



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.08.2017 Bulletin 2017/35

(51) Int Cl.:
B65H 65/00 (2006.01)

(21) Application number: **17157846.1**

(22) Date of filing: **24.02.2017**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(30) Priority: **29.02.2016 JP 2016036992**
12.01.2017 JP 2017003028

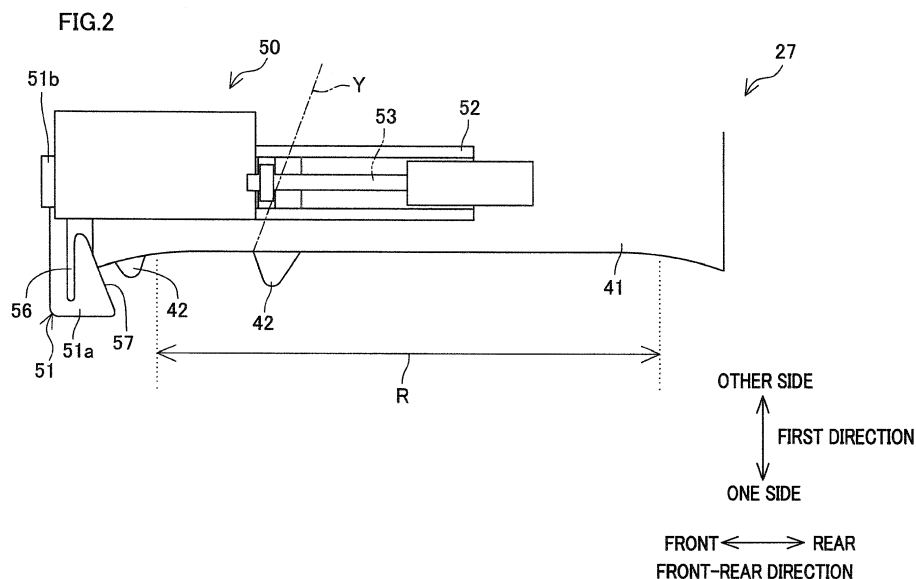
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(54) **SPUN YARN TAKE-UP MACHINE**

(57) A moving distance of a yarn catch guide, which is for catching a yarn traversed by a traverse unit, needed to release the yarn from the yarn catch guide, is reduced. A yarn catch guide 51 is configured to catch a yarn Y introduced into a groove portion 56. When the yarn catch guide 51 is moved from a catching position for catching the yarn Y to a yarn shifting position frontward of the catching position, a guided portion 58 is guided by the first guide groove 62a extending in a front-rear direction. Due to this, the yarn catch guide 51 is parallel translated

in the front-rear direction. When the yarn catch guide 51 is moved from the yarn shifting position toward the catching position, the guided portion 58 is guided by a second guide groove 62b that is disposed on one side in the second direction relative to the first guide groove 62a. Due to this, the yarn catch guide 51 is swung with respect to an insertion portion 51b. As a result, the yarn Y disengaged from the groove portion 56, and thus the yarn Y is released from the yarn catch guide 51.



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a spun yarn take-up machine configured to take up a yarn spun out from a spinning apparatus and to wind the yarn onto a bobbin.

[0002] Patent Literature 1 (Tokuhyou 2013-542898 (Published Japanese Translation of PCT Application)) describes an apparatus configured to wind up a yarn onto a spool housing (equivalent to a "bobbin" in the present invention) attached to a spindle while traversing the yarn by a traversing device. The apparatus of Patent Literature 1 is structured as follows. To enable the spindle to catch a yarn at the start of winding of the yarn onto the spool housing, the yarn is moved by an auxiliary device to a position outside the traversing device. After the yarn is caught by the spindle, the yarn is captured by a traverse wing of the traversing device. To be more specific, the auxiliary device includes a metal guide. The metal guide is moved by a first driving unit in a direction along the axial direction of the spool housing, between a parking position adjacent to the traversing device and a receiving position within the region of the traversing device. The metal guide is moved by a second driving unit in a direction crossing the axial direction of the spool housing, between a catching position and a releasing position. The metal guide of the auxiliary device is moved from the parking position to the receiving position while the yarn is traversed by the traversing device. As a consequence, the traversed yarn enters a guide groove of the metal guide, to be caught by the metal guide. After the yarn enters the guide groove, the metal guide is moved to the catching position, and then the metal guide is returned to the parking position. As such, the yarn is led out of the traversing device. After the yarn is caught by a yarn catching device provided to the spindle, the metal guide in the parking position is moved from the catching position to the releasing position. As a result, the yarn slides out of the guide groove, and then further slides toward a traverse center, to be caught by the traverse wing of the traversing device.

SUMMARY OF THE INVENTION

[0003] In Patent Literature 1, the direction in which the metal guide is moved from the catching position to the releasing position is along the depth direction of the guide groove. For this reason, in order to move the metal guide from the catching position to the releasing position so that the yarn slides out of the guide groove as described above, the metal guide has to be moved a long distance to some degree. That is to say, in the arrangement of Patent Literature 1, the moving distance of the metal guide needed to disengage the yarn from the guide groove is long.

[0004] An object of the present invention is to provide

a spun yarn take-up machine that enables reduction of a moving distance of a yarn catch guide, which is for catching a yarn traversed by a traverse unit, needed to release the yarn from the yarn catch guide.

[0005] According to a first aspect of the present invention, a spun yarn take-up machine includes: a winding device configured to hold a bobbin and to wind a yarn spun out from a spinning apparatus onto the bobbin; a traverse unit configured to traverse the yarn wound by the winding device in an axial direction of the bobbin; a yarn catch guide configured to catch the yarn traversed by the traverse unit; and a guide moving device configured to move the yarn catch guide, wherein: the traverse unit includes a traverse guide extending in the axial direction of the bobbin and configured to guide the yarn in the axial direction of the bobbin; the yarn catch guide includes a groove portion extending in a first direction orthogonal to the axial direction of the bobbin and overlapping the traverse guide when viewed from a second direction that is orthogonal both the axial direction of the bobbin and the first direction; the yarn catch guide is configured so that the yarn is insertable into the groove portion from one side in the axial direction of the bobbin; and the guide moving device is configured to move the yarn catch guide among positions of: i) a catching position where the yarn catch guide is able to catch the yarn traversed by the traverse unit, ii) a yarn shifting position for shifting the yarn to an end portion of the bobbin, the yarn shifting position being on an other side in the axial direction of the bobbin relative to the catching position, and iii) a yarn releasing position for releasing the caught yarn, the yarn releasing position being farther from the traverse guide in the second direction than the catching position and the yarn shifting position.

[0006] In this aspect of the present invention, the yarn is able to be released from the yarn catch guide by moving the yarn catch guide to the yarn releasing position. While the groove portion of the yarn catch guide extends in the first direction, the yarn releasing position is located farther from the traverse guide than the catching position and the yarn shifting position in the second direction orthogonal to both the axial direction of the bobbin and the first direction. Because of this, the yarn is able to be released from the yarn catch guide without distancing the yarn releasing position so far from the traverse guide. Thus, the moving distance of the yarn catch guide needed to release the yarn from the yarn catch guide is shorter than the case where the yarn is released from the yarn catch guide by moving the yarn catch guide in the first direction. Furthermore, in this aspect of the present invention, there is no need to move the yarn catch guide a long distance in the first direction when the yarn is released from the yarn catch guide. This enables downsizing of the machine in the first direction.

[0007] According to a second aspect of the invention, the spun yarn take-up machine of the first aspect is arranged such that the guide moving device includes: a driving unit configured to apply a force to the yarn catch

guide in the axial direction of the bobbin; a first guide unit configured to guide, in parallel to the axial direction of the bobbin, the yarn catch guide moving from the catching position to the yarn shifting position; and a second guide unit configured to guide, in the second direction, the yarn catch guide moving from the yarn shifting position toward the catching position so that the yarn catch guide passes through the yarn releasing position.

[0008] In Patent Literature 1, for example, two driving units are separately provided. Specifically, the drive unit configured to move the metal guide in the direction along the axial direction of the spool housing between the parking position and the receiving position, and the driving unit configured to move the metal guide in the direction crossing the axial direction of the spool housing between the catching position and the releasing position are provided.

[0009] In this regard, in this aspect of the present invention, the first guide unit and the second guide unit are provided, and this enables the yarn catch guide to be moved in the axial direction of the bobbin and in the second direction by the single driving unit configured to apply a force in the axial direction of the bobbin to the yarn catch guide. Thus, the machine has a simpler structure than in the case where a driving unit for moving the yarn catch guide in the axial direction of the bobbin and a driving unit for moving the yarn catch guide in the second direction are provided individually.

[0010] According to a third aspect of the invention, the spun yarn take-up machine of the second aspect is arranged such that: the yarn catch guide is supported so as to be movable in the axial direction of the bobbin, and so as to be swingable with respect to a swing axis parallel to the axial direction of the bobbin; and the second guide unit guides the yarn catch guide moving from the yarn shifting position toward the catching position so that the yarn catch guide is swung with respect to the swing axis.

[0011] In this aspect of the present invention, the yarn catch guide is movable in the second direction by swinging the yarn catch guide with respect to the swing axis parallel to the axial direction of the bobbin.

[0012] According to a fourth aspect of the invention, the spun yarn take-up machine of the second or third aspect is arranged such that: the yarn catch guide includes a guided portion guided by the first guide unit and the second guide unit; the first guide unit includes a first guide passage extending in parallel to the axial direction of the bobbin and configured to guide the guided portion; and the second guide unit includes a second guide passage disposed on one side in the second direction relative to the first guide passage and connected with two connection portions of the first guide passage which are apart from each other in the axial direction of the bobbin, the second guide passage being configured to guide the guided portion.

[0013] In this aspect of the present invention, when the yarn catch guide is moved from the catching position to the yarn shifting position, the guided portion is guided

along the first guide passage extending in parallel to the axial direction of the bobbin. Due to this, the yarn catch guide is parallel translated in the axial direction of the bobbin. Meanwhile, when the yarn catching guide is moved from the yarn shifting position toward the catching position, the guided portion is guided along the second guide passage disposed on the one side in the second direction relative to the first guide passage. Due to this, the yarn catch guide is swung to be moved to the yarn releasing position.

[0014] According to a fifth aspect of the invention, the spun yarn take-up machine of the fourth aspect is arranged such that: a divider is provided at one of the connection portions of the first guide passage which are connected with the second guide passage, the one of the connecting portions being closer to the yarn shifting position than the other, the divider partitioning the first guide passage in the axial direction of the bobbin; the divider is cantilevered and is therefore elastically deformable; and elastic deformation of the divider toward the yarn shifting position in the axial direction of the bobbin is allowed and elastic deformation of the divider toward the catching position in the axial direction of the bobbin is restricted.

[0015] In this aspect of the present invention, when the guided portion moves from a position closer to the catching position toward the yarn shifting position in the first guide passage, the guided portion passes through the portion of the first guide passage where the divider is disposed, by elastically deforming the divider. This enables the guided portion to be guided along the first guide passage when the yarn catch guide is moved from the catching position to the yarn shifting position. Meanwhile, when the guided portion moves from a position closer to the yarn shifting position toward the catching position in the first guide passage, the guided portion cannot elastically deform the divider, and therefore cannot pass through the portion of the first guide passage where the divider is disposed. This prevents the guided portion from being guided along the first guide passage instead of the second guide passage, when the yarn catch guide is moved from the yarn shifting position toward the catching position.

[0016] According to a sixth aspect of the invention, the spun yarn take-up machine of the fifth aspect is arranged such that the divider is inclined with respect to the second direction so that a distance between the divider and the yarn shifting position in the axial direction of the bobbin decreases toward a free end of the divider.

[0017] In this aspect of the present invention, the cantilevered divider is inclined with respect to the second direction so that the distance between the divider and the yarn shifting position in the axial direction of the bobbin decreases toward the free end of the divider. Because of this, it is easier for the divider to be elastically deformed toward the yarn shifting position, but it is difficult for the divider to be elastically deformed toward the catching position. In other words, elastic deformation of the divider

toward the yarn shifting position is allowed, but elastic deformation of the divider toward the catching position is restricted. Furthermore, in this aspect of the present invention, when the yarn catch guide is moved from the yarn shifting position toward the catching position, the guided portion is guided along the inclined divider into the second guide passage.

[0018] According to a seventh aspect of the invention, the spun yarn take-up machine of the fifth or sixth aspect is arranged such that a regulatory portion is provided in the first guide passage, the regulatory portion being configured to restrict the elastic deformation of the divider toward the catching position in the axial direction of the bobbin by contacting the divider.

[0019] In this aspect of the present invention, the regulatory portion is provided in the first guide passage. As a result, the elastic deformation of the divider toward the yarn shifting position is allowed and the elastic deformation of the divider toward the catching position is restricted.

[0020] According to an eighth aspect of the invention, the spun yarn take-up machine of any one of the fifth to seventh aspect is arranged such that the guide moving device includes: a first member in which the first guide passage and the second guide passage are disposed; and a second member in which the divider is disposed, the second member attached to the first member so as to be detachable from the first member.

[0021] Every time the yarn catch guide is moved, the divider is elastically deformed as a result of contact with the guided portion. Because of this, the divider is more likely to wear down and/or to suffer damage. If the divider wears down and/or suffers damage, part replacement is needed. When the first guide passage, the second guide passage, and the divider are disposed in a single member, this member has to be replaced entirely. In this aspect of the present invention, the divider is disposed in the second member, which is different from the first member in which the first guide passage and the second guide passage are disposed, and the second member is detachably attached to the first member. Because of this arrangement, it is only required to replace the second member in the above situation. Thus, the running cost of the spun yarn take-up machine is reducible.

[0022] According to a ninth aspect of the invention, the spun yarn take-up machine of the fourth aspect is arranged such that the guide moving device includes: a main body portion supporting the yarn catch guide so as to be movable in the axial direction of the bobbin; a moving member provided at a central portion of the first guide passage in the axial direction of the bobbin and supported by the main body portion so as to be movable in the first direction, the moving member being configured so that the guided portion is able to contact the moving member from one side in the first direction; and a biasing member biasing the moving member from an other side in the first direction to the one side in the first direction. The moving member includes a protruding portion protruding in the

first direction and provided between the two connecting portions of the first guide passage which are connected with the second guide passage. Apart of a surface of the protruding portion that is on the one side in the first direction, which part includes an end of the protruding portion on the one side in the axial direction of the bobbin, forms an inclined surface inclined linearly so that an end of the inclined surface on the other side in the axial direction of the bobbin is located on the one side in the first direction relative to an end of the inclined surface on the one side in the axial direction of the bobbin. An end face of the protruding portion that is on the other side in the axial direction of the bobbin forms a guide surface configured to guide the guided portion into the second guide passage.

[0023] In this aspect of the present invention, when the yarn catch guide is moved from the catching position to the yarn shifting position, the moving member is pressed by the guided portion moving along the surface of the protruding portion in the first direction (e.g., the inclined surface). As a result, the moving member is moved toward the other side in the first direction against the biasing force of the biasing member. After the guided portion passes over the protruding portion, the moving member is moved by the biasing force of the biasing member to the one side in the first direction, to be returned to its original position. Thus, the yarn catch guide is parallel translated in the axial direction of the bobbin. Meanwhile, when the yarn catch guide is moved from the yarn shifting position toward the catching position, the guided portion is guided by the guide surface, into the second guide passage. As the guided portion is guided along the second guide passage, the yarn catch guide is moved to the yarn releasing position.

[0024] According to a tenth aspect of the invention, the spun yarn take-up machine of the ninth aspect is arranged such that a deviation preventing portion is provided to the protruding portion, the deviation preventing portion being configured to prevent the guided portion moving along the surface of the protruding portion from moving in the second direction.

[0025] The above arrangement in this aspect of the present invention prevents the guided portion from moving in the second direction, during the movement along the surface of the protruding portion, and from entering the second guide passage.

