(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 470 956 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**04.12.2024 Bulletin 2024/49**

(21) Application number: **24172322.0**

(22) Date of filing: **25.04.2024**

(51) International Patent Classification (IPC):
***B65H 67/04*** *(2006.01)* ***B65H 67/048*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
**B65H 67/048; B65H 67/0411;** B65H 2701/3132

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA**
Designated Validation States:
**GE KH MA MD TN**

(30) Priority: **29.05.2023 JP 2023088036**

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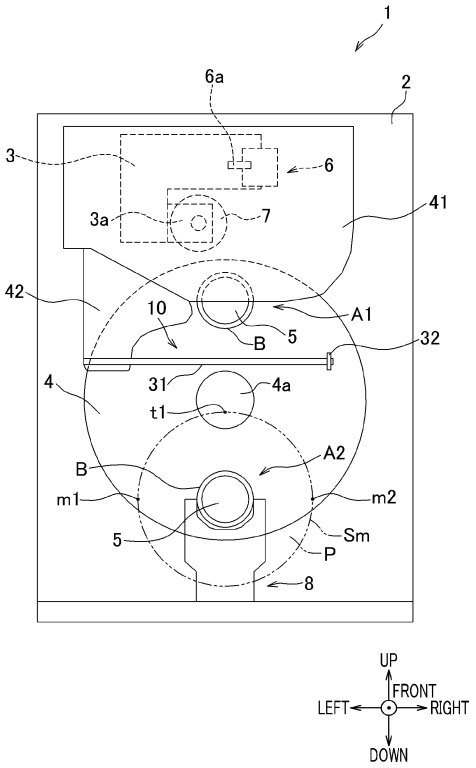
(54) **YARN WINDING DEVICE AND PACKAGE PRODUCTION SYSTEM**

(57) A yarn winding device 1 includes: two bobbin holders 5 to which a plurality of bobbins B is attached, the two bobbin holders 5 being configured to be switchable between a winding position A1 at which a yarn Y is wound around each of the bobbins B to form a plurality of packages P and a standby position A2 below the winding position A1; a pushing member 21 configured to be movable in a front-rear direction and configured to push out the plurality of packages P from a front end portion of the bobbin holder 5 at the standby position A2 by moving from a rear side to a front side in the front-rear direction; and a yarn entering preventing member 10 capable of blocking the yarn Y from entering the plurality of bobbins B attached to the bobbin holder 5 at the winding position A1. The yarn entering preventing member 10 includes the yarn contact portion 31 that extends in the left-right direction and with which the yarn Y can make contact from a lower side. The yarn contact portion 31 is located on the front side in the front-rear direction of the bobbin holder 5 at the standby position A2, is located above the bobbin holder 5 at the standby position A2, and is located on the lower side than the bobbin holder 5 at the winding position A1.

FIG.2

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## Description

### BACKGROUND OF THE INVENTION

**[0001]** The present invention relates to a yarn winding device for winding a yarn spun from a spinning apparatus around a bobbin, and a package production system including the yarn winding device.

### Related Art

**[0002]** JP 2011-84362 A discloses a yarn winding device (yarn winder of JP 2011-84362 A) that winds a yarn spun from a spinning apparatus around a bobbin to form a package. The yarn winding device includes two bobbin holders to which a plurality of bobbins is attached, and a disc-shaped turret that cantilevers each bobbin holder. Each bobbin holder is attached to two positions symmetrical to each other with respect to the rotation center of the turret, and can be switched between a winding position on an upper side and a standby position on a lower side by the rotation of the turret.

**[0003]** In the yarn winding device as in JP 2011-84362 A, a package is formed by winding yarns around a plurality of bobbins attached to a bobbin holder at the winding position on the upper side. When the package is fully wound, the turret rotates substantially a half turn, and the bobbin holder at the winding position moves to the standby position on the lower side. Thereafter, each package is doffed by a doffing device. Hereinafter, a specific flow until the package is doffed will be described.

**[0004]** First, a plurality of packages attached to the bobbin holder moved to the standby position is pushed out by a pusher and removed from the bobbin holder. More specifically, the pusher includes a pushing member (pushing plate of JP 2011-84362 A) configured to be movable in the axial direction of the bobbin holder, and a driving mechanism (driving unit of JP 2011-84362 A) that moves the pushing member to the opposite side of the turret along the axial direction of the bobbin holder. The pushing member is arranged between the bobbin closest to the turret among the plurality of bobbins attached to the bobbin holder at the standby position and the turret. The pusher moves the pushing member to the free end of the bobbin holder in the axial direction by the driving mechanism to collectively push out the plurality of packages and remove the plurality of packages from the bobbin holder at the standby position. Subsequently, the plurality of packages removed from the bobbin holder is delivered to the doffing device. More specifically, the doffing device has a package supporting shaft into which each package is inserted. When performing the doffing of the package, the doffing device takes a position and posture in which the package supporting shaft is arranged along an extension line in the axial direction of the bobbin holder at the standby position. Then, each package pushed out of the bobbin holder by the pushing member is inserted into the package supporting shaft as it is. Thereafter, the package supporting shaft into which the package is inserted is raised to a predetermined height further above the bobbin holder at the winding position, whereby the doffing of the package is completed.

**[0005]** Here, the package supporting shaft is raised to a predetermined height for the following two reasons. The first reason is to prevent the package supporting shaft into which the removed package is inserted from becoming an obstacle when the operation of newly attaching the bobbins to the bobbin holder at the standby position is performed. The second reason is to prevent an accident in which the package supporting shaft comes into contact with an operator walking in a factory when the doffing device moves in the factory to carry the doffed package to a storage location.

### SUMMARY OF THE INVENTION

**[0006]** In the yarn winding device as in JP 2011-84362 A, the bobbin holder to which the new bobbins are attached is set at the winding position on the upper side in place of the bobbin holder to which the fully-wound package is attached moving from the winding position to the standby position. While the doffing of the package is being carried out, the bobbin holder newly set at the winding position is rotated to start the winding of the yarns around the new bobbins.

**[0007]** At this time, wind is generated around the bobbin holder by the rotation of the bobbin holder. This wind allows the end portion of the yarn to move freely in the package being removed from the bobbin holder at the standby position on the lower side. Then, the end portion of the yarn may fall off the surface of the package and get caught on the pushing member, the bobbin holder at the standby position, and the like (hereinafter, simply referred to as a "bobbin holder or the like"). When the doffing progresses and each package delivered to the doffing device rises to a predetermined height together with the package supporting shaft, the yarn detached from the surface of the package and connected to the bobbin holder or the like is pulled upward. The yarn pulled upward is caught in the rotation of the bobbin holder at the winding position, and is entangled with the bobbins being wound with the yarns.

**[0008]** Conventionally, when the yarn is caught on the bobbin holder or the like, the operator manually cuts the yarn using scissors, a cutter, or the like. However, the operator needs to visually confirm the catching of the yarn, and overlooking occurs. Alternatively, as another countermeasure, an electric heating wire is attached to the leading end of the package supporting shaft, and the yarn is burned off by the electric heating wire. However, it is difficult to reliably bring the electric heating wire into contact with the yarn, and even if the electric heating wire can be brought into contact with the yarn, cutting with the electric heating wire lacks reliability as compared with cutting with scissors or the like.

**[0009]** An object of the present invention is to suppress

a yarn detached from a package during doffing from being entangled with bobbins attached to a bobbin holder at a winding position.

**[0010]** A yarn winding device of the present invention includes: two bobbin holders to which a plurality of bobbins is attached, the two bobbin holders being configured to be switchable between a winding position at which a yarn is wound around each of the bobbins to form a plurality of packages and a standby position below the winding position; a pushing member configured to be movable in an axial direction of the bobbin holder at the standby position and configured to push out the plurality of packages from an end portion on the other side of the bobbin holder at the standby position by moving from one side to the other side in the axial direction; and a yarn entering preventing member configured to prevent the yarn from entering the plurality of bobbins attached to the bobbin holder at the winding position, in which the yarn entering preventing member includes a yarn contact portion extending in an intersecting direction intersecting with the axial direction and configured to be contacted by the yarn from a lower side, and in which the yarn contact portion is located on the other side in the axial direction than the bobbin holder at the standby position, is located above the bobbin holder at the standby position, and is located on the lower side than the bobbin holder at the winding position.

**[0011]** The plurality of fully-wound packages is doffed from the yarn winding device by the doffing device. At the time of doffing, the doffing device raises the package supporting shaft into which the plurality of packages is inserted to a predetermined height. At this time, if the yarn detached from the package is caught on the bobbin holder or the like at the standby position, the yarn may be pulled upward as the package supporting shaft rises, and entangle with the bobbin attached to the bobbin holder at the winding position. In this regard, according to the present invention, the yarn contact portion arranged on the yarn entering preventing member is located on the other side in the axial direction than the bobbin holder at the standby position, above the bobbin holder at the standby position, and below the bobbins attached to the bobbin holder at the winding position. Therefore, even if the doffing further progresses in a state in which the yarn detached from the surface of the package during the doffing is caught on the bobbin holder or the like, the yarn is restricted from making contact with the yarn contact portion from the lower side and moving to the upper side than the yarn contact portion (to be described in detail later with reference to the drawings). Thus, the yarn entering preventing member can prevent the yarn from entering the bobbin holder at the winding position. Therefore, the yarn detached from the package during the doffing can be suppressed from being entangled with the bobbins attached to the bobbin holder at the winding position.

**[0012]** In the yarn winding device of the present invention, the yarn entering preventing member preferably has a bent shape inclined downward from an intermediate portion in the intersecting direction of the yarn contact portion toward both sides.

**[0013]** According to the present invention, when the yarn rises as the doffing progresses, the yarn moves toward the intermediate portion of the yarn contact portion along the inclination of the bent shape. That is, since the yarn moves in the direction opposite to the direction toward both end portions of the yarn contact portion, the yarn is less likely to be detached from both end portions of the yarn contact portion in the intersecting direction.

**[0014]** In the yarn winding device of the present invention, the yarn entering preventing member preferably includes a fall-off preventing portion formed at an end portion on at least one side in the intersecting direction of the yarn contact portion to prevent the yarn from detaching from the yarn contact portion.

**[0015]** According to the present invention, the yarn making contact with the yarn contact portion can be suppressed from being detached from the end portion of the yarn contact portion while the package is being doffed.

**[0016]** In the yarn winding device of the present invention, the yarn entering preventing member preferably includes an expansion/contraction mechanism that expands/contracts the yarn contact portion in the intersecting direction.

**[0017]** A path of the yarn detached from the surface of the package being doffed and connected to the bobbin holder or the like is determined by the winding diameter of the package to be doffed, the location where the yarn deviates in the entire circumferential surface of the package, the positional relationship between the doffing device and the yarn winding device, and the like. The longer the yarn contact portion in the intersecting direction, the more reliably the yarn can be brought into contact with the yarn contact portion regardless of the path of the yarn detached from the surface of the package and connected to the bobbin holder or the like is any path. On the other hand, if the yarn contact portion is too long in the intersecting direction, the yarn contact portion and the other member may interfere when the other member of the yarn winding device operates. According to the present invention, the yarn contact portion is expanded/contracted to an appropriate length according to the path of the yarn detached from the surface of the package and connected to the bobbin holder or the like, so that the yarn can be more reliably brought into contact with the yarn contact portion within a range in which interference with other member of the yarn winding device can be avoided.

**[0018]** In the yarn winding device of the present invention, a portion of the yarn contact portion making contact with the yarn preferably has a curved surface shape.

**[0019]** According to the present invention, the yarn is not caught on the corner of the yarn contact portion. Therefore, the yarn can be suppressed from being caught at the corner of the yarn contact portion and becoming a fixed state. As a result, the yarn can be suppressed from being excessively pulled out from the package by the

doffing proceeding in the state in which the yarn is fixed.

**[0020]** In the yarn winding device of the present invention, an entirety of the yarn entering preventing member is preferably located on the other side in the axial direction than the bobbin holder.

**[0021]** According to the present invention, since the entirety of the yarn entering preventing member is arranged on the other side in the axial direction than the bobbin holder, the contact between the yarn entering preventing member and the bobbin holder can be avoided. In addition, since there is generally a sufficient space on the other side in the axial direction than the bobbin holder, the yarn entering preventing member can be easily installed.

**[0022]** In the yarn winding device of the present invention, the yarn entering preventing member is preferably arranged at a position not in contact with the plurality of packages when the pushing member pushes out the plurality of packages attached to the bobbin holder at the standby position.

**[0023]** According to the present invention, when the package is pushed out from the bobbin holder at the standby position, the interference between the package and the yarn entering preventing member can be avoided.

**[0024]** In the yarn winding device of the present invention, the yarn entering preventing member is preferably arranged above an upper end of a virtual maximum circumferential surface of the plurality of packages attached to the bobbin holder at the standby position when wound up to a predetermined maximum winding diameter.

**[0025]** According to the present invention, when the package is pushed out from the bobbin holder at the standby position, the interference between the package and the yarn entering preventing member can be avoided.

**[0026]** In the yarn winding device of the present invention, the yarn entering preventing member is preferably arranged such that both ends in the intersecting direction of the yarn contact portion are located outside both ends in the intersecting direction of an intermediate circumferential surface of the plurality of packages attached to the bobbin holder at the winding position when wound up to a predetermined intermediate winding diameter when viewed from the axial direction. The predetermined intermediate winding diameter is a winding diameter of the plurality of packages formed by winding the yarn around each bobbin attached to the bobbin holder at the winding position at the time point at which the removal of the plurality of packages from the bobbin holder at the standby position is completed.

