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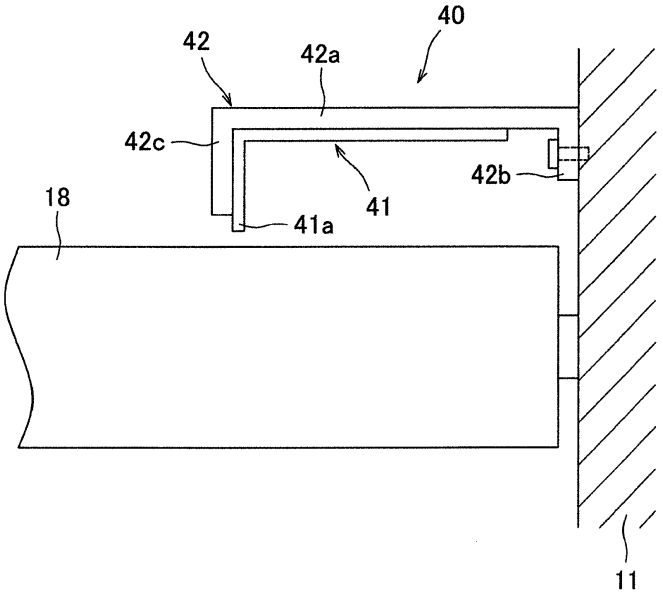
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(54) YARN WINDING APPARATUS

(57) An influence of static electricity generated by friction between a rotating body and a package is restrained in a yarn winding apparatus including the rotating body which rotates while being in contact with the outer circumferential surface of the package. A yarn winding apparatus forming a package by winding a yarn onto a bobbin includes a rotating body 18 configured to rotate while being in contact with the outer circumferential surface of the package and an antistatic unit 40 configured to remove static electricity from the rotating body 18.

FIG.4



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a yarn winding apparatus configured to form a package by winding a yarn onto a bobbin.

[0002] For example, in a yarn winding apparatus provided in a spun yarn take-up apparatus disclosed by Patent Literature 1 (Japanese Unexamined Patent Publication No. 2013-213307), a package is formed in such a way that a yarn is wound onto a bobbin attached to a bobbin holder. In this yarn winding apparatus, a contact roller is provided to adjust the shape of a package. The contact roller rotates while being in contact with the outer circumferential surface of the package so as to apply a predetermined contact pressure to the package. Static electricity is generated by friction between the contact roller and the package, and the generated static electricity is accumulated in the contact roller. An amount of the generated static electricity, however, is not so large and therefore the static electricity has not been particularly considered as a problem.

SUMMARY OF THE INVENTION

[0003] In order to improve the efficiency in producing packages, these days the winding speed of yarns by a yarn winding apparatus tends to be high and the number of bobbins attached to one bobbin holder tends to be large. As a result, an amount of static electricity generated by friction between the contact roller and the package is increased, and such static electricity accumulated in the contact roller causes an adverse effect. For example, when a conductive member is provided in the vicinity of the contact roller, electric discharge from the contact roller to the conductive member occurs, with the result that the conductive member is electrically corroded.

[0004] The present invention has been done to solve the problem above. An object of the present invention is to restrain an influence of static electricity generated by friction between a rotating body and a package in a yarn winding apparatus including the rotating body which rotates while being in contact with the outer circumferential surface of the package.

[0005] The present invention relates to a yarn winding apparatus forming at least one package by winding at least one yarn onto at least one bobbin, including: a rotating body configured to rotate while being in contact with an outer circumferential surface of the at least one package; and an antistatic unit configured to remove static electricity from the rotating body.

[0006] According to the present invention, because the antistatic unit is provided to remove static electricity from the rotating body, an influence of the static electricity generated by friction between the rotating body and the package.

[0007] In addition to the above, the present invention may be arranged such that a plurality of the at least one bobbin are attached to a bobbin supporting shaft supporting the bobbins, along an axial direction, and the rotating body makes contact with a plurality of the at least one package which are formed by winding a plurality of the at least one yarn onto the bobbins.

[0008] When the rotating body makes contact with plural packages, the friction between the rotating body and the packages occur at plural parts, and hence the total amount of the generated static electricity is large, and a harmful effect is more likely to happen. The effect of the antistatic unit is therefore conspicuous in this case.

[0009] In addition to the above, the present invention is preferably arranged such that the antistatic unit is provided to be separated from the rotating body.

[0010] If the antistatic unit makes contact with the rotating body, static electricity may not be properly removed or frequent replacement of components may be required, because the antistatic unit and the contact roller are worn. In the meanwhile, the amount of the static electricity generated between the antistatic unit and the rotating body may be large if the antistatic unit is in contact with the rotating body. When the antistatic unit is separated from the rotating body, the wearing of the antistatic unit and the rotating body is prevented and the above-described problems are avoided.

[0011] In addition to the above, the present invention is preferably arranged such that the antistatic unit includes a static electricity removing member in which conductive fibers are exposed at plural parts of the surface.

[0012] With this static electricity removing member, electric discharge from the rotating body occurs at plural parts where the conductive fibers are exposed, and hence the static electricity removing capability of the antistatic unit is improved.

[0013] In addition to the above, the present invention is preferably arranged such that the static electricity removing string includes a static electricity removing member in which conductive fibers are exposed at plural parts of the surface.

[0014] As the static electricity removing string is employed as the static electricity removing member, because the static electricity removing member is a relatively soft string, the damage of the rotating body is restrained even if the static electricity removing member makes contact with rotating body due to vibrations or the like.

[0015] The present invention is preferably arranged such that the static electricity removing string is attached along a mounting member which is higher in rigidity than the static electricity removing string.

[0016] When the static electricity removing string is provided without a base, it is sometimes difficult to maintain the string at a desired position due to slackening or swinging. In this regard, the slackening or swinging of the static electricity removing string is resolved by attaching the string along the highly-rigid mounting member, and hence the degree of freedom in the position of the

static electricity removing string is improved.

[0017] The present invention is preferably arranged such that the static electricity removing string includes a protrusion which protrudes from the mounting member toward an outer circumferential surface of the rotating body.

