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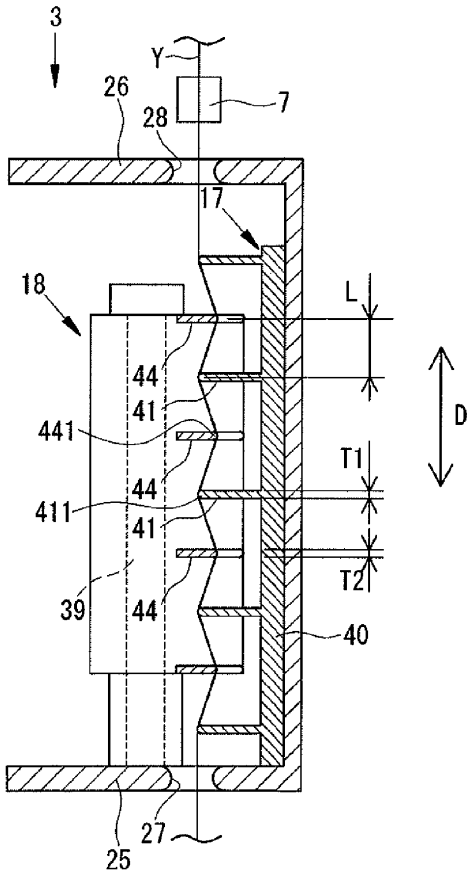
(54) Winding device

(57) A winding device (100) includes a yarn supplying section (11) in which a yarn supplying bobbin (B) is arranged, a winding section (6) adapted to wind a spun yarn (Y) into a package (P), and a tension applying section (3) arranged in a yarn path between the yarn supplying section (11) and the winding section (6) and adapted to apply a tension on the spun yarn (Y). The tension applying section (3) includes a plurality of contact members (41, 44) adapted to apply the tension on the spun yarn (Y) by making contact with the spun yarn (Y) and bending the spun yarn (Y). The contact members (41, 44) are arranged with an interval (L) between each other, and the interval (L) between the contact members (41, 44) in a yarn path direction is 5 mm or more.

FIG. 4



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a winding device adapted to wind, a spun yarn wound around a yarn supplying bobbin as a package.

2. Description of the Related Art

[0002] Conventionally, spinning of a compact yarn, which is a spun yarn where the amount of fluff is small, is possible in a spinning device such as a ring spinning machine and the like. The spinning of the compact yarn is disclosed in Japanese Unexamined Patent Application Publication No. 2003-155631. However, there is a problem in which the fluff increases when rewinding the yarn spun and wound around a yarn supplying bobbin as a package.

[0003] This is because a tension applying section and the like adapted to apply a tension on the spun yarn by making contact with the spun yarn is provided in a winding device such as an automatic winder or the like (see Japanese Unexamined Patent Application Publication No. 2010-126322) and the spun yarn makes contact with the tension applying section and the like at the time of being rewound, causing the fluff to occur. Since a yarn other than the compact yarn originally has a certain amount of fluff, the increase in the fluff caused by the rewinding can be tolerated. However, in a case of the compact yarn of which feature is having a small amount of fluff, if the increase in the fluff is not suppressed, the feature of the compact yarn would be lost.

[0004] To decrease the fluff having increased by rewinding, there is known a fluff binding device adapted to decrease the amount of the fluff sticking out of a parent yarn by binding the fluff with whirling airflow caused by compressed air or with a roller being in contact with the yarn. However, electric power for supplying the compressed air or driving the motor is required to operate the fluff binding device, which leads to energy consumption. Furthermore, the fluff binding device is required to be newly provided, thereby causing a configuration of the winding device to become complicated. Another problem arises that a tension on the yarn cannot be reduced since the yarn is required to go through the fluff binding device.

SUMMARY OF THE INVENTION

[0005] The present invention is made to solve the above-mentioned problems. The object of the present invention is to provide a winding device capable of suppressing the amount of the fluff that occurs when winding the spun yarn wound around the yarn supplying bobbin as the package.

[0006] The problems to be solved by the present invention are as mentioned above, and now, the means for solving such problems will be described below.

[0007] Specifically, a winding device of the present invention is a winding device adapted to wind a spun yarn wound around a yarn supplying bobbin as a package and includes a yarn supplying section, a winding section, and a tension applying section. A yarn supplying bobbin is arranged in the yarn supplying section. The winding section winds the spun yarn into the package. The tension applying section is arranged in a yarn path between the yarn supplying section and the winding section and applies a tension on the spun yarn. The tension applying section includes a plurality of contact members adapted to apply the tension on the spun yarn by making contact with the spun yarn and bending the spun yarn. The contact members are arranged with an interval between each other, and the interval between the contact members in a yarn path direction is 5 mm or more.

[0008] According to the winding device of the present invention, the interval between the contact members in the yarn path direction is 20 mm or less.

[0009] According to the winding device of the present invention, a ratio of a thickness of the contact member in the yarn path direction with respect to the interval between the contact members in the yarn path direction is 1:10 or more.

[0010] According to the winding device of the present invention, the ratio of the thickness of the contact member in the yarn path direction with respect to the interval between the contact members in the yarn path direction is 1:20 or less.

[0011] According to the winding device of the present invention, the contact member includes an arcuate-shaped contact portion that makes contact with the spun yarn.

[0012] The winding device of the present invention includes a fixed gate and a movable gate in which the contact members are arranged. The movable gate and the fixed gate are alternately arranged in the yarn path direction. The interval between the contact members in the yarn path direction is an interval in the yarn path direction between the contact portion of the movable gate in an operating position and the contact portion of the fixed gate adjacent thereto.

[0013] According to the winding device of the present invention, the interval between the contact portions in the yarn path direction is an interval in the yarn path direction between a center of the thickness of the contact portion of the movable gate and a center in a thickness of the contact portion of the fixed gate.

