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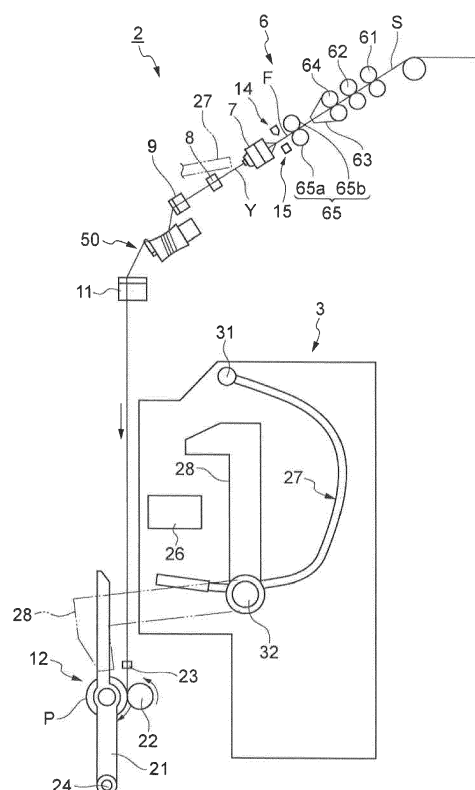
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(54) **SPINNING MACHINE AND SPINNING METHOD**

(57) A spinning unit 2 includes a draft device 6 adapted to draft a fiber bundle F, a pneumatic spinning device 7 arranged movable between a spinning position and a retracted position that is located further away from the draft device 6 than the spinning position, and adapted to produce a yarn Y at the spinning position by applying twists to the drafted fiber bundle F by injecting air to a spinning chamber 73, and an injecting device 14 adapted to inject air to a region C between the draft device 6 and the pneumatic spinning device 7. The injecting device 14 injects the air after the pneumatic spinning device 7 starts moving from the spinning position to the retracted position.

FIG. 2



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

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

2. Description of the Related Art

[0002] There is conventionally known a spinning machine including a draft device adapted to draft a fiber bundle and a pneumatic spinning device adapted to produce a yarn at a spinning position by applying twists to the drafted fiber bundle by injecting air to a spinning chamber (see Japanese Patent Application Laid-open No. 2006-144136, for example). In such a spinning machine, for example, in a case where a yarn defect has been detected, when a drafting operation of the draft device is stopped, a fiber bundle portion to which twists have not been applied is formed at a yarn end of the yarn.

SUMMARY OF THE INVENTION

[0003] In the spinning machine as described above, for example, when accumulating the yarn in a yarn accumulating device using a yarn accumulating roller, if a length of the fiber bundle portion is excessively long, the fiber bundle portion may remain at the yarn accumulating roller. If the length of the fiber bundle portion is excessively short, a yarn end of the yarn from a winding device may not be reliably caught when performing a yarn joining operation.

[0004] An object of the present invention is to provide a spinning machine and a spinning method that are capable of adjusting the length of the fiber bundle portion to be formed at the yarn end of the yarn.

[0005] A spinning machine of the present invention includes a draft device adapted to draft a fiber bundle, a pneumatic spinning device arranged movable between a spinning position and a retracted position that is located further away from the draft device than the spinning position, and adapted to produce a yarn at the spinning position by applying twists to the drafted fiber bundle by injecting air to a spinning chamber, and an injecting device adapted to inject air to a region between the draft device and the pneumatic spinning device. The injecting device is adapted to be injecting the air at least when the pneumatic spinning device is moving from the spinning position to the retracted position, and to stop injecting the air before the pneumatic spinning device reaches the retracted position.

[0006] In the spinning machine, since the air is injected by the injecting device to the fiber bundle that is passing the region between the draft device and the pneumatic spinning device, the fiber bundle is disconnected by the air. Thus, a length of a fiber bundle portion can be ap-

propriately adjusted by adjusting a timing to inject the air. Furthermore, since the injection of the air is stopped before the pneumatic spinning device reaches the retracted position, the air can be efficiently injected, and the length of the fiber bundle portion can be adjusted.

[0007] In the spinning machine of the present invention, the injecting device may inject the air to cross a fiber passage in the region between the draft device and the pneumatic spinning device. With this configuration, since the air can be reliably applied to the fiber bundle, the length of the fiber bundle portion can be more appropriately adjusted.

[0008] In the spinning machine of the present invention, the injecting device may inject the air along a direction orthogonal to the fiber passage. With this configuration, since force of the injection of the air is effectively applied to the fiber bundle, the fiber bundle portion can be disconnected by injection of a minimum amount of air.

[0009] The spinning machine of the present invention may further include a suction device arranged to face the injecting device with the region therebetween and adapted to suck fibers. With this configuration, since fibers that generate when the fiber bundle is disconnected by the air are sucked by the suction device, the fibers can be prevented from remaining in the spinning machine.

[0010] In the spinning machine of the present invention, the draft device may include a plurality of roller pairs, and the roller pair arranged closest to the pneumatic spinning device among the plurality of the roller pairs may include a driving roller adapted to rotate by receiving a driving force and a driven roller adapted to rotate in accordance with the driving roller. The injecting device may be arranged to a side where the driven roller is arranged with respect to the region between the draft device and the pneumatic spinning device, and the suction device may be arranged to a side where the driving roller is arranged with respect to the region between the draft device and the pneumatic spinning device. With this configuration, the fibers that generate when the fiber bundle is disconnected can be prevented from adhering to the driven roller.

[0011] In the spinning machine of the present invention, the pneumatic spinning device may include a nozzle block and a hollow guide shaft body arranged to form the spinning chamber, and a nozzle through which the air is injected into the spinning chamber may be formed in the nozzle block. With this configuration, whirling flow can be generated in the spinning chamber by injecting the air from the nozzle into the spinning chamber, and twists can be reliably applied to the fiber bundle.

[0012] The spinning machine of the present invention may further include a control section adapted to control start and stop of the injection of the air from the injecting device. With this configuration, the length of the fiber bundle portion can be automatically adjusted in accordance with a condition.

[0013] A spinning method of the present invention is executed in a spinning machine that includes a draft de-

vice adapted to draft a fiber bundle, a pneumatic spinning device arranged movable between a spinning position and a receded position that is located further away from the draft device than the spinning position, and adapted to produce a yarn at the spinning position by applying twists to the drafted fiber bundle by injecting air to a spinning chamber, and an injecting device adapted to inject air to a region between the draft device and the pneumatic spinning device. The spinning method includes a moving step of starting to move the pneumatic spinning device from the spinning position to the receded position, and an injecting step of injecting the air from the injecting device at least when the pneumatic spinning device is moving from the spinning position to the receded position, and stopping the injection of the air before the pneumatic spinning device reaches the receded position.

[0014] In the spinning method, since the air is injected by the injecting device to the fiber bundle that is passing the region between the draft device and the pneumatic spinning device, the fiber bundle is disconnected by the air. Thus, a length of a fiber bundle portion can be appropriately adjusted by adjusting a timing to inject the air.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a front view illustrating a spinning machine according to an embodiment of the present invention;

FIG. 2 is a side view illustrating a spinning unit of the spinning machine in FIG. 1;

FIG. 3 is a vertical sectional view illustrating a pneumatic spinning device of the spinning unit in FIG. 2; FIG. 4 is a vertical sectional view illustrating a pneumatic spinning device moving from a spinning position to a receded position;

FIG. 5 is a vertical sectional view illustrating the pneumatic spinning device located at the receded position; and

FIGS. 6A and 6B are each a timing chart of operations relating to an adjustment of a length of a fiber bundle portion.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0016] A preferred embodiment of the present invention will be hereinafter described in detail with reference to the accompanying drawings. The same reference numerals are denoted on the same or corresponding portions throughout the drawings, and redundant description will be omitted.

