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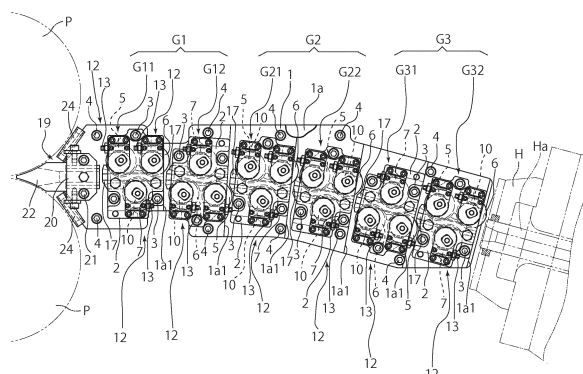
(54) **ROD-SHAPED STEEL MATERIAL GUIDING METHOD AND GUIDING DEVICE**

(57) To prevent generation of scratches of straight stocks and improve quality of the straight stocks, and obtain a stable ring shape.

Between a pinch roll P and a laying head H, first to third guidance equipments G1, G2, and G3 for guiding straight stocks are disposed, the first guidance equipment G1 on the most upstream side includes a plurality of bend forming roller guides G11 and G12 for giving a curvature enabling bending in a laying head H direction

to the above-described straight stocks, the second guidance equipment G2 includes a plurality of directing roller guides G21 and G22 that guide the above-described straight stocks downstream, and the third guidance equipment on the most downstream side is contiguous to the second guidance equipment G2 and includes a plurality of bend-back forming roller guides G31 and G32 for bending back the above-described straight stocks in the laying head H direction to make them straight.

F I G . 1



Description

Technical Field

[0001] The present invention relates to a guiding method and a guiding apparatus for straight stocks including bar steels and wire rods.

Background Art

[0002] When manufacturing a steel product into straight stocks by hot rolling, in a hot rolling line disclosed in Japanese Laid-open Patent Publication No. 2010-99669, for example, a heating furnace, a roughing mill, an intermediate rolling mill, a finishing mill, a final finishing mill, and a laying head are arranged in sequence from an upstream side to a downstream side, and between the above-described finishing mill and final finishing mill, a plurality of water-cooling apparatuses to cool a wire rod are provided.

[0003] Generally, between the final finishing mill and the laying head, a pinch roll stand is disposed and downstream thereof, a guiding means for directing the above-described wire rod to the laying head is disposed, which is not disclosed in the above-described Japanese Laid-open Patent Publication.

[0004] Then, the above-described laying head is placed obliquely at a predetermined angle relative to the above-described pinch roll stand, and when guiding a wire rod small in diameter to the above-described laying head from the pinch roll side at high speed, a pipe guide (guiding pipe) is used as the guiding means. The above-described pipe guide is disposed between the pinch roll stand and the laying head and has a convexly curved shape.

Prior Art Document

Patent Document

[0005] Patent Document 1: Japanese Laid-open Patent Publication No. 2010-99669

Summary of the Invention

Problems to be solved by the Invention

[0006] At the time of guiding of a wire rod, when the above-described wire rod having a small diameter and running at high speed that has been discharged from the pinch roll is guided to the laying head by the pipe guide, when the wire rod comes into contact with an inner surface of the above-described pipe guide, the contact causes scratches, and further by the contact, speed variations of the wire rod are caused, to thereby cause a problem that a good ring cannot be formed by the laying head. In other words, the above-described scratches and speed variations of the wire rod make it impossible to obtain

stable ring formation, to result in a problem that should be solved finally in terms of the quality of the wire rod and operational matters.

[0007] An object of the present invention is to prevent generation of scratches of straight stocks and improve quality of the straight stocks, and to obtain a stable ring shape.

Means for solving the problems

[0008] A first feature of the present invention lies in a guiding method for guiding straight stocks from a pinch roll on a downstream side of a final finishing mill in a hot rolling line to a laying head disposed at a position displaced downward from a position facing the pinch roll with a space left therebetween on a downstream side of the pinch roll. It includes: while guiding the straight stocks to the downstream side by a plurality of rollers of bend forming roller guides, bend forming the straight stocks in a laying head direction; and while bend-back forming the bent-formed straight stocks in the laying head direction by a plurality of rollers of bend-back forming roller guides on the downstream side, guiding the straight stocks to the laying head.

[0009] A second feature of the present invention lies in a straight stocks guiding apparatus including: a bending and guidance equipment and a bending-back and guidance equipment disposed for guiding straight stocks from a pinch roll on a downstream side of a final finishing mill in a hot rolling line to a laying head. The bending and guidance equipment and the bending-back and guidance equipment are mounted on a supporting means. The laying head is disposed at a position displaced downward from a position facing the pinch roll with a space left from the pinch roll on a downstream side of the pinch roll. The bending and guidance equipment on an upstream side includes a plurality of bend forming roller guides for guiding the straight stocks to the downstream side by a plurality of rollers and giving a curvature enabling bending in a laying head direction to the straight stocks. The bending-back and guidance equipment includes a plurality of bend-back forming roller guides for bending back the straight stocks bent by the bending and guidance equipment on the upstream side in the laying head direction by a plurality of rollers to form the straight stocks linearly and guiding the straight stocks to the laying head. The rollers in the respective bend forming roller guides and the respective bend-back forming roller guides are each easily rotatably attached to a roller pin via a bearing part.

[0010] A third feature of the present invention includes the above-described second feature, and lies in that it includes a guidance equipment for intermediate mill disposed between the bending and guidance equipment and the bending-back and guidance equipment, in which the guidance equipment for intermediate mill includes a plurality of directing roller guides for guiding the straight stocks along a downward inclined direction by a plurality of rollers and directing the straight stocks to the bending-

back and guidance equipment.

[0011] A fourth feature of the present invention includes the above-described second or third feature, and lies in that a center guide is provided in the roller guides of the respective guidance equipments.

[0012] A fifth feature of the present invention includes any one of the above-described second to fourth features, and lies in that the guidance equipments are each constituted by at least two consecutive roller guides, and the roller guides each combine at least three rollers.

[0013] A sixth feature of the present invention includes any one of the above-described second to fourth features and includes the above-described fifth feature, and lies in that the combination of the three rollers is made by two rollers disposed on one side of an upper side and a lower side and a single roller disposed on the other side, the adjacent combinations of the three rollers in both the bend forming roller guides are in a mutually inverted positional relationship, and the adjacent combinations of the three rollers in both the bend-back forming roller guides are in a mutually inverted positional relationship.

[0014] A seventh feature of the present invention includes any one of the above-described second to sixth features, and lies in that the roller guides in the guidance equipments each include roller eccentricity adjusting mechanisms for adjusting positions of the rollers.

[0015] An eighth feature of the present invention includes any one of the above-described second to seventh features, and lies in that the roller guides in the guidance equipments are each mounted on a base plate being the supporting means so as to be replaceable singly.

[0016] A ninth feature of the present invention includes any one of the above-described second to eighth features, and lies in that the roller guides in all the guidance equipments are the same in constitution.

[0017] A tenth feature of the present invention includes any one of the above-described second to ninth features, and lies in that a member with a small friction coefficient is used for a bearing of the bearing part.

[0018] An eleventh feature of the present invention includes any one of the above-described second to tenth features, and lies in that a resin-made seal is disposed on the bearing part.

Advantageous Effect of the Invention

[0019] According to the present invention, as the bending and guidance equipment, bend forming roller guides are provided and as the bending-back and guidance equipment, bend-back forming roller guides are provided, to thereby enable bend guiding and linear guiding of straight stocks, resulting in that it is possible to make the guiding of the above-described straight stocks to a laying head smooth, prevent generation of scratches on a pipe

guide that has been used conventionally, improve quality, avoid coming into contact with a quill pipe inside the laying head, and form a stable ring.

