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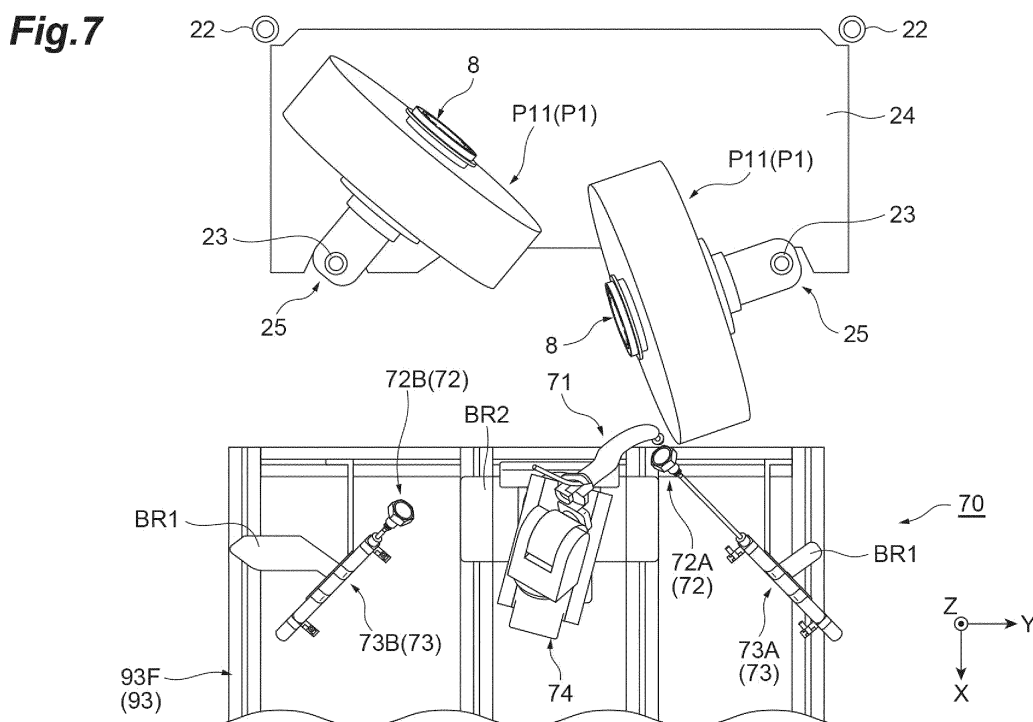
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(54) **YARN PACKAGE KNOT RELEASING DEVICE, YARN JOINING PROCESSING DEVICE, AND YARN FEEDING DEVICE**

(57) A knot releasing device 70 releases a knot KN including a slip knot of a yarn feeding package P1. The knot releasing device 70 includes a suction gun 71, a receiving portion 72 which contacts the suction gun 71 to sandwich a first yarn end Y1 captured by the suction gun 71 by suction, an air cylinder 73 which guides the receiving portion 72 from a first position PA to a second

position PB in a direction moving away from a yarn feeding package P1, and a threading robot 74 which guides the suction gun 71 to the second position while guiding the receiving portion 72 by the air cylinder 73 in a state in which the suction gun 71 contact the receiving portion 72 at the first position.



Description

TECHNICAL FIELD

[0001] An aspect of the present invention relates to a yarn package knot releasing device, a yarn joining processing device, and a yarn feeding device.

BACKGROUND

[0002] In a yarn package used for a textile machine, for example, in order to prevent a yarn portion at the end of winding of a yarn layer formed by winding a yarn on a bobbin from being released, the yarn may be tied by tying the yarn portion at the end of the winding on the outer peripheral surface of the yarn layer. At this time, if the yarn is tied by the knot including the slip knot (also called a "knot which is released by pulling"), the knot can be easily released by pulling the yarn portion at the end of winding of the yarn. In this case, a robot can easily untie the knot instead of an operator. Then, in order to release the knot of the yarn by the robot, the robot needs a yarn capturing portion which captures the end of the yarn portion at the end of winding by suction. The yarn capturing portion may include only a mechanism that captures the end of the yarn portion at the end of winding by suction or may include a mechanism that sandwiches the end of the yarn portion at the end of winding together with a mechanism that captures the end of the yarn portion at the end of winding by suction.

[0003] For example, a yarn line handling device described in Japanese Unexamined Patent Publication No. 2021-91987 includes a yarn capturing portion (second capturing mechanism) capable of capturing a yarn (yarn line) by a negative pressure generated when compressed fluid is supplied. The yarn capturing portion becomes a capturing state capable of capturing a yarn in a sandwiched state while compressed fluid is not supplied and becomes a releasing state not sandwiching a yarn from the capturing state when compressed fluid is supplied. The yarn line handling device includes not only a mechanism that captures the end of the yarn portion at the end of winding by suction but also a mechanism that sandwiches the end of the yarn portion at the end of winding.

[0004] Incidentally, the end of the yarn portion at the end of winding needs to be strongly pulled in a direction moving away from the yarn package in order to release the knot when capturing the end of the yarn portion at the end of winding with respect to the yarn package in which the end of the yarn portion at the end of winding is tied on the outer peripheral surface of the yarn layer of the yarn package by the knot including the slip knot. In the above-described conventional art, the end of the yarn portion at the end of winding needs to be sucked by a negative pressure generated when a large amount of compressed fluid is supplied in order to strongly pull the end of the yarn portion at the end of winding in a direction

moving away from the yarn package when releasing the knot in a case in which only the mechanism that captures the end of the yarn portion at the end of winding by suction is provided.

[0005] Further, in the above-described conventional art, the end of the yarn portion at the end of winding can be strongly pulled in a direction moving away from the yarn package by the yarn capturing portion capturing the yarn in a sandwiched state in a case in which not only the mechanism that captures the end of the yarn portion at the end of winding by suction but also the mechanism that sandwiches the end of the yarn portion at the end of winding are provided. However, in this case, since the yarn sandwiching mechanism (clamp mechanism, chuck mechanism, etc.) for sandwiching the yarn is provided in the yarn capturing portion, the size of the yarn capturing portion increase and the yarn capturing portion may not pass through a narrow space. Accordingly, this is unrealistic. Further, in this case, the yarn may get entangled in the yarn sandwiching mechanism when strongly pulling the end of the yarn portion at the end of winding in a direction moving away from the yarn package. This point is also unrealistic.

SUMMARY

[0006] Here, an object of an aspect of the present invention is to provide a yarn package knot releasing device, a yarn joining processing device, and a yarn feeding device capable of releasing a knot including a slip knot of a yarn package without supplying a large amount of compressed fluid causing a negative pressure for strongly pulling a yarn to a yarn capturing portion and providing a yarn sandwiching mechanism for sandwiching a yarn in the yarn capturing portion.

[0007] A yarn package knot releasing device according to an aspect of the present invention is a yarn package knot releasing device for releasing a knot in a yarn package in which a yarn portion at the end of winding of a yarn layer formed by winding a yarn on a bobbin is tied on an outer peripheral surface of the yarn layer by a knot including a slip knot, including: a yarn capturing portion which captures an end of the yarn portion at the end of winding by suction; a receiving portion which contacts the yarn capturing portion so that the end of the yarn portion at the end of winding captured by the yarn capturing portion is sandwiched between the yarn capturing portion and the receiving portion; a guide portion which guides the receiving portion from a first position to a second position in a direction moving away from the yarn package; and a yarn capturing portion moving portion which allows the yarn capturing portion to contact the receiving portion at the first position and moves the yarn capturing portion to the second position in a direction moving away from the yarn package while guiding the receiving portion by the guide portion in a state in which the yarn capturing portion contacts the receiving portion.

[0008] In the yarn package knot releasing device, the

yarn capturing portion capturing the end of the yarn portion at the end of winding is brought into contact with the receiving portion to sandwich the yarn therebetween. Then, the receiving portion is guided by the guide portion in this state so that the end of the yarn portion at the end of winding is strongly pulled in a direction moving away from the yarn package and the knot including the slip knot can be released. Thus, according to the yarn package knot releasing device of an aspect of the present invention, it is possible to release the knot including the slip knot of the yarn package without supplying a large amount of compressed fluid causing a negative pressure for strongly pulling the yarn to the yarn capturing portion and providing a yarn sandwiching mechanism for sandwiching the yarn in the yarn capturing portion.

[0009] In the yarn package knot releasing device according to an aspect of the present invention, the first position may be a position in a range in which the distance from the knot is equal to or shorter than the length from the knot to the end of the yarn portion at the end of winding. In this case, the yarn capturing portion capturing the yarn portion at the end of winding can be reliably brought into contact with the receiving portion. Further, the second position may be a position in a range from one end to the other end of the yarn package in the width direction of the yarn package. In this case, when the receiving portion is guided by the guide portion so that the end of the yarn portion at the end of winding is strongly pulled in a direction moving away from the yarn package, the yarn portion at the end of winding wound on the bobbin can be suppressed from moving in the width direction of the yarn package until the yarn portion comes off from the bobbin.

[0010] In the yarn package knot releasing device according to an aspect of the present invention, the guide portion may include an urging holding means configured to urge the receiving portion from the second position toward the first position and hold the receiving portion at the first position. In this case, since the guide portion is configured by using the urging holding means, the yarn capturing portion and the receiving portion are reliably in close contact with each other and the yarn can be reliably sandwiched therebetween.

[0011] In the yarn package knot releasing device according to an aspect of the present invention, the receiving portion may include an elastic member provided with a concave portion and an inner surface of the concave portion may include a tapered surface which is inclined inward toward a bottom side. Accordingly, when the yarn capturing portion capturing the end of the yarn portion at the end of winding is brought into contact with the receiving portion, the yarn can be reliably sandwiched therebetween.

[0012] In the yarn package knot releasing device according to an aspect of the present invention, the yarn capturing portion may be provided at the tip of the yarn capturing portion moving portion. Accordingly, the yarn capturing portion moving portion can easily operate the

yarn capturing portion.

[0013] In the yarn package knot releasing device according to an aspect of the present invention, the knot may be located on one side with respect to the center of the yarn package in a direction orthogonal to an axial direction of the yarn package, and the receiving portion may be located on the same one side as the knot with respect to the center of the yarn package. In this case, the yarn end of the yarn can be efficiently guided in a direction moving away from the yarn package.

[0014] In the yarn package knot releasing device according to an aspect of the present invention, the yarn package includes a first yarn package and a second yarn package, wherein the receiving portion includes a first receiving portion which contacts the yarn capturing portion so that the end of the yarn portion at the end of winding of the first yarn package is sandwiched between the yarn capturing portion and the first receiving portion and a second receiving portion which contacts the yarn capturing portion so that the end of the yarn portion at the end of winding of the second yarn package is sandwiched between the yarn capturing portion and the second receiving portion, wherein the guide portion includes a first guide portion which guides the first receiving portion in a direction moving away from the yarn package and a second guide portion which guides the second receiving portion in a direction moving away from the yarn package, wherein the yarn capturing portion moving portion allows the yarn capturing portion to contact the first receiving portion at the first position corresponding to the first receiving portion and moves the yarn capturing portion to the second position corresponding to the first receiving portion in a direction moving away from the yarn package while guiding the first receiving portion by the first guide portion in a state in which the yarn capturing portion contacts the first receiving portion, and wherein the yarn capturing portion moving portion allows the yarn capturing portion to contact the second receiving portion at the first position corresponding to the second receiving portion and moves the yarn capturing portion to the second position corresponding to the second receiving portion in a direction moving away from the yarn package while guiding the second receiving portion by the second guide portion in a state in which the yarn capturing portion contacts the second receiving portion. According to such a configuration, it is possible to release the knot corresponding to each of two yarn packages.

[0015] A yarn joining processing device according to an aspect of the present invention includes the yarn package knot releasing device and a yarn joining portion which connects a yarn end on an outer layer side of a first yarn package to a yarn end on an inner layer side of a second yarn package or connects a yarn end on an inner layer side of the first yarn package to a yarn end on an outer layer side of the second yarn package.

[0016] Since the yarn joining processing device includes the knot releasing device, it is possible to release the knot including the slip knot of the yarn package with-

out supplying a large amount of compressed fluid causing a negative pressure for strongly pulling the yarn and providing the yarn sandwiching mechanism for sandwiching the yarn in the yarn capturing portion as described above.

[0017] A yarn feeding device according to an aspect of the present invention includes: a yarn feeding stand which includes a first mounting portion allowing a first yarn package to be mounted thereon and a second mounting portion allowing a second yarn package to be mounted thereon; the yarn package knot releasing device; and a yarn joining portion which connects a yarn end on an outer layer side of the first yarn package to a yarn end on an inner layer side of the second yarn package or connects a yarn end on an inner layer side of the first yarn package to a yarn end on an outer layer side of the second yarn package.

[0018] Since the yarn feeding device includes the knot releasing device, it is possible to release the knot including the slip knot of the yarn package without supplying a large amount of compressed fluid causing a negative pressure for strongly pulling the yarn and providing the yarn sandwiching mechanism for sandwiching the yarn in the yarn capturing portion as described above.

[0019] According to an aspect of the present invention, it is possible to provide the yarn package knot releasing device, the yarn joining processing device, and the yarn feeding device capable of releasing the knot including the slip knot of the yarn package without supplying a large amount of compressed fluid causing the negative pressure for strongly pulling the yarn to the yarn capturing portion and providing the yarn sandwiching mechanism for sandwiching the yarn in the yarn capturing portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a diagram showing a yarn feeding device according to an embodiment.

FIG. 2 is a perspective view showing a yarn feeding package to which an adapter is attached.

FIG. 3 is a perspective view showing a creel stand.

FIG. 4 is a perspective view showing a package exchange device.

FIG. 5 is a diagram showing a schematic configuration of an exchange unit.

FIG. 6 is a block diagram showing a functional configuration of the package exchange device.

FIG. 7 is a plan view showing a knot releasing device.

FIG. 8 is a perspective view showing the knot releasing device.

FIG. 9 is a front view showing the knot releasing device.

FIG. 10 is a perspective view showing a suction gun and a threading robot.

FIG. 11 is a perspective view showing a receiving portion and an air cylinder.

FIG. 12 is a plan view of the knot releasing device

for illustrating a knot releasing process.

FIG. 13 is a plan view of the knot releasing device showing a continuation of FIG. 12.

FIG. 14 is a plan view of the knot releasing device showing a continuation of FIG. 13.

FIG. 15 (a) is a perspective view of the receiving portion and the air cylinder showing a continuation of FIG. 14. FIG. 15 (b) is a perspective view of the receiving portion and the air cylinder showing a continuation of FIG. 15 (a). FIG. 15 (c) is a perspective view of the receiving portion and the air cylinder showing a continuation of FIG. 15(b).

FIG. 16 is a schematic view illustrating a case in which a knot releasing process is performed on a first yarn feeding package.

FIG. 17 is a schematic view illustrating a case in which a knot releasing process is performed on a second yarn feeding package.

DETAILED DESCRIPTION

[0021] Hereinafter, an embodiment will be described in detail with reference to the accompanying drawings. In the description of the drawings, the same or corresponding elements are denoted by the same reference numerals, and overlapping descriptions are omitted.

