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(54) **YARN JOINING DEVICE, SPINNING MACHINE, AND AUTOMATIC WINDER**

FADENVERBINDUNGSVORRICHTUNG, SPINNMASCHINE UND AUTOMATISCHER WICKLER
DISPOSITIF D'ASSEMBLAGE DE FIL, MACHINE DE FILAGE ET ENROULEUR AUTOMATIQUE

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention mainly relates to a yarn joining device having a yarn joining section that performs yarn joining.

2. Description of the Related Art

[0002] In yarn winding machines, such as spinning machines, in a situation where a yarn becomes discontinuous for some reason, a yarn joining device performs an operation for connecting the yarns. Yarn joining devices having two untwisting pipes and a yarn joining section are known in the art. One of the discontinuous yarns (a first yarn) is inserted into one of the two untwisting pipes, and the other yarn (a second yarn) is inserted into the other untwisting pipe. One or more air blowing holes are formed in each of the untwisting pipes. Air is passed through those air blowing holes and jetted when an air current is to be generated inside the untwisting pipes. The untwisting pipes perform untwisting of the yarns that have been inserted therein by applying the air current on the yarns. The yarn joining section joins the two untwisted yarns together by twisting the yarns by applying the air current on those yarns.

[0003] Japanese Patent Laid-Open No. H5-338922 discloses a configuration in which plural (specifically, four) air blowing holes are formed in each of the two untwisting pipes. Japanese Patent Laid-Open No. 2014-234308 and its German family member DE 10 2014 007 731 A1 disclose a configuration that can separately regulate the amount of air to be supplied to each of the untwisting pipes.

[0004] For example, when the yarn formed in an air spinning machine becomes discontinuous, there are situations where the ease of untwisting is different for the first yarn and the second yarn. Therefore, it is desirable to be able to change the amount of air in the air current, the direction of the air current, and the like, in each of the untwisting pipes.

[0005] In the configuration disclosed in Japanese Patent Laid-Open No. H5-338922, holes having similar physical properties are formed in both the untwisting pipes, and there is no mention in this document about regulating the amount of air to be supplied to the untwisting pipes. Therefore, it can be assumed that the amount of air in the air current and the direction of the air current are similar in both the untwisting pipes disclosed in Japanese Patent Laid-Open No. H5-338922.

[0006] In Japanese Patent Laid-Open No. 2014-234308, by separately regulating the amount of air to be supplied to each of the untwisting pipes, the amount of air in the air current in each of the untwisting pipes can be changed. However, each of the first yarn and the sec-

ond yarn cannot be untwisted properly by simply changing the amount of air supplied to the untwisting pipes. If the yarns are not untwisted properly, a weak joint may be formed.

SUMMARY OF THE INVENTION

[0007] It is one object of the present invention to provide a yarn joining device that can change the manner in which the untwisting is performed in the first yarn and the second yarn thereby achieving a sufficiently strong joint. This object is achieved by a yarn joining device according to claim 1.

[0008] According to one aspect of the present invention, a yarn joining device includes a pipe-shaped first untwisting section with a first air blowing hole formed therein for passing air to generate an air current inside thereof that acts on a first yarn and untwists the first yarn; a pipe-shaped second untwisting section, having different physical properties than that of the first untwisting section, with a second air blowing hole formed therein for passing air to generate an air current inside thereof that acts on a second yarn and untwists the second yarn; and a yarn joining section that joins the first yarn untwisted by the first untwisting section and the second yarn untwisted by the second untwisting section.

[0009] According to another aspect of the present invention, a spinning machine includes the above yarn joining device; a drafting device that drafts a fiber bundle; an air spinning device that forms a yarn by applying twists to the fiber bundle; and a winding section that forms a package by winding the yarn.

[0010] According to still another aspect of the present invention, an automatic winder includes the above yarn joining device, and the automatic winder forms a new package by rewinding any one of a yarn supplying bobbin and a package on which a spun yarn has been wound.

[0011] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a front view of a configuration of a spinning frame according to a first embodiment of the present invention.

FIG. 2 is a side view of a spinning unit when it is winding a spun yarn.

FIG. 3 is a side view of the spinning unit when it is performing a yarn catching operation after a yarn breakage has occurred.

FIG. 4 is a side view of the spinning unit when it is performing yarn joining.

FIG. 5 is a cross-sectional view of an air spinning device and a neighboring configuration thereof.

FIG. 6 is a perspective view of a configuration of a yarn joining device.

FIG. 7A is a lateral cross-sectional view and FIG. 7B is a front cross-sectional view of a first untwisting pipe.

FIG. 8A is a lateral cross-sectional view and FIG. 8B is a front cross-sectional view of a second untwisting pipe.

FIG. 9 is a view for explaining a flow of air supply to the first untwisting pipe and the second untwisting pipe.

FIG. 10 is a side view of an automatic winder according to a second embodiment of the present invention.

DETAILED DESCRIPTION

[0013] A spinning frame according to a first embodiment of the present invention is explained below with reference to the drawings. A spinning frame 1 shown in FIG. 1 includes plural spinning units 2 arranged side-by-side, a yarn joining carrier 3, a motor box 4, and a machine frame control device 90.

[0014] The machine frame control device 90 centrally manages the various structural components of the spinning frame 1, and includes a monitor 91 and one or more input keys 92. An operator performs an appropriate operation by using the input keys 92 to perform a setting operation on a particular spinning unit 2 or all the spinning units 2, and to display on the monitor 91 setting, state, and the like of a particular spinning unit 2 or all the spinning units 2.

[0015] As shown in FIG. 2, each spinning unit 2 includes a drafting device 7, an air spinning device 9, a yarn accumulating device 14, and a winding device 96 arranged in this order from upstream to downstream. In the present specification, "upstream" and "downstream" mean upstream and downstream in the running (transportation) direction of a fiber bundle 8 and a spun yarn 10 at the time of performing the spinning operation. Each spinning unit 2 spins the fiber bundle 8 sent from the drafting device 7, with the air spinning device 9 to form the spun yarn 10, and winds the spun yarn 10 with the winding device 96 to form a package 28.

[0016] The drafting device 7 is arranged near an upper edge of a housing 5 of the spinning frame 1. The drafting device 7 includes four roller pairs: a back roller pair 21, a third roller pair 22, a middle roller pair 24, and a front roller pair 25 arranged in this order from the upstream side to the downstream side. In the middle roller pair 24, an apron belt 23 is provided on each roller thereof. The drafting device 7 drafts the fiber bundle 8, which is supplied thereto via a fiber bundle guide 20 from a not-shown fiber bundle case, until the fiber bundle 8 attains a predetermined thickness. The fiber bundle 8 drafted by the drafting device 7 is supplied to the air spinning device 9.

[0017] The air spinning device 9 applies twists, by us-

ing a swirling air current, to the fiber bundle 8 supplied from the drafting device 7 to form the spun yarn 10. A concrete structure of the air spinning device 9 will be explained later.

[0018] A yarn quality measuring device 12 and a spinning sensor 13 are arranged downstream of the air spinning device 9. The spun yarn 10 spun by the air spinning device 9 passes the yarn quality measuring device 12 and the spinning sensor 13.

[0019] The yarn quality measuring device 12 monitors a thickness of the running spun yarn 10 with a not-shown optical sensor. The yarn quality measuring device 12 transmits, upon detecting a yarn defect (a point where the spun yarn 10 has an abnormal thickness and the like) in the spun yarn 10, a yarn-defect detection signal to a not-shown unit controller. The yarn quality measuring device 12 is not limited to the optical sensor, and can be, for example, a device that monitors the thickness of the spun yarn 10 with a capacitance sensor. The yarn quality measuring device 12 can detect a foreign substance included in the spun yarn 10 as the yarn defect.

[0020] The spinning sensor 13 is arranged immediately downstream of the yarn quality measuring device 12. The spinning sensor 13 detects a tension of the spun yarn 10 between the air spinning device 9 and the yarn accumulating device 14. The spinning sensor 13 transmits a detection signal indicative of the detected tension to the unit controller. The unit controller detects an abnormal point, such as a point where the yarn is weak, by monitoring the tension detected by the spinning sensor 13. However, the spinning sensor 13 can be omitted.

[0021] The yarn accumulating device 14 is arranged downstream of the yarn quality measuring device 12 and the spinning sensor 13. The yarn accumulating device 14 includes, as shown in FIG. 2, a yarn accumulating roller 15 and a motor 16 that rotationally drives the yarn accumulating roller 15.

[0022] A predetermined amount of the spun yarn 10 can be wound on an outer periphery of the yarn accumulating roller 15 to temporarily store the spun yarn 10. While the spun yarn 10 has been wound around the outer periphery of the yarn accumulating roller 15, the spun yarn 10 can be drawn from the air spinning device 9 at a predetermined speed to transport the spun yarn 10 to the downstream side by rotating the yarn accumulating roller 15 at a predetermined rotation speed. Because the spun yarn 10 can be temporarily accumulated on the outer periphery of the yarn accumulating roller 15 in this manner, the yarn accumulating device 14 can be caused to function as a buffer. Accordingly, problems (e.g., slack of the spun yarn 10, and the like) that can occur when the spinning speed in the air spinning device 9 and the winding speed (the speed with which the spun yarn 10 is wound into the package 28) do not match each other due to some reason can be solved.

[0023] A yarn guide 17 and the winding device 96 are arranged downstream of the yarn pooling device 14. The winding device 96 is provided with a cradle arm 97 that

rotatably supports a bobbin on which the spun yarn 10 is wound.

