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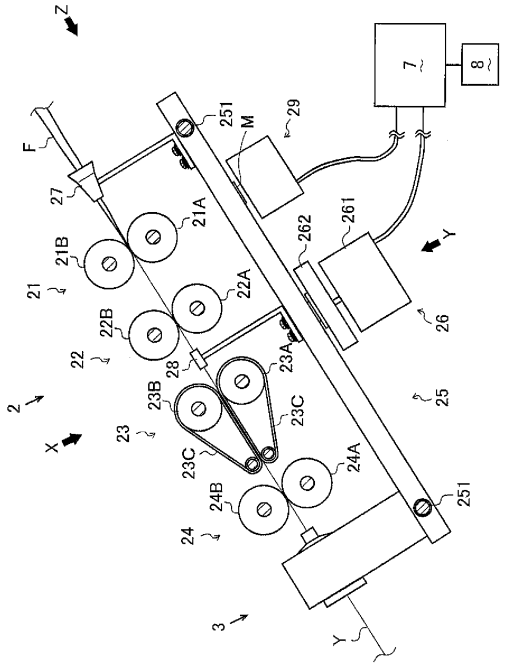
(54) SPINNING MACHINE

(57) A spinning machine is provided that can extend life of draft roller pairs by controlling to move and stop a fiber bundle with respect to the draft roller pairs according to the fiber bundle to be drafted, without reducing the quality of spun yarns.

There are included a movable base unit 25 to which a guiding unit 28 and a spinning unit 3 are mounted, a driving unit 26 configured to move the movable base unit 25 in parallel with respect to a rotating shaft direction of draft roller pairs 21, 22, 23, and 24, a detecting unit 29 configured to detect a position of at least one of the guiding unit 28, the spinning unit 3, and the movable base unit 25, and a control unit 7 configured to transmit a positional command signal to the driving unit 26 based on a detection signal from the detecting unit 29 and control the position of the movable base unit 25, thereby adjusting the relative positional relation of the guiding unit 28 and the spinning unit 3 with respect to the draft roller pairs 21, 22, 23, and 24 and changing the holding position of the fiber bundle F held by the draft roller pairs 21, 22, 23, and 24.

Fig. 2



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Description

[Technical Field]

[0001] The present invention relates to a technology of a spinning machine.

[Background Art]

[0002] Conventionally, there has been known a spinning machine that drafts a fiber bundle and twists the drafted fiber bundle, thereby producing spun yarns (for example, see Patent Document 1). In the spinning machine, a plurality of draft roller pairs that draft the fiber bundle are provided. Since the draft roller pairs feed the held fiber bundle by rotation, the draft roller pairs can draft the fiber bundle according to a difference in feeding speeds of the adjacent draft roller pairs.

[0003] The draft roller pair is constituted by a bottom roller that is rotated via a power mechanism and a top roller that is driven to rotate in a state of contact with the bottom roller. The top roller is an elastic roller formed of rubber and the like, and the surface of the top roller may sometimes be abraded. In particular, when the position of the fiber bundle held by the draft roller pairs is constant, the abrasion of a portion in contact with the fiber bundle may swiftly progress.

[0004] Accordingly, there has been proposed a structure wherein a guiding portion (trumpet) of the fiber bundle is moved in parallel with respect to a rotating shaft of the draft roller pairs, and a holding position of the fiber bundle (roving) is changed (for example, see Patent Document 2). However, in the above-described structure, when the fiber bundle is thick, fibers constituting the fiber bundle may fall off from the draft roller pairs. When the guiding portion moves while the rotation of the draft roller pairs is stopped, the fiber bundle held by the draft roller pairs is drafted, and the fiber bundle is unintentionally cut.

[Citation List]

[Patent Literature]

[0005]

[PTL 1] Japanese Unexamined Patent Application Publication No. 2011-99192.

[PTL 2] Japanese Unexamined Patent Application Publication No. 1996-291429.

[Summary of the Invention]

[Technical Problem]

[0006] It is an object of the present invention to provide a spinning machine that can extend the life of draft roller pairs by performing control to move or stop a fiber bundle with respect to the draft roller pairs according to the fiber bundle to be drafted, without reducing quality of a spun yarn.

[Solution to the Problem]

[0007] The spinning machine of the first aspect of the present invention includes draft roller pairs configured to draft a fiber bundle, a guiding unit configured to regulate a width (thickness) of the fiber bundle drafted by the draft roller pairs and guide the fiber bundle, a spinning unit configured to produce a spun yarn by twisting the fiber bundle drafted by the draft roller pairs, a movable base unit to which the guiding unit and the spinning unit are mounted, a driving unit configured to move the movable base unit in parallel with respect to a rotating shaft direction of the draft roller pairs, a detecting unit configured to detect a position of at least one of the guiding unit, the spinning unit, and the movable base unit, and a control unit configured to transmit a positional command signal to the driving unit based on a detection signal from the detecting unit and control a position of the movable base unit, thereby adjusting a relative positional relation of the guiding unit and the spinning unit with respect to the draft roller pairs and changing a holding position of the fiber bundle held by the draft roller pairs.

[0008] The spinning machine of the second aspect of the present invention includes draft roller pairs configured to draft a fiber bundle, a guiding unit configured to regulate a width (thickness) of the fiber bundle drafted by the draft roller pairs and guide the fiber bundle, a spinning unit configured to produce a spun yarn by twisting the fiber bundle drafted by the draft roller pairs, a movable base unit to which the guiding unit and the spinning unit are mounted, a driving unit configured to move the movable base unit in parallel with respect to a rotating shaft direction of the draft roller pairs, a detecting unit configured to detect a position of at least one of the guiding unit, the spinning unit, and the movable base unit, and a control unit configured to transmit a positional command signal and a speed command signal to the driving unit based on a detection signal from the detecting unit and control a position and a speed of the movable base unit, thereby adjusting a relative positional relation of the guiding unit and the spinning unit with respect to the draft roller pairs and changing a holding position of the fiber bundle held by the draft roller pairs.

[0009] The third aspect of the present invention relates to the spinning machine according to the first or second aspect of the present invention. In the spinning machine, the control unit controls the driving unit to successively reciprocate the movable base unit.

[0010] The fourth aspect of the present invention relates to the spinning machine according to the first or second aspect of the present invention. In the spinning machine, the control unit controls the driving unit to intermittently move the movable base unit.

