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(54) YARN SUPPLYING BOBBIN FEEDING DEVICE

(57) A yarn supplying bobbin feeding device (2) includes a yarn end cutting device (13) having a cutting member (32) capable of cutting yarn ends extending from yarn supplying bobbins (B). The yarn end cutting device (13) includes a suction member (31) having a suction vent (54) connected to a suction source (6) and that sucks the yarn ends by the action of a negative pressure supplied by the suction source (6) via the suction vent (54), a flexible hose (72) in which a communication path (76) that connects the suction vent (54) and the suction source (6) is formed, and an opening/closing member (80) capable of opening and closing at least one of the suction vent (54) and the communication path (76).

FIG.6A

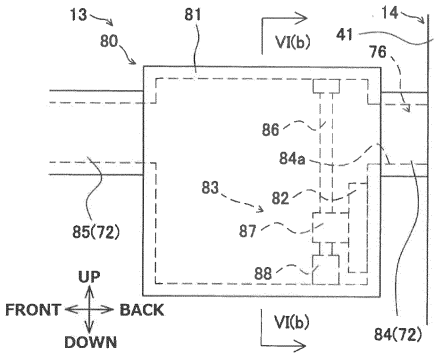
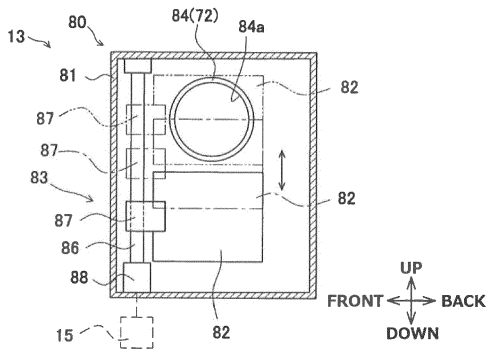


FIG.6B



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn supplying bobbin feeding device that supplies a yarn supplying bobbin on which a yarn has been wound.

2. Description of the Related Art

[0002] A yarn supplying bobbin feeding device disclosed in JP 2008-230830 A transports yarn supplying bobbins, on which a yarn has been wound, by using a vibration feeder. The yarn supplying bobbins transported by the vibration feeder are dropped into a parts feeder bowl in which the yarn supplying bobbins are aligned. In case of the yarn supplying bobbins fed by the vibration feeder, there are situations where the yarn ends are pulled out for a considerable length from the surface of the yarn supplying bobbins, or the yarn ends of a plurality of yarn supplying bobbins get entangled with each other. If the yarn supplying bobbins are dropped into the parts feeder bowl in this state, the yarn supplying bobbins may be entangled with each other and the yarn supplying bobbins may not be aligned as desired. To handle this issue, a yarn end cutting device that can cut the yarn ends is arranged between the vibration feeder and the parts feeder bowl in the transport direction of the yarn supplying bobbins. The yarn end cutting device includes a guiding member that guides the yarn supplying bobbins to downstream side in a transport direction of the yarn supplying bobbins, and a cutter that cuts the yarn ends extending from the yarn supplying bobbins.

[0003] Further, although not disclosed in JP 2008-230830 A, a yarn end cutting device, having a slit formed in the guiding member, for sucking the yarn ends is known in the art. More specifically, such a yarn end cutting device is connected to a suction source that generates a negative pressure by rotating a fan by using a motor, for example, and sucks the yarn ends of the yarns wound on the yarn supplying bobbins through this slit.

[0004] With this configuration, the yarn ends extending from the yarn supplying bobbins can be sucked, captured, and cut. Because the cut yarn ends are removed by suction as it is, the time and effort for collecting the yarn ends is also reduced.

SUMMARY OF THE INVENTION

[0005] The supply of the yarn supplying bobbins to the yarn end cutting device is not always continuous. For example, if the supply of yarn supplying bobbins to the vibration feeder is temporarily interrupted, the supply of yarn supplying bobbins to the yarn end cutting device is also temporarily interrupted. If the supply of the yarn supplying bobbins is interrupted but the negative pressure is continuously generated by the suction source, the suction source consumes power wastefully. On the other hand, for example, if the power supply of the suction source is turned on/off depending on whether the yarn supplying bobbin is supplied, it takes time and effort, and there is a possibility that the production efficiency may be reduced.

[0006] In view of the above discussion, one object of the present invention is to easily reduce power consumption of a suction source to which a yarn end cutting device is connected.

[0007] A yarn supplying bobbin feeding device according to one aspect of the present invention includes a yarn supplying bobbin transport device that transports a plurality of yarn supplying bobbins on which a yarn has been wound; a yarn supplying bobbin aligning device that aligns the yarn supplying bobbins and that is arranged downstream of the yarn supplying bobbin transport device in a transport direction of the yarn supplying bobbins; and a yarn end cutting device that includes a cutting member for cutting yarn ends extending from the yarn supplying bobbins and that is arranged between the yarn supplying bobbin transport device and the yarn supplying bobbin aligning device in the transport direction. The yarn end cutting device includes a suction member having a suction vent connected to a suction source and that sucks the yarn ends by the action of a negative pressure supplied thereto by the suction source via the suction vent; a connecting member in which a communication path that connects the suction vent and the suction source is formed; and an opening/closing member capable of switching, by opening and closing at least one of the suction vent and the communication path, the suction member between a supply state in which the negative pressure is supplied via the suction vent and a non-supply state in which the negative pressure is not supplied via the suction vent.

[0008] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a schematic diagram of a yarn winding equipment including a yarn supplying bobbin feeding device according one embodiment of the present invention.

FIG. 2 is a side view of the yarn supplying bobbin feeding device.

FIG. 3 is a perspective view of the yarn supplying bobbin feeding device.

FIGS. 4A to 4C are explanatory diagrams showing a basic configuration of a yarn end cutting device.

FIGS. 5A to 5C are explanatory diagrams showing the movement of a yarn end when a yarn supplying bobbin passes through the yarn end cutting device.
FIGS. 6A and 6B are explanatory diagrams showing an opening/closing member.
FIGS. 7A and 7B are explanatory views showing a mechanism for swinging a guiding member.
FIGS. 8A and 8B are plan views of a yarn end cutting device according to a modification.
FIGS. 9A and 9B are side views of the yarn end cutting device according to the modification.
FIG. 10 is a plan view of a yarn end cutting device according to another modification.
FIGS. 11A and 11B are front views of a yarn end cutting device according to still another modification.
FIGS. 12A and 12B are front views of a yarn end cutting device according to yet another modification.
FIG. 13 is a plan view of a yarn end cutting device according to still another modification.
FIG. 14 is a plan view of a yarn end cutting device according to yet another modification.

DETAILED DESCRIPTION

[0010] An exemplary embodiment of the present invention will be described below. For convenience of explanation, the up-down direction in FIG. 1 is defined as a vertical direction (up-down direction) in which the gravity acts. A left-right direction in FIG. 2 is defined as a front-back direction. A direction orthogonal to both the up-down direction and the front-back direction is defined as a left-right direction.

Yarn Winding Equipment

[0011] First, an outline of a yarn winding equipment 1 that includes a yarn supplying bobbin feeding device 2 according to the present embodiment will be described with reference to FIG. 1. As shown in FIG. 1, the yarn winding equipment 1 includes the yarn supplying bobbin feeding device 2, a yarn supplying bobbin processing device 3, a yarn winding machine 4, and a main controller 5.

[0012] The yarn supplying bobbin feeding device 2 transports yarn supplying bobbins B and supplies them to the yarn supplying bobbin processing device 3. A yarn has been wound on each of the yarn supplying bobbins B by a not-shown spinning machine that spins the yarn. The yarn supplying bobbin processing device 3 performs a predetermined process so that the yarn wound on the yarn supplying bobbin B can be smoothly unwound by the yarn winding machine 4. The yarn winding machine 4 includes a plurality of winding units 4a. Each winding unit 4a unwinds the yarn from a yarn supplying bobbin B, and forms a package by winding the yarn on a winding yarn supplying bobbin while removing any yarn defects in the yarn. The main controller 5 controls the entire yarn winding equipment 1 in an integrated manner.

[0013] The yarn winding equipment 1 includes a suction source 6 for sucking a yarn end Y (see FIG. 3) extending from the yarn supplying bobbin B fed by the yarn supplying bobbin feeding device 2 (see FIG. 3, details will be given later).

Yarn Supplying Bobbin Feeding Device

[0014] A configuration of the yarn supplying bobbin feeding device 2 will be described below with reference to FIGS. 2 and 3. FIG. 2 is a side view of the yarn supplying bobbin feeding device 2. FIG. 3 is a perspective view of the yarn supplying bobbin feeding device 2. Continuous-line arrows shown in FIG. 2 indicate a transport direction in which the yarn supplying bobbins B are transported. As shown in FIGS. 2 and 3, the yarn supplying bobbin feeding device 2 includes a yarn supplying bobbin receiving box 11, a yarn supplying bobbin transport device 12, a yarn end cutting device 13, a yarn supplying bobbin aligning device 14, and a control device 15.

[0015] The yarn supplying bobbin receiving box 11 is a container in which the yarn supplying bobbins B on which the yarn has been wound are put. The yarn supplying bobbin receiving box 11 is arranged at a back end of the yarn supplying bobbin feeding device 2. The yarn supplying bobbin receiving box 11 is movable between an initial position thereof (see a box shown with a solid line) and a supply position thereof (see a box shown with a two-dot chain line). A hydraulic cylinder 11a, for example, is used to move the yarn supplying bobbin receiving box 11. The yarn supplying bobbins B are put into the yarn supplying bobbin receiving box 11 manually by an operator or by a not-shown yarn supplying bobbin introducing device. The yarn supplying bobbins B fall on the yarn supplying bobbin transport device 12 by their own weight when the yarn supplying bobbin receiving box 11 moves from the initial position to the supply position.

[0016] The yarn supplying bobbin transport device 12 is a device that transports the yarn supplying bobbins B supplied from the yarn supplying bobbin receiving box 11. The yarn supplying bobbin transport device 12 is arranged, in the transport direction of the yarn supplying bobbins B, between the yarn supplying bobbin receiving box 11 and the yarn end cutting device 13. The yarn supplying bobbin transport device 12 includes a placement member 22 in which is formed a placement path 21 on which the yarn supplying bobbins B can be placed, and a vibration motor 23 that vibrates the placement member 22. In the yarn supplying bobbin transport device 12, the yarn supplying bobbins B placed on the placement path 21 can be transported forward when the vibration motor 23 vibrates the placement member 22. Typically, the yarn supplying bobbins B supplied from the yarn supplying bobbin receiving box 11 are transported on the placement path 21 in a piled state. Therefore, the yarn ends Y may be pulled out for a considerable length from the surface of the yarn supplying bobbins B, or the yarn ends Y of multiple yarn supplying bobbins B may get

entangled with each other.

[0017] The yarn end cutting device 13 is a device that cuts the yarn ends Y extending from the yarn supplying bobbins B. The yarn end cutting device 13 is arranged between the yarn supplying bobbin transport device 12 and the yarn supplying bobbin aligning device 14 in the transport direction. The yarn end cutting device 13 includes a guiding member 31 that guides the yarn supplying bobbins B forward and downward. A more detailed configuration of the yarn end cutting device 13 will be described later.

[0018] The yarn supplying bobbin aligning device 14 is a device that aligns the yarn supplying bobbins B and transports them one by one to the downstream side in the transport direction (toward the yarn supplying bobbin processing device 3). The yarn supplying bobbin aligning device 14 is arranged more downstream than the yarn supplying bobbin transport device 12 and the yarn end cutting device 13 in the transport direction. The yarn supplying bobbin aligning device 14 includes a housing 41, a bowl member 42 (a receiving member according to the present invention) arranged inside the housing 41 but below the guiding member 31 of the yarn end cutting device 13, and a vibrating solenoid 43 capable of vibrating the bowl member 42. The bowl member 42 is open from above. A spiral passage 44 in which the yarn supplying bobbins B are placed in a laying state is formed in the bowl member 42. In the yarn supplying bobbin aligning device 14, when the vibrating solenoid 43 vibrates the bowl member 42, the yarn supplying bobbins B are transported along the passage 44.

[0019] The control device 15 is electrically connected to the hydraulic cylinder 11a, the vibration motor 23, the vibrating solenoid 43, and the like. The control device 15 performs drive control of these parts.

Yarn End Cutting Device

[0020] A more detailed configuration of the yarn end cutting device 13 will be described below with reference to FIGS. 3 to 4C. FIG. 4A is a plan view of the guiding member 31. FIG. 4B is an explanatory view showing members and the like arranged below the guiding member 31. FIG. 4C is a side view of the yarn end cutting device 13.

[0021] The yarn end cutting device 13 is a device that cuts the yarn ends Y extending from the yarn supplying bobbins B while guiding the yarn supplying bobbins B transported by the yarn supplying bobbin transport device 12 to the downstream side in the transport direction (toward the yarn supplying bobbin aligning device 14). The yarn end cutting device 13 includes the guiding member 31 (see FIG. 3 and FIGS. 4A to 4C) that guides the yarn supplying bobbins B, and a plurality of cutting members 32 capable of cutting the yarn ends Y (see FIG. 4B). As will be described later, the yarn end cutting device 13 is capable of sucking and capturing the yarn ends Y.

[0022] The guiding member 31 (a suction member according to the present invention) is a member formed by sheet metal processing a metal plate, for example. The guiding member 31 is arranged above the bowl member 42 of the yarn supplying bobbin aligning device 14 (see FIG. 3). The guiding member 31 has a bottom part 52 in which a planar guide path 51 extending downward and forward is formed, and two side members 53 extending upward from both the left and right ends of the bottom part 52. The guide path 51 is inclined more downward as one goes more toward the front. A direction in which the guide path 51 extends, that is, a direction in which the yarn supplying bobbins B are guided along the guide path 51, is defined as a guiding direction (see FIG. 4C). The guiding direction intersects the up-down direction. In the guiding direction, the yarn supplying bobbin transport device 12 side is defined as a proximal end side (other side according to the present invention), and a side opposite to the proximal end side is defined as a distal end side (one side according to the present invention). The left-right direction is defined as a width direction of the guide path 51. The guide path 51 need not be necessarily flat but can be curved.

