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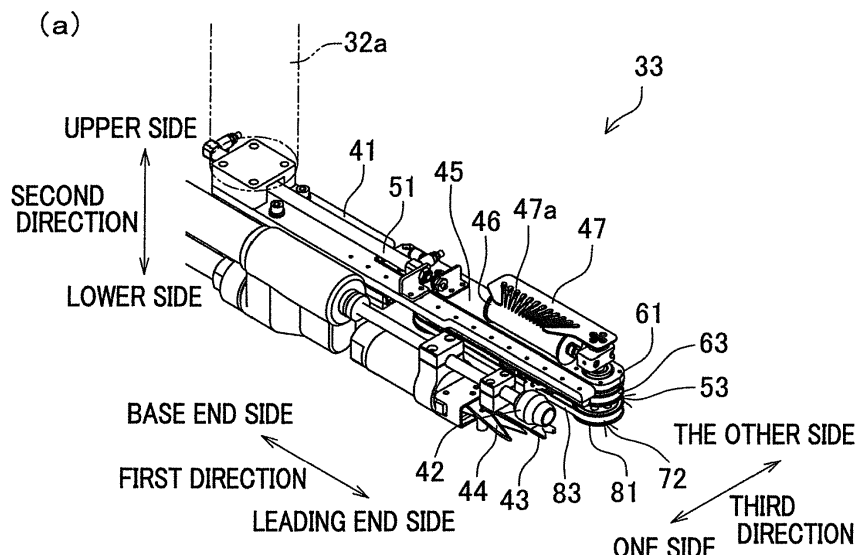
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(54) **AUTOMATIC YARN THREADING DEVICE**

(57) Yarns are automatically threaded onto yarn guides. A yarn threading unit 33 of an automatic yarn threading device includes a suction gun 42, a pressing roller 46, and a yarn separation guide 47. The suction gun 42 sucks and retains yarns having been spun out. The pressing roller 46 is pressed onto the yarns retained by the suction gun 42 so as to widen the intervals of the yarns. The yarn separation guide 47 is provided with grooves 47a lined up in one direction. After the grooves

47a of the yarn separation guide 47 are moved to a position opposing yarns with the intervals widened by the pressing roller 46, the yarns are inserted into the respective grooves 47a by retreating the pressing roller 46 to a position not making contact with the yarns. Thereafter, as the yarn separation guide 47 is moved toward the base end side in the first direction, the yarns are threaded onto fulcrum guides.

FIG.4



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an automatic yarn threading device configured to thread yarns onto plural yarn guides.

[0002] In a spun yarn take-up machine recited in Patent Literature 1 (Japanese Unexamined Patent Publication No. 2015-78455), yarns spun out from a spinning apparatus are wound onto a first godet roller and a second godet roller. The yarns are then threaded onto fulcrum guides, respectively. Subsequently, the yarns are traversed by a traverse guide about the respective fulcrum guides, and are wound onto bobbins attached to a bobbin holder. According to Patent Literature 1, to thread yarns spun out from the spinning apparatus onto the spun yarn take-up machine, to begin with, the first godet roller and the second godet roller are arranged to be close to each other by moving the second godet roller to a yarn threading position, and the fulcrum guides are arranged to be close to each other by moving the fulcrum guides to a yarn threading position. Subsequently, while the yarns spun out from the spinning apparatus are retained by a suction gun, the yarns are wound onto the first godet roller and the second godet roller in this order. Then the yarns are threaded onto the respective fulcrum guides.

SUMMARY OF THE INVENTION

[0003] In Patent Literature 1, to thread the yarns onto the respective fulcrum guides as above, the operator is required to, for each fulcrum guide, pick up one of the yarns retained by the suction gun and thread it onto the fulcrum guide. In this connection, the yarns retained by the suction gun may be close to each other at around the suction gun or may be twisted together. It is therefore tiresome to pick up one of the yarns retained by the suction gun and thread it onto the fulcrum guide.

[0004] An object of the present invention is to provide an automatic yarn threading device which is able to thread yarns onto yarn guides.

[0005] According to the first aspect of the invention, an automatic yarn threading device for threading yarns onto yarn guides, respectively, includes: a suction gun configured to suck the yarns having been spun out; a pressing roller configured to be pressed onto the yarns sucked by the suction gun to widen intervals of the yarns; and a yarn separation guide including grooves lined up in one direction, the yarns lined up at the intervals and widened by the pressing roller being inserted into the respective grooves.

[0006] The yarns sucked by the suction gun may be close to each other or may be twisted at around the suction gun. According to the present invention, as the pressing roller is pressed onto the yarns, the pressing roller rotates and the intervals of the yarns on the pressing roller are widened. This allows the yarns to be easily in-

serted into the respective grooves of the yarn separation guide. After the yarns are inserted into the respective grooves of the yarn separation guide, the yarns can be threaded onto the respective yarn guides.

[0007] According to the second aspect of the invention, the automatic yarn threading device of the first aspect further includes a roller sliding device configured to move the pressing roller pressed onto the yarns away from the suction gun by sliding the pressing roller in a direction orthogonal to an axis of the pressing roller.

[0008] When the pressing roller pressed onto the yarns are provided in the vicinity of the suction gun, the tilting angles of the yarns running from the pressing roller toward the suction gun are large in the axial direction of the pressing roller. When the tilting angles are large, the position where the yarns moves away from the pressing roller toward the suction gun is inconsistent, and may disadvantageously cause yarn swing. For this reason, in the present invention, the pressing roller pressed onto the yarns are slid and moved away from the suction gun. With this, the above-described tilting angles of the yarns are reduced and the yarn swing is restrained.

[0009] According to the third aspect of the invention, the automatic yarn threading device of the first or second aspect further includes a relative movement device configured to move the pressing roller and the yarn separation guide relative to each other so that the yarns having the intervals widened by the pressing roller are inserted into the respective grooves of the yarn separation guide.

[0010] According to the present invention, by moving the pressing roller and the yarn separation guide relative to each other, the yarns with the intervals widened by the pressing roller are inserted into the respective grooves of the yarn separation guide.

[0011] According to the fourth aspect of the invention, the automatic yarn threading device of the third aspect is arranged such that, the suction gun extends in a predetermined first direction, and the relative movement device includes: a roller swinging device configured to swing the pressing roller about a swing axis which extends in a second direction orthogonal to the first direction and is deviated from the suction gun in a third direction intersecting with the first direction and the second direction; and a guide swinging device configured to swing the yarn separation guide about the swing axis.

[0012] According to the present invention, the yarn separation guide is moved to a position overlapping the pressing roller after the intervals of the yarns are widened and then the pressing roller is moved to a position where the pressing roller is not pressed onto the yarns. With this, the yarns with the intervals widened by the pressing roller are inserted into the respective grooves of the yarn separation guide.

[0013] According to the fifth aspect of the invention, the automatic yarn threading device of any one of the first to fourth aspects further includes a retreat device configured to cause the pressing roller and the yarn separation guide to retreat to positions of not interfering with

the yarns.

[0014] According to the present invention, by retreating the pressing roller and the yarn separation guide relative to positions not interfering with the yarns, the pressing roller and the yarn separation guide does not obstruct, for example, the sucking of the yarns by the suction gun.

[0015] According to the sixth aspect of the invention, the automatic yarn threading device of the fifth aspect is arranged such that, the suction gun extends in a predetermined first direction, and the retreat device includes: a roller swinging device configured to swing the pressing roller about a swing axis which extends in a second direction orthogonal to the first direction and is deviated from the suction gun in a third direction intersecting with the first direction and the second direction; and a guide swinging device configured to swing the yarn separation guide about the swing axis.

[0016] According to the present invention, the pressing roller and the yarn separation guide are moved to positions deviated from the suction gun in the third direction. As such the pressing roller and the yarn separation guide can be moved away not to interfere with the yarns.

[0017] According to the seventh aspect of the invention, the automatic yarn threading device of any one of the first to fifth aspects is arranged such that the yarn guides are lined up in a predetermined arrangement direction and allow the yarns to be inserted into the yarn guides from one side in the arrangement direction, and a guide sliding device is further provided to slide the yarn separation guide retaining the yarns in a direction which is inclined with respect to the arrangement direction.

[0018] According to the present invention, the yarn separation guide in which the yarns are threaded onto the respective grooves are slid in an arrangement direction inclined with respect to the direction in which the yarn guides are lined up. With this, each yarn is inserted into the corresponding yarn guide from one side in the arrangement direction of the yarn guides

[0019] According to the eighth aspect of the invention, the automatic yarn threading device of any one of the first to seventh aspects further includes a cutter for cutting the yarns.

[0020] According to the present invention, the yarns are retained in advance, and after the retained yarns are sucked by the suction gun, the yarns are cut by the cutter. This allows the yarns retained in advance to be handed to the suction gun.

[0021] According to the ninth aspect of the invention, the automatic yarn threading device of any one of the first to eighth aspects further includes a yarn convergence guide onto which the yarns in a converged state are threaded.

[0022] According to the present invention, as the yarns are threaded onto the yarn convergence guide and converged in advance, the intervals of the yarns are shortened at a position opposing the suction gun, and hence the yarns are certainly sucked by the suction gun.

[0023] According to the tenth aspect of the invention,

the automatic yarn threading device of any one of the first to ninth aspects further includes a motor configured to rotationally drive the pressing roller.

[0024] According to the present invention, when the pressing roller pressed onto the yarns are rotationally driven, the pressing roller is stably rotated as compared cases where the pressing roller is rotated solely by the friction force with the yarns. This makes it possible to stably widen the intervals of the yarns Y.

[0025] According to the present invention, because the intervals of yarns are widened by pressing a pressing roller onto the yarns, the yarns are easily inserted into grooves of a yarn separation guide, respectively. After the yarns are inserted into the respective grooves of the yarn separation guide, the yarns can be threaded onto the respective yarn guides.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a schematic diagram of a spun yarn take-up machine of an embodiment of the present invention.

FIG. 2 shows the diagram of FIG. 1 in a direction indicated by an arrow II.

FIGs. 3(a) and 3(b) show fulcrum guides and their surroundings from above. FIG. 3(a) shows a state in which the fulcrum guides are at winding positions whereas FIG. 3(b) shows a state in which the fulcrum guides are at yarn threading positions.

FIG. 4(a) is a perspective view of a yarn threading unit. FIG. 4(b) shows the yarn threading unit at a different perspective from FIG. 4(a).

FIG. 5(a) shows the yarn threading unit viewed from the yarn separation guide side in a second direction. FIG. 5(b) shows the yarn threading unit from the suction gun side in a third direction. FIG. 5(c) is a partial cross section taken at the C-C line in FIG. 5(a). FIG. 6 is a block diagram showing an electric structure of the spun yarn take-up machine.

FIG. 7(a) shows a state in which yarns retained by a yarn holding member are threaded onto a yarn convergence guide and sucked by a suction gun, whereas FIG. 7(b) shows a state after the yarns are cut by a cutter.

FIG. 8(a) shows a state in which yarns are being wound onto the first godet roller, whereas FIG. 8(b) shows a state in which yarns are being wound onto the second godet roller.

FIGs. 9(a) and 9(b) show a state in which a pressing roller is in a pressing posture. FIG. 9(a) is equivalent to FIG. 5(a) whereas FIG. 9(b) is equivalent to FIG. 5(b).

FIGs. 10(a) and 10(b) show a state in which a slidable component is moved so that the pressing roller is moved away from the suction gun after the state shown in FIGs. 9(a) and 9(b). FIG. 10(a) is equivalent

to FIG. 5(a) whereas FIG. 10(b) is equivalent to FIG. 5(b).

FIGs. 11(a) and 11(b) show a state in which a yarn separation guide is in a yarn threading posture after the state shown in FIGs. 10(a) and 10(b). FIG. 11(a) is equivalent to FIG. 5(a) whereas FIG. 11(b) is equivalent to FIG. 5(b).

FIGs. 12 (a) and 12 (b) show a state in which the pressing roller is returned to a retreat posture and yarns are inserted into grooves of the yarn separation guide after the state shown in FIGs. 11(a) and 11(b). FIG. 12(a) is equivalent to FIG. 5(a) whereas FIG. 12(b) is equivalent to FIG. 5(b).

FIGs. 13 (a) and 13 (b) show a state in which the slidable component is returned after the state shown in FIGs. 12 (a) and 12(b). FIG. 13 (a) is equivalent to FIG. 5(a) whereas FIG. 13(b) is equivalent to FIG. 5(b).