[0024] The winding device 96 includes a winding drum 98, a traversing guide 99, and a not-shown winding drum driving motor. The winding drum 98 rotates while being in contact with the outer periphery of the bobbin or the package 28 when the driving force of the winding drum driving motor is transmitted thereto. The traversing guide 99 is engagable with the spun yarn 10. The winding device 96 drives the winding drum 98 with the winding drum driving motor while causing the traversing guide 99 to make a reciprocating motion by using a not-shown driving device. As a result, while the spun yarn 10 is being traversed, the winding device 96 rotates the package 28 that is in contact with the winding drum 98 whereby the spun yarn 10 is wound into the package 28.

[0025] As shown in FIGS. 1 and 2, the yarn joining cart 3 includes a yarn joining device 93, a suction pipe 94, and a suction mouth 95. When a yarn breakage or a yarn discontinuation occurs in one of the spinning units 2, the yarn joining carrier 3 travels on a not-shown rail up to the spinning unit 2, and stops there. The suction pipe 94 swings in an upper direction around a shaft to catch the spun yarn 10 (a second yarn, an upper yarn, or a yarn on the upstream side) fed out from the air spinning device 9 (state shown in FIG. 3), and then swings in a lower direction around the shaft to guide the caught spun yarn 10 to the yarn joining device 93 (state shown in FIG. 4). The suction mouth 95 swings in the lower direction around a shaft to catch the spun yarn 10 (a first yarn, a lower yarn, or a yarn on the downstream side) from the package 28 (state shown in FIG. 3), and then swings in the upper direction around the shaft to guide the caught spun yarn 10 to the yarn joining device 93 (state shown in FIG. 4). The yarn joining device 93 joins the spun yarns 10 guided thereto.

[0026] Referring now to FIG. 5, a configuration of the air spinning device 9 is explained below.

[0027] As shown in FIG. 5, the air spinning device 9 includes a first holder (nozzle block) 60 and a second holder 70. The first holder 60 is arranged at an upstream edge of the air spinning device 9. The first holder 60 includes a fiber guide 61, a spinning chamber 62, and a nozzle 63.

[0028] The fiber guide 61 guides the fiber bundle 8 drafted by the drafting device 7 toward the inside of the air spinning device 9. A fiber introduction port 61a and a guiding needle 61b are formed in the fiber guide 61. The fiber bundle 8 drafted by the drafting device 7 is guided, through the fiber introduction port 61a, into the spinning chamber 62 so as to be wound over the guiding needle 61b. The air spinning device 9 jets air inside the spinning chamber 62 from the nozzle 63 and applies a swirling air current to the fiber bundle 8 present in the spinning chamber 62. However, the guiding needle 61b can be omitted, and the downstream end of the fiber guide 61 can be caused to serve as the guiding needle 61b.

[0029] The second holder 70 includes a hollow guiding

shaft 71 and a yarn passage 72. The yarn passage 72 is formed at the axis of the hollow guiding shaft 71. The rear ends of the fibers in the fiber bundle 8 are rotated around the tip of the hollow guiding shaft 71 by the action of the air jetted from the nozzle 63. As a result, twists are applied to the fiber bundle 8 whereby the spun yarn 10 is formed. The spun yarn 10 passes through the yarn passage 72 and is led to the outside of the air spinning device 9 from a yarn outlet (not-shown) arranged downstream.

[0030] A concrete configuration of the yarn joining device 93 and a yarn joining operation performed by the yarn joining device 93 are explained below with reference to FIG. 6. The yarn joining device 93 includes, as shown in FIG. 6, a yarn joining section 31, a pair of yarn shifting levers 32, 33, a pair of clamping members 34, 35, a pair of yarn pressing levers 36, 37, a first untwisting pipe (the first untwisting member) 38, a second untwisting pipe (the second untwisting member) 39, and a pair of cutters 40, 41.

[0031] A yarn joining hole 30 is formed in the yarn joining section 31. Not-shown one or plural exhaust ports are formed inside of the yarn joining hole 30. A swirling air current can be generated inside the yarn joining hole 30 by jetting air from those exhaust ports.

[0032] Each of the yarn shifting levers 32, 33, the clamping members 34, 35, and the yarn pressing levers 36, 37 are arranged sandwiching the yarn joining section 31. The yarn shifting lever 32 (or the yarn shifting lever 33) shifts toward the yarn joining section 31 the first yarn (or the second yarn) guided to the yarn joining device 93. The clamping member 34 (or the clamping member 35) clamps and holds a predetermined point of the first yarn (or the second yarn) that has been guided to the yarn joining section 31. The yarn pressing lever 36 (or the yarn pressing lever 37) holds and secures the first yarn (or the second yarn) while yarn joining is performed in the yarn joining section 31.

[0033] In this state, a swirling current of the air is generated by jetting air inside the yarn joining hole 30 whereby twists are applied to the first yarn and the second yarn and the two yarns are connected. When the connection of the first yarn and the second yarn is completed, the hold on the first yarn (or the second yarn) by the clamping member 34 (or the clamping member 35) is released, and the operation of the yarn shifting lever 32 (or the yarn shifting lever 33) is stopped.

[0034] The first untwisting pipe 38 is for untwisting the first yarn. As shown in FIG. 7A, the first untwisting pipe 38 is a thin and elongated pipe. Moreover, the first untwisting pipe 38 has a substantially circular inner periphery in a cross-section (see FIG. 7B) taken along a plane orthogonal to a longitudinal direction thereof.

[0035] One first air blowing hole 45 is formed in the first untwisting pipe 38. The first air blowing hole 45 is a through-hole with a circular or an elliptical cross-section. In a cross-section (see FIG. 7A) taken along a plane parallel to the longitudinal direction of the first untwisting pipe

38, the first air blowing hole 45 is formed in an inclined manner such that the first air blowing hole 45 goes away from an inlet 38a of the first untwisting pipe 38 as the first air blowing hole 45 approaches an inside of the first untwisting pipe 38 from an outside thereof. The inlet 38a is an inlet portion of the first untwisting pipe 38. In the cross-section (see FIG. 7B) taken along the plane orthogonal to the longitudinal direction of the first untwisting pipe 38, the first air blowing hole 45 is formed so that a central axis thereof is orthogonal to the inner periphery (circular portion) of the first untwisting pipe 38 (in other words, a center of the first untwisting pipe 38 falls on the central axis of the first air blowing hole 45 when the central axis is extended).

[0036] Air (compressed air) is supplied from a later-explained air supplying section 50 in a space around the outer periphery of the first untwisting pipe 38. This air jets inside the first untwisting pipe 38 from the first air blowing hole 45 (as shown with a thick arrow in FIG. 7A and 7B). The swirling current is generated when this air current collides with an inner peripheral wall of the first untwisting pipe 38. The end of the first yarn (the spun yarn 10 from the package 28) is untwisted when it is whirled by this air current.

[0037] The second untwisting pipe 39 is for untwisting the second yarn. As shown in FIG. 8A, the second untwisting pipe 39 is a thin and elongated pipe. Moreover, the second untwisting pipe 39 has a substantially circular inner periphery in a cross-section (see FIG. 8B) taken along a plane orthogonal to a longitudinal direction thereof.

[0038] Second air blowing holes 46 to 49 are formed in the second untwisting pipe 39. The second air blowing holes 46 to 49 are through-holes with a circular or an elliptical cross-section. In a cross-section (see FIG. 8A) taken along a plane parallel to the longitudinal direction of the second untwisting pipe 39, the second air blowing holes 46 to 49 are formed in an inclined manner such that the second air blowing holes 46 to 49 go away from an inlet 39a of the second untwisting pipe 39 as the second air blowing holes 46 to 49 approach inside of the second untwisting pipe 39 from an outside thereof. The inlet 39a is an inlet portion of the second untwisting pipe 39. In the cross-section (see FIG. 8B) taken along the plane orthogonal to the longitudinal direction of the second untwisting pipe 39, the second air blowing holes 46 to 49 are formed so that central axes thereof go along the circular inner periphery of the second untwisting pipe 39. That is, in the cross-section (see FIG. 8B) taken along the plane orthogonal to the longitudinal direction of the second untwisting pipe 39, the second air blowing holes 46 to 49 are formed tangentially to the circular inner periphery of the second untwisting pipe 39. Each of the second air blowing holes 46 to 49 is formed at a position that is separated by 90 degrees in a peripheral direction from an adjoining second air blowing hole.

[0039] Air (the compressed air) is supplied from the later-explained air supplying section 50 in a space around

the outer periphery of the second untwisting pipe 39. This air jets inside the second untwisting pipe 39 from the second air blowing holes 46 to 49 (as shown with thick arrows in FIG. 8A and 8B). Because the air is jetted tangentially to the circular inner periphery of the second untwisting pipe 39 from the second air blowing holes 46 to 49, a swirling current is more easily generated in the second untwisting pipe 39 in comparison with the first untwisting pipe 38. Particularly, because the number of the second air blowing holes 46 to 49 is larger than the number of the first air blowing hole 45, a stronger swirling current is generated in the second untwisting pipe 39 than in the first untwisting pipe 38. The end of the second yarn (the spun yarn 10 from the air spinning device 9) is untwisted when it is whirled by this air current. Even in a situation where the second yarn is difficult to untwist, the stronger swirling current generated inside the second untwisting pipe 39 gives a physical impact to the second yarn and makes it fluffy. When the second yarn is fluffy, because the second yarn and the first yarn entwine during the yarn joining, a stronger joint is formed between the two yarns.

