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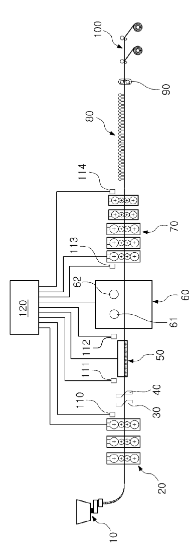
(54) CONTINUOUS CASTING-MILLING EQUIPMENT CAPABLE OF SWITCHING BETWEEN CONTINUOUS AND BATCH MILLING, AND METHOD THEREFOR

(57) The present invention provides continuous casting-milling equipment and method capable of switching between continuous and batch milling, which increase the process yield rate by reducing the portion which is unavoidably processed as scrap, when switching casting or at an initial stage. The continuous casting-milling equipment comprises: a casting unit; at least two rolling units; and a coil box arranged between the rolling units. The continuous casting-milling method comprises: a casting step for producing a slab; a first rolling step which reduces the thickness of the slab; a cutting step of cutting a predetermined distance from a front end portion of the slab at the initial stage of casting; a passing step of passing the continuously supplied slab through the coil box; and a second rolling step which reduces the thickness of the passed slab.

【Fig. 2】



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Description

[Technical Field]

[0001] The present disclosure relates to continuous casting and rolling equipment switching between continuous rolling and batch rolling, capable of improving percentage yields by reducing an amount of scrap discarded during switching casting types or in an initial stage of casting, and to a method of the same.

[Background Art]

[0002] Continuous casting and rolling equipment of the related art has been known for having the same structure as the embodiment of Patent Document 1, that is, a method of providing a holding furnace between a caster and a rolling line and a method of providing a coiler or a coiling box between a primary rolling line and a secondary rolling line in the same manner as Patent Document 2.

[0003] In detail, methods and equipment for performing continuous rolling after continuous casting, according to steel grades or operation conditions, in the same manner as Patent Document 1, or performing batch rolling by cutting slabs after continuous casting in a case in which temperatures at which rolling is possible are not secured, have been proposed.

[0004] In the case of continuous casting and continuous rolling performed in such a manner that slabs are connected during processes from casting to rolling, since the speed of continuous casting is lower than that of rolling, rolling may be performed more slowly than batch rolling in which rolling and continuous casting are separately performed. In addition, in a case in which predetermined temperature conditions are not satisfied, rolling may be difficult. Thus, in the case of continuous casting and continuous rolling, it is important to set temperatures of slabs to be higher than a specific temperature in a final rolling stand.

[0005] Thus, even in the case of equipment capable of continuous and batch rolling, when temperatures of slabs are relatively low in an initial stage of casting, it may be difficult to perform continuous rolling. Thus, there is a problem in which casting should be begun with batch rolling.

Patent Document 1: JP 2009-508691 A
Patent Document 2: EP 0841995 A

[Disclosure]

[Technical Problem]

[0006] An aspect of the present disclosure may provide continuous casting and rolling equipment switching between continuous rolling and batch rolling for improving a percentage yield of a process by reducing a portion thereof, which is inevitably discarded as scrap, when casting is switched or in an initial stage of casting.

[Technical Solution]

[0007] According to an aspect of the present disclosure, a method of continuous casting and rolling, switching continuous rolling and batch rolling, in equipment including a continuous casting unit, at least two rolling portions, and a coiling box disposed between the at least two rolling portions comprises performing continuous casting to produce a slab; primary rolling to reduce a thickness of the slab; cutting to cut a specific length of the slab from a front end portion thereof in an initial stage of casting; passing, in which the stab, continuously provided, passes through the coiling box; and secondary rolling to reduce a thickness of the slab having passed through the coiling box.

[0008] In this case, in the primary rolling, the thickness of the slab may be reduced using a rolling reduction rate lower than a normal rolling reduction rate.

[0009] In addition, heating to increase a temperature of the slab passing between the cutting and the passing may be further performed.

[0010] In an exemplary embodiment, in the heating, the temperature of the slab may be increased to be higher than a normal raised temperature.

[0011] In an exemplary embodiment, in the heating, the temperature of the slab may be increased to be higher than the normal raised temperature by 20°C to 50°C.

[0012] In addition, after the primary rolling, measuring a slab temperature to measure the temperature of the slab is performed, and in the cutting, the slab may be cut based on the temperature of the slab.

