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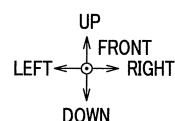
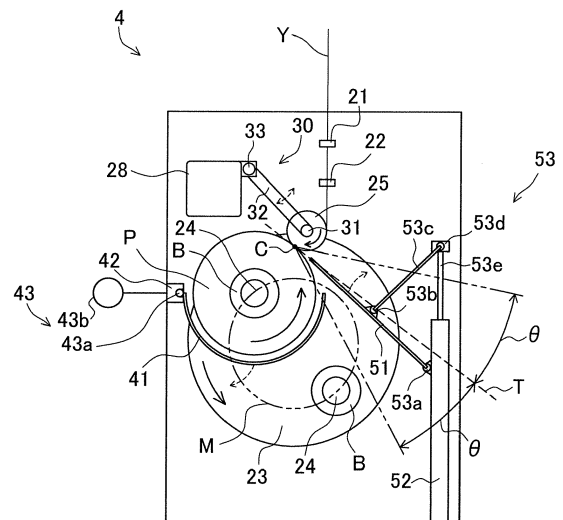
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(54) **YARN WINDER**

(57) An object of the present invention is to suppress air resistance applied to packages at the time of winding of yarns in a yarn winder including a bobbin holder to which plural bobbins are attached, so as to reduce power consumption.

A yarn winder 4 related to the present invention includes a bobbin holder 24 which is rotatably supported by the base 20, which extends along an axial direction which is along the horizontal direction, and to which bobbins B, which are capable of respectively winding yarns Y, are attached to be aligned in the axial direction, a contact roller 25 which extends in the direction of the axis and which makes contact with outer circumferential surfaces of packages P formed by winding the yarns Y onto the respective bobbins B, and a first cover member 41 which is provided in an area provided upstream of a contact point C in a rotational direction of each of the packages P and which guides air to gaps between the adjacent packages P. The contact point C is between the packages P and the contact roller 25. The air flows toward the contact point C in accordance with rotation of the packages P.

FIG.2



Description

BACKGROUND OF THE INVENTION

5 **[0001]** The present invention relates to a yarn winder configured to wind yarns.

[0002] Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2018-203472) discloses a yarn winder which is configured to wind yarns. As shown in FIG. 10, this yarn winder 104 includes bobbin holders 124 each of which is cantilevered by the base and extends in a horizontal direction, and plural bobbins B' which are attached to be aligned in an axial direction of each bobbin holder 124. The yarn winder 104 further includes a contact roller 125 configured to apply a contact pressure to plural packages P' formed by winding yarns Y onto the bobbins B. The yarn winder 104 is configured to wind yarns by rotating the bobbin holder 124. As the yarns are wound onto the bobbins B', the diameter of each package P is increased.

10 **[0003]** In the yarn winder 104 of Patent Literature 1, for example, when the bobbin holder 124 is rotated so as to wind the yarns Y, an accompanied flow F (airflow) is generated along the outer circumferential surface of each package P'. A part of this accompanied flow F is separated (separated air f shown in FIG. 10) from the outer circumferential surface of the package P' in accordance with the rotation of the package P', with the result that a part in which the density of air is low is provided. Then, toward the part in which the density of air is low, air is sucked from the space around the package P'. The air sucked at this stage is air resistance applied to the package P'. Because the air resistance applied to the package P' is transferred to a load when the bobbin holder 124 is rotated, power consumption is increased when
20 the yarns Y are wound.

[0004] For example, Patent Literature 2 (DE102016014977) recites a yarn winder provided with a shielding panel which extends in parallel to a direction, in which a winding spindle (bobbin holder) protrudes, and which is provided in a circumferential direction of a reel (package) formed by winding yarns onto a reel pipe (bobbin) attached to the winding spindle. In the shielding panel, an air guiding panel which extends along the circumferential direction of the reel is provided. By providing the shielding panel including the air guiding panel, the load caused by the accompanied flow is decreased.
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SUMMARY OF THE INVENTION

30 **[0005]** In Patent Literature 2, an accompanied flow caused by a rotating reel is separated by an air guiding panel included in a shielding panel, and guided in a circumferential direction of the reel. That is, in a yarn winder of Patent Literature 2, the shielding panel is provided in an area located on the downstream side in a reel rotating direction. Therefore, in the yarn winder of Patent Literature 2, separation of an accompanied flow from the outer circumferential surface of the package cannot be suppressed. In this regard, the accompanied flow flows toward the contact point
35 between a package (reel) and a pressing roller. Especially, as the diameter of the package and the area of the outer circumferential surface of the package are increased in accordance with yarn winding, air separated from the outer circumferential surface of the rotating package is also increased. Because of this, air resistance applied to the package is increased so that power consumption is further increased.

[0006] In order to increase the number of yarns which are simultaneously wound, these days a yarn winder is arranged so that the number of winding bobbins is increased. Power consumption is therefore large in the yarn winder in which
40 the number of winding bobbins is large, and hence the reduction of power consumption at the time of winding of yarns is highly required in the yarn winder structured as such.

[0007] An object of the present invention is to suppress increase in air resistance due to increase in diameter of a package in accordance with winding of yarns in a yarn winder including a bobbin holder to which plural bobbins are attached and to reduce power consumption.
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[0008] According to a first aspect of the invention, a yarn winder includes: a base; a bobbin holder which is rotatably supported by the base, which extends along an axial direction which is along the horizontal direction, and to which bobbins, which are capable of respectively winding yarns, are attached to be aligned in the axial direction; a contact roller which extends in the axial direction and which makes contact with outer circumferential surfaces of packages
50 formed by winding the yarns onto the respective bobbins; and a first cover member which is provided in at least a part of an area provided upstream of a contact point in a rotational direction of each of the packages and which is provided along a circumferential direction of each of the packages, and the contact point being between the packages and the contact roller.

[0009] According to the present invention, an accompanied flow is guided to the inner circumferential surface of the first cover member so as to flow along the outer circumferential surfaces of the packages toward the contact point. It is therefore possible to suppress the separation of air from the outer circumferential surfaces of the rotating packages. Because of this, the air resistance applied to the packages is suppressed at the time of winding of yarns, and hence the power consumption is reduced.
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[0010] According to a second aspect of the invention, the yarn winder of the first aspect is arranged such that at least a part of the first cover member is provided in an area surrounding lower halves in the vertical direction of entire circumferences of the packages.

[0011] Most of the accompanied flow flowing toward the contact point is separated in the area surrounding the lower halves of entire circumferences of the packages. According to the present invention, because the first cover member covers all of the lower half surfaces of the entire circumferences of the packages, suppression of the separation of the accompanied flow is further ensured.

[0012] According to a third aspect of the invention, the yarn winder of the second aspect is arranged such that the first cover member is provided along the circumferential direction to cover a range of up to 225 degrees from the contact point.

[0013] When the first cover member is provided to cover a wide range on the entire circumference of each of the packages, the weight of the entire yarn winder is increased. As a result, the yarn winder easily swings at the time of the winding of yarns. With this, the quality of packages may be deteriorated. According to the present invention, because the first cover member is provided along the circumferential direction of each of the packages to cover the range of up to 225 degrees from the contact point in the area provided upstream of the contact point in the rotational direction of each of the packages, increase in the weight of the yarn winder is suppressed while the separation of the accompanied flow flowing toward the contact point is suppressed. It is therefore possible to ensure the quality of packages while the power consumption is reduced.

[0014] According to a fourth aspect of the invention, the yarn winder of the second or third aspect is arranged such that the first cover member is provided in the area surrounding the lower halves in the vertical direction of the entire circumferences of the packages.

[0015] The first cover member may be warped downward by gravity, due to the vibration of the rotating packages. When the first cover member is provided in the area provided above the upper half surfaces, in the vertical direction, of the entire circumferences of the packages, the first cover member warped downward may make contact with the packages. According to the present invention, when the first cover member is provided in the area surrounding the lower halves in the vertical direction of the entire circumferences of the packages, the first cover member warped downward does not make contact with the packages. Because of this, the quality of packages is further ensured.

[0016] According to a fifth aspect of the invention, the yarn winder of any one of the first to fourth aspects further includes a second cover member which is provided upstream of the contact point in the rotational direction and provided downstream of the first cover member in the rotational direction, the second cover member guiding air, which flows toward the contact point in accordance with rotation of the packages, to gaps between the adjacent packages (P).

[0017] According to the present invention, by means of the second cover member, the accompanied flow flowing toward the contact point is guided to the gaps between the adjacent packages while avoiding separation from the outer circumferential surfaces of the packages. In this regard, the separation of the accompanied flow from the outer circumferential surfaces of the packages is caused due to the collision with the contact roller. It is therefore possible to further suppress the separation of the air from the outer circumferential surfaces of the rotating packages, and hence the power consumption is further reduced.

[0018] According to a sixth aspect of the invention, the yarn winder of the fifth aspect is arranged such that the second cover member is a flat plate provided to cover a range of up to 25 degrees from a tangent which passes the contact point and is centered at the contact point.

[0019] According to the present invention, the accompanied flow flowing toward the contact point is further certainly guided to the gaps between the adjacent packages, and hence the power consumption is further reduced.

[0020] According to a seventh aspect of the invention, the yarn winder of the fifth aspect is arranged such that the second cover member is provided along the circumferential direction of each of the packages.

[0021] According to the present invention, an amount of the accompanied flow which flows toward the contact point and which is sent to the gaps between adjacent packages is increased, and hence the power consumption is further reduced.

[0022] According to an eighth aspect of the invention, the yarn winder of any one of the first to seventh aspects is arranged such that the first cover member is provided along the circumferential direction to cover a range of 90 degrees or more.

[0023] According to the present invention, because the first cover member protects a wide range on the outer circumferential surfaces of the packages, the separation of the air from the outer circumferential surfaces of the rotating packages is further suppressed. As a result, the power consumption is further reduced.

[0024] According to a ninth aspect of the invention, the yarn winder of any one of the first to eighth aspects is arranged such that the diameter of the first cover member is variable along the outer circumferential surfaces of the packages in each of which the diameter is increased in accordance with winding of yarns.

[0025] In the present invention, the separation of the accompanied flow from the outer circumferential surfaces of the packages is suppressed from the start of the winding of yarns, and hence the power consumption is further reduced.

[0026] According to a tenth aspect of the invention, the yarn winder of any one of the fifth to ninth aspects is arranged

such that the first cover member and the second cover member extend along the axial direction and cover all of the gaps between the adjacent packages.

[0027] According to the present invention, the first cover member and the second cover member are provided along the axial direction without gaps. Because of this, it is possible to prevent the accompanied flow from passing through the gaps provided along the axial direction and being separated radially outward from the outer circumferential surfaces of the packages. It is therefore possible to further suppress the separation of the accompanied flow from the outer circumferential surfaces of the packages, and hence the power consumption is further reduced.

[0028] According to an eleventh aspect of the invention, the yarn winder of the tenth aspect is arranged such that both ends of each of the first cover member and the second cover member in the axial direction are provided outside outer ends of the outermost packages in the axial direction.

[0029] According to the present invention, the accompanied flow is prevented from being separated outward in the axial direction from the outer circumferential surfaces of packages provided at the both ends in the axial direction of the rotating packages. Because of this, the power consumption is further reduced.

[0030] According to a twelfth aspect of the invention, the yarn winder of any one of the fifth to eleventh aspects further includes a movement mechanism configured to cause the first cover member and the second cover member to retreat from a movement trace along which the bobbin holder moves between a yarn winding position and a standby position, and the bobbin holder being movable between the yarn winding position where the winding of yarns is performed and the standby position where the winding of yarns is not performed.