[0040] The ease of untwisting of the first yarn and the second yarn can sometimes be different; however, by generating air currents having different physical properties by using the first untwisting pipe 38 and the second untwisting pipe 39 having different physical properties as discussed above, both the spun yarns 10 can be surely untwisted.

[0041] A configuration that supplies the air to both the first untwisting pipe 38 and the second untwisting pipe 39 is explained below with reference to FIG. 9.

[0042] An air supplying system that includes the spinning frame 1 includes the air supplying section 50 and a regulating section 51. The air supplying section 50 supplies air and it is, for example, a compressor and the like. The air supplying section 50 is installed outside the spinning frame 1. The regulating section 51 is installed inside the spinning frame 1. That is, the spinning frame 1 includes the regulating section 51. The regulating section 51 is capable of separately regulating an amount of air to be supplied to the first untwisting pipe 38 and the second untwisting pipe 39. The regulating section 51 includes a first air amount regulating section 52, a first switching section 53, a second air amount regulating section 54, a second switching section 55, and a yarn joining controlling section 56. Air is supplied to the first air amount regulating section 52 and the second air amount regulating section 54 from the air supplying section 50.

[0043] The first air amount regulating section 52 regulates the amount of air to be supplied to the first switching section 53 (or the first untwisting pipe 38) by regulating a surface area of the flow path and the like. The first switching section 53 is capable of switching between supply and no-supply of the air to the first untwisting pipe 38. The first air amount regulating section 52 and the first switching section 53 are controlled by the yarn joining controlling section 56.

[0044] The second air amount regulating section 54 regulates the amount of air to be supplied to the second switching section 55 (or the second untwisting pipe 39) by regulating a surface area of the flow path and the like. The second switching section 55 is capable of switching between supply and no-supply of the air to the second untwisting pipe 39. The second air amount regulating section 54 and the second switching section 55 are controlled by the yarn joining controlling section 56.

[0045] In the present embodiment, the second yarn is more difficult to untwist than the first yarn, so that the number of the air blowing holes and the directions thereof are set such that a stronger swirling current is generated in the second untwisting pipe 39 than in the first untwisting pipe 38. In addition, the yarn joining controlling section 56 controls the first air amount regulating section 52 and the second air amount regulating section 54 so that more air is supplied to the second untwisting pipe 39 than to the first untwisting pipe 38. Thus, the manner in which the untwisting is performed can be made to differ greatly in the first yarn and the second yarn. Particularly, even if the second yarn is difficult to untwist, by applying a physical impact to the second yarn as mentioned earlier, the joint between the yarns can be made stronger.

[0046] The yarn joining controlling section 56 is capable of regulating a timing to generate the swirling current and a timing to stop the swirling current in the first untwisting pipe 38 (or the second untwisting pipe 39) by controlling the first switching section 53 (or the second switching section 55). For example, the first yarn (or the second yarn) may shift from a desired position if the timing to generate the swirling current is early. The time available for performing the untwisting becomes short if the timing to generate the swirling current is late. Therefore, the yarn joining controlling section 56 controls the first switching section 53 (or the second switching section 55) to generate the swirling current at an appropriate timing decided beforehand. The yarn joining controlling section 56 controls the first switching section 53 (or the second switching section 55) so that the generation of the swirling current is stopped at a timing that does not adversely affect the yarn joining performed after the untwisting operation is over.

[0047] As explained above, the yarn joining device 93 according to the present embodiment includes the first untwisting pipe 38, the second untwisting pipe 39, and the yarn joining section 31. The first untwisting pipe 38 is pipe-shaped. The first air blowing hole 45 is formed in the first untwisting pipe 38. The air jetted inside the first untwisting pipe 38, to generate the air current inside the first untwisting pipe 38, passes through the first air blowing hole 45. The first untwisting pipe 38 applies the air current to the first yarn (the spun yarn 10) and untwists the first yarn. The second untwisting pipe 39 is also pipe-shaped. The first untwisting pipe 38 and the second untwisting pipe 39 have different shapes. The second air blowing holes 46 to 49 are formed in the second untwisting pipe 39. The air jetted inside the second untwisting

pipe 39, to generate the air current inside the second untwisting pipe 39, passes through the second air blowing holes 46 to 49. The second untwisting pipe 39 applies the air current to the second yarn (spun yarn 10) and untwists the second yarn. The yarn joining section 31 joins the first yarn untwisted by the first untwisting pipe 38 and the second yarn untwisted by the second untwisting pipe 39.

[0048] Because the first untwisting pipe 38 and the second untwisting pipe 39 have different shapes, the amount of air in the air current (swirling current), the direction of the air current, and the like in each of these pipes can be made different. Therefore, different untwisting forces are applied on the first yarn and the second yarn.

[0049] In the yarn joining device 93 according to the present embodiment, the second air blowing holes 46 to 49 are more in number than the first air blowing hole 45.

[0050] Accordingly, the amount of air in the air current generated in the second untwisting pipe 39 is more than the amount of air in the air current generated in the first untwisting pipe 38.

[0051] In the yarn joining device 93 according to the present embodiment, the inner periphery in the cross-section taken along the plane orthogonal to the longitudinal direction of the first untwisting pipe 38 and the second untwisting pipe 39 is substantially circular. The first air blowing hole 45, when seen along the axis direction of the first untwisting pipe 38, is formed orthogonal to the circular inner periphery of the first untwisting pipe 38. The second air blowing holes 46 to 49, when seen along the axis direction of the second untwisting pipe 39, are formed so that they go along the circular inner periphery of the second untwisting pipe 39.

[0052] Accordingly, a stronger air current is generated in the second untwisting pipe 39 than in the first untwisting pipe 38. Therefore, for example, even if the spun yarn 10 is such that enough untwisting cannot be applied thereto, the strength of the joint can be secured by making the spun yarn 10 fluffy in the second untwisting pipe 39.

[0053] The yarn joining device 93 according to the present embodiment includes the regulating section 51 capable of separately regulating the amount of air to be supplied to the first untwisting pipe 38 and the second untwisting pipe 39.

[0054] Accordingly, the amount of air in the air current generated in the first untwisting pipe 38 and the amount of air in the air current generated in the second untwisting pipe 39 can be easily changed.

[0055] In the yarn joining device 93 according to the present embodiment, the amount of air supplied to the second untwisting pipe 39 is more than the amount of air supplied to the first untwisting pipe 38.

[0056] Accordingly, the amount of air in the air current generated in the second untwisting pipe 39 is more than the amount of air in the air current generated in the first untwisting pipe 38.

[0057] In the yarn joining device 93 according to the present embodiment, the regulating section 51 includes

the first switching section 53, the first air amount regulating section 52, the second switching section 55, and the second air amount regulating section 54. The first switching section 53 switches between supply and no-supply of the air to the first untwisting pipe 38. The first air amount regulating section 52 regulates the amount of air to be supplied to the first untwisting pipe 38. The second switching section 55 switches between supply and no-supply of the air to the second untwisting pipe 39. The second air amount regulating section 54 regulates the amount of air to be supplied to the second untwisting pipe 39.

[0058] Accordingly, not only the amount of air in the air current generated in the first untwisting pipe 38 and the second untwisting pipe 39, but also the timings to generate and stop the air current (i.e., a duration of time for which the untwisting operation is performed) can be regulated separately.

[0059] A second embodiment according to the present invention in which the present invention is applied to an automatic winder is explained below. The automatic winder includes plural winder units 100 arranged side-by-side. The automatic winder includes the yarn joining device 93 having the same configuration as explained in the first embodiment.

[0060] With reference to FIG. 10, a configuration of the winder unit 100 is explained briefly below. The winder unit 100 winds a spun yarn 82 unwound from a yarn supplying package 81, while applying a predetermined winding tension on the spun yarn 82 with a tension applying member 83, on a surface of a winding package 89 by using a winding drum 88 of a winding device 87 while traversing the spun yarn 82.

[0061] The winder unit 100 includes a yarn detecting device 86, a first catching member 84, a second catching member 85, and the yarn joining device 93. The yarn detecting device 86, for example, monitors presence / absence of a yarn defect in the running spun yarn 82. The first catching member 84 catches the spun yarn 82 (the first yarn) from the winding package 89 when a yarn disconnection occurs. The second catching member 85 catches the spun yarn 82 (the second yarn) from the yarn supplying package 81. The yarn joining device 93 joins the first yarn and the second yarn. In the second embodiment, the spun yarn 82 from the yarn supplying package 81 is wound into the winding package 89. Alternatively, the spun yarn 82 from a yarn supplying bobbin formed in a ring spinning frame can be wound into the winding package 89.

[0062] Exemplary embodiments of the present invention are explained above. The structure explained above can, for example, be modified as follows.

[0063] Among the two untwisting pipes, the air supply to which one of the untwisting pipes is to be increased, or the number of the air blowing holes in which one of the untwisting pipes is to be made larger can be decided appropriately. For example, the air supply to which one of the untwisting pipes is to be increased and the like can

be decided depending on the ease of or difficulty in untwisting the spun yarn, whether the location is relatively above or below in the vertical direction in the yarn winding machine (a spinning frame, an automatic winder, and the like), or whether the location is relatively upstream or downstream in the yarn path, and the like.