**[0027]** According to the present invention, the intermediate circumferential surface of the packages attached to the bobbin holder at the winding position at the time point at which the removal of the plurality of packages from the bobbin holder at the standby position is completed is located inside the yarn contact portion in the intersecting direction. That is, the entire intermediate circumferential surface of the package attached to the bobbin holder at the winding position in the intersecting direction is protected by the yarn contact portion. Therefore, until the removal of the plurality of packages from the bobbin holder at the standby position is completed, the yarn detached from the surface of the package and connected to the bobbin holder or the like can be reliably avoided from moving to the plurality of packages attached to the bobbin holder at the winding position.

**[0028]** In the yarn winding device of the present invention, the yarn entering preventing member is preferably arranged such that both ends in the intersecting direction of the yarn contact portion are located outside both ends in the intersecting direction of a virtual maximum circumferential surface of the plurality of packages attached to the bobbin holder at the standby position when wound up to a predetermined maximum winding diameter when viewed from the axial direction.

**[0029]** According to the present invention, when viewed from the axial direction, the circumferential surface of each package attached to the bobbin holder at the standby position is located inside both the ends of the yarn contact portion in the intersecting direction. Therefore, the yarn detached from the surface of the package during the doffing always passes through the inner side than both ends in the intersecting direction of the yarn contact portion and is connected to the bobbin holder and the like even if the yarn is detached from any position of the entire circumferential surface of the package. Therefore, the yarn detached from the surface of the package and connected to the bobbin holder or the like can be reliably brought into contact with the yarn contact portion.

**[0030]** In the yarn winding device of the present invention, the yarn entering preventing member is preferably arranged on one side of a component located on the most other side in the axial direction among components other than the yarn entering preventing member configuring the yarn winding device.

**[0031]** According to the present invention, the increase in the dimension in the axial direction of the entire yarn winding device can be suppressed.

**[0032]** A package production system of the present invention includes: any one of the yarn winding devices described above; and a doffing device for doffing the plurality of packages attached to the bobbin holder at the standby position of the yarn winding device, in which the doffing device includes a package supporting shaft configured to be able to insert the plurality of packages, and an elevation mechanism that moves the package supporting shaft in an up-down direction.

**[0033]** The plurality of fully-wound packages is doffed from the yarn winding device by the doffing device. At the time of doffing, the doffing device raises the package supporting shaft into which the plurality of packages is inserted to a predetermined height by the elevation mechanism. At this time, if the yarn detached from the package is caught on the bobbin holder or the like at the

standby position, the yarn may be pulled upward as the package supporting shaft rises, and entangle with the bobbin attached to the bobbin holder at the winding position. In this regard, according to the present invention, even if the doffing further progresses in a state in which the yarn detached from the surface of the package is caught on the bobbin holder or the like at the time of doffing, the yarn entering preventing member blocks the yarn from entering the bobbin holder at the winding position. Therefore, the yarn detached from the package doffed by the doffing device can be suppressed from being entangled with the bobbins attached to the bobbin holder at the winding position.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0034]**

FIG. 1 is a side view of a yarn winding device according to a first embodiment;
FIG. 2 is a front view of the yarn winding device according to the first embodiment;
FIG. 3 is a side view of the vicinity of a pushing member of a pusher at the start of removal of a package;
FIG. 4 is a side view of the vicinity of the pushing member of the pusher in the middle of removing the package;
FIG. 5 is a side view of the vicinity of the pushing member of the pusher when the pushing member is at a retracted position;
FIG. 6 is a front view of a yarn winding device according to a first embodiment, and is a view illustrating an intermediate circumferential surface of the package attached to a bobbin holder at a winding position;
FIG. 7 is a side view of a yarn winding device and a doffing device when the bobbin holder to which the package is attached is moved to a standby position;
FIG. 8 is a side view of the yarn winding device and the doffing device in the middle of a plurality of packages being pushed out from the bobbin holder at the standby position by the pushing member;
FIG. 9 is a side view of the yarn winding device and the doffing device when all the packages are removed from the bobbin holder at the standby position by the pushing member;
FIG. 10 is a side view of the yarn winding device and the doffing device when a package supporting shaft into which the plurality of packages is inserted is elevated up to a predetermined height by an elevation mechanism;
FIG. 11 is a front view of a yarn winding device according to a second embodiment;
FIG. 12 is a front view illustrating a yarn entering preventing member according to a first modification; and
FIG. 13 is a front view of a yarn winding device according to a second modification.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

(First embodiment)

**[0035]** Hereinafter, a first embodiment of the present invention will be described with reference to the drawings. FIG. 1 is a side view of a yarn winding device 1 according to the first embodiment. FIG. 2 is a front view of the yarn winding device 1. In the present specification, a left-right direction of the paper surface of FIG. 1 is defined as a front-rear direction, and a direction from a front side to a rear side of the paper surface is defined as a left-right direction (front side is a right side). In addition, a direction orthogonal to both the front-rear direction and the left-right direction is defined as an up-down direction in which gravity acts.

(Yarn winding device)

**[0036]** The yarn winding device 1 is configured to wind a plurality of yarns Y spun from a spinning apparatus (not illustrated) around a plurality of bobbins B to form a plurality of packages P. The plurality of packages P is doffed from the yarn winding device 1 by a doffing device 50 to be described later. As illustrated in FIGS. 1 and 2, the yarn winding device 1 includes a main body frame 2, a supporting frame 3, a turret 4, bobbin holders 5, a traverse unit 6, fulcrum guides 12, a contact roller 7, a unit cover 41, a pusher 8, and a yarn entering preventing member 10.

**[0037]** The turret 4 is a disc-shaped member rotatably supported by the main body frame 2. The turret 4 is rotatable about a rotation shaft 4a substantially parallel to the front-rear direction. Each of the two bobbin holders 5 is rotatably supported by the turret 4. Each bobbin holder 5 extends forward from the front surface of the turret 4. In other words, the rear end portion of each bobbin holder 5 in the front-rear direction is cantilevered by the turret 4. The rotational axis direction of each bobbin holder 5 is substantially parallel to the front-rear direction. When viewed from the front-rear direction, the two bobbin holders 5 are arranged in point symmetry with the rotation center of the turret 4 as a symmetry point (see FIG. 2). A plurality of bobbins B (16 in the present embodiment) respectively corresponding to the plurality of yarns Y is arranged in the front-rear direction and attached to each bobbin holder 5.

**[0038]** The turret 4 is rotationally driven about the rotation shaft 4a by a motor (not illustrated). When the turret 4 is rotated, the two bobbin holders 5 are movable between a winding position A1 of making contact with the contact roller 7 and winding the yarns Y around the bobbins B, and a standby position A2 that is lower than the winding position A1 and is point-symmetrical with the winding position A1 with respect to the rotation center of the turret 4 (see FIG. 2). Upon completion of formation of the packages P formed by winding the yarns Y around the bobbins B attached to the bobbin holder 5 at the wind-

ing position A1, , the turret 4 is rotationally driven, whereby the bobbin holder 5 at the winding position A1 and the bobbin holder 5 at the standby position A2 are switched. The plurality of packages P attached to the bobbin holder 5 moved to the standby position A2 is removed from the bobbin holder 5 by the pusher 8 (to be described in detail later) and doffed by the doffing device 50 to be described later. While the doffing of the plurality of packages P is being performed, the winding of the yarns Y around the plurality of bobbins B attached to the bobbin holder 5 moved to the winding position A1 is started in place of the bobbin holder 5 moved to the standby position A2.

**[0039]** Each of the two bobbin holders 5 supported by the turret 4 is individually rotationally driven by a winding motor (not illustrated). When the bobbin holder 5 at the winding position A1 is rotated, the plurality of yarns Y is respectively wound around the plurality of bobbins B attached to the bobbin holder 5 to form the packages P.

**[0040]** The supporting frame 3 is a member extending in the front-rear direction. As illustrated in FIG. 1, the supporting frame 3 is cantilevered by the main body frame 2 and protrudes forward. Supporting portions 3a that rotatably support the contact roller 7 are arranged at both end portions of the supporting frame 3 in the front-rear direction (see FIG. 2).

**[0041]** The contact roller 7 extends in a direction parallel to the bobbin holder 5 (that is, the front-rear direction). Both end portions of the contact roller 7 are supported by the supporting portions 3a of the supporting frame 3. The contact roller 7 can make contact with the plurality of bobbins B attached to the bobbin holder 5 at the winding position A1, or outer circumferential surfaces of the packages P formed by winding the yarns Y around the bobbins B. The contact roller 7 adjusts the shapes of the packages P by rotating while applying a predetermined contact pressure to the packages P at the time of winding the yarns around the bobbins B.

**[0042]** The traverse unit 6 is arranged on the supporting frame 3. The traverse unit 6 is arranged such that the same number as the number of the yarns Y is arranged in the front-rear direction. Each traverse unit 6 includes a traverse guide 6a corresponding to each of the plurality of bobbins B attached to the bobbin holder 5 at the winding position A1. When each traverse unit 6 reciprocates the traverse guide 6a in a state in which the yarn Y is threaded within a predetermined traversal range along the axial direction (front-rear direction) of the bobbin holder 5, the plurality of yarns Y is each wound around the corresponding bobbin B while being traversed.

**[0043]** The fulcrum guide 12 is a guide serving as a fulcrum when the traverse unit 6 traverses the yarn Y. The fulcrum guides 12 are arranged in the front-rear direction in the same number as the number of the yarns Y. As illustrated in FIG. 1, each fulcrum guide 12 is arranged above the corresponding traverse unit 6.

**[0044]** The unit cover 41 is a member for covering and protecting the supporting frame 3, the contact roller 7, the plurality of traverse units 6, the upper portion of the bobbin holder 5 at the winding position A1, and the like. Specifically, the unit cover 41 covers at least the upper side, the front side, and the rear side of the supporting frame 3, the contact roller 7, the plurality of traverse units 6, the upper portion of the bobbin holder 5 at the winding position A1, and the like (see FIG. 2). The unit cover 41 is attached to, for example, the supporting frame 3. A pop-out preventing plate 42 is attached to the front end portion and the lower left portion of the unit cover 41 (see FIG. 2). The pop-out preventing plate 42 is a member for preventing the bobbins B and the packages P from being detached from the bobbin holder at the winding position A1 and popping out to the front side. The pop-out preventing plate 42 extends in the up-down direction and the left-right direction. The pop-out preventing plate 42 is attached to the rear surface of the unit cover 41, for example.

**[0045]** Next, the pusher 8 will be described with reference to FIGS. 3 to 5. FIG. 3 is a side view of the vicinity of a pushing member 21 of the pusher 8 at the start of removal of the package P. FIG. 4 is a side view of the vicinity of the pushing member 21 during the removal of the package P. FIG. 5 is a side view of the vicinity of the pushing member 21 when the pushing member is at a retracted position.

**[0046]** As illustrated in FIGS. 3 to 5, the pusher 8 includes the pushing member 21, a driving mechanism 23 that moves the pushing member 21 in the front-rear direction (that is, the axial direction of the bobbin holder 5 at the standby position A2), and a switching mechanism 22 that switches the posture of the pushing member 21.

**[0047]** The pushing member 21 is a plate-like member configured to be movable in the front-rear direction. In addition, the pushing member 21 takes a standing posture (posture in FIGS. 3 and 4) and an inclined posture (posture in FIG. 5). The pushing member 21 in the standing posture stands upright parallel to the end face of the bobbins attached to the bobbin holder 5. The pushing member 21 in the standing posture is arranged between the bobbin B closest to the turret 4 side among the plurality of bobbins B attached to the bobbin holder 5 at the standby position A2 and the turret 4. The pushing member 21 in the standing posture is configured to be able to push out the plurality of packages P from the front end portion of the bobbin holder 5 at the standby position A2 by moving from the rear side in the front-rear direction (one side in the axial direction of the bobbin holder 5 at the standby position A2) toward the front side (the other side in the axial direction of the bobbin holder 5 at the standby position A2).

**[0048]** The driving mechanism 23 moves the pushing member 21 in the front-rear direction. The driving mechanism 23 is, for example, a fluid cylinder. However, the driving mechanism 23 is not limited thereto. For example, the driving mechanism 23 may be a motor or the like. The driving mechanism 23 is fixed to a lower portion of the main body frame 2. As illustrated in FIG. 3, in the driving mechanism 23, a piston rod 24 having a length

equal to or longer than a length in the axial direction of the bobbin holder 5 protrudes forward from a front end portion thereof. The driving mechanism 23 is driven to reciprocate the piston rod 24 along the front-rear direction from behind the front surface of the turret 4 to the front end portion of the bobbin holder 5. When the driving mechanism 23 moves the piston rod 24 from the rear to the front, the pushing member 21 moves forward (see the full-line arrow in FIG. 4), and the plurality of packages P is pushed forward.

**[0049]** The switching mechanism 22 is for switching the pushing member 21 between the standing posture and the inclined posture. As illustrated in FIG. 3, the switching mechanism 22 includes a connection member 25 and a swing member 26. The connection member 25 is coupled to the front end portion of the piston rod 24. The swing member 26 is a member that is attached to the connection member 25 and is swingable with respect to the connection member 25. The swing member 26 supports the pushing member 21. The swing member 26 is swingable with respect to the connection member 25 by rotating about a swing shaft 26a. When the swing member 26 swings, the pushing member 21 is switched between the standing posture and the inclined posture.

