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(54) **Spinning unit with a yarn pooling device, and spinning machine**

Spinneinheit mit einer Garnspeichervorrichtung, und Spinnmaschine

Unité de filage avec un dispositif de stockage de fil, et fileuse

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn pooling device that is arranged between a yarn supplying device and a winding device and that pools a spun yarn, and to a spinning unit and a spinning machine that include such a yarn pooling device.

2. Description of the Related Art

[0002] Spinning units that include a yarn supplying device that supplies a spun yarn, a winding device that winds the spun yarn to form a package, and a yarn pooling device that is arranged between the yarn supplying device and the winding device and that pools the spun yarn by winding the spun yarn around a yarn pooling roller are known in the art (for example, see Japanese Patent Application Laid-open No. 2010-174421). Various arrangements have been suggested for a yarn pooling roller of a yarn pooling device of such spinning units. For example, in one arrangement, an inclination angle of a yarn pooling section of the yarn pooling roller, where a spun yarn is wound, can be changed in a plurality of levels (see, for example, Japanese Patent Application Laid-open No. 2010-89908). In another arrangement, the yarn pooling roller is provided with a tapering section that widens from a base end section of the yarn pooling section where the winding starts towards the yarn supplying device side, by an inclination angle larger than or equal to 45 degrees (see, for example, Japanese Patent Application Laid-open No. 2010-76889).

[0003] As described above, various arrangements have been suggested for the yarn pooling roller of the yarn pooling device because systematic winding of the spun yarn around the yarn pooling roller is highly important to realize a smooth operation of the spinning unit. In addition, a smooth operation of the spinning unit can be maintained by preventing an end of the spun yarn from moving to an unexpected position of the yarn pooling roller when the spun yarn is broken.

[0004] GB 2 143 856 A describes a yarn feeding or supply apparatus for knitting machines. The apparatus has a rotatable storage drum supported on a holder, which can be coupled to a drive source setting it into rotation and having yarn guide elements for directing yarn to and from the drum associated with it. In order to assure satisfactory formation of windings of storage yarn on the storage drum even with yarns which may be difficult to handle, the arrangement is such that the yarn supply guide element directing the yarn onto a first conical circumferential surface, acting as the yarn run-on surface, is disposed at least at the height of this surface, that the storage drum has an inwardly receding conical yarn support surface adjoining a second conical circumferential

surface in the axial direction, the cone angle of the yarn support surface being substantially smaller than that of the second conical surface, an annular surface extending essentially at right angles to the two conical surfaces being disposed between these two conical surfaces, and the axial length of the yarn support surface being appropriate for receiving an intermediate group of yarn loops comprising a plurality of adjacent yarn windings, and that the conical yarn support surface merges with an essentially cylindrical circumferential surface of the storage drum accepting the storage loops of yarn.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a spinning unit including a yarn pooling device that can systematically wind a spun yarn around a yarn pooling roller and control a movement of an end of the spun yarn when the spun yarn is broken, and a spinning machine including a plurality of such spinning units. The yarn pooling device is arranged between a yarn supplying device that supplies the spun yarn and a winding device that winds the spun yarn to form a package, and pools a spun yarn. The yarn pooling device includes a yarn pooling roller around which the spun yarn is wound. The yarn pooling roller includes a yarn pooling section around which the yarn is wound, a first tapering section that widens from a base end section on a winding start side of the yarn pooling section towards the yarn supplying device by a first inclination angle, and a second tapering section that widens from the first tapering section towards the yarn supplying device by a second inclination angle that is smaller than the first inclination angle. The second tapering section has a function of receiving the spun yarn that is guided to the yarn pooling roller, and a function of preventing, when the yarn is broken on the yarn supplying device side, the end of the spun yarn that sways around on the base end section side from moving towards a tip end section side of the yarn pooling section. The first tapering section has a function of guiding the spun yarn received by the second tapering section to the base end section.

[0006] The spinning unit according to the present invention includes the above yarn pooling device, the yarn supplying device that supplies the spun yarn that is guided to the yarn pooling device, and the winding device that winds the spun yarn guided from the yarn pooling device to form a package.

[0007] The spinning machine according to the present invention includes a plurality of the above spinning units. Because the spinning machine includes the spinning units that can realize smooth operations during the winding of the spun yarn, when the spun yarn is broken, and the like, such a spinning machine can efficiently produce high quality packages.

[0008] The above and other objects, features, advantages and the technical and industrial significance of this invention will be better understood by reading the follow-

ing detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a front view of a spinning machine according to an embodiment of the present invention;
 FIG. 2 is a side view of a spinning unit according to an embodiment of the present invention;
 FIG. 3 is a perspective view of a yarn pooling device of the spinning unit according to an embodiment of the present invention;
 FIG. 4 is a perspective view of the yarn pooling device during a yarn-defect detection operation;
 FIG. 5 is a side view of the spinning unit during the yarn-defect detection operation;
 FIG. 6 is another side view of the spinning unit during the yarn-defect detection operation;
 FIG. 7 is a side view of the spinning unit when a breakage of a yarn has occurred;
 FIG. 8 is a perspective view of the yarn pooling device when a breakage of a yarn has occurred; and
 FIG. 9 is a partially enlarged view of a yarn pooling roller of the yarn pooling device shown in FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Exemplary embodiments of the present invention are explained in detail below with reference to the accompanying drawings. The parts that are identical or equivalent have been assigned the same reference numerals in the drawings and the description thereof is not repeated.

[0011] As shown in FIG. 1, a spinning machine 1 includes a plurality of spinning units 2, a yarn joining carrier 3, a blower box 4, and a motor box 5. The spinning units 2 are arranged side-by-side. Each spinning unit 2 forms a spun yarn Y and winds the spun yarn Y to form a package P. The yarn joining carrier 3 performs a yarn joining operation in the spinning unit 2 where a breakage of the spun yarn Y has occurred. The blower box 4 houses an air supplying source, and suchlike, that produces a suction flow, a swirling airflow, etc., in various parts of the spinning unit 2. The motor box 5 houses a motor, and suchlike, that supplies power to various parts of the spinning unit 2.

[0012] In the following explanation, the term "upstream side" refers to the side where the spun yarn Y is formed and the term "downstream side" refers to the side where the spun yarn Y is wound in a route in which the spun yarn Y runs (that is, a yarn path). The term "front side" is used for the side relative to the yarn joining carrier 3 where the yarn path is present, and the term "backside" is used for the opposite side relative to the yarn joining

carrier 3.

[0013] As shown in FIGS. 1 and 2, each of the spinning units 2 includes, sequentially from the upstream side, a drafting device (yarn supplying device) 6, a spinning device (yarn supplying device) 7, a yarn clearer (yarn-defect detecting device) 8, a tension sensor (tension measuring device) 9, a yarn pooling device 50, a waxing device 11, and a winding device 12. Each of the devices mentioned above is supported directly or indirectly by or on a frame 13 in such a way that the upstream side is located above (that is, the downstream side is located below). The yarn clearer 8, the tension sensor 9, the yarn pooling device 50, and the waxing device 11 form a yarn processing module 80 that is detachably mounted on the frame 13.

[0014] The drafting device 6 drafts a sliver S to form a fiber bundle F (that is, drafts the fiber bundle F). The drafting device 6 includes a pair of back rollers 14, a pair of third rollers 15, a pair of middle rollers 17 with an apron belt 16 stretched over them, and a pair of front rollers 18. The bottom roller of each of the pairs of the rollers 14, 15, 17, and 18 is driven at different rotational speed by the power from the motor box 5 or a not shown electric motor arranged in each of the spinning units 2. Because of the rotation of the rollers 14, 15, 17, and 18, the drafting device 6 drafts the sliver S supplied from the upstream side to form the fiber bundle F, and supplies the fiber bundle F to the spinning device 7 located on the downstream side.

[0015] The spinning device 7 is an air spinning device that twists the fiber bundle F using a swirling airflow to form the spun yarn Y. More specifically, the spinning device 7 includes the following not shown components: a spinning chamber, a fiber guiding section, a swirling-airflow producing nozzle, and a hollow guide shaft. The fiber guiding section guides the fiber bundle F supplied from the drafting device 6 on the upstream side into the spinning chamber. The swirling-airflow producing nozzle is arranged in the periphery of the route in which the fiber bundle F runs and produces the swirling airflow inside the spinning chamber. The swirling airflow causes yarn ends of the fiber bundle F guided into the spinning chamber to be reversed and whirled. The hollow guide shaft guides the spun yarn Y from inside the spinning chamber to outside of the spinning device 7.

[0016] The yarn clearer 8 monitors the running spun yarn Y between the spinning device 7 and the yarn pooling device 50 for any yarn defect, and sends a yarn-defect detection signal to a unit controller 10 upon detection of the yarn defect. For example, an abnormality in a thickness of the spun yarn Y or a foreign matter that is included in the spun yarn Y is detected as a yarn defect by the yarn clearer 8. The tension sensor 9 measures a tension of the running spun yarn Y between the spinning device 7 and the yarn pooling device 50, and sends a tension signal indicative of the measured tension to the unit controller 10. The waxing device 11 applies wax to the running spun yarn Y between the yarn pooling device 50 and the winding device 12. One unit controller 10 is ar-

ranged in each of the spinning units 2 and controls operations of the spinning unit 2.

[0017] The yarn pooling device 50 pools the running spun yarn Y between the spinning device 7 and the winding device 12. The yarn pooling device 50 has functions of stably drawing the spun yarn Y from the spinning device 7, preventing the spun yarn Y from slacking by pooling the spun yarn Y that is coming out of the spinning device 7 during the yarn joining operation by the yarn joining carrier 3, and preventing any variation in the tension of the spun yarn Y on the winding device 12 side from being conveyed to the spinning device 7 side by appropriately controlling the tension on the spun yarn Y on the winding device 12 side.

[0018] The winding device 12 forms a fully wound package P by winding the spun yarn Y into a 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. The cradle arm 21 causes a surface of a rotatably supported bobbin B and/or package P (i.e., the spun yarn Y wound on the bobbin B) to be in contact with a surface of the winding drum 22 with an appropriate pressure. The winding drum 22 is driven by the not shown electric motor included in each of the spinning units 2. As the winding drum 22 rotates, the bobbin B and/or the package P that is in contact with the winding drum 22 also rotates. The traverse device 23 is driven by a shaft 25 that is common to a plurality of the spinning units 2, and causes the spun yarn Y to traverse a predetermined width on the rotating bobbin B and/or package P.