[0064] The number of the air blowing holes formed in the first untwisting pipe 38 and the second untwisting pipe 39, the directions of the air blowing holes (direction in a cross-section taken along a plane orthogonal to a longitudinal direction of the untwisting pipe), and the shapes of the air blowing holes mentioned above are all exemplary, and one or more of these can be changed appropriately. The angle of inclination of the air blowing holes in the cross-section taken along a plane parallel to the longitudinal direction of the untwisting pipes can be set different in the first untwisting pipe 38 and the second untwisting pipe 39. The positions (e.g., the distance from the inlet 38a or the inlet 39a) of the air blowing holes in the cross-section taken along a plane parallel to the longitudinal direction of the untwisting pipes can be set different in the first untwisting pipe 38 and the second untwisting pipe 39. The hole diameters of the air blowing holes can be set different in the first untwisting pipe 38 and the second untwisting pipe 39. Furthermore, the diameters and/or the lengths of the untwisting pipes can be set different in the first untwisting pipe 38 and the second untwisting pipe 39.

[0065] In the first embodiment, the spun yarn 10 is drawn from the air spinning device 9 by rotating the yarn accumulating roller 15 of the yarn accumulating device 14. Alternatively, the spun yarn can be pinched between a delivery roller and a nip roller and drawn from the spinning device by rotating the delivery roller and the nip roller. When this configuration is employed, a slack tube that temporarily accumulates the spun yarn 10 by sucking the spun yarn 10 can be provided instead of the yarn accumulating device 14 having the yarn accumulating roller 15.

[0066] In the first embodiment, the layout is such that the package 28 is formed at a position that is below the air spinning device 9. Alternatively, the package 28 can be formed at a position that is above the air spinning device 9.

[0067] According to one aspect of the present invention, a yarn joining device includes a first untwisting section, a second untwisting section, and a yarn joining section. The first untwisting section is a pipe-shaped member. The first untwisting section has a first air blowing hole formed therein for passing air to generate an air current inside thereof. The first untwisting section applies the air current on a first yarn and untwists the first yarn. The second untwisting section is also a pipe-shaped member. The second untwisting section has a different shape from that of the first untwisting section. The second untwisting section has a second air blowing hole formed therein for passing air to generate an air current inside thereof. The second untwisting section applies the air

current on a second yarn and untwists the second yarn. The yarn joining section joins the first yarn untwisted by the first untwisting section and the second yarn untwisted by the second untwisting section.

[0068] Accordingly, because the first untwisting section and the second untwisting section have different shapes, the amount of air in the air current, the direction of the air current, and the like in each of these sections can be made different. Therefore, different untwisting forces are applied on the first yarn and the second yarn.

[0069] In the above yarn joining device, the number of the second air blowing holes is higher than the number of the first air blowing hole.

[0070] Accordingly, the amount of air in the air current generated in the second untwisting section is more than the amount of air in the air current generated in the first untwisting section.

[0071] In the above yarn joining device, the first untwisting section and the second untwisting section have a substantially circular inner periphery in a cross-section taken along a plane orthogonal to a longitudinal direction thereof, the first air blowing hole, when seen along an axis direction of the first untwisting section, is formed orthogonal to the circular inner periphery of the first untwisting section, and the second air blowing holes, when seen along an axis direction of the second untwisting section, are formed along the circular inner periphery of the second untwisting section.

[0072] Accordingly, a stronger air current is generated in the second untwisting section than in the first untwisting section. Therefore, for example, even if a yarn is such that enough untwisting cannot be applied thereto, the strength of the joint can be secured by making the yarn fluffy in the second untwisting section.

[0073] In the above yarn joining device, number of the first air blowing hole is one, and number of the second air blowing holes is four.

[0074] Accordingly, the amount of air in the air current generated in the second untwisting section is more than the amount of air in the air current generated in the first untwisting section. Therefore, for example, even if a yarn is such that enough untwisting cannot be applied thereto, the strength of the joint can be secured by making the yarn fluffy in the second untwisting section.

[0075] The above yarn joining device further includes a regulating section capable of separately regulating an amount of air to be supplied to the first untwisting section and an amount of air to be supplied to the second untwisting section.

[0076] Accordingly, the amount of air in the air current generated in the first untwisting section and the amount of air in the air current generated in the second untwisting section can be easily changed.

[0077] In the above yarn joining device, the amount of air supplied to the second untwisting section is more than the amount of air supplied to the first untwisting section.

[0078] Accordingly, the amount of air in the air current generated in the second untwisting section can be more

than the amount of air in the air current generated in the first untwisting section.

[0079] In the above yarn joining device, the regulating section includes a first switching section, a first air amount regulating section, a second switching section, and a second air amount regulating section. The first switching section is capable of switching air supply to the first untwisting section between on and off. The first air amount regulating section is capable of regulating the amount of air to be supplied to the first untwisting section. The second switching section is capable of switching air supply to the second untwisting section between on and off. The second air amount regulating section is capable of regulating the amount of air to be supplied to the second untwisting section.

[0080] Accordingly, not only the amount of air in the air current generated in the first untwisting section and the second untwisting section, but also the timings to generate and stop the air current (i.e., a duration of time for which the untwisting operation is performed) can be regulated separately.

[0081] According to another aspect of the present invention, a spinning machine includes the above yarn joining device, a drafting device, an air spinning device, and a winding section. The drafting device drafts a fiber bundle. The air spinning device forms a yarn by applying twists to the fiber bundle. The winding section forms a package by winding the yarn.

[0082] Accordingly, even if there are situations where the ease of untwisting is different for the two yarns produced in discontinuation of a yarn, both the yarns can be appropriately untwisted and joined.

[0083] In the above spinning machine, the air spinning device includes a fiber guiding member, a nozzle block, and a hollow guiding shaft. The fiber guiding member guides the fiber bundle to a spinning chamber. The nozzle block applies the twists to the fiber bundle by jetting air to generate a swirling current. The hollow guiding shaft member guides a spun yarn spun inside the spinning chamber.

[0084] Accordingly, yarn joining can be performed appropriately in a spinning machine that includes such an air spinning device.

[0085] According to still another aspect of the present invention, an automatic winder includes the above yarn joining device, and the automatic winder forms a new package by rewinding any one of a yarn supplying bobbin and a package on which a spun yarn has been wound.

[0086] Accordingly, yarn joining can be performed appropriately even in an automatic winder.

[0087] In the above explanation, the meaning of "plural" also includes "a predetermined number of".

[0088] Although the invention has been explained with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fall within the scope of the claims.

Claims**1.** A yarn joining device comprising:

a pipe-shaped first untwisting section (38) with a first air blowing hole (45) formed therein for passing air to generate an air current inside thereof that acts on a first yarn (10;82) and untwists the first yarn (10;82);
 a pipe-shaped second untwisting section (39), with at least one second air blowing hole (46-49) formed therein for passing air to generate an air current inside thereof that acts on a second yarn (10;82) and untwists the second yarn (10;82); and
 a yarn joining section (31) that joins the first yarn (10;82) untwisted by the first untwisting section (38) and the second yarn (10;82) untwisted by the second untwisting section (39), **characterized in that** the second untwisting section (39) has different physical properties than that of the first untwisting section (38) .

2. The yarn joining device as claimed in Claim 1, **characterized in that** the number of the second air blowing holes (46-49) formed in the second untwisting section (39) is higher than the number of the first air blowing holes (45) formed in the first untwisting section (38).**3.** The yarn joining device as claimed in Claim 2, **characterized in that** the first untwisting section (38) and the second untwisting section (39) have a substantially circular inner periphery in a cross-section taken along a plane orthogonal to a longitudinal direction thereof, the first air blowing hole (45), when seen along an axis direction of the first untwisting section (38), is formed orthogonal to the circular inner periphery of the first untwisting section (38), and the second air blowing holes (46-49), when seen along an axis direction of the second untwisting section (39), are formed along the circular inner periphery of the second untwisting section (39).**4.** The yarn joining device as claimed in any one of Claims 1 to 3, **characterized in that** number of the first air blowing hole (45) is one, and number of the second air blowing holes (46-49) is four.**5.** The yarn joining device as claimed in any one of Claims 1 to 4, **characterized in that** a shape of the first air blowing hole (45) is different from a shape of the second air blowing hole (46-49).**6.** The yarn joining device as claimed in any one of Claims 1 to 5, **characterized in that**

an angle of inclination of the first air blowing hole (45) is different from an angle of inclination of the second air blowing hole (46-49).

7. The yarn joining device as claimed in any one of Claims 1 to 6, **characterized in that** a hole diameter of the first air blowing hole (45) is different from a hole diameter of the second air blowing hole (46-49).**8.** The yarn joining device as claimed in any one of Claims 1 to 7, **characterized in that** a diameter of the first untwisting section (38) is different from a diameter of the second untwisting section (39) .**9.** The yarn joining device as claimed in any one of Claims 1 to 8, further **characterized by:** a regulating section (51) capable of separately regulating an amount of air to be supplied to the first untwisting section (38) and an amount of air to be supplied to the second untwisting section (39).**10.** The yarn joining device as claimed in Claim 9, **characterized in that** the regulating section (51) regulates the amount of air to be supplied to the second untwisting section (39) to be higher than the amount of air to be supplied to the first untwisting section (38),**11.** The yarn joining device as claimed in Claim 9 or 10, **characterized in that** the regulating section (51) includes a first switching section (53) capable of switching air supply to the first untwisting section (38) between on and off, a first air amount regulating section (52) capable of regulating the amount of air to be supplied to the first untwisting section (38), a second switching section (55) capable of switching air supply to the second untwisting section (39) between on and off, a second air amount regulating section (54) capable of regulating the amount of air to be supplied to the second untwisting section (39).**12.** A spinning machine comprising:

the yarn joining device as claimed in any one of Claims 1 to 11;
 a drafting device (7) that drafts a fiber bundle (8);
 an air spinning device (9) that forms a yarn by applying twists to the fiber bundle (8); and
 a winding section (96) that forms a package (28) by winding the yarn.