[0018] The static electricity removing string is preferably as close to the outer circumferential surface of the rotating body as possible, because electric discharge from the rotating body to the static electricity removing string is facilitated. However, when the highly-rigid mounting member extends to be too close to the outer circumferential surface of the rotating body, the rotating body may make contact with the mounting member due to vibrations or the like, with the result that the rotating body may be heavily damaged. On this account, as the protrusion is provided to cause only the static electricity removing string to protrude toward the outer circumferential surface of the rotating body, electric discharge from the rotating body to the static electricity removing string is facilitated but physical contact between the rotating body and the mounting member is restrained.

[0019] The present invention is preferably arranged such that, the static electricity removing string extends along the outer circumferential surface of the rotating body and is attached to the mounting member so as to face the outer circumferential surface of the rotating body.

[0020] With this arrangement, an area where the static electricity is discharged from the outer circumferential surface of the rotating body to the static electricity removing string is large, and hence the removal of the static electricity is ensured. Furthermore, as the static electricity removing string is provided between the outer circumferential surface of the rotating body and the mounting member, the static electricity removing string functions as a buffer material which prevents the rotating body from directly making contact with the highly-rigid mounting member due to vibrations or the like.

[0021] In addition to the above, the present invention is preferably arranged such that the rotating body is a contact roller which is rotationally driven in accordance with rotation of the at least one package.

[0022] When static electricity is accumulated in the contact roller, winding may not be properly done as the yarns are stuck onto the contact roller on account of the static electricity. With the antistatic unit, the winding is properly done and hence the quality of the packages is improved.

[0023] In addition to the above, the present invention is preferably arranged such that the rotating body is rotatably supported by a supporting member supporting the rotating body via a bearing, and a rubber-made ring member is provided between the supporting member and the bearing.

[0024] With such a rubber-made ring member, the bearing is firmly attached to the supporting member. However, escape of the static electricity from the contact roller to the supporting member via the bearing is obstructed, with the result that the accumulation of the static electricity in the contact roller is facilitated. The effect of the antistatic unit is therefore conspicuous in this case.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a front elevation of a spun yarn take-up apparatus of an embodiment of the present invention.

FIG. 2 is a profile of the spun yarn take-up apparatus of the embodiment.

FIG. 3 is an enlarged view showing a supporting structure of a contact roller.

FIG. 4 is a top view showing an antistatic unit.

FIG. 5 is a perspective view of an antistatic unit of a modification.

FIG. 6 shows the antistatic unit of the modification in a direction VI in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] The following will describe an embodiment of the present invention with reference to figures. In the present embodiment, a yarn winder of the present invention is used in a spun yarn take-up apparatus.

(Spun Yarn Take-Up Apparatus)

[0027] FIG. 1 is a front elevation of a spun yarn take-up apparatus of the embodiment of the present invention, and FIG. 2 is a profile of the spun yarn take-up apparatus of the embodiment. Hereinafter, forward, rearward, leftward, rightward, upward, and downward directions shown in FIGs. 1 and 2 will be referred to as forward, rearward, leftward, rightward, upward, and downward directions of the spun yarn take-up apparatus.

[0028] The spun yarn take-up apparatus 1 is configured to take up yarns Y spun out from a spinning apparatus 2 and includes members such as godet rollers 3 and 4 and a yarn winder 5. The spinning apparatus 2 is provided above the spun yarn take-up apparatus 1 and is configured to spin out yarns Y made of synthetic fibers (e.g., fibers made of synthetic resin such as polyethylene terephthalate) through plural spinnerets (not illustrated). The godet rollers 3 and 4 are disposed below the spinning apparatus 2 so that the axis of each godet roller is substantially in parallel to the left-right direction. The godet roller 4 is provided obliquely above and behind the godet roller 3. The yarns Y spun out from the spinning apparatus 2 are wound onto the godet rollers 3 and 4 in this order. The godet rollers 3 and 4 are rotationally driven by an unillustrated drive motor. The yarns Y spun out from the spinning apparatus 2 are sent to the yarn winder 5 by the godet rollers 3 and 4.

[0029] The yarn winder 5 includes two yarn winding

apparatuses 10 which are provided below the godet rollers 3 and 4. The two yarn winding apparatuses 10 are provided to oppose each other over a yarn path of the yarns Y which are sent from the godet rollers 3 and 4, so as to be symmetrical in the left-right direction. The yarns Y spun out from the spinning apparatus 2 are sent to the two yarn winding apparatuses 10 in a divided manner. For example, when 32 yarns Y are sent from the spinning apparatus 2, a half of, i.e., 16 yarns are wound by the left yarn winding apparatus 10, whereas the remaining 16 yarns are wound by the right yarn winding apparatus 10.

[0030] Each yarn winding apparatus 10 is constituted by members such as a supporting frame 11 and two bobbin holders 12. Each of the supporting frame 11 and the bobbin holders 12 is made of metal. The supporting frame 11 is cantilevered by a frame 13 to be substantially horizontal in posture. Each of the two bobbin holders 12 is a shaft member extending in the front-rear direction, and is cantilevered at its rear end portion by the turret 14. To the bobbin holder 12, plural (e.g., 16) bobbins B are attachable along the axial direction. The bobbin holder 12 is rotated about the axis by an unillustrated motor. The turret 14 is a disc-shaped member and is attached to the frame 13 to be rotatable. As the turret 14 rotates, the positions of the two bobbin holders 12 supported by the turret 14 are switched.

[0031] Above the supporting frame 11, a guide supporter 15 is provided to extend in the front-rear direction. On the guide supporter 15, plural fulcrum guides 16 are provided along the front-rear direction to correspond to the respective bobbins B attached to the bobbin holder 12. On the supporting frame 11, plural traverse guides 17 are provided along the front-rear direction to correspond to the respective bobbins B attached to the bobbin holder 12. The traverse guides 17 are provided below the fulcrum guides 16.

[0032] In addition to the above, the yarn winding apparatus 10 includes a contact roller 18 which is made of metal and is supported by the supporting frame 11 to be rotatable. The contact roller 18 is provided below the supporting frame 11 and is able to make contact with the outer circumferential surfaces of packages P formed on the upper bobbin holder 12. The contact roller 18 adjusts the shape of each package P in such a way that the contact roller 18 is rotationally driven while applying a predetermined contact pressure to the package P when the yarn Y is wound onto the bobbin B. While the yarn Y is wound onto the bobbin B and the diameter of the package P increases, the contact pressure is maintained to be constant as the position of the bobbin holder 12 is gradually lowered.