[0023] As shown in FIGS. 3 and 4A, a suction vent 54 that passes through the bottom part 52 in the up-down direction and extends in the left-right direction is formed in the middle of the bottom part 52 in the guiding direction. In a tip end part of the bottom part 52 in the guiding direction, a plurality of yarn end guide slits 55 that extends toward a proximal end side thereof at least in the guiding direction is formed. In other words, the suction vent 54 is arranged closer to the proximal end side than the yarn end guide slits 55 in the guiding direction. The yarn end guide slits 55 are formed side by side in the width direction. Each yarn end guide slit 55 is curved such that the width thereof narrows as one goes from the tip end part of the bottom part 52 toward the proximal end side thereof in the guiding direction. The yarn end guide slits 55 need not necessarily be curved, but can extend linearly, for example. Further, the yarn end guide slits 55 need not necessarily become narrower as one goes from the tip end part toward the proximal end side in the guiding direction of the bottom part 52.

[0024] The side members 53 of the guiding member 31 function to prevent the yarn supplying bobbins B, which are traveling on the guide path 51, from falling off the guide path 51. A front end of each of the side members 53 is supported so as to be swingable by an L-shaped support member 56, for example. A back end of each of the side members 53 is supported from below by, for example, a plate-like support member 57 (details will be given later).

[0025] As shown in FIG. 4B, the cutting members 32 are arranged below the bottom part 52 of the guiding member 31. The cutting member 32 includes a scissors-like cutter 61 arranged immediately below a tip end on the proximal end side in the guiding direction of the yarn end guide slit 55, and an air cylinder 62 that operates the cutter 61. The air cylinder 62 is controlled by the control

device 15. The cutter 61 is driven by the air cylinder 62 when cutting the yarn ends Y that have entered the tip end on the proximal end side in the guiding direction of the yarn end guide slit 55. The air cylinder 62 that drives the cutter 61 can be replaced with, for example, a motor.

[0026] As described above, the yarn winding equipment 1 is provided with the suction source 6 (see FIG. 3). The suction source 6 includes an electric motor 6a and a fan 6b that is rotationally driven by the motor 6a. The motor 6a is driven and controlled by the main controller 5, for example, so as to rotate at a constant rotational speed. The suction vent 54 of the guiding member 31 is connected to the suction source 6 via a connecting member 71 and a flexible hose 72. The connecting member 71 and the flexible hose 72 will be described in detail later. Thus, the yarn end cutting device 13 can suck the yarn ends Y extending from the yarn supplying bobbins B via the suction vent 54.

[0027] The connecting member 71 is a hollow member attached to a lower surface of the bottom part 52 of the guiding member 31. The connecting member 71 has an opening 73 that has a shape similar to the suction vent 54 of the guiding member 31. An internal space 74 of the connecting member 71 communicates with the suction vent 54 via the opening 73. The connecting member 71 is connected to the flexible hose 72. The flexible hose 72 is, for example, a bendable hose having a bellows structure. One end of the flexible hose 72 is connected to the connecting member 71, and the other end is connected to the suction source 6. For example, the flexible hose 72 is routed inside the housing 41 of the yarn supplying bobbin aligning device 14, and extends from a side surface of the housing 41 to the outside of the housing 41 (see FIG. 3). A communication path 76 that connects the suction source 6 and the suction vent 54 is formed by the internal space 74 of the connecting member 71 and an internal space 75 of the flexible hose 72. With this structure, a negative pressure is supplied in a space near the suction vent 54 via the suction vent 54. The connecting member 71 and the flexible hose 72 correspond to a connecting member according to the present invention.

Yarn End Cutting Operation Performed by Yarn End Cutting Device

[0028] A yarn end Y cutting operation performed by the yarn end cutting device 13 will be described with reference to FIGS. 5A to 5C. FIGS. 5A to 5C are explanatory diagrams showing the movement of the yarn ends Y when the yarn supplying bobbins B pass through the yarn end cutting device 13. However, in order to avoid complication of the drawings, only one yarn supplying bobbin B has been shown in FIGS. 5A to 5C.

[0029] First, the yarn supplying bobbin B is transported to the downstream side end in the transport direction of the placement path 21 by the yarn supplying bobbin transport device 12 (see FIG. 5A). Thereafter, the yarn supplying bobbin B slides under its own weight while being guided along the guide path 51 (see FIG. 5B). While the yarn supplying bobbin B is moving along the guide path 51, the yarn end Y extending from the yarn supplying bobbin B is sucked and captured by the action of the negative pressure supplied via the suction vent 54. Then, the yarn supplying bobbin B moves to the tip end in the guiding direction of the guide path 51 and then falls from the guiding member 31 by its own weight (see a two-dot chain line in FIG. 5B). In this process, a middle part of the yarn end Y is guided to the proximal end side in the guiding direction by one of the yarn end guide slits 55, and this yarn end Y enters the tip end on the proximal end side in the guiding direction of this yarn end guide slit 55 (see a two-dot chain arrow in FIG. 5C). The yarn end Y that has entered the tip end on the proximal end side in the guiding direction of the yarn end guide slit 55 is cut by the cutting member 32 (see FIG. 4B). The tip end side part of the cut yarn end Y is removed by suction via the communication path 76 (see FIG. 4C).

[0030] The supply of the yarn supplying bobbins B to the yarn end cutting device 13 is not always continuous. For example, if the supply of yarn supplying bobbins B to the yarn supplying bobbin transport device 12 is temporarily interrupted, the supply of yarn supplying bobbins B to the yarn end cutting device 13 is also temporarily interrupted. If the supply of the yarn supplying bobbins B is interrupted but the negative pressure is continuously generated by the suction source 6, the suction source 6 consumes power wastefully. On the other hand, for example, if the power supply of the suction source 6 is turned on/off depending on whether the yarn supplying bobbins B are supplied, it takes time and effort, and there is a possibility that the production efficiency may be reduced. Therefore, in order to easily reduce the power consumption of the suction source 6 to which the yarn end cutting device 13 is connected, the yarn end cutting device 13 has an opening/closing member 80 described later.

Opening/Closing Member

[0031] A structure of the opening/closing member 80 will be described with reference to FIG. 3 and FIGS. 6A and 6B. FIG. 6A is a front view of the opening/closing member 80 and its surrounding structure. FIG. 6B is a cross-sectional view along a line VI(b)-VI(b) shown in FIG. 6A.

[0032] As described above, the yarn end cutting device 13 includes the opening/closing member 80. In the present embodiment, the opening/closing member 80 is capable of opening and closing the flexible hose 72 that is a part of the connecting member described above. As an example, as shown in FIG. 6A, the opening/closing member 80 is arranged in front of the housing 41 of the yarn supplying bobbin aligning device 14. As shown in FIGS. 6A and 6B, the opening/closing member 80 includes a casing 81, a shutter 82, and a shutter moving mechanism 83.

[0033] The casing 81 is a member in which a sealed space is formed. The flexible hose 72 is connected to the casing 81. More specifically, one end of a first flexible hose 84, which is provided on the yarn end cutting device 13 side, is connected to a front end of the casing 81. One end of a second flexible hose 85, which is provided on the suction source 6 side, is connected to a back end of the casing 81.

[0034] The shutter 82 is a plate-like member arranged inside the casing 81. The shutter 82 functions to open and close an opening 84a on one end side of the first flexible hose 84, for example. A surface area of an end face of the shutter 82 is larger than a surface area of the opening 84a. The shutter 82 is driven to move by the shutter moving mechanism 83.

[0035] The shutter moving mechanism 83 is a mechanism that switches the positions of the shutter 82. The shutter moving mechanism 83 is, for example, a ball screw mechanism having a screw shaft 86 extending in the up-down direction and a nut 87 screwed to the screw shaft 86. However, the structure of the shutter moving mechanism 83 is not limited to the one mentioned here. For example, it is possible to employ a revolving shutter that opens and closes by revolving around a rotation axis. The shutter 82 is fixed to the nut 87. The screw shaft 86 is rotationally driven by a motor 88. The motor 88 is driven and controlled by the control device 15. When the motor 88 rotationally drives the screw shaft 86, the nut 87 and the shutter 82 move along an axial direction of the screw shaft 86. As a result, the shutter 82 is movable between an open position (see a solid line in FIG. 6B) at which the opening 84a of the first flexible hose 84 is completely open, and a closed position (see a two-dot chain line in FIG. 6B) at which the opening 84a is completely covered and closed by the shutter 82. Also, the shutter 82 can be moved to, for example, a half-open position (see a one-dot chain line in FIG. 6B) at which the opening 84a is only half-opened. As described above, the opening/closing member 80 is capable of adjusting an opening degree of the first flexible hose 84.

[0036] When the shutter 82 is in the open position, the negative pressure is supplied by the suction source 6 via the suction vent 54 of the guiding member 31 (see FIG. 4A, etc.) (that is, the suction member is in a supply state). At this time, the fan 6b is rotated by the motor 6a of the suction source 6 so that the air near the suction vent 54 of the guiding member 31 is discharged through the internal space 74 of the connecting member 71 and the internal space 75 of the flexible hose 72 resulting in the supply of the negative pressure to the space near the suction vent 54. On the other hand, when the shutter 82 is in the closed position, no negative pressure is supplied through the suction vent 54 (that is, the suction member is in a non-supply state). In the supply state, a lot of air is continuously discharged, while in the non-supply state, no air is discharged. Here, as described above, the motor 6a is controlled to rotate the fan 6b at a constant rotational speed. For this reason, in the supply state, in which a lot of air need to be continuously discharged, the load on the motor 6a is relatively large. Conversely, in the non-supply state, the load on the motor 6a is relatively small. Therefore, in the non-supply state, the power consumption of the motor 6a is lower than that in the supply state.

Other Configurations

[0037] Next, a configuration that further improves the yarn end cutting device 13 will be described by mainly using FIGS. 7A and 7B. FIGS. 7A and 7B are explanatory views showing a swinging mechanism 90 that swings the guiding member 31.

[0038] As described above, the yarn supplying bobbins B are transported by the yarn supplying bobbin transport device 12 in an overlapping and piled state (see FIG. 7A). For this reason, for example, the yarn supplying bobbins B may not move as desired on the guide path 51. Also, the yarn ends Y may not be sucked because the yarn ends Y may be sandwiched between the yarn supplying bobbins B. To address this issue, the yarn end cutting device 13 further includes the swinging mechanism 90. The swinging mechanism 90 includes the support members 56 and air cylinders 93 (a first swing drive member according to the present invention).

[0039] The support member 56 is, for example, an L-shaped member (see FIG. 3). As one specific example, a part of the support member 56 extending in the up-down direction is fixed to the housing 41 of the yarn supplying bobbin aligning device 14 (see FIG. 3). A part extending in the left-right direction of the support member 56 is a swing axis that supports the side member 53 of the guiding member 31 so as to be swingable (see FIGS. 4A to 4C). A back end of the side members 53 is supported from below by the support members 57 (see FIG. 4A, etc.). As a specific example, as shown in FIG. 4A and FIGS. 5A to 5C, a right end part of the support member 57 on the left (support member 91) is notched to form an upward-facing surface 91a. Further, a left end part of the support member 57 on the right (support member 92) is notched to form an upward-facing surface 92a. The back ends of the side members 53 of the guiding member 31 are supported by the support members 91 and 92 when the back ends touch these surfaces 91a and 92a by riding on the surfaces 91a and 92a.

[0040] Each air cylinder 93 has a piston rod 94 that can extend and contract in the substantially up-down direction. A tip end of the piston rod 94 is attached to a back end part of the side member 53 of the guiding member 31. The air cylinder 93 is connected to a not-shown compressed air source. When compressed air is supplied to the air cylinder 93 by the compressed air source via a not-shown pipe, the piston rod 94 extends, and when the compressed air is discharged from the air cylinder 93, the piston rod 94 contracts. The supply and discharge of compressed air can be switched by a not-shown solenoid valve that can be controlled by the control device 15, for example.

[0041] When the air cylinders 93 operate and the piston rods 94 thereof extend and contract, the guiding member 31 swings in the substantially up-down direction with the support members 56 as the swing axis (see an arrow in FIG. 7B). As a result, the yarn supplying bobbins B present on the guide path 51 rock. As a result, the pile of the yarn supplying bobbins B can be collapsed. When swinging the guiding member 31, the control device 15 (see FIG. 2) can temporarily stop the operation of the yarn supplying bobbin transport device 12. As a result, when the guiding member 31 is swinging, falling of the yarn supplying bobbins B through the gap between the placement member 22 of the yarn supplying bobbin transport device 12 and the guiding member 31 of the yarn end cutting device 13 can be prevented.

[0042] As described above, when no negative pressure is supplied (non-supply state), the load on the suction source 6 is lower than when the negative pressure is supplied (supply state), and the suction source 6 can be operated with lower power. Accordingly, the opening/closing member 80 can easily reduce the power consumption of the suction source 6 to which the yarn end cutting device 13 is connected.

[0043] Further, by adjusting the opening degree of the flexible hose 72 by using the opening/closing member 80, the absolute value of the supplied negative pressure can be changed. Therefore, the load on the suction source 6 can be effectively reduced depending on the yarn type and the like.

[0044] Furthermore, the suction vent 54 is formed in the guiding member 31. For this reason, compared with the case where the suction vent 54 is formed in a member other than the guiding member 31, the increase in the number of components can be suppressed. Moreover, the yarn ends Y extending from the yarn supplying bobbins B that are moving on the guide path 51 can be sucked easily.