[0031] In the yarn winder including the two bobbin holders, the position of the bobbin holder at the yarn winding position and the position of the bobbin holder at the standby position are switched from one another each time the winding of yarns onto the bobbins attached to the bobbin holder is completed. In the present invention, by causing the first cover member and the second cover member to retreat from the movement trace, switching of the positions of the bobbin holders is smoothly performed.

[0032] According to a thirteenth aspect of the invention, the yarn winder of the twelfth aspect is arranged such that the first cover member and the second cover member are formed to be independent from one another.

[0033] When the first cover member and the second cover member are formed to be independent from one another as described in the present invention, a space required to move the first cover member and the second cover member away from the movement trace is small as compared to cases where the first cover member and the second cover member are integrally formed. Because of this, increase in size of the entire yarn winder is suppressed.

[0034] According to a fourteenth aspect of the invention, the yarn winder of any one of the fifth to twelfth aspects is arranged such that the first cover member and the second cover member are integrally formed.

[0035] In the present invention, the accompanied flow is prevented from passing through the gap between the first cover member and the second cover member and from being separated from the outer circumferential surfaces of the packages. As a result, the air resistance is further decreased. Because of this, the power consumption is further reduced.

[0036] It is possible to suppress increase in air resistance due to increase in diameter of a package in accordance with winding of yarns in a yarn winder including a bobbin holder to which plural bobbins are attached and to reduce power consumption.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037]

FIG. 1 is a profile of a take-up apparatus including a yarn winder of an embodiment.

FIG. 2 is a front view of the yarn winder.

FIG. 3 is a front view showing a part of the yarn winder, for explaining an accompanied flow which flows along the outer circumferential surface of each package by means of a first cover member.

FIG. 4 is a perspective view showing a part of the yarn winder, for explaining the accompanied flow which is guided toward gaps between the adjacent packages by a second cover member.

FIG. 5 is a front view of the yarn winder in a state in which the first cover member and the second cover member are moved away from a movement trace of bobbin holders.

FIG. 6 is a front view of a yarn winder related to a first modification.

FIG. 7 is a front view of the yarn winder related to the first modification in a state in which the diameter of each package is increased.

FIG. 8 is a front view of a yarn winder related to a second modification.

FIG. 9 is a front view of a yarn winder related to a comparative example 3.

FIG. 10 is a front view of a conventional yarn winder, for explaining an accompanied flow separated from the outer circumferential surface of each package.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Overall Structure of Take-Up Apparatus 1)

[0038] The following will describe a preferred embodiment of the present invention with reference to figures. FIG. 1 is a profile of a take-up apparatus 1 including a yarn winder 4 of an embodiment. Hereinafter, an up-down direction and a front-rear direction shown in FIG. 1 will be referred to as an up-down direction and a front-rear direction. Furthermore, the direction orthogonal to FIG. 1 will be referred to as a left-right direction. In this regard, the side close to the viewer will be referred to as a right direction, and the side far from the viewer will be referred to as a left direction. A first cover member 41 and a second cover member 51 which are described later are not shown in FIG. 1.

[0039] The take-up apparatus 1 includes a first godet roller 8, a second godet roller 9, and a yarn regulating guide 7 for taking up yarns Y spun out from a spinning apparatus 3, and a yarn winder 4 configured to form packages P by winding the taken-up yarns Y onto bobbins B.

[0040] The first godet roller 8 is a roller which has an axis substantially in parallel to the left-right direction and which is provided above a front end portion of the yarn winder 4. The first godet roller 8 is rotationally driven by an unillustrated motor. The second godet roller 9 is a roller which has an axis substantially in parallel to the left-right direction and which is provided above and rearward of the first godet roller 8. The second godet roller 9 is rotationally driven by an unillustrated motor.

[0041] The yarn regulating guide 7 is provided above the first godet roller 8. The yarn regulating guide 7 is, for example, a known yarn guide with a comb teeth shape. When the yarns Y are threaded thereon, the yarn regulating guide 7 regulates the interval between neighboring yarns Y to a predetermined value.

(Yarn Winder 4)

[0042] The following will describe the yarn winder 4 with reference to FIG. 1 to FIG. 2. FIG. 2 is a front view of the yarn winder 4. The yarn winder 4 includes members such as: a base 20; fulcrum guides 21; traverse guides 22; a turret 23; two bobbin holders 24; a contact roller 25; and a controlling unit 26.

[0043] As shown in FIG. 1, the base 20 includes a base main body 27 which stands up from a rear portion of the yarn winder 4, and a frame 28 which is fixed to an upper portion of the base main body 27 and which extends forward. In the present embodiment, a combination of the base main body 27 and the frame 28 is equivalent to a base of the present invention. The base main body 27 supports the turret 23 or the like. The frame 28 supports the contact roller 25 which extends along the front-rear direction.

[0044] The fulcrum guides 21 are provided for the yarns Y, respectively, and are aligned in the front-rear direction. The fulcrum guides 21 are attached to a guide supporting member 29 supported by the frame 28. As the yarns Y are threaded, the fulcrum guides 21 function as fulcrums when the yarns Y are traversed.

[0045] The traverse guides 22 are provided for the yarns Y, respectively, and are aligned in the front-rear direction. The traverse guides 22 are driven by a traverse motor (not illustrated), and are configured to reciprocate in the front-rear direction. With this, the yarns Y threaded onto the traverse guides 22 are traversed about the fulcrum guides 21.

[0046] The turret 23 is a disc-shaped member having an axis substantially in parallel to the front-rear direction, and is rotatably supported by the base main body 27. The turret 23 is rotationally driven by a turret motor which is not illustrated. The turret 23 cantilevers two bobbin holders 24, and rotates about a rotation shaft substantially in parallel to the front-rear direction so as to move the two bobbin holders 24. Because of this, in the yarn winder 4, the position of the bobbin holder 24 located at a yarn winding position (upper position shown in FIG. 1) where winding of yarns Y is performed and the position of the bobbin holder 24 located at a standby position (lower position shown in FIG. 1) where the winding of yarns Y is not performed can be switched from one another. While the yarns Y are wound onto the bobbins B attached to the bobbin holder 24 located at the yarn winding position, the switching of bobbins B can be performed for the bobbin holder 24 located at the standby position. Furthermore, the turret 23 is arranged (see a solid arrow in FIG. 2) to be rotatable at the time of the winding of yarns Y onto the bobbins B in accordance with increase in amount of the wound yarns Y.

[0047] To each of the two bobbin holders 24, bobbins B are attached. The two bobbin holders 24 are rotatably supported at an upper end portion and a lower end portion of the turret 23 supported by the base main body 27, respectively, and protrude forward from the turret 23. To put it differently, the two bobbin holders 24 are cantilevered by the base main body 27 which is provided on the rear side. The axes of the two bobbin holders 24 are substantially in parallel to the front-rear direction. The leading end side (front portion) of the bobbin holder 24 is typically a working side where operations such as attaching the bobbins B to the bobbin holder 24 are performed.

[0048] The bobbins B are attached to each bobbin holder 24. The bobbins B are respectively provided for the yarns Y, and lined up in the front-rear direction. The number of the bobbins B attached to one bobbin holder 24 is, for example, 16. The two bobbin holders 24 are rotationally driven by their respective winding motors (not illustrated). In the present

embodiment, a direction in which the bobbin holder 24 rotates is an anticlockwise direction in FIG. 2.

[0049] The contact roller 25 is a roller which has an axis substantially in parallel to the front-rear direction and which is provided immediately above the upper bobbin holder 24. The contact roller 25 is configured to make contact with the outer circumferential surfaces of the packages P which are formed by winding the yarns Y onto the bobbins B attached to the upper bobbin holder 24. With this, the contact roller 25 applies a contact pressure to the surfaces of the unfinished packages P, to adjust the shape of each package P.

[0050] In the present embodiment, the contact roller 25 is swingably supported by the frame 28 via a roller supporting member 30. As shown in FIG. 1 and FIG. 2, the roller supporting member 30 includes, for example, a supporting portion 31, an arm portion 32, and a swing axis 33. The supporting portion 31 rotatably supports the contact roller 25 at the respective end portions of the contact roller 25 in the front-rear direction. The arm portion 32 has one end portion connected to the supporting portion 31, and extends toward the frame 28 in the direction orthogonal to the front-rear direction. The swing axis 33 is connected to the other end portion of the arm portion 32 and extends along the front-rear direction, and is swingably supported by the frame 28.

[0051] The controlling unit 26 includes members such as a CPU, a ROM, and a RAM. The controlling unit 26 is configured to control members by the CPU, based on a program stored in the ROM. To be more specific, the controlling unit 26 is configured to control members such as a turret motor (not illustrated), a traverse motor (not illustrated), a winding motor (not illustrated), and a first movement mechanism 43 and a second movement mechanism 53 which are described later.

[0052] In the yarn winder 4 structured as described above, when the upper bobbin holder 24 is rotationally driven, the yarns Y traversed by the traverse guides 22 are wound onto the bobbins B. As a result, the packages P are formed. At this stage, the packages P rotate with the rotating bobbin holder 24. In other words, the direction in which the packages P rotate is the same as the direction in which the bobbin holder 24 rotates, i.e., the anticlockwise direction (see a solid arrow in FIG. 2) in FIG. 2. While the packages P are being formed, the shape of each package P is adjusted in such a way that the contact roller 25 makes contact with the outer circumferential surfaces of the packages P and applies a contact pressure. The contact roller 25 rotates (see a solid arrow in FIG. 2) in the direction opposite to the rotational direction of the bobbin holder 24, i.e., rotates in a clockwise direction in FIG. 2. In the present embodiment, when the yarns Y are wound onto the bobbins B, the yarns Y making contact with the right side part of the contact roller 25 are sent, along the circumferential direction of the contact roller 25, to the downstream side in the rotational direction of the contact roller 25. Subsequently, the yarns Y pass a contact point C, and are sent to the downstream side in the rotational direction of the bobbin holder 24 along the circumferential direction of each bobbin B (or package P having been already formed around the bobbin B) attached to the bobbin holder 24.

[0053] In this connection, when the bobbin holder 24 is rotated in order to wind the yarns Y, an airflow (accompanied flow) is generated along the outer circumferential surface of each package P. As described above, for example, in the yarn winder 104 of Patent Literature 1, a part of the accompanied flow F (see dashed line arrows in FIG. 10) caused by the rotation of the bobbin holder 124 is separated (separated air f) from the outer circumferential surface of each package P' by the rotation of each package P'. Especially, as the diameter of each package P' is increased by the winding of the yarns Y onto the bobbins B', an amount of the part of the accompanied flow F, i.e., a separated air f is increased. In this regard, the part of the accompanied flow F is detached from the outer circumferential surface of the package P' as the separated air f. The air resistance applied to the package P' is therefore increased in accordance with the increase of the separated air f, with the result that the power consumption required to rotate the bobbin holder 124 is also increased.

[0054] In order to suppress the separation of the accompanied flow F from the outer circumferential surface of each package P, the yarn winder 4 of the present embodiment includes the first cover member 41 and the second cover member 51. The following explanation is given with reference to FIG. 2 to FIG. 4. FIG. 4 is a perspective view showing the bobbin holder 24 at the yarn winding position (upper position in FIG. 1).

(First Cover Member 41)

[0055] The first cover member 41 is provided to suppress the separation of the accompanied flow F (see dashed line arrows in FIG. 3) from the outer circumferential surfaces of the packages P. In the area surrounding the lower half of each package P in the up-down direction (vertical direction of the present invention), as shown in FIG. 2, the first cover member 41 is provided along the circumferential direction of each package P to cover a range of up to 180 degrees. The first cover member 41 extends along the front-rear direction, and is provided to cover all of the gaps between the adjacent packages P. The base end portion (provided on the left side in FIG. 2) of the first cover member 41 is supported by a cover supporter 42 extending in the front-rear direction, via a base end supporting portion 43a described later.