[0011] The fifth aspect of the present invention relates to the spinning machine according to any one of the first

to third aspect of the present invention. In the spinning machine, the control unit adjusts a position of the spinning unit at a start time of spinning to an origin position by controlling the driving unit.

[0012] The sixth aspect of the present invention relates to the spinning machine according to any one of the first to fifth aspect of the present invention. In the spinning machine, the control unit controls a movement of the movable base unit according to a thickness of the fiber bundle or/and a width dimension in the rotating shaft direction of the draft roller pairs.

[0013] The seventh aspect of the present invention relates to the spinning machine according to any one of the first to sixth aspect of the present invention. In the spinning machine, when the draft roller pairs are rotating, the control unit controls the driving unit to operate, and when the draft roller pairs are not rotating, the control unit controls the driving unit to stop.

[0014] The eighth aspect of the present invention relates to the spinning machine according to any one of the first to seventh aspect of the present invention. In the spinning machine, when the fiber bundle drafted by the draft roller pairs is larger than a predetermined value, the control unit controls the driving unit to stop.

[0015] The ninth aspect of the present invention relates to the spinning machine according to any one of the first to eighth aspect of the present invention. The driving unit is constituted by a stepping motor.

[0016] The tenth aspect of the present invention relates to the spinning machine according to any one of the first to ninth aspect of the present invention. The spinning unit twists the fiber bundle with swirling airflow and produces the spun yarn.

[0017] The eleventh aspect of the present invention relates to the spinning machine according to any one of the first to tenth aspect of the present invention. The spinning machine includes a setting unit configured to set control mode of the driving unit.

[0018] The twelfth aspect of the present invention relates to the spinning machine according to any one of the first to eleventh aspect of the present invention. The spinning machine includes a winding unit configured to wind the spun yarn around a package.

[0019] The thirteenth aspect of the present invention relates to the spinning machine according to any one of the first to twelfth aspect of the present invention. The spinning machine includes a memory unit configured to store a driving amount of the driving unit and a storing unit configured to store a durability threshold value of the draft roller pairs. The control unit changes the holding position of the fiber bundle held by the draft roller pairs based on the driving amount stored in the memory unit and the durability threshold value stored in the storing unit.

[Advantageous Effects of Invention]

[0020] As effects of the present invention, the following advantageous effects are provided.

[0021] According to the spinning machine of the first aspect of the present invention, since the positional control of the movable base unit is performed, the movable base unit can precisely be moved. Accordingly, the life of the draft roller pairs (more particularly, top rollers or/and bottom rollers constituting the draft roller pairs) can be extended without reducing the quality of the spun yarn. Even when the fiber bundle is thick, the fibers constituting the fiber bundle can be prevented from falling off from the draft roller pairs.

[0022] According to the spinning machine of the second aspect of the present invention, since the positional control and the speed control of the movable base unit are performed, the movable base unit can precisely be moved. Accordingly, occurrence of periodic unevenness and the like, which reduces the quality of the spun yarn, can be reduced. Even when the fiber bundle is thick, the fibers constituting the fiber bundle can be prevented from falling off from the draft roller pairs.

[0023] According to the spinning machine of the third aspect of the present invention, the holding position of the fiber bundle held by the draft roller pairs can successively be changed. Accordingly, progress of abrasion with regards to a portion of the draft roller pairs (more particularly, the top rollers or/and bottom rollers constituting the draft roller pairs) can be prevented, and the life of the draft roller pairs can be extended.

[0024] According to the spinning machine of the fourth aspect of the present invention, the holding position of the fiber bundle held by the draft roller pairs can intermittently be changed. Accordingly, the holding position can be changed before the abrasion of the draft roller pairs (more particularly, the top rollers or/and bottom rollers constituting the draft roller pairs) exceeds its tolerable range, and the life of the draft roller pairs can be extended. When successively changing the holding position, it is difficult to control the driving unit at a super low speed. Accordingly, the holding position of the fiber bundle held by the draft roller pairs is intermittently changed, and the reduction in the yarn quality can be prevented.

[0025] According to the spinning machine of the fifth aspect of the present invention, the spinning unit can be arranged at the origin position at the start of spinning. When starting the spinning, the fiber bundle F drafted by the draft roller pairs is introduced to the spinning unit. Accordingly, since the spinning is started in a state where the spinning unit is located at the origin position, the spinning can smoothly be started.

[0026] According to the spinning machine of the sixth aspect of the present invention, a holdable range of the fiber bundle held by the draft roller pairs can be obtained to the largest degree. Accordingly, the life of the draft roller pairs can be extended even more. Even when the fiber bundle is thick, the fibers constituting the fiber bundle can reliably be prevented from falling off from the draft roller pairs.

[0027] According to the spinning machine of the sev-

enth aspect of the present invention, when the draft roller pairs are not rotating, the movement of the movable base unit can be stopped. Accordingly, the fiber bundle held by the draft roller pairs can be prevented from being extended by the movable base unit, and unintentional cutting of the fiber bundle can be avoided.

[0028] According to the spinning machine of the eighth aspect of the present invention, when the thickness of the fiber bundle is larger than a predetermined value, the movement of the movable base unit can be stopped. Accordingly, even when the fiber bundle is thick, the fibers constituting the fiber bundle can reliably be prevented from falling off from the draft roller pairs.

[0029] According to the spinning machine of the ninth aspect of the present invention, a simple control system can be realized by use of the stepping motor. Accordingly, costs of the driving unit and the control system can be reduced.

[0030] According to the spinning machine of the tenth aspect of the present invention, since the fiber bundle is twisted by the swirling airflow, a high spinning speed can be realized. When the spinning speed becomes high, behavior of the fibers of the fiber bundle is also easily affected by external change. In addition, the progress of abrasion of the draft roller pairs (more particularly, the top rollers or/and the bottom rollers constituting the draft roller pairs) also becomes fast by the fiber bundle that is drafted at a high speed. The movable base unit is moved by performing the positional control of the movable base unit, and at least the life of the draft roller pairs can appropriately be extended without affecting the behavior of the fibers of the fiber bundle.

[0031] According to the spinning machine of the eleventh aspect of the present invention, the control mode can be set or selected by operating the setting unit. Accordingly, the spinning machine can perform optimal control in accordance with characteristics of the fiber bundle.