[0017] As illustrated in FIG. 1, a spinning machine 1 includes a plurality of spinning units 2, a yarn joining vehicle 3, a blower box 4, and a motor box 5. The plurality of spinning units 2 are arranged in a row, and each of the plurality of spinning units 2 is adapted to produce a

yarn Y to wind around a package P. The yarn joining vehicle 3 is adapted to perform a yarn joining operation in a spinning unit 2 in which the yarn Y has been disconnected. The blower box 4 accommodates an air supply source adapted to generate, for example, suction flow and whirling flow in each section of the spinning unit 2, and the like. The motor box 5 accommodates a motor adapted to supply power to each section of the spinning unit 2, and the like.

[0018] In the following description, upstream and downstream in a travelling direction of a sliver S, a fiber bundle F, and the yarn Y are respectively referred to as "upstream" and "downstream" simply. Furthermore, a side where a travelling path of the yarn Y is located with respect to the yarn joining vehicle 3 is simply referred to as a "front side", and a side opposite thereto is simply referred to as a "back side".

[0019] As illustrated in FIGS. 1 and 2, each spinning unit 2 includes a draft device 6, an injecting device 14 and a suction device 15, a pneumatic spinning device 7, a yarn monitoring device 8, a tension sensor 9, a yarn accumulating device 50, a waxing device 11, and a winding device 12 in this order from upstream. The devices are directly or indirectly supported by a machine frame 13 such that upstream becomes an upper side in a machine height direction (in other words, such that downstream becomes a lower side in the machine height direction).

[0020] The draft device 6 is adapted to produce the fiber bundle F by drafting the sliver S. The draft device 6 includes a back roller pair 61, a third roller pair 62, a middle roller pair 64 each of the roller is provided with an apron belt 63, and a front roller pair 65 in this order from upstream. Each of the roller pairs 61, 62, 64, and 65 is adapted to transport the sliver S fed from a sliver can (not illustrated) from upstream to downstream while drafting. Among each of the roller pairs 61, 62, 64, and 65, the front roller pair 65 is arranged closest to the pneumatic spinning device 7. The front roller pair 65 includes a bottom roller (a driving roller) 65a and a top roller (a driven roller) 65b. The bottom roller 65a is adapted to rotate by receiving a driving force from a drive motor (not illustrated). The top roller 65b is adapted to rotate in accordance with the bottom roller 65a.

[0021] As illustrated in FIG. 3, the pneumatic spinning device 7 is adapted to inject air and apply twists to the fiber bundle F drafted by the draft device 6 to produce the yarn Y while being located at a spinning position. The spinning position is a position where the pneumatic spinning device 7 is arranged to be close to the draft device 6 (specifically, the front roller pair 65) at the time of spinning, and is a position where the pneumatic spinning device 7 is located when the fiber bundle F is fed from the draft device 6 to the pneumatic spinning device 7. The pneumatic spinning device 7 includes a nozzle block 70 and a hollow guide shaft body 80. The hollow guide shaft body 80 is inserted into the nozzle block 70 from downstream. An internal space formed by the nozzle block 70

and the hollow guide shaft body 80 at this time is a spinning chamber 73.

[0022] The nozzle block 70 includes a fiber guiding section 71 and a whirling flow generating section 72. The fiber guiding section 71 is provided with a guiding hole 71a adapted to guide the fiber bundle F fed from the draft device 6 to the spinning chamber 73. The fiber guiding section 71 is also provided with a needle 75. A tip-end portion 75a of the needle 75 is located in the spinning chamber 73. The needle 75 has a function to prevent twists from propagating upstream of the spinning chamber 73. The whirling flow generating section 72 is provided with a plurality of nozzles 74 that communicate to the spinning chamber 73. The plurality of nozzles 74 are arranged such that whirling flow is generated in the spinning chamber 73 when air is injected. The whirling flow generating section 72 is provided with a hole portion 72a through which the hollow guide shaft body 80 is inserted. The hole portion 72a is formed into a truncated cone shape that tapers off towards upstream and communicates to the spinning chamber 73.

[0023] The hollow guide shaft body 80 can be inserted into the hole portion 72a of the whirling flow generating section 72. An upper-end portion 80a of the hollow guide shaft body 80 is formed into a truncated cone shape that tapers off towards upstream. The hollow guide shaft body 80 is provided with a passage 81 extending along a central axis of the hollow guide shaft body 80. The passage 81 communicates to the spinning chamber 73 at an upstream side thereof, and is formed in a widened manner towards an exit 83 located downstream. A collecting section 77 communicates to the spinning chamber 73 via a gap formed between the upper-end portion 80a of the hollow guide shaft body 80 and the hole portion 72a of the whirling flow generating section 72.

[0024] The pneumatic spinning device 7 is movably (swingably) supported by a support shaft (not illustrated). As illustrated in FIGS. 4 and 5, the pneumatic spinning device 7 can be moved to a retracted position, which is located further away from the draft device 6 than the spinning position. When the pneumatic spinning device 7 is located at the retracted position, the hollow guide shaft body 80 can be further moved from the nozzle block 70. When the pneumatic spinning device 7 is moved from the spinning position to the retracted position, as illustrated in FIG. 4, the nozzle block 70 and the hollow guide shaft body 80 are integrally moved away from the draft device 6. Then, as illustrated in FIG. 5, only the nozzle block 70 stops at a predetermined position. The hollow guide shaft body 80 continues the movement in order to be located away from the nozzle block 70. Subsequently, the hollow guide shaft body 80 that has been moved away from the nozzle block 70 stops at a predetermined position.

[0025] As illustrated in FIGS. 1 and 2, the yarn monitoring device 8 is adapted to monitor the travelling yarn Y between the pneumatic spinning device 7 and the yarn accumulating device 50. The yarn monitoring device 8

transmits a yarn defect detection signal to a unit controller (a control section) 10 upon detection of a yarn defect. The yarn monitoring device 8 detects as the yarn defect, for example, an abnormality in thickness of the yarn Y and/or a foreign substance in the yarn Y. Furthermore, the yarn monitoring device 8 detects a length of the yarn Y and transmits a length detection signal to the unit controller 10. The tension sensor 9 is adapted to measure tension of the travelling yarn Y between the pneumatic spinning device 7 and the yarn accumulating device 50, and to transmit a tension measurement signal to the unit controller 10. The waxing device 11 is adapted to apply wax to the travelling yarn Y between the yarn accumulating device 50 and the winding device 12.