[0019] The yarn joining carrier 3 moves to the spinning unit 2 where a breakage of the spun yarn Y has occurred and performs the yarn joining operation at the particular spinning unit 2. The yarn joining carrier 3 includes a splicer (yarn joining device) 26, a suction pipe 27, and a suction mouth 28. The suction pipe 27 is pivotably supported by a support shaft 31. The suction pipe 27 holds the end of the spun yarn Y on the spinning device 7 side by suction and guides it to the splicer 26. The suction mouth 28 is pivotably supported by a support shaft 32. The suction mouth 28 holds the end of the spun yarn Y on the winding device 12 side by suction and guides it to the splicer 26. The splicer 26 joins two ends of the spun yarns Y that have been guided.

[0020] A structure of the yarn pooling device 50 is explained below. As shown in FIGS. 2 and 3, the yarn pooling device 50 includes a yarn pooling roller 51, an electric motor (driving motor) 55, a pooled-yarn-amount lower limit sensor 56, a pooled-yarn-amount upper limit sensor 57, a yarn hooking member 61, a yarn taking-off member 64, a suction mechanism 65, and a regulating member 71. A first guiding member 78 and a yarn operation control member 75 are arranged sequentially from the upstream side between the spinning device 7 and the yarn pooling roller 51. A second guiding member 79 is arranged between the yarn pooling roller 51 and the winding device 12.

[0021] The yarn pooling roller 51 is fixed to a drive shaft of the electric motor 55 and is driven by the electric motor 55. The yarn pooling roller 51 includes a yarn pooling section 52, a base-end side tapering section 53, and a tip-end side tapering section 54. The yarn pooling section 52 is a cylindrical component around which the spun yarn Y is wound and tapers slightly towards the tip end. The base-end side tapering section 53 widens from a base end section 52a of the yarn pooling section 52 where winding starts towards the upstream side. The tip-end side tapering section 54 widens from a tip end section 52b of the yarn pooling section 52 towards the downstream side.

[0022] The base-end side tapering section 53 receives the spun yarn Y being guided from the upstream side to the yarn pooling roller 51 and smoothly guides it to the base end section 52a of the yarn pooling section 52. Thus, the spun yarn Y is wound systematically from the base end side to the tip end side of the yarn pooling section 52. The tip-end side tapering section 54 avoids sloughing that is a phenomenon in which the spun yarn Y wound around the yarn pooling section 52 comes off all at once when the spun yarn Y is unwound from the yarn pooling roller 51, and the tip-end side tapering section 54 also smoothly guides the spun yarn Y from the yarn pooling roller 51 to the downstream side.

[0023] The pooled-yarn-amount lower limit sensor 56 is a non-contact sensor that detects presence or absence of the spun yarn Y on the yarn pooling roller 51, and is arranged on the rear side of the yarn pooling roller 51 and facing the yarn pooling section 52. The pooled-yarn-amount lower limit sensor 56 sends a pooled-amount lower limit detection signal to the unit controller 10 when an amount of the spun yarn Y wound around the yarn pooling roller 51 reaches a lower limit. The pooled-yarn-amount upper limit sensor 57 is a non-contact sensor that detects presence or absence of the spun yarn Y on the yarn pooling roller 51, and is arranged by the side of the yarn pooling roller 51 and facing the tip end section 52b of the yarn pooling section 52. The pooled-yarn-amount upper limit sensor 57 sends a pooled-amount upper limit detection signal to the unit controller 10 when an amount of the spun yarn Y wound around the yarn pooling roller 51 reaches an upper limit.

[0024] The yarn hooking member 61 is arranged on the winding device 12 side with respect to the yarn pooling roller 51, and engages with the spun yarn Y and winds it around the yarn pooling roller 51. The yarn hooking member 61 includes a flier shaft 62 and a flier 63. The flier shaft 62 is supported on the tip end side of the yarn pooling roller 51 so as to rotate relative to and coaxially with the yarn pooling roller 51. The flier 63 is fixed to the tip end of the flier shaft 62 and is bent over the tip-end side tapering section 54 of the yarn pooling roller 51 so as to be able to engage with the spun yarn Y. A magnetic force is caused to act between the yarn pooling roller 51 and the flier shaft 62. In order for the yarn hooking member 61 to rotate relative to the yarn pooling roller 51, the

yarn hooking member 61 produces a torque greater than or equal to a predetermined value.

[0025] The yarn taking-off member 64 takes off the spun yarn Y from the yarn hooking member 61, and is arranged near the tip-end side tapering section 54 of the yarn pooling roller 51. The yarn taking-off member 64 is supported so as to be swingable between a descent position and an ascent position. The descent position is a position that is retracted from the yarn path. The ascent position is a position at which the spun yarn Y is pushed up in the yarn path and taken off from the yarn hooking member 61. The yarn taking-off member 64 is urged towards the descent position side by a not shown spring. The yarn taking-off member 64 is normally positioned at the descent position and is moved to the ascent position by a not shown air pressure cylinder provided in the yarn joining carrier 3 during the yarn joining operation, and suchlike.

[0026] The suction mechanism 65 produces a suction airflow in a suction vent 66a arranged facing the base-end side tapering section 53 of the yarn pooling roller 51. The suction vent 66a is provided at one end of a pipe-shaped member 66. The other end of the pipe-shaped member 66 is connected via a not shown pipe to a not shown fiber-waste collecting chamber, which is common to the suction pipe 27 and the suction mouth 28. As explained later, when a breakage of the spun yarn Y occurs on the spinning device 7 side, the end of the spun yarn Y sways about on the base end section 52a side of the yarn pooling section 52. The swaying end is subjected to the action of the suction airflow produced at the suction vent 66a. Thus, most fiber waste from the yarn end is removed by the suction mechanism 65 and is prevented from being scattered.

[0027] The regulating member 71 is a plate member that is arranged to the side of the yarn pooling roller 51 (facing the yarn pooling section 52), and includes a first regulating section 72, a second regulating section 73, and a third regulating section 74. The first regulating section 72 is located at the upstream of the suction vent 66a in a rotation direction of the yarn pooling roller 51 during winding of the spun yarn Y. The second regulating section 73 is located at the downstream of the suction vent 66a in the above rotation direction. The first regulating section 72 and the second regulating section 73 are arranged facing the base end section 52a of the yarn pooling section 52. The first regulating section 72 and the second regulating section 73 regulate the movement of the end of the spun yarn Y that sways about on the base end section 52a side of the yarn pooling section 52 when a breakage of the spun yarn Y occurs on the spinning device 7 side, such that the swaying end of the spun yarn Y is prevented from being moved to the tip end section 52b side of the yarn pooling section 52 before the spun yarn Y is orderly unwound from the tip end section 52b of the yarn pooling section 52. The third regulating section 74 is arranged facing the yarn pooling section 52. The third regulating section 74 regulates the movement of the

end of the spun yarn Y that sways about on the tip end section 52b side of the yarn pooling section 52 when a breakage of the spun yarn Y occurs on the winding device 12 side, such that the swaying end of the spun yarn Y is prevented from being moved to the base end section 52a side of the yarn pooling section 52 before the spun yarn Y is orderly unwound from the base end section 52a of the yarn pooling section 52. The pooled-yarn-amount upper limit sensor 57 is mounted at a bottom end of the regulating member 71.

[0028] The yarn operation control member 75 is a plate member mounted at the upstream of the yarn pooling roller 51 (in the present embodiment, on the bottom surface (end face on the downstream side) of the tension sensor 9), and includes a guiding component 76 and a regulating component 77. The guiding component 76 applies tension to the spun yarn Y and guides the spun yarn Y to the base-end side tapering section 53 of the yarn pooling roller 51, and prevents the twisting of the spun yarn Y coming from the spinning device 7 from being conveyed further downstream of the guiding component 76. When there is a breakage of the spun yarn Y on the spinning device 7 side, the regulating component 77 prevents the end of the spun yarn Y from being displaced from the yarn path of the spun yarn Y guided to the yarn pooling device 50 and from moving to the yarn hooking member 61 side by passing over the yarn pooling roller 51.

[0029] The first guiding member 78 is a plate member mounted at the upstream of the yarn pooling roller 51 (in the present embodiment, on the bottom surface (end face on the downstream side) of the tension sensor 9), and guides the spun yarn Y from a slit formed on a casing of the tension sensor 9 to a designated detection position inside the casing. The second guiding member 79 is a plate member mounted on the downstream side of the yarn pooling roller 51 (in the present embodiment, on a module frame 81 of the yarn processing module 80). The second guiding member 79 guides the spun yarn Y to a designated position of the waxing device 11 and regulates a track of the spun yarn Y being swayed about by the rotating yarn hooking member 61, stabilizing the running of the spun yarn Y further downstream of the second guiding member 79.

[0030] An operation of the yarn pooling device 50 is explained below. When the spinning unit 2 is operating normally by forming the spun yarn Y and winding the spun yarn Y to form the package P, the electric motor 55 drives the yarn pooling roller 51 at a substantially constant rotational speed. The yarn hooking member 61 rotates integrally with the yarn pooling roller 51, and the flier 63 engages with the spun yarn Y. The yarn hooking member 61, which is rotating with the spun yarn Y engaged thereon, winds the spun yarn Y around the rotating yarn pooling roller 51.

[0031] Once the spun yarn Y is wound around the yarn pooling roller 51, the unit controller 10 exerts control over the operation of the spinning unit 2. The unit controller

10 exerts this control based on the pooled-amount lower limit detection signal received from the pooled-yarn-amount lower limit sensor 56 and the pooled-amount upper limit detection signal received from the pooled-yarn-amount upper limit sensor 57, so that the pooled amount of the spun yarn Y that is wound around the yarn pooling roller 51 is greater than or equal to the lower limit and less than or equal to the upper limit. When the pooled amount of the spun yarn Y wound around the yarn pooling roller 51 is greater than or equal to the lower limit, the surface area of a contact between the yarn pooling section 52 of the yarn pooling roller 51 and the spun yarn Y increases. Consequently, there is almost no slippage, and suchlike, between the yarn pooling section 52 and the spun yarn Y. Therefore, the yarn pooling device 50 can draw the spun yarn Y stably (that is, while maintaining a substantially constant quality and speed) from the spinning device 7 by the rotation of the yarn pooling roller 51.

[0032] When the tension on the spun yarn Y on the winding device 12 side increases in the state where the spun yarn Y is wound around the yarn pooling roller 51, a force that causes the yarn hooking member 61 to rotate relative to the yarn pooling roller 51 (that is, a force that causes the rotation of the yarn hooking member 61 to stop) acts on the flier 63. When the torque produced in the yarn hooking member 61 increases to a value greater than or equal to a predetermined value as a consequence of the force, the yarn hooking member 61 rotates relative to the yarn pooling roller 51. Consequently, the spun yarn Y is unwound from the yarn pooling roller 51. When the tension on the spun yarn Y on the winding device 12 side decreases and the torque produced in the yarn hooking member 61 reduces to less than the predetermined value, the yarn hooking member 61 rotates integrally with the yarn pooling roller 51. Consequently, the spun yarn Y is wound around the yarn pooling roller 51. In this manner, the yarn pooling device 50 adjusts the tension on the spun yarn Y on the winding device 12 side and thereby prevents the variation in the tension on the spun yarn Y that occurs on the winding device 12 side from being conveyed to the spinning device 7 side.

