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(54) **Spinning machine**

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a spinning machine.

2. Description of the Related Art

[0002] Conventionally, there is known a spinning unit adapted to draft a fiber bundle and twist the drafted fiber bundle to produce a spun yarn (see e.g., Japanese Unexamined Patent Publication No. 2011-99192) . The spinning unit includes a defect detecting section adapted to detect a defective part of the spun yarn, and a winding section adapted to wind the spun yarn to form a package.

[0003] Conventionally, there is known a spinning machine including a plurality of spinning units (see e.g., Japanese Unexamined Patent Publication No. 2011-84854). The spinning machine includes an operation cart. When continuation of the spun yarn is disconnected in one of the spinning units, the operation cart travels to the relevant spinning unit to perform a yarn joining operation. The operation cart includes a braking section adapted to brake rotation of the package, a guiding section adapted to catch and guide the spun yarn, and a yarn joining section adapted to join the yarn ends of the spun yarn.

[0004] When the defect detecting section detects the defective part of the spun yarn, the spinning unit cuts the spun yarn to interrupt formation of the package. Upon arriving at the spinning unit, the operation cart makes the braking section to contact with the package and stops the rotation of the package. Thereafter, the operation cart catches the spun yarn and guides the spun yarn to a prescribed position by the guiding section, removes the defective part with the yarn joining section, and joins the yarn ends of the spun yarn. Through such series of steps, the spinning unit can resume the formation of the package.

[0005] JP 2010-189083 A relates to a textile machine in which the package rotates. A package positioning part has a plate drive arm and a package plate attached at the tip of the plate drive arm. The plate drive arm can be moved so that the package plate may be made to contact or separate to the package.

[0006] EP 1 457 447 A2 relates to a tension control and slack eliminating device for a yarn winder. A control means for reducing the rotation speed of the package applies a braking force to a support shaft of the bobbin or a bobbin supporting section of the cradle arm to force a reduction in the speed of the package.

BRIEF SUMMARY OF THE INVENTION

[0007] An object of the present invention is to provide a spinning machine capable of reliably stopping rotation of a package by adjusting a contacting time of the package and a braking section.

[0008] This object is achieved by a spinning machine according to claim 1.

[0009] The inventors found out that, when an inertia moment of the package is large, for example, when an outer diameter of the package is large due to the wound spun yarn, the rotation of the package may not be stopped even if the braking section is made to contact with the package for a predetermined period of time. When the operation cart arrives at the spinning unit in a short period of time, since a rotation speed of the package is not reduced, the rotation of the package may not be stopped even if the braking section is made to contact with the package for a predetermined period of time.

[0010] The operation cart rotates (reversely rotates) the package in an unwinding direction using a reverse-rotation roller such that the guiding section can catch the spun yarn wound into the package. Since the unwinding direction is a direction opposite to the winding direction of the package, such rotation is referred to as "reverse rotation" in the present description. The rotation in the winding direction of the package may be simply referred to as "rotation". If the rotation of the package has failed to be stopped, the reverse-rotation roller attempts to reversely rotate the package by making contact with the package that is continuously rotating in the winding direction. In this case, quality of the spun yarn wound into the package may degrade. Furthermore, if the rotation of the package has failed to be stopped, the package cannot be reversely rotated even if the reverse-rotation roller is used, and the guiding section cannot catch the spun yarn wound into the package.

[0011] According to an aspect of the present invention, a spinning machine includes a plurality of spinning units, each spinning unit being adapted to wind a spun yarn to form a package. The spinning machine includes a braking section, a driving section, and a control section. The braking section is adapted to make contact with the rotating package to brake rotation of the package. The driving section is adapted to drive the braking section to make contact with or separate from the package. The control section is adapted to control the driving section to adjust a contacting time of the package and the braking section by transmitting a control signal to the driving section. The rotation of the package thus can be reliably stopped.

[0012] The control section is adapted to adjust the contacting time in accordance with an outer diameter of the package.

[0013] The control section is adapted to adjust the contacting time in accordance with a travelling speed of the spun yarn wound into the package.

[0014] The spinning machine further includes an operation cart adapted to travel to one of the spinning units when continuation of the spun yarn is disconnected in such spinning unit and to perform a yarn joining operation. The control section is adapted to adjust the contacting time in accordance with a period of time from discon-

nection of the spun yarn until an arrival of the operation cart at the spinning unit. Accordingly, the rotation of the package can be reliably stopped before the operation cart carries out the yarn joining operation. As a result, the yarn joining operation by the operation cart can be reliably performed.

[0015] The spinning machine further includes an input section adapted to input the contacting time, and a storage section adapted to store the input contacting time. The control section is adapted to control the driving section such that the package and the braking section make contact with one another for the contacting time stored in the storage section. Accordingly, the contacting time can be arbitrarily changed, and the braking section can be made to contact with the package for an optimum contacting time.

[0016] The spinning machine further includes a reverse-rotation roller adapted to make contact with the package and to rotate the package in an unwinding direction. The reverse-rotation roller is adapted to make contact with the package after an elapse of the contacting time to rotate the package in the unwinding direction. Accordingly, the reverse-rotation roller can be prevented from making contact with the rotating package. As a result, the reverse-rotation roller can be prevented from degrading quality of the spun yarn wound into the package.

[0017] The control section is adapted to control the driving section by the contacting time, a length of the contacting time being at least a braking time from when the braking section makes contact with the package until when rotation of the package stops. Accordingly, the rotation of the package can be further reliably stopped. If the length of the contacting time is at least the braking time, since the braking section can be prevented from continuously making contact with the package even after the rotation of the package is stopped, operation efficiency of the spinning machine can be improved.

[0018] The operation cart includes the braking section, the driving section, the reverse-rotation roller, a guiding section adapted to catch the disconnected spun yarn and to guide the spun yarn to a prescribed position, and a yarn joining section adapted to join yarn ends of the disconnected spun yarn. A structure of each spinning unit can be simplified, and furthermore, a structure of the spinning machine can be simplified.

[0019] The spinning machine further includes a spinning section adapted to twist a fiber bundle by a whirling airflow. Production efficiency of the spun yarn in each spinning unit can be improved, and furthermore, production efficiency of the package in the spinning machine can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a view illustrating an overall structure of a spinning machine;

FIG. 2 is a view illustrating a structure of a spinning unit and an operation cart;

FIG. 3 is a view illustrating an operation manner of when stopping rotation of a package;

FIG. 4 is a view illustrating an operation manner of when reversely rotating the package;

FIG. 5 is a view illustrating an operation manner of when catching a disconnected spun yarn;

FIG. 6 is a view illustrating an operation manner of when guiding the disconnected spun yarn; and

FIG. 7 is a view illustrating a structure of a spinning section.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0021] First, an overall structure of a spinning machine 100 will be briefly described with reference to FIG. 1. In FIG. 1, black arrows indicate a travelling direction of an operation cart 20, and white arrows indicate a travelling direction of a doffing cart 30.

[0022] The spinning machine 100 includes a plurality of spinning units 10. The spinning machine 100 includes the operation cart 20, the doffing cart 30, and a control section 40.

[0023] The spinning unit 10 drafts a fiber bundle F and twists the drafted fiber bundle F to produce a spun yarn Y. The spinning unit 10 can form a package P by winding the spun yarn Y. The detailed structure of the spinning unit 10 will be described later.

[0024] The operation cart 20 can travel along a rail R1 extending in a direction in which the spinning units 10 are arranged. When continuation of the spun yarn Y is disconnected in one of the spinning units 10, the operation cart 20 travels to the relevant spinning unit 10 to perform a yarn joining operation. The detailed structure of the operation cart 20 will be described later.

[0025] The doffing cart 30 can travel along a rail R2 extending in a direction in which the spinning units 10 are arranged. When the package P is fully wound in one of the spinning units 10, the doffing cart 30 travels to the relevant spinning unit 10 to collect the package P. The doffing cart 30 can set a new bobbin B to the spinning unit 10. The doffing cart 30 may perform only the operation of collecting the fully-wound package P. If an operator manually collects the package P and sets the new bobbin B, the doffing cart 30 may be omitted.

[0026] The control section 40 can control each spinning unit 10, the operation cart 20, and the like. When the continuation of the spun yarn Y is disconnected in one spinning unit 10, for example, the control section 40 controls the spinning unit 10 to interrupt the formation of the package P. The control section 40 controls the operation cart 20 to perform the yarn joining operation, and then controls the spinning unit 10 to resume the formation of the package P.