[0056] When the accompanied flow F is separated from the outer circumferential surface of the package P, the amount of this accompanied flow F which is about to be separated is increased as the diameter of each package P increases. This amount of the accompanied flow F which is about to be separated is maximum when the diameter of the package P is maximum. In order to effectively reduce the power consumption, it is therefore preferable that, when the diameter

of the package P is maximum, the separation of the accompanied flow F from the outer circumferential surface of the package P is suppressed by moving the first cover member 41 close to both the outer circumferential surface of the package P and the contact point C. Meanwhile, when the distance between the inner circumferential surface of the first cover member 41 and the outer circumferential surface of each package P is too short, the first cover member 41 tends to disadvantageously make contact with the packages P. In the present embodiment, the first cover member 41 is provided along the circumferential direction of each package P when the diameter of the package P is maximum. In addition to that, when the diameter of the package P is maximum, the distance between the inner circumferential surface of the first cover member 41 and the outer circumferential surface of the package P is 10 to 60 mm. In this regard, "when the diameter of the package P is maximum" indicates that the winding of yarns Y onto bobbins B attached to the bobbin holder 24 is completed and therefore the formation of each package P is completed.

(Second Cover Member 51)

[0057] The second cover member 51 is a flat plate provided to guide an accompanied flow F (see dashed line arrows in FIG. 4) toward the gaps between the adjacent packages P. In this regard, the accompanied flow F flows toward the contact point C in accordance with the rotation of each package P. As shown in FIG. 2, the second cover member 51 is provided in the area provided upstream of the contact point C and provided in the area provided downstream of the first cover member 41 in the rotational direction of the package P. That is, in the present embodiment, the second cover member 51 is provided to the right of and below the contact point C and provided above the tip of the first cover member 41. The base end portion (provided on the right side in FIG. 2) of the second cover member 51 is supported by a supporting wall member 52 extending in the front-rear direction, via a base end supporting portion 53a described later. The leading end portion (provided on the left side in FIG. 2) of the second cover member 51 extends toward the contact point C from the supporting wall member 52. The second cover member 51 is provided so that an angle θ formed between the second cover member 51 and a tangent T which passes through the contact point C and is centered at the contact point C is within a range of up to 25 degrees. The second cover member 51 extends along the front-rear direction, and is provided to cover all of the gaps between the adjacent packages P.

[0058] Because of the above-described reason, in order to effectively reduce the power consumption, it is preferable that, when the diameter of the package P is maximum, the separation of the accompanied flow F from the outer circumferential surface of the package P is suppressed by moving the second cover member 51 close to the outer circumferential surface of the package P. Meanwhile, when the distance between the leading end portion of the second cover member 51 and the outer circumferential surface of each package P and the distance between the leading end portion of the second cover member 51 and the contact point C are too short, the second cover member 51 tends to disadvantageously make contact with the packages P. In the present embodiment, when the diameter of the package P is maximum, the second cover member 51 is provided upstream of the contact point C in the rotational direction of the package P and provided downstream of the first cover member 41 in the rotational direction of the package P. In addition to that, when the diameter of the package P is maximum, the distance between the leading end portion of the second cover member 51 and the outer circumferential surfaces of the packages P is 3 to 10 mm and the distance between the leading end portion of the second cover member 51 and the contact point C is 60 to 140 mm.

[0059] While the first cover member 41 and the second cover member 51 may be made of any material, aluminum is preferable in order to reduce the weights of the first cover member 41 and the second cover member 51. In this regard, resin is further preferable. The first cover member 41 and the second cover member 51 may be made of another type of metal.

(Movement Mechanism)

[0060] As described above, in the yarn winder 4, as the turret 23 rotates about the rotation shaft substantially in parallel to the front-rear direction, the position of the bobbin holder 24 at the yarn winding position and the position of the bobbin holder 24 at the standby position can be switched from one another. In this regard, when the first cover member 41 and the second cover member 51 are on a movement trace M along which the bobbin holders 24 move between the yarn winding position and the standby position, the first cover member 41 and the second cover member 51 obstruct the switching of the positions of the bobbin holders 24. In the present embodiment, the yarn winder 4 includes the first movement mechanism 43 configured to cause the first cover member 41 to retreat from the movement trace M and the second movement mechanism 53 configured to cause the second cover member 51 to retreat from the movement trace M. In the present embodiment, the first movement mechanism 43 and the second movement mechanism 53 are equivalent to a movement mechanism of the present invention.

[0061] The first movement mechanism 43 includes, e.g., the base end supporting portion 43a and a cover motor 43b. The base end supporting portion 43a is fixed to the cover supporter 42, and supports the base end portion of the first cover member 41. The base end supporting portion 43a is rotationally driven about an axis parallel to the front-rear

direction, by the cover motor 43b.

[0062] In the present embodiment, when the first movement mechanism 43 causes the first cover member 41 to retreat from the movement trace M along which the bobbin holders 24 move between the yarn winding position and the standby position, the base end supporting portion 43a is rotationally driven by the cover motor 43b. As a result, the first cover member 41 supported by the base end supporting portion 43a rotates (see a dashed line arrow in FIG. 2) about the base end supporting portion 43a in the same direction as the rotational direction of the base end supporting portion 43a. Because of this, as shown in FIG. 5, the first cover member 41 moves toward the left side in FIG. 5. As such, the first movement mechanism 43 causes the first cover member 41 to retreat from the movement trace M along which the bobbin holders 24 move between the yarn winding position and the standby position.

[0063] The second movement mechanism 53 includes, e.g., the base end supporting portion 53a, a central supporting portion 53b, an arm member 53c, an intervention portion 53d, and a cylinder 53e. The base end supporting portion 53a is fixed to the supporting wall member 52, and rotatably supports the base end portion of the second cover member 51. The central supporting portion 53b rotatably supports the second cover member 51 at a substantially central part of the second cover member 51. The arm member 53c is a rod shaped member having one end portion which is on the left side in FIG. 2 and which is connected to the central supporting portion 53b and the other end portion which is on the right side in FIG. 2 and which is connected to the intervention portion 53d. The intervention portion 53d rotatably supports the other end portion of the arm member 53c, and is provided at the leading end of the cylinder 53e. For example, the cylinder 53e is an air cylinder which is provided in the vicinity of the central, in the front-rear direction, of the supporting wall member 52 and which moves in the up-down direction by means of the supply and discharge of compressed air.

[0064] In the present embodiment, when the second movement mechanism 53 causes the second cover member 51 to retreat from the movement trace M along which the bobbin holders 24 move between the yarn winding position and the standby position, to begin with, the cylinder 53e moves upward. As a result, the other end portion of the arm member 53c rotatably supported via the intervention portion 53d moves upward, and the one end portion of the arm member 53c moves rightward and upward. The movement of the one end portion of the arm member 53c brings about the rightward and upward movement of the central supporting portion 53b. Subsequently, the second cover member 51 rotates (see a dashed line arrow in FIG. 2) about its base end portion rotatably supported by the base end supporting portion 53a so that the leading end portion of the second cover member 51 moves rightward and upward. Because of this, an angle formed between an extending direction of the second cover member 51 and the up-down direction is decreased. That is, the second cover member 51 stands up as shown in FIG. 5. In the extending direction of the second cover member 51, the second cover member 51 extends from its base end portion to its leading end portion. As such, the second movement mechanism 53 causes the second cover member 51 to retreat from the movement trace M along which the bobbin holders 24 move between the yarn winding position and the standby position.

(Advantageous Effects)

[0065] The yarn winder 4 of the present embodiment includes the bobbin holders 24 to each of which the bobbins B are attached to be aligned in the axial direction, the contact roller 25 configured to make contact with the outer circumferential surfaces of the packages P formed by winding the yarns Y onto the respective bobbins B, and the first cover member 41 which is provided in at least a part of the area provided upstream of the contact point C in the rotational direction of each package P and which is provided along the circumferential direction of each package P. In this regard, the contact point C is between the packages P and the contact roller 25. In this regard, "the area provided upstream of the contact point C" indicates that the area is provided upstream of the contact point C in the rotational direction of each package P, i.e., provided along the circumferential direction of each package P to cover a range of up to 180 degrees in the clockwise direction from the contact point C in FIG. 2. According to the present embodiment, the accompanied flow F is guided to the inner circumferential surface of the first cover member 41 so as to flow along the outer circumferential surfaces of the packages P toward the contact point C. It is therefore possible to suppress the separation of air from the outer circumferential surfaces of the rotating packages P. Because of this, the air resistance applied to the packages P is suppressed at the time of the winding of yarns Y, and hence the power consumption is reduced.

[0066] In the yarn winder 4 of the present embodiment, the first cover member 41 is provided in the area surrounding the lower halves of the entire circumferences of the packages P in the up-down direction. Most of the accompanied flow F flowing toward the contact point C is separated in the area surrounding the lower halves of the entire circumferences of the packages P. According to the present embodiment, because the first cover member 41 covers all of the lower half surfaces of the entire circumferences of the packages P, suppression of the separation of the accompanied flow F is further ensured. The first cover member 41 may be warped downward in which the gravity acts due to vibration of the rotating packages P. When the first cover member 41 is provided in the area surrounding the upper half of the entire circumference of each package P in the up-down direction, the first cover member 41 warped downward may make contact with the packages P. According to the present embodiment, because the first cover member 41 is provided in the area surrounding the lower half of the entire circumference of each package P, the first cover member 41 warped

downward does not make contact with the packages P. Because of this, the quality of packages P is further ensured.

[0067] In the yarn winder 4 of the present embodiment, the first cover member 41 is provided along the circumferential direction of each package P to cover a range of up to 225 degrees from the contact point C. When the first cover member 41 is provided to cover a wide range on the entire circumference of each package P, the weight of the entire yarn winder 4 is increased. As a result, the yarn winder 4 easily swings at the time of the winding of yarns Y. With this, the quality of packages P may be deteriorated. According to the present embodiment, because the first cover member 41 is provided along the circumferential direction of the package P to cover the range of up to 225 degrees from the contact point C in the area provided upstream of the contact point C in the rotational direction of the package P, increase in the weight of the yarn winder 4 is suppressed while the separation of the accompanied flow flowing toward the contact point C is suppressed. It is therefore possible to ensure the quality of packages P while the power consumption is reduced.

[0068] The yarn winder 4 of the present embodiment further includes the second cover member 51 which is provided upstream of the contact point C and downstream of the first cover member 41 in the rotational direction of each package P and which is configured to guide the air to the gaps between the adjacent packages P. In this regard, the air flows toward the contact point C in accordance with the rotation of each package P. According to the present embodiment, by means of the second cover member 51, the accompanied flow F flowing toward the contact point C is guided to the gaps between the adjacent packages P while avoiding separation from the outer circumferential surfaces of the packages P. In this regard, the separation of the accompanied flow F from the outer circumferential surfaces of the packages P is caused due to the collision with the contact roller 25. It is therefore possible to further suppress the separation of the air from the outer circumferential surfaces of the rotating packages P, and hence the power consumption is further reduced.

[0069] In the yarn winder 4 of the present embodiment, the second cover member 51 is a flat plate provided to cover the range of up to 25 degrees from the tangent T which passes the contact point C and is centered at the contact point C. When the flat plate-shaped second cover member 51 is provided to cover a larger range than the range of up to 25 degrees from the tangent T which passes the contact point C and is centered at the contact point C, most of the accompanied flow F may be deviated to the contact roller 25 or be not properly guided, by the second cover member 51, to the gaps between the adjacent packages P. According to the present embodiment, the accompanied flow F flowing toward the contact point C is further certainly guided to the gaps between the adjacent packages P, and hence the power consumption is further reduced.