Brief Description of Drawings

[0020]

FIG. 1 is a front view illustrating a straight stocks guiding apparatus according to the present invention, and is a view in which a part of a bed plate is cut out;

FIG. 2 is an enlarged front view illustrating a first bend forming roller guide in a first guidance equipment of the straight stocks guiding apparatus according to the present invention;

FIG. 3 is an enlarged side view illustrating the first bend forming roller guide in the first guidance equipment of the straight stocks guiding apparatus according to the present invention;

FIG. 4 is an enlarged plan view illustrating the first bend forming roller guide in the first guidance equipment of the straight stocks guiding apparatus according to the present invention;

FIG. 5 is a cross-sectional view illustrating a roller attached state of the first bend forming roller guide in the first guidance equipment of the straight stocks guiding apparatus according to the present invention in an enlarged manner;

FIG. 6 is a cross-sectional view illustrating a relationship between respective rollers of the first bend forming roller guide and a center guide in the first guidance equipment of the straight stocks guiding apparatus according to the present invention in an enlarged manner;

FIG. 7(i) to FIG. 7(iii) are constitution diagrams each for explaining interactions of respective rollers in the first guidance equipment and second and third guidance equipments of the straight stocks guiding apparatus according to the present invention; and FIG. 8 is an enlarged side view illustrating an exit guide of a pinch roll in the straight stocks guiding apparatus according to the present invention.

Best Mode for Carrying out the Invention

[0021] There will be explained a straight stocks guiding apparatus according to the present invention with reference to the drawings.

[0022] The straight stocks guiding apparatus illustrated in FIG. 1 includes: a first guidance equipment G1 being a bending and guidance equipment; a second guidance equipment G2 being a guidance equipment for intermediate mill; and a third guidance equipment G3 being a bending-back and guidance equipment in order to guide straight stocks from a pinch roll P disposed on a downstream side of a final finishing mill in a hot-rolling line to a laying head H.

[0023] In FIG. 1, the laying head H on the most downstream side (right side in the drawing) is disposed at a position displaced downward from a position facing the pinch roll with a space left from the pinch roll P on a downstream side of the pinch roll. That is, the laying head H is disposed in a downward inclined direction with a space left from the pinch roll P on the downstream side.

[0024] Between the pinch roll P and the laying head H, a base plate 1 having a substantially "upwardly curved shape" is disposed. A bed plate 1a having the same shape is overlaid on the front surface of the base plate 1, and the first, second and third guidance equipments G1, G2, and G3 are removably mounted on this bed plate.

[0025] The first guidance equipment G1 will be explained with reference to FIG. 1 to FIG. 6.

[0026] In FIG. 1, the first guidance equipment G1 on the upstream side includes a plurality of bend forming roller guides (two bend forming roller guides G11 and G12 in the illustrated example). The first and second bend forming roller guides G11 and G12 are to guide the above-described straight stocks to a laying head H direction and have a function to bend form the above-described straight stocks downward in FIG. 1, which is the laying head H direction.

[0027] The first bend forming roller guide G11, which is one of the first and second bend forming roller guides G11 and G12, will be explained.

[0028] In FIG. 2 to FIG. 4, the first bend forming roller guide G11 includes a guide unit 2. The guide unit 2 is attachably/detachably mounted on the bed plate 1a by mounting bolts 3, and this bed plate is fixed to the front surface of the base plate by fixing bolts 4 (FIG. 1). The first bend forming roller guide G11 is replaceable with a new one singly with respect to the base plate 1 via the guide unit 2.

[0029] A plurality of rollers 5, 6, and 7 are provided in the guide unit 2. In the example of the guide unit 2 illustrated in FIG. 2, the two rollers 5 and 6 are provided on the upper side and the single roller 7 is provided on the lower side, and a line connecting centers of the respective rollers forms an inverted triangle. The rollers 5, 6, and 7 give a bending force to draw a gentle circular arc in the laying head H direction to the above-described straight stocks to guide them to the downstream side (right side in FIG. 1).

[0030] In FIG. 3 to FIG. 5, the rollers 5, 6, and 7 are each easily rotatably attached to each roller pin 8 via a bearing part 9. A member with a small friction coefficient (for example, ceramic, or the like) is used for a bearing 9a of the bearing part 9, to thereby make it possible to suppress heat generation with respect to rotation of the roller corresponding to a running speed of the straight stocks. For the bearings 9a illustrated in FIG. 3 and FIG. 5, a ball bearing having balls 9b disposed therein is used. According to the example illustrated in FIG. 5, in the bearing part 9, a resin-made seal 9c is provided on both ends of the roller 6, to thereby prevent extraneous matters such as scales from entering the inside and make

it possible to suppress heat generation with the roller rotating at high speed. Also in the bearing parts of the other rollers 5 and 7 similarly (in FIG. 3, only the bearing part 9 of the roller 7 is illustrated), resin-made seals are provided.

[0031] In FIG. 5, 9d denotes a washer and 9e denotes a spacer.

[0032] In FIG. 2 to FIG. 5, a gear wheel 10 rotatably attached to an upper plate portion of the guide unit 2 is integrally joined to an upper portion of each of the roller pins 8. The respective roller pins 8 are eccentrically joined to the gear wheels 10. Further, a lower end portion of each of the roller pins 8 is borne by an eccentric piece 11 rotatably attached to a lower plate portion of the guide unit 2. The respective roller pins 8 are eccentrically connected to the eccentric pieces 11.

[0033] In FIG. 2, FIG. 4, and FIG. 6, inside the guide unit 2 of the first bend forming roller guide G11, a center guide 17 is provided. The center guide 17 is fixed to the guide unit 2 by center guide fixing bolts 18, and a tip portion (left end portion in FIG. 6) of the center guide 17 is protruded from the guide unit. The center guide 17 is to bring the straight stocks into the space between the rollers 5 and 6 on the upper side and the roller 7 on the lower side in FIG. 6. Then, from entering an entrance 17a to passing through an exit 17b of the center guide 17 illustrated in FIG. 6, the straight stocks are reduced by each of the rollers 5, 6, and 7 to be bent in the laying head H direction.

[0034] The thin straight stocks to run at high speed tend to swing up and down or right and left during running, and therefore the center guide 17 has a role of helping the above-described straight stocks passing through the inside of the guide unit 2 to run straight to make directing and reduction by the rollers 5, 6, and 7 secure.

[0035] The first bend forming roller guide G11 illustrated in FIG. 2 to FIG. 4 is provided with roller eccentricity adjusting mechanisms 12 for adjusting positions (reduction positions) of the rollers 5, 6, and 7 respectively.

[0036] The eccentricity adjusting mechanisms 12 each include: the gear wheel 10; the eccentric piece 11; a pinion shaft 13; and a pinion 14. Each of the pinion shafts 13 is rotatably borne by a pedestal 15. The respective pedestals 15 are firmly fixed onto the guide unit 2 by mounting bolts 16. Each of the pinions 14 is attached to the pinion shaft 13 to mesh with the gear wheel 10.

[0037] By rotation operations of the respective pinion shafts 13, the respective pinions 14 rotate and with the rotations of the respective pinions, the respective gear wheels 10 rotate, and thereby the respective roller pins 8 attached to the rotating gear wheels in an eccentric state also rotate and the respective rollers 5, 6, and 7 are made eccentric (move), resulting that the reduction positions can be adjusted.

[0038] In FIG. 1 and FIG. 2, the other second bend forming roller guide G12 in the first guidance equipment G1 is disposed adjacently to the one first bend forming roller guide G11 on the downstream side thereof (right

side in FIG. 1) with a space left therebetween. The constitution of the second bend forming roller guide G12 is the same as that of the first bend forming roller guide G11. For this reason, as for reference numerals and symbols denoting components of the second bend forming roller guide G12 common to those of the first bend forming roller guide G11, the reference numerals and symbols used during the explanation of the first bend forming roller guide are used as they are.

[0039] The difference of the second bend forming roller guide G12 from the first bend forming roller guide G11 is that as illustrated in FIG. 1, the second bend forming roller guide is half rotated (rotated by 180° clockwise) from the first bend forming roller guide to be mounted on the base plate 1. For this reason, dispositions of the components of the second bend forming roller guide G12 are positioned in an inverted manner from the first bend forming roller guide G11. As a result, of the second bend forming roller guide G12, two rollers 5 and 6 are disposed on the lower side in FIG. 1 and a single roller 7 is disposed on the upper side in the same drawing.

[0040] As above, the first guidance equipment G1 enables smooth guiding to the laying head in a manner that the first and second bend forming roller guides G11 and G12 having the same constitution are aligned contiguously on the base plate 1 (bed plate 1a) so as to be inverted to each other and are adjacently disposed in a form in which the combination of the two upper rollers 5 and 6 and the single lower roller 7 and the inverted combination (combination of the single upper roller 7 and the two lower rollers 5 and 6) are one set and a curvature enabling the straight stocks to bend in the laying head H direction is made.