[0013] In the measuring a slab temperature, the temperature of the slab having passed through a first rolling portion may be measured.

[0014] In an exemplary embodiment, in the cutting, a temperature when the slab passes through a second rolling portion may be predicted, and the slab may be cut until the temperature when the slab passes through the second rolling portion is higher than or equal to a temperature at which rolling is possible.

[0015] In an exemplary embodiment, in the secondary rolling, the slab may be rolled using a rolling reduction rate higher than the normal rolling reduction rate.

[0016] In an exemplary embodiment, in the primary rolling and the secondary rolling, the rolling reduction rate may be returned to the normal rolling reduction rate after a specific period of time, while, in the primary rolling, the rolling reduction rate may be gradually increased.

[0017] According to an aspect of the present disclosure, equipment switching between continuous rolling and batch rolling comprises a continuous casting unit; a first rolling portion and a second rolling portion, disposed in a direction of movement of a slab produced by the continuous casting unit and rolling the slab; a coiling box disposed between the first rolling portion and the second rolling portion and configured to allow the slab having passed through the first rolling portion to be coiled and uncoiled during batch rolling and to merely pass through the coiling box during continuous rolling; a cutter disposed between the first rolling portion and the coiling box; a sensor for measuring a slab temperature disposed on a rear portion of the first rolling portion; and a control unit connected to the first rolling portion, the second rolling portion, the coiling box, the cutter, and the sensor for measuring a slab temperature. The control unit enables the cutter to cut a portion of the slab cast in an initial stage of casting based on a value measured by the sensor for measuring a slab temperature during an initial stage of casting. In addition, the control unit enables the coiling box to allow the slab connected to the continuous casting unit to pass through the coiling box.

[0018] In this case, a heating portion disposed between the cutter and the coiling box and increasing a temperature of the slab passing therethrough may be further included. The control unit may control the heating portion to increase the temperature of the slab to be higher than a normal raised temperature.

[0019] In an exemplary embodiment, the control unit may maintain a final thickness of the slab in such a manner that a rolling reduction rate of the first rolling portion is reduced to be lower than a normal rolling reduction rate, and a rolling reduction rate of the second rolling portion is increased to be higher than the normal rolling reduction rate.

[0020] In an exemplary embodiment, the coiling box is configured to have a carousel type form. When the coiling box allows the slab to pass therethrough, a mandrel of the coiling box may be disposed above the slab passing therethrough.

[0021] In an exemplary embodiment, the heating portion may include an inductive heater having an open side surface. The inductive heater may be configured to enter and be removed in a lateral direction of the slab.

[0022] In addition, in an exemplary embodiment, a pusher and a piler, disposed between the heating portion and the cutter and removing a slab having been cut from a path of the slab, may be further included.

[Advantageous Effects]

[0023] According to an aspect of the present disclosure, continuous casting and rolling equipment switching between continuous rolling and batch rolling for improving a percentage yield of a process by reducing a portion thereof, which is inevitably discarded as scrap, when casting is switched or in an initial stage of casting, may be provided.

[Description of Drawings]

[0024]

FIG. 1 is a view illustrating batch rolling in an exemplary embodiment in the present disclosure.
FIG. 2 is a view illustrating continuous rolling in an exemplary embodiment.

[Best Mode for Invention]

[0025] Hereinafter, exemplary embodiments in the present disclosure will be described in detail with reference to the attached drawings.

[0026] FIGS. 1 and 2 illustrate an exemplary embodiment in the present disclosure. FIG. 1 illustrates continuous casting and rolling equipment switching between continuous rolling and batch rolling of an exemplary embodiment, performing batch rolling. FIG. 2 illustrates continuous casting and rolling equipment switching between continuous rolling and batch rolling, performing continuous rolling.