FIG. 14 illustrates an operation to thread yarns from the yarn separation guide to the respective fulcrum guides.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0027] The following will describe a preferred embodiment of the present invention.

(Overall Structure of Spun Yarn Take-Up Machine)

[0028] A spun yarn take-up machine 1 of the present embodiment is configured to take up yarns Y spun out from an unillustrated spinning apparatus and form packages P by winding the yarns Y onto bobbins B. As shown in FIG. 1 and FIG. 2, the spun yarn take-up machine 1 includes plural take-up units 3 and a single automatic yarn threading device 4 provided commonly for the take-up units 3.

[0029] The take-up units 3 are lined up in one horizontal direction. Hereinafter, the direction in which the take-up units 3 are lined up will be referred to as a left-right direction, the direction which is horizontal and orthogonal to the left-right direction will be referred to as a front-back direction, and the direction in which the gravity acts will be referred to as a vertical direction.

(Take-Up Unit)

[0030] Each take-up unit 3 includes a yarn holding member 11, a first godet roller 12, a second godet roller 13, and a winding unit 14. The yarn holding member 11 extends along the left-right direction and is configured to suck and retain yarns Y spun out from the spinning apparatus in advance before the yarns Y are placed onto the godet rollers 12 and 13 and the winding unit 14.

[0031] The first godet roller 12 is a roller having an axis substantially in parallel to the left-right direction and is provided below the yarn holding member 11 in the vertical direction. The first godet roller 12 is rotationally driven by

a first godet motor 111 (see FIG. 6). The second godet roller 13 is a roller having an axis substantially in parallel to the left-right direction and is provided backward of the first godet roller 12. The second godet roller 13 is rotationally driven by a second godet motor 112 (see FIG. 6). The second godet roller 13 is movably supported by a guide rail 15. The guide rail 15 is inclined upward in the vertical direction toward the back side in the front-back direction. This second godet roller 13 is connected with a cylinder 113 (see FIG. 6). As the cylinder 113 is driven, the second godet roller 13 moves along the guide rail 15. With this, the second godet roller 13 is movable between a winding position which is indicated by full lines in FIG. 2 and where winding of the yarns Y is performed and a yarn threading position which is indicated by dashed lines in FIG. 2 and is closer to the first godet roller 12 than the winding position and where yarn threading is performed. The yarns Y spun out from the spinning apparatus are wound onto the godet rollers 12 and 13 in this order.

[0032] The winding unit 14 includes plural fulcrum guides 21 (yarn guides of the present invention), plural traverse guides 22, a turret 23, two bobbin holders 24, and a contact roller 25. As shown in FIG. 2 and FIG. 3, the fulcrum guides 21 are provided for the respective yarns Y and are lined up in the front-back direction. Each fulcrum guide 21 has a groove 21a which is open to the back side. By inserting the yarn Y into the groove 21a from the back side, yarn threading is carried out.

[0033] The fulcrum guides 21 are attached to sliders 26. The sliders 26 are supported to be movable in the front-back direction along a guide rail 27. The sliders 26 are connected with a cylinder 114 (see FIG. 6). As the cylinder 114 is driven, the sliders 26 move in the front-back direction along the guide rail 27. With this, the fulcrum guides 21 are movable between winding positions which are shown in FIG. 2 and FIG. 3(a) and where the fulcrum guides 21 are separated from one another in the front-back direction and winding of the yarns Y is performed and yarn threading positions which are shown in FIG. 3(b) and where the fulcrum guides 21 are arranged to be close to one another on the front side of the guide rail 27 and yarn threading is performed.

[0034] The traverse guides 22 are provided for the respective yarns Y and are lined up in the front-back direction. Each traverse guide 22 is driven by a traverse motor 115 (see FIG. 6) and reciprocates in the front-back direction. With this, the yarn Y threaded onto the traverse guide 22 is traversed about the fulcrum guide 21.

[0035] The turret 23 is a disc-shaped member having an axis in parallel to the front-back direction. The turret 23 is rotationally driven by a turret motor 116 (see FIG. 6). The two bobbin holders 24 have axes in parallel to the front-back direction and are rotatably supported at an upper end portion and a lower end portion of the turret 23, respectively. To each bobbin holder 24, bobbins B provided for the respective yarns Y are attached to be lined up in the front-back direction. Each of the two bobbin holders 24 is rotationally driven by a different winding

motor 117 (see FIG. 6).

[0036] As the upper bobbin holder 24 is rotationally driven, the yarn Y traversed by the traverse guide 22 is wound onto the bobbin B, with the result that a package P is formed. After the completion of the formation of the package P, the positions of the two bobbin holders 24 are changed upside down as the turret 23 is rotated. As a result, the bobbin holder 24 which is on the lower side moves to the upper side, and a package P can be formed by winding a yarn Y onto a bobbin B attached to this bobbin holder 24. In the meanwhile, the bobbin holder 24 on the upper side moves to the lower side, and the completed package P is collected from this bobbin holder 24.

[0037] The contact roller 25 is a roller having an axis substantially in parallel to the front-back direction and is provided immediately above the upper bobbin holder 24. The contact roller 25 makes contact with the surface of the package P formed by winding the yarn Y onto the bobbin B attached to the upper bobbin holder 24, so as to apply a contact pressure to the surface of the package P on which the yarn Y is being wound.

(Automatic Yarn Threading Device)

[0038] Now, the automatic yarn threading device 4 will be described. The automatic yarn threading device 4 includes a main body 31, a robot arm 32, and a yarn threading unit 33. The main body 31 is rectangular parallelepiped in shape. Inside the main body 31, a yarn threading controller 102 (see FIG. 6) is mounted for controlling operations of the robot arm 32 and the yarn threading unit 33. On the front side of the take-up units 3, a guide rail 35 is provided to extend in the left-right direction over the take-up units 3. The main body 31 hangs down from the guide rail 35. The main body 31 is moved in the left-right direction along the guide rail 35 by a main body moving device 121 (see FIG. 6).

[0039] The robot arm 32 is attached to the lower surface of the main body 31. The robot arm 32 includes arms 32a and joints 32b connecting the arms 32a with one another. Each joint 32b includes an arm motor 122 (see FIG. 6). As the arm motor 122 is driven, the arm 32a is swung about the joint 32b.

[0040] The yarn threading unit 33 is attached to the leading end portion of the robot arm 32. As shown in FIG. 4 and FIG. 5, the yarn threading unit 33 is long in one direction (hereinafter, this direction will be referred to as a first direction), and the yarn threading unit 33 is connected with the arm 32a at an end portion on one side in the one direction (hereinafter, the base end side in the one direction). The yarn threading unit 33 includes a frame 41, a suction gun 42, a yarn convergence guide 43, a cutter 44, a slidable component 45, a pressing roller 46, and a yarn separation guide 47. Hereinafter, the side opposite to the base end side in the first direction will be referred to as a leading end side.

[0041] In the present embodiment, as the robot arm 32

is driven, the yarn threading unit 33 attached to the leading end portion of the robot arm 32 moves. In so doing, the direction of the yarn threading unit 33 may be changed. As described later, when yarn threading is carried out, the yarn threading unit 33 is mainly used with a posture such that the up-down direction in FIG. 5(b) is in parallel to the vertical direction, the upper side in FIG. 5(b) is the upper side in the vertical direction, and the lower side in FIG. 5(b) is the lower side in the vertical direction. Hereinafter, in the yarn threading unit 33, the up-down direction in FIG. 5(b) is a second direction, the upper side in FIG. 5(b) is the upper side in the second direction, and the lower side in FIG. 5(b) is the lower side in the second direction. Furthermore, the direction orthogonal to both the first direction and the second direction is a third direction. Furthermore, as shown in FIG. 4 and FIG. 5, one side and the other side in the third direction will be used in the explanations below.

[0042] The frame 41 is connected with the arm 32a at the base end portion in the first direction. The suction gun 42 is attached to a part on one side in the third direction of the frame 41. The suction gun 42 extends in the first direction and able to suck the yarns Y at its leading end portion. The yarn convergence guide 43 is attached to the frame 41 and is below the leading end portion of the suction gun 42 in the second direction. As described later, onto the yarn convergence guide 43, the yarns Y are threaded in a converged state. The cutter 44 is attached to the frame 41 and is below the yarn convergence guide 43 in the second direction. As described later, the cutter 44 is provided to cut the yarns Y when the yarns Y are handed from the yarn holding member 11 to the suction gun 42.

[0043] The slidable component 45 is deviated from the suction gun 42, the yarn convergence guide 43, and the cutter 44 toward the other side in the third direction. The slidable component 45 is attached to the frame 41 via the cylinder 51. As the cylinder 51 is driven, the slidable component 45 moves in the first direction relative to the frame 41.

[0044] The pressing roller 46 is a free roller rotatably supported by a shaft 46a which is orthogonal to the second direction, and is provided above the slidable component 45 in the second direction. An end portion on one side of the shaft 46a is attached to a hollow cylindrical shaft 52. The shaft 52 extends in the second direction to penetrate the slidable component 45. To an end portion on the lower side in the second direction of the shaft 52, a roller swinging device 53 is connected.

[0045] The roller swinging device 53 is provided below the slidable component 45 in the second direction and includes two pulleys 61 and 62, a belt 63, and a cylinder 64. The pulley 61 has an axis in parallel to the second direction and is attached to an end portion on the lower side in the second direction of the shaft 52. The pulley 62 is provided on the base end side in the first direction as compared to the pulley 61. The pulley 62 has an axis in parallel to the second direction and is rotatably sup-

ported by the slidable component 45. The belt 63 is made of a rubber material or the like and is wound onto the pulleys 61 and 62. On the belt 63, a cylinder attaching portion 63a is provided at a part between the pulleys 61 and 62. The cylinder 64 is fixed to the slidable component 45 and is attached to the cylinder attaching portion 63a. As the cylinder 64 is driven, the cylinder attaching portion 63a moves in the first direction so that the belt 63 moves, with the result that the pulleys 61 and 62 rotate. As the pulley 61 rotates, the shaft 52 rotates, with the result that the pressing roller 46 swings about the axis of the shaft 52 (a swing axis of the present invention). As the pressing roller 46 swings about the axis of the shaft 52, the pressing roller 46 is allowed to selectively take one of a retreat posture in which, as shown in FIG. 4(a), FIG. 5(a), and FIG. 5(b), the shaft 46a becomes substantially in parallel to the first direction and the entirety of the pressing roller 46 is on the other side in the third direction as compared to the region in which the suction gun 42, the yarn convergence guide 43, and the cutter 44 are provided and a pressing posture (see FIG. 10) in which the pressing roller 46 is, in the third direction, positioned in the region in which the suction gun 42, the yarn convergence guide 43, and the cutter 44 are provided.

[0046] The yarn separation guide 47 is provided above the pressing roller 46 in the second direction. In the yarn separation guide 47, grooves 47a are formed to be lined up along the length of the guide. Each of the grooves 47a is open at one end. The intervals of the grooves 47a increase in the direction away from the open end. The yarn separation guide 47 is, at an end portion on one side in the longitudinal direction, attached to a shaft 71 which extends to be in parallel to the second direction. As shown in FIG. 5(c), the shaft 71 is inserted into the hollow cylindrical shaft 52 and extends to reach a position lower than the pulley 61 in the second direction. To an end portion on the lower side in the second direction of the shaft 71, a guide swinging device 72 is connected.

[0047] The guide swinging device 72 is provided below the roller swinging device 53 in the second direction and includes two pulleys 81 and 82, a belt 83, and a cylinder 84. The pulley 81 has an axis in parallel to the second direction and is provided below the pulley 61 in the second direction. The pulley 81 is attached to an end portion on the lower side in the second direction of the shaft 71. The pulley 82 has an axis in parallel to the second direction and is provided below the pulley 62 in the second direction. The pulley 82 is rotatably supported by the slidable component 45. The belt 83 is made of a rubber material or the like and is wound onto the pulleys 81 and 82. On the belt 83, a cylinder attaching portion 83a is provided at a part between the pulleys 81 and 82. The cylinder 84 is fixed to the slidable component 45 and is attached to the cylinder attaching portion 83a. As the cylinder 84 is driven, the cylinder attaching portion 83a moves in the first direction so that the belt 83 moves, with the result that the pulleys 81 and 82 rotate. As the pulley 81 rotates, the shaft 71 rotates, with the result that the

yarn separation guide 47 swings about the axis of the shaft 71 (a swing axis of the present invention). As the yarn separation guide 47 swings about the axis of the shaft 71, the yarn separation guide 47 is allowed to selectively take one of a retreat posture in which, as shown in FIG. 4(a), FIG. 5(a), and FIG. 5(b), the longitudinal direction of the yarn separation guide 47 becomes substantially in parallel to the first direction and the entirety of the yarn separation guide 47 is on the other side in the third direction as compared to the region in which the suction gun 42, the yarn convergence guide 43, and the cutter 44 are provided and a pressing posture (see FIG. 11) in which the yarn separation guide 47 is, in the third direction, positioned in the region in which the suction gun 42, the yarn convergence guide 43, and the cutter 44 are provided.