[0033] An operation of the spinning unit 2 during a yarn-defect detection operation is explained below. When the yarn clearer 8 detects a defect while the spinning unit 2 is operating normally by forming the spun yarn Y and winding the spun yarn Y to form the package P, the yarn clearer 8 sends the yarn-defect detection signal to the unit controller 10. The unit controller 10 stops the operation of the drafting device 6, the spinning device 7, etc., immediately upon receiving the yarn-defect detection signal. Consequently, the fiber bundle F is not subjected to twisting, and the spun yarn Y is broken on the spinning device 7 side.

[0034] Even if the spun yarn Y is broken on the spinning device 7 side, the unit controller 10 causes the rotation of the yarn pooling roller 51 and the winding by the winding device 12 to be continued. Consequently, as shown in FIG. 4, the cut end of the spun yarn Y is wound around

the yarn pooling roller 51. While the spun yarn Y is unwound from the yarn pooling roller 51 to the winding device 12, the cut end of the spun yarn Y sways about on the base end section 52a side of the yarn pooling section 52. The swaying end is prevented from moving toward the tip end section 52b side of the yarn pooling section 52 by the first regulating section 72 of the regulating member 71, and is subjected to the suction airflow produced by the suction vent 66a. Consequently, the spun yarn Y is smoothly unwound from the yarn pooling roller 51 to the winding device 12 side. While the unwinding of the spun yarn Y is taking place, the fiber waste from the yarn end on the upstream side is removed by the suction mechanism 65 and is prevented from being scattered.

[0035] When the winding device 12 winds the spun yarn Y up to the cut end into the package P, the unit controller 10 sends a control signal that specifies the spinning unit 2 in which the spun yarn Y has been cut to the yarn joining carrier 3. Consequently, the yarn joining carrier 3 moves to a position in front of the specified spinning unit 2, and commences the yarn joining operation.

[0036] As shown in FIG. 5, the suction mouth 28 turns to a position near the surface of the package P and produces the suction airflow while the winding device 12 causes a reverse rotation of the package P. Consequently, the suction mouth 28 draws and holds by suction the end of the spun yarn Y from the surface of the package P. Thereafter, as shown in FIG. 6, the suction mouth 28 turns to its original position (standby position) and guides the end of the spun yarn Y on the winding device 12 side to the splicer 26. The winding device 12 stops the rotation of the package P.

[0037] As shown in FIG. 5, the suction pipe 27 pivots to a position at the downstream of the spinning device 7 and produces the suction airflow. Because during this operation the unit controller 10 restarts the operations of the drafting device 6, the spinning device 7, etc., the suction pipe 27 holds the end of the spun yarn Y that is formed. Thereafter, as shown in FIG. 6, the suction pipe 27 pivots to the original position (standby position), and guides the end of the spun yarn Y on the spinning device 7 side to the splicer 26.

[0038] When the end of the spun yarn Y on the winding device 12 side and the end of the spun yarn Y on the spinning device 7 side are guided to the splicer 26, the yarn hooking member 61 in the yarn pooling device 50 engages with the spun yarn Y on the spinning device 7 side and winds the spun yarn Y around the yarn pooling roller 51 with which the yarn hooking member 61 is integrally rotating. Consequently, almost no slack occurs in the spun yarn Y coming out of the spinning device 7, even if the winding by the winding device 12 is stopped. Thus, during the yarn joining operation, etc., by the yarn joining carrier 3, the yarn pooling device 50 pools the spun yarn Y coming out of the spinning device 7, thereby preventing the spun yarn Y from slacking.

[0039] When the pooled amount of the spun yarn Y wound around the yarn pooling roller 51 reaches the low-

er limit, almost no slippage, and suchlike, takes place between the yarn pooling section 52 of the yarn pooling roller 51 and the spun yarn Y. Consequently, the spun yarn Y is drawn stably (that is, while maintaining a substantially constant quality and speed) from the spinning device 7. The unit controller 10 causes the yarn taking-off member 64 to move from the descent position to the ascent position where the yarn taking-off member 64 takes off the spun yarn Y from the yarn hooking member 61.

[0040] When the spun yarn Y is taken off from the yarn hooking member 61 while the yarn pooling roller 51 is rotating as described above, there is almost no resistance to prevent the unwinding of the spun yarn Y from the yarn pooling roller 51. Consequently, the spun yarn Y that is wound around the yarn pooling roller 51 before the pooled amount of the spun yarn Y reaches the lower limit (that is, the spun yarn Y with an unstable quality) is unwound from the yarn pooling roller 51 and sucked into the suction pipe 27. The spun yarn Y is still stably drawn from the spinning device 7 and wound around the yarn pooling roller 51 while the spun yarn Y is being sucked into the suction pipe 27. Consequently, an amount of the pooled spun yarn Y that is greater than or equal to the lower limit can be attained.

[0041] Once the spun yarn Y with an unstable quality is removed by the suction pipe 27, the unit controller 10 causes the yarn taking-off member 64 to move from the ascent position to the descent position. Consequently, the spun yarn Y on the spinning device 7 side is engaged by the yarn hooking member 61, and no unwinding of the spun yarn Y at the downstream of the yarn pooling roller 51 occurs. The splicer 26 joins the end of the spun yarn Y on the winding device 12 side and the end of the spun yarn Y on the spinning device 7 side. Unnecessary yarn ends cut by the splicer 26 are removed by the suction pipe 27 and the suction mouth 28. Once the yarn joining operation by the splicer 26 is completed, the unit controller 10 causes the winding operation by the winding device 12 to restart.

[0042] An operation of the spinning unit 2 when a breakage of the spun yarn Y has occurred is explained next. As shown in FIG. 7, when the spinning unit 2 is operating normally by forming the spun yarn Y and winding the spun yarn Y to form the package P, if a breakage in the spun yarn Y occurs further downstream of the yarn pooling device 50, no spun yarn Y is detected by a not shown yarn detecting sensor arranged at the downstream of the yarn pooling device 50. Based on this, the unit controller 10 judges that a breakage of the spun yarn Y has occurred between the yarn pooling device 50 and the winding device 12, and immediately stops the operations of the drafting device 6, the spinning device 7, etc. Consequently, the fiber bundle F is not subjected to twisting and the spun yarn Y is broken on the spinning device 7 side as well.

[0043] Even if the spun yarn Y is broken on the spinning device 7 side, the unit controller 10 causes the rotation

of the yarn pooling roller 51 and the winding by the winding device 12 to be continued. Consequently, the cut end of the spun yarn Y is wound around the yarn pooling roller 51 and sways about on the base end section 52a side of the yarn pooling section 52. This end of the spun yarn Y is prevented from moving to the tip end section 52b side of the yarn pooling section 52 by the first regulating section 72 of the regulating member 71, and is subjected to the suction airflow produced by the suction vent 66a. Consequently, the fiber waste from the yarn end on the upstream side is removed by the suction mechanism 65 and is prevented from being scattered.

[0044] Because the spun yarn Y that is wound around the yarn pooling roller 51 is broken on the downstream side as well, the spun yarn Y does not get unwound towards the downstream side from the yarn pooling roller 51. Consequently, the unit controller 10 causes the yarn pooling roller 51 to stop positive rotation (rotation in the normal direction) and start reverse rotation. The upstream end of the spun yarn Y wound around the yarn pooling roller 51 is prevented from moving to the tip end section 52b side of the yarn pooling section 52 by the second regulating section 73 of the regulating member 71. Consequently, as shown in FIG. 8, the upstream yarn end is reliably held by suction by the suction vent 66a of the suction mechanism 65. Furthermore, the downstream end of the spun yarn Y wound around the yarn pooling roller 51 is prevented from moving to the base end section 52a side of the yarn pooling section 52 by the third regulating section 74 of the regulating member 71. Therefore, the spun yarn Y wound around the yarn pooling roller 51 is smoothly unwound from the base end section 52a side of the yarn pooling section 52 and sucked in by the suction mechanism 65.

[0045] Once the spun yarn Y wound around the yarn pooling roller 51 is removed by the suction mechanism 65, the unit controller 10 causes the yarn pooling roller 51 to stop the reverse rotation and start the positive rotation. The unit controller 10 sends a control signal that specifies the spinning unit 2 in which the spun yarn Y has been cut to the yarn joining carrier 3. Consequently, the yarn joining carrier 3 moves to a position in front of the specified spinning unit 2, and performs the yarn joining operation.

[0046] A structure of the yarn pooling roller 51 of the yarn pooling device 50 is more specifically explained below. As shown in FIG. 9, the base-end side tapering section 53 of the yarn pooling roller 51, which widens from the base end section 52a on the winding start side of the yarn pooling section 52 towards the upstream side, has the following structure.

[0047] The base-end side tapering section 53 includes a first tapering section 58 and a second tapering section 59. The first tapering section 58 widens from the base end section 52a of the yarn pooling section 52 towards the spinning device 7 side (that is, towards the spun yarn Y introducing side along a direction substantially parallel to the center line of the rotation of the yarn pooling roller

51) by a first inclination angle θ_1 . The second tapering section 59 widens from the first tapering section 58 towards the spinning device 7 side by a second inclination angle θ_2 that is smaller than the first inclination angle θ_1 . The surface of the yarn pooling section 52 and the surface of the first tapering section 58 are continuously formed. The surface of the first tapering section 58 and the surface of the second tapering section 59 are at the same level without a step. It is preferable that the first inclination angle θ_1 be between 40 degrees and 80 degrees, or more preferably, between 50 degrees and 70 degrees. It is preferable that the second inclination angle θ_2 be between 10 degrees and 35 degrees, or more preferably, between 15 degrees and 30 degrees.

[0048] The first inclination angle θ_1 is an average of inclination of an intersection line (a straight line or a curve) defined by a plane including the center line of the rotation of the yarn pooling roller 51 and the surface of the first tapering section 58. The second inclination angle θ_2 is an average of inclination of an intersection line (a straight line or a curve) defined by the plane including the center line of the rotation of the yarn pooling roller 51 and the surface of the second tapering section 59.

[0049] The second tapering section 59 has a function of receiving the spun yarn Y that is guided to the yarn pooling roller 51, and a function of preventing, when the spun yarn Y is broken on the spinning device 7 side, the end of the spun yarn Y that sways around and becomes out of control on the base end section 52a of the yarn pooling section 52 from moving towards the tip end section 52b of the yarn pooling section 52. The first tapering section 58 has a function of guiding the spun yarn Y received by the second tapering section 59 to the base end section 52a of the yarn pooling section 52. The suction vent 66a of the suction mechanism 65 is arranged facing at least the second tapering section 59 (the base-end side tapering section 53 and the base end section 52a of the yarn pooling section 52 in this example).

