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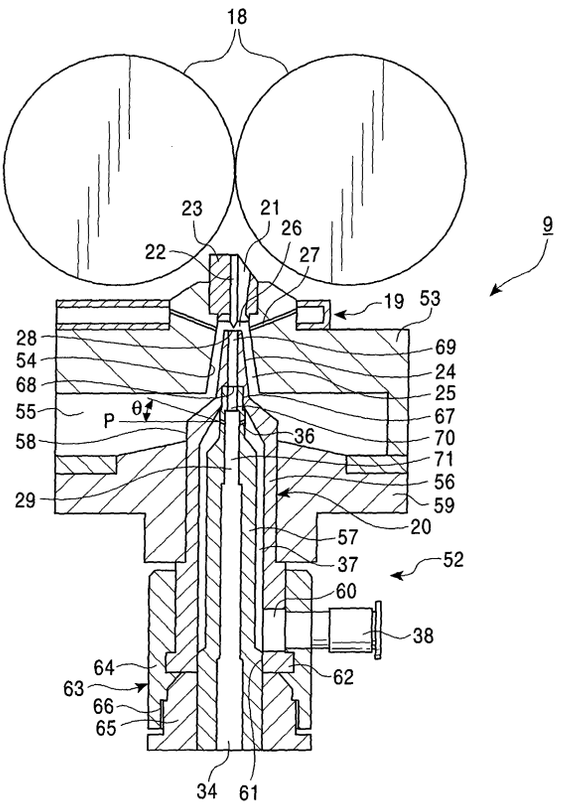
(54) Air vortex spinning device with arrangements for assisting piecing

(57) The present invention relates to a spinning device that can discharge and piece yarn more successfully and realize high speed spinning.

The spinning device comprises an air spinning nozzle 27 for generating vortex air current in and around a tip part 24 of a hollow guide shaft member 20 and an assistant nozzle 36 for generating vortex air current in a yarn passage 29 of the hollow guide shaft member 20, wherein the assistant nozzle 36 is tilted downstream to a plain P orthogonal to the yarn passage 29. The suitable tilt angle θ of the assistant nozzle is 10 degrees ≤ θ≤ 35 degrees preferably 20 degrees. This is because the vortex air current generated by the assistant nozzle develops a strong tendency to flow downstream and the power to suck a fiber bundle to the yarn passage becomes strong. Moreover, the vortex air current to the downstream direction and to the rotating direction are balanced suitably and yarn strength of the discharged fascinated yarn becomes strong, so that the problems such as yarn breakage are prevented.

FIG. 1



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Description

Field of the Invention

[0001] The present invention relates to a spinning device, which produces a truly twisted-like spun yarn by applying a vortex air current to a fiber bundle.

Background of the Invention

[0002] In a spinning device having a hollow guide shaft member that is disclosed in the laid-open Japanese Patent Application Publication (Tokkai) No. 2001-159033, a fiber is separated from a fiber bundle delivered from a drafting device by using the vortex air current generated by a compressed air which is jetted from an air spinning nozzle in and around a tip part of the hollow guide shaft, the fiber is made to be a truly twisted-like spun yarn after twisting the fiber to the rotating direction, and the fiber is discharged continuously by passing a yarn passage provided in a central part of the hollow guide shaft member and is wound to a winding package. Moreover, when activating the spinning device, and piecing yarns after generating yarn breakage, the vortex air current is generated by the compressed air jetted from the assistant nozzle that is formed in the yarn passage of the hollow guide shaft member and is open and stretched to the direction orthogonal to the yarn delivering direction as well as the direction tangent to the yarn passage. Thus, the first fiber bundle is sucked into the yarn passage by making the pressure in the entrance of the yarn passage negative, and the yarn in the spinning side is discharged by making the fiber bundle the fascinated yarn by using the cooperative work of the vortex air current from the assistant nozzle and from the air spinning nozzle (this is called "yarn discharge spinning"). After that, a yarn end in the spinning side and a yarn in a winding side (the winding package side) are pieced by a knotter or a splicer.

[0003] However, in the spinning devices as described above, the higher the spinning speed is, the success rate of discharging yarn in the upstream side when piecing the yarns in the yarn discharge spinning tends to be lower. Therefore, conventionally, the spinning speed in the normal spinning has been forced to be low just for keeping the success rate of discharging yarn in the yarn discharge spinning which is needed only in piecing the yarns, and it comes to limit production efficiency. Consequently, it is necessary to secure the high success rate when piecing the yarns in the high spinning speed for realizing high speed spinning and enhancing the normal spinning efficiency.

[0004] The present invention is provided in view of the above problems, and it is an object of the present invention to secure high success rate of piecing the yarns in a spinning device for discharging the yarn by cooperative work of an air spinning nozzle and an assistant nozzle.

Summary of the Invention

[0005] In a spinning device of the present invention, comprising an air spinning nozzle for generating the vortex air current in and around the tip part of the hollow guide shaft member, and an assistant nozzle for generating the vortex air current in the yarn passage of the hollow guide shaft member when piecing the yarns, sucking the fiber bundle into the yarn passage, and carrying out the yarn delivering spinning, the assistant nozzle is comprised so as to generate the vortex air current that flows to the opposite direction of the air spinning nozzle and is tilted to the downstream side to a plain orthogonal to the yarn passage.

[0006] When the spinning device is comprised as described above, the vortex air current generated by the assistant nozzle to the downstream side can be stronger. Therefore, the power of delivering the yarn to the downstream side and the negative pressure can be stronger in the entrance of the yarn passage, and the first suction of the fiber bundle into the yarn passage can be surely done.

[0007] Moreover, the vortex air current from the assistant nozzle to the downstream direction and to the rotating direction are balanced suitably and yarn strength of a fascinated yarn which is discharged from the spinning device becomes stronger, so that the problems such as yarn breakage before piecing are prevented and the success rate in piecing the yarns can be improved.

[0008] In this case, the tilt angle of the assistant nozzle is desired to be not smaller than 10 degrees and not higher than 35 degrees, more preferably 20 degrees.

[0009] This is because the vortex air current from the assistant nozzle to the downstream direction and the rotating direction are balanced suitably and the success rate in piecing the yarns can be improved.

Brief Description of the Drawings

[0010]

Figure 1 is a front longitudinal sectional view of a spinning device in a preferred embodiment of the present invention.

Figure 2 is a front longitudinal sectional view of the spinning device in the other embodiment of the present invention.

Figure 3 is a diagram showing the appearance of the spinning in the state of piecing yarns.

Figure 4 is a top transverse sectional view in the vicinity of the assistant nozzle.

Figure 5 is a front view of a spinning machine.

Figure 6 is a side longitudinal sectional view of the spinning machine.

Figure 7 is a schematic perspective view of the spinning machine.

Figure 8 is a graph showing a relation between a tilt

angle of the assistant nozzle and a success rate in piecing yarns. In this case, the spinning speed is 320 m/min..

Figure 9 is a graph showing a relation between a tilt angle of the assistant nozzle and a success rate in piecing yarns. In this case, the spinning speed is 350 m/min..

Figure 10 is a graph showing a relation between a tilt angle of the assistant nozzle and a success rate in piecing yarns. In this case, the spinning speed is 370 m/min..

Detailed Description of the preferred Embodiments

[0011] Hereinafter, a preferred embodiment of the present invention will be described with reference to accompanying drawings.

