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(54) **Winding tension control device**

Vorrichtung zur Wicklungsspannungssteuerung

Dispositif de contrôle de tension de bobinage

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Description

Field of the Invention

[0001] The present invention relates to a winding tension control device incorporated into a spinning machine comprising a spinning device that spins out a yarn from a fiber bundle, a winding device that winds the spun-out yarn into a package, and a yarn slack eliminating device that winds a part of the yarn located between the spinning device and the winding device, around a yarn slack eliminating roller to absorb slack of the yarn, the winding tension control device controlling winding tension.

Background of the Invention

[0002] A spinning machine is conventionally available in which a spinning device generates a spun yarn using slivers (fiber bundle) as a material and in which a winding device winds the spun yarn into a package. This spinning machine is configured such that for example, when a yarn defect is detected, the yarn defect portion is cut and removed using a cutting means such as a cutter, and such that a yarn piecing device then pieces a leading end of a yarn sequentially fed by the spinning device to a package-side yarn end. This yarn piecing operation is performed with the spinning device continuing to operate and with the winding of the yarn stopped. Consequently, the yarn may slack between the spinning device and the winding device. The slack needs to be eliminated.

[0003] Furthermore, where the spinning machine is to form, for example, cone winding packages, then in particular, without winding tension control performed immediately before winding, the tension of the yarn may disadvantageously vary periodically depending on a traverse operation. This is because a yarn winding speed (the peripheral speed of a package) varies between a smaller diameter side and a larger diameter side of the cone winding package, so that the amount of slack is larger on the smaller diameter side with a lower winding speed, and the amount of slack is smaller on the larger diameter side with a higher winding speed.

[0004] Thus, to solve the above-described problem, a proposal has been made of a yarn slack eliminating device described in the Unexamined Japanese Patent Application Publication (Tokkai) No. 2004-277946 (Figure 18, [0024] to [0026]). The yarn slack eliminating device described in the Unexamined Japanese Patent Application Publication (Tokkai) No. 2004-277946 (Figure 18, [0024] to [0026]) comprises a rotationally driven slack eliminating roller 21 and a rotary-type yarn hooking member 22. The yarn hooking member 22 is attached to the slack eliminating roller 21 so as to be concentrically rotatable relative to the slack eliminating roller 21. A predetermined rotational resistance is offered to the rotation of the yarn hooking member 22 relative to the slack eliminating roller 21 by means of the pressing force (frictional force) of a transmission force applying member 22f composed of biasing means such as a spring. Moreover, the rotational resistance can be adjusted in a nonstep manner by a tightening operation of a transmission force adjusting operation portion 22g having a threadable fitting portion.

[0005] Furthermore, a proposal has been made of a magnetic yarn slack eliminating device described in EP1717182. The yarn slack eliminating device described in EP1717182 is adapted to generate a predetermined rotational resistance between the yarn slack eliminating roller 21 and the rotatable yarn hooking member 22 by means of a combination of a hysteresis member 37 and a permanent magnet 36. Moreover, the rotational resistance can be adjusted in a nonstep manner by rotationally operating an adjustment bolt 32 to vary the overlapping area between the hysteresis material 37 and the permanent magnet 36.

[0006] With either of the above-described yarn slack eliminating devices, where a load acting on the yarn hooking member 22, that is, the tension of the yarn, is lower than the rotational resistance, the yarn hooking member 22 rotates integrally with the slack eliminating roller 21 to wind the spun yarn around the slack eliminating roller 21. In contrast, where the tension of the yarn exceeds a predetermined value to overcome the rotational resistance, the yarn hooking member 22 rotates independently of the slack eliminating roller 21 to unwind the spun yarn from the slack eliminating roller 21.

[0007] Thus, the above-described yarn slack eliminating devices can not only eliminate the slack of the yarn but also apply a predetermined winding tension to the spun yarn on the basis of the appropriately set rotational resistance.

[0008] However, with either of the above-described yarn slack eliminating devices, yarn winding needs to be stopped in order to adjust the rotational resistance of the yarn hooking member to the slack eliminating roller. This makes it impossible to adjust the winding tension with the winding continued. Moreover, the adjustment of the rotational resistance needs to be manually performed. Thus, in a spinning machine having a plurality of juxtaposed spinning units, where the rotational resistance of the yarn slack eliminating device varies among the spinning units, the rotational resistance must be appropriately adjusted for each spinning unit. This is a very complicated operation.

[0009] On the other hand, where the winding device forms a package, an appropriate package shape can be obtained by maintaining a high winding tension while the winding diameter is small and reducing the winding tension with increasing winding diameter. This requires a device that can vary the winding tension during the winding of the yarn.

Summary of the Invention

[0010] The present invention has been made in view of the above-described circumstances. An object of the

present invention is to provide a winding tension control device that can appropriately adjust winding tension in association with a yarn slack eliminating device during winding of a spun yarn.

[0011] For solving the above-described the problems, the present invention provides (1) a winding tension control device incorporated into a spinning machine comprising a spinning device that spins out a yarn from a fiber bundle, a winding device that winds the spun-out yarn into a package, and a yarn slack eliminating device that winds a part of the yarn located between the spinning device and the winding device, around a yarn slack eliminating roller to absorb slack of the yarn, the winding tension control device controlling winding tension, the winding tension control device being characterized by comprising a yarn path bending guide located close to and downstream of the slack eliminating roller to guide the yarn traveling from the slack eliminating device to the winding device while bending a yarn path of the yarn, and a yarn path bending guide displacing device that moves the yarn path bending guide closer to the slack eliminating roller to increase an angle of the bending when the winding tension is to be increased, while moving the yarn path bending guide away from the slack eliminating roller to reduce the angle of the bending when the winding tension is to be reduced.

[0012] Furthermore, the present invention provides a winding tension control device characterized in that in the above-described configuration, (2) the yarn path bending guide is adapted to guide the yarn through a guide hole through which the yarn is passed.

[0013] Furthermore, the present invention provides a winding tension control device characterized in that in the above-described configuration (2), (3) the yarn path bending guide displacing device displaces the yarn path bending guide so that a center of the guide hole is displaced on an extension of an axis of the slack eliminating roller.

[0014] Furthermore, the present invention provides a winding tension control device characterized in that in the above-described configurations (1) to (3), (4) the yarn path bending guide displacing device is adapted to displace the yarn path bending guide on the basis of a signal from tension detecting means for detecting tension of the yarn travel ing from the yarn slack eliminating device to the winding device.

[0015] Furthermore, the present invention provides a winding tension control device characterized in that in the above-described configurations (1) to (4), (5) the yarn path bending guide displacing device is further adapted to displace the yarn path bending guide on the basis of a signal from winding diameter detecting means for detecting a winding diameter of the package.

[0016] With the winding tension control device according to the present invention configured as described above, during winding of the spun yarn, the yarn path bending guide is appropriately moved closer to or away from the slack eliminating roller of the yarn slack eliminating device. As a result, adjustment is made of the bending angle of the yarn path of the spun yarn traveling from a tip of the yarn hooking member to the winding device via the yarn path bending guide. The winding tension is thus adjusted. That is, the winding tension control device according to the present invention can appropriately adjust the winding tension during winding.

[0017] Furthermore, the winding tension control device according to the present invention mechanically displaces the yarn path bending guide to adjust the winding tension. Thus, in the spinning machine having the plurality of juxtaposed spinning units, even if for example, the rotational resistance of the yarn slack eliminating device varies among the winding units, it is unnecessary to perform the complicated operation of manually adjusting the rotational resistance for each winding unit.