[0050] As explained above, in the yarn pooling device 50, the second tapering section 59 receives the spun yarn Y guided to the yarn pooling roller 51, and the first tapering section 58 guides the spun yarn Y received by the second tapering section 59 to the base end section 52a of the yarn pooling section 52. Because the second tapering section 59 has the second inclination angle θ_2 that is smaller than the first inclination angle θ_1 , the second tapering section 59 can stably receive the spun yarn Y. Because the first tapering section 58 has the first inclination angle θ_1 that is larger than the second inclination angle θ_2 , the first tapering section 58 can stably guide the spun yarn Y. Consequently, the spun yarn Y can be systematically wound around the yarn pooling roller 51. When the spun yarn Y is broken on the spinning device 7 side, the second tapering section 59 prevents the end of the spun yarn Y that sways around on the base end section 52a side of the yarn pooling section 52 from moving towards the tip end section 52b side of the yarn pooling section 52. Because the second tapering section 59

has the second inclination angle θ_2 that is smaller than the first inclination angle θ_1 , the second tapering section 59 can reliably control movement of the yarn end of the spun yarn Y. Accordingly, the movement of the end of the spun yarn Y can be controlled when a breakage of the spun yarn Y occurs. Thus, the yarn pooling device 50 can systematically wind the spun yarn Y around the yarn pooling roller 51 and also control the movement of the spun yarn Y when a breakage of the spun yarn Y occurs.

[0051] The suction vent 66a of the suction mechanism 65 is arranged facing the second tapering section 59. With this arrangement, when the spun yarn Y is broken on the spinning device 7 side, the second tapering section 59 regulates the movement of the end of the spun yarn Y, which sways around on the base end section 52a side of the yarn pooling section 52, towards the tip end section 52b side of the yarn pooling section 52, and the swaying end of the spun yarn Y is fully subjected to the action of the suction airflow. Therefore, the fiber waste can be reliably removed from the end of the spun yarn Y.

[0052] The regulating component 77 is arranged on the spinning device 7 side with respect to the yarn pooling roller 51. The regulating component 77 regulates the movement of the end of the spun yarn Y beyond the yarn pooling roller 51 towards the yarn hooking member 61 side when the spun yarn Y is broken on the spinning device 7 side. With this arrangement, when the spun yarn Y is broken on the spinning device 7 side for some reason such as jamming while a high tension is maintained on the spun yarn Y, the movement of the end of the spun yarn Y beyond the yarn pooling roller 51 towards the yarn hooking member 61 side can be regulated, and the end of the spun yarn Y can be prevented from becoming entangled with the yarn hooking member 61.

[0053] Each of the spinning units 2 includes the yarn pooling device 50 that can systematically wind the spun yarn Y around the yarn pooling roller 51 and control the movement of the end of the spun yarn Y when a breakage of the spun yarn Y occurs. Consequently, the spinning units 2 can realize a smooth operation during the winding of the spun yarn Y, when the spun yarn Y is broken, and the like.

[0054] The spinning unit 2 includes the splicer 26 between the yarn pooling device 50 and the winding device 12 to join the ends of the cut spun yarn Y together (in the present embodiment, one splicer 26 is shared by a plurality of spinning units 2). The yarn pooling device 50 smoothly performs the operation when the spun yarn Y is broken, and therefore the spinning unit 2 can reliably and efficiently join the ends of the cut spun yarn Y together.

[0055] The yarn supplying device that supplies the spun yarn Y includes the drafting device 6 and the spinning device 7. The spinning device 7 is an air spinning device that twists the fiber bundle F using a swirling airflow to form the spun yarn Y. By using these devices, a high quality spun yarn Y can be effectively supplied.

[0056] The spinning machine 1 includes the spinning unit 2 that can realize a smooth operation during the winding of the spun yarn Y, when the spun yarn Y is broken, and the like. Therefore, the spinning machine 1 can efficiently produce a high quality package P.

[0057] Although one embodiment of the present invention is explained above, the present invention is not limited to this embodiment alone. For example, in the spinning machine 1 and the spinning unit 2, the drafting device 6 and the spinning device 7 serve as the yarn supplying devices for supplying the spun yarn. However, any other yarn supplying device, such as, a yarn supplying device that supplies a spun yarn from a bobbin having the spun yarn wound thereon, can be used.

[0058] If the spinning device is an air spinning device, a needle that is held by a fiber guiding section to project into the spinning chamber can be further provided to prevent the twisting of the fiber bundle to be conveyed upstream of the spinning device. The twisting of the fiber bundle can be prevented from being conveyed upstream of the spinning device by a downstream end of a fiber guiding section instead of by the needle. Alternatively, the spinning device can include a pair of air-jet nozzles that produce airflows in mutually opposite directions, and can thus spin the fiber bundle in opposite directions at the same time.

[0059] In the spinning machine 1 and the spinning unit 2, the yarn pooling device 50 has a function of drawing the spun yarn Y from the spinning device 7. Alternatively, the spun yarn can be drawn from a yarn supplying device that supplies the spun yarn by a delivery roller and a nip roller.

[0060] In the spinning machine 1 and the spinning unit 2, the spun yarn Y is broken by a stoppage of the swirling airflow in the spinning device 7 during the yarn-defect detection operation. Alternatively, the spun yarn can be cut by a cutter during the yarn-defect detection operation.

[0061] In the spinning machine 1 and the spinning unit 2, the devices are arranged so that the spun yarn Y supplied from above is wound below. Alternatively, the devices can be arranged so that the spun yarn supplied from below is wound above.

[0062] In the spinning machine 1 and the spinning unit 2, the bottom rollers of the drafting device 6 and a traverse mechanism of the traverse device 23 are driven by the power of the motor box 5 (that is, concurrently driven in a plurality of the spinning units 2). Alternatively, each section (for example, the drafting device, the spinning device, the winding device, etc.) of the spinning unit can be driven independently in each spinning unit 2.

[0063] The tension sensor 9 can be arranged at the upstream of the yarn clearer 8 in the running direction of the spun yarn Y. A common unit controller 10 can be provided for a plurality of the spinning units 2 instead of one unit controller 10 per spinning unit 2. The waxing device 11, the tension sensor 9, and the yarn clearer 8 need not be provided in the spinning unit 2. The winding device 12 can be driven by a common drive source pro-

vided for a plurality of the spinning units 2 instead of by a separate driving motor provided for each spinning unit 2. In this case, during the reverse rotation of the package P, the cradle arm 21 is moved by a not shown air cylinder so that the package P is separated from the winding drum 22, and thereafter the package P is reverse-rotated by a not shown reverse roller provided in the yarn joining carrier 3. Instead of providing the yarn processing module 80, the yarn clearer 8, the tension sensor 9, the yarn pooling device 50, and the waxing device 11 can be individually mounted on the frame 13 directly or indirectly.

[0064] The yarn pooling device is arranged between a yarn supplying device that supplies the spun yarn and a winding device that winds the spun yarn to form a package, and pools a spun yarn. The yarn pooling device includes a yarn pooling roller around which the spun yarn is wound. The yarn pooling roller includes a yarn pooling section around which the yarn is wound, a first tapering section that widens from a base end section on the winding start side of the yarn pooling section towards the yarn supplying device by a first inclination angle, and a second tapering section that widens from the first tapering section towards the yarn supplying device by a second inclination angle that is smaller than the first inclination angle. The second tapering section has a function of receiving the spun yarn that is guided to the yarn pooling roller, and a function of preventing, when the yarn is broken on the yarn supplying device side, the end of the spun yarn that sways around on the base end section side from moving towards the tip end section side of the yarn pooling section. The first tapering section has a function of guiding the spun yarn received by the second tapering section to the base end section.

[0065] In this yarn pooling device, the second tapering section receives the spun yarn guided to the yarn pooling roller, and the first tapering section guides the spun yarn received by the second tapering section to the base end section of the yarn pooling section. Because the second tapering section has the second inclination angle that is smaller than the first inclination angle, the spun yarn can be stably received by the second tapering section. Because the first tapering section has the first inclination angle that is larger than the second inclination angle, the spun yarn can be stably guided by the first tapering section. Therefore, the spun yarn can be wound systematically around the yarn pooling roller. When the spun yarn is broken on the yarn supplying device side, the second tapering section prevents the end of the spun yarn that sways around on the base end section side of the yarn pooling section from moving towards the tip end section side of the yarn pooling section. Because the second tapering section has the second inclination angle that is smaller than the first inclination angle, the yarn end can be reliably prevented from moving by the second tapering section. Consequently, the movement of the end of the spun yarn when a breakage of the spun yarn occurs can be controlled. With this yarn pooling device, the spun yarn can be wound systematically around the yarn pool-

ing roller, and the movement of the end of the spun yarn when a breakage of the spun yarn occurs can be controlled.

[0066] The yarn pooling device can further include a suction mechanism that produces a suction airflow at a suction vent that is arranged facing at least the second tapering section. While the second tapering section is preventing the end of the spun yarn swaying around on the base end section side of the yarn pooling section from moving towards the tip end section side of the yarn pooling section, the swaying end of the spun yarn can be fully subjected to the action of the suction airflow. Therefore, fiber waste produced from the end of the spun yarn can be reliably removed.

[0067] The yarn pooling device can further include a yarn hooking member and a regulating component. The yarn hooking member is arranged on the winding device side with respect to the yarn pooling roller. The yarn hooking member hooks the spun yarn and winds the hooked spun yarn around the yarn pooling roller. The regulating component is arranged on the yarn supplying device side with respect to the yarn pooling roller. When the spun yarn is broken on the yarn supplying device side, the regulating component regulates the end of the spun yarn from moving beyond the yarn pooling roller towards the yarn hooking member side. When the spun yarn is broken on the yarn supplying device side, the end of the spun yarn can be regulated from moving beyond the yarn pooling roller towards the yarn hooking member side, and the end of the spun yarn is prevented from being entangled with the yarn hooking member.

[0068] The spinning unit according to the present invention includes the above yarn pooling device, the yarn supplying device that supplies the spun yarn that is guided to the yarn pooling device, and the winding device that winds the spun yarn guided from the yarn pooling device to form a package.

[0069] The spinning unit includes the yarn pooling device that can systematically wind the spun yarn around the yarn pooling roller and control the movement of the end of the spun yarn when the spun yarn is broken. The spinning unit can therefore realize a smooth operation during the winding of the spun yarn, at a breakage of the spun yarn, and the like.

[0070] The spinning unit can further include a yarn joining device that is arranged between the yarn pooling device and the winding device, and that joins ends of the cut spun yarn. With the above yarn pooling device, the operation can be smoothly performed when the spun yarn is broken, and thus the ends of the broken spun yarn can be efficiently and reliably joined together.