[0027] Next, the structure of the spinning unit 10 and

the operation cart 20 will be described with reference to FIG. 2. In FIG. 2, black arrows indicate a feeding direction of the fiber bundle F and the spun yarn Y, and a white arrow indicates a rotating direction of the package P.

[0028] First, the spinning unit 10 will be described. The spinning unit 10 includes a sliver supplying section 1, a drafting section 2, a spinning section 3, a defect detecting section 4, a tension stabilizing section 5, and a winding section 6 along the feeding direction of the fiber bundle F and the spun yarn Y.

[0029] The sliver supplying section 1 is adapted to supply the fiber bundle F to the drafting section 2. The sliver supplying section 1 includes a sliver case 11 and a sliver guide (not illustrated) . The fiber bundle F accommodated in the sliver case 11 is guided by the sliver guide to the drafting section 2.

[0030] The drafting section 2 drafts the fiber bundle F to make a thickness of the fiber bundle F uniform. The drafting section 2 includes four sets of draft roller pairs 2a, 2b, 2c, and 2d, i.e., the back roller pair 2a, the third roller pair 2b, the middle roller pair 2c, and the front roller pair 2d, along the feeding direction of the fiber bundle F. Each of the draft roller pairs 2a, 2b, 2c, and 2d includes a bottom roller, which is rotated via a power mechanism (not illustrated), and a top roller, which makes contact with the bottom roller and rotates accompanying rotation of the bottom roller. An apron band is wound around each of the bottom roller and the top roller constituting the middle roller pair 2c. Since the bottom rollers and the top rollers rotate while sandwiching the fiber bundle F, the draft roller pairs 2a, 2b, 2c, and 2d can feed the fiber bundle F. The drafting section 2 can draft the fiber bundle F by a difference in a feeding speed of the draft roller pairs 2a, 2b, 2c, and 2d adjacent to one another.

[0031] The spinning section 3 twists the drafted fiber bundle F to produce the spun yarn Y. The spinning section 3 is arranged downstream of the drafting section 2. The spinning section 3 can produce the spun yarn Y from the appropriately drafted fiber bundle F. A structure of the spinning section 3 will be described later.

[0032] The defect detecting section 4 detects a defective part of the produced spun yarn Y. Specifically, the defect detecting section 4 irradiates the spun yarn Y with a light emitting diode (not illustrated) as a light source, and detects a reflected light quantity from the spun yarn Y. The defect detecting section 4 is connected to the control section 40 via an analyzer (not illustrated). The control section 40 can determine a presence or an absence of the defective part based on a detection signal from the defect detecting section 4. A cutter 41 capable of cutting the spun yarn Y is provided in proximity to the defect detecting section 4. In addition to or in place of abnormality in which a portion of the spun yarn Y is too thick (thick yarn) or too thin (thin yarn), the defective part of the spun yarn Y may be foreign substances contained in the spun yarn Y. Instead of an optical sensor according to the present embodiment, a capacitance sensor or the like can be adopted as the defect detecting section 4.

[0033] The tension stabilizing section 5 is adapted to appropriately maintain and stabilize a tension applied to the spun yarn Y. The tension stabilizing section 5 includes an unwinding member 51 and a roller 52. The unwinding member 51 rotates with the roller 52 when the tension applied to the spun yarn Y is low, and winds the spun yarn Y around the roller 52. The unwinding member 51 rotates independently from the roller 52 when the tension applied to the spun yarn Y is high, and unwinds the spun yarn Y wound around the roller 52. The tension stabilizing section 5 can appropriately maintain and stabilize the tension applied to the spun yarn Y. The roller 52 is rotatably driven by a motor (not illustrated).

[0034] The winding section 6 is adapted to form the package P by winding the spun yarn Y. The winding section 6 includes a driving roller 61 and a cradle 62. The driving roller 61 rotates the bobbin B rotatably held by the cradle 62. The winding section 6 traverses the spun yarn Y by a traversing device (not illustrated) . Accordingly, the winding section 6 can wind the spun yarn Y around the bobbin B while traversing the spun yarn Y to form the package P.

[0035] Next, the operation cart 20 will be described. The operation cart 20 includes a braking section 21, a driving section 22, a reverse-rotation roller 23, a guiding section 24, and a yarn joining section 25.

[0036] The braking section 21 is adapted to make contact with the rotating package P to brake the rotation of the package P. In the present embodiment, the braking section 21 includes a plate 21a that makes contact with the outer peripheral surface of the package P, and an arm 21b that supports the plate 21a. The braking section 21 merely needs to make contact with the package P to brake the rotation of the package P, and a shape, a structure, and the like are not particularly limited.

[0037] The driving section 22 is adapted to drive the braking section 21 such that the braking section 21 makes contact with or separates from the package P. Specifically, the driving section 22 can drive the plate 21a of the braking section 21 to make contact with or separate from the outer peripheral surface of the package P (see FIG. 3 and FIG. 4). The driving section 22 is an electric motor or the like. The driving section 22 drives the braking section 21 based on a control signal from the control section 40.

[0038] The reverse-rotation roller 23 makes contact with the package P to rotate (reversely rotate) the package P in the unwinding direction, which is a direction opposite to the winding direction. Specifically, after the plate 21a of the braking section 21 separates from the outer peripheral surface of the package P, the reverse-rotation roller 23 makes contact with the package P and reversely rotates the package P (see FIG. 4, FIG. 5, and FIG. 6). In the present embodiment, the reverse-rotation roller 23 is driven by an electric motor (a servo motor or the like) of the driving section (not illustrated) . By swinging the arm 23b by a pneumatic actuator (not illustrated), the reverse-rotation roller 23 can make contact with or sep-

arate from the outer peripheral surface of the package P. The reverse-rotation roller 23 is driven based on a control signal from the control section 40.

[0039] The guiding section 24 can catch the disconnected spun yarn Y and guide the spun yarn Y to a prescribed position. The guiding section 24 includes a first guiding section 24a adapted to catch the spun yarn Y from the package P and guide the spun yarn Y to the prescribed position, and a second guiding section 24b adapted to catch the spun yarn Y spun from the spinning section 3 and guide the spun yarn Y to the prescribed position. The operation manner of the first guiding section 24a and the second guiding section 24b will be described later.

[0040] The yarn joining section 25 joins the yarn ends of the disconnected spun yarn Y. Specifically, the yarn joining section 25 joins the yarn end of the spun yarn Y guided by the first guiding section 24a and the yarn end of the spun yarn Y guided by the second guiding section 24b (see FIG. 6). The "disconnected spun yarn Y" is a concept including at least the spun yarn Y cut by the cutter 41 and the spun yarn Y broken when an abnormal tension is applied. In addition to an air splicer device adapted to join the yarn ends of the spun yarn Y by a whirling airflow, a mechanical splicer device or the like may also be adopted as the yarn joining section 25.

[0041] Therefore, since the operation cart 20 includes the braking section 21, the driving section 22, the reverse-rotation roller 23, the guiding section 24, and the yarn joining section 25, the structure of each spinning unit 10 can be simplified, and furthermore, the structure of the spinning machine 100 can be simplified.

[0042] Next, the operation manner of when stopping the rotation of the package P will be specifically described with reference to FIG. 3. In FIG. 3, black arrows indicate an operation direction of each member constituting the spinning unit 10 and the operation cart 20, and a white arrow indicates the rotating direction of the package P.

[0043] When the defect detecting section 4 detects the defective part of the spun yarn Y, the spinning unit 10 cuts the spun yarn Y by using the cutter 41. One end of the disconnected spun yarn Y (the spun yarn Y located downstream of the cutter 41) is wound into the package P. The other end of the disconnected spun yarn Y (the spun yarn Y located upstream of the cutter 41) is sucked and held by a suction opening arranged in proximity to the cutter 41.

[0044] The spinning unit 10 then swings the cradle 62 to move the package P away from the driving roller 61 (see the black arrow in FIG. 3). The package P thus continues to rotate in the winding direction by force of inertia (see the white arrow in FIG. 3) . The operation cart 20 travels to the relevant spinning unit 10 immediately after the cutter 41 cuts the spun yarn Y.

[0045] The operation cart 20 then stops the rotation of the package P. Specifically, the driving section 22 of the operation cart 20 swings the arm 21b from a standby position to an operating position, and causes the plate 21a to make contact with the outer peripheral surface of the package P (see the black arrow in FIG. 3). In this manner, the operation cart 20 stops the rotation of the package P by friction of the package P and the plate 21a.