[0026] According to an eleventh aspect of the invention, the spun yarn take-up machine of the tenth aspect is arranged such that: the guided portion has, at an end portion thereof, a groove extending in the axial direction of the bobbin; and the deviation preventing portion is a projection provided on the surface of the protruding portion, extending in the axial direction of the bobbin, and being fittable in the groove.

[0027] In this aspect of the present invention, the guided portion has the groove at its end portion, and the protruding portion has, on its surface, the projection fittable in the groove. This arrangement prevents the guided por-

tion from moving in the second direction during the movement along the surface of the protruding portion and entering into the second guide passage.

[0028] In the present invention, the yarn is able to be released from the yarn catch guide by moving the yarn catch guide to the yarn releasing position. While the groove portion of the yarn catch guide extends in the first direction, the yarn releasing position is located farther from the traverse guide than the catching position and the yarn shifting position in the second direction orthogonal to both the axial direction of the bobbin and the first direction. Because of this, the yarn is able to be released from the yarn catch guide without distancing the yarn releasing position so far from the traverse guide. Thus, the moving distance of the yarn catch guide needed to release the yarn from the yarn catch guide is shorter than the case where the yarn is released from the yarn catch guide by moving the yarn catch guide in the first direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

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

FIG. 2 is a schematic diagram of a traverse unit shown in FIG. 1.

FIG. 3 A is a cross section of a yarn shifting unit shown in FIG. 2, taken along its center line with respect to a second direction. FIG. 3B is a cross section taken along a line B-B in FIG. 3A. FIG. 3C is a cross section taken along a line C-C in FIG. 3B.

FIG. 4A is a perspective view of a yarn catch guide and a guide member shown in FIG. 2 and FIGs. 3A to 3C. FIG. 4B is an exploded perspective view of the members shown in FIG. 4A.

FIG. 5A is a diagram analogous to FIG. 3A, and shows the state where the yarn catch guide is at a catching position. FIG. 5B is a diagram analogous to FIG. 3B, and shows the state where the yarn catch guide is at the catching position.

FIG. 6A is a diagram analogous to FIG. 3B, and shows the state where a divider is elastically deformed by a guided portion when the yarn catch guide is moved from the catching position to a yarn shifting position. FIG. 6B is a diagram analogous to FIG. 3B, and shows the state where the guided portion is guided by the divider when the yarn catch guide is moved from the yarn shifting position toward the catching position.

FIG. 7 is an explanatory diagram illustrating a "straight winding part" and a "bunch winding part". FIG. 8A is a diagram analogous to FIG. 3B, and shows the state where the yarn catch guide is at a yarn releasing position. FIG. 8B is a diagram analogous to FIG. 3C, and shows the state where the yarn catch guide is at the yarn releasing position.

FIG. 9A is a diagram analogous to FIG. 3A, and shows a yarn shifting unit of Modification 1. FIG. 9B shows a cam member detached from a main body shown in FIG. 9A. FIG. 9C shows the main body from which the cam member shown in FIG. 9A has been detached.

FIG. 10A is a diagram analogous to FIG. 3B, and shows the yarn shifting unit of Modification 1. FIG. 10B shows the cam member detached from the main body shown in FIG. 10A. FIG. 10C shows the main body from which the cam member shown in FIG. 10A has been detached.

FIG. 11A is a diagram analogous to FIG. 3A, and shows a yarn shifting unit of Modification 2. FIG. 11B is a diagram analogous to FIG. 3B, and shows the yarn shifting unit of Modification 2.

FIG. 12A is a diagram analogous to FIG. 11 A, and shows the state where a yarn catch guide is at the catching position. FIG. 12B is a diagram analogous to FIG. 11 B, and shows the state where the yarn catch guide is at the catching position.

FIG. 13 A is an explanatory diagram analogous to FIG 11A, and illustrates the yarn catch guide being moved from the catching position to the yarn shifting position. FIG. 13B is an explanatory diagram analogous to FIG. 11B, and illustrates the yarn catch guide being moved from the catching position to the yarn shifting position.

FIG. 14A is an explanatory diagram analogous to FIG 11A, and illustrates the yarn catch guide being moved from the yarn shifting position to the yarn releasing position. FIG. 14B is an explanatory diagram analogous to FIG. 11B, and illustrates the yarn catch guide being moved from the yarn shifting position to the yarn releasing position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] The following will describe a preferred embodiment of the present invention.

(Outline of Spun Yarn Take-Up Apparatus)

[0031] As shown in FIG. 1, a spun yarn take-up machine 1 is configured to take up yarns Y spun out from a spinning apparatus 2 and to form packages P by winding the yarns Y onto bobbins B, respectively. In the following description, an up-down direction and a front-rear direction of the spun yarn take-up machine 1 are defined as shown in FIG. 1. Further, in the following description, the direction orthogonal to the up-down direction and the front-rear direction (the direction orthogonal to the sheet of FIG. 1) is defined as a left-right direction. Furthermore, with respect to the left-right direction, the side farther from a viewer of FIG. 1 is defined as a left side, and the side closer the viewer is defined as a right side.

[0032] The spun yarn take-up machine 1 includes: a drawing unit 3, take-up rollers 4 and 5, an interlacing unit

6, a winding device 7, and the like. The operation of the spun yarn take-up machine 1 is controlled by a controller 8. The spinning apparatus 2 includes a polymer supplier (not illustrated), which is a gear pump, for example. Polymer supplied from the polymer supplier is extruded downward through spinnerets. As a consequence, yarns Y are spun out while being arranged in the left-right direction.

[0033] The yarns Y spun out from the spinning apparatus 2 travel along a yarn path through the drawing unit 3, the take-up roller 4, the interlacing unit 6, and the take-up roller 5, while keeping the arrangement in the left-right direction. Thereafter, the yarns Y are distributed in the front-rear direction at the take-up roller 5, and then wound onto the bobbins B in the winding device 7, respectively.

[0034] The drawing unit 3 is located below the spinning apparatus 2. The drawing unit 3 includes: a heat retaining box 10; and heating rollers (not illustrated) accommodated in the heat retaining box 10. In the drawing unit 3, the heating rollers draw the yarns Y spun out from the spinning apparatus 2 while heating the yarns Y. A cutter 11 is provided upstream of the drawing unit 3. The cutter 11 cuts the yarns Y to stop winding operation when yarn breakage occurs, for example.

[0035] The yarns Y having been drawn in the drawing unit 3 are fed to the winding device 7 by the two take-up rollers 4 and 5. The interlacing unit 6 is located between the two take-up rollers 4 and 5. The interlacing unit 6 is configured to entangle multiple filaments constituting each yarn Y with one another to impart cohesiveness. As the interlacing unit 6, a device configured to entangle filaments by airflow ejected from air nozzles is preferably used.

[0036] The winding device 7 includes two bobbin holders 22, a contact roller 26, and the like. Each bobbin holder 22 is long in the front-rear direction. The bobbins B are attached to each bobbin holder 22 so that the bobbins B are arranged in the axial direction of the bobbin holder 22. By rotating the bobbin holder 22, the winding device 7 winds the yarns Y fed from the take-up roller 5 onto the bobbins B at the same time, to form packages P. The contact roller 26 contacts the surfaces of the packages P to apply a predetermined contact pressure to the packages P, to properly shape the packages P. In addition, the contact roller 26 rotates at a surface speed which is substantially equal to that of the packages P, to feed the yarns Y to the packages P.

(Winding Device)

[0037] The following will describe the structure of the winding device 7. As shown in FIG. 1, the winding device 7 includes members such as a turret 21, the two bobbin holders 22, a supporting frame 23, the contact roller 26, and a traverse unit 27.

[0038] The turret 21 is a disc-shaped member having an axis 21a which is in parallel to the front-rear direction. The turret 21 is driven and rotated by a motor (not illus-

trated) about the axis 21 a. The two long cylindrical bobbin holders 22 are cantilevered by the turret 21. The bobbin holders 22 extend in the front-rear direction. The two bobbin holders 22 are respectively attached to portions of the turret 21 that are symmetrical with respect to the center of rotation of the turret 21. Each bobbin holder 22 is driven and rotated by a motor (not illustrated) about its axis 22a which is in parallel to the front-rear direction. The two bobbin holders 22 at an upper winding position and a lower retracted position are replaceable by each other by rotating the turret 21.

[0039] Each bobbin holder 22 has a plurality of (in FIG. 1, eight) bobbin attachment sections 30 arranged in its axial direction. The bobbins B are respectively attached to the bobbin attachment sections 30. As the bobbin holder 22 at the upper winding position is driven and rotated by the motor (not illustrated), yarns Y are respectively wound onto the bobbins B, so that packages P are formed. After the packages P are formed on the bobbin holder 22 at the upper winding position, the turret 21 is rotated, to replace this bobbin holder 22 by the other one, on which new packages P will be formed.

[0040] The supporting frame 23 is a long frame-like member extending in the axial direction of the bobbin holders 22 (in the front-rear direction). A roller supporting member 37, which is long in the front-rear direction, is attached to a lower portion of the supporting frame 23 so as to be vertically movable relative to the supporting frame 23.

[0041] The roller supporting member 37 supports the contact roller 26 in a rotatable manner. The contact roller 26 extends in the axial direction of the bobbin holders 22. The contact roller 26 contacts the surfaces of the packages P formed on the bobbin holder 22 at the winding position, and rotates at a surface speed substantially equal to that of the packages P, as the packages P rotate. As a consequence, a predetermined contact pressure is applied by the contact roller 26 to the packages P in the course of formation. It should be noted that the contact roller 26 may be configured to be driven and rotated by a motor (not illustrated), instead of being configured to rotate with the rotation of the packages P.

[0042] The roller supporting member 37 is provided with fulcrum guides 35 and traverse units 27. The fulcrum guides 35 are disposed so as to respectively correspond to the bobbin attachment sections 30 of the bobbin holder 22.

(Traverse Unit)

[0043] The traverse units 27 are disposed so as to respectively correspond to the fulcrum guides 35, and are located below the respective fulcrum guides 35. Each of the traverse units 27 traverses, in the front-rear direction, the yarn Y which is to be wound onto the bobbin B corresponding thereto.

[0044] As shown in FIG. 2 and FIG. 3A to FIG. 3C, each traverse unit 27 includes a traverse guide 41 and

two wing guides 42. The traverse guide 41 is a plate-like member long in the front-rear direction. The traverse guide 41 extends in the front-rear direction and in a first direction orthogonal to the front-rear direction. The first direction is inclined with respect to the up-down direction so that a line along the first direction extends upward and leftward from an intersection with a line along the up-down direction. The traversed yarn Y is in contact with one of end portions of the traverse guide 41 in the first direction. The traverse guide 41 is configured to guide the traversed yarn Y in the front-rear direction. The two wing guides 42 overlap each other when viewed from a second direction orthogonal to both the front-rear direction and the first direction. The wing guides 42 further overlap the traverse guide 41 when viewed from the second direction. The two wing guides 42 rotate in opposite directions to each other, with respect to an axis which is in parallel to the second direction. Thus, the yarn Y contacting the traverse guide 41 is moved frontward by one of the wing guides 42. When the yarn Y reaches a front end portion of a traverse range R in which the yarn Y is traversed, the yarn Y is passed to the other wing guide 42. The yarn Y having been passed to the other wing guide 42 is moved rearward by the other wing guide 42. When the yarn Y reaches a rear end portion within the traverse range R, the yarn Y is passed to the one wing guide 42. As a result of the repetition of the above operations, the yarn Y is traversed in the front-rear direction about the fulcrum guide 35 within the traverse range R. The above-described arrangement for traversing a yarn using the two wing guides 42 has been known as is described in Patent Literature 1, for example. For this reason, a further detailed description of this arrangement is not given here.

(Yarn Shifting Unit)

[0045] As shown in FIG. 2 and FIG. 3A to FIG. 3C, each traverse unit 27 is provided with a yarn shifting unit 50. The yarn shifting unit 50 is configured to release the yarn Y from the traverse unit 27, and to move the yarn Y to a yarn shifting position frontward of the traverse range R (toward "the other side in the axial direction of the bobbin" in the present invention) at the time of replacement of the bobbins B. The bobbins B attached to the bobbin holder 22 at the winding position are replaced when become full, by empty bobbins B, onto which the yarns Y are wound next.

[0046] As shown in FIG. 2 to FIG. 4B, the yarn shifting unit 50 includes: a yarn catch guide 51; a guide member 52 configured to guide the yarn catch guide 51; and a cylinder 53 functioning as a driving unit configured to move the yarn catch guide 51. In the present embodiment, a combination of the guide member 52 and the cylinder 53 is equivalent to a "guide moving device" in the present invention. It should be noted that the traverse guide 41 and the wing guides 42 are not illustrated in FIG. 3B.

[0047] The yarn catch guide 51 includes a catch portion 51a and an insertion portion 51b. The catch portion 51a is disposed on the opposite side of the traverse guide 41 from the two wing guides 42 in the second direction. The catch portion 51a overlaps an end portion of the traverse guide 41 that is on one side in the first direction. The catch portion 51a has a groove portion 56. The groove portion 56 extends in the first direction. Both ends of the groove portion 56 in the second direction are open. Further, an end of the groove portion 56 that is on the other side in the first direction is open. Furthermore, a rear end face (end face "on one side in the axial direction of the bobbin" in the present invention) of the catch portion 51a forms an inclined surface 57. The inclined surface 57 is inclined with respect to the first direction so that the distance between the inclined surface 57 and the groove portion 56 in the front-rear direction decreases toward the other side in the first direction.

[0048] The insertion portion 51b has a substantially cylindrical shape and its axis extends in the front-rear direction. The insertion portion 51b is inserted into the guide member 52 along the front-rear direction. Thus, the yarn catch guide 51 is supported by the guide member 52 so as to be movable in the front-rear direction and so as to be swingable with respect to the axis of the insertion portion 51b. An end portion of the catch portion 51a that is on the other side in the first direction is fixed to a front portion (in the front-rear direction) of an end portion of the insertion portion 51b that is on a side closer to the traverse guide 41 in the second direction. The side closer to the traverse guide 41 in the second direction is hereinafter referred to as a "traverse guide 41 side in the second direction". Further, a guided portion 58 is provided at a front portion (in the front-rear direction) of an end portion of the insertion portion 51b that is on the other side in the first direction. The guided portion 58 protrudes outward in a radial direction of the insertion portion 51b. The cylinder 53 is attached to a rear end portion of the insertion portion 51b. As the cylinder 53 is driven, a force in the front-rear direction is applied to the yarn catch guide 51.

[0049] The guide member 52 is a cylindrical member extending in the front-rear direction. The guide member 52 has a slit 61 at its end portion that is on the traverse guide 41 side in the second direction. The slit 61 extends in the front-rear direction and opens at a front end portion of the guide member 52. Through this slit 61, a part of the yarn catch guide 51 passes, which part connecting the catch portion 51a and the insertion portion 51b with each other. The guide member 52 further has a guide groove 62 in its end portion that is on the other side in the first direction. The guide groove 62 is configured to guide the guided portion 58.

(Guide Groove)

[0050] The guide groove 62 includes: a first guide groove 62a ("first guide passage" in the present inven-

tion); and a second guide groove 62b ("second guide passage" in the present invention). The first guide groove 62a extends substantially in parallel to the front-rear direction. The second guide groove 62b is disposed on the traverse guide 41 side in the second direction relative to the first guide groove 62a. The second guide groove 62b has two connection portions connected with the first guide groove 62a. The two connection portions are apart from each other in the front-rear direction. Out of the front and rear connecting portions of the second guide groove 62b that are connected with the first guide groove 62a, the front connecting portion is inclined with respect to the front-rear direction so that the distance between the front connecting portion and the first guide groove 62a in the second direction increases rearward. The rear connecting portion is inclined with respect to the front-rear direction so that the distance between the rear connecting portion and the first guide groove 62a in the second direction increases frontward. An intermediate portion of the second guide groove 62b that is between, in the front-rear direction, the two connecting portions connected with the first guide groove 62a extends in the front-rear direction. The intermediate portion is separated by a partition wall 63 from the first guide groove 62a.