[0032] According to the spinning machine of the twelfth aspect of the present invention, production capacity of the packages by the spinning machine can be improved.

[0033] According to the spinning machine of the thirteenth aspect of the present invention, the draft roller pairs (more particularly, the top rollers or/and the bottom rollers constituting the draft roller pairs) can be used up to their limitation.

[Brief Description of Drawings]

[0034]

[FIG. 1] FIG. 1 is a drawing illustrating an overall configuration of a spinning machine.

[FIG. 2] FIG. 2 is a drawing illustrating a configuration of a draft unit.

[FIG. 3] FIG. 3 is a drawing of the draft unit viewed from a direction of an arrow X.

[FIG. 4] FIG. 4 is a drawing of the draft unit viewed from a direction of an arrow Y.

[FIG. 5] FIG. 5 is a drawing of the draft unit viewed from a direction of an arrow Z.

[FIG. 6] (FIG. 6A) is a drawing illustrating a configuration for converting a rotational movement into a sliding movement by a spiral shaft and a nut. (FIG. 6B) is a drawing illustrating a configuration for converting the rotational movement into the sliding movement by a rack gear and a pinion gear.

[FIG. 7] FIG. 7 is a diagram illustrating displacement of a spinning unit and the like over time.

[FIG. 8] FIG. 8 is a diagram illustrating displacement of the spinning unit and the like over time.

[FIG. 9] FIG. 9 is a drawing illustrating a configuration of an air spinning device.

[Description of Embodiments]

[0035] First, the entire configuration of a spinning machine 100 will briefly be described. The spinning machine 100 is a spinning machine that produces a spun yarn Y from a fiber bundle F and forms a package P. The spinning machine 100 includes a sliver supply unit 1, a draft unit 2, a spinning unit 3, a defect detecting unit 4, a tension stabilizing unit 5, and a winding unit 6, which are arranged in this order along a feeding direction of the fiber bundle F and the spun yarn Y. The spinning machine 100 is connected to a control unit 7 that enables transmission of a control signal to each unit (see FIG. 2).

[0036] The sliver supply unit 1 supplies the fiber bundle F (sliver), which serves as a raw material of the spun yarn Y, to the draft unit 2. The sliver supply unit 1 includes a sliver case 11 and a sliver guide (not illustrated). The fiber bundle F stored in the sliver case 11 is guided by the sliver guide and introduced to the draft unit 2.

[0037] The draft unit 2 drafts the fiber bundle F and draws the fiber bundle F into a predetermined thickness. The draft unit 2 includes four sets of draft roller pairs 21, 22, 23, and 24, which are a back roller pair 21, a third roller pair 22, a middle roller pair 23, and a front roller pair 24, arranged in this order along the feeding direction of the fiber bundle F. Since the draft roller pairs 21, 22, 23, and 24 feed the held fiber bundle F by rotation, the draft roller pairs 21, 22, 23, and 24 can draft the fiber bundle F by the difference in the feeding speeds of the adjacent draft roller pairs.

[0038] The spinning unit 3 twists the fiber bundle F that has been drafted to the predetermined thickness, thereby producing the spun yarn Y. The spinning unit 3 is arranged downstream of the front roller pair 24 of the draft unit 2. The spinning unit 3 can produce the spun yarn Y from the fiber bundle F that is drafted to the predetermined thickness. The detailed configuration of the spinning unit 3 will be described later.

[0039] The defect detecting unit 4 detects a defective portion of the produced spun yarn Y. More specifically, the defect detecting unit 4 irradiates the spun yarn Y with a light-emitting diode (not illustrated) as a light source and detects a reflection light amount from the spun yarn

Y. The defect detecting unit 4 is connected to the control unit 7 via an analyzer (not illustrated) and can transmit a detection signal to the control unit 7. The control unit 7 can determine presence or absence of the defective portion based on the detection signal from the defect detecting unit 4. The defective portion that can be detected by the defect detecting unit 4 includes foreign matters such as polypropylene contained in the spun yarn Y, in addition to irregularity in the thickness of the spun yarn Y. Besides an optical sensor according to the present embodiment, the defect detecting unit 4 may adapt an electrostatic capacitance type sensor.

[0040] The tension stabilizing unit 5 appropriately maintains and stabilizes the tension applied to the spun yarn Y. The tension stabilizing unit 5 includes an unwinding member 51 and a roller 52. When the tension applied to the spurn yarn Y is low, the unwinding member 51 rotates with the roller 52 and winds the spun yarn Y around the roller 52. When the tension applied to the spurn yarn Y is high, the unwinding member 51 independently rotates with respect to the roller 52 and unwinds the spun yarn Y wound around the roller 52.

[0041] The winding unit 6 winds the spun yarn Y and forms the package P. The winding unit 6 includes a driving roller 61 and a cradle (not illustrated). The driving roller 61 rotates a bobbin B held by the cradle. The winding unit 6 winds the spun yarn Y, thereby forming the package P. Since the winding unit 6 traverses the spun yarn Y by a not-illustrated traverse device, unevenness of the spun yarn Y on the package P is prevented.

[0042] As long as the draft unit 2 that is the characterizing feature of the spinning machine 100 is provided, detailed configuration does not matter. The sliver supply unit 1, the spinning unit 3, the defect detecting unit 4, the tension stabilizing unit 5, the winding unit 6, and/or other configuration are not limited. The position at which each unit is arranged is also not limited.

[0043] Next, the configuration of the draft unit 2 will be described in detail. The draft roller pairs 21, 22, 23, and 24 are respectively constituted by bottom rollers 21A, 22A, 23A, and 24A and top rollers 21B, 22B, 23B, and 24B. Apron bands 23C and 23C made of synthetic rubber are wound around the bottom roller 23A and the top roller 23B constituting the middle roller pair 23.

[0044] The bottom rollers 21A, 22A, 23A, and 24A are rotated by a not-illustrated power mechanism in a travel direction of the fiber bundle F. The top rollers 21B, 22B, 23B, and 24B are driven to rotate while making contact with the bottom rollers 21A, 22A, 23A, and 24A. The respective draft roller pairs 21, 22, 23, and 24 are set such that circumferential speeds of the draft roller pairs 21, 22, 23, and 24 are sequentially increased along the feeding direction of the fiber bundle F.