[0022] As shown in FIG. 1, a yarn feeding device 100 of an embodiment includes a creel stand (yarn feeding stand) 20 and a yarn joining processing device 9A. The creel stand 20 is provided in a false twisting machine 1. The yarn joining processing device 9A of an embodiment is mounted on a package exchange device 9. The yarn joining processing device 9A includes a yarn joining device (yarn joining portion) 60, a control unit 94, and a knot releasing device (yarn package knot releasing device) 70 (see FIG. 6). In the following description, the "Z direction" shown in the figure is the vertical direction (the up and down direction), the "X direction" is the horizontal direction, and the "Y direction" is the horizontal direction orthogonal to the "X direction".

[0023] The false twisting machine 1 shown in FIG. 1 manufactures a winding package P2 by processing yarns Y supplied from a plurality of yarn feeding packages (yarn packages) P1. The yarn Y is, for example, a synthetic yarn made of thermoplastic synthetic fibers such as polyester and polyamide. The yarn feeding package P1 is formed by winding a partially oriented yarn (POY) on a yarn feeding bobbin B1. The winding package P2 is formed by winding a draw textured yarn (DTY) on a winding bobbin B2. That is, the false twisting machine 1 processes the yarn Y which is the partially oriented yarn to generate the draw textured yarn.

[0024] As shown in FIG. 2, an adapter 8 is attached to the yarn feeding package P1. The adapter 8 is attached to the end portion of the yarn feeding bobbin B1 of the yarn feeding package P1 to be synchronously rotatable. The adapter 8 is formed in a cylindrical shape. The adapter 8 is provided with a holding hole portion 81 which holds

a yarn end of the yarn Y on the outer layer side (lead yarn side) of the yarn feeding package P1 (hereinafter, the yarn end of the yarn Y on the outer layer side is referred to as a "first yarn end Y1") while the yarn end enters the holding hole portion. The first yarn end Y1 is an end of a yarn portion at the end of winding of a yarn layer YL formed by winding the yarn Y around the yarn feeding bobbin B1.

[0025] The holding hole portion 81 is formed by a narrow tubular pipe provided inside the adapter 8 and extending in a bent manner. The holding hole portion 81 opens in the axial direction of the adapter 8. An opening portion of the holding hole portion 81 is provided with a suction port that abuts on a suction mouth 712 to be described later. The suction port is a concave portion that tapers toward the center. The adapter 8 is mounted on the yarn feeding package P1 by, for example, an operator.

[0026] A yarn portion at the end of winding of the yarn layer YL in the yarn feeding package P1 is tied on the outer peripheral surface of the yarn layer YL with a knot KN including a slip knot. In other words, the yarn portion at the end of winding of the yarn layer YL in the yarn feeding package P1 is tied with the knot KN not to be released. The slip knot is also called a knot which is released by pulling. Such a knot KN fixes the yarn portion at the end of winding of the yarn layer YL onto the outer peripheral surface of the yarn layer YL and is untied by pulling the first yarn end Y1 to release the fixation. The knot KN is located vertically below the center of the yarn feeding package P1 (one side in the direction perpendicular to the axial direction of the yarn feeding package P1) (see FIGS. 16 and 17).

[0027] As shown in FIG. 1, the false twisting machine 1 includes a yarn feeding portion 2, a processing portion 3, and a winding portion 4. A plurality of configurations of the yarn feeding portion 2, the processing portion 3, and the winding portion 4 are arranged in the Y direction (the longitudinal direction of the base) orthogonal to the traveling surface (the paper surface of FIG. 1) of the yarn Y in which the yarn path is disposed from the yarn feeding portion 2 to the winding portion 4 through the processing portion 3.

[0028] The yarn feeding portion 2 feeds the yarn Y to the processing portion 3. The yarn feeding portion 2 includes a creel stand 20 which holds a plurality of the yarn feeding packages P1. As shown in FIGS. 1 and 3, the creel stand 20 includes a creel base portion 21, a first support column 22, a second support column 23, a partition dish plate 24, a peg 25, and a clip 29. The creel base portion 21 is installed on a floor surface or the like and supports the first support column 22 and the second support column 23. The first support column 22 and the second support column 23 are erected on the creel base portion 21.

[0029] The first support column 22 extends along the Z direction. The first support columns 22 are arranged at equal intervals in the Y direction. The first support column

22 is disposed at one side F1 of the creel stand 20 in the X direction. One side F1 of the X direction is a side in which the processing portion 3 to be described later in detail in the rear stage is disposed and a side in which the yarn Y is sent to the processing portion 3 for performing false twisting.

[0030] The second support column 23 extends along the Z direction. The second support columns 23 are arranged in pairs in the Y direction and a plurality of pairs of second support columns 23 and 23 are arranged in the Y direction. The second support column 23 is disposed at the other side F2 of the creel stand 20 in the X direction. The other side F2 of the X direction is a side in which the package exchange device 9 to be described later in detail in the rear stage travels and a side in which the operator performs a yarn joining processing work. A group of the first support columns 22 including the plurality of first support columns 22 and a group of the second support columns 23 including the plurality of second support columns 23 are arranged in the X direction to face each other.

[0031] The partition dish plate 24 is provided to straddle the first support column 22 and the second support column 23. The partition dish plate 24 is a dish plate-shaped member and is arranged at a predetermined interval in the Z direction. The partition dish plate 24 prevents the yarn feeding package P1 from falling from the peg 25.

[0032] The peg 25 supports the yarn feeding package P1. The peg 25 is provided in the second support column 23. A plurality of (for example, four) pegs 25 are arranged at predetermined intervals in the Z direction of the second support column 23. The peg 25 is disposed between two partition dish plates 24 in the Z direction. Further, the pegs 25 are arranged in pairs corresponding to the second support columns 23 and 23 and a plurality of sets (pairs) of the pegs 25 and 25 are arranged in the Y direction.

[0033] In the peg 25 with this configuration, the yarn Y of the yarn feeding package P1 supported by one peg 25 of the pair of pegs can be connected to the yarn Y of the yarn feeding package P1 supported by the other peg 25 of the pair of pegs. Specifically, the first yarn end Y1 of the yarn feeding package P1 supported by one peg 25 of the pair of pegs can be connected to the yarn end of the yarn Y on the inner layer side (tail yarn side) of the yarn feeding package P1 supported by the other peg 25 of the pair of pegs (hereinafter, the yarn end of the yarn Y on the inner layer side is referred to as a "second yarn end") or the second yarn end of the yarn feeding package P1 supported by one peg 25 of the pair of pegs can be connected to the first yarn end Y1 of the yarn feeding package P1 supported by the other peg 25 of the pair of pegs. Accordingly, one yarn Y is supplied (the yarn Y is continuously supplied) from two yarn feeding packages P1 and P1 respectively supported by the pair of pegs 25 and 25 to the processing portion 3.

[0034] The clip 29 is disposed between the pair of pegs

25 and 25 in the Y direction. In this embodiment, the clip 29 is disposed at the center portion of the pair of pegs 25 and 25. The yarn Y is sandwiched and locked by the clip 29. Specifically, the clip 29 sandwiches and locks the yarn obtained by connecting the first yarn end Y1 and the second yarn end of two yarn feeding packages P1 and P1 respectively supported by the pair of pegs 25 and 25.

[0035] The processing portion 3 performs false twisting on the yarn Y fed from the yarn feeding portion 2. The processing portion 3 includes a twisting guide 31, a first heating device 32, a cooling device 33, a false twisting device 34, a second heating device 35, and a feed roller 36 (feed rollers 361 to 363). Each of the twisting guide 31, the first heating device 32, the cooling device 33, the false twisting device 34, the second heating device 35, and the feed roller 36 (the feed rollers 361 to 363) is individually provided for each yarn Y fed from the yarn feeding portion 2 and they are arranged in a row in the Y direction.

[0036] The twisting guide 31 prevents the twist applied to the yarn Y by the false twisting device 34 to be described later from propagating to the upstream side of the twisting guide 31 in the yarn traveling direction. The first heating device 32 heats the yarn Y sent from the yarn feeding portion 2 through the feed roller 361. The cooling device 33 cools the yarn Y heated by the first heating device 32. The false twisting device 34 twists the yarn Y. The second heating device 35 heats the yarn Y sent from the false twisting device 34 through the feed roller 362.

[0037] The feed roller 361 is provided between the creel stand 20 and the twisting guide 31, the feed roller 362 is provided between the false twisting device 34 and the second heating device 35, and the feed roller 363 is provided between the second heating device 35 and a winding device 41. Each feed roller 36 (feed rollers 361 to 363) includes a drive roller and a driven roller. The feed rollers 36 are also arranged in a row in the Y direction.

[0038] The transfer speed of the yarn Y by the feed roller 362 is faster than the transfer speed of the yarn Y by the feed roller 361 and the yarn Y is stretched between the feed roller 361 and the feed roller 362. The transfer speed of the yarn Y by the feed roller 363 is slower than the transfer speed of the yarn Y by the feed roller 362 and the yarn Y is relaxed between the feed roller 362 and the feed roller 363.

[0039] In the processing portion 3 with the above-described configuration, the yarn Y stretched between the feed roller 361 and the feed roller 362 is twisted by the false twisting device 34. The twist formed by the false twisting device 34 is propagated to the twisting guide 31, but is not propagated to the upstream side of the twisting guide 31 in the yarn traveling direction. The yarn Y which is stretched and twisted is heated by the first heating device 32 to be heat-fixed and is cooled by the cooling device 33. The yarn Y is untwisted on the downstream

side from the false twisting device 34, but each filament is maintained in a false twisted state by the above heat-fixing. The yarn Y is heat-fixed by the second heating device 35 while being relaxed between the feed roller 362 and the feed roller 363. Finally, the yarn Y sent from the feed roller 363 is wound by the winding device 41 of the winding portion 4 to form the winding package P2.

[0040] The winding portion 4 includes the winding device 41, a package stocker 42, a doffing device (not shown), and the like. The winding device 41 winds the yarn Y false-twisted by the processing portion 3 to form the winding package P2. The package stocker 42 stores the winding package P2 formed by the winding device 41. The doffing device removes the winding package P2 formed by the winding device 41, transfers the winding package P2 to the package stocker 42, and attaches an empty winding bobbin B2 to the winding device 41.

[0041] The package exchange device 9 collects the yarn feeding bobbin B1 from the peg 25 and attaches the yarn feeding package P1 to the peg 25. As shown in FIG. 4, the package exchange device 9 travels along a rail 98. The rail 98 is laid on a floor and extends in the Y direction. That is, the package exchange device 9 is provided to be able to travel along the Y direction. The package exchange device 9 includes a traveling unit 90, an elevating unit 91, a holding unit 92, an exchange unit 93, the yarn joining device 60, and a control unit 94 (see FIG. 6) which controls the operations thereof.

[0042] The traveling unit 90 is provided with a vehicle wheel traveling on the rail 98, a drive mechanism, and the like. The traveling unit 90 supports the elevating unit 91, the holding unit 92, and the exchange unit 93. The elevating unit 91 is elevated while the operator gets thereon. The elevating unit 91 is used for the maintenance or the like. The elevating unit 91 includes a work table 911 on which the operator gets, a guide portion 912 which supports the work table 911 to be movable in the Z direction, and a drive mechanism (not shown) which drives the work table.

[0043] The holding unit 92 holds the plurality of (for example, four) yarn feeding packages P1. The holding unit 92 receives the yarn feeding package P1 supplied from a package replenishing device (not shown), temporarily stores the yarn feeding package P1, and supplies the yarn feeding package P1 to the exchange unit 93. The holding unit 92 is provided to be rotatable in a range of about 90°. More specifically, the holding unit 92 is provided to be rotatable between a replenishment position in which the yarn feeding package P1 is supplied from the package replenishing device and a supply position (a position shown in FIG. 4) in which the yarn feeding package P1 is supplied to the exchange unit 93.

[0044] The exchange unit 93 exchanges the yarn feeding bobbin B1 and the yarn feeding package P1 in the peg 25. Specifically, the exchange unit 93 collects the yarn feeding bobbin B1 (see FIG. 1) from the peg 25 and attaches the yarn feeding package P1 to the peg 25. The exchange unit 93 is provided adjacent to the holding unit

92. As shown in FIG. 5, the exchange unit 93 includes a base 931, a rotation device 932, a collection device 933, a supply device 934, and a rotary table 936. Additionally, in FIG. 4, the description of the rotation device 932, the collection device 933, the supply device 934, the rotary table 936, the yarn joining device 60, and the knot releasing device 70 is omitted.

[0045] The base 931 includes the rotation device 932, the collection device 933, the supply device 934, and the rotary table 936 supporting the yarn joining device 60. The base 931 is provided to be elevatable along the Z direction. The rotation device 932 is fixed to the base 931. The rotation device 932 rotates the peg 25 of the creel stand 20. The rotation device 932 includes the rotation driver 932A and a rotation arm 932B.

[0046] The rotation driver 932A is a Geneva driver that constitutes the Geneva mechanism. The rotation driver 932A is rotated by the rotational driving of the motor (not shown). The rotation arm 932B supports the rotation driver 932A. The rotation arm 932B is provided to be swingable in the horizontal direction. The rotation arm 932B is driven by, for example, a motor or an air cylinder (not shown). The rotation device 932 is provided to correspond to one peg 25 and the other peg 25 provided in pairs in the creel stand 20.

[0047] The rotation device 932 changes the direction of the peg 25 by rotating the peg 25 when attaching the yarn feeding package P1 to the peg 25. More specifically, the rotation device 932 swings the rotation arm 932B so that the rotation driver 932A engages with the peg 25. The rotation device 932 rotates the rotation driver 932A in one direction when the rotation driver 932A engages with the peg 25. Accordingly, the peg 25 rotates.

[0048] The collection device 933 is provided in the rotary table 936 rotatably supported by the base 931. The collection device 933 collects the yarn feeding bobbin B1 from the peg 25. The collection device 933 includes a yarn feeding bobbin support portion 933A which supports the yarn feeding bobbin B1. The collection device 933 supports the yarn feeding bobbin B1 by advancing the yarn feeding bobbin support portion 933A while the yarn feeding bobbin B1 is not supported by the peg 25 and collects the yarn feeding bobbin B1 from the peg 25 by retracting the yarn feeding bobbin support portion 933A while the yarn feeding bobbin B1 is supported by the peg 25.

[0049] The supply device 934 is provided in the rotary table 936 rotatably supported by the base 931. The supply device 934 supplies the yarn feeding package P1 to the peg 25. The supply device 934 includes a yarn feeding package supply unit 934A supporting the yarn feeding package P1. The supply device 934 attaches the yarn feeding package P1 to the peg 25 by advancing the yarn feeding package supply unit 934A while the yarn feeding package P1 is supported by the peg 25 and supplies the yarn feeding package P1 to the peg 25 by retracting the yarn feeding package supply unit 934A while the yarn feeding package P1 is not supported by the peg 25.

[0050] The package exchange device 9 releases the knot KN of the yarn feeding package P1 (knot releasing process) and connects the yarn ends of the pair of yarn feeding packages P1 and P1 attached to the pair of pegs 25 and 25 of the creel stand 20 (yarn joining process) together with the collection of the yarn feeding bobbin B1 from the peg 25 and the attachment of the yarn feeding package P1 to the peg 25. The knot releasing process and the yarn joining process are performed by the yarn joining processing device 9A. The yarn joining processing device 9A includes the yarn joining device 60, the knot releasing device 70, and the control unit 94.