[0041] There will be explained the second guidance equipment G2 with reference to FIG. 1.

[0042] The second guidance equipment G2 is contiguous to the above-described first guidance equipment G1 on the downstream side thereof. The second guidance equipment G2 includes a plurality of directing roller guides (two directing roller guides G21 and G22 in the illustrated example). The first and second directing roller guides G21 and G22 have a function to guide the above-described straight stocks along the above-described downward inclined direction to direct them to the third guidance equipment G3.

[0043] Each constitution of the first and second directing roller guides G21 and G22 is the same as that of the above-described first and second bend forming roller guides G11 and G12. For this reason, as for reference numerals and symbols denoting components of the first and second directing roller guides G21 and G22 common to those of the first and second bend forming roller guides G11 and G12, the reference numerals and symbols used during the explanation of the first and second bend forming roller guides G11 and G12 are used as they are.

[0044] The difference lies in disposition positions of the first and second directing roller guides G21 and G22 that are provided contiguously.

[0045] That is, the first guidance equipment G1 and the second guidance equipment G2 are different in that the first and second bend forming roller guides G11 and G12 placed on the left side in FIG. 1 are in a state inverted to each other, while each of both the first and second directing roller guides G21 and G22 includes rollers 5 and 6 positioned on the upper side and a roller 7 positioned on the lower side and therefore the first and second directing roller guides G21 and G22 are not in an inverted state.

[0046] The relationship between the adjacent first directing roller guide G21 and second bend forming roller guide G12 is that the roller 7 of the one first directing roller guide (right in FIG. 1) is positioned on the lower side and the roller 7 of the other second bend forming roller guide (left) is positioned on the upper side, resulting in that the second bend forming roller guide G12 is mounted on the base plate 1 so as to be inverted.

[0047] The first and second directing roller guides G21 and G22 can direct the straight stocks passing through the center guide 17 by their upper rollers 5 and 6 and their lower rollers 7.

[0048] In roller eccentricity adjusting mechanisms 12 in the first and second directing roller guides G21 and G22 illustrated in FIG. 1, directing positions of the rollers 5, 6, and 7 can be adjusted by their eccentric operations.

[0049] There will be explained the third guidance equipment G3 with reference to FIG. 1.

[0050] The third guidance equipment G3 is contiguous to the above-described second guidance equipment G2 on the downstream side thereof, and includes a plurality of bend-back forming roller guides (two bend-back forming roller guides G31 and G32 in the illustrated example) for bending back the above-described straight stocks to make the guiding to the laying head H smooth.

[0051] The first and second bend-back forming roller guides G31 and G32 achieve the guiding of the above-described straight stocks to the laying head H, and have a function for bending back the above-described straight stocks being guided in a bent state and forming them linearly in order to make the guiding to the laying head smooth. In other words, the first and second bend-back forming roller guides G31 and G32 constituting the third guidance equipment G3 have a function to linearly form the straight stocks running while being guided by the second guidance equipment G2 in a bent state in order to prevent the straight stocks from running directly toward the laying head H direction and coming into contact with a quill pipe Ha being a guiding pipe in the laying head.

[0052] Each constitution of the first and second bend-back forming roller guides G31 and G32 is the same as that of the first and second bend forming roller guides G11 and G12. For this reason, as for reference numerals and symbols denoting components of the first and second bend-back forming roller guides G31 and G32 common to those of the first and second bend forming roller guides G11 and G12, the reference numerals and symbols used during the explanation of the first and second

bend forming roller guides are used as they are.

[0053] Regarding disposition positions of rollers 5, 6, and 7, the first guidance equipment G1 and the third guidance equipment G3 are different in that the first bend forming roller guide G11 has a combination of the two upper rollers 5 and 6 and the single lower roller 7, while the first bend-back forming roller guide G31 has a combination of the single upper roller 7 and the two lower rollers 5 and 6. Then, the first guidance equipment G1 and the third guidance equipment G3 are different in that the second bend forming roller guide G12 has a combination of the single upper roller 7 and the two lower rollers 5 and 6, while the second bend-back forming roller guide G32 has a combination of the two upper rollers 5 and 6 and the single lower roller 7.

[0054] Further, the first and second bend-back forming roller guides G31 and G32 are different from the first bend forming roller guide in that the first and second bend-back forming roller guides G31 and G32 are each inclined by a predetermined angle toward the clockwise side in FIG. 1 relative to the first bend forming roller guide G11 to be mounted on the bed plate 1a.

[0055] The dispositions of the rollers 5, 6, and 7 of the first bend-back forming roller guide G31 are in a state inverted to those of the rollers 5, 6, and 7 of the second directing roller guide G22 adjacent on the upstream side (left side in FIG. 1).

[0056] As illustrated in FIG. 1, in the third guidance equipment G3, the first and second bend-back forming roller guides G31 and G32 with their combinations of the rollers 5, 6, and 7 being inverted to each other are disposed contiguously, and in order to prevent the bent straight stocks guided by the second guidance equipment G2 from proceeding according to the curvature, the rollers of respective groups of the first and second bend-back forming roller guides bend back the straight stocks in the laying head H direction and correct them straight to smoothly guide them to the quill pipe Ha in the laying head H along the straight line.

[0057] There will be explained interactions of six groups of the rollers 5, 6, and 7 of the respective first, second, and third guidance equipments G1, G2, and G3 illustrated in FIG. 1 with reference to FIG. 7(i) to FIG. 7(iii).

[0058] Incidentally, in FIG. 7(i) to FIG. 7(iii), in order to distinguish the respective rollers of the combinations in the six groups of the rollers from one another, reference numerals and symbols 5A1 to 5A6 are used for the rollers 5 illustrated in FIG. 1, reference numerals and symbols 6A1 to 6A6 are used for the rollers 6, and reference numerals and symbols 7A1 to 7A6 are used for the rollers 7.

[0059] In the first guidance equipment G1 in FIG. 7(i), first three-point bending of the straight stocks is performed through reductions performed by three of the rollers 5A1, 7A1, and 6A1 of the first bend forming roller guide G11, and next second three-point bending of the straight stocks is performed through reductions performed by three of the rollers 7A1 and 6A1 and the roller 6A2 of the second bend forming roller guide G12 in total,

and continuously third three-point bending of the straight stocks is performed through reductions performed by three of the roller 6A1, and the rollers 6A2 and 7A2 of the second bend forming roller guide G12 in total, and further fourth three-point bending of the straight stocks is performed through reductions performed by three of the rollers 6A2, 7A2, and 5A2 of the second bend forming roller guide G12.

[0060] Therefore, in a course where the straight stocks are guided to the downstream side by the first bend forming roller guide G11 and the second bend forming roller guide G12, a bending force is given to the straight stocks four times by the group of the inverted rollers 5A1, 7A1, and 6A1 and the group of the rollers 5A2, 7A2, and 6A2, and forming to draw a gentle circular arc is performed along the laying head H direction.

[0061] In the second guidance equipment G2 in FIG. 7(ii), the bent-formed straight stocks are smoothly guided to the third guidance equipment G3 by the rollers 5A3, 7A3, and 6A3 of the first directing roller guide G21 and the rollers 5A4, 7A4, and 6A4 of the second directing roller guide G22.

[0062] In the third guidance equipment G3 in FIG. 7(iii), first three-point bending of the straight stocks is performed through reductions performed by three of the rollers 6A5, 7A5, and 5A5 of the first bend-back forming roller guide G31, and next second three-point bending of the straight stocks is performed through reductions performed by three of the rollers 7A5 and 5A5 and the roller 5A6 of the second bend-back forming roller guide G32 in total, and continuously third three-point bending of the straight stocks is performed through reductions performed by three of the roller 5A5, and the rollers 5A6 and 7A6 of the second bend-back forming roller guide G32 in total, and further fourth three-point bending of the straight stocks is performed through reductions performed by three of the rollers 5A6, 7A6, and 6A6 of the second bend-back forming roller guide G32.

[0063] Therefore, in a course where the straight stocks are guided to the downstream side by the first bend-back forming roller guide G31 and the second bend-back forming roller guide G32, a bending force is given to the straight stocks four times by the group of the inverted rollers 6A5, 7A5, and 5A5 and the group of the rollers 5A6, 7A6, and 6A6, and correct-forming of the straight stocks to extend linearly along the laying head H direction is performed.