[0027] As illustrated in FIG. 1, the continuous casting and rolling equipment switching between continuous rolling and batch rolling of an exemplary embodiment includes a continuous casting unit 10; a first rolling portion 20 disposed in a direction of movement of a slab produced by the continuous casting unit 10 and rolling the slab; temperature measuring sensors 110, 111, 112, 113, and 114, measuring a temperature of the slab having passed through the first rolling portion 20; cutters 30 and 40 cutting the slab having passed through the first rolling portion 20; a heating portion 50 heating a slab not having been cut; a coiling box 60 configured in such a manner that the slab having passed through the first rolling portion 20 and the heating portion 50 is coiled and uncoiled during batch rolling and passes through the coiling box 60 during continuous rolling; a second rolling portion 70 disposed to be contiguous with the coiling box 60; a run out table 80 cooling a slab having become a strip after rolling is finished; a cutter 90 cutting the slab corresponding to an amount of a single coil; a coiler 100; and a control unit 120 connected to the first rolling portion 20, the second rolling portion 70, the coiling box 60, the cutters 30, 40, and 90, and the temperature measuring sensors 110, 111, 112, 113, and 114.

[0028] In an exemplary embodiment, the continuous casting portion 10 may adopt any composition that may perform continuous casting. In the exemplary embodiment, the continuous casting portion 10 cools the slab in such a manner that a plurality of segments, (not illustrated), are disposed below a mold.

[0029] The first rolling portion 20 is disposed to be contiguous with the continuous casting portion 10 and applies rolling force to the slab having passed through the continuous casting portion 10, thereby rolling the slab to have a target thickness. An exemplary embodiment of FIGS. 1 and 2 illustrates a rolling portion including three stands, but the number of stands may be increased or reduced according to need. The first rolling portion 20 is connected to the control unit 120 and may control a rolling reduction rate depending on a signal of the control unit 120.

[0030] A temperature measuring sensor 110 is disposed on a rear end portion of the first rolling portion 20 and measures a temperature of a slab of which first rolling is finished. The temperature measuring sensor 110 may be configured to be either a contact type or a non-contact type. The temperature measuring sensor 110 may be disposed in a plurality of positions, such as on the rear end portion of the first rolling portion 20, as well as on front and rear end portions of the heating portion 50 and the second rolling portion 70 and on a rear end portion of the continuous casting portion 10, in order to detect a temperature of the slab passing therethrough.

[0031] The cutters 30, 40, and 90 are provided as three cutters in an exemplary embodiment. Two cutters are disposed on the rear end portion of the first rolling portion 20, while a cutter is disposed on a front end portion of the coiler 100. In the case of a cutter 30 disposed on the rear end portion of the first rolling portion 20, a plurality of cutters are disposed depending on a thickness of the slab. However, only a single cutter may be used.

[0032] The heating portion 50 is configured using an inductive heater having an open side surface in an exemplary embodiment. In other words, the heating portion 50 is configured to have a '⊏' shape overall when taken from the front thereof, since a side surface thereof is open. The inductive heater may be connected to a means of movement to be able to enter and be removed in a lateral direction of the slab. The inductive heater may deviate from a path of the slab when heating is unnecessary.

[0033] In addition, temperature measuring sensors 111 and 112 may be disposed on the front and rear end portion of the heating portion 50. Thus, the control unit 120 may control the heating portion 50 to increase a temperature of the slab to a desired temperature.

[0034] In the meantime, although not illustrated in FIGS. 1 and 2, a pusher and piler (not illustrated) may be disposed in a space between the cutters 30 and 40 and the heating portion 50. The pusher and the piler push the slab cut by the cutters 30 and 40 out to remove the slab cut by the cutters from a path of the slab. A cut slab removal device in addition to the pusher and the piler may also be used.

[0035] In an exemplary embodiment, the coiling box 60 may include two mandrels 61 and 62. The two mandrels 61 and 62 may be configured to have a carousel type form having a structure in which the two mandrels 61 and 62 rotate around a circular track, and coiling and uncoiling are alternately performed. In addition, in a case in which continuous rolling is performed as illustrated in FIG. 2, in order not to block the path of the slab, the coiling box 60 may be disposed in a higher position so that a plurality of mandrels may be disposed above the slab passing therethrough, but the present disclosure is not limited thereto. In detail, the coiling box 60 may have a structure in which the slab passes between the mandrels 61 and 62.

[0036] The second rolling portion 70 is disposed to be contiguous with the coiling box 60. In the exemplary embodiment, the second rolling portion 70 includes five rolling stands. However, the second rolling portion 70 is not limited thereto, but may include a plurality of rolling stands. In addition, rolling stands may be disposed contiguously, and may be disposed to be spaced apart from each other.