[0051] The yarn joining device 60 is provided in the rotary table 936 rotatably supported by the base 931. The yarn joining device 60 performs yarn joining processing on the first yarn end Y1 of the yarn feeding package P1 supported by one peg 25 and the second yarn end Y2 of the yarn feeding package P1 supported by the other peg 25 or yarn joining processing on the second yarn end Y2 of the yarn feeding package P1 supported by one peg 25 and the first yarn end Y1 of the yarn feeding package P1 supported by the other peg 25. Hereinafter, the yarn feeding package P1 supported (attached) by one peg 25 is referred to as a first yarn feeding package (first yarn package) P11 and the yarn feeding package P1 supported (attached) by the other peg 25 is referred to as a second yarn feeding package (second yarn package) P12.

[0052] Additionally, the peg 25 on which the first yarn feeding package P11 is mounted constitutes a first mounting portion and the peg 25 on which the second yarn feeding package P12 is mounted constitutes a second mounting portion. The yarn joining device 60 constitutes the yarn joining portion which connects the first yarn end Y1 of the first yarn feeding package P11 to the second yarn end of the second yarn feeding package P12 or connects the second yarn end of the first yarn feeding package P11 to the first yarn end Y1 of the second yarn feeding package P12.

[0053] The rotary table 936 is rotated so that the yarn feeding bobbin support portion 933A is located in front of the target peg 25 when the yarn feeding bobbin B1 is collected. Further, the rotary table 936 is rotated so that the yarn feeding package supply unit 934A is located in front of the target peg 25 when the yarn feeding package P1 is supplied. Further, the rotary table 936 is rotated to be located in front of the target peg 25 when joining the yarn Y by the yarn joining device 60.

[0054] As shown in FIGS. 7 to 10, the knot releasing device 70 includes a suction gun (yarn capturing portion) 71, a receiving portion 72, an air cylinder (guide portion) 73, and a threading robot (yarn capturing portion moving portion) 74. The suction gun 71 captures the first yarn end Y1 which is an end of the yarn portion at the end of winding by suction (hereinafter also simply referred to as "capturing by suction"). The suction gun 71 is provided at the tip of the threading robot 74. The suction gun 71 includes a suction gun 711 and the suction mouth 712.

[0055] A suction hose 713 leading to a negative pressure source is connected to the suction gun 711, so that a suction flow is generated in the suction gun 71. The base end side of the suction gun 711 is connected to the threading robot 74. The suction mouth 712 is provided at the tip of the suction gun 711. The suction mouth 712 sucks the yarn Y. The suction mouth 712 has a hemispherical surface on the tip side. The suction mouth 712 is connected to the suction gun 711 through a shaft portion and is elastically moved by a spring or the like with respect to the suction gun 711 in the axial direction. The suction gun 71 is connected to the control unit 94 (see FIG. 6) and the capturing by suction is performed and stopped by the control unit 94.

[0056] As shown in FIGS. 7 to 9 and FIG. 11, the receiving portion 72 contacts the suction gun 71 to sandwich the first yarn end Y1 captured by the suction gun 71 to be sandwiched by the suction gun 71 and the receiving portion. Specifically, the receiving portion 72 contacts the tip side of the suction mouth 712 to sandwich the first yarn end Y1 captured by the suction mouth 712 by suction to be sandwiched by the suction mouth 712 and the receiving portion.

[0057] The receiving portion 72 includes an elastic member 721 provided with a concave portion 721h. The inner surface of the concave portion 721h includes a tapered surface which is inclined inward toward a bottom side. The concave portion 721h here has a hemispherical concave shape corresponding to the tip side of the suction mouth 712. The elastic member 721 is made of, for example, urethane rubber. The receiving portion 72 is located vertically below the center of the yarn feeding package P1 (one side in the direction orthogonal to the axial direction of the yarn feeding package P1). The receiving portion 72 includes a first receiving portion 72A which contacts the suction gun 71 so that the first yarn end Y1 of the first yarn feeding package P11 is sandwiched between the suction gun 71 and the first receiving portion and a second receiving portion 72B which contacts the suction gun 71 so that the first yarn end Y1 of the second yarn feeding package P12 is sandwiched between the suction gun 71 and the second receiving portion. For example, the first receiving portion 72A is disposed at one end side of the exchange unit 93 in the Y direction and the second receiving portion 72B is disposed at the other end side of the exchange unit 93 in the Y direction.

[0058] The air cylinder 73 guides the receiving portion 72 from a first position to a second position in a direction moving away from the yarn feeding package P1. The air cylinder 73 includes a piston rod 731 in which the receiving portion 72 is provided on the tip side and a cylinder tube 732 into which the piston rod 731 is inserted. The air cylinder 73 includes a throttle (not shown) that throttles the exhaust of air. The air cylinder 73 is connected to the control unit 94 and the supply of air to the air cylinder 73 is controlled by the control unit 94. The throttle of the air cylinder 73 can be realized, for example, by providing a

throttle valve on the exhaust side.

[0059] The piston rod 731 has, for example, a bar shape having a circular cross-section. The tip of the piston rod 731 is fixed to the end portion on the side opposite to the concave portion 721h in the receiving portion 72. The piston rod 731 is disposed to be inclined with respect to the horizontal direction so that the tip side becomes higher than the base end side in the axial direction. The piston rod 731 is disposed in an inclined manner to be located on the inside of the Y direction as it goes toward the tip side. The center of the concave portion 721h of the receiving portion 72 is located on the axis of the piston rod 731. The cylinder tube 732 has, for example, a cylindrical shape. The cylinder tube 732 is supported by a frame 93F of the exchange unit 93 through a bracket BR1.

[0060] For example, when air is supplied to such an air cylinder 73, the piston rod 731 extends and the receiving portion 72 is located at the first position (see FIG. 15(a)). In this state, the throttle acts as a resistance and prevents air from being exhausted from the air cylinder 73. Accordingly, an urging force that urges the receiving portion 72 from the second position toward the first position is generated and the receiving portion 72 is held at the first position. Then, when the receiving portion 72 is pressed toward the cylinder tube 732 against the urging force, the piston rod 731 contracts and the receiving portion 72 moves along the axial direction of the piston rod 731 to the second position in a direction moving away from the yarn feeding package P1 (see FIG. 15(c)). Additionally, a throttle for restricting the exhaust of air in the air cylinder 73 constitutes an urging holding means urging the receiving portion 72 from the second position toward the first position and holding the receiving portion at the first position.

[0061] The first position is a position in a range in which the distance from the knot KN is equal to or shorter than the length from the knot KN to the first yarn end Y1. The first position is a position of the receiving portion 72 when the piston rod 731 of the air cylinder 73 is in the most extended state. The second position is a position farther from the yarn feeding package P1 than the first position. For example, the second position is separated from the first position by, for example, 100 mm or more. The second position is a position of the receiving portion 72 when the piston rod 731 of the air cylinder 73 is in the most retracted state. Further, the second position is a position in a range between one end and the other end of the yarn feeding package P1 in the width direction of the yarn feeding package P1 in a state in which the peg 25 is operated so that the end surface of the adapter 8 faces the suction gun 71.

[0062] The air cylinder 73 includes a first air cylinder (first guide portion) 73A which guides the first receiving portion 72A in a direction moving away from the first yarn feeding package P11 and a second air cylinder (second guide portion) 73B which guides the second receiving portion 72B in a direction moving away from the second yarn feeding package P12. The first position of the sec-

ond receiving portion 72B is lower than the first position of the first receiving portion 72A. The second position of the second receiving portion 72B is lower than the second position of the first receiving portion 72A. The first air cylinder 73A is disposed at one end side of the exchange unit 93 in the Y direction and the second air cylinder 73B is disposed at the other end side of the exchange unit 93 in the Y direction.

[0063] As shown in FIGS. 7 to 10, the threading robot 74 moves the suction gun 71. The threading robot 74 is connected to the base end side of the suction gun 71. The threading robot 74 includes a link mechanism and a plurality of motors. The threading robot 74 is supported by the frame 93F of the exchange unit 93 through a bracket BR2. The threading robot 74 is disposed at the center portion of the exchange unit 93 in the Y direction. The threading robot 74 is located between the first receiving portion 72A and the second receiving portion 72B in the Y direction. The threading robot 74 is not particularly limited, and various known robot arms can be used.

[0064] The threading robot 74 is connected to the control unit 94. The threading robot 74 performs the knot releasing process under the control of the control unit 94. That is, the threading robot 74 allows the suction mouth 712 of the suction gun 71 to contact the receiving portion 72 at the first position and moves the suction mouth 712 to the second position in a direction moving away from the yarn feeding package P1 while guiding the receiving portion 72 by the air cylinder 73 in a state in which the suction mouth 712 contacts the receiving portion 72.

[0065] Specifically, the threading robot 74 allows the suction mouth 712 to contact the first receiving portion 72A at the first position corresponding to the first receiving portion 72A and moves the suction mouth 712 to the second position corresponding to the first receiving portion 72A in a direction moving away from the first yarn feeding package P11 while guiding the first receiving portion 72A by the first air cylinder 73A in a state in which the suction mouth 712 contacts the first receiving portion 72A. The threading robot 74 allows the suction mouth 712 to contact the second receiving portion 72B at the first position corresponding to the second receiving portion 72B and moves the suction mouth 712 to the second position corresponding to the second receiving portion 72B in a direction moving away from the second yarn feeding package P12 while guiding the second receiving portion 72B by the second air cylinder 73B in a state in which the suction mouth 712 contacts the second receiving portion 72B.

[0066] As shown in FIG. 6, the control unit 94 is an electronic control unit including a central processing unit (CPU), a read only memory (ROM), a random access memory (RAM), an I/O port, a communication port, and the like. The ROM stores a program for controlling each of the traveling unit 90, the elevating unit 91, the holding unit 92, and the exchange unit 93. Further, each function in the control unit 94 is executed under the control of the CPU by loading predetermined computer software on the

hardware such as the CPU and the main storage unit. The control unit 94 performs the knot releasing process by controlling at least the suction gun 71, the air cylinder 73, and the threading robot 74. The control unit 94 performs the yarn joining process by controlling at least the suction gun 71, the threading robot 74, and the yarn joining device 60.

[0067] Next, a series of operations including the knot releasing process of the yarn joining processing device 9A will be described in detail.

[0068] In the following description, an example of releasing the knot KN provided on the outer peripheral surface of the yarn layer YL of the first yarn feeding package P11 when joining the first yarn end Y1 of the first yarn feeding package P11 and the second yarn end of the second yarn feeding package P12 will be described with reference to FIGS. 12 to 16. Here, the first yarn feeding package P11 is a newly introduced package and the second yarn feeding package P12 is a package which is currently being wound.

[0069] As shown in FIG. 12, in the initial state, for example, the peg 25 is not operated by a peg rotation device (not shown) of the yarn joining device 60, the first yarn feeding package P11 does not rotate yet, and the end surface of the adapter 8 faces the side opposite to the suction gun 71. Air is not supplied to the first air cylinder 73A, the piston rod 731 contracts, and the first receiving portion 72A is located at the second position.

[0070] In such an initial state, as shown in FIG. 13, the peg 25 is first operated to rotate the first yarn feeding package P11 so that the end surface of the adapter 8 faces the suction gun 71. The control unit 94 controls the threading robot 74 so that the suction mouth 712 of the suction gun 71 is moved and the suction mouth 712 is brought into contact with the suction port of the holding hole portion 81 holding the first yarn end Y1 in the adapter 8. At the same time, the control unit 94 starts the suction by the suction gun 71 and captures the first yarn end Y1 by suction in the suction mouth 712. Further, the control unit 94 supplies air to the first air cylinder 73A, extends the piston rod 731, and positions the first receiving portion 72A at the first position.

[0071] Next, as shown in FIG. 14, the control unit 94 controls the threading robot 74 so that the suction mouth 712 capturing the first yarn end Y1 by suction is moved, the suction mouth 712 is brought into contact with the concave portion 721h of the first receiving portion 72A, and the first yarn end Y1 is sandwiched therebetween. In this state, as shown in FIG. 15(a), the control unit 94 controls the threading robot 74 so that the suction mouth 712 is pressed with respect to the concave portion 721h of the first receiving portion 72A against the urging force of the first air cylinder 73A along the axial direction of the piston rod 731. Accordingly, as shown in FIG. 15(b), the piston rod 731 contracts and the suction mouth 712 and the first receiving portion 72A move in a direction moving away from the first yarn feeding package P11 along the axial direction of the piston rod 731 while being guided

by the first air cylinder 73A in a contact state.

[0072] Then, the control unit 94 controls the threading robot 74 so that the suction mouth 712 is continuously pressed into the first receiving portion 72A. Accordingly, as shown in FIG. 15(c), the piston rod 731 further contracts and the suction mouth 712 and the first receiving portion 72A move to the second position in a direction moving away from the first yarn feeding package P11 along the axial direction of the piston rod 731 while being guided by the first air cylinder 73A in a contact state. As a result, as shown in FIG. 16, the first yarn end Y1 can be strongly pulled in a direction moving away from the first yarn feeding package P11 from the position of the first position PA of the first receiving portion 72A to the second position PB. As a result, the knot KN including the slip knot of the first yarn feeding package P11 is released.

[0073] Then, the control unit 94 controls the threading robot 74 so that the suction mouth 712 capturing the first yarn end Y1 by suction is moved to the yarn joining device 60, the suction by the suction mouth 712 is stopped to release the capturing by suction, and the first yarn end Y1 is set (guided) to the yarn joining device 60. Further, the control unit 94 controls the suction gun 71 and the threading robot 74 so that the second yarn end of the second yarn feeding package P12 is captured by the suction mouth 712 by suction, the suction mouth 712 is moved to the yarn joining device 60, the suction by the suction mouth 712 is stopped to release the capturing by suction, and the second yarn end of the second yarn feeding package P12 is set to the yarn joining device 60. Then, the control unit 94 controls the yarn joining device 60 so that the first yarn end Y1 of the first yarn feeding package P11 is joined (connected) to the second yarn end of the second yarn feeding package P12.

[0074] Additionally, a case of releasing the knot KN provided on the outer peripheral surface of the yarn layer YL of the second yarn feeding package P12 when joining the first yarn end Y1 of the second yarn feeding package P12 which is newly introduced and the second yarn end of the first yarn feeding package P11 which is currently being wound is also the same as the above-described example shown in FIGS. 12 to 15. In this case, as shown in FIG. 17, the first yarn end Y1 can be strongly pulled in a direction moving away from the second yarn feeding package P12 from the position of the first position PA of the second receiving portion 72B to the second position PB and the knot KN including the slip knot of the second yarn feeding package P12 can be released.

[0075] As described above, in the knot releasing device 70, the suction gun 71 capturing the first yarn end Y1 is brought into contact with the receiving portion 72 to sandwich the yarn Y therebetween. Then, the receiving portion 72 is guided by the air cylinder 73 in this state so that the first yarn end Y1 is strongly pulled in a direction moving away from the yarn feeding package P1 (the first yarn end Y1 is pulled in a clamp state) and the knot KN including the slip knot can be released. Thus, according

to the knot releasing device 70, the knot KN including the slip knot of the yarn feeding package P1 can be released without supplying a large amount of compressed fluid causing a negative pressure for strongly pulling the yarn Y to the suction gun 71 and providing a yarn sandwiching mechanism for sandwiching the yarn Y in the suction gun 71.