[0014] According to the winding device of the present invention, the fixed gate includes five contact members and the movable gate includes four contact members.

[0015] The present invention provides the following effects.

[0016] According to the winding device of the present invention, the tension applying section includes the plurality of contact members adapted to apply the tension

on the spun yarn by making contact with the spun yarn and bending the spun yarn. The contact members are arranged with the interval between each other, and the interval between the contact members in the yarn path direction is 5 mm or more. This allows suppression of the amount of the fluff that occurs when winding as the package, the spun yarn wound around the yarn supplying bobbin.

[0017] A consideration can be made as a reason for allowing, in the above-described manner, suppression of the amount of the fluff that occurs. That is, when the yarn travels between the contact members, the tension is applied on the spun yarn by force from the contact members. In a case where the interval between the contact members is less than 5 mm and the contact members are densely arranged, a free length of the spun yarn (a length of a portion of the spun yarn laid across an adjacent contact member) is short, and elasticity of the spun yarn decreases (a tension of the spun yarn increases). When the force from the contact members is applied on the spun yarn under this state, the spun yarn is likely to be damaged, thereby easily causing the fluff. On the other hand, in a case where the interval between the contact members is 5 mm or more and the contact members are not densely arranged, the free length of the spun yarn is long and the elasticity of the spun yarn increases (the tension of the spun yarn decreases). Even when the force from the contact members is applied on the spun yarn under this state, the spun yarn is less likely to be damaged since the spun yarn absorbs the force by stretching, thereby allowing suppression of the fluff occurrence.

[0018] According to the winding device of the present invention, the interval between the contact members in the yarn path direction is 20 mm or less. This allows suppression of the amount of the fluff that occurs when winding the spun yarn wound around the yarn supplying bobbin as the package without causing the tension applying section to be large.

[0019] According to the winding device of the present invention, the contact members are set such that the ratio of the thickness in the yarn path direction with respect to the interval between the contact members in the yarn path direction is 1:10 or more. By determining the interval between the contact members so as to realize such a ratio, it is possible to suppress the amount of the fluff that occurs when winding the spun yarn wound around the yarn supplying bobbin as the package.

[0020] According to the winding device of the present invention, the contact members are set such that the ratio of the thickness in the yarn path direction with respect to the interval between the contact members in the yarn path direction is 1:20 or less. By determining the interval between the contact members so as to realize such a ratio, it is possible to suppress the amount of the fluff that occurs when winding the spun yarn wound around the yarn supplying bobbin as a package.

[0021] According to the winding device of the present invention, the contact member includes the arcuate-shaped contact portion that makes contact with the spun yarn. This allows suppression of the fluff occurrence since the spun yarn is less likely to be damaged even when the force from the contact members is applied on the spun yarn.

[0022] According to the winding device of the present invention, the fixed gate and the movable gate each having the contact members are provided, and the movable gate and the fixed gate are alternately arranged in the yarn path direction. The interval between the contact members in the yarn path direction is the interval in the yarn path direction between the contact portion of the movable gate in the operating position and the contact portion of the fixed gate adjacent thereto. By determining the interval between the contact members in such a manner, it is possible to suppress the amount of the fluff that occurs when winding as the package, the spun yarn wound around the yarn supplying bobbin.

[0023] According to the winding device of the present invention, the interval between the contact members in the yarn path direction is the interval in the yarn path direction between the center of the thickness of the movable gate and the center of the thickness of the fixed gate. By determining the interval between the contact members in the yarn path direction in such a manner, it is possible to suppress the amount of the fluff that occurs when winding the spun yarn wound around the yarn supplying bobbin as the package.

[0024] According to the winding device of the present invention, the fixed gate includes five contact members; while the movable gate includes four contact members. This allows suppression of the fluff occurrence while applying the required tension.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a lateral plan view of a tension applying section according to one embodiment of the present invention;
FIG.2 is a front view of an automatic winder;
FIG.3 is an A-A line cross-sectional view of FIG. 1;
FIG.4 is a B-B line cross-sectional view of FIG. 3; and
FIG.5 is a lateral plan view for explaining an operation of the tension applying section.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0026] Next, an automatic winder 100 as a winding device according to an embodiment of the present invention will be described by use of FIGS. 1 to 5.

[0027] In the present embodiment, for convenience of explanation, directions that are illustrated in the drawings by use of crossing arrows and indications of front-back, left-right, and upper-lower are defined as a front-back direction, a left-right direction, and an upper-lower direc-

tion. As illustrated in FIG. 2, the automatic winder 100 is a device for winding (rewinding) as a package P, a yarn (spun yarn) Y wound around a yarn supplying bobbin B. The automatic winder 100 is configured of an upright oblong box-shaped main body frame 1 as a base body. The main body frame 1 includes along a yarn path of the yarn Y stretching from a lower part to an upper part, each device such as a yarn supplying section 11, an unwinding assisting device 2, a tension applying section 3, a tension sensor 7, a yarn joining device 4, a yarn clearer 5 serving as a yarn defect removing device, and a winding section 6.

[0028] The yarn supplying bobbin B supplied to the automatic winder 100 is arranged in the yarn supplying section 11. The unwinding assisting device 2 assists unwinding of the yarn Y from the yarn supplying bobbin B by suppressing increase in a tension for unwinding that is caused by decrease in the amount of yarn wound around the yarn supplying bobbin B. The tension applying section 3 applies a predetermined tension on the yarn Y supplied from the yarn supplying bobbin B. A detailed description will be made on the tension applying section 3 later. The tension sensor 7 is arranged in the yarn path of the yarn Y having passed through the tension applying section 3 and is adapted to output measurement data obtained by measuring the tension of the yarn Y. The tension sensor 7 may be e.g., a device adapted to measure the tension of the yarn Y based on force that is applied to a movable rod by the yarn Y, which is hooked over two fixed rods and the movable rod arranged therebetween.