[0045] Further, the guiding member 31 is proactively driven to swing by the air cylinders 93. Therefore, even if the yarn supplying bobbins B are transported in the piled state, the yarn supplying bobbins B present on the guide path 51 are rocked whereby the pile of the yarn supplying bobbins B can be collapsed.

[0046] Furthermore, before the yarn supplying bobbins B fall from the guiding member 31, the yarn ends Y of the yarn supplying bobbins B can be sucked in advance through the suction vent 54 arranged on the proximal end side in the guiding direction (that is, upstream side in the transport direction) than the yarn end guide slits 55. Thereby, when the yarn supplying bobbins B fall from the guiding member 31, the middle part of the yarn ends Y can be made to enter at least in the yarn end guide slits 55 that extend the other side in the guiding direction. Therefore, the yarn ends Y that have entered the yarn end guide slits 55 can be surely cut by the cutter 61.

[0047] Modification examples in which the above-described embodiments are modified will be described below. However, the parts having the same or similar configuration as the above-mentioned embodiments are denoted by the same reference numerals and description thereof has been omitted as appropriate.

(1) In the above-described embodiments, the opening/closing member 80 (see FIGS. 6A and 6B) can adjust the opening degree of the communication path 76, but the structure is not limited thereto. The opening/closing member 80 may simply be able to open and close the communication path 76.

(2) The yarn end cutting device 13 can have a below-described swinging mechanism 100 that causes the pile of the yarn supplying bobbins B transported by the yarn supplying bobbin transport device 12 in an overlapping state to collapse. Hereinafter, this configuration will be explained with reference to FIGS. 8A and 8B and FIGS. 9A and 9B. The swinging mechanism 100 includes a plate member 101 (a swing member according to the present invention) and air cylinders 102 (a second swing drive member according to the present invention). First, as shown in FIG. 8A, a gap 105 that extends in the left-right direction is formed between a rear end 103 of the bottom part 52 of the guiding member 31 and a front end 104 of the placement member 22 of the yarn supplying bobbin transport device 12. Moreover, as shown in FIG. 8B and FIGS. 9A and 9B, the plate member 101 extends in the up-down direction and the left-right direction, and is capable of passing through the gap 105. For example, support members 106 are attached to the lower ends of the left and right ends of the plate member 101. Each support member 106 is attached to a piston rod 107 of the corresponding air cylinder 102. The air cylinder 102 functions to extend and contract the piston rod 107 in the up-down direction. Accordingly, the plate member 101 can be swung in the up-down direction by using the air cylinders 102. In other words, the plate member 101 can swing in a space above the guide path 51. Here, the space above the guide path 51 is not limited to the space directly above the guide path 51, but includes the space directly above the gap 105 described above. The plate member 101 can be caused to interfere with the yarn supplying bobbins B by swinging the plate member 101 in the space above the guide path 51. Therefore, even when a plurality of yarn supplying bobbins B is transported in the piled state (see FIG. 9A), the pile of the yarn supplying bobbins B on the guide path 51 can be collapsed by the plate member 101 (see FIG. 9B).

(3) The yarn end cutting device 13 may include, in addition to the swinging mechanism 100 or instead of the swinging mechanism 100, a swinging mechanism 110 described below, for example. As shown in FIG. 10, the swinging mechanism 110 can include, instead of the plate member 101 described above, a rod member 111 that can swing on the guide path 51 and a motor 112 that drives the rod member 111

to swing. The rod member 111 can swing (see an arrow in FIG. 10), for example, with a swing shaft 113 arranged on the front side than the guiding member 31 as a swing center. A tip end of the rod member 111 can be arranged so as to be swingable in the space above the guide path 51. In this configuration, the rod member 111 corresponds to the swing member according to the present invention. The motor 112 corresponds to the second swing drive member according to the present invention. In this configuration, the gap 105 (see FIG. 8A, etc.) need not be formed.

(4) In the above-described embodiments, the guiding member 31 of the yarn end cutting device 13 is supported from below by the support members 57, but the configuration is not limited thereto. For example, the guiding member 31 and the support members 57 may be fixed to each other, and the support members 57 may be supported from below by the housing 41 of the yarn supplying bobbin aligning device 14. Alternatively, the guiding member 31 and the support members 57 may be integrated and formed as one member. That is, the air cylinders 93 can swing both the guiding member 31 and the support members 57 integrally.

(5) In the above-described embodiments, the guiding member 31 of the yarn end cutting device 13 is swingable, but the configuration is not limited thereto. The guiding member 31 need not necessarily be swingable.

(6) In the above-described embodiments, the opening/closing member 80 opens and closes the first flexible hose 84; however, the present invention is not limited to this configuration. The opening/closing member 80 can open and close the communication path 76 at some other location. Alternatively, in addition to or instead of the opening/closing member 80, as shown in FIGS. 11A and 11B, an opening/closing member 120 that opens and closes the suction vent 54 of the guiding member 31 can be provided. The opening/closing member 120 has an opening/closing part 121 that extends in the left-right direction and that opens and closes the suction vent 54. The opening/closing part 121 is arranged as explained below, for example. That is, a through hole 53a penetrating in the left-right direction and extending in the front-back direction can be formed in a back side portion of each of the side members 53 on both the left and right sides of the guiding member 31. The opening/closing part 121 extends in the left-right direction and is inserted into the two through holes 53a. The left and right ends of the opening/closing part 121 are supported by, for example, two air cylinders 122 so as to be movable along the through holes 53a. As a result, the opening/closing part 121 can open and close the suction vent 54. That is, the opening/closing part 121 is capable of moving between an open position at which the suction vent 54 is open (see FIG. 11A) and a closed position at which the suction vent 54 is closed (see FIG. 11B). Instead of the air cylinders 122, for example, a typical ball screw mechanism may be provided. That is, the opening degree of the suction vent 54 can be adjusted by adjusting the position of the opening/closing part 121.

(7) In the above-described embodiments, the opening/closing member 80 only opens and closes the suction vent 54 and/or the communication path 76, but the configuration is not limited thereto. For example, the yarn ends Y can be cut by an opening/closing member 130 as shown in FIGS. 12A and 12B. In this configuration, the opening/closing member 130 corresponds to the cutting members according to the present invention. The opening/closing member 130 has an opening/closing part 131 (a cutter member according to the present invention) that extends in the left-right direction and is similar in function to the opening/closing part 121 described above. Regarding a difference between the opening/closing part 121 and the opening/closing part 131, the opening/closing part 131 is formed with a blade 132 extending in the left-right direction. The left and right ends of the opening/closing part 131 are supported by the two air cylinders 122 described above, for example, so as to be movable along the through holes 53a. As a result, the opening/closing part 131 is movable between an open position at which the suction vent 54 is open (see FIG. 12A) and a closed position at which the suction vent 54 is closed (see FIG. 12B). Furthermore, the opening/closing part 131 can cut the yarn ends Y by the blade 132 when the suction vent 54 is closed. In this way, the yarn ends Y can also be cut by the opening/closing member 130. The tip ends of the cut yarn ends Y are removed by suction via the communication path 76 as they are. As a result, the yarn ends Y can be prevented from being entangled with the opening/closing member 130, so that the opening/closing failure of the opening/closing member 130 can be suppressed. Moreover, because the yarn ends Y can be cut by the opening/closing member 130, the above-described cutting members 32 (see FIG. 4B) may not be provided. Furthermore, the yarn end guide slits 55 need not be formed on the guiding member 31. Accordingly, the size of the guiding member 31 in the guiding direction can be reduced.

(8) The yarn end cutting device 13 can include a member that blows gas on the yarn ends Y in order to make the yarn ends Y extending from the yarn supplying bobbins B falling from the guiding member 31 easily enter the yarn end guide slits 55. For example, as shown in FIG. 13, the yarn end cutting device 13 includes a nozzle member 141 (a blowing member according to the present invention) in front of the guiding member 31 (at least in the guiding direction, at the tip end side than the yarn end guide

slits 55). The nozzle member 141 is arranged such that a tip end thereof faces the guiding member 31. As shown in FIG. 13, a plurality of the nozzle members 141 may be arranged side by side in the left-right direction. Alternatively, only one nozzle member 141 may be provided. The nozzle member 141 is connected to a compressed air source 142. A pipe 143 that connects the nozzle member 141 and the compressed air source 142 is opened and closed by an electromagnetic valve 144 that is controlled by the control device 15, for example. As a result, compressed air (gas according to the present invention) can be blown from the tip end of the nozzle member 141 toward the guiding member 31 at least on the proximal end side in the guiding direction. For this reason, the yarn ends Y extending from the yarn supplying bobbins B can be surely moved to at least toward the proximal end side in the guiding direction by the action of the compressed air. Therefore, the yarn ends Y can be made to enter the yarn end guide slits 55 more easily. Alternatively, instead of the nozzle member 141 and the compressed air source 142, a not-shown fan and a not-shown motor that rotationally drives the fan may be provided. With this configuration, the air can be blown onto the guiding member 31.

(9) Each cutting member 32 of the yarn end cutting device 13 can have a suction member in which a suction vent is formed. For example, as shown in FIG. 14, a suction vent 151 can be formed near each cutter 61 of the guiding member 31, and each suction vent 151 is connected to the suction source 6. In this manner, in the configuration in which the suction vent 151 is provided corresponding to each cutting member 32, the yarn ends Y located near the cutting member 32 can be easily sucked and captured. In this configuration, the suction vent 54 may not be necessary.

(10) In the above-described embodiments, the suction vent 54 is formed at the bottom part 52 of the guiding member 31, but the configuration is not limited thereto. For example, a suction vent may be formed in the side members 53. Alternatively, separate member having a suction vent can be provided instead of the guiding member 31.

(11) In the above-described embodiments, the position of the cutter 61 of the cutting members 32 is fixed; however, the present invention is not limited to this configuration. For example, as disclosed in JP 2008-230830 A, the cutter may be movable in the left-right direction.

(12) In the above-described embodiments, the opening/closing member 80 is controlled by the control device 15, but the configuration is not limited thereto. The operator can manually move the opening/closing member 80 or the like.

(13) The yarn supplying bobbin feeding device 2 is not limited to be applied to the yarn winding equipment 1 as described above, but can be applied to various facilities that handle the yarn supplying bobbins B.

[0048] A yarn supplying bobbin feeding device according to one aspect of the present invention includes a yarn supplying bobbin transport device that transports a plurality of yarn supplying bobbins on which a yarn has been wound; a yarn supplying bobbin aligning device that aligns the yarn supplying bobbins and that is arranged downstream of the yarn supplying bobbin transport device in a transport direction of the yarn supplying bobbins; and a yarn end cutting device that includes a cutting member for cutting yarn ends extending from the yarn supplying bobbins and that is arranged between the yarn supplying bobbin transport device and the yarn supplying bobbin aligning device in the transport direction. The yarn end cutting device includes a suction member having a suction vent connected to a suction source and that sucks the yarn ends by the action of a negative pressure supplied thereto by the suction source via the suction port; a connecting member in which a communication path that connects the suction vent and the suction source is formed; and an opening/closing member capable of switching, by opening and closing at least one of the suction vent and the communication path, the suction member between a supply state in which the negative pressure is supplied via the suction vent and a non-supply state in which the negative pressure is not supplied via the suction vent.

[0049] In the present invention, when the negative pressure is supplied through the suction vent, the yarn ends extending from the yarn supplying bobbins are sucked and captured. Typically, in the non-supply state, the load on the suction source is lower than in the supply state, and the suction source consumes less power. Therefore, the power consumption of the suction source to which the yarn end cutting device is connected can be easily reduced by the opening/closing member.

[0050] In the above yarn supplying bobbin feeding device, the opening/closing member is capable of adjusting an opening degree of at least one of the suction vent and the communication path.

[0051] For example, in case of a yarn supplying bobbin on which is wound a yarn that does not entangle easily with the yarns of other bobbins or a yarn supplying bobbin on which is wound a yarn that is easy to break when tangled with the yarns of other bobbins the yarn end thereof can be easily sucked and captured as compared to a case in which a yarn supplying bobbin on which is wound a yarn that easily entangles with the yarns of other bobbins is transported. For this reason, when the yarn supplying bobbins or the like on which is wound a yarn that is difficult to entangle are transported, the absolute value of the negative pressure can be reduced to weaken the suction force. In the present invention, the absolute value of the supplied negative pressure can be changed by adjusting the opening degree of at least one of the

suction vent and the communication path by the opening/closing member. Therefore, the load on the suction source can be effectively reduced depending on the yarn type and the like.

[0052] In the above yarn supplying bobbin feeding device, the yarn end cutting device includes a guiding member formed with a guide path for guiding the yarn supplying bobbins to a downstream side in the transport direction, and the suction vent is formed in the guiding member.

[0053] In the present invention, an increase in the number of components can be suppressed as compared to a case in which the suction vent is formed in a member other than the guiding member. Moreover, the yarn ends extending from the yarn supplying bobbins that are moving on the guide path can be sucked easily.

[0054] In the above yarn supplying bobbin feeding device, the yarn end cutting device includes a guiding member formed with a guide path for guiding the yarn supplying bobbins to a downstream side in the transport direction; and a first swing drive member that swings the guiding member.

[0055] When the yarn supplying bobbins are transported by the yarn supplying bobbin transport device in an overlapping and piled state, for example, there is a possibility that the yarn supplying bobbins do not move as desired on the guide path. Also, the yarn ends may not be sucked by the suction member because the yarn ends may be sandwiched between the yarn supplying bobbins. However, in the present invention, the guiding member is proactively swung by the first swing drive member. Therefore, even when the yarn supplying bobbins are transported in the overlapping state, the pile of the yarn supplying bobbins can be collapsed by causing the yarn supplying bobbins on the guide path to rock.