(Overall Structure of Spun Yarn Take-Up Machine)

[0048] Now, an electric structure of the spun yarn take-up machine 1 will be described. In the spun yarn take-up machine 1, as shown in FIG. 6, a take-up unit controller 101 is provided for each take-up unit 3, and the take-up unit controller 101 controls the first godet motor 111, the second godet motor 112, the cylinders 113 and 114, the traverse motor 115, the turret motor 116, the winding motor 117, or the like. Each take-up unit 3 includes plural traverse motors 115 and two winding motors 117, but FIG. 6 shows only one traverse motor 115 and only one winding motor 117. Furthermore, FIG. 6 shows, for only one single take-up unit controller 101, the first godet motor 111, the second godet motor 112, the cylinders 113 and 114, the traverse motor 115, the turret motor 116, and the winding motor 117 which are the targets of control by that take-up unit controller 101.

[0049] In the spun yarn take-up machine 1, the yarn threading controller 102 is provided in the automatic yarn threading device 4 and the yarn threading controller 102 controls the main body moving device 121, the arm motor 122, the suction gun 42, the cutter 44, the cylinders 51, 64, and 84, or the like. While the robot arm 32 includes plural joints 32b and plural arm motors 122 corresponding to the respective joints 32b, FIG. 6 shows only one arm motor 122.

[0050] In addition to the above, the spun yarn take-up machine 1 includes a controller 100 which serves to control the entire apparatus. The controller 100 is connected with the take-up unit controllers 101 of the take-up units 3 and the yarn threading controller 102. By controlling the take-up unit controllers 101 and the yarn threading controller 102, the controller 100 controls the entire spun yarn take-up machine 1.

(Method of Yarn Threading)

[0051] Now, the following will describe a method of causing the automatic yarn threading device 4 to perform yarn threading onto the godet rollers 12 and 13 and the

fulcrum guides 21. Before causing the automatic yarn threading device 4 to perform yarn threading, the yarn holding member 11 is arranged to suck and retain the yarns Y spun out from the spinning apparatus in advance. Furthermore, the second godet roller 13 of the take-up unit 3 performing yarn threading is positioned at the above-described yarn threading position to be close to the first godet roller 12. Furthermore, the fulcrum guides 21 are positioned at the above-described yarn threading positions to be close to one another. Furthermore, in the yarn threading unit 33, each of the pressing roller 46 and the yarn separation guide 47 is arranged to be in the retreat posture.

[0052] When causing the automatic yarn threading device 4 to perform yarn threading, to begin with, the automatic yarn threading device 4 is moved to a position where the automatic yarn threading device 4 overlaps, in the front-back direction, with the take-up unit 3 which will perform yarn threading. Subsequently, the robot arm 32 is driven so that the yarn threading unit 33 is positioned to be above the yarn holding member 11 in the vertical direction, with a posture that the first direction is in parallel to the front-back direction, the second direction is in parallel to the vertical direction, and the third direction is in parallel to the left-right direction. At this stage, the leading end portion in the first direction of the suction gun 42 is arranged to oppose the yarns Y. Then the robot arm 32 is driven to move the yarn threading unit 33 to the leading end side in the first direction. With this, as shown in FIG. 7(a), the yarns Y are threaded onto the yarn convergence guide 43. In this state, parts of the yarns Y between the yarn convergence guide 43 and the yarn holding member 11 pass a position where the cutter 44 is able to cut the yarns.

[0053] Then the suction gun 42 is driven so that the yarns Y are sucked and retained by the suction gun 42. At this stage, because the yarns Y are converged by the yarn convergence guide 43, the yarns Y are close to one another at a part opposing the leading end portion of the suction gun 42. This ensures that the yarns Y are sucked by the suction gun 42 when it is driven.

[0054] Then the yarns Y are cut by the cutter 44. As a result, yarn parts on the yarn holding member 11 side of the yarns Y having been cut are sucked by the yarn holding member 11. In the meanwhile, yarn parts on the yarn convergence guide 43 side of the yarns Y are sucked and retained by the suction gun 42 as shown in FIG. 7(b). This makes it possible to hand the yarns Y from the yarn holding member 11 to the suction gun 42.

[0055] In the present embodiment, as described above, while the yarns Y are handed from the yarn holding member 11 to the suction gun 42, each of the pressing roller 46 and the yarn separation guide 47 is in the retreat posture in which the entirety thereof is on the other side in the third direction as compared to the suction gun 42, the yarn convergence guide 43, and the cutter 44. The pressing roller 46 and the yarn separation guide 47 therefore do not interfere the yarns Y and obstruct the passing

of the yarns Y, when the yarns Y are handed from the yarn holding member 11 to the suction gun 42.

[0056] Then the robot arm 32 is driven to move the yarn threading unit 33. As a result, as shown in FIG. 8(a), the yarns Y retained by the suction gun 42 are wound onto the first godet roller 12 from below in the vertical direction. Then the yarns Y are wound onto the second godet roller 13 from above in the vertical direction, as shown in FIG. 8(b).

[0057] Then the robot arm 32 is driven to move the yarn threading unit 33 to a position below the fulcrum guides 21, with a posture that the second direction is in parallel to the vertical direction and the first direction is inclined with respect to the front-back direction. Subsequently, as shown in FIG. 9(a) and 9(b), the pressing roller 46 is swung about the shaft 52 so that the posture thereof is switched from the retreat posture to the pressing posture. As a result, the pressing roller 46 is pressed onto the yarns Y and rotates on account of the friction force with the yarns Y. This widens the intervals of the yarns Y at the part onto which the pressing roller 46 is pressed. The intervals of the yarns Y become substantially identical with the intervals of the grooves 47a of the yarn separation guide 47 at the opening.

[0058] Subsequently, as shown in FIG. 10(a) and FIG. 10(b), the slidable component 45 is slid toward the leading end side in the first direction. As a result, the pressing roller 46 pressed onto the yarns Y is slid toward the leading end side in the first direction together with the slidable component 45, so as to move away from the suction gun 42. With this, as compared to the states shown in FIG. 9(a) and FIG. 9(b), the tilting angles of the yarns Y running from the pressing roller 46 to the suction gun 42 decrease in the third direction, when viewed in the second direction. In this connection, when the tilting angles of the yarns Y are large, the position where the yarns Y moves away from the pressing roller 46 toward the suction gun 42 is inconsistent, and may disadvantageously cause yarn swing. In particular, the tilting angles are large on outer sides in the axial direction of the pressing roller 46, and problems tend to occur at these positions. In the present embodiment, as described above, the tilting angles of the yarns Y are decreased and yarn swing is restrained, by providing the pressing roller 46 away from the suction gun.

[0059] Subsequently, as shown in FIG. 11(a) and FIG. 11(b), the yarn separation guide 47 is swung about the shaft 71 so that the posture thereof is switched from the retreat posture to the yarn threading posture. As a result, the grooves 47a of the yarn separation guide 47 oppose the respective yarns Y onto which the pressing roller 46 is pressed. Subsequently, as shown in FIG. 12(a) and FIG. 12(b), the pressing roller 46 is swung about the shaft 52 so that the posture thereof is returned from the pressing posture to the retreat posture. As a result, the pressing roller 46 moves away from the yarns Y, and the yarns Y are inserted into the respective grooves 47a. In this connection, because the intervals of the grooves 47a in-

crease in the direction away from the open end, the intervals of the yarns Y inserted into the grooves 47a are further widened.

[0060] As shown in FIG. 7(b), when the yarns Y are sucked and retained by the suction gun 42, the yarns Y may be close to each other at around the suction gun 42 or may be twisted together. On this account, it is difficult to pick up each yarn Y from the yarns Y in this state and to insert it into the corresponding groove 47a of the yarn separation guide 47.

[0061] For this reason, in the present embodiment, the pressing roller 46 is pressed onto the yarns Y sucked and retained by the suction gun 42. With this, the intervals of the yarns Y are widened at the part onto which the pressing roller 46 is pressed, and become substantially identical with the intervals of the grooves 47a. Thereafter, the yarn separation guide 47 is arranged to be in the yarn threading posture and the pressing roller 46 is returned to the retreat posture. This allows the yarns Y to be inserted into the grooves 47a of the yarn separation guide 47.

[0062] Subsequently, as shown in FIG. 13(a) and 13(b), the slidable component 45 is slid toward the base end side in the first direction. With this, as shown in FIG. 14, the yarn separation guide 47 is slid toward the base end side in the first direction together with the slidable component 45, with the result that the yarns Y inserted into the grooves 47a are threaded onto the corresponding fulcrum guides 21, respectively. In this connection, as described above, the first direction is tilted with respect to the front-back direction in the states shown in FIG. 9 to FIG. 13. To be more specific, as shown in FIG. 14, the first direction is in parallel to a linear line which connects each groove 47a of the yarn separation guide 47 with the opening at the leading end of the groove 21a of the corresponding fulcrum guide 21. After the yarn threading onto the fulcrum guides 21 is completed, the second godet roller 13 and the fulcrum guides 21 are moved to the winding positions. Furthermore, in the yarn threading unit 33, the yarn separation guide 47 is swung about the shaft 71 to the retreat posture.

[0063] In the present embodiment, the pressing roller 46 is moved away from the suction gun 42 in such a way that the pressing roller 46 is slid toward the leading end side in the first direction by sliding the slidable component 45 toward the leading end side in the first direction. In the meanwhile, yarn threading onto each of the fulcrum guides 21 is carried out in such a way that the yarn separation guide 47 in which the yarns Y are inserted into the respective grooves 47a is slid toward the base end side in the first direction by sliding the slidable component 45 toward the base end side in the first direction. As such, in the present embodiment, a mechanism formed of the slidable component 45 and the cylinder 51 for sliding the slidable component 45 in the first direction functions as both a roller sliding device and a guide sliding device of the present invention.

[0064] In addition to the above, in the present embod-

iment, when the yarns Y are handed from the yarn holding member 11 to the suction gun 42, the pressing roller 46 and the yarn separation guide 47 do not interfere with the yarns Y as these members are arranged to be in the retreat postures. In the meanwhile, the yarns Y are inserted into the grooves 47a of the yarn separation guide 47 in such a way that, after the intervals of the yarns Y are widened by the pressing roller 46, the yarn separation guide 47 is switched from the retreat posture to the yarn threading posture and then the pressing roller 46 is returned to the retreat posture. As such, in the present embodiment, a mechanism formed of the roller swinging device 53 for swinging the pressing roller 46 and the guide swinging device 72 for swinging the yarn separation guide 47 functions as both a relative movement device and a retreat device of the present invention.

[0065] The following will describe modifications of the above-described embodiment of the present invention.

[0066] While in the embodiment above the pressing roller 46 is pressed onto the yarns Y at the stage of switching the posture of the pressing roller 46 from the retreat posture to the pressing posture, the disclosure is not limited to this arrangement. For example, the pressing roller 46 may be separated from the yarns Y at the stage of switching the posture of the pressing roller 46 from the retreat posture to the pressing posture, and thereafter the pressing roller 46 may be pressed onto the yarns Y during the sliding of the pressing roller 46. In this case, during the sliding of the pressing roller 46, the pressing roller 46 is pressed onto the yarns Y and the intervals of the yarns Y are widened and the pressing roller 46 moves away from the suction gun 42.

[0067] In the embodiment above, a mechanism formed of the slidable component 45 and the cylinder 51 for driving the slidable component 45 in the first direction functions as both the roller sliding device and the guide sliding device of the present invention, and a mechanism formed of the roller swinging device 53 for swinging the pressing roller 46 and the guide swinging device 72 for swinging the yarn separation guide 47 functions as both the relative movement device and the retreat device of the present invention. In this regard, the roller sliding device, the guide sliding device, the relative movement device, and the retreat device may be differently arranged.

[0068] For example, different slidable components may be provided for the pressing roller 46 and the yarn separation guide 47, respectively, and these two slidable components may be driven by different cylinders. In this case, a mechanism formed of a slidable component to which the pressing roller 46 is attached and a cylinder for driving this slidable component is equivalent to the roller sliding device of the present invention. Furthermore, a mechanism formed of a slidable component to which the yarn separation guide 47 is attached and a cylinder for driving this slidable component is equivalent to the guide sliding device of the present invention.