[0051] The first guide groove 62a has two connecting portions that are respectively connected to the above connecting portions of the second guide groove 62b. In the front connecting portion of these connecting portions of the first guide groove 62a, a divider 64 is provided. The divider 64 partitions the space in the first guide groove 62a in the front-rear direction. The divider 64 is cantilevered by the partition wall 63, and therefore the divider 64 is elastically deformable. The divider 64 is inclined frontward with respect to the second direction so that the distance between the divider 64 and the yarn shifting position in the front-rear direction decreases toward a free end of the divider 64. Note that the free end is the end of the divider 64 that is opposite from its end supported by the partition wall 63. Therefore, it is easier for the divider 64 to be elastically deformed frontward, but it is difficult for the divider to be elastically deformed rearward. In other words, frontward elastic deformation of the divider 64 is allowed, but rearward elastic deformation of the divider 64 is restricted. Further, a regulatory portion 62c is provided on a wall portion of the first guide groove 62a that is opposite to the second guide groove 62b in the second direction. The regulatory portion 62c is configured to contact the divider 64 in the course of the rearward elastic deformation, to restrict the rearward elastic deformation of the divider 64.

(Operation at the time of replacement of bobbins)

[0052] The following will describe operation carried out when winding of the yarns Y onto the bobbins B is completed and the bobbins B are replaced by empty bobbins B, onto which the yarns Y are wound next. While the yarn Y is being wound onto each bobbin B, the yarn catch

guide 51 is at the yarn shifting position that is frontward of the traverse range R, as shown in FIG. 2 and FIG. 3A to FIG. 3C. In this situation, the guided portion 58 is located at a front end portion of the first guide groove 62a.

[0053] When winding of the yarn Y onto each bobbin B is completed, the turret 21 is rotated to switch the positions of the two bobbin holders 22 to each other. Subsequently, the cylinder 53 is driven to move the yarn catch guide 51 rearward. As a result, the yarn catch guide 51 is moved to a catching position that is within the traverse range R, as shown in FIG. 5A and FIG. 5B. When the yarn catch guide 51 is moved from the yarn shifting position to the catching position, the guided portion 58 enters the second guide groove 62b, and this causes the yarn catch guide 51 to swing and pass a yarn releasing position. However, the swing of the yarn catch guide 51 in this movement has no special meaning, and therefore the detailed description thereof is not given here.

[0054] As the yarn catch guide 51 has been moved to the catching position, the traversed yarn Y is guided by the inclined surface 57 and introduced into the groove portion 56 from the rear side when the yarn Y is moved frontward. In this way, the yarn Y is caught by the yarn catch guide 51.

[0055] Subsequently, the cylinder 53 is driven to move the yarn catch guide 51 frontward, to the yarn shifting position. In this process, the guided portion 58 is guided by the first guide groove 62a. In the first guide groove 62a, there is the divider 64. As described above, the frontward elastic deformation of the divider 64 is allowed. Because of this, the guided portion 58 elastically deforms the divider 64 frontward and passes through a portion of the first guide groove 62a where the divider 64 is disposed, as shown in FIG. 6A. When the guided portion 58 is guided by the portion of the first guide groove 62a extending parallel to the front-rear direction, the yarn catch guide 51 is parallel translated without swing. As such, the yarn catch guide 51 is moved to the yarn shifting position while holding the yarn Y.

[0056] The yarn catch guide 51 is then kept at the yarn shifting position, thereby to form a straight winding part S at a front end portion of the bobbin B, as shown in FIG. 7. After the straight winding part S is formed, the yarn catch guide 51 is moved rearward by the cylinder 53. During this movement, the guided portion 58 is first guided to a portion of the first guide groove 62a that is frontward of the divider 64. As a result, the yarn catch guide 51 is parallel translated rearward while holding the yarn Y. In this process, a spiral bunch winding part T is formed on the bobbin B. The bunch winding part T is formed between the front end portion where the straight winding part S is formed and a yarn-winding portion where the yarn Y is wound. The yarn-winding portion is the portion indicated by a dashed line in FIG. 7.

[0057] When the yarn catch guide 51 is moved rearward farther, the guided portion 58 comes into contact with the divider 64. It is difficult for the divider 64 to be elastically deformed rearward. Further, the rearward de-

formation is restricted by the regulatory portion 62c. In addition, the divider 64 is inclined frontward with respect to the second direction. Because of these structures, the guided portion 58 having got into contact with the divider 64 does not pass through the portion of the first guide groove 62a where the divider 64 is disposed. Instead of this, the guided portion 58 is guided by the divider 64 to enter the second guide groove 62b, as shown in FIG. 6B. As a result, as shown in FIG. 8A and FIG. 8B, the guided portion 58 is moved toward the traverse guide 41 side in the second direction, to swing the yarn catch guide 51. The swing of the yarn catch guide 51 causes the catch portion 51a to get away from the traverse guide 41 in the second direction, with the result that the yarn Y is disengaged from the groove portion 56. That is, the yarn Y is released from the yarn catch guide 51. The yarn Y released from the yarn catch guide 51 is caught by the wing guide 42, to be wound onto the bobbin B while being traversed by the traverse unit 27. Note that the position of the yarn catch guide 51 shown in FIG. 8A and FIG. 8B, at which the yarn Y is released from the yarn catch guide 51 is the yarn releasing position in the present invention. In FIG. 8A, the catch portion 51a of the yarn catch guide 51 is not illustrated to clearly show the guided portion 58 and the guide groove 62. After the yarn Y is released from the yarn catch guide 51, the cylinder 53 is driven to move the yarn catch guide 51 frontward, to return the yarn catch guide 51 back to the yarn shifting position.

[0058] In the above-described embodiment, the catch portion 51a of the yarn catch guide 51 having the groove portion 56 is moved to the yarn releasing position which is farther from the traverse guide 41 in the second direction than the catching position and the yarn shifting position, to release the yarn Y from the yarn catch guide 51. Now, consider the following arrangement different from that of the present invention: the yarn Y can be released from the yarn catch guide 51 by moving the yarn catch guide 51 toward the one side in the first direction relative to the traverse guide 41. In this arrangement, however, the yarn catch guide 51 has to be moved toward the one side in the first direction until the opening of the groove portion 56 that is on the other side in the first direction reaches a position where the opening is on the one side in the first direction relative to the traverse guide 41. For this reason, the moving distance of the yarn catch guide 51 needed to release the yarn Y from the yarn catch guide 51 is longer. To the contrary, in the present embodiment, the yarn Y is released by moving the yarn catch guide 51 in the second direction. This arrangement enables the yarn Y to be released from the yarn catch guide 51 without moving the yarn catch guide 51 so far away from the traverse guide 41. Thus, in the present embodiment, the moving distance of the yarn catch guide 51 needed to release the yarn Y from the yarn catch guide 51 is shorter than the case where the yarn Y is released from the yarn catch guide 51 by moving the yarn catch guide 51 in the first direction. Furthermore, in the present

embodiment, there is no need to move the yarn catch guide 51 a long distance in the first direction when the yarn Y is released from the yarn catch guide 51. This enables downsizing of the machine in the first direction.

[0059] In the present embodiment, when the yarn catch guide 51 is moved from the catching position to the yarn shifting position, the yarn catch guide 51 is moved frontward by the cylinder 53, and the guided portion 58 is guided along the first guide groove 62a. As a result, the yarn catch guide 51 is parallel translated. Meanwhile, when the yarn catch guide 51 is moved from the yarn shifting position toward the catching position, the yarn catch guide 51 is moved rearward by the cylinder 53, and the guided portion 58 is guided along the second guide groove 62b, to swing the yarn catch guide 51. As a result, the yarn catch guide 51 is moved to the yarn releasing position, which is farther from the traverse guide 41 in the second direction than the catching position and the yarn shifting position. That is, in the present embodiment, the yarn catch guide 51 is moved in the front-rear direction and in the second direction with the use of the single cylinder 53 configured to apply a force in the front-rear direction to the yarn catch guide 51. Thus, the yarn shifting unit of the present embodiment has a simpler structure than in the case where a driving unit for moving the yarn catch guide 51 in the front-rear direction and a driving unit for moving the yarn catch guide 51 in the second direction are provided individually.

[0060] Furthermore, in the present embodiment, the divider 64 partitioning the space in the first guide groove 62a in the front-rear direction is cantilevered by the partition wall 63, and the divider 64 is inclined frontward with respect to the second direction, as described above. Because of this structure, it is easier for the divider 64 to be elastically deformed frontward, but it is difficult for the divider 64 to be elastically deformed rearward. Moreover, the regulatory portion 62c configured to restrict the rearward elastic deformation of the divider 64 is provided in the first guide groove 62a. When the yarn catch guide 51 moves from the catching position to the yarn shifting position, the guided portion 58 elastically deforms the divider 64 frontward, and passes through the portion of the first guide groove 62a where the divider 64 is disposed. Meanwhile, when the yarn catch guide 51 moves from the yarn shifting position toward the catching position, the guided portion 58 cannot elastically deform the divider 64 rearward. Because of this, the guided portion 58 does not pass through the portion of the first guide groove 62a where the divider 64 is disposed. Thus, the guided portion 58 is prevented from being guided into the above portion of the first guide groove 62a when the yarn catch guide 51 is moved from the yarn shifting position toward the catching position. Furthermore, because the divider 64 is inclined frontward with respect to the second direction, the guided portion 58 is guided by the divider 64 so as to enter the second guide groove 62b during the above movement.

[0061] The following will describe modifications of the

above-described embodiment of the present invention.

[0062] In the above-described embodiment, the guide member 52 is a single member including the guide groove 62, the partition wall 63, the divider 64, and the like. However, the present invention is not limited to this. In Modification 1, as shown in FIG. 9A to FIG. 9C and FIG. 10A to FIG. 10C, a guide member 101 is formed by a main body 102 ("first member" in the present invention) and a cam member 103 ("second member" in the present invention) attached to the main body 102. The cam member 103 is a substantially quadrangular plate-like member. The cam member 103 is attached to the main body 102 in a detachable manner. The partition wall 63, the divider 64, and a recess 104 are provided on a surface of the cam member 103 that is on the one side in the first direction. The recess 104 forms a part of an end portion of the guide groove 62 that is on the other side in the first direction, which part is in the vicinity of the partition wall 63 and the divider 64. The main body 102 has a structure similar to that of the guide member 52 (see FIG. 3A) except the components included in the cam member 103. The main body 102 has a housing portion 105 at its end portion that is on the other side in the first direction. The housing portion 105 houses therein the cam member 103.

[0063] As described in the above embodiment, when the yarn catch guide 51 is moved in the front-rear direction, the divider 64 is elastically deformed by the guided portion 58, and guides the guided portion 58 into the second guide groove 62b by contacting the guided portion 58. Because of this, the divider 64 is more likely to wear down, and/or to suffer damage. If the divider 64 wears down and/or suffers damage, part replacement is needed. In the arrangement of the above-described embodiment, however, the guide member 52 including the divider 64 has to be entirely replaced. Meanwhile, in this modification, it is only required to replace the cam member 103 including the divider 64, out of the components of the guide member 101. That is, there is no need to replace the main body 102. Thus, in this modification, the running cost of the spun yarn take-up machine is reducible.

[0064] In Modification 1, the cam member 103 includes the recess 104 in addition to the partition wall 63 and the divider 64. However, the present invention is not limited to this. The cam member 103 does not have to include the recess 104. The cam member 103 may form the wall portion of the guide groove 62 that is on the other side in the first direction.

[0065] In the above-described embodiment, the regulatory portion 62c configured to restrict the rearward elastic deformation of the divider 64 is provided in the first guide groove 62a. However, the regulatory portion 62c does not have to be provided. As described above, the divider 64 is inclined frontward with respect to the second direction so that the distance between the divider 64 and the yarn shifting position in the front-rear direction decreases toward the free end of the divider 64. Because

of this, even without the regulatory portion, it is easier for the divider 64 to be elastically deformed frontward, but it is difficult for the divider 64 to be elastically deformed rearward. Accordingly, on the premise that the divider 64 has a certain degree of rigidity, even if the regulatory portion 62c is not provided, the divider 64 is not elastically deformed rearward to the extent that the guided portion 58 can pass when the guided portion 58 comes into contact with the divider 64 from the front, and the guided portion 58 is guided by the divider 64 into the second guide groove 62b.

[0066] In the above-described embodiment, the divider 64 is inclined frontward with respect to the second direction so that the distance between the divider 64 and the yarn shifting position in the front-rear direction decreases toward the free end of the divider 64. However, the present invention is not limited to this. The divider 64 may extend in parallel to the second direction. Alternatively, the divider 64 may be inclined rearward with respect to the second direction so that the distance between the divider 64 and the catching position in the front-rear direction decreases toward the free end of the divider 64. If the regulatory portion 62c configured to restrict the rearward elastic deformation of the divider 64 is provided in the first guide groove 62a in the above alternatives, the guided portion 58 does not pass through the portion of the first guide groove 62a where the divider 64 is disposed when the yarn catch guide 51 is moved from the yarn shifting position toward the catching position. Provided however, in the above alternatives, it is necessary to separately provide an arrangement for guiding the guided portion 58 into the second guide groove 62b when the yarn catch guide 51 is moved rearward from the yarn shifting position toward the catching position.

[0067] The divider 64 may be configured so that its frontward elastic deformation is allowed and its rearward elastic deformation is restricted, in a way other than the above-described ways: the divider 64 is inclined frontward with respect to the second direction so that the distance between the divider 64 and the yarn shifting position in the front-rear direction decreases toward the free end of the divider 64; and/or the regulatory portion 62c configured to restrict the rearward elastic deformation of the divider 64 is provided.

[0068] Furthermore, in the above-described embodiment, the divider 64 is provided in the first guide groove 62a. However, the present invention is not limited to this. An arrangement different from the divider 64 may be provided to guide the guided portion 58 into the first guide groove 62a when the yarn catch guide 51 is moved from the catching position to the yarn shifting position and to guide the guided portion 58 into the second guide groove 62b when the yarn catch guide 51 is moved from the yarn shifting position toward the catching position.

[0069] For example, in Modification 2, as shown in FIG. 11A and FIG. 11B, a yarn shifting unit 110 includes: a yarn catch guide 111; a guide member 112 configured to guide the yarn catch guide 111; and a cylinder 113

functioning as a driving unit configured to move the yarn catch guide 111. In the Modification 2, a combination of the guide member 112 and the cylinder 113 is equivalent to the "guide moving device" in the present invention. The traverse guide 41 and the wing guides 42 are not illustrated in FIG. 11B.

[0070] The yarn catch guide 111 includes a catch portion 111a and an insertion portion 111b. The catch portion 111a is located on the opposite side of the traverse guide 41 from the two wing guides 42 in the second direction. The catch portion 111a overlaps an end portion of the traverse guide 41 that is on the one side in the first direction. The catch portion 111a has a groove portion 116. The groove portion 116 extends in the first direction. Both ends of the groove portion 116 in the second direction are open. Further, an end of the groove portion 116 that is on the other side in the first direction is open. Furthermore, a rear end face (end face "on one side in the axial direction of the bobbin" in the present invention) of the catch portion 111a forms an inclined surface 117. The inclined surface 117 is inclined with respect to the first direction so that the distance between the inclined surface 117 and the groove portion 116 in the front-rear direction decreases toward the other side in the first direction.