[0076] In the knot releasing device 70, the first position is a position in a range in which the distance from the knot KN is equal to or shorter than the length from the knot KN to the first yarn end Y1. In this case, the suction gun 71 capturing the yarn portion at the end of winding of the yarn layer YL in the yarn feeding package P1 can be reliably brought into contact with the receiving portion 72. Further, the second position is a position in a range between one end and the other end of the yarn feeding package P1 in the width direction of the yarn feeding package P1. In this case, when the receiving portion 72 is guided by the air cylinder 73 so that the first yarn end Y1 is strongly pulled in a direction moving away from the yarn feeding package P1, the yarn portion at the end of winding of the yarn layer YL wound on the yarn feeding bobbin B1 can be suppressed from moving in the width direction of the yarn feeding package P1 until the yarn portion comes off from the yarn feeding bobbin B1.

[0077] In the knot releasing device 70, the air cylinder 73 urges the receiving portion 72 from the second position toward the first position to be held at the first position. In this case, the suction gun 71 and the receiving portion 72 are in close contact with each other and the yarn Y can be reliably sandwiched.

[0078] In the knot releasing device 70, the receiving portion 72 includes the elastic member 721 provided with the concave portion 721h and the inner surface of the concave portion 721h includes a tapered surface which is inclined inward toward a bottom side. Accordingly, when the suction gun 71 capturing the first yarn end Y1 contacts the receiving portion 72, the yarn Y can be reliably sandwiched therebetween.

[0079] In the knot releasing device 70, the suction gun 71 is provided at the tip of the threading robot 74. Accordingly, the threading robot 74 can easily operate the suction gun 71.

[0080] In the knot releasing device 70, the knot KN is located at one side with respect to the center of the yarn feeding package P1 in a direction orthogonal to the axial direction of the yarn feeding package P1. The receiving portion 72 is located at the same side as the knot KN with respect to the center of the yarn feeding package P1. In this case, the first yarn end Y1 can be efficiently guided in a direction moving away from the yarn feeding package P1.

[0081] In the knot releasing device 70, the yarn feeding package P1 includes the first yarn feeding package P11 and the second yarn feeding package P12, the receiving portion 72 includes the first receiving portion 72A and the second receiving portion 72B, and the air cylinder 73 includes the first air cylinder 73A and the second air cylinder 73B.

der 73B. The threading robot 74 allows the suction gun 71 to contact the first receiving portion 72A at the first position corresponding to the first receiving portion 72A and moves the suction gun 71 to the second position corresponding to the first receiving portion 72A in a direction moving away from the yarn feeding package P1 while guiding the first receiving portion 72A by the first air cylinder 73A in a state in which the suction gun 71 contacts the first receiving portion 72A. Further, the threading robot 74 allows the suction gun 71 to contact the second receiving portion 72B at the first position corresponding to the second receiving portion 72B and moves the suction gun 71 to the second position corresponding to the second receiving portion 72B in a direction moving away from the yarn feeding package P1 while guiding the second receiving portion 72B by the second air cylinder 73B in a state in which the suction gun 71 contacts the second receiving portion 72B. According to such a configuration, it is possible to release the knot KN corresponding to each of two yarn feeding packages P1.

[0082] Since the yarn joining processing device 9A and the yarn feeding device 100 include the knot releasing device 70, it is possible to release the knot KN including the slip knot of the yarn feeding package P1 without supplying a large amount of compressed fluid causing a negative pressure for strongly pulling the yarn Y to the suction gun 71 and providing a yarn sandwiching mechanism for sandwiching the yarn Y in the suction gun 71 as described above.

[0083] In this embodiment, the yarn feeding package P1 may be rotated or the yarn feeding package P1 may not be rotated so the tension is applied to the yarn portion at the end of winding of the yarn layer YL of the yarn feeding package P1 while the suction gun 71 capturing the first yarn end Y1 is brought into contact with the receiving portion 72 to sandwich the yarn Y. When the yarn feeding package P1 is not rotated, energy consumption can be reduced. Further, in this embodiment, the suction by the suction gun 71 may be continued or the suction may be stopped while the suction gun 71 capturing the first yarn end Y1 is brought into contact with the receiving portion 72 to sandwich the yarn Y. When the suction by the suction gun 71 stops, energy consumption can be reduced.

[0084] Although the embodiment of an aspect of the present invention has been described above, an aspect of the present invention is not necessarily limited to the above-described embodiment, and various modifications can be made without departing from the gist of the present invention.

[0085] In the above-described embodiment, an example has been described in which the control unit 94 that comprehensively controls the traveling unit 90, the elevating unit 91, the holding unit 92, the exchange unit 93, and the yarn joining device 60 of the package exchange device 9 controls the knot releasing device 70, but the present invention is not limited thereto. The control unit 94 may be provided to exclusively control the knot re-

leasing device 70. Further, the control unit 94 may not be provided in the package exchange device 9, but may be provided at a position remote from the package exchange device 9 to communicate with the package exchange device by wire or wirelessly.

[0086] In the above-described embodiment and the above-described modified example, a magnetic force using a magnet may be used for the contact of the suction mouth 712 of the suction gun 71 with respect to the receiving portion 72. In the above-described embodiment and the above-described modified example, the receiving portion 72 is urged from the second position toward the first position by the throttle of the exhaust of the air cylinder 73, but the present invention is not limited thereto. For example, the receiving portion 72 may be urged from the second position toward the first position by the elastic force of the spring and the magnetic force of the magnet. In the above-described embodiment and the above-described modified example, the false twisting machine 1 has been described as an example of the yarn processing device, but the present invention is not limited thereto. That is, as an example of the processing portion 3, a device for twisting (false twisting) has been described, but a device for non-twisting (air jet processing) may be applied.

[0087] In the air cylinder 73 of the above-described embodiment and the above-described modified example, in order to make the movement smooth when the piston rod 731 is extended to move (advance) the receiving portion 72 in a direction moving close to the yarn feeding package P1, the throttle of the exhaust may be configured in a one-way direction. In the air cylinder 73 of the above-described embodiment and the above-described modified example, since air is released from the air cylinder 73 when the receiving portion 72 moves in a direction moving away from the yarn feeding package P1 and is located at the second position, the resistance (urging force) may not be maintained. In the air cylinder 73 of the above-described embodiment and the above-described modified example, the first yarn end Y1 may be sandwiched between the receiving portion 72 and the suction gun 71 by using the urging force only while the suction mouth 712 is pressed into the receiving portion 72 to move the receiving portion 72.

REFERENCE SIGNS LIST

[0088] 9A: yarn joining processing device, 20: creel stand (yarn feeding stand), 25: peg (first mounting portion, second mounting portion), 60: yarn joining device (yarn joining portion), 70: knot releasing device (yarn package knot releasing device), 71: suction gun (yarn capturing portion), 72: receiving portion, 72A: first receiving portion, 72B: second receiving portion, 73: air cylinder (guide portion), 73A: first air cylinder (first guide portion), 73B: second air cylinder (second guide portion), 74: threading robot (yarn capturing portion moving portion), 100: yarn feeding device, 721: elastic member, 721h:

concave portion, B1: yarn feeding bobbin (bobbin), KN: knot, PA: first position, PB: second position, P1: yarn feeding package (yarn package), P11: first yarn feeding package (first yarn package), P12: second yarn feeding package (second yarn package), Y: yarn, YL: yarn layer, Y1: first yarn end (end of yarn portion at the end of winding, yarn end on outer layer side).

Claims

1. A yarn package knot releasing device (70) for releasing a knot in a yarn package (P1) in which a yarn portion at the end of winding of a yarn layer (YL) formed by winding a yarn (Y) on a bobbin (B1) is tied on an outer peripheral surface of the yarn layer by a knot (KN) including a slip knot, comprising:

a yarn capturing portion (71) which captures an end (Y1) of the yarn portion at the end of winding by suction;

a receiving portion (72) which contacts the yarn capturing portion so that the end of the yarn portion at the end of winding captured by the yarn capturing portion is sandwiched between the yarn capturing portion and the receiving portion; a guide portion (73) which guides the receiving portion from a first position (PA) to a second position (PB) in a direction moving away from the yarn package; and

a yarn capturing portion moving portion (74) which allows the yarn capturing portion to contact the receiving portion at the first position and moves the yarn capturing portion to the second position in a direction moving away from the yarn package while guiding the receiving portion by the guide portion in a state in which the yarn capturing portion contacts the receiving portion.

2. The yarn package knot releasing device according to claim 1, wherein the first position is a position in a range in which a distance from the knot is equal to or shorter than a length from the knot to the end of the yarn portion at the end of winding.
3. The yarn package knot releasing device according to claim 1 or 2, wherein the second position is a position in a range between one end and the other end of the yarn package in a width direction of the yarn package.
4. The yarn package knot releasing device according to any one of claims 1 to 3, wherein the guide portion includes an urging holding means configured to urge the receiving portion from the second position toward the first position and hold the receiving portion at the first position.

5. The yarn package knot releasing device according to any one of claims 1 to 4,

wherein the receiving portion includes an elastic member (721) provided with a concave portion (721h), and wherein an inner surface of the concave portion includes a tapered surface which is inclined inward toward a bottom side.

6. The yarn package knot releasing device according to any one of claims 1 to 5, wherein the yarn capturing portion is provided at a tip of the yarn capturing portion moving portion.

7. The yarn package knot releasing device according to any one of claims 1 to 6,

wherein the knot is located on one side with respect to the center of the yarn package in a direction orthogonal to an axial direction of the yarn package, and wherein the receiving portion is located on the same one side as the knot with respect to the center of the yarn package.

8. The yarn package knot releasing device according to any one of claims 1 to 7,

wherein the yarn package includes a first yarn package (P11) and a second yarn package (P12),

wherein the receiving portion includes a first receiving portion (72A) which contacts the yarn capturing portion so that the end of the yarn portion at the end of winding of the first yarn package is sandwiched between the yarn capturing portion and the first receiving portion and a second receiving portion (72B) which contacts the yarn capturing portion so that the end of the yarn portion at the end of winding of the second yarn package is sandwiched between the yarn capturing portion and the second receiving portion, wherein the guide portion includes a first guide portion (73A) which guides the first receiving portion in a direction moving away from the yarn package and a second guide portion (73B) which guides the second receiving portion in a direction moving away from the yarn package, wherein the yarn capturing portion moving portion allows the yarn capturing portion to contact the first receiving portion at the first position corresponding to the first receiving portion and moves the yarn capturing portion to the second position corresponding to the first receiving portion in a direction moving away from the yarn package while guiding the first receiving portion by the first guide portion in a state in which the

yarn capturing portion contacts the first receiving portion, and
 wherein the yarn capturing portion moving portion allows the yarn capturing portion to contact the second receiving portion at the first position corresponding to the second receiving portion and moves the yarn capturing portion to the second position corresponding to the second receiving portion in a direction moving away from the yarn package while guiding the second receiving portion by the second guide portion in a state in which the yarn capturing portion contacts the second receiving portion.

9. A yarn joining processing device (9A) comprising: 15

the yarn package knot releasing device according to claim 8; and
 a yarn joining portion (60) which connects a yarn end on an outer layer side of a first yarn package to a yarn end on an inner layer side of a second yarn package or connects a yarn end on an inner layer side of the first yarn package to a yarn end on an outer layer side of the second yarn package.

10. A yarn feeding device (100) comprising:

a yarn feeding stand (20) which includes a first mounting portion (25) allowing a first yarn package to be mounted thereon and a second mounting portion (25) allowing a second yarn package to be mounted thereon;
 the yarn package knot releasing device according to claim 8; and
 a yarn joining portion (60) which connects a yarn end on an outer layer side of the first yarn package to a yarn end on an inner layer side of the second yarn package or connects a yarn end on an inner layer side of the first yarn package to a yarn end on an outer layer side of the second yarn package.

