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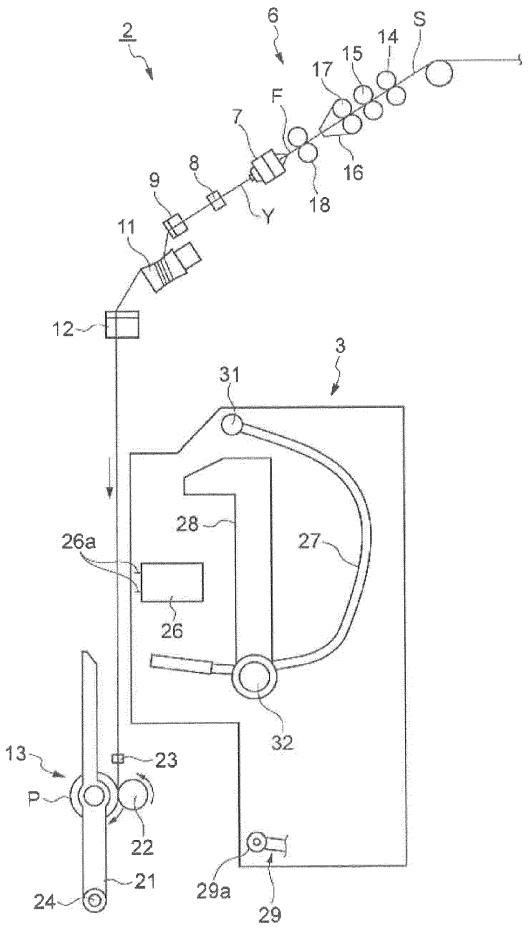
(54) Yarn winding machine and yarn winding method

(57) A spinning machine (1) includes a draft device (6), a spinning device (7), a winding device (13), a splicer (26), a suction pipe (27), a suction mouth (28), and a unit controller. The unit controller is adapted to control a package (P) to be reversely rotated after a completion of a yarn guiding operation by the section pipe (27) and the suction mouth (28) and before a start of a yarn joining operation by the splicer (26).

FIG. 2



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine adapted to wind a yarn into a package, and a yarn winding method.

2. Description of the Related Art

[0002] A conventional yarn winding machine that is known includes a yarn joining device adapted to join a yarn from a supplying side and a yarn from a winding side when the yarn is disconnected (including cases of when the yarn is disconnected to remove a yarn defect and when the yarn is unexpectedly disconnected) (seee.g., Japanese Unexamined Patent Publication No. 2007-284812).

BRIEF SUMMARY OF THE INVENTION

[0003] It is an object of the present invention to provide a yarn winding machine and a yarn winding method capable of appropriately joining yarns.
This object is achieved by a yarn winding machine according to claim 1, and by a yarn winding method according to claim 9.

[0004] With regard to the conventional yarn winding machine described above, it has been found out that, when the rotation of the package is stopped after guiding the yarn from the winding side to the yarn joining device, the yarn from the winding side may break or drawbacks may occur in joining the yarn from the supplying side and the yarn from the winding side at the time of the yarn joining operation by the yarn joining device.

[0005] A yarn winding machine includes a yarn supplying device adapted to supply a yarn; a winding device adapted to forwardly rotate a package and to wind the yarn into the package; a yarn joining device adapted to perform a yarn joining operation to join the yarn from the yarn supplying device and the yarn from the winding device upon disconnection of the yarn; a yarn guiding device adapted to perform a yarn guiding operation to guide the yarn from the yarn supplying device and the yarn from the winding device to the yarn joining device upon disconnection of the yarn; and a control section adapted to control the package to be reversely rotated after a completion of the yarn guiding operation by the yarn guiding device and before a start of the yarn joining operation by the yarn joining device.

[0006] When the yarn is disconnected (including cases of when the yarn is disconnected to remove a yarn defect and when the yarn is unexpectedly disconnected), the package is reversely rotated after the completion of the yarn guiding operation by the yarn guiding device and before the start of the yarn joining operation by the yarn joining device. The tension of the yarn from the winding device thus becomes loose, whereby the yarn from the winding device can be suppressed from breaking and the drawbacks can be suppressed from occurring during the yarn joining operation. The yarn thus can be appropriately joined.

[0007] The yarn winding machine further includes a reversal-rotation mechanism adapted to reversely rotate the package; wherein the control section may be adapted to control the reversal-rotation mechanism to reversely rotate the package after the completion of the yarn guiding operation by the yarn guiding device and before the start of the yarn joining operation by the yarn joining device. Alternatively, the control section may be adapted to control the winding device to reversely rotate the package after the completion of the yarn guiding operation by the yarn guiding device and before the start of the yarn joining operation by the yarn joining device. The package thus can be appropriately reversely rotated.

[0008] During the yarn guiding operation by the yarn guiding device, the control section may be adapted to reversely rotate the package, and after the completion of the yarn guiding operation by the yarn guiding device and before the start of the yarn joining operation by the yarn joining device, the control section may be adapted to once stop reversal-rotation of the package and then to reversely rotate the package again. Since the reversal-rotation of the package is once stopped, the reversal-rotation speed and/or reversal-rotation amount of when reversely rotating the package again can be easily controlled.

[0009] When controlling the package to be reversely rotated, the control section may be adapted to adjust at least one of a reversal-rotation speed and a reversal-rotation amount of the package. The tension of the yarn from the winding device can be appropriately loosened according to the diameter of the package, type of the yarn, and/or yarn count of the yarn, and the like.

[0010] The yarn supplying device may include a draft device adapted to draft a fiber bundle, and a spinning device adapted to apply twists to the fiber bundle and to generate the yarn. A high quality yarn thus can be efficiency supplied.

[0011] The spinning device may be an air-jet spinning device adapted to apply the twists to the fiber bundle and to generate the yarn by a whirling airflow. A higher quality yarn thus can be efficiently supplied.

[0012] The yarn winding machine may further include a plurality of yarn winding units, each winding unit including the yarn supplying device and the winding device; and at least one yarn joining carrier including the yarn joining device and the yarn guiding device. The yarn joining device and the yarn guiding device can be shared among the plurality of yarn winding units, thus simplifying the structure of the yarn winding unit.

[0013] A yarn winding method is a yarn winding method for supplying a yarn and forwardly rotating a package to wind the yarn into the package, the method including a

first step and a second step. In the first step, a yarn guiding operation for guiding a supplied yarn and a wound yarn to a yarn joining device for performing a yarn joining operation to join the supplied yarn and the wound yarn is performed upon disconnection of the yarn. In the second step, the package is reversely rotated after a completion of the yarn guiding operation and before a start of the yarn joining operation by the yarn joining device. Similar to the yarn winding machine described above, the yarn can be appropriately joined.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is a front view of a spinning machine, which is a yarn winding machine, according to one embodiment of the present invention;
FIG. 2 is a side view of a spinning unit, which is a yarn winding unit, according to one embodiment of the present invention;
FIG. 3 is a timing chart illustrating an operation of the spinning unit from a middle of a yarn guiding operation to a completion of the yarn joining operation;
FIG. 4 is a side view of the spinning unit at the time of yarn disconnection;
FIG. 5 is a side view of the spinning unit during the yarn guiding operation;
FIG. 6 is a side view of the spinning unit at the completion of the yarn guiding operation;
FIG. 7 is a side view of the spinning unit at the time of reversal-rotation of the package; and
FIG. 8 is a side view of the spinning unit during the yarn joining operation.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0015] Preferred embodiments of the present invention will be hereinafter described in detail with reference to the drawings. In the drawings, the same reference numerals are denoted for the same or corresponding portions, and redundant description will be omitted.