[0070] In the yarn winder 4 of the present embodiment, the first cover member 41 is provided along the circumferential direction of each package P to cover a range of 90 degrees or more. According to the present embodiment, because the first cover member 41 protects a wide range on the outer circumferential surfaces of the packages P, the separation of the accompanied flow F from the outer circumferential surfaces of the rotating packages P is further suppressed. As a result, the power consumption is further reduced.

[0071] In the yarn winder 4 of the present embodiment, the first cover member 41 and the second cover member 51 extend along the axial direction of the bobbin holder 24, and cover all of the gaps between the adjacent packages P. According to the present embodiment, the first cover member 41 and the second cover member 51 are provided along the axial direction of the bobbin holder 24 without gaps. Because of this, it is possible to prevent the accompanied flow F from passing through the gaps provided along the axial direction of the bobbin holder 24 and being separated radially outward from the outer circumferential surfaces of the packages P. It is therefore possible to further suppress the separation of the accompanied flow F from the outer circumferential surfaces of the packages P, and hence the power consumption is further reduced.

[0072] In the yarn winder 4 of the present embodiment, the both ends of each of the first cover member 41 and the second cover member 51 in the axial direction of the bobbin holder 24 are provided outside outer end portions of the outermost packages P in the axial direction of the packages P. According to the present embodiment, the accompanied flow F is prevented from being separated outward in the axial direction of the bobbin holder 24 from the outer circumferential surfaces of packages P provided at the both end portions in the axial direction of the rotating packages P. Because of this, the power consumption is further reduced.

[0073] The yarn winder 4 of the present embodiment is arranged such that the bobbin holders 24 are movable between the yarn winding position where the winding of yarns Y is performed and the standby position where the winding of yarns Y is not performed, and includes the first movement mechanism 43 and the second movement mechanism 53 which respectively cause the first cover member 41 and the second cover member 51 to retreat from the movement trace M along which the bobbin holders 24 move between the yarn winding position and the standby position. In the yarn winder 4 including the two bobbin holders 24, the position of the bobbin holder 24 at the yarn winding position and the position of the bobbin holder 24 at the standby position are switched from one another each time the winding of the yarns Y onto the bobbins B attached to each bobbin holder 24 is completed. At this stage, by causing the first cover member 41 and the second cover member 51 to retreat from the movement trace M, the switching of the positions of the bobbin holders 24 is smoothly performed.

[0074] In the yarn winder 4 of the present embodiment, the first cover member 41 and the second cover member 51 are formed to be independent from one another. Assume that the first cover member 41 and the second cover member

51 are formed to be independent from one another as described in the present embodiment. In this case, when the first cover member 41 and the second cover member 51 are moved away from the movement trace M, the movement of these is performed in small space as compared to cases where the first cover member 41 and the second cover member 51 are integrally formed. Because of this, increase in size of the entire yarn winder 4 is suppressed.

[0075] A preferred embodiment of the present invention has been described. It should be noted that the present invention is not limited to the above-described embodiment, and various changes, substitutions, and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims. The following will describe modifications of the above-described embodiment. The members identical with those in the embodiment above will be denoted by the same reference numerals and the explanations thereof are not repeated.

(First Modification)

[0076] In the embodiment above, the first cover member 41 is provided along the circumferential direction of each package P when the diameter of the package P is maximum. Alternatively, the diameter of the first cover member 41 may be variable along the outer circumferential surfaces of the packages P in each of which the diameter is increased as the yarns Y are wound. As shown in FIG. 6 and FIG. 7, for example, a yarn winder 74 of a first modification includes a first diameter expanding mechanism 82 and a second diameter expanding mechanism 83 which are configured to change the diameter of a first cover member 81. The first cover member 81 is made of a material having flexibility, such as fabric used for tents and rubber of which sheets are made. The first diameter expanding mechanism 82 includes a base end supporting portion 82a, a first arm member 82b, a first arm supporting portion 82c, and a first guide 82d. The base end supporting portion 82a includes a winding axis 86 extending in the front-rear direction, and a part of the first cover member 81 is housed in the base end portion 82a in such a way that the first cover member 81 is wound onto the winding axis 86 by a predetermined length from the base end portion (provided on the left side in FIG. 6) of the first cover member 81. The winding axis 86 is rotationally driven by an unillustrated motor so that the first cover member 81 wound onto the winding axis 86 is sent out or wound. Because of this, the first cover member 81 is extendable and contractible along the circumferential direction of each package P. The first arm member 82b is a rod shaped member having one end portion which is on the upper side in FIG. 6 and which is connected to the base end supporting portion 82a and the other end portion which is on the lower side in FIG. 6 and which is connected to the first arm supporting portion 82c. The first arm supporting portion 82c supports the other end portion of the first arm member 82b, and is fixed to the upper surface of the first guide 82d provided below the first arm supporting portion 82c. The first guide 82d is configured to be movable integrally with the base end supporting portion 82a, the first arm member 82b, and the first arm supporting portion 82c along a rail 84 provided below the first guide 82d in the left-right direction. The first guide 82d is formed of, e.g., a linear guide, a ball screw, and a motor which are not illustrated.

[0077] The second diameter expanding mechanism 83 includes a leading end supporting portion 83a, a second arm member 83b, a second arm supporting portion 83c, and a second guide 83d. The leading end supporting portion 83a supports the leading end (provided on the right in FIG. 6) of the first cover member 81. The second arm member 83b is a rod shaped member having one end portion which is on the upper side in FIG. 6 and which is connected to the leading end supporting portion 83a and the other end portion which is on the lower side in FIG. 6 and which is connected to the second arm supporting portion 83c. The second arm member 83b includes, e.g., a linear guide and a motor, and is configured to be extendable and contractible in a direction (see a dashed line arrow in FIG. 7) in which the second arm member 83b extends. The second arm supporting portion 83c rotatably supports the other end portion of the second arm member 83b, and is fixed to the upper surface of the second guide 83d provided below the second arm supporting portion 83c. The second arm supporting portion 83c includes a motor (not illustrated) such as a servo motor and a stepping motor. The second arm supporting portion 83c causes, by an unillustrated motor, the second arm member 83b to be rotationally driven about the second arm supporting portion 83c only by a predetermined angle. The second guide 83d is configured to be movable integrally with the leading end supporting portion 83a, the second arm member 83b, and the second arm supporting portion 83c along a rail 85 provided below the second guide 83d in the left-right direction. The second guide 83d is formed of, e.g., a linear guide, a ball screw, and a motor which are not illustrated. In this regard, the first guide 82d and the second guide 83d may be formed of a linear guide and a cylinder.

[0078] The controlling unit 26 controls a motor (not illustrated) provided for rotationally driving the winding axis 86, a motor (not illustrated) provided for moving the first guide 82d, a motor (not illustrated) provided for causing the second arm member 83b to extend and contract, a motor (not illustrated) of the second arm supporting portion 83c, and a motor (not illustrated) provided for moving the second guide 83d. As shown in FIG. 7, in accordance with the winding of yarns Y, the controlling unit 26 moves the first diameter expanding mechanism 82 and the second movement mechanism 83 so as to increase the diameter of the first cover member 81 and so as to correspond to variation of the position of the outer circumferential surface of each package P. The variation is caused due to the increase of the diameter of each package P and the rotation of the turret (see solid arrows in FIG. 6 and FIG. 7). To be more specific, the controlling unit 26 causes the first guide 82d to move leftward (see a dashed line arrow in FIG. 7) and causes the second guide 83d to

move rightward (see a dashed line arrow in FIG. 7) so as to correspond to the variation of the position of the outer circumferential surface of the package P. Subsequently, the controlling unit 26 causes (see a dashed line arrow in FIG. 7) the second arm member 83b to rotate about the second arm supporting portion 83c by a predetermined angle and causes (see a dashed line arrow in FIG. 7) the second arm member 83b to contract so as to correspond to the variation of the position of the outer circumferential surface of the package P. At this stage, the controlling unit 26 rotationally drives the winding axis 86 of the base end supporting portion 82a so that the first cover member 81 wound onto the winding axis 86 is sent rightward only by a predetermined length. In this regard, because the first cover member 81 is formed of a material having the flexibility as described above, the first cover member 81 having been sent rightward from the base end supporting portion 82a is warped downward by its own weight. In order to allow the length and curvature of the circumference of the first cover member 81 to correspond to the circumference of a package P with an increased diameter, the controlling unit 26 determines the length of the first cover member 81 sent rightward from the base end supporting portion 82a in consideration of the downward warping of the first cover member 81. As such, even when the diameter of each package P is increased, the first cover member 81 is always provided along the outer circumferential surfaces of the packages P. Because of this, the separation of the accompanied flow F from the outer circumferential surfaces of the packages P is suppressed from the start of the winding of yarns Y, and hence the power consumption is further reduced.

(Second Modification)

[0079] In the embodiment above, the first cover member 41 and the second cover member 51 are formed to be independent from one another. Alternatively, the first cover member and the second cover member may be integrally formed. As shown in FIG. 8, for example, an upstream end portion (provided on the right side in FIG. 8) of a first cover member 141 in the rotational direction of each package P is in contact with the base end portion of a second cover member 151 in a yarn winder 134 of a second modification. With this arrangement, it is possible to prevent the accompanied flow F from passing through the gap between the first cover member 141 and the second cover member 151 and being separated from the outer circumferential surfaces of the packages P. In the embodiment above, the second cover member 51 is a flat plate. Alternatively, as shown in FIG. 8, the second cover member 151 may be provided along the circumferential direction of each package P. With this arrangement, a passage allowing the accompanied flow F flowing along the outer circumferential surfaces of the packages P to be guided to the gaps between the adjacent packages P can be formed. Because of this, most of the accompanied flow F flowing toward the contact point C is sent to the gaps between the adjacent packages P. As such, the power consumption is further reduced.

(Other Modifications)

[0080] In the embodiment above, both the first cover member 41 and the second cover member 51 are provided. Alternatively, only the first cover member 41 may be provided. An end portion of the first cover member 41, which is close to the contact point C, may be flat plate-shaped and the first cover member 41 except the end portion may be formed along the circumferential direction of each package P. The same applies to the first cover member 141 integrally formed with the second cover member 151 in the second modification described above.

[0081] In the embodiment above, the first cover member 41 is provided along the circumferential direction of the package P to cover the range of up to 225 degrees from the contact point C. Alternatively, the first cover member 41 may be provided along the circumferential direction of the package P to cover a larger range than the range of up to 225 degrees from the contact point C. For example, the first cover member 41 may be provided upstream and downstream of the contact point C in the rotational direction of the package P. A plurality of the first cover member 41 may be provided to be aligned in the circumferential direction of the package P.

[0082] In the embodiment above, when the diameter of the package P is maximum, the second cover member 51 is provided upstream of the contact point C and downstream of the first cover member 41 in the rotational direction of the package P. Alternatively, the position of the second cover member 51 may be variable and the second cover member 51 may be provided upstream of the contact point C and downstream of the first cover member 41 in the rotational direction of the package P. In this regard, the position of the contact point C varies in accordance with increase in the diameter of the package P. In this case, the second cover member 51 is provided, by means of the second movement mechanism 53, upstream of the contact point C the position of which varies and downstream of the first cover member 41 in the rotational direction of the package P. Because of this, in a manner similar to cases where the diameter of the first cover member 41 is variable, the separation of the accompanied flow F from the outer circumferential surfaces of the packages P is suppressed from the start of the winding of yarns Y. Therefore, the power consumption is further reduced.