[0029] When the yarn clearer 5 detects a yarn defect, the yarn joining device 4 cuts the yarn Y for removal of a portion of the yarn defect and joins a lower yarn from the yarn supplying bobbin B and an upper yarn from the package P after removing the portion of the yarn defect. For allowing this, a relay pipe 12 adapted to catch the lower yarn and to pass the lower yarn to the yarn joining device 4, and a suction mouth 13 adapted to catch the upper yarn and to pass the upper yarn to the yarn joining device 4 are mounted on the main body frame 1 both in a state of being capable of swinging. Introduction of the yarn Y into the tension applying section 3 is carried out in a process where the relay pipe 12 passes the lower yarn to the yarn joining device 4. The winding section 6 winds the yarn Y into the package P. The winding section 6 includes a traverse drum 14 adapted to displace (traverse) the yarn Y at a predetermined width and a cradle 15 adapted to support a winding tube 9 of the package P.

[0030] Next, the tension applying section 3 will be described. As illustrated in FIG. 1 and FIG. 3, the tension applying section 3 includes a comb-shaped fixed gate (tension applying body in a fixed side) 17, a comb-shaped movable gate (tension applying body in a movable side) 18, a driving mechanism 19, a casing 23, and an open/close sensor 20. The driving mechanism 19 is configured capable of switching the movable gate 18 to an operating position (position indicated by a solid line in FIG. 1) and a waiting position (position indicated by a broken line in FIG. 1). In the operating position, the movable gate 18 applies the tension on the yarn Y by sandwiching and bending the yarn Y together with the fixed gate 17; while in the waiting position, the movable gate 18 separates from the fixed gate 17 and prepares for the introduction of the yarn Y between the movable gate 18 and the fixed gate 17. A plurality of contact members (41, 44) is arranged in each of the movable gate 18 and the fixed gate 17.

[0031] As illustrated in FIG. 1 and FIG. 3, the fixed gate 17 is fixed on an outer surface of a left wall of the casing 23. The movable gate 18 is swingably supported by a swinging shaft 39 fixed to a bracket 25 in a lower part. The fixed gate 17 is arranged on one side of a flat plate-like base 40, five horizontal fixed contact members 41 side by side with an interval between each other in a yarn path direction D. In a case where a thickness of a plate of the fixed contact member 41 is T1 as illustrated in FIG. 4, a plate thickness T1 is set to 1 mm in the present embodiment. The fixed contact member 41 includes in a portion where the fixed contact member 41 makes contact with the yarn Y, a contact portion 411 with an arcuate-shaped cross-section. For allowing a smooth introduction of the yarn Y, the fixed contact member 41 has a front end portion with an arcuate-shaped cross section and a semicircular projecting section 42 in a back part, projecting to regulate backward movement of the yarn Y.

[0032] The movable gate 18 is configured of a boss 43 rotatably supported by the swinging shaft 39, four horizontal movable contact members 44 formed in a front part of the boss 43, and a coupling boss 37 arranged in the boss 43 in a projecting manner. In the operating position, the movable contact members 44 are arranged side by side with an interval between each other in the yarn path direction D so as to alternately cross the fixed contact members 41 in the yarn path direction D. In the operating position, the movable contact members 44 and the fixed contact members 41 alternately cross each other in the yarn path direction D and apply the tension on the yarn Y by sandwiching and bending the yarn Y. In a case where a thickness of a plate of the movable contact member 44 is T2 as illustrated in FIG. 4, a plate thickness T2 is set to 1 mm, which is the same as the fixed contact member 41 in the present embodiment. The movable contact member 44 includes in a portion where the movable contact member 44 makes contact with the yarn Y, a contact portion 441 with an arcuate-shaped cross-section. For allowing smooth introduction of the yarn Y, the movable contact member 44 has a front end portion with an arcuate-shaped cross section. The movable contact member 44 on a side of the fixed contact member 41 is curved in an inwardly recessed state. Since the movable contact member 44 is curved, when the movable contact member 44 and the fixed contact member 41 sandwich the yarn Y in cooperation, a forward movement of the yarn Y is regulated.

[0033] The fixed contact member 41 of the fixed gate

17 and the movable contact member 44 of the movable gate 18 are, in a state of alternately crossing each other in the yarn path direction D (in the operating position) as illustrated in FIG. 4, set such that an interval L in the yarn path direction D between the fixed contact member 41 and the movable contact member 44 adjacent to each other in the yarn path direction D is set to 5 mm or more and 20 mm or less. Furthermore, the fixed contact member 41 and the movable contact member 44 are set such that a ratio of the thickness T1, T2 in the yarn path direction D with respect to the interval L between the fixed contact member 41 and the movable contact member 44 adjacent to each other in the yarn path direction D is 1: 10 or more and 1:20 or less. In the present embodiment, the interval L in the yarn path direction D between the fixed contact member 41 and the movable contact member 44 adjacent to each other in the yarn path direction D is set to 15 mm. In the present embodiment, since the plate thicknesses T1 and T2 in the yarn path direction D are set to 1 mm, the ratio of the plate thickness T1, T2 in the yarn path direction D with respect to the interval L (=15 mm) between the fixed contact member 41 and the movable contact member 44 adjacent to each other in the yarn path direction D is 1:15. In the present embodiment, the interval L is a distance between centers of the thicknesses of the fixed contact member 41 and the movable contact member 44 in a direction of the plate thicknesses T1, T2. If the interval L exceeds 20 mm, the tension applying section 3 becomes large, thereby causing the automatic winder 100 to be large, which is not preferable.