[0056] In the above yarn supplying bobbin feeding device, the yarn end cutting device includes a guiding member formed with a guide path for guiding the yarn supplying bobbins to a downstream side in the transport direction; a swing member capable of swinging in a space above the guide path; and a second swing drive member that swings the swing member.

[0057] In the present invention, the swing member can be caused to interfere with the yarn supplying bobbins by swinging the swing member in the space above the guide path. Therefore, even when the yarn supplying bobbins are transported in the overlapping state, the pile of the yarn supplying bobbins on the guide path can be collapsed by the swing member.

[0058] In the above yarn supplying bobbin feeding device, the yarn supplying bobbin aligning device includes a receiving member that opens upward and receives the yarn supplying bobbins, the yarn end cutting device includes a guiding member that is arranged above the receiving member and formed with a guide path for guiding the yarn supplying bobbins to one side in a predetermined guiding direction that is orthogonal to a vertical direction, a yarn end guide slit that extends at least to other side in the guiding direction is formed at an end of the guiding member on the one side in the guiding direction, the suction vent is arranged on the other side in the guiding direction with respect to the yarn end guide slit, and the cutting member includes a cutter capable of cutting the yarn end that has entered an end portion of the yarn end guide slit on the other side in the guiding direction.

[0059] In the present invention, the yarn supplying bobbins are received by the receiving member of the yarn supplying bobbin aligning device when the yarn supplying bobbins drop by their own weight from the downstream side end (i.e., an end portion on the one side in the guiding direction) of the guiding member in the transport direction. Therefore, before the yarn supplying bobbins fall from the guiding member, the yarn ends can be sucked through the suction vent that is arranged more on the other side in the guiding direction (i.e., the upstream side in the transport direction) than the yarn end guide slit. As a result, when the yarn supplying bobbins fall from the guiding member, the middle part of the yarn ends can be made to enter at least the yarn end guide slit that extends to the other side in the guiding direction. Therefore, the yarn ends that have entered the yarn end guide slit can be cut surely by the cutter.

[0060] In the above yarn supplying bobbin feeding device, the yarn end cutting device includes a blowing member that is arranged on the one side with respect to the yarn end guide slit in the guiding direction and that blows gas toward at least the other side in the guiding direction toward the guiding member.

[0061] In the present invention, by blowing the gas toward the guiding member, the yarn ends extending from the yarn supplying bobbins can be proactively moved to at least the other side in the guiding direction. Therefore, the yarn ends can be easily inserted into the yarn end guide slit.

[0062] In the above yarn supplying bobbin feeding device, the opening/closing member includes the cutting member, and the cutting member includes a cutter member capable of opening and closing the suction vent and capable of cutting the yarn end when closing the suction vent.

[0063] In the configuration in which the opening/closing member simply switches the state of the suction member between the supply state and the non-supply state, if the sucked yarn end entangles with the opening/closing member, the opening/closing member may not operate as desired, also, there is a chance that the opening/closing member malfunctions. To address this issue, in the present invention, the opening/closing member also cuts the yarn end. The cut yarn end is sucked and removed by the suction member. As a result, entangling of the yarn ends with the opening/closing member can be prevented, and the occurrence of malfunctioning of the opening/closing member can be suppressed.

[0064] In the above yarn supplying bobbin feeding device, the yarn end cutting device includes a plurality of the cutting members, and each cutting member includes

the suction member.

[0065] In the present invention, a suction vent is provided corresponding to each cutting member. Therefore, it is possible to easily suck and capture the yarn end located near the cutting member.

[0066] In the above explanation, the meaning of "a plurality of" also includes "a predetermined number of'.

[0067] Although the invention has been explained with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the scope of the claims.

Claims

1. A yarn supplying bobbin feeding device (2) comprising:

a yarn supplying bobbin transport device (12) configured to transport a plurality of yarn supplying bobbins (B) on which a yarn has been wound;
a yarn supplying bobbin aligning device (14) configured to align the yarn supplying bobbins (B) and that is arranged downstream of the yarn supplying bobbin transport device (12) in a transport direction of the yarn supplying bobbins (B); and
a yarn end cutting device (13) that includes a cutting member (32) for cutting yarn ends extending from the yarn supplying bobbins (B) and that is arranged between the yarn supplying bobbin transport device (12) and the yarn supplying bobbin aligning device (14) in the transport direction, wherein
the yarn end cutting device (13) includes

a suction member (31) having a suction vent (54) connected to a suction source (6) and configured to suck the yarn ends by the action of a negative pressure supplied thereto by the suction source (6) via the suction vent (54);
a connecting member (71, 72) in which a communication path (76) connecting the suction vent (54) and the suction source (6) is formed; and
an opening/closing member (80) capable of switching, by opening and closing at least one of the suction vent (54) and the communication path (76), the suction member (31) between a supply state in which the negative pressure is supplied via the suction vent (54) and a non-supply state in which the negative pressure is not supplied via the suction vent (54).

2. The yarn supplying bobbin feeding device (2) as claimed in Claim 1, wherein the opening/closing member (80) is capable of adjusting an opening degree of at least one of the suction vent (54) and the communication path (76).

3. The yarn supplying bobbin feeding device (2) as claimed in Claim 1 or 2, wherein
the yarn end cutting device (13) includes a guiding member (31) formed with a guide path (51) for guiding the yarn supplying bobbins (B) to a downstream side in the transport direction, and
the suction vent (54) is formed in the guiding member (31).

4. The yarn supplying bobbin feeding device (2) as claimed in any one of Claims 1 to 3, wherein the yarn end cutting device (13) includes
a guiding member (31) formed with a guide path (51) for guiding the yarn supplying bobbins (B) to a downstream side in the transport direction; and
a first swing drive member (93) configured to swing the guiding member (31).

5. The yarn supplying bobbin feeding device (2) as claimed in any one of Claims 1 to 4, wherein the yarn end cutting device (13) includes
a or the guiding member (31) formed with a guide path (51) for guiding the yarn supplying bobbins (B) to a downstream side in the transport direction;
a swing member (101, 111) capable of swinging in a space above the guide path (51); and
a second swing drive member (102, 112) configured to swing the swing member (101, 111).

6. The yarn supplying bobbin feeding device (2) as claimed in any one of Claims 1 to 5, wherein
the yarn supplying bobbin aligning device (14) includes a receiving member (42) that is configured to open upward and to receive the yarn supplying bobbins (B),
the yarn end cutting device (13) includes a or the guiding member (31) that is arranged above the receiving member (42) and formed with a guide path (51) for guiding the yarn supplying bobbins (B) to one side in a predetermined guiding direction that is orthogonal to a vertical direction,
a yarn end guide slit (55) that extends at least to another side in the guiding direction is formed at an end of the guiding member (31) on the one side in the guiding direction,
the suction vent (54) is arranged on the other side in the guiding direction with respect to the yarn end guide slit (55), and
the cutting member (32) includes a cutter (61) capable of cutting the yarn end that has entered an end

portion of the yarn end guide slit (55) on the other side in the guiding direction.

7. The yarn supplying bobbin feeding device (2) as claimed in Claim 6, wherein the yarn end cutting device (13) includes a blowing member (141) that is arranged on the one side with respect to the yarn end guide slit (55) in the guiding direction and that is configured to blow gas toward at least the other side in the guiding direction toward the guiding member (31).

8. The yarn supplying bobbin feeding device (2) as claimed in any one of Claims 1 to 5, wherein
the opening/closing member (80) includes the cutting member (32), and
the cutting member (32) includes a cutter member (131) capable of opening and closing the suction vent (54) and capable of cutting the yarn end when closing the suction vent (54).

9. The yarn supplying bobbin feeding device (2) as claimed in any one of Claims 1 to 8, wherein
the yarn end cutting device (13) includes a plurality of the cutting members (32), and each cutting member (32) includes the suction member (31).