[0012] Figure 5 illustrates a spinning machine 1 having numerous spinning units 2 which are laid in parallel. The spinning machine 1 is equipped with a yarn piecing device (yarn piecing truck) 3 that is provided along the spinning units 2 so as to travel freely, a blower box 4, and a motor box 5.

[0013] As shown in Figure 6 and Figure 7, the respective spinning units 2 are provided in a casing 6 in the main body of the spinning machine 1, and comprise a drafting device 7 provided in the vicinity of the upper end of the casing 6, a spinning part 9, which is provided in the downstream side of the drafting device 7, for spinning a fiber bundle 8 which is delivered from the drafting device 7, a yarn delivering device 11, which is provided in the downstream side of the spinning part 9, for delivering a spun yarn 10 discharged from the spinning part 9, a winding device 12, which is provided in the downstream side of the yarn delivering device 11, for winding the spun yarn 10, and a slack tube 50 and a yarn clearer 51 which are provided between the yarn delivering device 11 and the winding device 12.

[0014] As shown in Figure 7, the drafting device 7 is provided for drafting a sliver 13 to make the fiber bundle 8, comprising four rollers including a back roller 14, a third roller 15, a middle roller 17 on which an apron belt 16 is bridged, and a front roller 18.

[0015] As shown in Figure 6 and Figure 7, the yarn delivering device 11, comprising a delivery roller 39 supported by the casing 6 in the main body of the spinning machine 1 and a nip roller 40 provided to be freely separated or closed to the delivery roller 39, can deliver the spun yarn 10 to the winding device 12 side after sandwiching the spun yarn 10 discharged from the spinning part 9 in between the delivery roller 39 and the nip roller 40 and driving to rotate the delivery roller 39.

[0016] The yarn piecing device 3 comprises a truck 42 traveling on a rail 41 provided in the casing 6 in the main body of the spinning machine 1, a knotter (or a splicer, etc.) 43 provided in the truck 42, a suction pipe 44 provided to be moved up and down freely in the truck 42 and guided to a knotter 43 after sucking and catching a yarn end discharged from the spinning part 9, and a suction mouth 46 provided to be moved up and down freely in the truck 42 and guided the yarn end from a package 45 supported rotatably in the winding device 12 to the knotter 43 after sucking and grasping the yarn end.

[0017] The slack tube 50 is provided for storing the spun yarn 10 temporarily when piecing yarns. The yarn clearer 51 is provided for detecting defects of the spun yarn 10.

[0018] As shown in Figure 1 and Figure 3, the spinning part 9 in the preferred embodiment of the present invention mainly comprises a spinning nozzle part 19 for applying the vortex air current to the fiber bundle 8 while passing the fiber bundle 8 delivered from the front roller 18 through the spinning part 9, a hollow guide shaft member (a spindle) 20 wherein the tip part of the fiber bundle 8 is inserted into the spinning nozzle part 19 concentrically, and a holder member 52 retaining the hollow guide shaft member 20.

[0019] The nozzle part 19 comprises a needle holder 23 located in an outlet part of the front roller 18 and a casing 53 in the nozzle part wherein the needle holder 23 is fixed. The needle holder 23, including a guide hole 21 introducing the drafted fiber bundle 8, retains a needle 22 on a flow path of the fiber bundle 8 discharged from the guide hole 21. A taper hole 54 is provided in the casing 53 in the nozzle part regarding the location in the downstream side than the needle holder 23, and a tip part 24 of the hollow guide shaft member 20 which has an almost same taper angle as the one of the taper hole 54 is inserted into the taper hole 54 concentrically and at a predetermined intervals. A spinning room 26 is formed between a tip surface of the hollow guide shaft member 20 and the needle holder 23, and the tip of the needle 22 is protruded in the spinning room 26 and faced to the tip surface of the hollow guide shaft member 20. Moreover, a vortex air current generating room 25 is formed between the taper hole 54 and the tip part 24.

[0020] A plurality of air spinning nozzles 27 whose outlet end is open to the spinning room 26 is provided in the casing 53 in the nozzle part. These air spinning nozzles 27, comprising holes made in the casing 53 in the nozzle part, are oriented after tilting to a tangent direction of the spinning room 26 and to a downstream side to a yarn delivering direction, and get compressed air from a compressed air source (not shown in the drawings). After that, these air spinning nozzles 27 jet compressed air to the spinning room 26, and generate such as the vortex air current which rotates counterclockwise in the spinning room 26, as shown in Figure 3. This vortex air current flows downstream spirally along with the vortex air current generating room 25 around the tip part 24 of the hollow guide shaft member 20, and is discharged from a discharge room 55 formed in the casing 53 in the nozzle part.

[0021] The hollow guide shaft member 20 comprises an external chassis 56 having the tip part 24 and an in-

ternal chassis 57 which is engaged concentrically and fixed integrally with the external chassis 56. A yarn passage 29, formed along the shaft center of the hollow guide shaft member 20, introduces the fiber bundle 8 from an entrance 28 of the tip part 24 and discharges the spun yarn 10 from an outlet 34 in the opposite side of the entrance 28. The cross sectional area of the yarn passage 29 becomes broader step by step as heading for the downstream side. A thick diameter part 58 whose diameter becomes broader to the downstream side than the tip part 24 of the external chassis 56 is formed in the hollow guide shaft member 20, and the thick diameter part 58 is exposed in the discharge room 55. In order to eliminate the fiber stuck in the spinning room 26 and the vortex air current generating room 25, a shaft retention member 59 is fitted in the casing 53 in the nozzle part to be removed freely and the thick diameter part 58 is inserted and fixed in the shaft retention member 59.

[0022] A plurality of assistant nozzles 36 for jetting compressed air during the yarn discharging spinning is provided in the hollow guide shaft member 20. The assistant nozzles 36, comprising holes formed by penetrating in the internal chassis 57 in the vicinity of the connecting location with the external chassis 56, are oriented to the tangent direction to the yarn passage 29 as shown in Figure 4, and generate the vortex air current which flows clockwise, that is the opposite direction to the vortex air current generated by the air spinning nozzle 27 in the yarn passage 29 as shown in Figure 3. A compressed air passage 37 for introducing compressed air to the assistant nozzle 36 is formed between the internal chassis 57 and the external chassis 56. The compressed air passage 37 is connected to a compressed air introduction hole 60 formed in the external chassis 56 and a compressed air source (not shown in the drawings) through a supply tube 38 etc. that is communicated with the compressed air introduction hole 60.

[0023] Partivularly, the assistant nozzle 36 is tilted by an angle θ so as to head for the downstream side to a plane P orthogonal to the yarn passage 29. More specifically, the assistant nozzle 36 is provided for jetting compressed air, heading for the downstream side of the yarn passage 29 by the angle θ. In addition, the angle of the conventional assistant nozzle is θ = Zero (0) degrees, and the conventional assistant nozzle jet compressed air to the direction orthogonal to the yarn passage 29.

[0024] The internal chassis 57 and the external chassis 56 are engaged together in an engage part 61 in the downstream side or the back end side of the hollow guide shaft member 20. A front holder 64 and a back holder 65 forming a shaft holder 63 are screwed together in a screw part 66 with sandwiching a collar part 62 formed in the external chassis 56, and retain the back side of the hollow guide shaft member 20 from the peripheral side. The supply tube 38 is fixed to the front holder 64. As described above, the holder member 52 comprises the shaft retention member 59 and the shaft holder 63.

