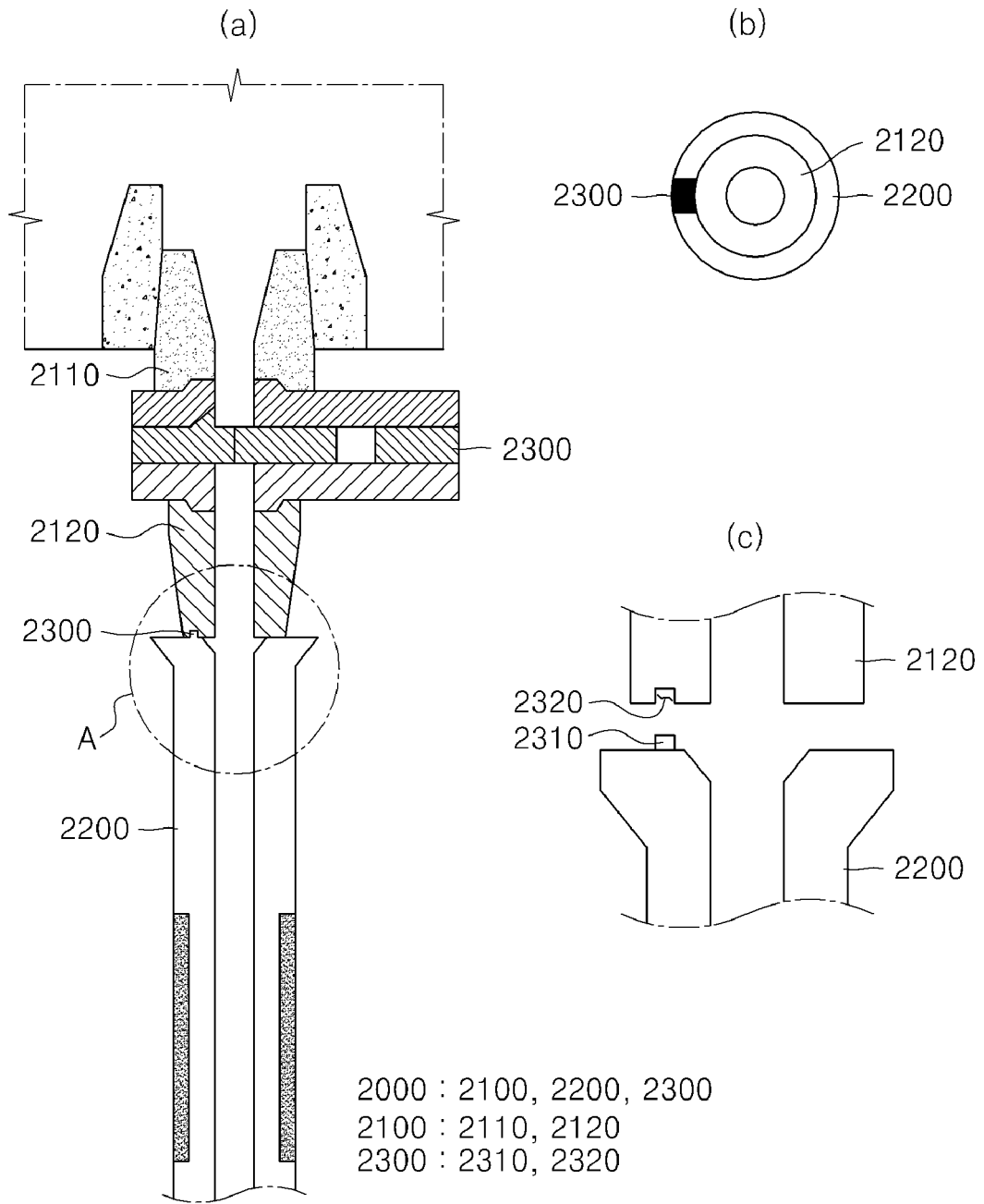


FIG. 4

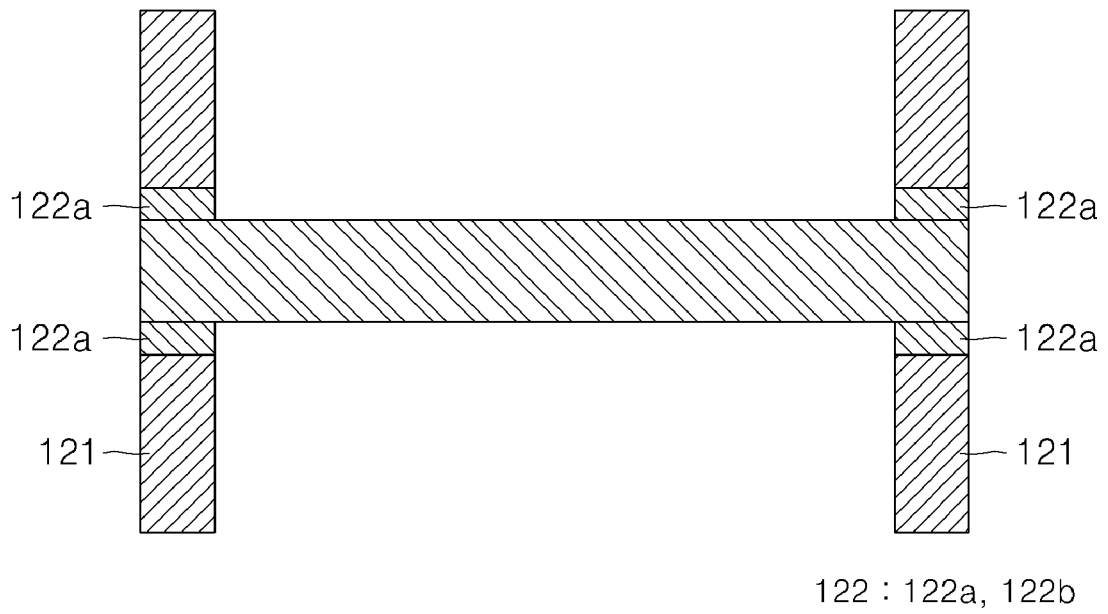