[0046] The operation cart 20 is required to reversely rotate the package P such that the first guiding section 24a can catch the spun yarn Y wound into the package P. Therefore, the driving section 22 of the operation cart 20 swings the arm 21b from the operating position to the standby position to separate the plate 21a from the outer peripheral surface of the package P (see the black arrow in FIG. 4). The spinning machine 100 can adjust the contacting time of the package P and the plate 21a by having the control section 40 control the driving section 22.

[0047] Since the contacting time of the package P and the plate 21a (the braking section 21) can be adjusted, the spinning machine 100 can reliably stop the rotation of the package P. The details on an adjustment method of the contacting time will be described later.

[0048] The spinning machine 100 can adjust the contacting time of the package P and the plate 21a based on the outer diameter of the package P. Therefore, even if the outer diameter of the package P is large, that is, even if the inertia moment of the package P is large, the braking section 21 can reliably stop the rotation of the package P.

[0049] Each spinning unit 10 includes an angle sensor (not illustrated) for detecting a tilt angle α (see FIG. 2) of the cradle 62. The tilt angle α of the cradle 62 has a correlative relationship with the outer diameter of the package P. Thus, the angle sensor can indirectly detect the outer diameter of the package P by detecting the tilt angle α of the cradle 62. The angle sensor may be an incremental-type sensor or the like, other than a so-called absolute-type sensor.

[0050] Specifically, if the outer diameter of the package P is large, the inertia moment of the package P is large, and hence the control section 40 controls the driving section 22 such that the contacting time of the package P and the plate 21a becomes long. If the outer diameter of the package P is small, the inertia moment of the package P is small, and hence the control section 40 controls the driving section 22 such that the contacting time of the package P and the plate 21a becomes short. Since the contacting time of the package P and the plate 21a can be variably adjusted based on the outer diameter of the package P, the spinning machine 100 according to the present embodiment can reliably stop the rotation of the package P.

[0051] If the outer diameter of the package P is small, the contacting time can be shortened. The plate 21a is not required to continuously make contact with the package P even after the rotation of the package P is stopped. Thus, after stopping the rotation of the package P, the spinning machine 100 can immediately reversely rotate the package P to perform the yarn joining operation or the like, and the operation efficiency of the spinning machine 100 can be improved. Furthermore, since the op-

eration cart 20 can resume the winding operation in a certain spinning unit 10 within a short period of time, the operation cart 20 can immediately travel to another spinning unit 10 and perform the operation of stopping the rotation of the package P for the yarn joining operation. The operation efficiency of the entire spinning machine 100 thus can be improved.

[0052] When controlling the contacting time based on the outer diameter of the package P, the control section 40 may adjust the contacting time each time based on the outer diameter of the package P of when the plate 21a is made to contact with the package P. Different contacting times may be set in advance in the control section 40 for every predetermined range of the outer diameter of the package P, and the control section 40 may control the driving section 22 according to the set contacting time.

[0053] According to another embodiment, the spinning machine 100 may adjust the contacting time of the package P and the plate 21a based on the travelling speed of the spun yarn Y guided to the package P. In the spinning unit 10, since a spinning speed (speed in which the spinning section 3 produces the spun yarn Y) is set in advance, the travelling speed of the spun yarn Y wound into the package P can be recognized. However, a speed sensor for detecting the travelling speed of the spun yarn Y may be arranged in each spinning unit 10. The spinning machine 100 may calculate the outer diameter of the package P based on the travelling speed of the spun yarn Y, an elapsed period of time from a start of winding of the package P, and a winding condition of the package P (the diameter of the bobbin B, the rotation speed of the bobbin B, a traverse speed of the traverse device, or the like), and control the contacting time of the package P and the plate 21a. If the travelling speed of the spun yarn Y is low, a speed at which the outer diameter of the package P increases is also low. If the travelling speed of the spun yarn Y is high, the speed at which the outer diameter of the package P increases is also high.

[0054] Since the contacting time of the package P and the plate 21a can be adjusted based on the travelling speed of the spun yarn Y wound into the package P, the spinning machine 100 according to this embodiment can reliably stop the rotation of the package P.

[0055] According to a further alternative embodiment, the spinning machine 100 may adjust the contacting time of the package P and the plate 21a based on a period of time from when the continuation of the spun yarn Y is disconnected in a certain spinning unit 10 until the operation cart 20 arrives at the relevant spinning unit 10. Specifically, after the continuation of the spun yarn Y is disconnected, if the operation cart 20 arrives at the spinning unit 10 within a short period of time, the rotation speed of the package P may not have been reduced. In such a case, the control section 40 controls the driving section 22 such that the contacting time of the package P and the plate 21a becomes long. After the continuation of the spun yarn Y is disconnected, if the operation cart 20 took a predetermined period of time or longer to arrive at the spinning unit 10, the rotation speed of the package P may already have been reduced or the rotation of the package P may already have been stopped due to an elapse of the period of time from when the package P is separated from the driving roller 61. In such a case, the control section 40 controls the driving section 22 such that the contacting time of the package P and the plate 21a becomes short.

[0056] In such a case, the control section 40 is required to measure the period of time from when the operation cart 20 starts to travel until when the operation cart 20 arrives at the target spinning unit 10. For example, the control section 40 may measure the period of time from when the cutter 41 cuts the spun yarn Y until when the operation cart 20 arrives at the target spinning unit 10.

[0057] Since the spinning machine 100 according to this embodiment can adjust the contacting time of the package P and the plate 21a based on the period of time from when the continuation of the spun yarn Y is disconnected until when the operation cart 20 arrives at the spinning unit 10, the spinning machine 100 can reliably stop the rotation of the package P. If the rotation speed of the package P is already reduced when the operation cart 20 arrives at the spinning unit 10, the contacting time of the package P and the plate 21a can be reduced, and the plate 21a is not required to be continuously made to contact with the package P even after the rotation of the package P is stopped. Thus, after stopping the rotation of the package P, the spinning machine 100 can immediately reversely rotate the package P to perform the yarn joining operation or the like, and hence the operation efficiency of the spinning machine 100 can be improved. Furthermore, since the operation cart 20 can resume the winding operation in a certain spinning unit 10 within a short period of time, the operation cart 20 can immediately travel to another spinning unit 10 and perform the operation of stopping the rotation of the package P for the yarn joining operation. The operation efficiency of the entire spinning machine 100 thus can be improved.

[0058] The contacting time of the package P and the plate 21a is the same as or longer than the braking time, which is a period of time from when the plate 21a makes contact with the package P until when the rotation of the package P is stopped. The rotation of the package P thus can be more reliably stopped.

[0059] The spinning machine 100 includes an input section 40A adapted to enable an operator to input the contacting time, and a storage section 40B adapted to store the input contacting time (see FIG. 1). Since the control section 40 can control the driving section 22 such that the plate 21a and the package P are made to contact for the contacting time stored in the storage section 40B, the spinning machine 100 can arbitrarily change the contacting time and achieve optimization.

[0060] Next, with reference to FIG. 4 to FIG. 6, the operation manner of when catching the disconnected spun yarn Y and guiding the spun yarn Y to the prescribed

position will be described. In FIG. 4 to FIG. 6, black arrows indicate the operation direction of each member constituting the spinning unit 10 and the operation cart 20, and the white arrow indicates the rotating direction of the package P.

[0061] The operation cart 20 reversely rotates the package P such that the first guiding section 24a can catch the spun yarn Y wound into the package P. Thus, after stopping the rotation of the package P by the plate 21a, the operation cart 20 reversely rotates the package P by using the reverse-rotation roller 23. Specifically, the pneumatic actuator (not illustrated) arranged in the operation cart 20 swings the arm 23b to make the reverse-rotation roller 23 into contact with the outer peripheral surface of the package P (see the black arrows in FIG. 4). The reverse-rotation roller 23 is driven by the driving section (not illustrated) arranged in the operation cart 20 to reversely rotate the package P (see the white arrow in FIG. 4).

[0062] Since the reverse-rotation roller 23 makes contact with the package P and reversely rotates the package P after elapse of the contacting time, the spinning machine 100 can unwind the spun yarn Y from the package P without degrading the quality of the spun yarn Y wound into the package P.

[0063] The operation cart 20 then catches the disconnected spun yarn Y and guides the spun yarn Y to the prescribed position. Specifically, the first guiding section 24a is swung from the standby position to a lower side (downstream in the yarn travelling direction) to catch the spun yarn Y wound into the package P (see the black arrows in FIG. 5) . The first guiding section 24a is then swung to an upper side (upstream in the yarn travelling direction) while holding the spun yarn Y by suction to guide the spun yarn Y to the prescribed position (see the black arrows in FIG. 6). The second guiding section 24b is swung from the standby position to the upper side to catch the spun yarn Y spun from the spinning section 3 (see the black arrows in FIG. 5). The second guiding section 24b is swung to the lower side while holding the spun yarn Y by suction to guide the spun yarn Y to the prescribed position (see the black arrows in FIG. 6).