[0025] An tip engage part 67, formed in the tip part of the internal chassis 57 and located in the upper stream side than the assistant nozzle 36, is engaged in an engage hole 68 formed in the external chassis 56, and the contact surfaces of the tip engage part 67 and the engage hole 68 are bonded. Thus, the internal chassis 57 and the external chassis 56 are engaged together in the vicinity of the root of the tip part 24, and they are bonded in the peripheral surface and the tip surface of the tip engage part 67 as well as the engage part 61 located in the downstream side. Additionally, they are engaged and bonded so as not to generate gap and projection in the yarn passage 29.

[0026] In the vicinity of the tip engage part 67, the yarn passage 29 comprises a hole 69 formed in the tip part 24 of the external chassis 56, a hole 70 provided in the upper stream side than the assistant nozzle 36 of the internal chassis 57 and having the same diameter as the one of the hole 69, and a hole 71 which has a slight larger diameter than the one of the hole 70 and provided in the downstream side of the hole 70 in the internal chassis 57 and the assistant nozzle 36.

[0027] Next, the operation in the preferred embodiment of the present invention will be described.

[0028] In the normal spinning, the assistant nozzle 36 does not jet compressed air, which is not in the working condition, and only the air spinning nozzle 27 jets compressed air, which is in the working condition. In this case, the vortex air current flowing counterclockwise is generated in the spinning room 26 as shown in Figure 3, and the vortex air current is discharged from a discharge room 55 with flowing spirally in the vortex air current generating room 25.

[0029] The fiber bundle 8 or the yarn come from the front roller 18 to the yarn delivering device 11 through the guide hole 21, the spinning room 26 and the yarn passage 29, and tension is applied to the yarn as the delivering power is applied to the downstream side by the yarn delivering device 11.

[0030] The fiber bundle 8 discharged from the front roller 18 of the drafting device 7 comes from the guide hole 21 into the spinning room 26, and the vortex air current is applied from the air spinning nozzle 27 to the fiber bundle 8. Thus, a residual short fiber is separated from a long fiber that becomes a core fiber in the fiber bundle 8, and the fiber bundle 8 is stirred in the vortex air current generating room 25 and twisted (see Figure 3). The twist tends to be propagated to the front roller 18 side, however the fiber bundle 8 is not twisted by the above twist as the needle 22 prevents the propagation. In this way, the needle 22 comprises a twist propagation prevention means. The fiber twisted as described above is made to be a truly twisted-like spun yarn whose most part becomes twining fiber sequentially, and is discharged from the outlet 34 by passing through the yarn passage 29. After that, the spun yarn 10 is wound to the winding device 12 through the yarn delivering device 11.

[0031] Next, the yarn piecing operation when starting the spinning device and generating yarn breakage will be described with reference to Figure 3.

[0032] In the beginning of the yarn piecing operation, the drafting device 7, the air spinning nozzle 27, and the assistant nozzle 36 are not in the working condition. Moreover, the fiber and the yarn are not existed in the downstream side of the front roller 18. Thus, the yarn tension is not also generated by the yarn delivering device 11.

[0033] First, the yarn piecing device 3 is moved to the spinning unit 2, where yarns are pieced before starting yarn piecing, and next, the drafting device 7, the air spinning nozzle 27 and the assistant nozzle 36 are operated.

[0034] The fiber bundle 8 is delivered to the spinning part 9 by the operation of the drafting device 7. The delivered fiber bundle 8 is entered into the spinning room 26 after passing through the guide hole 21, and the vortex air current is applied from the air spinning nozzle 27 to the fiber bundle 8. As the yarn tension is not existed, the fiber bundle 8 is guided by the needle 22 and delivered to the vicinity of the entrance 28 of the yarn passage 29 with the state of loose false twisting by the vortex air current. Also in this case, the twist propagation is prevented by the needle 22, the residual fiber is separated from the fiber in the core part by the vortex air current, and the fiber is swung in the vortex air current generation room 25. The vortex air current from the air spinning nozzle 27 in starting yarn piecing prevents the fiber bundle 8 from overswinging and the stable yarn piecing can be made, so that it is preferable that the vortex air current (the compressed air to be jetted) is made to be low pressure in a predetermined time after operating the air spinning nozzle 27, and after that, the pressure is switched to be high pressure (the nozzle pressure in the normal spinning).

[0035] Meanwhile, the compressed air jetted from the assistant nozzle 36 generates the vortex air current in the yarn passage 29. The area of the yarn passage 29 becomes broader as it goes to the downstream side and the assistant nozzle 36 is tilted to the downstream side, so that the vortex air current in the yarn passage 29 flows spirally to the downstream side. Thus, as the air to the suction direction is generated in the yarn passage 29 and the negative pressure is generated in the entrance 28 of the yarn passage 29, the fiber bundle in the spinning room 26 can be sucked into the yarn passage 29. The assistant nozzle 36 can suck the fiber bundle into the yarn passage 29 if there is no yarn tension generated by the yarn delivering device 11 and deliver the fiber bundle to the downstream direction.

[0036] As the vortex air current from the assistant nozzle 36 flows reversely to the vortex air current from the air spinning nozzle 27, the fiber bundle applying the vortex air current from the assistant nozzle 36 is twisted reversely to the rotating direction from the air spinning nozzle 27 and untwisted. Then, the fiber bundle in the state of loose false twisting is spun to make the fascinated yarn and is discharged from the outlet 34 of the yarn passage 29. Thus, yarn delivering can be carried out.

[0037] More specifically, most part of the fiber bundle delivered to the assistant nozzle 36 is twisted in between the assistant nozzle 36 and the needle 22 by the twisting action of the assistant nozzle 36, and the fiber bundle is collected as the core fiber. Meanwhile, the residual fiber that is not twisted and collected as the core fiber in the former process is twined around the core fiber along the vortex air current from the air spinning nozzle 27. The core fiber is twisted by the assistant nozzle 36, however the core fiber is untwisted after passing the assistant nozzle 36. The core fiber is untwisted to the reverse direction to the vortex air current from the assistant nozzle 36, which is the same direction as the vortex air current from the air spinning nozzle 27. Therefore, the twining fiber can be twined around the core fiber strongly by untwisting the core fiber, and the fascinated yarn that the twining fiber is twined can be generated around the core fiber that is untwisted.

[0038] When the fascinated yarn 47 is discharged from the yarn passage 29, the yarn piecing device 3 that is arrived in advance is driven and the fascinated yarn 47 is sucked by the suction pipe 44 and is guided to the knotter 43. When the fascinated yarn 47 is sandwiched in between the delivery roller 39 and the nip roller 40 which are rotating continuously during the guide, the assistant nozzle 36 is stopped and the yarn delivering is controlled by the yarn delivering device 11. After that, the yarn is spun in the normal spinning condition, and the truly twisted-like spun yarn is generated. Finally, the whole fascinated yarn 47 is sucked into the suction pipe 44, and the truly twisted-like spun yarn is passed to the knotter 43 substantially.

[0039] In parallel with the above process, the suction mouth 46 also sucks the yarn on the package 45 side, and the yarn is passed to the knotter 43. After that, the knotter 43 is driven, and the yarn piecing process is finished by knotting the both truly twisted-like spun yarns. In addition, the fascinated yarn 47 is eliminated by cutting yarn in piecing as described above.

[0040] In the preferred embodiment of the present invention as described above, the assistant nozzle 36 is the angle θ tilted to the downstream side to the plane P orthogonal to the yarn passage 29. Therefore, the stronger suction air to the downstream side can be generated in the yarn passage 29 compared with the conventional assistant nozzle orthogonal to the yarn passage 29, and the fiber bundle can be easily introduced to the yarn passage 29 as the negative pressure in the entrance 28 of the yarn passage 29 can be also stronger. Thus, the success rate of delivering yarn goes up even if the spinning speed is higher, and the success rate of piecing the yarns can also be improved.