[0016] As illustrated in FIG. 1, a spinning machine (yarn winding machine) 1 includes a plurality of spinning units (yarn winding units) 2, a yarn joining carrier 3, a blower box 4, and a motor box 5. Each spinning unit 2 is adapted to produce a yarn Y and to wind the yarn Y into a package P. The yarn joining carrier 3 travels among the plurality of spinning units 2 arranged in a line. The blower box 4 accommodates an air supply source, and the like for generating a suction flow, a whirling airflow, or the like at each section of the spinning unit 2. The motor box 5 accommodates a motor, and the like for supplying a power to each section of the spinning unit 2. A unit controller (control section) 10 is arranged in each spinning unit 2. The unit controller 10 controls the operation of the spinning unit 2 while communicating with a higher-level controller (higher-level control section) (not illustrated).

[0017] As illustrated in FIG. 1 and FIG. 2, each spinning unit 2 includes a draft device (yarn supplying device) 6, a spinning device (yarn supplying device) 7, a yarn clearer 8, a tension sensor 9, a yarn accumulating device 11, a waxing device 12, and a winding device 13 in this order from the upstream. Each device is directly or indirectly supported by a frame 19 such that the upstream is the upper side (i.e., downstream is the lower side) in a machine height direction. In the present embodiment, in a path where the yarn Y travels (i.e., a yarn path), a side where the yarn Y is produced is referred to as upstream and a side where the yarn Y is wound is referred to as downstream.

[0018] The draft device 6 drafts a sliver S to generate a fiber bundle F (i.e., drafts the fiber bundle F). The draft device 6 include a back roller pair 14, a third roller pair 15, a middle roller pair 17 provided with an apron belt 16, and a front roller pair 18. The bottom rollers of the roller pairs 14, 15, 17, and 18 are driven at different rotation speeds by the power from the motor box 5 or an electric motor (not illustrated) arranged for every spinning unit 2. The draft device 6 thus drafts the sliver S supplied from the upstream to generate the fiber bundle F, and supplies the fiber bundle F to the downstream spinning device 7.

[0019] The spinning device 7 is an air-jet spinning device adapted to produce the yarn Y by applying twists to the fiber bundle F with a whirling airflow. More specifically (but not illustrated), the spinning device 7 includes a spinning chamber, a fiber guiding section, a whirling airflow generation nozzle, and a hollow guide shaft body. The fiber guiding section is adapted to guide the fiber bundle F supplied from the upstream draft device 6 to the spinning chamber. The whirling airflow generation nozzle is arranged at a periphery of the path on which the fiber bundle F travels, and generates a whirling airflow in the spinning chamber. This whirling airflow causes the fiber end of the fiber bundle F guided into the spinning chamber to be inverted and whirled. The hollow guide shaft body is adapted to guide the spun yarn Y to the outside of the spinning device 7 from the spinning chamber.

[0020] The yarn clearer 8 detects the yarn defect of the travelling yarn Y between the spinning device 7 and the yarn accumulating device 11. The yarn clearer 8 detects, for example, thickness abnormality of the yarn Y and/or foreign substances contained in the yarn Y as the yarn defect. The tension sensor 9 is adapted to measure a tension of the travelling yarn Y between the spinning device 7 and the yarn accumulating device 11. The waxing device 12 is adapted to apply wax to the travelling yarn Y between the yarn accumulating device 11 and the winding device 13.

[0021] The yarn accumulating device 11 is adapted to accumulate the travelling yarn Y between the spinning device 7 and the winding device 13. The yarn accumulating device 11 has a function of stably pulling out the yarn Y from the spinning device 7, a function of accumu-

lating the yarn Y fed from the spinning device 7 to prevent the yarn Y from slackening during the yarn joining operation, and a function of adjusting the tension of the yarn Y from the winding device 13 to prevent a fluctuation in the tension of the yarn Y from the winding device 13 from propagating toward the spinning device 7.

[0022] The winding device 13 forwardly rotates the package P to wind the yarn Y into a package P and forms a fully-wound package P. The winding device 13 includes a cradle arm 21, a winding drum 22, and a traverse device 23. The cradle arm 21 is swingably supported by a supporting shaft 24. The cradle arm 21 brings a surface of a rotatably-supported bobbin B or a surface of the package P (i.e., the bobbin B wound with the yarn Y) into contact with the surface of the winding drum 22 at an appropriate pressure. The winding drum 22 is driven by a driving source (not illustrated) commonly arranged for a plurality of spinning units 2 to forwardly rotate the package P making contact with the winding drum 22. The traverse device 23 is driven through a shaft 25 shared among the plurality of spinning units 2, and traverses the yarn Y over a prescribed width with respect to the forwardly rotating package P.

[0023] The yarn joining carrier 3 travels among the plurality of spinning units 2 arranged in a line to join the disconnected yarn Y in each spinning unit 2. The yarn joining carrier 3 includes a splicer (yarn joining device) 26, a suction pipe (yarn guiding device) 27, a suction mouth (yarn guiding device) 28, and a reversal-rotation mechanism 29. In the yarn joining carrier 3, the suction pipe 27 is swingably supported by a supporting shaft 31, and the suction mouth 28 is swingably supported by a supporting shaft 32.

[0024] The splicer 26 performs the yarn joining operation of joining the yarn Y from the spinning device 7 and the yarn Y from the winding device 13 upon disconnection of the yarn Y. The suction pipe 27 sucks and catches a yarn end of the yarn Y fed from the spinning device 7 and guides the yarn Y from the spinning device 7 to the splicer 26 upon disconnection of the yarn Y. The suction mouth 28 sucks and catches a yarn end of the yarn Y from the winding device 13 and guides the yarn Y from the winding device 13 to the splicer 26 upon disconnection of the yarn Y. That is, upon disconnection of the yarn Y, the suction pipe 27 and the suction mouth 28 perform the yarn guiding operation of guiding the yarn Y from the spinning device 7 and the yarn Y from the winding device 13 to the splicer 26. When the cradle arm 21 is swung so as to separate the package P from the winding drum 22, the reversal-rotation mechanism 29 brings the surface of a reversal-rotation roller 29a into contact with the surface of the package P at an appropriate pressure to reversely rotate the package P.

[0025] Next, with reference to the timing chart of FIG. 3, a description will be made on the operation of the spinning unit 2 of when the yarn Y is disconnected (yarn winding method performed by the spinning unit 2). A case in which the yarn Y is disconnected includes a case in which the yarn Y is disconnected to remove the yarn defect and a case in which the yarn Y is unexpectedly disconnected.

[0026] When the yarn Y is disconnected to remove the yarn defect, the unit controller 10 determines that the yarn Y is disconnected by performing the control to disconnect the yarn Y by the unit controller 10 itself. More specifically, when receiving a yarn defect detection signal from the yarn clearer 8 while the yarn Y is being produced and being wound into the package P, the unit controller 10 stops the operations of the draft device 6 and the spinning device 7 to disconnect the yarn Y. At this timing, the unit controller 10 determines that the yarn Y is disconnected. When the yarn Y is unexpectedly disconnected, the unit controller 10 determines that the yarn Y is disconnected based on a yarn detection signal transmitted from a yarn travelling sensor (not illustrated) arranged at a predetermined position on the yarn path. In this case as well, the unit controller 10 stops the operations of the draft device 6 and the spinning device 7.

[0027] As illustrated in FIG. 4, when a determination is made that the yarn Y is disconnected, the unit controller 10 swings the cradle arm 21 after the yarn Y from the winding device 13 is wound into the package P, and operates a brake mechanism (not illustrated) arranged on the cradle arm 21. The forward rotation of the package P is thereby stopped with the package P separated from the winding drum 22. The unit controller 10 then transmits to the yarn joining carrier 3, a control signal indicating the spinning unit. 2 of which the determination has been made that the yarn Y is disconnected. The yarn joining carrier 3 thus travels to the front of the relevant spinning unit 2 and stops thereat.

[0028] As illustrated in FIG. 5, the suction pipe 27 is swung toward the downstream of the spinning device 7 and generates the suction flow. Since the unit controller 10 resumes the operations of the draft device 6 and the spinning device 7 at this point of time, the suction pipe 27 can suck and catch the yarn end of the produced spun yarn Y. The suction pipe 27 is then swung to a predetermined position before returning to the original position (standby position), and performs the yarn guiding operation of guiding the yarn Y from the spinning device 7 to the splicer 26.