[0071] The insertion portion 111b has a substantially cylindrical shape and its axis extends in the front-rear direction. The insertion portion 111b is inserted into the guide member 112 (specifically, into a main body portion 121, which will be described later) along the front-rear direction. Thus, the yarn catch guide 111 is supported by the guide member 112 so as to be movable in the front-rear direction and so as to be swingable with respect to the axis of the insertion portion 111b. An end portion of the catch portion 111a that is on the other side in the first direction is fixed to a front portion (in the front-rear direction) of an end portion of the insertion portion 111b that is on the traverse guide 41 side in the second direction. Further, a guided portion 118 is provided at a front portion (in the front-rear direction) of an end portion of the insertion portion 111b that is on the other side in the first direction. The guided portion 118 protrudes outward in a radial direction of the insertion portion 111b. The guided portion 118 has a substantially cylindrical shape. The guided portion 118 has, at its leading end portion (radially outer end portion), a groove 118a extending in the front-rear direction. The cylinder 113 is attached to a rear end portion of the insertion portion 111b. As the cylinder 113 is driven, a force in the front-rear direction is applied to the yarn catch guide 111.

[0072] The guide member 112 includes: the main body portion 121; a moving member 122; and a spring 123 ("biasing member" in the present invention). The main body portion 121 is a cylindrical member extending in the front-rear direction. The main body portion 121 has a slit 124 at its end portion that is on the traverse guide 41 side in the second direction. The slit 124 extends in the front-rear direction and opens at a front end portion of the guide

member 112. Through this slit 124, a part of the yarn catch guide 111 passes, which part connecting the catch portion 111a and the insertion portion 111b with each other.

[0073] The main body portion 121 has a recess 121a at its end portion that is on the other side in the first direction. An end portion of the recess 121a that is on the one side in the first direction is open. The moving member 122 is in the recess 121a, and is supported so as to be movable in the first direction along the recess 121a. The spring 123 is in the recess 121a, and biases the moving member 122 from the other side to the one side in the first direction. The guide member 112 further has a guide groove 130 in its end portion that is on the other side in the first direction. The guide groove 130 is configured to guide the guided portion 118.

(Guide Groove)

[0074] The guide groove 130 includes a first guide passage 130a and a second guide passage 130b. The first guide passage 130a extends substantially in parallel to the front-rear direction. Only both end portions of the first guide passage 130a in the front-rear direction are disposed in the main body portion 121. The remaining portion of the first guide passage 130a is disposed in the moving member 122. A protruding portion 132 is provided at a central portion in the front-rear direction of the above remaining portion of the first guide passage 130a that is disposed in the moving member 122. The protruding portion 132 protrudes toward the one side in the first direction. A surface of the protruding portion 132 that is on the one side in the first direction is hereinafter referred to as a "leading end surface". A part of the leading end surface of the protruding portion 132 that is from its rear end portion to its central portion in the front-rear direction forms an inclined surface 133. The inclined surface 133 is inclined linearly with respect to the front-rear direction so that its front end is located on the one side in the first direction relative to its rear end. Portions of the leading end surface of the protruding portion 132 other than the inclined surface 133 extend in parallel to the front-rear direction. A projection 134 extending in the front-rear direction is provided on the leading end surface of the protruding portion 132. The projection 134 ranges over the inclined surface 133 and portions of the leading end surface which are adjacent to both ends of the inclined surface 133 in the front-rear direction. The protruding portion 132 has a front end face forming a guide surface 135. The guide surface 135 is inclined with respect to the front-rear direction so that the distance between the guide surface 135 and the traverse guide 41 in the second direction decreases rearward. The guide surface 135 is configured to guide the guided portion 118 of the yarn catch guide 111 from the first guide passage 130a to the second guide passage 130b.

[0075] The entire second guide passage 130b is disposed in the moving member 122. The second guide

passage 130b is disposed on the traverse guide 41 side in the second direction relative to the first guide passage 130a. The second guide passage 130b has two connection portions connected with the first guide passage 130a. The two connection portions are immediately in front of and behind the protruding portion 132, respectively. In other words, the protruding portion 132 is located between the two connecting portions of the second guide passage 130b in the front-rear direction that are connected with the first guide passage 130a. Out of the front and rear connecting portions of the second guide passage 130a that are connected with the first guide groove 130a, the front connecting portion is inclined with respect to the front-rear direction so that the distance between the front connecting portion and the first guide passage 130a in the second direction increases rearward. The rear connecting portion is inclined with respect to the front-rear direction so that the distance between the rear connecting portion and the first guide passage 130a in the second direction increases frontward.

(Operation at the time of replacement of bobbins)

[0076] The following will describe operation carried out when winding of the yarns Y onto the bobbins B (see FIG. 1) is completed and the bobbins B are replaced by empty bobbins B, onto which the yarns Y are wound next. While the yarn Y is being wound onto each bobbin B, the yarn catch guide 111 is at the yarn shifting position that is frontward of the traverse range R, as shown in FIG. 11A and FIG. 11B. In this situation, the guided portion 118 is located at a front end portion of the first guide passage 130a.

[0077] When winding of the yarn Y onto each bobbin B is completed, the turret 21 (see FIG. 1) is rotated to switch the positions of the two bobbin holders 22 (see FIG. 1) to each other. Subsequently, the cylinder 113 is driven to move the yarn catch guide 111 rearward. As a result, the yarn catch guide 111 is moved to the catching position that is within the traverse range R, as shown in FIG. 12A and FIG. 12B. When the yarn catch guide 111 is moved from the yarn shifting position to the catching position, the guided portion 118 enters the second guide passage 130b, and this causes the yarn catch guide 111 to swing and pass the yarn releasing position. However, the swing of the yarn catch guide 111 in this movement has no special meaning, and therefore the detailed description thereof is not given here.

[0078] As the yarn catch guide 111 has been moved to the catching position, the traversed yarn Y is guided by the inclined surface 117 and introduced into the groove portion 116 from the rear side when the yarn Y is moved frontward. In this way, the yarn Y is caught by the yarn catch guide 111.

[0079] Subsequently, the cylinder 113 is driven to move the yarn catch guide 111 frontward, to the yarn shifting position. During this movement, the guided portion 118 is guided by the first guide passage 130a. In the

course of this movement, the guided portion 118 is guided along the inclined surface 133, as shown in FIG. 13A and FIG. 13B. When guided along the inclined surface 133, the guided portion 118 presses the inclined surface 133.

Due to this, the moving member 122 moves toward the other side in the first direction against the biasing force of the spring 123. After the guided portion 118 passes over the protruding portion 132, the moving member 122 is no longer pressed by the guided portion 118. Because of this, the moving member 122 is moved by the biasing force of the spring 123 toward the one side in the first direction, to be returned to its original position. Thus, the yarn catch guide 111 is parallel translated in the front-rear direction when moved from the catching position to the yarn shifting position. Accordingly, the yarn catch guide 111 is moved to the yarn shifting position while holding the yarn Y.

[0080] Furthermore, in the above movement, the groove 118a of the leading end portion of the guided portion 118 is fit with the projection 134 on the leading end surface of the protruding portion 132. This prevents the guided portion 118 from moving toward the traverse guide side in the second direction during the movement along the protruding portion 132 and entering into the second guide passage 130b.

[0081] The yarn catch guide 111 is kept at the yarn shifting position, thereby to form a straight winding part S at a front end portion of the bobbin B, as shown in FIG. 7. After the straight winding part S is formed, the yarn catch guide 111 is moved rearward by the cylinder 113. During this movement, the guided portion 118 is first guided to a portion of the first guide passage 130a that is frontward of the protruding portion 132. As a result, the yarn catch guide 111 is parallel translated rearward while holding the yarn Y. In this process, a spiral bunch winding part T is formed on the bobbin B. The bunch winding part T is formed between the front end portion where the straight winding part S is formed and a yarn-winding portion where the yarn Y is wound. The yarn-winding portion is the portion indicated by the dashed line in FIG. 7.

[0082] When the yarn catch guide 111 is moved rearward farther, the guided portion 118 comes into contact with the guide surface 135. The guide surface 135 is inclined frontward with respect to the second direction. Because of this, as shown in FIG. 14A and FIG. 14B, the guided portion 118 is guided by the guide surface 135 so as to enter the second guide passage 130b. As a result, the guided portion 118 is moved toward the traverse guide 41 side in the second direction, to swing the yarn catch guide 111. The swing of the yarn catch guide 111 causes the catch portion 111a to get away from the traverse guide 41 in the second direction, with the result that the yarn Y is disengaged from the groove portion 116. That is, the yarn Y is released from the yarn catch guide 111. The yarn Y released from the yarn catch guide 111 is caught by the wing guide 42, to be wound onto the bobbin B while being traversed by the traverse unit 27. Note that the position of the yarn catch guide 111

shown in FIG. 14A and FIG. 14B, at which the yarn Y is released from the yarn catch guide 111 is the yarn releasing position in the present invention. In FIG. 14A, the catch portion 111a of the yarn catch guide 111 is not illustrated to clearly show the guided portion 118 and the guide groove 130. After the yarn Y is released from the yarn catch guide 111, the cylinder 113 is driven to move the yarn catch guide 111 frontward, to return the yarn catch guide 111 back to the yarn shifting position.

[0083] In Modification 2, the catch portion 111a of the yarn catch guide 111 having the groove portion 116 is moved to the yarn releasing position which is farther from the traverse guide 41 in the second direction than the catching position and the yarn shifting position, to release the yarn Y from the yarn catch guide 111. In Modification 2, the yarn Y is released by moving the yarn catch guide 111 in the second direction. This arrangement enables the yarn Y to be released from the yarn catch guide 111 without moving the yarn catch guide 111 so far away from the traverse guide 41. Thus, in Modification 2, the moving distance of the yarn catch guide 111 needed to release the yarn Y from the yarn catch guide 111 is shorter than the case where the yarn Y is released from the yarn catch guide 111 by moving the yarn catch guide 111 in the first direction. Furthermore, in Modification 2, there is no need to move the yarn catch guide 111a long distance in the first direction when the yarn Y is released from the yarn catch guide 111. This enables downsizing of the machine in the first direction.

[0084] Still further, in Modification 2, when the yarn catch guide 111 is moved from the catching position to the yarn shifting position, the yarn catch guide 111 is moved frontward by the cylinder 113, and the guided portion 118 is guided along the first guide passage 130a. As a result, the yarn catch guide 111 is parallel translated. Meanwhile, when the yarn catch guide 111 is moved from the yarn shifting position toward the catching position, the yarn catch guide 111 is moved rearward by the cylinder 113, and the guided portion 118 is guided along the second guide passage 130b, to swing the yarn catch guide 111. As a result, the yarn catch guide 111 is moved to the yarn releasing position, which is farther from the traverse guide 41 in the second direction than the catching position and the yarn shifting position. That is, in Modification 2, the yarn catch guide 111 is moved in the front-rear direction and in the second direction with the use of the single cylinder 113 configured to apply a force in the front-rear direction to the yarn catch guide 111. Thus, the yarn shifting unit of this modification has a simpler structure than in the case where a driving unit for moving the yarn catch guide 111 in the front-rear direction and a driving unit for moving the yarn catch guide 111 in the second direction are provided individually.

[0085] In the above-described embodiment, the divider 64 is deformed when the yarn catch guide 51 is moved from the catching position to the yarn shifting position. Meanwhile, in Modification 2, when the yarn catch guide 111 is moved from the catching position to the yarn shift-

ing position, the moving member 122 is moved toward the other side in the first direction against the biasing force of the spring 123. In this process, though the spring 123 is deformed, the moving member 122 is not elastically deformed. For this reason, the yarn shifting unit 110 of Modification 2 has high durability.

[0086] Furthermore, in Modification 2, the guided portion 118 of the yarn catch guide 111 has the groove 118a at its leading end portion, and the protruding portion 132 has, at its leading end surface, the projection 134 fittable in the groove 118a. This arrangement prevents the guided portion 118 from moving in the second direction during the movement along the protruding portion 132 and entering into the second guide passage 130b. However, the present invention is not limited to this. For example, a deviation preventing portion may be provided at an edge portion of the leading end surface of the protruding portion 132 that is on the traverse guide 41 side in the second direction. The diversion preventing portion may project in the first direction and extend in the front-rear direction, and may be configured to prevent the guided portion 118 from moving toward the traverse guide 41 side in the second direction. Alternatively, such an arrangement for preventing the guided portion 118 from moving in the second direction during the movement along the protruding portion 132 and entering into the second guide passage 130b does not have to be provided.

[0087] Furthermore, in Modification 2, in addition to a variable portion of the first guide passage 130a that is formed by the protruding portion 132, (i) portions of the first guide passage other than the variable portion and (ii) the second guide passage 130b are also disposed in the moving member 122. However, the present invention is not limited to this. It is only required that at least the above variable portion of the first guide passage 130a that is formed by the protruding portion 132 is disposed in the moving member 122. The portion of the guide groove 130 other than the variable portion may be disposed in the main body portion 121.

[0088] Further, in the above-described embodiment, when the yarn catch guide 51 is moved from the catching position to the yarn shifting position, the guided portion 58 is guided along the first guide groove 62a, and thereby the yarn catch guide 51 is parallel translated in the front-rear direction. When the yarn catch guide 51 is moved from the yarn shifting position toward the catching position, the guided portion 58 is guided along the second guide groove 62b, thereby to swing the yarn catch guide 51, so that the yarn catch guide 51 passes through the yarn releasing position. However, the present invention is not limited to this. When the yarn catch guide 51 is moved from the catching position to the yarn shifting position, the yarn catch guide 51 may be guided to be parallel translated in the front-rear direction by a first guide unit which is different in structure from the first guide groove 62a. When the yarn catch guide 51 is moved from the yarn shifting position toward the catching position,

the yarn catch guide 51 may be guided to pass through the yarn releasing position by a second guide unit which is different in structure from the second guide groove 62b. In the above alternative, the first and second guide units do not have to guide the guided portion 58. For example, the following arrangement is possible: the yarn catch guide 51 does not have the guided portion 58; and the first and second guide units are configured to guide a portion of the yarn catch guide 51 other than the guided portion 58.

[0089] In the above-described embodiment, the catch portion 51a is distanced away from the traverse guide 41 in the second direction by swinging the yarn catch guide 51 with respect to the insertion portion 51b. However, the present invention is not limited to this. For example, the following arrangement is possible: the insertion portion 51b is supported so as to be parallel translatable in the front-rear direction and in the second direction; and, when the yarn catch guide 51 is moved rearward from the yarn shifting position toward the catching position, the insertion portion 51b is guided in the second direction, so that the entire yarn catch guide 51 is distanced away from the traverse guide 41 in the second direction.

[0090] Furthermore, in the above-described embodiment, because the first guide groove 62a and the second guide groove 62b for guiding the guided portion 58 of the yarn catch guide 51 are provided, the yarn catch guide 51 is able to be moved both in the front-rear direction and in the second direction with the use of the single cylinder 53 configured to apply a force in the front-rear direction to the yarn catch guide 51. However, the present invention is not limited to this. For example, the following configuration is also possible: the guided portion 58 and the guide groove 62 are not provided; and a driving unit configured to move the yarn catch guide 51 in the front-rear direction and a driving unit configured to swing the yarn catch guide 51 are provided individually.

[0091] Further, in the above-described embodiment, the yarn shifting position is frontward of the traverse range R, and the straight winding part S and the bunch winding part T are formed at the front end portion of the bobbin B. However, the present invention is not limited to this. The yarn shifting position may be rearward of the traverse range R, and the straight winding part S and the bunch winding part T may be formed at a rear end portion of the bobbin B.

