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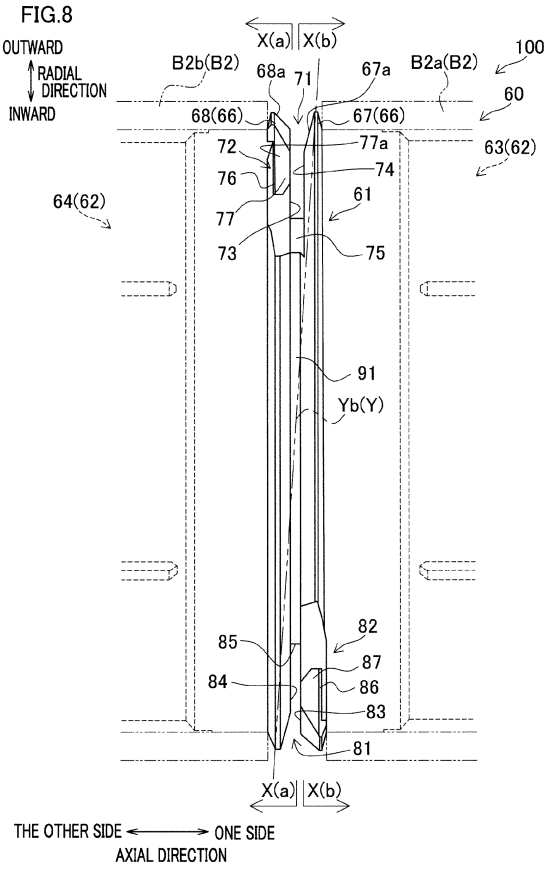
(54) **CONNECTION MEMBER AND YARN THREADING METHOD**

(57) An object of the present invention is to reliably capture yarns without loosening the yarns in yarn threading to winding bobbins attached to a connection member.

A connection member 60 is configured to connect two winding bobbins B2a and B2b, which are provided for winding at least one running yarn Y, to be aligned in a predetermined axial direction. The connection member 60 includes (i) a base portion 61 which is sandwiched by the two winding bobbins B2a and B2b aligned in the axial direction and (ii) paired attachment units 62 which are provided on both sides of the base portion 61 in the axial direction, the two winding bobbins B2a and B2b being attachable to the paired attachment units 62. The base portion 61 includes (i) a guide surface 73 configured to guide at least one running yarn Y (yarn Yb) radially inward and (ii) a capturing claw 72 configured to capture the at least one running yarn Y (yarn Yb) guided radially inward by the guide surface 73.

FIG.8



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a connection member which connects winding bobbins, which are provided for respectively winding yarns, and a yarn threading method.

[0002] Patent Literatures 1 and 2 (Japanese Laid-Open Patent Publication No. 2013-35640 and Japanese Laid-Open Patent Publication No. 2013-23385) discloses a winding device configured to wind yarns, and the winding device is able to change the number of yarns which are able to be simultaneously wound onto take-up tubes (i.e., winding bobbins) held by a bobbin holder. To the bobbin holder, for example, two winding bobbins (hereinafter, these bobbins may be referred to as winding bodies) are detachably attached. The two winding bobbins are connected with each other by a connection member in the axial direction of the winding bobbins. With this arrangement, the winding device is able to wind two yarns onto the winding bodies. An end portion of one of the two yarns is held by being sandwiched between, e.g., (i) an end face of one of the two winding bobbins and (ii) the bobbin holder. An end portion of the other of the two yarns is held by being sandwiched between, e.g., (i) an end face of the other of the two winding bobbins and (ii) the connection member.

[0003] When the two yarns are threaded to the two winding bodies in the winding device, the two yarns are sent from the upstream side of the two winding bodies in a yarn running direction while being sucked and held by, e.g., two suction mouths. An operator or an automatic yarn threading device disclosed in Patent Literature 2 guides the two running yarns radially inward of the two rotating winding bobbins, i.e., toward a border between (i) the two rotating winding bobbins and (ii) the bobbin holder (or the connection member). After the end portions of the two yarns are sandwiched and captured between the two winding bobbins and the bobbin holder (or the connection member), parts of the two yarns running upstream of the two winding bodies in the yarn running direction are held by being wound onto the two winding bodies in the vicinity of the sandwiched end portions of the two yarns. At this time, parts of the two yarns running downstream of the two winding bodies in the yarn running direction are naturally broken due to, e.g., tension and are sucked and discarded by the suction mouths. As such, the end portions of the two yarns are held between the two winding bobbins and the bobbin holder (or the connection member) so that the two yarns can be wound onto the two winding bobbins.

SUMMARY OF THE INVENTION

[0004] Because yarns which are thinner than before can be produced, the following problem has become obvious when the thin yarns are captured between winding bobbins and a connection member. That is, even after the thin yarns are sandwiched between the winding bobbins and the connection member, the thin yarns are less likely to be tightly held. Because of this, the thin yarns are likely to drop off from the gap. With this arrangement, the running yarns may be unstably tensioned and loosened. When the loosening of the yarns is propagated to the upstream side in a yarn running direction, parts of the yarns running on the upstream side in the yarn running direction may not properly run. Furthermore, (i) the thin yarns may not be captured between the winding bobbins and the connection member and (ii) yarn threading may be failed.

[0005] An object of the present invention is to reliably capture yarns without loosening the yarns Y in yarn threading to winding bobbins attached to a connection member.

[0006] According to a first aspect of the invention, a connection member is configured to connect two winding bobbins, which are provided for winding running at least one running yarn, to be aligned in a predetermined axial direction. The connection member includes: a base portion which is sandwiched by the two winding bobbins aligned in the axial direction; and paired attachment units which are provided on both sides of the base portion in the axial direction, the two winding bobbins being attachable to the paired attachment units, and the base portion includes: paired stoppers which are provided between the paired attachment units in the axial direction, the paired stoppers restricting movement of the two winding bobbins in the axial direction; a guide surface which is provided between the paired stoppers in the axial direction, the guide surface being configured to guide the at least one yarn inward in a radial direction of the base portion; and a capturing claw configured to capture the at least one yarn guided inward in the radial direction by the guide surface.

[0007] For the sake of convenience, a component formed by connecting the two winding bobbins with the connection member will be referred to as a winding body. In the present invention, the at least one running yarn is moved toward the rotating winding body so as to be hooked by the capturing claw of the connection member, with the result that the at least one yarn is reliably captured by the capturing claw. When resistance is unintentionally imparted to the at least one yarn by a part of the connection member before the at least one yarn reaches the capturing claw, the at least one yarn may not properly run but be loosened. However, in the present invention, the guide surface is configured to smoothly guide the at least one yarn inward in the radial direction. With this arrangement, the at least one yarn reaches the capturing claw while the resistance which is unintentionally imparted to the at least one yarn is suppressed. It is therefore possible to reliably capture the at least one yarn without loosening the at least one yarn.

[0008] According to a second aspect of the invention, the connection member of the first aspect is arranged

such that the capturing claw includes: a receiving surface which is provided to be oriented at least to the downstream side of the receiving surface in one direction in a circumferential direction of the base portion; and a protruding portion which protrudes from the receiving surface at least in the one direction of the circumferential direction, the protruding portion being configured to prevent drop off of the at least one yarn received by the receiving surface.

[0009] In the present invention, when the winding body is rotated in the one direction of the circumferential direction, the at least one yarn is captured by being received by the receiving surface. In this regard, the receiving surface is configured to simply receive the at least one yarn. The receiving surface is not configured to, e.g., sandwich and capture the at least one yarn. In other words, at least immediately after being received by the receiving surface, the at least one yarn is slidable toward the receiving surface. This arrangement suppresses the at least one yarn from being unstably tensioned and loosened because of the capturing claw. The at least one yarn received by the receiving surface is prevented, by the protruding portion, from moving outward in the radial direction so as to drop off from the base portion. With this arrangement, the at least one yarn is stably captured and retained.

[0010] According to a third aspect of the invention, the connection member of the first or second aspect is arranged such that the base portion further includes a guiding slit formed by the guide surface and an opposing surface provided to oppose the guide surface in the axial direction.

[0011] In the present invention, the at least one yarn is guided inward in the radial direction along the guiding slit in a stable and reliable manner.

[0012] According to a fourth aspect of the invention, the connection member of any one of the first to third aspects is arranged such that the guide surface is oriented at least to one side in the axial direction, the capturing claw is provided on the other side in the axial direction as compared to the guide surface and protrudes at least in one direction of a circumferential direction of the base portion, and the base portion further includes: a reserve guide surface which is oriented at least to the other side in the axial direction, the reserve guide surface being able to guide the at least one running yarn inward in the radial direction; and a reserve capturing claw which is provided on the one side in the axial direction as compared to the guide surface, the reserve capturing claw protruding at least in the other direction of the circumferential direction.

[0013] In the present invention, when the connection member is provided to be deviated by 180 degrees from the connection member provided in a regular direction on a flat surface parallel to the axial direction, the reserve guide surface and the reserve capturing claw respectively function instead of the guide surface and the capturing claw. With this arrangement, even when the winding body is attached to a device dedicated to yarn winding in a direction opposite to the regular direction, the at least one yarn is reliably captured. That is, when the connection member is attached to the device dedicated to the yarn winding, it is unnecessary to consider the direction of the connection member. It is therefore possible to achieve reduction in effort for the consideration of the direction of the connection member.

[0014] According to a fifth aspect of the invention, the connection member of the fourth aspect is arranged such that a position of the reserve capturing claw is different from a position of the capturing claw in the circumferential direction.

[0015] When the capturing claw is provided to overlap the entire or a part of the reserve capturing claw in the circumferential direction, the size of the base portion may be increased in the axial direction. Meanwhile, when the capturing claw and the reserve capturing claw are formed to be small in the axial direction to avoid this problem, the risk of failure in capturing and/or retention of the at least one yarn increases. The present invention allows the capturing claw and the reserve capturing claw to be larger while the increase in size of the base portion is suppressed in the axial direction, as compared to cases where the capturing claw is provided to overlap the entire or a part of the reserve capturing claw in the circumferential direction. It is therefore possible to suppress increase in size of the connection member while suppressing the failure in capturing and/or retention of the at least one yarn.

[0016] According to a sixth aspect of the invention, the connection member of any one of the first to fifth aspects is arranged such that the guide surface and the capturing claw are provided inside an outermost part of an end portion of each of the paired stoppers in the radial direction.

[0017] When the guide surface and/or the capturing claw are/is provided outside the paired stoppers in the radial direction, the guide surface and/or the capturing claw may protrude outward in the radial direction as compared to the two winding bobbins. In this case, it may be difficult to handle the winding body in the same manner as to handle one long winding bobbin in, e.g., the device dedicated to the yarn winding. In the present invention, the guide surface and the capturing claw are provided inside the outermost parts of the end portions of the paired stoppers in the radial direction. With this arrangement, the two winding bobbins which are lager in outer diameter than the paired stoppers are attached to the connection member so that the winding body can be handled in the same manner as to handle the one long winding bobbin.

[0018] According to a seventh aspect of the invention, the connection member of the sixth aspect is arranged such that one of the paired stoppers includes an inclined surface which is connected to the guide surface and which extends radially inward toward the guide surface in the axial direction.

[0019] In the present invention, the inclined surface is configured to smoothly guide the at least one yarn toward the guide surface.

[0020] According to an eighth aspect of the invention, a yarn threading method is to thread running yarns to a winding body including the connection member according to any one of the first to seventh aspects and two winding bobbins attached to the connection member, the yarn threading method comprising a step of causing the guide surface to guide one of the running yarns inward in the radial direction and causing the capturing claw to capture the one of the running yarns while rotating the winding body.

[0021] In the present invention, the one of the yarns is captured by the capturing claw so as to be reliably captured and retained without loosening of the one of the yarns. It is therefore possible to improve the success rate of yarn threading.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 is a profile of a false-twist texturing machine including each winding device related to an embodiment.

FIG. 2 is a schematic diagram of the false-twist texturing machine, expanded along paths of yarns.

FIG. 3(a) illustrates a single winding bobbin and its surroundings, and FIG. 3(b) illustrates a winding body including two winding bobbins and its surroundings.

Each of FIGs. 4(a) and 4(b) is a schematic diagram of a yarn threading device and its surroundings.

FIGs. 5(a) to 5(c) illustrate how the yarn threading device works in yarn threading to each winding bobbin.

FIG. 6 is a perspective view of a base portion of a connection member.

FIG. 7 illustrates the base portion viewed in a direction orthogonal to an axial direction of the base portion and along an arrow VII in FIG. 6.

FIG. 8 illustrates the base portion viewed in a direction orthogonal to the axial direction of the base portion and along an arrow VIII in FIG. 6.

FIG. 9(a) is a partially enlarged view of FIG. 7, and FIG. 9(b) is a partially enlarged view of FIG. 8.

FIG. 10(a) is a cross section taken along a line X(a)-X(a) in FIG. 8, and FIG. 10(b) is a cross section taken along a line X(b)-X(b) in FIG. 8.

FIGs. 11(a) to 11(c) illustrate how each yarn is captured by a capturing claw.

FIGs. 12(a) to 12(c) illustrate how each yarn is captured and retained by the capturing claw.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] The following will describe an embodiment of the present invention. A vertical direction to the sheet of FIG. 1 is defined as a base longitudinal direction, and a left-right direction to the sheet of FIG. 1 is defined as a base width direction. A direction orthogonal to the base longitudinal direction and the base width direction is defined as an up-down direction (vertical direction) in which the gravity acts.

(Overall Structure of False-Twist Texturing Machine)

[0024] The following will describe the overall structure of a false-twist texturing machine 1 including each winding device 21 (described later) of the present embodiment, with reference to FIG. 1 and FIG. 2. FIG. 1 is a profile of the false-twist texturing machine 1. FIG. 2 is a schematic diagram of the false-twist texturing machine 1, expanded along paths of yarns Y (i.e., yarn paths).

[0025] The false-twist texturing machine 1 is able to false-twist each yarn Y made of synthetic fibers. The false-twist texturing machine 1 includes a yarn supplying unit 2, a processing unit 3, and a winding unit 4. The yarn supplying unit 2 is able to supply yarns Y. The processing unit 3 is configured to pull out the yarns Y from the yarn supplying unit 2 and to false-twist the yarns Y. The winding unit 4 is configured to wind each yarn Y false-twisted by the processing unit 3 onto a corresponding winding bobbin B1 or a corresponding winding body 100 (see FIG. 1, FIG. 2, and FIG. 3(b); described later). Components of the yarn supplying unit 2, the processing unit 3, and the winding unit 4 are aligned to form plural lines (see FIG. 2) in the base longitudinal direction orthogonal to a yarn running surface (i.e., the sheet of FIG. 1) on which the yarn paths from the yarn supplying unit 2 to the winding unit 4 through the processing unit 3 are provided.

