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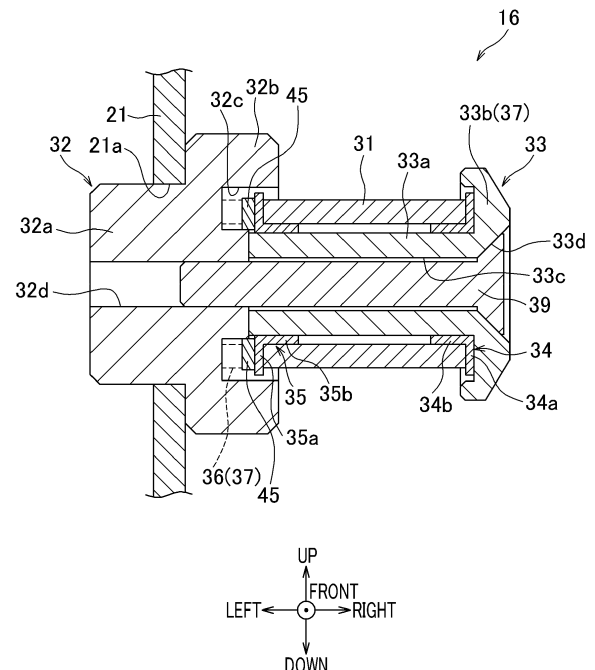
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(54) **SPINNING TAKE-UP DEVICE**

(57) A spinning take-up device 1 includes a guide body 16 having a fulcrum guide 31, and a controller 60. The controller 60 switches a rotation speed of godet rollers 3 and 4 between a first yarn winding speed and a first yarn threading speed. The controller 60 switches a rotation speed of a bobbin holder 13 between a second yarn winding speed and a second yarn threading speed. The fulcrum guide 31 has a cylindrical shape and is rotatable around the central axis. In the spinning take-up device 1, a maximum rotation speed of the fulcrum guide 31 in an acceleration period is larger than a maximum rotation speed of the fulcrum guide 31 in a constant speed period. The guide body 16 is provided with a rotational resistance applying means 37 that applies rotational resistance to the fulcrum guide 31 so that the rotation speed of the fulcrum guide 31 in the acceleration period is less than 14400 rpm.

FIG.3



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a spinning take-up device including a guide body having a fulcrum guide serving as a fulcrum when winding a yarn around a bobbin while traversing the yarn.

[0002] Conventionally, a spinning take-up device that winds a yarn spun from a spinning device around a bobbin while traversing the yarn is known. Such a spinning take-up device is provided with a fulcrum guide serving as a supporting point when traversing the yarn. For example, in JP 2022-112481 A, a cylindrical fulcrum guide is provided, and the yarn is threaded on an outer peripheral surface of the fulcrum guide.

[0003] The fulcrum guide of JP 2022-112481 A is configured to rotate at a peripheral speed slower than the travelling speed of the yarn when the fulcrum guide receives a torque of a predetermined value or more from the travelling yarn. By rotating the fulcrum guide during the winding of the yarn, the portion in contact with the yarn on the outer peripheral surface of the fulcrum guide can be changed, and local abrasion of the outer peripheral surface of the fulcrum guide can be suppressed.

SUMMARY OF THE INVENTION

[0004] However, in the configuration of JP 2022-112481 A, there is a problem that the fulcrum guide is damaged early.

[0005] Therefore, an object of the present application is to reduce local wear of the fulcrum guide and to suppress early breakage of the fulcrum guide.

[0006] A spinning take-up device of the present invention is a spinning take-up device configured to wind a plurality of yarns fed by a yarn feeding roller around a plurality of bobbins attached to a bobbin holder, the spinning take-up device including: a guide body including a fulcrum guide serving as a fulcrum when winding the yarn around the bobbin attached to the bobbin holder while traversing the yarn, the guide body being arranged between the yarn feeding roller and the bobbin holder in a yarn travelling direction in which the yarn travels; a first switching control unit configured to switch a rotation speed of the yarn feeding roller between a first yarn winding speed when winding the yarn around the bobbin and a first yarn threading speed lower than the first yarn winding speed and when threading the yarn around the bobbin; and a second switching control unit configured to switch a rotation speed of the bobbin holder between a second yarn winding speed when winding the yarn around the bobbin and a second yarn threading speed lower than the second yarn winding speed and when threading the yarn around the bobbin, in which the fulcrum guide has a cylindrical shape and is rotatable about a central axis, in which a maximum rotation speed of the fulcrum guide in an acceleration period, which is a period

in which a rotation speed of the yarn feeding roller is accelerated from the first yarn threading speed to the first yarn winding speed, and a rotation speed of the bobbin holder is accelerated from the second yarn threading speed to the second yarn winding speed is greater than a maximum rotation speed of the fulcrum guide in a constant speed period when the rotation speed of the yarn feeding roller is the first yarn winding speed and the rotation speed of the bobbin holder is the second yarn winding speed, and in which the guide body is provided with a rotational resistance applying means configured to apply rotational resistance to the fulcrum guide such that the maximum rotation speed of the fulcrum guide in the acceleration period is less than 14400 rpm.

[0007] The inventors of the present application have intensively investigated the cause of the problem that the fulcrum guide is damaged early, and as a result, have estimated that the rotation speed of the fulcrum guide in the acceleration period may be excessively larger than the rotation speed of the fulcrum guide in the constant speed period, a large torque is applied to the fulcrum guide in the acceleration period, and the load on the bearing becomes very large. Then, the inventors have found that when the rotation speed of the fulcrum guide becomes about 14000 rpm or more, the fulcrum guide is damaged and wear of the bearing becomes severe. Based on such findings, when the rotational resistance with respect to the fulcrum guide is adjusted so that the rotation speed of the fulcrum guide during the acceleration period is less than 14400 rpm, early damage of the fulcrum guide is effectively suppressed, and in addition, wear of the bearing is effectively suppressed.

[0008] The spinning take-up device of the present invention further preferably includes: a contact roller configured to make contact with outer peripheral surfaces of the plurality of bobbins attached to the bobbin holder; and a third switching control unit configured to switch a rotation speed of the contact roller between a third yarn winding speed when winding the yarn around the bobbin and a third yarn threading speed lower than the third yarn winding speed and when threading the yarn around the bobbin, in which, in the acceleration period, a rotation speed of the contact roller is preferably accelerated from the third yarn threading speed to the third yarn winding speed, and in which, in the constant speed period, the rotation speed of the contact roller is preferably the third yarn winding speed.

[0009] According to the present invention, in the configuration in which the rotation speed of the contact roller is accelerated during the acceleration period, it is possible to effectively suppress early breakage of the fulcrum guide.

[0010] In the spinning take-up device of the present invention, the rotational resistance applying means preferably applies rotational resistance to the fulcrum guide so that a maximum rotation speed of the fulcrum guide in the acceleration period is 12000 rpm or less.

[0011] By further reducing the rotation speed of the

fulcrum guide to 12000 rpm or less, it is possible to further suppress early breakage of the fulcrum guide.

[0012] The spinning take-up device of the present invention, the rotational resistance applying means preferably includes: a pressed portion arranged on one side in an axial direction of the fulcrum guide; and a pressing member that presses the fulcrum guide toward the pressed portion, and in which an interposed member is arranged between the fulcrum guide and the pressed portion and/or between the fulcrum guide and the pressing member.

[0013] The rotational resistance can be applied to the fulcrum guide by the pressing force of the pressing member. In addition, the pressing force acting on the fulcrum guide can be adjusted by the shape, size, material, and the like of the interposed members, and the rotation speed and peripheral speed of the fulcrum guide can be easily adjusted.

[0014] In the spinning take-up device of the present invention, the interposed member is preferably made of PEEK-based resin.

[0015] According to the present invention, since the PEEK-based resin excellent in slidability and heat resistance is used as the interposed member, it is possible to suppress wear and deterioration of the interposed member in direct contact with the rotating fulcrum guide.

[0016] In the spinning take-up device of the present invention, a dispersion member for dispersing a force from the pressing member toward the interposed member is preferably arranged between the pressing member and the interposed member.

[0017] According to the present invention, it is possible to suppress application of a force locally from the pressing member to the interposed member and to suppress early damage of the interposed member.

[0018] In the spinning take-up device of the present invention, the fulcrum guide is preferably made of ceramic.