[0037] The second rolling portion 70 rolls the slab, a thickness of which has been reduced by passing through the first rolling portion 20, using the plurality of rolling stands and applies rolling force to the slab, so that a thickness thereof may be reduced to a final target thickness. In this case, the control unit 120 may manage a temperature of the second rolling portion 70 to be a temperature at which rolling is possible, using temperature measuring sensors 113 and 114 disposed on the front and rear end portion of the second rolling portion 70.

[0038] The run out table 80 has a structure in which the slab, having become a strip, is cooled using a cooling water supplying device disposed thereabove by allowing the slab to pass through a specific section above a roller. In the case of continuous rolling, the cutter 90 cuts the slab having passed through the run out table 80 to be an amount of a single coil before the strip is wound around the coiler 100.

[0039] The control unit 120 is connected to each device and may control a different device based on information of each device. In detail, in an exemplary embodiment, the control unit 120 is connected to at least the first rolling portion 20, the cutters 30 and 40, the heating portion 50, the coiling box 60, the second rolling portion 70, and the temperature measuring sensor 110 and controls the first rolling portion 20, the cutters 30 and 40, the heating portion 50, the coiling box 60, and the second rolling portion 70 based on a temperature value of the temperature measuring sensor 110.

[0040] In the case of a structure described above, if casting is begun with continuous rolling in an initial stage of casting, it is impossible to secure the temperature at which rolling is possible before a portion of the slab, a temperature of which is relatively low in the initial stage of casting, passes through the last stand of the second rolling portion 70. In addition, in the case of the structure of the exemplary embodiment, when batch rolling is converted into continuous rolling, mandrels 61 and 62 should be moved in the coiling box 60, so that the time to unwind a coil having been previously wound may be required. Thus, a slab continuously cast while the coil is being unwound should be cut using the cutters 30 and 40 to be discarded as scrap. In a case in which the slab cast while the coil is being unwound is discarded as scrap, the slab weighing 10 tons or more is discarded as scrap, thereby significantly affecting a percentage yield.

[0041] Thus, the continuous casting and rolling equipment switching between continuous rolling and batch rolling of an exemplary embodiment begins casting with continuous rolling allowing the slab to pass through a coiling box merely in the initial stage of casting, using the control unit 120, while a specific length of a front end portion of the slab is cut. In this case, a cutting length may be controlled by the control unit 120 so that a temperature of the slab before passing through the last stand of the second rolling portion 70 may be a temperature at which rolling is possible.

[0042] In addition, in order to reduce the cutting length, in an exemplary embodiment, when the heating portion 50 is in a normal state, the slab is heated so that a temperature thereof may be higher than a heating rate, thereby compensating for a relatively low temperature in the initial stage. In this case, the normal state refers to a time at which casting is stable.

[0043] In other words, when a temperature of the slab is relatively low in the initial stage of casting, a quantity of heat greater than a heating amount provided in the middle of casting is provided. In this case, a temperature increasing a temperature of the slab by the heating amount is increased to a temperature higher than a normal state by 20°C to 50°C, so that a temperature of the second rolling portion 70 may be secured in the initial stage. In a case in which a difference in raised temperatures is less than 20°C, an effect caused by additional heating is insignificant. In a case in which a difference in heat rates is greater than 50°C, a quality of the slab may be affected. In addition, peripheral equipment of the heating portion 50 may be degraded, and a reduction in lifespan thereof may be affected.

[0044] In addition, the control unit 120 may improve plastic energy dissipation of the slab in the second rolling portion 70 to secure the temperature of the second rolling portion 70 in such a manner that a rolling reduction rate of the first rolling portion 20 is reduced to be lower than that in a normal state in the initial stage of casting, and a rolling reduction rate of the second rolling portion 70 is increased to be higher than that in the normal state.

[0045] In detail, in the case of the heating portion 50, when a thickness of the slab is relatively thick, heating efficiency may be improved. Thus, the rolling reduction rate of the first rolling portion 20 may be reduced to be lower than that in the normal state, thereby improving efficiency of the heating portion 50 to increase a heating amount provided to the slab.

[0046] In case of the first rolling portion 20 and the second rolling portion 70, in the normal state, maximum rolling force is not used, but a certain margin is retained in case that there is a problem, such as equipment trouble, during a process. However, in the initial stage of casting, the control unit 120 reduces the rolling reduction rate of the first rolling portion 20 using a marginal rolling reduction rate of the second rolling portion 70 and increases the rolling reduction rate of the second rolling portion 70 to cover a relatively low temperature of the slab in the initial stage using plastic energy dissipation of the second rolling portion 70.