[0033] In the yarn winding apparatus 10 structured as above, the yarns Y threaded onto the respective fulcrum guides 16 are traversed in the front-rear direction about the fulcrum guides 16 by the traverse guides 17. As the traversed yarns Y are wound onto the bobbins B attached to the upper bobbin holder 12, the packages P are formed. When the formation of the packages P on the upper bobbin holder 12 is completed, the turret 14 rotates to switch the two bobbin holders 12. In other words, the lower bobbin holder 12 is moved to the upper side, and the yarns Y are newly wound onto the bobbins B attached to this bobbin holder 12. The bobbin holder 12 on which the packages P are fully formed is moved to the lower side, and the fully-formed packages P are removed from the front side of the bobbin holder 12. The winding speed of winding the yarns Y in the present embodiment is considerably high, i.e., about 4000 to 5000m/min.

(Influence of Static Electricity at Contact Roller)

[0034] The following will detail the supporting structure of the contact roller 18. FIG. 3 is an enlarged view showing the supporting structure of the contact roller 18. While FIG. 3 shows the supporting structure at an end portion on one side (right side in FIG. 2) of the contact roller 18, an end portion on the other side (left side in FIG. 2) has the same supporting structure.

[0035] A shaft end portion 18a of the contact roller 18 is smaller in diameter than the other parts of the contact roller 18. In the supporting frame 11, a recess 11a where a bearing 19 is provided is formed. The shaft end portion 18a is rotatably supported by the bearing 19. To put it differently, the contact roller 18 is rotatably supported by the supporting frame 11 via the bearing 19. The bearing 19 is a ball bearing with balls 20. Between the outer circumferential surface of the bearing 19 and the circumferential wall of the recess 11a, ring members 21 made of rubber which is an insulating material are provided. While two ring members 21 are provided in the present embodiment, the number of the ring members 21 may be suitably changed.

[0036] In the yarn winding apparatus 10 of the spun yarn take-up apparatus 1, static electricity is generated by friction between the contact roller 18 and the package P. In order to improve the efficiency in producing packages P, these days the number of bobbins B attached to the bobbin holder 12, i.e., the number (16 in the present embodiment) of packages P making contact with the contact roller 18 tends to be large. Furthermore, in order to improve the efficiency in producing packages P, these days the winding speed of the yarns Y, i.e., the rotation speed of the bobbin holder 12 tends to be high. Because of these tendencies, the amount of static electricity generated between the contact roller 18 and the package P gets larger and larger.

[0037] As described above, the contact roller 18 is made of metal which is a conductive material, whereas the yarns Y forming the packages P are made of synthetic resin which is an insulating material. For this reason, the static electricity generated between the contact roller 18 and the package P moves to the contact roller 18. In this connection, between the bearing 19 and the supporting frame 11 supporting the contact roller 18, the ring members 21 made of rubber which is an insulating material are provided. To the bearing 19, insulating grease is ap-

plied for lubrication. On this account, the static electricity is very unlikely to escape from the contact roller 18 via the bearing 19 and the rubber-made ring members 21.

[0038] Under this circumstance, a large amount of static electricity is accumulated in the contact roller 18 as compared to the past. As a result, electric discharge to a conductive member (e.g., an unillustrated cover member covering the contact roller 18) provided in the vicinity of the contact roller 18 occurs, and the conductive member may be electrically corroded. In the meanwhile, when an electrical component is provided in the vicinity of the contact roller 18, noise generated by the discharge of the static electricity may cause an abnormal operation or breakdown of the electrical component, with the result that the yarn winder 5 may malfunction. Furthermore, as the yarns Y are stuck onto the contact roller 18 on account of the static electricity, winding may not be properly done. To solve these problems, the yarn winding apparatus 10 of the present embodiment is arranged such that an antistatic unit is provided at a predetermined part which will be described below, and the static electricity is discharged through the antistatic unit.

(Antistatic unit)

[0039] FIG. 4 is a top view showing an antistatic unit 40. In FIG. 4, members such as the packages P in contact with the contact roller 18 are suitably omitted. The antistatic unit 40 is fixed to the supporting frame 11 so that the antistatic unit 40 is separated from the contact roller 18. The antistatic unit 40 includes a static electricity removing string 41 and a mounting member 42 to which the static electricity removing string 41 is mounted.

[0040] The static electricity removing string 41 is a string-shaped static electricity removing member in which conductive fibers are exposed at many parts of the surface. As electric discharge occurs from the contact roller 18 to the many parts, static electricity removal is effectively done. The mounting member 42 is a long member formed of a metal bar which is rectangular in cross section. The rigidity of the mounting member 42 is higher than that of the static electricity removing string 41. The mounting member 42 includes a long portion 42a which extends along the axis of the contact roller 18, a fixed portion 42b which extends at substantially right angles from one end of the long portion 42a, and a protruding portion 42c which extends at substantially right angles from the other end of the long portion 42a toward the outer circumferential surface of the contact roller 18. The mounting member 42 is fixed to the supporting frame 11 as the fixed portion 42b is fixed to the supporting frame 11 by means of a bolt.

[0041] The static electricity removing string 41 is provided to form an L-shape along the long portion 42a and the protruding portion 42c of the mounting member 42, and is attached to the mounting member 42 by, for example, a conductive adhesive. The static electricity removing string 41 may not be attached to the mounting member 42 by a conductive adhesive. The static electricity removing string 41 in contact with the mounting member 42 may be fixed by a suitable wire or the like. In the static electricity removing string 41, a leading end portion of a part along the protruding portion 42c of the mounting member 42 is a protrusion 41a which protrudes toward the outer circumferential surface of the contact roller 18 as compared to the protruding portion 42c.

[0042] With this antistatic unit 40, the static electricity in the contact roller 18 is discharged toward the protrusion 41a of the static electricity removing string 41 in the vicinity of the outer circumferential surface of the contact roller 18, and flows to the ground part via the mounting member 42 and the supporting frame 11. This restrains the accumulation of the static electricity in the contact roller 18, and hence the above-described problems caused by the static electricity are resolved.

[Advantageous Effects]

[0043] As described above, because the yarn winding apparatus 10 of the present embodiment includes the antistatic unit 40 for removing static electricity from the contact roller 18 (equivalent to a rotating body of the present invention), an influence of the static electricity generated by the friction between the contact roller 18 and the package P is restrained.