[0019] In the case of the ceramic fulcrum guide, the yarn in contact with the fulcrum guide can be suppressed from being worn by friction as compared with the case of using a fulcrum guide of another material. On the other hand, the ceramic fulcrum guide has a property of being easily damaged. In such a configuration using the ceramic fulcrum guide which is easily damaged, the damage of the fulcrum guide can be more effectively suppressed by applying the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a side view of a spinning take-up device 1 according to the present embodiment;
FIGS. 2A and 2B are side views of a guide unit;
FIG. 3 is a cross-sectional view of a guide body;
FIG. 4 is a block diagram illustrating an electrical configuration of the spinning take-up device;

FIG. 5 is a graph showing a relationship between a peripheral speed of a bobbin holder and a tension of a yarn threaded on the bobbin holder;

FIG. 6 is a graph showing a transition of a rotation speed of a fulcrum guide in an acceleration period; and

FIG. 7 is a table illustrating a relationship between strength of a spring and a maximum rotation speed of a fulcrum guide in an acceleration period.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Hereinafter, an embodiment of a spinning take-up device according to the present invention will be described with reference to the drawings.

(Spinning take-up device)

[0022] FIG. 1 is a side view of a spinning take-up device 1 according to the present embodiment. In the present specification, front, back, left, right, up, and down directions illustrated in FIG. 1 are defined as front, back, left, right, up, and down directions of the spinning take-up device 1.

[0023] The spinning take-up device 1 is a device configured to receive a plurality of (16 in the present embodiment) yarns Y spun from a spinning device 2, and includes godet rollers 3 and 4 (yarn feeding roller of the present invention) and a yarn winding device 10. The spinning device 2 is arranged above the spinning take-up device 1, and spins the plurality of yarns Y made of synthetic resin. The godet rollers 3 and 4 are arranged below the spinning device 2, and are rotationally driven by roller motors 51 and 52 (see FIG. 4) to be described later. The plurality of yarns Y spun from the spinning device 2 are fed to the yarn winding device 10 via the godet rollers 3 and 4.

[0024] The yarn winding device 10 is arranged below the godet rollers 3 and 4. The yarn winding device 10 includes two bobbin holders 13 cantilevered by a turret 12 incorporated in a machine base 11. The bobbin holder 13 extends in the front-rear direction, and a rear end portion thereof is supported by the turret 12. A plurality of bobbins B can be attached to the bobbin holder 13 in the front-rear direction. The bobbin holder 13 is rotationally driven around the axis by a winding motor 53 (see FIG. 4) to be described later.

[0025] The turret 12 is a disc-shaped member having a rotation axis parallel to the front-rear direction, and the bobbin holder 13 is attached to each of an upper position and a lower position different by 180 degrees in the circumferential direction. By rotating the turret 12, the two bobbin holders 13 are moved between the upper position and the lower position. In the bobbin holder 13 at the upper position, the plurality of yarns Y are wound around the plurality of bobbins B to form a plurality of packages P. On the other hand, in the bobbin holder 13 at the lower position, the plurality of packages P are collected and a

plurality of new bobbins B are attached.

[0026] The yarn winding device 10 includes a supporting frame 14 cantilevered by a machine base 11. A rear end portion of the supporting frame 14 is supported by the machine base 11. A guide unit 15 is arranged above the supporting frame 14. In the guide unit 15, guide bodies 16 of the same number as the number of the yarns Y are arranged in the front-rear direction. Traverse devices 17 of the same number as the number of the yarns Y are arranged in the front-rear direction on the supporting frame 14. The traverse device 17 traverses the yarn Y in the front-rear direction with the corresponding guide body 16 as a supporting point.

[0027] A contact roller 18 rotatably supported by the supporting frame 14 is arranged below the supporting frame 14. The contact roller 18 makes contact with the outer peripheral surfaces of the plurality of bobbins B attached to the bobbin holder 13 at the upper position or the outer peripheral surfaces of the plurality of packages P formed by winding the yarns Y around the plurality of bobbins B. At the time of yarn winding, the contact roller 18 rotates while applying a predetermined contact pressure to the package P, so that the shape of the package P can be adjusted. The contact roller 18 is rotationally driven by a CR motor 54 (see FIG. 4) to be described later.

(Electrical configuration of spinning take-up device)

[0028] Next, an electrical configuration of the spinning take-up device 1 of the present embodiment will be described with reference to FIG. 4. FIG. 4 is a block diagram illustrating an electrical configuration of the spinning take-up device 1. The spinning take-up device 1 includes a controller 60. The controller 60 is electrically connected to the roller motor 51, a roller motor 52, the winding motor 53, and the CR motor 54.

[0029] The controller 60 controls the roller motor 51 to switch the rotation speed of the godet roller 3 between a first yarn winding speed and a first yarn threading speed. The first yarn winding speed of the godet roller 3 is the rotation speed of the godet roller 3 when winding the yarn Y around the bobbin B by the yarn winding device 10. The first yarn threading speed of the godet roller 3 is lower than the first yarn winding speed, and is the rotation speed of the godet roller 3 when threading the yarn Y on the bobbin B. Further, the controller 60 controls the roller motor 52 to switch the rotation speed of the godet roller 4 between the first yarn winding speed and the first yarn threading speed. The first yarn winding speed of the godet roller 4 is the rotation speed of the godet roller 4 when winding the yarn Y around the bobbin B by the yarn winding device 10. The first yarn threading speed of the godet roller 4 is lower than the first yarn winding speed, and is the rotation speed of the godet roller 4 when threading the yarn Y on the bobbin B. As described above, the controller 60 of the present embodiment corresponds to a first switching control unit of the present invention. The first yarn winding speed and the first yarn threading speed

of the godet roller 3 may be different from or the same as the first yarn winding speed and the first yarn threading speed of the godet roller 4.

[0030] Further, the controller 60 controls the winding motor 53 to switch the rotation speed of the bobbin holder 13 between a second yarn winding speed and a second yarn threading speed. The second yarn winding speed is the rotation speed of the bobbin holder 13 when winding the yarn Y around the bobbin B by the yarn winding device 10. The second yarn threading speed is lower than the second yarn winding speed, and is the rotation speed of the bobbin holder 13 when threading the yarn Y on the bobbin B. As described above, the controller 60 of the present embodiment also corresponds to the second switching control unit of the present invention.

[0031] Furthermore, the controller 60 controls the CR motor 54 to switch the rotation speed of the contact roller 18 between a third yarn winding speed and a third yarn threading speed. The third yarn winding speed is the rotation speed of the contact roller 18 when winding the yarn Y around the bobbin B by the yarn winding device 10. The third yarn threading speed is lower than the third yarn winding speed, and is the rotation speed of the contact roller 18 when threading the yarn Y on the bobbin B. As described above, the controller 60 of the present embodiment also corresponds to a third switching control unit of the present invention.

(Guide unit)

[0032] A configuration of the guide unit 15 will be described. FIGS. 2A and 2B are side views of the guide unit 15. FIG. 2A illustrates a state in which the plurality of guide bodies 16 are located at winding positions, and FIG. 2B illustrates a state in which the plurality of guide bodies 16 are located at yarn threading positions. The winding positions are positions of the plurality of guide bodies 16 when winding the plurality of yarns Y around the plurality of bobbins B. The yarn threading positions are positions of the plurality of guide bodies 16 when threading the plurality of yarns Y on the plurality of guide bodies 16. The plurality of guide bodies 16 are configured to be movable between the winding positions and the yarn threading positions.

[0033] The guide unit 15 includes the plurality of guide bodies 16, a plurality of sliders 21, a guide rail 22, and an air cylinder 23. The sliders 21 are provided as many as the number of guide bodies 16, and each guide body 16 is attached to the corresponding slider 21. The guide rail 22 is a member extending in the front-rear direction, and is fixed to the supporting frame 14 via a bracket (not illustrated). The plurality of sliders 21 are slidably attached to the guide rail 22 in a state of being arranged in the front-rear direction. The sliders 21 adjacent to each other are connected by a belt (not illustrated). The air cylinder 23 is a driving device for moving the plurality of guide bodies 16 between the winding positions and the yarn threading positions. A rod 23a of the air cylinder 23

is connected to the rearmost slider 21. The driving device that moves the plurality of guide bodies 16 is not limited to the air cylinder 23, and may be another actuator such as a motor.

[0034] As illustrated in FIG. 2A, when the rod 23a of the air cylinder 23 is contracted, the plurality of sliders 21 are arranged in the front-rear direction in a state of being separated from each other. The positions of the plurality of guide bodies 16 at this time are the winding positions. On the other hand, as illustrated in FIG. 2B, when the rod 23a of the air cylinder 23 extends, the plurality of sliders 21 gather at the front end portion of the guide rail 22. The positions of the plurality of guide bodies 16 at this time are the yarn threading positions.