[0029] Meanwhile, as illustrated in FIG. 5, the suction mouth 28 is swung to proximity of the surface of the package P and generates the suction flow. At this point of time, the reversal-rotation mechanism 29 brings the reversal-rotation roller 29a into contact with the package P and reversely rotates the package P at a first reversal-rotation speed V1 (period to T1 of FIG. 3), and thus the suction mouth 28 can suck and catch the yarn end of the yarn Y unwound from the package P. The suction mouth 28 is then swung to a predetermined position before returning to the original position (standby position), and performs the yarn guiding operation of guiding the yarn Y from the winding device 13 to the splicer 26. While the suction mouth 28 is performing the yarn guiding operation, the reversal-rotation mechanism 29 reversely ro-

tates the package P at a second reversal-rotation speed V2 lower than the first reversal-rotation speed V1 (period from T2 to T3 of FIG. 3). As described above, the unit controller 10 performs control to reversely rotate the package P while the suction mouth 28 is performing the yarn guiding operation (first step).

[0030] After the yarn guiding operation of the suction mouth 28 is completed, as illustrated in FIG. 6, the reversal-rotation mechanism 29 once stops the reversal-rotation of the package P (period from T4 to T5 of FIG. 3). Then, as illustrated in FIG. 7, the reversal-rotation mechanism 29 again reversely rotates the package P at a third reversal-rotation speed V3 lower than the second reversal-rotation speed V2 (period from T6 to T7 of FIG. 3). As described above, after the completion of the yarn guiding operation by the suction mouth 28 and before the start of the yarn joining operation by the splicer 26, the unit controller 10 performs control to once stop the reversal-rotation of the package P and to reversely rotate the package P again (second step).

[0031] Next, as illustrated in FIG. 8, when the reversal-rotation mechanism 29 stops the resumed reversal-rotation of the package P, the splicer 26 performs the yarn joining operation (period from T8 to T11 of FIG. 3). More specifically, when moved by a prescribed amount toward the yarn path, the splicer 26 operates yarn gathering levers 26a to perform the yarn gathering operation of the yarn Y from the spinning device 7 and the yarn Y from the winding device 13 (period from T8 to T9 of FIG. 3). After the yarn gathering operation is completed (time point of T9 of FIG. 3), the splicer 26 disconnects the yarn Y from the spinning device 7 and the yarn Y from the winding device 13 at a predetermined position, and performs the yarn joining operation of the yarn end of the yarn Y from the spinning device 7 and the yarn end of the yarn Y from the winding device 13 with the operation of the whirling airflow (period from T9 to T10 of FIG. 3). After the yarn joining operation is completed (time point of T10 of FIG. 3), the splicer 26 operates the yarn gathering levers 26a and cancels the yarn gathering operation of the joined yarn Y (period from T10 to T11 of FIG. 3).

[0032] After the yarn joining operation of the splicer 26 is completed (time point of T11 of FIG. 3), the unit controller 10 operates the suction pipe 27, the suction mouth 28, and the reversal-rotation roller 29a to return to the original position (standby position) of the yarn joining carrier 3. As illustrated in FIG. 2, the unit controller 10 then swings the cradle arm 21, brings the package P into contact with the winding drum 22, and resumes the winding by the winding device 13.

[0033] As described above, in the spinning unit 2, when the yarn Y is disconnected, the package P is reversely rotated after the completion of the yarn guiding operation by the suction pipe 27 and the suction mouth 28, and before the start of the yarn joining operation by the splicer 26. Since the tension of the yarn Y from the winding device 13 is thus loosened, the yarn Y from the winding device 13 can be suppressed from breaking or the drawbacks are suppressed from occurring in the yarn joining operation. With the spinning machine 1, the yarn Y can be appropriately joined.

[0034] In the spinning unit 2, the package P is reversely rotated while the suction pipe 27 and the suction mouth 28 perform the yarn guiding operation, and the reversal-rotation of the package P is once stopped and the package P is reversely rotated again after the completion of the yarn guiding operation by the suction pipe 27 and the suction mouth 28 and before the start of the yarn joining operation by the splicer 26. Since the reversal-rotation of the package P is once stopped, the reversal-rotation speed and/or reversal-rotation amount of when reversely rotating the package P again can be easily controlled.

[0035] In the spinning unit 2, when the package P is reversely rotated after the completion of the yarn guiding operation by the suction pipe 27 and the suction mouth 28 and before the start of the yarn joining operation by the splicer 26, the unit controller 10 can adjust at least one of the reversal-rotation speed or the reversal-rotation amount of the package P. The tension of the yarn Y from the winding device 13 thus can be appropriately loosened according to the diameter of the package P, type of the yarn Y, and/or yarn count of the yarn Y, and the like.

[0036] As specific examples, the following adjustment is made for the reversal-rotation speed. As the suction force of the suction mouth 28 becomes greater, the yarn Y is more likely to easily break. Therefore, in such a case, the reversal-rotation speed is made faster. As the yarn Y has lower stretching properties, the yarn Y is more likely to easily break. Therefore, in such a case, the reversal-rotation speed is made faster. As the twist of the yarn Y becomes stronger, a kink (a state in which the yarn Y becomes frizzled and the yarn Y is wound to a spiral form with the fiber of a part of the yarn Y as a central core) is more likely to easily occur. Therefore, in such a case, the reversal-rotation speed is made slower. As the yarn Y becomes thinner, the yarn Y is more likely to easily break. Therefore, in such a case, the reversal-rotation speed is made faster. The following adjustment is made for the reversal-rotation amount. As the diameter of the package P becomes larger, the reversal-rotation amount is increased to enable the reversal-rotation reliably. As the yarn Y has lower stretching properties, the yarn Y is more likely to easily break. Therefore, in such a case, the reversal-rotation amount is increased. As the twist of the yarn Y becomes stronger, the yarn Y is more likely to easily entangle when being slackened. Therefore, in such a case, the reversal-rotation amount is reduced. As the yarn Y becomes thinner, the yarn Y is more likely to easily break. Therefore, in such a case, the reversal-rotation amount is increased.

[0037] The unit controller 10 stores information indicating the type of yarn Y to be wound, and thus the unit controller 10 can adjust at least one of the reversal-rotation speed or the reversal-rotation amount of the package P based on the stored information indicating the type of yarn Y. The information indicating the type of yarn Y to

be wound may be input to the unit controller 10 by the operator in advance. The unit controller 10 can detect the rotation number of the front roller pair 18 of the draft device 6, and calculate the diameter of the package P based on the detection result of the rotation number of the front roller pair 18, the time from the start of winding of one package P, the information indicating the type of yarn Y, the diameter of the bobbin B and the traverse speed, and the like. A sensor capable of detecting the diameter of the package P may be separately arranged.

[0038] In the spinning unit 2, the yarn supplying device adapted to supply the yarn Y is configured by the draft device 6 and the spinning device 7. The spinning device 7 is an air-jet spinning device adapted to produce the yarn Y by applying twists to the fiber bundle F with a whirling airflow. A high quality yarn Y thus can be efficiency supplied.

[0039] In the spinning machine 1, the draft device 6, the spinning device 7, and the winding device 13 are arranged in each of the plurality of spinning units 2, and the splicer 26, the suction pipe 27, and the suction mouth 28 are arranged in the yarn joining carrier 3 that travels among the plurality of spinning units 2. Thus, the splicer 26, the suction pipe 27, and the suction mouth 28 are shared among the plurality of spinning units 2, whereby the structure of the spinning unit 2 can be simplified. The yarn joining carrier 3 may be arranged in plurals in one spinning machine 1 in accordance with the number of spinning units 2.