[0083] The structures of the first movement mechanism 43 and the second movement mechanism 53 are not limited to those in the embodiment described above as long as the first movement mechanism 43 and the second movement

mechanism 53 can cause the first cover member 41 and the second cover member 51 to retreat from the movement trace M.

[0084] A surface of the second cover member 51, which faces the outer circumferential surfaces of the packages P, may be provided with a concave portion in order to guide the accompanied flow F flowing toward the contact point C to gaps between the adjacent packages P. In this case, the accompanied flow F flows into the gaps between the adjacent packages P along the concave portion. Because of this, the amount of the accompanied flow F which flows toward the contact point C and which is guided to the gaps between adjacent packages P is increased, and hence the power consumption is further reduced.

[0085] In the embodiment above, the first cover member 41 and the second cover member 51 extend along the front-rear direction. Alternatively, the first cover member 41 and the second cover member 51 may not extend along the front-rear direction. In this case, for example, the first cover member 41 and the second cover member 51 may be provided in areas covering the gaps between the adjacent packages P in the front-rear direction. In other words, in this case, first cover members 41 and second cover members 51 are aligned at predetermined intervals in the front-rear direction.

(Example)

[0086] Regarding yarn winders 4 of Example 1 and 2 and Comparative Examples 1 to 3, the following simulation results are shown in Table 1 below: simulation results of the transition of an amount of power consumption loss (W) due to the increase in the diameter of each of the packages P; and simulation results of an amount of loss reduction (W), due to the increase in the diameter of each of the packages P, as compared to the yarn winder 4 (Comparative Example 1) in which cover members are not provided. Simulation analysis was done with Simcenter STAR-CCM produced by Siemens AG.

[0087] The yarn winder 4 of Example 1 is provided with only a first cover member 41 (see FIG. 2) provided along the circumferential direction of each of packages P to cover a range of up to 180 degrees in the area surrounding the lower half, in the up-down direction, of each package P in which the diameter is maximum (435 mm). The yarn winder 4 of Example 2 is provided with a first cover member 41 which is the same as that in Example 1 and a second cover member 51 (see FIG. 2) which is provided in the area provided upstream of the contact point C in the rotational direction of each of packages P and provided in the area provided downstream of the first cover member 41 in the rotational direction of each of the packages P in each of which the diameter is maximum (435 mm). In this regard, the second cover member 51 is a flat plate provided along the tangent T passing the contact point C. In Example 2, the first cover member 41 and the second cover member 51 are formed to be independent from one another. In the yarn winder 4 of Comparative Example 1, both the first cover member 41 and the second cover member 51 are not provided. In the yarn winder 4 of Comparative Example 2, only a second cover member 51 which is the same as that in Example 2 is provided. The yarn winder 4 of Comparative Example 3 is a combination of the structure of the shielding panel of Patent Literature 2 with the embodiment above, and this yarn winder 4 is provided with a shielding panel 201. The shielding panel 201 is provided downstream of the contact point C in the rotational direction of each of packages P, the shielding panel 201 is provided along the circumferential direction (rotational direction) of each of the packages P, in each of which the diameter is maximum (435 mm), and the shielding panel 201 covers a range of up to 135 degrees from the contact point C as shown in FIG. 9. To be more specific, the shielding panel 201 is provided to cover a range of 10 to 135 degrees from the contact point C in the circumferential direction (rotational direction) of each package P. On the inner circumferential surface of the shielding panel 201, air guiding panels (not illustrated) extending along the circumferential direction of each package P are formed to be aligned along the front-rear direction. Each of the air guiding panels is formed at the position corresponding to each of the gaps between the adjacent packages P.

[0088] In Examples 1 and 2 and Comparative Examples 1 to 3, a simulation value of an amount of power consumption loss (W) of the yarn winder 4 and a simulation value of an amount of loss reduction (W) as compared to Comparative Example 1 are measured. In these examples, the diameter of each package P is 360mm, 380mm, 400mm, 420mm, and 435mm while the rotation speed of the bobbin holder 24 is constant at 3300 m/min.

[Table 1]

3300m/min	COMPARATIVE EXAMPLE 1	COMPARATIVE EXAMPLE 2	COMPARATIVE EXAMPLE 3	EXAMPLE 1	EXAMPLE 2
	NO COVERS	ONLY THE SECOND COVER	SHIELDING PANEL	ONLY THE FIRST COVER	THE FIRST COVER +THE SECOND COVER
DIAMETER OF PACKAGE [mm]	AMOUNT OF POWER CONSUMPTION LOSS [W]				
360	832.00	835.76	844.56	821.73	820.48
380	883.12	888.42	898.25	865.30	865.58
400	925.89	927.26	941.82	889.76	876.78
420	962.10	977.18	987.22	900.05	877.25
435	1002.50	1002.40	1006.60	910.78	880.19
DIAMETER OF PACKAGE [mm]	AMOUNT OF LOSS REDUCTION [W]				
360		-3.76	-12.56	10.27	11.52
380		-5.30	-15.13	17.82	17.54
400		-1.37	-15.93	36.13	49.11
420		-15.08	-25.12	62.05	84.85
435		0.10	-4.10	91.72	122.31

[0089] According to Table 1, in the yarn winder 4 of Comparative Example 1 in which both the first cover member 41 and the second cover member 51 were not provided, an amount of power consumption loss was increased as the diameter of each package P was increased. In Comparative Example 2 in which only the second cover member 51 was provided, the transition of an amount of power consumption loss due to the increase in the diameter of each package P was substantially same as that in Comparative Example 1. In Comparative Example 3 in which the shielding panel 201 was provided, the transition of an amount of power consumption loss due to the increase in the diameter of each package P was increased as compared to that in Comparative Example 1. In each of Examples 1 and 2, an amount of power consumption loss was decreased as compared to that in Comparative Example 1. Especially, as the diameter of each package P was increased, an amount of loss reduction was also increased. In Example 2 in which both the first cover member 41 and the second cover member 51 were provided, when the diameter of each package P was 400 mm or more, the amount of loss reduction was further increased as compared to that in Example 1. In Example 2, when the diameter of each package P was increased from 400 to 435 mm, the amount of power consumption loss was scarcely increased. As such, it was found that the power consumption was decreased by providing the first cover member 41 in the yarn winder 4 and that the power consumption was further decreased by providing both the first cover member 41 and the second cover member 51.

Claims

1. A yarn winder (4, 74, 134) comprising: a base (20) ;
a bobbin holder (24) which is rotatably supported by the base (20), which extends along an axial direction which is along the horizontal direction, and to which bobbins (B), which are capable of respectively winding yarns (Y), are attached to be aligned in the axial direction;
a contact roller (25) which extends in the axial direction and which makes contact with outer circumferential surfaces of packages (P) formed by winding the yarns (Y) onto the respective bobbins (B); and
a first cover member (41, 81, 141) which is provided in at least a part of an area provided upstream of a contact

point (C) in a rotational direction of each of the packages (P) and which is provided along a circumferential direction of each of the packages (P), and the contact point (C) being between the packages (P) and the contact roller (25).

2. The yarn winder (4, 74, 134) according to claim 1, wherein, at least a part of the first cover member (41, 81, 141) is provided in an area surrounding lower halves in the vertical direction of entire circumferences of the packages (P).
3. The yarn winder (4, 74, 134) according to claim 2, wherein, the first cover member (41, 81, 141) is provided along the circumferential direction to cover a range of up to 225 degrees from the contact point (C).
4. The yarn winder (4, 74, 134) according to claim 2 or 3, wherein, the first cover member (41, 81, 141) is provided in the area surrounding the lower halves in the vertical direction of the entire circumferences of the packages (P).
5. The yarn winder (4, 74, 134) according to any one of claims 1 to 4, further comprising a second cover member (51, 151) which is provided upstream of the contact point (C) in the rotational direction and provided downstream of the first cover member (41, 81, 141) in the rotational direction, the second cover member (51, 151) guiding air (F), which flows toward the contact point (C) in accordance with rotation of the packages (P), to gaps between the adjacent packages (P).
6. The yarn winder (4, 74, 134) according to claim 5, wherein, the second cover member (51) is a flat plate provided to cover a range of up to 25 degrees from a tangent (T) which passes the contact point (C) and is centered at the contact point (C).
7. The yarn winder (134) according to claim 5, wherein, the second cover member (151) is provided along the circumferential direction of each of the packages (P).
8. The yarn winder (4, 74, 134) according to any one of claims 1 to 7, wherein, the first cover member (41, 81, 141) is provided along the circumferential direction to cover a range of 90 degrees or more.
9. The yarn winder (74) according to any one of claims 1 to 8, wherein, the diameter of the first cover member (81) is variable along the outer circumferential surfaces of the packages (P) in each of which the diameter is increased in accordance with winding of yarns (Y).
10. The yarn winder (4, 74, 134) according to any one of claims 5 to 9, wherein, the first cover member (41, 81, 141) and the second cover member (51, 151) extend along the axial direction and cover all of the gaps between the adjacent packages (P).
11. The yarn winder (4, 74, 134) according to claim 10, wherein, both ends of each of the first cover member (41, 81, 141) and the second cover member (51, 151) in the axial direction are provided outside outer ends of the outermost packages (P) in the axial direction.
12. The yarn winder (4, 74, 134) according to any one of claims 5 to 11, further comprising a movement mechanism (43, 53) configured to cause the first cover member (41, 81, 141) and the second cover member (51, 151) to retreat from a movement trace (M) along which the bobbin holder (24) moves between a yarn winding position and a standby position, and the bobbin holder (24) being movable between the yarn winding position where the winding of yarns (Y) is performed and the standby position where the winding of yarns (Y) is not performed.
13. The yarn winder (4, 74) according to claim 12, wherein, the first cover member (41, 81) and the second cover member (51) are formed to be independent from one another.
14. The yarn winder (134) according to any one of claims 5 to 12, wherein, the first cover member (141) and the second cover member (151) are integrally formed.

