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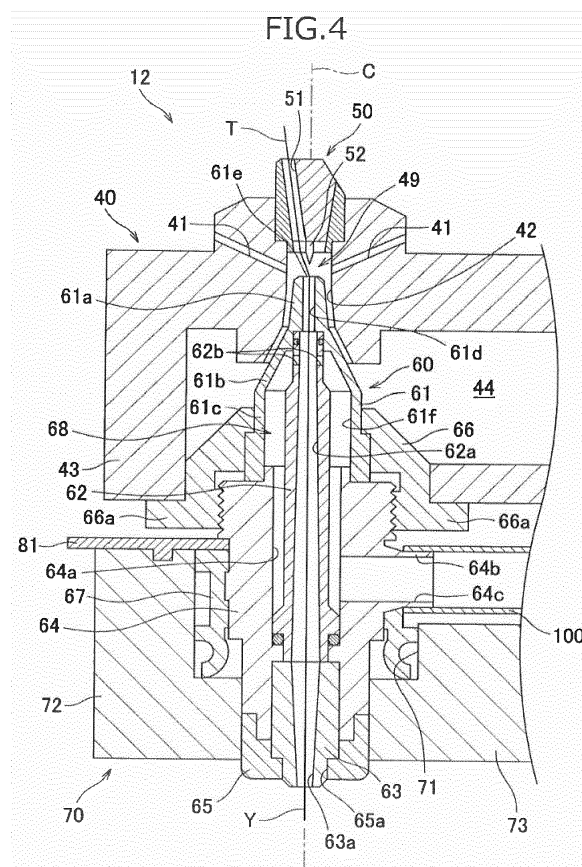
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(54) **AIR SPINNING DEVICE**

(57) Provided is an air spinning device (12) that twists a fiber bundle (T) by a swirling air current occurring in a spinning chamber (49) to form a yarn (Y). The air spinning device (12) includes a hollow guiding shaft unit (60) including a hollow guiding shaft (61, 62, 63) whose tip end part (61a) is arranged in the spinning chamber (49) and in which a fiber passage (61d, 62a, 63a) is formed along an axis line (C); and a rotating unit that rotates the hollow guiding shaft unit (60) around the axis line (C) in forward and reverse directions in a predetermined range.



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an air spinning device that performs spinning by using a swirling air current.

2. Description of the Related Art

[0002] For example, the air spinning device disclosed in Japanese Patent Application Laid-Open No. 2016-125149 generates a swirling air current in a spinning chamber by jetting air from a plurality of nozzles arranged around the spinning chamber. A tip end part of a hollow guiding shaft is arranged inside the spinning chamber. A fiber bundle is twisted as the ends of the fibers in the fiber bundle are reversed and swirled around the tip end part of the hollow guiding shaft by the swirling air current. The yarn formed by twisting the fiber bundle is sent downstream via a fiber passage formed along an axis line of the hollow guiding shaft.

[0003] In such an air spinning device, the hollow guiding shaft wears down when the fibers contact the tip end part of the hollow guiding shaft. Of the entire tip end part of the hollow guiding shaft, the wearing down is concentrated at specific locations corresponding to the positions of the nozzles, and grooves may be formed at those locations. Because such grooves adversely affect the quality of the formed yarn, it is desirable to prevent such concentrating of the wearing down at the specific locations. To address this issue, Japanese Patent Application Laid-Open No. 2016-125149 teaches to periodically rotate the hollow guiding shaft around the axis line thereof to scatter the locations at which such wearing down occurs.

[0004] In the air spinning device disclosed in Japanese Patent Application Laid-Open No. 2016-125149, to rotate the hollow guiding shaft around the axis line thereof, it was necessary to once disassemble a hollow guiding shaft unit including the hollow guiding shaft, fixing members that fix the hollow guiding shaft, and the like, and reassemble the hollow guiding shaft unit again after rotating the hollow guiding shaft. However, this work requires time and efforts, puts a burden on an operator, and reduces the rate of operation of the air spinning device.

SUMMARY OF THE INVENTION

[0005] The present invention was made in view of the above discussion. It is one object of the present invention to provide an air spinning device in which a hollow guiding shaft can be easily rotated around the axis line thereof.

[0006] An air spinning device according to an embodiment of the present invention is an air spinning device that twists a fiber bundle by a swirling air current occurring

in a spinning chamber to form a yarn. The air spinning device includes a hollow guiding shaft unit, a support member, and a rotating unit. The hollow guiding shaft unit includes a hollow guiding shaft. The hollow guiding shaft has a tip end part arranged in the spinning chamber and a fiber passage is formed therein along an axis line thereof. The support member supports the hollow guiding shaft unit. The rotating unit that rotates the hollow guiding shaft unit with respect to the support member around the axis line in forward / reverse directions in a predetermined range.

[0007] In an embodiment of the present invention, an air spinning device that twists a fiber bundle by a swirling air current occurring in a spinning chamber to form a yarn includes a hollow guiding shaft unit, a support member, and a rotating unit. The hollow guiding shaft unit includes a hollow guiding shaft. The hollow guiding shaft has a tip end part arranged in the spinning chamber and a fiber passage is formed therein along an axis line thereof. The support member supports the hollow guiding shaft unit. The rotating unit makes it possible to rotate the hollow guiding shaft unit with respect to the support member around the axis line. The rotating unit includes an operating member and a positioning mechanism. The operating member is a member for rotating the hollow guiding shaft unit with respect to the support member around the axis line. The positioning mechanism is a member that positions the hollow guiding shaft unit in a circumferential direction around the axis line at a plurality of different positions.

[0008] 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

[0009]

FIG. 1 is a front view of an overall configuration of an air spinning frame according to the present embodiment.

FIG. 2 is a side view of a spinning unit and a yarn joining cart.

FIG. 3 is a block diagram of an electrical configuration of the air spinning frame.

FIG. 4 is a cross-sectional view of an air spinning device.

FIG. 5 is a perspective view of a hollow guiding shaft unit and a rotating unit.

FIG. 6 is a perspective view indicating a variation of the hollow guiding shaft unit and the rotating unit.

DETAILED DESCRIPTION

Overall Configuration of Spinning Frame

[0010] Exemplary embodiments of an air spinning frame including an air spinning device according to the present invention are explained below while referring to the accompanying drawings. An air spinning frame 1 shown in FIG. 1 includes a plurality of spinning units 2, a yarn joining cart 3, a blower box 4, and a motor box 5. The spinning units 2 are arranged in a predetermined arrangement direction (left-right direction in FIG. 1). The yarn joining cart 3 is movable in the arrangement direction. The blower box 4 is arranged at one end in the arrangement direction. The motor box 5 is arranged at the other end in the arrangement direction.

[0011] In the spinning unit 2, an air spinning device 12 spins a fiber bundle T that is sent thereto from a drafting device 11 to form a yarn Y, and a winding device 13 winds the yarn Y on a bobbin B to form a package P. When a yarn breakage or a yarn cut occurs in any of the spinning units 2, the yarn joining cart 3 moves to that spinning unit 2 and performs yarn joining. A not-shown suction device and the like are arranged in the blower box 4. The suction device supplies a negative pressure to the spinning units 2 and the yarn joining cart 3. Moreover, a not-shown driving source and the like are arranged in the motor box 5. The driving source is a common driving source for a machine-frame controlling device 6 and the spinning units 2. However, each spinning unit 2 can be provided with a dedicated driving source.

Spinning Unit

[0012] As shown in FIG. 2, the spinning unit 2 mainly includes the drafting device 11, the air spinning device 12, a yarn accumulating device 14 (drawing device), and the winding device 13. These devices are sequentially arranged from the upstream to the downstream (from an upper part to a lower part in FIG. 2) in a traveling direction (yarn traveling direction) of the fiber bundle T or the yarn Y. Note that, in the following explanation, the upstream and the downstream in the yarn traveling direction will be called merely the upstream and the downstream.

[0013] The drafting device 11 is arranged near an upper end of a frame 15 of the air spinning frame 1. The drafting device 11 includes four drafting roller pairs 16 to 19. The four drafting roller pairs include a back roller pair 16, a third roller pair 17, a middle roller pair 18, and a front roller pair 19 sequentially from the upstream to the downstream. An apron belt 20 made of rubber is wound on the middle roller pair 18. Each of the four drafting roller pairs 16 to 19 includes a bottom roller 16a to 19a that is a driver roller and a top roller 16b to 19b that is a driven roller. The rotational speed of the drafting roller pairs increases from the drafting roller pair 16 to the drafting roller pair 19, that is, as one goes toward the downstream. Accordingly, the drafting device 11 pinches a sliver S,

which is a raw material of the fiber bundle T, between the drafting roller pairs 16 to 19 to transport the sliver S, and draws (drafts) the sliver S so that the sliver S has a predetermined thickness thereby forming the fiber bundle T. The number of the drafting roller pairs in the drafting device 11 is not limited to four.

[0014] The air spinning device 12 is arranged immediately downstream of the front roller pair 19. The air spinning device 12 forms the yarn Y by applying twist to the fiber bundle T drafted by the drafting device 11. More detailed explanation of the air spinning device 12 will be given later.

[0015] As shown in FIG. 2, the yarn accumulating device 14 is arranged between the air spinning device 12 and the winding device 13 in the yarn traveling direction. The yarn accumulating device 14 includes an accumulating roller 21, a yarn hooking member 22, and a motor 23. The accumulating roller 21 is configured such that a predetermined amount of yarn Y can be temporarily wound on an outer peripheral surface thereof. The accumulating roller 21 is rotationally driven by the motor 23. The yarn Y is pulled from the air spinning device 12 by rotation of the accumulating roller 21. The yarn Y pulled from the air spinning device 12 is wound on the accumulating roller 21 and accumulated thereon. The yarn accumulating device 14 applies a predetermined tension to the yarn Y, when the yarn Y is unwound therefrom by the winding device 13, by relative rotation of the yarn hooking member 22 and the accumulating roller 21 with respect to each other. Alternatively, it is allowable to arrange between the air spinning device 12 and the yarn accumulating device 14 a drawing roller pair (drawing device), such as a delivery roller pair, and the yarn Y can be pulled from the air spinning device 12 by using the drawing roller pair. Alternatively, the yarn accumulating device 14 can be omitted.