[0040] One embodiment of the present invention has been described above, but the present invention is not limited to the above embodiment. For example, in the embodiment described above, each device is arranged in the machine height direction such that the yarn Y supplied from an upper side is wound at the lower side, but in the yarn winding unit and the yarn winding machine of the present invention, each device may be arranged such that the spun yarn supplied from the lower side is wound at the upper side. In the travelling direction of the yarn Y, the tension sensor 9 may be arranged upstream of the yarn clearer 8. The unit controller 10 may be arranged, not for each spinning unit 2, but for each group of the plurality of spinning units 2. A part of or all of the control described as control performed by the unit controller 10 may be carried out by other controllers such as the high-order controller, and the like.

[0041] In the embodiment described above, the brake mechanism arranged on the cradle arm 21 is used to stop the forward rotation of the package P, but a package stopping mechanism arranged in the yarn joining carrier 3 may be used. In this case, in the spinning unit 2, the cradle arm 21 is first swung and the package P is separated away from the winding drum 22. At this time, the package P continues to forwardly rotate through inertia. The yarn joining carrier 3 then travels to the front of the relevant spinning unit 2 and stops thereat. The yarn joining carrier 3 then swings the package stopping mechanism to be brought into contact with the package P, thus stopping the forward rotation of the package P.

[0042] In the embodiment described above, the unit controller 10 controls the yarn joining carrier 3, but a carrier controller (carrier control section) arranged separate from the unit controller 10 may control the yarn joining carrier 3. In this case, a yarn joining request signal is first transmitted from the unit controller 10 to the high-order controller. The high-order controller that received the yarn joining request signal instructs the carrier controller to perform the yarn joining operation in the spinning unit 2 including the unit controller 10 that transmitted the yarn joining request signal. The carrier controller then controls the suction pipe 27, the suction mouth 28, the splicer 26, and the like to perform the yarn joining operation in the relevant spinning unit 2.

[0043] In the embodiment described above, the yarn accumulating device 11 has a function of pulling out the yarn Y from the spinning device 7. In the yarn winding unit and the yarn winding machine of the present invention, the yarn may be pulled out with a delivery roller and a nip roller from the yarn supplying device adapted to supply the yarn. In the embodiment described above, the disconnection of the yarn Y at the time of detecting the yarn defect is performed by the stop of the whirling airflow in the spinning device 7. In the yarn winding unit and the yarn winding machine of the present invention, the disconnection of the yarn at the time of detecting the yarn defect may be performed with a cutter.

[0044] In the embodiment described above, the yarn supplying device adapted to supply the yarn Y is configured by the draft device 6 and the spinning device 7. Other yarn supplying devices such as a yarn supplying device configured to supply the yarn from a bobbin, around which the yarn is wound, may be applied to the yarn winding unit and the yarn winding machine of the present invention.

[0045] If the spinning device is the air-jet spinning device, the spinning device may further include a needle held by the fiber guiding section and arranged to protrude into the spinning chamber to prevent the twists of the fiber bundle from being propagated toward the upstream of the spinning device. In place of the needle, the spinning device may prevent the twists of the fiber bundle from being propagated toward the upstream of the spinning device by a downstream end of the fiber guiding section. The spinning device may include a pair of air-jet nozzles adapted to apply twists in opposite directions from each other.

[0046] In the embodiment described above, at least a portion of the bottom rollers of the draft device 6 and the shaft 25 of the traverse device 23 are driven by the power from the motor box 5 (i.e., common among the plurality of spinning units 2). Each section (e.g., the draft device 6, the spinning device 7, the winding device 13, etc.) of the spinning unit 2 may be driven independently for each spinning unit 2.

[0047] In the embodiment described above, the unit controller 10 controls the reversal-rotation mechanism

29 to reversely rotate the package P after the completion of the yarn guiding operation by the suction pipe 27 and the suction mouth 28 and before the yarn joining operation by the splicer 26. The present invention is not limited thereto. If the winding device 13 is driven independently for each spinning unit 2, the unit controller 10 may control the winding device 13 to reversely rotate the package P after the completion of the yarn guiding operation by the suction pipe 27 and the suction mouth 28 and before the start of the yarn joining operation by the splicer 26. In either configuration, the package P can be appropriately reversely rotated.

[0048] In the embodiment described above, after the completion of the yarn joining operation by the suction pipe 27 and the suction mouth 28 and before the start of the yarn joining operation by the splicer 26, the reversal-rotation of the package P is once stopped and then the package P is reversely rotated again. The present invention is not limited thereto. The package P may be continued to reversely rotate while gradually reducing the reversal-rotation speed, for example, from while the suction pipe 27 and the suction mouth 28 are performing the yarn guiding operation until the splicer 26 starts the yarn joining operation.

[0049] In the embodiment described above, the reversal-rotation of the package P after the completion of the yarn joining operation by the suction pipe 27 and the suction mouth 28 and before the start of the yarn joining operation by the splicer 26 is stopped before the yarn gathering operation of the yarn Y by the yarn gathering levers 26a. The present invention is not limited thereto. The reversal rotation of the package P may be stopped after the yarn gathering operation of the yarn Y by the yarn gathering levers 26a and before the yarn joining operation of the yarn ends by the splicer 26.

Claims

1. A yarn winding machine comprising:

a yarn supplying device (6, 7) adapted to supply a yarn (Y);
a winding device (13) adapted to forwardly rotate a package (P) and to wind the yarn (Y) into the package (P);
a yarn joining device (26) adapted to perform a yarn joining operation to join the yarn (Y) from the yarn supplying device (6, 7) and the yarn (Y) from the winding device (13) upon disconnection of the yarn (Y);
a yarn guiding device (27, 28) adapted to perform a yarn guiding operation to guide the yarn (Y) from the yarn supplying device (6, 7) and the yarn (Y) from the winding device (13) upon disconnection of the yarn (Y); and
a control section (10) adapted to control the package (P) to be reversely rotated after a completion of the yarn guiding operation by the yarn guiding device (27, 28) and before a start of the yarn joining operation by the yarn joining device (26).

2. The yarn winding machine according to claim 1, further comprising a reversal-rotation mechanism (29) adapted to reversely rotate the package (P);
wherein the control section (10) is adapted to control the reversal-rotation mechanism (29) to reversely rotate the package (P) after the completion of the yarn guiding operation by the yarn guiding device (27, 28) and before the start of the yarn joining operation by the yarn joining device (26).

3. The yarn winding machine according to claim 1, wherein the control section (10) is adapted to control the winding device (13) to reversely rotate the package (P) after the completion of the yarn guiding operation by the yarn guiding device (27, 28) and before the start of the yarn joining operation by the yarn joining device (26).

4. The yarn winding machine according to any one of claim 1 through claim 3, wherein during the yarn guiding operation by the yarn guiding device (27, 28), the control section (10) is adapted to reversely rotate the package (P), and
after the completion of the yarn guiding operation by the yarn guiding device (27, 28) and before the start of the yarn joining operation by the yarn joining device (26), the control section (10) is adapted to once stop reversal-rotation of the package (P) and then to reversely rotate the package (P) again.

5. The yarn winding machine according to any one of claim 1 through claim 4, wherein when controlling the package (P) to be reversely rotated, the control section (10) is adapted to adjust at least one of a reversal-rotation speed and a reversal-rotation amount of the package (P).

6. The yarn winding machine according to any one of claim 1 through claim 5, wherein the yarn supplying device includes a draft device (6) adapted to draft a fiber bundle (F), and a spinning device (7) adapted to apply twists to the fiber bundle (F) and to generate the yarn (Y).

7. The yarn winding machine according to any one of claim 6, wherein the spinning device (7) is an air-jet spinning device adapted to apply the twists to the fiber bundle (F) and to generate the yarn (Y) by a whirling airflow.

8. The yarn winding machine according to any one of claim 1 through claim 7, further comprising:

a plurality of yarn winding units (2), each winding unit (2) including the yarn supplying device (6, 7) and the winding device (13); and
at least one yarn joining carrier (3) including the yarn joining device (26) and the yarn guiding device (27, 28).