[0026] The unit controller 10 is formed of, for example, a Central Processing Unit (CPU) adapted to perform arithmetic processing, a Read Only Memory (ROM) and a Random Access Memory (RAM) each adapted to function as a storage section, and the like, and is provided to every spinning unit 2. The unit controller 10 receives the yarn defect detection signal transmitted from the yarn monitoring device 8. The unit controller 10 calculates a length of the yarn Y that has been wound by the winding device 12 based on the length detection signal of the yarn Y transmitted from the yarn monitoring device 8. The unit controller 10 determines based on the calculated result, whether or not the package P is fully-wound. The unit controller 10 may be provided to every predetermined number of spinning units 2. Alternatively, a controller adapted to control the entire spinning machine 1 may be provided, and all the spinning units 2 may be controlled by such a controller.

[0027] As illustrated in FIG. 4, the injecting device 14 is adapted to inject air towards a region C between the draft device 6 and the pneumatic spinning device 7 after the pneumatic spinning device 7 starts being moved from the spinning position to the retracted position. The injecting device 14 is arranged to inject the air to cross a fiber passage (a path where the fiber bundle F travels) in the region C. The injecting device 14 is preferably arranged to inject the air along a direction orthogonal to the fiber passage. The injecting device 14 is controlled by the unit controller 10 to inject the air at a desired timing. The suction device 15 is arranged to face the injecting device 14 with the region C therebetween and is adapted to suck fibers that remain in and around the region C. The injecting device 14 is arranged to a side where the top roller 65b is arranged (a top roller 65b side) with respect to the region C, and the suction device 15 is arranged to a side where the bottom roller 65a is arranged (a bottom roller 65a side) with respect to the region C. The top roller 65b side means a region on a side where the top roller 65b is arranged with the fiber passage as a reference when seen in an axial direction of the front roller pair 65 (a direction penetrating a page of FIG. 3), and includes a region downstream of the top roller 65b. The bottom roller 65a side means a region on a side where the bottom roller 65a is arranged with the fiber passage as a refer-

ence when seen in the axial direction of the front roller pair 65, and includes a region downstream of the bottom roller 65a.

[0028] As illustrated in FIGS. 1 and 2, the yarn accumulating device 50 is adapted to accumulate the travelling yarn Y between the pneumatic spinning device 7 and the winding device 12 by winding the travelling yarn Y around a yarn accumulating roller. The yarn accumulating device 50 has a function to stably draw the yarn Y from the pneumatic spinning device 7, a function to accumulate the yarn Y fed from the pneumatic spinning device 7 to prevent the yarn Y from slackening, for example, when the yarn joining vehicle 3 performs a yarn joining operation, and a function to adjust tension of the yarn Y located downstream of the yarn accumulating device 50 to prevent variation in the tension of the downstream yarn Y from propagating to the pneumatic spinning device 7.

[0029] The winding device 12 is adapted to wind the yarn Y produced by the pneumatic spinning device 7 around a bobbin B to form the package P. The winding device 12 includes a cradle arm 21, a winding drum 22, and a traverse device 23. The cradle arm 21 is swingably supported by a support shaft 24 and brings a surface of the bobbin B or the package P each rotatably supported by the cradle arm 21 into contact with a surface of the winding drum 22 with an appropriate pressure. The winding drum 22 is driven by an electric motor (not illustrated) provided to every spinning unit 2, and rotates the bobbin B or the package P being in contact therewith. The traverse device 23 is driven by a shaft 25 provided in common to the plurality of spinning units 2 and traverses the yarn Y at a predetermined width with respect to the rotating bobbin B or the rotating package P.

[0030] The yarn joining vehicle 3 travels to a spinning unit 2 in which the yarn Y has been disconnected, and performs a yarn joining operation in such a spinning unit 2. The yarn joining vehicle 3 includes a splicer 26, a suction pipe 27, and a suction mouth 28. The suction pipe 27 is swingably supported by a support shaft 31. The suction pipe 27 sucks and catches a yarn end of the yarn Y from the pneumatic spinning device 7 and guides the caught yarn end to the splicer 26. The suction mouth 28 is swingably supported by a support shaft 32. The suction mouth 28 sucks and catches a yarn end of the yarn Y from the winding device 12 and guides the caught yarn end to the splicer 26. The splicer 26 performs yarn joining of the guided yarn ends.

[0031] Next, operations relating to an adjustment of a length of a fiber bundle portion Y1 to be formed at a yarn end of the yarn Y will be described. As illustrated in FIG. 5, the fiber bundle portion Y1 means a region to which twists have not been applied at a yarn end of the yarn Y connected to the package P. Operations to form the fiber bundle portion Y1 are performed, for example, when spinning is interrupted upon detection of a yarn defect or when the package P becomes fully-wound and spinning is finished.

[0032] During spinning, air is injected from the plurality of nozzles 74 to the spinning chamber 73, and whirling flow of air is generated in the spinning chamber 73. Accordingly, twists are applied to the fiber bundle F fed to the spinning chamber 73, and the yarn Y is produced. The produced yarn Y is discharged from the exit 83 via the passage 81. Fibers that did not become the yarn Y are collected into the collecting section 77. During spinning, the pneumatic spinning device 7 is located at the spinning position.

[0033] When a yarn defect is detected by the yarn monitoring device 8 during spinning, the yarn defect detection signal is transmitted to the unit controller 10. Upon receiving the yarn defect detection signal, the unit controller 10 controls the draft device 6 to stop driving the back roller pair 61 (a drafting operation of the draft device 6). Since the front roller pair 65 is connected to a drive source (a drive source provided in common to front roller pairs 65 in other spinning units 2) different from a drive source of the back roller pair 61, driving of the front roller pair 65 continues. Consequently, the fiber bundle F is disconnected between the back roller pair 61 and the front roller pair 65. A timing at which the unit controller 10 controls the draft device 6 as described above is referred to as a "timing K to stop the drafting operation of the draft device 6".

[0034] The unit controller 10 then controls the pneumatic spinning device 7 to stop the injection of the air from the plurality of nozzles 74. When the injection of the air from the plurality of nozzles 74 is stopped, the whirling flow in the spinning chamber 73 disappears and thus twists are not applied to the yarn end of the yarn Y. Consequently, the fiber bundle portion Y1 to which twists have not been applied is formed at the yarn end of the yarn Y. A timing at which the unit controller 10 controls the pneumatic spinning device 7 as described above is referred to as a "first timing L to stop injection of air". The first timing L is set by the unit controller 10 to be after an elapse of a predetermined period of time from the timing K to be linked with the timing K to stop the drafting operation of the draft device 6. The unit controller 10 has a function as a setting section of the first timing L.

[0035] Subsequently, the unit controller 10 controls the pneumatic spinning device 7 to start moving from the spinning position to the retracted position (a moving step). A timing at which the unit controller 10 controls the pneumatic spinning device 7 as described above is referred to as a "second timing M to start moving the pneumatic spinning device 7 from the spinning position to the retracted position". The second timing M is set by the unit controller 10 to be after an elapse of a predetermined period of time from the first timing L to be linked with the first timing L to stop the injection of the air. The unit controller 10 has a function as a setting section of the second timing M.

[0036] Subsequently, for example, the unit controller 10 controls the injecting device 14 to inject air after the pneumatic spinning device 7 starts moving from the spin-

ning position to the receded position (after the second timing M) (an injecting step). A timing at which the unit controller 10 controls the injecting device 14 as described above is referred to as a "third timing N to inject air". The third timing N is set by the unit controller 10 with the second timing M to start moving the pneumatic spinning device 7 from the spinning position to the receded position as a reference. The unit controller 10 has a function as a setting section of the third timing N. The air is injected to the fiber bundle F that is passing the region C between the draft device 6 and the pneumatic spinning device 7. The fiber bundle F is disconnected by the injected air. In such a manner, the fiber bundle F is disconnected between the back roller pair 61 and the front roller pair 65, and is further disconnected by the injecting device 14.