[0044] In addition to the above, in the present embodiment, the bobbins B are attached along the axial direction of the bobbin holder 12 (equivalent to a bobbin supporting shaft of the present invention) supporting the bobbins B, and the contact roller 18 is arranged to be in contact with the packages P formed by winding the yarns Y into the bobbins B. When the contact roller 18 is in contact with the packages P at plural parts in this way, the friction between the contact roller 18 and the packages P occur at the plural parts, and hence the total amount of the generated static electricity is large, and a harmful effect is more likely to happen. The effect of the antistatic unit 40 is therefore conspicuous in this case.

[0045] In addition to the above, in the present embodiment, the antistatic unit 40 is provided to be separated from the contact roller 18. If the antistatic unit 40 makes contact with the contact roller 18, static electricity may not be properly removed or frequent replacement of components may be required, because the antistatic unit 40 and the contact roller 18 are worn. When the antistatic unit 40 is separated from the contact roller 18, the wearing of the antistatic unit 40 and the contact roller 18 is prevented and the above-described problems are avoided. In the meanwhile, when the winding speed of the yarns Y is high, the amount of the static electricity generated between the antistatic unit 40 and the contact roller 18 may be large if the antistatic unit 40 is in contact with the contact roller 18. On this account, when the winding speed of the yarns Y is high, the arrangement in which the antistatic unit 40 is not in contact with the contact roller 18 is particularly advantageous.

[0046] In addition to the above, according to the present embodiment, the antistatic unit 40 includes the static electricity removing member (static electricity removing string 41) in which conductive fibers are exposed at many parts of the surface. With this static electricity removing member 41, electric discharge from the contact roller 18 occurs at plural parts where the conductive fibers are exposed, and hence the static electricity removing capability of the antistatic unit 40 is improved.

[0047] In addition to the above, according to the present embodiment, the static electricity removing member is the string-shaped static electricity removing string 41 in which conductive fibers are exposed at plural parts of the surface. As the static electricity removing string 41 is employed as the static electricity removing member, because the static electricity removing member 41 is a relatively soft string, the damage of the contact roller 18 is restrained even if the static electricity removing member 41 makes contact with contact roller 18 due to vibrations or the like.

[0048] In addition to the above, according to the present embodiment, the static electricity removing string 41 is attached along the mounting member 42 which is higher in rigidity than the static electricity removing string 41. When the static electricity removing string 41 is provided without such a base, it is sometimes difficult to maintain the string at a desired position due to slackening or vibrations. In this regard, the slackening or vibrations of the static electricity removing string 41 are resolved by attaching the string 41 along the highly-rigid mounting member 42, and hence the degree of freedom in the position of the static electricity removing string 41 is improved.

[0049] In addition to the above, according to the present embodiment, the static electricity removing string 41 has the protrusion 41a protruding from the mounting member 42 toward the outer circumferential surface of the contact roller 18. The static electricity removing string 41 is preferably as close to the outer circumferential surface of the contact roller 18 as possible, because electric discharge from the contact roller 18 to the static electricity removing string 41 is facilitated. However, when the highly-rigid mounting member 42 extends to be too close to the outer circumferential surface of the contact roller 18, the contact roller 18 may make contact with the mounting member 42 due to vibrations or the like, with the result that the contact roller 18 may be heavily damaged. On this account, as the protrusion 41a is provided to cause only the static electricity removing string 41 to protrude toward the outer circumferential surface of the contact roller 18, electric discharge from the contact roller 18 to the static electricity removing string 41 is facilitated but physical contact between the contact roller 18 and the mounting member 42 is restrained.

[0050] In addition to the above, in the present embodiment, the "rotating body" of the present invention is equivalent to the contact roller 18 which is rotationally driven in accordance with the rotation of the packages P. When static electricity is accumulated in the contact roller 18, winding may not be properly done as the yarns Y are stuck onto the contact roller 18 on account of the static electricity. With the antistatic unit 40, the winding is properly done and hence the quality of the packages P is improved.

[0051] In addition to the above, in the present embodiment, the contact roller 18 is rotatably supported by the supporting frame 11 (equivalent to a supporting member of the present invention) via the bearing 19, and between the bearing 19 and the supporting frame 11, the ring members 21 made of rubber which is an insulating material are provided. With such rubber-made ring members 21, the bearing 19 is firmly attached to the supporting frame 11. However, escape of the static electricity from the contact roller 18 to the supporting frame 11 via the bearing 19 is obstructed, with the result that the accumulation of the static electricity in the contact roller 18 is facilitated. The effect of the antistatic unit 40 is therefore conspicuous in this case.

(Modification of Antistatic unit)

[0052] FIG. 5 is a perspective view of an antistatic unit 50 of a modification. FIG. 6 shows the antistatic unit 50 of the modification in a direction VI in FIG. 5. In FIGs. 5 and 6, members such as the packages P in contact with the contact roller 18 are suitably omitted. Being similar to the antistatic unit 40 of the embodiment above, the antistatic unit 50 is fixed to the supporting frame 11 so that the antistatic unit 50 is separated from the contact roller 18, and includes a static electricity removing string 51 and a mounting member 52 for attaching the static electricity removing string 51. The arrangements and effects identical with those of the antistatic unit 40 are not repeated here, and differences from the antistatic unit 40 will be mainly described below.

[0053] The mounting member 52 includes a long portion 53 which extends along the axis of the contact roller 18 and an arc portion 54 which extends in the circumferential direction along the outer circumferential surface of the contact roller 18. Each of the long portion 53 and the arc portion 54 is a long member formed of a metal bar which is rectangular in cross section. One end of the long portion 53 is fixed to the supporting frame 11 by a bolt, and the arc portion 54 is fixed to the other end of the long portion 53 by a bolt. The static electricity removing string 51 is attached to a surface of the arc portion 54, which surface faces the outer circumferential surface of the contact roller 18.