[0064] As above, in the first and second bend forming roller guides G11 and G12, the combination of three rollers being the rollers 5A1, 6A1, and 7A1 and the combination of three rollers being the rollers 5A2, 6A2, and 7A2 are continued downstream, and in the first and second directing roller guides G21 and G22, the combination of three rollers being the rollers 5A3, 6A3, and 7A3 and the combination of three rollers being the rollers 5A4, 6A4, and 7A4 are continued downstream, and in the first and second bend-back forming roller guides G31 and G32, the combination of three rollers being the rollers 5A5,

6A5, and 7A5 and the combination of three rollers being the rollers 5A6, 6A6, and 7A6 are continued downstream, and thereby bend-forming, directing, and bend-back forming of the straight stocks are performed smoothly and securely.

[0065] As illustrated in FIG. 1, at the exit side of the pinch roll P, an exit guide 19 is disposed.

[0066] The exit guide 19 is to guide the straight stocks pressed out from the pinch roll P to the first bend forming roller guide G11 in the first guidance equipment G1 positioned on the most upstream side.

[0067] As illustrated in FIG. 1 and FIG. 8, the exit guide 19 is provided with a guide box 20. The guide box 20 is mounted on the bed plate 1a by mounting bolts 21. A cylindrical delivery guide 22 is fixed inside the guide box 20 by a fixing bolt 23. A tip portion side of the delivery guide 22 (left end portion side in FIG. 1) is protruded from the inside of the guide box 20 toward a space facing the pinch roll P. The straight stocks discharged from the pinch roll P pass through an inner hole 22a of the delivery guide 22 to be guided to the center guide 17 of the first bend forming roller guide G11.

[0068] A reference numeral and symbol 24 illustrated in FIG. 8 denotes a roll cooling water nozzle.

[0069] Next, there will be explained a straight stocks guiding method of the present invention.

[0070] As illustrated in FIG. 1, in a hot rolling step, straight stocks discharged from a final finishing mill are then guided to the pinch roll P and are pressed out from the pinch roll to proceed to the two consecutive first and second bend forming roller guides G11 and G12 of the first guidance equipment G1 on the most upstream side, where a bending force is given to the straight stocks by the rollers 5, 6, and 7 and the straight stocks are guided to the laying head H direction sequentially while drawing a gentle downward curve, and then the straight stocks proceed to the two consecutive first and second directing roller guides G21 and G22 of the second guidance equipment G2, where the straight stocks are guided to the downstream side by the rollers along the downward inclined direction, and further the straight stocks proceed to the two consecutive first and second bend-back forming roller guides G31 and G32 of the third guidance equipment G3, where bending of the straight stocks is gradually returned to an original state by the rollers and the straight stocks become straight and then are guided to the laying head H, and by the laying head, the straight stocks are formed into a ring shape to be discharged.

[0071] There will be explained operations of the roller eccentricity adjusting mechanisms 12 illustrated in FIG. 1 and FIG. 2. When all or one of the pinion shafts 13 is rotated in the first and second bend forming roller guides G11 and G12, the first and second directing roller guides G21 and G22, and the first and second bend-back forming roller guides G31 and G32, the gear wheels/gear wheel 10 rotate/rotates via the pinions/pinion 14 and all or one of the rollers 5, 6, and 7 corresponding to the roller pins eccentrically rotates through the roller pins/roller pin

8 rotating simultaneously, and thereby positions of the rollers (reduction positions in the respective bend forming roller guides G11 and G12 and the respective bend-back forming roller guides G31 and G32, and directing positions in the first and second directing roller guides G21 and G22) are adjusted, to thereby enable optimum forming and guiding.

[0072] According the illustrated present invention, between the pinch roll P and the laying head H, the rollers 5, 6, and 7 are disposed in place of a pipe guide explained in a conventional example, thereby making it possible to prevent generation of scratches of the straight stocks and improve their quality, and form a stable ring shape.

[0073] Further, the laying head H has the linear quill pipe Ha in the inside thereof, and when an inner surface of this quill pipe and the straight stocks come into contact with each other, the contact causes scratches and further by the contact, speed variations of the straight stocks are caused, to thereby cause a risk that a good ring cannot be formed. However, according to the illustrated present invention, by disposing the rollers 5, 6, and 7, the generation of scratches can be prevented. Then, the straight stocks having had the curvature provided thereto proceed to the laying head side (lower side) along the curvature, to then come into contact with the inside of the quill pipe Ha to cause a problem of ring forming, but the straight stocks having had the curvature provided thereto are corrected straight (bent back), so that the contact inside the quill pipe can be prevented, and further it is also useful for preventing the rearmost end tail of the straight stocks from being whipping shaped and a stable ring can be formed.

[0074] Although on the top surface of the base plate 1, the bed plate 1a as a part of the base plate 1 is overlaid in the example illustrated in FIG. 1 and FIG. 2, the bed plate is not necessarily required to be used.

[0075] Although the first guidance equipment G1 is constituted by the two consecutive roller guides G11 and G12, the second guidance equipment G2 is constituted by the two consecutive roller guides G21 and G22, and the third guidance equipment G3 is constituted by the two consecutive roller guides G31 and G32 in the example illustrated in FIG. 1, all or one of the guidance equipments may also be constituted by three or more consecutive roller guides. Then, since the roller guides G11, G12, G21, G22, G31, and G32 in the first, second and third guidance equipments G1, G2, and G3 are each mountable on and removable from the base plate 1 singly, replacement of the single roller guide can be performed as necessary and there is an advantage of making it easy to perform mounting and maintenance, but mounting/removing singly is not necessarily an indispensable condition. Further, each of the roller guides G11, G12, G21, G22, G31, and G32 can be placed so as to counterrotate and their dispositions can be selected without any inhibition, but the present invention is not necessarily limited to this disposition example. Furthermore, since for all the respective roller guides G11, G12, G21,

G22, G31, and G32 in the illustrated example, one with the same structure is used, a decrease in cost of manufacture can be achieved and as long as placement positions of the respective roller guides are set on the bed plate 1a beforehand, any roller guide can be used as it is, so that there is an advantage of facilitating mounting and removing workability and maintenance work, but all the roller guides do not necessarily have to have the same structure. In the two consecutive roller guides G11 and G12, their groups of rollers are disposed so as to be inverted to each other, and in the two consecutive roller guides G31 and G32 similarly, their groups of rollers are also disposed so as to be inverted to each other, and thereby four bend formings become possible in the former case and four bend-back formings become possible in the latter case, resulting in that forming of the straight stocks can be performed smoothly and securely and smooth guiding to the laying head H becomes possible.

[0076] In the two consecutive roller guides G21 and G22 illustrated in FIG. 1, both the adjacent groups of rollers are aligned without being disposed so as to be inverted to each other to make directing smooth, but like the respective groups of rollers in the two consecutive roller guides G11 and G12, they may also be disposed so as to be inverted to each other.

[0077] The example where members with a small friction coefficient are used for the bearing 9a of the bearing part 9 and the seal 9c is described, which means that the above-described members are selectively used according to the speed of the straight stocks, and the members are not necessarily limited to the above-described example.

[0078] Although it is designed so that the first, second, and third guidance equipments G1, G2, and G3 are disposed, to thereby perform guiding and forming of the above-described straight stocks smoothly in the example illustrated in FIG. 1, the second guidance equipment G2 aiming at guiding does not necessarily have to be disposed. When the second guidance equipment G2 is not disposed, it is designed so that the first guidance equipment G1 bends the straight stocks to guide them to the third guidance equipment G3 directly and the third guidance equipment G3 bends back the straight stocks here to guide them to the laying head H. Then, in the example illustrated in FIG. 1, as for the one first directing roller guide G21 in the second guidance equipment G2, the above case is treated by a method of changing the reduction positions of the respective rollers 5, 6, and 7 by the roller eccentricity adjusting mechanisms 12, or by a method of adjusting, of the first directing roller guide G21 in the second guidance equipment, the distance from and the inclination relative to the second bend forming roller guide G12 in the first guidance equipment G1. As for the other second directing roller guide G22 as well, the above case is treated by a method of changing the reduction positions of the respective rollers 5, 6, and 7 by the roller eccentricity adjusting mechanisms 12, or by a method of

adjusting, of the second directing roller guide G22 in the second guidance equipment G2, the distance from and the inclination relative to the first bend-back forming roller guide G31 in the third guidance equipment G3.