[0037] Fibers that are generated when the fiber bundle F is disconnected are sucked by the suction device 15. The unit controller 10 then controls the injecting device 14 to stop the injection of the air before the pneumatic spinning device 7 reaches the receded position.

[0038] The unit controller 10 has a function as an adjusting section of the third timing N. The unit controller 10 can adjust the third timing N by storing data selected by an operator via an input section (not illustrated) in the storage section and performing a control program in accordance with the selected data. When shortening the length of the fiber bundle portion Y1, as illustrated in FIG. 6A, the third timing N is adjusted to be relatively early (for example, to be earlier than the third timing N illustrated in FIG. 6B). Accordingly, since a length of the yarn end of the yarn Y to be disconnected by the injecting device 14 becomes long, the length of the fiber bundle portion Y1 becomes short. The length of the fiber bundle portion Y1 is shortened, for example, in a case of preventing the fiber bundle portion Y1 from remaining at the yarn accumulating roller of the yarn accumulating device 50, or the like. On the other hand, when lengthening the length of the fiber bundle portion Y1, as illustrated in FIG. 6B, the third timing N is adjusted to be relatively delayed (for example, to be later than the third timing N illustrated in FIG. 6A). Accordingly, since the length of the yarn end of the yarn Y to be disconnected by the injecting device 14 becomes short, the length of the fiber bundle portion Y1 becomes long. The length of the fiber bundle portion Y1 is lengthened, for example, in a case of reliably catching the yarn end of the yarn Y when performing the yarn joining operation, or the like. In such a manner, the third timing N may be adjusted to be early by the unit controller 10 when shortening the length of the fiber bundle portion Y1.

[0039] A case in which spinning is interrupted upon detection of a yarn defect has been described above, but similar operations are performed also in a case in which the package P is determined to be fully-wound and spinning is finished. However, in this case, the length of the fiber bundle portion Y1 is preferably shortened such that a knot of the yarn Y is not disconnected when unwinding the package P by a warper in the following step. Thus,

the third timing N is preferably adjusted to be early as illustrated in FIG. 6A, for example.

[0040] As described above, in the spinning machine 1 and a spinning method executed in the spinning machine 1, since air is injected by the injecting device 14 to the fiber bundle F that is passing the region C between the draft device 6 and the pneumatic spinning device 7, the fiber bundle F is disconnected by the air. Thus, the length of the fiber bundle portion Y1 can be appropriately adjusted by adjusting the third timing N to inject the air. In addition, by starting to move the pneumatic spinning device 7 from the spinning position to the receded position (a moving step), the air can be effectively injected to the fiber bundle F without being disturbed by the pneumatic spinning device 7. Furthermore, by starting to move the pneumatic spinning device 7 from the spinning position to the receded position, a gap occurs in a positional relation of the draft device 6 and the pneumatic spinning device 7, and thus twists are not appropriately applied to the fiber bundle F. Accordingly, twists are prevented from propagating to the fiber bundle F that is passing the region C. Since the fiber bundle F to which twists are prevented from propagating and which is located in the region C is weaker against external force such as air or the like than the fiber bundle F to which twists have been applied, such a fiber bundle F is reliably disconnected by the air from the injecting device 14.

[0041] Accordingly, the length of the fiber bundle portion Y1 can be adjusted, for example, such that the fiber bundle portion Y1 does not remain at the yarn accumulating roller of the yarn accumulating device 50 located downstream of the pneumatic spinning device 7. Furthermore, the length of the fiber bundle portion Y1 can be adjusted such that the yarn end of the yarn Y can be reliably caught when performing the yarn joining operation. On the other hand, the length of the fiber bundle portion Y1 can be shortened when the package P becomes fully-wound such that a knot of the yarn Y is not disconnected when unwinding the package P by the warper in the following step.

[0042] In the spinning machine 1, the injection of the air is stopped before the pneumatic spinning device 7 reaches the receded position. With this configuration, the air can be efficiently injected, and the length of the fiber bundle portion Y1 can be adjusted. Furthermore, since the air is not injected more than necessary, the fibers that generate when the fiber bundle F is disconnected can be prevented from flying.

[0043] In the spinning machine 1, the air is injected to cross the fiber passage in the region C between the draft device 6 and the pneumatic spinning device 7. With this configuration, since the air can be reliably applied to the fiber bundle F, the length of the fiber bundle portion Y1 can be more appropriately adjusted.

[0044] In the spinning machine 1, the air is injected along a direction orthogonal to the fiber passage. With this configuration, since force of the injection of the air is effectively applied to the fiber bundle F, the fiber bundle

portion Y1 can be disconnected by injection of a minimum amount of air.

[0045] The spinning machine 1 is provided with the suction device 15 arranged to face the injecting device 14 with the region C therebetween and adapted to suck fibers. With this configuration, since the fibers that generate when the fiber bundle F is disconnected by the air are sucked by the suction device 15, the fibers can be prevented from remaining in the spinning machine 1.

[0046] In the spinning machine 1, the draft device 6 includes a plurality of the roller pairs 61, 62, 64, and 65. The front roller pair 65 arranged closest to the pneumatic spinning device 7 among the plurality of the roller pairs 61, 62, 64, and 65 includes the bottom roller 65a that rotates by receiving a driving force and the top roller 65b that rotates in accordance with the bottom roller 65a. The injecting device 14 is arranged to the side where the top roller 65b is arranged with respect to the region C between the draft device 6 and the pneumatic spinning device 7. The suction device 15 is arranged to the side where the bottom roller 65a is arranged with respect to the region C between the draft device 6 and the pneumatic spinning device 7. With this configuration, the fibers that generate when the fiber bundle F is disconnected can be prevented from adhering to the top roller 65b.

[0047] The spinning machine 1 includes the nozzle block 70 and the hollow guide shaft body 80 arranged to form the spinning chamber 73. Air is injected into the spinning chamber 73 from the plurality of nozzles 74 arranged in the nozzle block 70. With this configuration, the whirling flow is generated in the spinning chamber 73 by injecting the air from the plurality of nozzles 74 into the spinning chamber 73, and twists can be reliably applied to the fiber bundle F.

[0048] The spinning machine 1 includes the unit controller 10 that controls the injecting device 14 to inject the air after the pneumatic spinning device 7 starts moving from the spinning position to the receded position. With this configuration, the length of the fiber bundle portion Y1 can be automatically adjusted in accordance with a condition set for the case in which spinning is interrupted upon detection of a yarn defect, the case in which the package P is determined to be fully-wound and spinning is finished, or the like.

[0049] An embodiment of the present invention has been described above, but the present invention is not limited to the above-described embodiment.

[0050] In the above-described embodiment, the third timing N is set to be after the second timing M. However, a timing at which the injecting device 14 starts injecting the air may be before the second timing M or simultaneous with the second timing M. In other words, the injecting device 14 is merely required to be injecting the air at least when the pneumatic spinning device 7 is moving from the spinning position to the receded position.