**[0050]** When the positions of the two bobbin holders 5 are switched by rotating the turret 4, the pusher 8 switches the pushing member 21 to the inclined posture by the switching mechanism 22. Further, the pusher 8 moves the pushing member 21 in the inclined posture to the retracted position by the driving mechanism 23. The retracted position is a position away from the movable range of the bobbin holder 5 that moves with the rotation of the turret 4.

(Yarn entering preventing member)

**[0051]** The yarn entering preventing member 10 is a member capable of blocking the yarn Y from entering the plurality of bobbins B attached to the bobbin holder 5 at the winding position A1. The yarn entering preventing member 10 is a long cylindrical member extending in the left-right direction (that is, the intersecting direction intersecting the axial direction of the bobbin holder 5). The yarn entering preventing member 10 includes a yarn contact portion 31 with which the yarn Y can make contact from the lower side. As illustrated in FIGS. 1 and 2, the yarn entering preventing member 10 is attached to, for example, a lower portion of the pop-out preventing plate 42. More specifically, the yarn entering preventing member 10 is attached to the front surface of the pop-out preventing plate 42. Therefore, the entirety of the yarn entering preventing member 10 is located on the front side in the front-rear direction of the bobbin holder 5.

**[0052]** The yarn entering preventing member 10 is arranged at a position not in contact with the plurality of packages P when the pushing member 21 pushes out the plurality of packages P attached to the bobbin holder 5 at the standby position A2. More specifically, the yarn entering preventing member 10 is arranged above an upper end t1 of a virtual maximum circumferential surface Sm of the plurality of packages P attached to the bobbin holder 5 at the standby position A2 (see FIG. 2). The virtual maximum circumferential surface Sm of the package P is a circumferential surface of the package P at the maximum winding diameter of the package P defined in the mechanical specification of the yarn winding device 1.

**[0053]** The yarn entering preventing member 10 is arranged on the rear side of the component portion located on the foremost side in the front-rear direction among the components other than the yarn entering preventing member 10 configuring the yarn winding device 1. Specifically, in the present embodiment, the component portion located on the foremost side in the front-rear direction among the component portions other than the yarn entering preventing member 10 configuring the yarn winding device 1 is the front end portion of the supporting frame 3. Therefore, the yarn entering preventing member 10 is arranged on the rear side of the front end portion of the supporting frame 3.

**[0054]** The yarn contact portion 31 is a portion where the yarn Y can make contact from the lower side of the lower surface of the yarn entering preventing member 10. The yarn contact portion 31 is a lower surface of the yarn entering preventing member 10 extending in the left-right direction, that is, extending in the left-right direction. The yarn contact portion 31 is a lower surface of the cylindrical yarn entering preventing member 10, that is, has a curved surface shape when viewed from the left-right direction. As illustrated in FIG. 1, the yarn entering preventing member 10 is arranged on the front side in the front-rear direction than the bobbin holder 5 at the standby position A2. In other words, the yarn contact portion 31 is located on the front side in the front-rear direction than the bobbin holder 5 at the standby position A2. As illustrated in FIG. 2, the yarn entering preventing member 10 is arranged above the bobbin holder 5 at the standby position A2. In other words, the yarn contact portion 31 is also located above the bobbin holder 5 at the standby position A2. Furthermore, the yarn entering preventing member 10 is arranged below the bobbin holder 5 at the winding position A1. In other words, the yarn contact portion 31 is located below the bobbin holder 5 at the winding position A1.

**[0055]** As illustrated in FIG. 6, the yarn entering preventing member 10 is arranged such that both ends in the left-right direction of the yarn contact portion 31 is located outside both ends r1 and r2 in the left-right direction of an intermediate circumferential surface Sr of the plurality of packages P attached to the bobbin holder 5 at the winding position A1 when viewed from the front-rear direction. Specifically, the left end of the yarn contact portion 31 is located on the left side of the left end r1 of the intermediate circumferential surface Sr of the plurality of packages P attached to the bobbin holder 5 at the winding position A1 when viewed from the front-rear di-

rection. The right end of the yarn contact portion 31 is located on the right side of the right end r2 of the intermediate circumferential surface Sr of the plurality of packages P attached to the bobbin holder 5 at the winding position A1 when viewed from the front-rear direction. The intermediate circumferential surface Sr of the package P is a circumferential surface of the package P when the yarn Y is wound up to a predetermined intermediate winding diameter around the bobbin B attached to the bobbin holder 5 at the winding position A1.

**[0056]** The predetermined intermediate winding diameter is a winding diameter of the plurality of packages P formed by winding the yarn Y around each bobbin B attached to the bobbin holder 5 at the winding position A1 at the time point at which the removal of the plurality of packages P from the bobbin holder 5 at the standby position A2 is completed by the pusher 8. The "time point at which the removal of the plurality of packages P from the bobbin holder 5 at the standby position A2 is completed" is, for example, a time point immediately after the pushing member 21 moves to the frontmost side and the plurality of packages P is pushed out from the front end portion of the bobbin holder 5 at the standby position A2. Alternatively, the "time point at which the removal of the plurality of packages P from the bobbin holder 5 at the standby position A2 is completed" may be a time point when the plurality of packages P is pushed out from the front end portion of the bobbin holder 5 at the standby position A2 by the pushing member 21 and then the pushing member 21 returns to the position near the turret 4.

**[0057]** Furthermore, as illustrated in FIG. 2, the yarn entering preventing member 10 is arranged such that both ends in the left-right direction of the yarn contact portion 31 are located outside both ends m1 and m2 in the left-right direction of the virtual maximum circumferential surface Sm of the plurality of packages P attached to the bobbin holder 5 at the standby position A2 when viewed from the front-rear direction. Specifically, the left end of the yarn contact portion 31 is located on the left side of the left end m1 of the virtual maximum circumferential surface Sm of the plurality of packages P attached to the bobbin holder 5 at the standby position A2 when viewed from the front-rear direction. The right end of the yarn contact portion 31 is located on the right side of the right end m2 of the virtual maximum circumferential surface Sm of the plurality of packages P attached to the bobbin holder 5 at the standby position A2 when viewed from the front-rear direction.

**[0058]** In addition, the yarn entering preventing member 10 includes a fall-off preventing portion 32 that is formed at a right end portion in the left-right direction of the yarn contact portion 31 and prevents the yarn Y from being detached from the yarn contact portion 31. Specifically, as illustrated in FIG. 2, the fall-off preventing portion 32 is formed at a position slightly left of the right end of the yarn contact portion 31. In the present embodiment, the fall-off preventing portion 32 is formed in a cylindrical shape. The axial center of the fall-off preventing portion 32 is coaxial with the axial center of the yarn entering preventing member 10. The diameter of the fall-off preventing portion 32 is greater than the diameter of the yarn entering preventing member 10. The fall-off preventing portion 32 may be formed only at the left end portion of the yarn contact portion 31, or may be formed at both the right end portion and the left end portion of the yarn contact portion 31.

(Doffing of package)

**[0059]** Next, a procedure when the plurality of packages P is doffed by the doffing device 50 will be described below with reference to FIGS. 7 to 10. First, the doffing device 50 for doffing the package P will be described. As illustrated in FIG. 7, the doffing device 50 includes a package supporting shaft 51 configured to be able to insert the plurality of packages P, and an elevation mechanism 52 that moves the package supporting shaft 51 in the up-down direction. The package supporting shaft 51 is a long cylindrical member into which the plurality of packages P is inserted in series. The length of the package supporting shaft 51 along the axial direction is substantially the same as the length of the bobbin holder 5 along the axial direction. The elevation mechanism 52 cantilevers the package supporting shaft 51 and includes a motor (not illustrated). Although not described in detail, the doffing device 50 is configured to be freely movable on the floor surface, and can carry the package P subjected to doffing to a predetermined storage location.

**[0060]** In the present embodiment, a package production system 70 for producing the plurality of packages P includes the yarn winding device 1, the doffing device 50, and a controller (not illustrated) that controls operations of the yarn winding device 1 and the doffing device 50 (see FIGS. 7 to 10). The package production system 70 first controls the operation of the yarn winding device 1 by the controller to form the plurality of packages P from the plurality of yarns Y spun from the spinning apparatus. Thereafter, the package production system 70 controls the operations of the yarn winding device 1 and the doffing device 50 by the controller to doffing the plurality of packages P from the yarn winding device 1. Subsequently, the package production system 70 controls the operation of the doffing device 50 by the controller to convey the plurality of packages P to a predetermined storage location. Hereinafter, a procedure when the plurality of packages P is doffed from the yarn winding device 1 by the doffing device 50 will be described. In the following description, in practice, the operation of each component of the yarn winding device 1 and each component of the doffing device 50 is controlled by a controller (not illustrated), but for the sake of brevity of description, description indicating that the controller is controlling is omitted.

**[0061]** First, as described above, when the yarns Y are wound around the bobbins B attached to the bobbin holder 5 at the winding position A1 to form the packages P,

the turret 4 is rotationally driven, so that the bobbin holder 5 at the winding position A1 moves to the standby position A2 (state of FIG. 7). At this time, as illustrated in FIG. 7, the doffing device 50 is at a position at which the plurality of packages P can be received from the yarn winding device 1. Specifically, the doffing device 50 takes such a position and posture that the package supporting shaft 51 is arranged along an extended line in the axial direction of the bobbin holder 5 at the standby position A2.

**[0062]** Subsequently, as illustrated in FIG. 8, the pusher 8 moves the pushing member 21 forward along the front-rear direction by the driving mechanism 23 (see the full-line arrow in FIG. 8) . Then, the plurality of packages P attached to the bobbin holder 5 at the standby position A2 is collectively pushed out to the front side. Then, in order from the package P on the front side, the bobbin holder 5 is detached and inserted into the package supporting shaft 51.

**[0063]** When all the packages P are removed from the bobbin holder 5 at the standby position A2 and delivered to the package supporting shaft 51 by the pushing member 21, the pushing member 21 moves rearward and returns to the original position (see FIG. 9).

**[0064]** As illustrated in FIG. 10, the doffing device 50 raises the package supporting shaft 51 into which the plurality of packages P is inserted to a predetermined height further above the bobbin holder 5 at the winding position A1 by the elevation mechanism 52. Thus, the doffing of the plurality of packages P by the doffing device 50 is completed. A plurality of empty bobbins in a state in which the yarn Y is not wound is newly attached to the bobbin holder 5 from which the plurality of packages P have been removed.

(Effects)

**[0065]** The yarn winding device 1 of the present embodiment includes: the two bobbin holders 5 configured to be switchable between the winding position A1 at which the yarn Y is wound around the plurality of bobbins B to form the plurality of packages P and the standby position A2 below the winding position A1; the pushing member 21 configured to be movable in the front-rear direction (the axial direction of the bobbin holder 5 at the standby position A2) and configured to push out the plurality of packages P from the front end portion of the bobbin holder 5 at the standby position A2 by moving from the rear side (one side in the axial direction of the bobbin holder 5 at the standby position A2) to the front side (the other side in the axial direction of the bobbin holder 5 at the standby position A2) in the front-rear direction; and the yarn entering preventing member 10 capable of blocking the yarn Y from entering the bobbin B attached to the bobbin holder 5 at the winding position A1. The yarn entering preventing member 10 includes the yarn contact portion 31 that extends in the left-right direction and with which the yarn Y can make contact from a lower side. The yarn contact portion 31 is located on the front side in the front-rear direction of the bobbin holder 5 at the standby position A2, is located above the bobbin holder 5 at the standby position A2, and is located on the lower side than the bobbin holder 5 at the winding position A1.

**[0066]** The package production system 70 of the present embodiment includes the yarn winding device 1 including the yarn entering preventing member 10, and the doffing device 50. The doffing device 50 includes the package supporting shaft 51 configured to be able to insert the plurality of packages P, and the elevation mechanism 52 that moves the package supporting shaft 51 in the up-down direction.

**[0067]** The plurality of fully-wound packages P is doffed from the yarn winding device 1 by the doffing device 50. At the time of doffing, the doffing device 50 raises the package supporting shaft 51 into which the plurality of packages P is inserted to a predetermined height. At this time, if the yarn Y detached from the package P is caught on the bobbin holder 5 or the like at the standby position A2, the yarn Y may be pulled upward as the package supporting shaft 51 rises, and entangle with the bobbin B attached to the bobbin holder 5 at the winding position A1. In this regard, according to the present embodiment, the yarn contact portion 31 arranged on the yarn entering preventing member 10 is located on the front side in the front-rear direction of the bobbin holder 5 at the standby position A2, is located above the bobbin holder 5 at the standby position A2, and is located on the lower side than the bobbin holder 5 at the winding position A1. Therefore, even if the doffing further progresses in a state in which the yarn Y detached from the surface of the package P during the doffing is caught on the pushing member 21, the bobbin holder 5 at the standby position A2, and the like, the yarn Y is restricted from making contact with the yarn contact portion 31 from the lower side and moving to the upper side than the yarn contact portion 31. Thus, the yarn entering preventing member 10 can prevent the yarn Y from entering the bobbin holder 5 at the winding position A1.