9. A yarn winding method for supplying a yarn (Y) and forwardly rotating a package (P) to wind the yarn (Y) into the package (P), the method comprising the steps of:

a first step of performing a yarn guiding operation for guiding the supplied yarn (Y) and the wound yarn (Y) to a yarn joining device (26) for performing a yarn joining operation to join the supplied yarn (Y) and the wound yarn (Y) upon disconnection of the yarn (Y); and
a second step of reversely rotating the package (P) after a completion of the yarn guiding operation and before a start of the yarn joining operation by the yarn joining device (26).

FIG. 1

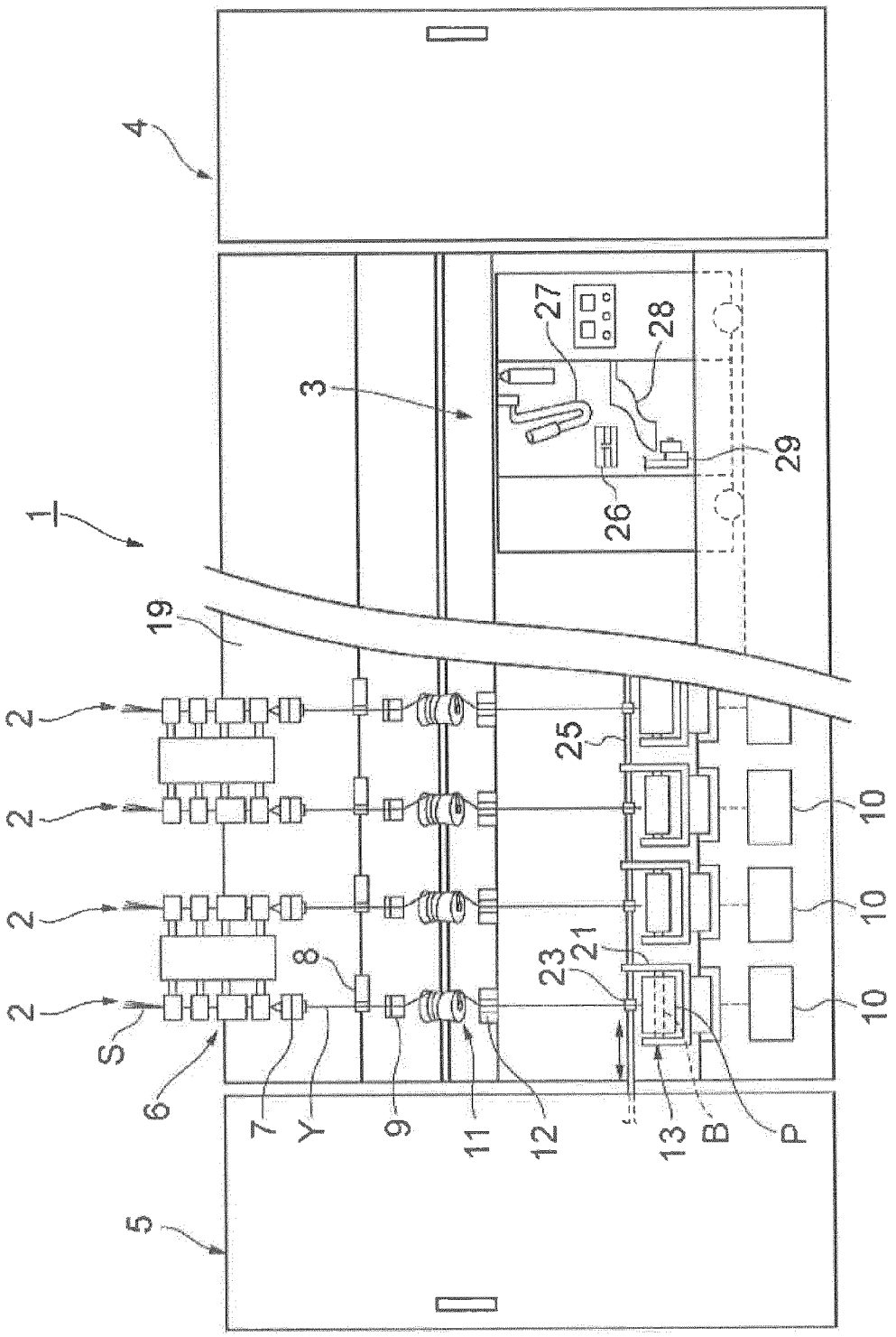
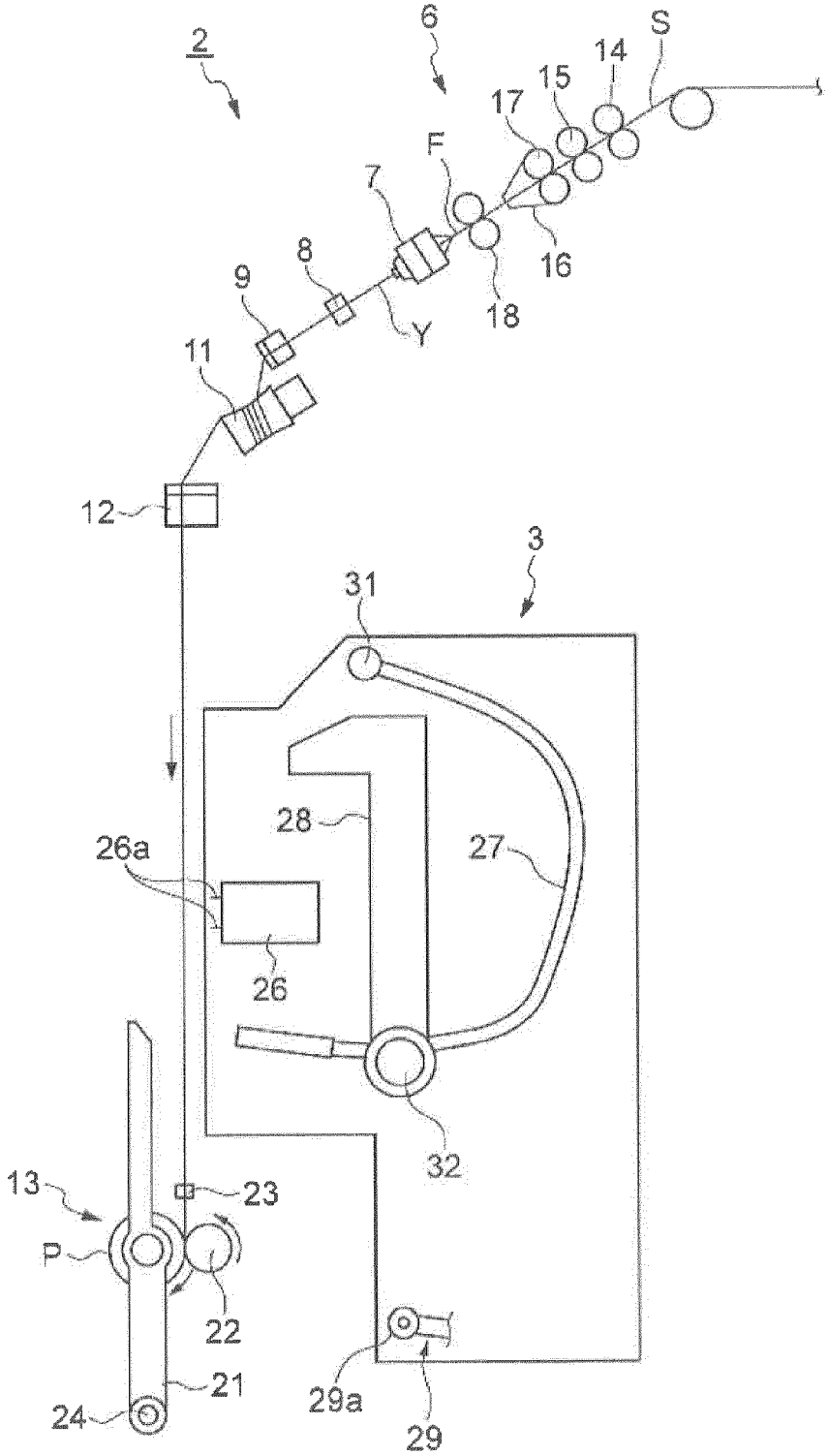