FIG.1

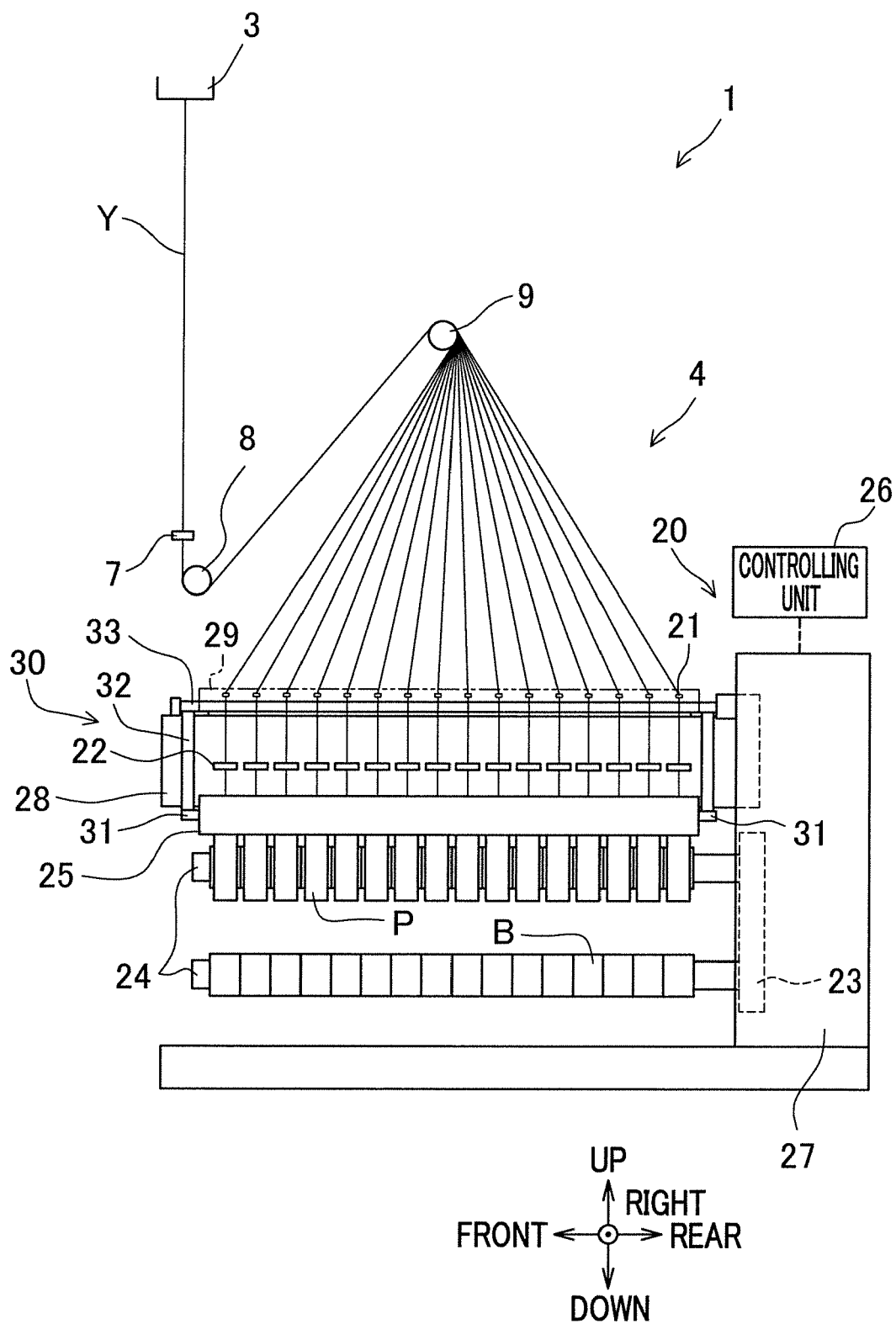


FIG.2

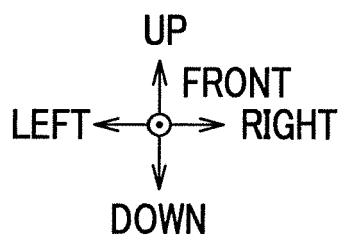
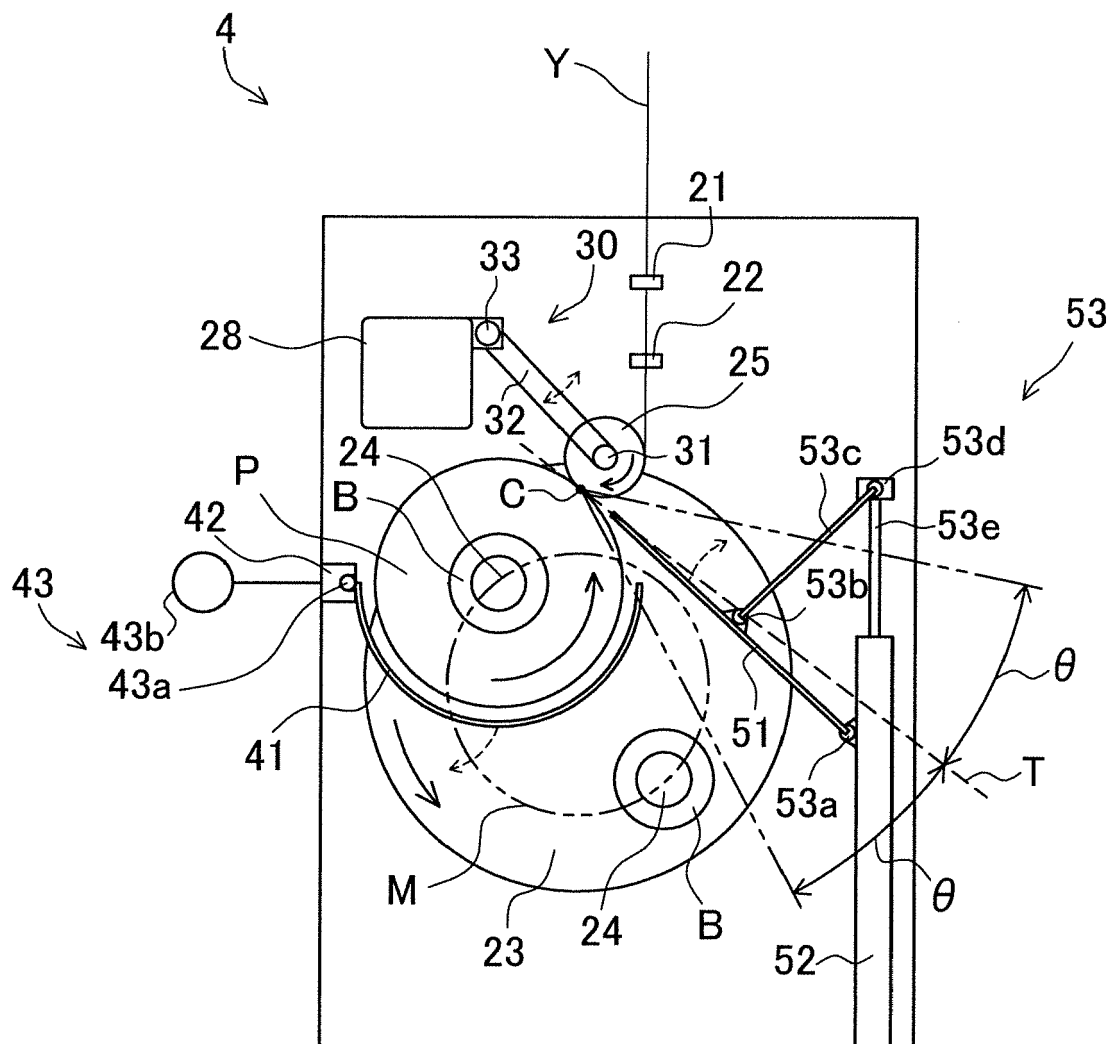


FIG.3

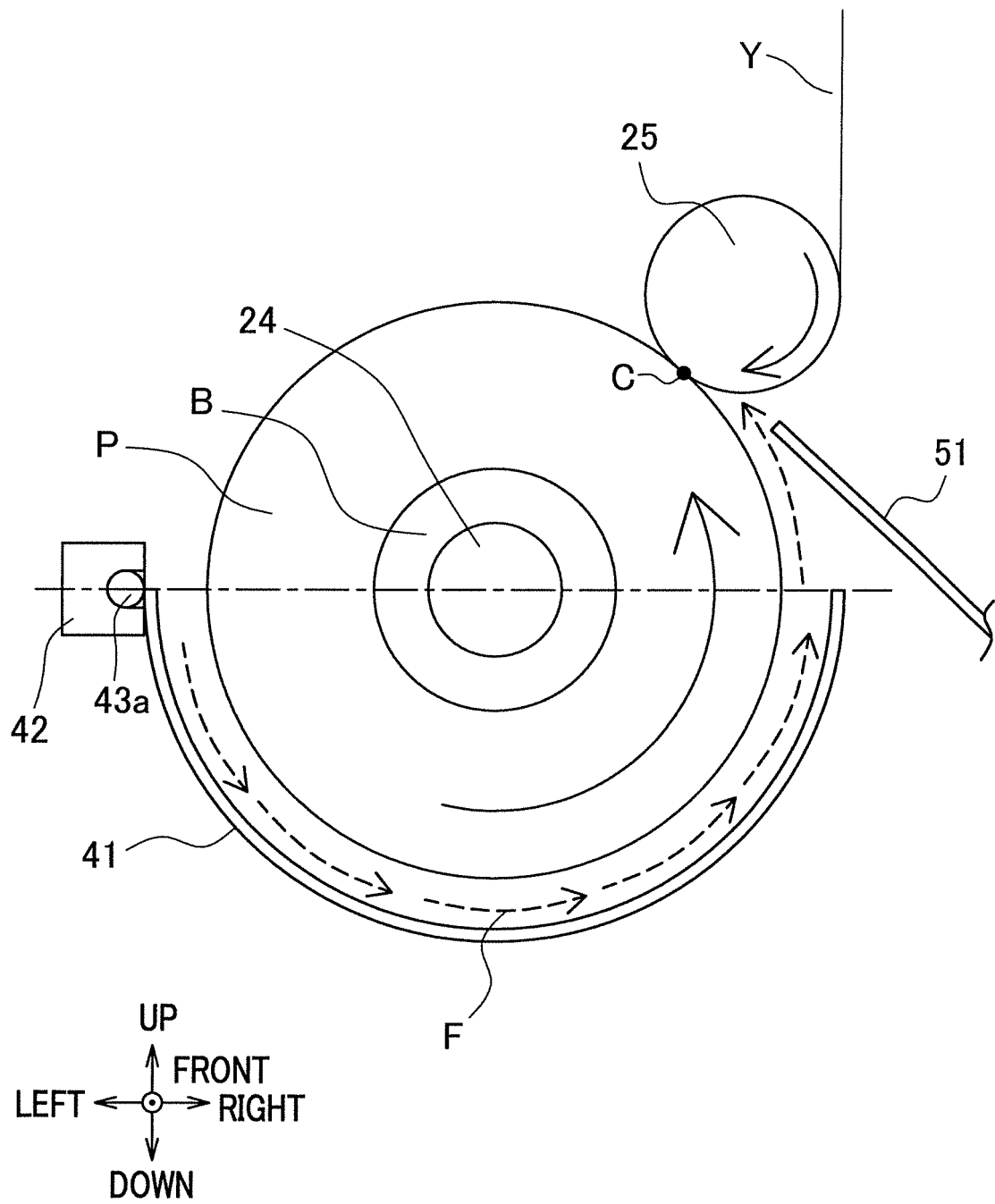


FIG.4

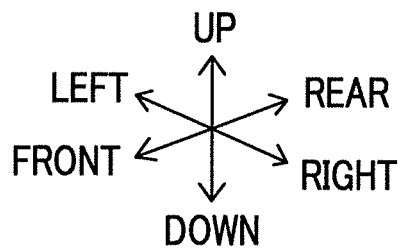
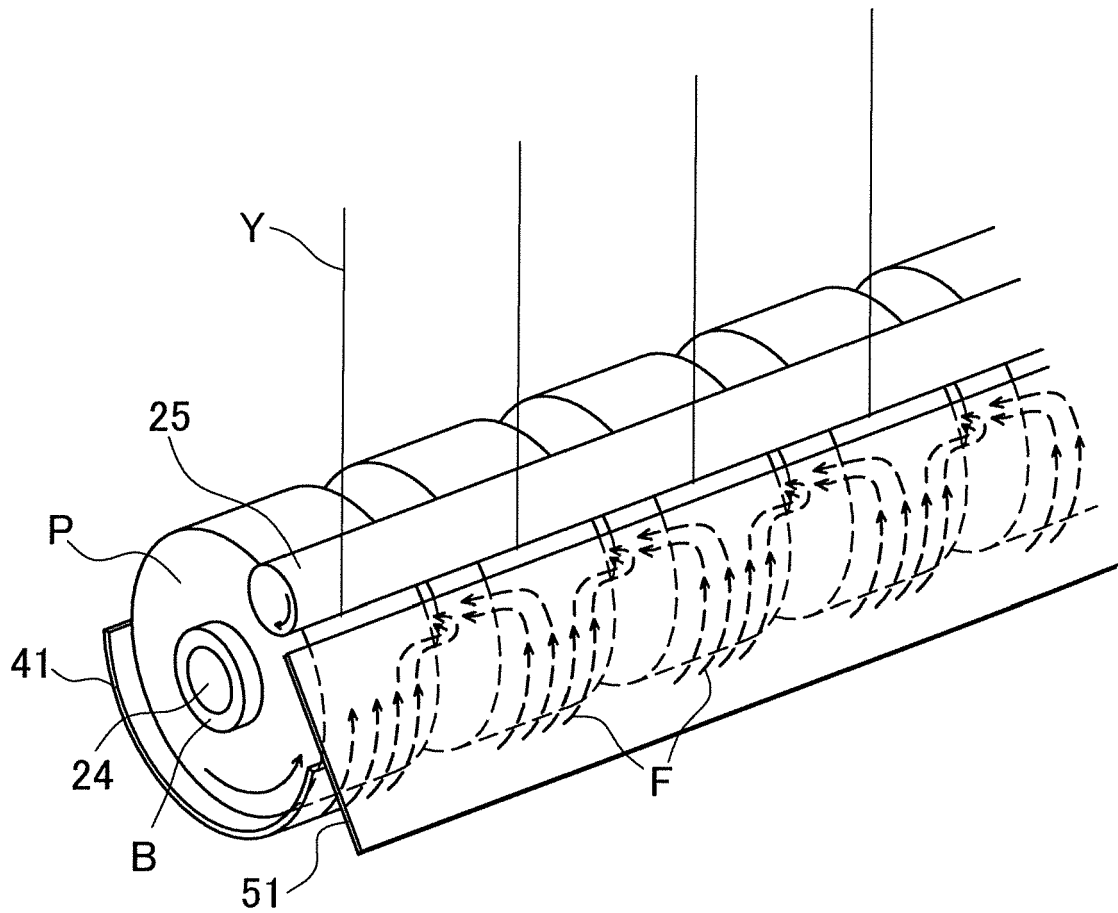