[0069] Furthermore, in the case above, the slidable component to which the pressing roller 46 is attached

may be moved toward the base end side in the first direction from a state similar to those shown in FIG. 11(a) and 11(b). With this, the pressing roller 46 is separated from the yarns Y and the yarns Y is inserted into the grooves 47a of the yarn separation guide 47. In this case, a mechanism formed of the slidable component to which the pressing roller 46 is attached and a cylinder for moving this slidable component functions as the relative movement device of the present invention.

[0070] Furthermore, in the case above, the movable ranges of the slidable component to which the pressing roller 46 is attached and the slidable component to which the yarn separation guide 47 is attached may be arranged to be long on the base end side in the first direction as compared to the slidable component 45 of the embodiment above. With this, the pressing roller 46 in the pressing posture and the yarn separation guide 47 in the yarn threading posture are movable to positions on the base end side in the first direction as compared to the leading end portion of the suction gun 42. In this case, by moving the pressing roller 46 in the pressing posture and the yarn separation guide 47 in the yarn threading posture to positions which are on the base end side in the first direction as compared to the leading end portion of the suction gun 42, the pressing roller 46 and the yarn separation guide 47 retreat so as not to interfere with the yarns Y. In this case, a mechanism formed of the two slidable components to which the pressing roller 46 and the yarn separation guide are attached and cylinders for moving these two slidable components functions as the retreat device of the present invention.

[0071] Furthermore, in the case above, because the pressing roller 46 is always allowed to be in parallel to the third direction, the roller swinging device 53 may not be provided and the shaft 46a of the pressing roller 46 may be fixed to the slidable component 45 while being in parallel to the third direction. Furthermore, in the case above, because the yarn separation guide 47 is always allowed to extend in the third direction, the guide swinging device 72 may not be provided and the yarn separation guide 47 may be fixed to the slidable component 45 while extending in the third direction.

[0072] While in the embodiment above the pressing roller 46 is separated from the suction gun 42 in such a way that the pressing roller 46 is pressed onto the yarns Y and then the pressing roller 46 is moved toward the leading end side in the first direction, the disclosure is not limited to this arrangement. After the pressing roller 46 is switched from the retreat posture to the pressing posture and the intervals of the yarns Y are widened, inserting of the yarns Y into the grooves 47a and yarn threading onto the fulcrum guides 21 may be performed without sliding the pressing roller 46.

[0073] In the embodiment above, when the yarns Y inserted into the grooves 47a are threaded onto the fulcrum guides 21, the yarn separation guide 47 is moved toward the base end side in the first direction by moving the slidable component 45 toward the base end side in

the first direction. The disclosure, however, is not limited to this arrangement. For example, the yarn separation guide 47 may be moved toward the base end side in the first direction by driving the robot arm 32 to move the entirety of the yarn threading unit 33 toward the base end side in the first direction. In this case, the robot arm 32 is equivalent to the guide sliding device of the present invention.

[0074] In addition to the above, the roller sliding device, the guide sliding device, the relative movement device, and the retreat device may be embodied as structures different from the above. Furthermore, four independent devices may be provided as the roller sliding device, the guide sliding device, the relative movement device, and the retreat device, or a single device may function as two or more of these four devices.

[0075] While in the embodiment above the yarn convergence guide 43 is provided below the suction gun 42 in the second direction and the cutter 44 is provided below the yarn convergence guide 43 in the second direction, the positions of the yarn convergence guide 43 and the cutter 44 may be inverted.

[0076] While in the embodiment above the cutter 44 is provided in the yarn threading unit 33, the cutter 44 may not be provided in the yarn threading unit 33. For example, a cutter may be provided in the yarn holding member 11. Also in this case, as the yarns Y retained by the yarn holding member 11 is sucked by the suction gun 42 and then cut by the cutter, the yarn parts on the yarn holding member 11 side are sucked by the yarn holding member 11 whereas the yarn parts on the suction gun 42 side are sucked by the suction gun.

[0077] While in the embodiment above the yarn convergence guide 43 is provided in the yarn threading unit 33, the yarn convergence guide 43 may not be provided. When the position of the suction gun 42 at the time of the handing of the yarns Y from the yarn holding member 11 to the suction gun 42 (i.e., the position of the suction gun 42 in the state shown in FIG. 7(a)) is not very far from the yarn holding member 11, the intervals of the yarns Y are not very long at the part opposing the suction gun 42 even if the yarn convergence guide 43 is not provided. It is therefore possible to suck and retain the yarns Y by driving the suction gun 42 even if the yarn convergence guide 43 is not provided.

[0078] In addition to the above, while in the embodiment above the pressing roller 46 is a free roller rotatably supported by the shaft 46a, the pressing roller 46 may be a drive roller rotationally driven by a motor. In this case, as shown in FIG. 9(a) and 9(b), the pressing roller 46 is rotationally driven when the pressing roller 46 is pressed onto the yarns Y. With this, the pressing roller 46 is stably rotated as compared to cases where the pressing roller 46 is rotated only by the friction force between the yarns Y and the pressing roller 46. This makes it possible to stably widen the intervals of the yarns Y at the part onto which the pressing roller 46 is pressed.

[0079] While in the embodiment above the automatic

yarn threading device 4 performs both of the winding of the yarns Y onto the godet rollers 12 and 13 and the yarn threading of the yarns Y onto the fulcrum guides 21, the disclosure is not limited to this arrangement. For example, an operator may wind the yarns Y onto the godet rollers 12 and 13 and then the automatic yarn threading device 4 may perform the yarn threading onto the fulcrum guides 21.

[0080] While in the embodiment above the take-up unit 3 includes the two godet rollers 12 and 13, the disclosure is not limited to this arrangement. The take-up unit may, for example, include godet rollers (heating rollers) each including a heater therein, as disclosed in Japanese Unexamined Patent Publication No. 2014-5555. Also in such a case, the yarn placing robot is able to place yarns onto these godet rollers.

[0081] While in the embodiment above the yarn threading is performed onto the fulcrum guides 21 each of which functions as a fulcrum of traversal of the yarn Y by the traverse guide 22, the disclosure is not limited to this arrangement. The present invention may be used for performing yarn threading onto a yarn guide other than the fulcrum guide.

Claims

1. An automatic yarn threading device for threading yarns onto yarn guides, respectively, comprising:

a suction gun configured to suck the yarns having been spun out;
 a pressing roller configured to be pressed onto the yarns sucked by the suction gun to widen intervals of the yarns; and
 a yarn separation guide including grooves lined up in one direction, the yarns lined up at the intervals and widened by the pressing roller being inserted into the respective grooves.

2. The automatic yarn threading device according to claim 1, further comprising a roller sliding device configured to move the pressing roller pressed onto the yarns away from the suction gun by sliding the pressing roller in a direction orthogonal to an axis of the pressing roller.

3. The automatic yarn threading device according to claim 1 or 2, further comprising a relative movement device configured to move the pressing roller and the yarn separation guide relative to each other so that the yarns having the intervals widened by the pressing roller are inserted into the respective grooves of the yarn separation guide.

4. The automatic yarn threading device according to claim 3, wherein,
 the suction gun extends in a predetermined first di-

rection, and
 the relative movement device includes:

a roller swinging device configured to swing the pressing roller about a swing axis which extends in a second direction orthogonal to the first direction and is deviated from the suction gun in a third direction intersecting with the first direction and the second direction; and
 a guide swinging device configured to swing the yarn separation guide about the swing axis.

5. The automatic yarn threading device according to any one of claims 1 to 4, further comprising a retreat device configured to cause the pressing roller and the yarn separation guide to retreat to positions of not interfering with the yarns.

6. The automatic yarn threading device according to claim 5, wherein,
 the suction gun extends in a predetermined first direction, and
 the retreat device includes:

a roller swinging device configured to swing the pressing roller about a swing axis which extends in a second direction orthogonal to the first direction and is deviated from the suction gun in a third direction intersecting with the first direction and the second direction; and
 a guide swinging device configured to swing the yarn separation guide about the swing axis.

7. The automatic yarn threading device according to any one of claims 1 to 6, wherein,
 the yarn guides are lined up in a predetermined arrangement direction and allow the yarns to be inserted into the yarn guides from one side in the arrangement direction, and
 a guide sliding device is further provided to slide the yarn separation guide retaining the yarns in a direction which is inclined with respect to the arrangement direction.

8. The automatic yarn threading device according to any one of claims 1 to 7, further comprising a cutter for cutting the yarns.

9. The automatic yarn threading device according to any one of claims 1 to 8, further comprising a yarn convergence guide onto which the yarns in a converged state are threaded.

10. The automatic yarn threading device according to any one of claims 1 to 9, further comprising a motor configured to rotationally drive the pressing roller.