[0016] A yarn monitoring device 24 that monitors a state of the yarn Y is arranged between the air spinning device 12 and the yarn accumulating device 14 in the yarn traveling direction. The yarn monitoring device 24 monitors a thickness of the traveling yarn Y and / or presence / absence of a foreign substance in the traveling yarn Y by using a not-shown optical sensor. The yarn monitoring device 24 can detect a yarn defect. The yarn defect can be an abnormal thickness of the yarn Y, a foreign substance in the yarn Y, and the like. The yarn monitoring device 24 is not limited to an optical sensor, and can be, for example, an electrostatic capacitance sensor. When the yarn defect in the yarn Y is detected by the yarn monitoring device 24, in the spinning unit 2, the supply of air to the air spinning device 12 is stopped thereby cutting the yarn Y by stopping the formation of the yarn Y. Alternatively, a cutter can be arranged near the yarn monitoring device 24 and the yarn Y can be cut by using the cutter. Alternatively, the yarn Y can be cut by stopping the rotation of the back roller pair 16 of the drafting device 11.

[0017] The winding device 13 is arranged downstream

of the yarn accumulating device 14. The winding device 13 winds the yarn Y on the bobbin B while traversing the yarn Y thereby forming the package P. The winding device 13 includes a cradle arm 25, a winding drum 26, and a traversing device 27.

[0018] The cradle arm 25 is rotatably supported by a support shaft 25a. The cradle arm 25 can rotatably support the bobbin B (package P) on which the yarn Y is wound. The winding drum 26 is rotationally driven at a constant rotational speed in a predetermined direction. By pivoting the cradle arm 25 around the support shaft 25a, the outer peripheral surface of the bobbin B (package P) can be made to contact with or separated from the winding drum 26. When the outer peripheral surface of the bobbin B (package P) contacts with the rotationally driven winding drum 26, the yarn Y can be wound on the outer peripheral surface of the bobbin B (package P) by causing the bobbin B (package P) to follow the rotation in the winding direction.

[0019] The traversing device 27 includes a traversing guide 28 that guides the yarn Y. The traversing guide 28 is caused to make reciprocating movement along a direction that is parallel to a rotation shaft of the winding drum 26 by a not-shown driving source. As a result, the yarn Y is wound on the rotating bobbin B (package P) while being traversed by a predetermined width by the traversing guide 28. Note that, the yarn Y can be traversed by using a winding drum in which a traverse groove has been formed.

Yarn Joining Cart

[0020] The yarn joining cart 3 is explained next. When the yarn breakage or the yarn cut occurs in a certain spinning unit 2, the yarn joining cart 3 moves to that spinning unit 2 and performs the yarn joining of the discontinuous yarns Y. As shown in FIG. 2, the yarn joining cart 3 includes a yarn joining device 30, a suction pipe 31, and a suction mouth 32.

[0021] The suction pipe 31 can pivot around an axis 31a in an up-down direction. When the suction pipe 31 is pivoted up, a tip of the suction pipe 31 is positioned near the downstream of the air spinning device 12 so that the suction pipe 31 can suction hold the yarn (upper yarn) Y spun by the air spinning device 12 by sucking the yarn Y. When the suction pipe 31 is pivoted down while the upper yarn Y spun by the air spinning device 12 is being suction held by the suction pipe 31, the suction pipe 31 can guide the upper yarn Y to the yarn joining device 30.

[0022] The suction mouth 32 can pivot around an axis 32a in the up-down direction. When the suction mouth 32 is pivoted down, a tip of the suction mouth 32 is positioned near the outer peripheral surface of the package P so that the suction mouth 32 can suction hold the yarn (lower yarn) Y pulled from the package P by sucking the yarn Y. When the suction mouth 32 is pivoted up while the lower yarn Y pulled from the package P is being suction held by the suction mouth 32, the suction mouth 32

can guide the lower yarn Y to the yarn joining device 30.

[0023] The yarn joining device 30 joins the upper yarn Y guided thereto from the air spinning device 12 by the suction pipe 31 and the lower yarn Y guided thereto from the winding device 13 by the suction mouth 32. In the present embodiment, a splicer that applies twist to yarn ends of the upper yarn Y and the lower yarn Y by using a swirling air current thereby forming a spliced point is used as the yarn joining device 30. However, the yarn joining device 30 can be, for example, a knoter that knots the upper yarn Y and the lower yarn Y, or a piecer that links the upper yarn Y and the lower yarn Y by restarting spinning of the air spinning device 12 after the lower yarn Y is guided to the air spinning device 12.

Electrical Configuration

[0024] As shown in FIG. 3, each of the spinning units 2 includes a unit controlling section 29 that controls operation of each part of the spinning unit 2. Moreover, the yarn joining cart 3 includes a cart controlling section 33 that controls operation of each part of the yarn joining cart 3. The unit controlling section 29 and the cart controlling section 33 are electrically connected to the machine-frame controlling device 6 allowing exchanging of electric signals therebetween. Note that, one unit controlling section 29 can be shared by a predetermined number of spinning units 2.

Air Spinning Device

[0025] The air spinning device 12 will be explained in more detail while referring to FIG. 4. The air spinning device 12 performs a spinning operation of twisting the fiber bundle T supplied from the drafting device 11 to form the spun yarn Y. The air spinning device 12 includes a nozzle block 40, a fiber guide 50, a hollow guiding shaft unit 60, a support block 70 (support member), and a spinning chamber 49.

[0026] The nozzle block 40 guides to the spinning chamber 49 compressed air sent thereto from a not-shown compressed air supply source. The nozzle block 40 includes a plurality of nozzles 41 arranged around the spinning chamber 49. In the present embodiment, four nozzles 41 are formed in a circumferential direction at equal intervals, that is, at every 90 degrees. However, the number and layout of the nozzles 41 is not limited to this. A swirling air current is generated in the spinning chamber 49 when the compressed air is jetted into the spinning chamber 49 from the nozzles 41. The fiber bundle T is twisted in the spinning chamber 49 by the swirling air current.

[0027] A substantially conical space 42 is formed in the nozzle block 40. The fiber guide 50 is arranged upstream of the space 42. A substantially conical tip end part of the hollow guiding shaft unit 60 is inserted in the space 42 from the downstream. A part of the space 42, in which the tip end part of the hollow guiding shaft unit

60 is arranged, functions as the spinning chamber 49. Moreover, the nozzle block 40 includes an abutting member 43 that abuts from above with a flange 66a of a later-explained fixed member 66.

[0028] The fiber guide 50 guides to the spinning chamber 49 the fiber bundle T drafted by the drafting device 11. A fiber introducing path 51 is formed in the fiber guide 50 along the yarn traveling direction. Moreover, the fiber guide 50 has a guiding needle 52 that projects into the spinning chamber 49. The fiber bundle T drafted by the drafting device 11 is guided, through the fiber introducing path 51, into the spinning chamber 49 so as to be wound over the guiding needle 52.

[0029] The hollow guiding shaft unit 60 applies further twist to the fiber bundle T, which was twisted in the spinning chamber 49, thereby forming the spun yarn Y, and guides this yarn Y to the downstream. The hollow guiding shaft unit 60 includes a first hollow guiding shaft 61, a second hollow guiding shaft 62, a third hollow guiding shaft 63, a storing member 64, a locking member 65, the fixed member 66, and a sheath member 67.

[0030] The first hollow guiding shaft 61 is constituted by connecting a conical tip end part 61a, a circular truncated conical intermediate part 61b, and a cylindrical base end part 61c in this order from the upstream to the downstream. The tip end part 61a is arranged in the spinning chamber 49. A first fiber passage 61d is formed in the tip end part 61a so as to penetrate along an axis line C. A fiber introduction port 61e is an opening on the upstream side of the first fiber passage 61d. A space 61f for accommodating an upstream part of the second hollow guiding shaft 62 is formed in the intermediate part 61b and the base end part 61c.

[0031] The second hollow guiding shaft 62 is a cylindrical member. A second fiber passage 62a is formed in the second hollow guiding shaft 62 so as to penetrate along the axis line C. A plurality of nozzles 62b is formed around the axis line C at equal intervals in an upstream end part of the second hollow guiding shaft 62. The upstream end part of the second hollow guiding shaft 62 abuts with a downstream end part of the tip end part 61a of the first hollow guiding shaft 61. As a result, the second fiber passage 62a communicates with the first fiber passage 61d.

[0032] The third hollow guiding shaft 63 is a cylindrical member. A third fiber passage 63a is formed in the third hollow guiding shaft 63 so as to penetrate along the axis line C. An upstream end part of the third hollow guiding shaft 63 abuts with a downstream end part of the second hollow guiding shaft 62. As a result, the third fiber passage 63a communicates with the second fiber passage 62a.

[0033] The storing member 64 is a cylindrical member. A space 64a for accommodating a downstream part of the second hollow guiding shaft 62 and for accommodating an upstream part of the third hollow guiding shaft 63 is formed in the storing member 64. A connecting member 64b to which an air feeding pipe 100 is connected is

arranged on an outer peripheral part of the storing member 64. An air introducing path 64c that communicates with the space 64a is formed in the connecting member 64b. The air feeding pipe 100 is connected to a not-shown compressed air supply source. The compressed air is supplied to the hollow guiding shaft unit 60 from the air feeding pipe 100 via the connecting member 64b. The air feeding pipe 100 is constituted by, for example, a flexible hose and the like.