[0035] As illustrated in FIG. 2A, the yarn paths of the plurality of yarns Y distributed from the godet roller 4 to the plurality of guide bodies 16 located at the winding positions are substantially symmetrical with respect to a vertical plane passing through the centers of the plurality of guide bodies 16 in the front-rear direction. The eight yarns Y on the front half are threaded on the front side of the guide body 16, whereas the eight yarns Y on the back half are threaded on the back side of the guide body 16. Of the plurality of guide bodies 16, the closer to the end the greater the contact angle (winding angle) with the yarn Y, and the closer to the center the smaller the contact angle (winding angle) with the yarn Y.

(Guide body)

[0036] Details of the guide body 16 will be described. FIG. 3 is a cross-sectional view of the guide body 16. The guide body 16 includes a fulcrum guide 31, a fixing member 32, and a shaft member 33. The guide body 16 is arranged between the godet roller 4 and the bobbin holder 13 in the yarn travelling direction in which the yarn Y travels. The fulcrum guide 31 serves as a fulcrum when winding the yarn Y around the bobbin B attached to the bobbin holder 13 while traversing the yarn Y. The fulcrum guide 31 has a cylindrical shape extending in the left-right direction, and is supported by the shaft member 33 so as to be rotatable about the central axis. The yarn Y is threaded on the outer peripheral surface of the fulcrum guide 31, and travels while making contact with the outer peripheral surface of the fulcrum guide 31 at the time of yarn winding. The material of the fulcrum guide 31 is not limited, but is preferably ceramic, for example.

[0037] The fixing member 32 has a cylindrical small-diameter portion 32a and a cylindrical large-diameter portion 32b. The small-diameter portion 32a is inserted into a circular attachment hole 21a formed in the slider 21. An annular concave portion 32c is formed at the right end portion of the large-diameter portion 32b. A spring 36 (pressing member of the present invention) is arranged in the concave portion 32c. A female screw portion 32d penetrating in the left-right direction is formed in the fixing member 32. The fixing member 32 is fixed to the slider 21 by a bolt (not illustrated) in a state where the small-

diameter portion 32a is inserted from the right side of the attachment hole 21a and the flange surface of the large-diameter portion 32b abuts on the slider 21.

[0038] The shaft member 33 is a member in which a shaft portion 33a and a flange portion 33b (pressed portion of the present invention) are integrally formed. The shaft portion 33a has a cylindrical shape extending in the left-right direction. The shaft portion 33a rotatably supports the fulcrum guide 31 externally fitted to the shaft portion 33a. The flange portion 33b is an annular portion expanding radially outward of the shaft portion 33a from a right end portion of the shaft portion 33a. The shaft member 33 is formed with a through hole 33c penetrating in the left-right direction. The right end portion of the through hole 33c has a larger inner diameter toward the right, and a tapered surface 33d on which the head of the bolt 39 abuts is formed.

[0039] The interposed members 34 and 35 made of resin are arranged adjacent to the fulcrum guide 31 on both axial sides of the fulcrum guide 31. The interposed members 34 and 35 are annular members having an L-shaped cross section, and include thrust bearing portions 34a and 35a extending in the radial direction of the fulcrum guide 31 and radial bearing portions 34b and 35b extending in the axial direction of the fulcrum guide 31. By providing such resin interposed members 34 and 35, wear of the fulcrum guide 31 and the shaft member 33 can be suppressed. For example, PEEK-based resin is used for the interposed members 34 and 35.

[0040] The thrust bearing portion 34a of the interposed member 34 on the right side is arranged between the fulcrum guide 31 and the flange portion 33b of the shaft member 33 in the axial direction of the fulcrum guide 31, and abuts on the right end surface of the fulcrum guide 31. The thrust bearing portion 35a of the interposed member 35 on the left side is arranged between the fulcrum guide 31 and the spring 36 via a dispersion ring 45 to be described later in the axial direction of the fulcrum guide 31, and abuts on the left end surface of the fulcrum guide 31. The radial bearing portions 34b and 35b are arranged between the fulcrum guide 31 and the shaft portion 33a of the shaft member 33 in the radial direction of the fulcrum guide 31, and abut on the inner peripheral surface of the fulcrum guide 31.

[0041] The dispersion ring 45 (dispersion member of the present invention) is provided between the spring 36 and the thrust bearing portion 35a of the interposed member 35. The dispersion ring 45 is an annular member. The dispersion ring 45 is a member for dispersing a force from the spring 36 toward the interposed member 35. The dispersion ring 45 may be made of metal or resin, for example.

[0042] In a state where the fulcrum guide 31 is externally fitted to the shaft member 33, when the bolt 39 is inserted into the through hole 33c and the bolt 39 is tightened to the female screw portion 32d of the fixing member 32, the shaft member 33 is fixed to the fixing member 32. At this time, the fulcrum guide 31 is pressed toward the

flange portion 33b by the biasing force of the spring 36 arranged in the concave portion 32c of the fixing member 32.

(Yarn threading period, acceleration period, and constant speed period)

[0043] The spinning take-up device 1 of the present embodiment takes a yarn threading period, an acceleration period, and a constant speed period as the controller 60 controls the driving of each motor. Specifically, the yarn threading period is a period in which the yarn Y is threaded on the bobbin B attached to the bobbin holder 13 at the upper position. In the yarn threading period, the rotation speed of the godet rollers 3 and 4 is the first yarn threading speed, the rotation speed of the bobbin holder 13 is the second yarn threading speed, and the rotation speed of the contact roller 18 is the third yarn threading speed. In other words, in the yarn threading period, the controller 60 controls the driving of each motor so that the rotation speed of the godet rollers 3 and 4 becomes a constant speed at the first yarn threading speed, the rotation speed of the bobbin holder 13 becomes a constant speed at the second yarn threading speed, and the rotation speed of the contact roller 18 becomes a constant speed at the third yarn threading speed.

[0044] The acceleration period is a period when the rotation speed of the bobbin holder 13 is accelerated to the yarn winding speed after the yarn Y is threaded on the bobbin holder 13. During the acceleration period, the rotation speeds of the godet rollers 3 and 4 are accelerated from the first yarn threading speed to the first yarn winding speed, the rotation speed of the bobbin holder 13 is accelerated from the second yarn threading speed to the second yarn winding speed, and the rotation speed of the contact roller 18 is accelerated from the third yarn threading speed to the third yarn winding speed. In other words, in the acceleration period, the controller 60 controls the driving of each motor so that the rotation speed of the godet rollers 3 and 4 is accelerated from the first yarn threading speed to the first yarn winding speed, the rotation speed of the bobbin holder 13 is accelerated from the second yarn threading speed to the second yarn winding speed, and the rotation speed of the contact roller 18 is accelerated from the third yarn threading speed to the third yarn winding speed.

[0045] The constant speed period is a period in which the rotation speed of the bobbin holder 13 at the upper position is constant at the yarn winding speed. In the constant speed period, the rotation speed of the godet rollers 3 and 4 is the first yarn winding speed, the rotation speed of the bobbin holder 13 is the second yarn winding speed, and the rotation speed of the contact roller 18 is the third yarn winding speed. In other words, in the constant speed period, the controller 60 controls the driving of each motor so that the rotation speed of the godet rollers 3 and 4 becomes a constant speed at the first yarn winding speed, the rotation speed of the bobbin holder

13 becomes a constant speed at the second yarn winding speed, and the rotation speed of the contact roller 18 becomes a constant speed at the third yarn winding speed.

[0046] The maximum rotation speed of the fulcrum guide 31 configured to rotate by making contact with the yarn Y in the acceleration period becomes greater than the maximum rotation speed of the fulcrum guide 31 in the constant speed period.

[0047] When the spinning take-up device 1 transitions from the acceleration period to the constant speed period, the turret 12 first rotates to move the bobbin holder 13 to which the bobbin B around which the yarn Y is wound during the acceleration period is attached to the lower position, and move the bobbin holder 13 to which the empty bobbin B is attached to the upper position. Thereafter, the yarn Y is wound around the bobbin B attached to the bobbin holder 13 newly moved to the upper position to form the package P.

[0048] Here, in the configuration of JP 2022-112481 A described above, there is a problem that the fulcrum guide is damaged early. In response to this, the inventors of the present application have intensively investigated the cause of the problem that the fulcrum guide is damaged early, and as a result, have estimated that the rotation speed of the fulcrum guide in the acceleration period may be excessively larger than the rotation speed of the fulcrum guide in the constant speed period, a large torque is applied to the fulcrum guide in the acceleration period, and the load on the bearing becomes very large. Then, the present inventors have found that when the rotation speed of the fulcrum guide becomes about 14000 rpm or more, the fulcrum guide 31 is damaged and wear of the bearing becomes severe. Details will be described below.