FIG.1

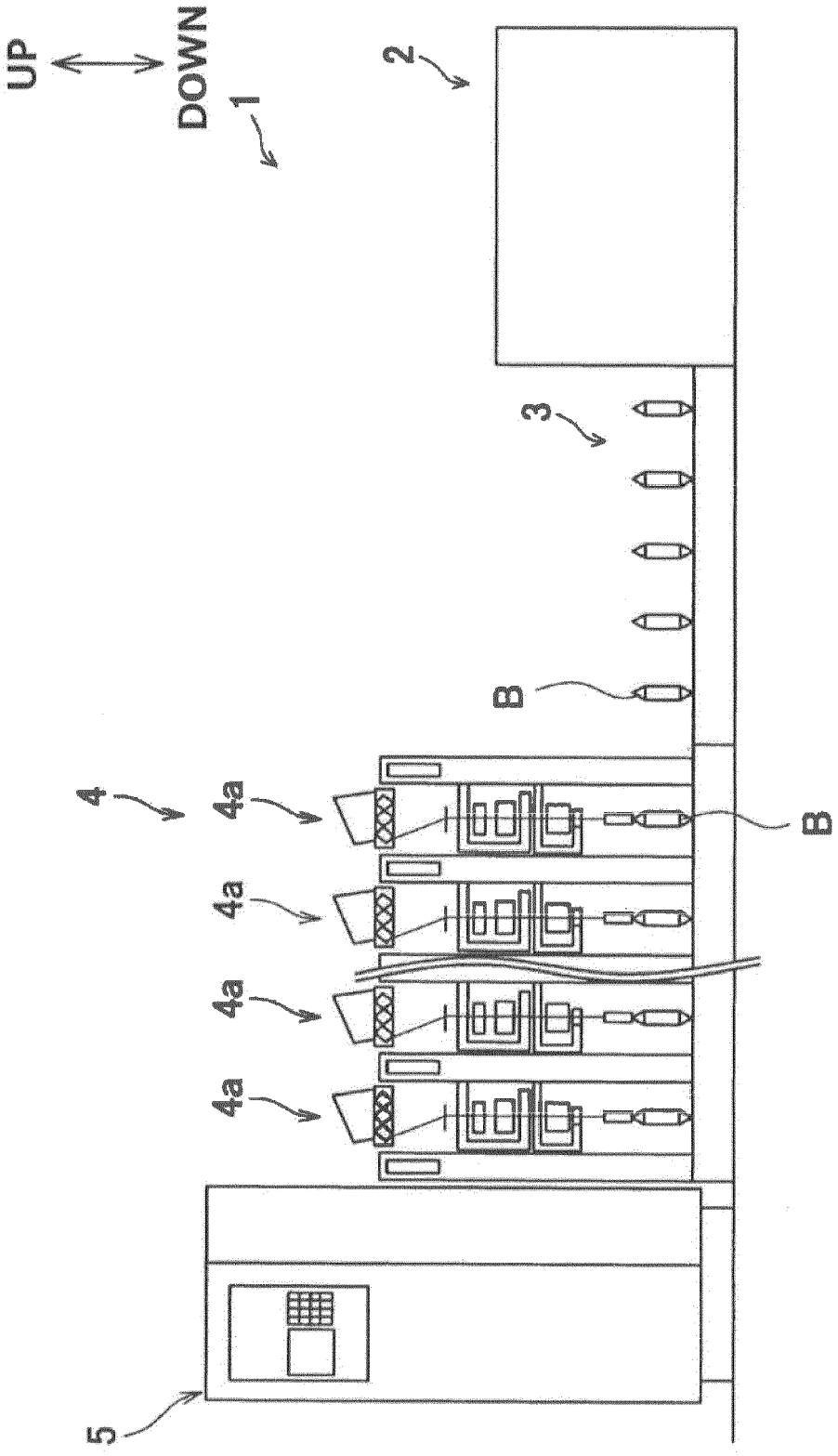


FIG.2

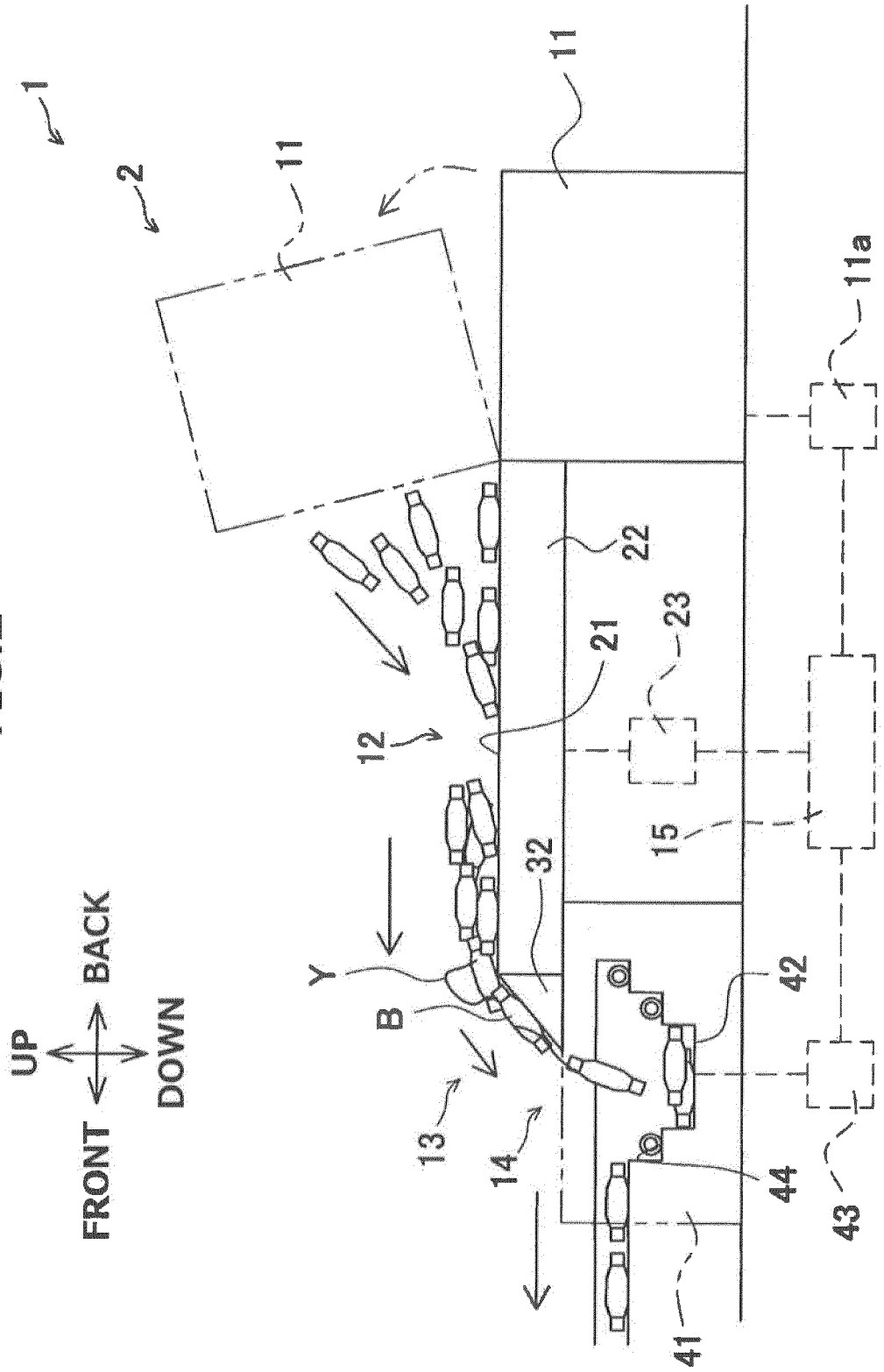

1
2
11
11
11a
22
21
23
12
15
32
Y
B
42
13
14
44
43
41
UP
BACK
FRONT
DOWN

FIG.3

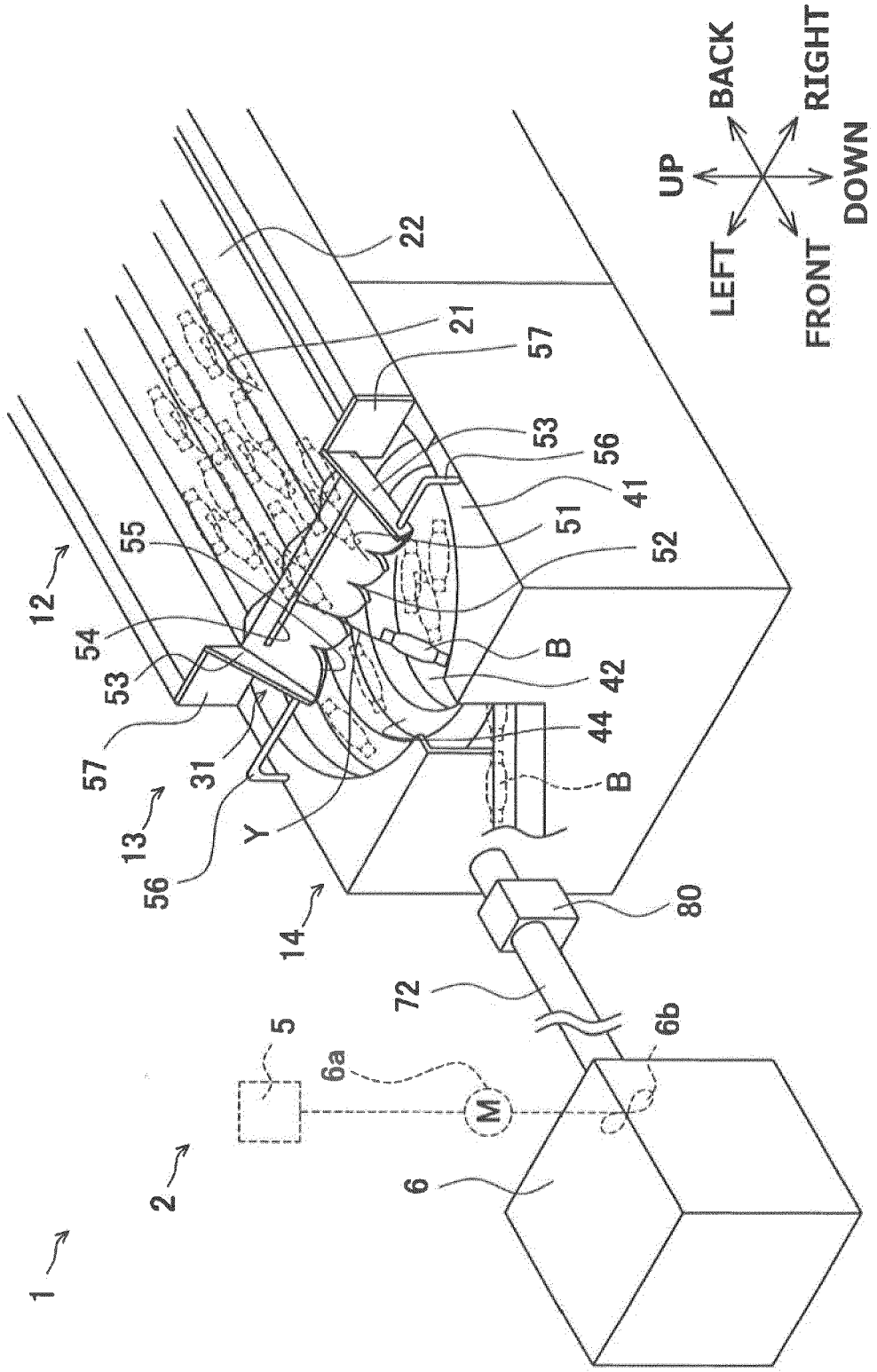

UP
BACK
RIGHT
LEFT
FRONT
DOWN
1
2
5
6
6a
6b
M
12
13
14
21
22
31
41
42
44
51
52
53
54
55
56
57
72
80
B
Y

FIG.4A

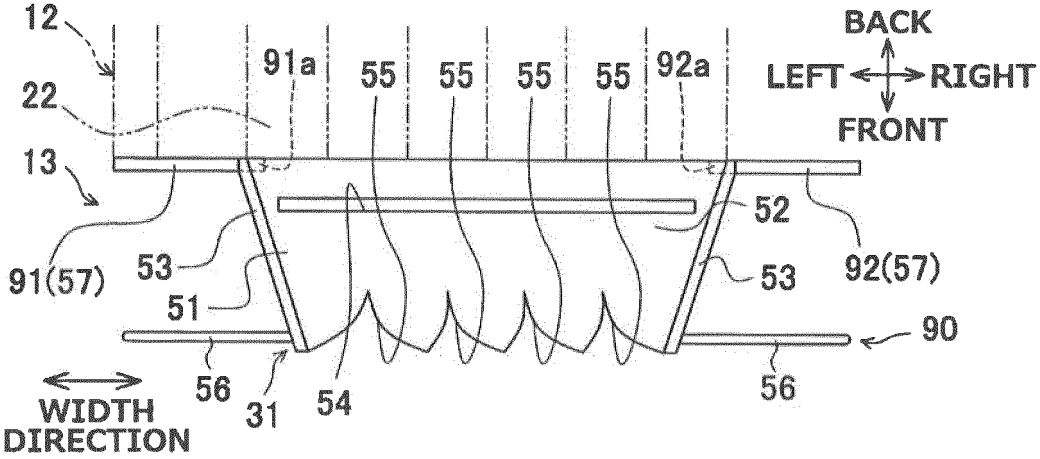


FIG.4B

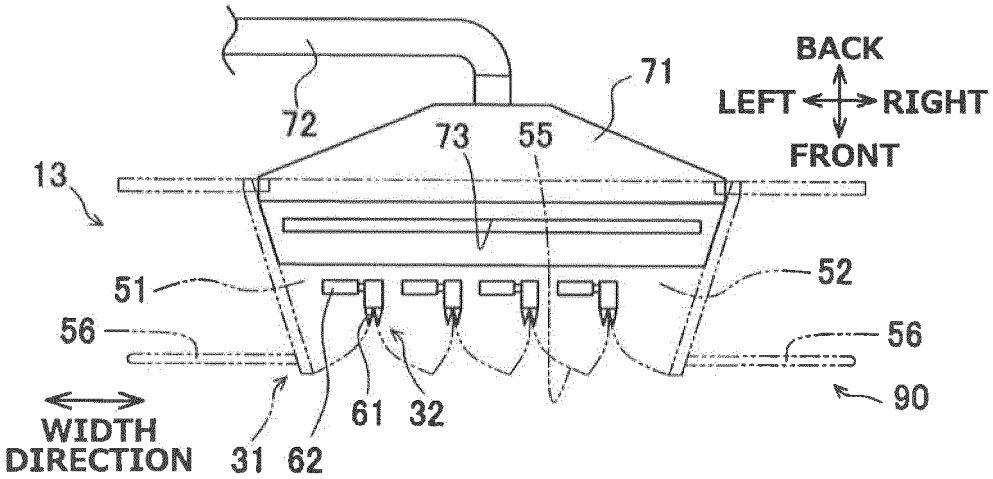


FIG.4C

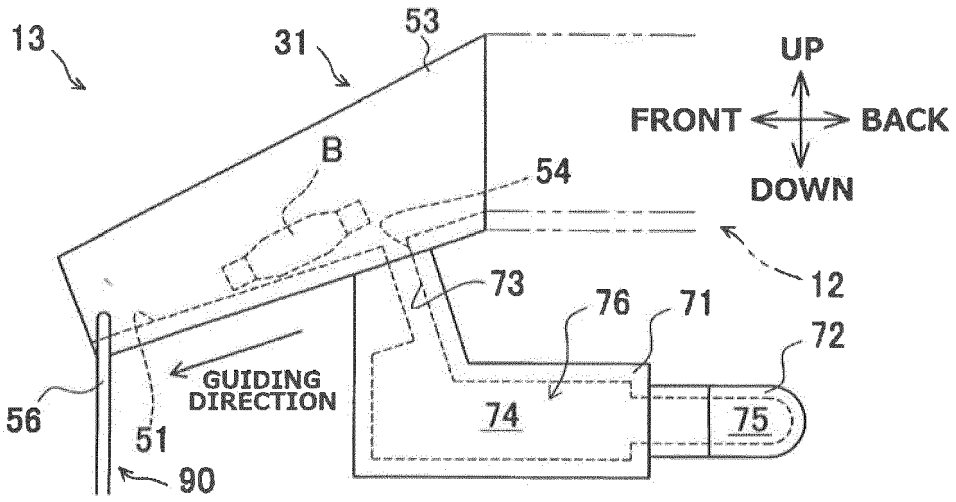


FIG.5A

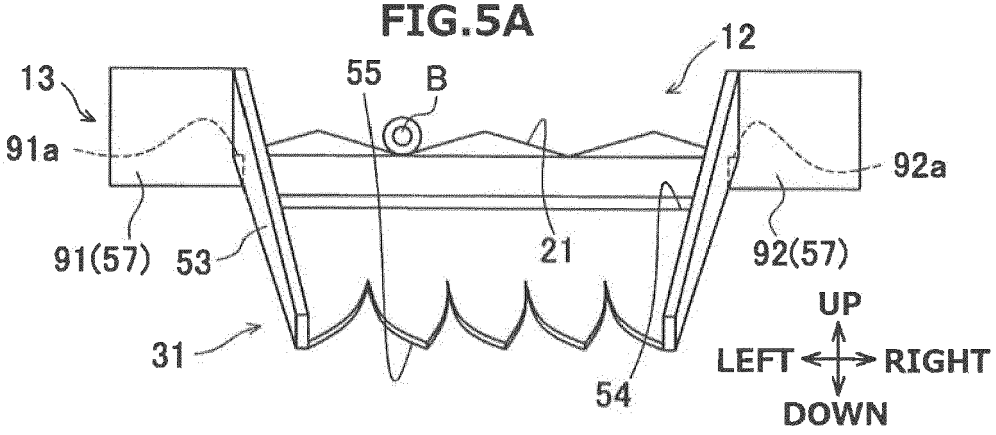


FIG.5B

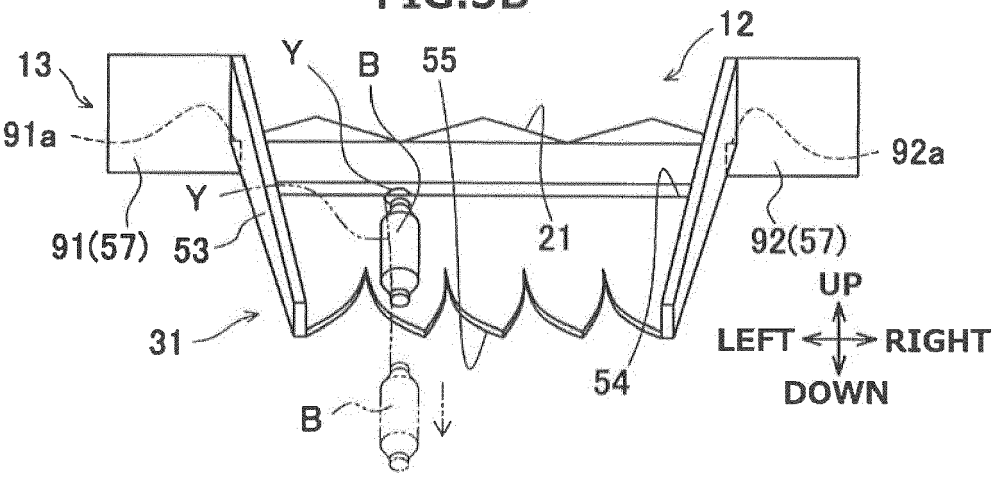


FIG.5C

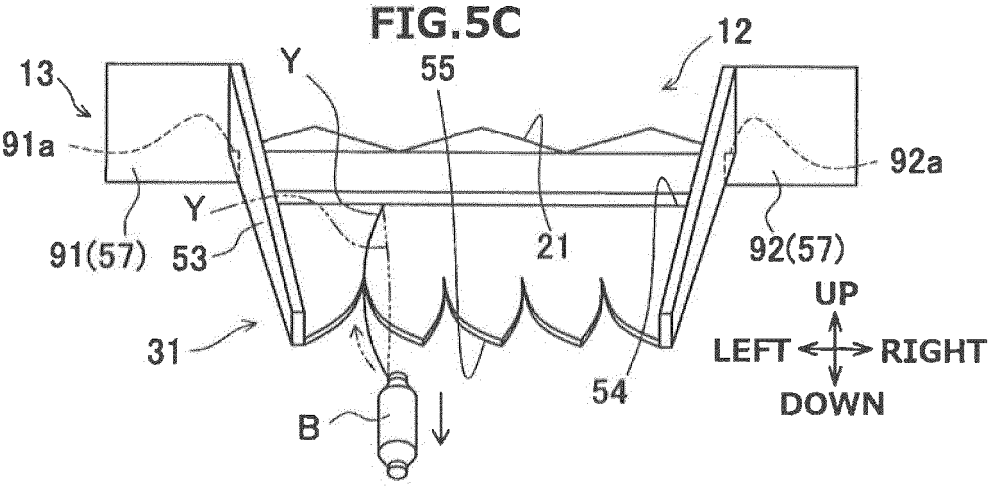


FIG.6A

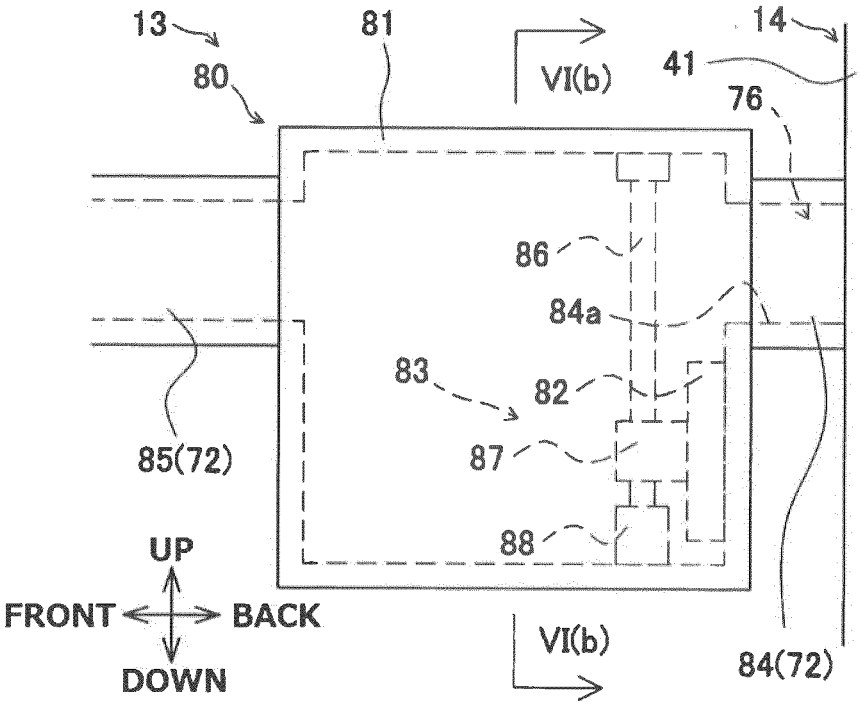

13
80
81
VI(b)
14
41
76
86
84a
83
82
87
85(72)
88
UP
FRONT
BACK
DOWN
VI(b)
84(72)