13. The spinning machine as claimed in Claim 12, **characterized in that** the air spinning device includes

a fiber guiding member (61) that guides the fiber bundle (8) to a spinning chamber (62);
 a nozzle block (60) that applies the twists to the fiber bundle (8) by jetting air to generate a swirling current; and
 a hollow guiding shaft member (71) that guides a spun yarn (10;82) spun inside the spinning chamber (62).

14. An automatic winder comprising the yarn joining device as claimed in any one of Claims 1 to 11, **characterized in that** the automatic winder forms a new package (28) by rewinding any one of a yarn supplying bobbin and a package (81) on which a spun yarn (10;82) has been wound.

Patentansprüche

1. Fadenverbindungs­vorrichtung, welche aufweist:

einen rohrförmigen ersten Auf­drehab­schnitt (38), in dem ein erstes Luft­blasloch (45) ausgebildet ist, zum Leiten von Luft, um in seinem Inneren einen Luftstrom zu erzeugen, der auf einen ersten Faden (10; 82) wirkt und den ersten Faden (10; 82) auf­dreht;
 einen rohrförmigen zweiten Auf­drehab­schnitt (39), in dem zumindest ein zweites Luft­blasloch (46-49) ausgebildet ist, zum Leiten von Luft, um in seinem Inneren einen Luftstrom zu erzeugen, der auf einen zweiten Faden (10; 82) wirkt und den zweiten Faden (10; 82) auf­dreht; und
 einen Faden­ver­bindungs­abschnitt (31), der den von dem ersten Auf­drehab­schnitt (38) auf­gedrehten ersten Faden (10; 82) mit dem von dem zweiten Auf­drehab­schnitt (39) auf­gedrehten zweiten Faden (10; 82) verbindet, **dadurch gekennzeichnet, dass** der zweite Auf­drehab­schnitt (39) vom ersten Auf­drehab­schnitt (38) verschiedene physikalische Eigenschaften hat.

2. Die Faden­ver­bindungs­vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Anzahl der im zweiten Auf­drehab­schnitt (39) ausgebildeten Luft­blaslöcher (46-49) höher ist als die Anzahl der im ersten Auf­drehab­schnitt (38) ausgebildeten Luft­blaslöcher (45).

3. Die Faden­ver­bindungs­vorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** der erste Auf­drehab­schnitt (38) und der zweite Auf­drehab­schnitt (39) im Querschnitt entlang einer Ebene orthogonal zur Längsrichtung einen im Wesentlichen kreisförmigen Innen­umfang aufweist, das erste Luft­blasloch (45), bei Betrachtung entlang einer Achsrichtung des ersten Auf­drehab­schnitts

(38), orthogonal zum kreisförmigen Innen­umfang des ersten Auf­drehab­schnitts (38) ausgebildet ist, und
 die zweiten Luft­blaslöcher (46-49) bei Betrachtung entlang einer Achsrichtung des zweiten Auf­drehab­schnitts (39), entlang dem kreisförmigen Innen­umfang des zweiten Auf­drehab­schnitts (39) ausgebildet sind.

4. Die Faden­ver­bindungs­vorrichtung nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Anzahl der ersten Luft­blaslöcher (45) eins ist, und die Anzahl der zweiten Luft­blaslöcher (46-49) vier ist.

5. Die Faden­ver­bindungs­vorrichtung nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** eine Form des ersten Luft­blaslochs (45) von einer Form des zweiten Luft­blaslochs (46-49) verschieden ist.

6. Die Faden­ver­bindungs­vorrichtung nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** ein Neigungswinkel des ersten Luft­blaslochs (45) von einem Neigungswinkel des zweiten Luft­blaslochs (46-49) verschieden ist.

7. Die Faden­ver­bindungs­vorrichtung nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** ein Loch­durchmesser des ersten Luft­blaslochs (45) vom einem Loch­durchmesser des zweiten Luft­blaslochs (46-49) verschieden ist.

8. Die Faden­ver­bindungs­vorrichtung nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** ein Durchmesser des ersten Auf­drehab­schnitts (38) von einem Durchmesser des zweiten Auf­drehab­schnitts (39) verschieden ist.

9. Die Faden­ver­bindungs­vorrichtung nach einem der Ansprüche 1 bis 8, ferner **gekennzeichnet durch:** einen Regulierabschnitt (51), der in der Lage ist, eine dem ersten Auf­drehab­schnitt (38) zuzuführende Luftmenge und eine dem zweiten Auf­drehab­schnitt (39) zuzuführende Luftmenge separat zu regulieren.

10. Die Faden­ver­bindungs­vorrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** der Regulierabschnitt (51) die dem zweiten Auf­drehab­schnitt (39) zuzuführende Luftmenge so reguliert, dass sie höher ist als die dem ersten Auf­drehab­schnitt (38) zuzuführende Luftmenge.

11. Die Faden­ver­bindungs­vorrichtung nach Anspruch 9 oder 10, **dadurch gekennzeichnet, dass** der Regulierabschnitt (51) enthält:

einen ersten Schaltabschnitt (53), der in der Lage ist, die Luftzufuhr zu dem ersten Auf­drehab­

schnitt (38) zwischen Ein und Aus umzuschalten,
 einen ersten Luftmengenregulierabschnitt (52),
 der in der Lage ist, die dem ersten Aufdrehabschnitt (38) zuzuführende Luftmenge zu regulieren,
 einen zweiten Schaltabschnitt (55), der in der Lage ist, die Luftzufuhr zu dem zweiten Aufdrehabschnitt (39) zwischen Ein und Aus umzuschalten,
 einen zweiten Luftmengenregulierabschnitt (54), der in der Lage ist, die dem zweiten Aufdrehabschnitt (39) zuzuführende Luftmenge zu regulieren.

12. Spinnmaschine, welche aufweist:

eine Fadenverbindungs Vorrichtung nach einem der Ansprüche 1 bis 11;
 eine Streckvorrichtung (7), die ein Faserbündel (8) streckt;
 eine Luftspinnmaschine (9), die durch Verdrehen des Faserbündels (8) einen Faden bildet; und
 einen Wickelabschnitt (96), der durch Aufwickeln des Fadens eine Packung (28) bildet.

13. Die Spinnmaschine nach Anspruch 12, **dadurch gekennzeichnet, dass** die Luftspinnmaschine enthält:

ein Faserführungselement (61), das das Faserbündel (8) einer Spinnkammer (62) zuführt;
 einen Düsenblock (60), der das Faserbündel (8) verdreht, indem er Luft zum Erzeugen eines Wirbelstroms auswirft; und
 ein hohles Führungsschaftelement (71), das einen innerhalb der Spinnkammer (62) gesponnenen Faden (10; 82) führt.

14. Automatischer Wickler, der die Fadenverbindungs Vorrichtung nach einem der Ansprüche 1 bis 11 aufweist, **dadurch gekennzeichnet, dass** der automatische Wickler eine neue Packung (28) bildet, indem er eine Fadenzuführspule oder eine Packung (81), auf die ein gesponnener Faden (10; 82) gewickelt worden ist, umwickelt.

Revendications

1. Un dispositif d'assemblage de fil, comprenant :

une première section de détorsion tubulaire (38) avec une première ouverture d'air soufflé (45) formée là-dedans pour faire passer de l'air pour générer un courant d'air dedans qui agit sur un premier fil (10;82) et détord le premier fil (10;82) ;

une deuxième section de détorsion tubulaire (39) avec au moins une deuxième ouverture d'air soufflé (46-49) formée là-dedans pour faire passer de l'air pour générer un courant d'air dedans qui agit sur un deuxième fil (10;82) et détord le deuxième fil (10 ;82) ; et
 une section d'assemblage de fil (31) qui rattache le premier fil (10;82) détordu par la première section de détorsion (38) et le deuxième fil (10;82) détordu par la deuxième section de détorsion (39) **caractérisé en ce que** la deuxième section de détorsion (39) a des caractéristiques physiques différents de ceux de la première section de détorsion (38).

2. Le dispositif d'assemblage de fil selon la revendication 1,

caractérisé en ce que le nombre de deuxième ouvertures d'air soufflé (46-49) formées dans la deuxième section de détorsion (39) est plus grande que le nombre de premières ouvertures d'air soufflé (45) formées dans la première section de détorsion (38).

3. Le dispositif d'assemblage de fil selon la revendication 2,

caractérisé en ce que la première section de détorsion (38) et la deuxième section de détorsion (39) ont une périphérie intérieur essentiellement circulaire dans une section transversale le long d'un plan orthogonal à un sens longitudinal de celle-ci, la première ouverture d'air soufflé (45), vue le long d'un sens axial de la première section de détorsion (38), est formée de manière orthogonal à la première périphérie intérieur de la première section de détorsion (38), et
 les deuxième ouvertures d'air soufflé (46-49) vues le long d'un sens axial de la deuxième section de détorsion (39) sont formées le long de la périphérie intérieur circulaire de la deuxième section de détorsion tubulaire (39).

4. Le dispositif d'assemblage de fil selon une des revendications 1 à 3,

caractérisé en ce que le nombre de la première ouverture d'air soufflé (45) est un, et
 le nombre des deuxième ouvertures d'air soufflé (46-49) est quatre.

5. Le dispositif d'assemblage de fil selon une des revendications 1 à 4,

caractérisé en ce que une forme de la première ouverture d'air soufflé (45) est différente de la forme de la deuxième ouverture d'air soufflé (46-49).