[0071] It is preferable that the yarn supplying device includes a drafting device that drafts a fiber bundle and a spinning device that twists the fiber bundle to form the spun yarn. A high quality spun yarn can be efficiently supplied.

[0072] It is preferable that the spinning device be an air spinning device that twists the fiber bundle using a

swirling airflow to form the spun yarn. A further higher quality spun yarn can be efficiently supplied.

[0073] The spinning machine according to the present invention includes a plurality of the above spinning units. Because the spinning machine includes the spinning units that can realize smooth operations during the winding of the spun yarn, when the spun yarn is broken, and the like, such a spinning machine can efficiently produce high quality packages.

Claims

1. A spinning unit comprising:

a yarn pooling device (50);
a yarn supplying device (6, 7) adapted to supply spun yarn (Y) that is guided to the yarn pooling device (50); and
a winding device (12) adapted to wind the spun yarn (Y) guided from the yarn pooling device (50) to form a package (P),
wherein the yarn pooling device is arranged between the yarn supplying device (6, 7) and the winding device (12), and is adapted to pool the spun yarn (Y), the yarn pooling device comprising:

a yarn pooling roller (51) around which the spun yarn (Y) is wound, the yarn pooling roller (51) including a yarn pooling section (52) around which the spun yarn (Y) is wound;

characterized in that

the yarn pooling roller (51) further includes

a first tapering section (58) that widens from a base end section (52a) on a winding start side of the yarn pooling section (52) towards the yarn supplying device (6, 7) side by a first inclination angle; and

a second tapering section (59) that widens from the first tapering section (58) towards the yarn supplying device (6, 7) side by a second inclination angle that is smaller than the first inclination angle,

the second tapering section (59) is adapted to receive the spun yarn (Y) that is guided to the yarn pooling roller (51), and adapted to prevent, when the spun yarn (Y) is broken on the yarn supplying device (6, 7) side, an end of the spun yarn (Y) swaying around on the base end section (52a) side from moving towards a tip end section (52b) side of the yarn pooling section (52), and

- the first tapering section (58) is adapted to guide the spun yarn (Y) received by the second tapering section (59) to the base end section (52a). 5
2. The spinning unit according to Claim 1, wherein the yarn pooling device further comprises a suction mechanism (65) adapted to produce a suction airflow at a suction vent (66a) that is arranged facing at least the second tapering section (59). 10
3. The spinning unit according to Claim 1 or 2, wherein the yarn pooling device further comprises:
- a yarn hooking member (61) arranged on the winding device (12) side with respect to the yarn pooling roller (51), and adapted to engage with the spun yarn (Y) and to wind the spun yarn (Y) around the yarn pooling roller (51); and 15
- a regulating component (77) arranged on the yarn supplying device (6, 7) side with respect to the yarn pooling roller (51), and adapted to regulate, when the spun yarn (Y) is broken on the yarn supplying device (6, 7) side, the end of the spun yarn (Y) from moving beyond the yarn pooling roller (51) towards the yarn hooking member (61) side. 20 25
4. The spinning unit according to one of Claims 1 to 3, further comprising a yarn joining device (26) arranged between the yarn pooling device (50) and the winding device (12), and adapted to join ends of the spun yarn (Y) that has been cut. 30
5. The spinning unit according to one of Claims 1 to 4, wherein the yarn supplying device (6, 7) includes a drafting device (6) adapted to draft a fiber bundle (F); and 35
- a spinning device (7) adapted to form the spun yarn (Y) by twisting the fiber bundle (F). 40
6. The spinning unit according to Claim 5, wherein the spinning device (7) is an air spinning device adapted to form the spun yarn (Y) by twisting the fiber bundle (F) using a swirling airflow. 45
7. A spinning machine comprising a plurality of the spinning units (2) according to any one of Claims 1 to 6. 50

Patentansprüche

1. Eine Spinnereinheit, die folgende Merkmale aufweist:
- eine Garnbündelungsvorrichtung (50); 55
- eine Garnzuführvorrichtung (6, 7), die angepasst ist, um gesponnenes Garn (Y), das zu der Garnbündelungsvorrichtung (50) hin geführt

wird, zuzuführen; und

eine Wickelvorrichtung (12), die angepasst ist, um das gesponnene Garn (Y), das von der Garnbündelungsvorrichtung (50) weg geführt wird, zu wickeln, um einen Wickelkörper (P) zu bilden,

wobei die Garnbündelungsvorrichtung zwischen der Garnzuführvorrichtung (6, 7) und der Wickelvorrichtung (12) angeordnet ist und angepasst ist, um das gesponnene Garn (Y) zu bündeln, wobei die Garnbündelungsvorrichtung folgendes Merkmal aufweist:

eine Garnbündelungsrolle (51), um die das gesponnene Garn (Y) gewickelt ist, wobei die Garnbündelungsrolle (51) einen Garnbündelungsabschnitt (52) aufweist, um den das gesponnene Garn (Y) gewickelt wird; **dadurch gekennzeichnet, dass:**

die Garnbündelungsrolle (51) ferner folgende Merkmale aufweist:

einen ersten Verjüngungsabschnitt (58), der sich von einem Basisendabschnitt (52a) auf einer Wickelstartseite des Garnbündelungsabschnitts (52) in Richtung der Seite der Garnzuführvorrichtung (6, 7) um einen ersten Neigungswinkel verbreitert; und

einen zweiten Verjüngungsabschnitt (59), der sich von dem ersten Verjüngungsabschnitt (58) in Richtung der Seite der Garnzuführvorrichtung (6, 7) um einen zweiten Neigungswinkel verbreitert, der kleiner ist als der erste Neigungswinkel,

wobei der zweite Verjüngungsabschnitt (59) angepasst ist, um das gesponnene Garn (Y), das zu der Garnbündelungsrolle (51) hin geführt wird, aufzunehmen, und angepasst ist, um zu verhindern, dass, wenn das gesponnene Garn (Y) auf der Seite der Garnzuführvorrichtung (6, 7) reißt, ein Ende des gesponnenen Garns (Y), das um die Seite des Basisendabschnitts (52a) schwingt, sich in Richtung einer Seite eines Kopfendabschnitts (52b) des Garnbündelungsabschnitts (52) bewegt, und wobei der erste Verjüngungsabschnitt (58) angepasst ist, um das gesponnene Garn (Y), das durch den zweiten Verjüngungsabschnitt

(59) aufgenommen wird, zu dem Basisendabschnitt (52a) zu führen.

2. Die Spinnereinheit gemäß Anspruch 1, bei der die Garnbündelungsvorrichtung ferner einen Saugmechanismus (65) aufweist, der angepasst ist, um einen Saugluftfluss an einer Saugöffnung (66a) zu erzeugen, die so angeordnet ist, dass sie zumindest dem zweiten Verjüngungsabschnitt (59) zugewandt ist. 10

3. Die Spinnereinheit gemäß Anspruch 1 oder 2, bei der die Garnbündelungsvorrichtung ferner folgende Merkmale aufweist: 15
 - ein Garneinhakbauteil (61), das in Bezug auf die Garnbündelungsrolle (51) auf der Seite der Wickelvorrichtung (12) angeordnet ist und angepasst ist, um das gesponnene Garn (Y) in Eingriff zu nehmen und das gesponnene Garn (Y) um die Garnbündelungsrolle (51) zu wickeln; und 20
 - eine Regulierungskomponente (77), die in Bezug auf die Garnbündelungsrolle (51) auf der Seite der Garnzuführvorrichtung (6, 7) angeordnet ist und angepasst ist, um, wenn das gesponnene Garn (Y) auf der Seite der Garnzuführvorrichtung (6, 7) reißt, das Ende des gesponnenen Garns (Y) so zu regulieren, dass sich dieses nicht über die Garnbündelungsrolle (51) hinaus in Richtung der Seite des Garneinhakbauteils (61) bewegt. 25 30

4. Die Spinnereinheit gemäß einem der Ansprüche 1 bis 3, die ferner eine Garnaneinanderfügungsvorrichtung (26) aufweist, die zwischen der Garnbündelungsvorrichtung (50) und der Wickelvorrichtung (12) angeordnet ist und angepasst ist, um Enden des gesponnenen Garns (Y), das durchgeschnitten wurde, aneinanderzufügen. 35 40

5. Die Spinnereinheit gemäß einem der Ansprüche 1 bis 4, bei der die Garnzuführvorrichtung (6, 7) folgende Merkmale aufweist: 45
 - eine Ziehvorrichtung (6), die angepasst ist, um ein Faserbündel (F) zu ziehen; und
 - eine Spinnvorrichtung (7), die angepasst ist, um das gesponnene Garn (Y) durch Verdrillen des Faserbündels (F) zu bilden. 50

6. Die Spinnereinheit gemäß Anspruch 5, bei der die Spinnvorrichtung (7) eine Luftspinnvorrichtung ist, die angepasst ist, um das gesponnene Garn (Y) durch Verdrillen des Faserbündels (F) unter Verwendung eines Wirbelluftflusses zu bilden. 55

7. Eine Spinnmaschine mit einer Mehrzahl der Spinnereinheiten (2) gemäß einem der Ansprüche 1 bis 6.

5 Revendications

1. Unité de filage, comprenant:

un dispositif de regroupement de fil (50);
 un dispositif d'alimentation de fil (6, 7) adapté pour alimenter un fil filé (Y) qui est guidé vers le dispositif de regroupement de fil (50); et
 un dispositif d'enroulement (12) adapté pour enrouler le fil filé (Y) guidé depuis le dispositif de regroupement de fil (50) pour former un paquet (P),
 dans laquelle le dispositif de regroupement de fil est disposé entre le dispositif d'alimentation de fil (6, 7) et le dispositif d'enroulement (12), et est adapté pour regrouper le fil filé (Y), le dispositif de regroupement de fil comprenant:

un rouleau de regroupement de fil (51) autour duquel est enroulé le fil filé (Y), le rouleau de regroupement de fil (51) comportant un segment de regroupement de fil (52) autour duquel est enroulé le fil filé (Y);
caractérisée par le fait que
 le rouleau de regroupement de fil (51) comprend par ailleurs

un premier segment effilé (58) qui s'élargit d'un segment d'extrémité de base (52a) d'un côté de début d'enroulement du segment de regroupement de fil (52) vers le côté du dispositif d'alimentation de fil (6, 7) selon un premier angle d'inclinaison; et
 un deuxième segment effilé (59) qui s'élargit du premier segment effilé (58) vers le côté du dispositif d'alimentation de fil (6, 7) selon un deuxième angle d'inclinaison qui est plus petit que le premier angle d'inclinaison,

le deuxième segment effilé (59) est adapté pour recevoir le fil filé (Y) qui est guidé vers le rouleau de regroupement de fil (51), et est adapté pour empêcher, lorsque le fil filé (Y) est cassé sur le dispositif d'alimentation de fil (6, 7), qu'une extrémité du fil filé (Y) ondoyant librement du côté de l'extrémité de base (52a) ne se déplace vers un côté du segment d'extrémité de pointe (52b) du segment de regroupement de fil (52), et le premier segment effilé (58) est adapté pour guider le fil filé (Y) reçu par le deuxième segment effilé (59) vers le segment d'extré-

mité de base (52a).