[0034] The locking member 65 is a cylindrical member. The locking member 65 is formed in a stepped shape capable of engaging with a downstream end part of the storing member 64 and a downstream end part of the third hollow guiding shaft 63. An opening 65a is formed in the locking member 65 along the axis line C. The downstream end part of the third hollow guiding shaft 63 is inserted into the opening 65a.

[0035] The fixed member 66 is a nut formed into a circular truncated conical shape. The fixed member 66 can be screwed in an upstream end part of the storing member 64. The flange 66a is formed in a downstream end part of the fixed member 66.

[0036] The sheath member 67 is a cylindrical member. The sheath member 67 is attached to an outer peripheral surface of the storing member 64. An outer diameter of the sheath member 67 is substantially equal to an inner diameter of a cylindrical space 71 formed in the support block 70. The hollow guiding shaft unit 60 is supported by the support block 70 in a state that the sheath member 67 is accommodated in the cylindrical space 71.

[0037] Note that, though not shown in the drawings, a slipping prevention member that prevents the hollow guiding shaft unit 60 from slipping toward the axis line C from the support block 70 is arranged. For example, the slipping prevention member includes an annular groove formed in an outer peripheral surface of the hollow guiding shaft unit 60 and an inserting member formed in the support block 70 and insertable into the annular groove. For example, in a state in which the inserting member has been inserted (attached) into the annular groove, the inserting member is biased in an insertion direction with an elastic member such as a spring. In this state, by pressing a not-shown button and the like, the inserted state of the inserting member can be released against an urging force of the elastic member and the hollow guiding shaft unit can be taken out. The slipping prevention member allows rotation of the hollow guiding shaft unit around the axis line while preventing the slipping toward the axis line direction of the hollow guiding shaft unit from the support member.

[0038] In the hollow guiding shaft unit 60, the first hollow guiding shaft 61, the second hollow guiding shaft 62, and the third hollow guiding shaft 63 are assembled from the upstream in this order in a mutually abutting state. As a result, the first fiber passage 61d, the second fiber passage 62a, and the third fiber passage 63a communicate with each other. Moreover, the second hollow guiding shaft 62 is assembled between inner peripheral sur-

faces of the space 61f and the space 64a such that an air flow passage 68 is secured. As a result, the air introducing path 64c, the air flow passage 68, and the nozzles 62b communicate with each other whereby the compressed air can be jet from the nozzles 62b into the second fiber passage 62a. In this manner, the hollow guiding shaft unit 60 is formed by screwing the fixed member 66 in the storing member 64 in the state in which the hollow guiding shafts 61 to 63, the storing member 64, and the locking member 65 are assembled.

[0039] The support block 70 supports the hollow guiding shaft unit 60. The support block 70 includes a cylindrical member 72 and an extending member 73. The cylindrical space 71 for accommodating a part of the hollow guiding shaft unit 60 is formed in the cylindrical member 72. A notch 72a for passing the air feeding pipe 100 is formed in a part of the cylindrical member 72 to which the extending member 73 is connected (see FIG. 5). The extending member 73 extends in a left-right direction in FIG. 4. A left end of the extending member 73 is connected to the cylindrical member 72, and a right end is supported by the frame 15 (see FIG. 1) of the air spinning frame 1.

[0040] The support block 70 is attached to the frame 15 so as to be swingable up and down. When the support block 70 is swung down by using a not-shown actuator such as an air cylinder, the flange 66a of the fixed member 66 separates from the abutting member 43 of the nozzle block 40. As a result, an operator can perform the maintenance of the hollow guiding shaft unit 60 and the like from a front side (left side in FIG. 4) of the air spinning frame 1.

[0041] During the spinning operation of the air spinning device 12, the support block 70 that supports the hollow guiding shaft unit 60 is located up, and the abutting member 43 of the nozzle block 40 abuts with the flange 66a of the fixed member 66. At this time, a gap is formed between an inner peripheral surface of the space 42 of the nozzle block 40 and an outer peripheral surface of the first hollow guiding shaft 61. The air jetted into the spinning chamber 49 from the nozzles 41 during the spinning operation flows through the gap into a pressure-reduced chamber 44 formed in the nozzle block 40 and the air is discharged along with the fibers that did not become the yarn Y.

[0042] The spinning operation performed by the air spinning device 12 having such a configuration is explained below. At the start of the spinning operation, the compressed air is jetted into the spinning chamber 49 from the nozzles 41 and the compressed air is jetted into the second fiber passage 62a from the nozzles 62b. As a result, the fiber bundle T introduced by the drafting device 11 into the spinning chamber 49 via the fiber guide 50 is passed through the first fiber passage 61d, the second fiber passage 62a, and the third fiber passage 63a and guided to the downstream.

[0043] When the yarn Y begins to be spun by the air spinning device 12, jetting of the air from the nozzles 62b

into the second fiber passage 62a is stopped, and only jetting of the air from the nozzles 41 into the spinning chamber 49 is continued. As a result, the swirling air current is generated in the spinning chamber 49. Accordingly, fiber ends of fibers constituting the fiber bundle T are reversed and whirled by this swirling air current around the fiber introduction port 61e of the first hollow guiding shaft 61 and the fiber bundle T is twisted in the spinning chamber 49. The yarn Y formed by twisting the fiber bundle T is passed through the first fiber passage 61d, the second fiber passage 62a, and the third fiber passage 63a and guided to the downstream.

Wearing Down of First Hollow Guiding Shaft

[0044] As mentioned earlier, while the air spinning device 12 is performing the spinning operation, the fiber ends of the fiber bundle T that are reversed around the fiber introduction port 61e contact the tip end part 61a of the first hollow guiding shaft 61. The locations at which the fibers contact the tip end part 61a vary depending on the positions of the nozzles 41. That is, in the present embodiment, the fibers contact at four locations, in the circumferential direction of the tip end part 61a of the first hollow guiding shaft 61, corresponding to the four nozzles 41. As a result, wearing down progresses at the locations where the fibers contact continuously, and grooves may be formed in the tip end part 61a of the first hollow guiding shaft 61. Because such grooves adversely affect the spinning quality, it is desirable to prevent such wearing down. To address this issue, in the present embodiment, a rotating unit that rotates the hollow guiding shaft unit 60 with respect to the support block 70 around the axis line C in forward / reverse directions (forward direction and reverse direction) in a predetermined range is provided. By appropriately rotating the hollow guiding shaft unit 60 by using the rotating unit, it is possible to prevent wearing down from concentrating at the specific locations. The rotating unit is explained in detail below.

[0045] In the present embodiment, the rotating unit does not include a configuration that necessitates the work to disassemble and reassemble the hollow guiding shaft unit 60 when rotating the first hollow guiding shaft 61 around the axis line. That is, the rotating unit according to the present embodiment is limited to a configuration capable of changing a relative positional relationship between the nozzles for spinning (nozzles 41), formed in the nozzle block 40, and the first hollow guiding shaft 61, in the circumferential direction of the first hollow guiding shaft 61 around the axis line without requiring to perform the work of disassembling the hollow guiding shaft unit 60. The work of disassembling the hollow guiding shaft unit 60 includes the work of releasing an attachment member such as a bolt to temporarily release a fixed state of the first hollow guiding shaft 61 to some other member.

Rotating Unit

[0046] One example of the rotating unit is explained while referring to FIG. 5. In FIG. 5, to facilitate the understanding, the hollow guiding shaft unit 60 and the support block 70 are shown separated from each other. A rotating unit 80 shown in FIG. 5 includes an operating lever 81 and a positioning mechanism 82. The operating lever 81 is fixed to the storing member 64 of the hollow guiding shaft unit 60. The operating lever 81 extends outward from the hollow guiding shaft unit 60 in a diametrical direction that is orthogonal to the axis line C. In the present embodiment, to make the operation easy for the operator, as shown in FIG. 4, the operating lever 81 extends so as to project toward the front side (left side in FIG. 4) of the air spinning frame 1 than the support block 70.

[0047] The positioning mechanism 82 includes a convex part 83 formed on the operating lever 81 and a plurality of concave parts 84 formed in the support block 70. The convex part 83 and the concave parts 84 are shaped such that the convex part 83 can engage with any of the concave parts 84. Only one convex part 83 is formed on a surface of the operating lever 81 opposing the support block 70. On the other hand, several (four in the present embodiment) concave parts 84 are formed in a circumferential direction in an end surface (surface opposing the operating lever 81) of the cylindrical member 72 of the support block 70. With respect to a range in the circumferential direction in which the concave parts 84 are formed, 5 degrees or more and 50 degrees or less is a desirable range while 5 degrees or more and less than 45 degrees is a more desirable range. The operating lever 81 is capable of undergoing elastic deformation in directions that allow engagement / disengagement of the convex part 83 and the concave part 84 with / from each other.

[0048] In the rotating unit 80 having such a configuration, when the operator operates the operating lever 81 to change the concave part 84 that is to engage with the convex part 83, the hollow guiding shaft unit 60 rotates around the axis line C whereby the hollow guiding shaft unit 60 is positioned in a different position in the circumferential direction with respect to the support block 70. Note that, it is desirable that the operating lever 81 is made of resin material, stainless steel material, and the like having elasticity to make the engagement / disengagement of the convex part 83 and the concave part 84 easy. Moreover, a mark or a symbol indicating a position of each of the concave parts 84 can be made on an upper surface or a side surface of the cylindrical member 72 at a position corresponding to each of the concave parts 84.

[0049] When changing the position in the circumferential direction of the hollow guiding shaft unit 60, the operator stops the spinning operation of the air spinning device 12, and causes the support block 70 to swing downward by using a not-shown actuator. As a result, the operator can easily operate the operating lever 81 from the front side of the air spinning frame 1. Such op-

eration of changing the position in the circumferential direction of the hollow guiding shaft unit 60 can be performed, for example, when performing the maintenance of the air spinning device 12 or can be performed each time the spinning operation is performed for a predetermined period.