**[0068]** Hereinafter, a mechanism in which the movement of the yarn Y to the bobbin holder 5 at the winding position A1 is restricted by the yarn contact portion 31 arranged in the yarn entering preventing member 10 will be described in detail with reference to FIGS. 9 and 10. FIG. 9 is a view illustrating a state in which the end of the yarn Y is detached from the surface of the rearmost package P among the plurality of packages P removed from the bobbin holder 5 at the standby position A2 and is caught on the pushing member 21. FIG. 10 illustrates a state of the yarn Y detached from the package P and connected to the pushing member 21 when the package supporting shaft 51 into which the plurality of packages P is inserted is raised. Although FIGS. 9 and 10 illustrate a state in which the yarn Y is detached from the rearmost package P among the plurality of packages P, it should be noted that the yarn Y can be detached from any one or a plurality of packages P among the plurality of pack-

ages P. Furthermore, FIGS. 9 and 10 illustrate a state in which the yarn Y detached from the package P is caught on the pushing member 21, but it should be noted that the yarn Y detached from the package P can be similarly caught on the bobbin holder 5 at the standby position A2. Furthermore, the yarn Y detached from the package P can also be caught at a component (including one not illustrated) in the vicinity of the bobbin holder 5 at the standby position A2 among the components of the yarn winding device 1.

**[0069]** In the present embodiment, the yarn contact portion 31 is located above the bobbin holder 5 at the standby position A2. Therefore, as illustrated in FIG. 10, the yarn Y detached from the surface of the package P and connected to the pushing member 21 comes into contact with the yarn contact portion 31 (lower portion of the yarn entering preventing member 10 in FIG. 10) of the yarn entering preventing member 10 from the lower side. Thus, a yarn Ya (see FIG. 10), which is the portion of the yarn Y between the yarn contact portion 31 and the pushing member 21, of the yarn Y detached from the surface of the package P is restricted from moving to the upper side than the yarn contact portion 31. The yarn contact portion 31 is located lower than the plurality of bobbins B attached to the bobbin holder 5 at the winding position A1. Therefore, the movement of the yarn Ya, which is the portion of the yarn Y between the yarn contact portion 31 and the pushing member 21, of the yarn Y detached from the surface of the package P to the bobbin holder 5 at the winding position A1 can be restricted. Of the yarn Y detached from the surface of the package P, the yarn Yb (see FIG. 10), which is the portion of the yarn Y between the package P and the yarn contact portion 31, moves to the upper side than the yarn contact portion 31 as the package P rises. In this respect, the yarn contact portion 31 is located on the front side in the front-rear direction of the bobbin holder 5 at the standby position A2. Therefore, the bobbin holder 5 at the winding position A1 does not exist on the upper side of the yarn Yb, which is the portion of the yarn Y between the package P and the yarn contact portion 31. Therefore, even if the yarn Yb moves to the upper side than the yarn contact portion 31, the yarn Yb does not move to the bobbin holder 5 at the winding position A1. As described above, according to the yarn winding device 1 of the present embodiment, the yarn Y detached from the package P being doffed can be suppressed from being entangled with the bobbin B attached to the bobbin holder 5 at the winding position A1. The yarn Y detached from the surface of the package P and caught on the yarn contact portion 31 is cut with a cutter or the like by an operator, for example.

**[0070]** The yarn entering preventing member 10 of the present embodiment is located on the front side in the front-rear direction than the two bobbin holders 5. Thus, when the two bobbin holders 5 are rotationally moved about the rotation shaft 4a by the turret 4, the yarn entering preventing member 10 does not interfere with the rotationally moved bobbin holder 5.

**[0071]** In the yarn winding device 1 of the present embodiment, the yarn entering preventing member 10 includes the fall-off preventing portion 32 that is formed at an end portion on at least one side in the left-right direction of the yarn contact portion 31 and prevents the yarn Y from being detached from the yarn contact portion 31. According to this, the yarn Y making contact with the yarn contact portion 31 can be suppressed from being detached from the end portion of the yarn contact portion 31 while the package P is being doffed.

**[0072]** In the yarn winding device 1 of the present embodiment, the yarn contact portion 31 has a curved surface shape at a portion making contact with the yarn Y. According to this, the yarn Y is not caught on the corner of the yarn contact portion 31. Therefore, the state in which the yarn Y is fixed by the yarn Y being caught at the corner of the yarn contact portion 31 can be suppressed. As a result, the yarn Y can be suppressed from being excessively pulled out from the package P by the doffing proceeding in the state in which the yarn Y is fixed.

**[0073]** In the yarn winding device 1 of the present embodiment, the entirety of the yarn entering preventing member 10 is located on the front side in the front-rear direction of the bobbin holder 5. According to this, the contact between the yarn entering preventing member 10 and the bobbin holder 5 can be avoided. In addition, since there is generally a sufficient space on the front side in the front-rear direction than the bobbin holder 5, the yarn entering preventing member 10 can be easily installed.

**[0074]** In the yarn winding device 1 of the present embodiment, the yarn entering preventing member 10 is arranged above the upper end t1 of the virtual maximum circumferential surface Sm of the plurality of packages P attached to the bobbin holder 5 at the standby position A2 when wound up to the predetermined maximum winding diameter. According to this, when the package P is pushed out from the bobbin holder 5 at the standby position A2, the interference between the package P and the yarn entering preventing member 10 can be avoided.

**[0075]** Furthermore, in the yarn winding device 1 of the present embodiment, the yarn entering preventing member 10 is arranged such that both ends in the left-right direction of the yarn contact portion 31 are located outside both the ends r1 and r2 in the left-right direction of the intermediate circumferential surface Sr of the plurality of packages P attached to the bobbin holder 5 at the winding position A1 when wound up to a predetermined intermediate winding diameter when viewed from the front-rear direction. According to this, the intermediate circumferential surface Sr of the packages P attached to the bobbin holder 5 at the winding position A1 at the time point at which the removal of the plurality of packages P from the bobbin holder 5 at the standby position A2 is completed is located inside the yarn contact portion 31 in the left-right direction. That is, the entire intermediate circumferential surface Sr of the package P attached to the bobbin holder 5 at the winding position A1 in the left-

right direction is protected by the yarn contact portion 31. Therefore, until the removal of the plurality of packages P from the bobbin holder 5 at the standby position A2 is completed, the yarn Y detached from the surface of the package P and connected to the pushing member 21 and the like can be reliably avoided from moving to the plurality of packages P attached to the bobbin holder 5 at the winding position A1.

**[0076]** In the yarn winding device 1 of the present embodiment, the yarn entering preventing member 10 is arranged such that both ends in the left-right direction of the yarn contact portion 31 are located outside both ends in the left-right direction of the virtual maximum circumferential surfaces Sm of the plurality of packages P attached to the bobbin holder 5 at the standby position A2 when viewed from the front-rear direction. According to this, when viewed from the front-rear direction, the circumferential surface of each package attached to the bobbin holder 5 at the standby position A2 is located inside both the ends of the yarn contact portion 31 in the left-right direction. Therefore, the yarn Y detached from the surface of the package P during the doffing always passes through the inner side than both ends in the left-right direction of the yarn contact portion 31 and is connected to the pushing member 21 and the like even if the yarn Y is detached from any position of the entire circumferential surface of the package P. Therefore, the yarn Y detached from the surface of the package P and connected to the pushing member 21 and the like can be reliably brought into contact with the yarn contact portion 31.

**[0077]** In the yarn winding device 1 of the present embodiment, the yarn entering preventing member 10 is arranged on the rear side of the component portion located on the foremost side in the front-rear direction among the components other than the yarn entering preventing member 10 configuring the yarn winding device 1. According to this, the dimension in the front-rear direction of the entire yarn winding device 1 can be suppressed from increasing.

(Second embodiment)

**[0078]** Next, a second embodiment in which various modifications are made to the first embodiment will be described. However, components having the same configuration as that of the first embodiment are denoted by the same reference numerals, and the description thereof is appropriately omitted.

**[0079]** As illustrated in FIG. 11, in a yarn winding device 101 according to the second embodiment, a yarn entering preventing member 110 includes an expansion/contraction mechanism 33 that expands/contracts the yarn contact portion 31 in the left-right direction. The expansion/contraction mechanism 33 is, for example, a cylinder. However, the expansion/contraction mechanism 33 is not limited thereto. The yarn contact portion 31 can be expanded/contracted in the left-right direction (see the full-line arrow in FIG. 11) by driving the expansion/contraction mechanism 33.

**[0080]** A path of the yarn Y detached from the surface of the package P being doffed and connected to the pushing member 21, the bobbin holder at the standby position A2, or the like is determined by the winding diameter of the package P to be doffed, the location where the yarn Y deviates in the entire circumferential surface of the package P, the positional relationship between the doffing device 50 and the yarn winding device 1, and the like. The longer the yarn contact portion 31 in the left-right direction, the more reliably the yarn Y can be brought into contact with the yarn contact portion 31 regardless of the path of the yarn Y detached from the surface of the package P and connected to the pushing member 21, the bobbin holder 5, and the like. On the other hand, if the yarn contact portion 31 is too long in the left-right direction, the yarn contact portion 31 and the other member may interfere when the other member of the yarn winding device 1 operates. According to the second embodiment, the yarn contact portion 31 is expanded/contracted to an appropriate length according to the path of the yarn Y detached from the surface of the package P and connected to the pushing member 21, the bobbin holder 5, and the like, so that the yarn Y can be more reliably brought into contact with the yarn contact portion 31 within a range in which interference with other member of the yarn winding device 1 can be avoided.

(Modification)

**[0081]** Hereinafter, modifications of the first embodiment and the second embodiment will be described. Hereinafter, the term "embodiment" refers to both the first embodiment and the second embodiment. Hereinafter, components having the same configurations as those of the above embodiment are denoted by the same reference numerals, and the description thereof will be appropriately omitted.

(First modification)

**[0082]** The yarn entering preventing member 10 extends straight in the left-right direction. However, the yarn entering preventing member 10 may be bent. For example, as illustrated in FIG. 12, a yarn entering preventing member 310 according to a first modification has a bent shape inclined downward from an intermediate portion 131a in the left-right direction of a yarn contact portion 131 toward both sides. According to this, when the yarn Y rises as the doffing progresses, the yarn Y moves toward the intermediate portion 131a along the inclination of the bent shape of the yarn contact portion 131. That is, since the yarn Y moves in a direction opposite to the direction toward both end portions of the yarn contact portion 131, the yarn Y is less likely to be detached from both end portions of the yarn contact portion 131 in the left-right direction.

(Second modification)

**[0083]** In the embodiment described above, a part of the role of the yarn entering preventing member 10 may be substituted with a lambda guide 9. First, the lambda guide 9 will be specifically described. As illustrated in FIG. 13, the yarn winding device 201 according to the second modification includes the lambda guide 9. The lambda guide 9 is a guide for guiding the plurality of yarns Y to a predetermined winding position when winding the plurality of yarns Y fed from the spinning apparatus (not illustrated) around empty bobbins B attached to the bobbin holder 5 at the winding position A1. The lambda guide 9 includes a swing shaft 9a, an arm portion 9b, and a guide portion 9c. The lambda guide 9 is swingably supported by an upright member 60 installed at a lower portion of the main body frame 2 via a swing shaft 9a. The swing shaft 9a is formed at a base end portion of the arm portion 9b, and the guide portion 9c is formed at a leading end of the arm portion 9b. The lambda guide 9 is swingable about the swing shaft 9a (see the full-line arrow in FIG. 13). Swing of the lambda guide 9 is driven by, for example, a motor (not illustrated). The lambda guide 9 is arranged, for example, on the front side of the yarn entering preventing member 10 in the front-rear direction. Thus, the plurality of yarns Y can be easily threaded on the lambda guide 9. However, the position at which the lambda guide 9 is arranged is not limited thereto.

**[0084]** The plurality of yarns Y fed from the spinning apparatus (not illustrated) is threaded on the plurality of fulcrum guides 12, and then threaded together on the guide portion 9c. Subsequently, by swinging the lambda guide 9 clockwise about the swing shaft 9a, the plurality of yarns Y collectively threaded on the guide portion 9c is delivered to a separator (not illustrated) and then guided to a predetermined winding position. Then, by rotating the bobbin holder 5 at the winding position A1, the yarn Y is wound around the empty bobbin B attached to the bobbin holder 5.

**[0085]** Next, a method of substituting a part of the role of the yarn entering preventing member 10 with the lambda guide 9 will be described. After all the packages P are removed from the bobbin holder 5 at the standby position A2 by the pushing member 21 and delivered to the package supporting shaft 51, the lambda guide 9 is swung about the swing shaft 9a before the package supporting shaft 51 is raised by the elevation mechanism 52. More specifically, when viewed from the front-rear direction, the lambda guide 9 is swung such that a right side surface 9b1 of the arm portion 9b is substantially parallel to the left-right direction. As a result, the right side surface 9b1 of the arm portion 9b is located on the front side in the front-rear direction of the bobbin holder 5 at the standby position A2, above the bobbin holder 5 at the standby position A2, and below the bobbin holder 5 at the winding position A1. Thus, the lower surface of the arm portion 9b can be used as the yarn contact portion with which the yarn Y can make contact from the lower side. In other words, in the second modification, the yarn entering preventing member 10 and the lambda guide 9 correspond to a yarn entering preventing member of the present invention.