2. Unité de filage selon la revendication 1, **caractérisée par le fait que** le dispositif de regroupement de fil comprend par ailleurs un mécanisme d'aspiration (65) adapté pour produire un flux d'air d'aspiration à un événement d'aspiration (66a) disposé de manière à faire face à au moins le deuxième segment effilé (59). 5

3. Unité de filage selon la revendication 1 ou 2, dans laquelle le dispositif de regroupement de fil comprend par ailleurs: 10
 - un élément d'accrochage de fil (61) disposé du côté du dispositif d'enroulement (12) par rapport au rouleau de regroupement de fil (51), et adapté pour venir en prise avec le fil filé (Y) et pour enrouler le fil filé (Y) autour du rouleau de regroupement de fil (51); et 15
 - un composant de régulation (77) disposé du côté du dispositif d'alimentation de fil (6, 7) par rapport au rouleau de regroupement de fil (51), et adapté pour réguler, lorsque le fil filé (Y) est cassé du côté du dispositif d'alimentation de fil (6, 7), que l'extrémité du fil filé (Y) ne se déplace au-delà du rouleau de regroupement de fil (51) vers le côté de l'élément d'accrochage de fil (61). 20 25

4. Unité de filage selon l'une des revendications 1 à 3, comprenant par ailleurs un dispositif de jonction de fils (26) disposé entre le dispositif de regroupement de fil (50) et le dispositif d'enroulement (12), et adapté pour joindre les extrémités du fil filé (Y) qui a été cassé. 30 35

5. Unité de filage selon l'une des revendications 1 à 4, **caractérisée par le fait que** le dispositif d'alimentation de fil (6, 7) comporte un dispositif d'étirage (6) adapté pour étirer un faisceau de fibres (F); et 40 un dispositif de filage (7) adapté pour former le fil filé (Y) en torsadant le faisceau de fibres (F).

6. Unité de filage selon la revendication 5, dans laquelle le dispositif de filage (7) est un dispositif de filage à air adapté pour former le fil filé (Y) en torsadant le faisceau de fibres (F) à l'aide d'un flux d'air tourbillonnant. 45