[0018] Other features, elements, processes, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the present invention with reference to the attached drawings.

Brief Description of the Drawings

[0019]

Figure 1 is a schematic front view showing an example of a spinning machine to which a winding tension control device according to the present invention is applied.

Figure 2 is a schematic side view of the spinning machine in Figure 1.

Figure 3 is a side sectional view of an essential part of the spinning machine in Figure 1, showing a yarn slack eliminating device and a winding tension control device.

Figure 4 is a side sectional view of an essential part of the spinning machine, showing a state into which the state shown in Figure 3 has been changed by rotating an adjustment bolt for movement.

Figure 5 is a perspective view showing the yarn slack eliminating device and winding tension control device in the spinning machine in Figure 1.

Figure 6 is a schematic side view of a spinning machine according to a variation.

Detailed Description of the Preferred Embodiments

[0020] With reference to the drawings, a description will be given of a preferred embodiment of a winding tension control device according to the present invention.

[0021] As shown in Figure 1, a spinning machine 1 according to the present embodiment is composed of a large number of spinning units U juxtaposed between a motor box MB and a dust box DB in a longitudinal direction of a machine body. A rail R is provided at the bottom of the spinning machine 1 along the juxtaposing direction of the spinning units U. A yarn piecing vehicle 3 is located

on the rail R so as to be reciprocatable along the juxtaposing direction of the spinning units U. The yarn piecing vehicle 3 travels and moves to one of the spinning units U which requires yarn piecing. The yarn piecing vehicle 3 stops at the corresponding position to perform a yarn piecing operation.

[0022] As shown in Figure 1 or Figure 2, the spinning unit U has, as main components, a draft device 4, a spinning device 5, a yarn feeding device 6, a yarn slack eliminating device 7, a winding tension control device 8, a downstream side guide 10, and a winding device 9 which are arranged in this order from upstream to downstream.

[0023] The draft device 4 is composed of a combination of a back roller pair 41, a third roller pair 42, a middle roller pair 44 around which an apron belt 43 is installed, and a front roller pair. The draft device 4 drafts slivers SL to form a fiber bundle Y.

[0024] Although the configuration of the spinning device 5 is not shown in detail, the present embodiment adopts a pneumatic type that utilizes whirling currents from air injecting nozzles to generate a spun yarn SY from the fiber bundle Y obtained by the drafting.

[0025] The yarn feeding device 6 is composed of a delivery roller 61 and a nip roller 62 provided in contact with the delivery roller 61. The spun yarn SY fed out of the spinning device 5 is sandwiched between the delivery roller 61 and the nip roller 62 and fed downward by being rotationally driven by the delivery roller 61.

[0026] The spun yarn SY fed downstream side by the yarn feeding device 6 passes through a cutter device 16 and a yarn clearer 17 which are used to remove yarn defects, the yarn slack eliminating device 7, the winding tension control device 8, and the downstream side guide 10. The spun yarn SY is then wound into a winding package WP by the winding device 9.

[0027] The yarn clearer 17 monitors the thickness of the traveling spun yarn SY, and when a yarn defect in the spun yarn is detected, transmits a yarn defect detection signal to a unit controller (not shown in the drawings). Upon receiving the yarn detection signal, the unit controller immediately actuates the cutter device 16 to cut the yarn. The unit controller further stops the draft device 4 and the spinning device 5, and allows the yarn piecing vehicle 3 to travel automotively to the front of the appropriate spinning unit U. Subsequently, the unit controller drives the spinning device 5 and other devices again, and allows the yarn piecing vehicle 3 to perform yarn piecing. The unit controller then resumes spinning and winding.

[0028] As shown in Figure 1, the yarn piecing vehicle 3 is located so as to travel along the rail R, provided in a casing 2 of the spinning machine 1 main body. The yarn piecing vehicle 3 comprises a suction pipe (supply-side yarn end catching means) that sucks and catches the spun yarn SY continuously supplied by the spinning device 5, corresponding to a supply side, a suction mouth (winding-side yarn end catching means) 19 that sucks and catches a part of the spun yarn SY which is located closer to the winding package WP, and a yarn piecing device 20 that join the spun yarns SY together which have been caught by the suction pipe 18 and the suction mouth 19.

[0029] Suction air currents are generated at ends of the suction pipe 18 and the suction mouth 19 by a suction current generation source (not shown in the drawings) to suck and catch yarn ends. The yarn piecing device 20 is composed of a clamp portion, a cutter portion, and a splicer or a knotter (none of these portions are shown in the drawings).

[0030] The yarn slack eliminating device 7 is provided in each of the plurality of spinning units U and located so as to be engageable with the spun yarn SY. As shown in Figures 2 and 3, the yarn slack eliminating device 7 includes a slack eliminating roller 71, a yarn hooking member 72, an upstream side guide 73, a moving forward and backward means (for example, an air cylinder) 74 for moving the upstream side guide 73 forward and backward, and a rotational driving source 75 that rotationally drives the slack eliminating roller 71.

[0031] The rotational driving source 75 is composed of an electric motor or the like and attached to the spinning unit U via a bracket 70.

[0032] As shown in Figure 3, the slack eliminating roller 71 comprises, as main components, a roller main body 71a and a nut member 71b secured integrally to the inside the roller main body 71a.

[0033] The roller main body 71a is fixed to a rotating shaft 75a of the rotational driving source 75 by a fixation screw 71f.

[0034] An adjustment bolt 71c is threadably fitted into the nut member 71b from a tip side of the roller main body 71a. The adjustment bolt 71c has a through-hole that is coaxial with the roller main body 71a. The through-hole receives the shaft portion 72a of the yarn hooking member 72 via a bearing 71d.

[0035] As shown in Figure 3, the yarn hooking member 72 is composed of a shaft portion 72a and a flyer 72b attached to one end of the shaft portion 72a. The yarn hooking member 72 is attached to the slack eliminating roller 71 so as to be concentrically rotatable with respect to the slack eliminating roller 71, by inserting the shaft portion 72a into the through-hole in the adjustment bolt 71c so that the shaft portion 72a is supported by the bearing 71d, described above.

[0036] The flyer 72b has a tip shaped to be bent as required and engages with the spun yarn SY (the spun yarn SY is hooked on the flyer 72b) to reliably wind the spun yarn SY around an outer peripheral surface of the slack eliminating roller 71.

[0037] The shaft portion 72a of the yarn hooking member 72 comprises an increased diameter portion 72c in a middle portion thereof in an axial direction thereof. An outer peripheral surface of the increased diameter portion 72c can be located opposite an inner peripheral surface of the adjustment bolt 71c. A permanent magnet 72d is located around the outer peripheral surface of the

increased diameter portion 72c. The permanent magnet 72d is magnetized such that N poles and S poles are alternately arranged in a circumferential direction thereof. On the other hand, a hysteresis material (semi-rigid magnetic material) 71e is located on the inner peripheral surface of the adjustment bolt 71. A part of the permanent magnet 72d around the increased diameter portion 72c is located opposite the hysteresis material 71e of the adjustment bolt 71c via an appropriate gap (that is, in a non-contact manner).

[0038] The adjustment bolt 71c is displaced relative to the nut member 71b by gripping and rotating a head portion thereof by the hand (or with an appropriate tool). In this case, the adjustment bolt 71c is displaced relative to the increased diameter portion 72c of the yarn hooking member 72. This changes the opposite area over which the hysteresis material 71e lies opposite the permanent magnet 72d.

[0039] Figure 4 shows a state into which the state shown in Figure 3 is changed by displacing the adjustment bolt 71c relative to the slack eliminating roller 71.