[0041] Moreover, as the vortex air current to the downstream direction and the vortex air current to the rotating direction can be balanced suitably as described later,

the problems such as breaking yarn before piecing the yarns can be prevented by strengthening the yarn strength of the fascinated yarn 47 discharged from the outlet 34 of the yarn passage 29, and the success rate of piecing the yarns can be improved. Therefore, high speed spinning can be carried out.

[0042] Figure 8, Figure 9 and Figure 10 are curve charts showing the success rate (vertical axis) in piecing the yarns to the tilt angel θ (horizontal axis) of the assistant nozzle 36 when changing a spinning speed V. Figure 8, Figure 9 and Figure 10 show the cases that the spinning speeds are 320, 350 and 370 (m/min.) respectively. It is known that the yarn delivering becomes more difficult as the fiber length of the material yarn becomes shorter and the composition number of the fiber becomes lower. Here, success rate tests are performed using a carded cotton yarn (the fiber bundle is raveled and trued up to the longitudinal direction of the fiber to make the diameter even) 100% Ne 40 that is thought to be most difficult to succeed in piecing the yarns.

[0043] As seen from Figures 9 ~ 10, the success rate tends to be lower as the spinning speed V becomes faster. Meanwhile, the success rate becomes higher than the case in using the conventional assistant nozzle (θ= 0 degrees) only by tilting the assistant nozzle 36. A more suitable angle θ is about 20 degrees, and in this case a high success rate of 84 ~ 85 % can be acquired even if the spinning speed is as high as V = (m/min.). The higher success rate can be acquired than before in the range of 10 degrees ≦ θ ≦ 35 degrees at any spinning speed. Therefore, judging from the results so far obtained, the suitable angle θ is not smaller than 10 degrees and not higher than 35 degrees, and the optimum angle is 20 degrees.

[0044] Regarding the vortex air current generated by the assistant nozzle 36, the balance of the vortex air current to the rotating direction and the yarn delivering direction to the downstream side is important. When the balance is off, the success rate becomes lower. This is because the vortex air current to the rotating direction becomes too small and the fascinated yarn spinning, working with the air spinning nozzle 27, cannot be carried out normally when the tilt angle θ is set to be too wide, so that it is considered that the success rate of the yarn delivering spinning that is the yarn piecing success rate becomes lower. When the assistant nozzle 36 is tilted and the tilt angle is set as described above, the balance of the both vortex air currents can be more suitable and the strong fascinated yarn can be produced even if the spinning speed is high. The yarn breakage in piecing the yarns can be prevented, the success rate of piecing the yarns can be improved, and the spinning speed can be high.

[0045] It is an advantage that the soft cloth can be made of the yarn generated by the high speed spinning. In other words, the high speed spinning can shorten the time of swinging the fiber of unit length by the vortex air current from the air spinning nozzle 27 and can be prevented the yarn from too fastening, so that the cloth as well as the generated yarn can be soften.

[0046] Here, the distance between the air spinning nozzle 27 and the assistant nozzle 36 (more specifically, the distance between the respective outlets) is almost same as or shorter than the average fiber length comprising the fiber bundle (see laid-open Japanese Patent Application Publication (Tokkai) No. 2001-159033). Therefore, most of the fiber can be affected by the vortex air currents from the both nozzles at the same time, the fascinated yarn to be generated can be strengthen more, and the yarn can be prevented from cutting and mistaking when piecing the yarns. The assistant nozzle 36 may be close to the air spinning nozzle 27 as much as possible structurally.

[0047] Moreover, it is preferable that the outlet of the assistant nozzle 36 may be close to the nipping point of the fiber bundle 8 of the front roller 18 as much as possible. This is because the fiber bundle 8 discharged from the front roller 18 is sucked into the spinning part 9 by the stronger suction power in the yarn delivering spinning, and the fiber loss is decreased by introducing the twist by the vortex air current from the assistant nozzle 36 to the vicinity of the front roller 18 as much as possible (the needle 22 prevents the twist introduction in the normal spinning) and by delivering a plurality of the fibers into the spinning part 9 after binding the yarn more strongly.

[0048] Moreover, the peripheral length of the thick diameter part 58 in the hollow guide shaft member 20 (the external chassis 56) is made to be longer than the average fiber length of the fiber bundle. Thus, the fiber swung around the hollow guide shaft member 20 can be prevented from involving each other.

[0049] Next, another preferred embodiment of the present invention will be described with reference to Figure 2. The other preferred embodiments of the present invention solve the following problems in the preferred embodiment of the present invention in Figure 1.

[0050] In the preferred embodiment of Figure 1, the hollow guide shaft member 20 is comprised by bonding (or sintering) the ceramic external chassis 56 and the internal chassis 57. However, as the hollow guide shaft member 20 has to be exchanged altogether according to the spinning condition of yarn type and yarn count if the hollow guide shaft member 20 is comprised as one, many parts are needed according to the condition and the conventional hollow guide shaft causes to increase the number of the parts to be prepared, to waste parts management, and to add cost. Moreover, there is a defect that it is difficult to maintain the spinning machine as there is no way to eliminate the sudden choke of the fiber in the inner passage (the assistant nozzle 36, the yarn passage 29, etc.).

[0051] Consequently, in another embodiment of the present invention as shown in Figure 2, the hollow guide shaft member 20 can be separated for solving the above problems.

[0052] The hollow guide shaft member 20 comprises a former external chassis 75 corresponding to the former part (the upstream side) of the external chassis 56, a rear external chassis 76 corresponding to the integration of the last half (downstream side) of the external chassis 56 and the shaft holder 63, and an internal chassis 77 corresponding to the internal chassis 57. The former external chassis 75 includes the tip part 24, the hole 69, and the engaged hole 68, etc. as described above. The internal chassis 77 includes the holes 70, 71, and the assistant nozzle 36, etc. as described above. The rear external chassis 76, including the compressed air introduction hole 60 as described above, is connected to the supply tube 38. Regarding the same composition as the one in the preferred embodiment of the present invention, the same code is numbered in the Figures.

[0053] The engage hole 68 of the former external chassis 75 and the tip engage part 67 of the inner chassis 77 are engaged each other in the vicinity of the root of the tip part 24. However, the engage hole 68 and the tip engage part 67 are not bonded and they can be separated. An 0-ring 78 is placed as the seal member and sealed in this engage part for preventing the air leakage between the yarn passage 29 and the compressed air passage 37.

[0054] The former external chassis 75 and the rear external chassis 76 are also engaged each other. More specifically, an engage tube part 79, being formed in the protruding manner in the former end surface of the rear external chassis 76, is engaged in the inner side of the former external chassis 75. An 0-ring 80, used as the elastic member, lies between the back end surface (the downstream side) of the former external chassis 75 and the former end surface (the upstream side) of the rear external chassis 76. An insert hole 81 is provided in the shaft retention member 59 for inserting the former external chassis 75 and the rear external chassis 76 freely, and a collar part 82 is provided in the former end part of the insert hole 81 for regulating the insert position by engaging with the former external chassis 75.