(Transition of tension of yarn in acceleration period and constant speed period)

[0049] First, the transition of the tension of the yarn Y in the acceleration period and the constant speed period will be described below with reference to FIG. 5. FIG. 5 is a graph simultaneously showing the time dependency of a peripheral speed V1 and a tension T in order to know the relationship between the peripheral speed V1 [m/min] of the bobbin holder 13 and the tension T [cN] of the yarn Y threaded on the bobbin holder 13. The peripheral speed V1 [m/min] of the bobbin holder 13 and the tension T [cN] of the yarn Y illustrated in FIG. 5 are values when the spinning take-up device 1 of the present embodiment is used.

[0050] The horizontal axis in FIG. 5 indicates the lapse of time [sec]. The tension T of the yarn Y is a measured value of the tension T of the yarn Y travelling between the fulcrum guide 31 and the godet roller 4. The measured value of the tension T of the yarn Y is a value obtained when selecting one fulcrum guide 31 from the plurality of fulcrum guides 31 and measuring the tension T of the

yarn Y travelling between the fulcrum guide 31 and the godet roller 4. The tension T of the yarn Y is assumed to exhibit a similar behavior regardless of which fulcrum guide 31 is selected.

[0051] In FIG. 5, the peripheral speed V1 of the bobbin holder 13 has a constant speed period (0 sec to about 2 sec) at about 1700 m/min, an acceleration period (about 2 sec to about 37 sec) from about 1700 m/min to about 4300 m/min, and a constant speed period (about 37 sec to 50 sec) at about 4300 m/min. These indicate a yarn threading period (0 sec to about 2 sec), an acceleration period (about 2 sec to about 37 sec), and a constant speed period (about 37 sec to 50 sec), respectively. The timing at which the peripheral speed V1 of the bobbin holder 13 fluctuates, that is, the timing at which the rotation speed of the bobbin holder 13 fluctuates is the same as the timing at which the rotation speeds of the godet rollers 3 and 4 and the contact roller 18 fluctuate. In FIG. 5, the peripheral speed V1 of the bobbin holder 13 is illustrated to illustrate the yarn threading period, the acceleration period, and the constant speed period, and the description of the peripheral speeds (or the rotation speeds) of the godet rollers 3 and 4 and the contact roller 18, which exhibit the same behavior as the transition of the peripheral speed V1 (or the rotation speed) of the bobbin holder 13, is omitted. In FIG. 5, only the last part of the yarn threading period is illustrated, but actually, the yarn threading period is generally longer than 2 sec. Similarly, although only the first part of the constant speed period is illustrated in FIG. 5, the constant speed period is actually much longer than the acceleration period. Although not illustrated in FIG. 5, the tension T of the yarn Y when the yarn Y is wound around the bobbin B to form the package P in the constant speed period is 10 [cN] or less.

[0052] As shown in FIG. 5, the tension T of the yarn Y in the acceleration period (about 2 sec to about 37 sec in FIG. 5) is generally larger than the tension T of the yarn Y in the constant speed period (about 37 sec to 50 sec in FIG. 5). As shown in FIG. 5, the degree of fluctuation of the tension T of the yarn Y in the acceleration period is greater than the degree of fluctuation of the tension T of the yarn Y in the constant speed period. Specifically, the tension T of the yarn Y constantly fluctuates in the acceleration period, whereas the tension T of the yarn Y greatly decreases first and then remains substantially constant in the constant speed period. As described above, the tension T of the yarn Y is large and unstable during the acceleration period. Due to this, the torque applied from the yarn Y to the fulcrum guide 31 increases, and as a result, the fulcrum guide 31 rotates excessively, and the inventors of the present application estimate that the load on the fulcrum guide 31 and the bearing (for example, the thrust bearing portions 34a and 35a and the radial bearing portions 34b and 35b) increases.

(Behavior of fulcrum guide in acceleration period)

[0053] Next, the behavior of the fulcrum guide 31 in the acceleration period will be described below with reference to FIGS. 6 and 7. FIG. 6 is a graph showing the transition of the rotation speed [rpm] of the fulcrum guide 31 in the acceleration period. FIG. 7 is a table illustrating the relationship between the strength [gf] of the spring 36 and the maximum rotation speed [rpm] of the fulcrum guide 31 in the acceleration period. The rotation speed of the fulcrum guide 31 illustrated in FIGS. 6 and 7 is a value when the fulcrum guide of JP 2022-112481 A described above is used. In addition, it should be noted that the strength [gf] of the spring 36 illustrated in FIG. 7 is adjusted to change the maximum rotation speed [rpm] of the fulcrum guide 31, and does not mean that the strength of the spring 36 of the invention of the present application is limited to this value.

[0054] The vertical axis in FIG. 6 indicates the rotation speed [rpm] of the fulcrum guide 31. The horizontal axis in FIG. 6 indicates the lapse of time [sec]. In FIG. 6, 0 sec is set when the rotation speed of the fulcrum guide 31 rapidly decreases. As shown in FIG. 6, after the rotation speed of the fulcrum guide 31 reaches 14400 rpm, the rotation speed rapidly decreases to about 3000 rpm. This is considered to be due to the occurrence of whirling of the fulcrum guide 31. FIG. 7 illustrates that whirling of the fulcrum guide 31 occurs when the maximum rotation speed of the fulcrum guide 31 is 14400 rpm. The whirling of the fulcrum guide 31 is visually confirmed.

[0055] The whirling of the fulcrum guide 31 will be described. In the guide body 16 as in JP 2022-112481 A or the present embodiment, there are slight gaps between the fulcrum guide 31 and the radial bearing portions 34b and 35b, between the shaft portion 33a and the radial bearing portions 34b and 35b, between the flange portion 33b and the thrust bearing portion 34a, and the like. When the rotation speed of the fulcrum guide 31 increases, each member moves to fill the gap by centrifugal force. However, since the moving directions of the respective members are different, the fulcrum guide 31 vibrates. This is whirling of the fulcrum guide 31. When whirling of the fulcrum guide 31 occurs, the fulcrum guide 31 and the bearing (for example, the thrust bearing portions 34a and 35a and the radial bearing portions 34b and 35b) may be damaged and eventually damaged. In particular, in a case where the fulcrum guide 31 is made of ceramic, when whirling of the fulcrum guide 31 occurs, the risk of breakage of the fulcrum guide 31 becomes greater. Further, as a result of whirling of the fulcrum guide 31, the posture of the fulcrum guide 31 collapses, and the fulcrum guide 31 cannot rotate normally. Then, the rotation speed of the fulcrum guide 31 rapidly decreases. This state is considered to be shown at 0 sec in FIG. 6.

(Rotational resistance applying means)

[0056] Based on the above knowledge, in order to sup-

press early damage of the fulcrum guide 31, in the present embodiment, the rotational resistance applying means 37 that applies rotational resistance to the fulcrum guide 31 is provided so that the maximum rotation speed of the fulcrum guide 31 in the acceleration period is less than 14400 rpm. The rotational resistance applying means 37 is adjusted so that the rotation speed of the fulcrum guide 31 becomes 14400 rpm or less when the fulcrum guide 31 receives a torque of a predetermined value or more from the yarn Y. The predetermined value is a predetermined torque value received by the fulcrum guide 31 in the acceleration period. 14400 rpm is the rotation speed of the fulcrum guide 31 when whirling of the fulcrum guide 31 occurs as described above, and is a peripheral speed slower than the travelling speed of the yarn Y in the acceleration period.

[0057] The predetermined value is preferably larger than a torque value received by the fulcrum guide 31 when the winding of the yarn Y around the bobbin B attached to the bobbin holder 13 at the upper position is being carried out in the constant speed period. In other words, the rotational resistance applying means 37 preferably applies the rotational resistance to the fulcrum guide 31 so that the fulcrum guide 31 does not rotate when the yarn Y is wound around the bobbin B attached to the bobbin holder 13 at the upper position in the constant speed period. However, the predetermined value is not limited thereto.

[0058] The fulcrum guide 31 may receive a torque of a predetermined value or more even in the constant speed period. Also in this case, the fulcrum guide 31 is driven to rotate at a rotation speed of less than 14400 rpm by the rotational resistance applied from the rotational resistance applying means 37.

[0059] The configuration of the rotational resistance applying means 37 of the present embodiment will be specifically described. The rotational resistance applying means 37 includes the spring 36 and the flange portion 33b of the shaft member 33. When the spring 36 presses the fulcrum guide 31 toward the flange portion 33b, frictional resistance when the fulcrum guide 31 rotates increases, and rotational resistance can be applied. As a result, the rotation speed of the fulcrum guide 31 can be reduced.