[0064] Thereafter, the yarn joining section 25 joins the yarn end of the spun yarn Y guided to the prescribed position by the first guiding section 24a and the yarn end of the spun yarn Y guided to the prescribed position by the second guiding section 24b. The spinning machine 100 thus can resume the formation of the package P. Although detailed description will be omitted, the spun yarn Y is again wound around the roller 52 of the tension stabilizing section 5 by operation of the tension stabilizing section 5 and the second guiding section 24b.

[0065] Next, the spinning section 3 will be described with reference to FIG. 7. The spinning section 3 is a so-called pneumatic spinning device adapted to twist the fiber bundle F by the whirling airflow. In FIG. 7, black arrows indicate the feeding direction of the fiber bundle F and the spun yarn Y, and white arrows indicate a flowing direction of supplied air.

[0066] The spinning section 3 forms the whirling airflow in the spinning chamber SC by injecting air into the spinning chamber SC from a nozzle hole formed in a nozzle block 33, and twists the fiber bundle F by the whirling airflow. The spinning chamber SC is divided into a space SC1 formed between a fiber guide 31 and a spindle 32, and a space SC2 formed between the spindle 32 and the nozzle block 33.

[0067] In the space SC1, a trailing end of the fibers constituting the fiber bundle F is reversed by the whirling airflow (see chain double dashed lines in FIG. 7). In the space SC2, the trailing end of the reversed fibers is whirled by the whirling airflow (see chain double dashed lines in FIG. 7). The fibers whirled by the whirling airflow are sequentially wound around fibers at a center portion. In this manner, the spinning section 3 can twist the fiber bundle F.

[0068] In the spinning section 3, the fiber guide 31 is provided with a needle 31n. The needle 31n guides the fiber bundle F to a fiber passage 32h, and prevents the twist of the fiber bundle F from being transmitted upstream. However, the needle 31n may be omitted. The spinning section 3 is not limited to a structure of applying twists on the fiber bundle F by the nozzle hole adapted to generate the whirling airflow in one direction, and may adopt various spinning methods. For example, the spinning section 3 may include a pair of nozzles that generate the whirling airflow in opposite directions from one another to simultaneously apply twists on the fiber bundle F in opposite directions from one another.

[0069] Since the spinning unit 10 includes the spinning section 3 adapted to twist the fiber bundle F by the whirling airflow, the production efficiency of the spun yarn Y in each spinning unit 10 can be improved, and furthermore, the production efficiency of the package P in the spinning machine 100 can be improved.

[0070] The spinning machine 100 according to one embodiment of the present invention has been described above, but the present invention is not limited to the embodiment described above, and the above structure may be modified to the following structure, for example.

[0071] In the embodiment described above, the timing in which the package P and the plate 21a are made to contact with one another is before the yarn joining operation. For example, the plate 21a may be made into contact with the package P when the package P is fully wound. In this case, the rotation of the package P may be stopped by the plate 21a of the operation cart 20, or the braking section 21, the driving section 22, and the reverse-rotation roller 23 may be arranged in the doffing cart 30 such that the rotation of the package P may be stopped by the plate 21a arranged in the doffing cart 30. Since the package P having different fully-wound diameters can be wound, the spinning unit 10 may control the contacting time of the package P and the plate 21a based on the fully wound diameter of the package P set in advance. When the package P is fully wound, since the

package P is not required to be rotated in the unwinding direction, the reverse-rotation roller 23 is not made into contact with the package P.

[0072] In the embodiments described above, the package P is rotated in the unwinding direction by the reverse-rotation roller 23. When reversely rotating the package P with a different means, the reverse-rotation roller 23 may be omitted.

[0073] In the embodiments described above, the braking section 21, the driving section 22, and the reverse-rotation roller 23 are arranged in the operation cart 20, but the braking section 21, the driving section 22, and the reverse-rotation roller 23 may be arranged in each spinning unit 10. The driving section of the drafting section 2 and the driving section of the winding section 6 may be independently arranged in each spinning unit 10, and an independent winding operation can be performed in each spinning unit 10.

[0074] In the embodiments described above, the plurality of spinning units 10, the operation cart 20, and the doffing cart 30 are controlled by the control section 40, but a unit control section for individually controlling each spinning unit 10 may be arranged in each spinning unit 10. In this case, the control section 40 collectively controls the plurality of spinning units 10.

[0075] In the embodiments described above, the spun yarn Y is cut by the cutter 41, but the supply of air to the spinning section 3 may be stopped, and the spun yarn Y may be cut by interrupting the production of the spun yarn Y by the spinning section 3.

[0076] Other than the plurality of embodiments described above, for example, the method of detecting the outer diameter of the package P may be measuring the length of the spun yarn Y wound into the package P by the defect detecting section 4 to estimate the outer diameter of the package P based on the thickness (a yarn count) of the spun yarn Y and the winding condition of the package P (the traverse speed of the traverse device, the diameter of the bobbin B, or the like).

Claims

1. A spinning machine comprising:

a plurality of spinning units (10), each spinning unit (10) being adapted to wind a spun yarn (Y) to form a package (P),
a braking section (21) adapted to make contact with the rotating package (P) to brake rotation of the package (P),
a driving section (22) adapted to drive the braking section (21) to make contact with or separate from the package (P),
characterized in that the spinning machine further comprises
a control section (40) adapted to control the driving section (22) to variably adjust a contacting time of the package (P) and the braking section (21) by transmitting a control signal to the driving section (22).

2. The spinning machine according to claim 1, wherein the control section (40) is adapted to variably adjust the contacting time in accordance with an outer diameter of the package (P).

3. The spinning machine according to claim 1 or claim 2, wherein the control section (40) is adapted to variably adjust the contacting time in accordance with a travelling speed of the spun yarn (Y) wound into the package (P).

4. The spinning machine according to any one of claim 1 through claim 3, further comprising an operation cart (20) adapted to travel to one of the spinning units (10) when continuation of the spun yarn (Y) is disconnected in such spinning unit (10) and to perform a yarn joining operation,
wherein the control section (40) is adapted to control the contacting time in accordance with a period of time from disconnection of the spun yarn until an arrival of the operation cart (20) at the spinning unit (10).

5. The spinning machine according to any one of claim 1 through claim 4, further comprising:

an input section (40A) adapted to input the contacting time, and
a storage section (40B) adapted to store the input contacting time,
wherein the control section (40) is adapted to control the driving section (22) such that the package (P) and the braking section (21) make contact with one another for the contacting time stored in the storage section (40B).

6. The spinning machine according to any one of claim 1 through claim 5, further comprising a reverse-rotation roller (23) adapted to make contact with the package (P) and to rotate the package (P) in an unwinding direction, the reverse-rotation roller (23) being adapted to make contact with the package (P) after an elapse of the contacting time to rotate the package (P) in the unwinding direction.

7. The spinning machine according to any one of claim 1 through claim 6, wherein the control section (40) is adapted to control the driving section (22) by the contacting time, a length of the contacting time being at least a braking time from when the braking section (21) makes contact with the package (P) until when rotation of the package (P) stops.

8. The spinning machine according to claim 6, wherein

the operation cart (20) includes:

the braking section (21),
the driving section (22),
the reverse-rotation roller (23),
a guiding section (24) adapted to catch the disconnected spun yarn (Y) and to guide the spun yarn (Y) to a prescribed position, and
a yarn joining section (25) adapted to join yarn ends of the disconnected spun yarn (Y).

9. The spinning machine according to any one of claim 1 through claim 8, further comprising a spinning section (3) adapted to twist a fiber bundle (F) by a whirling airflow.

Patentansprüche

1. Eine Spinnmaschine, die folgende Merkmale aufweist:

eine Mehrzahl von Spinneinheiten (10), wobei jede Spinneinheit (10) angepasst ist, ein gesponnenes Garn (Y) zu wickeln, um einen Wickelkörper (P) zu bilden,
einen Bremsabschnitt (21), der angepasst ist, den sich drehenden Wickelkörper (P) zu berühren, um eine Drehung des Wickelkörpers (P) zu bremsen,
einen Antriebsabschnitt (22), der angepasst ist, den Bremsabschnitt (21) zu treiben, den Wickelkörper (P) zu berühren oder sich von demselben zu trennen,
dadurch gekennzeichnet, dass die Spinnmaschine ferner einen Steuerabschnitt (40) aufweist, der angepasst ist, den Antriebsabschnitt (22) zu steuern, um eine Berührungszeit des Wickelkörpers (P) und des Bremsabschnitts (21) variabel einzustellen, indem ein Steuersignal an den Antriebsabschnitt (22) übertragen wird.