FIG. 1

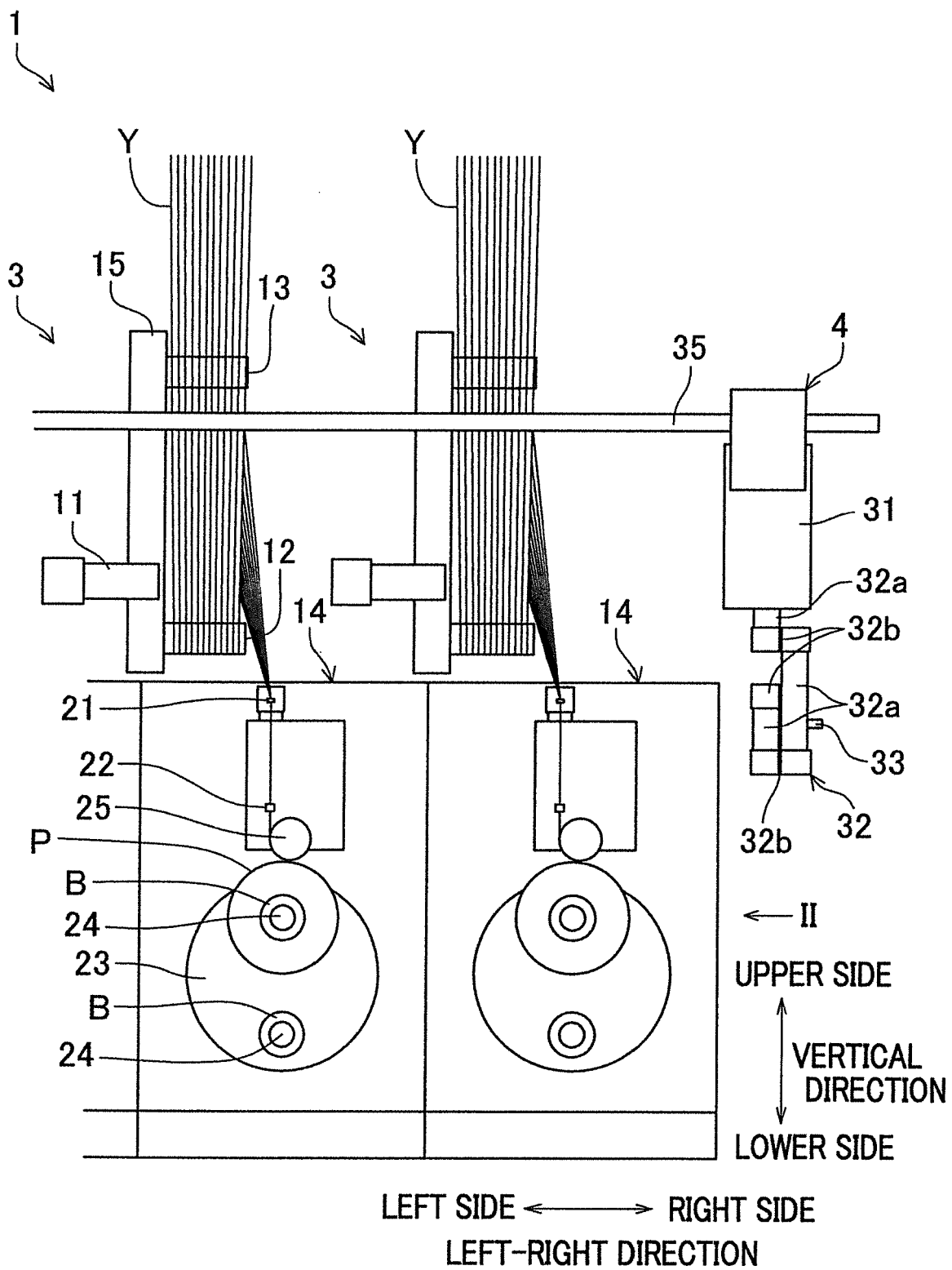


FIG.2

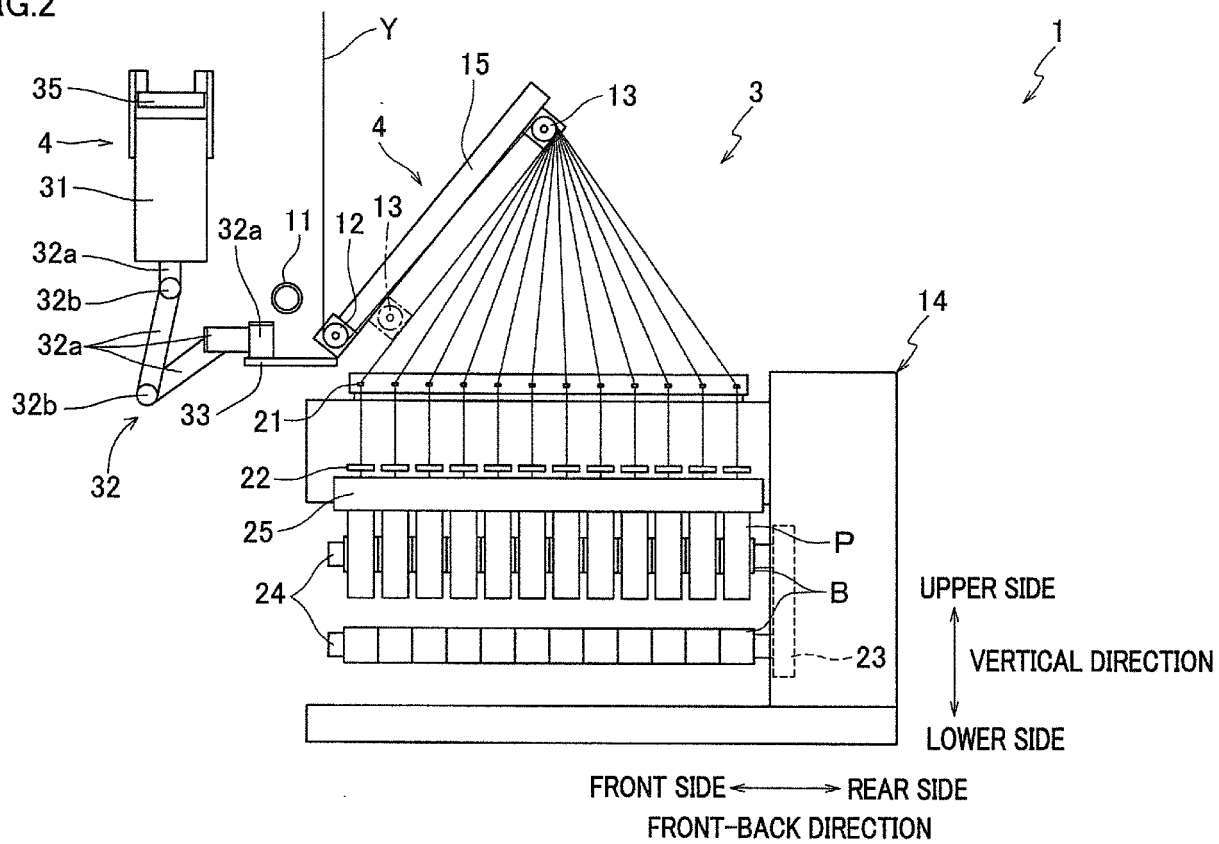


FIG.3

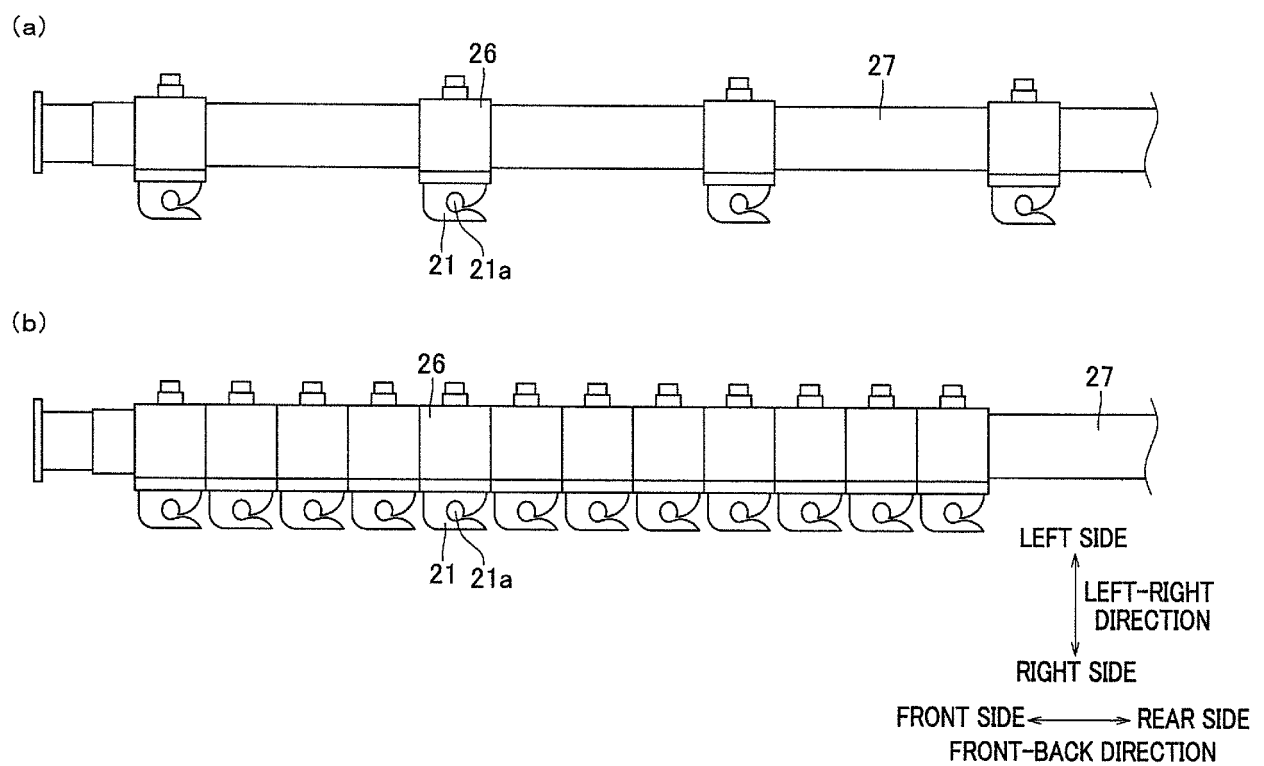


FIG.4

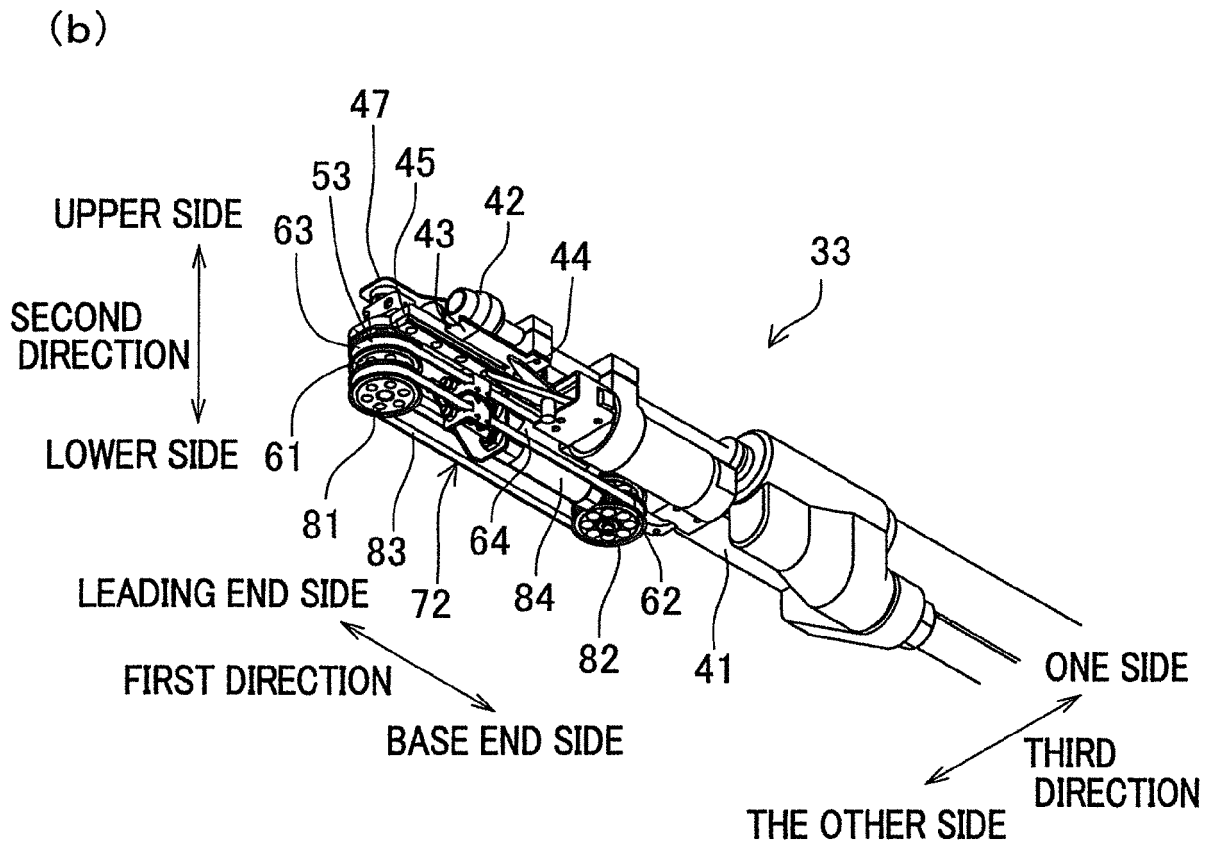
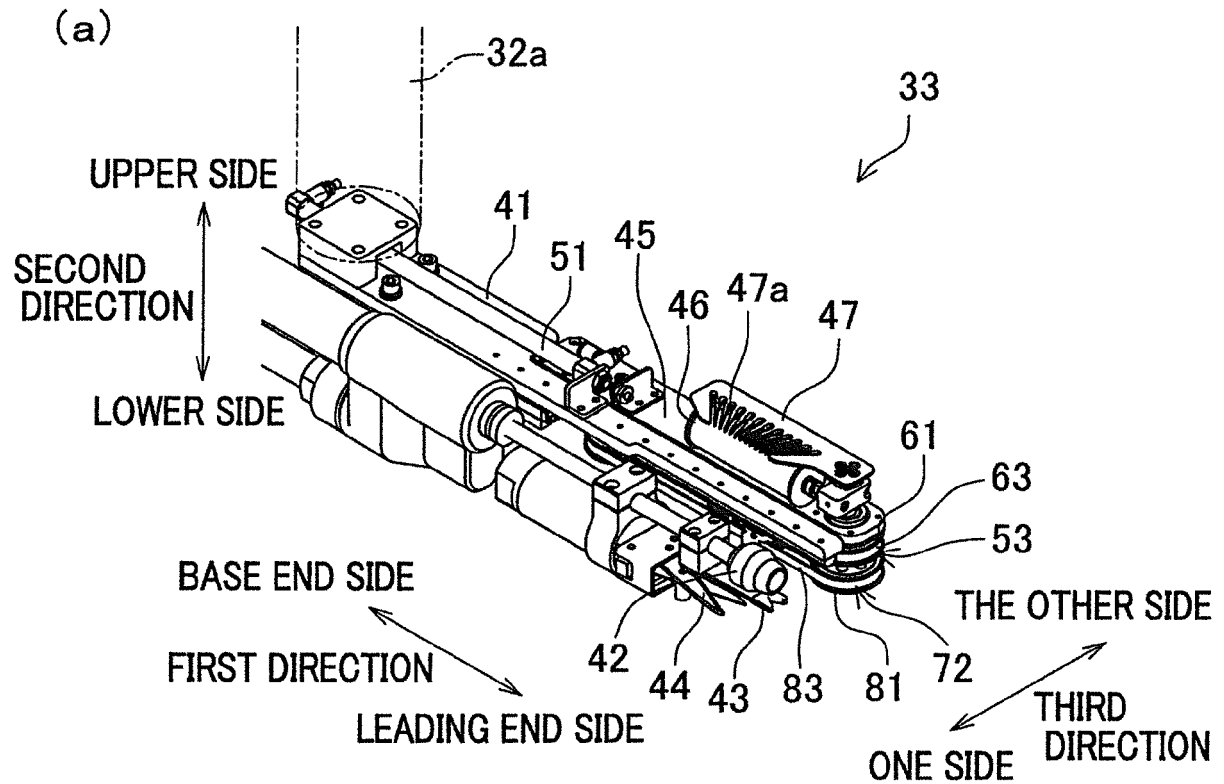