Variation of Rotating Unit

[0050] A variation of the rotating unit is explained next while referring to FIG. 6. A rotating unit 90 shown in FIG. 6 is configured as a driving mechanism that rotationally drives the hollow guiding shaft unit 60 around the axis line C in the forward / reverse directions. In the following explanation, this component will be called as the rotating unit 90 or a driving mechanism 90 as appropriate. The driving mechanism 90 includes a motor 91 and a cam mechanism 92. The motor 91 is a driving source for the cam mechanism 92. The motor 91 is a stepping motor capable of rotating in the forward / reverse directions. The motor 91 is fixed to the extending member 73 extending from the support block 70.

[0051] The cam mechanism 92 includes a lever 93 and a rotating member 94. The lever 93 is fixed to the storing member 64 of the hollow guiding shaft unit 60. The lever 93 extends outward from the hollow guiding shaft unit 60 in a diametrical direction that is orthogonal to the axis line C (specifically, toward back side of the air spinning frame 1, i.e., the right side in FIG. 6). An elongated slit 93a is formed in one end part of the lever 93 parallel to the direction of extension of the lever 93. The rotating member 94 is a disc-shaped member. A rotation shaft 94a of the rotating member 94 is connected to an output shaft of the motor 91. A cylindrical pin 94b that projects in an axial direction of the rotation shaft 94a is formed in a peripheral part of a top surface of the rotating member 94. The pin 94b has a shape capable of engaging with the elongated slit 93a formed in the lever 93. When the pin 94b is inserted in the elongated slit 93a, the lever 93 and the rotating member 94 are in a coupled state. When the lever 93 and the rotating member 94 are in the coupled state, the pin 94b can move inside the elongated slit 93a in the direction of extension.

[0052] The motor 91 is controlled by the unit controlling section 29. The spinning unit 2 is provided with a switch 9 for operating the motor 91. When the operator operates the switch 9, the motor 91 can be operated via the unit controlling section 29. When the unit controlling section 29 rotates the motor 91 in the forward / reverse directions, the rotating member 94 also rotates around the rotation shaft 94a in the forward / reverse directions. Accordingly, because the lever 93 is moved by the pin 94b, the hollow guiding shaft unit 60 rotates around the axis line C in the forward / reverse directions. In this variation, a rotation range of the motor 91 is controlled such that the hollow guiding shaft unit 60 can rotate in the circumferential direction in the forward / reverse directions desirably in a range of 5 degrees or more and 50 degrees or less or

more desirably in a range of 5 degrees or more and less than 45 degrees.

[0053] The unit controlling section 29 can intermittently drive the motor 91 to intermittently operate the driving mechanism 90 during the spinning operation, or can continuously drive the motor 91 to continuously operate the driving mechanism 90 during the spinning operation. Alternatively, the unit controlling section 29 can drive the motor 91 while the spinning operation is not being performed to operate the driving mechanism 90 while the spinning operation is not being performed.

Advantageous Effects

[0054] According to the present embodiment, the first hollow guiding shaft 61 can be rotated in the forward / reverse directions around the axis line C by rotating the entire hollow guiding shaft unit 60 including the first hollow guiding shaft 61 in the forward / reverse directions around the axis line C by using the rotating unit 80 or 90. Therefore, because there is no need to disassemble or reassemble the hollow guiding shaft unit 60 when rotating the first hollow guiding shaft 61, the first hollow guiding shaft 61 can be easily rotated by the operator around the axis line C with less efforts. Also, it can be prevented that wearing down is concentrated at the specific locations where the fibers contact the tip end part 61a of the first hollow guiding shaft 61.

[0055] In the example shown in FIG. 5 of the present embodiment, the rotating unit 80 includes the operating lever 81 (operating member according to the present invention) that rotates the hollow guiding shaft unit 60 around the axis line C in the forward / reverse directions, and the positioning mechanism 82 that positions the hollow guiding shaft unit 60 in the circumferential direction around the axis line C. With such a configuration, the operator can first rotate the hollow guiding shaft unit 60 by operating the operating lever 81 and then position the hollow guiding shaft unit 60 in the circumferential direction by using the positioning mechanism 82. Accordingly, because a driving means such as a motor becomes needless the costs of the rotating unit 80 can be suppressed.

[0056] In the present embodiment, the operating member according to the present invention is the operating lever 81 that extends outward from the hollow guiding shaft unit 60 in a direction that is orthogonal to the axis line C. In such a configuration, because a position at which the operator performs the operation can be kept away from the axis line C, a large rotation torque can be achieved with a relatively small force. Therefore, the hollow guiding shaft unit 60 can be rotated easily.

[0057] The present embodiment further includes the support block 70 (support member according to the present invention) that supports the hollow guiding shaft unit 60, and the positioning mechanism 82 includes the convex part 83 (first engaging member according to the present invention) formed on the operating lever 81 and the concave parts 84 (second engaging member accord-

ing to the present invention) formed in the support block 70 and engageable with the convex part 83. Several concave parts 84 are formed at regular intervals in the circumferential direction. The position of the hollow guiding shaft unit 60 in the circumferential direction can be changed easily by changing a point of engagement of the convex part 83 and the concave parts 84.

[0058] In the present embodiment, several concave parts 84 are formed in the support block 70 in the circumferential direction. With this configuration, since only one convex part 83 is formed on the operating lever 81, the length of the operating lever 81 in the circumferential direction can be made short. Therefore, it is possible to make the operating lever 81 easy for the operator to grasp and improve the operability.

[0059] In the present embodiment, since the first engaging member according to the present invention is the convex part 83 and the second engaging member according to the present invention is the concave part 84, the configuration of the positioning mechanism 82 can be simplified.

[0060] In the variation shown in FIG. 6 according to the present embodiment, the rotating unit 90 is a driving mechanism that drives the hollow guiding shaft unit 60 to rotate around the axis line C in the forward / reverse directions. According to such a configuration, the hollow guiding shaft unit 60 can be rotated by operating the driving mechanism 90, and the burden on the operator can be reduced more effectively.

[0061] In the present embodiment, the driving mechanism 90 includes the motor 91 and the cam mechanism 92 driven by the motor 91 for rotating the hollow guiding shaft unit 60 around the axis line C in the forward / reverse directions. In this way, by configuring the driving mechanism 90 by the combination of the motor 91 and the cam mechanism 92, the structure of the driving mechanism 90 can be simplified.

[0062] In the present embodiment, the cam mechanism 92 includes the lever 93, which is attached to the hollow guiding shaft unit 60, and the rotating member 94, which is coupled to the lever 93, that is rotated by the motor 91 to rotate the lever 93 around the axis line C in the forward / reverse directions. According to such a configuration, by rotating the motor 91 in the forward / reverse directions, the hollow guiding shaft unit 60 can be easily rotated around the axis line C in the forward / reverse directions via the rotating member 94 and the lever 93.

[0063] In the present embodiment, the rotating member 94 includes the pin 94b that projects in the axial direction of the rotation shaft 94a of the rotating member 94, and the elongated slit 93a that permits movement of the pin 94b in a state in which the pin 94b has been engaged in the elongated slit 93a is formed in the lever 93. In this way, while having a simple and inexpensive configuration, rattling between the rotating member 94 and the lever 93 can be suppressed, and the hollow guiding shaft unit 60 can be rotated smoothly.

[0064] In the present embodiment, since the motor 91

is a stepping motor, it is possible to more accurately position the hollow guiding shaft unit 60 in the circumferential direction. Therefore, it is possible to more reliably prevent wearing down from concentrating at the specific locations of the tip end part 61a of the first hollow guiding shaft 61.

[0065] In the present embodiment, the unit controlling section 29 (control section according to the present invention) can intermittently operate the driving mechanism 90 during the spinning operation. In this case, because it is unnecessary to operate the driving mechanism 90 constantly during the spinning operation, the power consumption can be suppressed. While the driving mechanism 90 is not operated, a minimum electric current can be supplied to the driving mechanism 90 to maintain the position of the hollow guiding shaft unit 60 in the circumferential direction.

[0066] In the present embodiment, the unit controlling section 29 can continuously operate the driving mechanism 90 during the spinning operation. In this case, since the hollow guiding shaft unit 60 can be continuously rotated during the spinning operation, it is possible to more effectively disperse the locations where the fibers contact the tip end part 61a of the first hollow guiding shaft 61, and it is possible to improve the wearing down suppression effect.

[0067] In the present embodiment, the unit controlling section 29 can operate the driving mechanism 90 while the spinning operation is not being performed. If the hollow guiding shaft unit 60 is rotated during the spinning operation, there may be some adverse effect on the fibers that contact the tip end part 61a of the first hollow guiding shaft 61. To address this issue, by rotating the hollow guiding shaft unit 60 while the spinning operation is not being performed, it is possible to reliably avoid the effect on the spinning that may occur when the hollow guiding shaft unit 60 is rotated.

[0068] In the present embodiment, since the switch 9 for operating the driving mechanism 90 is further provided, the operator can easily operate the driving mechanism 90 at a desired timing.

[0069] In the present embodiment, the hollow guiding shaft unit 60 includes the connecting member 64b to which the air feeding pipe 100 for supplying air to be jetted into the second fiber passage 62a is connected. In this way, when the air feeding pipe 100 is connected to the connecting member 64b of the hollow guiding shaft unit 60, the range in which the hollow guiding shaft unit 60 can rotate is restricted by the air feeding pipe 100. In this case, the configuration presented in the present embodiment in which the hollow guiding shaft unit 60 is not rotated in one direction but is rotated in the forward / reverse directions is particularly effective.