2. Die Spinnmaschine gemäß Anspruch 1, bei der der Steuerabschnitt (40) angepasst ist, die Berührungszeit variabel gemäß einem Außendurchmesser des Wickelkörpers (P) einzustellen.

3. Die Spinnmaschine gemäß Anspruch 1 oder Anspruch 2, bei der der Steuerabschnitt (40) angepasst ist, die Berührungszeit variabel gemäß einer Bewegungsgeschwindigkeit des gesponnenen Garns (Y) einzustellen, das in den Wickelkörper (P) gewickelt wird.

4. Die Spinnmaschine gemäß einem der Ansprüche 1 bis 3, die ferner einen Betriebswagen (20) aufweist, der angepasst ist, sich zu einer der Spinneinheiten (10) zu bewegen, wenn die Fortführung des gesponnenen Garns (Y) in einer derartigen Spinneinheit (10) unterbrochen ist, und einen Garnverbindungsvorgang durchzuführen,
wobei der Steuerabschnitt (40) angepasst ist, die Berührungszeit gemäß einem Zeitraum von der Trennung des gesponnenen Garns bis zum Eintreffen des Betriebswagens (20) an der Spinneinheit (10) zu steuern.

5. Die Spinnmaschine gemäß einem der Ansprüche 1 bis 4, die ferner folgende Merkmale aufweist:

einen Eingabeabschnitt (40A), der angepasst ist, die Berührungszeit einzugeben, und
einen Speicherabschnitt (40B), der angepasst ist, die Eingabeberührungszeit zu speichern,
wobei der Steuerabschnitt (40) angepasst ist, den Antriebsabschnitt (22) derart zu steuern, dass der Wickelkörper (P) und der Bremsabschnitt (21) einander für die Dauer der Berührungszeit, die in dem Speicherabschnitt (40B) gespeichert ist, berühren.

6. Die Spinnmaschine gemäß einem der Ansprüche 1 bis 5, die ferner eine Gegendrehungsrolle (23) aufweist, die angepasst ist, den Wickelkörper (P) zu berühren und den Wickelkörper (P) in eine Abwickelrichtung zu drehen, wobei die Gegendrehungsrolle (23) angepasst ist, den Wickelkörper (P) nach Ablauf der Berührungszeit zu berühren, um den Wickelkörper (P) in der Abwickelrichtung zu drehen.

7. Die Spinnmaschine gemäß einem der Ansprüche 1 bis 6, bei der der Steuerabschnitt (40) angepasst ist, den Antriebsabschnitt (22) anhand der Berührungszeit zu steuern, wobei eine Länge der Berührungszeit zumindest eine Bremszeit ab dem Zeitpunkt, wenn der Bremsabschnitt (21) den Wickelkörper (P) berührt, bis zu dem Zeitpunkt ist, wenn die Drehung des Wickelkörpers (P) stoppt.

8. Die Spinnmaschine gemäß Anspruch 6, bei der der Betriebswagen (20) Folgendes umfasst:

den Bremsabschnitt (21),
den Antriebsabschnitt (22),
die Gegendrehungsrolle (23),
einen Führungsabschnitt (24), der angepasst ist, das getrennte gesponnene Garn (Y) einzufangen und das gesponnene Garn (Y) zu einer vorgeschriebenen Position zu führen, und
einen Garnverbindungsabschnitt (25), der angepasst ist, Garnenden des getrennten gesponnenen Garns (Y) zu verbinden.

9. Die Spinnmaschine gemäß einem der Ansprüche 1 bis 8, die ferner einen Spinnabschnitt (3) aufweist, der angepasst ist, ein Faserbündel (F) mittels eines

Wirbelluftstroms zusammenzudrehen.

Revendications

1. Métier à filer, comprenant:

   une pluralité d'unités de filage (10), chaque unité de filage (10) étant adaptée pour enrouler un fil filé (Y) pour former un paquet (P),
   un segment de freinage (21) adapté pour entrer en contact avec le paquet tournant (P) pour freiner la rotation du paquet (P),
   un segment d'entraînement (22) adapté pour entraîner le segment de freinage (21) pour entrer en contact avec le ou se séparer du paquet (P),
   caractérisé par le fait que le métier à filer comprend par ailleurs
   un segment de commande (40) adapté pour commander le segment d'entraînement (22) pour ajuster de manière variable un temps de contact du paquet (P) et du segment de freinage (21) en transmettant un signal de commande au segment d'entraînement (22).

2. Métier à filer selon la revendication 1, dans lequel le segment de commande (40) est adapté pour ajuster de manière variable le temps de contact selon un diamètre extérieur du paquet (P).

3. Métier à filer selon la revendication 1 ou la revendication 2, dans lequel le segment de commande (40) est adapté pour ajuster de manière variable le temps de contact selon une vitesse de défilement du fil filé (Y) enroulé pour former le paquet (P).

4. Métier à filer selon l'une quelconque de la revendication 1 à la revendication 3, comprenant par ailleurs un chariot d'opération (20) adapté pour se déplacer vers l'une des unités de filage (10) lorsque la continuation du fil filé (Y) est déconnectée dans cette unité de filage (10) et pour effectuer une opération de jonction de fil,
   dans lequel le segment de commande (40) est adapté pour commander le temps de contact selon un laps de temps allant de la déconnexion du fil filé jusqu'à une arrivée du chariot d'opération (20) à l'unité de filage (10).

5. Métier à filer selon l'une quelconque de la revendication 1 à la revendication 4, comprenant par ailleurs:

   un segment d'entrée (40A) adapté pour entrer le temps de contact, et
   un segment de mémoire (40B) adapté pour mémoriser le temps de contact d'entrée,
   dans lequel le segment de commande (40) est adapté pour commander le segment d'entraînement (22) de sorte que le paquet (P) et le segment de freinage (21) entrent en contact l'un avec l'autre pendant le temps de contact mémorisé dans la segment de mémoire (40B).

6. Métier à filer selon l'une quelconque de la revendication 1 à la revendication 5, comprenant par ailleurs un rouleau de rotation inverse (23) adapté pour entrer en contact avec le paquet (P) et à faire tourner le paquet (P) dans une direction de déroulement, le rouleau de rotation inverse (23) étant adapté pour entrer en contact avec le paquet (P) après l'écoulement du temps de contact pour faire tourner le paquet (P) dans la direction de déroulement.

7. Métier à filer selon l'une quelconque de la revendication 1 à la revendication 6, dans lequel le segment de commande (40) est adapté pour commander le segment d'entraînement (22) par le temps de contact, une durée du temps de contact étant au moins un temps de freinage à partir du moment où le segment de freinage (21) entre en contact avec le paquet (P) jusqu'au moment où s'arrête la rotation du paquet (P).

8. Métier à filer selon la revendication 6, dans lequel le chariot d'opération (20) comporte:

   le segment de freinage (21),
   le segment d'entraînement (22),
   le rouleau de rotation inverse (23),
   un segment de guidage (24) adapté pour attraper le fil filé déconnecté (Y) et pour guider le fil filé (Y) vers une position prescrite, et
   un segment de jonction de fil (25) adapté pour joindre les extrémités du fil filé déconnecté (Y).

9. Métier à filer selon l'une quelconque de la revendication 1 à la revendication 8, comprenant par ailleurs un segment de filage (3) adapté pour tordre un faisceau de fibres (F) par un flux d'air tourbillonnant.