[0034] The casing 23 is formed into a box shape and a driving mechanism 19 is accommodated therein. The casing 23 is mounted in a removable manner with respect to an auxiliary frame 24 fixed to the main frame 1. In FIG. 1 and FIG. 3, a pair of flat plate-like brackets 25 and 26 is formed in a projecting manner in an upper part and a lower part of a left wall of the casing 23. The both of the gates 17 and 18 are arranged in a space where the brackets 25 and 26 oppose each other. Introducing grooves 27 and 28, which are large in length in a front-back direction and are open in a front edge of the brackets 25 and 26, are respectively formed in both of the brackets 25 and 26. The lower yarn caught by the relay pipe 12 at the time of the yarn joining is, as illustrated in FIG. 5, introduced from a part in front of the tension applying section 3 between the movable gate 18 in the waiting position and the fixed gate 17 via the introducing grooves 27 and 28, then an upper end of the lower yarn is passed to the yarn joining device 4.

[0035] The driving mechanism 19 includes a pair of rotary first solenoid 30 and second solenoid 31, a first lever 32, a second lever 33, an interlocking rod 34, an operating rod 35. The first lever 32 is bent at an acute angle, and the bent portion is fixed to a rotation shaft of the first solenoid 30. The second lever 33 is bent at an obtuse angle, and the bent portion is fixed to a rotation shaft of the second solenoid 31. The interlocking rod 34 interlockably couples one end of the first lever 32 with one end of the second lever 33. The operating rod 35 interlockably couples the other end of the first lever 32 with the coupling boss 37 arranged in the movable gate 18. A permanent magnet 22 is fixed at the other end of the second lever 33.

[0036] The driving of both solenoids 30 and 31 is controlled by a control device 46 (see FIG. 2) adapted to control each of the sections of the automatic winder 100. Rotating power of the second solenoid 31 is transmitted to the movable gate 18 via the second lever 33, the interlocking rod 34, the first lever 32, and the operating rod 35. When the second solenoid 31 is driven, the movable gate 18 is switched from the operating position to the waiting position.

[0037] Rotating power of the first solenoid 30 is transmitted to the movable gate 18 via the first lever 32 and the operating rod 35. When the first solenoid 30 is driven, the movable gate 18 is switched from the waiting position to the operating position. When the movable gate 18 is in the operating position, the movable contact member 44 and the fixed contact member 41 cross each other as illustrated in FIG. 1. In such a manner, the yarn Y is sandwiched by the both of comb teeth 41 and 44 so as to bend in a zig-zag manner in a left-right direction as illustrated in FIG. 4, whereby the tension is applied on the yarn Y by frictional force acting on the bending portion.

[0038] The open/close sensor 20 detects a switching state of the movable gate 18. Specifically, the open/close sensor 20 is configured of the permanent magnet (an object to be detected) 22 adapted to be reciprocally displaced in conjunction with a switching operation of the driving mechanism 19, and a reed switch (sensor body) 21 adapted to output an ON/OFF signal upon detecting that the permanent magnet 22 has been moved to the waiting position.

[0039] The reed switch 21 of the open/close sensor 20 is arranged on a lower wall of the casing 23 and, as illustrated in FIG. 5, when the movable gate 18 is in the waiting position, the reed switch 21 faces the permanent magnet 22 with a small gap therebetween. The control device 46 adjusts, by controlling electric voltage (electric current) to be applied on the first solenoid 30 in accordance with the measurement data from the tension sensor 7, a torque value applied on the movable gate 18 such that the tension of the yarn Y is appropriate.

[0040] In the automatic winder 100 configured as described above, e.g., when a yarn defect is found and a portion of the yarn defect is cut by a cutter provided in the yarn clearer 5 or the like, the relay pipe 12 and the suction mouth 13 suck and catch the cut yarn Y. At this time, the control device 46 switches the movable gate 18 from the operating position to the waiting position by driving the second solenoid 31. When the movable gate 18 reaches the waiting position from the switching operation, the reed switch 21 of the open/close sensor 20 faces the permanent magnet 22 and turns ON.

[0041] Subsequently, the yarn Y is introduced between

the movable gate 18 in the waiting position and the fixed gate 17 via the introducing groove 27 of the bracket 25 and the introducing groove 28 of the bracket 26 by swinging the relay pipe 12 upward. The control device 46 then brings back the movable gate 18 from the waiting position to the operating position by driving the first solenoid 30. In such a manner, the yarn Y is sandwiched by both the comb teeth 41 and 44 of the fixed gate 17 and the movable gate 18 in a zig-zag manner, and the tension is applied on the yarn Y. The control device 46 adjusts the tension by controlling driving of the first solenoid 30 in accordance with the measurement result from the tension sensor 7.

[0042] With the automatic winder 100 according to the above-described present embodiment, the following effects are provided.

[0043] The tension applying section 3 includes a plurality of fixed contact members 41 and movable contact members 44 both adapted to apply the tension on the yarn Y by making contact with the yarn Y and bending the yarn Y. The fixed contact members 41 and the movable contact members 44 are arranged with an interval between each other, and the interval L between the fixed member 41 and the movable member 44 in the yarn path direction D is set to 5 mm or more. This allows suppression of the amount of fluff that occurs when winding the yarn Y wound around the yarn supplying bobbin B as the package P.

[0044] The interval L between the fixed member 41 and the movable member 44 in the yarn path direction D is set to 20 mm or less. This allows, without causing the tension applying section 3 to be large, suppression of the amount of fluff that occurs when winding the yarn Y wound around the yarn supplying bobbin B as the package P.

[0045] The fixed contact member 41 and the movable contact member 44 are set such that the ratio of the thickness T1, T2 in the yarn path direction D with respect to the interval L between the fixed contact member 41 and the movable contact member 44 in the yarn path direction D is 1:10 or more. By determining the interval L between the fixed contact member 41 and the movable contact member 44 so as to realize such a ratio, it is possible to suppress the amount of fluff that occurs when winding the yarn Y wound around the yarn supplying bobbin B as the package P.