[0045] As the fiber bundle F held by the draft roller pairs 21, 22, 23, and 24 passes through the respective draft roller pairs 21, 22, 23, and 24, the feeding speed is increased, and the fiber bundle F is drafted between the adjacent draft roller pairs 21, 22, 23, and 24. Thus, the draft unit 2 can gradually narrow the width (thickness) of the fiber bundle F to a predetermined thickness.

[0046] The spinning unit 3 is mounted to a movable base unit 25 via a bracket that holds the spinning unit 3. The movable base unit 25 is supported by two guiding shafts 251 provided in parallel with respect to the rotating shafts of the draft roller pairs 21, 22, 23, and 24. The movable base unit 25 is supported under a state in which the guiding shafts 251 are inserted through sliding holes of the movable base unit 25.

[0047] A driving unit 26 is arranged below the movable base unit 25 (the opposite side with respect to the side where the draft roller pairs 21, 22, 23, and 24 are arranged). The driving unit 26 according to the present embodiment includes a stepping motor 261, a cam 262, and a cam follower 263. The stepping motor 261 rotates the cam 262, thereby having the cam follower 263, which is mounted to the movable base unit 25, to be driven. Since the movable base unit 25 is urged by springs 253 mounted on the guiding shafts 251, the movable base unit 25 can follow the shape of the cam 262.

[0048] The movable base unit 25 can smoothly move in parallel with respect to the rotating shafts of the draft roller pairs 21, 22, 23, and 24 (see an arrow T in FIGs. 3 and 4). The spinning unit 3 mounted to the movable base unit 25 can also move in parallel with respect to the rotating shafts of the draft roller pairs 21, 22, 23, and 24, integrally with the movable base unit 25.

[0049] As described above, the driving unit 26 according to the present embodiment adopts the configuration in which a cam mechanism converts a rotational movement into a linear movement. As is illustrated in FIG. 6A, a spiral shaft 264 and a nut 265 can alternatively convert a rotational movement into a sliding movement. As is illustrated in FIG. 6B, a rack gear 266 and a pinion gear 267 can also convert the rotational movement into the sliding movement.

[0050] The driving unit 26 according to the present embodiment can be realized by not only a stepping motor but also a servo motor and the like. The stepping motor is used as the power source of the driving unit 26, thereby simplifying a control system. Accordingly, the costs of the driving unit 26 and the control system can be reduced.

[0051] The draft unit 2 includes a first guiding unit 27 at upstream of the back roller pair 21. The first guiding unit 27 guides the fiber bundle F supplied from the sliver supply unit 1 to the back roller pair 21. The first guiding unit 27 is mounted to the movable base unit 25 via a bracket that supports the first guiding unit 27.

[0052] The draft unit 2 includes a second guiding unit 28 between the third roller pair 22 and the middle roller pair 23. The second guiding unit 28 guides the fiber bundle F fed from the third roller pair 22 to the middle roller pair 23. The second guiding unit 28 is mounted to the movable base unit 25 via a bracket that supports the second guiding unit 28.

[0053] The first guiding unit 27 and the second guiding unit 28 that are mounted to the movable base unit 25 can

move in parallel with respect to the rotating shafts of the draft roller pairs 21, 22, 23, and 24, integrally with the movable base unit 25 (see the arrow T in FIGs. 3 and 4). The first guiding unit 27 and the second guiding unit 28 can move in parallel with respect to the rotating shafts of the draft roller pairs 21, 22, 23, and 24 under a state in which their positions are kept constant with respect to the spinning unit 3.

[0054] As described above, since the first guiding unit 27 according to the present embodiment is mounted to the movable base unit 25, the first guiding unit 27 moves together with the spinning unit 3. The first guiding unit 27 may be fixed on a frame of a main body of the spinning machine 100 and the like and may be configured not to move.

[0055] As is illustrated in FIG. 3, in the present embodiment, the first guiding unit 27, the second guiding unit 28, and the spinning unit 3 are arranged on a straight line. The first guiding unit 27, the second guiding unit 28, and the spinning unit 3 may be arranged on a substantially straight line. When the first guiding unit 27 is fixed on the frame, the first guiding unit 27 may not necessarily be arranged on the straight line with respect to the second guiding unit 28 and the spinning unit 3.

[0056] As a case where the first guiding unit 27 is configured not to be movable, there is a case in which the fiber bundle F is thick. When the width (thickness) of the fiber bundle F held by the back roller pair 21 is large and there is no extra space with respect to the width dimension of the back roller pair 21, if the first guiding unit 27 is moved, the fibers constituting the fiber bundle F would fall off from the back roller pair 21. Accordingly, when the fiber bundle F is thick, it is preferable that the first guiding unit 27 be provided not movable.

[0057] In the draft unit 2, a detecting unit 29 is mounted in the vicinity of the movable base unit 25. The detecting unit 29 is a magnetic sensor (Hall IC) that can detect the magnetic force of a magnet M mounted to the movable base unit 25. More specifically, the detecting unit 29 converts an output voltage in accordance with change in magnetic flux density, thereby detecting the position of the magnet M based on the value of the output voltage. The detecting unit 29 is connected to the control unit 7 via an analyzer (not illustrated). Accordingly, the control unit 7 can recognize the position of the magnet M, that is, the position of the movable base unit 25, based on a detection signal from the detecting unit 29. The mounting position of the magnet M and the like are not limited.

[0058] The control unit 7 can transmit a control signal to the driving unit 26 based on the detection signal from the detecting unit 29. The control unit 7 can control the position of the movable base unit 25, that is, the position of the spinning unit 3 and the like, based on the detection signal from the detecting unit 29.

[0059] As is illustrated in FIG. 6A, with regards to the configuration in which the rotational movement is converted into the sliding movement by the spiral shaft 264 and the nut 265, overrunning of the movable base unit 25 is necessary to be prevented. Accordingly, the detecting unit 29 may be provided on bilateral sides of the moving range of the movable base unit 25. In this embodiment and other embodiments, it is also possible, that the mounting position of the detecting unit 29 is not limited. Similarly, the number of detecting units 29 is also not limited.