[0079] Although in the illustrated example, it is designed so that the roller eccentricity adjusting mechanisms 12 are provided in the respective roller guides G11, G12, G21, G22, G31, and G32 to arbitrarily change the reduction positions or the directing positions of the respective rollers 5, 6, and 7, to thereby enable optimum forming and guiding of the above-described straight stocks, the roller eccentricity adjusting mechanisms are not necessarily required to be provided.

[0080] Although in the example illustrated in FIG. 1, in order to facilitate positionings of the first and second bend forming roller guides G11 and G12, the first and second directing roller guides G21 and G22, and the first and second bend-back forming roller guides G31 and G32, projecting or recessed positioning portions 1a1 are provided on the bed plate 1a in a width direction of the bed plate 1a (up and down direction in the drawing), these are provided as necessary.

Explanation of References

[0081]

G1	first guidance equipment (bending and guidance equipment)
G11	first bend forming roller guide (roller guide)
G12	second bend forming roller guide (roller guide)
G2	second guidance equipment (guidance equipment for intermediate mill)
G21	first directing roller guide (roller guide)
G22	second directing roller guide (roller guide)
G3	third guidance equipment (bending-back and guidance equipment)
G31	first bend-back forming roller guide (roller guide)
G32	second bend-back forming roller guide (roller guide)
H	laying head
P	pinch roll
1	base plate (supporting means)
2	guide unit
5, 6, and 7	roller
8	roller pin
9	bearing part
9a	bearing
9c	seal
10	gear wheel
12	roller eccentricity adjusting mechanism
13	pinion shaft
14	pinion
15	pedestal
17	center guide

Claims

1. A straight stocks guiding method being a guiding method for guiding straight stocks from a pinch roll on a downstream side of a final finishing mill in a hot rolling line to a laying head disposed at a position displaced downward from a position facing the pinch roll with a space left therebetween on a downstream side of the pinch roll, the method comprising: while guiding the straight stocks to the downstream side by a plurality of rollers of bend forming roller guides, bend forming the straight stocks in a laying head direction; and while bend-back forming the bent-formed straight stocks in the laying head direction by a plurality of rollers of bend-back forming roller guides on the downstream side, guiding the straight stocks to the laying head.
 2. A straight stocks guiding apparatus comprising:
 - a bending and guidance equipment and a bending-back and guidance equipment disposed for guiding straight stocks from a pinch roll on a downstream side of a final finishing mill in a hot rolling line to a laying head, wherein the bending and guidance equipment and the bending-back and guidance equipment are mounted on a supporting means, the laying head is disposed at a position displaced downward from a position facing the pinch roll with a space left from the pinch roll on a downstream side of the pinch roll, the bending and guidance equipment on an upstream side includes a plurality of bend forming roller guides for guiding the straight stocks to the downstream side by a plurality of rollers and giving a curvature enabling bending in a laying head direction to the straight stocks, the bending-back and guidance equipment includes a plurality of bend-back forming roller guides for bending back the straight stocks bent by the bending and guidance equipment on the upstream side in the laying head direction by a plurality of rollers to form the straight stocks linearly and guiding the straight stocks to the laying head, and the rollers in the respective bend forming roller guides and the respective bend-back forming roller guides are each easily rotatably attached to a roller pin via a bearing part.
 3. The straight stocks guiding apparatus according to claim 2, further comprising:
 - a guidance equipment for intermediate mill disposed between the bending and guidance equipment and the bending-back and guidance equipment, wherein
- the guidance equipment for intermediate mill includes a plurality of directing roller guides for guiding the straight stocks along a downward inclined direction by a plurality of rollers and directing the straight stocks to the bending-back and guidance equipment.
4. The straight stocks guiding apparatus according to claim 2 or 3, wherein a center guide is provided in the roller guides of the respective guidance equipments.
5. The straight stocks guiding apparatus according to any one of claims 2 to 4, wherein the guidance equipments are each constituted by at least two consecutive roller guides, and the roller guides each combine at least three rollers.
6. The straight stocks guiding apparatus according to any one of claims 2 to 4, wherein the guidance equipments are each constituted by at least two consecutive roller guides, the roller guides each combine at least three rollers, the combination of the three rollers is made by two rollers disposed on one side of an upper side and a lower side and a single roller disposed on the other side, the adjacent combinations of the three rollers in both the bend forming roller guides are in a mutually inverted positional relationship, and the adjacent combinations of the three rollers in both the bend-back forming roller guides are in a mutually inverted positional relationship.
7. The straight stocks guiding apparatus according to any one of claims 2 to 6, wherein the roller guides in the guidance equipments each include roller eccentricity adjusting mechanisms for adjusting positions of the rollers.
8. The straight stocks guiding apparatus according to any one of claims 2 to 7, wherein the roller guides in the guidance equipments are each mounted on a base plate being the supporting means so as to be replaceable singly.
9. The straight stocks guiding apparatus according to any one of claims 2 to 8, wherein the roller guides in all the guidance equipments are the same in constitution.
10. The straight stocks guiding apparatus according to any one of claims 2 to 9, wherein a member with a small friction coefficient is used for a bearing of the bearing part.
11. The straight stocks guiding apparatus according to any one of claims 2 to 10, wherein a resin-made seal is disposed on the bearing part.

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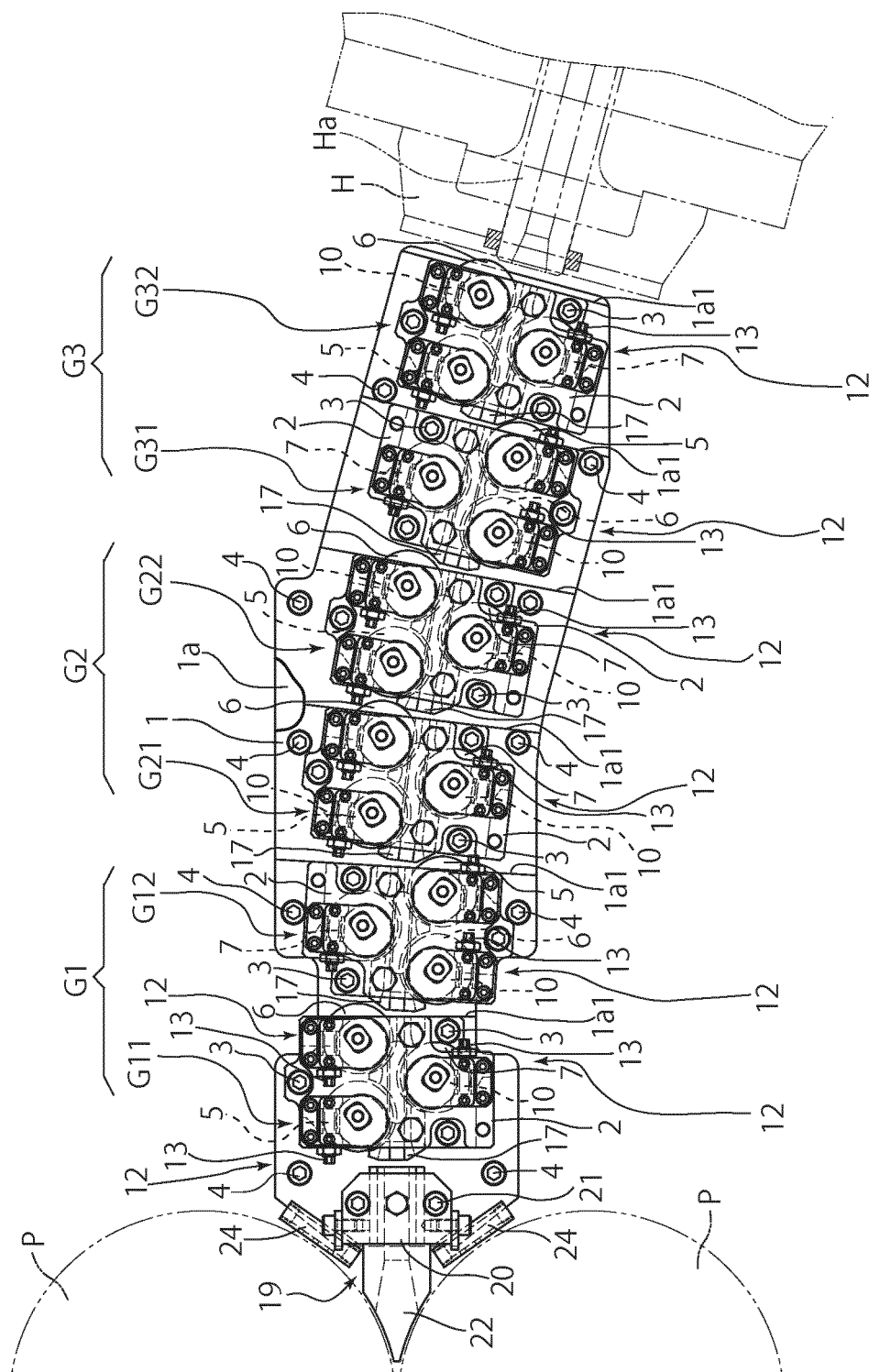