[0026] The yarn supplying unit 2 includes a creel stand 7 retaining yarn supply packages Ps, and is configured to supply the yarns Y to the processing unit 3. The processing unit 3 is configured to pull out the yarns Y from the yarn supplying unit 2 and to process the yarns Y. In the processing unit 3, the following members are placed in this order from the upstream side in a yarn running direction in which the yarns Y run: first feed rollers 11; twist-stopping guides 12; first heaters 13; coolers 14; false-twisting devices 15; second feed rollers 16; combining units 17; third feed rollers 18; a second heater 19; and fourth feed rollers 20. The winding unit 4 includes plural winding devices 21. Among the yarns Y false-twisted by the processing unit 3, each winding device 21 is configured to wind one yarn Y or plural yarns Y onto a corresponding winding bobbin B1 or a corresponding winding body 100 to form one or plural wound packages Pw.

[0027] The false-twist texturing machine 1 includes a main frame 8 and a winding base 9 that are spaced apart from each other in the base width direction. The main frame 8 and the winding base 9 are substantially identical in length in the base longitudinal direction. The main

frame 8 and the winding base 9 oppose each other in the base width direction. The false-twist texturing machine 1 includes units which are termed spans each of which includes a pair of the main frame 8 and the winding base 9. In one span, each device is placed so that the yarns Y running while being aligned in the base longitudinal direction can be false-twisted at the same time. In the false-twist texturing machine 1, the spans are placed in a left-right symmetrical manner to the sheet, with a center line C of the base width direction of the main frame 8 being set as a symmetry axis (main frame 8 is shared between the left span and the right span). The spans are aligned in the base longitudinal direction.

(Processing Unit)

[0028] The structure of the processing unit 3 will be described with reference to FIG. 1 and FIG. 2. Each first feed roller 11 is configured to unwind yarns Y from some yarn supply packages Ps attached to the yarn supplying unit 2, and to feed the yarns Y to one first heater 13. For example, the first feed roller 11 is able to feed two yarns Y to the first heater 13. However, the disclosure is not limited to this. Each twist-stopping guide 12 is provided to prevent twist of a corresponding yarn Y from being propagated to the upstream side of the twist-stopping guide 12 in the yarn running direction. The twist of the yarn Y is formed by a corresponding false-twisting device 15. Each first heater 13 is configured to heat the yarns Y fed from the first feed rollers 11. As shown in FIG. 2, for example, the first heater 13 is able to heat four yarns Y. However, the disclosure is not limited to this. Each cooler 14 is configured to cool the yarns Y heated by the first heater 13. As shown in FIG. 2, for example, the cooler 14 is configured to cool four yarns Y. However, the disclosure is not limited to this. Each false-twisting device 15 is provided downstream of the cooler 14 in the yarn running direction, and configured to twist a corresponding yarn Y. The false-twisting device 15 is, e.g., a so-called disc-friction false-twisting device. However, the disclosure is not limited to this. Each second feed roller 16 is configured to feed the yarns Y processed by the false-twisting devices 15 to a corresponding combining unit 17. The conveyance speed of conveying the yarns Y by the second feed roller 16 is higher than the conveyance speed of conveying the yarns Y by the first feed roller 11. With this arrangement, each yarn Y is therefore drawn between the first feed roller 11 and the second feed roller 16.

[0029] Each combining unit 17 is configured to combine a yarn Ya with a yarn Yb, so as to produce a yarn Yc. For example, the combining unit 17 is able to combine a yarn Ya processed by one false-twisting device 15 with a yarn Yb processed by another false-twisting device 15 adjacent to the one false-twisting device 15. The combining unit 17 includes two interlace nozzles 31 and 32 (see FIG. 2). For example, the combining unit 17 blows air onto the yarn Ya and the yarn Yb (see the left part of the sheet of FIG. 2) which are passing inside the interlace nozzle 31, combines the yarn Ya with the yarn Yb by air-interlace in which the yarn Ya is interlaced with the yarn Yb by airflow, and produces the yarn Yc. In this regard, the combining unit 17 can guide the two yarns Y toward the downstream side in the yarn running direction without combining the yarn Ya with the yarn Yb. In this case, the yarn Ya passes inside the interlace nozzle 31, and the yarn Yb passes inside the interlace nozzle 32 (see the right part of the sheet of FIG. 2).

[0030] Each third feed roller 18 is configured to feed at least one yarn Y running downstream of the combining unit 17 in the yarn running direction, to the second heater 19. As shown in FIG. 2, for example, the third feed roller 18 is able to feed two yarns Y to the second heater 19. However, the disclosure is not limited to this. The conveyance speed of conveying the yarns Y by the third feed roller 18 is lower than the conveyance speed of conveying the yarns Y by the second feed roller 16. Each yarn Y is therefore relaxed between the second feed roller 16 and the third feed roller 18. The second heater 19 is configured to heat the yarns Y fed from the third feed rollers 18. The second heater 19 extends along a vertical direction, and one second heater 19 is provided in one span. Each fourth feed roller 20 is configured to feed at least one yarn Y heated by the second heater 19 to one winding device 21. As shown in FIG. 2, for example, the fourth feed roller 20 is able to feed two yarns Y to the winding device 21. However, the disclosure is not limited to this. The conveyance speed of conveying the yarns Y by the fourth feed roller 20 is lower than the conveyance speed of conveying the yarns Y by the third feed roller 18. Each yarn Y is therefore relaxed between the third feed roller 18 and the fourth feed roller 20.

[0031] In the processing unit 3 described above, each of the yarns Y which have been drawn between the first feed roller 11 and the second feed roller 16 is twisted by the false-twisting device 15. The twist formed by the false-twisting device 15 propagates to the twist-stopping guide 12 but does not propagate to the upstream of the twist-stopping guide 12 in the yarn running direction. Each yarn Y which is twisted and drawn is heated and thermally set by the first heater 13. After that, the yarn Y is cooled by the cooler 14. The yarn Y is untwisted on the downstream side of the false-twisting device 15 in the yarn running direction. However, the yarn Y is maintained to be wavy in shape on account of the thermal setting described above. Subsequently, after the two yarns Y (yarn Ya and yarn Yb) which have been false-twisted are combined by the combining unit 17 while being relaxed between the second feed roller 16 and the third feed roller 18, the two yarns Y are guided to the downstream side in the yarn running direction. Alternatively, the two false-twisted yarns Y are guided to the downstream side in the yarn running direction without being combined. Furthermore, each yarn Y is thermally set by the second heater 19 while being relaxed between the third feed roller 18 and the fourth feed roller 20. Finally, each yarn Yc or

each pair of yarns Ya and Yb is wound by a corresponding winding device 21. The yarns Ya, Yb, and Yc are fed from the fourth feed roller 20. As such, each winding device 21 produces one wound package P1 or two wound packages P2.

(Winding Unit)

[0032] The structure of the winding unit 4 will be described with reference to FIG. 2 and FIGs. 3(a) and 3(b). FIG. 3(a) illustrates one winding bobbin Bw and its surroundings. FIG. 3(b) illustrates plural winding bobbins Bw (winding bobbins B2), one winding body 100 including a later-described connection member 60, and its surroundings. The winding unit 4 includes the plural winding devices 21. As recited in Japanese Laid-Open Patent Publication No. 2013-35640, each winding device 21 is configured to wind one yarn Y onto a corresponding winding bobbin Bw or two yarns Y onto the respective winding bobbins Bw. That is, a single mode and a plural mode are selectable as an operational mode of each winding device 21. In the single mode, one yarn Yc is wound onto a corresponding winding bobbin Bw (winding bobbin B1). In the plural mode, two yarns Ya and Yb are wound onto the respective winding bobbins Bw (winding bobbins B2). Each winding device 21 includes fulcrum guides 41 which are fulcrums when at least one yarn Y is traversed, a traverse unit 42 which traverses at least one yarn Y, a single cradle 43 which supports at least one winding bobbin Bw to be rotatable, and a controller 44 (see FIG. 1). For example, a controller (not illustrated) programmed to control the plural winding devices 21 may be provided instead of the controller 44.

[0033] As described above, the fulcrum guides 41 are guides which are fulcrums when at least one yarn Y is traversed. In this regard, each winding device 21 includes three fulcrum guides 41 aligned in, e.g., the base longitudinal direction (see FIG. 2). For example, when one yarn Y formed by yarn combination at the combining unit 17 is guided, the one yarn Y is threaded to the central one among the three fulcrum guides 41 (see the left part of the sheet of FIG. 2). Meanwhile, when two yarns Y which are sent without being combined are guided, the two yarns Y are respectively threaded to two fulcrum guides 41 at both ends among the three fulcrum guides 41 (see the right part of the sheet of FIG. 2).

[0034] For example, the traverse unit 42 is able to traverse at least one yarn Y by means of traverse guides 45 which are attached to an endless belt (not illustrated) driven in a reciprocating manner by a motor (not illustrated). The number of the traverse guides 45 attached to the endless belt can be changed depending on the number of traversed yarns Y. For example, one traverse guide 45 is provided for the traverse unit 42 which traverses one yarn Y formed by yarn combination at one combining unit 17 (see the left part of the sheet of FIG. 2). Meanwhile, two traverse guides 45 are provided for the traverse unit 42 which traverses two yarns Y which are sent without being combined (see the right part of the sheet of FIG. 2). A traveling range of each traverse guide 45 can be changed depending on the number of the traversed yarns Y. Information regarding settings such as the number of the traversed yarns Y and the traveling range of each traverse guide 45 is stored in, e.g., the controller 44.

[0035] The cradle 43 is configured to rotatably support one winding bobbin Bw (winding bobbin B1; see FIG. 3(a)) on which the yarn Yc is wound or one winding body 100 (see FIG. 3(b)) on which the yarns Ya and Yb are wound. The winding body 100 will be described. The winding body 100 includes two winding bobbins Bw (winding bobbins B2) and the connection member 60. The length of each winding bobbin B2 is less than half of the length of the winding bobbin B1 in an axial direction of each winding bobbin Bw attached to the cradle 43 (hereinafter, this direction will be simply referred to as the axial direction). The outer diameter and inner diameter of the winding bobbin B2 are substantially identical with those of the winding bobbin B1.

[0036] The connection member 60 is, e.g., a resin member. The connection member 60 is configured to connect two winding bobbins B2 to be aligned in the axial direction. The connection member 60 includes a base portion 61 and paired attachment units 62 (first attachment unit 63 and second attachment unit 64) provided on both sides of the base portion 61 in the axial direction. The base portion 61 is provided at a central portion of the connection member 60 in the axial direction. The base portion 61 is sandwiched between the two winding bobbins B2 (winding bobbins B2a and B2b) in the axial direction. For the sake of convenience, the right side of the sheet of each of FIGs. 3(a) and 3(b) is defined as one side in the axial direction, and the left side of the sheet of each of FIGs. 3(a) and 3(b) is defined as the other side in the axial direction. For example, the first attachment unit 63 is provided on the one side in the axial direction as compared to the base portion 61. The second attachment unit 64 is provided on the other side in the axial direction as compared to the base portion 61. Each of the first attachment unit 63 and the second attachment unit 64 is able to be inserted into a corresponding winding bobbin B2. With this arrangement, as the two winding bobbins B2 are respectively attached to (i.e., fixed by) the first attachment unit 63 and the second attachment unit 64, the winding body 100 is formed. The length of the winding body 100 is substantially identical with that of the winding bobbin B1 in the axial direction. The connection member 60 will be detailed later.

[0037] The winding bobbin B1 and the winding body 100 can be detachably attached to the cradle 43. As shown in FIGs. 3(a) and 3(b), the cradle 43 includes paired bobbin holders 47 (bobbin holders 47a and 47b) which are provided to hold the winding bobbin B1 or the winding body 100. The bobbin holders 47a and 47b are rotatably supported by paired arm members 43a and 43b of the cradle 43. Each bobbin holder 47 includes (i) an

insertion portion 48 which is inserted into the winding bobbin B1 or a corresponding winding bobbin B2 and (ii) a press portion 49 configured to press the insertion portion 48 in the axial direction. The press portion 49 is a part of each bobbin holder 47, which is larger in diameter than corresponding one of the winding bobbins B1 and B2. For example, an unillustrated spring exert a force to the press portion 49 so that the press portion 49 presses the winding bobbin B1 (or a corresponding winding bobbin B2) in the axial direction. An unillustrated cutout is formed (see Japanese Laid-Open Patent Publication No. 2013-35640) in the press portion 49 of the bobbin holder 47 on the one side in the axial direction, so that a corresponding yarn Y is moved radially inward at a time of yarn threading described later.

[0038] A contact roller 46 is provided in the vicinity of the cradle 43. The contact roller 46 is configured to apply a contact pressure by making contact with the surface of one wound package P1 which is formed as one yarn Y is wound onto one winding bobbin B1 (see FIG. 3(a)) or the surfaces of two wound packages P2 which are formed as two yarns Y are respectively wound onto two winding bobbins B2 (see FIG. 3(b)). The contact roller 46 is substantially cylindrical in shape, and the outer diameter of the contact roller 46 is substantially uniform in the axial direction. The contact roller 46 can apply a contact pressure to the one wound package P1, and to the two wound packages P2. (The reason of this arrangement will be described later.) In other words, the contact roller 46 is a common roller used at a time of forming the one wound package P1 and at a time of forming the two wound packages P2.

[0039] The winding bobbin B1 or the winding body 100 which is supported by the cradle 43 is rotationally driven by, e.g., an unillustrated motor. With this arrangement, the contact roller 46 in contact with the surface of the wound package P1 or the surfaces of the wound packages P2 applies a contact pressure to the wound package P1 (or wound packages P2) while being rotationally driven by friction. Alternatively, instead of the winding bobbin B1 and the winding body 100, the contact roller 46 may be rotationally driven by an unillustrated motor. In this case, the wound package P1 (or wound packages P2) in contact with the contact roller 46 is rotationally driven by friction.

[0040] The controller 44 is programmed to control the operation of the traverse unit 42 and the operation of the motor which rotationally drives the winding bobbin B1 (or the winding body 100). In addition to that, the controller 44 can change the setting related to the number of the yarns Y which are wound onto one winding device 21. In this regard, the controller 44 can switch the operational mode between the single mode in which one yarn Y is wound onto one winding bobbin B1 (see the left part of the sheet of FIG. 2) and the plural mode in which two yarns Y are respectively wound onto two winding bobbins B2 (see the right part of the sheet of FIG. 2).