7. Machine à filer comprenant une pluralité d'unités de filage (2) selon l'une quelconque des revendications 1 à 6. 50

55

FIG.1

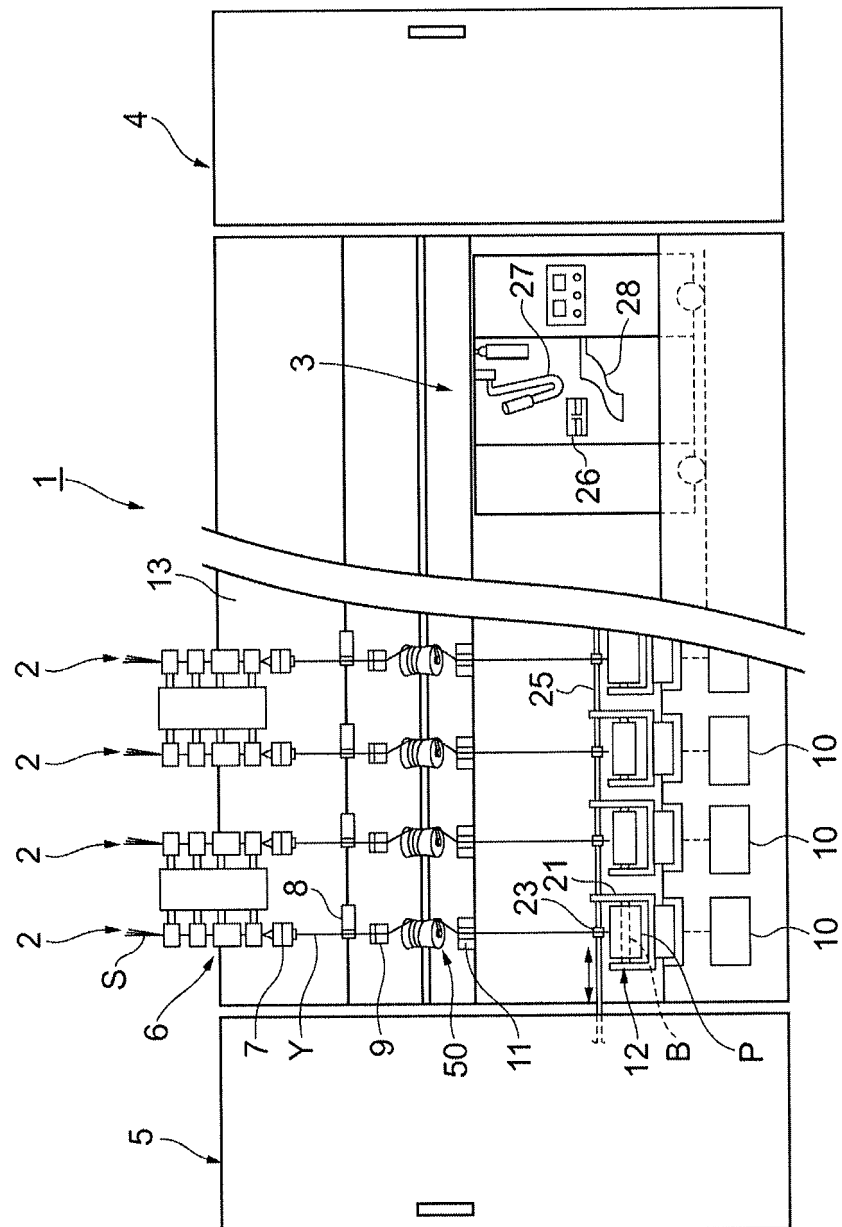


FIG.2

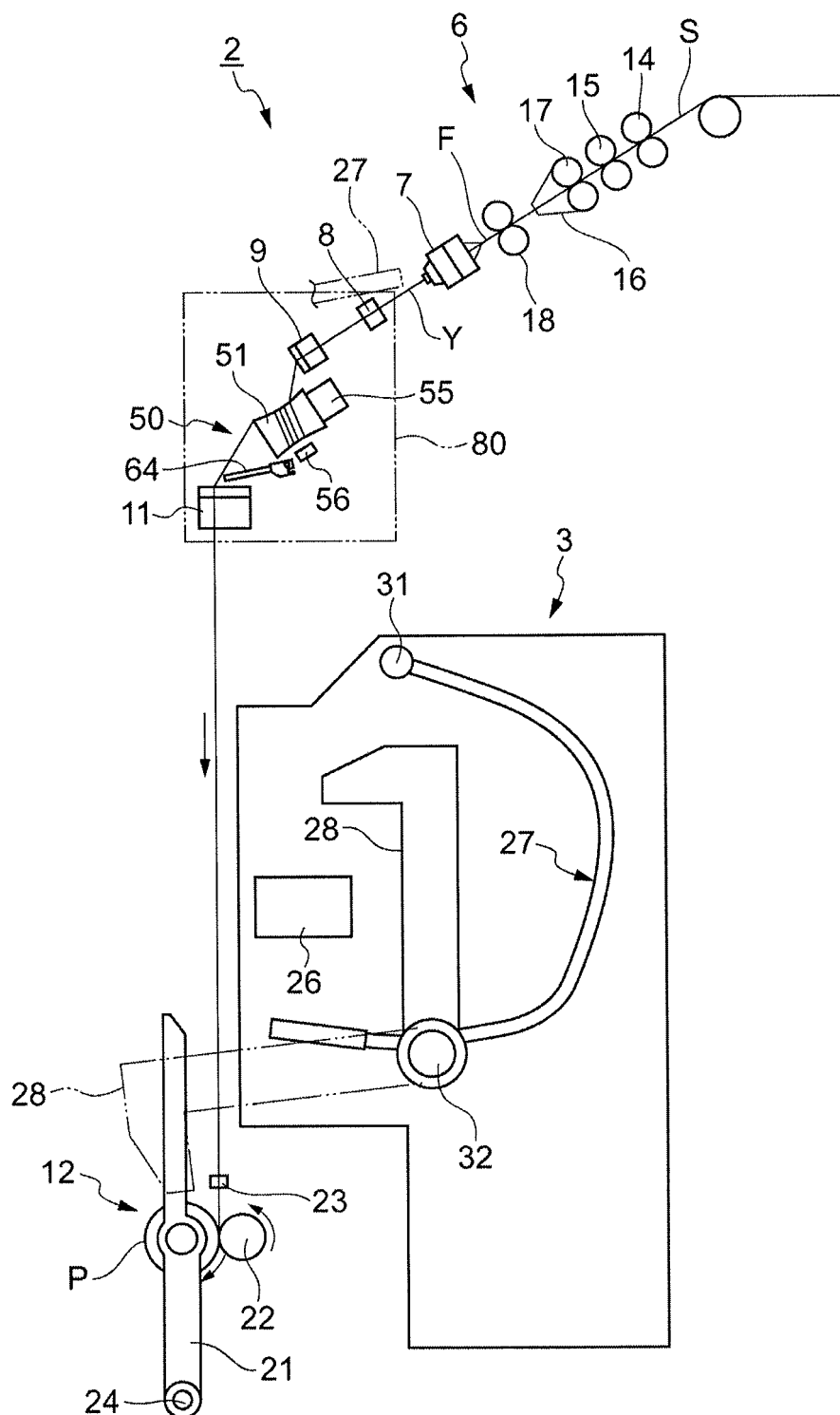


FIG.4

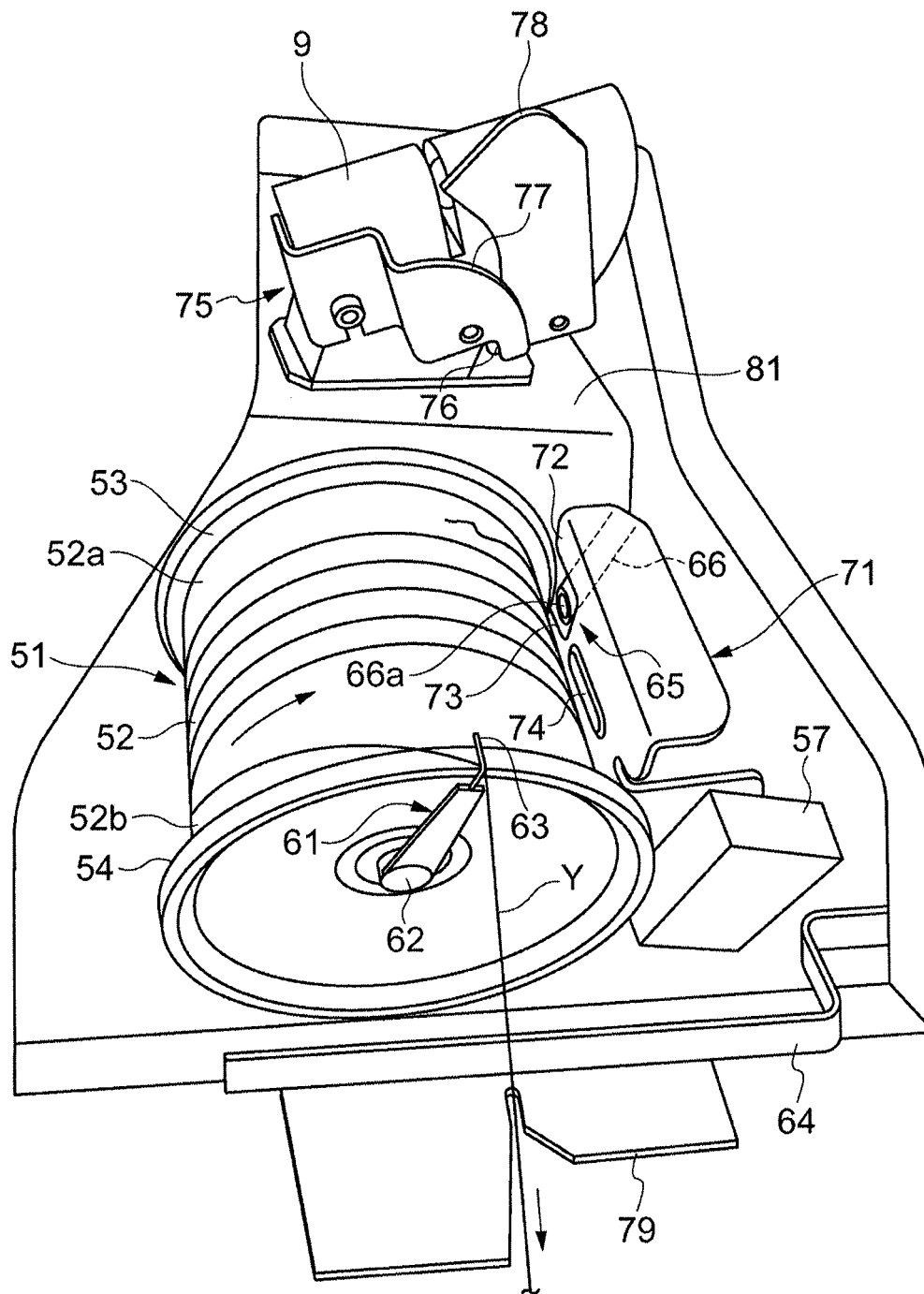


FIG.5

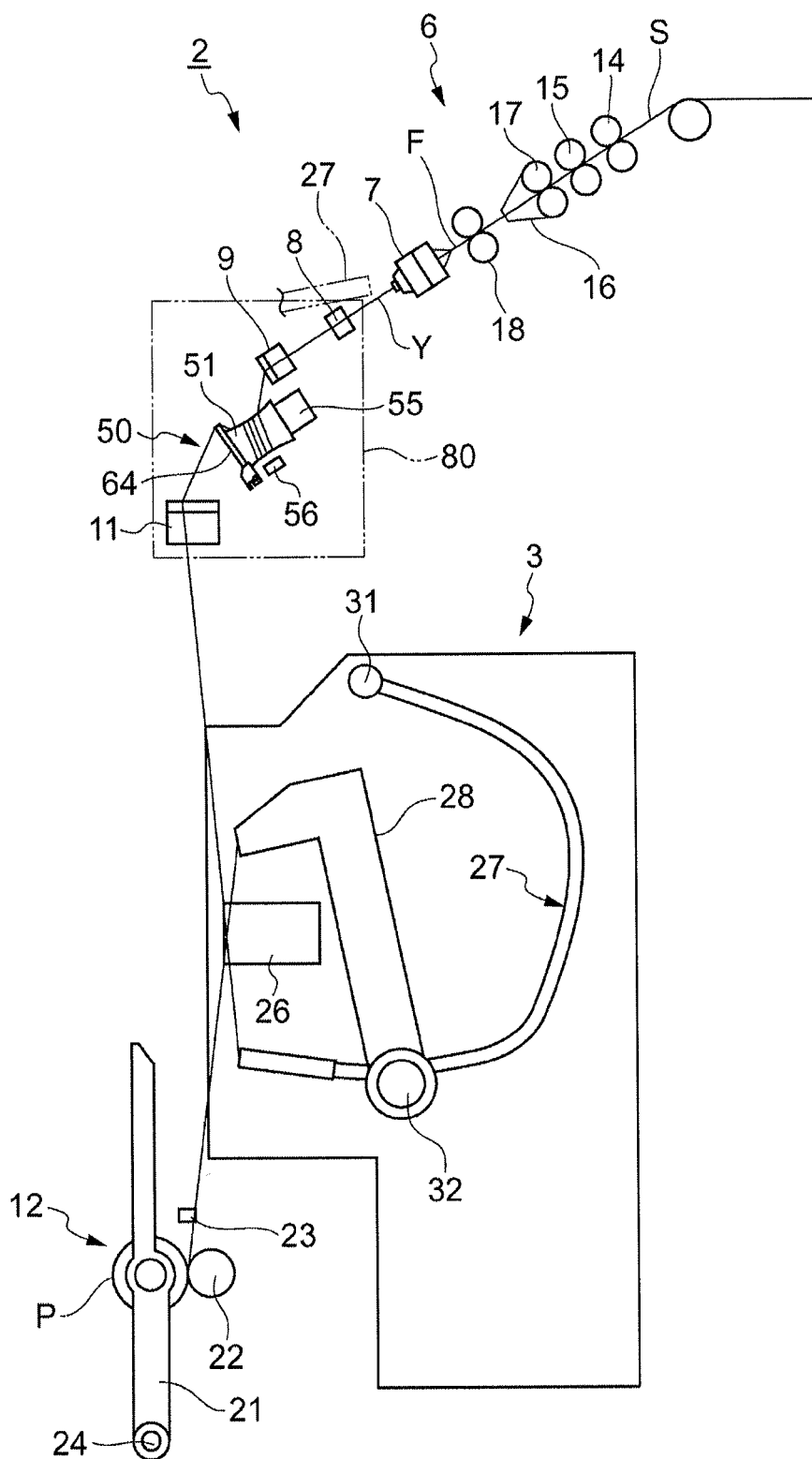