FIG. 2

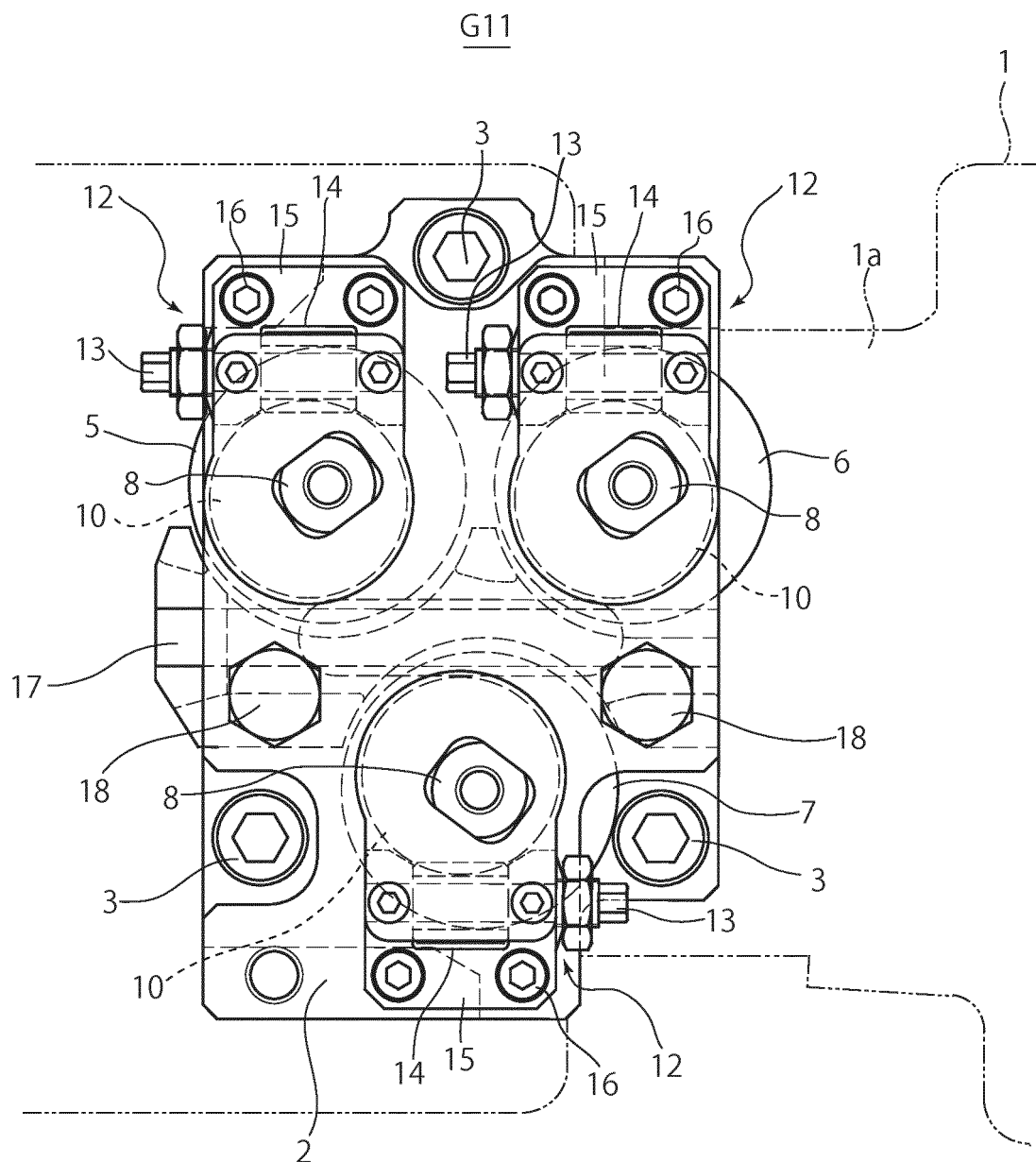


FIG. 3

G11

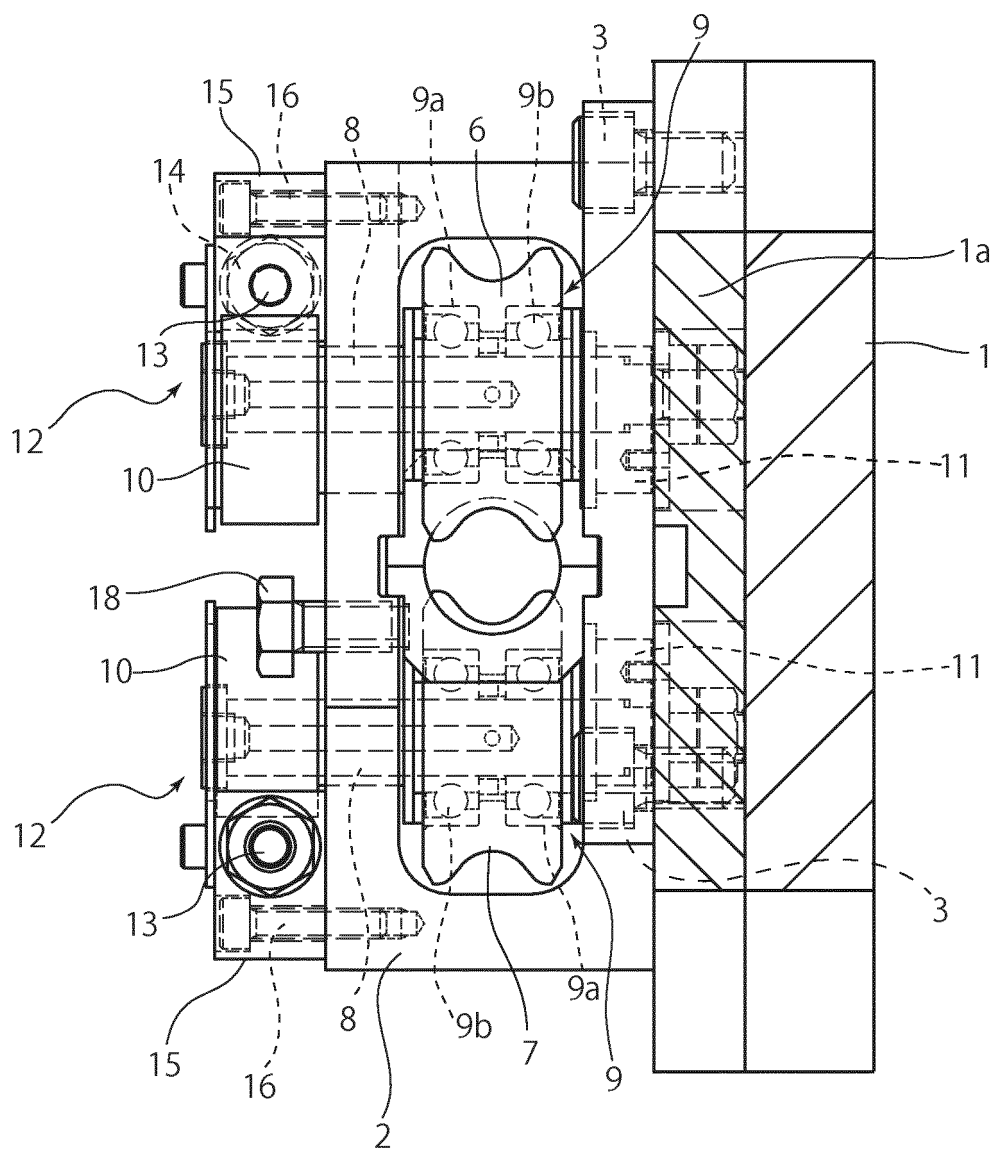


FIG. 4

G11

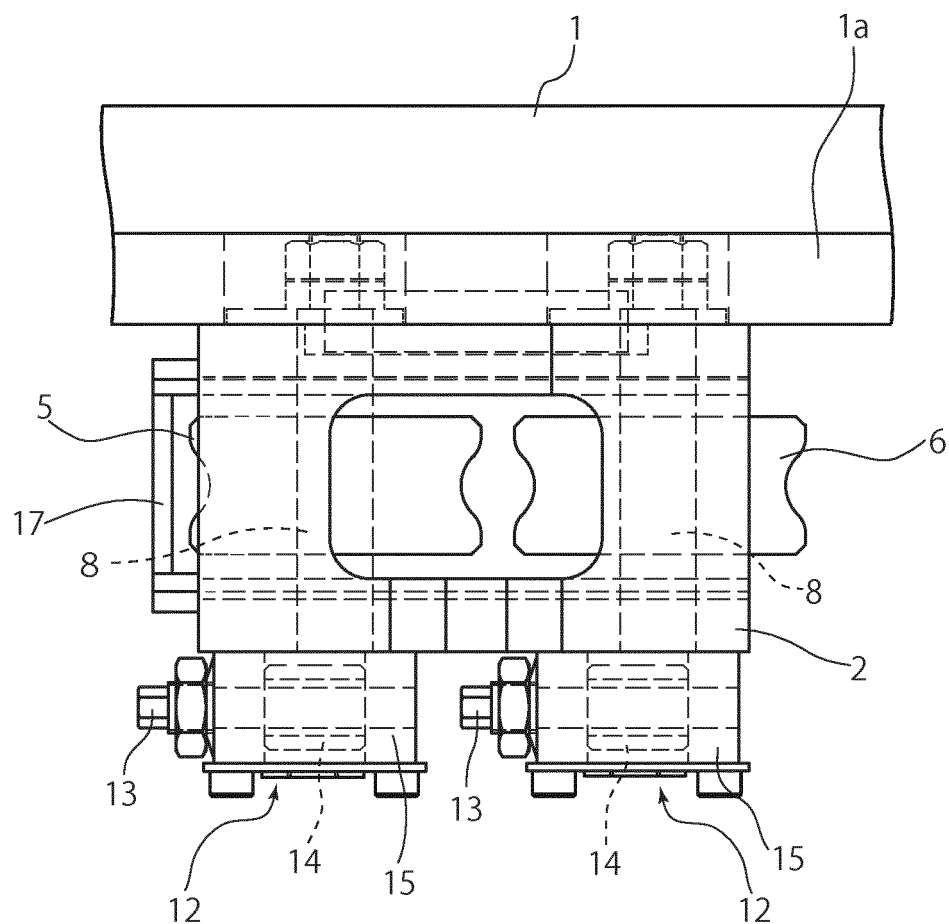


FIG. 5

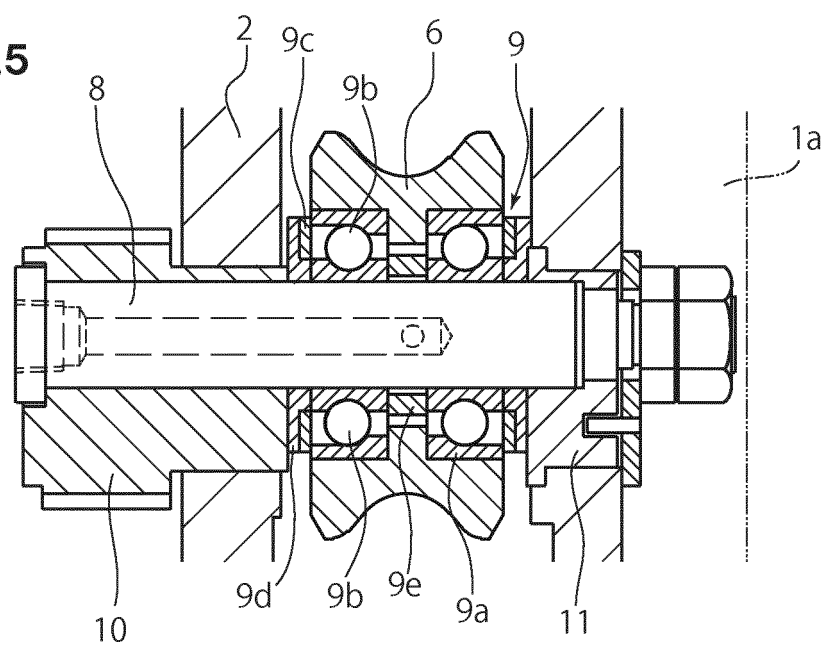


FIG.6

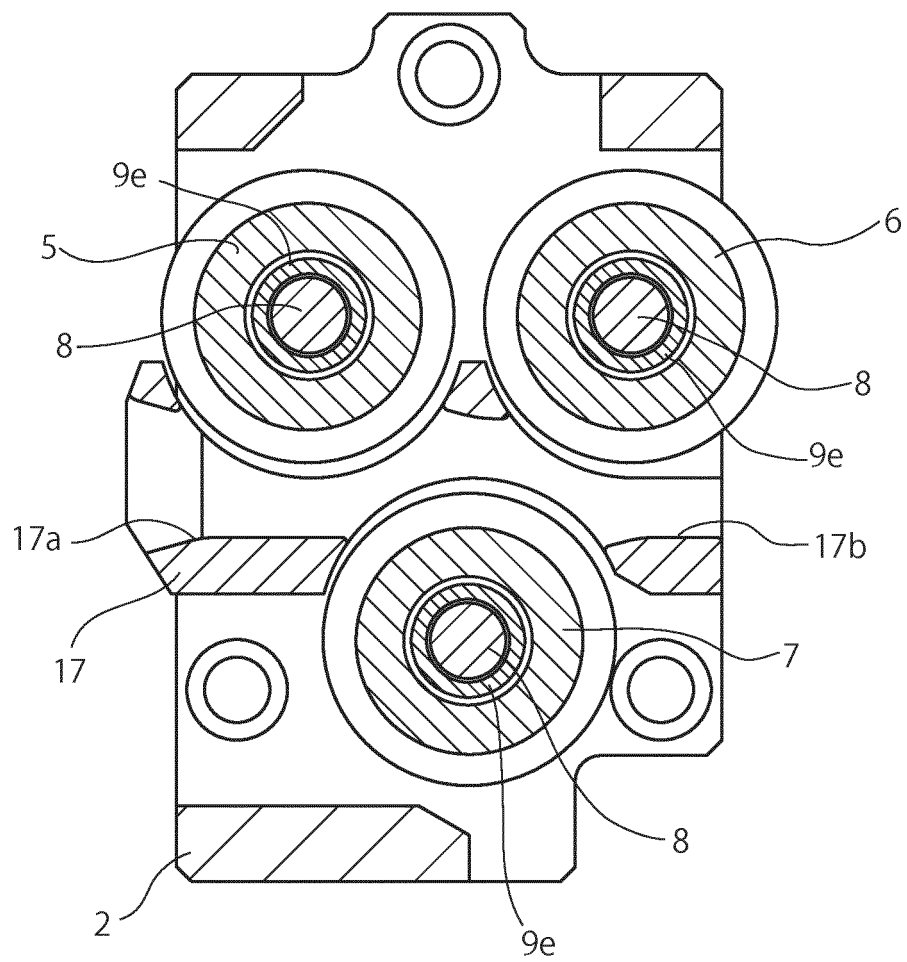


FIG.7

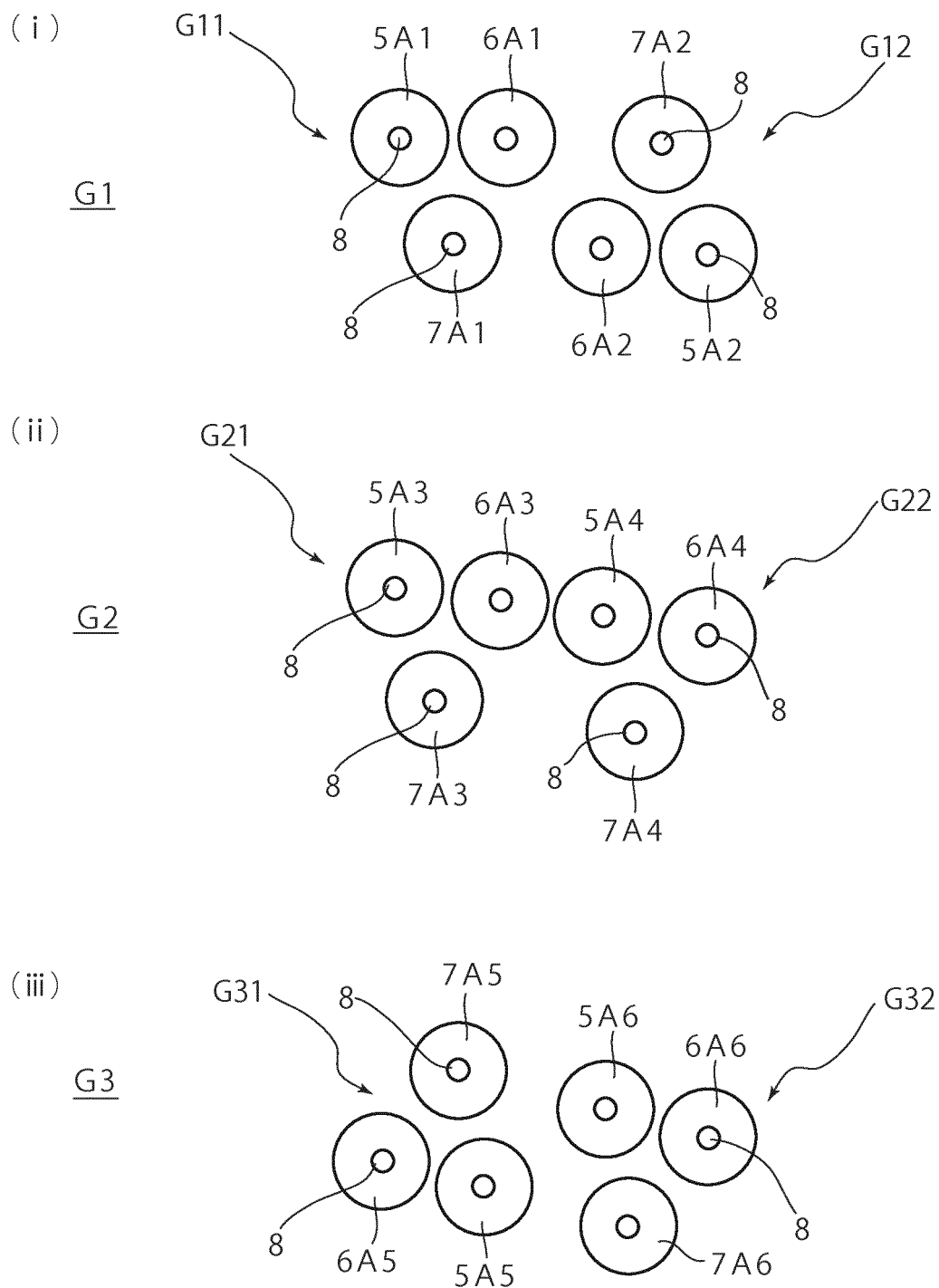
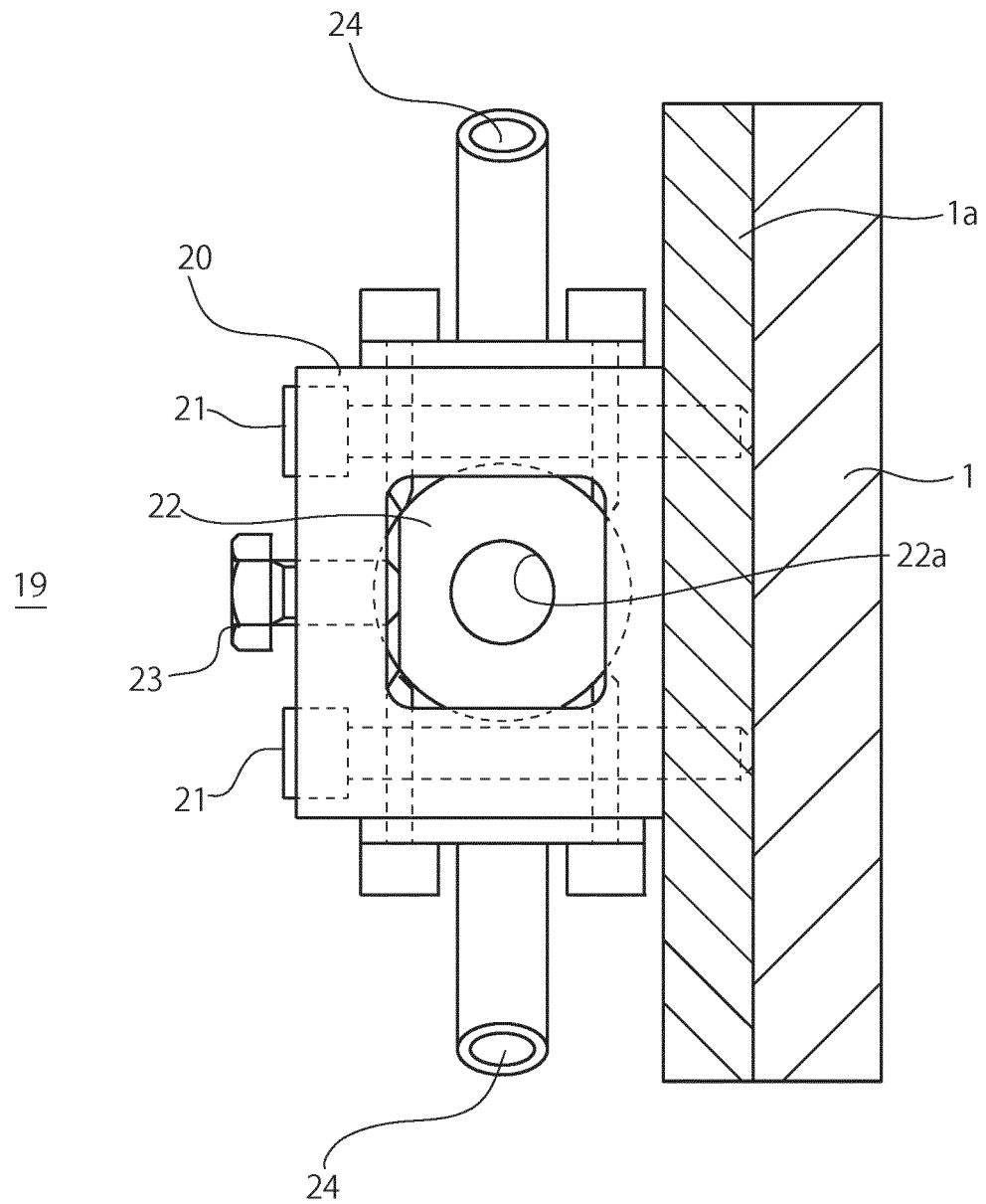


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/080699

A. CLASSIFICATION OF SUBJECT MATTER

B21B39/00(2006.01)i, B21B39/14(2006.01)i, B21C47/14(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)

B21B39/00, B21B39/14, B21C47/14

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015

Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2013-530050 A (Siemens Industry, Inc.), 25 July 2013 (25.07.2013), paragraph [0010]; fig. 1 to 2 & US 2012/0000959 A1 & WO 2012/003105 A1 & CN 102791394 A & CA 2804022 A	1-5, 7-11 6
Y A	JP 2003-205308 A (Daido Steel Co., Ltd.), 22 July 2003 (22.07.2003), paragraphs [0009] to [0023]; fig. 1 to 2 (Family: none)	1-5, 7-11 6
Y	JP 58-116921 A (Kotobuki Sangyo Co., Ltd.), 12 July 1983 (12.07.1983), page 4, upper right column, line 6 to page 4, lower right column, line 6 (Family: none)	11

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

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Date of the actual completion of the international search
04 February 2015 (04.02.15)Date of mailing of the international search report
17 February 2015 (17.02.15)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/080699

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2005-280941 A (Mitsui Engineering & Shipbuilding Co., Ltd.), 13 October 2005 (13.10.2005), paragraphs [0035] to [0041]; fig. 3, 5 (Family: none)	5-11

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010099669 A [0002] [0005]