[0060] The magnitude of the rotational resistance applied to the fulcrum guide 31 can be adjusted by changing the interposed members 34 and 35 or the spring 36. Alternatively, a spacer may be provided at an appropriate position between the concave portion 32c of the fixing member 32 and the flange portion 33b of the shaft member 33 to adjust the biasing force of the spring 36. The rotational resistance applying means 37 adjusts the maximum rotation speed of the fulcrum guide 31 in the acceleration period to be less than 14400 rpm, more preferably 12000 rpm or less, and still more preferably 6000 rpm or less.

[0061] Furthermore, when the rotation speed of the fulcrum guide 31 is small, a precise bearing structure such

as a ball bearing is unnecessary, and a simple bearing structure such as a plain bearing can be used, so that there is also a secondary effect that the cost can be further reduced.

[0062] In the guide body 16 (one of the plurality of guide bodies 16 that is close to the end, see FIGS. 2A and 2B) having a large contact angle (winding angle) with the yarn Y, the frictional force between the yarn Y and the fulcrum guide 31 is large. On the other hand, in the guide body 16 (one of the plurality of guide bodies 16 that is close to the center, see FIGS. 2A and 2B) having a small contact angle (winding angle) with the yarn Y, the frictional force between the yarn Y and the fulcrum guide 31 is small. Therefore, the timing at which the torque acting on the fulcrum guide 31 exceeds the predetermined value differs between the guide body 16 having a large contact angle (winding angle) with the yarn Y and the guide body 16 having a small contact angle (winding angle) with the yarn Y. Thus, the torque acting on the fulcrum guide 31 may exceed the predetermined value in the guide body 16 having a large contact angle (winding angle) with the yarn Y, but the torque acting on the fulcrum guide 31 may not exceed the predetermined value in the guide body 16 having a small contact angle (winding angle) with the yarn Y. However, this is not particularly problematic.

[0063] When the torque acting on the fulcrum guide 31 by the frictional force with the yarn Y does not reach the predetermined value, that is, when the fulcrum guide 31 is not driven to rotate by the travelling of the yarn Y, the yarn Y continues to be held in contact with the same portion of the outer peripheral surface of the fulcrum guide 31 and local wear occurs. When wear occurs in the fulcrum guide 31, the frictional force with the yarn Y increases, the torque acting on the fulcrum guide 31 reaches the predetermined value, and the fulcrum guide 31 is slightly driven to rotate. When the yarn Y comes into contact with the non-worn portion of the fulcrum guide 31, the fulcrum guide 31 does not rotate again. Even with such behavior of the fulcrum guide 31, the local wear of the fulcrum guide 31 can be suppressed, and the change in the yarn quality due to the yarn Y continuing to be held in contact with the worn portion of the fulcrum guide 31 can be suppressed.

(Effects)

[0064] The spinning take-up device 1 of the present embodiment is the spinning take-up device 1 configured to wind the plurality of yarns Y fed by the godet rollers 3 and 4 around the plurality of bobbins B attached to the bobbin holder 13. The spinning take-up device 1 includes the guide body 16 having the fulcrum guide 31 serving as a fulcrum when winding the yarn Y around the bobbin B attached to the bobbin holder 13 while traversing the yarn Y, and the controller 60 (first switching control unit and second switching control unit of the present invention). The guide body 16 is arranged between the godet roller 4 and the bobbin holder 13 in the yarn trav-

elling direction in which the yarn Y travels. The controller 60 switches the rotation speed of the godet rollers 3 and 4 between a first yarn winding speed when winding the yarn around the bobbin B and the first yarn threading speed lower than the first yarn winding speed and when threading the yarn Y on the bobbin B. The controller 60 switches the rotation speed of the bobbin holder 13 between the second yarn winding speed when winding the yarn around the bobbin B and the second yarn threading speed lower than the second yarn winding speed and when threading the yarn Y on the bobbin B. The fulcrum guide 31 has a cylindrical shape and is rotatable around the central axis. In the spinning take-up device 1 of the present embodiment, the maximum rotation speed of the fulcrum guide 31 in the acceleration period, which is a period in which the rotation speed of the godet rollers 3 and 4 is accelerated from the first yarn threading speed to the first yarn winding speed and the rotation speed of the bobbin holder 13 is accelerated from the second yarn threading speed to the second yarn winding speed, is larger than the maximum rotation speed of the fulcrum guide 31 in the constant speed period when the rotation speed of the godet rollers 3 and 4 is the first yarn winding speed and the rotation speed of the bobbin holder 13 is the second yarn winding speed. The guide body 16 is provided with the rotational resistance applying means 37 that applies rotational resistance to the fulcrum guide 31 so that the maximum rotation speed of the fulcrum guide 31 in the acceleration period is less than 14400 rpm.

[0065] The inventors of the present application have intensively investigated the cause of the problem that the fulcrum guide 31 is damaged early, and as a result, have estimated that the rotation speed of the fulcrum guide 31 in the acceleration period may be excessively larger than the rotation speed of the fulcrum guide 31 in the constant speed period, a large torque is applied to the fulcrum guide 31 in the acceleration period, and the load on the bearing becomes very large (for details, see the description of "transition of tension of yarn in acceleration period and constant speed period" described above). Then, the inventors of the present application have found that when the rotation speed of the fulcrum guide 31 becomes about 14000 rpm or more, the fulcrum guide 31 is damaged and wear of the bearing becomes severe (for details, see the description of "behavior of fulcrum guide in acceleration period" described above). Based on such findings, when the rotational resistance with respect to the fulcrum guide 31 has been adjusted so that the maximum rotation speed of the fulcrum guide 31 during the acceleration period is less than 14400 rpm, early damage of the fulcrum guide 31 has been effectively suppressed, and in addition, wear of the bearing has been effectively suppressed. Furthermore, in the spinning take-up device 1 of the present embodiment, since the fulcrum guide 31 is rotated at least in the acceleration period, local wear of the outer peripheral surface of the fulcrum guide 31 can be reduced.

[0066] In addition, the spinning take-up device 1 of the present embodiment includes the contact roller 18 that makes contact with the outer peripheral surfaces of the plurality of bobbins B attached to the bobbin holder 13. The controller 60 switches the rotation speed of the contact roller 18 between the third yarn winding speed when winding the yarn Y around the bobbin B and the third yarn threading speed lower than the third yarn winding speed and when threading the yarn Y around the bobbin B. In the acceleration period, the rotation speed of the contact roller 18 is accelerated from the third yarn threading speed to the third yarn winding speed, and in the constant speed period, the rotation speed of the contact roller 18 is the third yarn winding speed. According to this, in the configuration in which the rotation speed of the contact roller 18 is accelerated during the acceleration period, it is possible to effectively suppress early breakage of the fulcrum guide 31.

[0067] In the spinning take-up device 1 of the present embodiment, the rotational resistance applying means 37 applies the rotational resistance to the fulcrum guide 31 so that the maximum rotation speed of the fulcrum guide 31 in the acceleration period is preferably 12000 rpm or less. According to this, by further reducing the rotation speed of the fulcrum guide 31 to 12000 rpm or less, it is possible to further suppress early breakage of the fulcrum guide 31.

[0068] In the spinning take-up device 1 of the present embodiment, the rotational resistance applying means 37 includes the flange portion 33b arranged on one side in the axial direction of the fulcrum guide 31, and the spring 36 that presses the fulcrum guide 31 toward the flange portion 33b, and the interposed members 34 and 35 are arranged between the fulcrum guide 31 and the flange portion 33b and between the fulcrum guide 31 and the spring 36. According to this, the rotational resistance can be applied to the fulcrum guide 31 by the pressing force of the spring 36. In addition, the pressing force acting on the fulcrum guide 31 can be adjusted by the shape, size, material, and the like of the interposed members 34 and 35, and the rotation speed and peripheral speed of the fulcrum guide 31 can be easily adjusted.

[0069] Furthermore, in the spinning take-up device 1 of the present embodiment, the interposed members 34 and 35 are made of PEEK-based resin. According to this, since PEEK-based resin excellent in slidability and heat resistance is used as the interposed members 34 and 35, it is possible to suppress wear and deterioration of the interposed members 34 and 35 in direct contact with the rotating fulcrum guide 31.

[0070] Furthermore, in the spinning take-up device 1 of the present embodiment, the dispersion ring 45 for dispersing the force from the spring 36 toward the interposed member 35 is arranged between the spring 36 and the interposed member 35. According to this, it is possible to suppress application of a force locally from the spring 36 to the interposed member 35 and to suppress early damage of the interposed member 35.