[0060] Next, the control mode of the spinning machine 100 will be described. A vertical axis of FIG. 7 represents an elapsed time t. A horizontal axis of FIG. 7 represents displacement of the spinning unit 3 and the like. The displacement of the spinning unit 3 or the like is the distance the spinning unit 3, the first guiding unit 27, and the second guiding unit 28 moved from an origin position O.

[0061] In the present control mode, the control unit 7 controls the driving unit 26, thereby successively reciprocating the movable base unit 25. Since the spinning machine 100 includes a setting unit 8 that can set the control mode of the driving unit 26 (see FIG. 2), the control mode can be set according to a type of fiber bundle F. Accordingly, in the present control mode of the present embodiment, since the control unit 7 controls the driving unit 26 based on the settings of the setting unit 8, the movable base unit 25 can successively be reciprocated.

[0062] According to this control mode, the spinning machine 100 can successively change the holding position of the fiber bundle F held by the draft roller pairs 21, 22, 23, and 24. Accordingly, abrasion with regards to a portion of the draft roller pairs 21, 22, 23, and 24 (in the present embodiment, the top rollers 21B, 22B and 24B) can be prevented from exceeding its tolerable range, and the life of the top rollers 2 1 B, 22B and 24B can be extended. In the present embodiment, since the apron bands 23C and 23C are wound around the middle roller pair 23, the life of the apron bands 23C can be extended instead of the middle roller pair 23 in a precise sense.

[0063] The target position of the spinning unit 3 means the ideal position of the spinning unit 3 for every unit time, which is determined based on ideal control varied according to the characteristics of the fiber bundle F. The control unit 7 moves the spinning unit 3 to the ideal position for every unit time, thereby realizing optimal control, that is, positional control according to the characteristics of the fiber bundle F. In the present embodiment, the positional control of the spinning unit 3, the first guiding unit 27, and the second guiding unit 28 can be realized via the movable base unit 25.

[0064] Accordingly, for example, since amplitude and/or cycle can be changed according to the thickness of the fiber bundle F, the life of the draft roller pairs 21, 22, 23, and 24 (in the present embodiment, the top rollers 21B, 22B and 24B) can be extended without reducing the quality of the spun yarn Y. Since the optimal positional control can be realized according to the characteristics of the fiber bundle F, even when the fiber bundle F is thick, the fibers constituting the fiber bundle F can be prevented from falling off from the draft roller pairs 21, 22, 23, and 24.

[0065] In the present control mode, the control unit 7 may set the target position and target speed of the spinning unit 3 and control the driving unit 26, and accordingly, the movable base unit 25 can be successively reciprocated.

[0066] The target speed of the spinning unit 3 means the ideal speed of the spinning unit 3 for every unit time, which is determined based on ideal control varied according to the characteristics of the fiber bundle F. The control unit 7 accelerates or decelerates the spinning unit 3 for every unit time up to the ideal speed, thereby realizing optimal control, that is, speed control according to the characteristics of the fiber bundle F. In the present embodiment, the speed control of the spinning unit 3, the first guiding unit 27, and the second guiding unit 28 can be realized via the movable base unit 25.

[0067] Accordingly, for example, since at least any of the amplitude, the cycle, and the moving speed can be changed according to the thickness of the fiber bundle F, the occurrence of periodic unevenness and the like, which reduces the quality of the spun yarn Y, can be reduced. Since the optimal positional control and speed control can be realized according to the characteristics of the fiber bundle F, even when the fiber bundle F is thick, the fibers constituting the fiber bundle F can be prevented from falling off from the draft roller pairs 21, 22, 23, and 24.

[0068] In the present control mode, the control unit 7 controls the driving unit 26 such that the position of the spinning unit 3 is adjusted to the origin position O at the start time of spinning. The start of the spinning includes a case where the spinning is restarted after an interruption of the winding due to a yarn cut, which is attributed to the detection of a defective portion by the defect detecting unit 4, and/or a yarn breakage during the winding, besides the case where the spun yarn Y starts to be wound around a new bobbin B. Hereinafter, a case where the spun yarn Y starts to be wound around a new bobbin B and a case where the winding is restarted will be described in detail.

[0069] When starting to wind the spun yarn Y around the bobbin B, the fiber bundle F drafted by the draft unit 2 is introduced to the spinning unit 3 and spun by swirling airflow in two different directions in the spinning unit 3, thereby producing the spun yarn Y. The spun yarn Y from the spinning unit 3 is sucked by a non-illustrated suction pipe, and the spun yarn Y is positioned with respect to the bobbin B, and the package P is wound by the above-described method.

[0070] When restarting the winding, the spun yarn Y from the spinning unit 3 is sucked by a non-illustrated suction pipe and guided to a non-illustrated yarn joining device. At the same time or at almost the same time, another suction pipe sucks the spun yarn Y from the package P and guides the spun yarn Y to the yarn joining device. The yarn joining device performs a yarn joining operation of the guided spun yarns Y.

[0071] In the above-described case, when the position of the spinning unit 3 is adjusted to the origin position O, and the fiber bundle F is introduced to the spinning unit 3, the yarn path of the spun yarn Y can be formed straight, which stabilizes the success rate of introducing the fiber bundle F. If the spinning unit 3 is located at the origin position O, the position at which the non-illustrated suction pipe sucks the spun yarn Y becomes constant. As a result, the success rate of sucking the spun yarn Y from the spinning unit 3 by the suction pipe is stabilized.

[0072] For example, when the yarn cut or the yarn breakage occurs, the draft roller pairs 21, 22, 23, and 24 can be stopped after the position of the spinning unit 3 is adjusted to the origin position O. However, when the yarn cut or the yarn breakage occurs, the draft roller pairs 21, 22, 23, and 24 may be immediately stopped, and the position of the spinning unit 3 may be adjusted to the origin position O at the start time of spinning (at the restart of spinning).

[0073] As is illustrated in FIG. 7, the origin position O in the present embodiment is set at a central portion in the shaft direction of the draft roller pairs 21, 22, 23, and 24. The origin position O may not necessarily be provided at the central portion in the shaft direction of the draft roller pairs 21, 22, 23, and 24 but, for example, may be set at an end portion in the shaft direction. The position of the origin position O is not limited. The origin position O is a position that is set in advance, for example, by an origin determining operation of the driving unit 26, which is performed by an operator prior to the start of spinning.