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Fig. 1

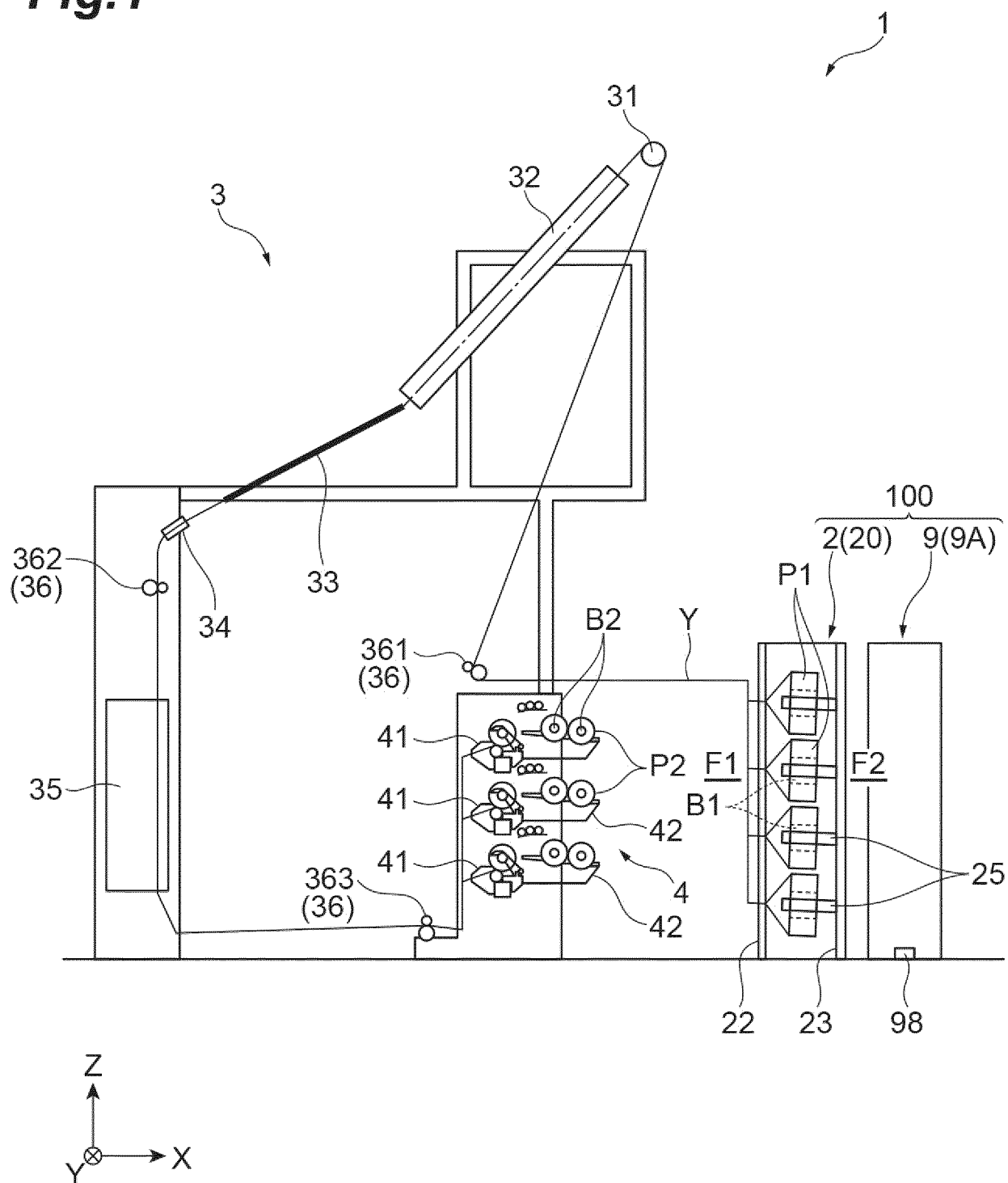


Fig.2

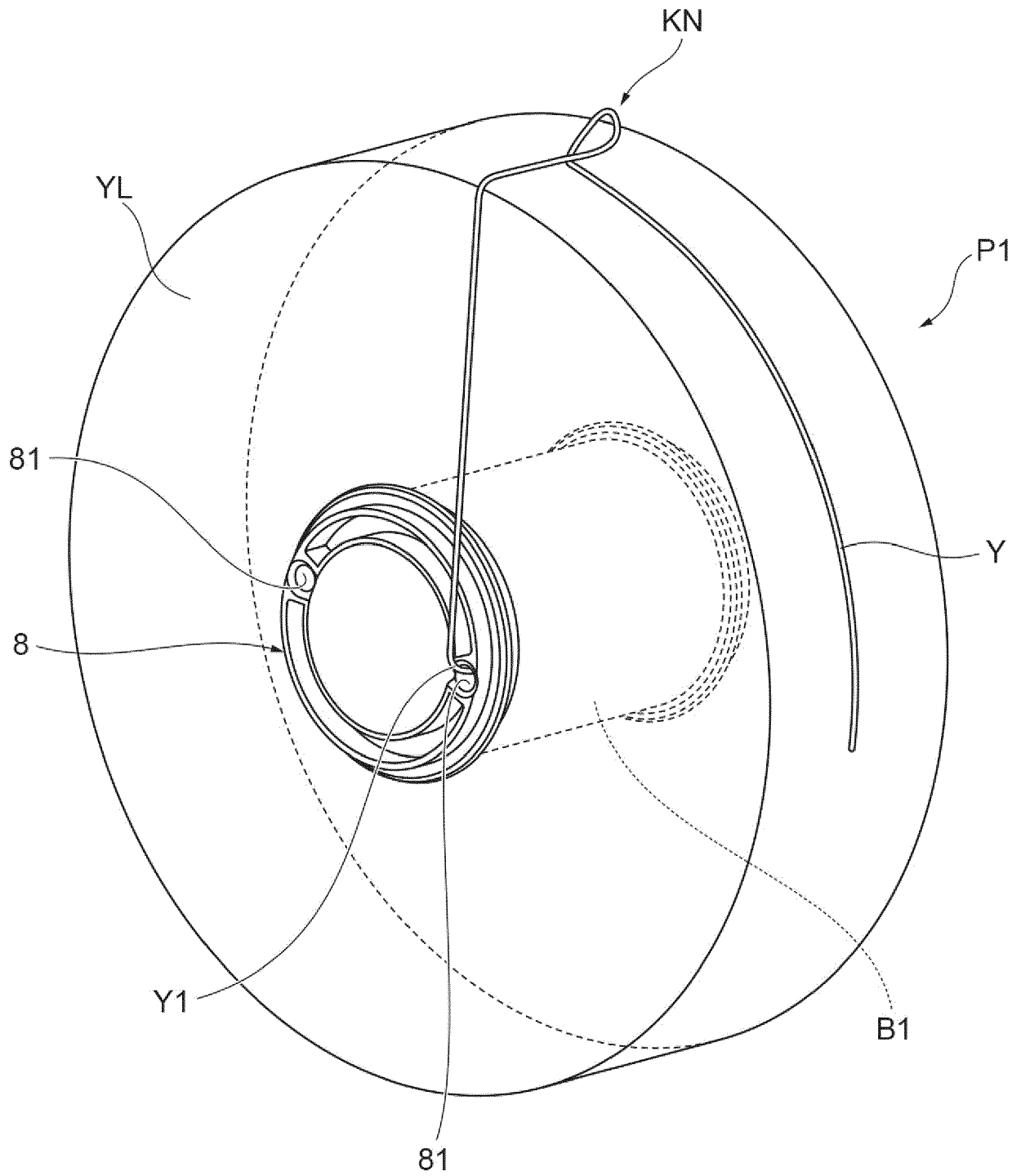


Fig.3

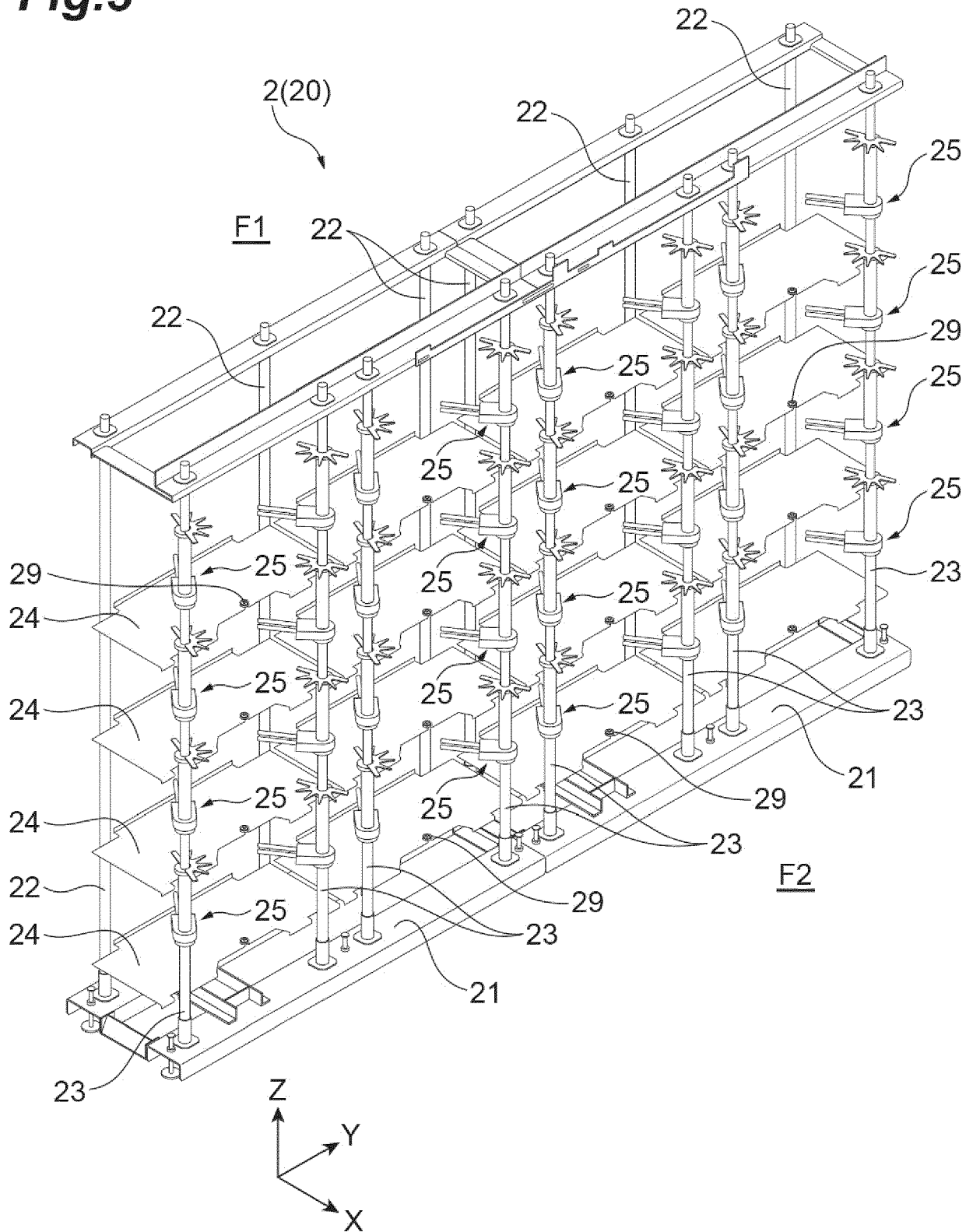


Fig.4

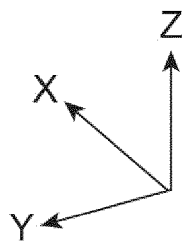
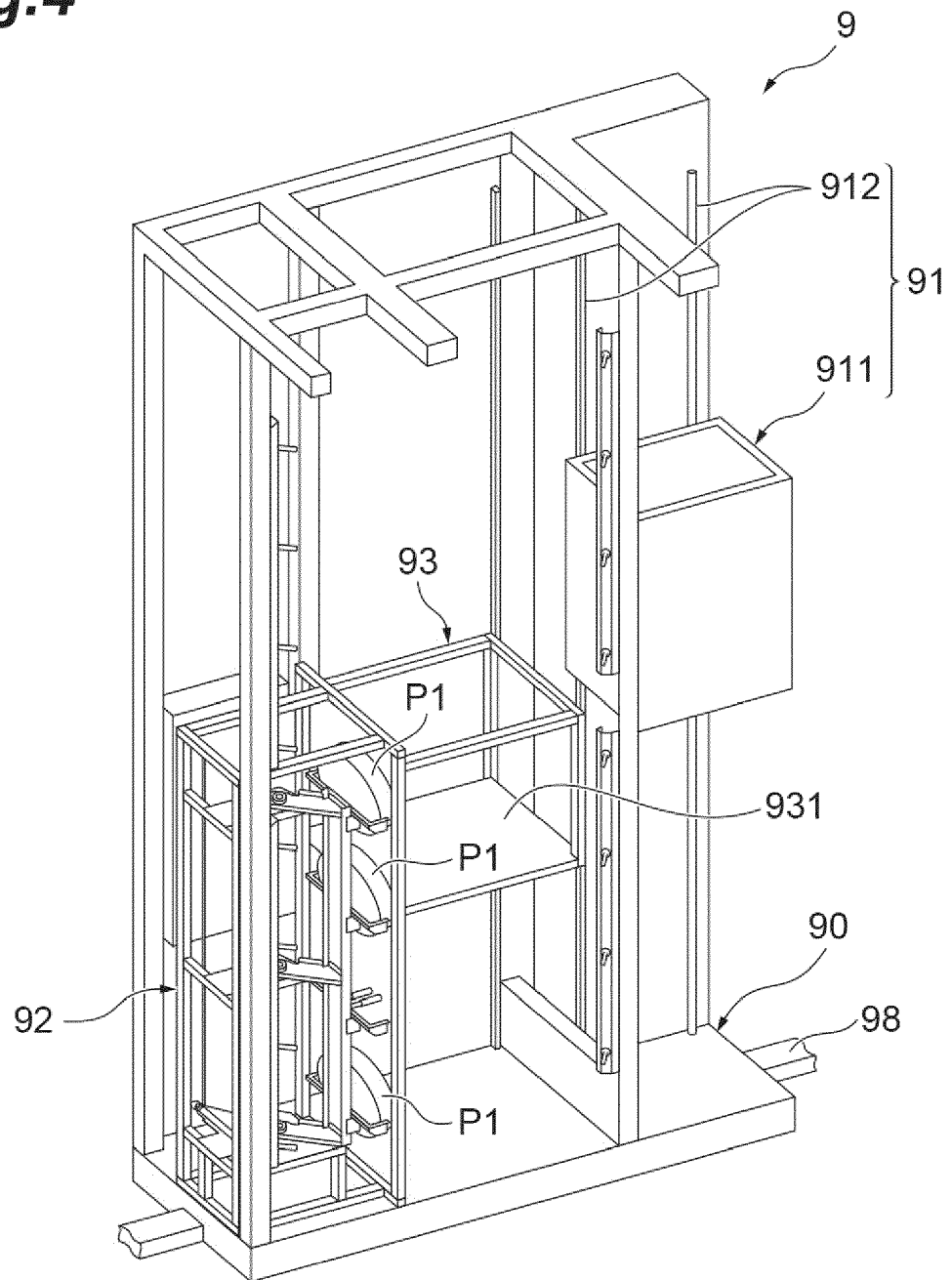