[0071] In the spinning take-up device 1 of the present embodiment, the fulcrum guide 31 is preferably made of ceramic. In the case of the ceramic fulcrum guide, the yarn in contact with the fulcrum guide can be suppressed from being worn by friction as compared with the case of using a fulcrum guide of another material. On the other hand, the ceramic fulcrum guide has a property of being easily damaged. In such a configuration using the ceramic fulcrum guide which is easily damaged, the damage of the fulcrum guide can be more effectively suppressed by applying the present invention.

(Modified Example)

[0072] Hereinafter, modified examples in which modifications are made to the above embodiment will be described. However, components having the same configurations as those of the above embodiment are denoted by the same reference numerals, and the description thereof will be appropriately omitted.

[0073] In the above embodiment, the pressing member of the present invention is configured by the spring 36. However, the pressing member may be formed of an elastic body such as an O-ring.

[0074] In the above embodiment, the spring 36 is arranged in the concave portion of the fixing member 32. However, the arrangement of the spring 36 is not limited thereto. For example, the spring 36 may be arranged between the fulcrum guide 31 and the flange portion 33b. In this case, the fixing member 32 functions as a pressed portion of the present invention.

[0075] In the above embodiment, the interposed members 34 and 35 are provided. However, the interposed members 34 and 35 can be omitted, or only one of the interposed members 34 and 35 may be provided. In addition, specific shapes and materials of the interposed members 34 and 35 are not limited to those of the above embodiment.

[0076] In the above embodiment, the plurality of guide bodies 16 are movable between the winding positions and the yarn threading positions. However, it is not essential to configure the plurality of guide bodies 16 to be movable.

[0077] In the above embodiment, the rotational resistance applying means 37 is configured by the spring 36 and the flange portion 33b. However, the specific configuration of the rotational resistance applying means is not limited thereto.

[0078] In the above embodiment, the controller 60 corresponds to the first switching control unit, the second switching control unit, and the third switching control unit of the present invention. However, the first switching control unit, the second switching control unit, and the third switching control unit may be provided separately.

[0079] In the above embodiment, the rotation speed of the contact roller 18 is configured to be switchable between the third yarn threading speed and the third yarn winding speed. However, the contact roller 18 in contact

with the outer peripheral surface of the bobbin B or the outer peripheral surface of the package P attached to the bobbin holder 13 may be configured to rotate following the rotation of the bobbin holder 13.

[0080] In the above embodiment, a PEEK-based resin is used for the interposed members 34 and 35. However, other resins such as polyacetal (POM) may be used for the interposed members 34 and 35.

[0081] In the above embodiment, the dispersion ring 45 is arranged between the spring 36 and the interposed member 35. However, it is not essential to arrange the dispersion ring 45.

15 Claims

1. A spinning take-up device (1) configured to wind a plurality of yarns (Y) fed by a yarn feeding roller (3, 4) around a plurality of bobbins (B) attached to a bobbin holder (13), the spinning take-up device (1) comprising:

a guide body (16) including a fulcrum guide (31) serving as a fulcrum when winding the yarn (Y) around the bobbin (B) attached to the bobbin holder (13) while traversing the yarn (Y), the guide body (16) being arranged between the yarn feeding roller (3, 4) and the bobbin holder (13) in a yarn travelling direction in which the yarn (Y) travels;

a first switching control unit (60) configured to switch a rotation speed of the yarn feeding roller (3, 4) between a first yarn winding speed when winding the yarn (Y) around the bobbin (B) and a first yarn threading speed lower than the first yarn winding speed and when threading the yarn (Y) around the bobbin (B); and

a second switching control unit (60) configured to switch a rotation speed of the bobbin holder (13) between a second yarn winding speed when winding the yarn (Y) around the bobbin (B) and a second yarn threading speed lower than the second yarn winding speed and when threading the yarn (Y) around the bobbin (B), wherein the fulcrum guide (31) has a cylindrical shape and is rotatable about a central axis, a maximum rotation speed of the fulcrum guide (31) in an acceleration period, which is a period in which the rotation speed of the yarn feeding roller (3, 4) is accelerated from the first yarn threading speed to the first yarn winding speed, and the rotation speed of the bobbin holder (13) is accelerated from the second yarn threading speed to the second yarn winding speed is greater than the maximum rotation speed of the fulcrum guide (31) in a constant speed period when the rotation speed of the yarn feeding roller (3, 4) is the first yarn winding speed and the ro-

- tation speed of the bobbin holder (13) is the second yarn winding speed, and the guide body (16) is provided with a rotational resistance applying means (37) configured to apply rotational resistance to the fulcrum guide (31) such that the maximum rotation speed of the fulcrum guide (31) in the acceleration period is less than 14400 rpm. 5
2. The spinning take-up device (1) according to claim 1, further comprising: 10
- a contact roller (18) configured to make contact with outer peripheral surfaces of the plurality of bobbins (B) attached to the bobbin holder (13); and 15
- a third switching control unit (60) configured to switch a rotation speed of the contact roller (18) between a third yarn winding speed when winding the yarn (Y) around the bobbin (B) and a third yarn threading speed lower than the third yarn winding speed and when threading the yarn (Y) around the bobbin (B), 20
- wherein, in the acceleration period, the rotation speed of the contact roller (18) is accelerated from the third yarn threading speed to the third yarn winding speed, and 25
- in the constant speed period, the rotation speed of the contact roller (18) is the third yarn winding speed. 30
3. The spinning take-up device (1) according to claim 1 or 2, wherein the rotational resistance applying means (37) applies rotational resistance to the fulcrum guide (31) so that a maximum rotation speed of the fulcrum guide (31) in the acceleration period is 12000 rpm or less. 35
4. The yarn winding device according to any one of claim 1 to 3, wherein 40
- the rotational resistance applying means (37) includes:
- a pressed portion (33b) arranged on one side in an axial direction of the fulcrum guide (31); and 45
- a pressing member (36) that presses the fulcrum guide (31) toward the pressed portion (33b), and an interposed member (34, 35) is arranged between the fulcrum guide (31) and the pressed portion (33b) and/or between the fulcrum guide (31) and the pressing member (36). 50
5. The spinning take-up device (1) according to claim 4, wherein the interposed member (34, 35) is made of PEEK-based resin. 55
6. The spinning take-up device (1) according to claim 4 or 5, wherein a dispersion member (45) for dispersing a force from the pressing member (36) toward the interposed member (34, 35) is arranged between the pressing member (36) and the interposed member (34, 35).
7. The spinning take-up device (1) according to any one of claims 1 to 6, wherein the fulcrum guide (31) is made of ceramic.