Claims

1. A spun yarn take-up machine comprising:

a winding device configured to hold a bobbin and to wind a yarn spun out from a spinning apparatus onto the bobbin;
a traverse unit configured to traverse the yarn wound by the winding device in an axial direction of the bobbin;

a yarn catch guide configured to catch the yarn traversed by the traverse unit; and
a guide moving device configured to move the yarn catch guide, wherein:

the traverse unit includes a traverse guide extending in the axial direction of the bobbin and configured to guide the yarn in the axial direction of the bobbin;
the yarn catch guide includes a groove portion extending in a first direction orthogonal to the axial direction of the bobbin and overlapping the traverse guide when viewed from a second direction that is orthogonal both the axial direction of the bobbin and the first direction;
the yarn catch guide is configured so that the yarn is insertable into the groove portion from one side in the axial direction of the bobbin; and
the guide moving device is configured to move the yarn catch guide among positions of:

- i) a catching position where the yarn catch guide is able to catch the yarn traversed by the traverse unit,
- ii) a yarn shifting position for shifting the yarn to an end portion of the bobbin, the yarn shifting position being on an other side in the axial direction of the bobbin relative to the catching position, and
- iii) a yarn releasing position for releasing the caught yarn, the yarn releasing position being farther from the traverse guide in the second direction than the catching position and the yarn shifting position.

2. The spun yarn take-up machine according to claim 1, wherein the guide moving device comprises:

a driving unit configured to apply a force to the yarn catch guide in the axial direction of the bobbin;
a first guide unit configured to guide, in parallel to the axial direction of the bobbin, the yarn catch guide moving from the catching position to the yarn shifting position; and
a second guide unit configured to guide, in the second direction, the yarn catch guide moving from the yarn shifting position toward the catching position so that the yarn catch guide passes through the yarn releasing position.

3. The spun yarn take-up machine according to claim

2, wherein:

the yarn catch guide is supported so as to be movable in the axial direction of the bobbin, and so as to be swingable with respect to a swing axis parallel to the axial direction of the bobbin; and

the second guide unit guides the yarn catch guide moving from the yarn shifting position toward the catching position so that the yarn catch guide is swung with respect to the swing axis.

4. The spun yarn take-up machine according to claim 2 or 3, wherein:

the yarn catch guide includes a guided portion guided by the first guide unit and the second guide unit;

the first guide unit includes a first guide passage extending in parallel to the axial direction of the bobbin and configured to guide the guided portion; and

the second guide unit includes a second guide passage disposed on one side in the second direction relative to the first guide passage and connected with two connection portions of the first guide passage which are apart from each other in the axial direction of the bobbin, the second guide passage being configured to guide the guided portion.

5. The spun yarn take-up machine according to claim 4, further comprising a divider provided at one of the connection portions of the first guide passage which are connected with the second guide passage, the one of the connecting portions being closer to the yarn shifting position than the other, the divider partitioning the first guide passage in the axial direction of the bobbin, wherein:

the divider is cantilevered and is therefore elastically deformable; and

elastic deformation of the divider toward the yarn shifting position in the axial direction of the bobbin is allowed and elastic deformation of the divider toward the catching position in the axial direction of the bobbin is restricted.

6. The spun yarn take-up machine according to claim 5, wherein

the divider is inclined with respect to the second direction so that a distance between the divider and the yarn shifting position in the axial direction of the bobbin decreases toward a free end of the divider.

7. The spun yarn take-up machine according to claim 5 or 6, wherein a regulatory portion is provided in the first guide pas-

sage, the regulatory portion being configured to restrict the elastic deformation of the divider toward the catching position in the axial direction of the bobbin by contacting the divider.

8. The spun yarn take-up machine according to any one of claims 5 to 7, wherein the guide moving device includes:

a first member in which the first guide passage and the second guide passage are disposed; and

a second member in which the divider is disposed, the second member attached to the first member so as to be detachable from the first member.

9. The spun yarn take-up machine according to claim 4, wherein the guide moving device comprises:

a main body portion supporting the yarn catch guide so as to be movable in the axial direction of the bobbin;

a moving member provided at a central portion of the first guide passage in the axial direction of the bobbin and supported by the main body portion so as to be movable in the first direction, the moving member being configured so that the guided portion is able to contact the moving member from one side in the first direction; and a biasing member biasing the moving member from an other side in the first direction to the one side in the first direction,

wherein the moving member includes a protruding portion protruding in the first direction and provided between the two connecting portions of the first guide passage which are connected with the second guide passage,

wherein a part of a surface of the protruding portion that is on the one side in the first direction, which part includes an end of the protruding portion on the one side in the axial direction of the bobbin, forms an inclined surface inclined linearly so that an end of the inclined surface on the other side in the axial direction of the bobbin is located on the one side in the first direction relative to an end of the inclined surface on the one side in the axial direction of the bobbin, and

wherein an end face of the protruding portion that is on the other side in the axial direction of the bobbin forms a guide surface configured to guide the guided portion into the second guide passage.

10. The spun yarn take-up machine according to claim 9, wherein

a deviation preventing portion is provided to the protruding portion, the deviation preventing portion be-

ing configured to prevent the guided portion moving along the surface of the protruding portion from moving in the second direction.

11. The spun yarn take-up machine according to claim 10, wherein:

the guided portion has, at an end portion thereof, a groove extending in the axial direction of the bobbin; and

the deviation preventing portion is a projection provided on the surface of the protruding portion, extending in the axial direction of the bobbin, and being fittable in the groove.

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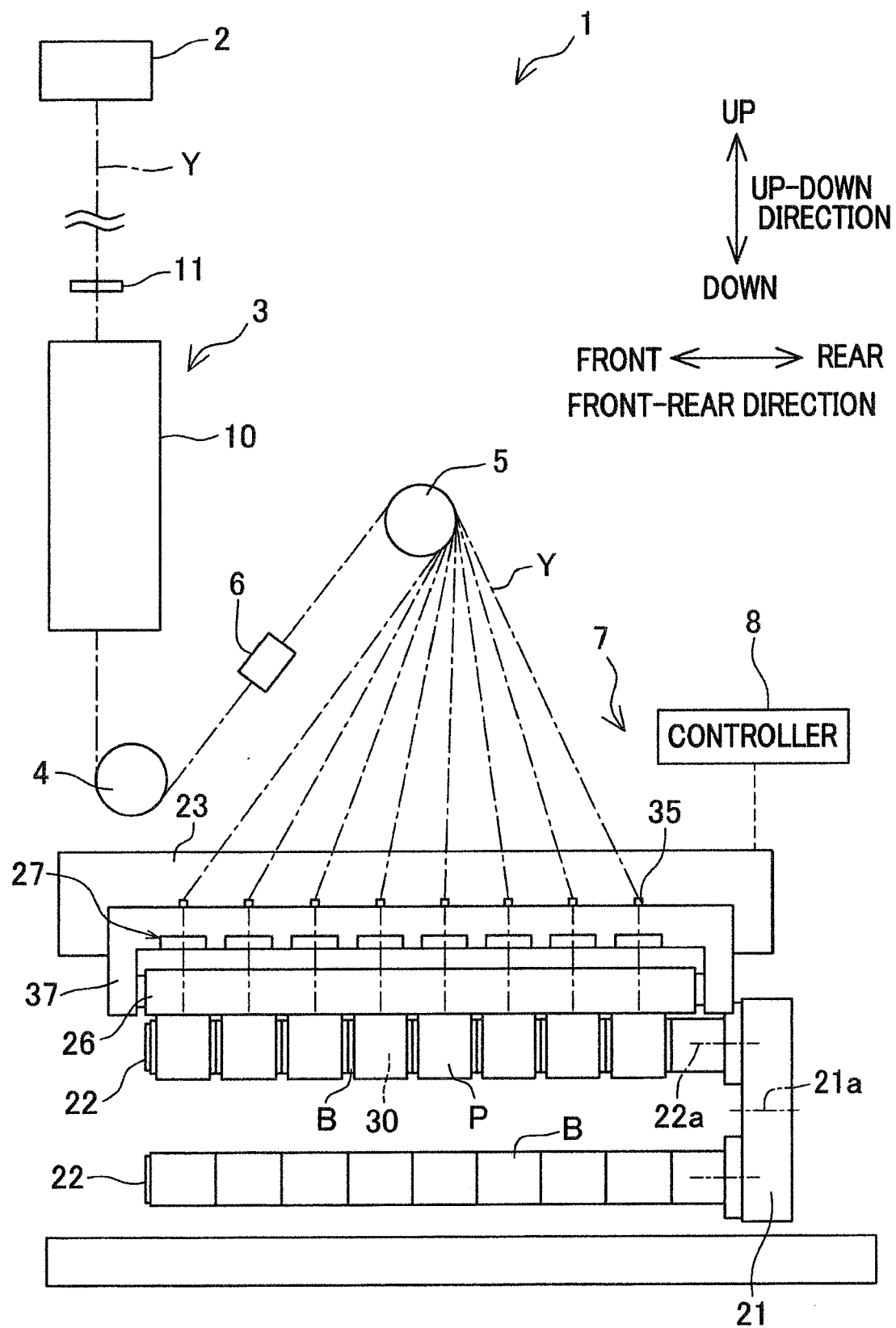
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FIG.1