[0054] As such, the static electricity removing string 51 extends along the outer circumferential surface of the contact roller 18 and is attached to the mounting member 52 so as to face the outer circumferential surface of the contact roller 18. With this arrangement, an area where the static electricity is discharged from the outer circumferential surface of the contact roller 18 to the static electricity removing string 51 is large, and hence the removal

of the static electricity is ensured. Furthermore, as the static electricity removing string 51 is provided between the outer circumferential surface of the contact roller 18 and the mounting member 52, the static electricity removing string 51 functions as a buffer material which prevents the contact roller 18 from directly making contact with the highly-rigid mounting member 52 due to vibrations or the like.

[0055] A similar effect can be achieved even if the static electricity removing string 51 is not provided in the circumferential direction along the outer circumferential surface of the contact roller 18 as in this modification. That is to say, as long as the static electricity removing string 51 is provided along the outer circumferential surface of the contact roller 18, the static electricity removing string 51 may be provided along the axis of the contact roller 18, or may be provided along a direction which is synthesis of the circumferential direction and the axial direction.

(Other embodiments)

[0056] Although the embodiment of the present invention has been described, the present invention is not limited to the above and can be suitably changed within the scope of the present invention as described below.

[0057] For example, in the embodiment above, the present invention is applied to the yarn winding apparatus 10 of the spun yarn take-up apparatus 1. Alternatively, the present invention may be applied to a yarn winding apparatus provided in a textile machine which is different from the spun yarn take-up apparatus.

[0058] In addition to the above, in the embodiment above, the rotating body of the present invention is the contact roller 18 which is rotationally driven in accordance with the rotation of the packages P. In this regard, the rotating body of the present invention may not be rotationally driven in an indirect manner. The rotating body may be, for example, a winding drum which is directly rotated by a motor as disclosed in Japanese Unexamined Patent Publication No. 2014-15334.

[0059] In addition to the above, the antistatic unit 40, 50 may be different from the above in terms of the arrangement. For example, the position of the antistatic unit 40, 50 is suitably changeable in both the axial direction and the circumferential direction of the contact roller 18. Furthermore, the shape of the mounting member 42 or the way of attaching the static electricity removing string 41 may be changed so that protrusions 41a of the static electricity removing string 41 are formed at plural parts. The static electricity removing member with conductive fibers is not limited to the string-shaped static electricity removing string 41, 51. The conductive fibers may form a lump or may be provided to form a blush. As a static electricity removing member, a metal blush, a metal needle for static electricity removal, or the like may be provided in the vicinity of the outer circumferential surface of the contact roller 18 so that electric discharge occurs from the contact roller 18 to the metal blush or the metal needle. In addition to the above, the antistatic unit 40, 50 may be provided to be in contact with the contact roller 18. Furthermore, the mounting member 42, 52 supporting the static electricity removing string 41, 51 may be fixed to a member which is different from the supporting frame 11.

Claims

1. A yarn winding apparatus forming at least one package by winding at least one yarn onto at least one bobbin, comprising:

   a rotating body configured to rotate while being in contact with an outer circumferential surface of the at least one package; and
   an antistatic unit configured to remove static electricity from the rotating body.

2. The yarn winding apparatus according to claim 1, wherein,
   a plurality of the at least one bobbin are attached to a bobbin supporting shaft supporting the bobbins, along an axial direction, and
   the rotating body makes contact with a plurality of the at least one package which are formed by winding a plurality of the at least one yarn onto the bobbins.

3. The yarn winding apparatus according to claim 1 or 2, wherein, the antistatic unit is provided to be separated from the rotating body.

4. The yarn winding apparatus according to claim 3, wherein, the antistatic unit includes a static electricity removing member in which conductive fibers are exposed at plural parts of the surface.

5. The yarn winding apparatus according to claim 4, wherein, the static electricity removing member is a string-shaped static electricity removing string in which conductive fibers are exposed at plural parts of the surface.

6. The yarn winding apparatus according to claim 5, wherein, the static electricity removing string is attached along a mounting member which is higher in rigidity than the static electricity removing string.

7. The yarn winding apparatus according to claim 6, wherein, the static electricity removing string includes a protrusion which protrudes from the mounting member toward an outer circumferential surface of the rotating body.

8. The yarn winding apparatus according to claim 6,

wherein, the static electricity removing string extends along the outer circumferential surface of the rotating body and is attached to the mounting member so as to face the outer circumferential surface of the rotating body.

9. The yarn winding apparatus according to any one of claims 1 to 8, wherein, the rotating body is a contact roller which is rotationally driven in accordance with rotation of the at least one package.

10. The yarn winding apparatus according to any one of claims 1 to 9, wherein,
the rotating body is rotatably supported by a supporting member supporting the rotating body via a bearing, and
a rubber-made ring member is provided between the supporting member and the bearing.