[0055] The internal chassis 77 and the rear external chassis 76 are also engaged and connected each other. More specifically, an engage part 83 whose diameter becomes a little bit wider, being formed in the rear end part of the internal chassis 77, is engaged with an engage hole 84 of the rear external chassis 76. The diameter of the outlet 34 in the rear part of the engage hole 84 is smaller than the one of the engage part 83, and a collar part 85 formed in the inner peripheral side in a protruding manner can push the internal chassis 77 forward. An 0-ring 86, provided as an elastic member, lies in between the collar part 85 and the internal chassis 77.

[0056] A bolt 87 is inserted into the rear external chassis 76 from backside, and the bolt 87 is screwed into a screw hole 88 formed in the shaft retention member 59.

[0057] In the preferred embodiment of the present invention, the hollow guide shaft member 20 is assembled as follows. The former external chassis 75 fixing the 0-ring 78 is inserted into the insert hole 81 of the shaft retention member 59 from backside in advance, and the former external chassis 75 is fixed in the shaft retention member 59. Next, the tip engage part 67 of the internal chassis 77 is engaged with the engage hole 68 of the former external chassis 75, and the internal chassis 77 is fixed in the former external chassis 75. After that, the rear external chassis 76 fixing the 0-ring 80 in advance is inserted into the insert hole 81 from backside and engaged with the former external chassis 75, and the rear external chassis 76 is fixed in the shaft retention member 59 and the former external chassis 75. Lastly, the bolt 87 is fastened. Thus, as the rear external chassis 76 is pushed forward, the former external chassis 75 and the internal chassis 77 are also pushed forward through the 0-rings 80, 86.

[0058] Then, the former external chassis 75 is positioned to the shaft direction by bumping into the collar part 82, and the internal chassis 77 is positioned to the shaft direction as the tip surface of the tip engage part 67 is bumped into the forward end surface (base) of the engage hole 68 in the former external chassis 75.

[0059] Here, the former external chassis 75 is contacted with the collar part 82 directly by a predetermined contact pressure, and the internal chassis 77 is also connected with the forward end surface of the engage hole 68 of the former external chassis 75 directly by a predetermined contact pressure. The contact parts are likely to be broken when a sizable pressure is placed on the contact parts. However, the contact parts are prevented from breaking by using the 0-rings 80, 86. More specifically, the power pressured by the rear external chassis 76 is loosen by the 0-rings 80, 86, and the power that is designed in advance can be applied to the former external chassis 75 and the internal chassis 77. Therefore, the excessive contact pressure in the contact part can be prevented, and the breakage in the contact part can be also prevented in advance. Naturally, the 0-rings 80, 86 can also prevent air leakage.

[0060] In the preferred embodiment of the present invention, the hollow guide shaft member 20 is not comprised as one but is divided into the former external chassis 75, the rear external chassis 76, and the internal chassis 77, and they can be assembled and dismounted, so that the respective parts can be exchanged. As the combination of the respective parts can be changed when the difference of the spinning condition including yarn type and count is occurred, the parts are not needed to be prepared respectively for every condition. Therefore, the number of the parts can be reduced, the parts management can be efficient, and the cost can be reduced. Moreover, as the hollow guide shaft member 20 can be disassembled easily even if the internal passage (the assistant nozzle 36, the yarn passage 29, etc.) is choked suddenly, the spinning machine can be easily maintained. In addition, the other operation and effect are same as the ones in the preferred embodiment of

the present invention.

[0061] As described above, the assistant nozzle might be close to the air spinning nozzle as much as possible. However, in this case, the assistant nozzle is arranged in the inner part in the tip part of the hollow guide shaft member generally, and it is difficult to process the assistant nozzle. According to Figure 1 and Figure 2 as described above in the preferred embodiment of the present invention, the internal chassis 57, 77 wherein the assistant nozzle 36 is provided are the divided added parts. As the tip parts of the divided added parts are inserted and engaged with the external chassis 56 or the former external chassis 75, the assistant nozzle 36 can be easily processed and has access to the air spinning nozzle 27 as much as possible.

[0062] The present invention is not limited to the embodiments as described above.

[0063] For example, the rotating direction of the assistant nozzle 36 can be same as the rotating direction of the air spinning nozzle 27. However, it is more preferable to adopt the opposite case for the effect. The member except the needle 22 can be used for preventing the propagation of the twist to the upstream side.

[0064] As described above, the present invention demonstrates the following advantages. (1) The success rate of yarn discharge spinning and yarn piecing can be improved even in the case of high speed spinning. (2) Spinning speed can be higher, which leads to make soft cloth.

Claims

1. A spinning device comprising:

an air spinning nozzle for generating vortex air current in and around a tip part of a hollow guide shaft member; and

an assistant nozzle for generating the vortex air current in the yarn passage of the hollow guide shaft member when piecing yarns, sucking the fiber bundle into the yarn passage, and carrying out the yarn delivering spinning;

wherein the assistant nozzle is comprised so as to generate the vortex air current that flows to the opposite direction of the air spinning nozzle and is tilted to the downstream side to a plain orthogonal to the yarn passage.

2. A spinning device as in claim 1, wherein the tilt angle of the assistant nozzle is not smaller than 10 degrees and not higher than 35 degrees.

3. A spinning device as in claim 2, wherein the tilt angle of the assistant nozzle is 20 degrees.

FIG. 1

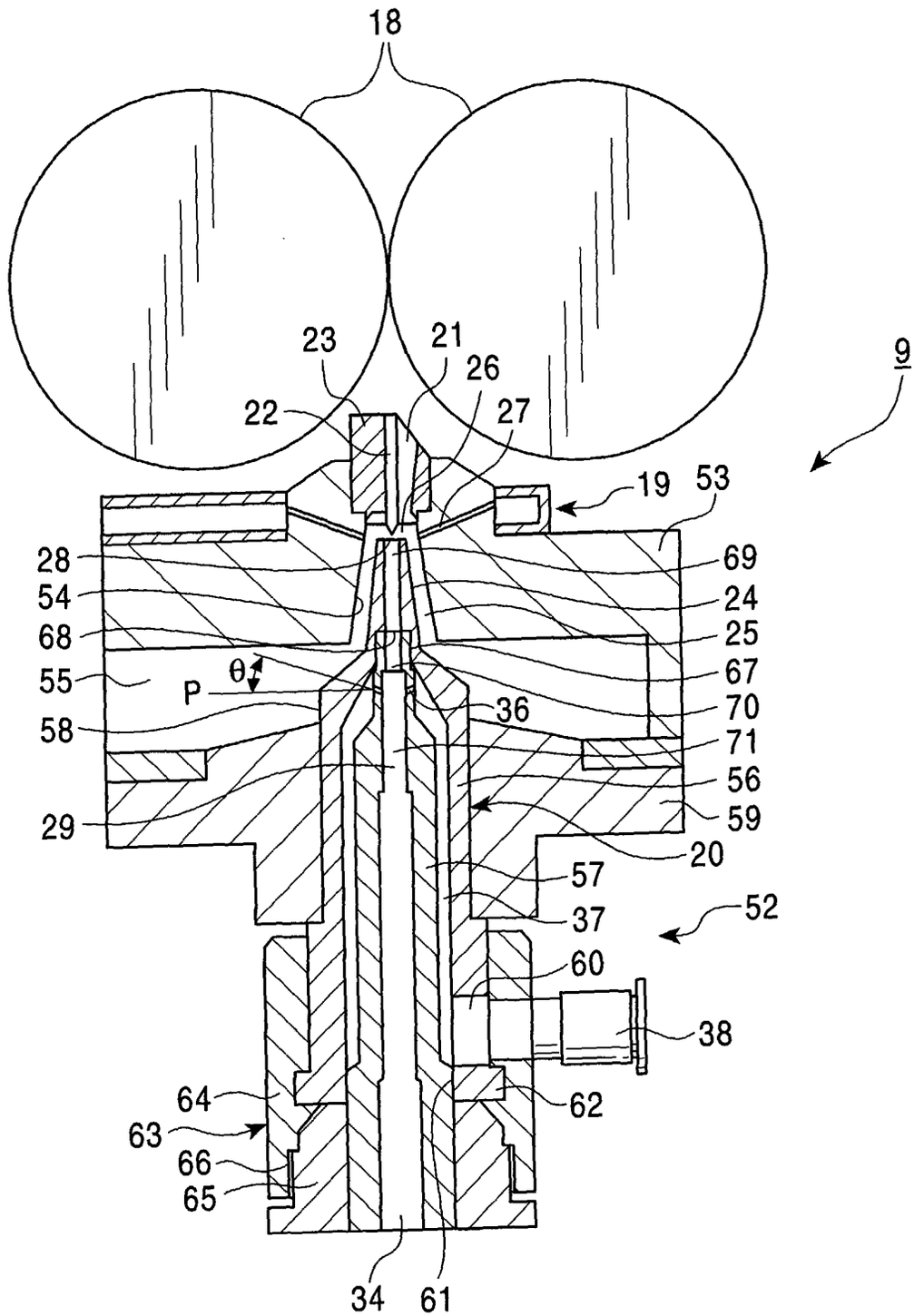
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FIG. 2