[0051] In the above-described embodiment, the unit controller 10 controls operations relating to an adjustment of the third timing N. However, an adjustment mechanism

to adjust the third timing N may be arranged separately, and an operator may directly adjust the third timing N by such an adjustment mechanism without the unit controller 10. For example, in the injecting device 14 in which a length of an air path until the air is injected can be adjusted, the length of the air path may be adjusted by the operator. Since a timing at which air is injected from the injecting device 14 is varied by adjusting the length of the air path, the third timing N can be adjusted. In such a manner, the third timing N may be adjusted without the unit controller 10.

[0052] In the above-described embodiment, the first timing L and the second timing M are set to be predetermined timings, but may be adjusted when shortening (or lengthening) the length of the fiber bundle portion Y1. For example, the first timing L and the second timing M may be adjusted by the unit controller 10 or the operator with the timing K as a reference to be delayed when shortening the length of the fiber bundle portion Y1.

[0053] In the above-described embodiment, the injecting device 14 is arranged to the side where the top roller 65b is arranged with respect to the region C, and the suction device 15 is arranged to the side where the bottom roller 65a is arranged with respect to the region C, but the positions of the injecting device 14 and the suction device 15 may be reversed.

[0054] Various materials and shapes may be applied to a material and a shape of each component of the spinning machine 1 without being limited to the above-described material and shape. The needle 75 may be omitted, and a downstream end of the fiber guiding section 71 may function as the needle 75. Furthermore, the front roller pair 65 is not required to be connected to the drive source provided in common to the front roller pairs 65 in other spinning units 2, and driving force may be respectively applied from individual drive sources. Without being limited to the front roller pairs 65, driving force may be respectively applied from individual drive sources to each of other roller pairs 61, 62, and 64 in the same manner.

Claims

1. A spinning machine (1) comprising:

- a draft device (6) adapted to draft a fiber bundle (F);
- a pneumatic spinning device (7) arranged movable between a spinning position and a receded position that is located further away from the draft device (6) than the spinning position, and adapted to produce a yarn (Y) at the spinning position by applying twists to the drafted fiber bundle (F) by injecting air to a spinning chamber (73); and
- an injecting device (14) adapted to inject air to a region (C) between the draft device (6) and the pneumatic spinning device (7), the injecting

- device (14) being adapted to be injecting the air at least when the pneumatic spinning device (7) is moving from the spinning position to the re-
ceded position, and to stop injecting the air be-
fore the pneumatic spinning device (7) reaches
the receded position. 5
2. The spinning machine (1) according to claim 1,
wherein the injecting device (14) is adapted to inject
the air to cross a fiber passage in the region (C) be-
tween the draft device (6) and the pneumatic spin-
ning device (7). 10
3. The spinning machine (1) according to claim 2,
wherein the injecting device (14) is adapted to inject
the air along a direction orthogonal to the fiber pas-
sage. 15
4. The spinning machine (1) according to any one of
claim 1 through claim 3, further comprising a suction
device (15) arranged to face the injecting device (14)
with the region (C) therebetween and adapted to
suck fibers. 20
5. The spinning machine (1) according to claim 4, 25
wherein the draft device (6) includes a plurality of
roller pairs (61, 62, 64, 65), and the roller pair (65)
arranged closest to the pneumatic spinning device
(7) among the plurality of the roller pairs (61, 62, 64,
65) include a driving roller (65a) adapted to rotate
by receiving a driving force and a driven roller (65b)
adapted to rotate in accordance with the driving roller
(65a), 30
the injecting device (14) is arranged to a side where
the driven roller (65b) is arranged with respect to the
region (C) between the draft device (6) and the pneu-
matic spinning device (7), and 35
the suction device (15) is arranged to a side where
the driving roller (65a) is arranged with respect to
the region (C) between the draft device (6) and the
pneumatic spinning device (7). 40
6. The spinning machine (1) according to any one of
claim 1 through claim 5, wherein the pneumatic spin-
ning device (7) includes a nozzle block (70) and a
hollow guide shaft body (80) arranged to form the
spinning chamber (73), and a nozzle (74) through
which the air is injected into the spinning chamber
(73) is formed in the nozzle block (70). 45
7. The spinning machine (1) according to any one of
claim 1 through claim 6, further comprising a control
section (10) adapted to control start and stop of the
injection of the air from the injecting device (14). 50
8. A spinning method executed in a spinning machine
(1) that includes a draft device (6) adapted to draft
a fiber bundle (F); a pneumatic spinning device (7)

arranged movable between a spinning position and
a receded position that is located further away from
the draft device (6) than the spinning position, and
adapted to produce a yarn (Y) at the spinning position
by applying twists to the drafted fiber bundle (F) by
injecting air to a spinning chamber (73); and an in-
jecting device (14) adapted to inject air to a region
(C) between the draft device (6) and the pneumatic
spinning device (7), the spinning method comprising:

a moving step of starting to move the pneumatic
spinning device (7) from the spinning position to
the receded position; and
an injecting step of injecting the air from the in-
jecting device (14) at least when the pneumatic
spinning device (7) is moving from the spinning
position to the receded position, and stopping
the injection of the air before the pneumatic spin-
ning device (7) reaches the receded position.