FIG.6B

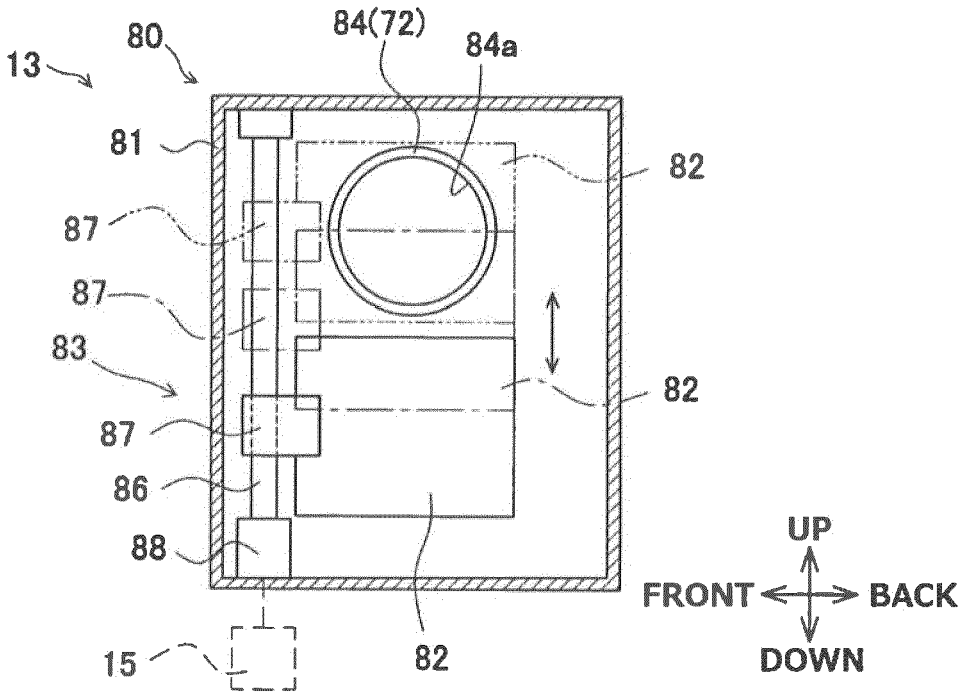

80
84(72)
84a
13
81
82
87
87
83
82
87
86
88
15
82
UP
FRONT
BACK
DOWN

FIG.7A

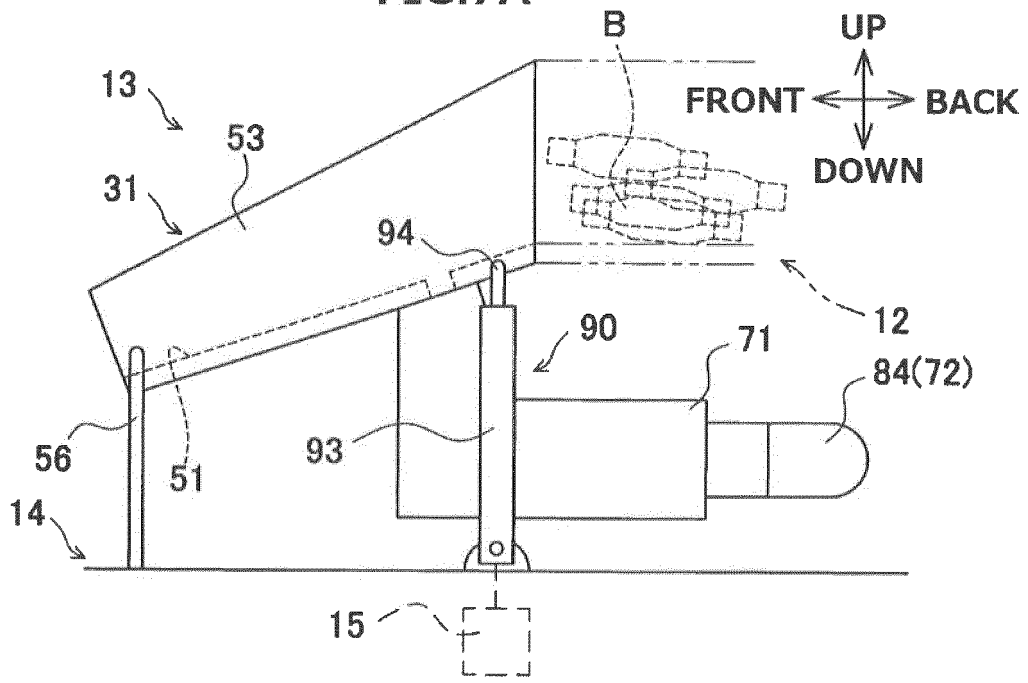

B
UP
FRONT
BACK
DOWN
13
53
31
94
12
90
71
84(72)
56
51
93
14
15

FIG.7B

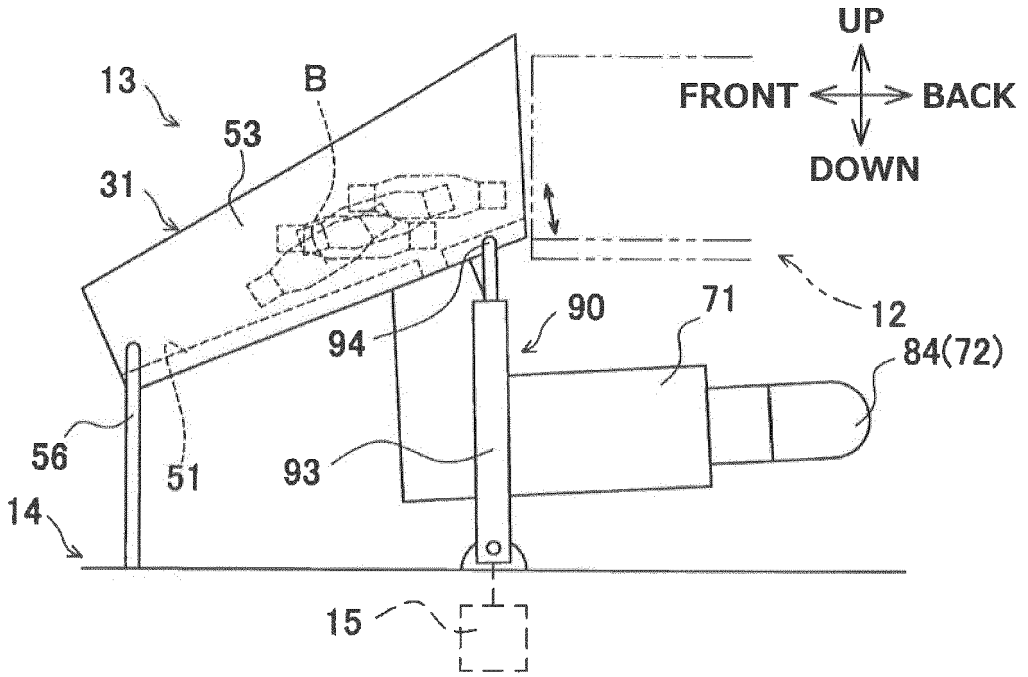

UP
FRONT
BACK
DOWN
13
B
53
31
12
90
71
94
84(72)
56
51
93
14
15

FIG.8A

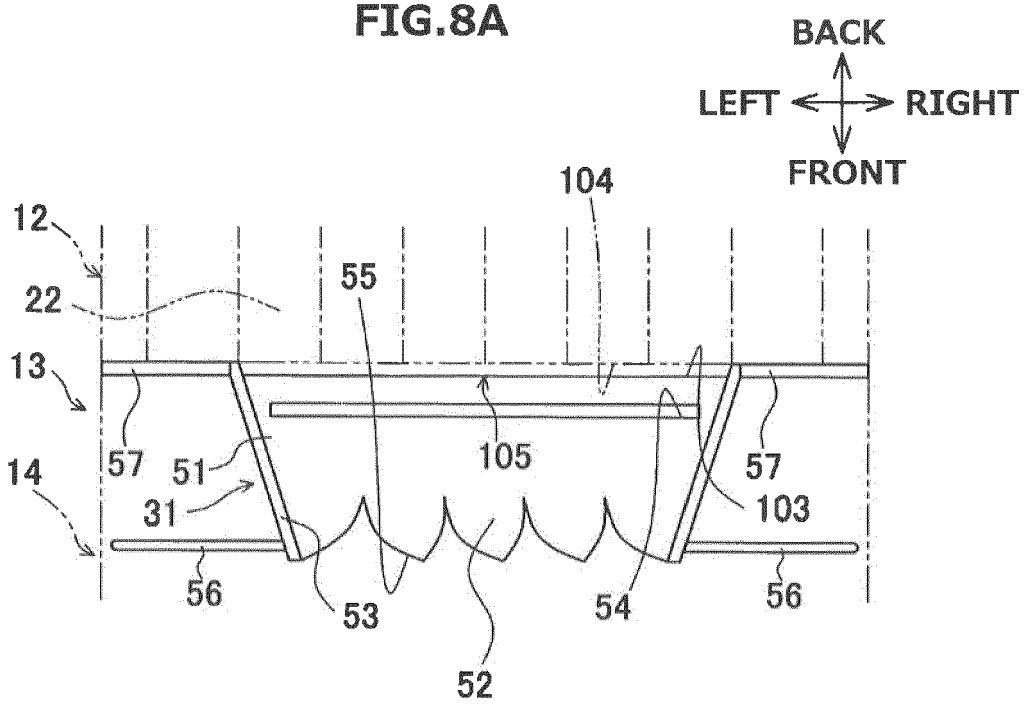

BACK
LEFT
RIGHT
FRONT
104
12
22
55
13
57
51
105
57
14
31
103
56
53
54
56
52

FIG.8B

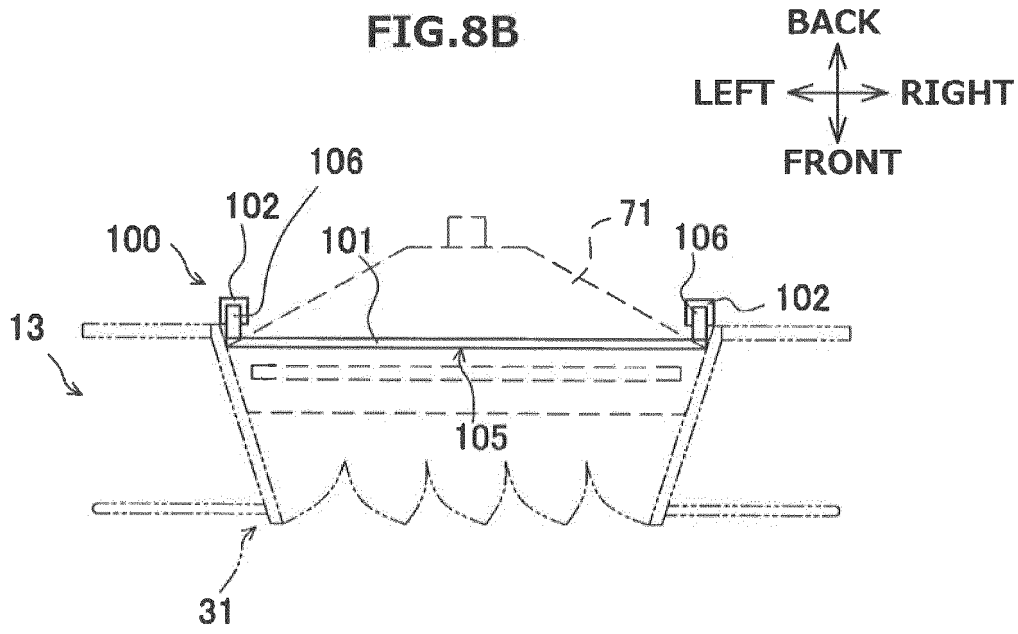