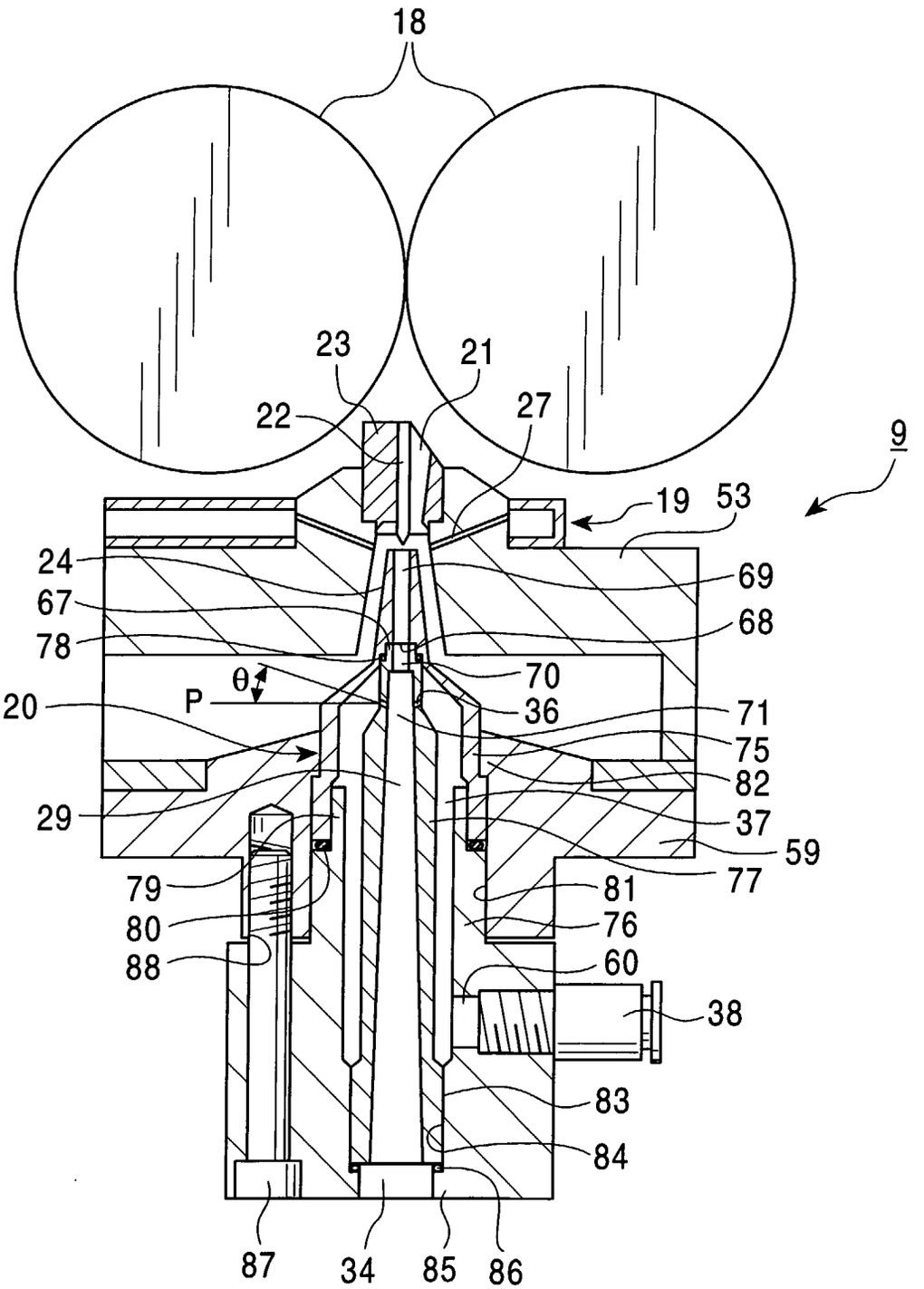
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FIG. 3