[0074] In the present embodiment illustrated in FIG. 7, the displacement of the spinning unit 3 and the like is moved to the left side of the drawing (right side with respect to the travel direction of the fiber bundle F) after the start from the origin position O. The displacement of the spinning unit 3 and the like may be moved to the right side of the drawing (left side with respect to the travel direction of the fiber bundle F) after the start from the origin position O.

[0075] Next, another control mode of the spinning machine 100 will be described. A vertical axis of FIG. 8 represents an elapsed time t. A horizontal axis of FIG. 8 represents the displacement of the spinning unit 3 and the like. The displacement of the spinning unit 3 and the like is the distance the spinning unit 3, the first guiding unit 27, and the second guiding unit 28 moved from the origin position O.

[0076] In the present control mode, the control unit 7 controls the driving unit 26, thereby intermittently moving the movable base unit 25. More specifically, in the present control mode, the control unit 7 sets the target position of the spinning unit 3 and controls the driving unit 26, thereby intermittently moving the movable base unit 25.

[0077] According to this control mode, the spinning machine 100 can intermittently change the holding position of the fiber bundle F held by the draft roller pairs 21, 22, 23, and 24. Accordingly, before abrasion of the draft roller pairs 21, 22, 23, and 24 (in the present embodiment, the

top rollers 21B, 22B and 24B) exceeds a tolerable range, the holding position can be changed, thereby extending the life of the draft roller pairs 21, 22, 23, and 24. In the present embodiment, since the apron bands 23C and 23C are wound around the middle roller pair 23, the life of the apron bands 23C can be extended instead of the middle roller pair 23 in a precise sense.

[0078] The target position of the spinning unit 3 means the ideal position of the spinning unit 3 for every predetermined time, which is determined based on the progress speed of abrasion, varied according to the characteristics of the fiber bundle F, with regards to the draft roller pairs 21, 22, 23, and 24 (in the present embodiment, the top rollers 21B, 22B and 24B). The control unit 7 controls the spinning unit 3 to be moved to the ideal position for every predetermined time, thereby realizing optimal control, that is, positional control according to the characteristics of the fiber bundle F. In the present embodiment, the positional control of the spinning unit 3, the first guiding unit 27, and the second guiding unit 28 can be realized via the movable base unit 25.

[0079] Accordingly, since the moving distance and/or moving time can be changed according to, for example, the thickness of the fiber bundle F, the life of the top rollers 21B, 22B and 24B can be extended. Since the optimal positional control can be realized according to the characteristics of the fiber bundle F, even if the fiber bundle F is thick, the fibers constituting the fiber bundle F can be prevented from falling off from the draft roller pairs 21, 22, 23, and 24.

[0080] A case where the holding position of the fiber bundle F is intermittently changed includes, for example, a case where the driving unit 26 constituted by the stepping motor 261 is driven stepwise, thereby switching between moving and retaining of the holding position as required. FIG. 8 illustrates an embodiment in which the holding position is moved stepwise from the origin position O by a moving distance L. The control unit 7 may perform the positional control of the movable base unit 25 such that after the holding position reaches the moving distance L, the holding position reaches the origin position O again while being retained at a position where the holding position has not been retained before reaching the movable distance L.

[0081] When the driving unit 26 is constituted by the stepping motor 261, a rotor of the stepping motor 261 is driven so as to rotate forward/backward. A forward rotation amount of the rotor is preferably equal to a backward rotation amount, but may be different. A correction value of a rotation amount until the rotor returns to an origin position may be set in advance in the control unit 7 according to the mounting position of the detecting unit 29, thereby absorbing a detection error of the detecting unit 29.

[0082] In the present control mode, the control unit 7 sets the target position and the target speed of the spinning unit 3 and controls the driving unit 26, thereby intermittent moving the movable base unit 25.

[0083] The target speed of the spinning unit 3 means the ideal speed of the spinning unit 3 for every predetermined time, which is determined based on the progress speed of abrasion, varied according to the characteristics of the fiber bundle F, with regards to the draft roller pairs 21, 22, 23, and 24 (in the present embodiment, the top rollers 21B, 22B, and 24B). The control unit 7 accelerates the spinning unit 3 to the ideal speed, thereby realizing optimal control, that is, speed control according to the characteristics of the fiber bundle F, before abrasion of the draft roller pairs 21, 22, 23, and 24 (in the present embodiment, the top rollers 21B, 22B and 24B) exceeds a tolerable range. In the present embodiment, the speed control of the spinning unit 3, the first guiding unit 27, and the second guiding unit 28 can be realized via the movable base unit 25.

[0084] Accordingly, for example, since at least any of the moving distance, the moving time, and the moving speed can be changed according to the thickness of the fiber bundle F, the life of the draft roller pairs 21, 22, 23, and 24 (in the present embodiment, the top rollers 2 1 B, 22B and 24B) can be extended, and the occurrence of periodic unevenness and the like, which reduces the quality of the spun yarn Y, can be reduced. Since the optimal positional control and speed control can be realized according to the characteristics of the fiber bundle F, even if the fiber bundle F is thick, the fibers constituting the fiber bundle F can be prevented from falling off from the draft roller pairs 21, 22, 23, and 24.

[0085] As is described above, the spinning machine 100 of the present embodiment can extend the life of the top rollers 21B, 22B, and 24B formed of rubber and the like. When the bottom rollers 21 A, 22A, and 24A are formed of rubber and the like, the life of bottom rollers 21 A, 22A, and 24A can be extended. Even when the top rollers 21B, 22B, and 24B and the bottom rollers 21 A, 22A, and 24A are respectively formed of materials that wear away, the life can also be extended.

[0086] Next, other characteristic features added to the above-described control mode will be described.

[0087] In the present embodiment, the control unit 7 sets the moving distance L of the movable base unit 25 according to the thickness of the fiber bundle F or the width dimension W of the draft roller pairs 21, 22, 23, and 24 (the width dimension of the top roller 24B in the present embodiment: see FIG. 3) (see FIGs. 7 and 8). The moving distance L of the movable base unit 25 may be set according to the thickness of the fiber bundle F and the width dimension W of the draft roller pairs 21, 22, 23, and 24.

[0088] The moving distance L means the maximum distance from the origin position O, in which the fibers constituting the fiber bundle F do not fall off from the draft roller pairs 21, 22, 23, and 24. Since the moving distance L is set based on the thickness of the fiber bundle F and the like, even when the types of the fiber bundle F drafted by the draft unit 2 are changed, the spinning machine 100 according to the present embodiment can handle it

accordingly.