[0047] In the meantime, in a case in which a temperature of the slab is secured after the slab has passed through the coiler 100 in the initial stage, the control unit 120 controls an entirety of the first rolling portion 20 and the second rolling portion 70 to have a marginal rolling reduction rate in such a manner that the rolling reduction rate of the first rolling portion 20 is increased to be that in the normal state and the rolling reduction rate of the second rolling portion 70 is reduced to be that in the normal state. In this case, rolling reduction rates of the first rolling portion 20 and the second rolling portion 70 may gradually be changed.

[0048] However, even though a rolling reduction rate and the heating portion 50 are controlled as described above, in a certain section in the initial stage of casting, a temperature at which rolling is possible may not be secured in the second rolling portion 70. Thus, the control unit 120 measures a temperature of the slab having passed through the first rolling portion 20 using the temperature measuring sensor 110 disposed on an exit side of the first rolling portion 20. The control unit 120 predicts a temperature of the slab when the slab passes through the second rolling portion 70 in consideration of a measured temperature, a heating amount that the heating portion 50 may provide, and a heating amount lost from the slab while the slab is passing through the heating portion 50, the coiling box 60, and the second rolling portion 70. In a case in which the temperature of the slab is lower than the temperature at which rolling is possible, the section of the slab, the temperature of which is relatively low, is cut by the cutters 30 and 40.

[0049] In the meantime, the control unit 120 may control to prevent a collision occurring when the slab enters the first rolling portion 20 in such a manner that the first rolling portion 20 applies rolling force thereto after a front end portion of the slab passes through the first rolling portion 20 in the initial stage.

[0050] A method of operating the continuous casting and rolling equipment switching between continuous rolling and batch rolling described above will be described.

[0051] In order to begin casting with continuous rolling in the initial stage of casting, as illustrated in FIG. 2, the coiling box 60 begins casting with the mandrels 61 and 62 moved above the path of the slab.

[0052] After a continuous casting operation to continuously cast the slab in a continuous casting portion, in order to prevent a problem related to the slab entering the first rolling portion 20 in the initial stage of casting, a primary rolling operation in which the first rolling portion 20 begins to apply roll force thereto after the front end portion of the slab passes therethrough is performed. In this case, a temperature measuring operation to measure a temperature of the slab having passed through the first rolling portion 20 using the temperature measuring sensor 110 is performed. Based on a measured temperature, a temperature when the slab passes through the second rolling portion 70 is predicted. In a case in which the temperature is lower than the temperature at which rolling is possible, a cutting operation to cut the slab using the cutters 30 and 40 is performed. In the cutting operation, it is possible to cut the slab uniformly at a length obtained based on experience without the temperature measuring operation. However, based on a temperature value in the temperature measuring operation, the cutting length may be reduced, thereby improving a percentage yield.

[0053] A slab having been cut is removed from the path of the slab. In the case of a slab not having been cut and connected to the continuous casting portion 10, a heating operation to raise a temperature of the slab using the heating portion 50 is performed. In order to provide a larger quantity of heat by improving efficiency of a temperature rise and to raise a temperature on a rear end portion of the slab by plastic energy dissipation, in the first rolling portion 20, rolling reduction is performed using a rolling reduction rate lower than that in the normal state in the primary rolling operation. Insufficient rolling reduction in the first rolling portion 20 is compensated for in such a manner that rolling reduction greater than that in the normal state in the second rolling portion 70 is performed in a secondary rolling operation to be subsequently described.

[0054] After the heating operation, a passing operation in which the slab merely passes through the coiling box 60. Subsequently, the secondary rolling operation is performed by the second rolling portion 70. In the secondary rolling operation as described above, rolling reduction is performed to the slab using a rolling reduction rate higher than that in the normal state, while a portion thereof in which rolling reduction is not performed in the primary rolling operation is compensated for.

[0055] According to a method of an exemplary embodiment, a coiling box is controlled so that continuous rolling may be performed in the initial stage of casting, and a portion of the slab in which continuous rolling may not be performed is cut, thereby reducing an amount of scrap generated during a switch between continuous rolling and batch rolling or in the initial stage of casting. Thus, a percentage yield may be improved.