6. Le dispositif d'assemblage de fil selon une des re-

vendications 1 à 5,

caractérisé en ce que

un angle d'inclinaison de la première ouverture d'air soufflé (45) est différent d'un angle d'inclinaison de la deuxième ouverture d'air soufflé (46-49).

7. Le dispositif d'assemblage de fil selon une des revendications 1 à 6,

caractérisé en ce que

un diamètre d'ouverture de la première ouverture d'air soufflé (45) est différent d'un diamètre d'ouverture de la deuxième ouverture d'air soufflé (46-49).

8. Le dispositif d'assemblage de fil selon une des revendications 1 à 7,

caractérisé en ce que

un diamètre de la première section de détorsion (38) est différent d'un diamètre de la deuxième section de détorsion (39).

9. Le dispositif d'assemblage de fil selon une des revendications 1 à 8,

caractérisé en outre par :

une section de réglage (51) capable de régler séparément une quantité d'air à être fournie à la première section de détorsion (38) et une quantité d'air à être fournie à la deuxième section de détorsion (39).

10. Le dispositif d'assemblage de fil selon la revendication 9,

caractérisé en ce que

la section de réglage (51) règle la quantité d'air à être fournie à la deuxième section de détorsion (39) de sorte qu'elle soit plus grande que la quantité d'air à être fournie à la première section de détorsion (38).

11. Le dispositif d'assemblage de fil selon la revendication 9 ou 10,

caractérisé en ce que la section de réglage (51) comprend :

une première section de commutation (53) capable de commuter l'alimentation en air à la première section de détorsion (38) entre ON et OFF,

une première section de réglage de quantité d'air (52) capable de régler la quantité d'air à être fournie à la première section de détorsion (38),

une deuxième section de commutation (55) capable de commuter l'alimentation en air à la deuxième section de détorsion (39) entre ON et OFF,

une deuxième section de réglage de quantité d'air (54) capable de régler la quantité d'air à être fournie à la première section de détorsion (39).

12. Une machine à filer, comprenant :

le dispositif d'assemblage de fil selon une des revendications 1 à 11 ;

un dispositif d'étirage (7) qui étire un faisceau de fibres (8) ;

un dispositif pour filer à jet d'air (9) qui forme un fil en appliquant des torsions au faisceau de fibres (8) ; et

une section de bobinage (96) qui forme un paquet (28) en enroulant le fil.

13. La machine à filer selon la revendication 12, **caractérisée en ce que** le dispositif pour filer à jet d'air comprend

un membre de guidage de fibre (61) qui guide le faisceau de fibres (8) à une chambre de filage (62) ; un ensemble de buses (60) qui applique les torsions au faisceau de fibres (8) par des jets d'air pour générer un courant tourbillonnant ; et

un membre d'arbre guidant creux (71) qui guide un fil filé (10;82) filé à l'intérieur de la chambre de filage (62).

14. Un enrouleur automatique comprenant le dispositif d'assemblage de fil selon une des revendications 1 à 11, **caractérisé en ce que**

l'enrouleur automatique forme un nouveau paquet (28) par rembobinage d'un parmi bobine d'alimentation de fil et paquet (81) sur lequel un fil file (10;82) a été enroulé.