[0041] In the winding unit 4 structured as such, each winding device 21 is configured to wind a corresponding yarn Y fed from the above-described fourth feed roller 20 onto the winding bobbin B1 (or winding bobbins B2), with the result that one wound package P1 (or wound packages P2) is formed. When two yarns Y are combined by the combining unit 17, the operational mode of the winding device 21 is set in the single mode. Meanwhile, when the two yarns Y are guided to the downstream side of the combining unit 17 in the yarn running direction without being combined, the operational mode of the winding device 21 is set in the plural mode. The following description assumes that the operational mode of the winding device 21 is set in the plural mode.

(Yarn Threading Device)

[0042] In the present embodiment, a yarn threading device 50 is provided (see FIGs. 4(a) and 4(b) and FIGs. 5(a) to 5(c)) in the vicinity of each winding device 21. FIG. 4(a) illustrates the yarn threading device 50 viewed from above. FIG. 4(b) illustrates the yarn threading device 50 viewed from the one side in the axial direction. FIGs. 5(a) to 5(c) illustrate how the yarn threading device 50 works at a time of yarn threading to each winding bobbin B2.

[0043] The yarn threading device 50 is configured to finish the winding of yarns Y onto the winding body 100 attached to the cradle 43, and to perform yarn threading for a winding body 100 which is newly attached to the cradle 43. The yarn threading device 50 is configured to respectively thread the yarns Y to two winding bobbins B2. The following will describe an example of the yarn threading device 50. The yarn threading device 50 includes two yarn threading portions 51 (yarn threading portions 51a and 51b) which are aligned in the axial direction. The yarn threading portion 51a is configured to thread one of the yarns Y on the one side in the axial direction (i.e., yarn Ya) to one of the two winding bobbins B2 on the one side in the axial direction (i.e., winding bobbin B2a). The yarn threading portion 51b is configured to thread the other of the yarns Y on the other side in the axial direction (i.e., yarn Yb) to the other of the two winding bobbins B2 on the other side in the axial direction (i.e., winding bobbin B2b). As shown in FIGs. 4(a) and 4(b), each yarn threading portion 51 includes a suction mouth 52, a yarn shifting arm 53, a yarn providing arm 54, a yarn pressing arm 55, a yarn supporting arm 56, and a cutter 57 (see FIG. 4(a)). Each yarn threading portion 51 is able to finish winding of one of the yarns Y onto one of the winding bobbins B2, and to perform yarn threading for a new winding bobbin B2.

[0044] The suction mouth 52 is provided for temporarily sucking and retaining one running yarn Y after the winding body 100 finishes winding of yarns Y, until yarn threading to a new winding body 100 is completed. The one running yarn Y has been false-twisted by the processing unit 3. The suction mouth 52 is provided outside an area where one yarn Y is traversed by a corresponding traverse guide 45 (see the yarn Y indicated by

a solid line and a two-dot chain line in FIG. 4(a)) in the axial direction. That is, in the axial direction, the suction mouth 52 is provided outside (on the one side in the axial direction in the present embodiment) an area where one yarn Y which is to be wound onto a corresponding winding bobbin B2 is traversed. The yarn shifting arm 53 is configured to shift one yarn Y, which is traversed by a corresponding traverse guide 45, toward the one side in the axial direction. The yarn shifting arm 53 is rotatable about a rotation shaft 53a extending in a direction substantially orthogonal to the axial direction. A guide member 58 capable of guiding one yarn Y toward the suction mouth 52 is provided in the vicinity of the rotation shaft 53a. The position of the yarn shifting arm 53 is switchable between a retracted position (see FIG. 5(a)) which is along the axial direction and a yarn shifting position (see FIG. 5(b)) which forms an angle of approximately 90 degrees with the retracted position. The yarn providing arm 54 is configured to provide one yarn Y to be substantially above the winding body 100 (see FIG. 5(c)). The one yarn Y is sucked and retained by the suction mouth 52. The yarn providing arm 54 of the yarn threading portion 51a is rotatable about a rotation shaft 54a, which extends in the axial direction, together with the yarn providing arm 54 of the yarn threading portion 51b. The yarn pressing arm 55 is configured to press one yarn Y onto an outer circumferential portion of the winding body 100. The yarn pressing arm 55 of the yarn threading portion 51a is rotatable about a rotation shaft 55a, which extends in the axial direction, together with the yarn pressing arm 55 of the yarn threading portion 51b. The yarn supporting arm 56 is configured to sandwich one yarn Y with the yarn pressing arm 55 so as to retain the one yarn Y. The yarn supporting arm 56 is rotatable together with the yarn providing arm 54. The cutter 57 is configured to cut one yarn Y, which is moved toward the one side in the axial direction, by the yarn shifting arm 53. For details, see Japanese Laid-Open Patent Publication No. 2013-23385, for example.

[0045] The following will describe yarn threading which is performed by the yarn threading device 50 (i.e., two yarn threading portions 51), with reference to FIG. 5(a) to FIG. 5(c). For example, to the cradle 43, the winding body 100 including two winding bobbins B2 is attached. Onto the two winding bobbins B2, two yarns Y are wound so as to form two wound packages P2 (see FIG. 5(a)). At this time, the yarn shifting arms 53 are rotated from the retracted position to the yarn shifting position so that the two yarns Y are moved toward the one side in the axial direction while being guided along the respective guide members 58. Because of this, the two yarns Y are removed from the respective traverse guides 45 and cut by the respective cutters 57. As a result, the winding of the two yarns Y onto the winding body 100 attached to the cradle 43 ends. At the same time, parts of the two yarns Y provided on the upstream side of the cutters 57 in the yarn running direction are sucked and captured (see FIG. 5(b)) by the respective suction mouths 52. After the two yarns Y are sucked and captured by the suction mouths 52, the yarn shifting arms 53 return to the retracted position. Subsequently, the fully-formed wound packages P2 are removed from the cradle 43 by means of, e.g., an unillustrated automatic doffer, and a new winding body 100 including two empty winding bobbins B2 is attached to the cradle 43.

[0046] The yarn providing arms 54 are then rotated upward (see FIG. 5(c)) while the yarns Y are sucked and retained by the suction mouths 52. Because of this, the yarns Y are provided substantially above the winding body 100. In this regard, the yarn supporting arms 56 are also rotated together with the yarn providing arms 54 (see FIG. 5(c)). In each yarn threading portion 51, as the yarn pressing arm 55 is rotated, the yarn Y between the yarn providing arm 54 and the suction mouth 52 in the yarn running direction is pressed onto the rotating winding bobbin B2 and its surroundings (see FIG. 5(c) and FIG. 3(b)). To be more specific, one of the two yarns Y on the one side in the axial direction (yarn Ya) is guided radially inward along the cutout (not illustrated) formed in one of the press portions 49 of the bobbin holder 47, so as to be held by (i) an end face of the winding bobbin B2a on the one side in the axial direction and (ii) the one of the press portions 49. Because of this, the yarn Ya can be wound onto the winding bobbin B2a. Meanwhile, the other of the two yarns Y on the other side in the axial direction (yarn Yb) is captured by the connection member 60 as described later so that the yarn Yb can be wound onto a rotating winding bobbin B2b.

[0047] At least a part of the yarn threading portion 51b may be detachable from the yarn threading device 50. With this arrangement, when the operation mode of the winding device 21 is switched from the plural mode to the single mode, at least a part of the yarn threading portion 51b may be detached from the yarn threading device 50 and only the yarn threading portion 51a may be used as a target of yarn threading of one yarn Y. Alternatively, the yarn threading device 50 itself may be replaced by a yarn threading device (not illustrated) dedicated to the single mode. The above-described steps of yarn threading may be performed by an operator, instead of the yarn threading device 50.

[0048] A known connection member (not illustrated) is configured to capture the yarn Yb by sandwiching the yarn Yb between the known connection member and the winding bobbin B2b. However, because a yarn Y which is thinner than before can be produced, the following problem has become obvious. That is, even after the thin yarn Y is sandwiched between the known connection member and the winding bobbin B2b, the thin yarn Y is less likely to be tightly held. Because of this, the thin yarn Y is likely to drop off from the gap. With this arrangement, the running yarn Y may be unstably tensioned and loosened. When the loosening of the yarn Y is propagated to the upstream side in the yarn running direction, a part of the yarn Y running on the upstream side in the yarn running direction may not properly run. Furthermore, (i)

the thin yarn Y may not be captured between the winding bobbin B2b and the known connection member and (ii) yarn threading may be failed. In the present embodiment, the connection member 60 is structured as below in order to reliably capture the yarn Y without loosening the yarn Y. When the yarn Y is captured between the winding bobbin B2a and the bobbin holder 47, the above-described problem does not occur. The present inventor considers that this may be related to the above-described cutout which is formed on one of the bobbin holders 47 to capture the yarn Y.

(Connection Member)

[0049] The connection member 60 (in particular, the base portion 61) will be detailed with reference to FIG. 6 to FIG. 10(b). FIG. 6 is a perspective view of the base portion 61. FIG. 7 illustrates the base portion 61 viewed in a direction orthogonal to the axial direction and along an arrow VII in FIG. 6. FIG. 8 illustrates the base portion 61 viewed in the direction orthogonal to the axial direction and along an arrow VIII in FIG. 6. FIG. 9(a) is a partially enlarged view of the base portion 61 of FIG. 7. FIG. 9(b) is a partially enlarged view of the base portion 61 of FIG. 8. FIG. 10(a) is a cross section taken along a line X(a)-X(a) in FIG. 8. FIG. 10(b) is a cross section taken along a line X(b)-X(b) in FIG. 8. In each of FIG. 6 to FIG. 8, the base portion 61 is indicated by solid lines, the attachment units 62 (the first attachment unit 63 and the second attachment unit 64) are indicated by dotted lines, and the winding bobbins B2a and B2b are indicated by two-dot chain lines.

[0050] In each of FIG. 7 and FIG. 8, the first attachment unit 63 is provided on one side in the axial direction (on the right side of the sheet of each of FIG. 7 and FIG. 8) as compared to the base portion 61, and the second attachment unit 64 is provided on the other side in the axial direction (on the left side of the sheet of each of FIG. 7 and FIG. 8) as compared to the base portion 61. For the sake of convenience, when the connection member 60 is provided as such, the connection member 60 will be described so that "the connection member 60 is provided in the regular direction". Furthermore, when the connection member 60 is provided in the regular direction and viewed from the one side in the axial direction, a counterclockwise direction is defined as one direction in a circumferential direction of the connection member 60 (see FIG. 10(a)). In this case, a clockwise direction is defined as the other direction in the circumferential direction (see FIG. 10(a)). Meanwhile, FIG. 10(b) is a cross section of the connection member 60 which is viewed from the other side in the axial direction. Therefore, in FIG. 10(b), (i) a clockwise direction is defined as the one direction in the circumferential direction and (ii) a counterclockwise direction is defined as the other direction in the circumferential direction.

[0051] The base portion 61 is a part of the connection member 60, and is a roughly disc-shaped member. The base portion 61 is smaller than the winding bobbins B2a and B2b in a radial direction of the connection member 60. In other words, the base portion 61 is provided inside the winding bobbins B2a and B2b in the radial direction.

[0052] As shown in FIG. 6 to FIG. 10(a), the base portion 61 includes paired stoppers 66, a guiding slit 71 (see FIG. 7 to FIG. 10(b)), and a capturing claw 72. When the connection member 60 is provided in the regular direction, the base portion 61 is able to guide one of the running yarns Y (yarn Yb) radially inward by means of the guiding slit 71 and to capture the yarn Yb by means of the capturing claw 72.

[0053] The paired the stoppers 66 (stoppers 67 and 68) are configured to restrict movement of the winding bobbins B2 in the axial direction. The stopper 67 is formed on an end portion of the base portion 61 on the one side in the axial direction. The stopper 67 is provided radially outside an end portion of the first attachment unit 63 on the other side in the axial direction. The stopper 67 includes an inclined surface 67a. The inclined surface 67a is a roughly truncated cone in shape and is tapered toward, e.g., the other side in the axial direction (i.e., the inclined surface 67a extends radially inward toward the other side in the axial direction). The stopper 68 (corresponding to one of the paired stoppers of the present invention) is formed in the end portion of the base portion 61 on the other side in the axial direction. The stopper 68 is provided radially outside an end portion of the second attachment unit 64 on the one side in the axial direction. The stopper 68 includes an inclined surface 68a. The inclined surface 68a is a roughly truncated cone in shape and is tapered toward, e.g., the one side in the axial direction (i.e., the inclined surface 68a extends radially inward toward a later-described guide surface 73). The inclined surfaces 67a and 68a are, e.g., linear in shape (see FIG. 7 and FIG. 8) when viewed in a direction orthogonal to the axial direction. However, the disclosure is not limited to this. The inclined surface 67a and/or the inclined surface 68a has/have a curved surface/curved surfaces which is/are curved when viewed in, e.g., the direction orthogonal to the axial direction.

[0054] The guiding slit 71 (see FIG. 7 to FIG. 10(b)) is provided for guiding the yarn Yb radially inward. The guiding slit 71 is formed at an internal portion (i.e., substantially at the central portion) of the base portion 61 in the axial direction. To be more specific, the guiding slit 71 is provided between the stoppers 67 and 68 (see FIG. 8 to FIG. 9(b)) in the axial direction. The guiding slit 71 includes the guide surface 73 and an opposing surface 74. The guide surface 73 is oriented at least to the one side in the axial direction. For example, the guide surface 73 is a roughly L-shaped surface. To be more specific, a radially outer part of the guide surface 73 extends in the circumferential direction as shown in FIG. 10(a). There is a gap in the radial direction between (i) a bottom surface 75 and (ii) a downstream part of the guide surface 73 in the one direction. An upstream part of the guide surface 73 in the one direction extends in the radial direction, and

is connected to an upstream part of the bottom surface 75 in the one direction. The guide surface 73 is formed at a part of the connection member 60 with respect to the circumferential direction. The guide surface 73 is connected to the inclined surface 68a, and provided radially inside the inclined surface 68a (see FIG. 10(a)). In other words, the guide surface 73 is provided inside outermost parts of end portions of the paired stoppers 66 in the radial direction. The guide surface 73 is formed to extend radially inward of the capturing claw 72. The opposing surface 74 is oriented to the other side in the axial direction, and provided to oppose the guide surface 73 in the axial direction (see FIG. 8 and FIG. 9(b)). The opposing surface 74 is a roughly crescent-shaped surface (see FIG. 10(b)). The opposing surface 74 is connected to the inclined surface 67a, and provided radially inside the inclined surface 67a (see FIG. 10(b)). The bottom surface 75 is formed between the guide surface 73 and the opposing surface 74 in the axial direction so that an inner edge of the guide surface 73 in the radial direction is connected to an inner edge of the opposing surface 74 in the radial direction. The bottom surface 75 is oriented at least to the outer side in the radial direction. When viewed in the axial direction, the bottom surface 75 is roughly linear in shape. The bottom surface 75 may be substantially linear. Alternatively, end portions of the bottom surface 75 may be curved as shown in FIG. 10(a) and FIG. 10(b).