[0046] The fixed contact member 41 and the movable contact member 44 are set such that the ratio of the thickness T1, T2 in the yarn path direction D with respect to the interval L between the fixed contact member 41 and the movable contact member 44 in the yarn path direction D is 1:20 or less. By determining the interval L between the fixed contact member 41 and the movable contact member 44 so as to realize such a ratio, it is possible to suppress the amount of the fluff that occurs when winding the yarn Y wound around the yarn supplying bobbin B as the package P.

[0047] The fixed contact member 41 includes the arcuate-shaped contact portion 411 being in contact with the yarn Y; while the movable contact member 44 includes the arcuate-shaped contact portion 441 being in contact with the yarn Y. Accordingly, even when the force from the fixed contact member 41 and the movable contact member 44 is applied on the yarn Y, the yarn Y is less likely to be damaged by the fixed contact member 41 and the movable contact member 44, thereby allowing suppression of the fluff occurrence.

[0048] Provided are the fixed gate 17 in which the fixed contact member 41 is arranged and the movable gate 18 in which the movable contact member 44 is arranged, and the fixed gate 17 and the movable gate 18 are alternately arranged in the yarn path direction D. The interval L between the fixed contact member 41 and the movable contact member 44 in the yarn path direction D is the interval L in the yarn path direction D between the contact portion 441 of the movable gate 18 in the operating position and the contact portion 411 of the fixed gate 17 adjacent thereto. By determining the interval L between the contact portion 411 and the contact portion 441 in such a manner, it is possible to suppress the amount of the fluff that occurs when winding the yarn Y wound around the yarn supplying bobbin B as the package P.

[0049] The interval L between the contact portion 411 and the contact portion 441 in the yarn path direction D is the interval L in the yarn path direction D between the center of the thickness of the contact portion 441 of the movable gate 18 and the center of the thickness of the contact portion 411 of the fixed gate 17. By determining the interval L between the contact portion 411 and the contact portion 441 in the yarn path direction D in such a manner, it is possible to suppress the amount of the fluff that occurs when winding the yarn Y wound around the yarn supplying bobbin B as the package P. Thus, when rewinding the yarn spun by a ring spinning machine or the like by a winding device such as the automatic winder or the like, it is possible to suppress the fluff occurrence, thereby allowing maintenance of the yarn quality from the time of spinning.

[0050] The fixed gate 17 includes five fixed contact members 41; while the movable gate 18 includes four movable contact members 44. This allows suppression of the fluff occurrence while applying the required tension.

[0051] Although the embodiments of the present invention have been described, the present invention is not limited to the above-described embodiments, and various changes may be made.

Claims

1. A winding device (100) adapted to wind a spun yarn (Y) wound around a yarn supplying bobbin (B) as a package (P) comprising:

   a yarn supplying section (1) in which the yarn

supplying bobbin (B) is arranged;
a winding section (6) adapted to wind the spun yarn (Y) into the package (P); and
a tension applying section (3) arranged in a yarn path between the yarn supplying section (1) and the winding section (6) and adapted to apply a tension on the spun yarn (Y);
wherein the tension applying section (3) includes a plurality of contact members (41, 44) adapted to apply the tension on the spun yarn (Y) by making contact with the spun yarn (Y) and bending the spun yarn (Y); **characterized in that** the contact members (41, 44) are arranged with an interval (L) between each other, and the interval (L) between the contact members (41, 44) in a yarn path direction is 5 mm or more.

2. The winding device (100) according to claim 1, **characterized in that** the interval (L) between the contact members (41, 44) in the yarn path direction is 20 mm or less.

3. The winding device (100) according to claim 1 or claim 2, **characterized in that** a ratio of a thickness (T1, T2) of the contact member (41, 44) in the yarn path direction with respect to the interval (L) between the contact members (41, 44) in the yarn path direction is 1:10 or more.

4. The winding device (100) according to claim 3, **characterized in that** the ratio of the thickness (T1, T2) of the contact member (41, 44) in the yarn path direction with respect to the interval (L) between the contact members (41, 44) in the yarn path direction is 1:20 or less.

5. The winding device (100) according to any one of claim 1 through claim 4, **characterized in that** the contact member (41, 44) includes an arcuate-shaped contact portion (411, 441) that makes contact with the spun yarn (Y).

6. The winding device (100) according to any one of claim 1 through claim 5, comprising a fixed gate (17) and a movable gate (18) in which the contact members (41, 44) are arranged; **characterized in that**
the movable gate (18) and the fixed gate (17) are alternately arranged in the yarn path direction; and
the interval (L) between the contact members (41, 44) in the yarn path direction is an interval (L) in the yarn path direction between the contact portion (441) of the movable gate (18) in an operating position and the contact portion (411) of the fixed gate (17) adjacent thereto.

7. The winding device (100) according to claim 6, **characterized in that** the interval (L) between the contact portions (411, 441) in the yarn path direction is an interval (L) in the yarn path direction between a center of the thickness of the contact portion (441) of the movable gate (18) and a center of the thickness of the contact portion (411) of the fixed gate (17).

8. The winding device (100) according to any one of claim 1 through claim 7, **characterized in that** the fixed gate (17) includes five contact members (41) and the movable gate (18) includes four contact members (44).