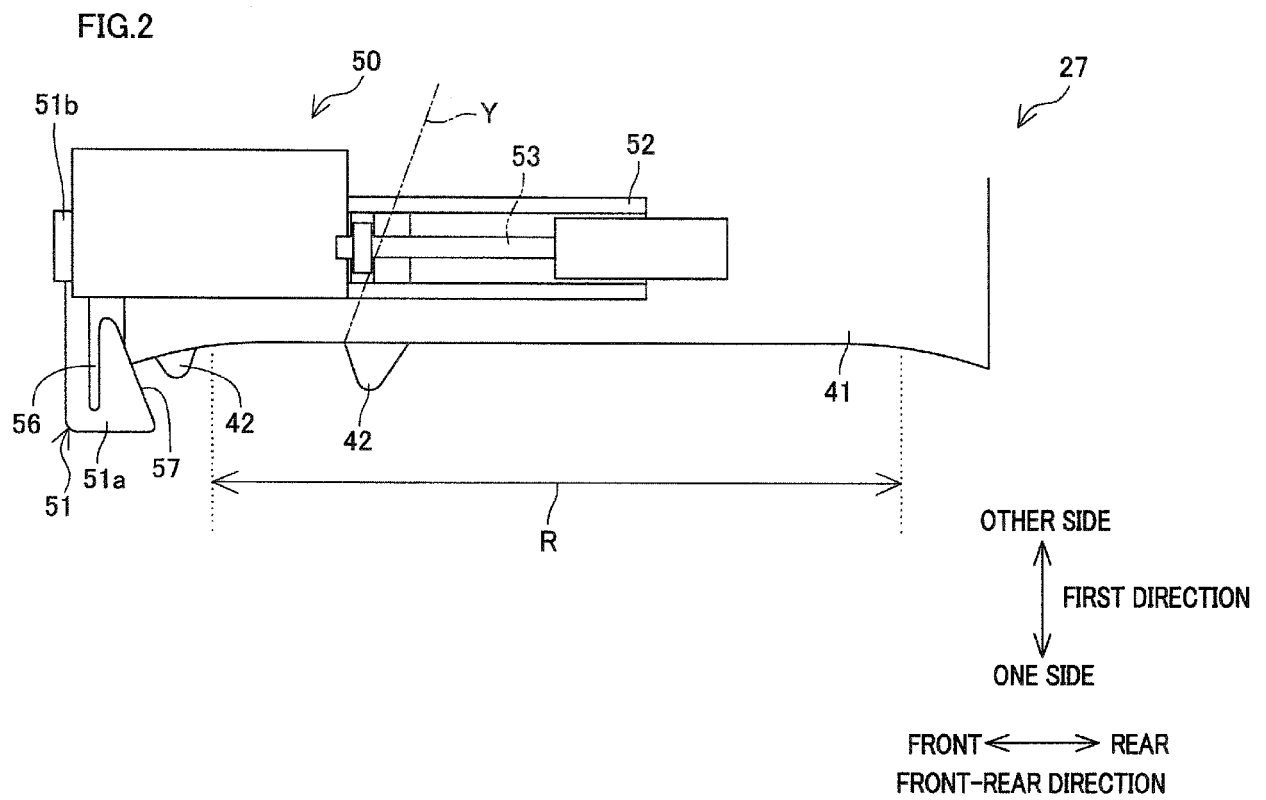


FIG.3A

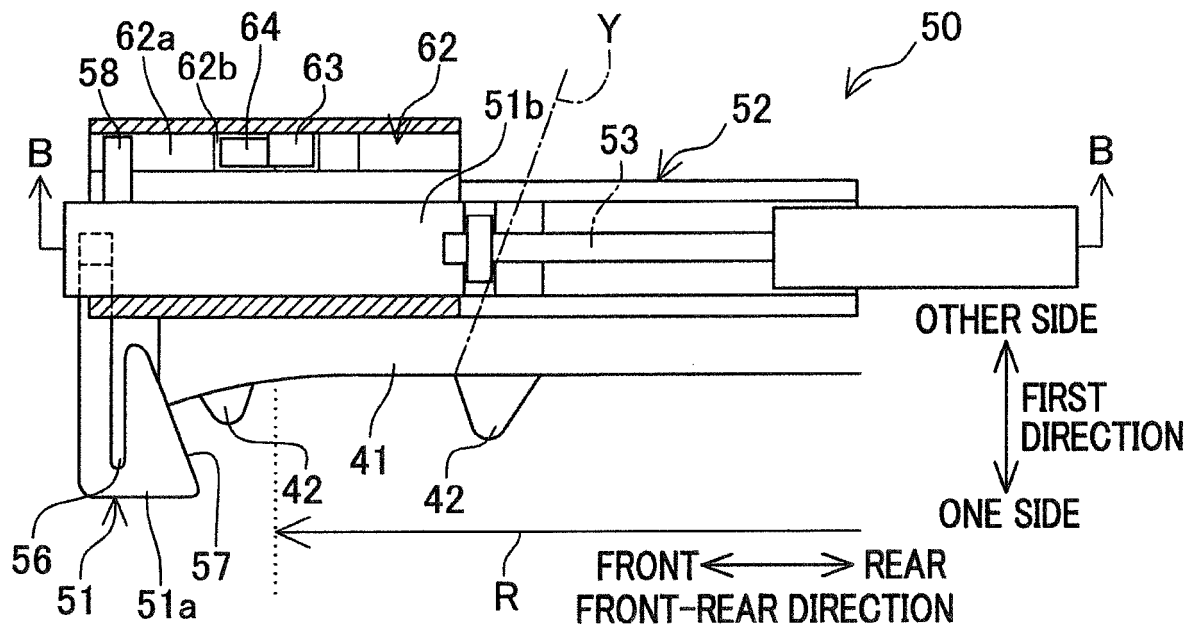


FIG.3B

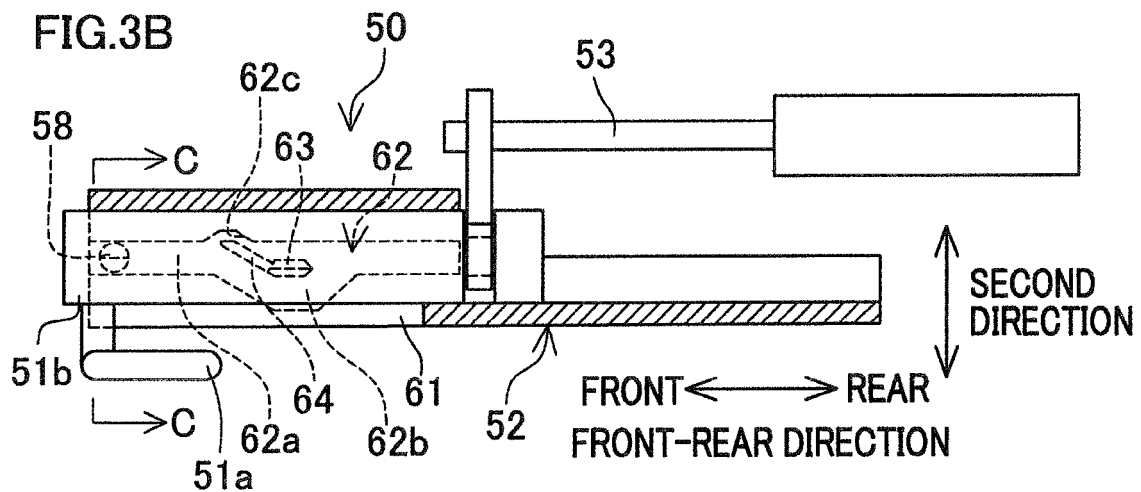
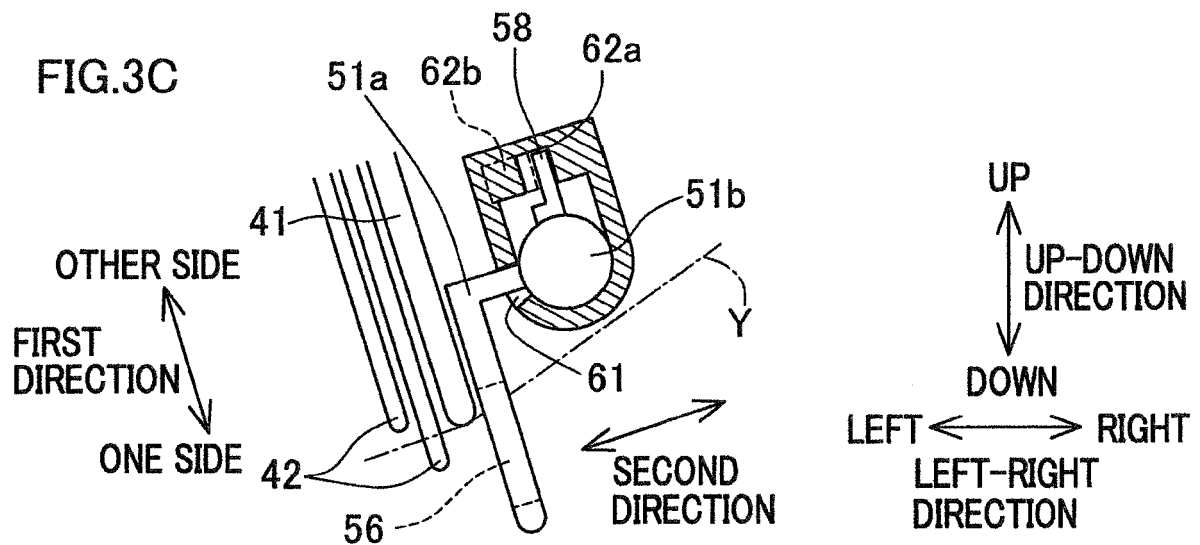


FIG.3C



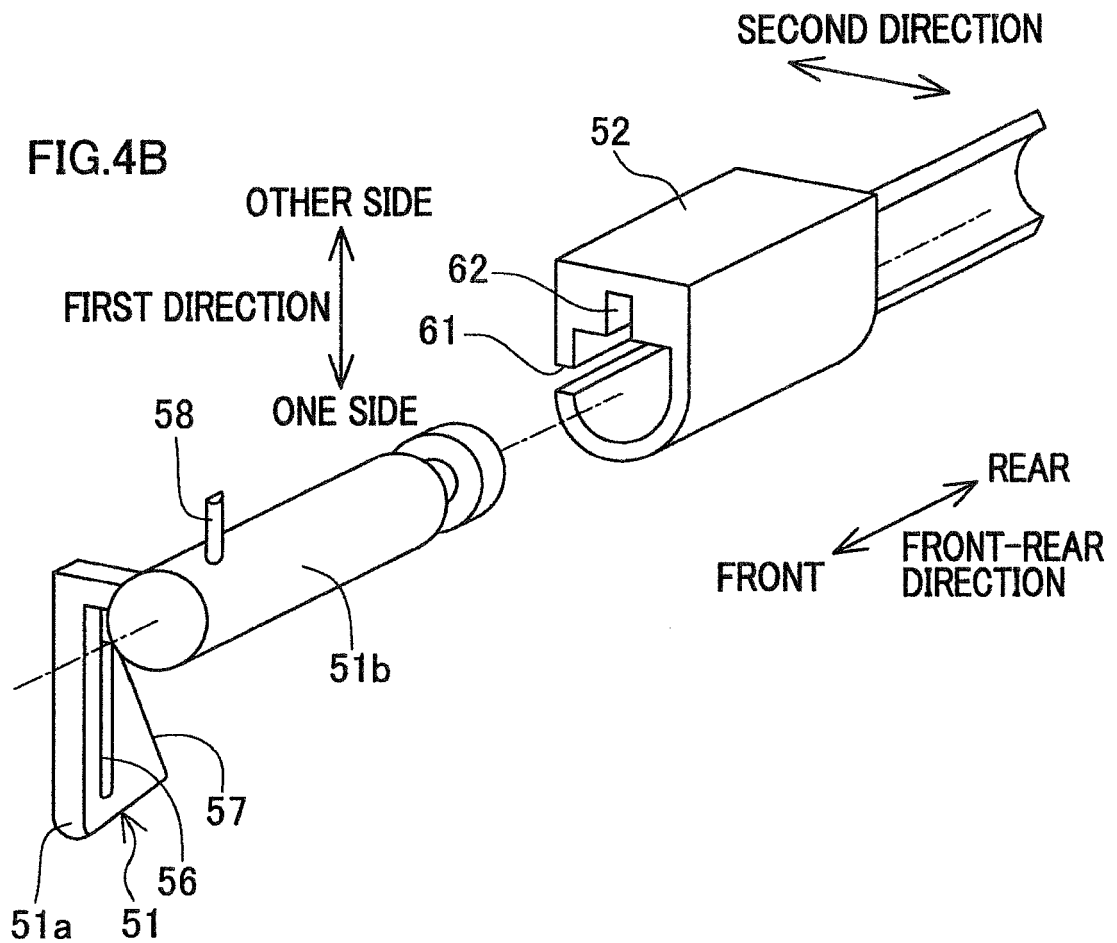
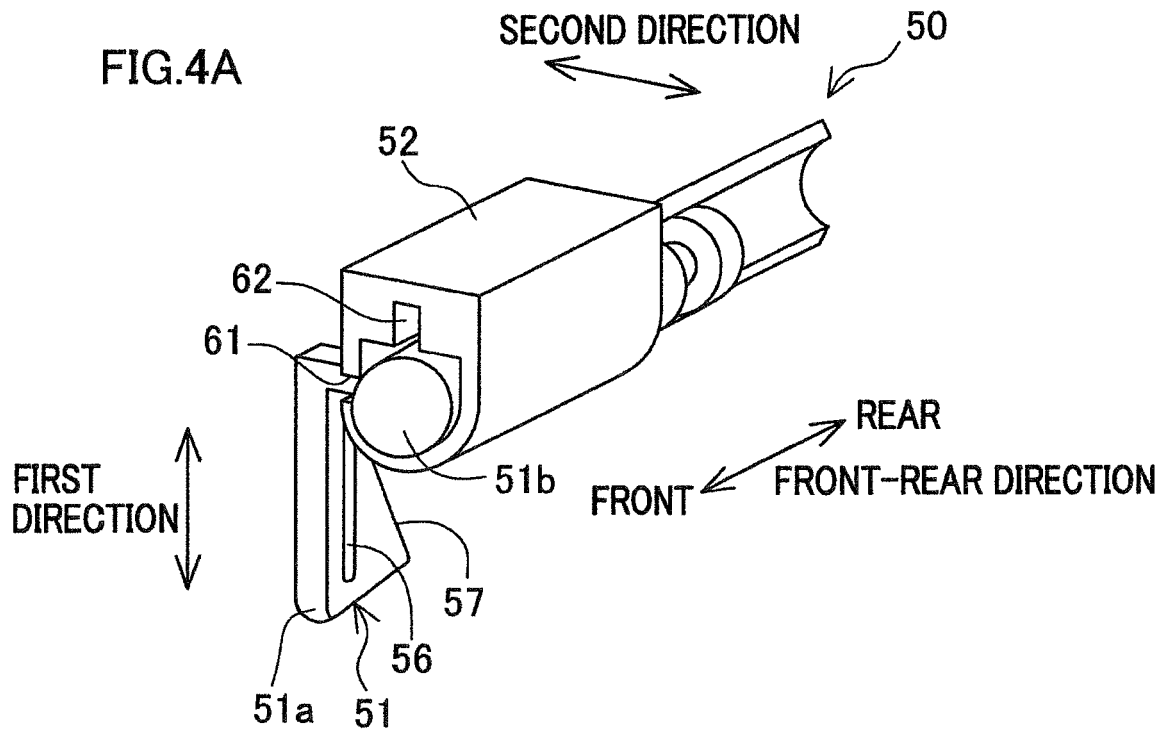