FIG.1

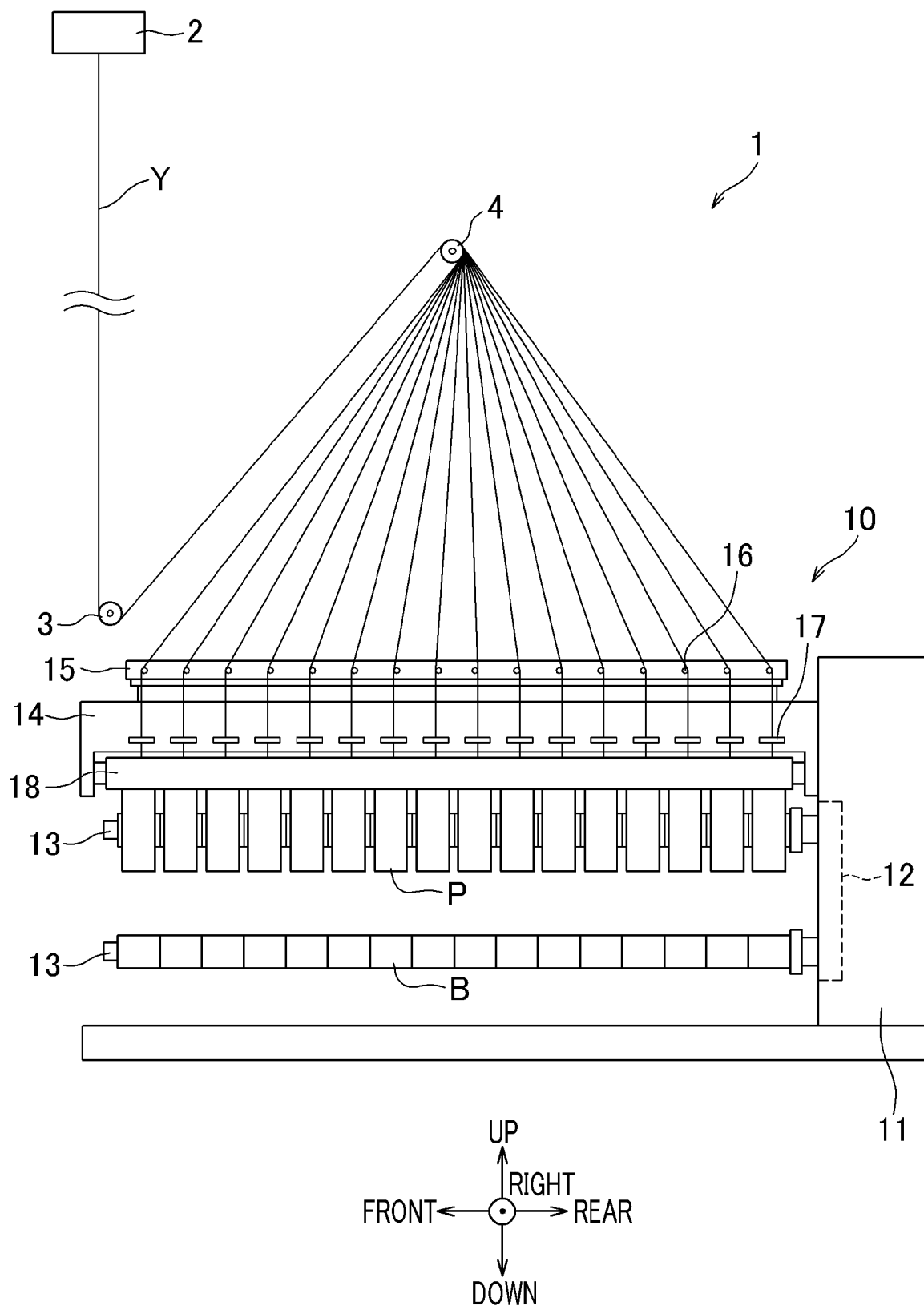


FIG.2

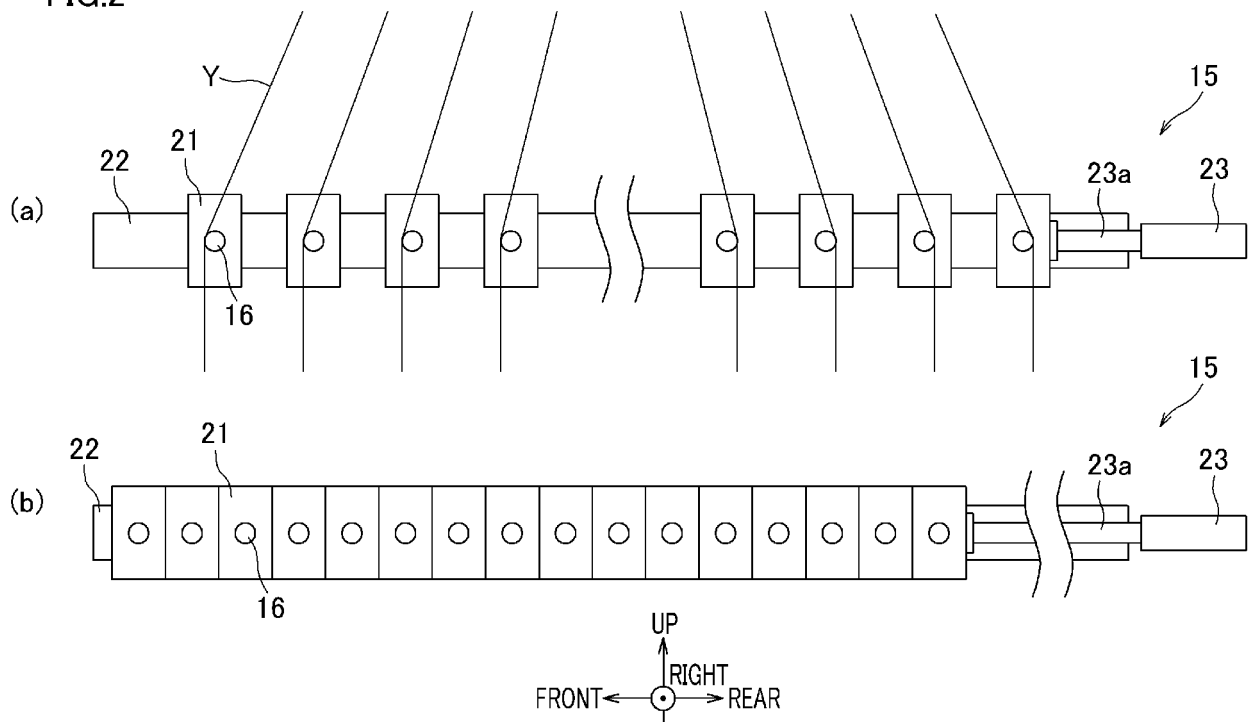


FIG.3

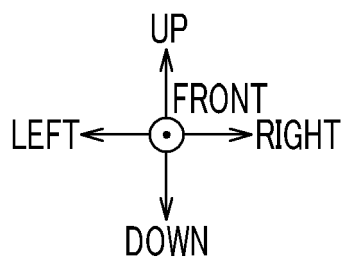
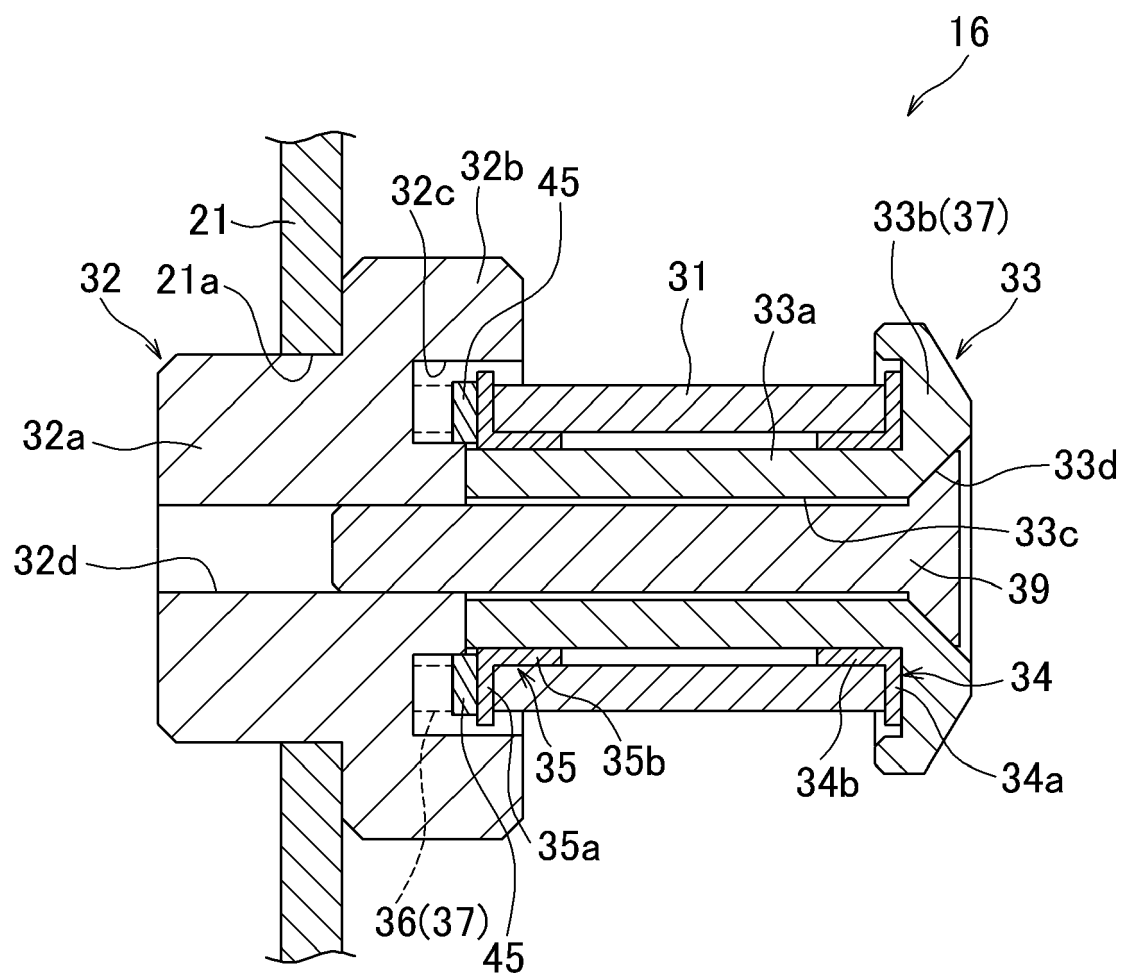