FIG. 1

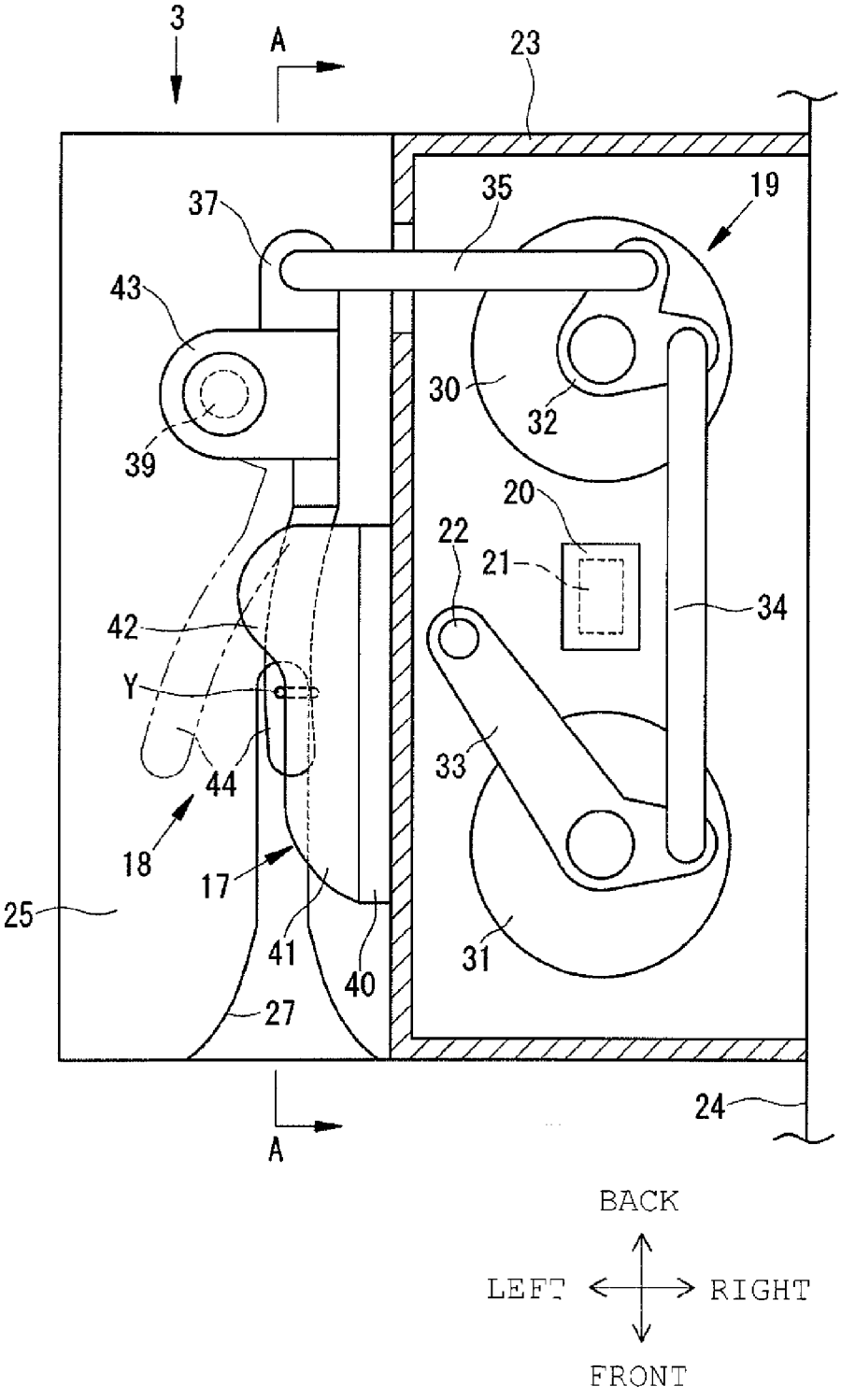

3
A
23
37
35
19
43
30
32
39
20
22
21
34
42
Y
33
44
18
17
25
41
40
31
27
24
A
BACK
LEFT
RIGHT
FRONT

FIG. 2

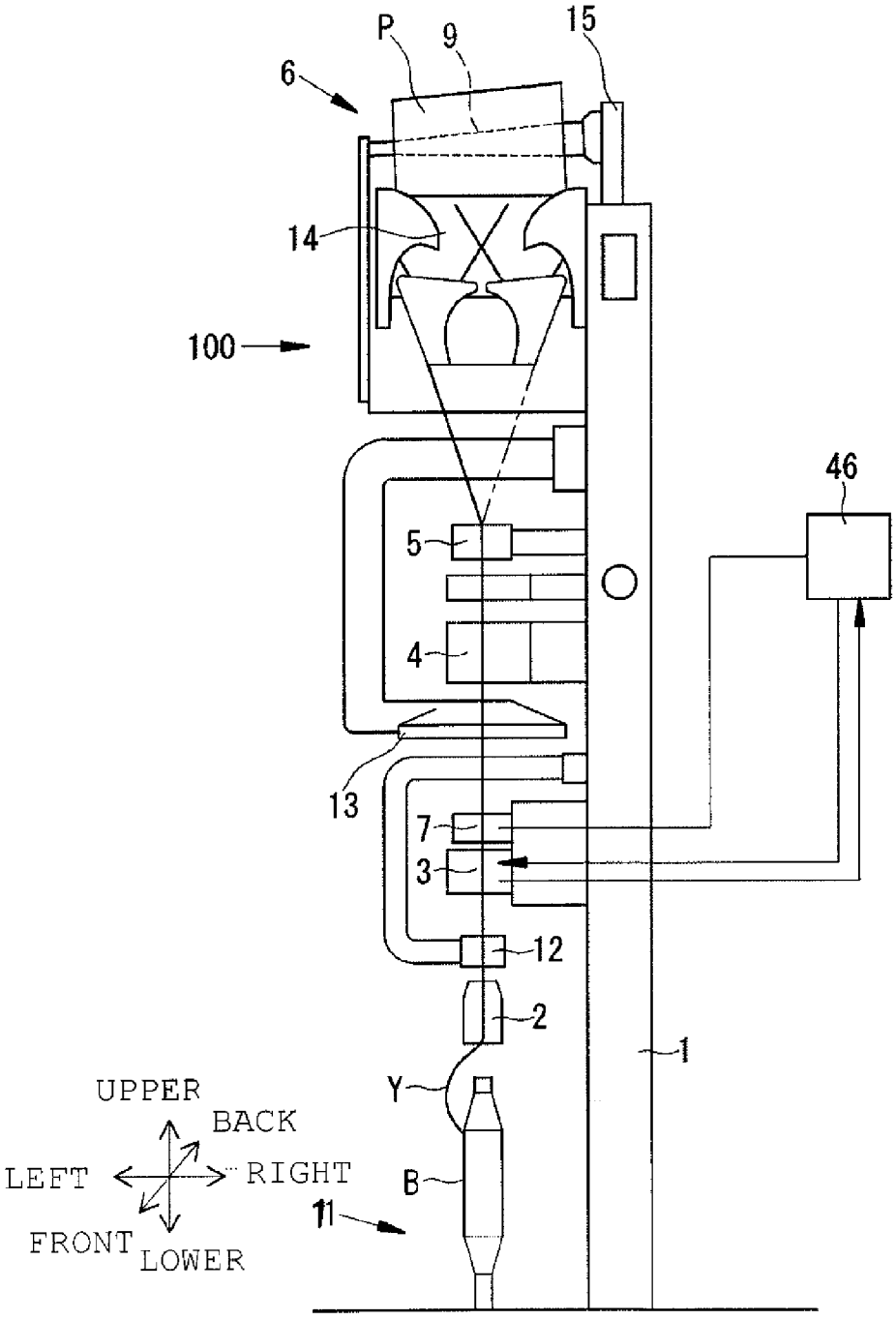

P