FIG.5A

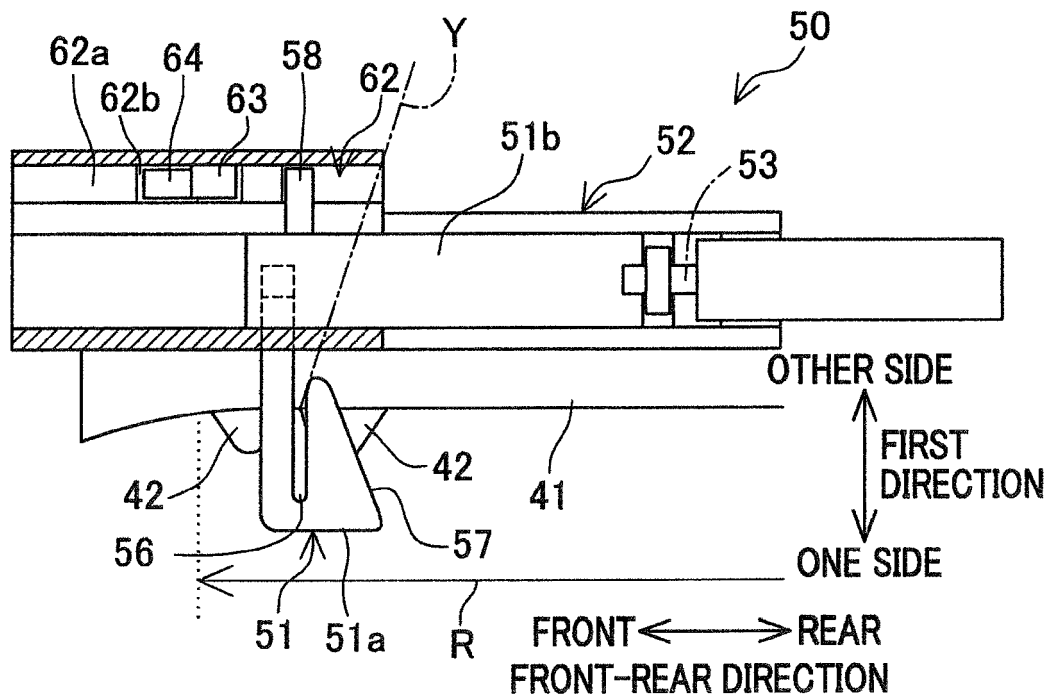


FIG.5B

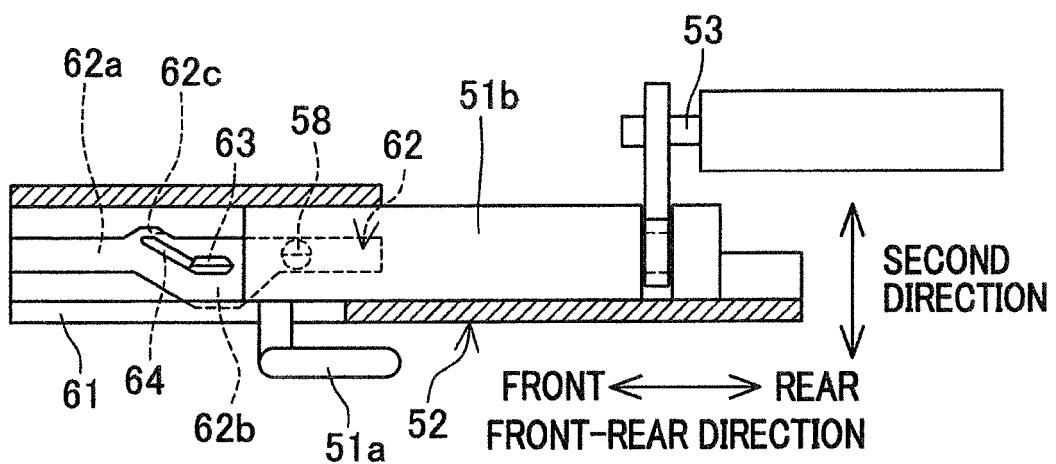


FIG.6A

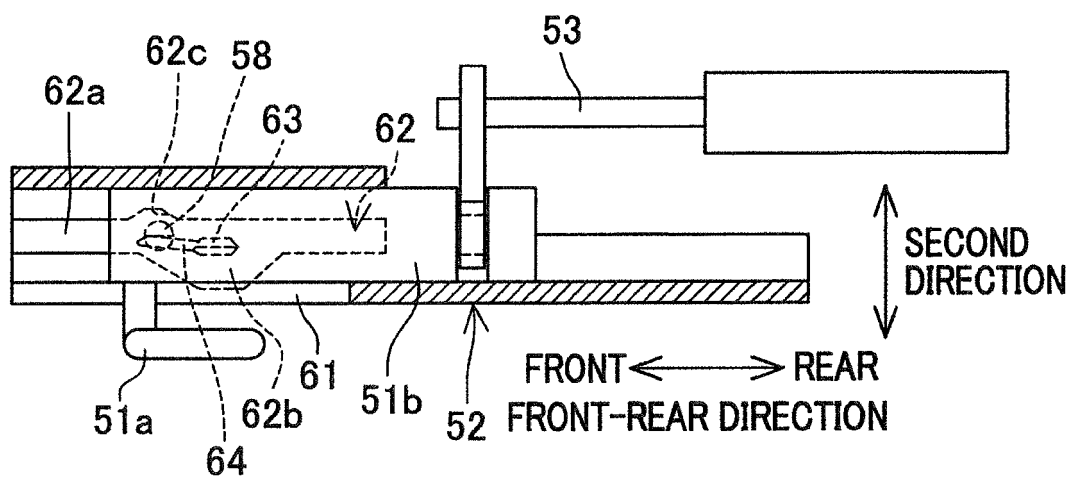


FIG.6B

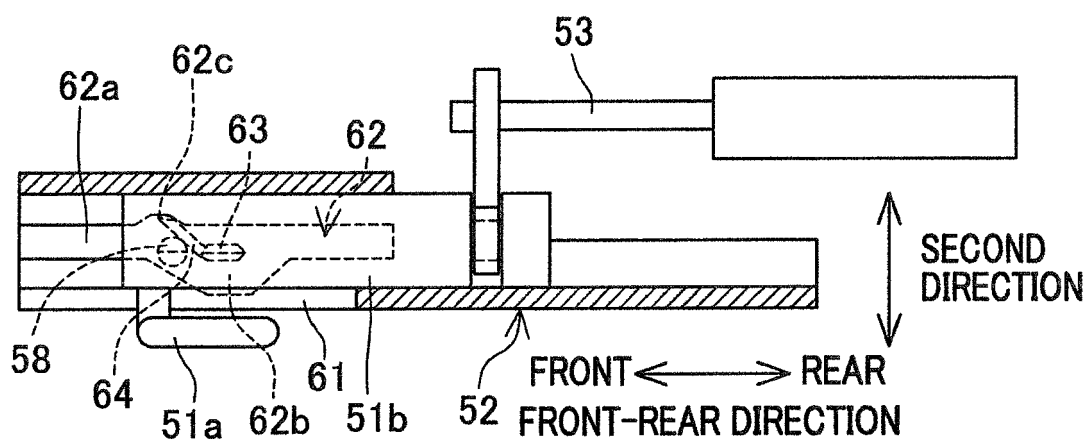


FIG.7

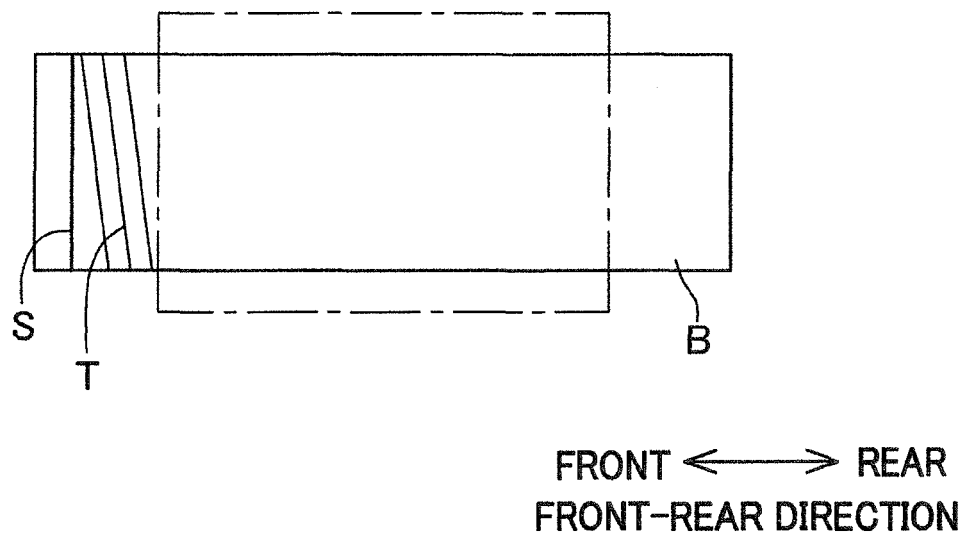


FIG.8A

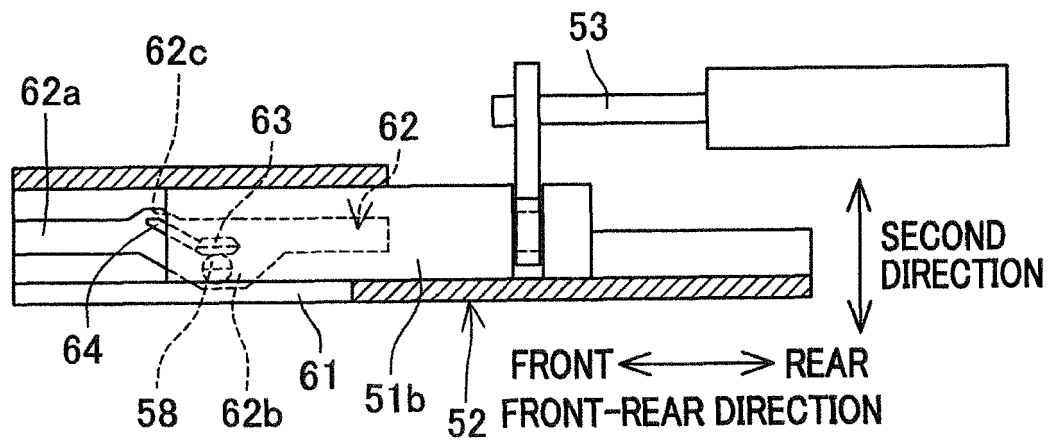


FIG. 8B

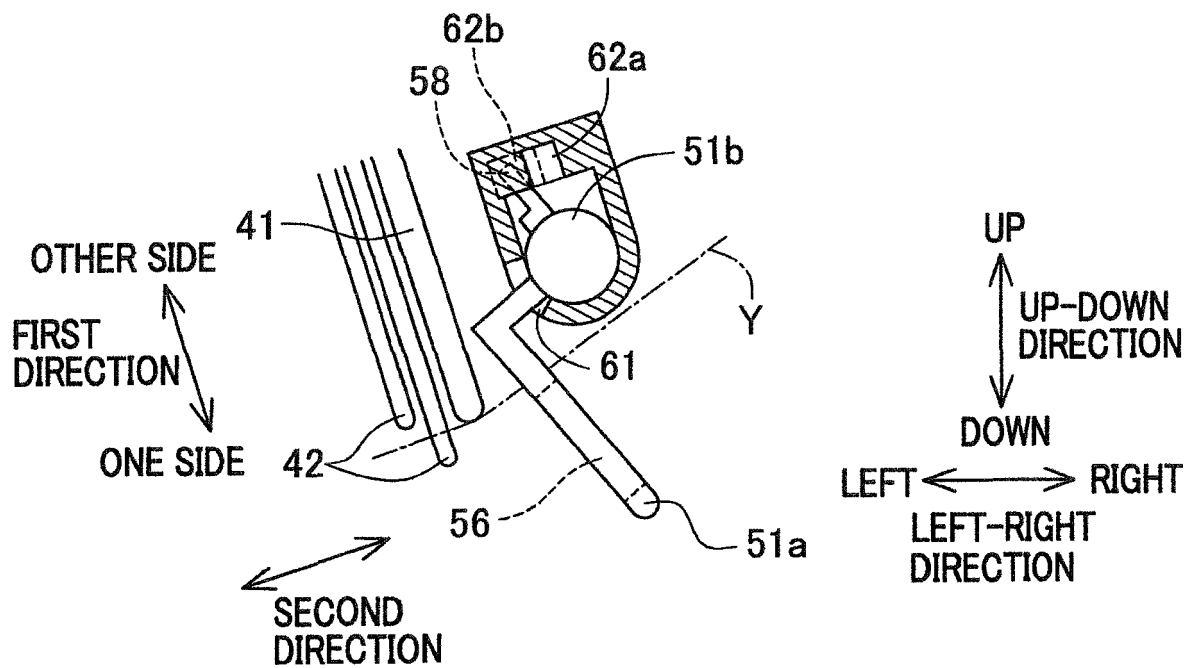


FIG.9A

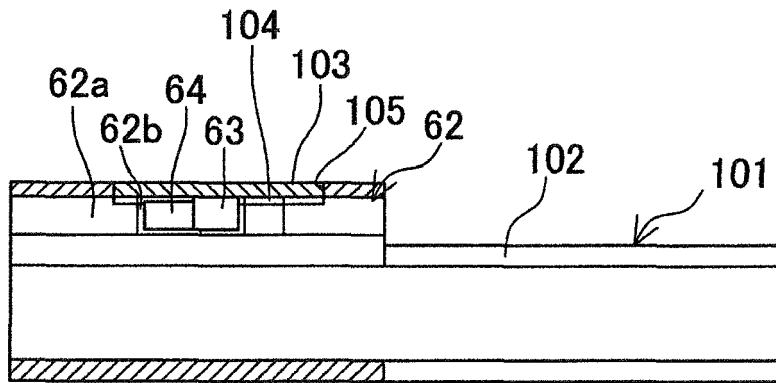


FIG.9B

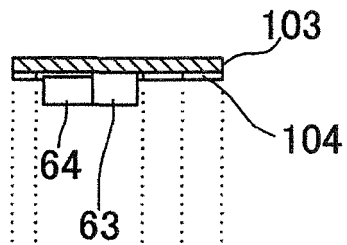
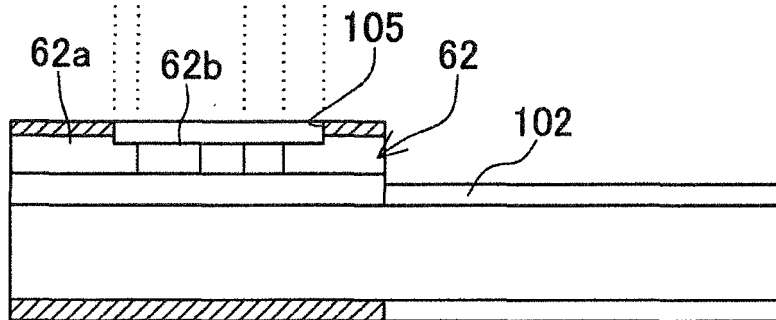


FIG.9C



OTHER SIDE
 ↑
 FIRST DIRECTION
 ↓
 ONE SIDE
 FRONT ↔ REAR
 FRONT-REAR DIRECTION

FIG.10A

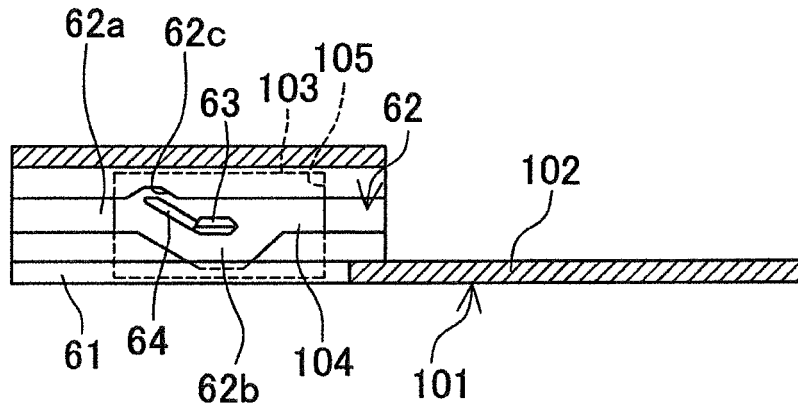


FIG.10B

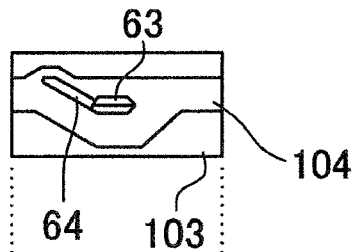


FIG.10C

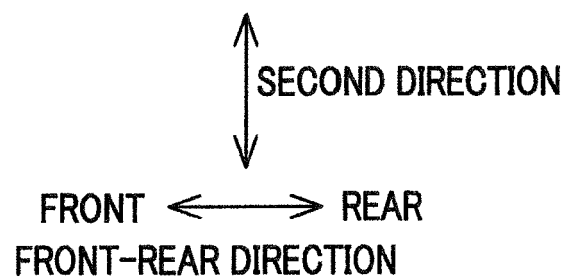
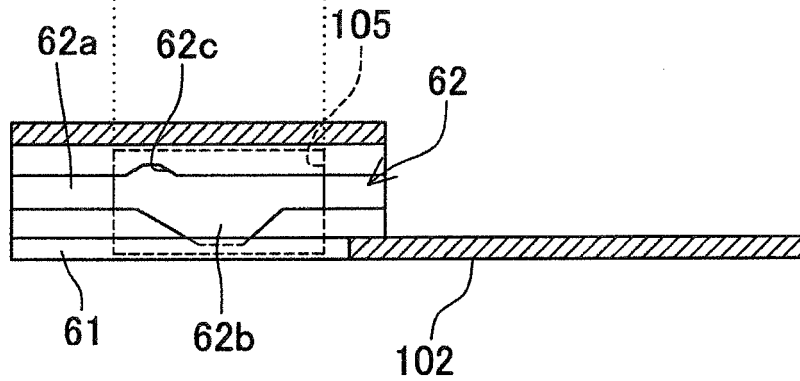