FIG. 2


2
6
S
14
15
17
F
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16
8
9
18
Y
11
12
3
31
28
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26a
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P
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29a
29

FIG. 3

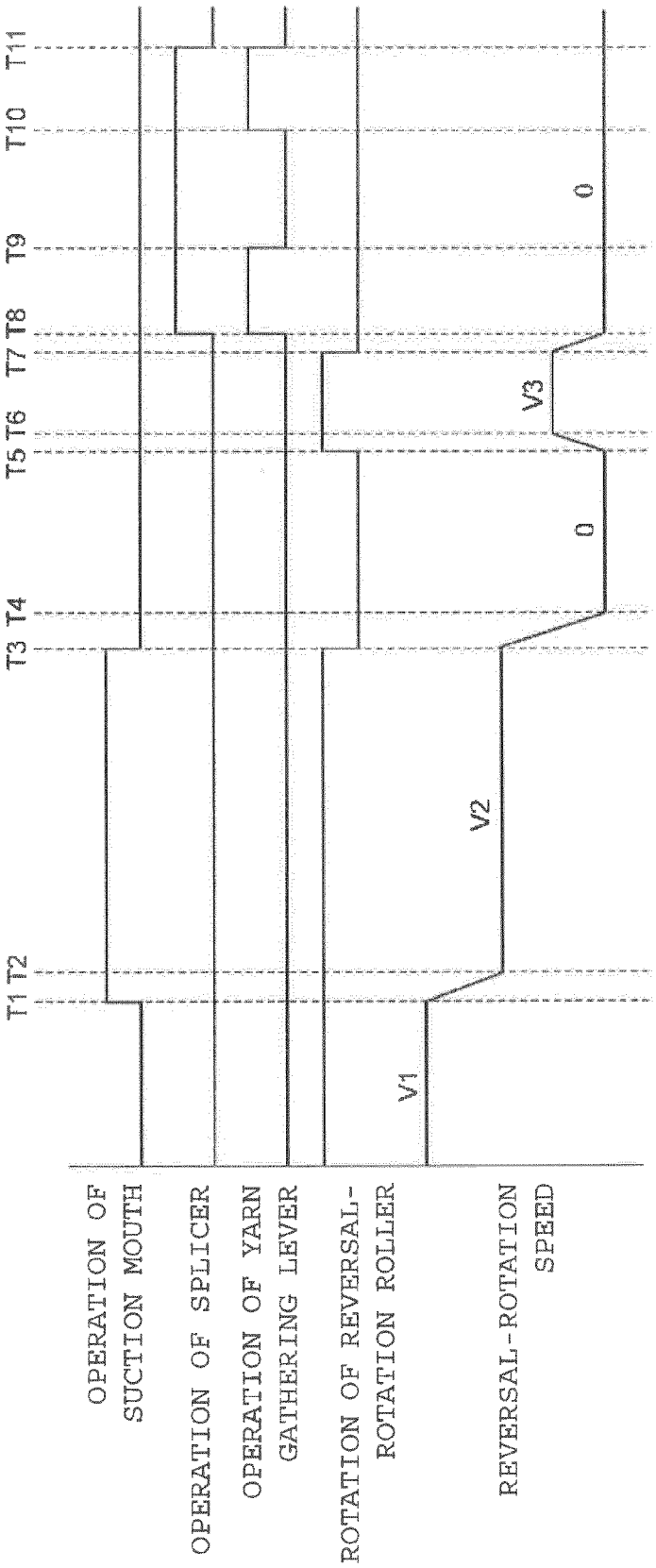
T1 T2
T3 T4
T5 T6
T7 T8
T9
T10
T11
V1
V2
V3
0
0
OPERATION OF SUCTION MOUTH
OPERATION OF SPLICER
OPERATION OF YARN GATHERING LEVER
ROTATION OF REVERSAL-ROTATION ROLLER
REVERSAL-ROTATION SPEED

FIG. 4

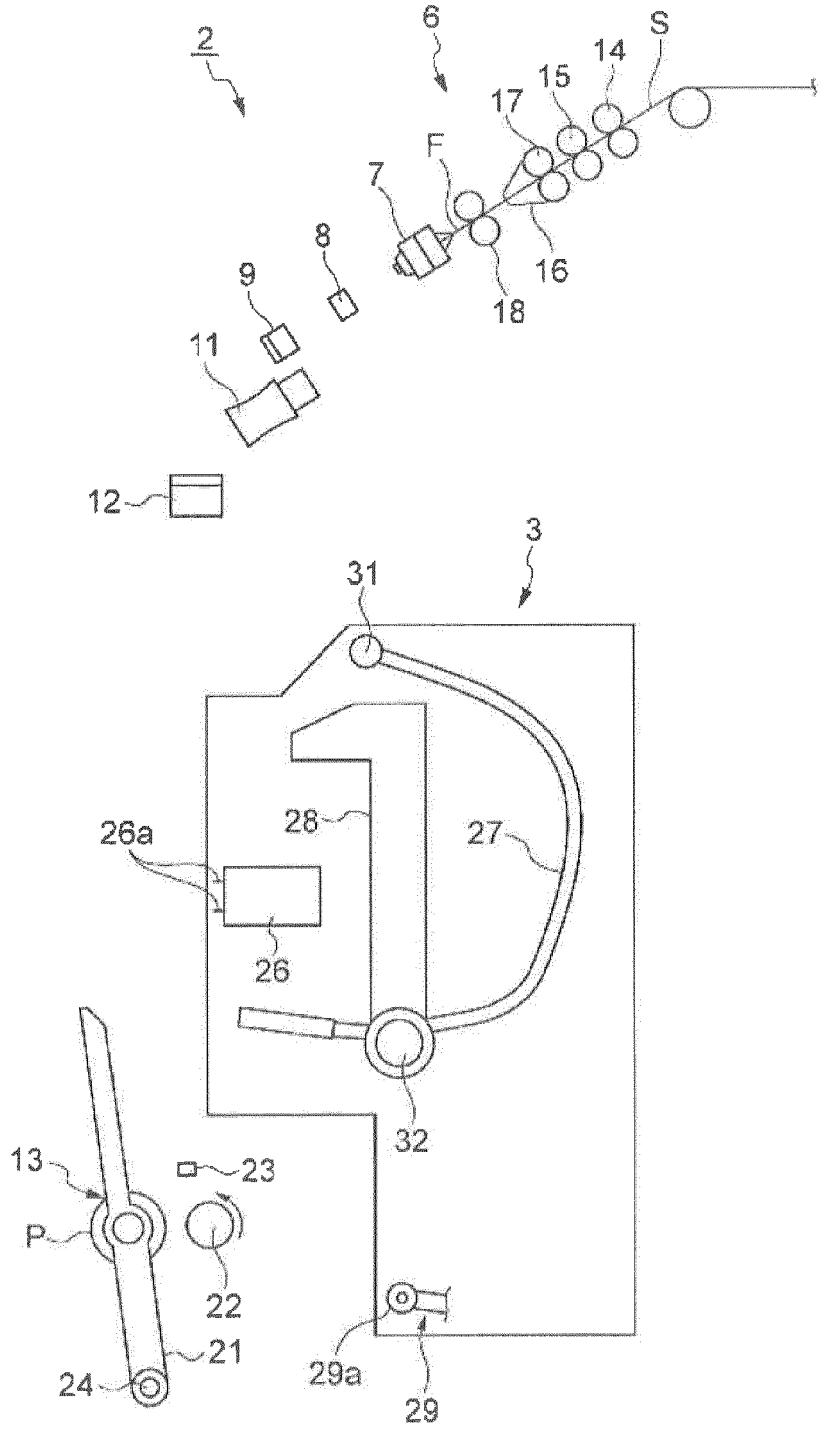
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FIG. 5