(Other modifications)

**[0086]** In the embodiment described above, the yarn entering preventing member 10 is attached to the pop-out preventing plate 42. However, the yarn entering preventing member 10 may be attached to another member. For example, the yarn entering preventing member 10 may be attached to a lower portion of the unit cover 41.

**[0087]** In the embodiment described above, the yarn contact portion 31 extends in the left-right direction. However, the yarn contact portion 31 may be, for example, inclined such that the left end portion is located above or below the right end portion.

**[0088]** In the embodiment described above, the yarn entering preventing member 10 includes the fall-off preventing portion 32. However, the yarn entering preventing member 10 may not include the fall-off preventing portion 32.

**[0089]** In the embodiment described above, the yarn entering preventing member 10 is a long cylindrical member. However, the yarn entering preventing member 10 is not limited to such a shape. The yarn entering preventing member 10 may have any shape as long as it has the yarn contact portion 31 that extends in the left-right direction and can be contacted by the yarn Y from the lower side.

**[0090]** In the embodiment described above, the yarn entering preventing member 10 is arranged above the upper end t1 of the virtual maximum circumferential surface Sm of the plurality of packages P attached to the bobbin holder 5 at the standby position A2. However, the present invention is not limited to such an aspect. However, the yarn entering preventing member 10 is preferably arranged at a position not in contact with the plurality of packages P when the pushing member 21 pushes out the plurality of packages P attached to the bobbin holder 5 at the standby position A2. Thus, when the package P is pushed out from the bobbin holder 5 at the standby position A2, the interference between the package P and the yarn entering preventing member 10 can be avoided.

**[0091]** In the embodiment described above, the entirety of the yarn entering preventing member 10 is located on the front side in the front-rear direction than the bobbin holder 5. However, a part of the yarn entering preventing member 10 may be present on the rear side in the front-rear direction than the front end of the bobbin holder 5.

**[0092]** The present invention is not limited to the yarn winding device 1 that winds the yarn Y spun from the spinning apparatus as in the above embodiment, and can be applied to various yarn winding devices configured to wind a plurality of yarns Y.

## Claims

1. A yarn winding device (1, 101, 201) comprising:

   two bobbin holders (5) to which a plurality of bobbins (B) is attached, the two bobbin holders (5) being configured to be switchable between a winding position (A1) at which a yarn (Y) is wound around each of the bobbins (B) to form a plurality of packages (P) and a standby position (A2) below the winding position (A1);
   a pushing member (21) configured to be movable in an axial direction of the bobbin holder (5) at the standby position (A2) and configured to push out the plurality of packages (P) from an end portion on the other side of the bobbin holder (5) at the standby position (A2) by moving from one side to the other side in the axial direction; and
   a yarn entering preventing member (10, 110, 310) configured to prevent the yarn (Y) from entering the plurality of bobbins (B) attached to the bobbin holder (5) at the winding position (A1),
   wherein the yarn entering preventing member (10, 110, 310) includes a yarn contact portion (31, 131) extending in an intersecting direction intersecting with the axial direction and configured to be contacted by the yarn (Y) from a lower side, and
   the yarn contact portion (31, 131) is located on the other side in the axial direction than the bobbin holder (5) at the standby position (A2), is located above the bobbin holder (5) at the standby position (A2), and is located on the lower side than the bobbin holder (5) at the winding position (A1).

2. The yarn winding device (1, 101, 201) according to claim 1, wherein the yarn entering preventing member (310) has a bent shape inclined downward from an intermediate portion (131a) in the intersecting direction of the yarn contact portion (131) toward both sides.

3. The yarn winding device (1, 101, 201) according to claim 1 or 2, wherein the yarn entering preventing member (10, 110, 310) includes a fall-off preventing portion (32) formed at an end portion on at least one side in the intersecting direction of the yarn contact portion (31, 131) to prevent the yarn (Y) from detaching from the yarn contact portion (31, 131).

4. The yarn winding device (101) according to any one of claims 1 to 3, wherein the yarn entering preventing member (110) includes an expansion/contraction mechanism (33) that expands/contracts the yarn contact portion (31) in the intersecting direction.

5. The yarn winding device (1, 101, 201) according to any one of claims 1 to 4, wherein a portion of the yarn contact portion (31, 131) making contact with the yarn (Y) has a curved surface shape.

6. The yarn winding device (1, 101, 201) according to any one of claims 1 to 5, wherein an entirety of the yarn entering preventing member (10, 110, 310) is located on the other side in the axial direction than the bobbin holder (5) .

7. A package production system (70) comprising:

   the yarn winding device (1, 101, 201) according to any one of claims 1 to 6; and
   a doffing device (50) for doffing the plurality of packages (P) attached to the bobbin holder (5) at the standby position (A2) of the yarn winding device (1, 101, 201),
   wherein the doffing device (50) includes a package supporting shaft (51) configured to be able to insert the plurality of packages (P), and an elevation mechanism (52) that moves the package supporting shaft (51) in an up-down direction.

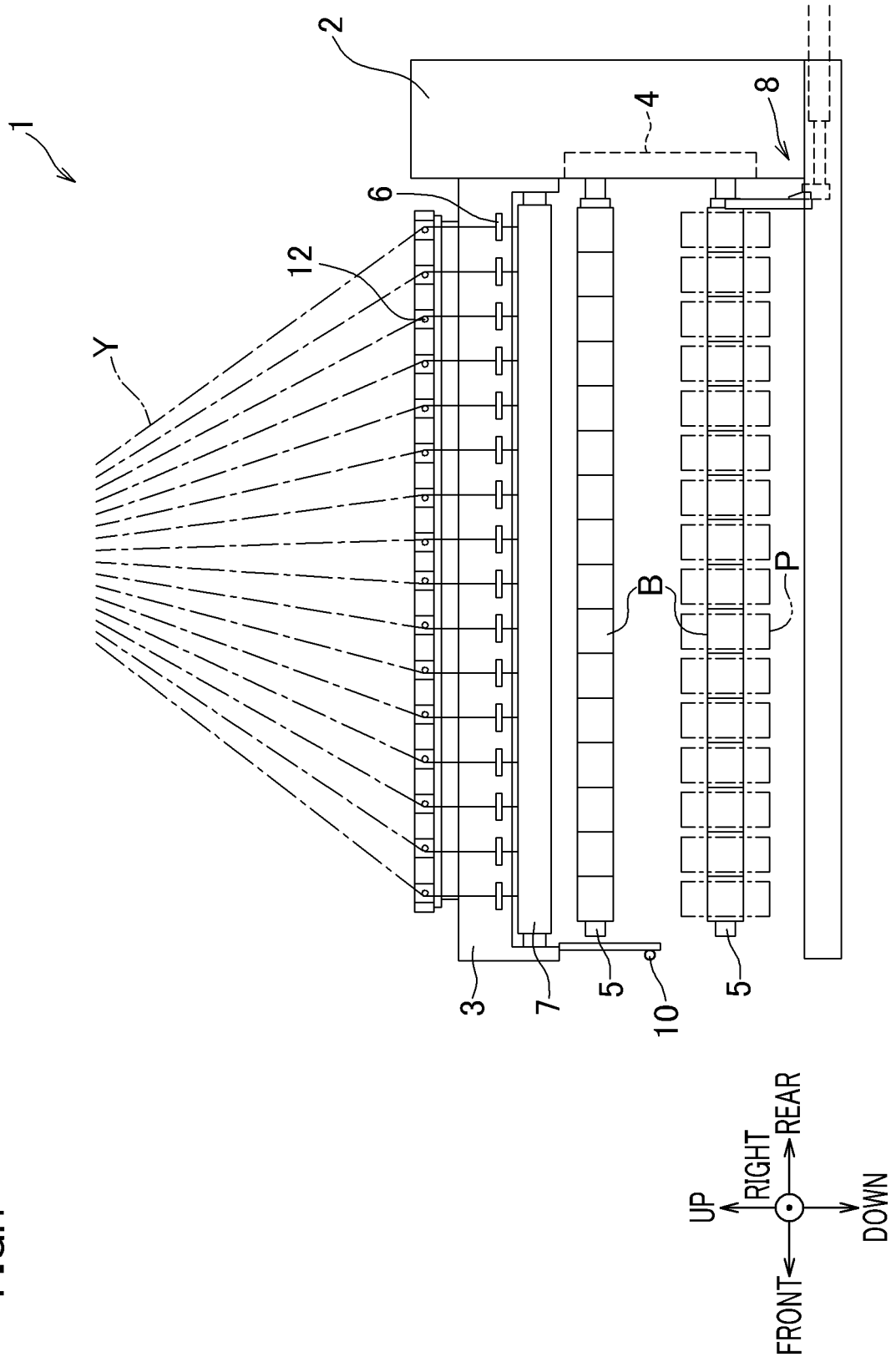



FIG.1

FIG.2

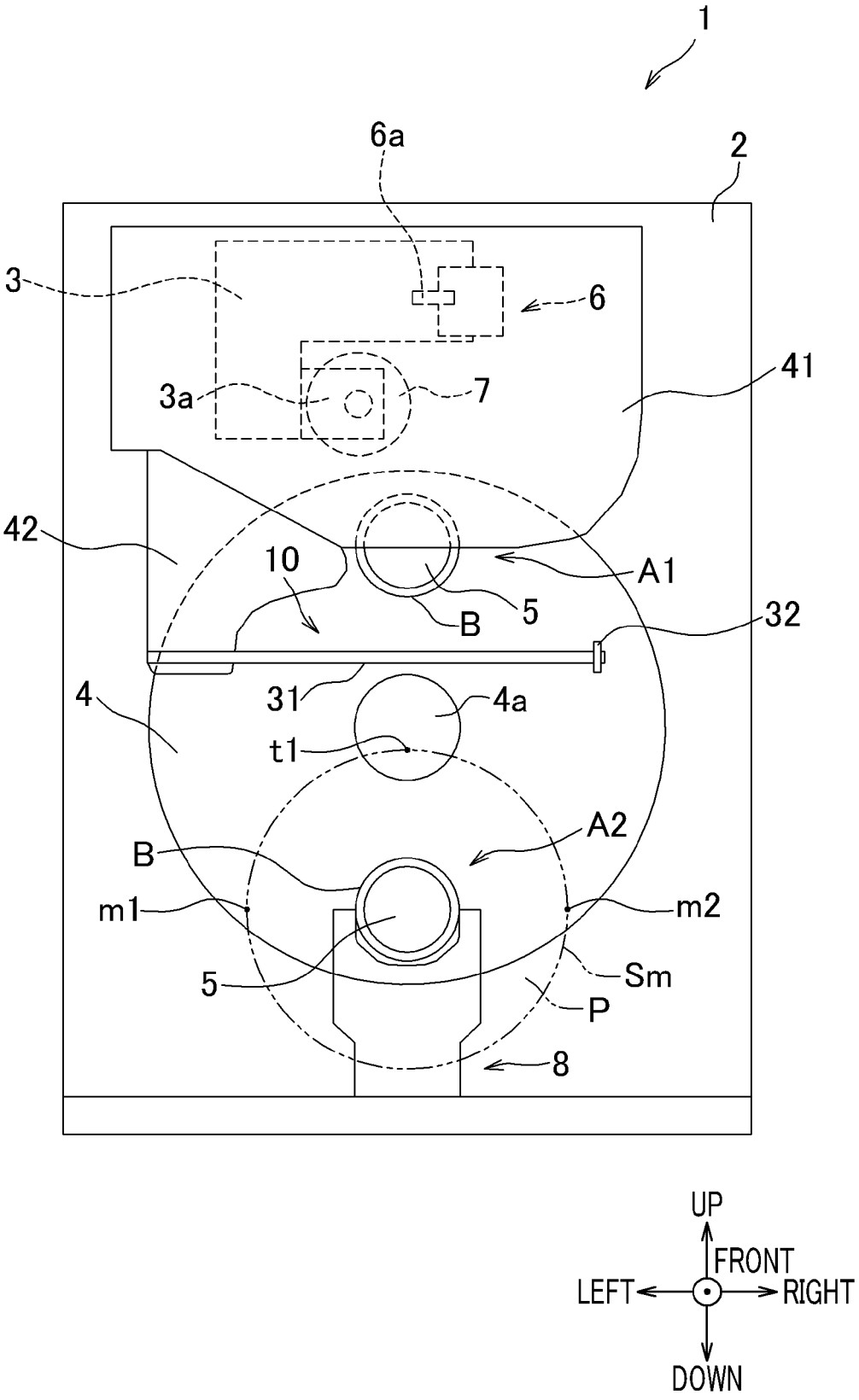

1
6a
2
3
6
41
3a
7
42
10
A1
B
5
32
4
31
4a
t1
A2
B
m1
m2
5
Sm
P
8
UP
FRONT
LEFT
RIGHT
DOWN