FIG.4

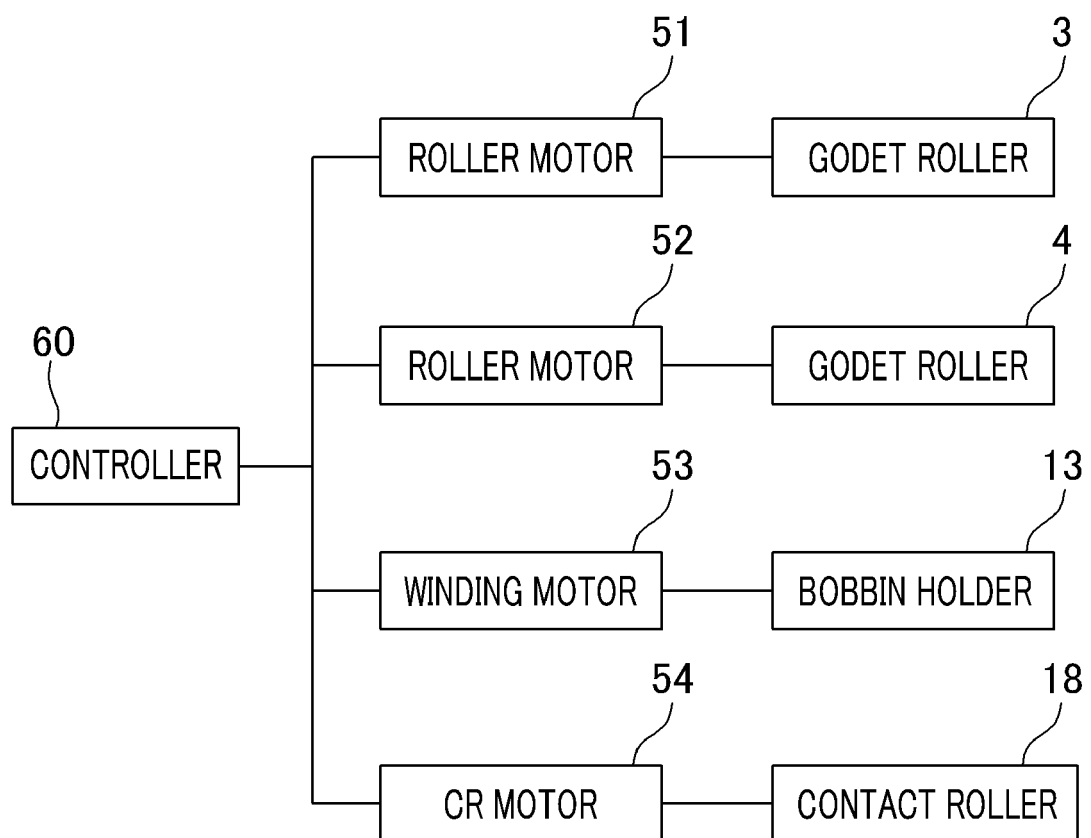


FIG.5

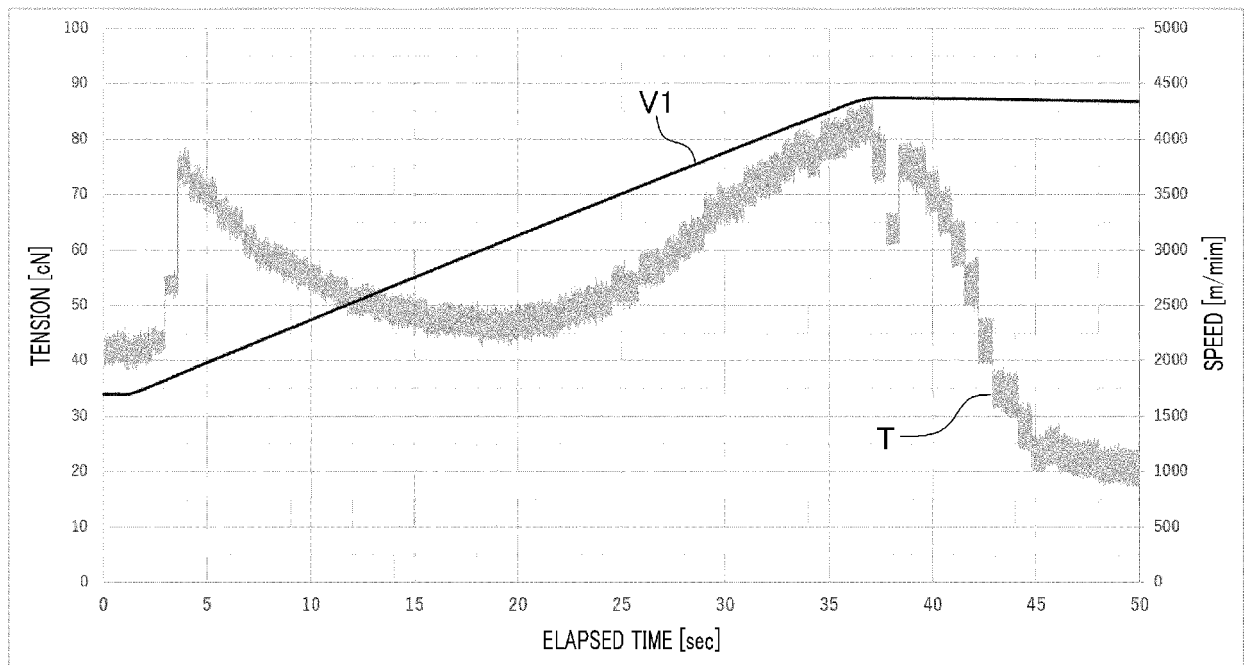


FIG.6

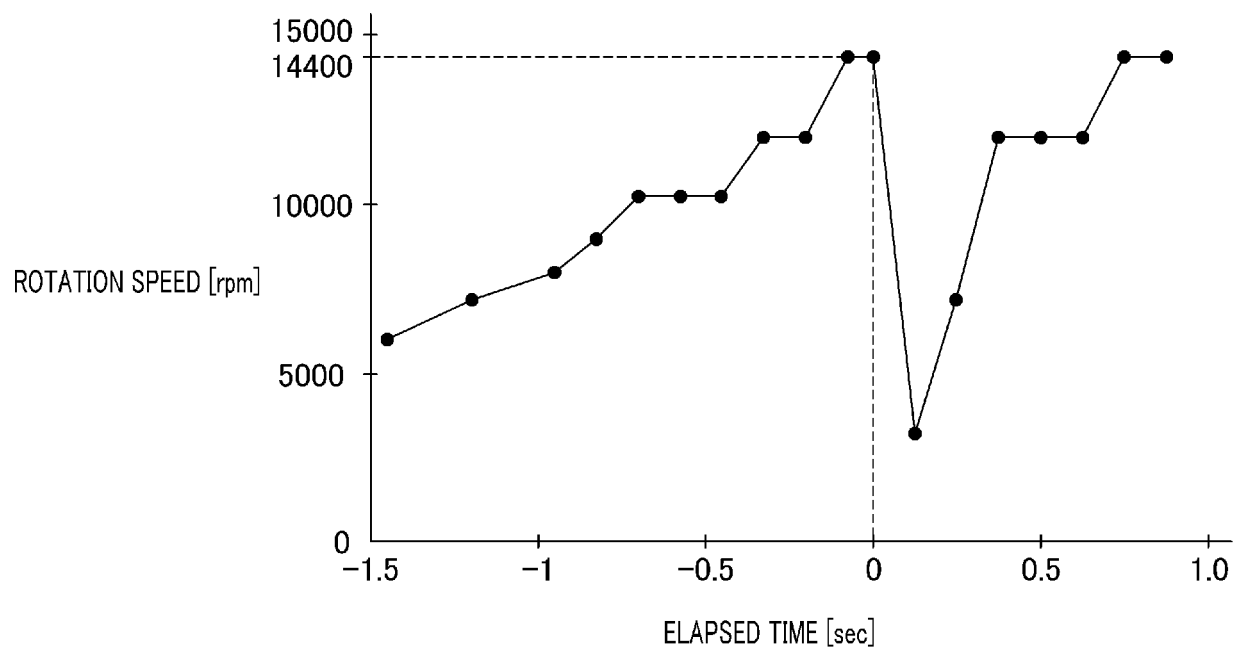


FIG.7

STRENGTH OF SPRING [gf]	MAXIMUM ROTATION SPEED [rpm]	REMARKS
40	14400	WHIRLING OF FULCRUM GUIDE OCCURS
60	6000	—



EUROPEAN SEARCH REPORT

Application Number

EP 24 17 4048

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		21 August 2024	Lemmen, René
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