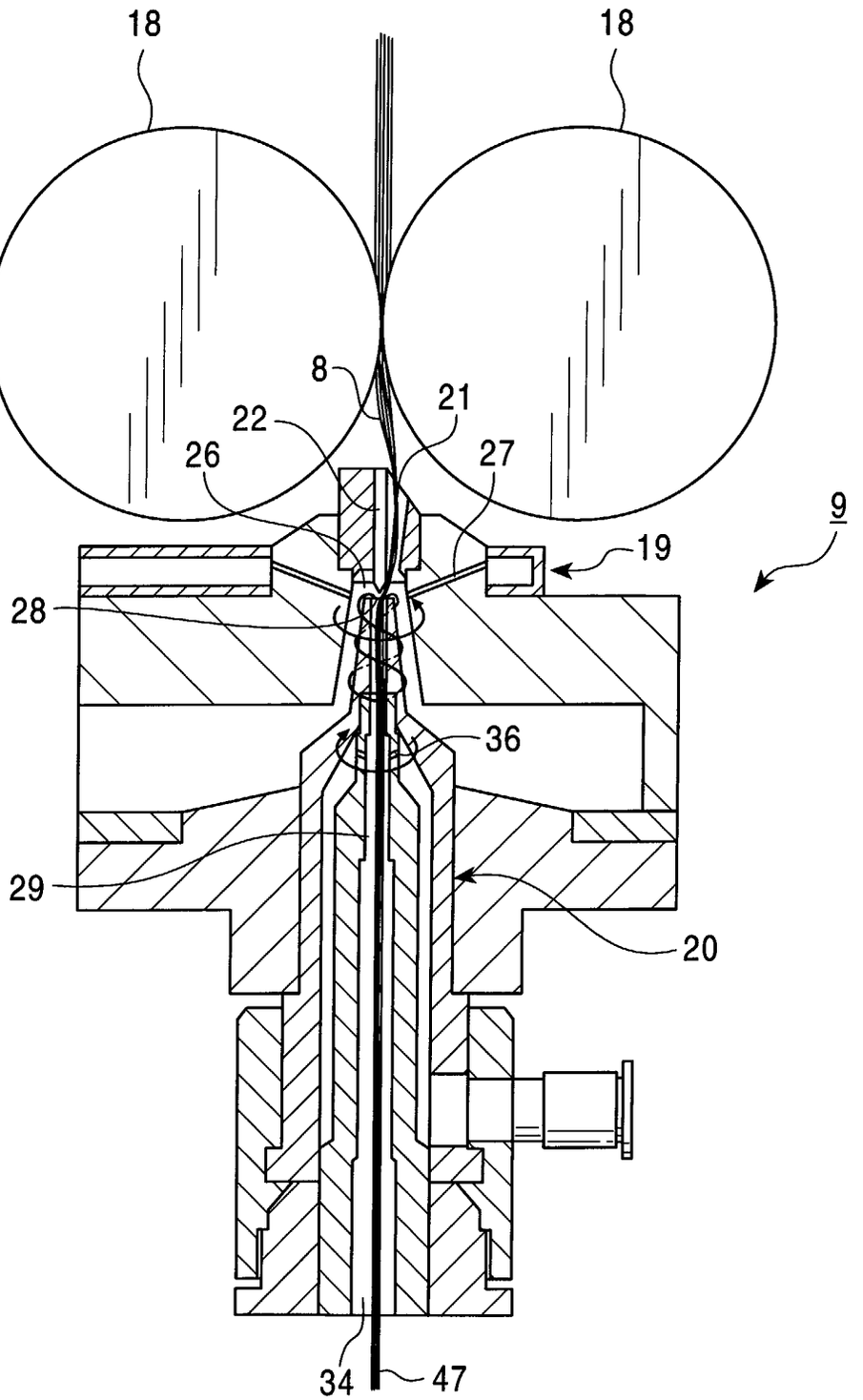

FIG. 4

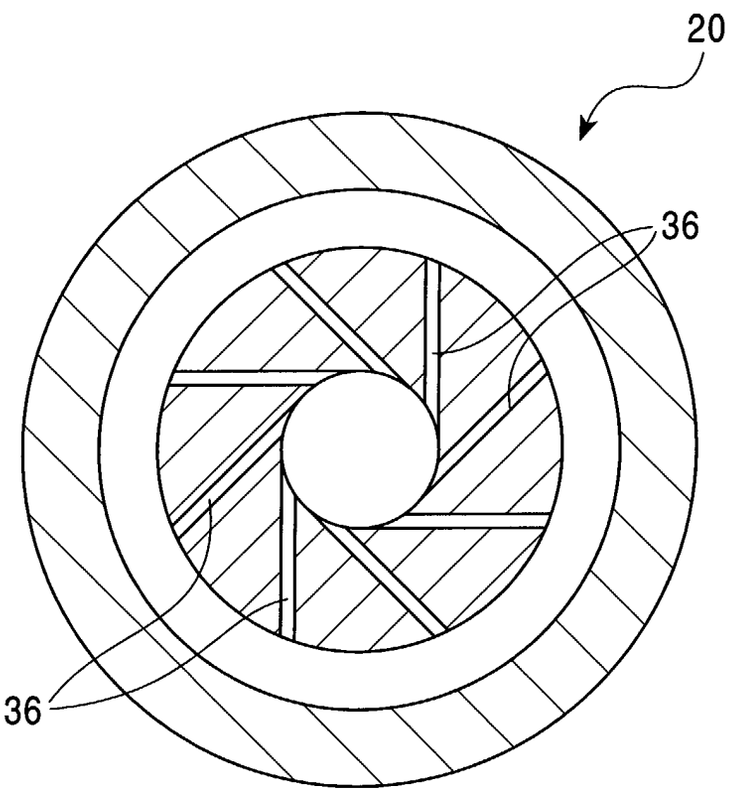

FIG. 5

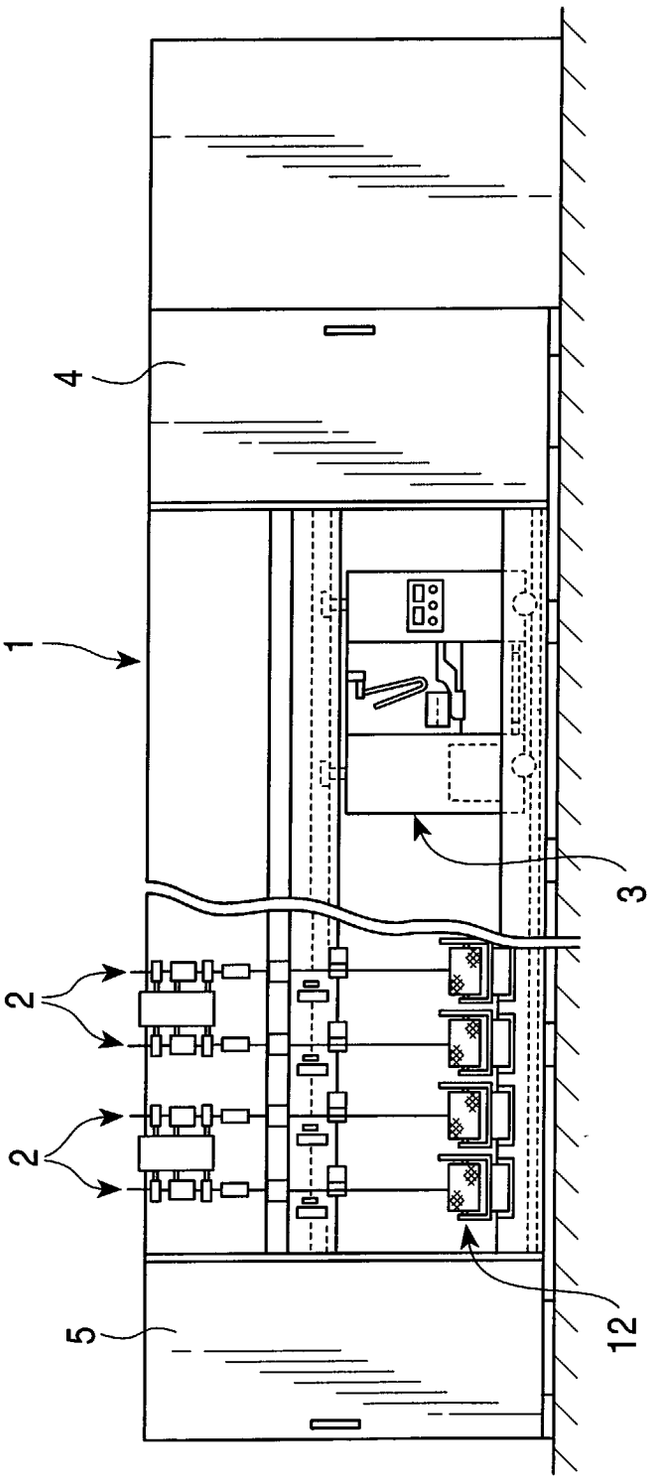

FIG. 6

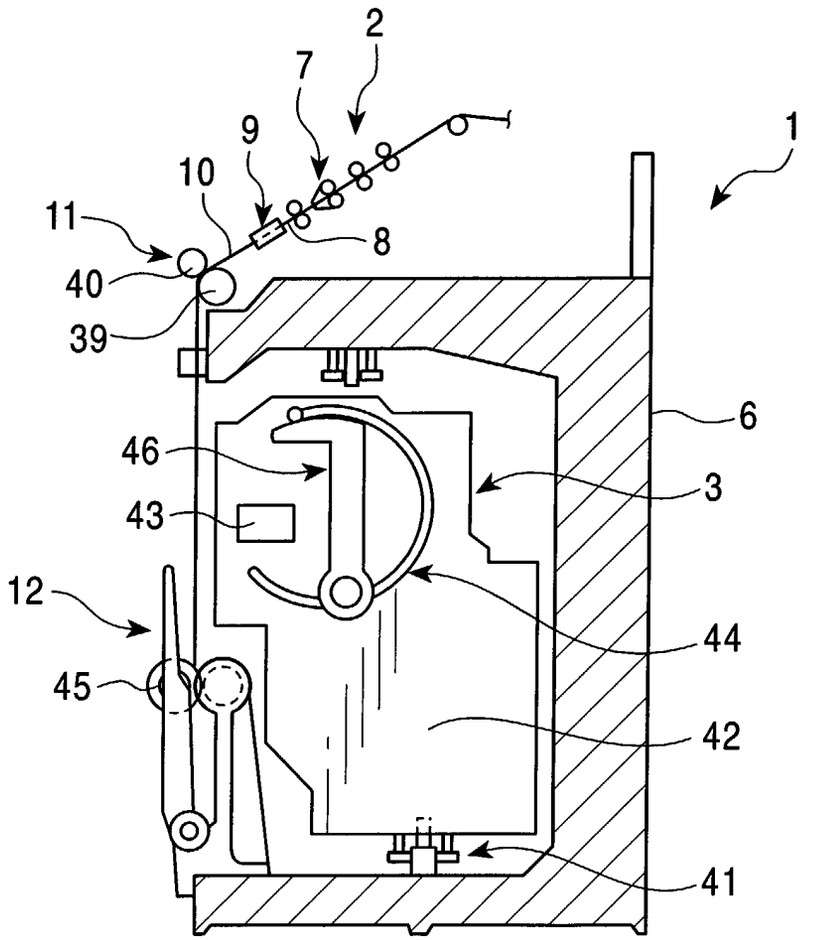