Fig.5

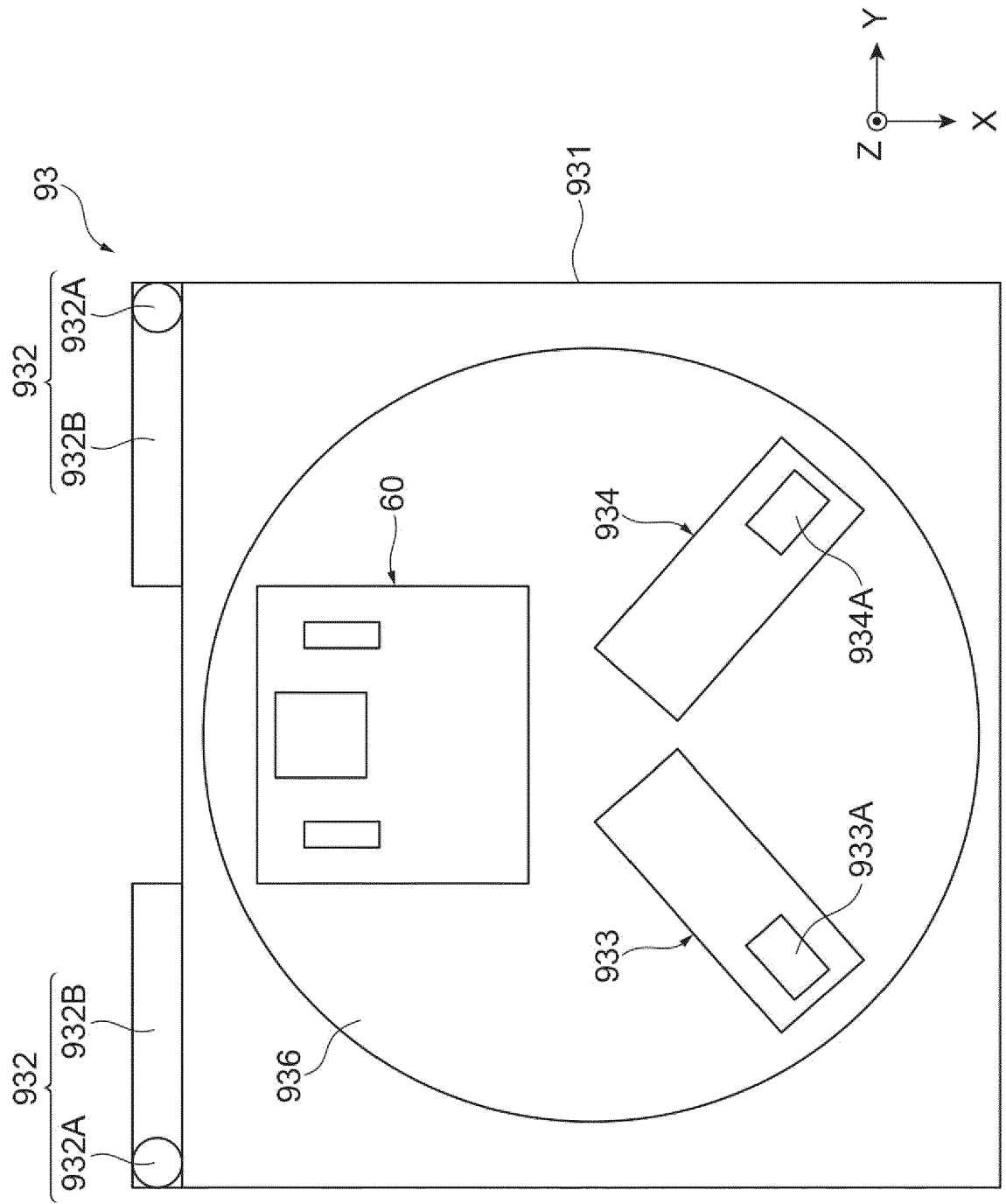


Fig.6

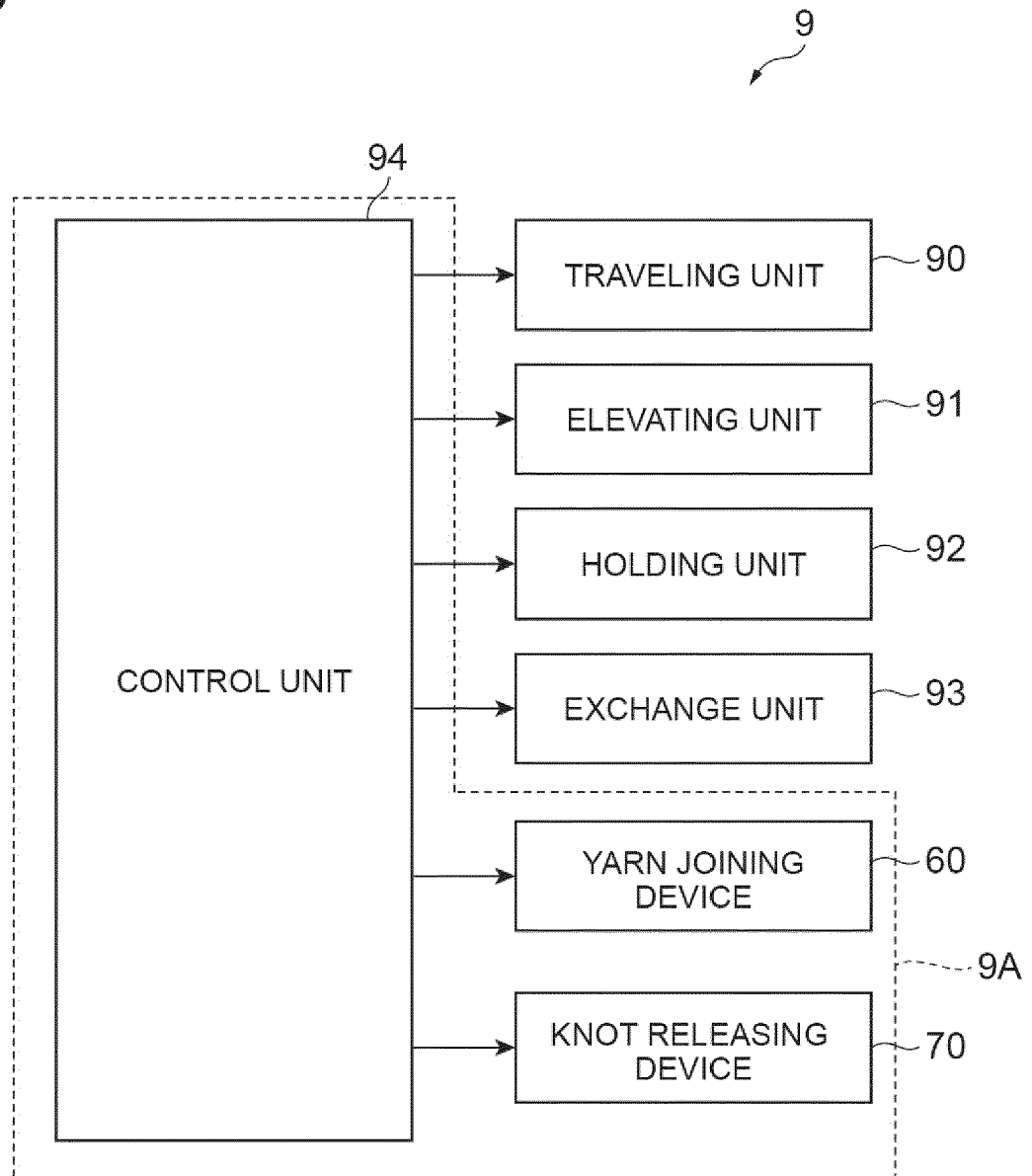


Fig.7

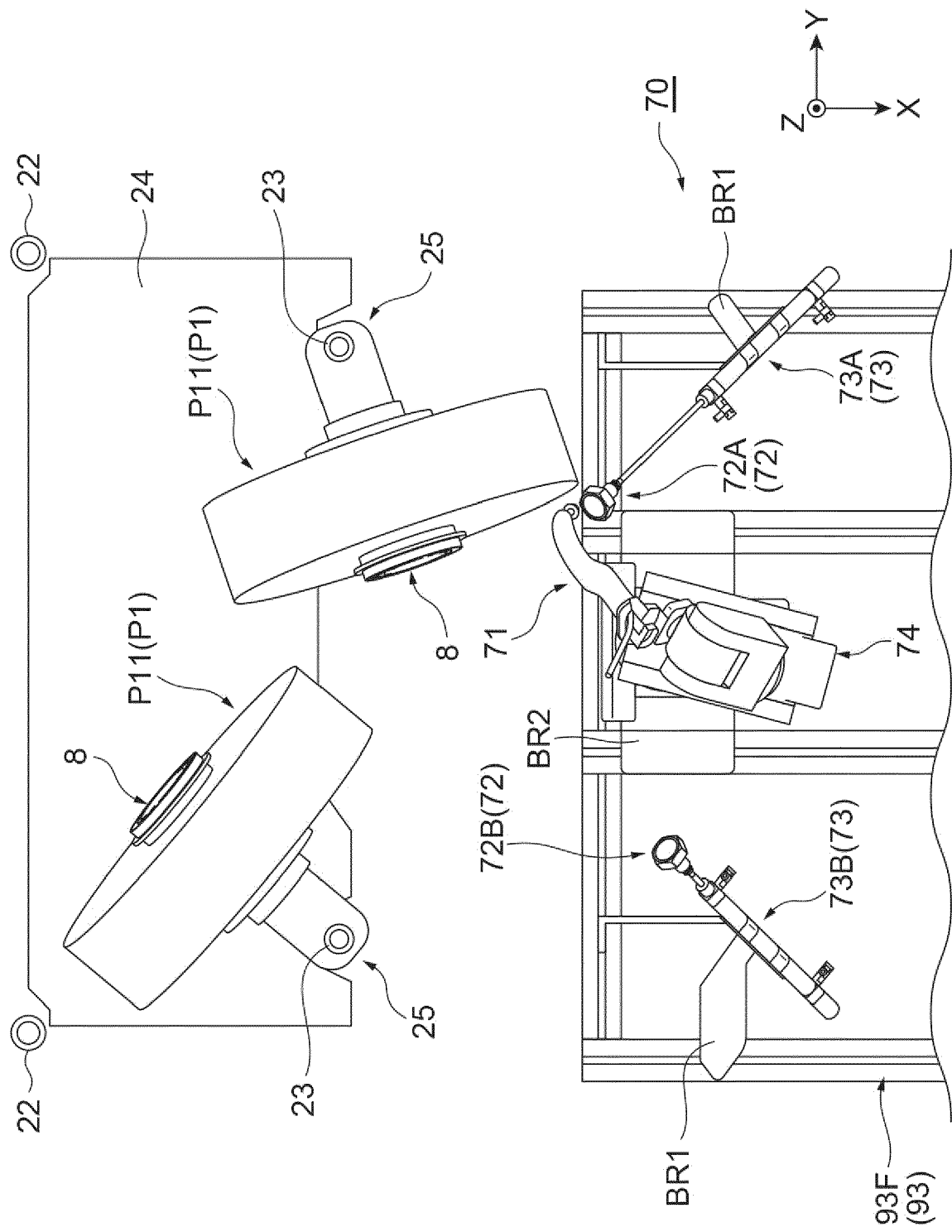


Fig.8

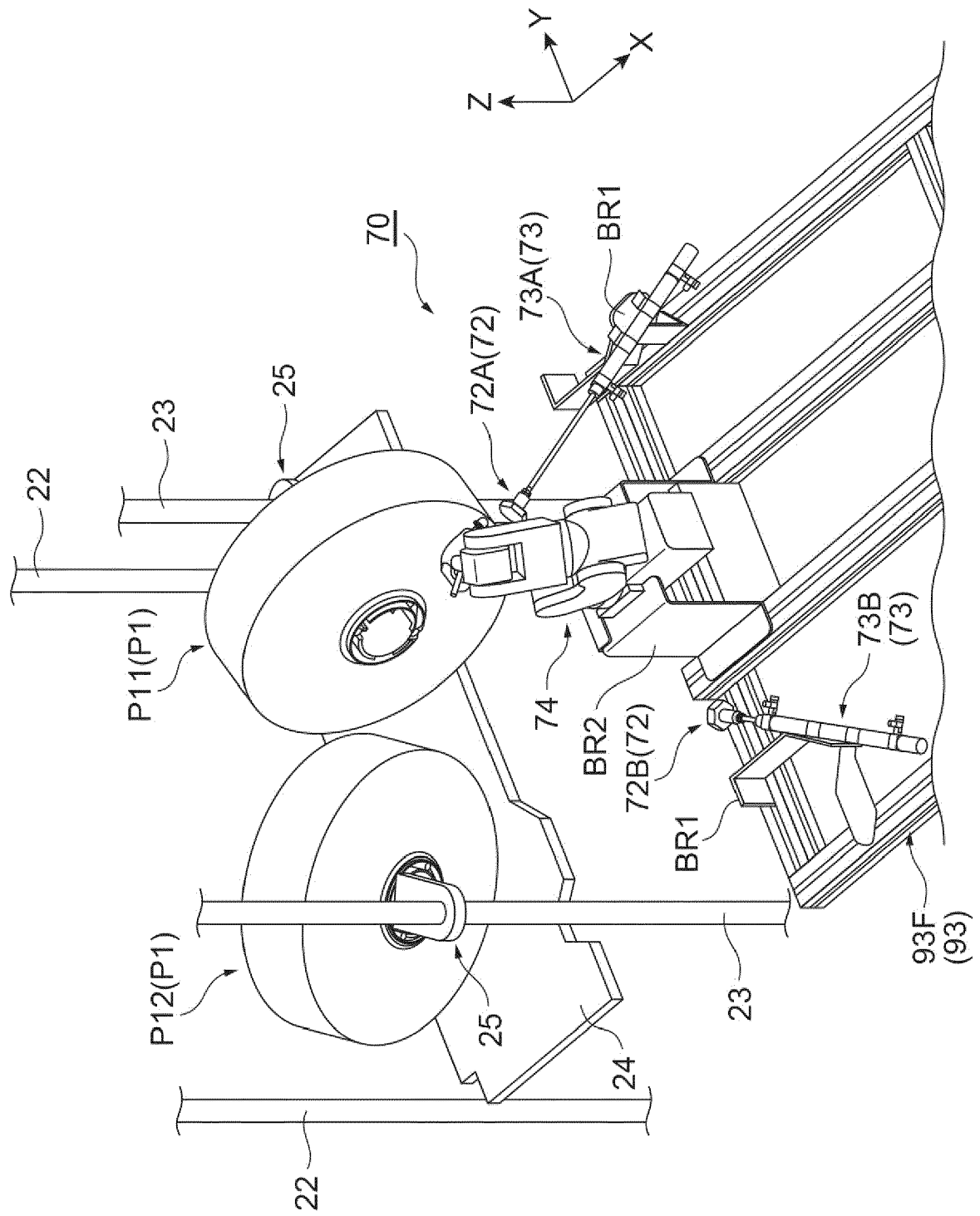
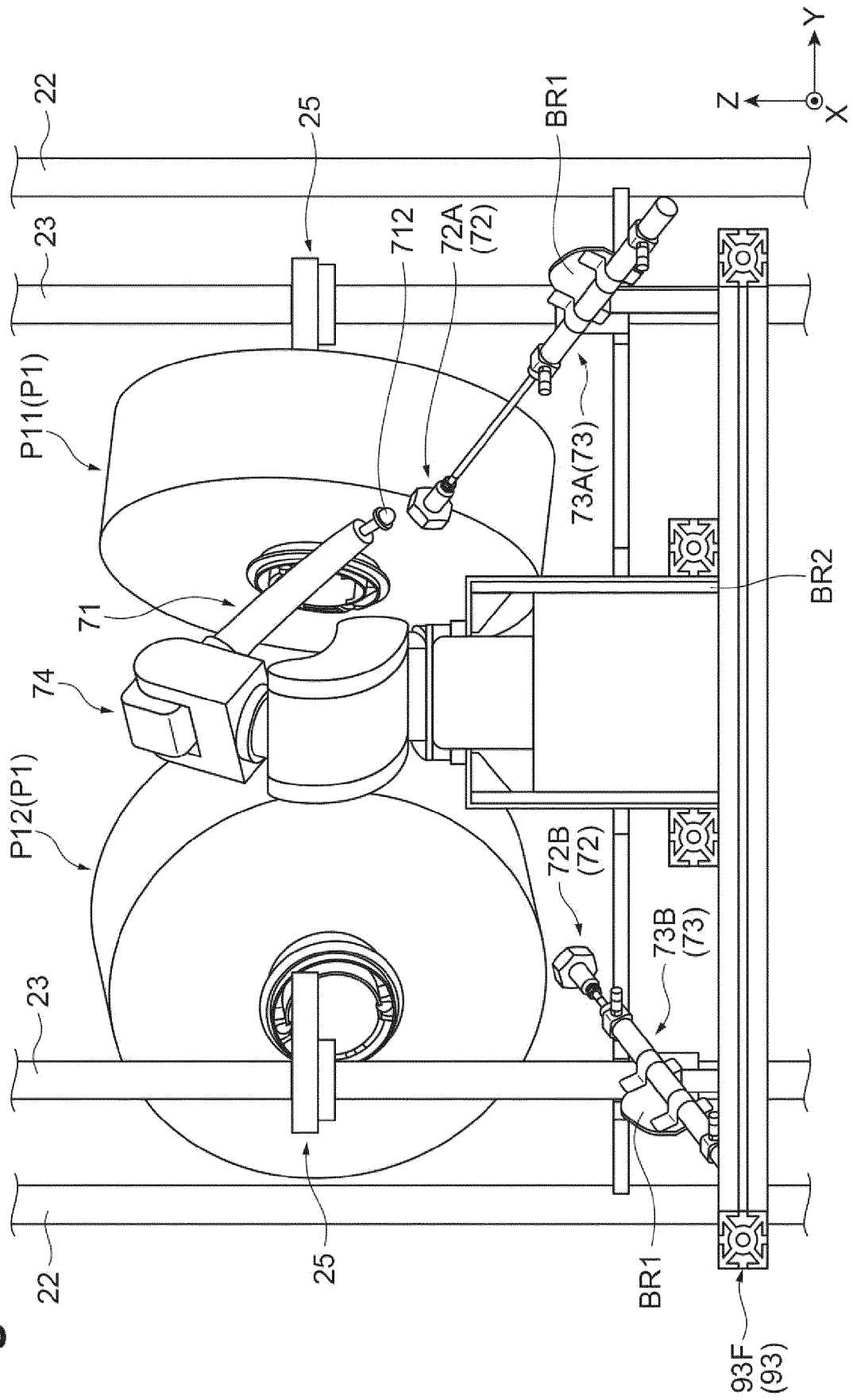