FIG. 1

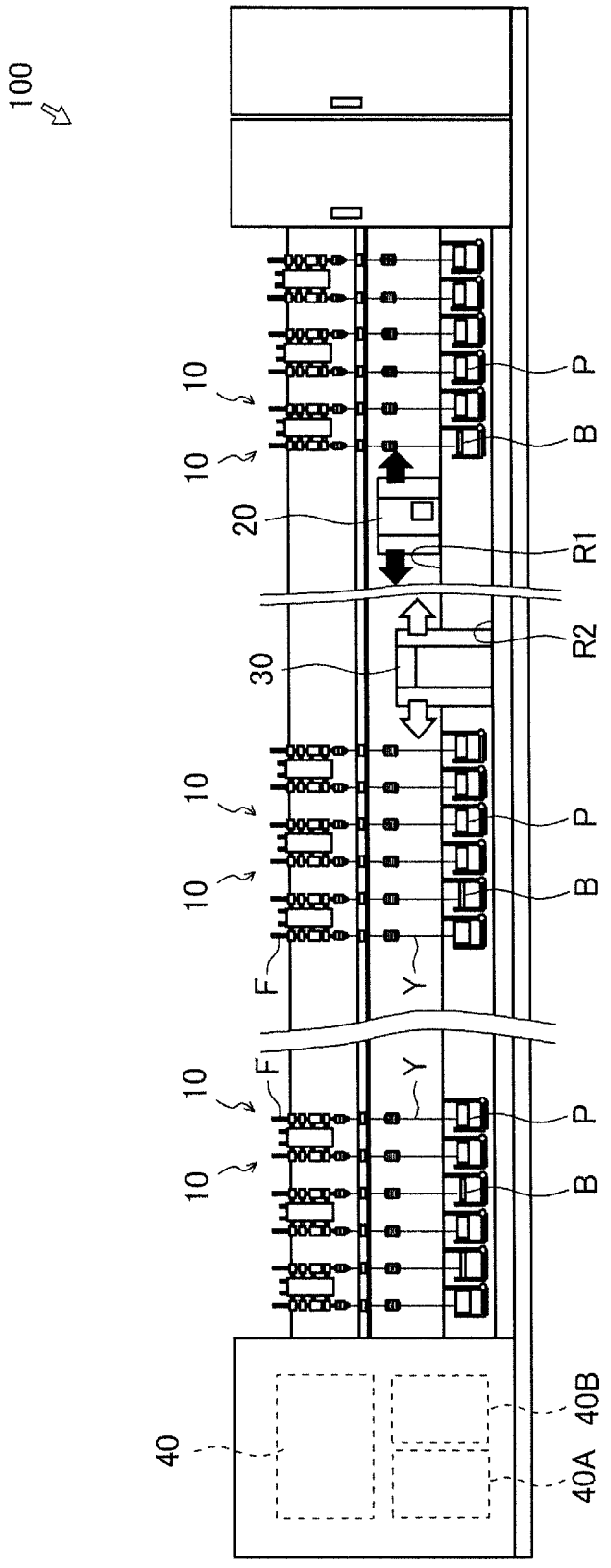
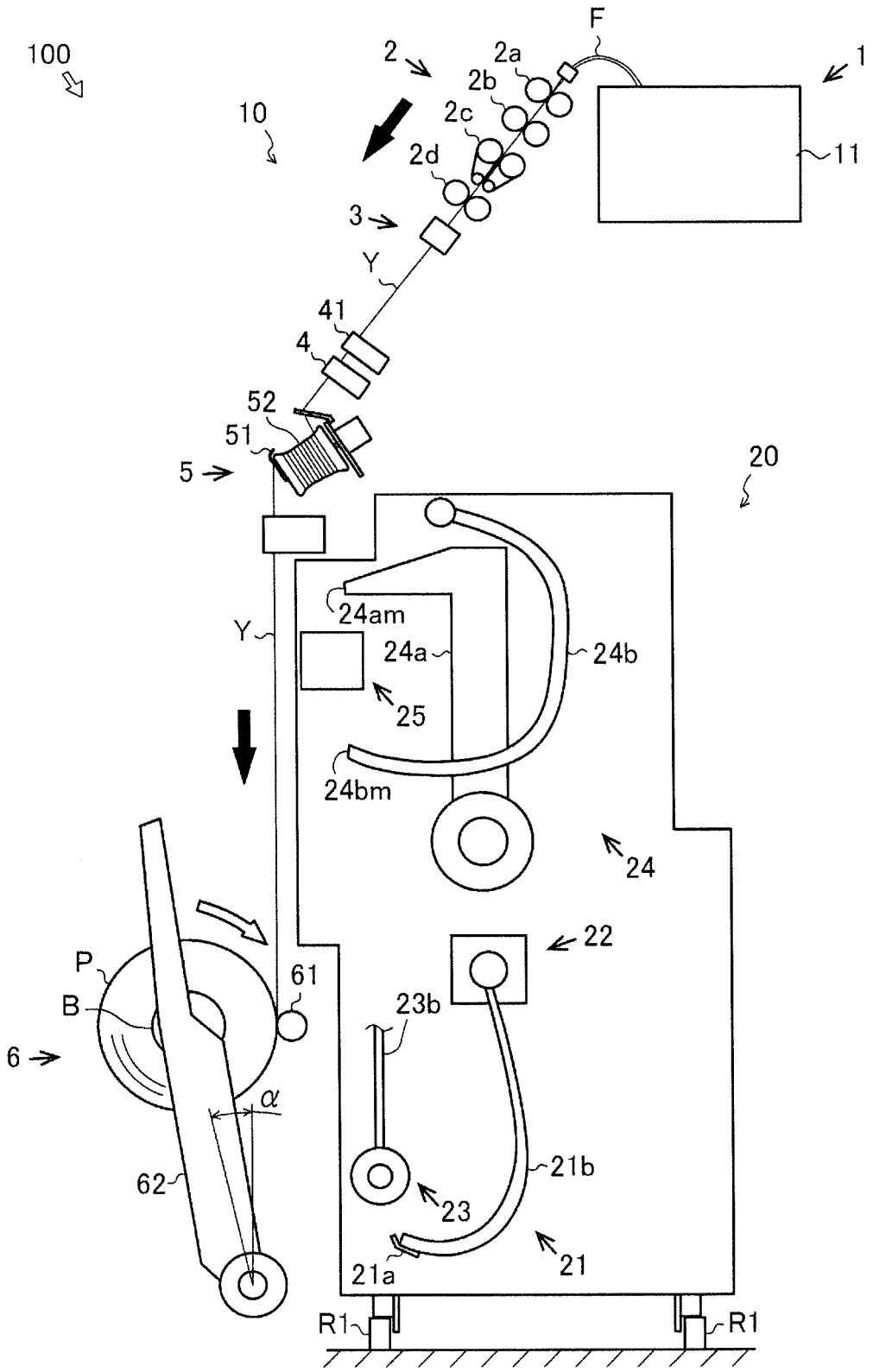


FIG. 2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2a
2b
2c
2d
F
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11
3
Y
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4
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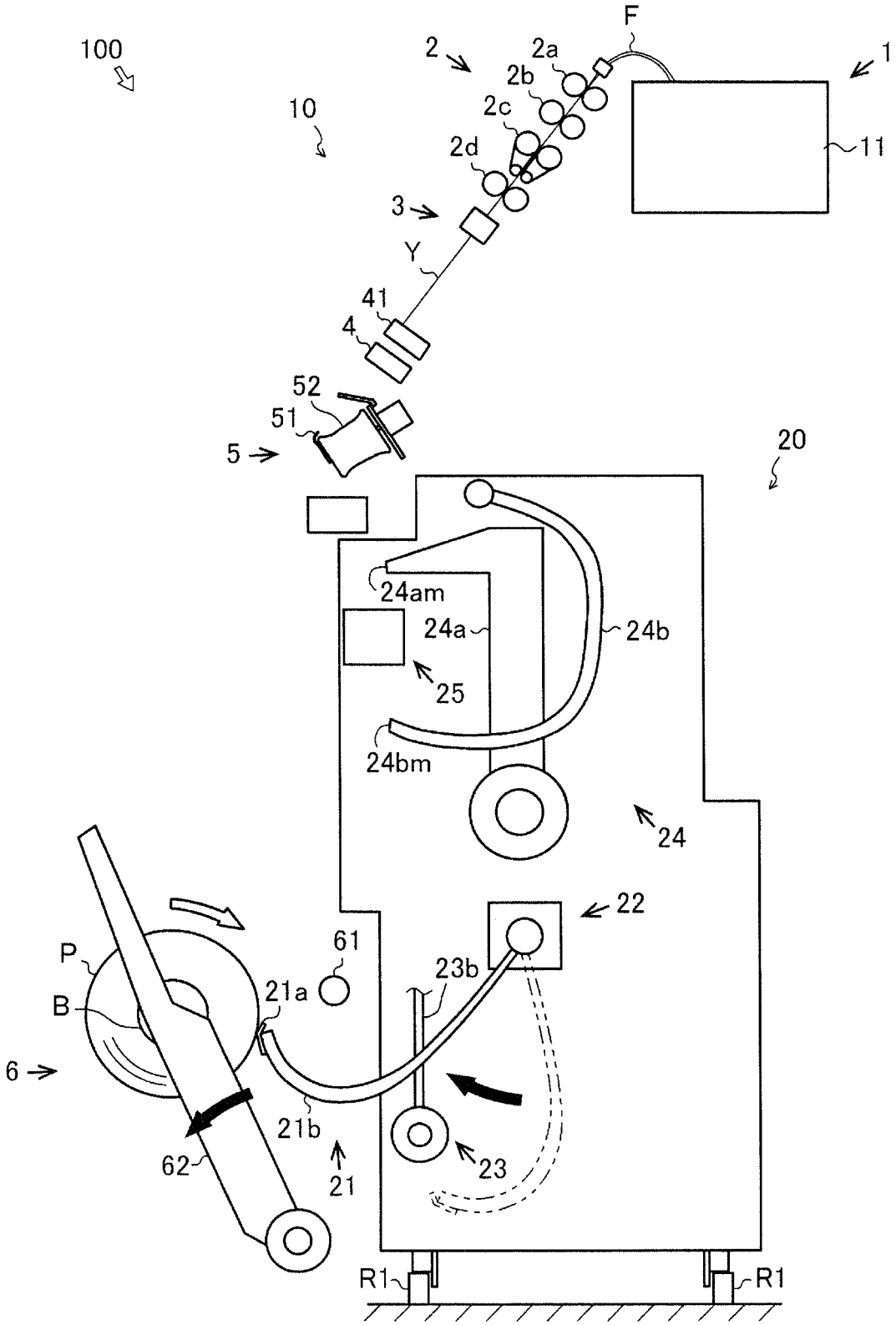
24am
24a
24b
25
24bm
24
22
23b
21b
23
21
21a
R1
R1
Y
P
B
61
6
α
62