[0070] In the present embodiment, it is preferable that the predetermined range in which the hollow guiding shaft unit 60 can rotate is set to 5 degrees or more and 50 degrees or less. If the rotation range is too narrow, the locations at which the fibers contact the tip end part

61a of the first hollow guiding shaft 61 cannot be dispersed so much, and the expected effect of suppressing the wearing down is not achieved. On the other hand, if the rotation range is too wide, handling becomes difficult as the air feeding pipe 100 and the like have been connected to the hollow guiding shaft unit 60. Therefore, it is preferable that the rotation range of the hollow guiding shaft unit 60 is set to about 5 degrees or more and about 50 degrees or less.

[0071] In the present embodiment, four nozzles 41 for jetting air into the spinning chamber 49 are formed at equal intervals around the spinning chamber 49, and it is desirable that a predetermined range in which the hollow guiding shaft unit 60 can rotate is set to 5 degrees or more and less than 90 (= 360/4) degrees. The locations at which the fibers contact the tip end part 61a of the first hollow guiding shaft 61 are determined according to the positions of the nozzles 41. When the four nozzles 41 are formed at equal intervals as in the present embodiment, the fibers contact at four locations in the circumferential direction corresponding to the four nozzles 41 of the tip end part 61a of the first hollow guiding shaft 61. In this case, when the hollow guiding shaft unit 60 is rotated by 90 degrees or more, the locations at which the fibers contact the tip end part 61a may overlap each other, and the effect of suppressing the wearing down may be reduced. Therefore, it is preferable to set the rotation range of the hollow guiding shaft unit 60 to less than 90 degrees.

Other Embodiments

[0072] Variations that are different from the above embodiment are explained below.

[0073] In the above embodiment, the operating lever 81 is provided as the operating member according to the present invention. However, the concrete example of the operating member is not limited to this. For example, the operator can directly rotate the hollow guiding shaft unit 60 around the axis line C by holding with his hand an outer peripheral surface of the flange 66a of the fixed member 66. In this case, the outer peripheral surface of the fixed member 66 functions as the operating member. It is sufficient that the operating lever 81 is attached to any one of a plurality of members constituting the hollow guiding shaft unit 60, and is not limited to the example in which the operating lever 81 is attached to the storing member 64.

[0074] In the above embodiment, the convex part 83 is provided in the operating lever 81 as the first engaging member according to the present invention, and the support block 70 is provided with the concave parts 84 as the second engaging member according to the present invention. However, concave parts can be provided in the operating lever 81 as the first engaging member, and a convex part can be provided in the support block 70 as the second engaging member. Moreover, the first engaging member formed in the operating lever 81 may be

provided in a plurality in the circumferential direction. Further, the first engaging member may be provided in any one of the members constituting the hollow guiding shaft unit 60 instead of the operating lever 81. In that case, the operating lever 81 can be omitted. Moreover, the member in which the first engaging member is provided can be made of a material capable of undergoing elastic deformation in directions that allow engagement / disengagement. The specific structure of the positioning mechanism 82 is not limited to the configuration including the convex part 83 and the concave parts 84, and for example, a ratchet mechanism and the like can be used.

[0075] In the above embodiment, the driving mechanism 90 is configured by the motor 91 and the cam mechanism 92; however, the configuration of the driving mechanism 90 is not limited thereto. For example, a driving source other than the motor 91 can be used, and the specific configuration of the cam mechanism 92 can be other than that in the above embodiment. A concrete example of the driving source, other than the motor 91, includes a cylinder (e.g., air cylinder). When the cylinder is used as the driving source, a stopper may be provided at each of the positions corresponding to an end of the forward / reverse rotations of the hollow guiding shaft unit 60. Moreover, as the motor 91, a motor other than the stepping motor can be used.

[0076] In the above embodiment, the yarn Y is sent to the downstream at the start of the spinning operation by using the compressed air jetted into the second fiber passage 62a via the nozzles 62b. However, it is possible to configure such that the yarn Y is guided to the spinning chamber 49 from the downstream by using the compressed air jetted into the second fiber passage 62a.

[0077] In the above embodiment, three hollow guiding shafts 61 to 63 are provided in the hollow guiding shaft unit 60. However, the number of the hollow guiding shafts is not limited to three, and one hollow guiding shaft, two hollow guiding shafts, or four or more hollow guiding shafts can be provided. The member in which the nozzles 62b are formed is not limited to the second hollow guiding shaft 62 but the nozzles 62b can be formed in the first hollow guiding shaft 61 or in the third hollow guiding shaft 63.

[0078] An air spinning device according to the present invention is an air spinning device that twists a fiber bundle by a swirling air current occurring in a spinning chamber to form a yarn. The air spinning device includes a hollow guiding shaft unit, a support member, and a rotating unit. The hollow guiding shaft unit includes a hollow guiding shaft. The hollow guiding shaft has a tip end part arranged in the spinning chamber and a fiber passage is formed therein along an axis line thereof. The support member supports the hollow guiding shaft unit. The rotating unit that rotates the hollow guiding shaft unit with respect to the support member around the axis line in forward / reverse directions in a predetermined range.

[0079] According to the present invention, the hollow guiding shaft can be rotated in the forward / reverse di-

rections with respect to the support member around the axis line by rotating the entire hollow guiding shaft unit including the hollow guiding shaft in the forward / reverse directions with respect to the support member around the axis line by using the rotating unit. Therefore, because there is no need to disassemble or reassemble the hollow guiding shaft unit when rotating the hollow guiding shaft, the hollow guiding shaft can be easily rotated by the operator around the axis line with less efforts.

[0080] In the present invention, it is preferable that the rotating unit includes an operating member for rotating the hollow guiding shaft unit with respect to the support member around the axis line in the forward / reverse directions, and a positioning mechanism that positions the hollow guiding shaft unit in a circumferential direction around the axis line.

[0081] With such a configuration, the operator can first rotate the hollow guiding shaft unit by operating the operating member and then position the hollow guiding shaft unit in the circumferential direction by using the positioning mechanism. Accordingly, because a driving means such as a motor becomes needless the costs of the rotating unit can be suppressed.

[0082] In the present invention, it is preferable that the positioning mechanism includes a first engaging member formed in a member that constitutes the hollow guiding shaft unit or a member attached to the hollow guiding shaft unit, and a second engaging member formed in the support member and engageable with the first engaging member, and at least one between the first engaging member and the second engaging member is formed in a plurality in the circumferential direction.

[0083] With such a configuration, the position of the hollow guiding shaft unit in the circumferential direction can be changed easily by changing a point of engagement of the first engaging member and the second engaging member.

[0084] In the present invention, it is preferable that the second engaging member formed in the support member is formed in a plurality in the circumferential direction.

[0085] With such a configuration, since only one first engaging member is formed, the configuration of the rotating part including the hollow guiding shaft unit can be simplified.

[0086] In the present invention, it is preferable that three or more second engaging members are formed at equal intervals in the circumferential direction.

[0087] With such a configuration, the hollow guiding shaft unit can be rotated and positioned in two or more different states from the first state thereof.

[0088] In the present invention, it is preferable that the first engaging member is one of a convex part and a concave part, and the second engaging member is the other of the convex part and the concave part.

[0089] With such a configuration, the configuration of the positioning mechanism can be simplified.

[0090] It is preferable that the operating member is capable of undergoing elastic deformation in directions that

allow engagement / disengagement of the first engaging member and the second engaging member with / from each other.

[0091] With such a configuration, the state of the first engaging member and the second engaging member can be easily changed to an engaged state and a non-engaged state by elastic deformation of the operating member.

[0092] In the present invention, the operating member is attached to the hollow guiding shaft unit. The operating member is an operating lever that extends outward from the hollow guiding shaft unit in a direction that is orthogonal to the axis line. The first engaging member is formed in the operating lever.

[0093] With such a configuration, because a position at which the operator performs the operation can be kept away from the axis line, a large rotation torque can be achieved with a relatively small force. Therefore, the hollow guiding shaft unit can be rotated easily.

[0094] In the present invention, it is preferable that the rotating unit is a driving mechanism that drives the hollow guiding shaft unit to rotate with respect to the support member around the axis line in the forward / reverse directions.

[0095] With such a configuration, the hollow guiding shaft unit can be rotated by operating the driving mechanism, and the burden on the operator can be reduced more effectively.

[0096] In the present invention, it is preferable that the driving mechanism includes a motor, and a cam mechanism driven by the motor for rotating the hollow guiding shaft unit with respect to the support member around the axis line in the forward / reverse directions.

[0097] In this way, by configuring the driving mechanism by the combination of the motor and the cam mechanism, the structure of the driving mechanism can be simplified.

[0098] In the present invention, the air spinning device further includes a controlling section that controls the driving mechanism. It is preferable that the controlling section intermittently or continuously operates the driving mechanism during a spinning operation.

[0099] In this case, when operating the driving mechanism intermittently, because it is unnecessary to operate the driving mechanism constantly during the spinning operation, the power consumption can be suppressed. On the other hand, when continuously rotating the hollow guiding shaft unit during the spinning operation, it is possible to more effectively disperse the locations where the fibers contact the tip end part of the hollow guiding shaft, and it is possible to improve the wearing down suppression effect.

[0100] In the present invention, the air spinning device further includes a controlling section that controls the driving mechanism. It is preferable that the controlling section operates the driving mechanism while a spinning operation is not being performed.

[0101] If the hollow guiding shaft unit is rotated during

the spinning operation, there may be some adverse effect on the fibers that contact the tip end part of the hollow guiding shaft. To address this issue, by rotating the hollow guiding shaft unit while the spinning operation is not being performed, it is possible to reliably avoid the effect on the spinning that may occur when the hollow guiding shaft unit is rotated.

[0102] In the present invention, it is preferable that the hollow guiding shaft unit includes a connecting member to which an air feeding pipe for supplying air to be jetted into the fiber passage is connected.