FIG.1

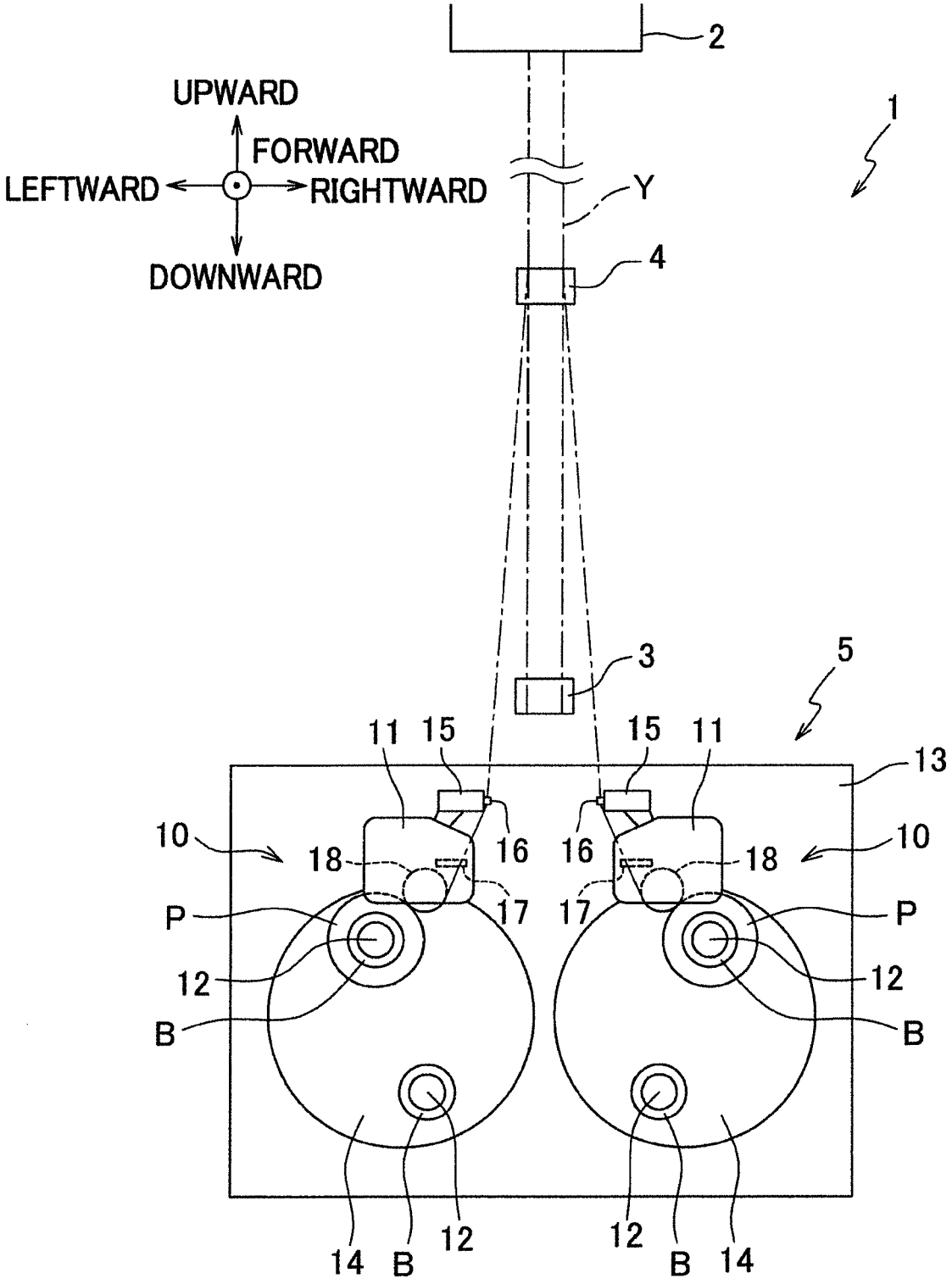

UPWARD
FORWARD
LEFTWARD
RIGHTWARD
DOWNWARD
2
1
Y
4
3
5
11
15
15
11
13
10
18
16
16
18
10
17
17
P
P
12
12
B
B
14
B
12
12
B
14

FIG.2

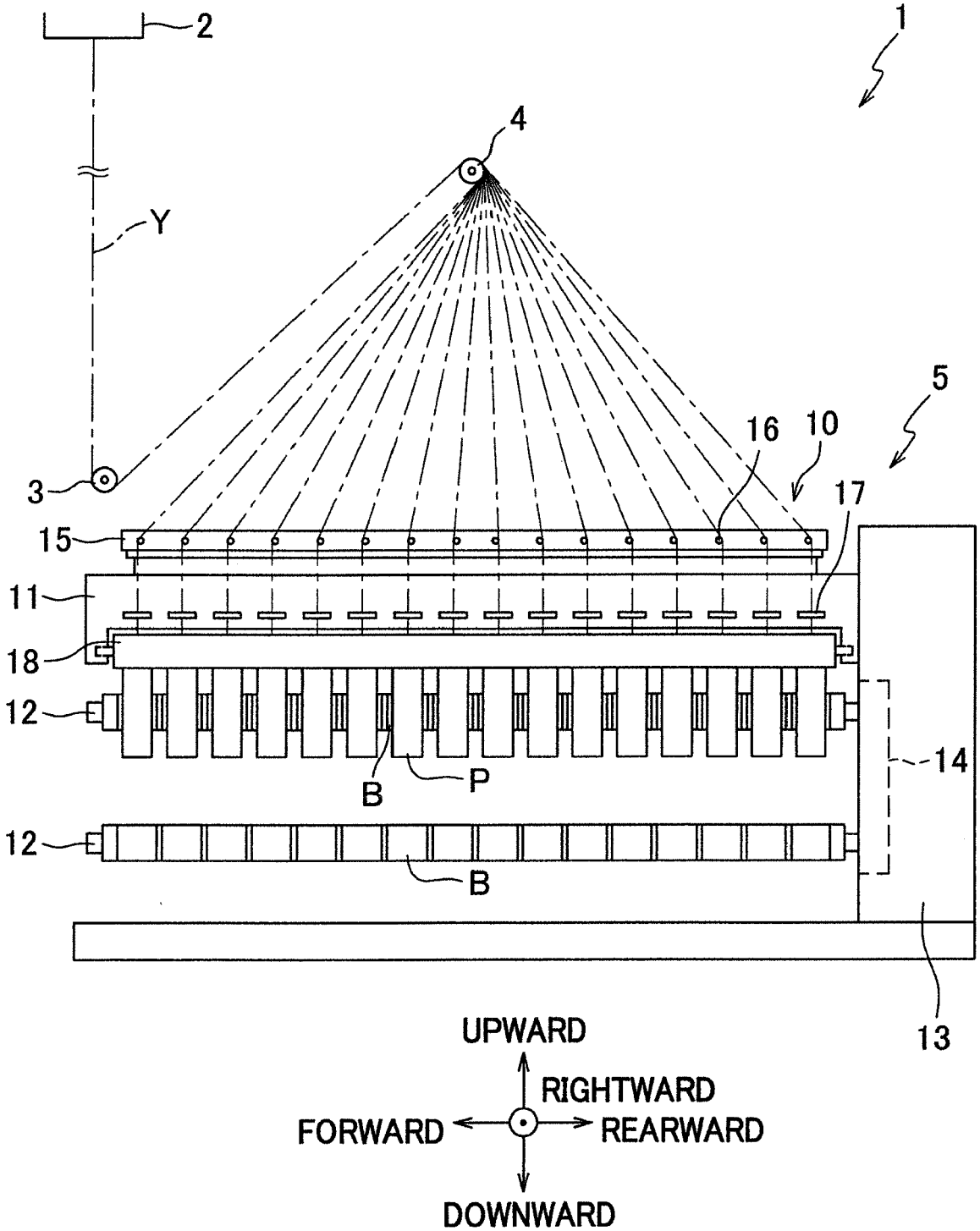

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Y
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18
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14
B
P
12
B
13
UPWARD
RIGHTWARD
FORWARD
REARWARD
DOWNWARD