[0056] In addition, the heating amount is increased and plastic energy dissipation is used to reduce a portion of the slab in which continuous rolling may not be performed, thereby generating scrap only about 20% to 30% of scrap generated when batch rolling is switched to continuous rolling. Thus, the switch between batch rolling and continuous rolling is possible, thereby greatly contributing to improving a percentage yield.

Exemplary Example

[0057] Table 1 below is a contrast table contrasting a case in which rolling in the initial stage is performed on condition of continuous casting and rolling equipment switching between continuous rolling and batch rolling in a normal state and a case in which rolling is performed using a method of the present disclosure.

[0058] A rolling reduction rate of a first rolling portion was reduced to be lower than that in the normal state, and a rolling reduction rate of a second rolling portion was increased, so that an entirety of rolling reduction rates were equal, and a degree of temperature rise of a heating portion was increased to be higher than that in the normal state by 45°C. As a result, there was a temperature difference of about 20°C between a temperature on an exit side of the second rolling portion 70 in the initial stage and a temperature in the normal state. Thus, an amount of discarded scrap was significantly reduced, thereby improving a percentage yield.

[Table 1]

Item	Comparative Example (Normal State)	Exemplary Example
Rolling Reduction Rate of First Rolling Portion	60%	55%
Degree of Temperature Rise of Heating Portion	100°C	145°C
Rolling Reduction Rate of Second Rolling Portion	80%	82%

(continued)

Item	Comparative Example (Normal State)	Exemplary Example
Temperature on Exit Side of Second Rolling Portion in Initial Stage	About 780°C	About 800°C
Amount of Scrap	15 tons	5 tons

[0059] In a case in which a certain degree of casting in the initial stage and rolling is performed, for example, about four coils are produced, and a stable temperature on the exit side thereof is secured, a slab is returned to the normal state so that each component of the continuous casting and rolling equipment switching between continuous rolling and batch rolling may have a marginal operation range.

[0060] While exemplary embodiments have been shown and described above, it will be apparent to those skilled in the art that modifications and variations could be made without departing from the scope of the present invention as defined by the appended claims.

Claims

1. A method of continuous casting and rolling, switching continuous rolling and batch rolling, in equipment including a continuous casting unit, at least two rolling portions, and a coiling box disposed between the at least two rolling portions, the method comprising:

   performing continuous casting to produce a slab;
   primary rolling to reduce a thickness of the slab;
   cutting to cut a specific length of the slab from a front end portion of the slab in an initial stage of casting;
   passing, in which the slab, continuously provided, passes through the coiling box; and
   secondary rolling to reduce a thickness of the slab having passed through the coiling box.

2. The method of claim 1, wherein in the primary rolling, the thickness of the slab is reduced using a rolling reduction rate lower than a rolling reduction rate in normal condition.

3. The method of claim 2, further comprising heating, to increase a temperature of the slab, between the cutting and the passing.

4. The method of claim 3, wherein in the heating, the temperature of the slab is increased to be higher than a raised temperature in normal condition.

5. The method of claim 4, wherein in the heating, the temperature of the slab is increased to be higher than the raised temperature in normal condition by 20°C to 50°C.

6. The method of claim 2, wherein after the primary rolling, measuring a slab temperature to measure the temperature of the slab is performed, and in the cutting, the slab is cut based on the temperature of the slab.

7. The method of claim 6, wherein in the measuring a slab temperature, the temperature of the slab having passed through a first rolling portion is measured.

8. The method of claim 7, wherein in the cutting, a temperature when the slab passes through a second rolling portion is predicted, and the slab is cut until the temperature when the slab passes through the second rolling portion is higher than or equal to a temperature at which rolling is possible.

9. The method of claim 6, wherein in the secondary rolling, the slab is rolled using a rolling reduction rate higher than the rolling reduction rate in normal condition.

10. The method of claim 9, wherein in the primary rolling and the secondary rolling, the rolling reduction rate is returned to the rolling reduction rate in normal condition after a specific period of time.