FIG. 11A

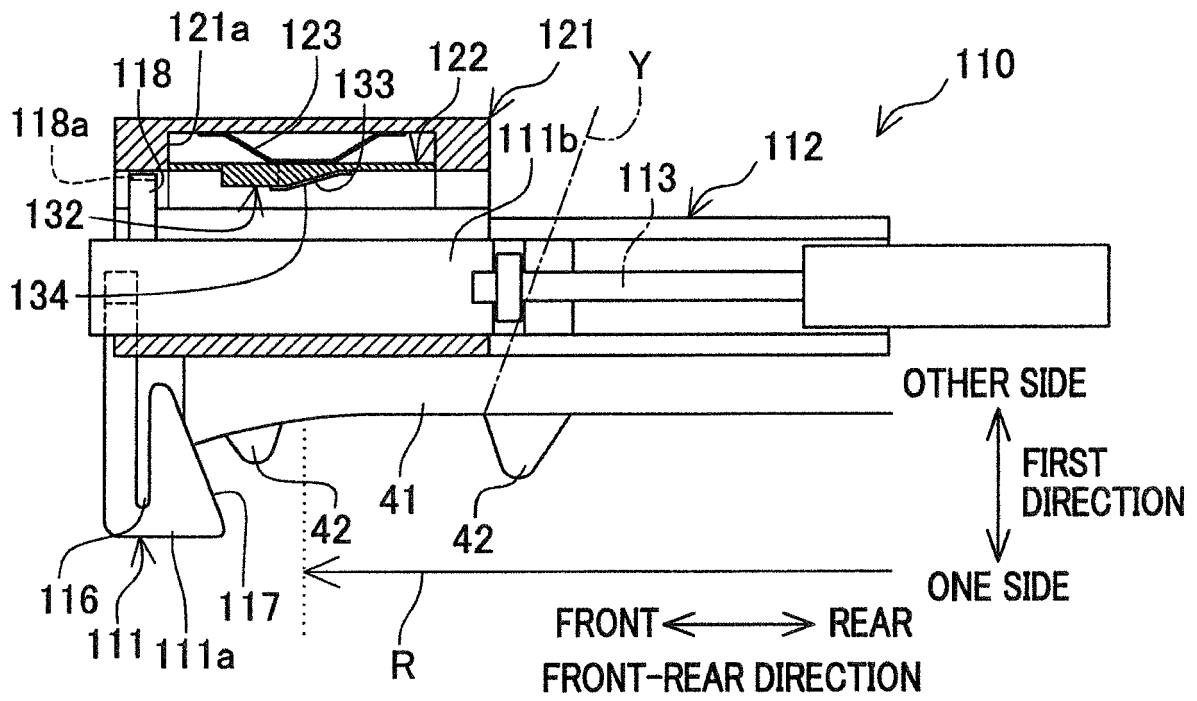


FIG. 11B

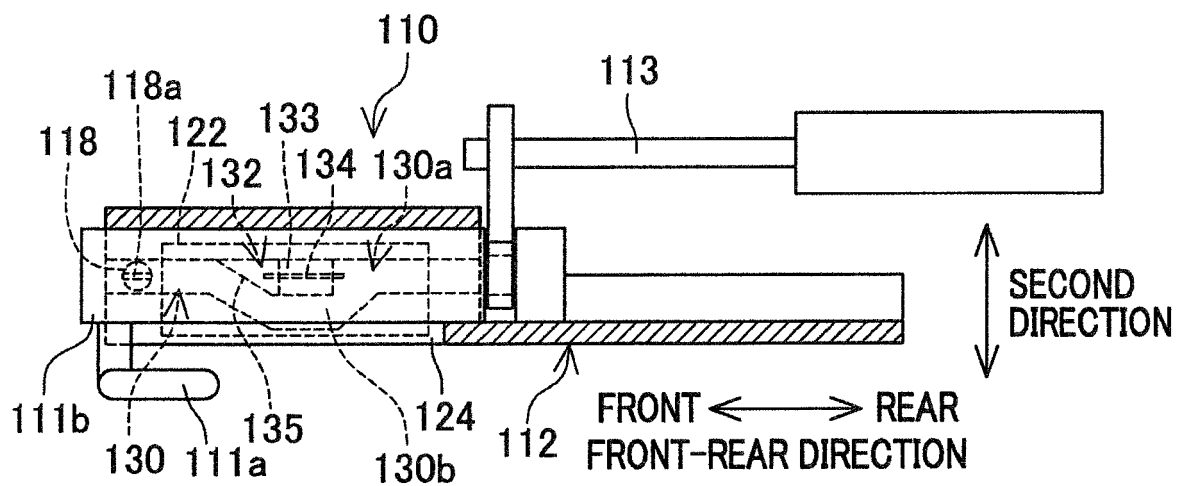


FIG. 12A

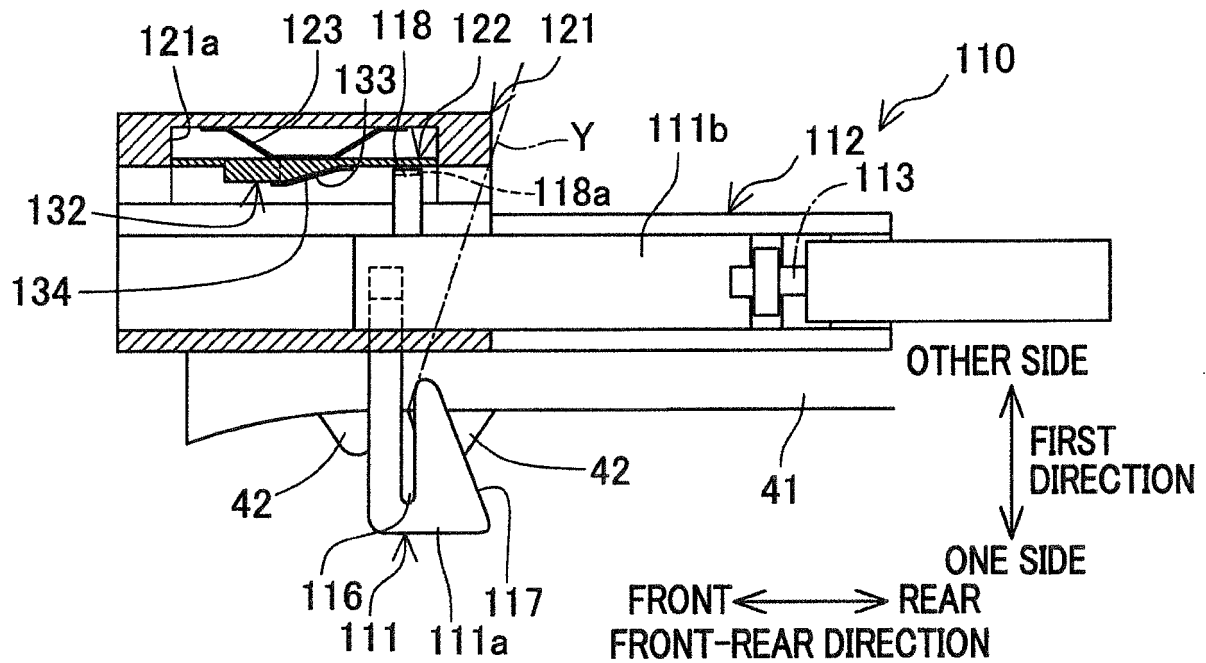


FIG. 12B

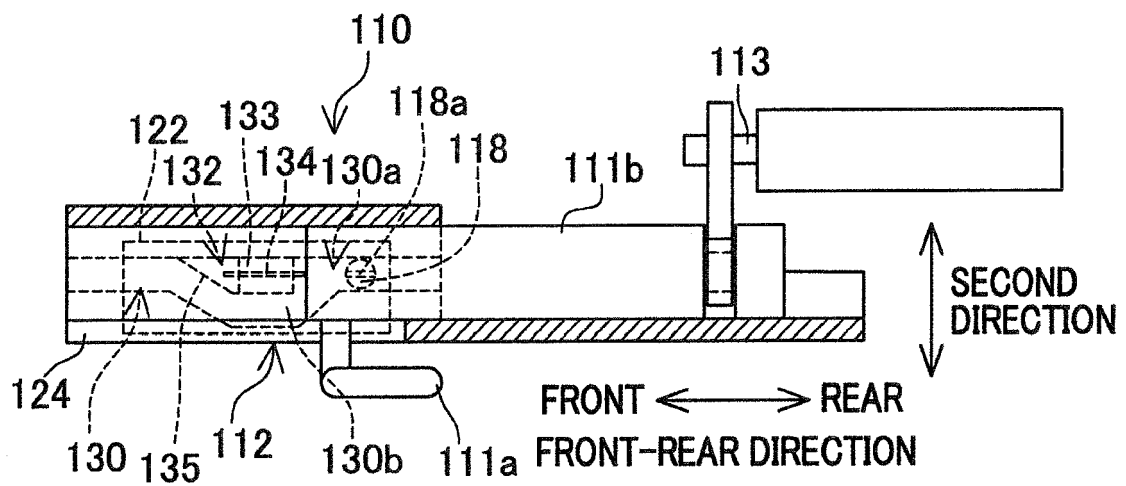


FIG. 13A

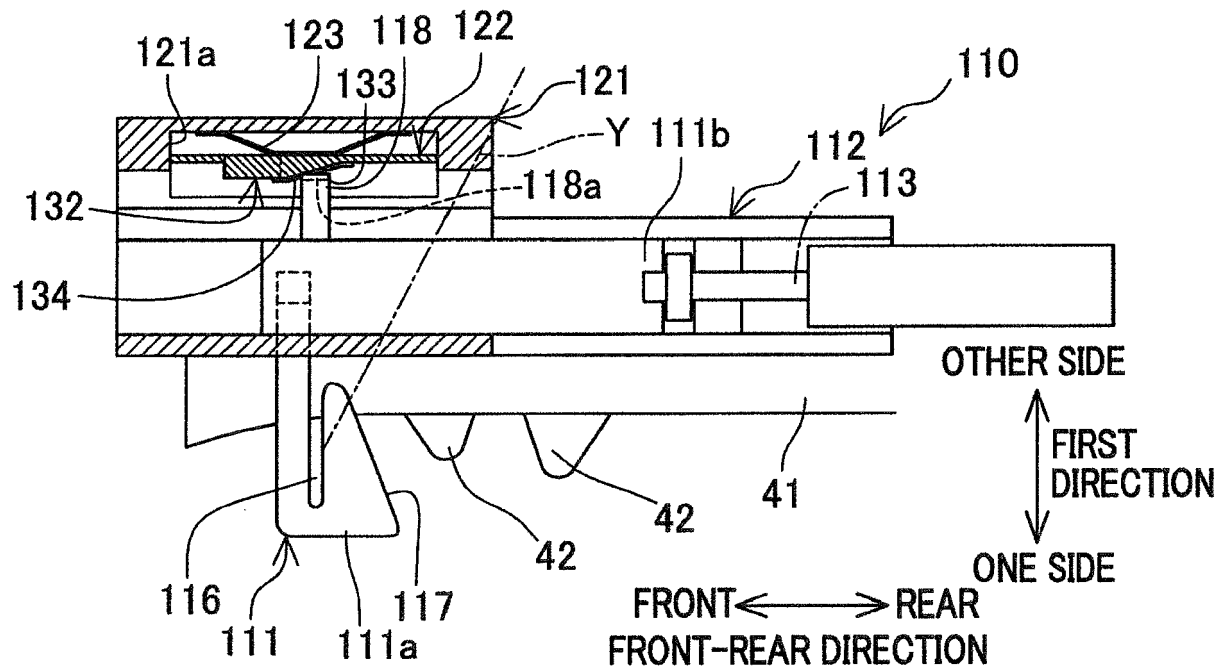


FIG. 13B

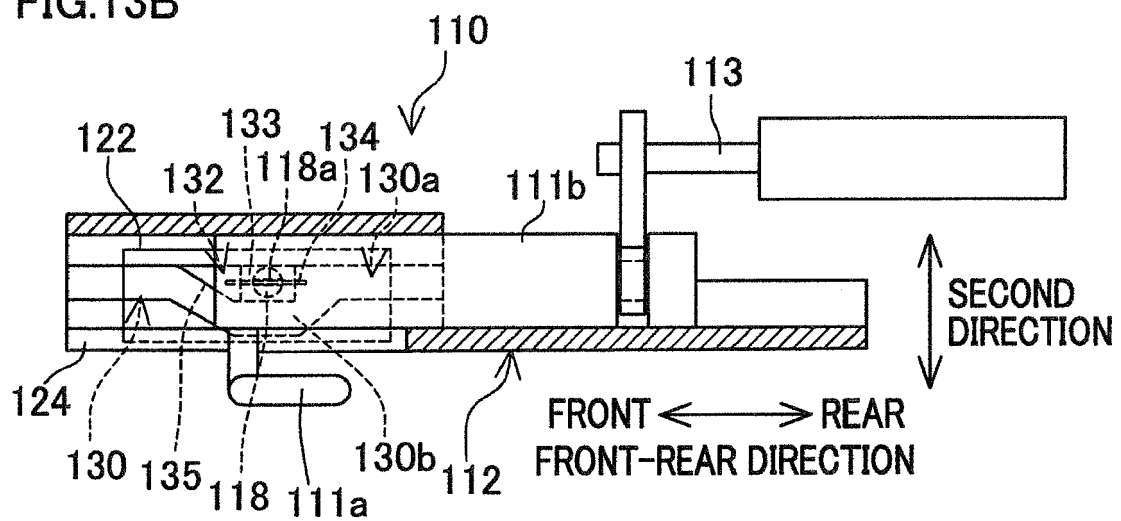


FIG. 14A

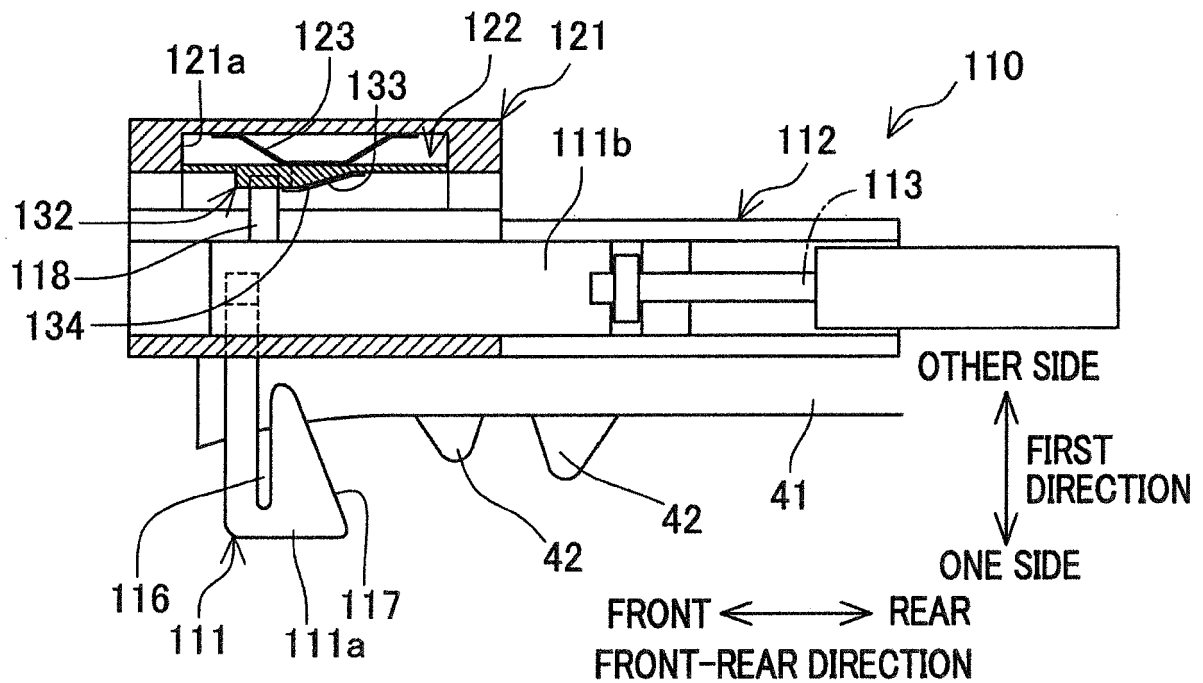
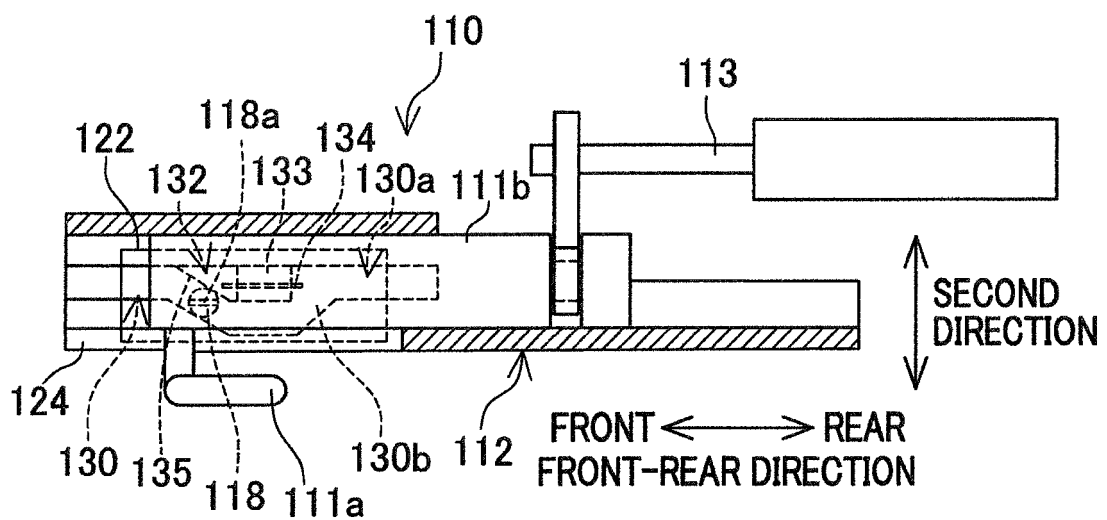


FIG. 14B





EUROPEAN SEARCH REPORT

Application Number
EP 17 15 7846

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	JP 2013 542898 A (OERLIKON TEXTILE GMBH & CO. KG) 28 November 2013 (2013-11-28) * abstract; figures 1-8 *	1-11	INV. B65H65/00
A	DE 81 16 938 U1 (BARMAG BARMER MASCHF) 14 October 1982 (1982-10-14) * page 6, line 13 - page 14, line 10; figures 1-3,9-11 *	1	
A	US 6 045 081 A (OBERSTRASS DETLEV [DE] ET AL) 4 April 2000 (2000-04-04) * column 4, line 7 - column 5, line 7; figure 1 *	1	
A	US 6 024 320 A (SCHIPPERS HEINZ [DE] ET AL) 15 February 2000 (2000-02-15) * column 6, line 23 - column 7, line 30; figures 6,7 *	1	
A	US 5 016 829 A (SCHIPPERS HEINZ [DE] ET AL) 21 May 1991 (1991-05-21) * column 7, line 21 - column 10, line 54; figures 1A-6B *	1	TECHNICAL FIELDS SEARCHED (IPC) B65H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 26 June 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			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 15 7846

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 2013542898	A	28-11-2013	CN 103221324 A	24-07-2013
			EP 2640653 A1	25-09-2013
			JP 2013542898 A	28-11-2013
			US 2013248639 A1	26-09-2013
			WO 2012066082 A1	24-05-2012

DE 8116938	U1	14-10-1982	NONE	

US 6045081	A	04-04-2000	CN 1217286 A	26-05-1999
			EP 0921087 A2	09-06-1999
			JP 4636636 B2	23-02-2011
			JP H11217160 A	10-08-1999
			TR 9802302 A2	21-06-1999
			TW 443986 B	01-07-2001
			US 6045081 A	04-04-2000

US 6024320	A	15-02-2000	EP 0873276 A1	28-10-1998
			TW 374750 B	21-11-1999
			US 6024320 A	15-02-2000
			WO 9816458 A1	23-04-1998

US 5016829	A	21-05-1991	DE 3805347 A1	31-08-1989
			DE 58902509 D1	26-11-1992
			EP 0362310 A1	11-04-1990
			JP H02503903 A	15-11-1990
			US 5016829 A	21-05-1991
			WO 8907573 A1	24-08-1989

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2013542898 A [0002]