[0089] According to this control mode, the spinning machine 100 can obtain a range of the fiber bundle F that can be held by the draft roller pairs 21, 22, 23, and 24 to the largest degree. Furthermore, the life of the top rollers 21B, 22B, and 24B can be extended. Even when the fiber bundle F is thick, the fibers constituting the fiber bundle F can reliably be prevented from falling off from the draft roller pairs 21, 22, 23, and 24.

[0090] When the draft roller pairs 21, 22, 23, and 24 are rotating, the control unit 7 controls the driving unit 26 to operate, and when the draft roller pairs 21, 22, 23, and 24 are not rotating, the control unit 7 stops the driving unit 26. When the fiber bundle F is drafted, the moving of the spinning unit 3 and the like is carried out, and when the fiber bundle F is not drafted, the moving of the spinning unit 3 and the like is stopped. In the present embodiment, when the back roller pair 21 is rotating, the driving unit 26 is operated, and when the back roller pair 21 is not rotating, the driving unit 26 is stopped. Among the plurality of the draft roller pairs 21, 22, 23, and 24, when at least the draft roller pair that is holding the fiber bundle F is rotating, the driving unit 26 is preferably operated.

[0091] According to this control mode, the spinning machine 100 can avoid the unintentional cutting of the fiber bundle F held by the draft roller pairs 21, 22, 23, and 24 while the draft unit 2 is being stopped.

[0092] When the fiber bundle F is thicker than a predetermined value, the control unit 7 stops the driving unit 26. Specifically, an operator inputs the type of the fiber bundle F to be spun by the spinning machine 100 through the setting unit 8. The control unit 7 determines whether or not the thickness of the fiber bundle F exceeds the predetermined value based on the input information of the fiber bundle F. When the thickness of the fiber bundle F exceeds the predetermined value, the control unit 7 performs control such that the driving unit 26 is stopped.

[0093] According to this control mode, even when the fiber bundle F is thick, the spinning machine 100 can reliably prevent the fibers constituting the fiber bundle F from falling off from the draft roller pairs 21, 22, 23, and 24.

[0094] Next, other characteristic features of the spinning machine 100 according to the present embodiment will be described.

[0095] The spinning unit 3 constituting the spinning machine 100 is an air spinning device 3 that twists the fiber bundle F with swirling airflow. The air spinning device 3 forms the swirling airflow in a spinning chamber SC and twists the fiber bundle F by the swirling airflow. The spinning chamber SC is divided into a space SC1 formed between a fiber guide 31 and a spindle 32 and a space SC2 formed between the spindle 32 and a nozzle block 33.

[0096] In the space SC1, rear end portion of the fibers constituting the fiber bundle F is inverted by the swirling airflow (see a chain double-dashed line in the drawing). In the space SC2, the rear end portion of each inverted fiber is rotated by the swirling airflow (see the chain double-dashed line in the drawing). The rotated rear end portion of the fibers is sequentially wound around the fibers at the central portion. Thus, the air spinning device 3 can spin the fiber bundle F into the spun yarn Y.

[0097] Further, as is illustrated in FIG. 9, a needle is provided in the fiber guide 31 in the air spinning device 3 according to the present embodiment. The needle is provided in order to guide the fiber bundle F to the spindle 32 and prevent the twists of the fibers from propagating to the upstream side. However, the needle of the fiber guide 31 may be omitted.

[0098] The spinning machine 100 can produce the spun yarn Y at a high spinning speed. When the spinning speed becomes high, behavior of the fibers of the fiber bundle F becomes more easily affected by external change. The progress of abrasion of the draft roller pairs 21, 22, 23, and 24 (in the present embodiment, the top rollers 21B, 22B and 24B) also becomes fast by the fiber bundle F that is drafted at a high speed. The positional control of the movable base unit 25 is performed, and the movable base unit 25 is moved, thereby appropriately extending the life of the draft roller pairs 21, 22, 23, and 24 without affecting the behavior of the fibers of the fiber bundle F.

[0099] As long as the spinning unit 3 is configured to twist the fiber bundle F by the swirling airflow, any configuration may be applied irrespective of details. For example, two swirling airflows flowing in different directions from each other may be formed, and the fiber bundle F may be twisted by these swirling airflows (for example, Japanese Unexamined Patent Application Publication No. 1993-86510, Japanese Unexamined Patent Application Publication No. 2006-161171, and the like). The spinning machine 100 can perform the optimal control according to the characteristics of the fiber bundle F.

[0100] Furthermore, as described above, the spinning machine 100 includes the winding unit 6 that winds the spun yarn Y and forms the packages P (see FIG. 1). Since the spinning machine 100 can extend the life of the top rollers 21 B, 22B,, and 24B, the packages P can successively be produced over a long period of time. The spinning machine 100 can improve the production capacity of the packages P.

[0101] In the above-described embodiment, the detecting unit 29 detects the position of the movable base unit 25, and the control unit 7 controls the position or/and the speed of the movable base unit 25 based on the detection result of the detecting unit 29. The control unit 7 may further include a memory unit (not illustrated) that stores history of the holding position of the fiber bundle F held by the front roller pair 24 and the driving amount of the driving unit 26, which indicates the change (speed and time) of the holding position, based on the detection result of the detecting unit 29, and a storing unit (not illustrated) that stores a durability threshold value of the front roller pair 24.

[0102] In this case, the control unit 7 compares the driving amount stored in the memory unit with the dura-

bility threshold value stored in the storing unit and determines whether there remains a portion that can further perform the drafting by the front roller pair 24. When the control unit 7 determines that there remains the portion that can perform the drafting, the control unit 7 controls the position or/and the speed of the movable base unit 25 such that the fiber bundle F is positioned at the corresponding portion and the fiber bundle F is drafted. Accordingly, the front roller pair 24 (in the present embodiment, the top roller 24B), which is easily worn at the high speed spinning, can be used to the limit thereof.

[0103] When the top roller 24B is replaced with a new top roller 24B, the operator may input the replacement to the control unit 7, which resets the content stored in the memory unit.