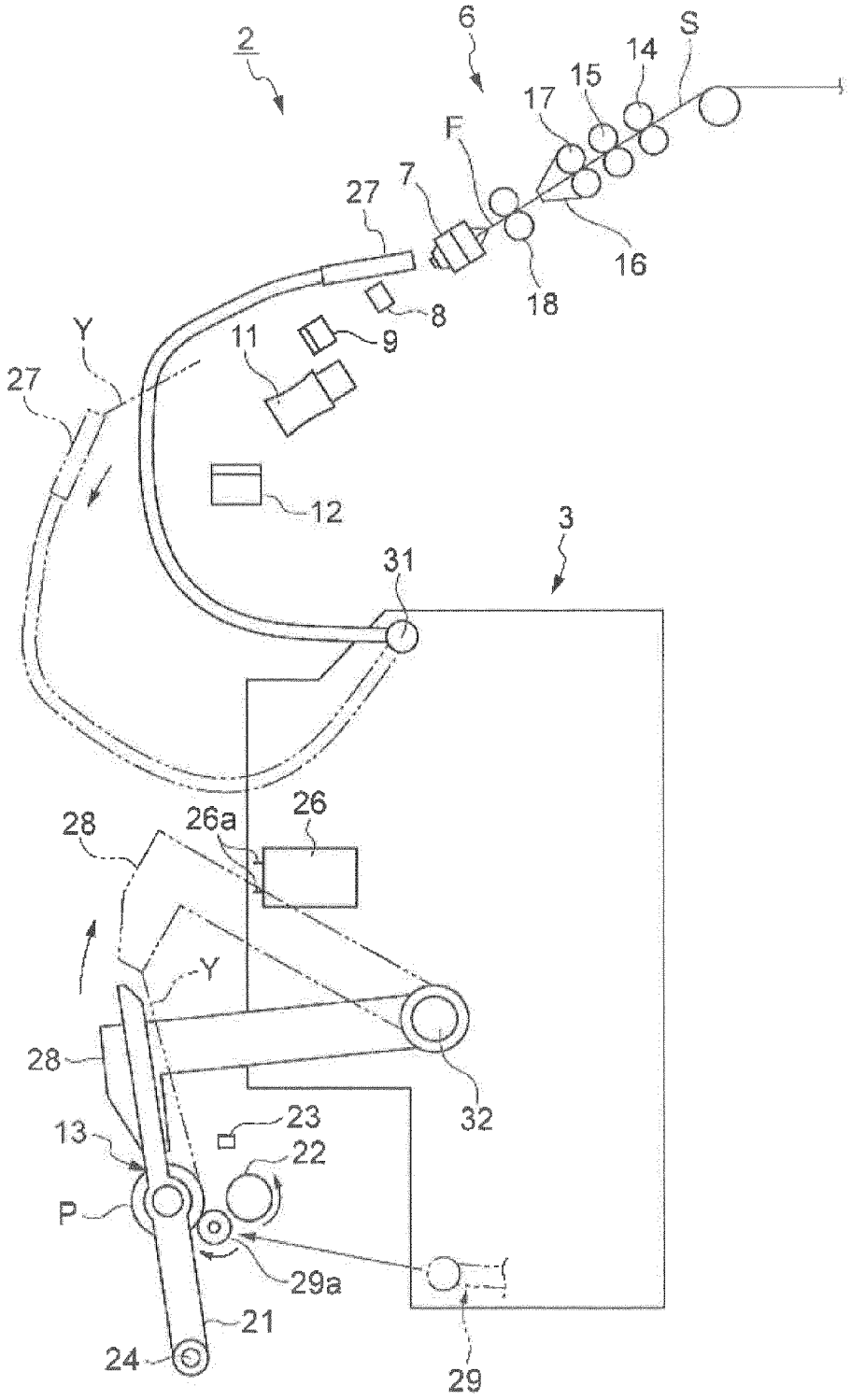
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FIG. 6

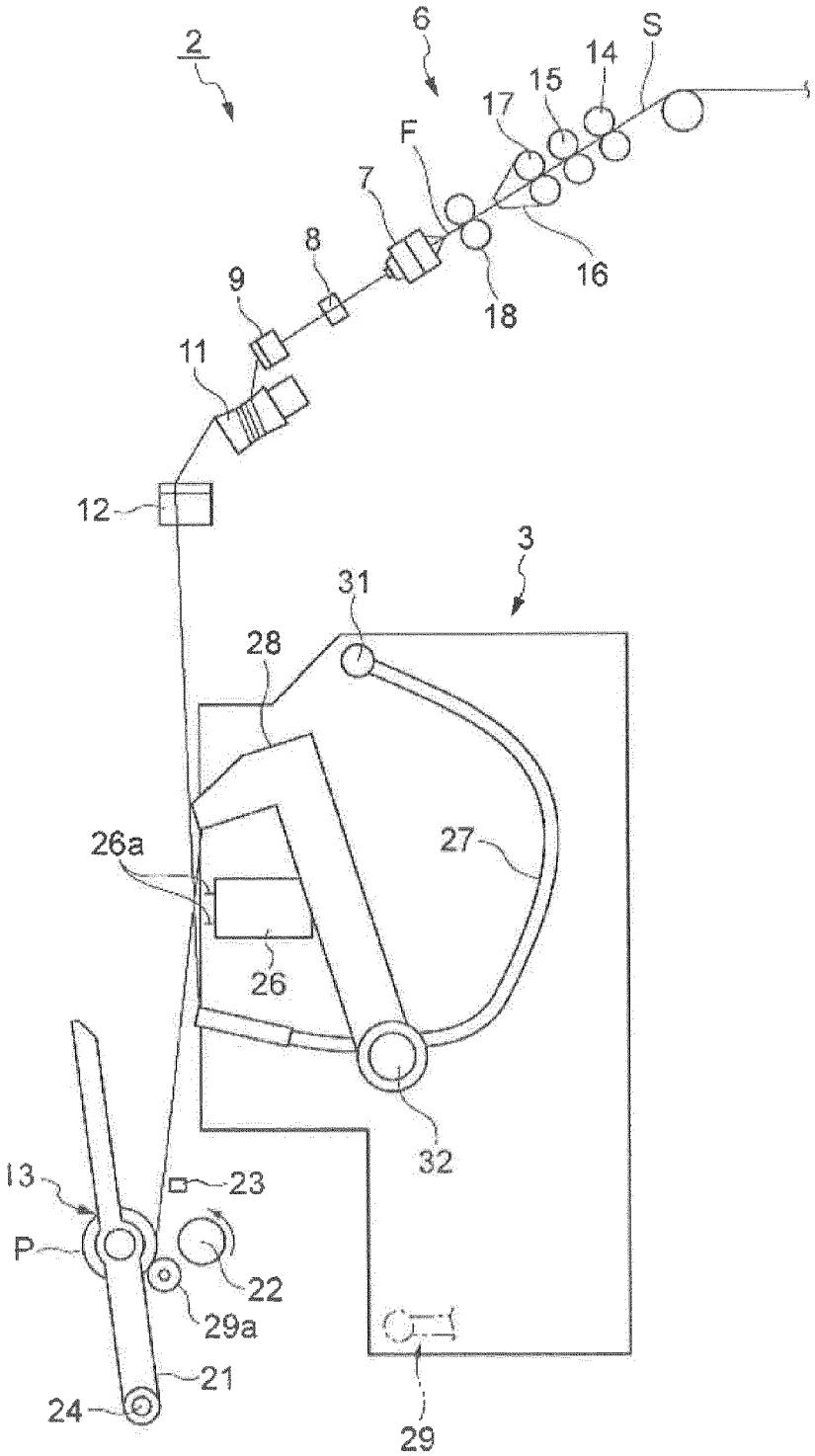
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FIG. 7