[0040] By changing the opposite area between the permanent magnet 72d and the hysteresis material 71e as described above, it is possible to adjust the magnitude of the rotational resistance of the flyer 72b to the slack eliminating roller 71 in a nonstep manner.

[0041] That is, where the permanent magnet 72d and the hysteresis material 71e are located opposite each other over a large area as shown in Figure 3, a high level of magnetic coupling occurs between the permanent magnet 72d and the hysteresis material 71e. This results in a strong resistance to the rotation of the yarn hooking member 72 relative to the slack eliminating roller 71. On the other hand, where the opposite area between the permanent magnet 72d and the hysteresis material 71e is almost zero as shown in Figure 4, the yarn hooking member 72 can rotate substantially freely relative to the slack eliminating roller 71.

[0042] The upstream side guide 73 is located slightly upstream side of the slack eliminating roller 71. The upstream side guide 73 is moved forward and backward by the moving forward and backward means 74. Where the upstream side guide 73 is in a forward position (a state shown by a dashed line in Figure 3), the spun yarn SY is guided so as not to engage the yarn hooking member 72 of the yarn slack eliminating device 7. On the other hand, where the upstream side guide 73 is in a backward position (a state shown by a solid line in Figure 3), the spun yarn SY engages the yarn hooking member 72 of the yarn slack eliminating device 7 and is wound around the slack eliminating roller 71.

[0043] As shown in Figure 3 or Figure 5, the winding tension control device 8 comprises a yarn path bending guide 81 and a yarn path bending guide displacing device 82 that displaces the yarn path bending guide 81.

[0044] The yarn path bending guide displacing device 82 is composed of a stepping motor or a direct-acting cylinder and fixed to the vicinity of the yarn slack eliminating device 7, in the present embodiment, to a bracket 70. The yarn path bending guide displacing device 82 has a rod 82a that can move forward and backward along the axis of the slack eliminating roller 71 of the yarn slack eliminating roller 7.

[0045] One end of the yarn path bending guide 81 is attached to the tip of the rod 82a of the yarn path bend displacing device 82. A guide hole 81a (a round hole according to the present embodiment) is formed at the other end of the yarn path bending guide 81 so that the spun yarn SY traveling from the upstream side guide 73 or slack eliminating roller 71 of the yarn slack eliminating device 7 to the downstream side guide 10 can be passed through the guide hole 81a. The guide hole 81a is located such that the center of the guide hole 81a is present downstream side of the slack eliminating roller 71 and on an extension of the axis of the slack eliminating roller 71.

[0046] The guide hole 81a need not necessarily be a round hole but may be, for example, a notch. However, since the yarn being guided moves in the circumferential direction, where the guide hole 81a is a notch, a hook or the like may be provided to prevent the yarn from slipping out of the notch.

[0047] The center of the guide hole 81a need not necessarily be located on the extension of the axis of the slack eliminating roller 71. However, when the center of the guide hole 81a is displaced from the extension of the axis of the slack eliminating roller 71, where the spun yarn SY is engaged with the yarn slack eliminating device 7 (a state shown by a solid line in Figure 3), then the bending angle of the yarn varies depending on the rotating position of the yarn hooking member 72. Consequently, winding tension varies, though slightly, depending on the position of the yarn hooking member 72. Thus, the center of the guide hole 81a is preferably located on the extension of the axis of the slack eliminating roller 71.

[0048] When the winding tension needs to be increased, the rod 82a of the yarn path bending guide displacing device 82 is moved backward to move the yarn path bending guide 81 closer to the slack eliminating roller 71 (a state shown by an alternate long and two short dashes line in Figure 3). On the other hand, when the winding tension needs to be reduced, the rod 82a of the yarn path bending guide displacing device 82 is moved forward to move the yarn path bending guide 81 away from the slack eliminating roller 71a (a state shown by a solid line in Figure 3).

[0049] Here, the case in which the winding tension needs to be increased is, for example, the case in which the spun yarn SY is engaged with the yarn slack eliminating device 7 and in which the rotational resistance of the yarn hooking member 72 is low, resulting in a winding tension with a value smaller than the appropriate one. In contrast, the case in which the winding tension needs to be reduced is, for example, the case in which the rotational resistance of the yarn hooking member 72 to the slack eliminating roller 71 is high, resulting in a winding

tension with a value greater than the appropriate one.

[0050] The winding tension is detected by a tension sensor 11 located downstream side of the downstream side guide 10 as shown in Figure 2. A detection signal from the tension sensor 11 is input to a controller 83. When the winding tension detected by the tension sensor 11 is of a value smaller than the appropriate one, the controller 83 moves the rod 82a of the yarn path bending guide displacing device 82 backward. In contrast, when the winding tension detected by the tension sensor 11 is of a value smaller than the appropriate one, the controller 83 moves the rod 82a of the yarn path bending guide displacing device 82 backward.

[0051] When the yarn path bending guide 81 is moved closer to the slack eliminating roller 71a (a state shown by an alternate long and two short dashes line in Figure 3), a large bending angle (θ_1 in Figure 3) is formed by the yarn path of the spun yarn SY traveling from the tip of the flyer 72b of the yarn hooking member 72 (or from the upstream side guide 73 when the spun yarn SY is not engaged with the flyer 72b) to the downstream side guide 10 through the guide hole 81a in the yarn path bending guide 81. In this case, the large bending angle increases the resistance to the traveling of the spun yarn SY, thus increasing the winding tension.

[0052] In contrast, when the yarn path bending guide 81 is moved away from the slack eliminating roller 71a (a state shown by a solid line in Figure 3), a small bending angle (θ_2 in Figure 3) is formed by the yarn path of the spun yarn SY traveling from the tip of the flyer 72b (or from the upstream side guide 73 when the spun yarn SY is not engaged with the flyer 72b) to the downstream side guide 10 via the guide hole 81a. In this case, the small bending angle reduces the resistance to the traveling of the spun yarn SY, thus reducing the winding tension.

[0053] The downstream side guide 10 is located downstream side of the winding tension control device 8. The downstream side guide 10 guides the spun yarn SY having passed through the yarn path bending guide 81 of the winding tension control device 8, to the winding device 9 side.

[0054] Now, the operation of the spinning machine 1 configured as described above will be described.

[0055] In each of the spinning units U in the spinning machine 1, the draft device 4 drafts and feeds the fiber bundle Y into the spinning device 5. Then, the spun yarn SY spun out by the spinning device 5 is fed out downstream side by the yarn feeding device 6 and then passes through the cutter 16 and the yarn clearer 17. Then, via the yarn slack eliminating device 7 and the winding tension control device 8, the spun yarn SY is finally fed to the winding device 9, where the spun yarn Y is wound into the package WP.

[0056] When the yarn clearer 17 in any of the spinning units U detects a defect in the spun yarn SY, the unit controller (not shown in the drawings) in the spinning unit U allows the cutter 16 to cut the spun yarn SY. At substantially the same time, the unit controller stops the rotation of the back roller pair 41 and third roller pair 42 of the draft device 4. The fiber bundle Y is cut in such a manner that the fiber bundle Y is torn off between the stopped third roller pair 42 and the middle roller pair 44 continuing to rotate. A part of the spun yarn SY which is located downstream of the cut portion is sucked and removed by suction means (not shown in the drawings).