FIG.6

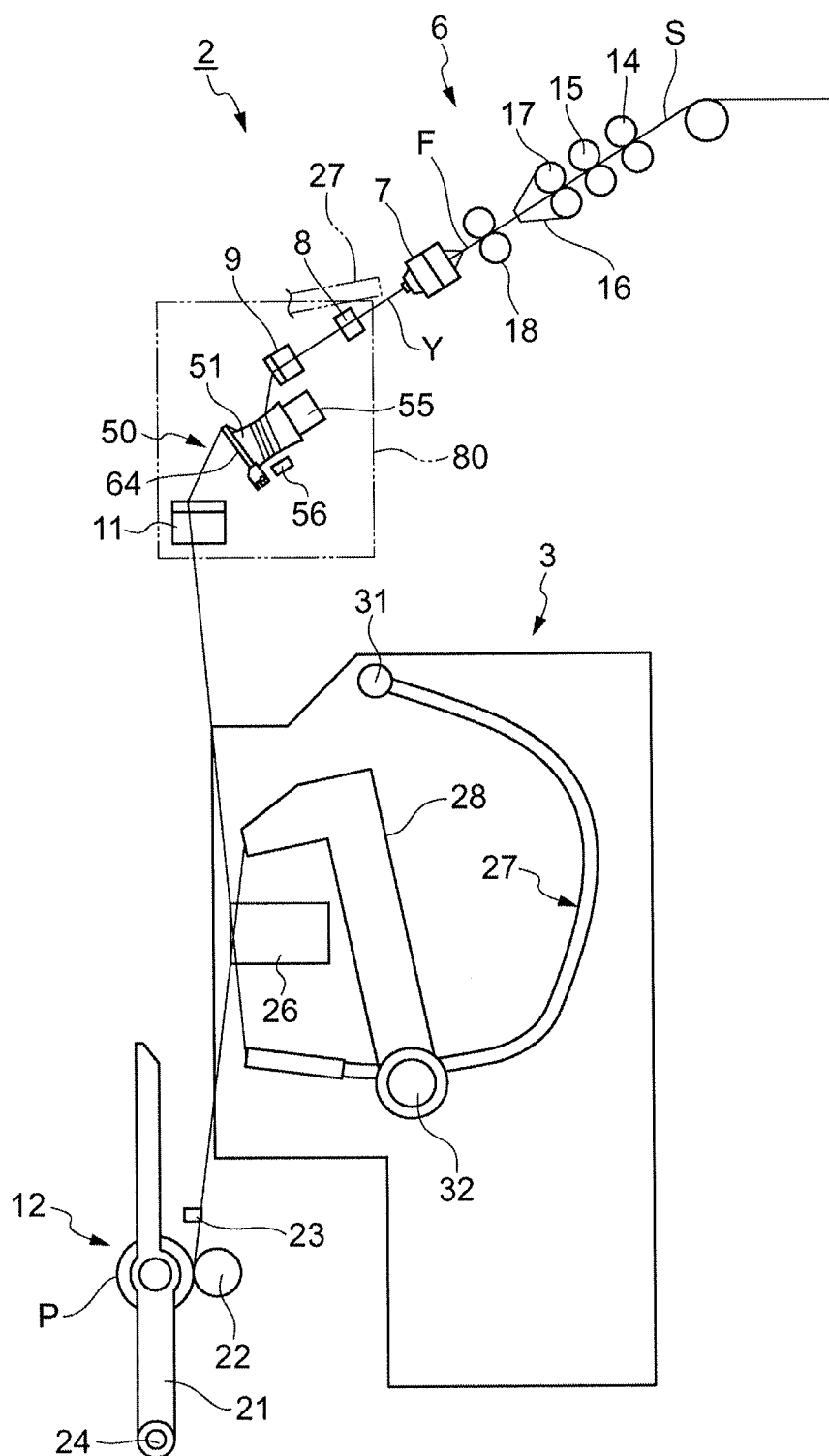


FIG. 7

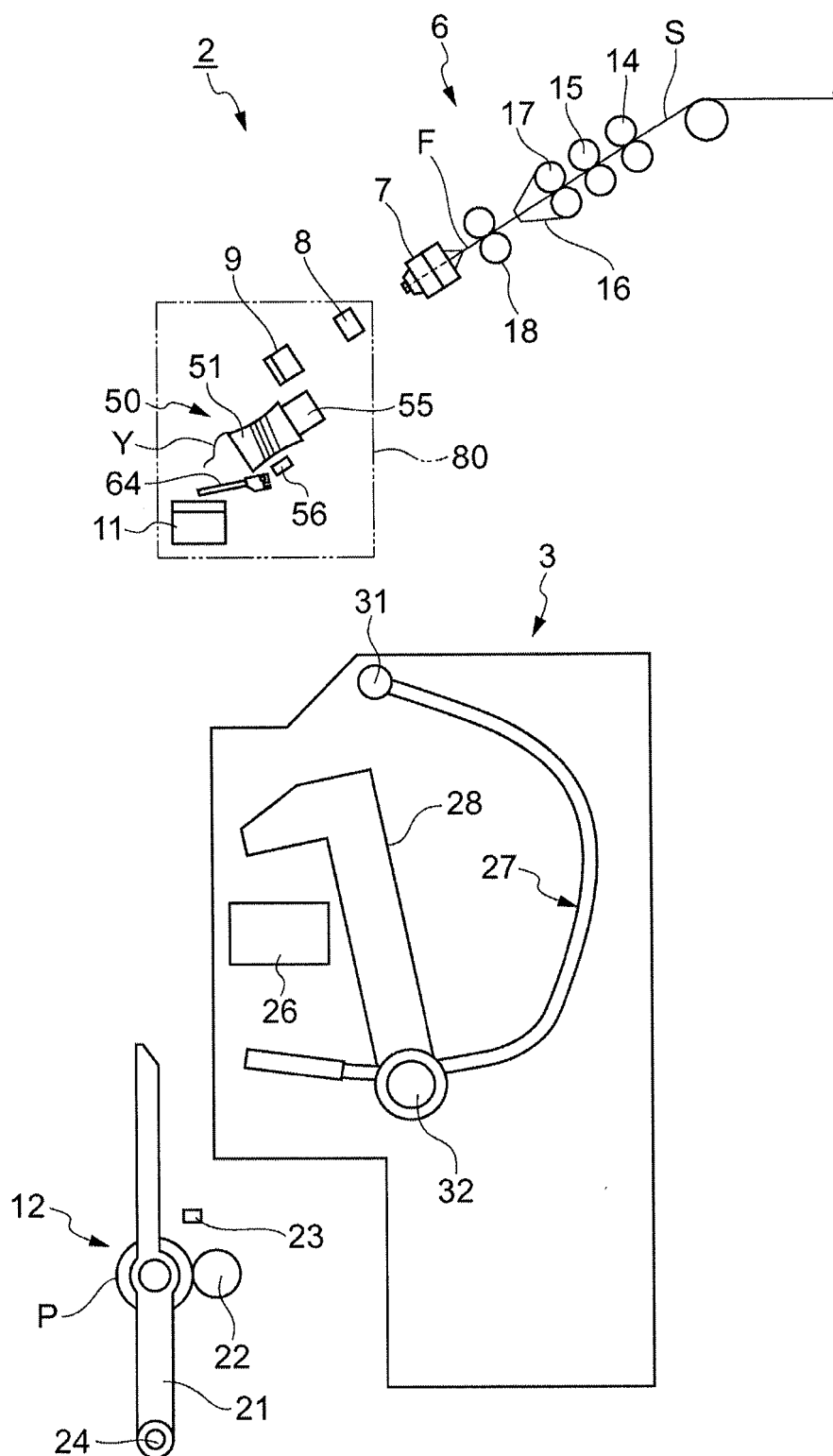


FIG.8

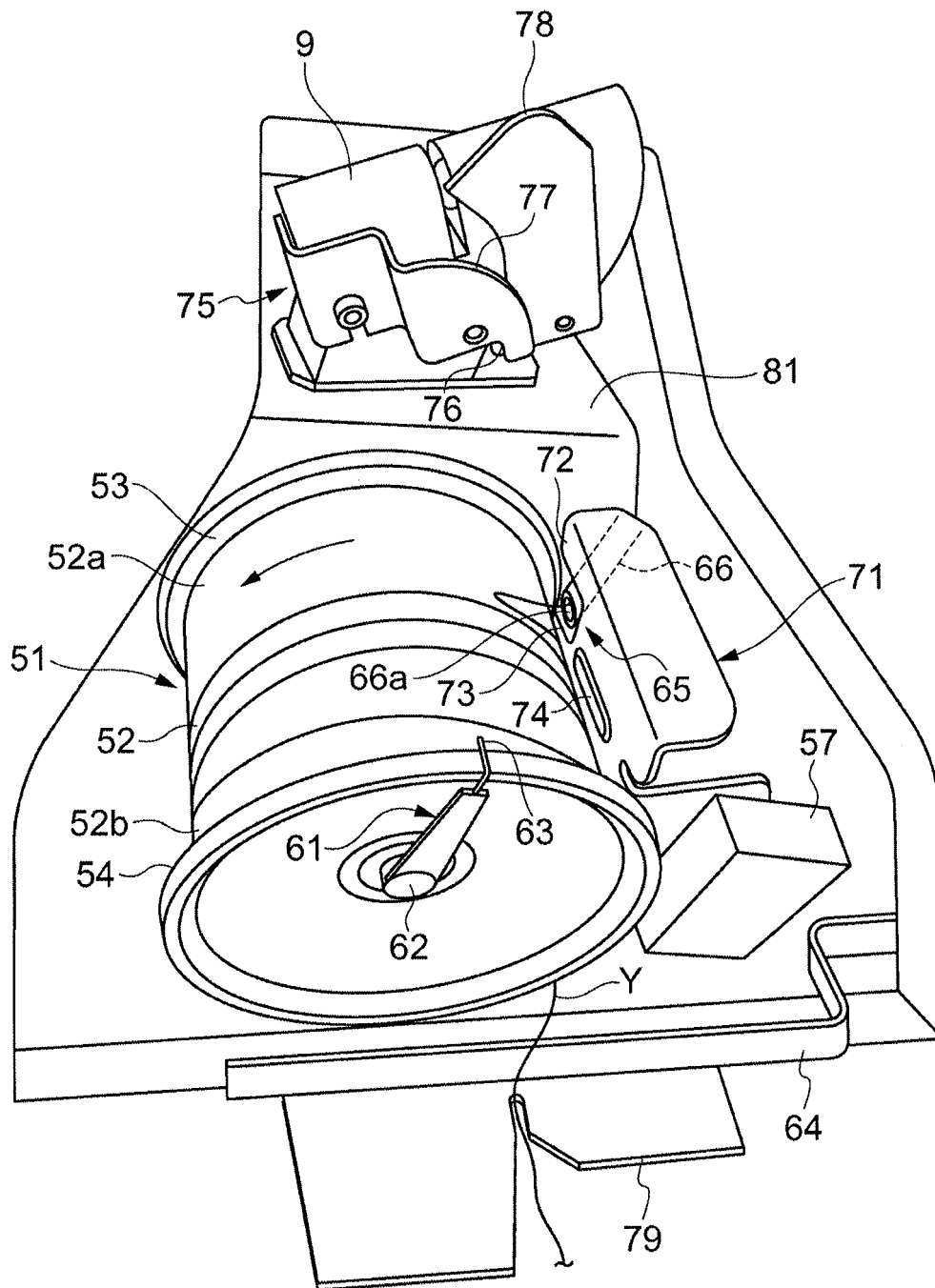
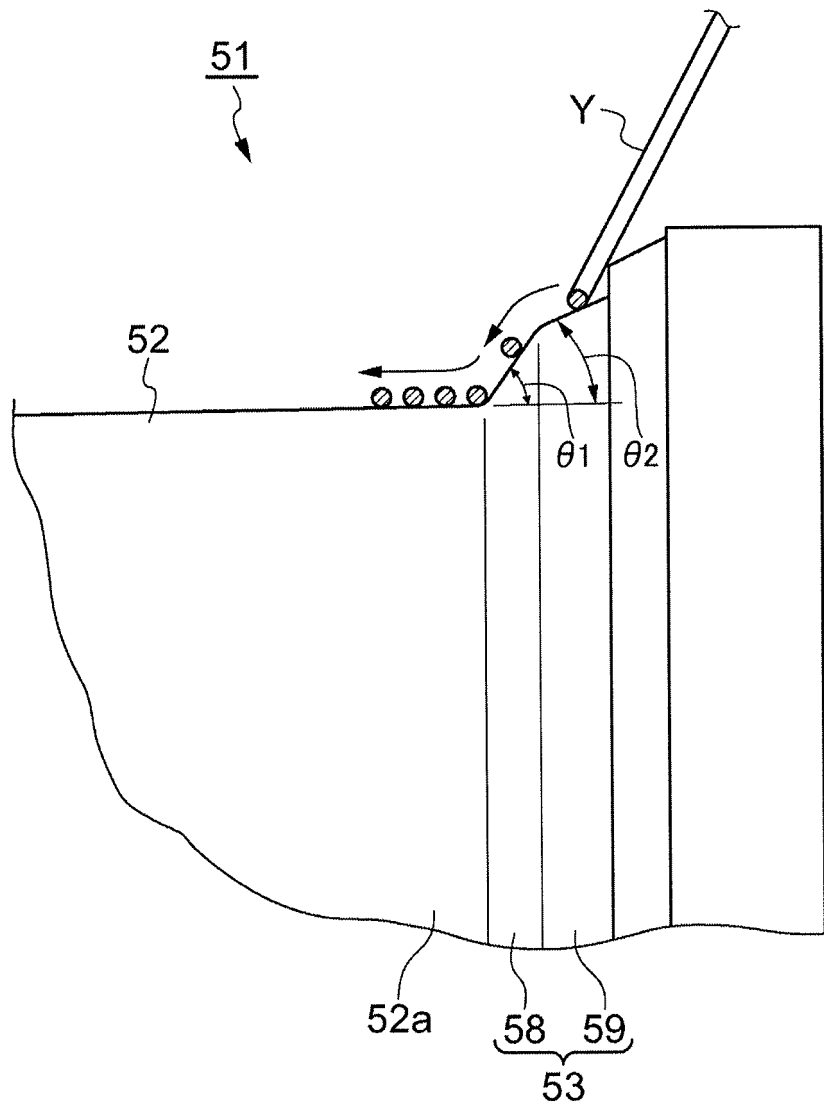


FIG.9



REFERENCES CITED IN THE DESCRIPTION

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