[0055] The capturing claw 72 is configured to capture the yarn Yb guided radially inward by the guide surface 73. As shown in FIG. 7 to FIG. 9(b), for example, the capturing claw 72 is provided on the other side in the axial direction as compared to the guide surface 73. The capturing claw 72 is provided to overlap, e.g., at least a part of the stopper 68 in the axial direction. For example, the capturing claw 72 is provided at one end of the guide surface 73, which is provided downstream of the other end of the guide surface 73 in the one direction. The capturing claw 72 includes, e.g., a receiving surface 76 and a protruding portion 77. The receiving surface 76 is configured to receive the running yarn Yb. The receiving surface 76 is oriented at least to, e.g., the downstream side of the receiving surface 76 in the one direction. The protruding portion 77 is configured to prevent the yarn Yb received by the receiving surface 76, from dropping off from the receiving surface 76. The protruding portion 77 protrudes from, e.g., the receiving surface 76 in the one direction. The protruding portion 77 is provided on the one side in the axial direction as compared to the receiving surface 76. The protruding portion 77 includes, e.g., a side surface 77a (see FIGs. 9(a) and 9(b)) which is a substantially flat surface oriented to (i) the other side in the axial direction and (ii) the downstream side of the protruding portion 77 in the one direction.

[0056] Even when the connection member 60 is provided in a direction opposite to the regular direction (that is, when the connection member 60 is deviated by 180 degrees from the connection member 60 which is provided in the regular direction on a flat surface parallel to the axial direction), the base portion 61 is configured to capture the yarn Yb. As shown in FIG. 8 and FIG. 10(b), the base portion 61 includes a reserve guiding slit 81 and a reserve capturing claw 82. The positions of the reserve guiding slit 81 and the reserve capturing claw 82 are different from those of the guiding slit 71 and the capturing claw 72 in the circumferential direction. To be more specific, the reserve guiding slit 81 and the reserve capturing claw 82 are provided to be deviated from the guiding slit 71 and the capturing claw 72 by approximately 180 degrees in the circumferential direction (see FIGs. 10(a) and 10(b)). When viewed in a predetermined direction orthogonal to the axial direction, (i) the reserve guiding slit 81 and the reserve capturing claw 82 and (ii) the guiding slit 71 and the capturing claw 72 are positioned symmetrical with respect to the center in the axial direction and radial direction of the base portion 61 (see FIG. 8).

[0057] The reserve guiding slit 81 is substantially identical in shape with the guiding slit 71. The reserve guiding slit 81 includes a reserve guide surface 83 which is substantially identical in shape with the guide surface 73 and a reserve opposing surface 84 which is substantially identical in shape with the opposing surface 74. The reserve guide surface 83 is oriented at least to the other side in the axial direction. The reserve guide surface 83 is connected to the inclined surface 67a, and provided radially inside the inclined surface 67a (see FIG. 10(b)). In other words, the guide surface 83 is also provided inside an outermost part of the end portion of each stopper 66 in the radial direction. The reserve opposing surface 84 is oriented at least to the one side in the axial direction, and provided to oppose the reserve guide surface 83 in the axial direction. The reserve opposing surface 84 is connected to the inclined surface 68a, and provided radially inside the inclined surface 68a (see FIG. 10(a)). A bottom surface 85 (see FIG. 8) is formed between the reserve guide surface 83 and the reserve opposing surface 84 in the axial direction so that an inner edge of the reserve guide surface 83 in the radial direction is connected to an inner edge of the reserve opposing surface 84 in the radial direction. The bottom surface 85 is substantially identical in shape with the bottom surface 75.

[0058] The reserve capturing claw 82 is substantially identical in shape with the capturing claw 72. As shown in FIG. 8, for example, the reserve capturing claw 82 is provided on the one in the axial direction as compared to the reserve guide surface 83. The reserve capturing claw 82 is provided to overlap, e.g., at least a part of the stopper 67 in the axial direction. For example, the reserve capturing claw 82 is provided at one end of the reserve guide surface 83, which is provided upstream of the other end of the reserve guide surface 83 in the one direction. The reserve capturing claw 82 includes, e.g., a reserve receiving surface 86 which is substantially identical in shape with the receiving surface 76 and a reserve protruding portion 87 which is substantially identical in shape with the protruding portion 77. The reserve receiving sur-

face 86 is oriented at least to, e.g., the downstream side of the reserve receiving surface 86 in the other direction. The reserve protruding portion 87 protrudes from, e.g., the reserve receiving surface 86 in the other direction. The reserve protruding portion 87 is provided on the other side in the axial direction as compared to the reserve receiving surface 86.

[0059] As shown in FIGs. 10(a) and 10(b), for example, an outer circumferential surface 91 which is provided radially outside the bottom surface 75 is connected to a downstream end part of the bottom surface 75 in the one direction. Furthermore, an outer circumferential surface 92 which is provided radially outside the bottom surface 75 is connected to an upstream end part of the bottom surface 75 in the one direction. When viewed in the axial direction, each of the outer circumferential surfaces 91 and 92 is substantially circular-arc-shaped. The outer circumferential surface 91 is connected to an upstream end part of the bottom surface 85 in the one direction. The outer circumferential surface 92 is connected to a downstream end part of the bottom surface 85 in the one direction. The bottom surfaces 75 and 85 and the outer circumferential surfaces 91 and 92 are formed substantially at the central portion of the base portion 61 in the axial direction. The inclined surface 67a is connected to edges of the outer circumferential surfaces 91 and 92 on the one side in the axial direction (see FIGs. 9(a) and 9(b)). The inclined surface 68a is connected to edges of the outer circumferential surfaces 91 and 92 on the other side in the axial direction (see FIGs. 9(a) and 9(b)).

(Method of Yarn Threading to Connection Member)

[0060] The following will describe how to thread the yarns Y to the winding body 100 as described above, especially how to thread one of the yarns Y to the connection member 60, with reference to FIG. 11(a) to FIG. 12(c). To be more specific, the following will describe how the one of the yarns Y (yarn Yb) is captured by the connection member 60 after being pressed onto the surface of the winding body 100 by the yarn threading device 50 (or the operator; see FIG. 3(b) and FIG. 5(c)). The following description assumes that the connection member 60 is provided in the regular direction.

[0061] When viewed in a direction orthogonal to the axial direction (see FIG. 3(b), FIG. 7, and FIG. 8) and yarn threading is performed, the yarn Yb is provided in the vicinity of a surface of the base portion 61 while being slightly inclined from a direction in which the base portion 61 of the connection member 60 extends (i.e., from the up-down direction of each of FIG. 3(b), FIG. 7, and FIG. 8). As described above, the yarn Yb runs toward corresponding one of the suction mouths 52 (i.e., downward as indicated by dashed line arrows in FIG. 11(a) to FIG. 12(c)). The winding body 100 including the connection member 60 is rotated in the one direction (see a solid arrow in each of FIG. 11(a) to FIG. 12(c)).

[0062] When the running yarn Yb is provided to be pressed onto the surface of the rotating winding body 100 (see FIG. 5(c)), the yarn Yb is guided inward in the axial direction and radial direction of the base portion 61 along the inclined surfaces 67a and 68a of the base portion 61 of the connection member 60 (see FIG. 11(a)). As the winding body 100 is further rotated, the yarn Yb guided radially inward by the inclined surfaces 67a and 68a is guided further radially inward along the guide surface 73 (see FIG. 11(b)). Subsequently, as the winding body 100 is further rotated, the yarn Yb is hooked and captured by the capturing claw 72 (see FIG. 11(c) and FIG. 12(a)). The yarn Yb captured by the capturing claw 72 is received by the receiving surface 76 (see FIG. 12 (b)). The yarn Yb received by the receiving surface 76 is prevented from dropping off from the receiving surface 76 by the protruding portion 77. (To be more specific, the yarn Yb is prevented from moving radially outward and toward the one side in the axial direction so as to drop off from the receiving surface 76.) As such, the yarn Yb is captured and retained by the capturing claw 72. In this regard, immediately after being captured by the capturing claw 72, the yarn Yb is simply received by the receiving surface 76 and is slidable relative to the receiving surface 76. This arrangement suppresses the yarn Yb from being unstably tensioned and loosened because of the capturing claw 72.

[0063] As the winding body 100 is rotated, the yarn Yb is guided radially inward along the reserve guiding slit 81. However, when the connection member 60 is provided in the regular direction, the reserve capturing claw 82 is rotated in the opposite direction to the direction in which the reserve capturing claw 82 is rotated to hook the yarn Yb. With this arrangement, the reserve capturing claw 82 does not unintentionally capture the yarn Yb.

[0064] The yarn Yb is wound onto the connection member 60 plural times in such a way that the winding body 100 keeps rotating (see FIG. 12(c)). As a result, the yarn Yb is tightly retained by the connection member 60. Because of this, a part of the yarn Yb provided downstream of the winding body 100 in the yarn running direction (i.e., provided on the suction mouths 52 side) is naturally broken due to tension. As such, the yarn Yb can be wound onto the winding bobbin B2b.

[0065] When the connection member 60 is provided in the direction opposite to the regular direction, the reserve capturing claw 82 is provided to protrude in the one direction. In this case, the reserve guiding slit 81 and the reserve capturing claw 82 respectively function instead of the guiding slit 71 and the capturing claw 72. That is, when the connection member 60 is provided in the direction opposite to the regular direction, the yarn Yb guided radially inward along the reserve guiding slit 81 (i.e., the reserve guide surface 83 and the reserve opposing surface 84) is captured and retained by the reserve capturing claw 82. In this case, the capturing claw 72 does not unintentionally capture the yarn Yb.

[0066] As such, the running yarn Yb is moved toward the rotating winding body 100 so as to be hooked by the

capturing claw 72 of the connection member 60, with the result that the yarn Yb is reliably captured by the capturing claw 72. The guide surface 73 is configured to smoothly guide the yarn Yb radially inward. With this arrangement, the yarn Yb reaches the capturing claw 72 while the resistance which is unintentionally imparted to the yarn Yb is suppressed. It is therefore possible to reliably capture the yarn Yb without loosening the yarn Yb.

[0067] When the winding body 100 is rotated in the one direction, the yarn Yb is captured by being received by the receiving surface 76. In this regard, the receiving surface 76 is configured to simply receive the yarn Yb. The receiving surface 76 is not configured to, e.g., sandwich and capture the yarn Yb. In other words, at least immediately after being received by the receiving surface 76, the yarn Yb is slidable toward the receiving surface 76. This arrangement suppresses the yarn Yb from being unstably tensioned and loosened because of the capturing claw 72. The yarn Yb received by the receiving surface 76 is prevented, by the protruding portion 77, from moving radially outward so as to drop off from the base portion 61. With this arrangement, the running yarn Yb is stably captured and retained.

[0068] The yarn Yb is guided radially inward along the guiding slit 71 in a stable and reliable manner.

[0069] When the connection member 60 is provided to be deviated by 180 degrees from the connection member 60 provided in the regular direction on the flat surface parallel to the axial direction, the reserve guide surface 83 and the reserve capturing claw 82 respectively function instead of the guide surface 73 and the capturing claw 72. With this arrangement, even when the winding body 100 is attached to the winding device 21 in the direction opposite to the regular direction, the yarn Yb is reliably captured. That is, when the connection member 60 is attached to the winding device 21, it is unnecessary to consider the direction of the connection member 60. It is therefore possible to achieve reduction in effort for the consideration of the direction of the connection member 60.

[0070] The position of the reserve capturing claw 82 is different from that of the capturing claw 72 in the circumferential direction. This arrangement allows the capturing claw 72 and the reserve capturing claw 82 to be larger while the increase in size of the base portion 61 is suppressed in the axial direction, as compared to cases where the capturing claw 72 is provided to overlap the entire or a part of the reserve capturing claw 82 in the circumferential direction. It is therefore possible to suppress increase in size of the connection member 60 while suppressing failure in capturing and/or retention of the yarn Yb.

[0071] The guide surface 73 and the capturing claw 72 are provided inside the outermost parts of the end portions of the paired stoppers 66 in the radial direction. With this arrangement, the two winding bobbins B2 which are lager in outer diameter than the paired stoppers 66 are attached to the connection member 60 so that the winding body 100 can be handled in the same manner as the winding bobbin B1. Especially, the contact roller 46 is common between the winding device 21 in the plural mode and the winding device 21 in the single mode. It is therefore unnecessary to replace the contact roller 46 when the operational mode of the winding device 21 is changed.

[0072] The inclined surface 68a is configured to smoothly guide the running yarn Yb toward the guide surface 73.

[0073] In the yarn threading method of the present embodiment, the yarn Yb is captured by the capturing claw 72 so as to be reliably captured and retained without loosening of the yarn Yb. It is therefore possible to improve the success rate of the yarn threading.

[0074] The following will describe modifications of the above-described embodiment. The members identical with those in the embodiment above will be denoted by the same reference numerals and the explanations thereof are not repeated.

(1) In the embodiment above, the base portion 61 of the connection member 60 forming the winding body 100 is provided inside the winding bobbins B2a and B2b in the radial direction. However, the disclosure is not limited to this. The base portion 61 may be formed to be identical in size with the winding bobbins B2a and B2b in the radial direction. The contact roller 46 is common also in this case, between the winding device 21 in the plural mode and the winding device 21 in the single mode.

[0075] Alternatively, the base portion 61 may be larger in size than the winding bobbins B2a and B2b in the radial direction. For example, the guide surface 73 and the capturing claw 72 may protrude radially outward from the stoppers 67 and 68. However, in this case, a contact roller (not illustrated) in which the central portion in the axial direction is a concave is needed in order to reliably apply a contact pressure to the wound packages P2 in the plural mode.