[0057] Then, the unit controller (not shown in the drawings) in the spinning unit U transmits a yarn piecing request signal to the yarn piecing vehicle 3. The yarn piecing vehicle 3 moves to and stops at a position where the yarn piecing vehicle 3 lies opposite the spinning unit U. Then, the unit controller starts rotating the slack eliminating roller 71 of the yarn slack eliminating device 7 at an appropriate timing. Furthermore, at the same time, the unit controller allows the moving forward and backward means 74 to move the upstream side guide 73 of the yarn slack eliminating device 7 forward. The yarn path is thus held so as to avoid engaging the next spun yarn SY to be spun, with the yarn hooking member 72 of the yarn slack eliminating device 7 when the engagement is not required.

[0058] Then, when the suction pipe 18 on the yarn piecing vehicle 3 is caused to pivot upward, the unit controller starts driving the draft device 4 and the spinning device 5 almost in synchronism with the upward pivoting so that the spun yarn SY spun out by the spinning device 5 is sucked and caught in the suction pipe 18. Furthermore, at the same time, on the winding device 9 side, the suction mouth 19 on the yarn piecing vehicle 3 pivots downward to suck and catch the yarn end wound around the package WP. The suction pipe 18 and the suction mouth 19 guide the respective sucked yarn ends to the yarn piecing device 20 for yarn piecing.

[0059] Immediately before the yarn piecing device 20 starts the yarn piecing operation, the moving forward and backward means 74 of the yarn slack eliminating device 7 moves backward to move the upstream side guide 73 to a backward position thereof. Then, the yarn path of the spun yarn SY is changed so as to overlap a rotation trajectory of the flyer 72b as shown by a chain line in Figure 3. As a result, the spun yarn SY is wound around the outer peripheral surface of the slack eliminating roller 71 by the flyer 72b.

[0060] That is, even during the yarn piecing operation of the yarn piecing device 20, the spun yarn SY continues to be spun out by the spinning device 5. This may cause a large amount of spun yarn SY to accumulate upstream side of the yarn piecing device 20. The yarn slack eliminating device 7 winds the spun yarn SY around the slack eliminating roller 71 during the yarn piecing operation of the yarn piecing device 20 to prevent the spun yarn SY from slacking or accumulating. This allows the yarn piecing operation and the spinning resuming operation to be smoothly performed.

[0061] As described above, the yarn hooking member 72 can rotate independently of the slack eliminating roller 71. However, the above-described mechanism com-

posed of the permanent magnet 72d and the hysteresis material 71e allows the yarn hooking member 72 to rotate integrally with the hysteresis material 71e unless a load with a value larger than a given one (the load overcoming the magnetic coupling between the permanent magnet 72d and the hysteresis material 71e) is imposed. During the above-described yarn piecing operation, the downstream side of the spun yarn SY is stopped from traveling, with only a light load imposed on the flyer 72b. Thus, the yarn hooking member 72 rotates integrally with the slack eliminating roller 71 to wind the spun yarn SY around the outer periphery of the slack eliminating roller 71.

[0062] In the meantime, the yarn path bending guide 81 of the winding tension control device 8 stands by in a predetermined initial position.

[0063] After the yarn piecing operation of the yarn piecing device 20 is completed, the winding device 9 rotates the package WP to resume winding the spun yarn SY.

[0064] The ratio of a feed-out speed of the yarn feeding device 6 to a winding speed of the winding device 9 is set such that when the winding operation of the winding device 9 is resumed, an appropriate winding tension is applied to the spun yarn SY. Thus, after the winding is resumed, the yarn speed at which the spun yarn SY is drawn out from the slack eliminating roller 71 is higher than that at which the spun yarn SY is wound around the slack eliminating roller 71. Consequently, the flyer 72b of the yarn hooking member 72 rotates independently of the slack eliminating roller 71 continuing to rotate in the winding direction. The spun yarn SY wound and stored around the slack eliminating roller 71 is gradually unwound.

[0065] While the spun yarn SY is being unwound from the slack eliminating roller 71, the flyer 72b prevents the spun yarn SY from slipping out and guides the spun yarn SY so that the spun yarn Y is averagely wound out from the slack eliminating roller 71. The flyer 72b further contacts with the spun yarn SY to offer an appropriate resistance to the spun yarn SY. The appropriate winding tension is thus obtained to allow the spun yarn SY to be suitably wound into the package WP.

[0066] Provided that during the winding operation, the tension sensor 11 detects the appropriate winding tension, the controller 83 allows the yarn path bending guide 81 to stand by in an initial position thereof. When the winding tension detected by the tension sensor 11 has a value smaller than the appropriate one, the controller 83 makes the winding tension appropriate by moving the rod 82a of the yarn path bending guide displacing device 82 backward to increase the bending angle of the yarn path. In contrast, when the winding tension detected by the tension sensor 11 has a value greater than the appropriate one, the controller 83 makes the winding tension appropriate by moving the rod 82a of the yarn path bending guide displacing device 82 forward to reduce the bending angle of the yarn path.

[0067] According to the spinning machine 1 configured as described above, during the winding of the spun yarn SY, the yarn path bending guide 81 of the winding tension control device 8 is appropriately moved closer to or away from the slack eliminating roller 71 of the yarn slack eliminating device 7. This allows the adjustment of the bending angle of the yarn path of the spun yarn SY traveling from the tip of the flyer 72b of the yarn hooking member 72 to the downstream side guide 10 via the guide hole 81a in the yarn path bending guide 81. The winding tension is thus adjusted. That is, the spinning machine 1 comprising the winding tension control device 8 according to the present invention can appropriately adjust the winding tension during winding.

[0068] Furthermore, according to the above-described spinning machine 1, on the basis of the winding tension detected by the tension sensor 11, the controller 83 automatically displaces the yarn path bending guide 81 to adjust the winding tension. Thus, with the spinning machine 1 having the plurality of juxtaposed spinning units, even if for example, the rotational resistance of the yarn slack eliminating device 7 varies among the spinning units U, it is unnecessary to manually adjust the rotational resistance for each spinning unit U.

[0069] Furthermore, according to the above-described spinning machine 1, the center of the guide hole 81a is present on the extension of the axis of the slack eliminating roller 71a. That is, even when the yarn hooking member 72 rotates to change the position of the flyer 72b, the distance between the flyer 72b and the guide hole 81a is maintained constant. Thus, a possible change in the position of the flyer 72b is prevented from varying the bending angle of the yarn path or the winding tension.

[0070] The preferred embodiment of the present invention has been described. However, the present invention is not limited to the embodiment.

[0071] For example, as shown in Figure 6, the spinning machine 1 may be configured to further have a winding diameter detecting means 13 for detecting the winding diameter of the package WP so that the yarn path bending guide 81 is displaced on the basis of a signal from the winding diameter detecting means 13.

[0072] That is, when the winding device 9 forms the package WP, an appropriate package shape can be obtained by maintaining a high winding tension while the winding diameter is small and reducing the winding tension with increasing winding diameter.

[0073] The winding diameter detecting means 13 may measure the rotation speed of the package WP to calculate the winding diameter of the package WP from the rotation speed. It is possible to use known winding diameter detecting means such as means for performing the calculation on the basis of winding time.

[0074] While the present invention has been described with respect to preferred embodiments thereof, it will be apparent to those skilled in the art that the disclosed invention is defined by the appended claims.

Claims

1. A winding tension control device (8) incorporated into a spinning machine (1) comprising a spinning device (5) that spins out a yarn (SY) from a fiber bundle (Y), a winding device (9) that winds the spun-out yarn (SY)into a package (WP), and a yarn slack eliminating device (7) that winds a part of the yarn (SY) located between the spinning device (5) and the winding device (9), around a yarn slack eliminating roller (71) to absorb slack of the yarn (SY), the winding tension control device (8) controlling winding tension, the winding tension control device (8) being **characterized by** comprising:

   a yarn path bending guide (81) located close to and downstream side of said slack eliminating roller (71) to guide the yarn (SY) traveling from said slack eliminating device (7) to said winding device (9) while bending a yarn path of the yarn (SY); and
   a yarn path bending guide displacing device (82) that moves said yarn path bending guide (81) closer to said slack eliminating roller (71) to increase an angle of said bending when said winding tension is to be increased, while moving said yarn path bending guide (81) away from said slack eliminating roller (71) to reduce the angle of said bending when said winding tension is to be reduced.