FIG.5

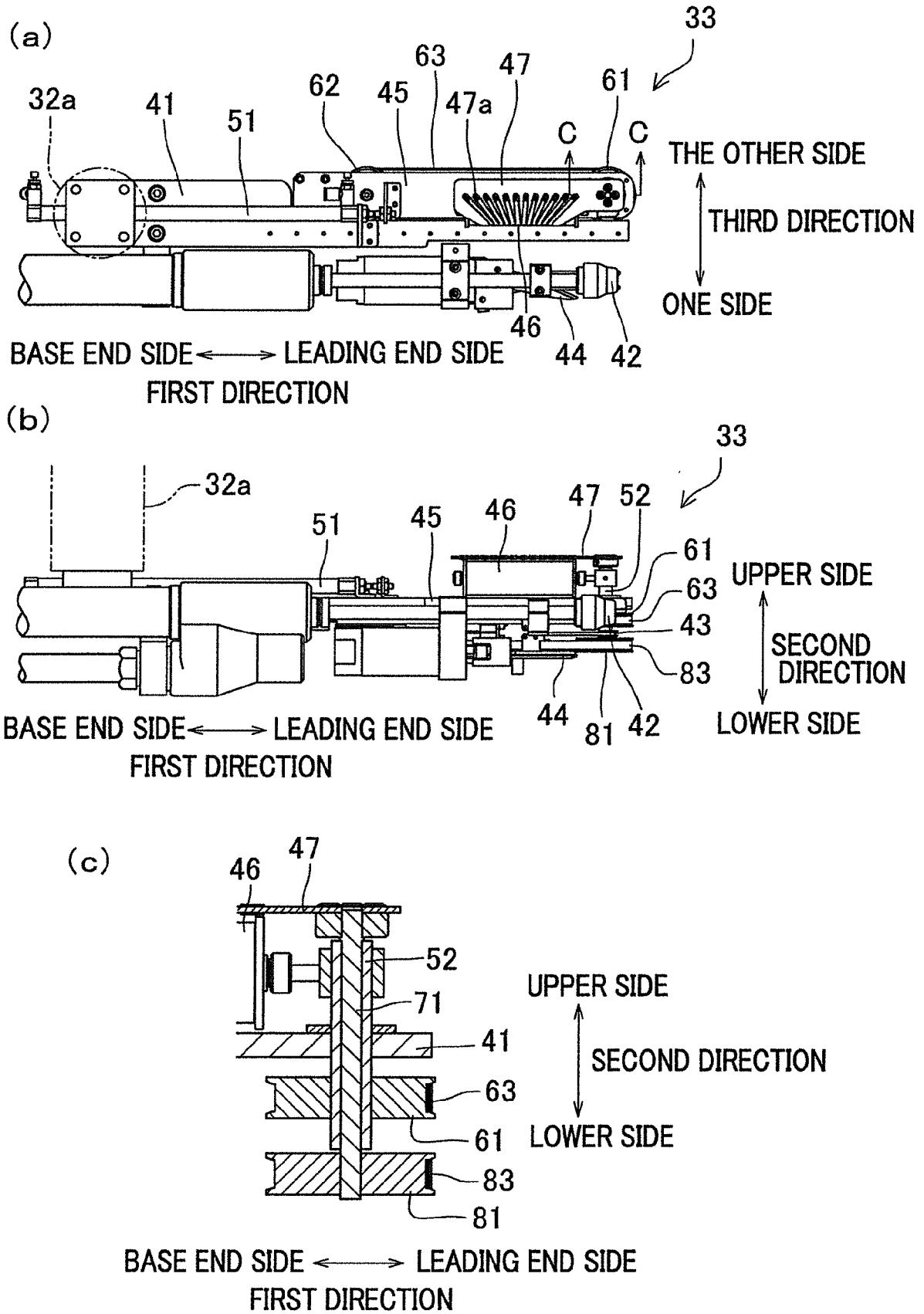


FIG.6

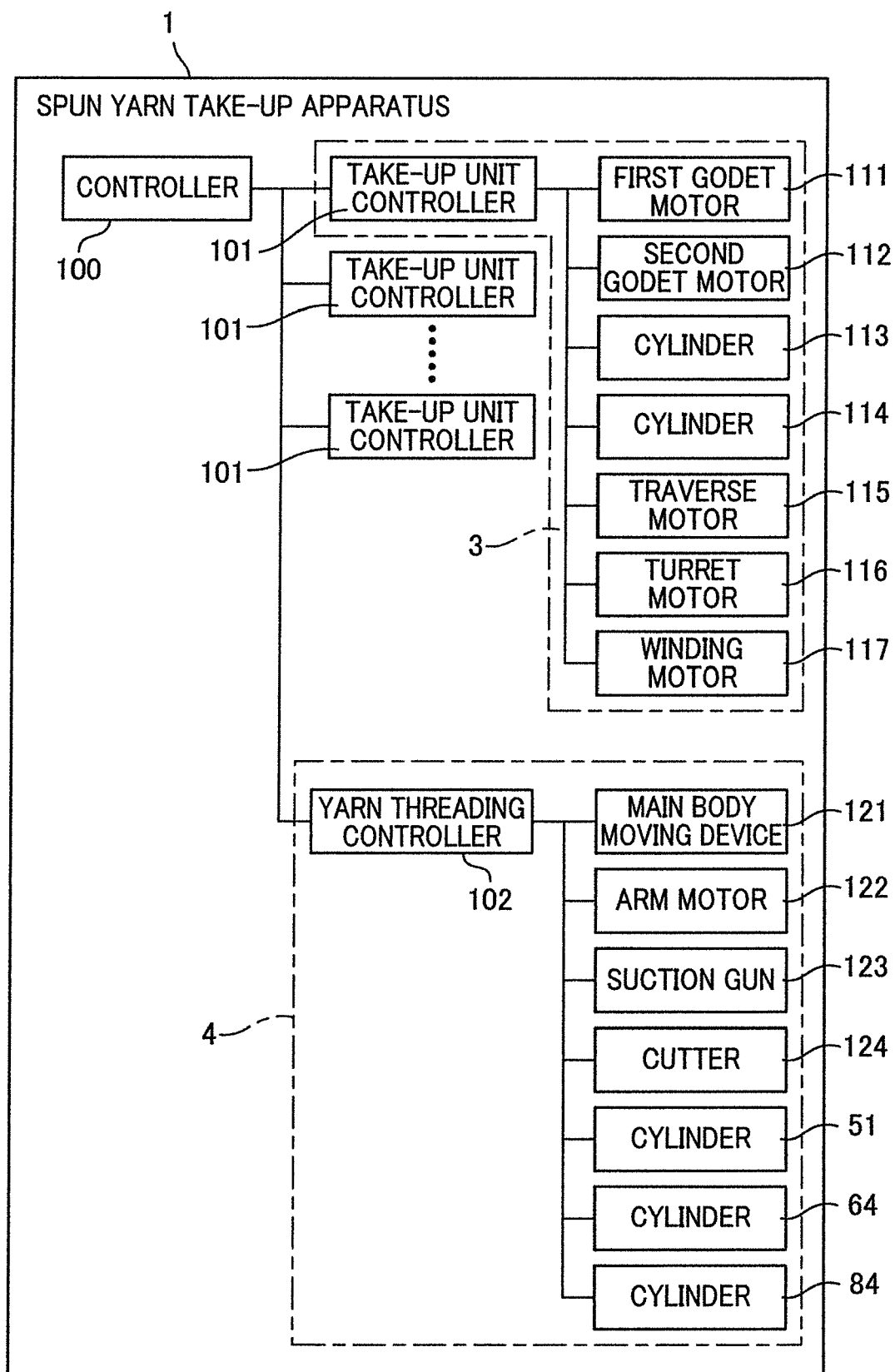


FIG. 7

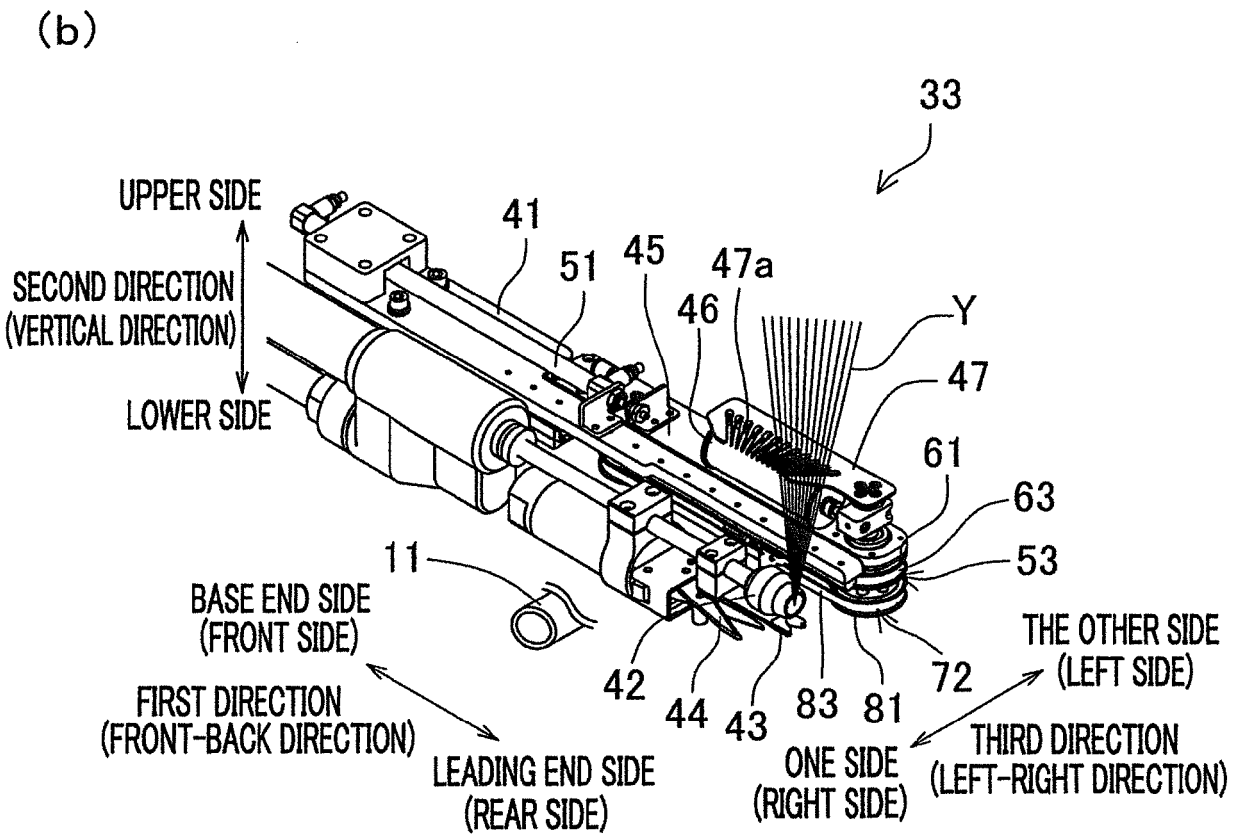
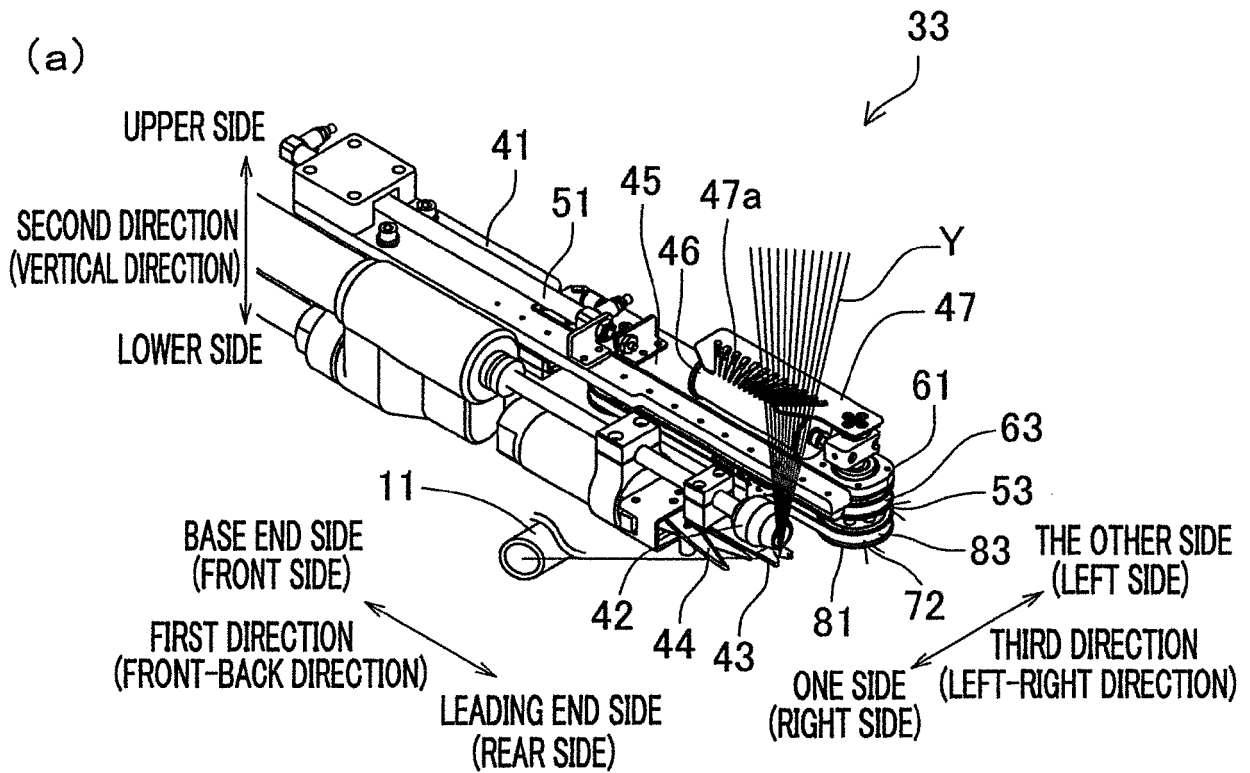
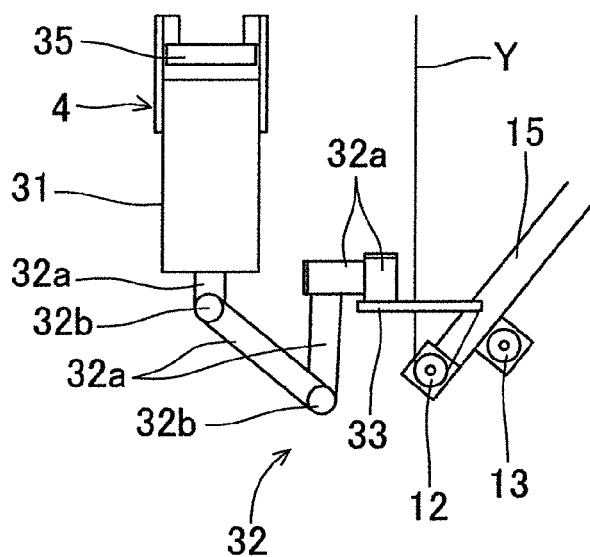