FIG.3

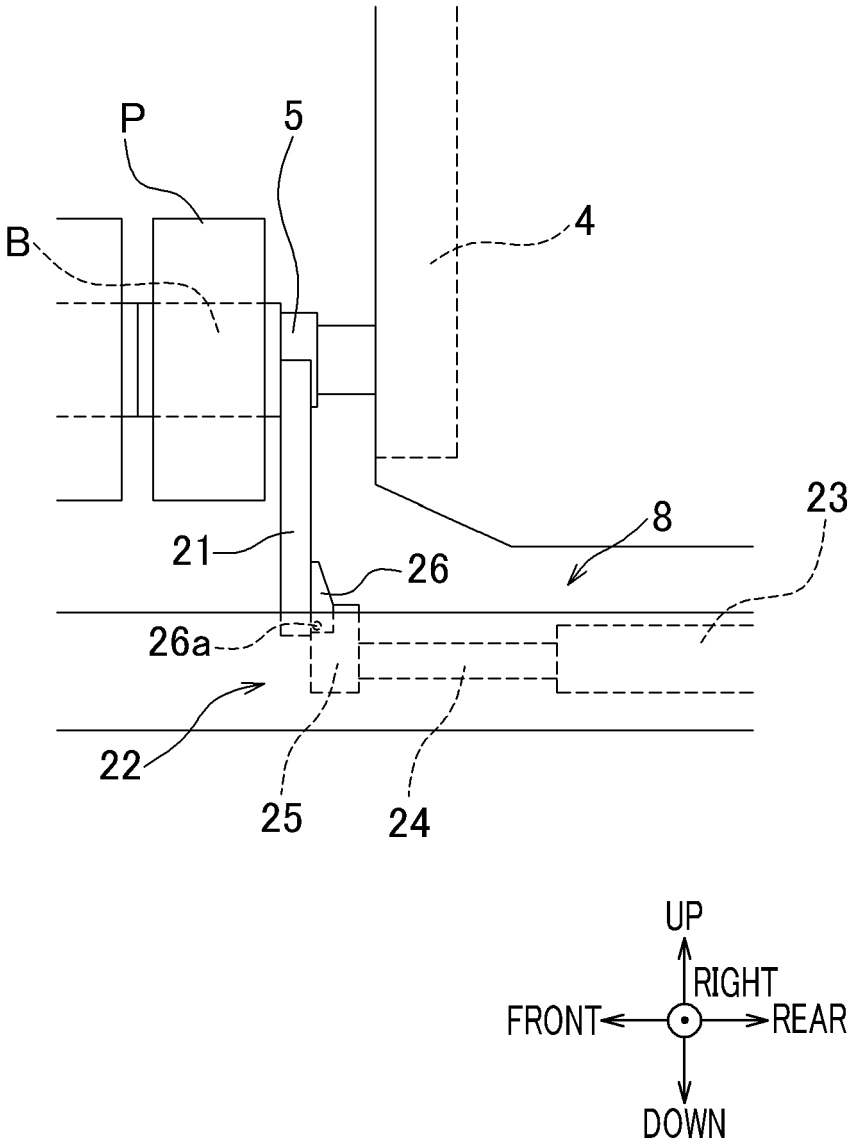


FIG.4

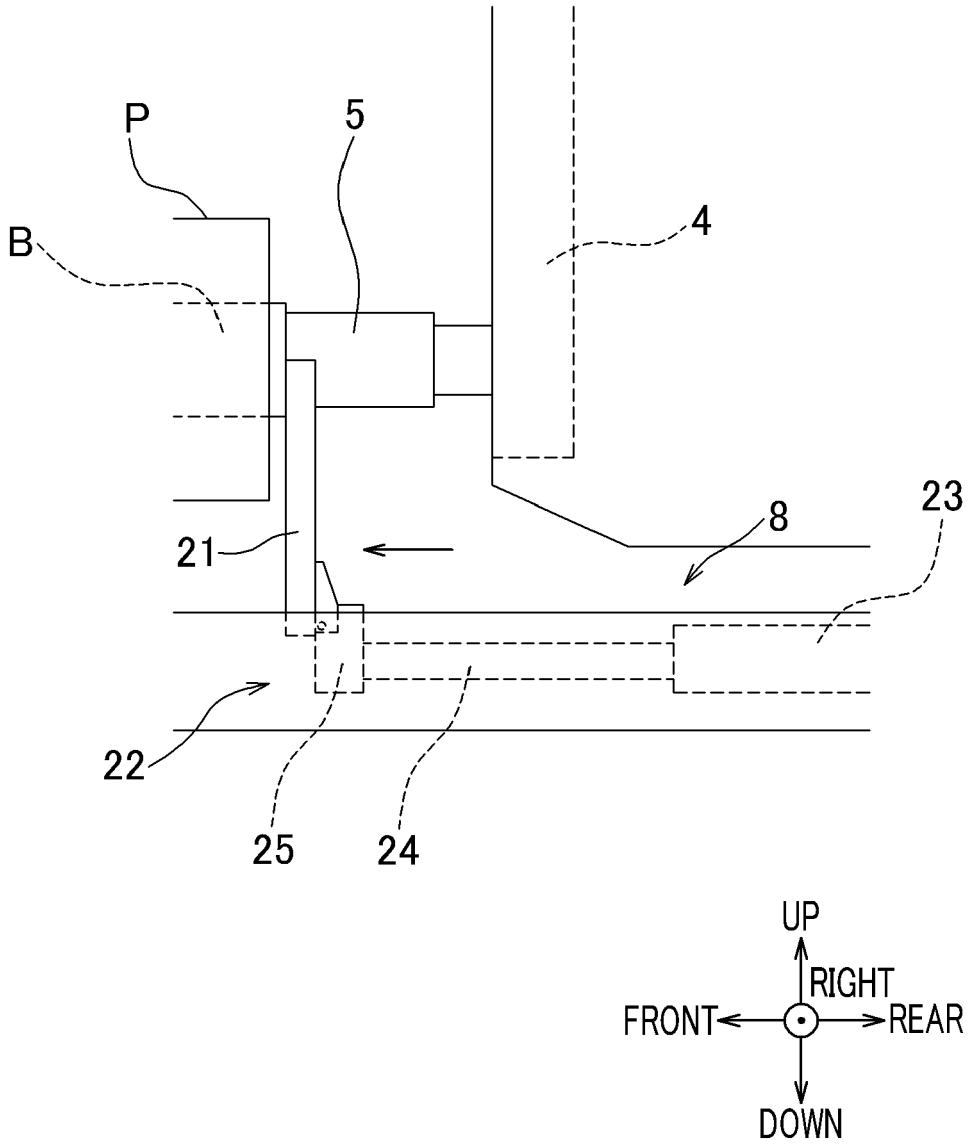


FIG.5

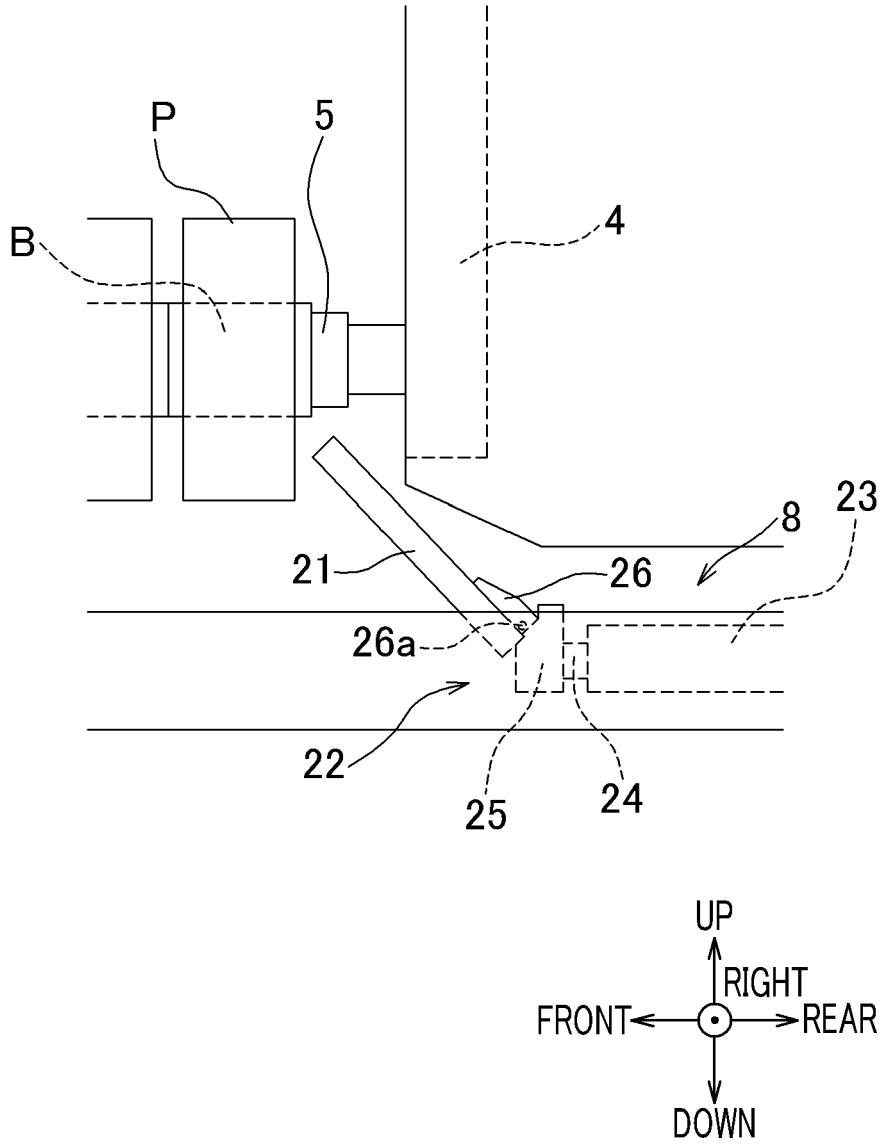


FIG.6

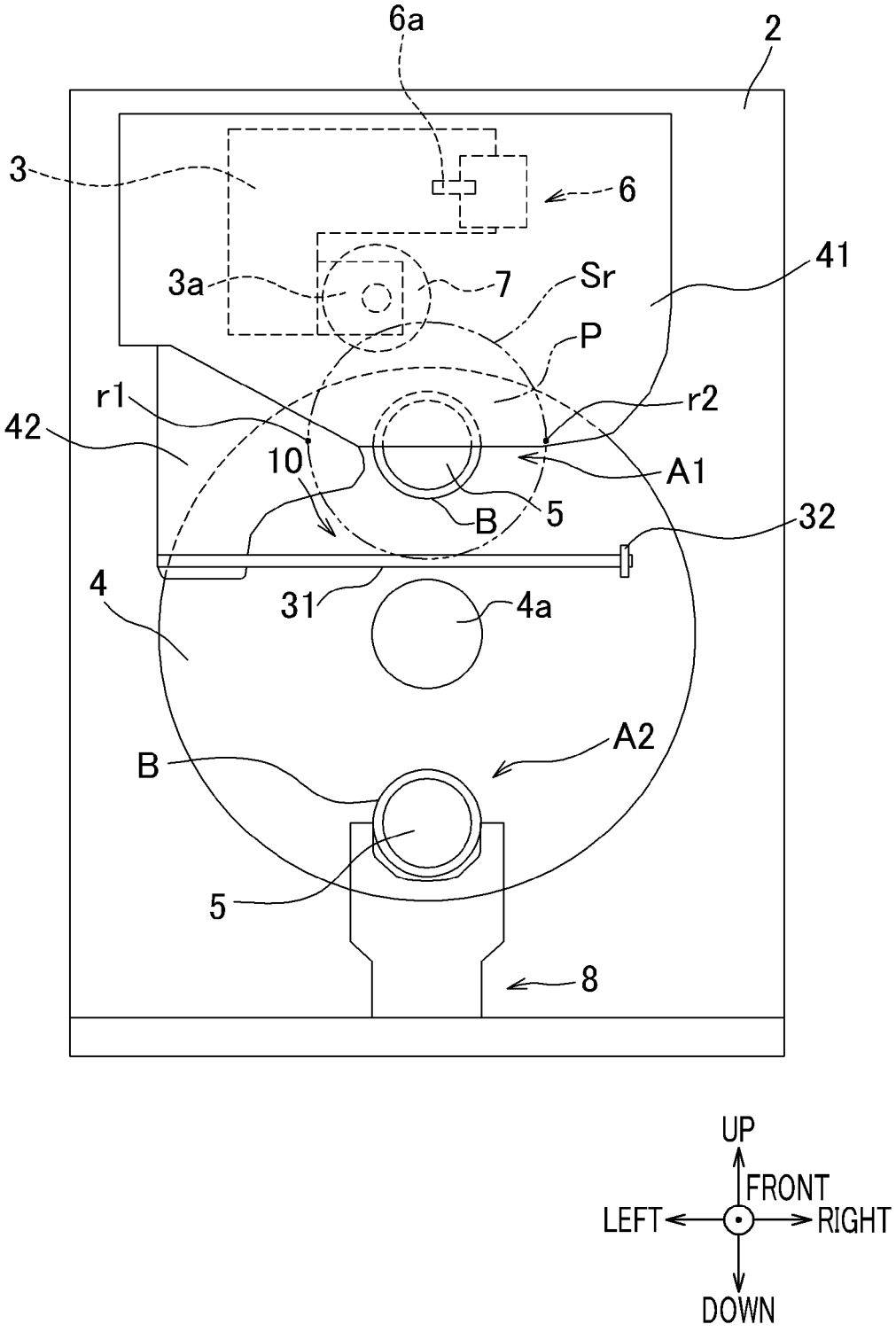

6a
2
3
6
41
3a
7
Sr
P
r1
r2
42
10
A1
B
5
32
4
31
4a
A2
B
5
8
UP
FRONT
LEFT
RIGHT
DOWN

FIG.7

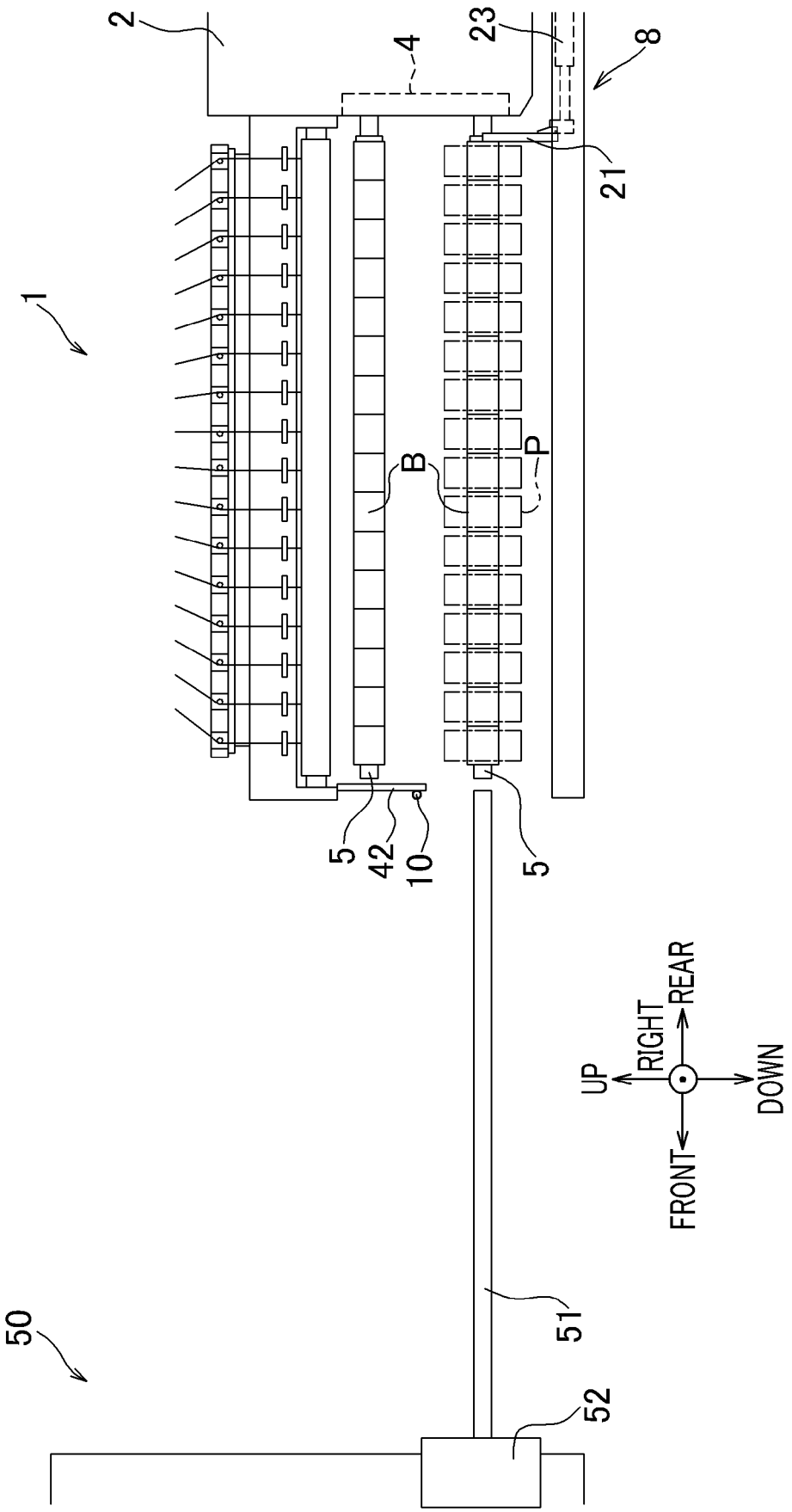


FIG.8

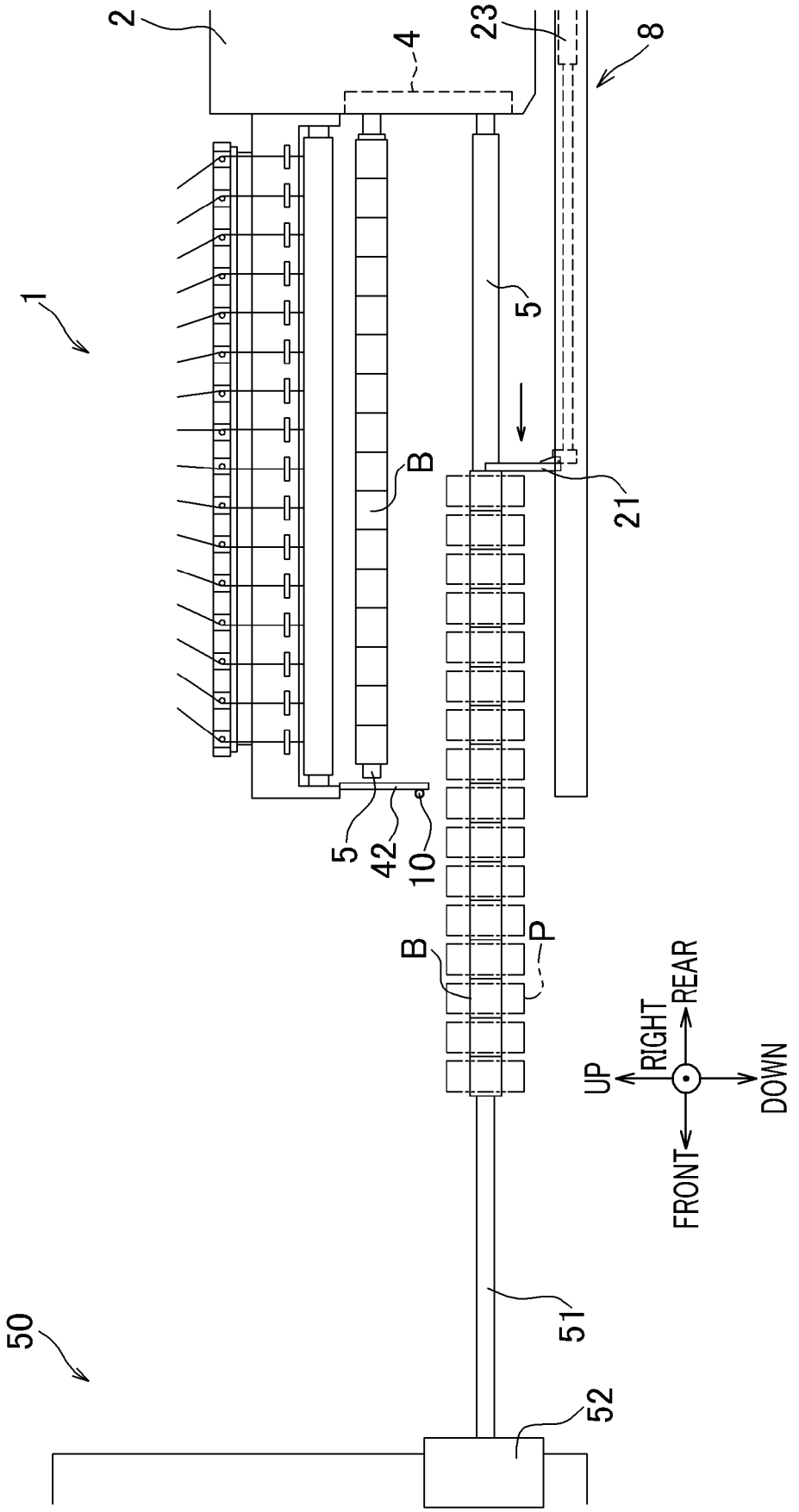


FIG.9

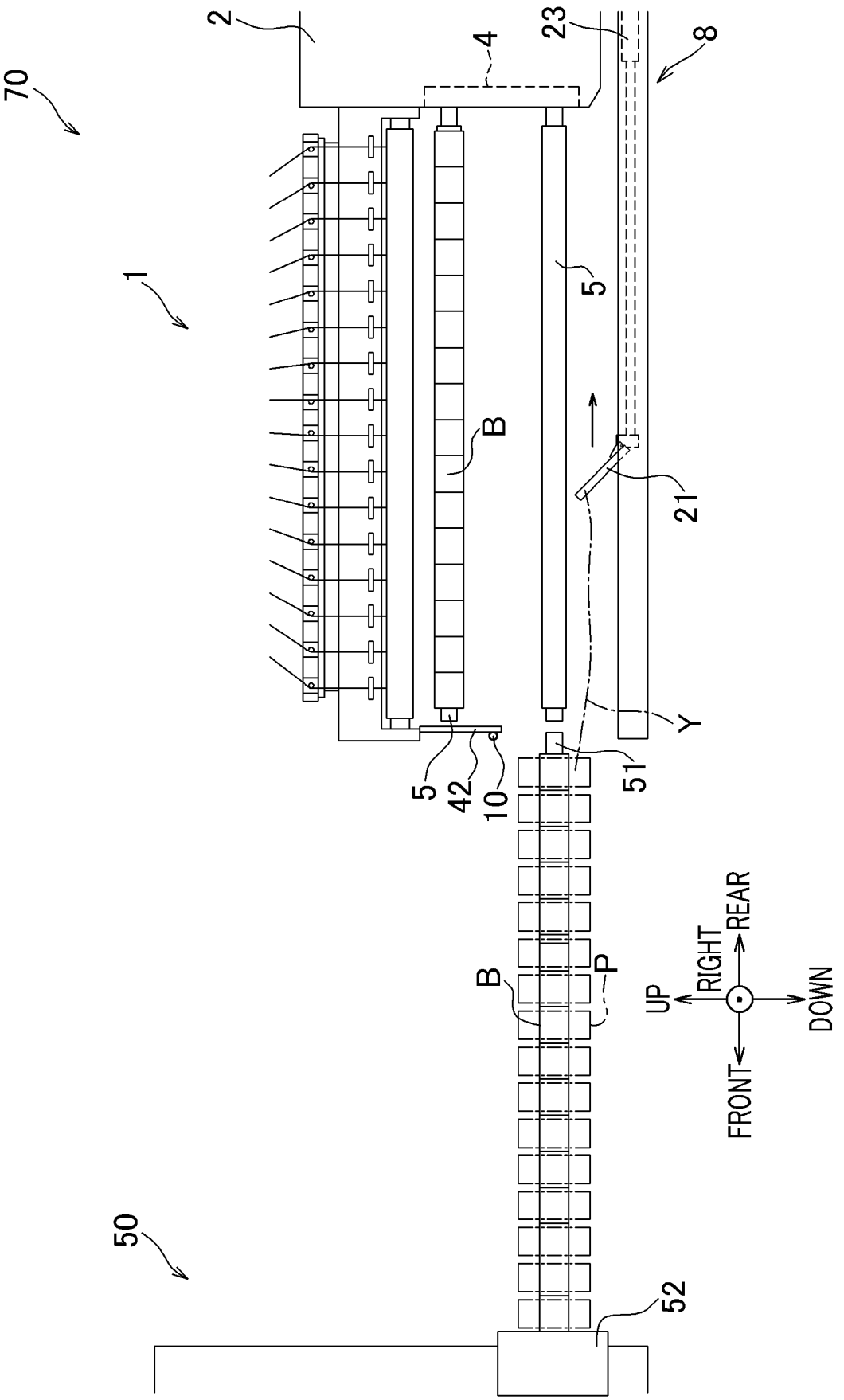