2. A winding tension control device (8) according to Claim 1, **characterized in that** said yarn path bending guide (81) is adapted to guide said yarn (SY) through a guide hole (81a) through which said yarn (SY) is passed.

3. A winding tension control device (8) according to Claim 2, **characterized in that** said yarn path bending guide displacing device (82) displaces said yarn path bending guide (81) so that a center of said guide hole (81a) is displaced on an extension of an axis of said slack eliminating roller (71).

4. A winding tension control device (8) according to any one of Claims 1 to 3, **characterized in that** said yarn path bending guide displacing device (82) is adapted to displace said yarn path bending guide (81) on the basis of a signal from a tension detecting means (11) for detecting tension of the yarn (SY) traveling from said yarn slack eliminating device (7) to said winding device (9).

5. A winding tension control device (8) according to any one of Claims 1 to 4, **characterized in that** said yarn path bending guide displacing device (82) is further adapted to displace said yarn path bending guide (81) on the basis of a signal from winding diameter detecting means (13) for detecting a winding diameter of said package (WP).

Patentansprüche

1. Spulspannungssteuervorrichtung (8), die in eine Spinnmaschine (1) integriert ist, die eine Spinneinrichtung (5) enthält, die aus einem Faserband (Y) ein Garn (SY) spinnt, eine Spuleinrichtung (9), die das gesponnene Garn (SY) zu einer Auflaufspule (WP) wickelt, und eine Garndurchhangbeseitigungseinrichtung (7), die einen Teil des zwischen der Spinneinrichtung (5) und der Spuleinrichtung (9) befindlichen Garns (SY) um eine Garndurchhangbeseitigungsrolle (71) wickelt, um den Durchhang des Garns (SY) zu beseitigen, wobei die Spulspannungssteuervorrichtung (8) **dadurch gekennzeichnet ist, dass** sie enthält:

   eine Garnwegkrümmungsführung (81), die auf der stromabwärts gelegenen Seite nahe an der Durchhangbeseitigungsrolle (71) angeordnet ist, um das von der Durchhangbeseitigungsrolle (71) zu der Spuleinrichtung (9) laufende Garn (SY) zu führen, während dem Garnweg des Garns (SY) eine Krümmung verliehen wird; und eine Garnwegkrümmungsführungs-Verschiebeeinrichtung (82), welche die Garnwegkrümmungsführung (81) näher an die Durchhangbeseitigungsrolle (71) bewegt, um einen Krümmungswinkel zu erhöhen, wenn die Spulspannung erhöht werden soll, während die Garnwegkrümmungsführung (81) von der Durchhangbeseitigungsrolle (71) weg bewegt wird, um den Winkel der Krümmung zu reduzieren, wenn die Spulspannung reduziert werden soll.

2. Spulspannungssteuervorrichtung (8) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Garnwegkrümmungsführung (81) dafür ausgelegt ist, das Garn (SY) durch eine Führungsöffnung (81 a) zu führen, durch welche das Garn (SY) läuft.

3. Spulspannungssteuervorrichtung (8) nach Anspruch 2, **dadurch gekennzeichnet, dass** die Garnwegkrümmungsführungs-Verschiebeeinrichtung (82) die Garnwegkrümmungsführung (81) so verschiebt, dass ein Mittelpunkt der Führungsöffnung (81a) auf einer Verlängerung einer Achse der Durchhangbeseitigungsrolle (71) verschoben wird.

4. Spulspannungssteuervorrichtung (8) nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Garnwegkrümmungsführungs-Verschiebeeinrichtung (82) dafür ausgelegt ist, die Garnwegkrümmungsführung (81) auf der Basis eines Signals von einer Spannungserfassungseinrichtung (11)

zum Erfassen der Spannung des von der Garndurchhangbeseitigungseinrichtung (7) zu der Spuleinrichtung (9) laufenden Garns (SY) zu verschieben.

5. Spulspannungssteuervorrichtung (8) nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Garnwegkrümmungsführungs-Verschiebeeinrichtung (82) ferner dafür ausgelegt ist, die Garnwegkrümmungsführung (81) auf der Basis eines Signals von einer Wicklungsdurchmessererfassungseinrichtung (13) zum Erfassen eines Wicklungsdurchmessers der Auflaufspule (WP) zu verschieben.

Revendications

1. Dispositif de réglage de tension de bobinage (8) incorporé à une machine de filage (1) comprenant un dispositif de filage (5) qui file un fil (SY) à partir d'un faisceau de fibres (Y), un dispositif de bobinage (9) qui enroule le fil filé (SY) en un paquet (WP), et un dispositif éliminateur du mou de fil (7) qui enroule une partie du fil (SY) située entre le dispositif de filage (5) et le dispositif de bobinage (9), autour d'un galet éliminateur de mou (71) afin d'absorber le mou du fil (SY), le dispositif de réglage de tension de bobinage (8) réglant la tension de bobinage, le dispositif de réglage de tension de bobinage (8) étant **caractérisé en ce qu'**il comprend :

un guide (81) de flexion de trajet de fil situé à proximité et du côté aval dudit galet éliminateur de mou (71) pour guider le fil (SY) se déplaçant dudit dispositif éliminateur de mou (7) audit dispositif de bobinage (9) tout en faisant fléchir un trajet de fil (SY) ; et
un dispositif (82) déplaçant le guide de flexion de trajet de fil qui déplace ledit guide (81) de flexion de trajet de fil plus près dudit galet éliminateur de mou (71) pour augmenter l'angle de ladite flexion lorsque ladite tension de bobinage doit être augmentée, tout en déplaçant ledit guide (81) de flexion de trajet de fil pour l'écarter dudit rouleau éliminateur de mou (71) afin de réduire l'angle de ladite flexion lorsque ladite tension de bobinage doit être réduite.

2. Dispositif de réglage de tension de bobinage (8) selon la revendication 1, **caractérisé en ce que** ledit guide (81) de flexion de trajet de fil est à même de guider ledit fil (SY) à travers un trou de guidage (81a) par lequel ledit fil (SY) est passé.

3. Dispositif de réglage de tension de bobinage (8) selon la revendication 2, **caractérisé en ce que** ledit dispositif (82) déplaçant le guide de flexion de trajet de fil déplace ledit guide (81) de flexion de trajet de fil de sorte qu'un centre dudit trou de guidage (81a) soit déplacé sur une extension d'un axe dudit galet éliminateur de mou (71).

4. Dispositif de réglage de tension de bobinage (8) selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** ledit dispositif (82) déplaçant le guide de flexion de trajet de fil est à même de déplacer ledit guide (81) de flexion de trajet de fil sur la base d'un signal provenant d'un moyen de détection de tension (11) pour détecter la tension du fil (SY) se déplaçant dudit dispositif éliminateur de mou (7) audit dispositif de bobinage (9).

5. Dispositif de réglage de tension de bobinage (8) selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** ledit dispositif (82) déplaçant le guide de flexion de trajet de fil est encore à même de déplacer ledit guide (81) de flexion de trajet de fil sur la base d'un signal provenant d'un moyen de détection de diamètre de bobinage (13) pour détecter un diamètre de bobinage dudit paquet (WP).