11. The method of claim 2, wherein in the primary rolling, the rolling reduction rate is gradually increased.

12. Continuous casting and rolling equipment switching between continuous rolling and batch rolling, comprising:

a continuous casting unit;
a first rolling portion and a second rolling portion, disposed in a direction of movement of a slab produced by the continuous casting unit and rolling the slab;
a coiling box disposed between the first rolling portion and the second rolling portion and configured to allow the slab having passed through the first rolling portion to be coiled and uncoiled during batch rolling and to merely pass through the coiling box during continuous rolling;
a cutter disposed between the first rolling portion and the coiling box;
a sensor for measuring a slab temperature disposed on a rear portion of the first rolling portion; and
a control unit connected to the first rolling portion, the second rolling portion, the coiling box, the cutter, and the sensor for measuring a slab temperature,
wherein the control unit enables the cutter to cut a portion of the slab cast in an initial stage of casting based on a value measured by the sensor for measuring a slab temperature during an initial stage of casting and enables the coiling box to allow the slab connected to the continuous casting unit to pass through the coiling box.

13. The continuous casting and rolling equipment switching between continuous rolling and batch rolling of claim 12, further comprising a heating portion disposed between the cutter and the coiling box and increasing a temperature of the slab passing through the heating portion,
wherein the control unit controls the heating portion to increase the temperature of the slab to be higher than a raised temperature in normal condition.

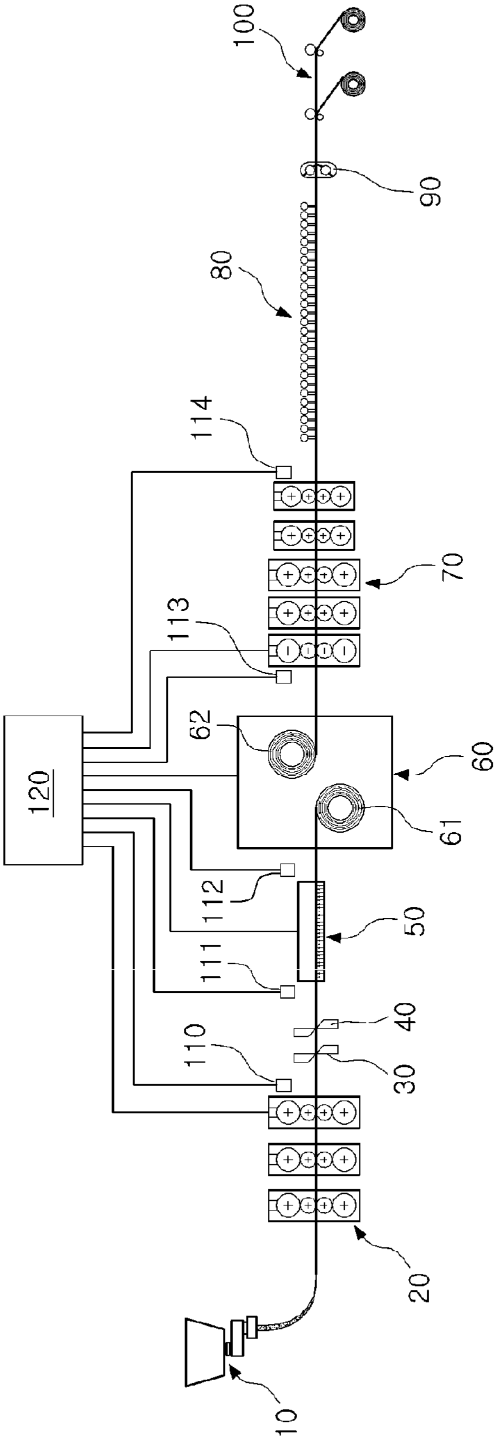
14. The continuous casting and rolling equipment switching between continuous rolling and batch rolling of claim 13, wherein the control unit maintains a final thickness of the slab in such a manner that a rolling reduction rate of the first rolling portion is reduced to be lower than a rolling reduction rate in normal condition, and a rolling reduction rate of the second rolling portion is increased to be higher than the rolling reduction rate in normal condition.

15. The continuous casting and rolling equipment switching between continuous rolling and batch rolling of claim 12, wherein the coiling box is configured to have a carousel type form including a plurality of mandrels, and when the coiling box allows the slab to pass through the coiling box, a mandrel of the coiling box is disposed above the slab passing through the coiling box.