FIG.3

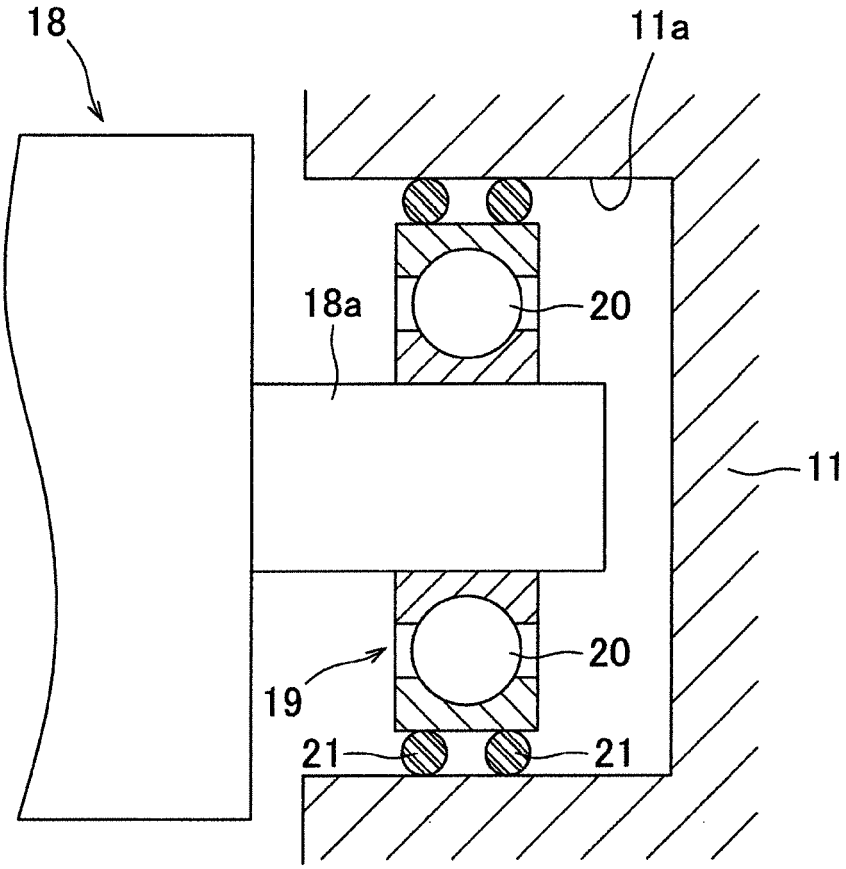


FIG.4

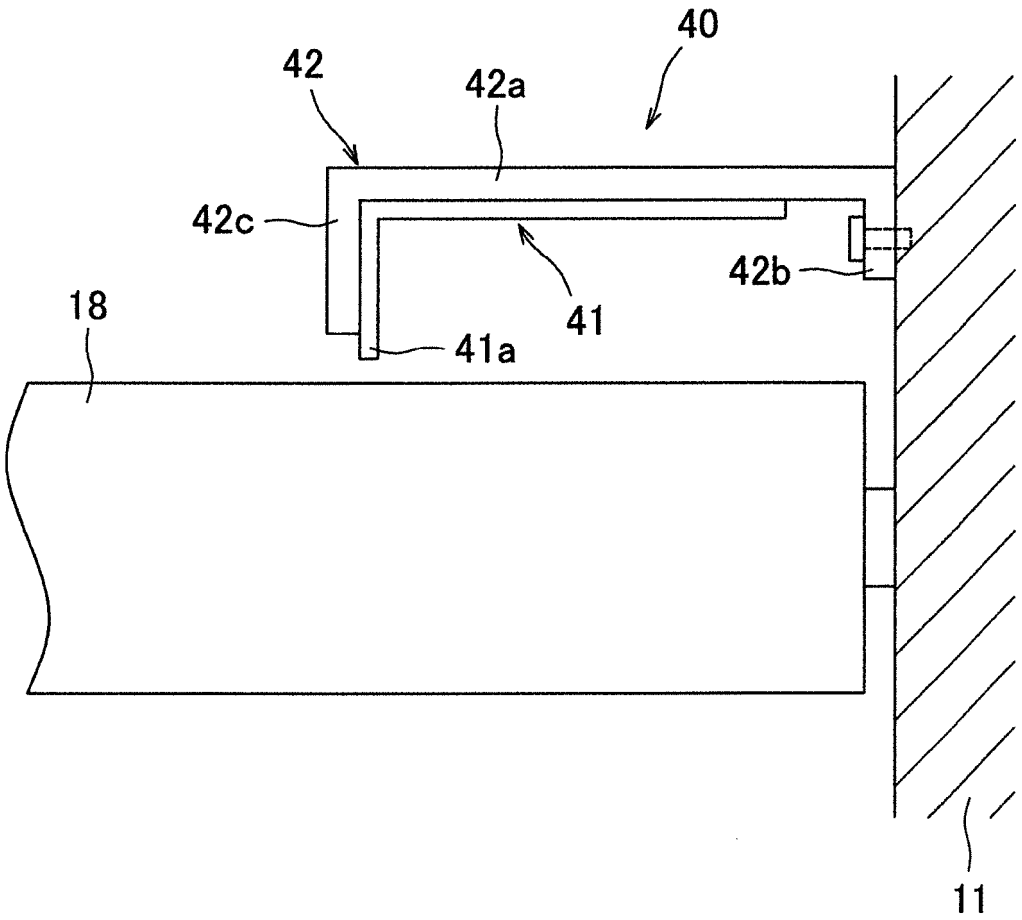


FIG.5

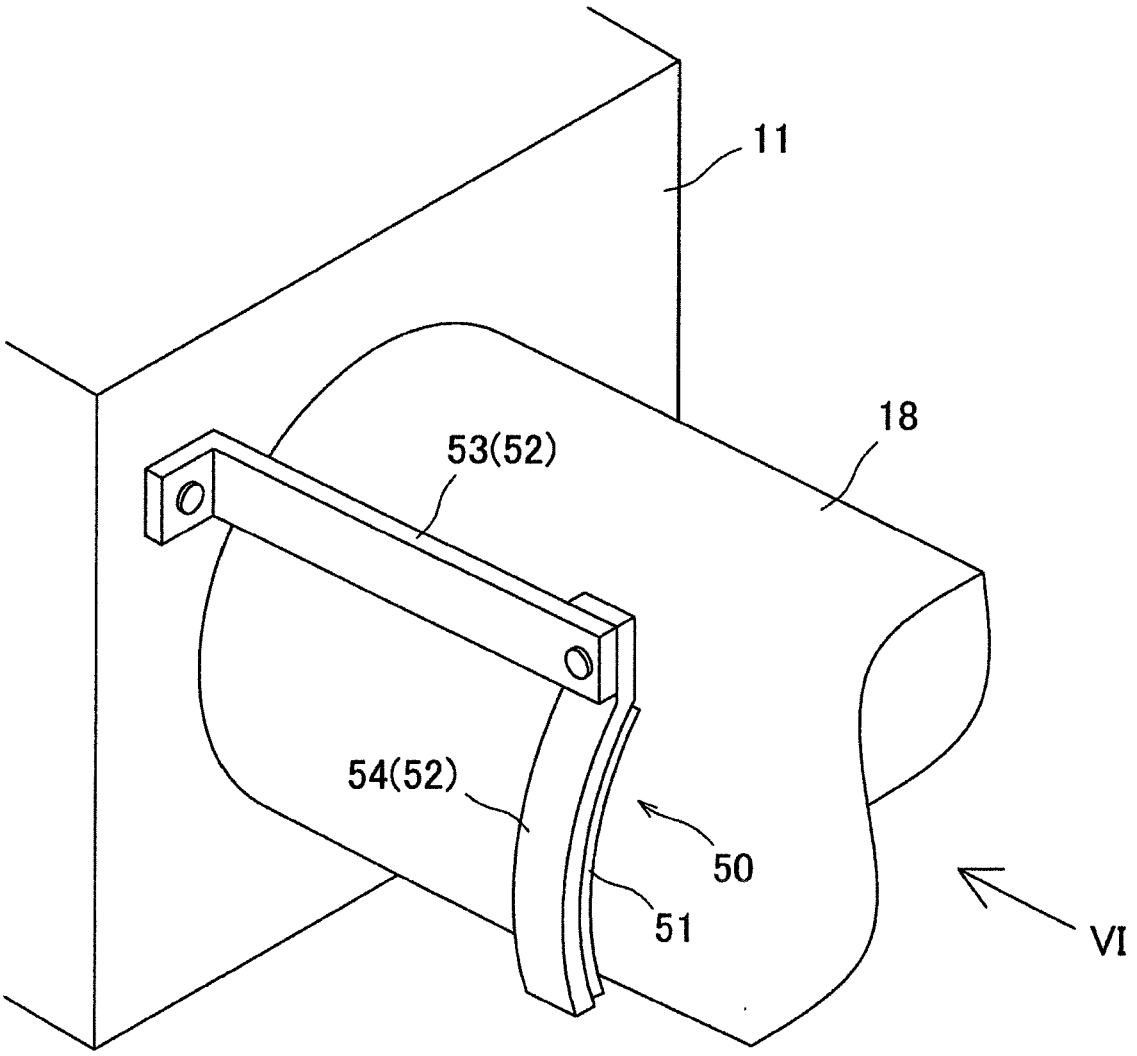
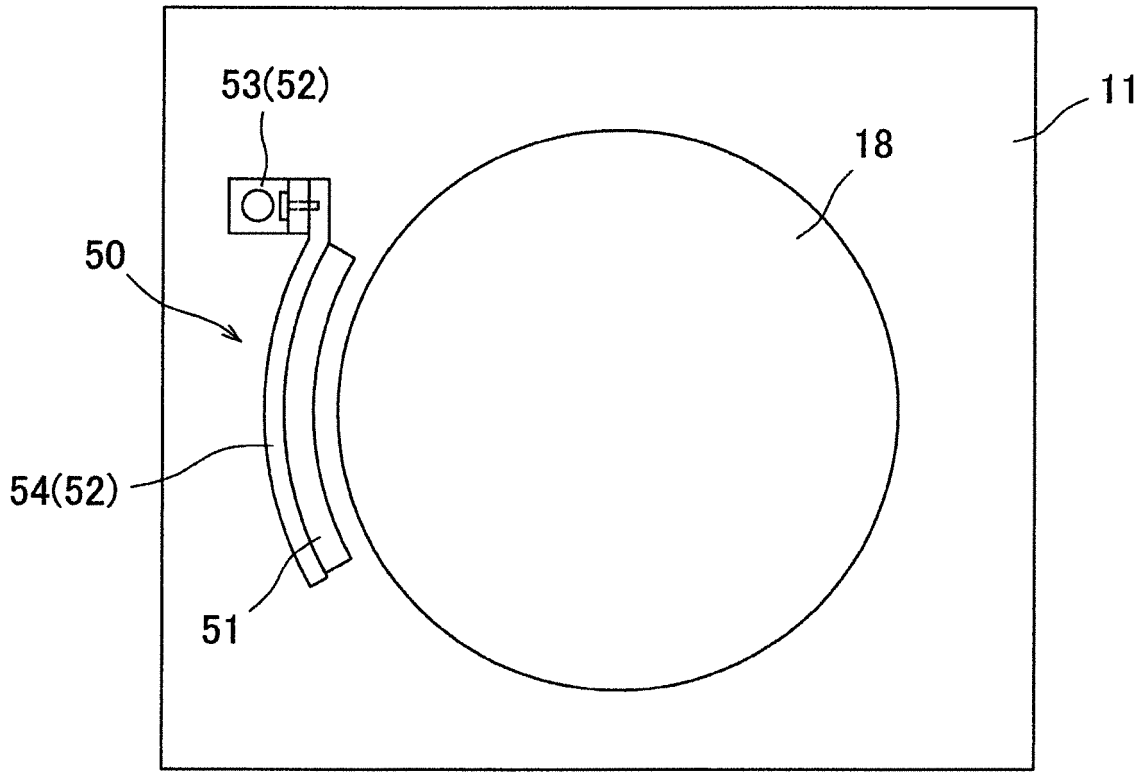


FIG.6



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EUROPEAN SEARCH REPORT

Application Number
EP 17 17 6827

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 November 2017	Pussemier, Bart

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