FIG. 5

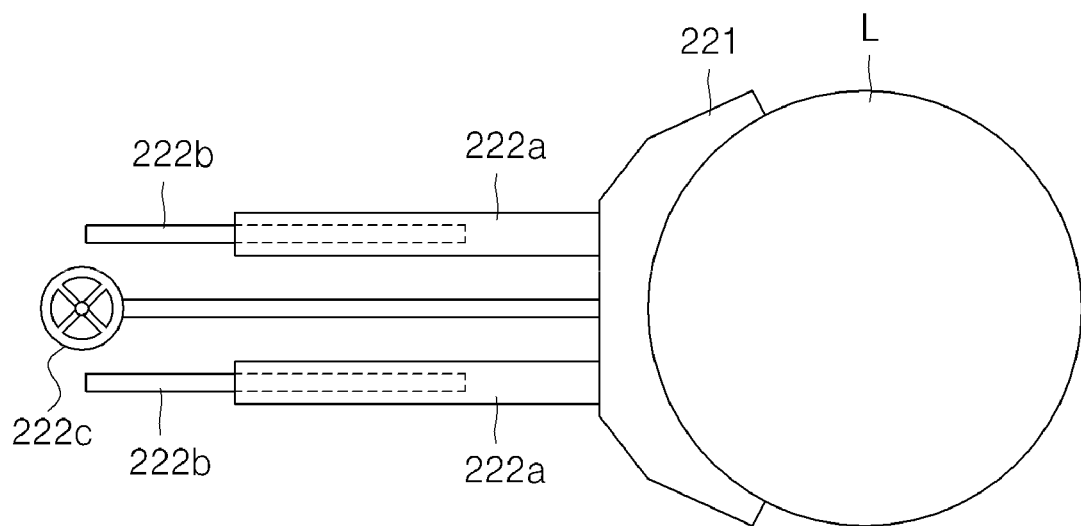
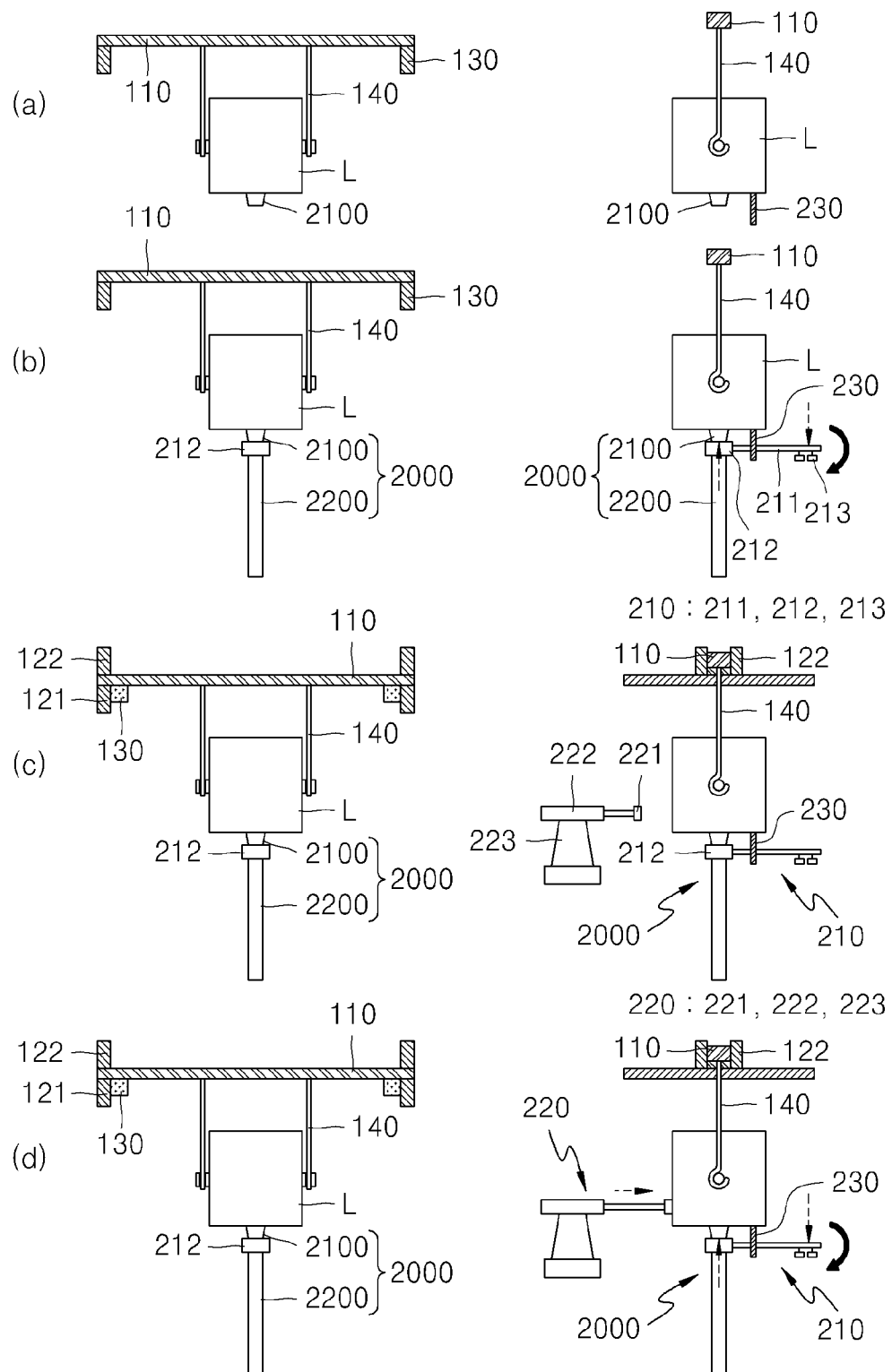