FIGURE 1

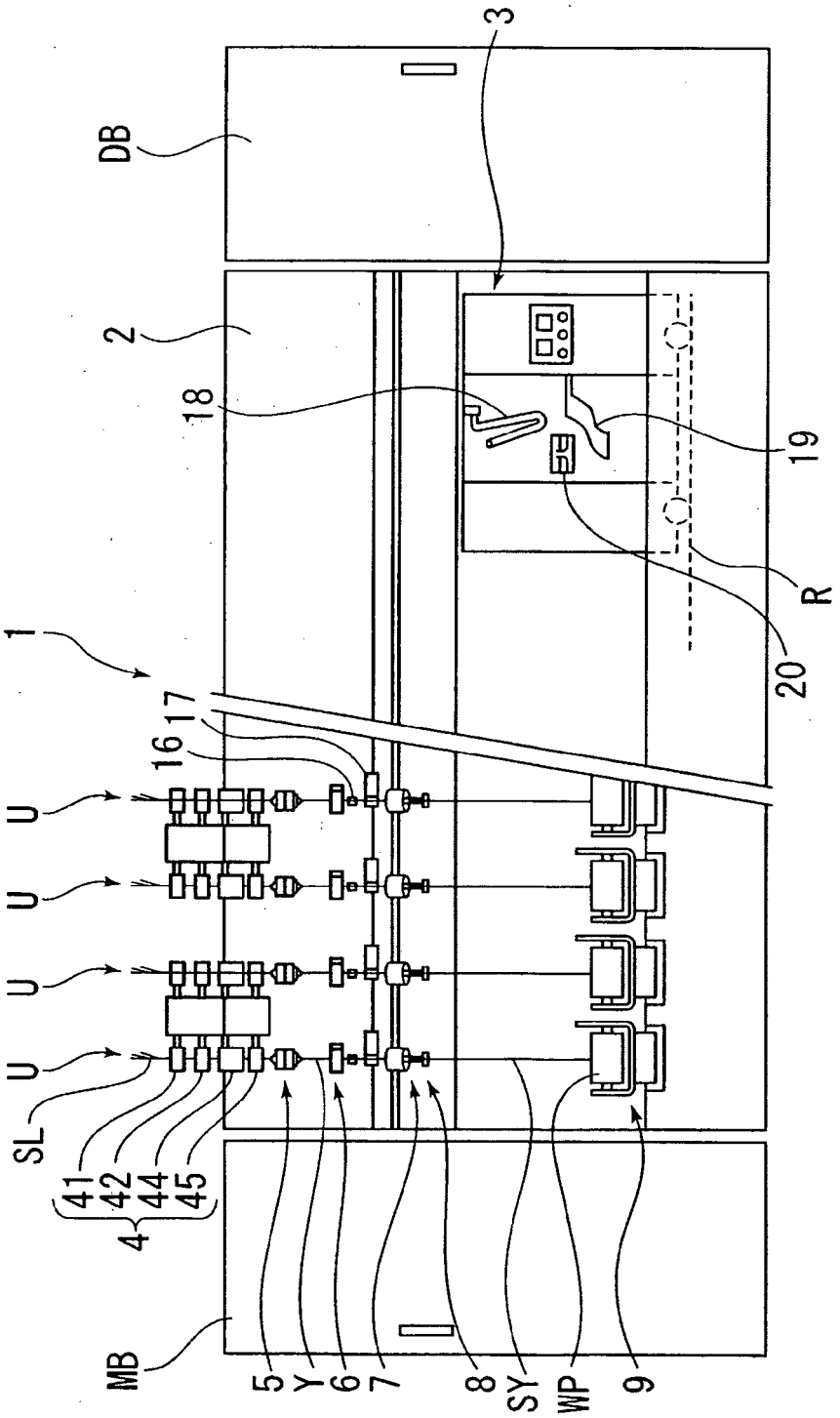


FIGURE 2

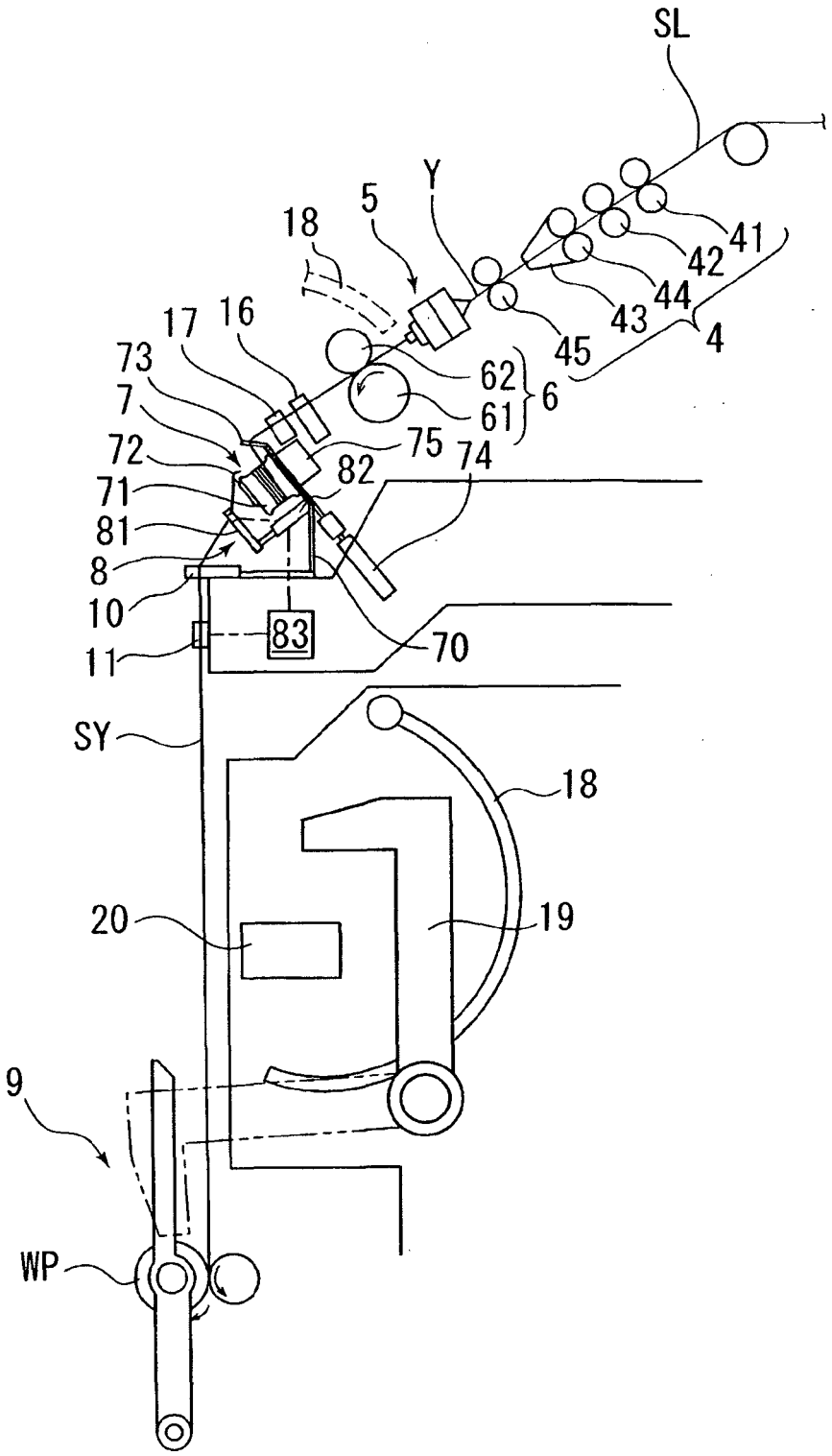

SL
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WP

FIGURE 3

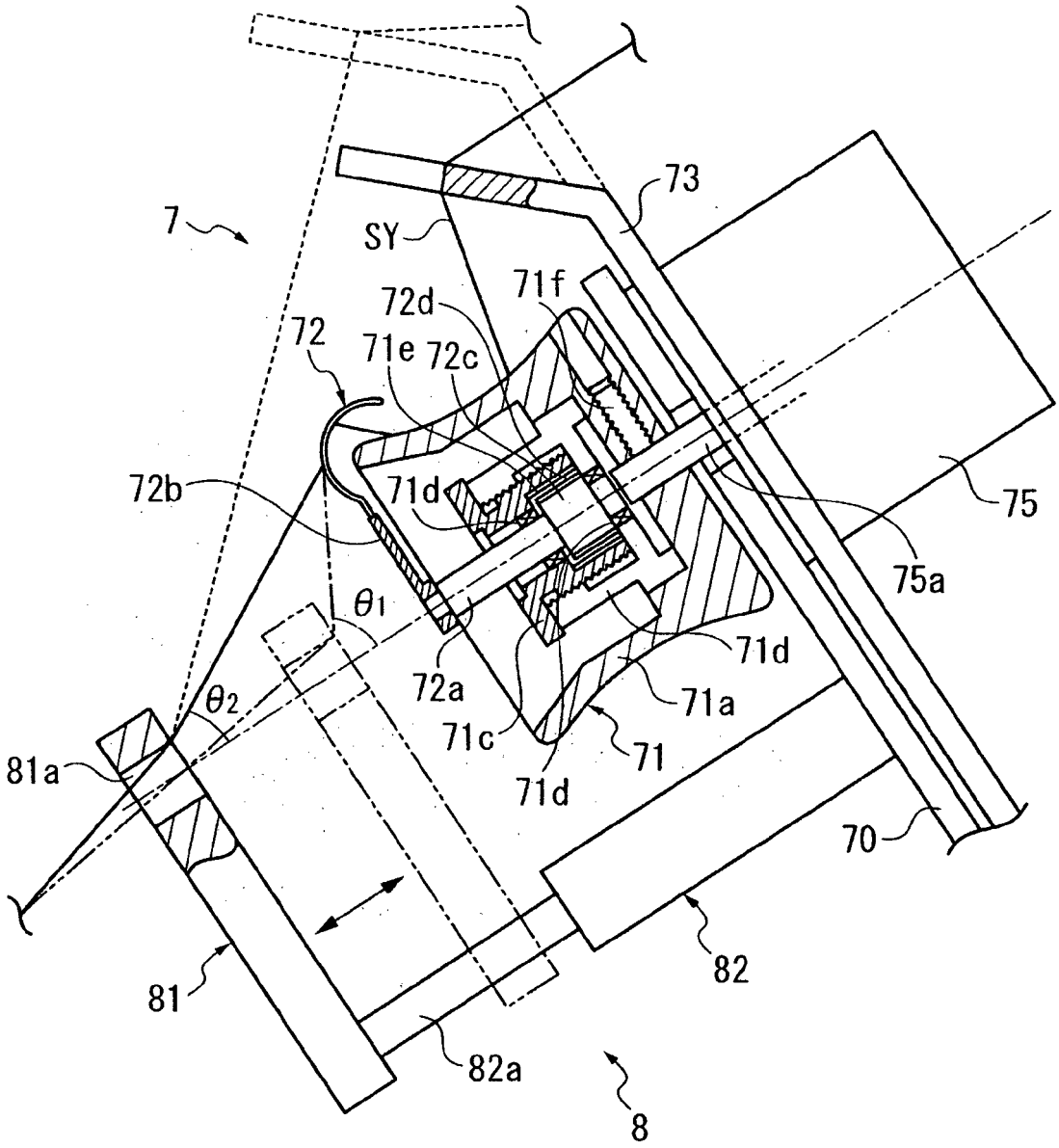

7
SY
73
71f
72d
72
71e
72c
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75a
θ1
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θ2
71c
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81a
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FIGURE 4