FIG.10

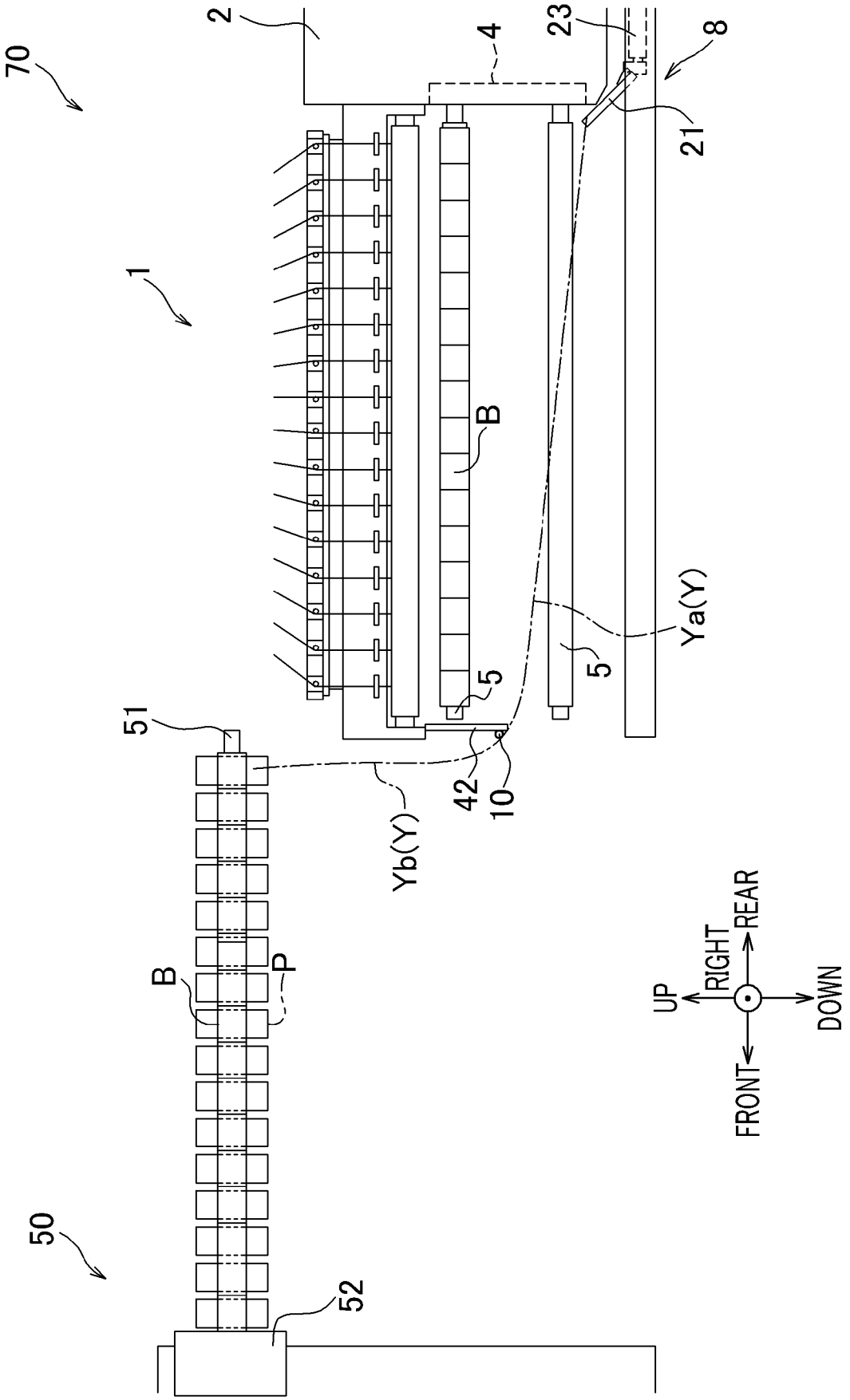

70
2
4
23
8
21
1
B
Ya(Y)
5
5
51
42
10
Yb(Y)
B
P
50
52
UP
RIGHT
REAR
DOWN
FRONT

FIG.11

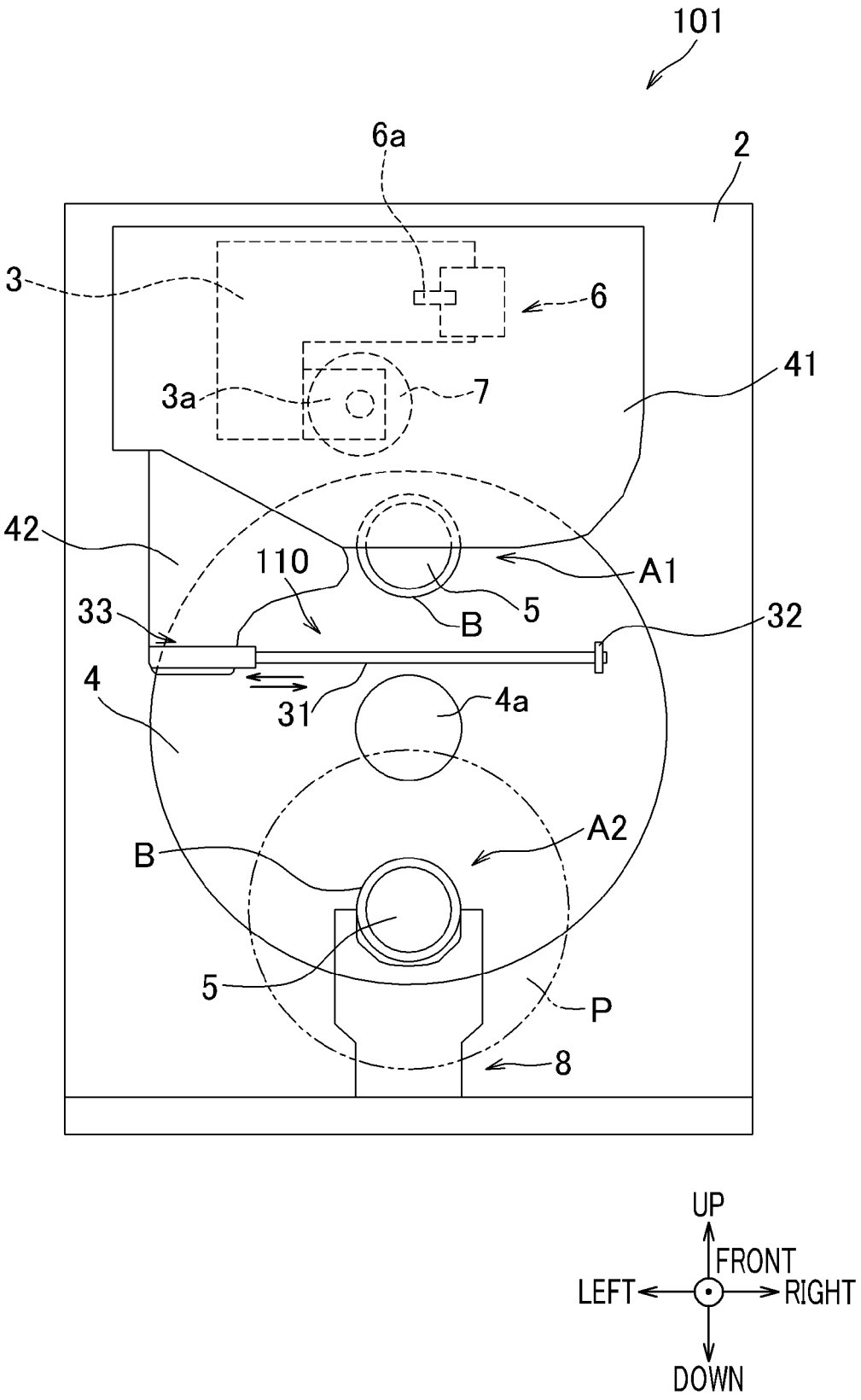

101
6a
2
3
6
41
3a
7
42
110
A1
5
B
33
32
4
31
4a
A2
B
5
P
8
UP
FRONT
LEFT
RIGHT
DOWN

FIG.12

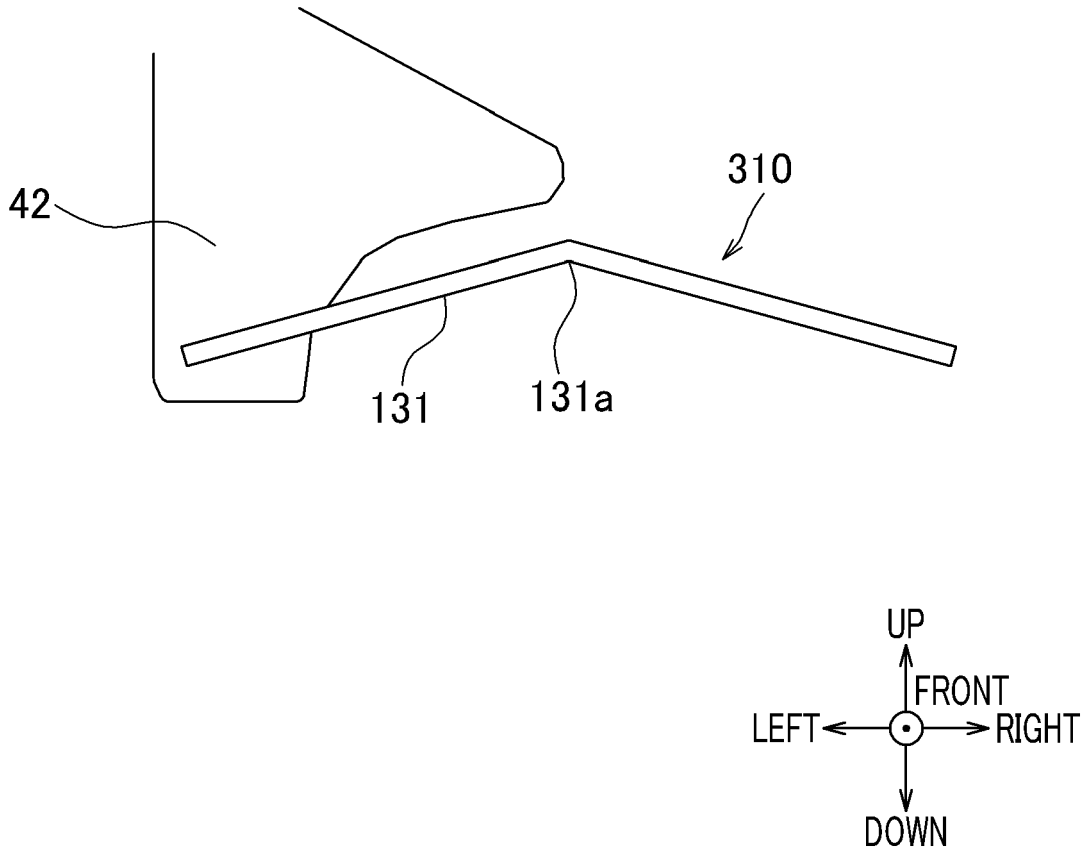
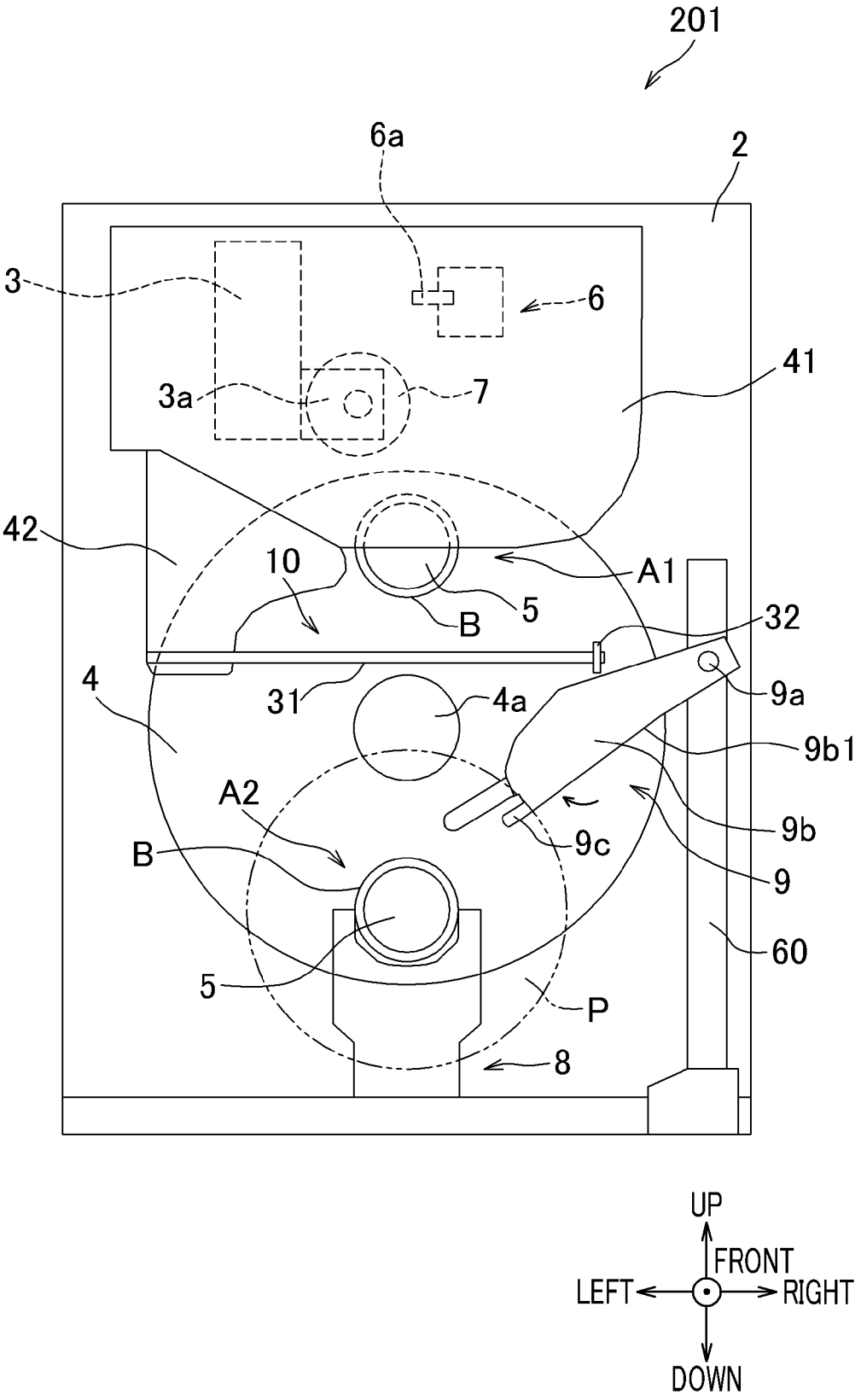


FIG.13


201
6a
2
3
6
41
3a
7
42
10
A1
B
5
32
4
31
4a
9a
9b1
A2
9b
B
9c
9
60
5
P
8
UP
FRONT
LEFT
RIGHT
DOWN

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# EUROPEAN SEARCH REPORT

Application Number
EP 24 17 2322

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| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 21 August 2024 | Lemmen, René |

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21-08-2024

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