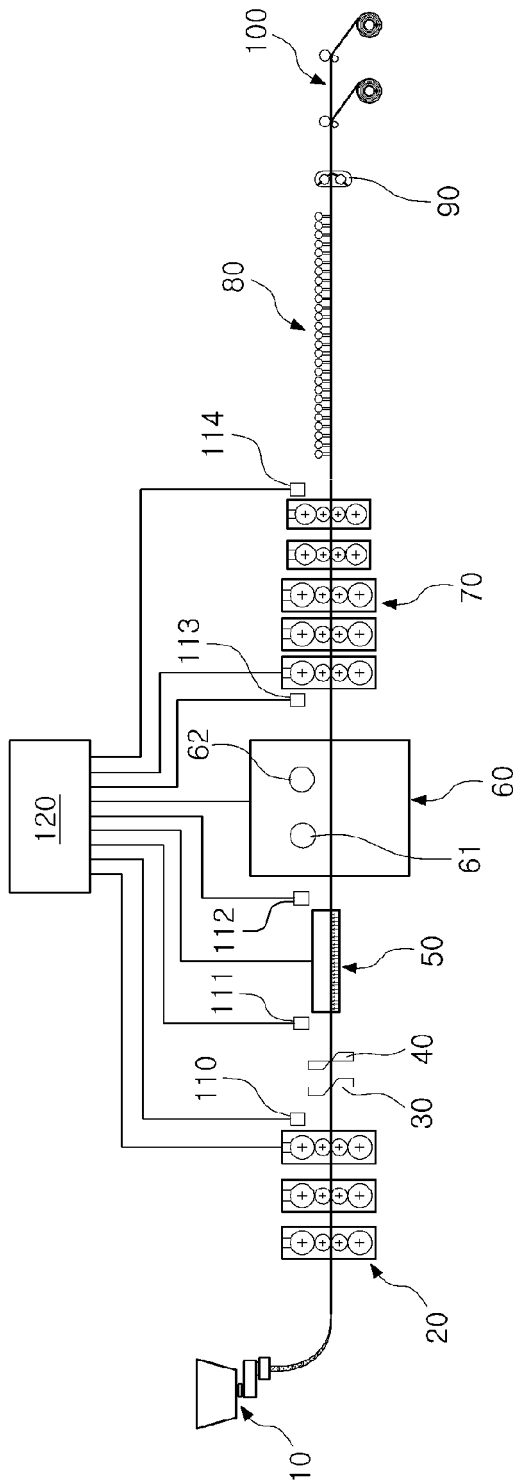
16. The continuous casting and rolling equipment switching between continuous rolling and batch rolling of claim 13, wherein the heating portion includes an inductive heater having an open side surface, and the inductive heater is configured to enter and be removed in a lateral direction of the slab.

17. The continuous casting and rolling equipment switching between continuous rolling and batch rolling of claim 13, further comprising a pusher and a piler, disposed between the heating portion and the cutter and removing a slab having been cut from a path of the slab.

【Fig. 1】



【Fig. 2】



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2015/004349

A. CLASSIFICATION OF SUBJECT MATTER

B21B 1/46(2006.01)i, B21B 37/16(2006.01)i, B21B 37/74(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)
B21B 1/46; B22D 11/16; B21B 1/26; B22D 11/126; B21B 37/58; B21B 37/16; B21B 37/74

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: continuous casting, rolling, batch rolling, rolling reduction, reduction, heating, temperature rising, cutting, coil, coiling, un-coil, un-coiling, temperature, control

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2010-0078425 A (POSCO) 08 July 2010 See pages 6 to 9, figure 2 and claims 1 to 10.	1
Y		12,15
A		2-11,13,14,16,17
Y	KR 10-2013-0071551 A (POSCO) 01 July 2013 See pages 1 to 5 and claims 1 to 4.	12,15
A	KR 10-2014-0081590 A (POSCO) 01 July 2014 See abstract and claims 1 to 11.	1-17
A	KR 10-2009-0025450 A (POSCO) 11 March 2009 See abstract and claims 1, 2.	1-17

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 JULY 2015 (13.07.2015)	**14 JULY 2015 (14.07.2015)**

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2015/004349

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-2010-0078425 A	08/07/2010	NONE	
KR 10-2013-0071551 A	01/07/2013	NONE	
KR 10-2014-0081590 A	01/07/2014	NONE	
KR 10-2009-0025450 A	11/03/2009	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009508691 A **[0005]**
- EP 0841995 A **[0005]**