FIG. 1

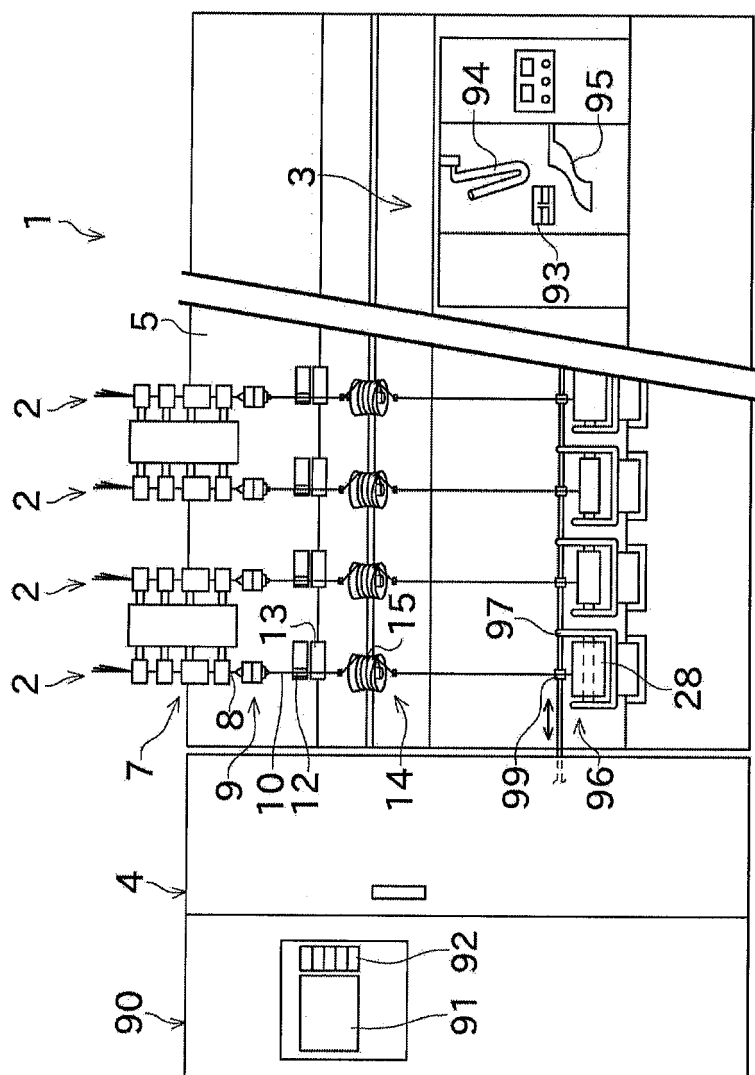


FIG.2

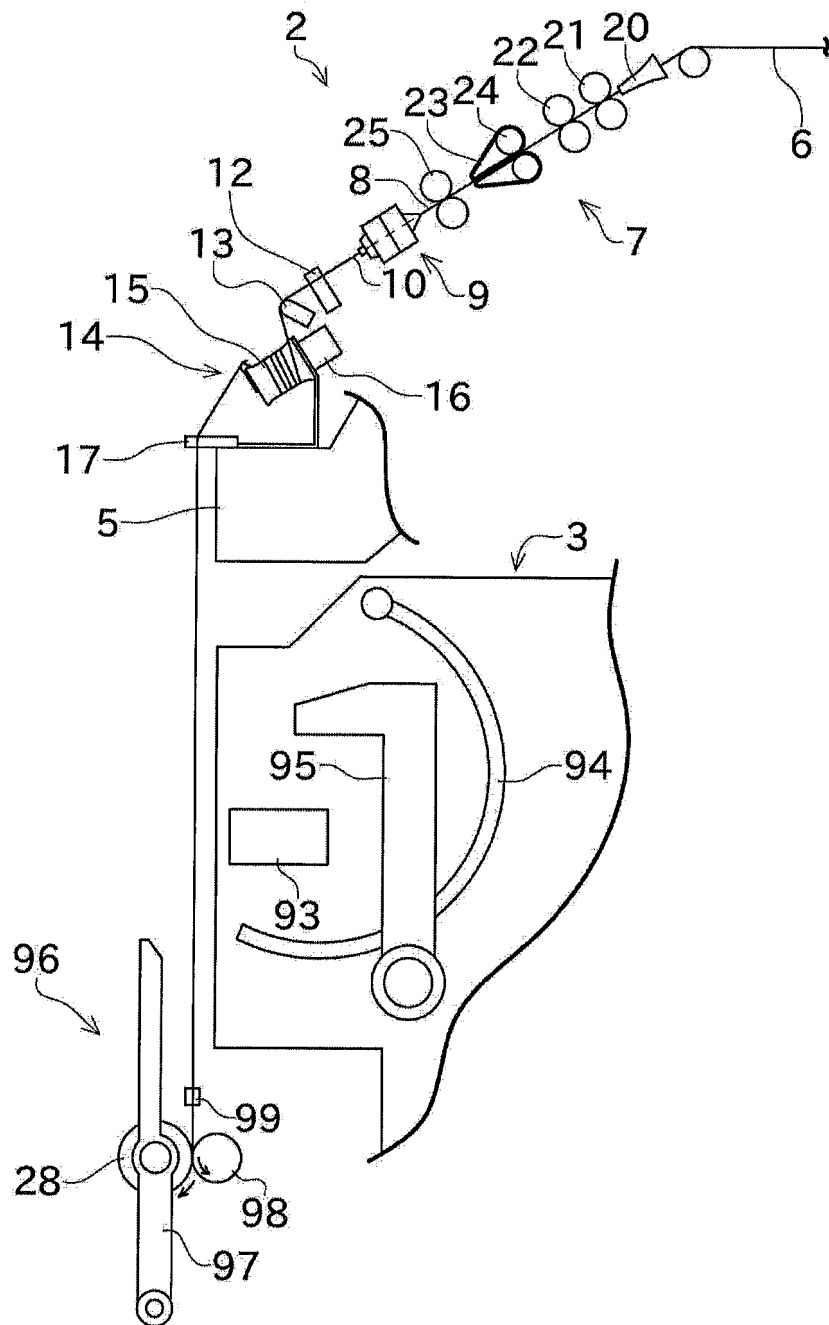


FIG.3

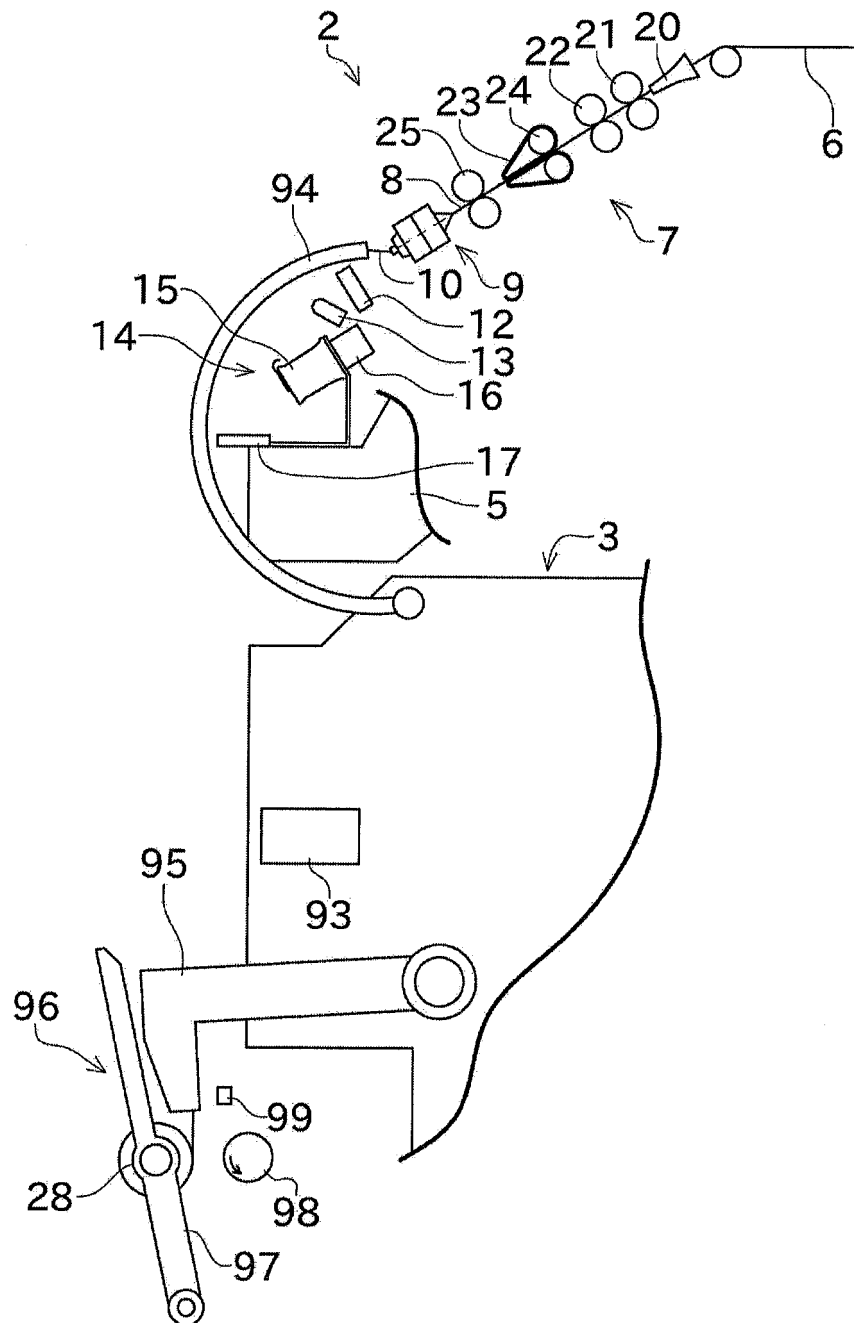


FIG.4

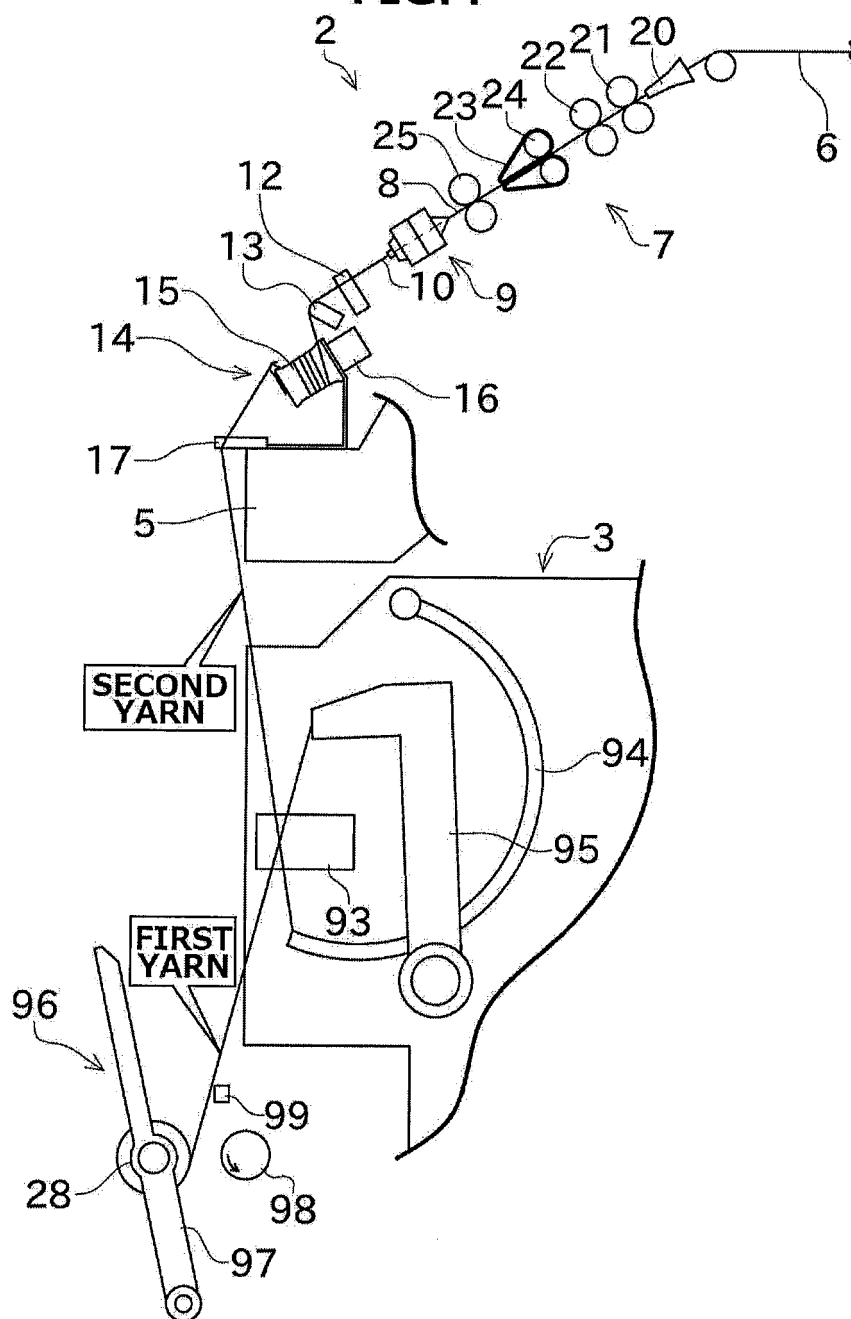


FIG.5

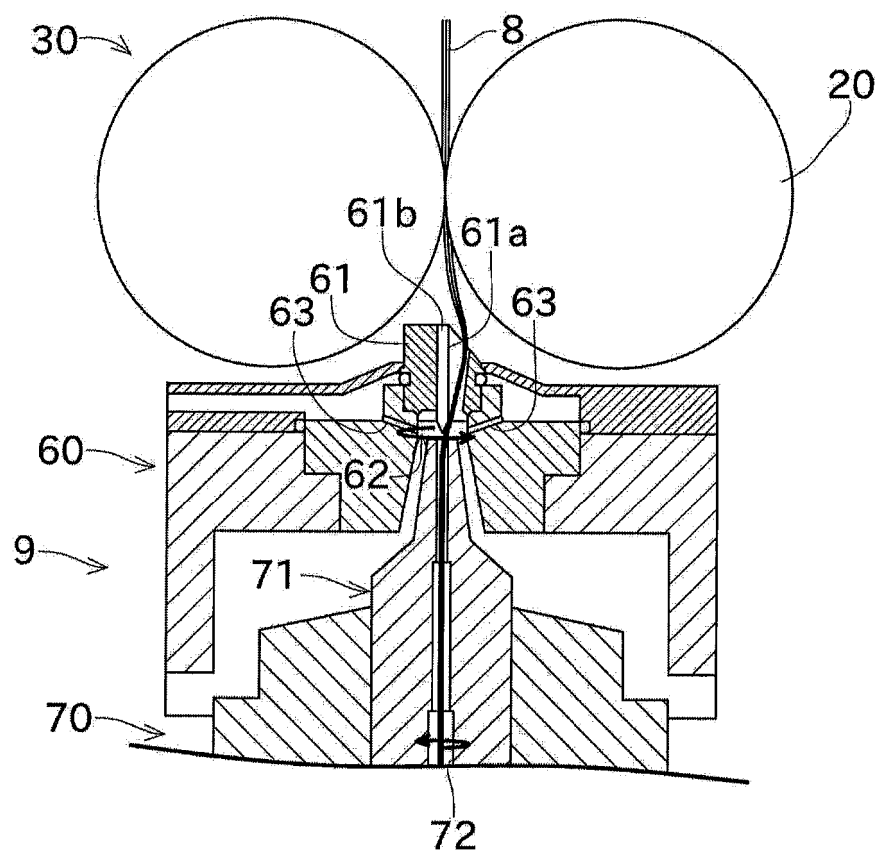


FIG.6

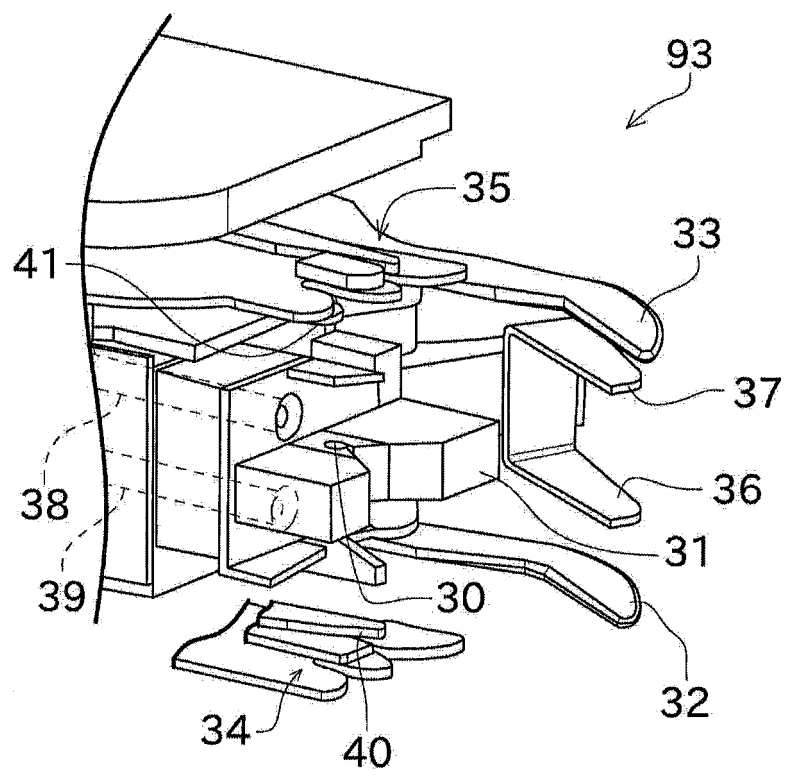


FIG.7A

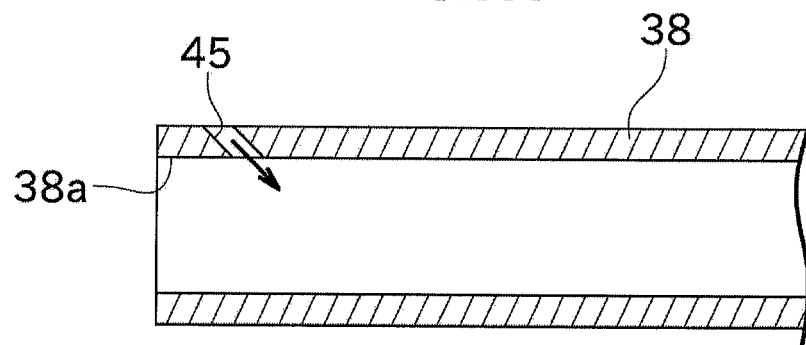