[0103] In this way, when the air feeding pipe is connected to the connecting member of the hollow guiding shaft unit, the range in which the hollow guiding shaft unit can rotate is restricted by the air feeding pipe. Accordingly, the configuration according to the present invention in which the hollow guiding shaft unit is not rotated in one direction but is rotated in the forward / reverse directions is particularly effective.

[0104] In the present invention, it is preferable that when "n" number of nozzles are formed around the spinning chamber for jetting the air into the spinning chamber, the predetermined range in which the hollow guiding shaft unit can rotate with respect to the support member is 5 or more degrees and less than "360/n" degrees.

[0105] The locations at which the fibers contact the tip end part of the hollow guiding shaft are determined according to the positions of the nozzles. When four nozzles are formed, for example, the fibers contact at four locations in the circumferential direction corresponding to the four nozzles of the tip end part of the hollow guiding shaft. In this case, when the hollow guiding shaft unit is rotated by 90 degrees ($= 360/4$) or more, the locations at which the fibers contact the tip end part may overlap each other, and the effect of suppressing the wearing down may be reduced. Therefore, it is preferable that the rotation range of the hollow guiding shaft unit is set to less than "360/n" degrees. Four nozzles can be formed, for example, at equal intervals.

[0106] In the present invention, an air spinning device that twists a fiber bundle by a swirling air current occurring in a spinning chamber to form a yarn includes a hollow guiding shaft unit, a support member, and a rotating unit. The hollow guiding shaft unit includes a hollow guiding shaft. The hollow guiding shaft has a tip end part arranged in the spinning chamber and a fiber passage is formed therein along an axis line thereof. The support member supports the hollow guiding shaft unit. The rotating unit makes it possible to rotate the hollow guiding shaft unit with respect to the support member around the axis line. The rotating unit includes an operating member and a positioning mechanism. The operating member is a member for rotating the hollow guiding shaft unit with respect to the support member around the axis line. The positioning mechanism is a member that positions the hollow guiding shaft unit in a circumferential direction around the axis line at a plurality of different positions.

[0107] According to the present invention, by rotating

the entire hollow guiding shaft unit including the hollow guiding shaft with respect to the support member around the axis line by using the rotating unit, because there is no need to disassemble or reassemble the hollow guiding shaft unit when rotating the hollow guiding shaft, the efforts of the operator can be reduced, and the hollow guiding shaft can be easily rotated around the axis line. The operator can first rotate the hollow guiding shaft unit by operating the operating member and then position the hollow guiding shaft unit at one of a plurality of positions in the circumferential direction by using the positioning mechanism. Accordingly, because a driving means such as a motor becomes needless the costs of the rotating unit can be suppressed.

[0108] According to the present invention, the positioning mechanism can include a first engaging member and a second engaging member. The first engaging member is formed in a member that constitutes the hollow guiding shaft unit or a member attached to the hollow guiding shaft unit. The second engaging member is a member formed in the support member and engageable with the first engaging member. At least one between the first engaging member and the second engaging member is formed in a plurality in the circumferential direction.

[0109] Note that, in the present invention, "rotate / rotating" means rotating the hollow guiding shaft with respect to the support member by 5 or more degrees around the axis line by employing a configuration that uses the operating member or a configuration that uses the driving mechanism. The "rotate / rotating" does not include the rotation of the hollow guiding shaft with respect to the support member by less than 5 degrees around the axis line due to wobble at the time of installation.

[0110] In the present invention, it is preferable to include the air spinning device, a drafting device, a drawing device, and a winding device. The drafting device has a plurality of drafting roller pairs for supplying the fiber bundle to the air spinning device. The drawing device pulls the yarn from the air spinning device. The winding device is arranged downstream of the drawing device and winds the yarn on a bobbin while traversing the yarn thereby forming a package.

[0111] In the above explanation, the meaning of "a plurality of" also includes "a predetermined number of". 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 fairly fall within the scope of the claims.

Claims

1. An air spinning device (12) configured to twist a fiber bundle (T) by a swirling air current occurring in a spinning chamber (49) to form a yarn (Y), compris-

ing:

a hollow guiding shaft unit (60) including a hollow guiding shaft (61, 62, 63) whose tip end part (61a) is arranged in the spinning chamber (49) and in which a fiber passage (61d, 62a, 63a) is formed along an axis line (C);
a support member (70) that supports the hollow guiding shaft unit (60); and
a rotating unit (80, 90) configured to rotate the hollow guiding shaft unit (60) with respect to the support member (70) around the axis line (C) in forward / reverse directions in a predetermined range.

2. The air spinning device as claimed in Claim 1, wherein the rotating unit (80) includes
an operating member (81) for rotating the hollow guiding shaft unit (60) with respect to the support member (70) around the axis line (C) in the forward / reverse directions; and
a positioning mechanism (82) configured to position the hollow guiding shaft unit (60) in a circumferential direction around the axis line (C).
3. The air spinning device as claimed in Claim 2, wherein the positioning mechanism (82) includes
a first engaging member (83) formed in a member that constitutes the hollow guiding shaft unit (60) or a member (81) attached to the hollow guiding shaft unit (60); and
a second engaging member (84) formed in the support member (70) and engageable with the first engaging member (83), wherein
at least one of the first engaging member (83) and the second engaging member (84) is formed in a plurality in the circumferential direction.
4. The air spinning device as claimed in Claim 3, wherein the second engaging member (84) formed in the support member (70) is formed in a plurality in the circumferential direction.
5. The air spinning device as claimed in Claim 4, wherein three or more second engaging members (84) are formed at equal intervals in the circumferential direction.
6. The air spinning device as claimed in any one of Claims 3 to 5, wherein the first engaging member (83) is one of a convex part and a concave part, and the second engaging member (84) is the other of the convex part and the concave part.
7. The air spinning device as claimed in Claim 6, wherein the operating member (81) is capable of undergoing elastic deformation in directions that allow engagement / disengagement of the first engaging

member (83) and the second engaging member (84) with / from each other.

8. The air spinning device as claimed in any one of Claims 3 to 7, wherein
the operating member (81) is an operating lever (81) attached to the hollow guiding shaft unit (60) and extends outward from the hollow guiding shaft unit (60) in a direction that is orthogonal to the axis line (C), and
the first engaging member (83) is formed in the operating lever (81) .
9. The air spinning device as claimed in Claim 1, wherein the rotating unit (90) is a driving mechanism (90) configured to drive the hollow guiding shaft unit (60) to rotate with respect to the support member (70) around the axis line (C) in the forward / reverse directions.
10. The air spinning device as claimed in Claim 9, wherein the driving mechanism (90) includes
a motor (91); and
a cam mechanism (92) driven by the motor (91) for rotating the hollow guiding shaft unit (60) with respect to the support member (70) around the axis line (C) in the forward / reverse directions.
11. The air spinning device as claimed in Claim 9 or 10, further comprising a controlling section (29) configured to control the driving mechanism (90), wherein the controlling section (29) is configured to intermittently or continuously operate the driving mechanism (90) during a spinning operation.
12. The air spinning device as claimed in any one of Claims 9 to 11, further comprising a controlling section (29) configured to control the driving mechanism (90), wherein
the controlling section (29) is configured to operate the driving mechanism (90) while a spinning operation is not being performed.
13. The air spinning device as claimed in any one of Claims 1 to 12, wherein the hollow guiding shaft unit (60) includes a connecting member (64b) to which an air feeding pipe (100) for supplying air to be jetted into the fiber passage (62a) is connected.
14. The air spinning device as claimed in any one of Claims 1 to 13, wherein when "n" number of nozzles (41) are formed around the spinning chamber (49) for jetting the air into the spinning chamber (49), the predetermined range in which the hollow guiding shaft unit (60) can rotate with respect to the support member (70) is 5 or more degrees and less than "360/n" degrees.

15. An air spinning frame (1) comprising:

the air spinning device (12) as claimed in any one of Claims 1 to 14;
a drafting device (11) having a plurality of drafting roller pairs (16 to 19) for supplying the fiber bundle (T) to the air spinning device (12);
a drawing device (14) configured to pull the yarn (Y) from the air spinning device (12); and
a winding device (13) arranged downstream of the drawing device (14) and configured to wind the yarn (Y) on a bobbin (B) while traversing the yarn (Y) thereby forming a package (P).

16. An air spinning device (12) configured to twist a fiber bundle (T) by a swirling air current occurring in a spinning chamber (49) to form a yarn (Y), comprising:

a hollow guiding shaft unit (60) including a hollow guiding shaft (61, 62, 63) whose tip end part (61a) is arranged in the spinning chamber (49) and in which a fiber passage (61d, 62a, 63a) is formed along an axis line (C);
a support member (70) that supports the hollow guiding shaft unit (60); and
a rotating unit (80) configured to rotate the hollow guiding shaft unit (60) with respect to the support member (70) around the axis line (C), wherein
the rotating unit (80) includes

an operating member (81) for rotating the hollow guiding shaft unit (60) with respect to the support member (70) around the axis line (C); and
a positioning mechanism (82) configured to position the hollow guiding shaft unit (60) in a circumferential direction around the axis line (C) at a plurality of different positions.

17. The air spinning device as claimed in Claim 16, wherein the positioning mechanism (82) includes
a first engaging member (83) formed in a member that constitutes the hollow guiding shaft unit (60) or a member (81) attached to the hollow guiding shaft unit (60); and
a second engaging member (84) formed in the support member (70) and engageable with the first engaging member (83), wherein
at least one of the first engaging member (83) and the second engaging member (84) is formed in a plurality in the circumferential direction.