[0076] (2) In the embodiment above, the positions of the reserve guide surface 83 and the reserve capturing claw 82 are different from those of the guide surface 73 and the capturing claw 72 in the circumferential direction. However, the disclosure is not limited to this. The reserve guide surface 83 and the reserve capturing claw 82 may be respectively provided to overlap at least a part of the guide surface 73 and at least a part of the capturing claw 72 in the circumferential direction.

[0077] (3) In the embodiment above, one capturing claw 72 and one reserve capturing claw 82 are provided in the connection member 60. However, the disclosure is not limited to this. For example, the number of the capturing claws 72 may be more than one, and the number of the reserve capturing claws 82 may be more than one. For another example, two capturing claws 72 may be aligned in the circumferential direction. Alternatively, the

two capturing claws 72 may be provided so that one of the two capturing claws 72 is at the same position as the reserve opposing surface 84. In the connection member 60, the number of capturing claws 72 may be the same as or different from the number of reserve capturing claws 82.

[0078] (4) In the embodiment above, the reserve guide surface 83 and the reserve capturing claw 82 are provided in the connection member 60. However, the disclosure is not limited to this. The connection member 60 may not include the reserve guide surface 83 and the reserve capturing claw 82. However, in this case, it is necessary to pay attention to the direction of the winding body 100 when the winding body 100 is attached to the cradle 43.

[0079] (5) In the embodiment above, the opposing surface 74 is provided on the one side in the axial direction as compared to the guide surface 73, and the guide surface 73 and the opposing surface 74 form the guiding slit 71. However, the disclosure is not limited to this. The opposing surface 74 may not be provided.

[0080] (6) The shape of the receiving surface 76 may be different from the above. For example, the receiving surface 76 may be curved as a concave.

[0081] (7) The shape of the protruding portion 77 may be different from the above. For example, the protruding portion 77 may be a cylindrical shape protruding at least in the circumferential direction.

[0082] (8) While in the embodiment above the receiving surface 76 and the protruding portion 77 are independently provided, the disclosure is not limited to this. For example, the receiving surface 76 may not be provided. In this case, for example, the side surface 77a of the protruding portion 77 may receive the yarn Yb.

[0083] (9) The structure of the capturing claw 72 may be different from the above. The capturing claw 72 may be differently arranged as long as the capturing claw 72 is able to capture the yarn Yb guided radially inward by the guide surface 73, in a different manner from the manner in which the yarn Yb is sandwiched between the winding bobbin B2 and the base portion 61.

[0084] (10) In the embodiment above, the bottom surfaces 75 and 85 and the outer circumferential surfaces 91 and 92 are provided at the central portion of the base portion 61 in the axial direction. However, the disclosure is not limited to this. For example, a bottom surface (not illustrated) which is formed across the entire the base portion 61 in the circumferential direction and which is substantially circular-shaped when viewed in the axial direction may be provided at the central portion of the base portion 61 in the axial direction. This bottom surface may be provided radially inside, e.g., the above-described bottom surfaces 75 and 85.

[0085] (11) The winding device 21 may be able to execute only the plural mode as the operation mode in which the yarns Y are wound.

[0086] (12) The winding device 21 may be able to wind yarns Y onto three or more winding bobbins (not illustrated). In other words, the winding body 100 may include two or more connection members 60 and three or more winding bobbins (not illustrated).

[0087] (13) The connection member 60 of the present invention may be applicable not only to the winding device 21 of the false-twist texturing machine 1 but also to various winding devices (not illustrated) each of which is able to wind two or more yarns (not illustrated).

Claims

1. A connection member (60) configured to connect two winding bobbins (B2a, B2b), which are provided for winding at least one running yarn (Ya, Yb), to be aligned in a predetermined axial direction, the connection member (60) comprising:

   a base portion (61) which is sandwiched by the two winding bobbins (B2a, B2b) aligned in the axial direction; and
   paired attachment units (62) which are provided on both sides of the base portion (61) in the axial direction, the two winding bobbins (B2a, B2b) being attachable to the paired attachment units (62), and
   the base portion (61) comprising:

      paired stoppers (66) which are provided between the paired attachment units (62) in the axial direction, the paired stoppers (66) restricting movement of the two winding bobbins (B2a, B2b) in the axial direction;
      a guide surface (73) which is provided between the paired stoppers (66) in the axial direction, the guide surface (73) being configured to guide the at least one running yarn (Yb) inward in a radial direction of the base portion (61); and
      a capturing claw (72) configured to capture the at least one running yarn (Yb) guided inward in the radial direction by the guide surface (73).

2. The connection member (60) according to claim 1, wherein, the capturing claw (72) includes:

   a receiving surface (76) which is provided to be oriented at least to the downstream side of the receiving surface (76) in one direction in a circumferential direction of the base portion (61); and
   a protruding portion (77) which protrudes from the receiving surface (76) at least in the one direction of the circumferential direction, the protruding portion (77) being configured to prevent drop off of the at least one running yarn (Yb) received by the receiving surface (76).

3. The connection member (60) according to claim 1 or 2, wherein, the base portion (61) further includes a guiding slit (71) formed by the guide surface (73) and an opposing surface (74) provided to oppose the guide surface (73) in the axial direction.

4. The connection member (60) according to any one of claims 1 to 3, wherein, the guide surface (73) is oriented at least to one side in the axial direction,

the capturing claw (72) is provided on the other side in the axial direction as compared to the guide surface (73) and protrudes at least in one direction of a circumferential direction of the base portion (61), and
the base portion (61) further includes:

a reserve guide surface (83) which is oriented at least to the other side in the axial direction, the reserve guide surface (83) being able to guide the at least one running yarn (Yb) inward in the radial direction; and
a reserve capturing claw (82) which is provided on the one side in the axial direction as compared to the guide surface (73), the reserve capturing claw (82) protruding at least in the other direction of the circumferential direction.

5. The connection member (60) according to claim 4, wherein, a position of the reserve capturing claw (82) is different from a position of the capturing claw (72) in the circumferential direction.

6. The connection member (60) according to any one of claims 1 to 5, wherein,
the guide surface (73) and the capturing claw (72) are provided inside an outermost part of an end portion of each of the paired stoppers (66) in the radial direction.

7. The connection member (60) according to claim 6, wherein, one of the paired stoppers (66) includes an inclined surface (68a) which is connected to the guide surface (73) and which extends radially inward toward the guide surface (73) in the axial direction.

8. A yarn threading method for threading running yarns (Ya, Yb) to a winding body (100) including the connection member (60) according to any one of claims 1 to 7 and two winding bobbins (B2a, B2b) attached to the connection member (60),
the yarn threading method comprising a step of causing the guide surface (73) to guide one (Yb) of the running yarns (Ya, Yb) inward in the radial direction and causing the capturing claw (72) to capture the one (Yb) of the running yarns (Ya, Yb) while rotating the winding body (100).

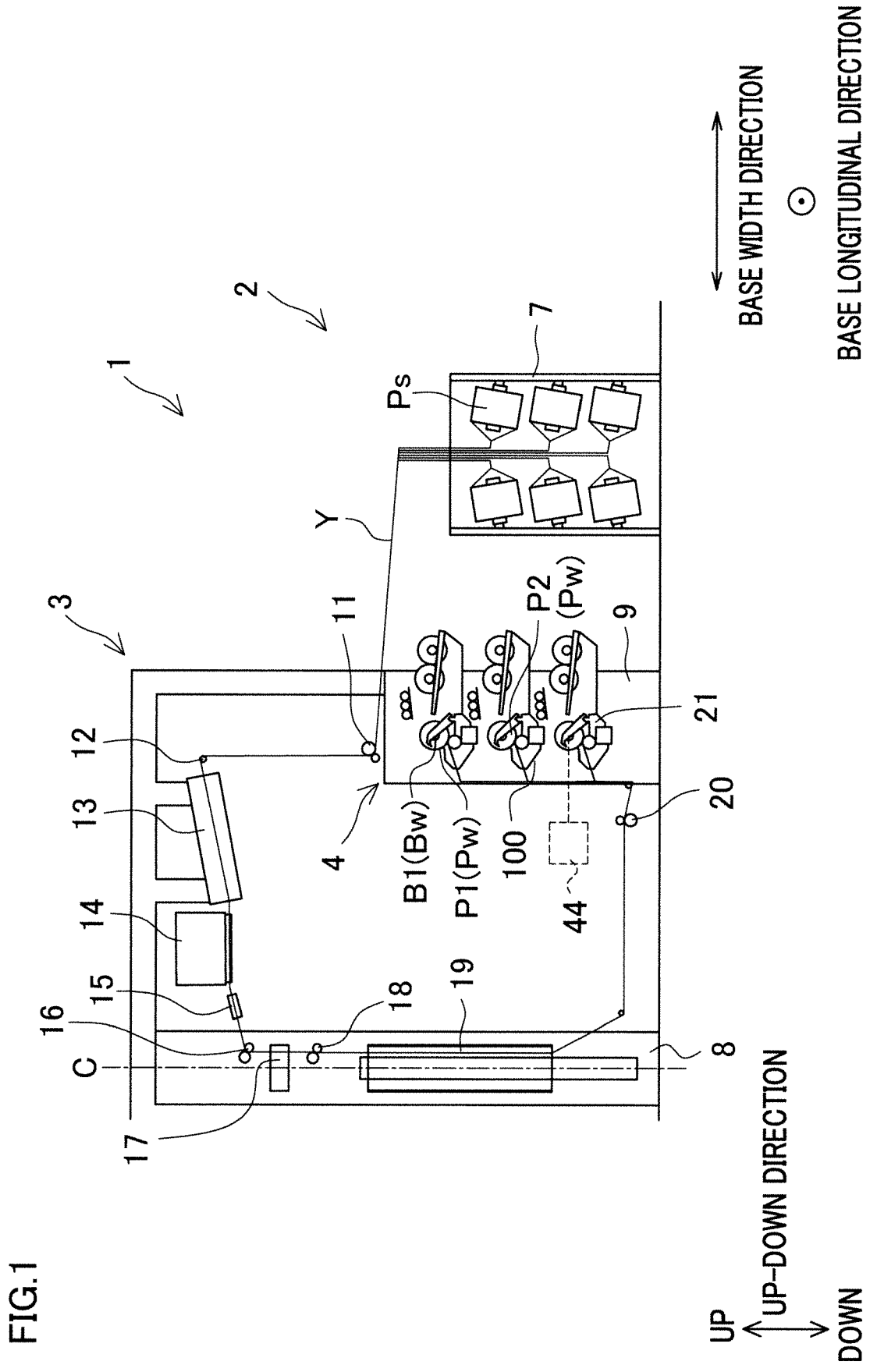

1
2
3
4
7
Ps
Y
11
P2
(Pw)
9
12
13
14
15
16
C
17
18
19
B1(Bw)
P1(Pw)
100
44
20
21
8
BASE WIDTH DIRECTION
BASE LONGITUDINAL DIRECTION
UP
UP-DOWN DIRECTION
DOWN

FIG.1

FIG.2

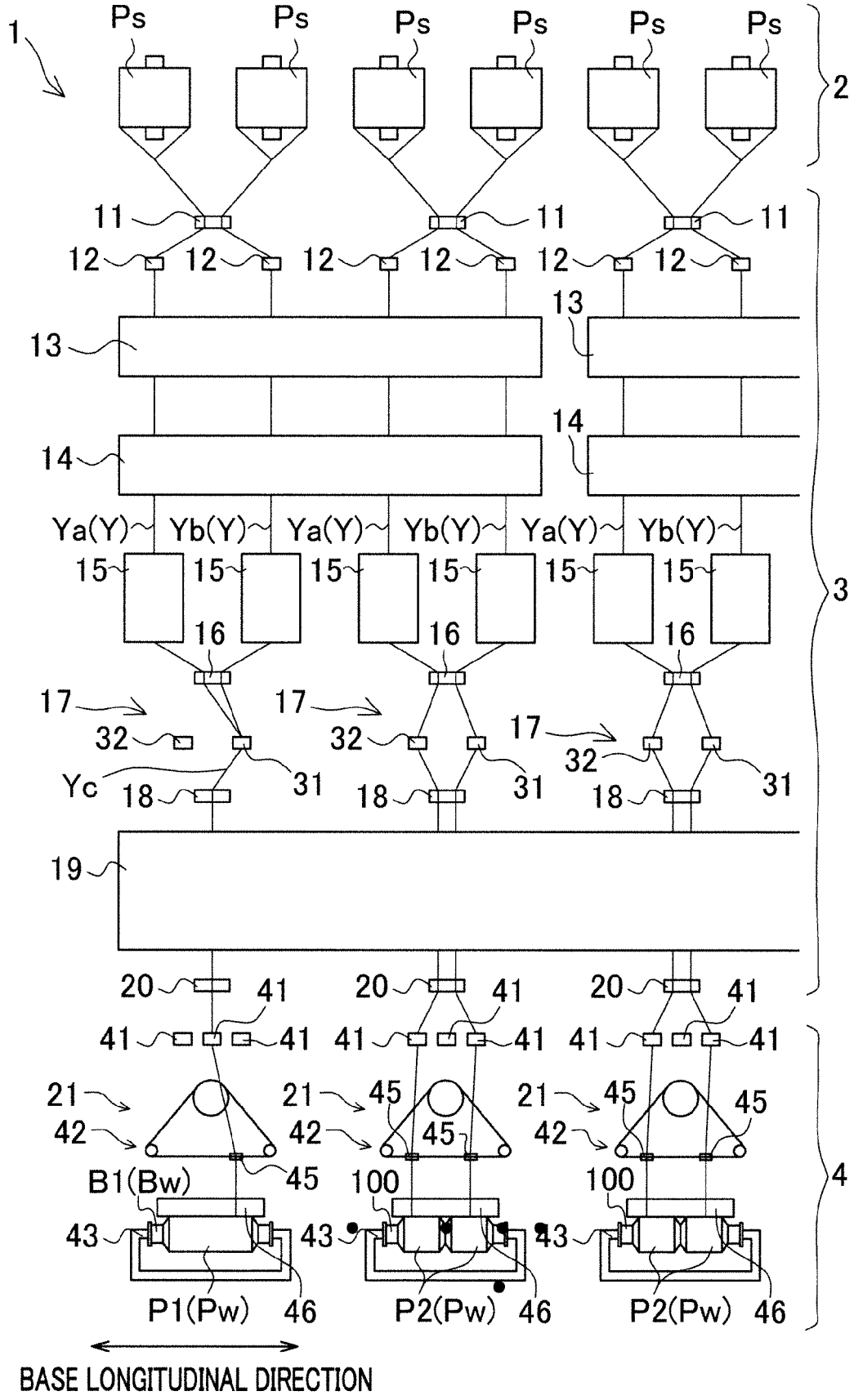

1
Ps
2
11
12
13
14
Ya(Y)
Yb(Y)
15
16
3
17
32
31
Yc
18
19
20
41
21
45
42
4
B1(Bw)
100
43
P1(Pw)
P2(Pw)
46
BASE LONGITUDINAL DIRECTION