BACK
LEFT
RIGHT
FRONT
106
102
71
100
101
106
102
13
105
31

FIG.9A

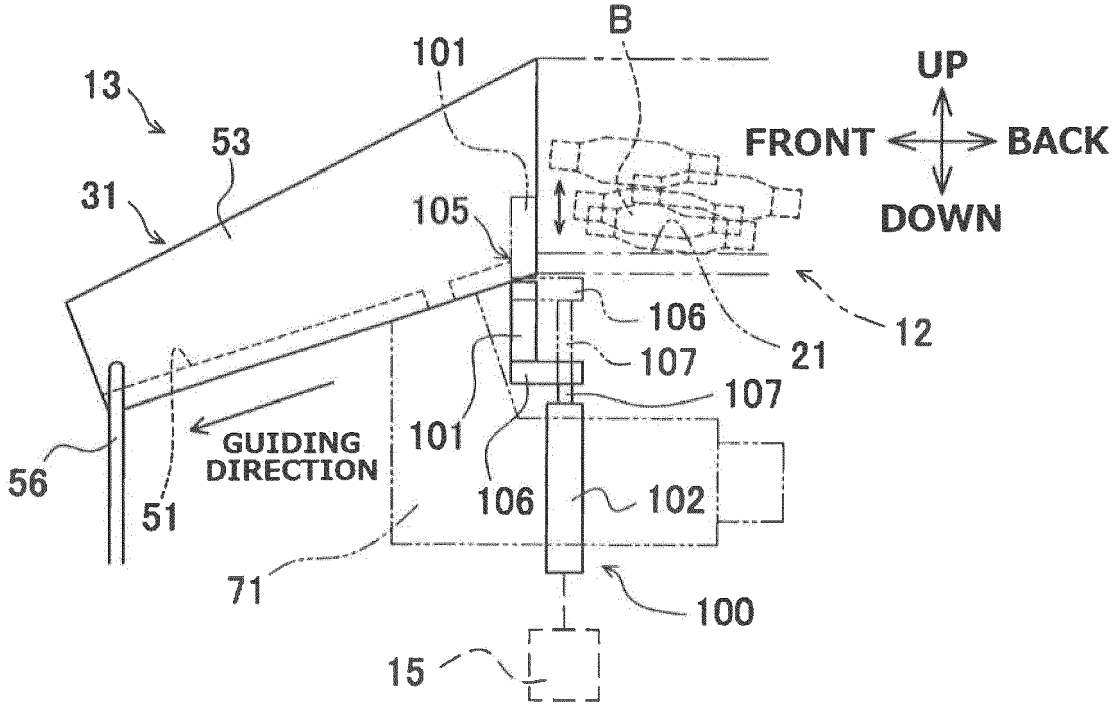

B
101
13
53
31
105
UP
FRONT
BACK
DOWN
106
107
21
12
107
101
GUIDING
DIRECTION
56
51
106
102
71
100
15

FIG.9B

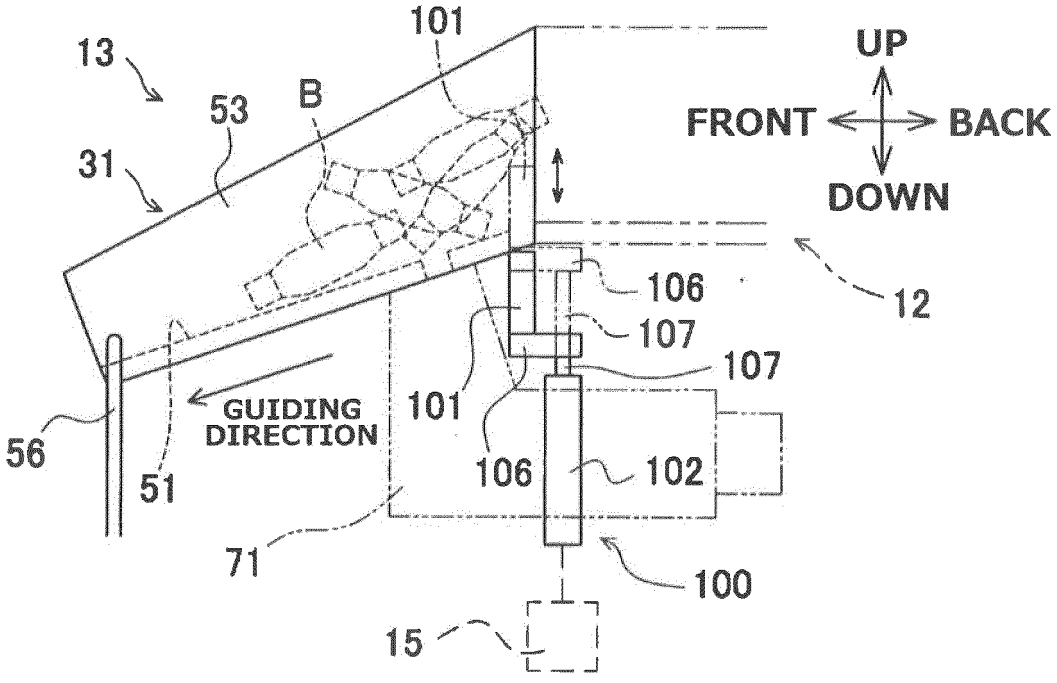

101
13
53
B
31
UP
FRONT
BACK
DOWN
106
12
107
107
101
GUIDING
DIRECTION
56
51
106
102
71
100
15

FIG.10

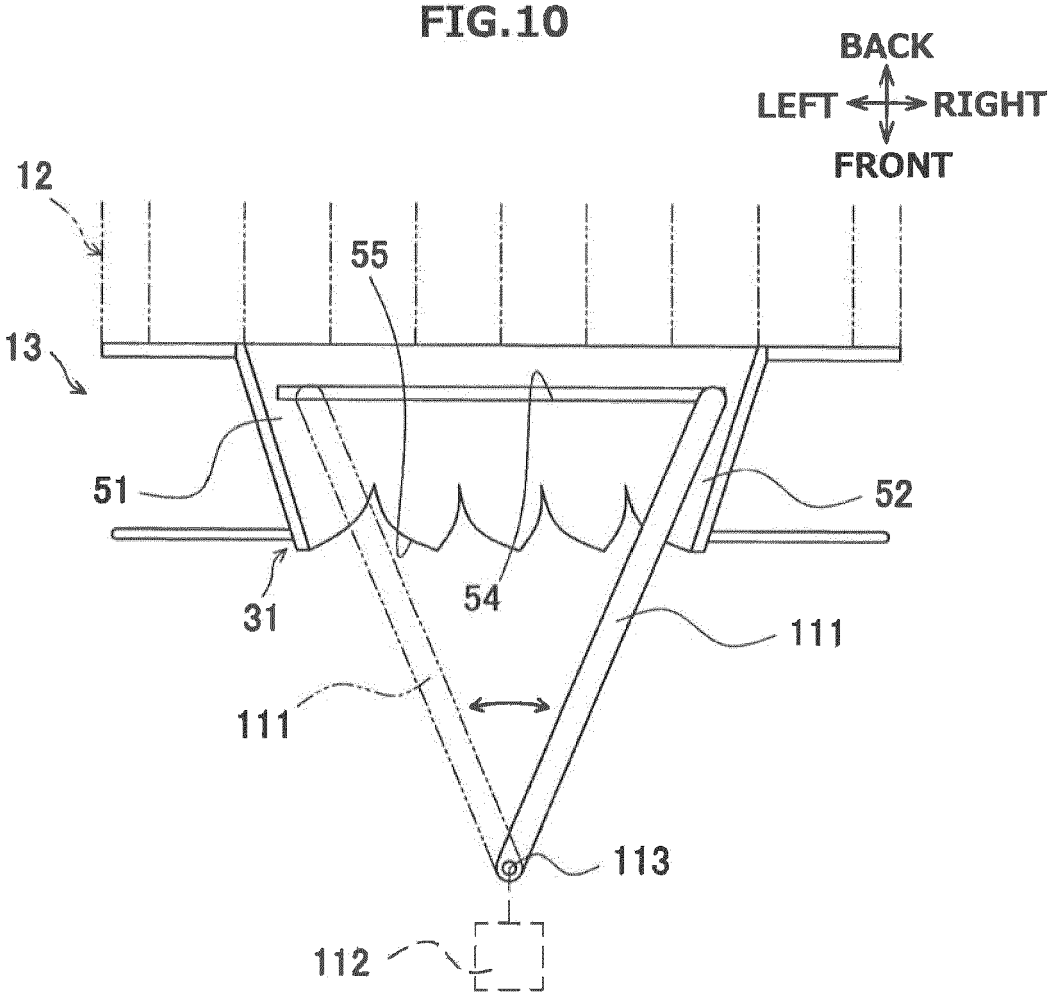


FIG.11A

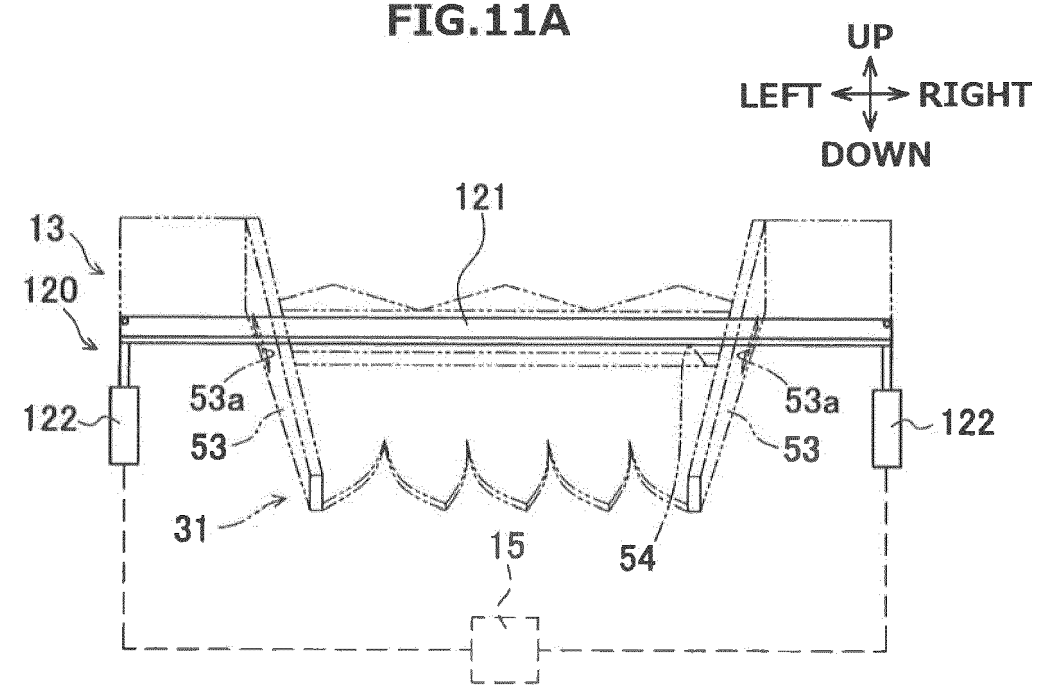


FIG.11B

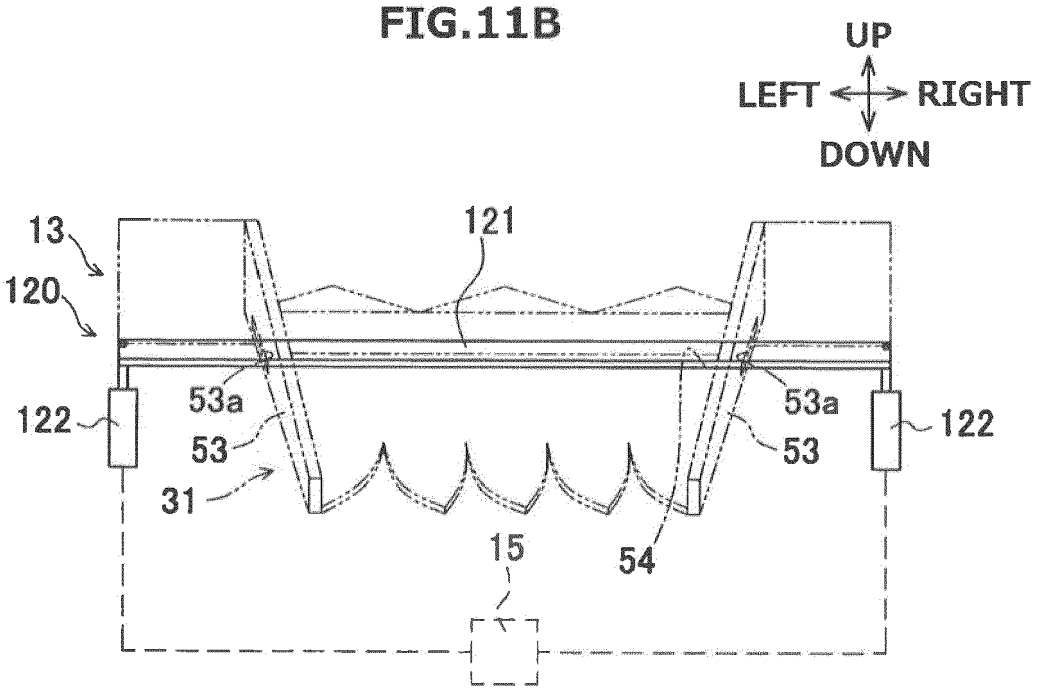