FIG.1

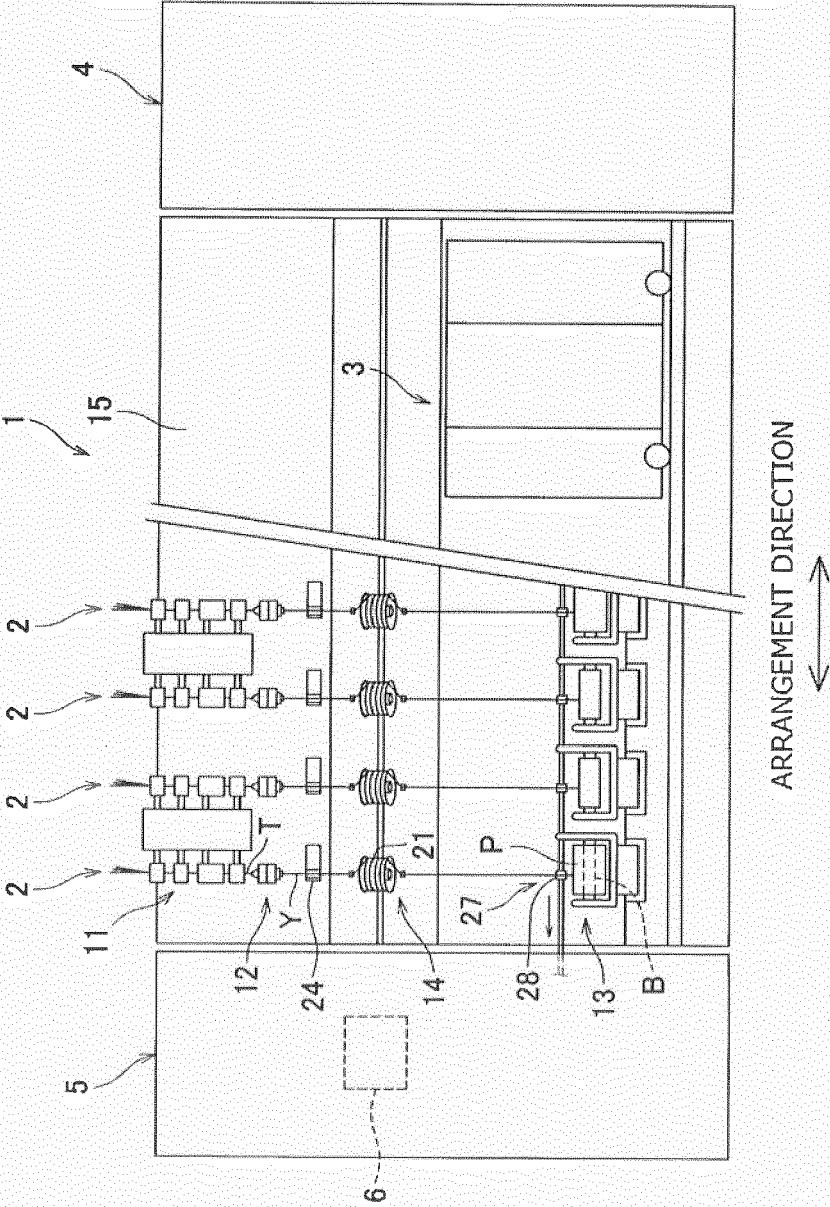


FIG. 2

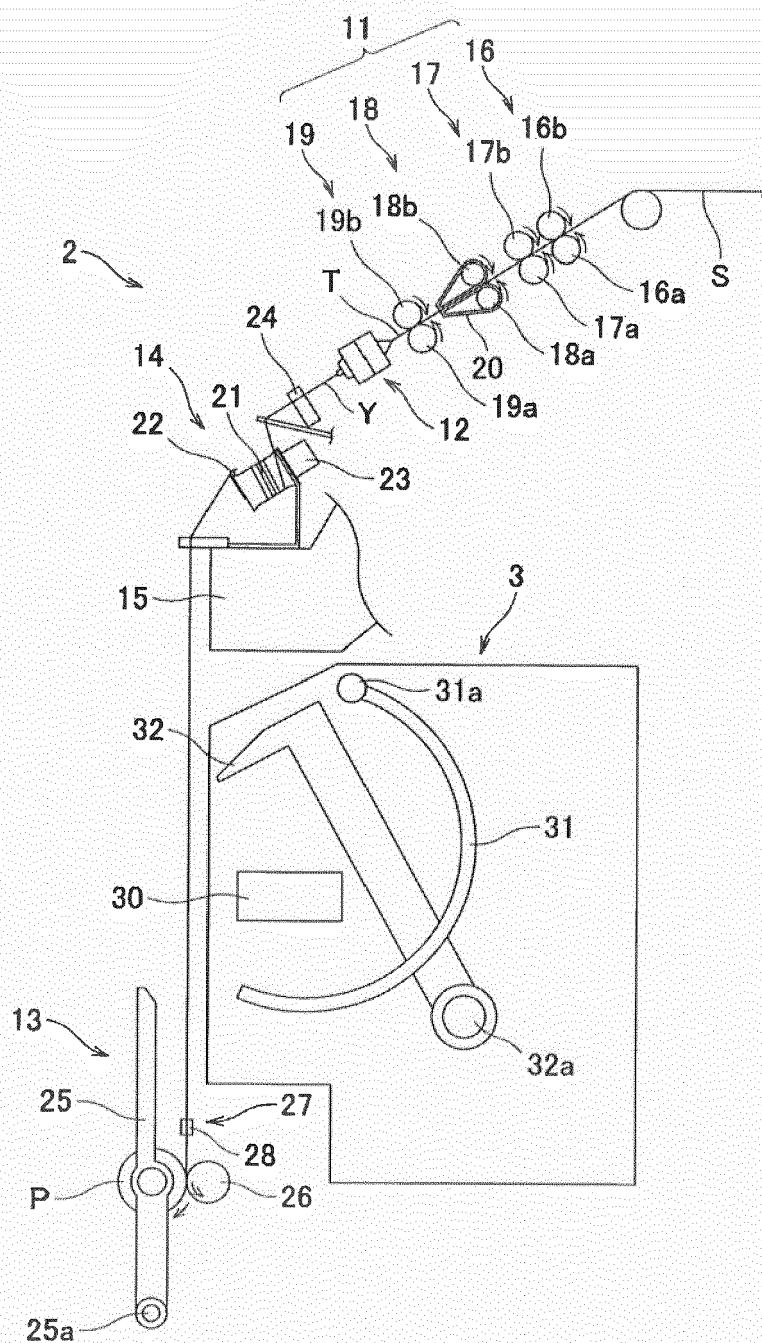


FIG.3

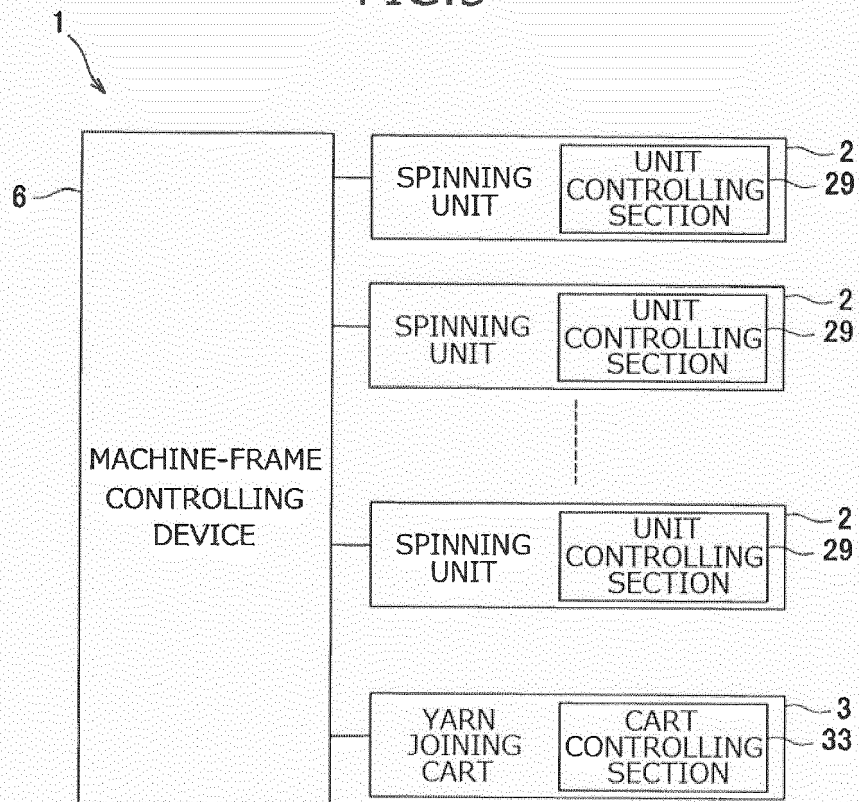
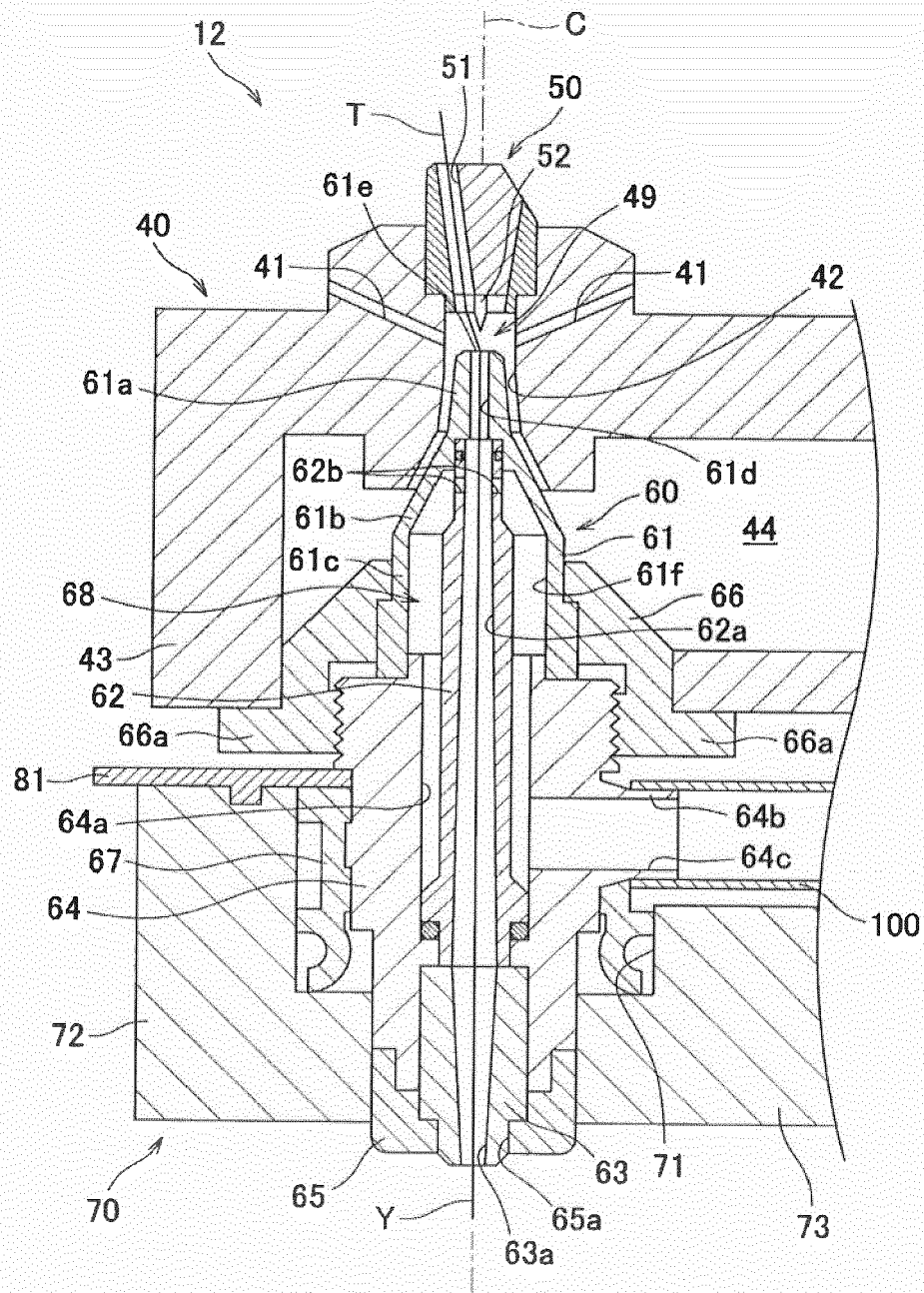