FIG.3

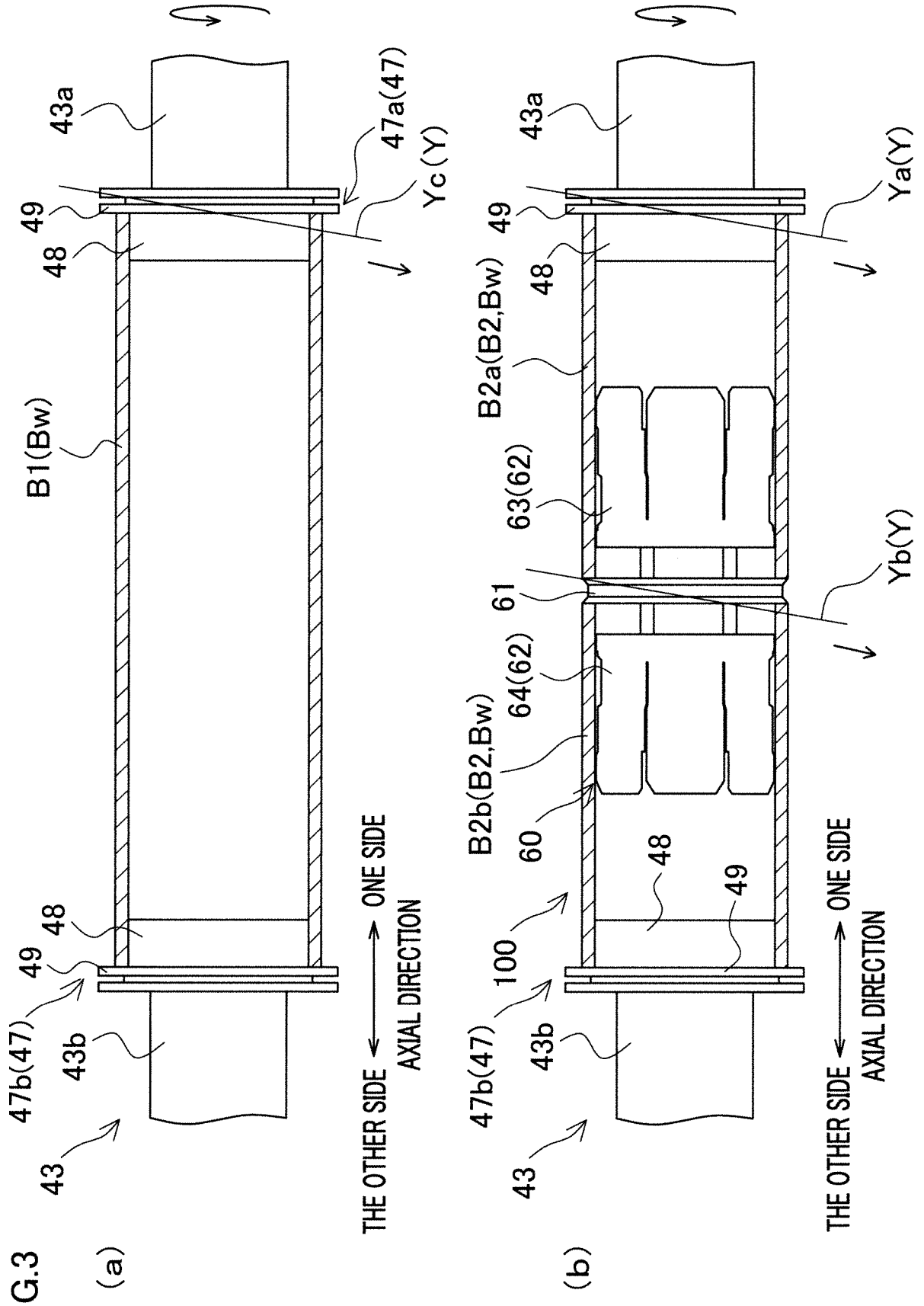
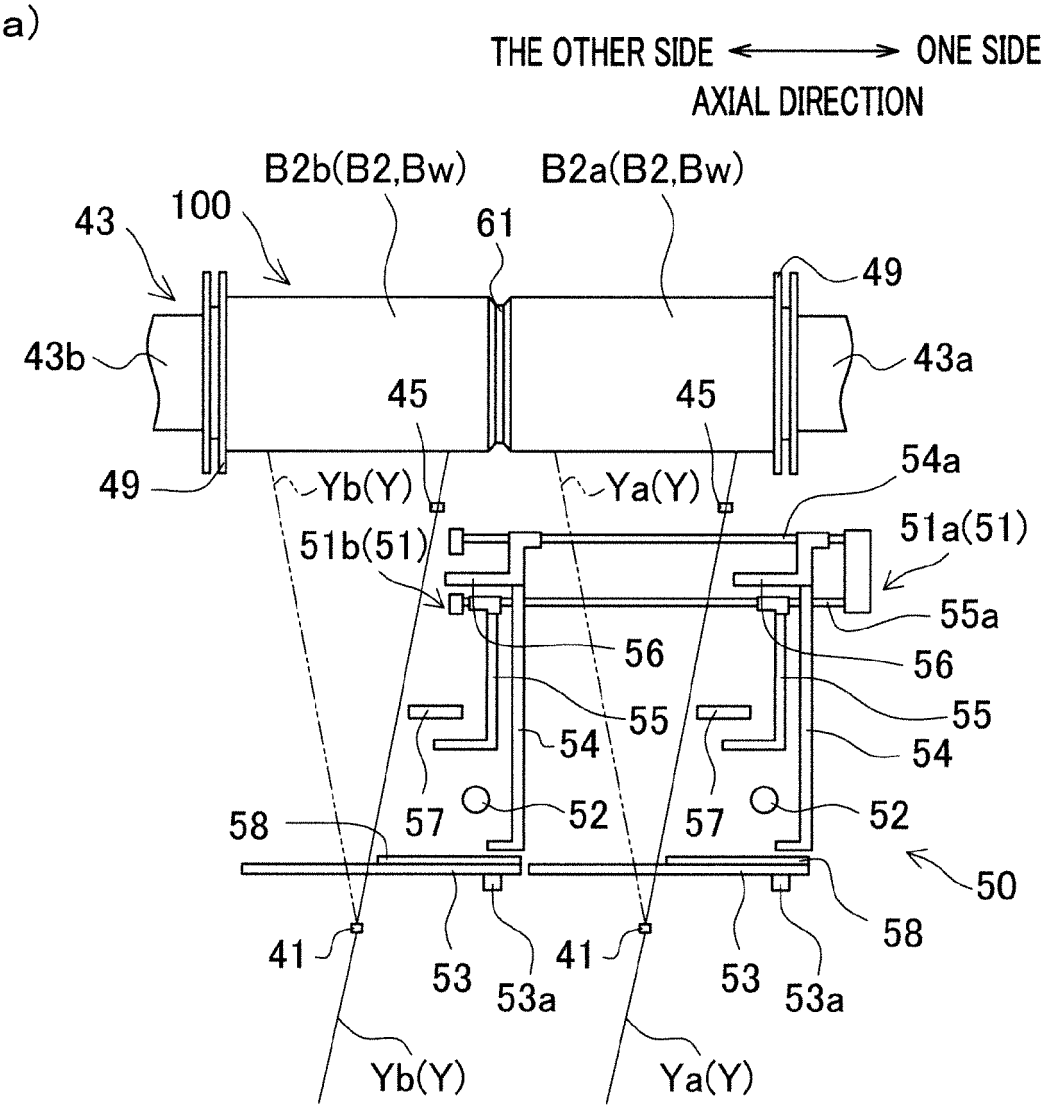

(a)
43a
47a(47)
Yc(Y)
49
48
B1(Bw)
48
49
47b(47)
43b
43
THE OTHER SIDE
ONE SIDE
AXIAL DIRECTION
(b)
43a
Ya(Y)
49
48
B2a(B2,Bw)
63(62)
Yb(Y)
61
64(62)
B2b(B2,Bw)
60
48
49
100
47b(47)
43b
43
THE OTHER SIDE
ONE SIDE
AXIAL DIRECTION

FIG.4

(a)


THE OTHER SIDE
ONE SIDE
AXIAL DIRECTION
B2b(B2,Bw)
B2a(B2,Bw)
43
100
61
49
43b
43a
45
45
49
Yb(Y)
Ya(Y)
54a
51b(51)
51a(51)
55a
56
56
55
55
54
54
58
57
52
57
52
50
58
41
53
53a
41
53
53a
Yb(Y)
Ya(Y)

(b)

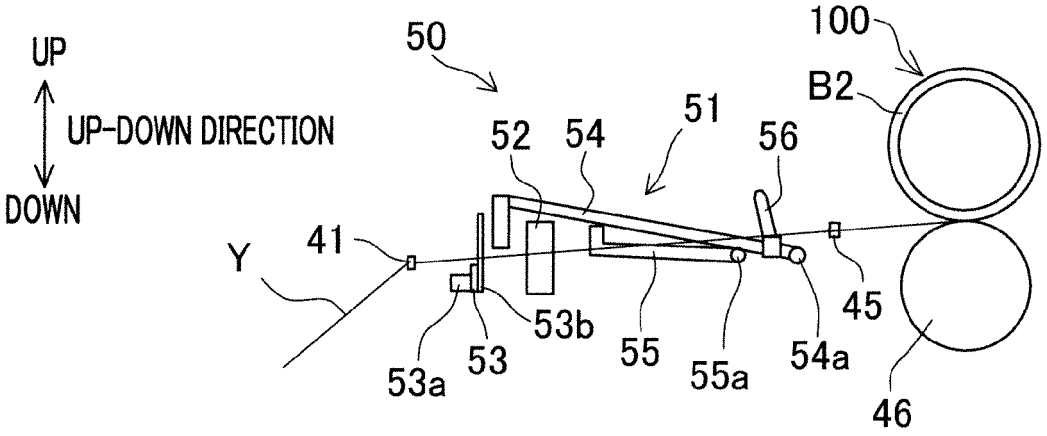

UP
UP-DOWN DIRECTION
DOWN
50
100
B2
51
52
54
56
Y
41
45
53b
55
55a
54a
53a
53
46

FIG.5

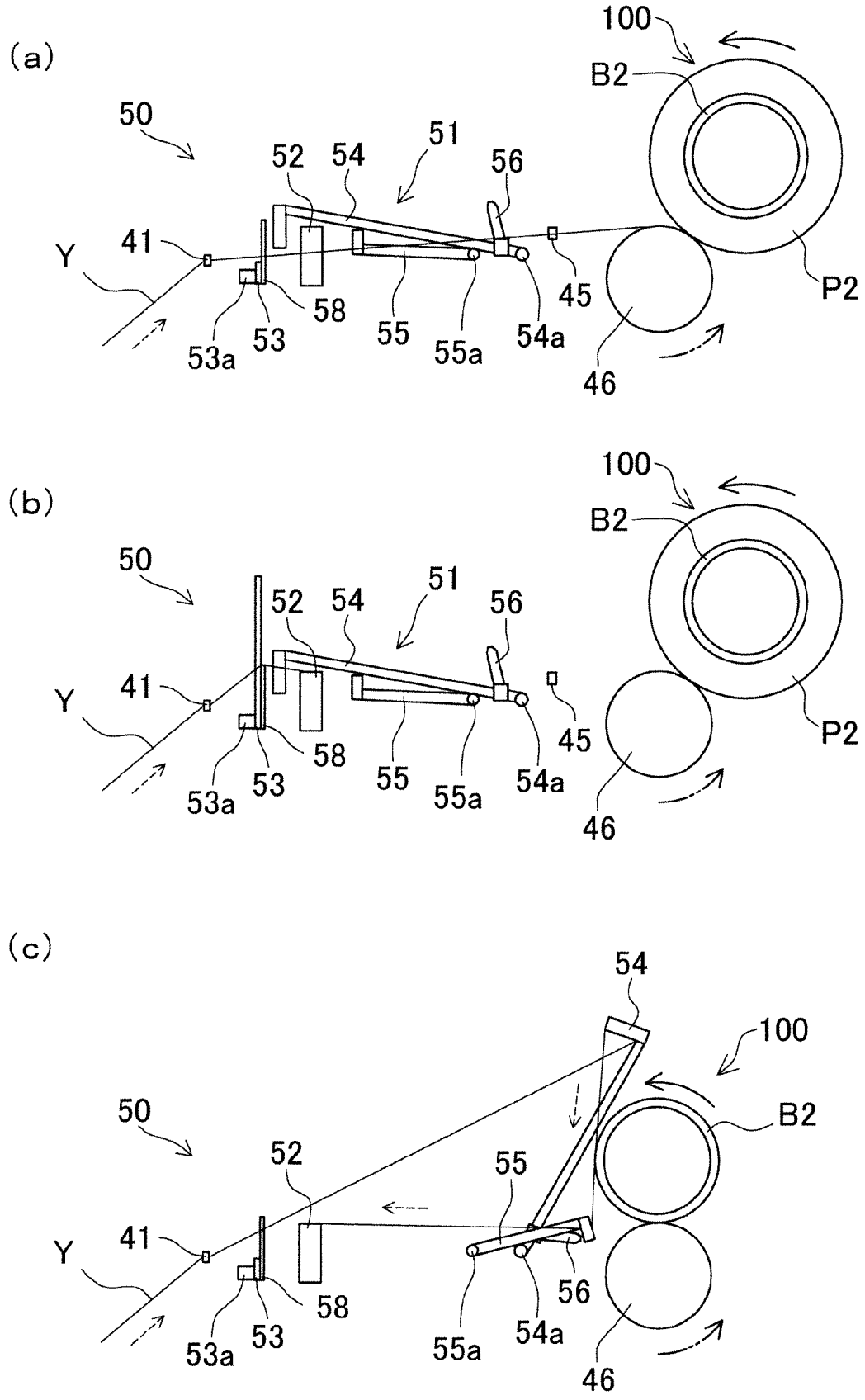

(a)
100
B2
50
51
52
54
56
Y
41
45
P2
58
53
55
54a
53a
55a
46
(b)
100
B2
50
51
52
54
56
Y
41
45
P2
58
53
55
54a
53a
55a
46
(c)
54
100
50
B2
52
55
Y
41
58
56
53
54a
53a
55a
46