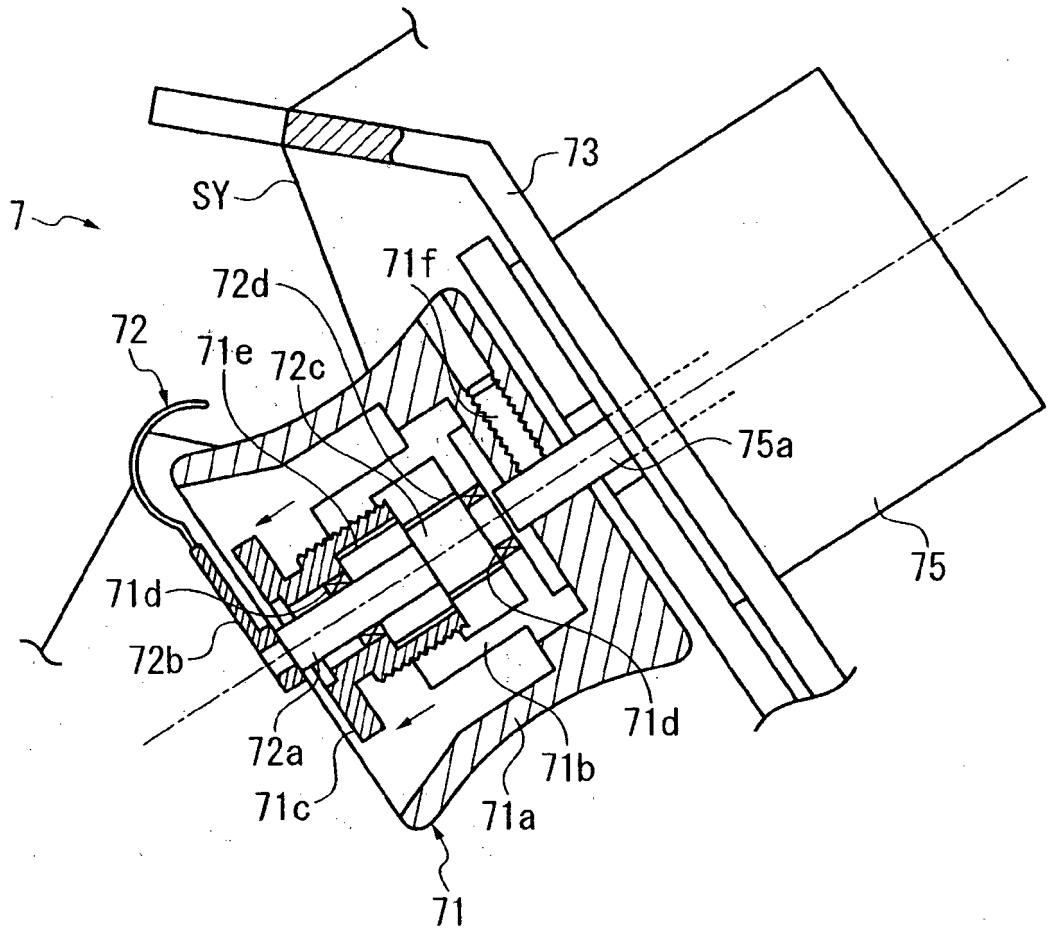


FIGURE 5

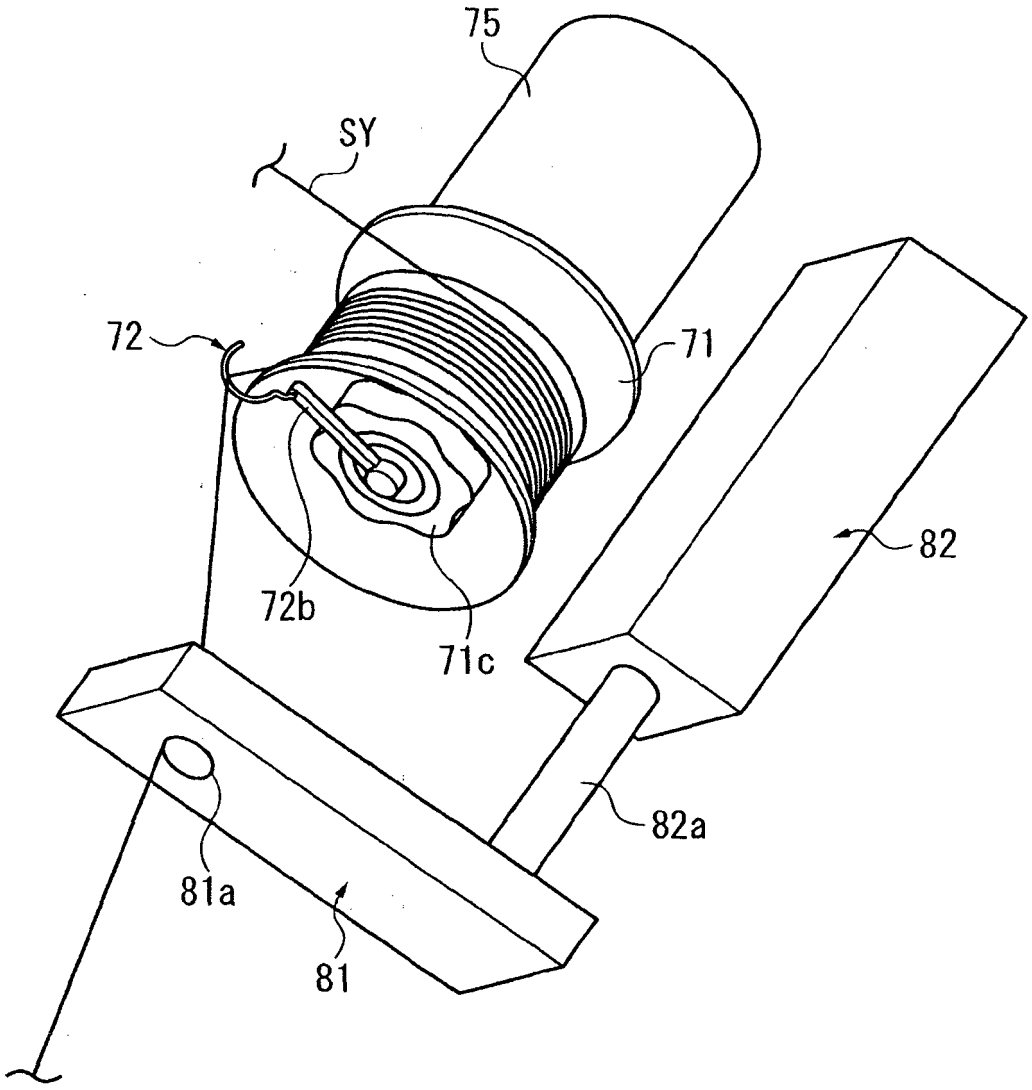
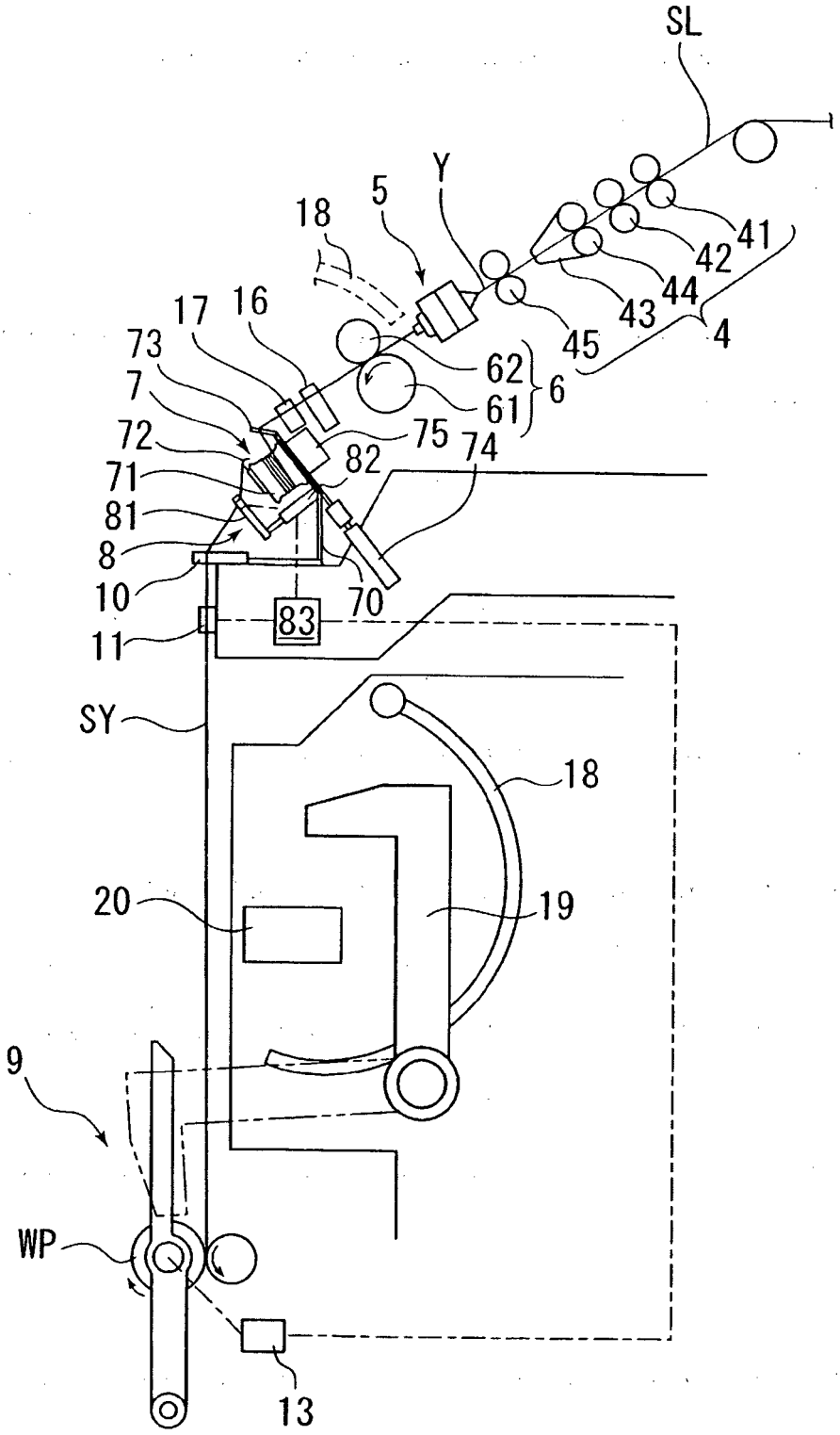


FIGURE 6


SL
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SY
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WP
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REFERENCES CITED IN THE DESCRIPTION

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- EP 1717182 A **[0005]**