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2016/012589

A. CLASSIFICATION OF SUBJECT MATTER

B22D 41/00(2006.01)i, B22D 41/50(2006.01)i, B22D 11/04(2006.01)i, B22D 11/11(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 41/00; G01D 5/36; B22D 11/10; B22D 11/16; B22D 41/06; B22D 41/56; B22D 41/50; B22D 11/04; B22D 11/11

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

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

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

eKOMPASS (KIPO internal) & Keywords: casting, ladle, nozzle, balance, balance, moment, weight, holding part, grip member

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2013-0088310 A (HYUNDAI STEEL COMPANY) 08 August 2013 See paragraphs [0002]-[0003], [0020]-[0042] and figures 1-4.	1-3
Y		12-13
A		4-11, 14-19
Y	KR 10-2013-0075570 A (POSCO) 05 July 2013 See paragraphs [0019]-[0022] and figures 3, 6.	12-13
A	KR 10-2010-0128988 A (SAM WOO) 08 December 2010 See paragraphs [0020]-[0022] and figures 1-5.	1-19
A	KR 10-2012-0071013 A (POSCO) 02 July 2012 See paragraphs [0013]-[0020] and figure 1.	1-19
A	KR 10-2012-0020483 A (HYUNDAI STEEL COMPANY) 08 March 2012 See paragraphs [0026]-[0029] and figure 2.	1-19

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

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"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

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Date of the actual completion of the international search

02 FEBRUARY 2017 (02.02.2017)

Date of mailing of the international search report

03 FEBRUARY 2017 (03.02.2017)

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Authorized officer

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2016/012589

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REFERENCES CITED IN THE DESCRIPTION

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- KR 20130120149 [0003]
- KR 20130075570 [0005]