FIG.6

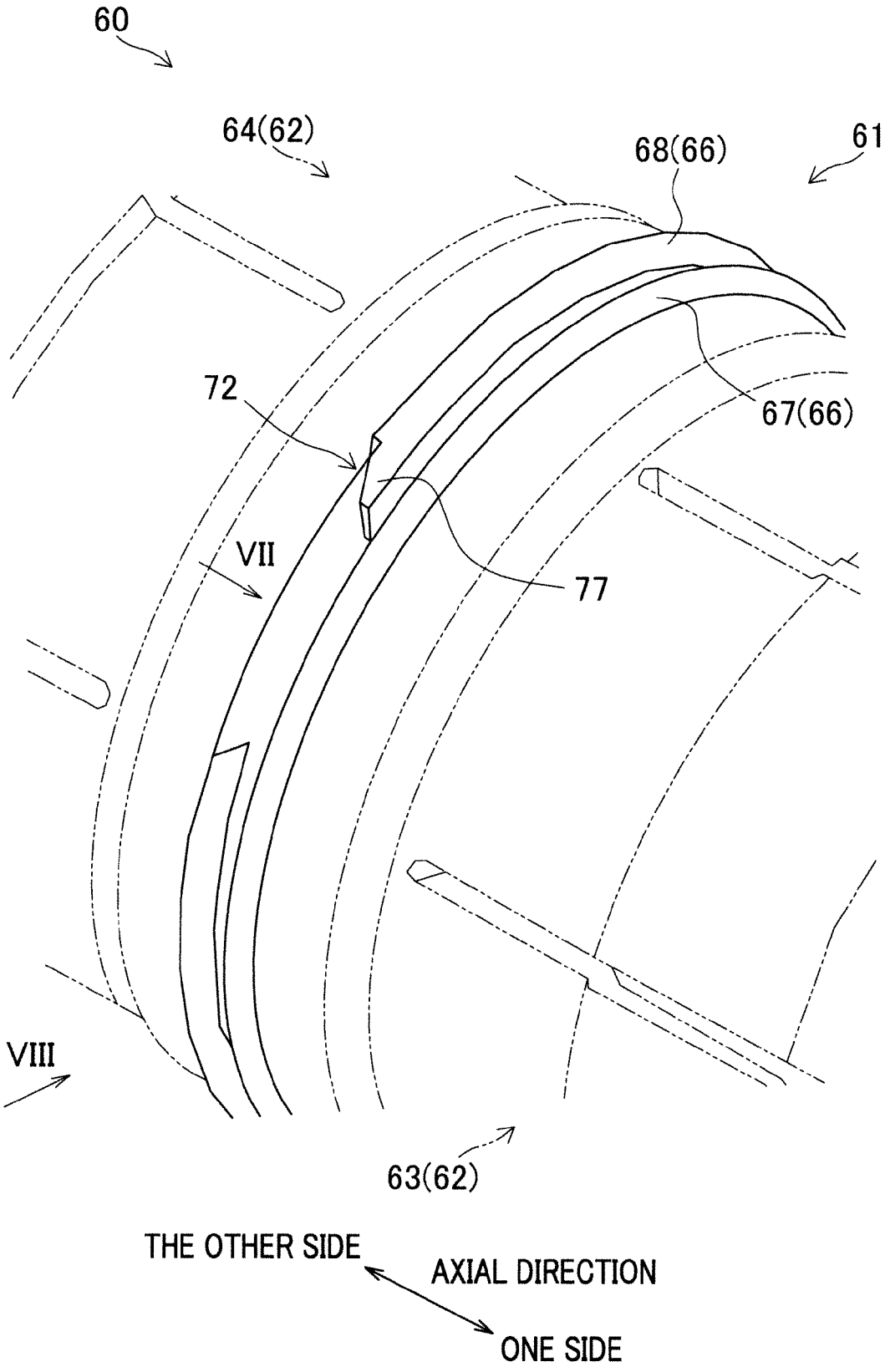

60
64(62)
68(66)
61
72
67(66)
VII
77
VIII
63(62)
THE OTHER SIDE
AXIAL DIRECTION
ONE SIDE

FIG.7

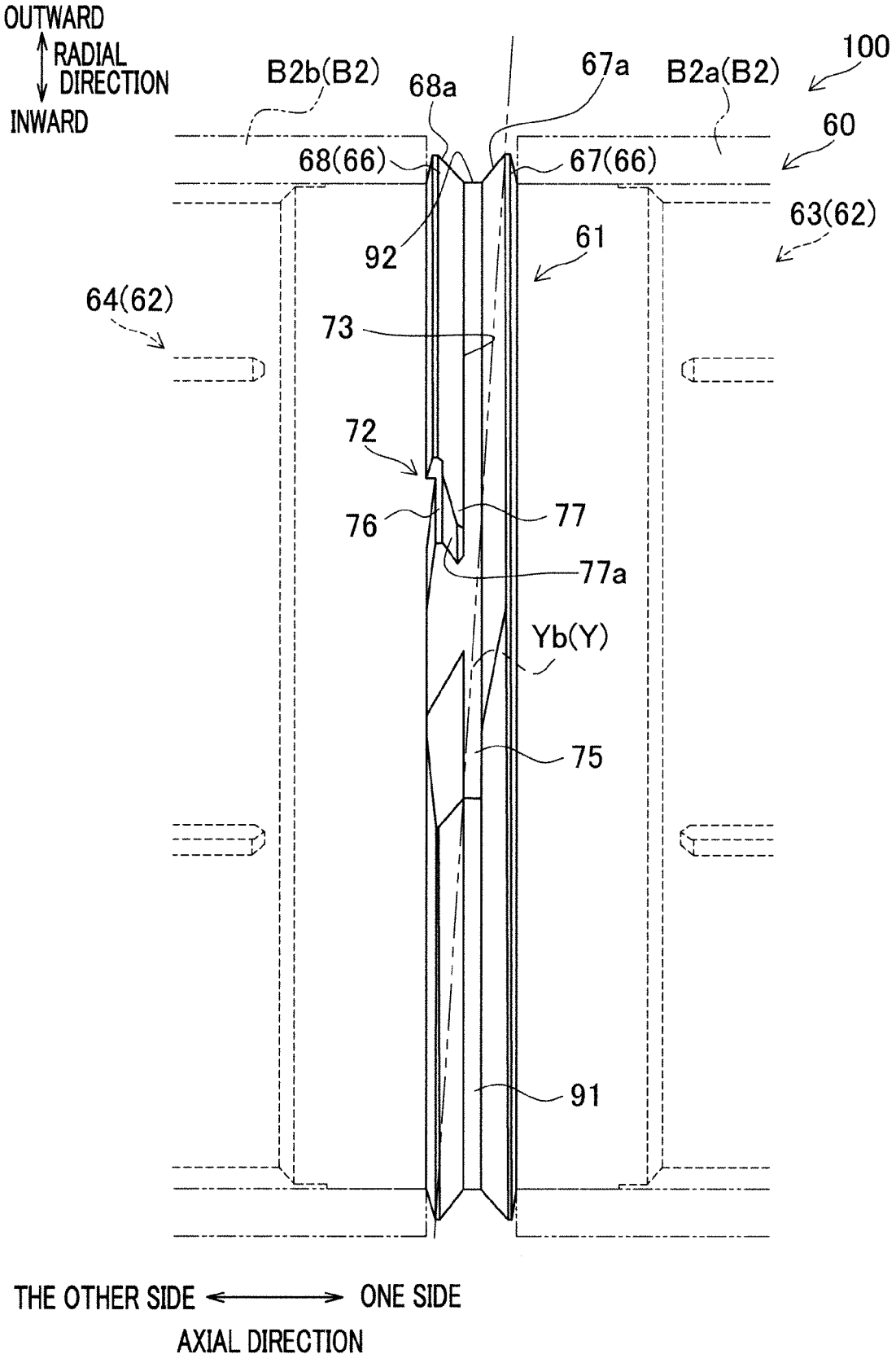

OUTWARD
RADIAL DIRECTION
INWARD
B2b(B2)
68a
67a
B2a(B2)
100
60
68(66)
67(66)
63(62)
92
61
64(62)
73
72
76
77
77a
Yb(Y)
75
91
THE OTHER SIDE
ONE SIDE
AXIAL DIRECTION

FIG.8

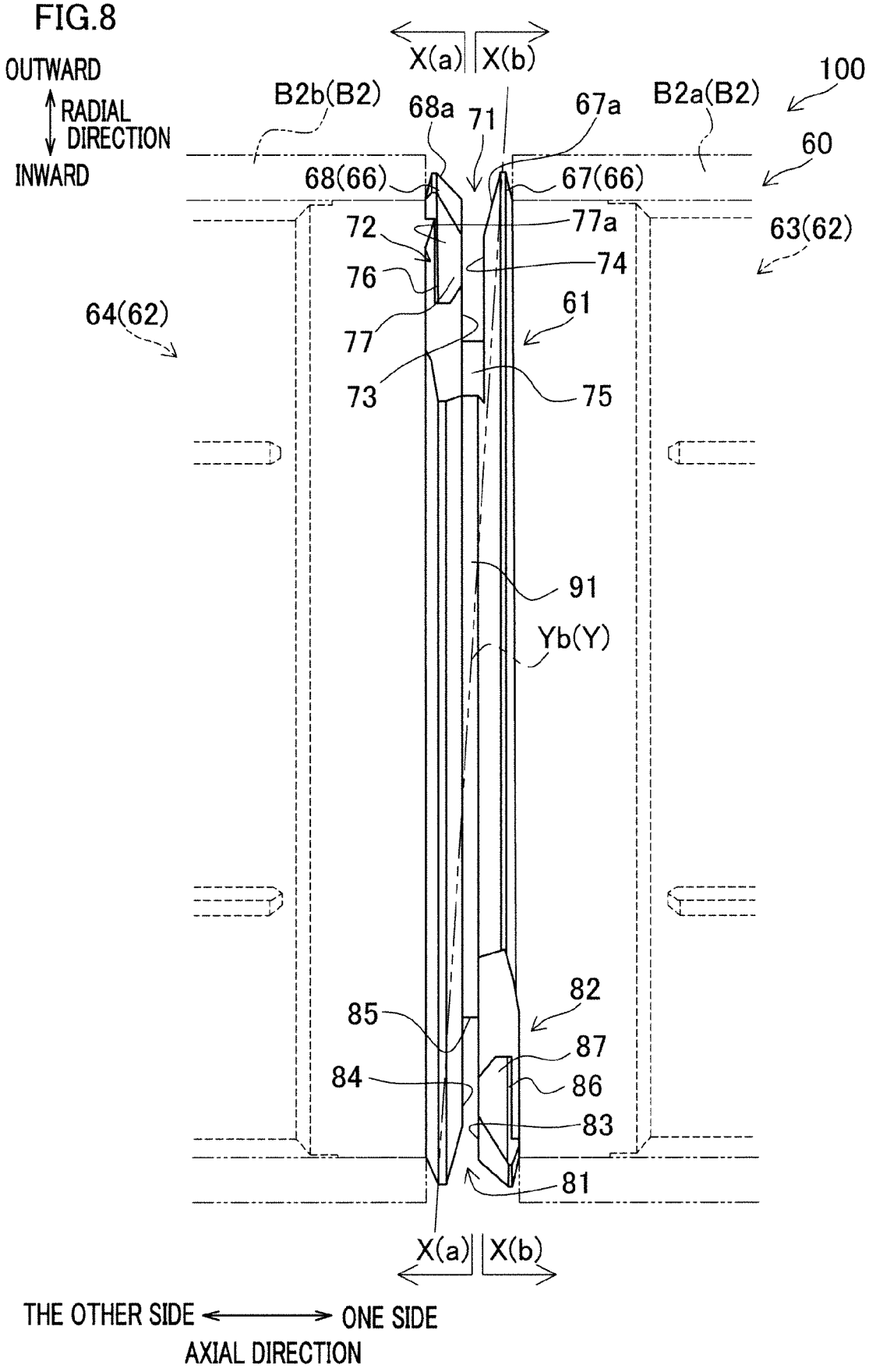

OUTWARD
RADIAL DIRECTION
INWARD
X(a)
X(b)
100
B2b(B2)
68a
71
67a
B2a(B2)
60
68(66)
67(66)
72
77a
63(62)
76
74
64(62)
61
77
73
75
91
Yb(Y)
82
85
87
84
86
83
81
X(a)
X(b)
THE OTHER SIDE
ONE SIDE
AXIAL DIRECTION