FIG. 7

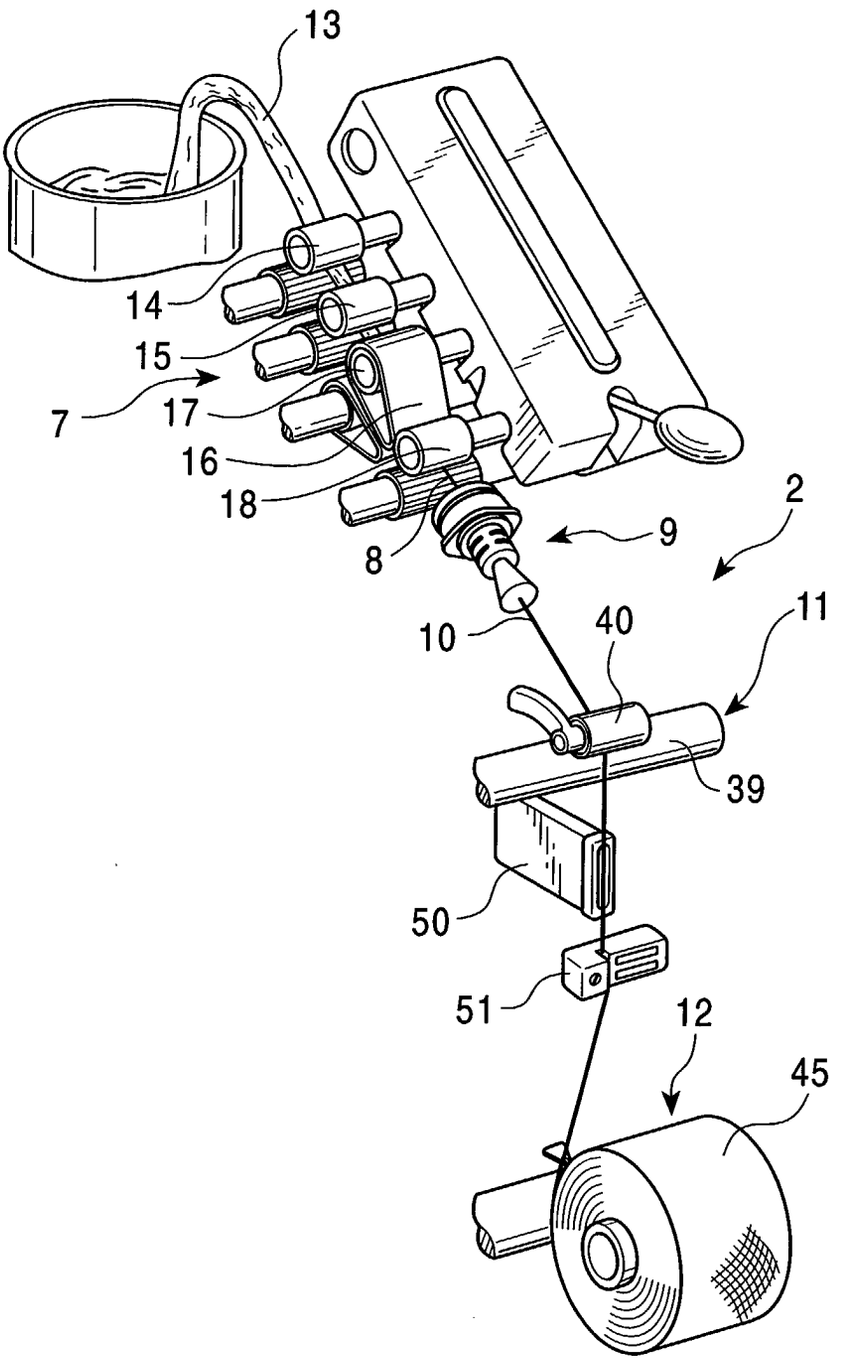

FIG. 8

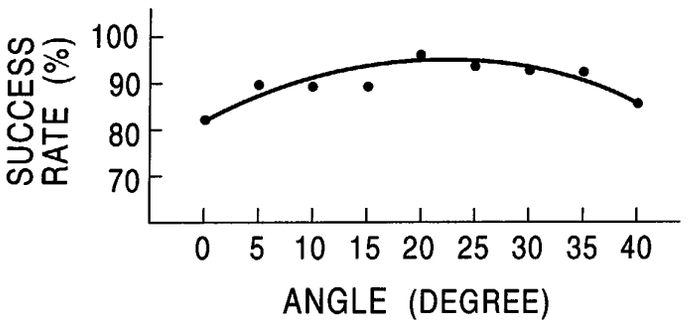

FIG. 9

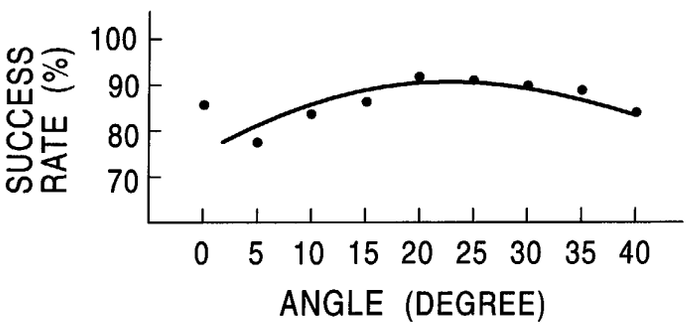

FIG. 10