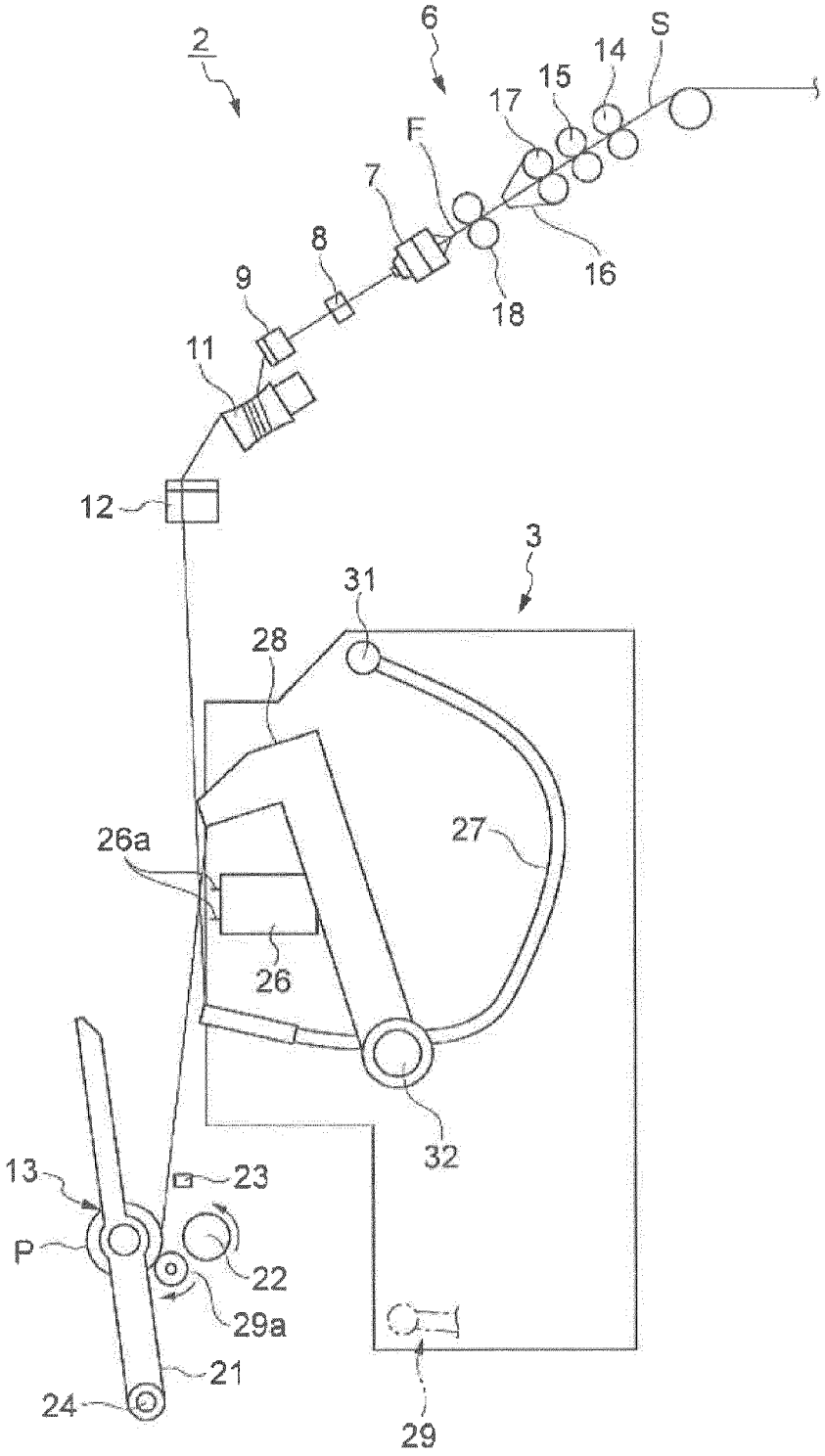
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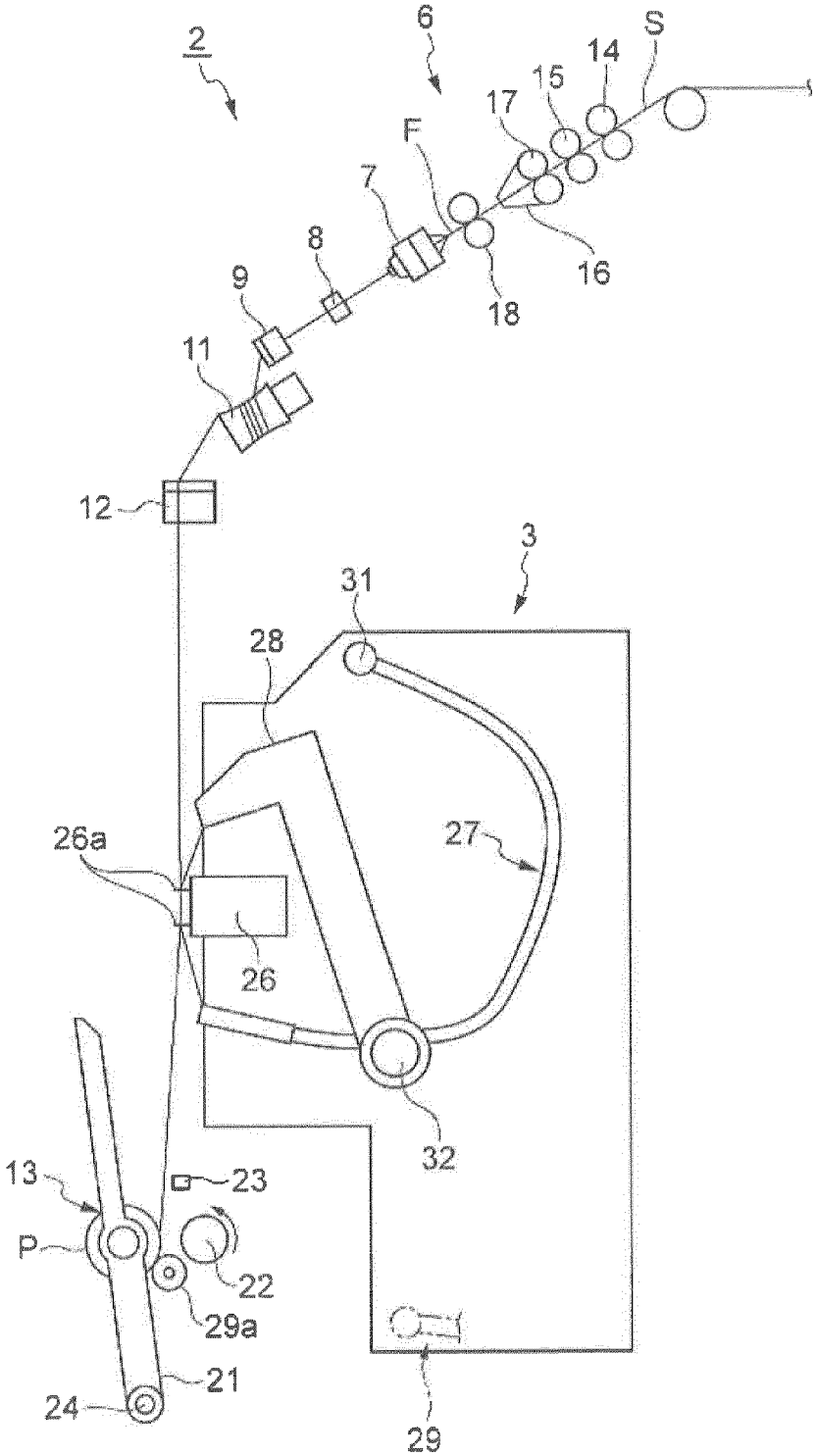
FIG. 8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P
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29a
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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