FIG.12A

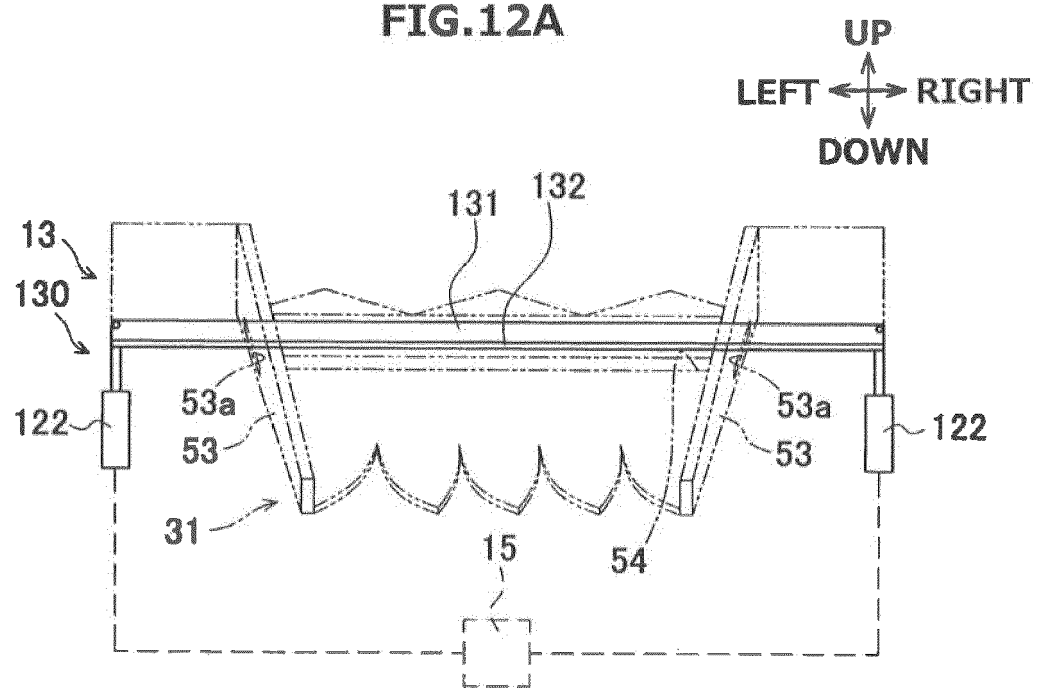


FIG.12B

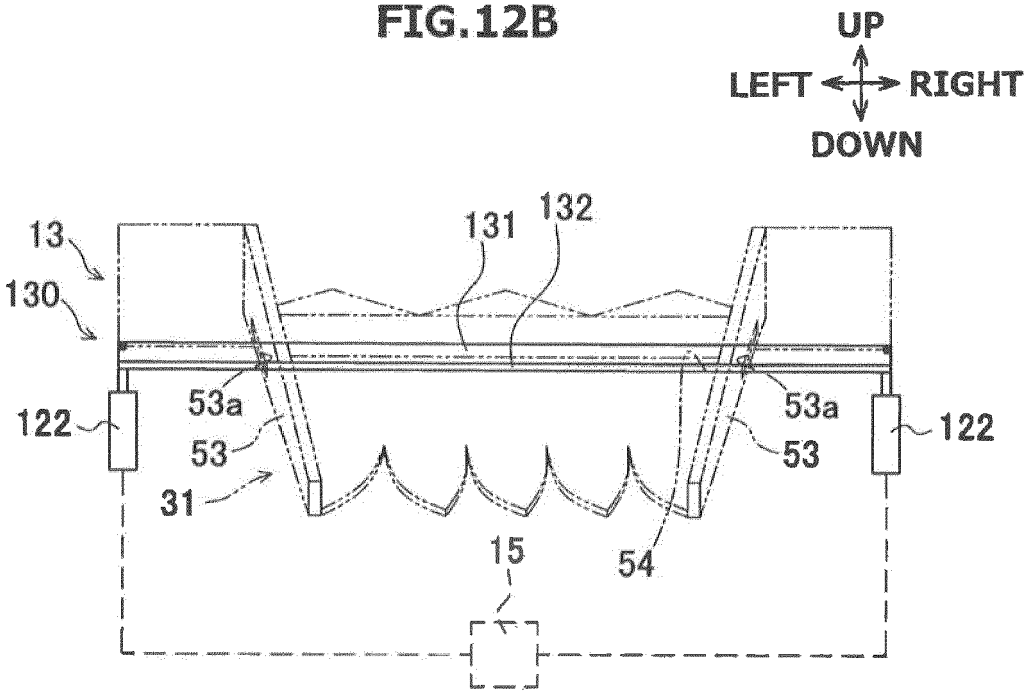


FIG.13

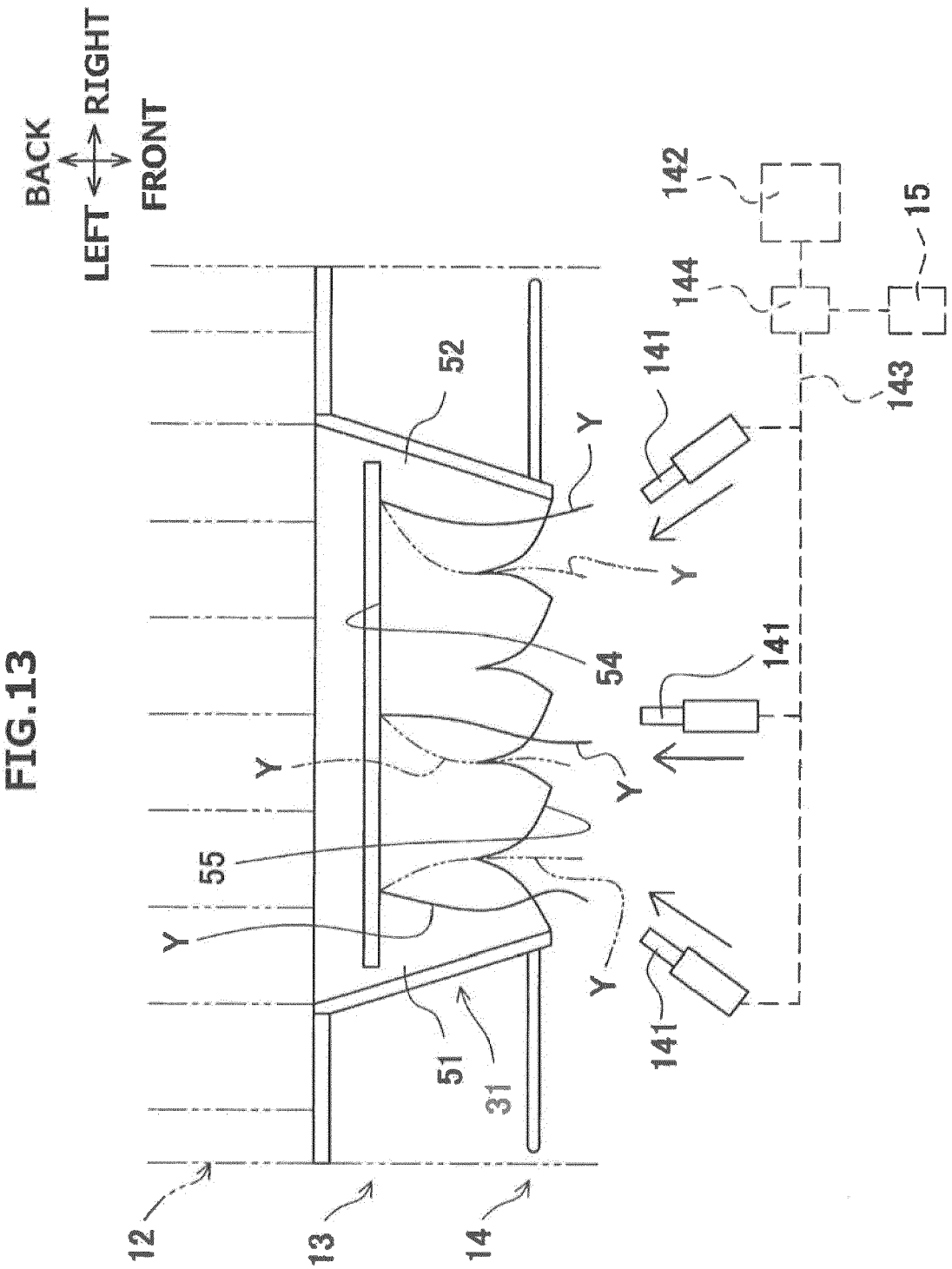
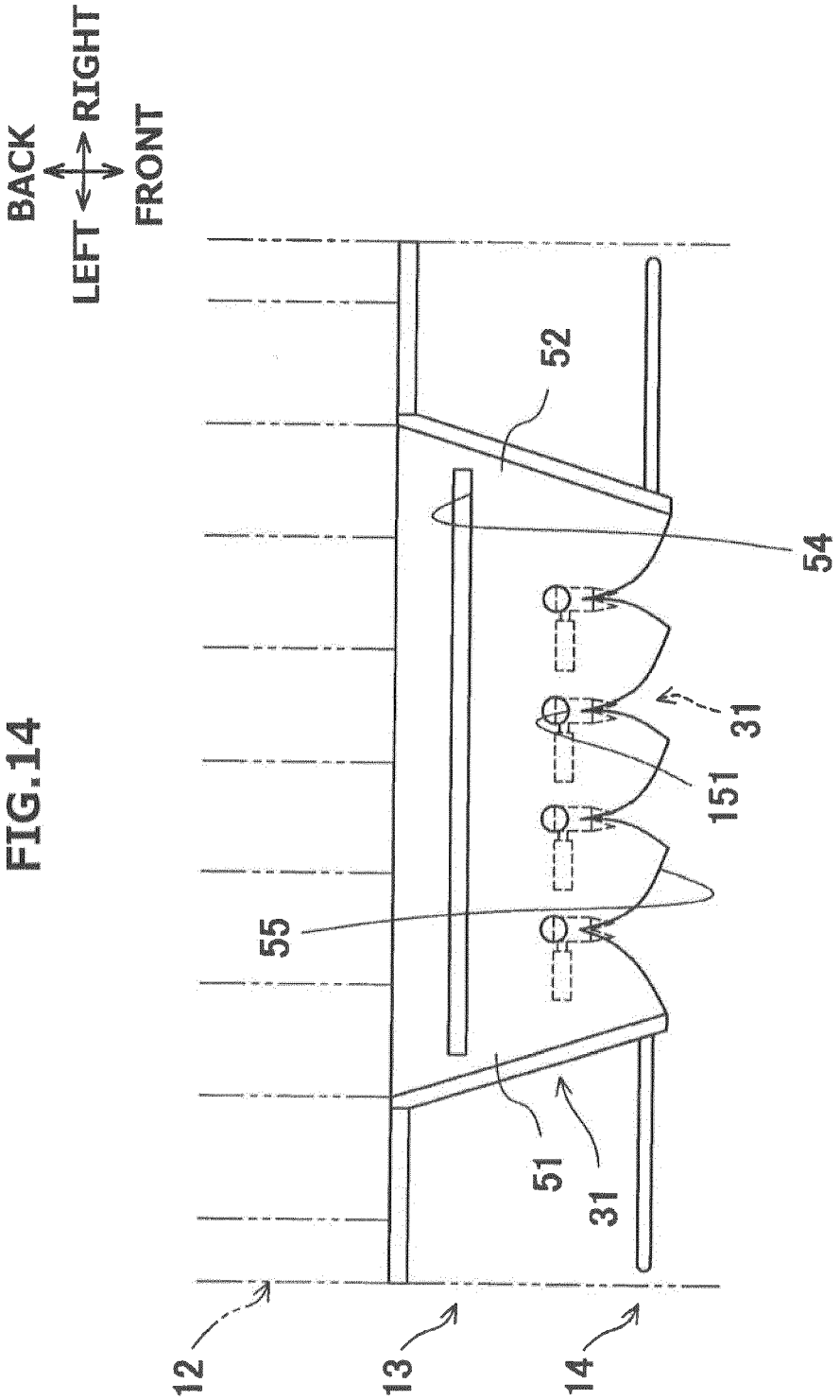


FIG.14



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EUROPEAN SEARCH REPORT

Application Number
EP 20 15 0553

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Place of search	Date of completion of the search	Examiner
The Hague	4 May 2020	Pussemier, Bart

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