FIG.7B

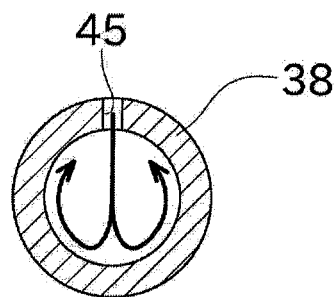


FIG.8A

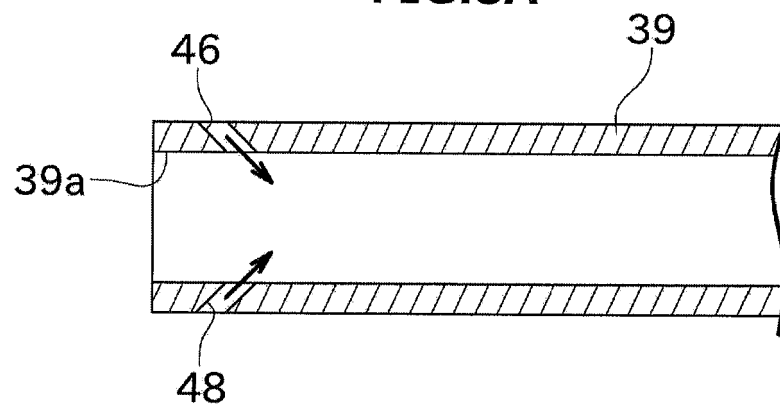


FIG.8B

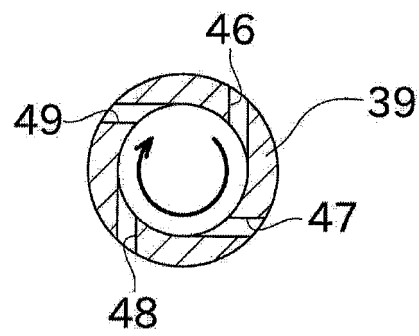


FIG.9

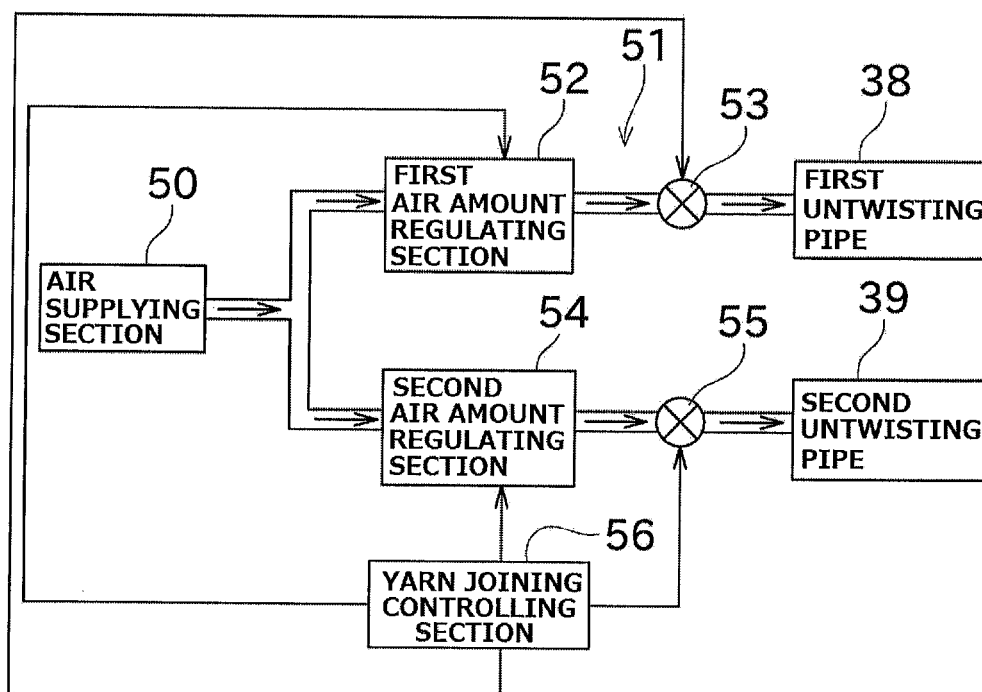
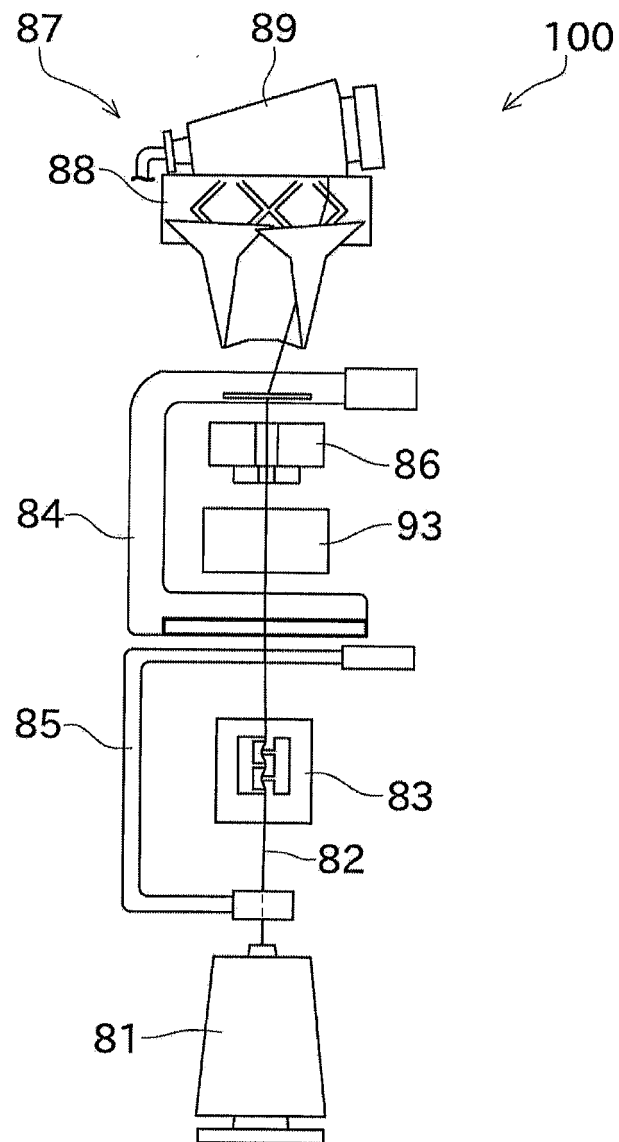


FIG.10



REFERENCES CITED IN THE DESCRIPTION

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