FIG.8

(a)



(b)

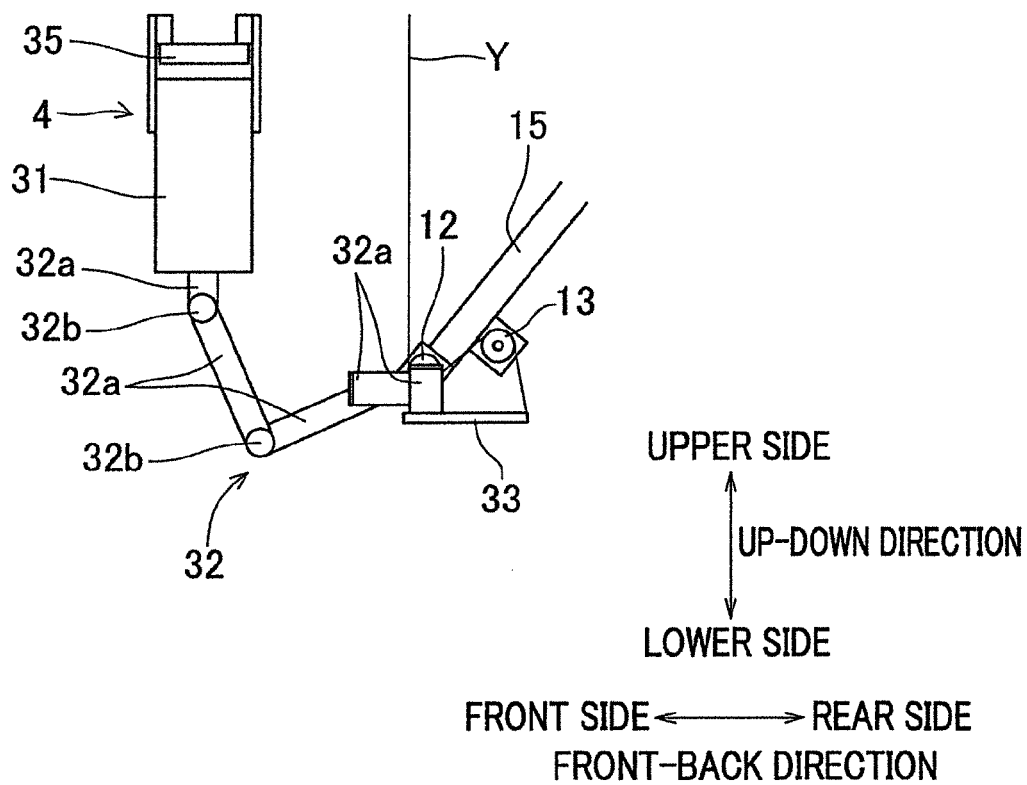


FIG.9

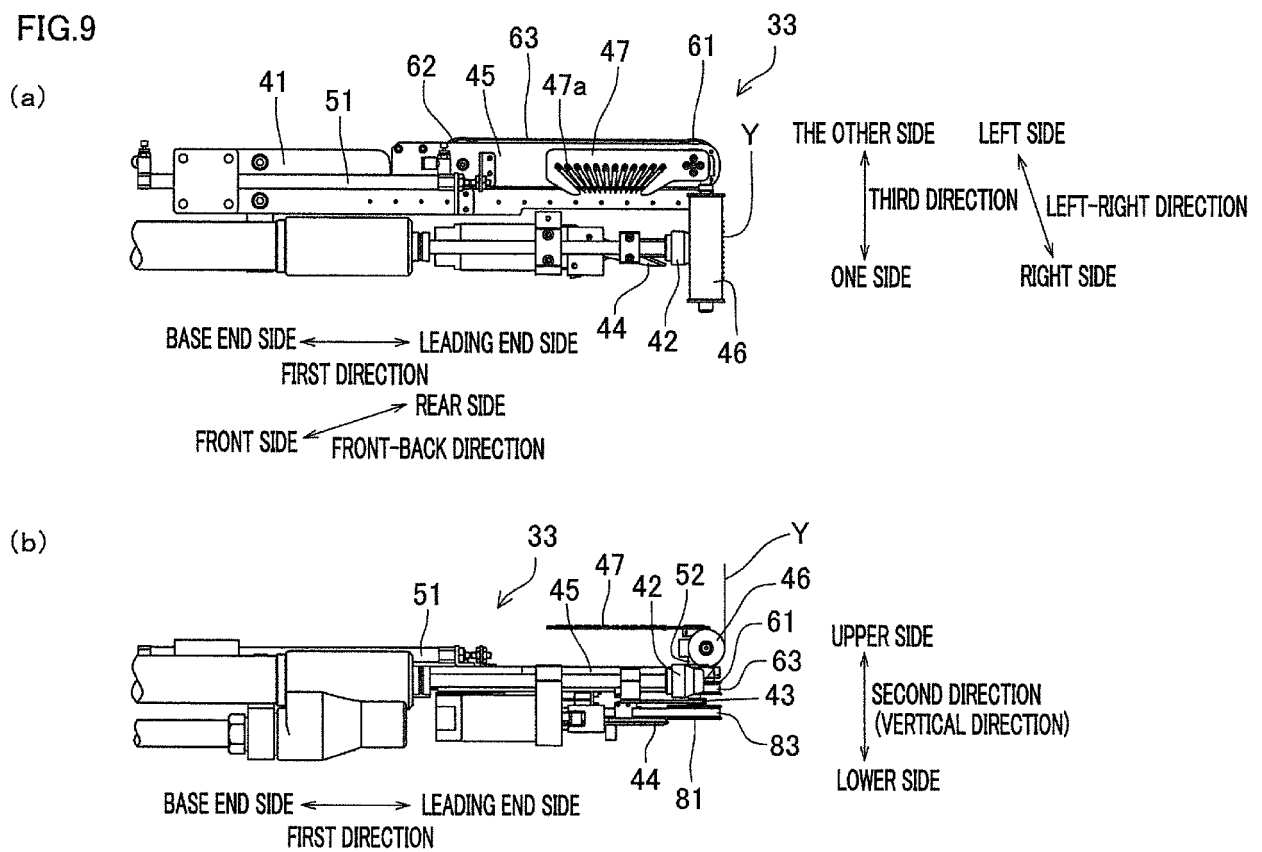


FIG.10

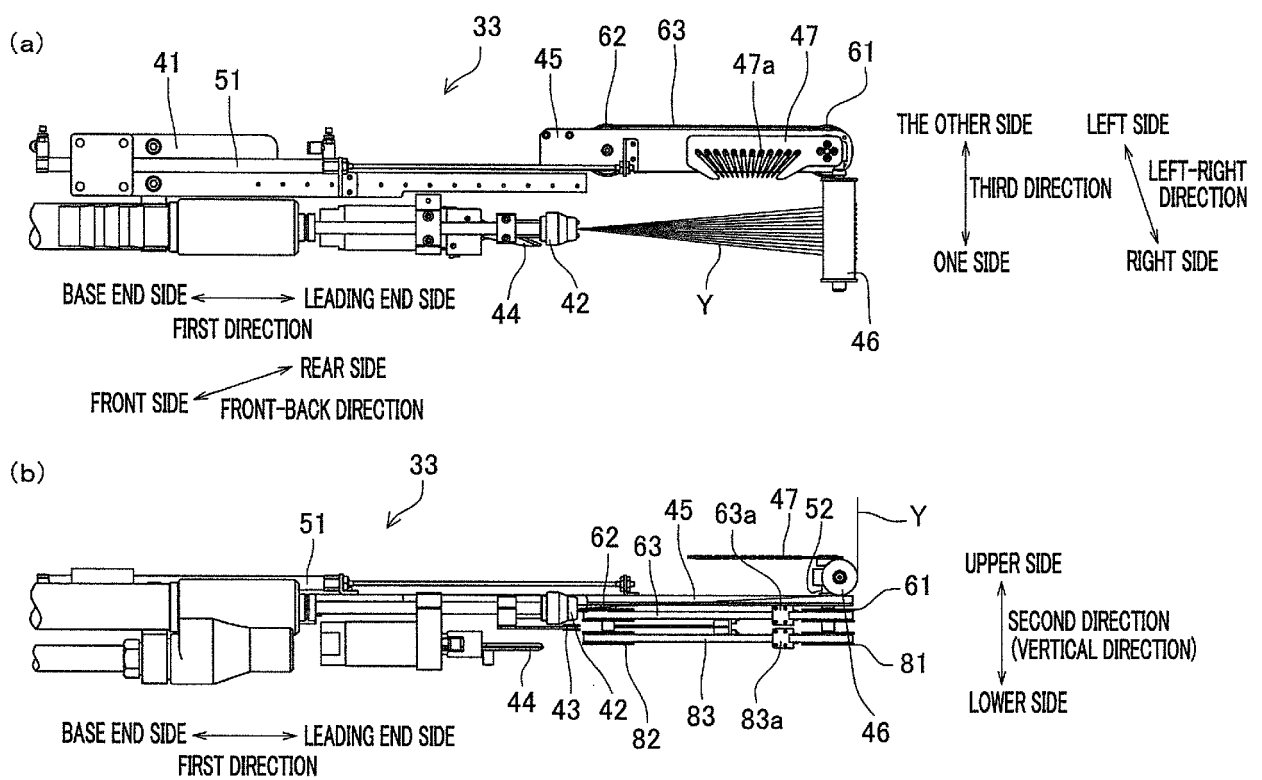


FIG.11

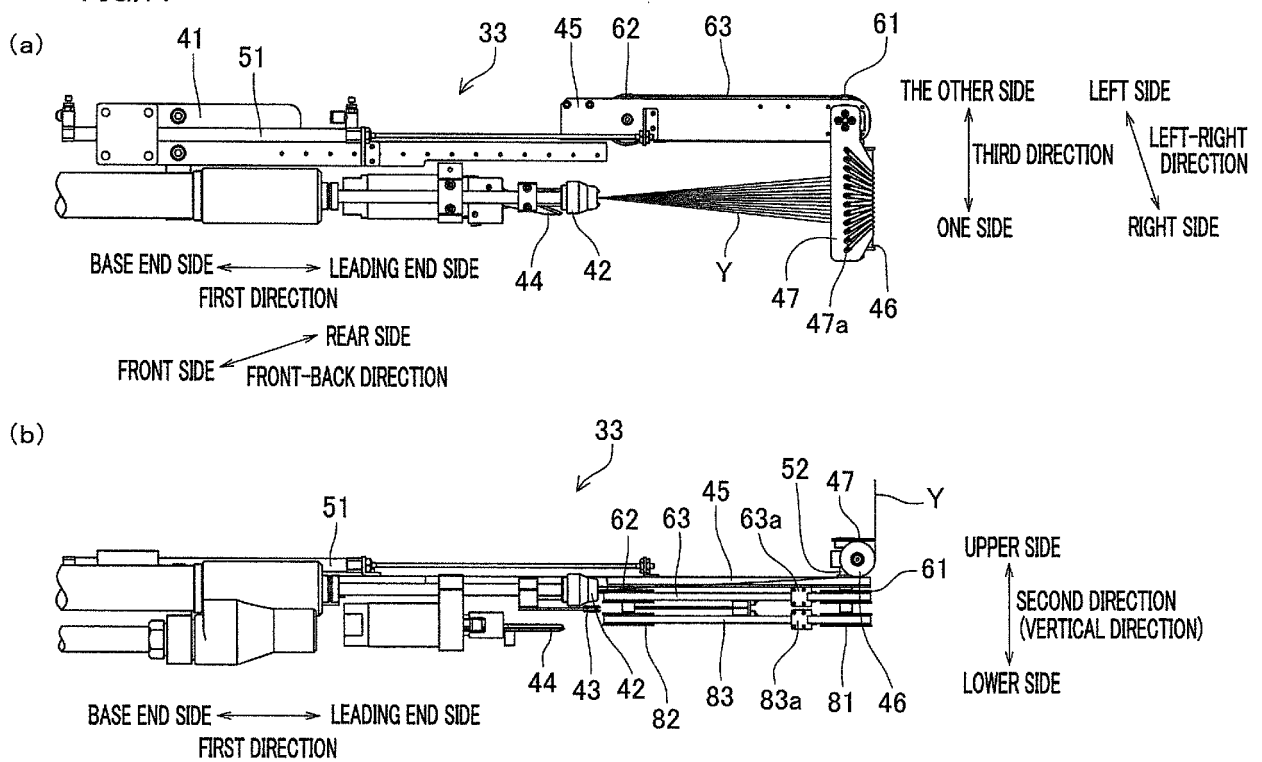


FIG.12

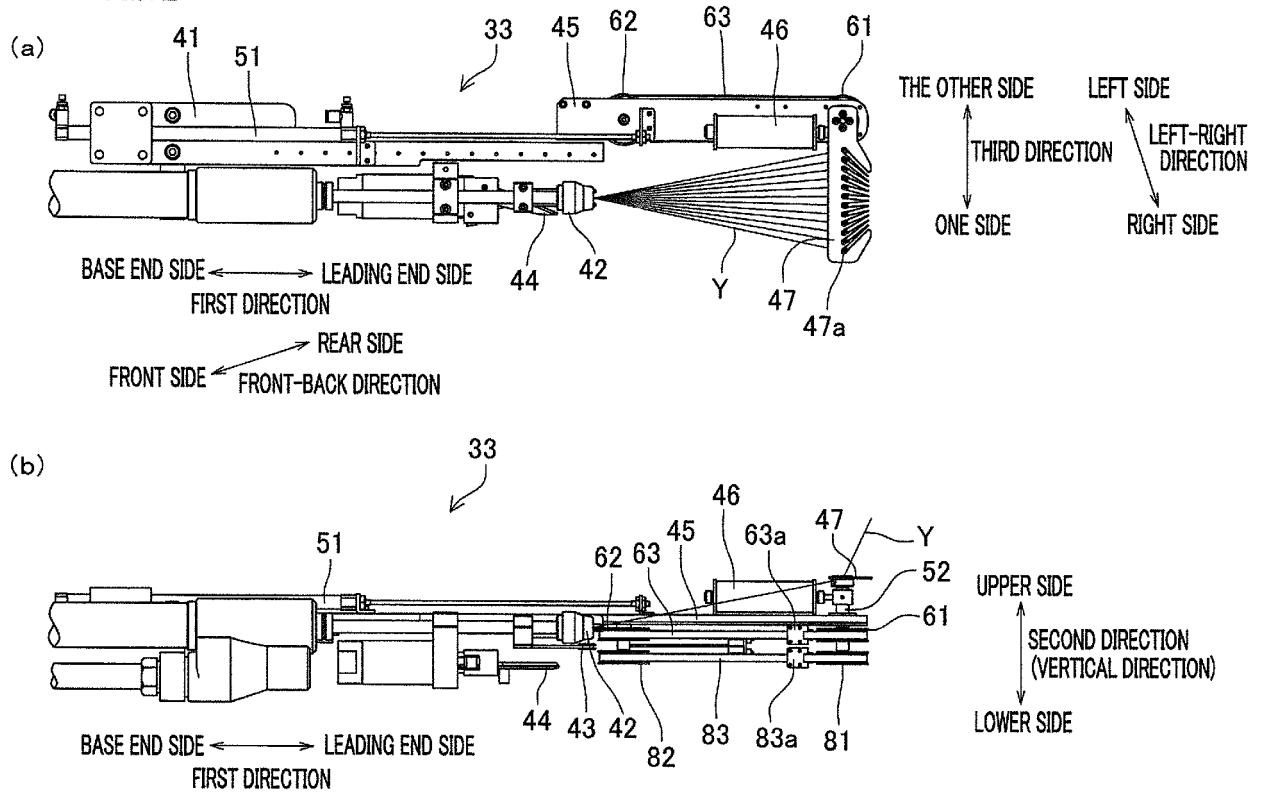
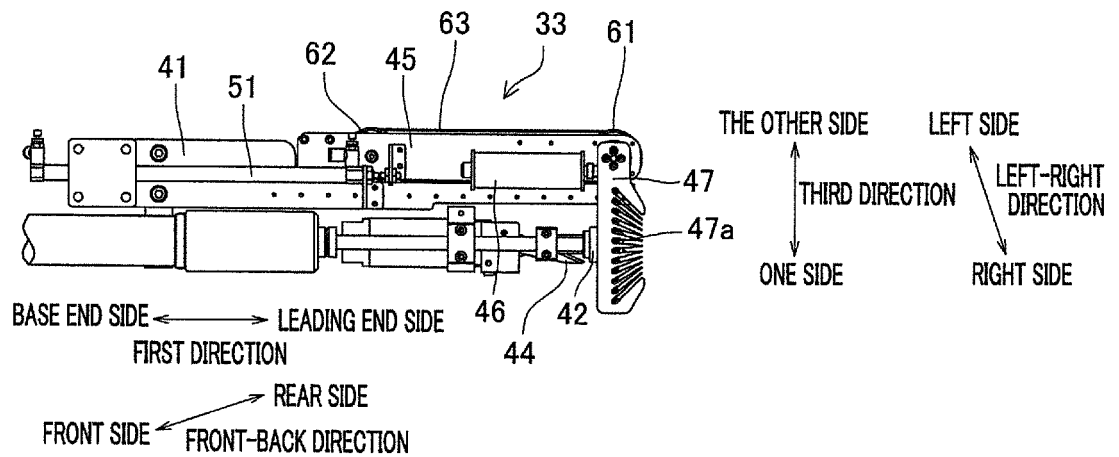


FIG.13

(a)



(b)

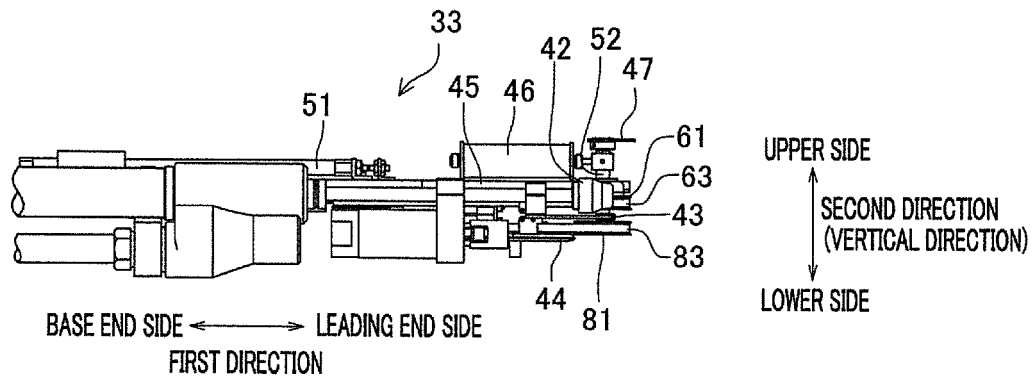