FIG.5

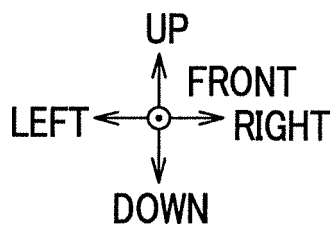
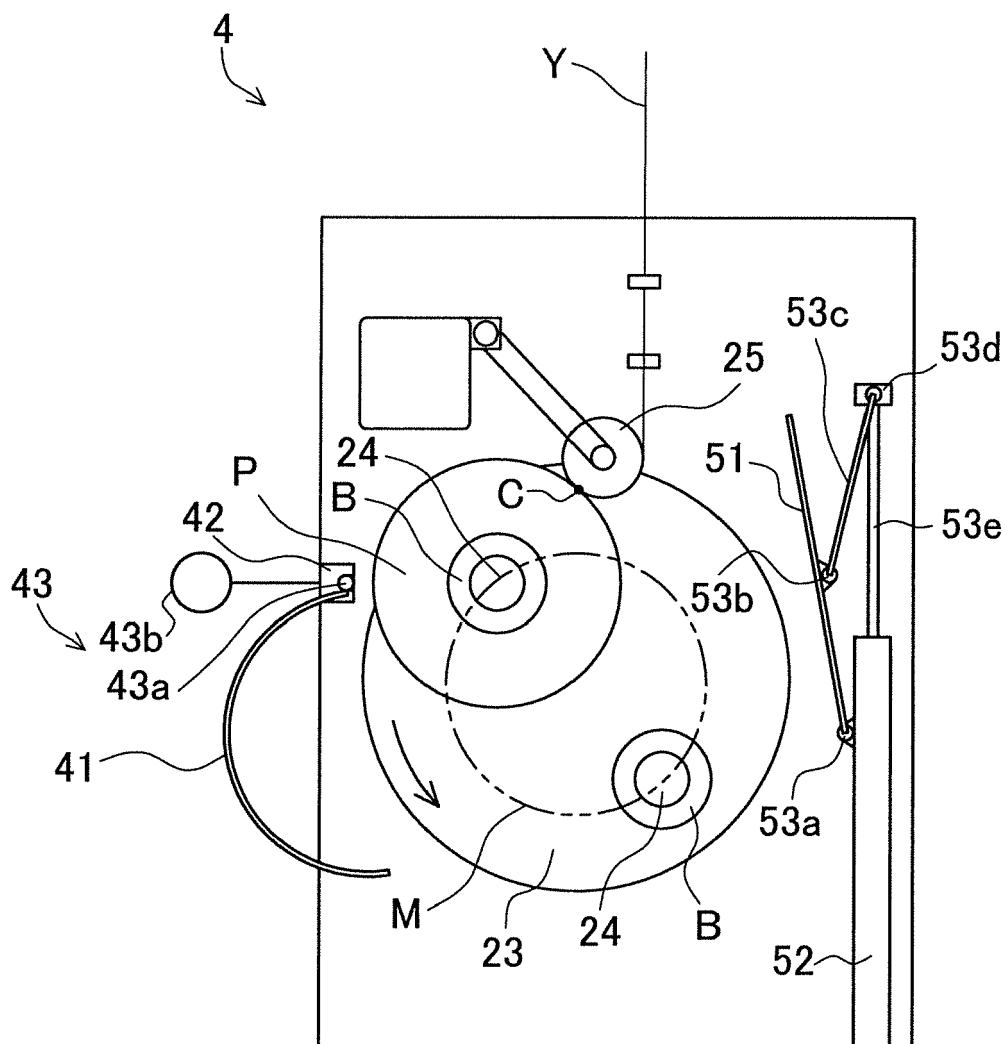


FIG.6

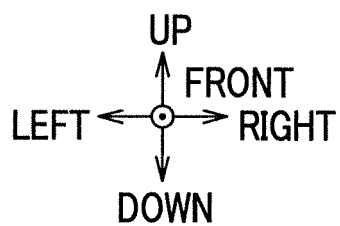
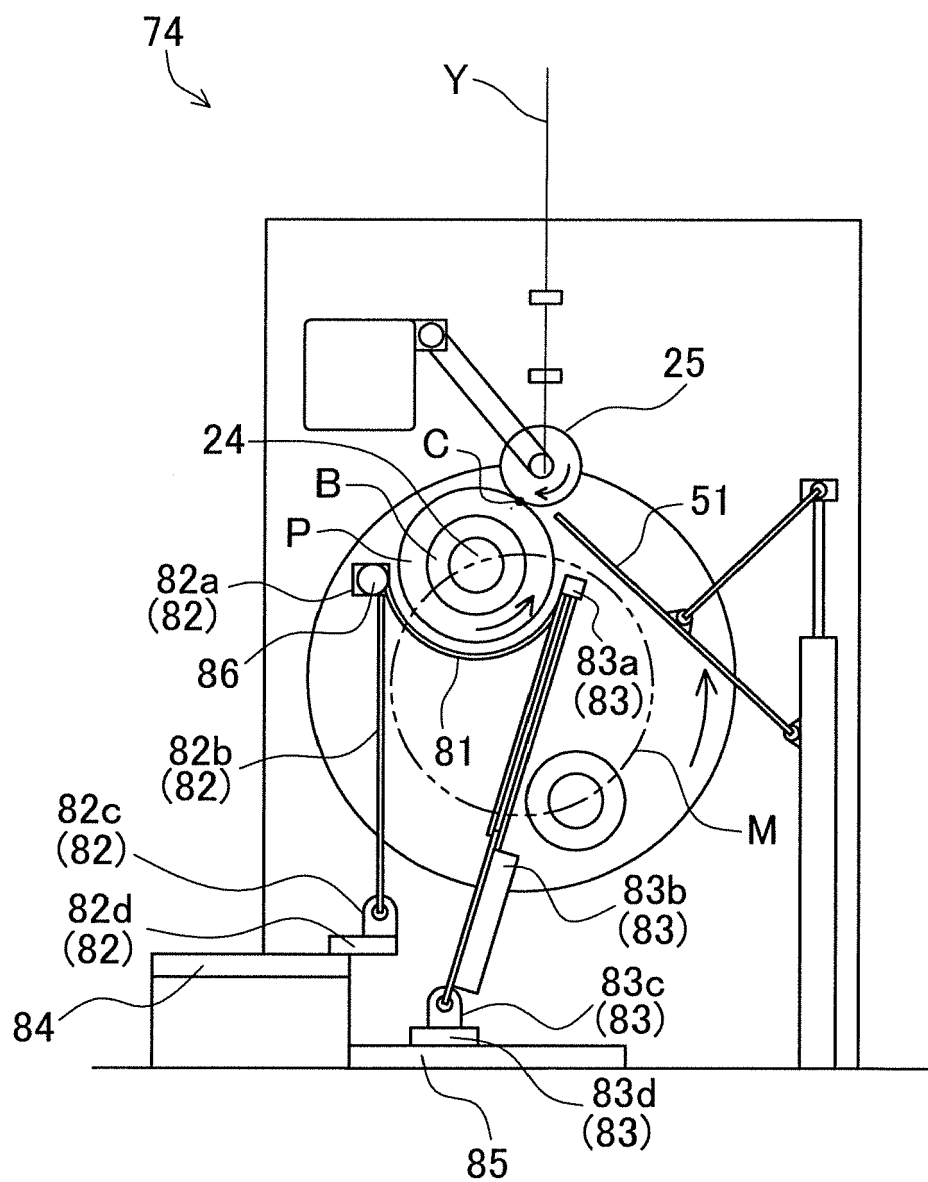


FIG.7

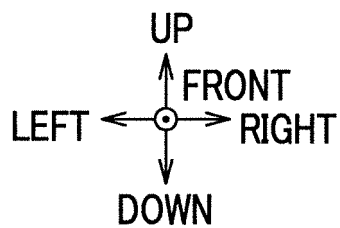
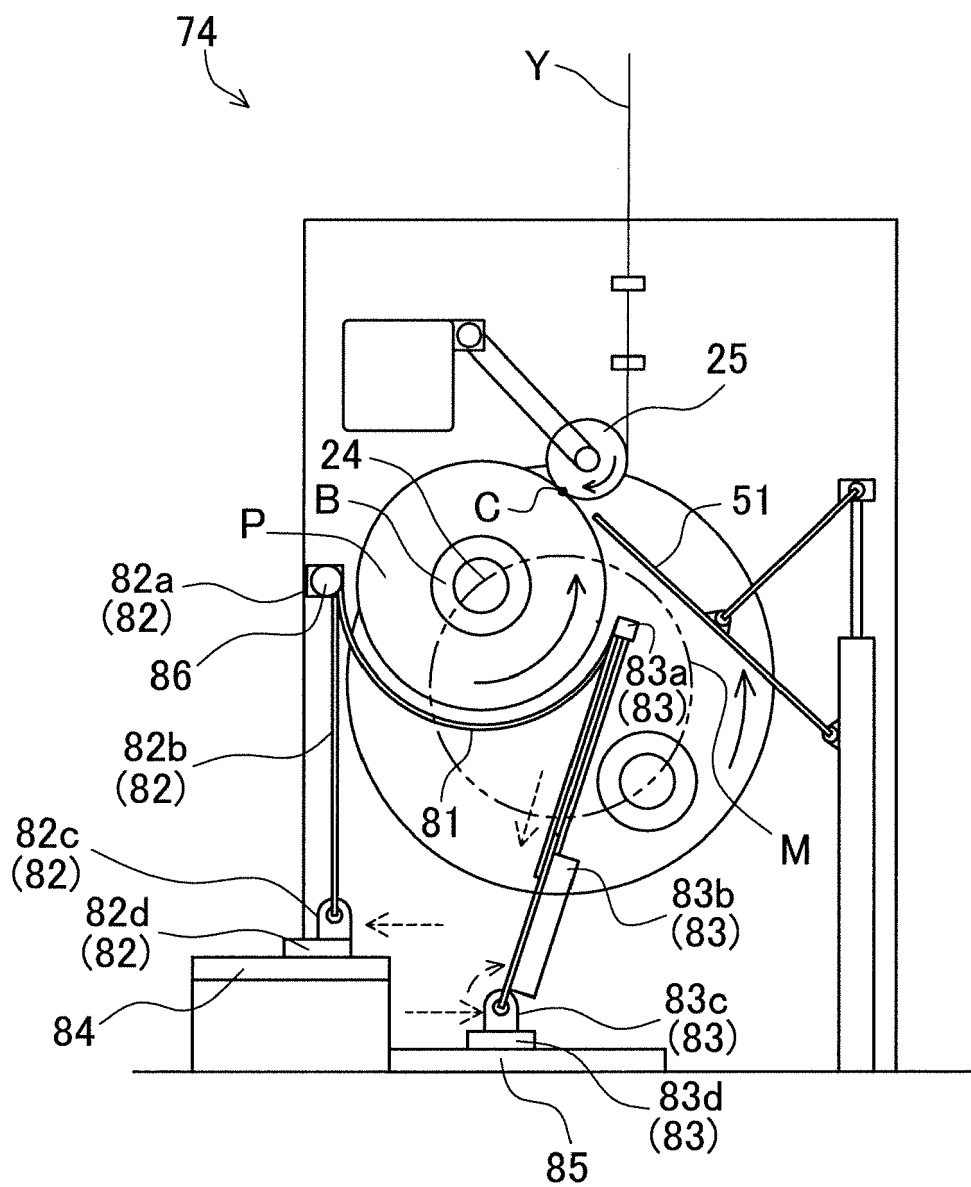