Fig. 9



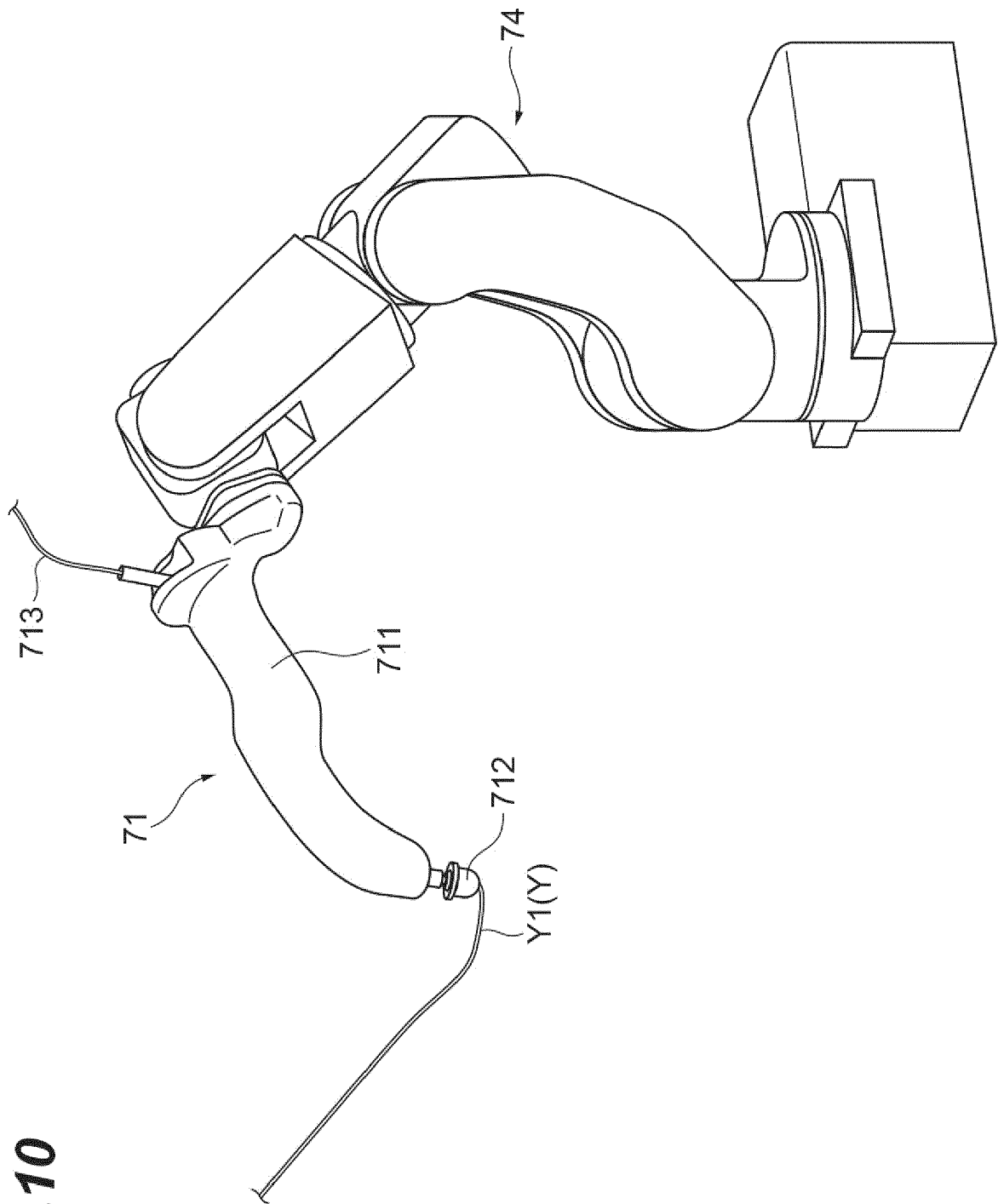


Fig. 10

Fig.11

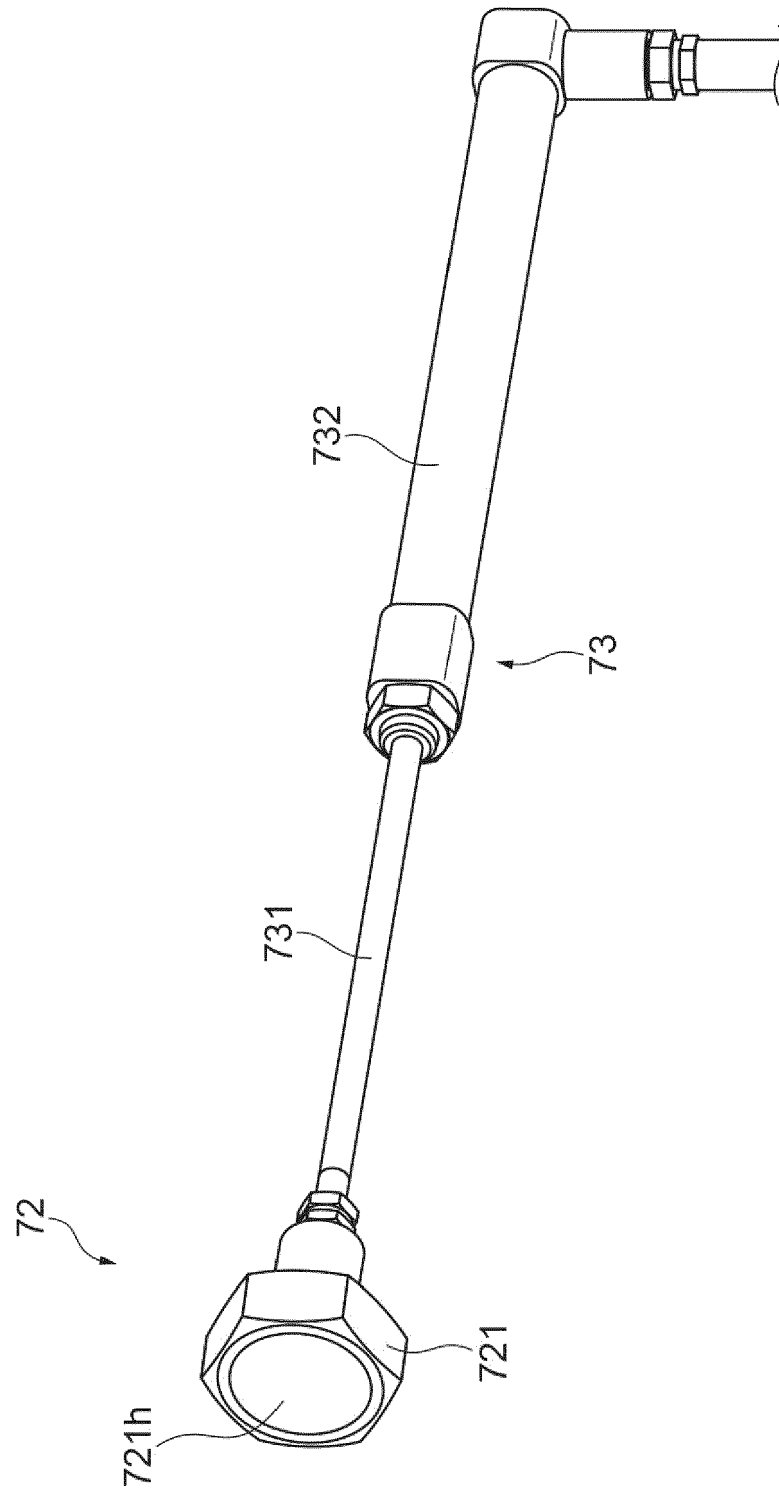


Fig.12

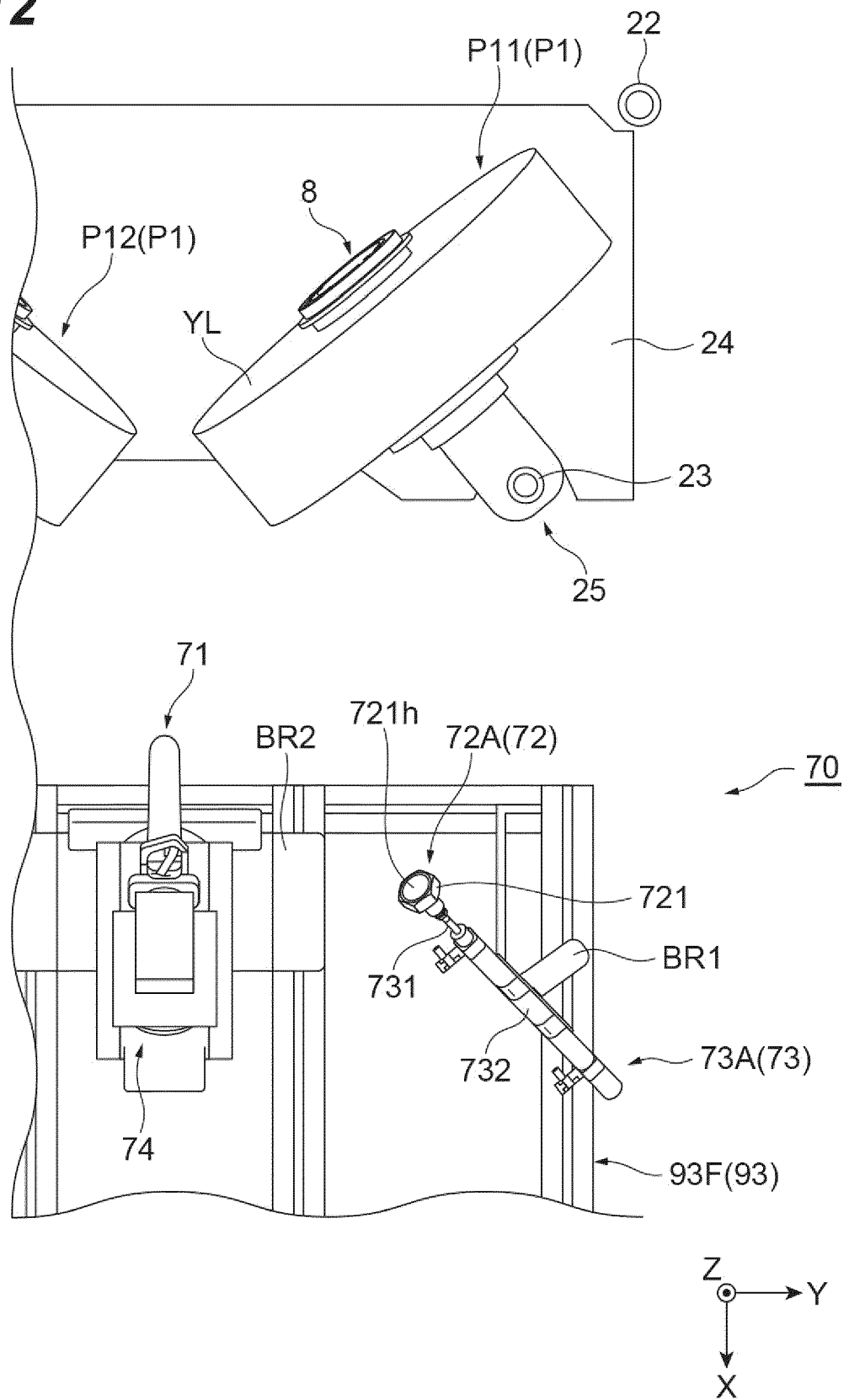


Fig.13

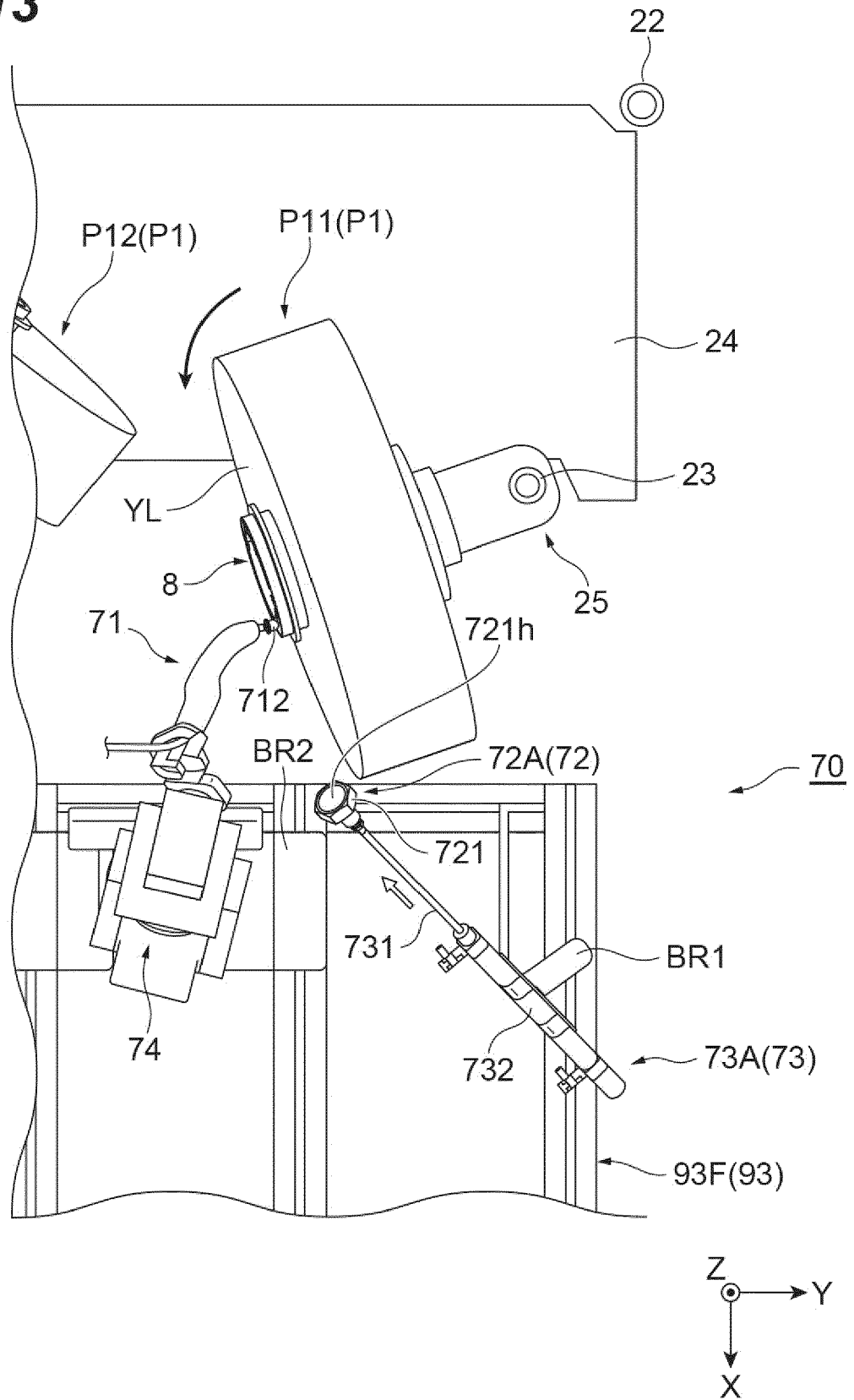


Fig.14

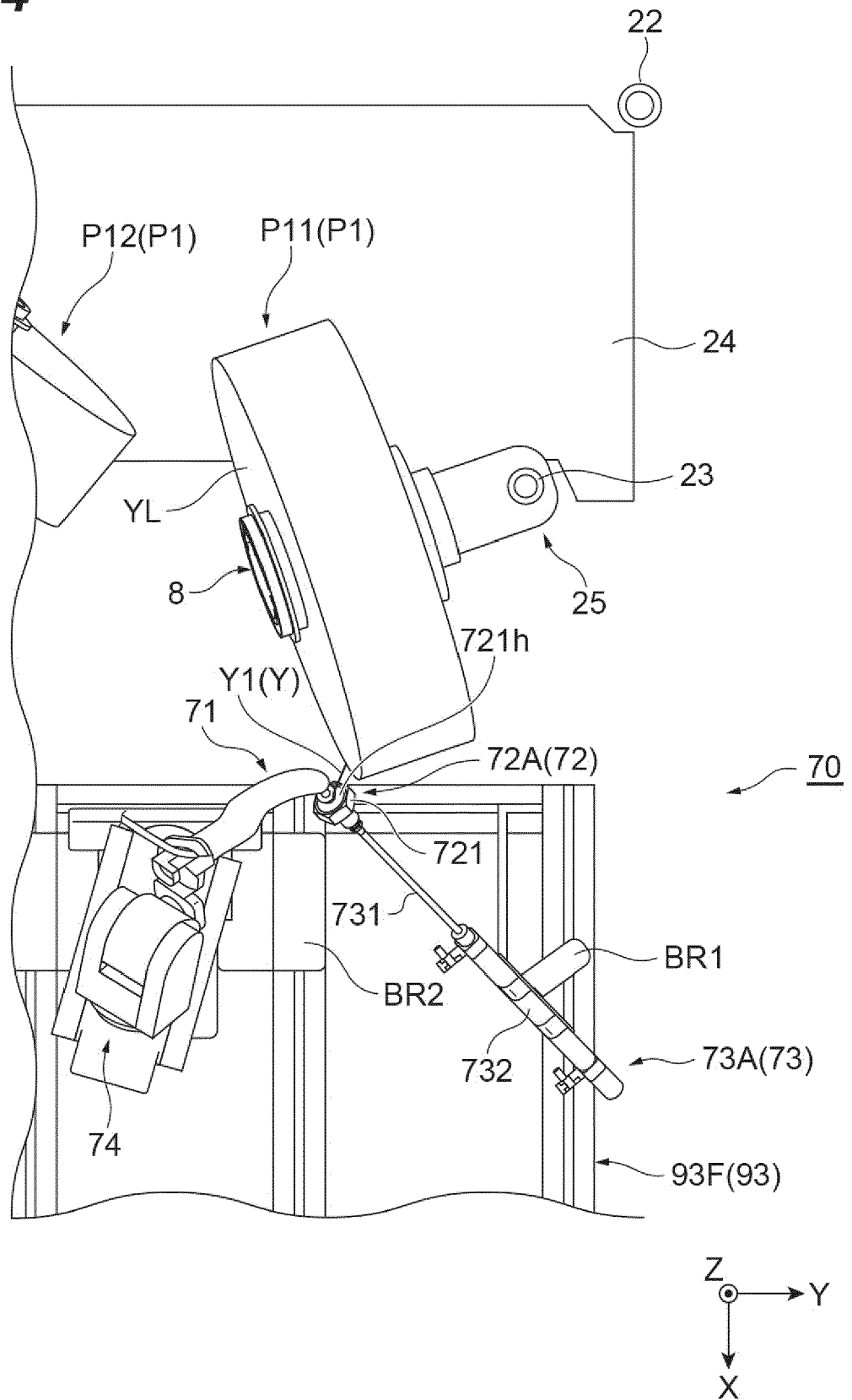


Fig.15

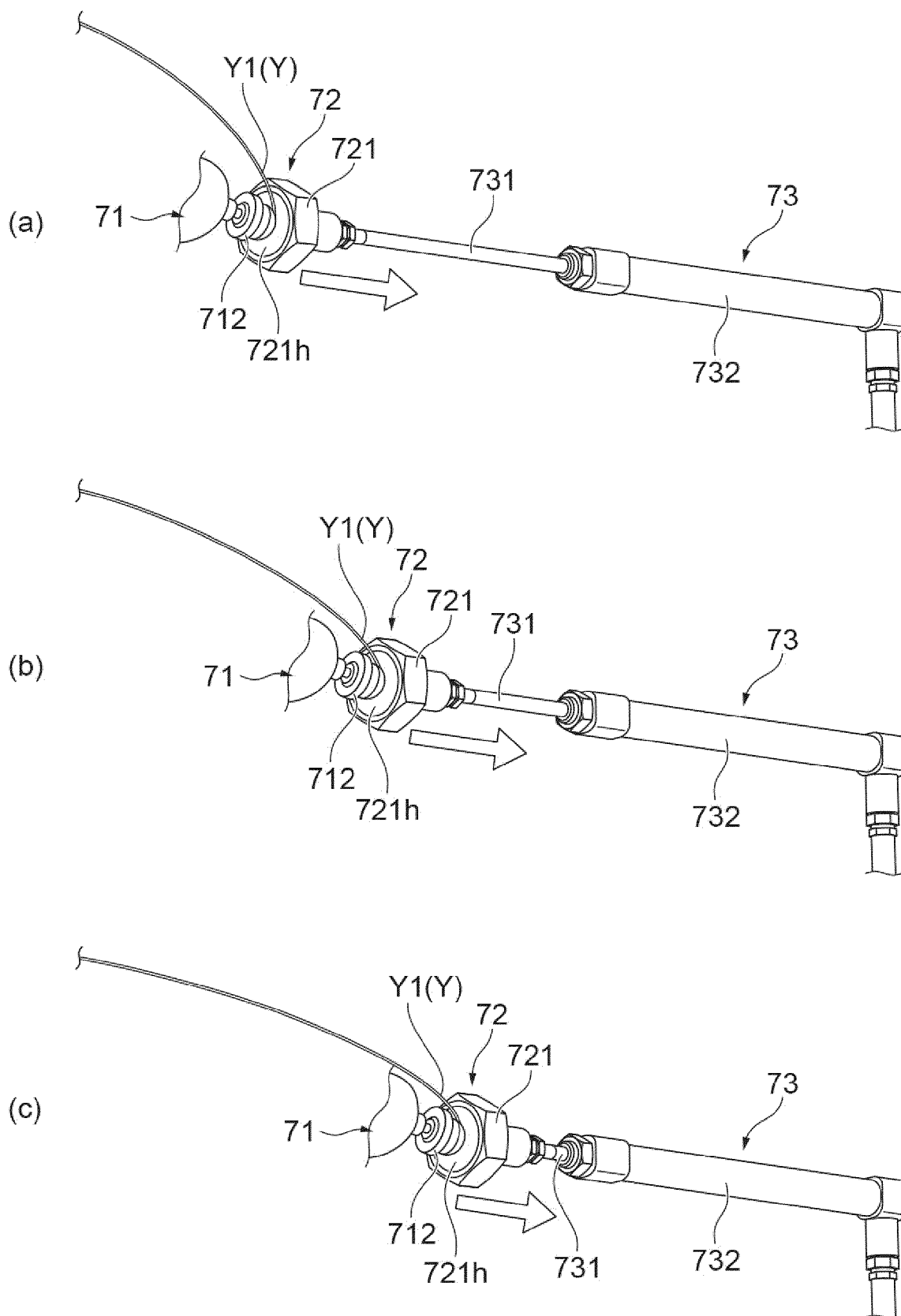


Fig.16

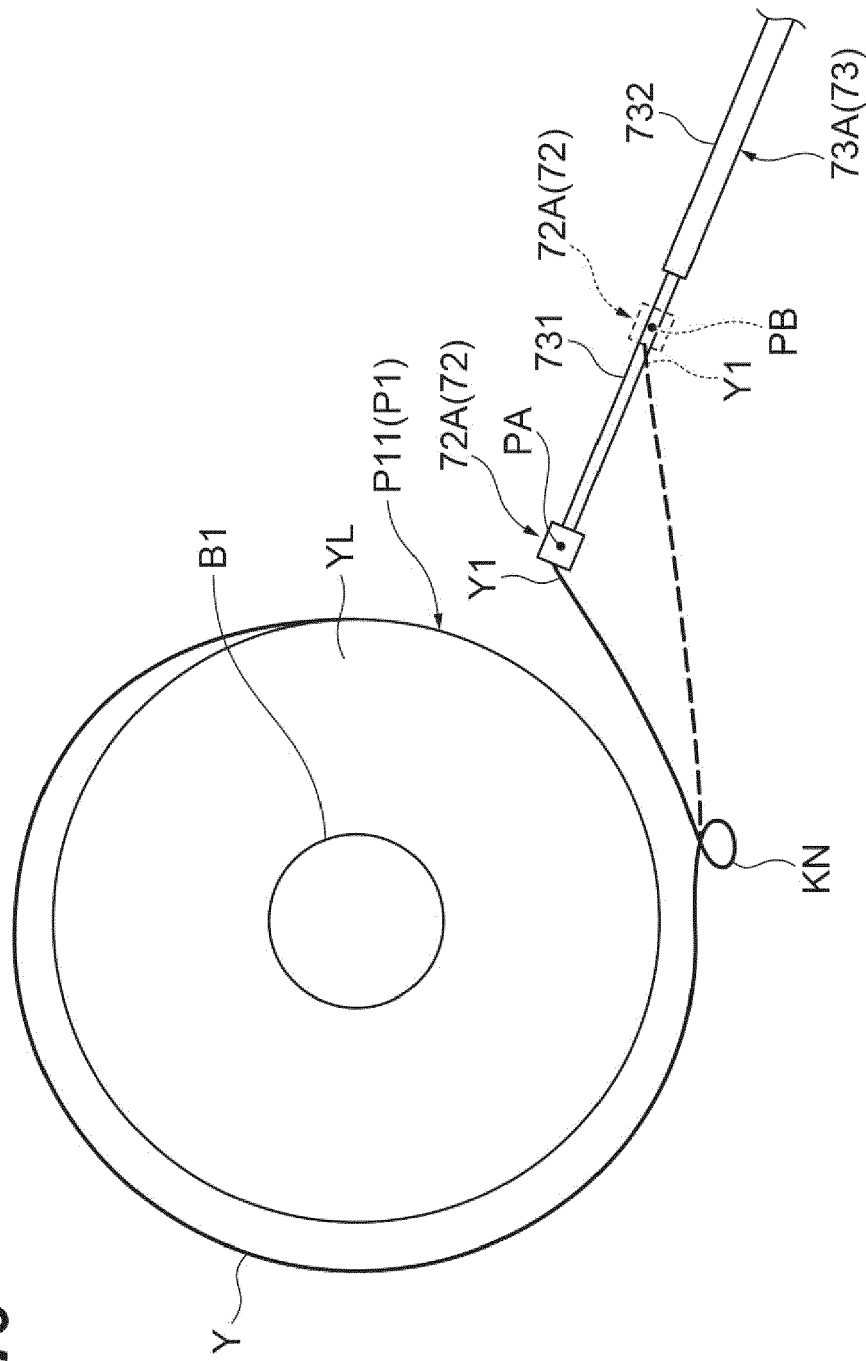
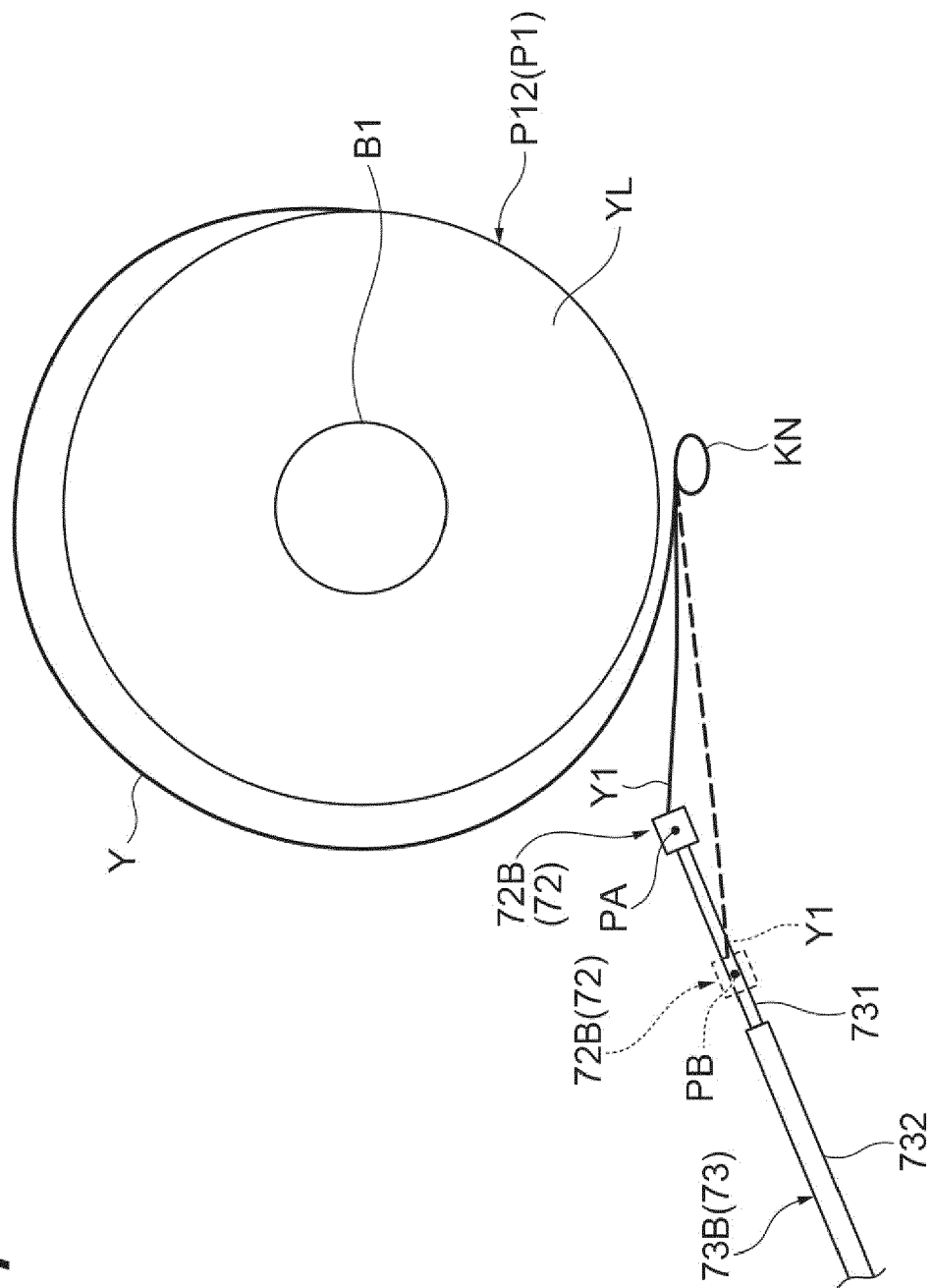


Fig.17





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Application Number

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			TECHNICAL FIELDS SEARCHED (IPC)
			B65H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 28 April 2023	Examiner Pussemier, Bart
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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