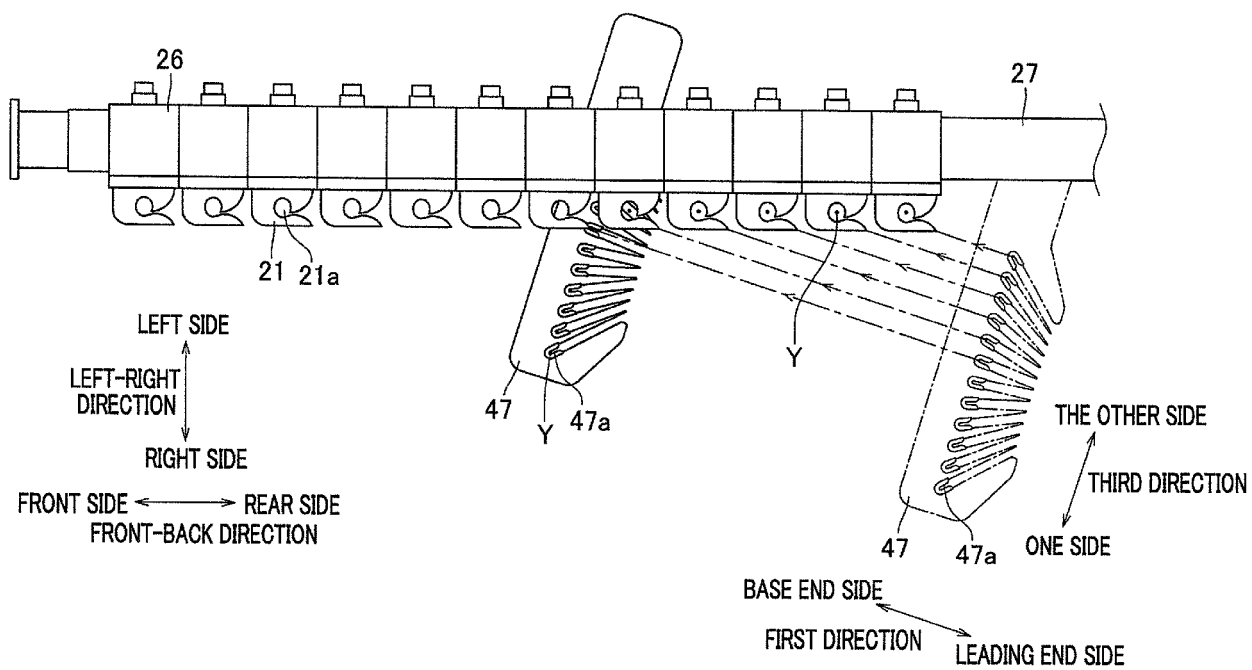


FIG.14





EUROPEAN SEARCH REPORT

Application Number
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			B65H D01D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 8 March 2017	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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