FIG.8

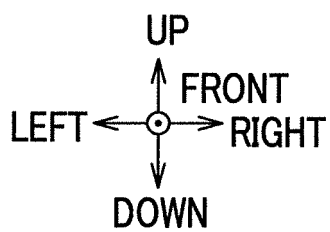
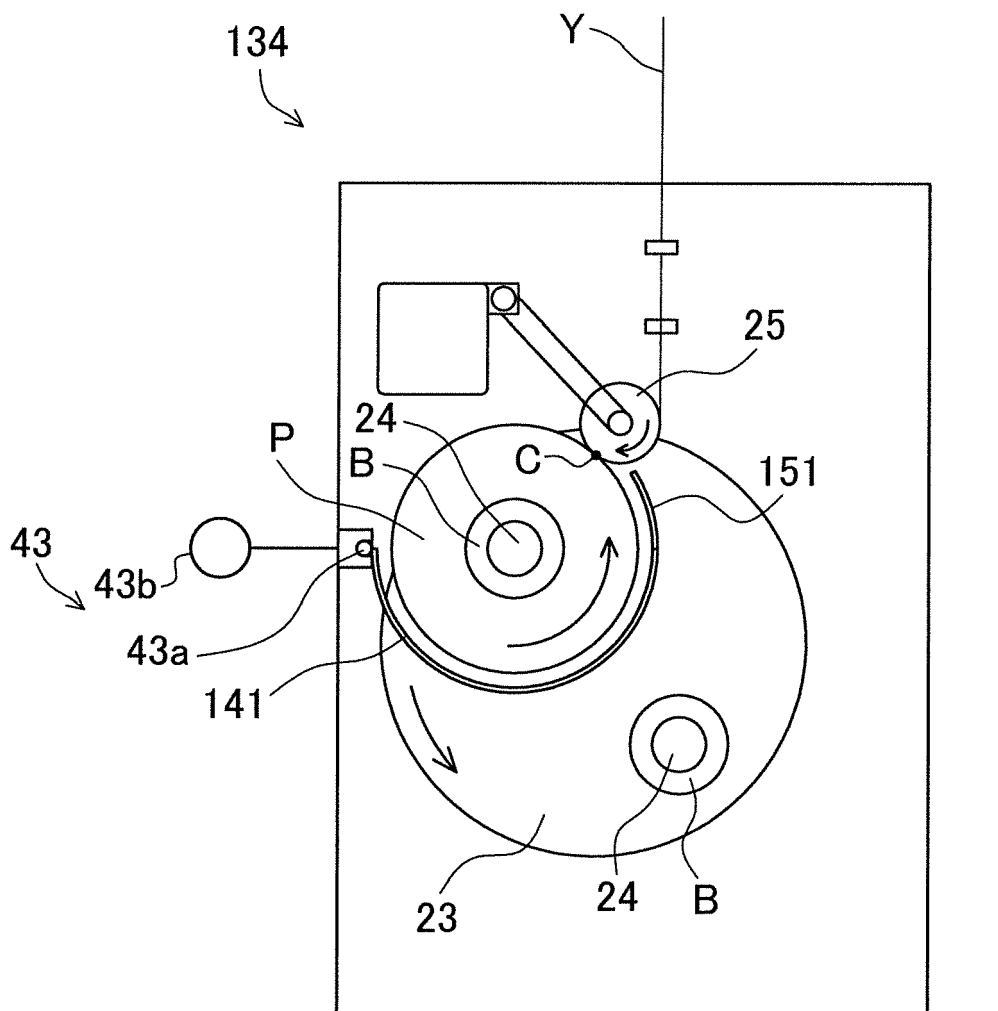


FIG.9

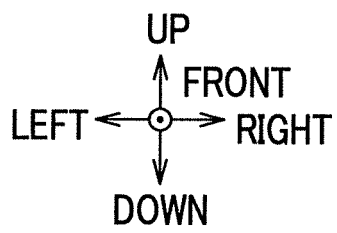
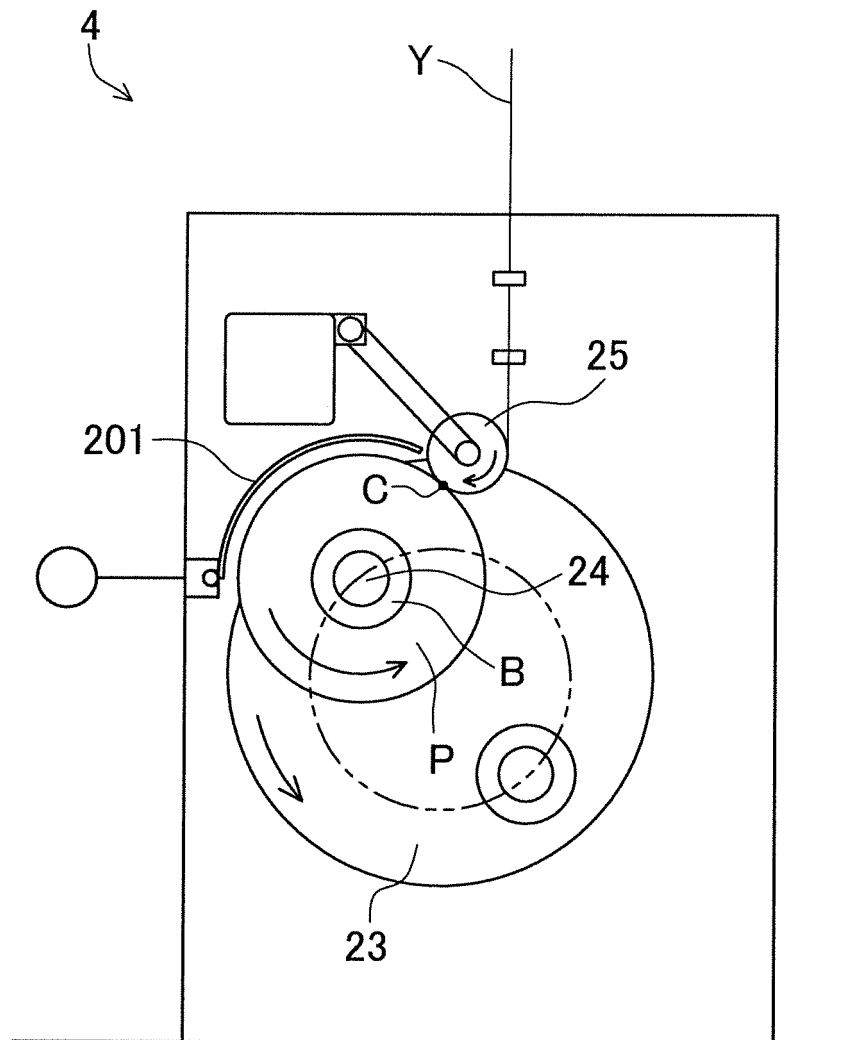
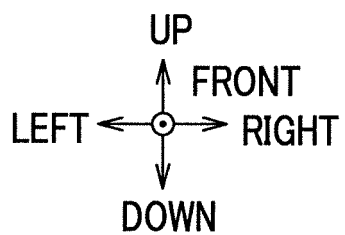
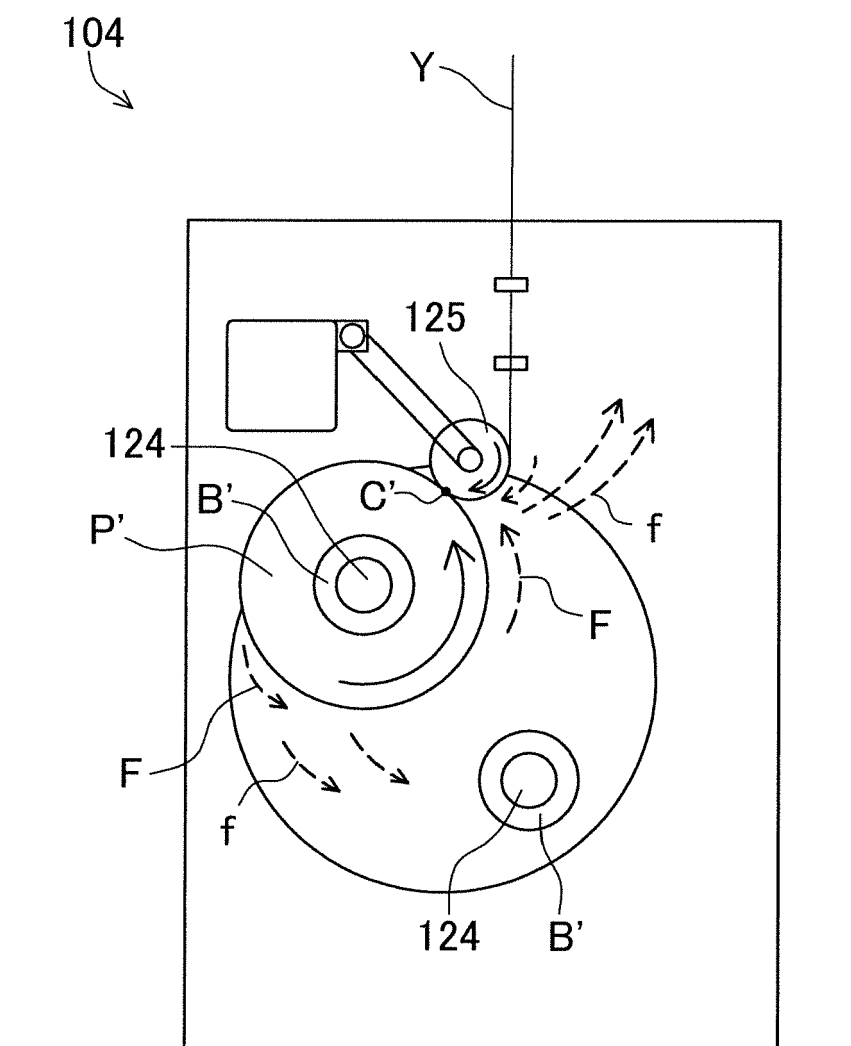


FIG.10





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