FIG. 1

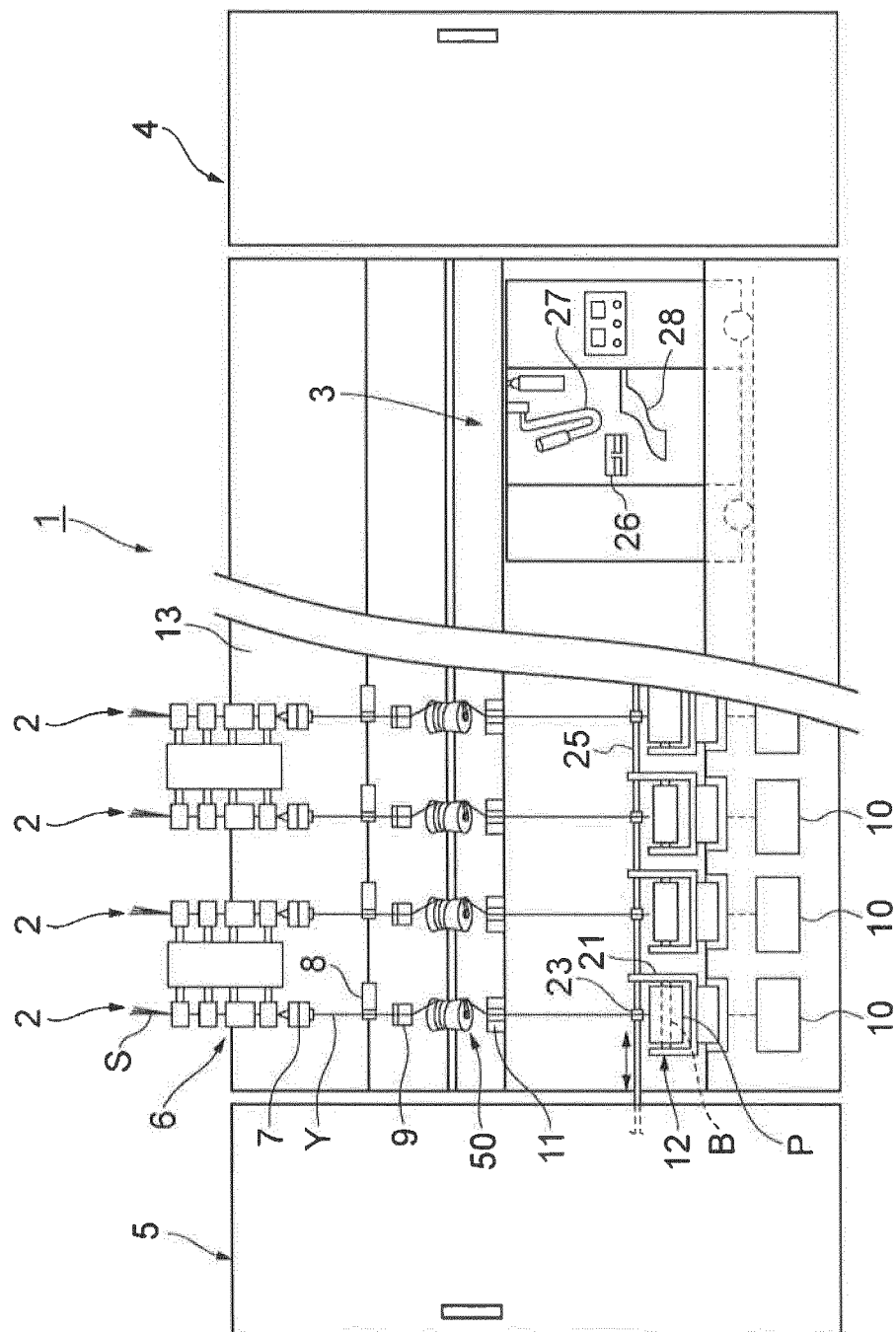


FIG. 2

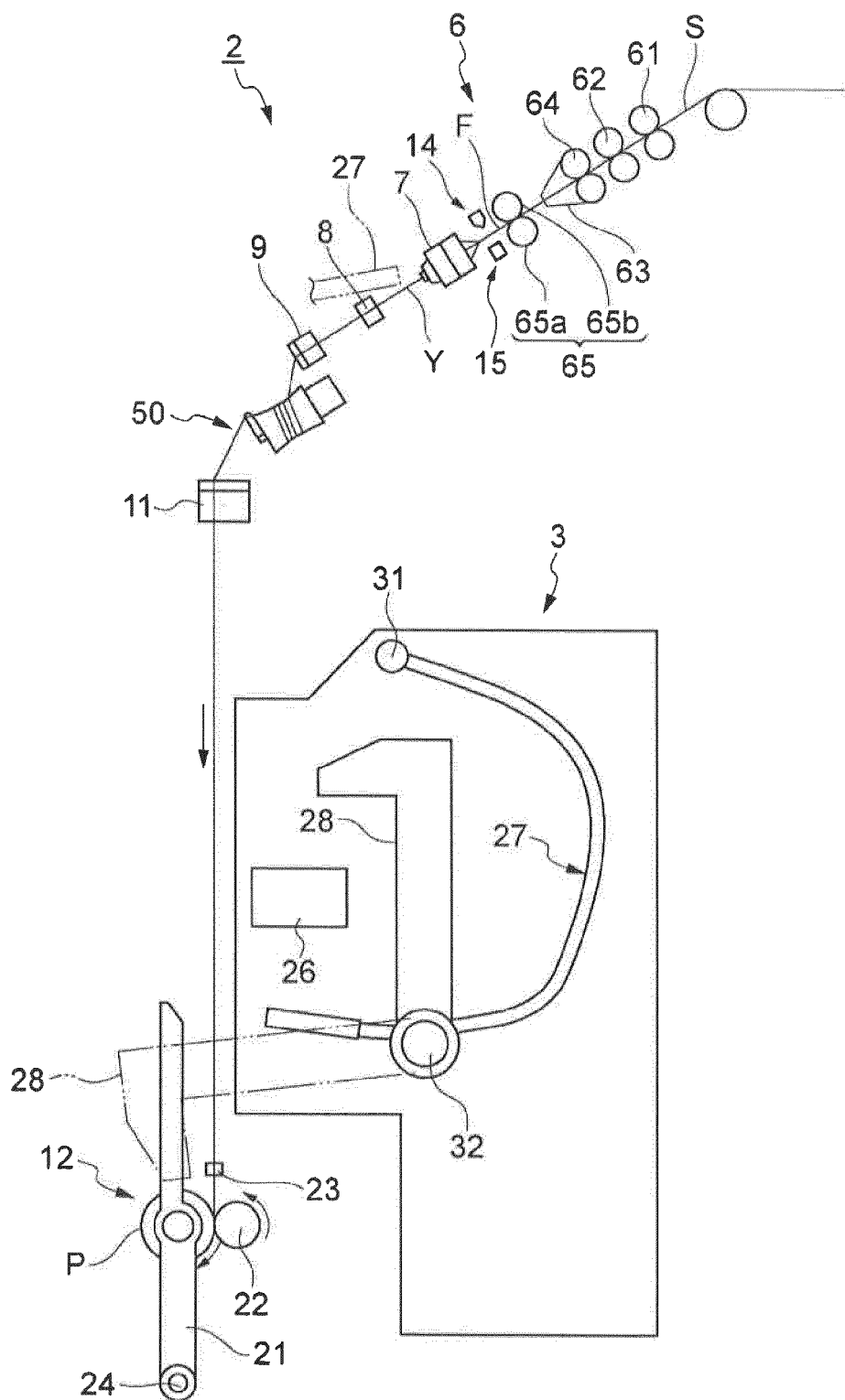


FIG. 3

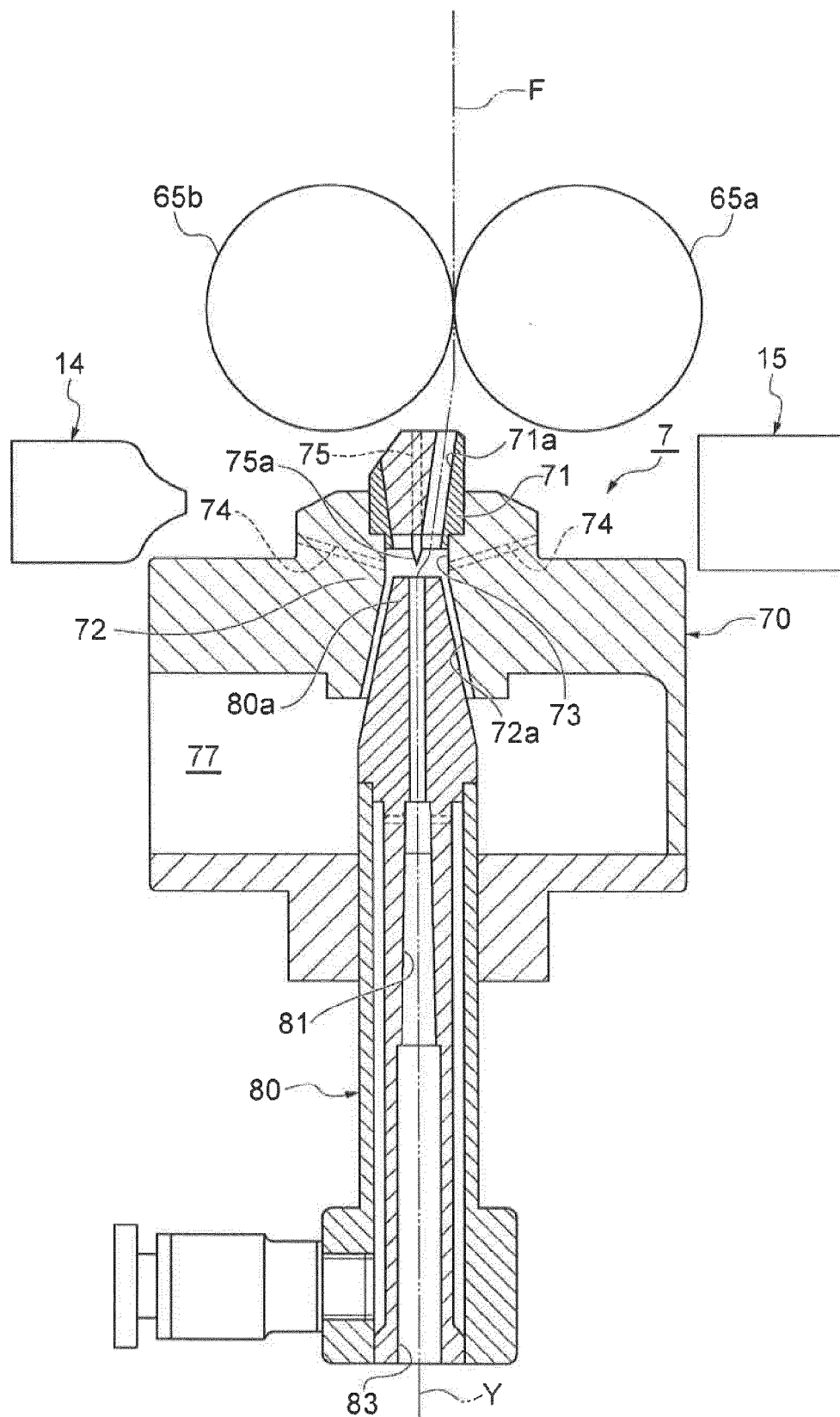


FIG. 4

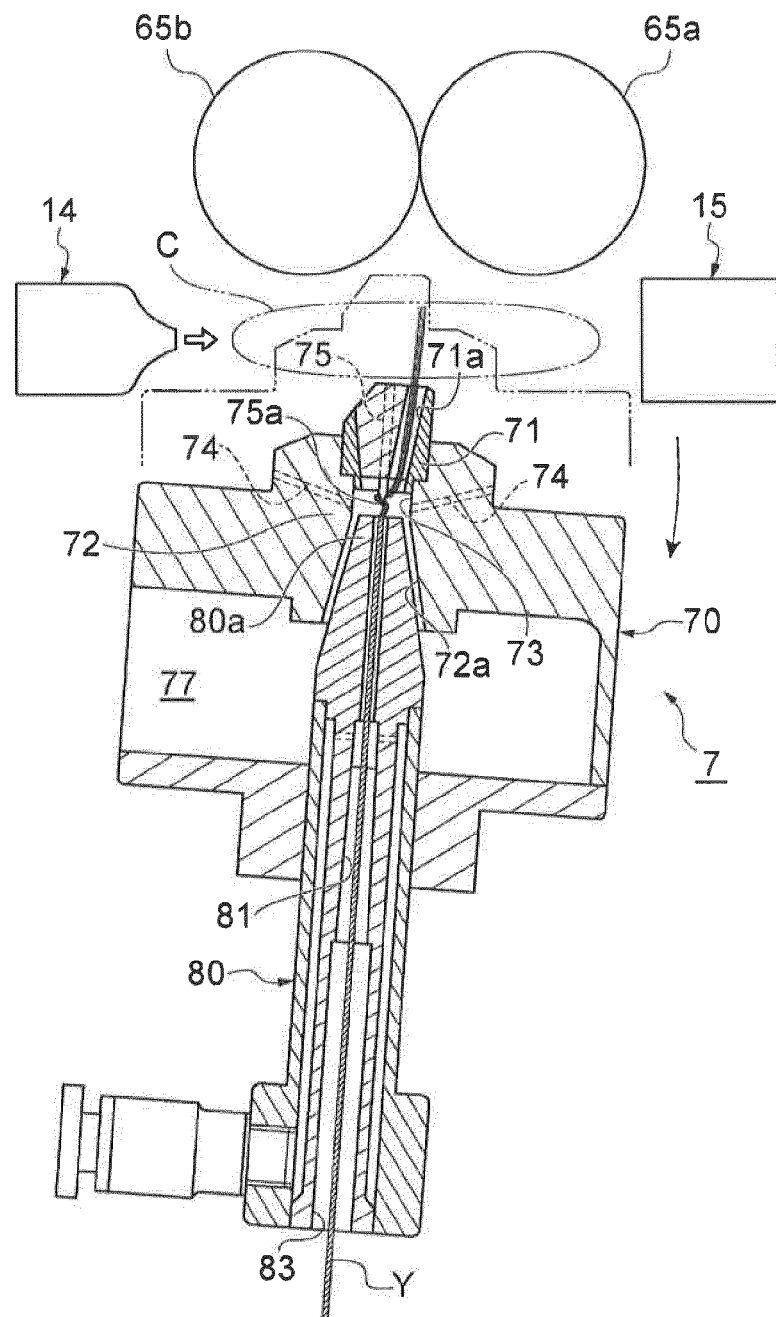


FIG. 5

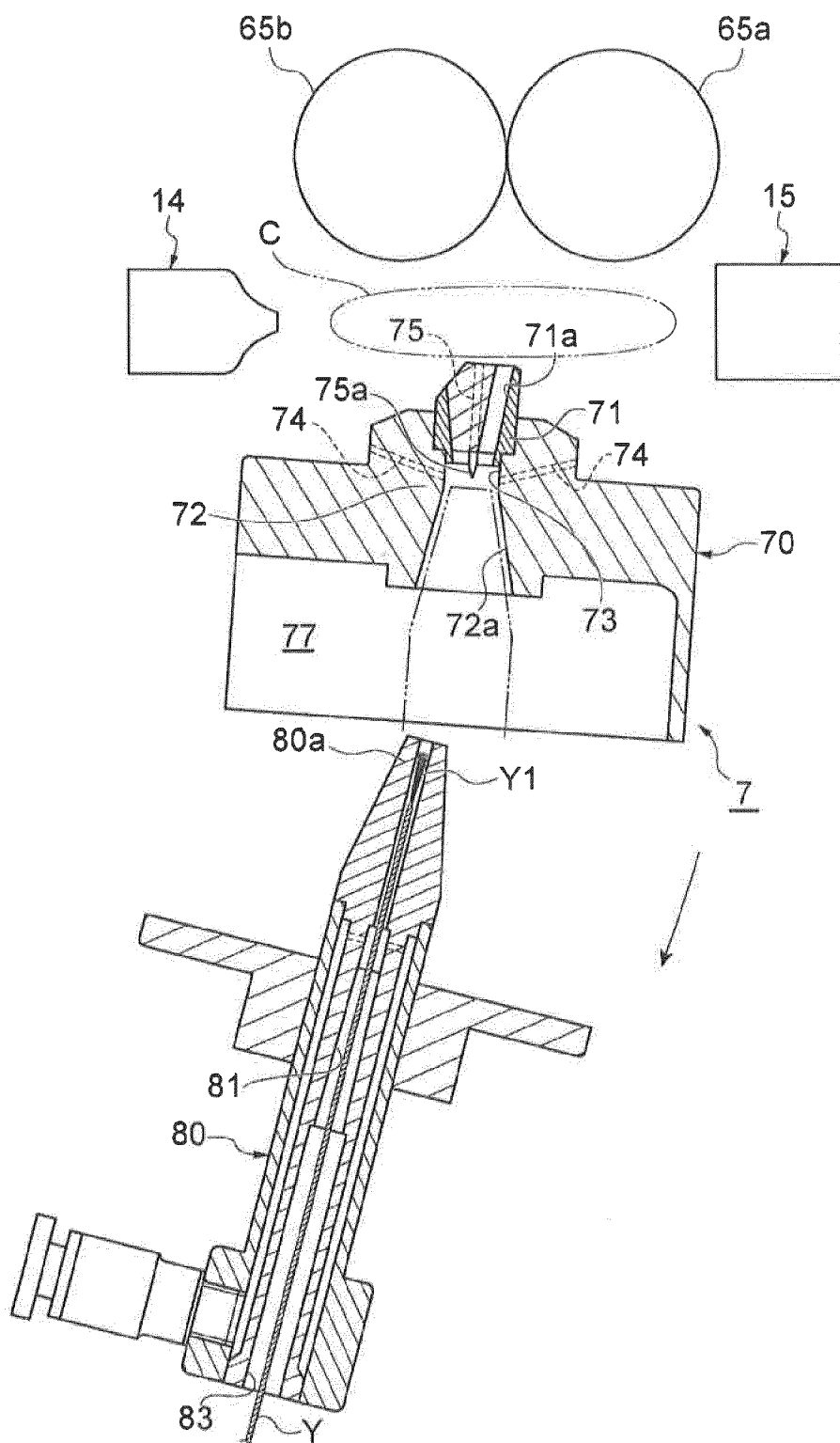


FIG. 6A

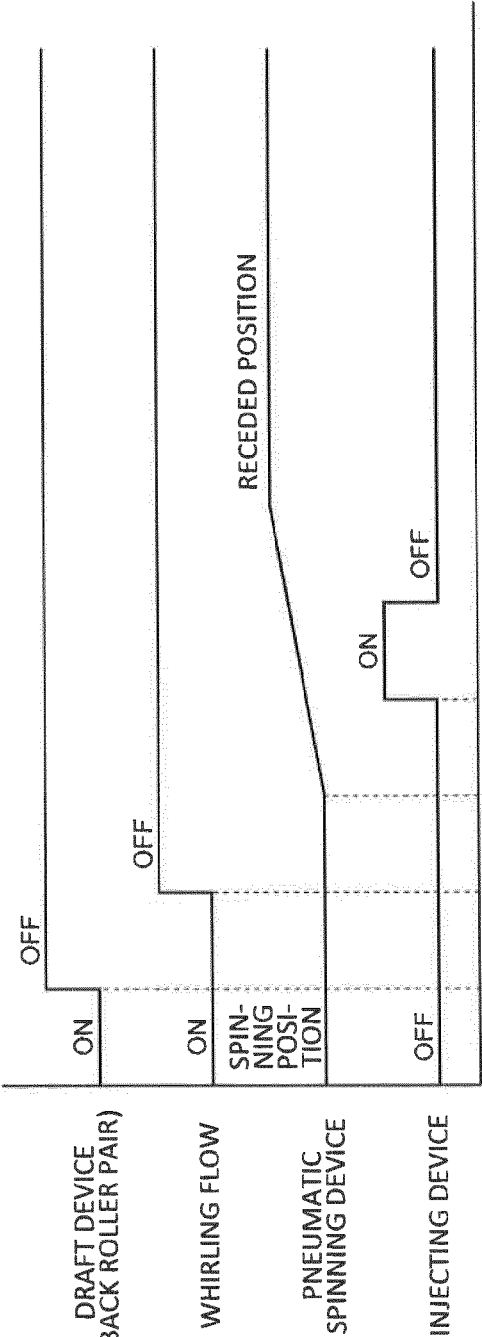
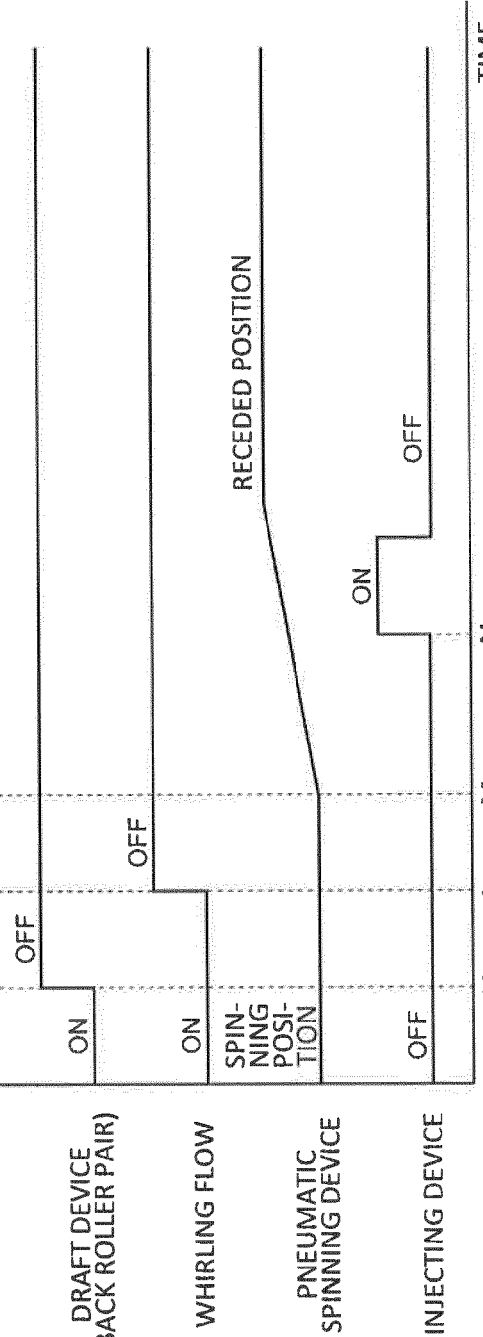


FIG. 6B





EUROPEAN SEARCH REPORT

Application Number
EP 15 16 6315

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2001 131834 A (MURATA MACHINERY LTD) 15 May 2001 (2001-05-15) * paragraph [0015] * * paragraph [0062] * * paragraph [0075] * * paragraph [0088] * * figures 3,8,9,10-13 * -----	1-6	INV. D01H1/115
X	EP 0 853 149 A2 (MURATA MACHINERY LTD [JP]) 15 July 1998 (1998-07-15) * column 4, line 41 - line 49 * * column 5, line 40 - line 44 * * column 5, line 53 - column 6, line 9 * * figures 1-3,5 * -----	1-5	
			TECHNICAL FIELDS SEARCHED (IPC)
			D01H B65H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 October 2015	Examiner Humbert, Thomas
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03/82 (P04C01)

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The members are as contained in the European Patent Office EDP file on
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15-10-2015

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