9
15
6
14
100
46
5
4
13
7
3
12
2
1
Y
B
11
UPPER
BACK
LEFT
RIGHT
FRONT
LOWER

FIG. 3

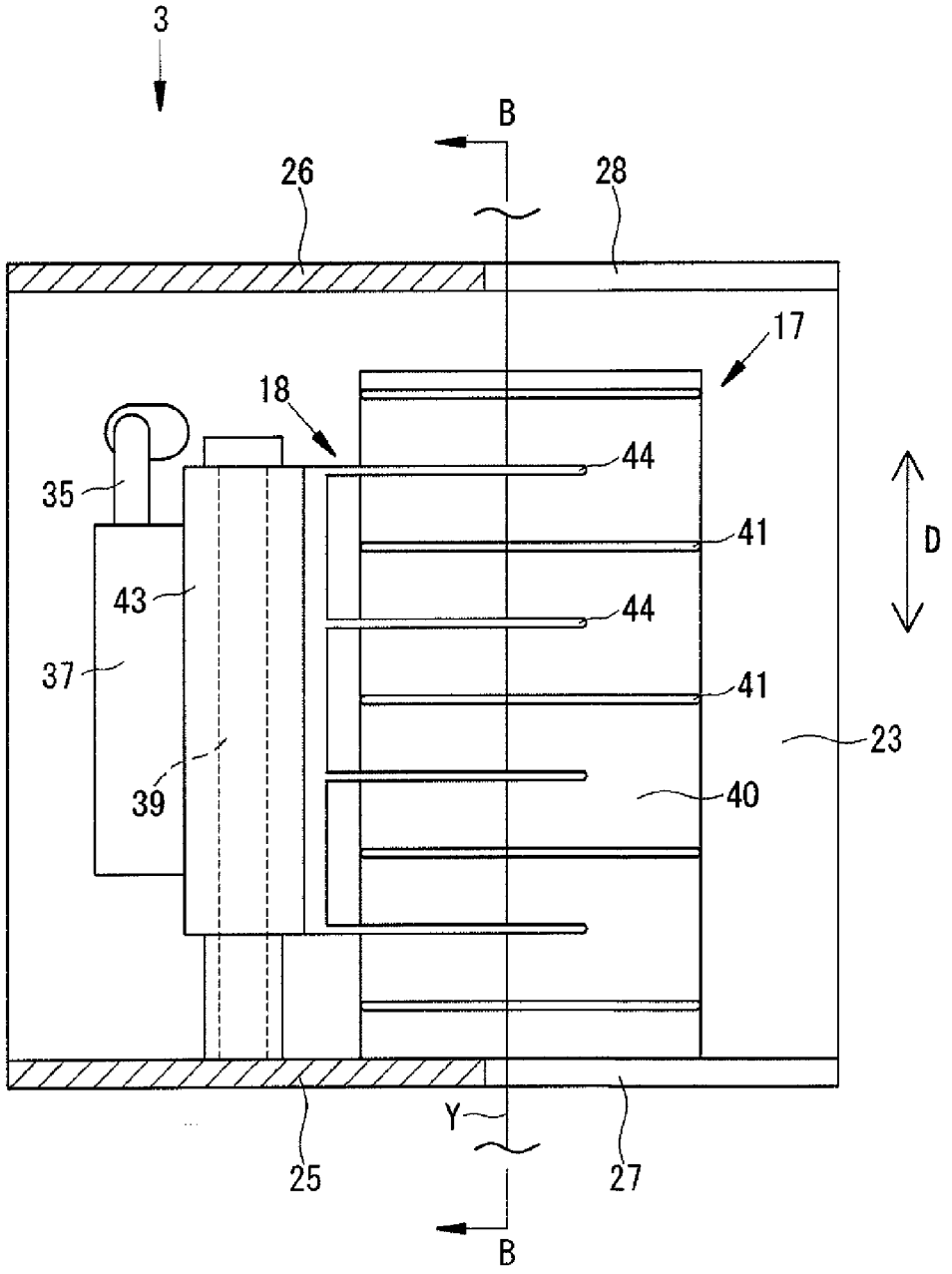


FIG. 4

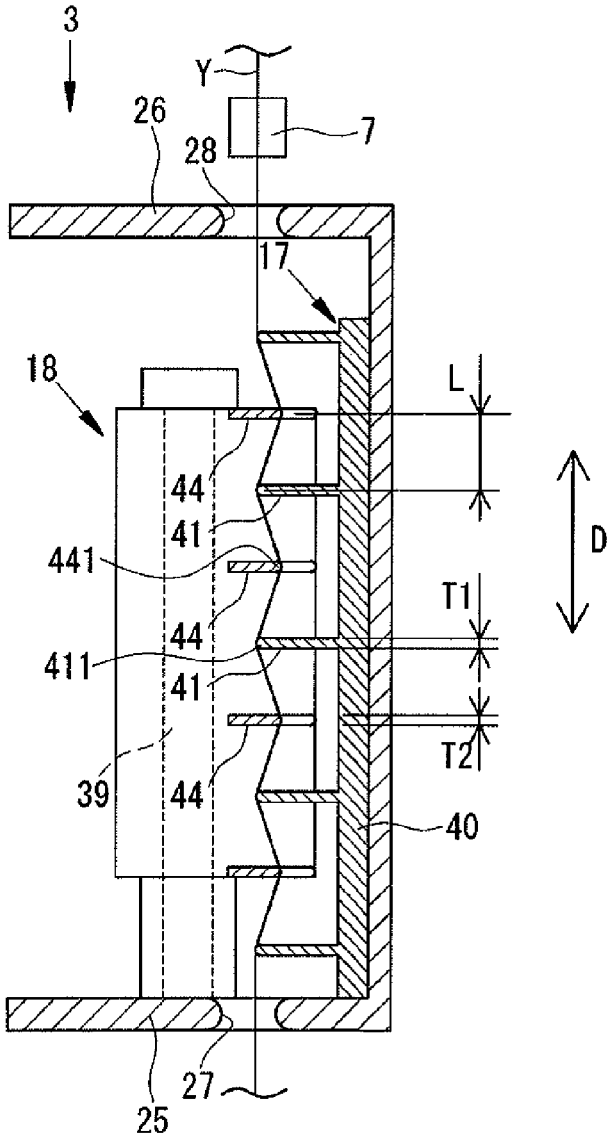
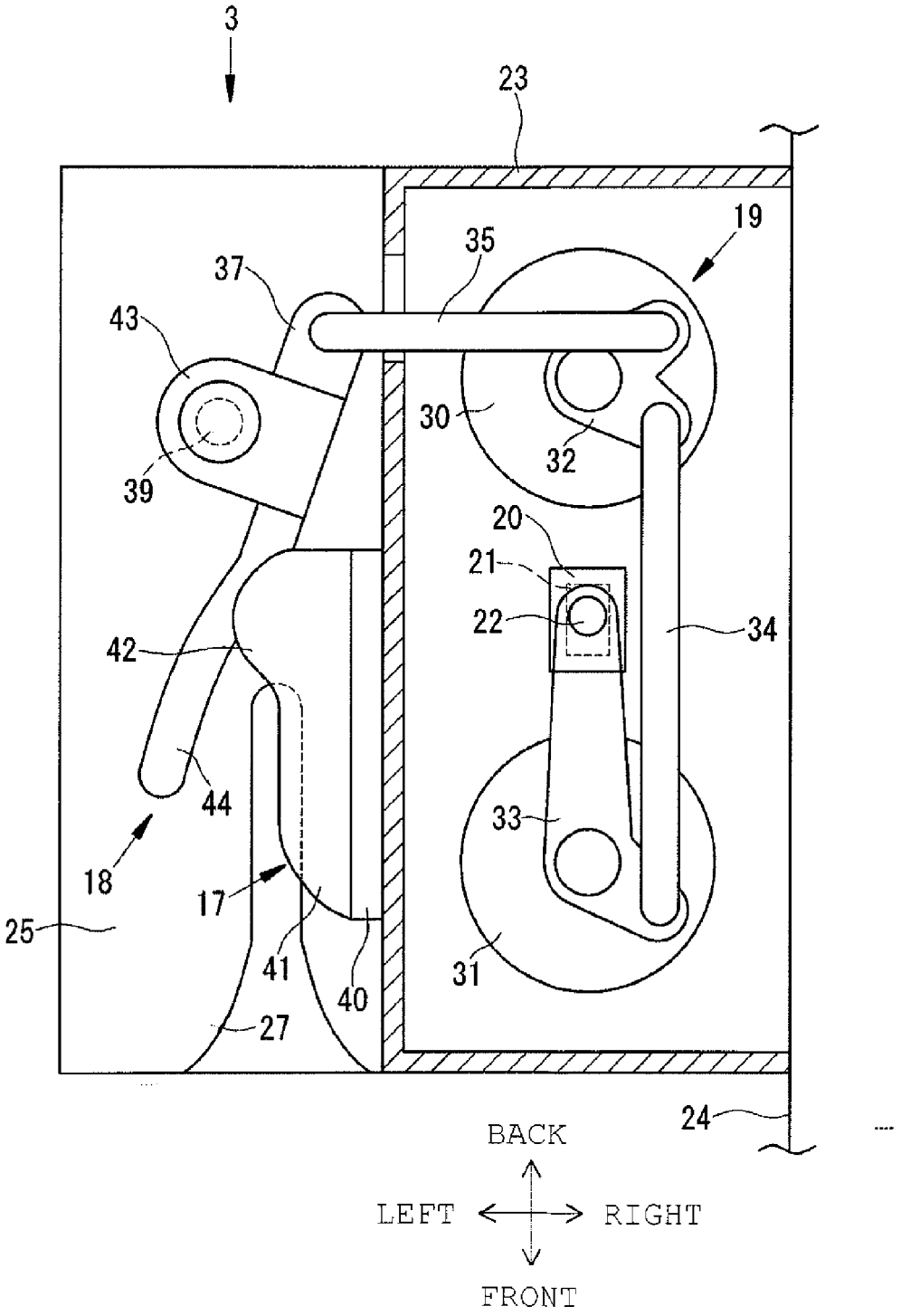


FIG. 5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BACK
LEFT
RIGHT
FRONT

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2003155631 A **[0002]**
- JP 2010126322 A **[0003]**