FIG. 3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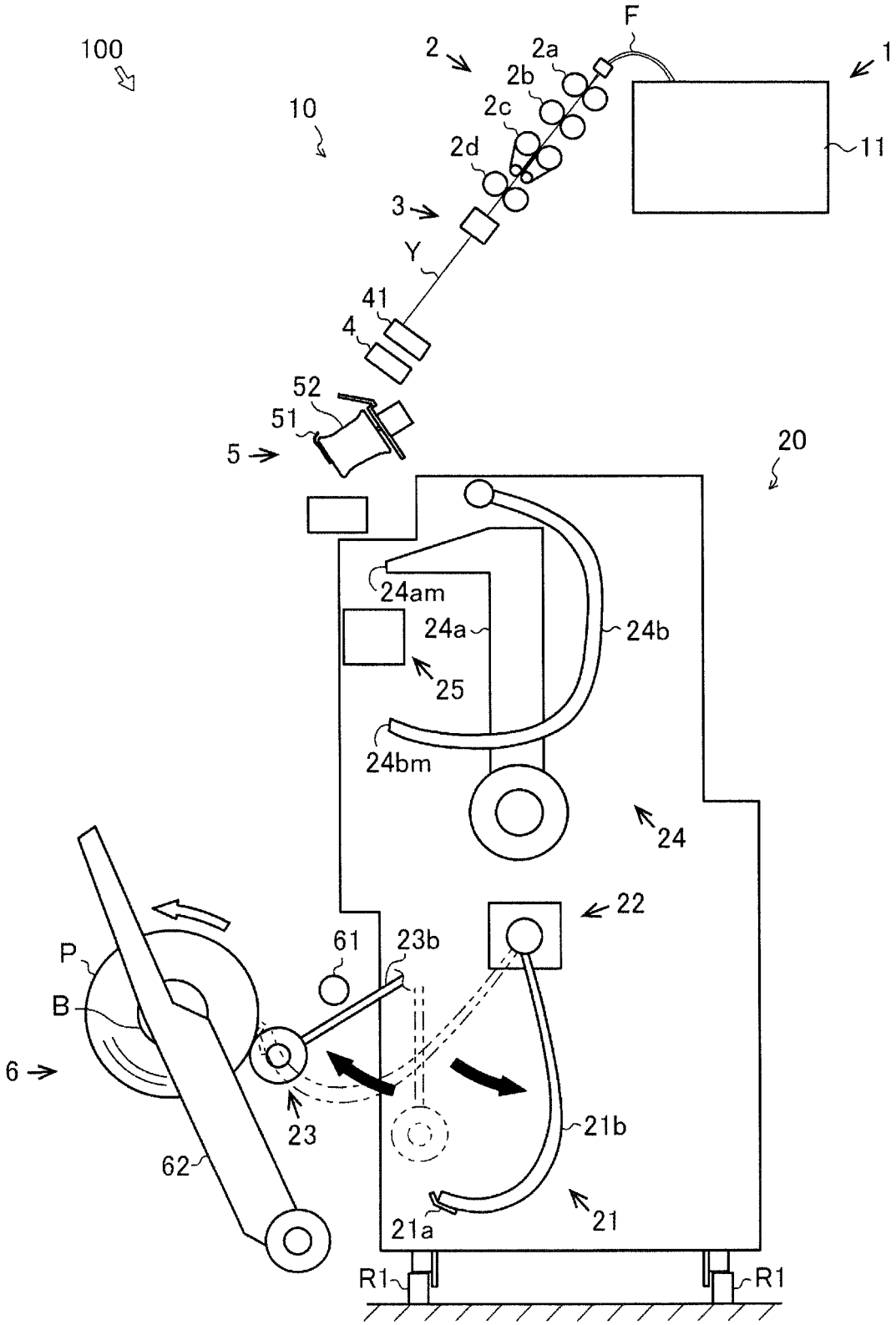
21
23
R1
R1

FIG. 4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23b
P
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21
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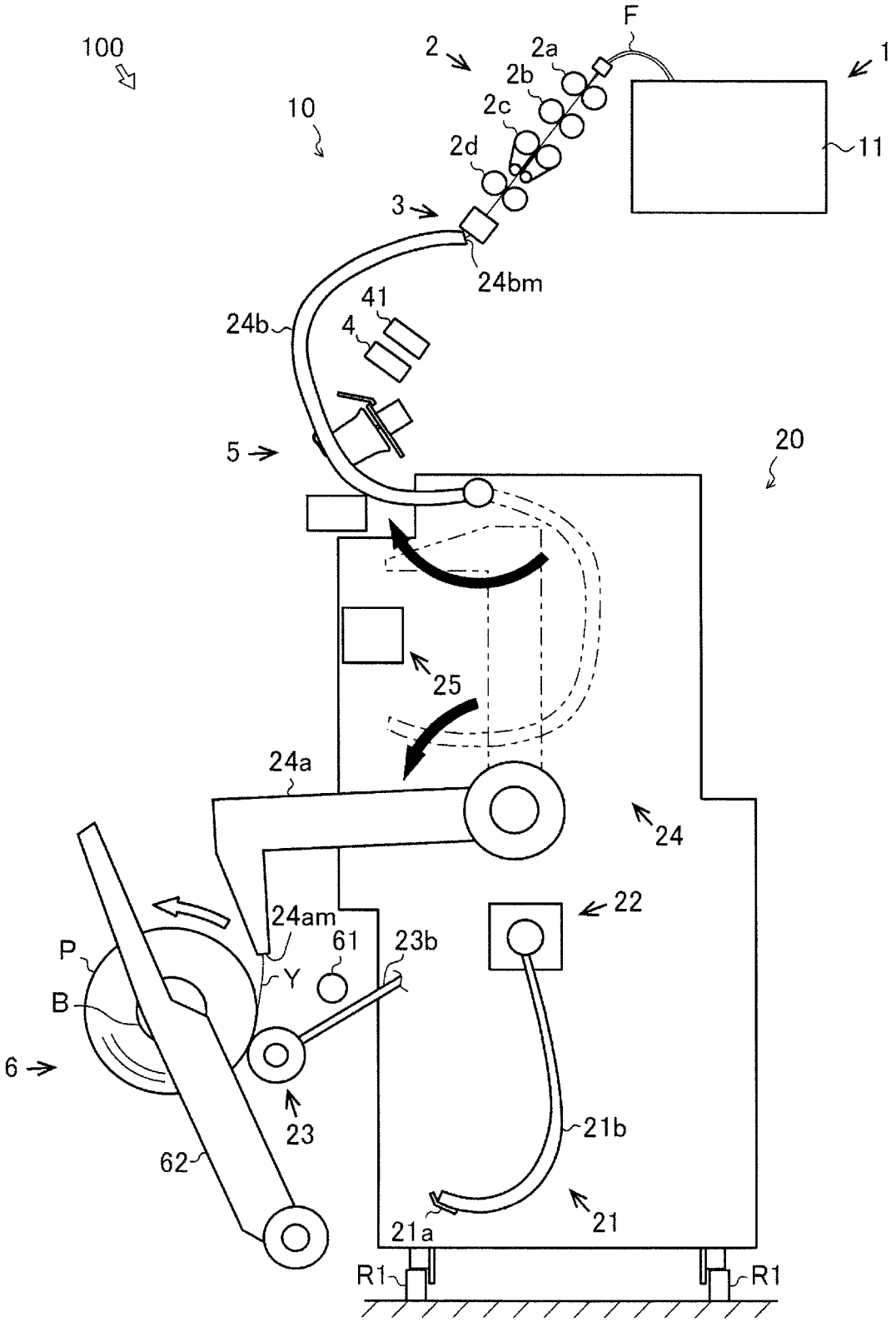
R1
R1