FIG.9

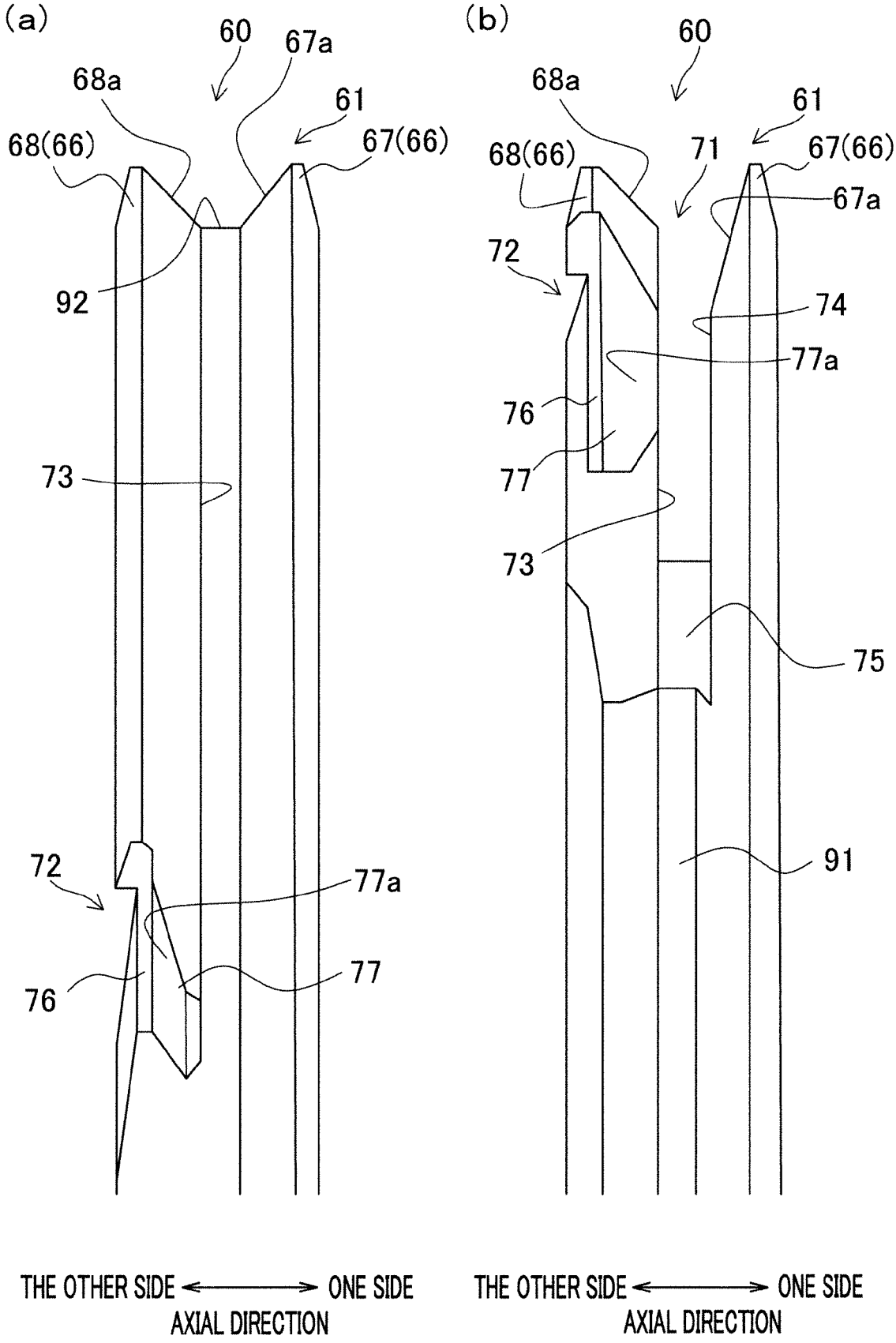

(a)
60
67a
68a
61
68(66)
67(66)
92
73
72
77a
77
76
THE OTHER SIDE
ONE SIDE
AXIAL DIRECTION
(b)
60
68a
61
68(66)
71
67(66)
67a
72
74
77a
76
77
73
75
91
THE OTHER SIDE
ONE SIDE
AXIAL DIRECTION

FIG.10

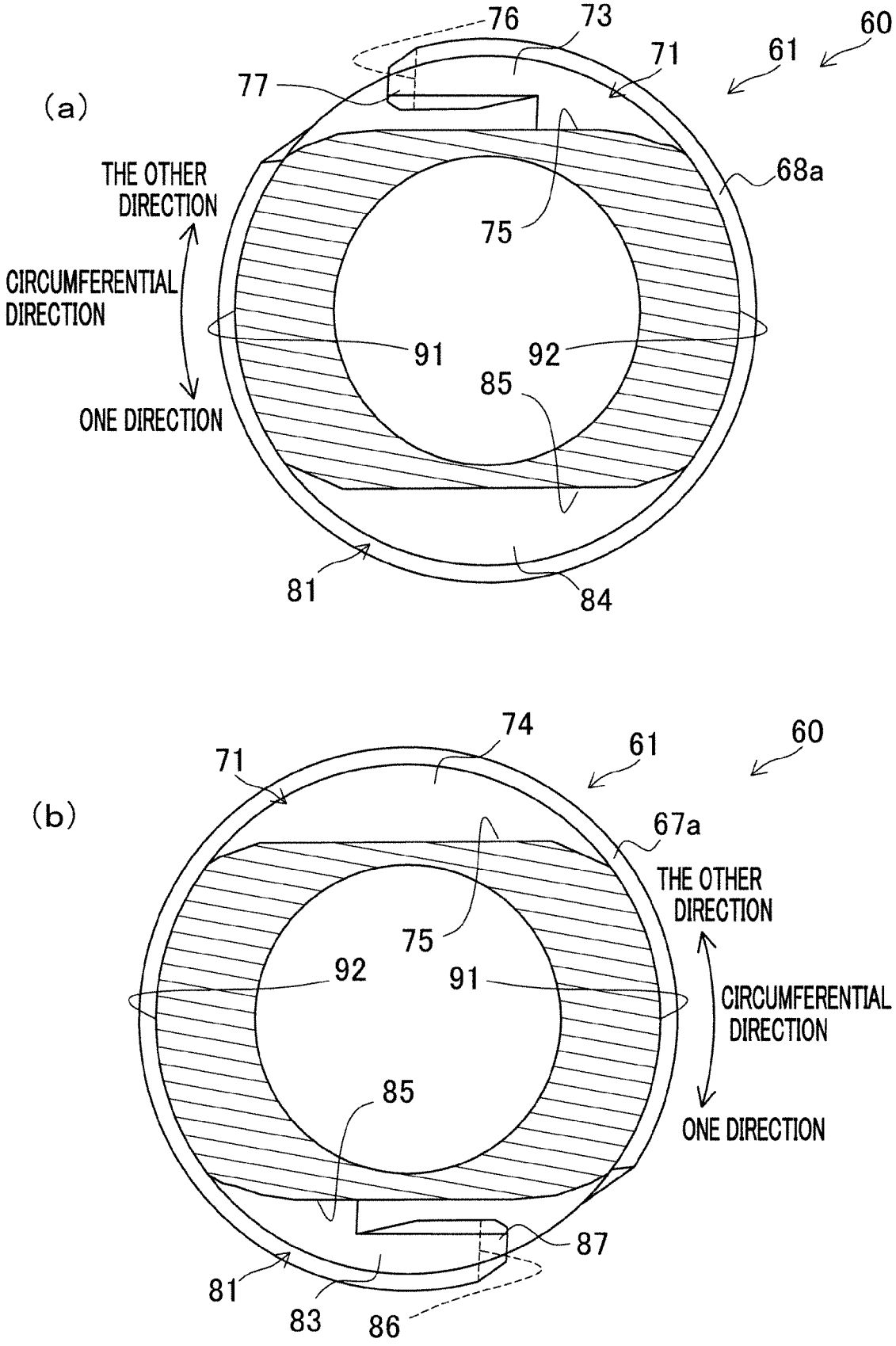

(a)
76
73
71
61
60
77
68a
THE OTHER DIRECTION
75
CIRCUMFERENTIAL DIRECTION
91
92
85
ONE DIRECTION
81
84
(b)
74
61
60
71
67a
THE OTHER DIRECTION
75
92
91
CIRCUMFERENTIAL DIRECTION
85
ONE DIRECTION
87
81
83
86

FIG.11

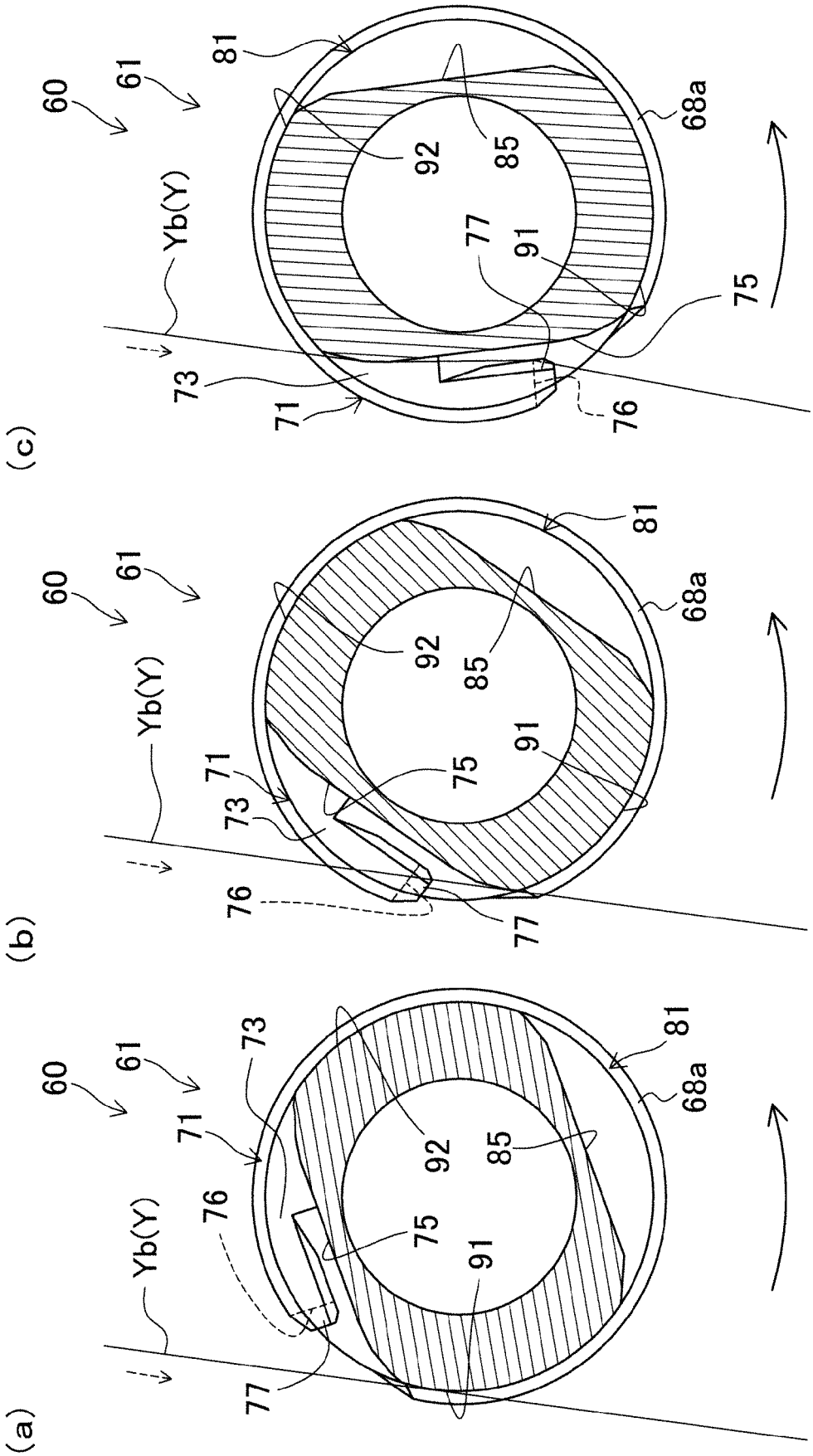
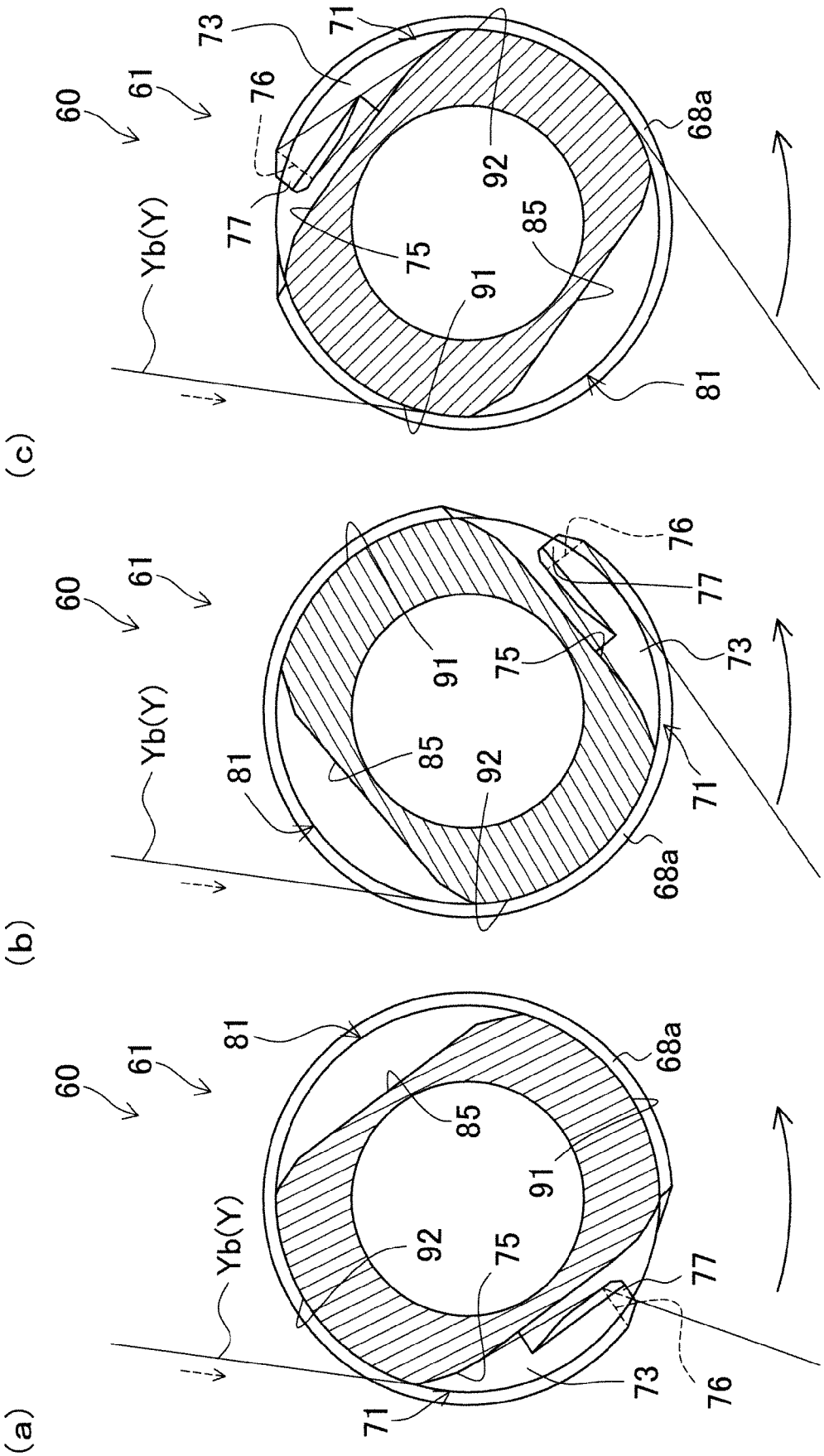


FIG.12



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EUROPEAN SEARCH REPORT

Application Number
EP 22 16 8398

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	EP 0 139 897 A1 (RIETER AG MASCHF [CH]) 8 May 1985 (1985-05-08) * figures 1,2 *	1	
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			B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 September 2022	Pussemier, Bart

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