FIG.4



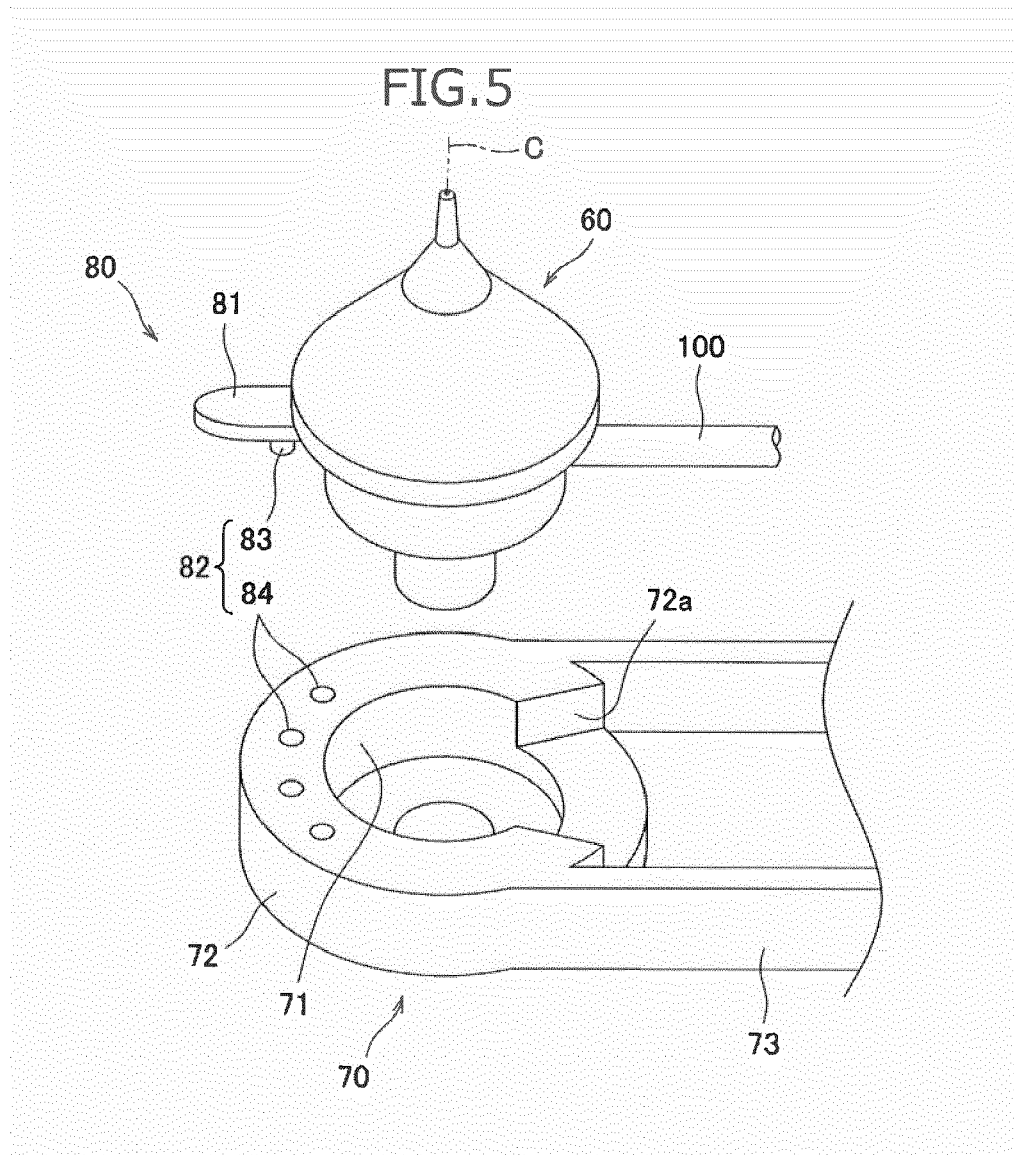
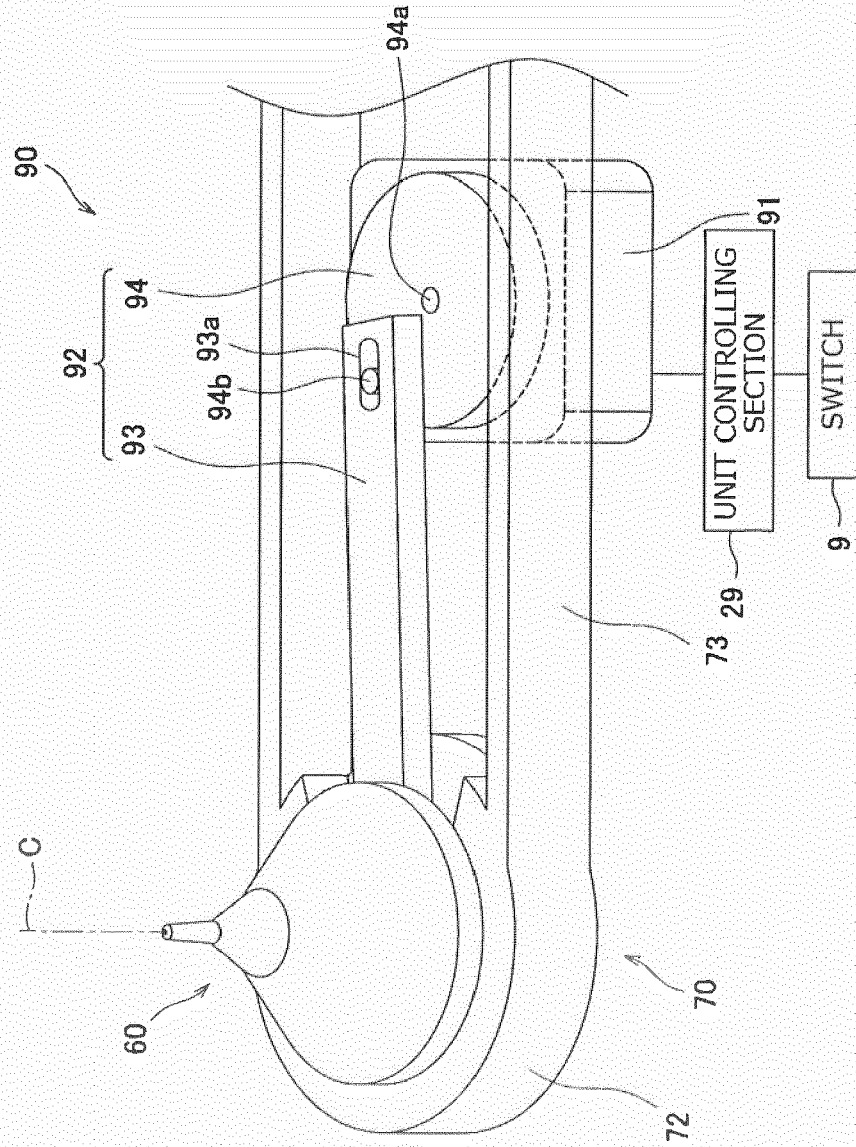


FIG.6





EUROPEAN SEARCH REPORT

Application Number
EP 18 18 2755

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 November 2018	Examiner Hausding, Jan
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EP 18 18 2755

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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