FIG. 5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P
Y
B
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23
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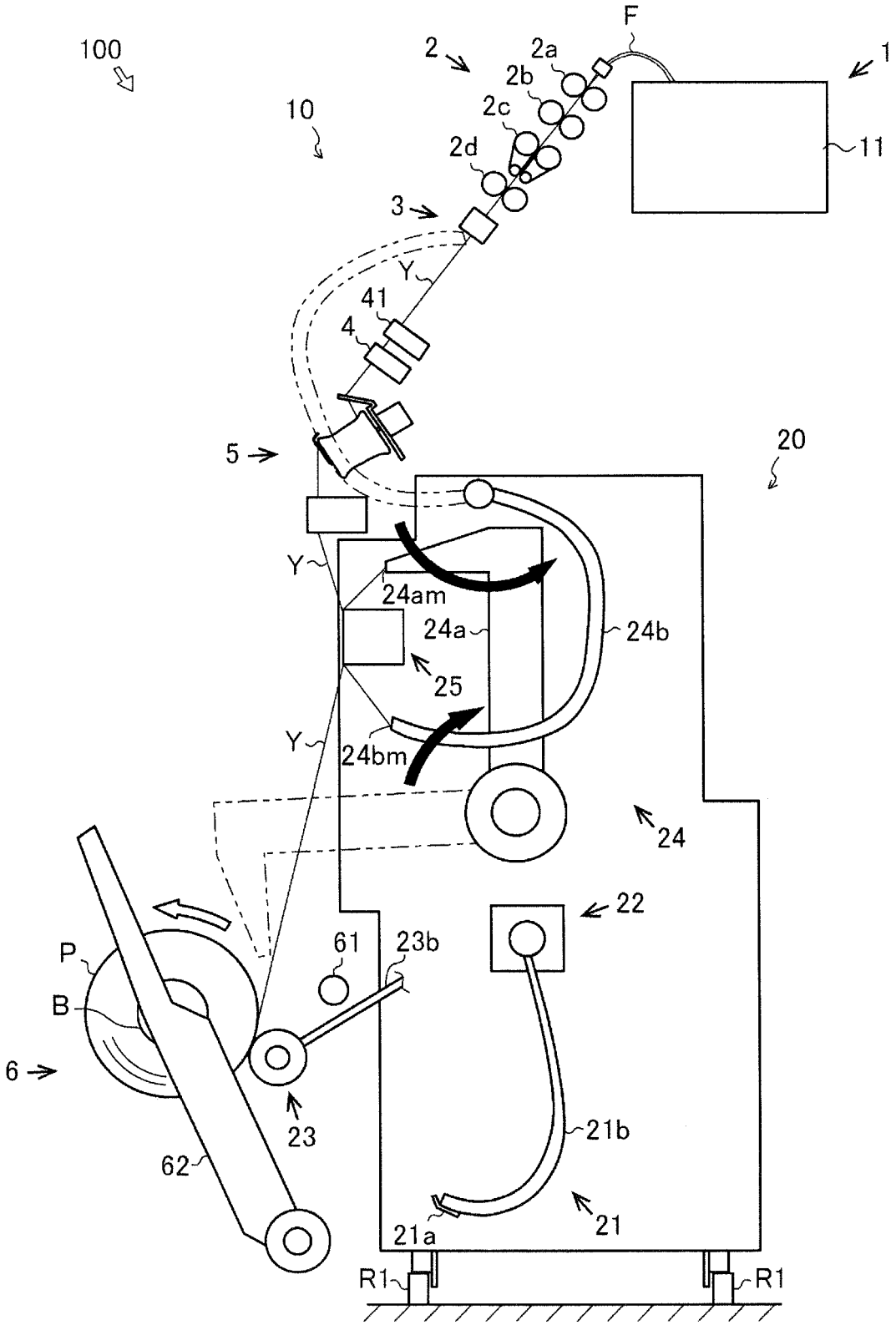
21
21a
R1
R1

FIG. 6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25
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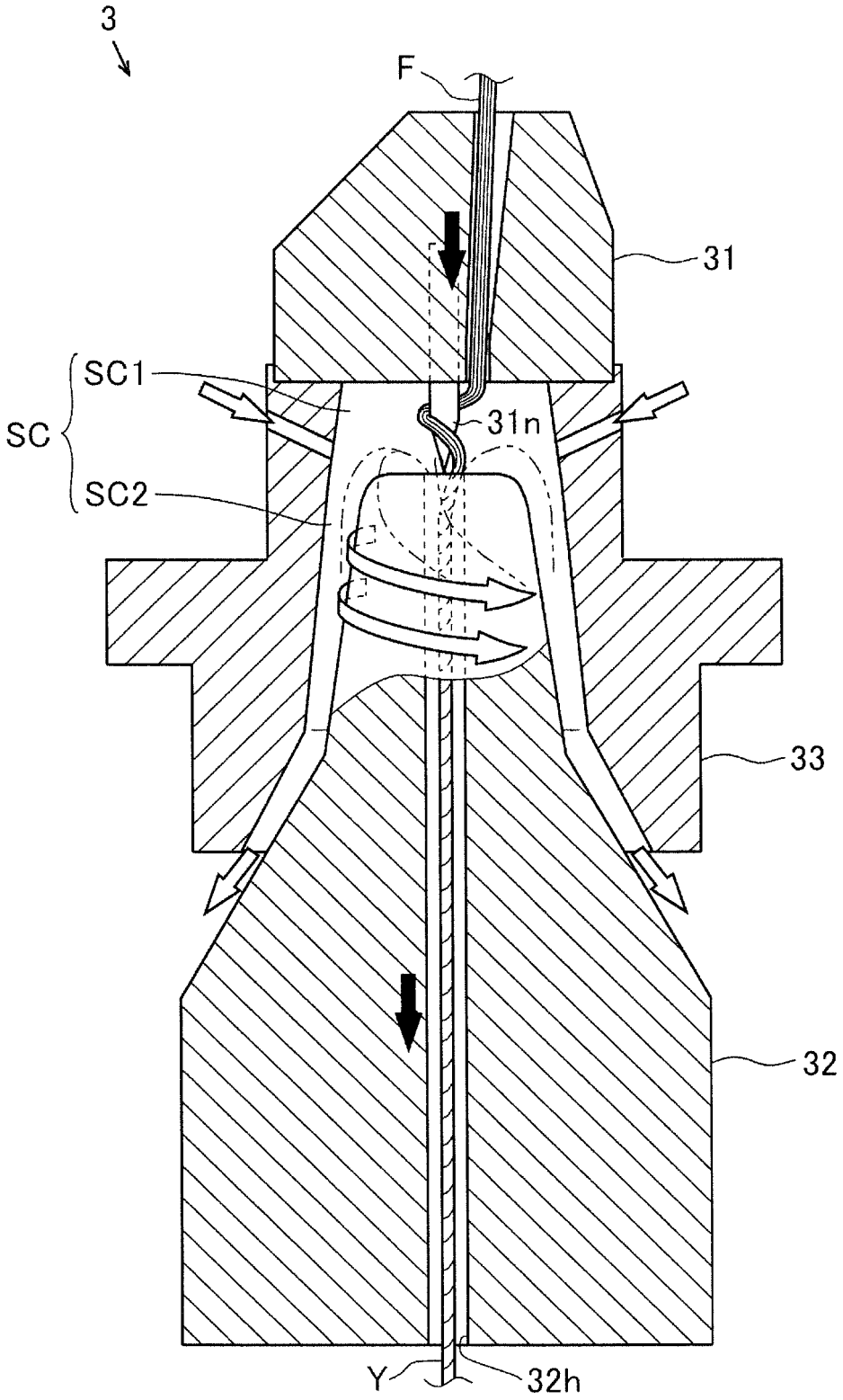
21a
R1
R1

FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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- EP 1457447 A2 **[0006]**