[0104] In the present embodiment, one set of spinning machine 100 is provided. However, a plurality of spinning machines 100 may be aligned side by side, thereby constituting a textile machine. In this case, the movable base units 25 may be moved in the same direction or may be moved in different directions in adjacent spinning machines 100. When the movable base units 25 are moved in different directions, vibration which is attributed to the movement of the movable base units 25 in the same direction can be restrained.

[0105] The spinning machine 100 includes the draft roller pairs 21, 22, 23, and 24 configured to draft the fiber bundle F, the guiding units 27 and 28 configured to regulate the width of the fiber bundle F drafted by the draft roller pairs 21, 22, 23, and 24 and guide the fiber bundle F, the spinning unit 3 configured to produce the spun yarn Y by twisting the fiber bundle F drafted by the draft roller pairs 21, 22, 23, and 24, the movable base unit 25 to which the guiding units 27 and 28 and the spinning unit 3 are mounted, the driving unit 26 configured to move the movable base unit 25 in parallel with respect to the rotating shaft direction of the draft roller pairs 21, 22, 23, and 24, the detecting unit 29 configured to detect a position of at least any of the guiding units 27 and 28, the spinning unit 3, and the movable base unit 25, and the control unit 7 configured to transmit the positional command signal to the driving unit 26 based on the detection signal from the detecting unit 29 and control the position of the movable base unit 25, thereby adjusting the relative positional relation of the guiding units 27 and 28 and the spinning unit 3 with respect to the draft roller pairs 21, 22, 23, and 24 and changing the holding position of the fiber bundle F held with the draft roller pairs 21, 22, 23, and 24.

[0106] The spinning machine 100 includes the draft roller pairs 21, 22, 23, and 24 configured to draft the fiber bundle F, the guiding units 27 and 28 configured to regulate the width of the fiber bundle F drafted by the draft roller pairs 21, 22, 23, and 24 and guide the fiber bundle F, the spinning unit 3 configured to produce the spun yarn Y by twisting the fiber bundle F drafted by the draft roller pairs 21, 22, 23, and 24, the movable base unit 25 to which the guiding units 27 and 28 and the spinning unit 3 are mounted, the driving unit 26 configured to move the movable base unit 25 in parallel with respect to the rotating shaft direction of the draft roller pairs 21, 22, 23, and 24, the detecting unit 29 configured to detect a position of at least one of the guiding units 27 and 28, the spinning unit 3, and the movable base unit 25, and the control unit 7 configured to transmit the positional command signal and the speed command signal to the driving unit 26 based on the detection signal from the detecting unit 29 and control the position and the speed of the movable base unit 25, thereby adjusting the relative positional relation of the guiding units 27 and 28 and the spinning unit 3 with respect to the draft roller pairs 21, 22, 23, and 24 and changing the holding position of the fiber bundle F with the draft roller pairs 21, 22, 23, and 24.

[0107] The control unit 7 controls the driving unit 26 to continuously reciprocate the movable base unit 25. Alternatively, the control unit 7 controls the driving unit 26 to intermittently move the movable base unit 25.

[0108] The control unit 7 controls the driving unit 26 to adjust the relative position of the spinning unit 3 with respect to the draft roller pairs 21, 22, 23, and 24 at a start time of spinning to an origin position. The control unit 7 controls movement of the movable base unit 25 according to a thickness of the fiber bundle F or/and a width dimension in the rotating shaft direction of the draft roller pairs 21, 22, 23, and 24.

[0109] When the draft roller pairs 21, 22, 23, and 24 are rotating, the control unit 7 controls the driving unit 26 to operate, and when the draft roller pairs 21, 22, 23, and 24 are not rotating, the control unit 7 controls the driving unit 26 to stop. When the fiber bundle F drafted by the draft roller pairs 21, 22, 23, and 24 is larger than a predetermined value, the control unit 7 stops the driving unit 26.

[0110] The driving unit 26 is constituted by the stepping motor. The spinning unit 2 twists the fiber bundle F with the swirling airflow and produces the spun yarn Y.

[0111] The spinning machine 100 includes the setting unit 8 that can set the control mode of the driving unit 26. The spinning machine 100 includes the winding unit 6 configured to wind the spun yarn Y around the package P.

[0112] The spinning machine 100 includes the memory unit configured to store the driving amount of the driving unit 26 and the storing unit configured to store the durability threshold value of the draft roller pairs 21, 22, 23, and 24. The control unit 7 changes the holding position of the fiber bundle F held by the draft roller pairs 21, 22, 23, and 24 based on the driving amount stored in the memory unit and the durability threshold value stored in the storing unit.

[Industrial Applicability]

[0113] A spinning machine of the present invention can extend the life of draft roller pairs without reducing the quality of spun yarns, which is industrially useful.

[Reference Signs List]

[0114]

100	spinning machine
1	sliver supply unit
2	draft unit
21	back roller pair (draft roller pair)
21A	bottom roller
21B	top roller
22	third roller pair (draft roller pair)
22A	bottom roller
22B	top roller
23	middle roller pair (draft roller pair)
23A	bottom roller
23B	top roller
24	front roller pair (draft roller pair)
24A	bottom roller
24B	top roller
25	movable base unit
26	driving unit
27	first guiding unit
28	second guiding unit
29	detecting unit
3	spinning unit
4	defect detecting unit
5	tension stabilizing unit
6	winding unit
7	control unit
F	fiber bundle (sliver)
Y	spun yarn

Claims

1. A spinning machine comprising:

draft roller pairs configured to draft a fiber bundle;
a guiding unit configured to regulate a width of the fiber bundle drafted by the draft roller pairs and guide the fiber bundle;
a spinning unit configured to produce a spun yarn by twisting the fiber bundle drafted by the draft roller pairs;
a movable base unit to which the guiding unit and the spinning unit are mounted;
a driving unit configured to move the movable base unit in parallel with respect to a rotating shaft direction of the draft roller pairs;
a detecting unit configured to detect a position of at least one of the guiding unit, the spinning unit, and the movable base unit; and
a control unit configured to transmit a positional command signal to the driving unit based on a detection signal from the detecting unit and control a position of the movable base unit, thereby adjusting a relative positional relation of the guiding unit and the spinning unit with respect to the draft roller pairs and changing a holding position of the fiber bundle held by the draft roller pairs.

2. A spinning machine comprising:

draft roller pairs configured to draft a fiber bundle;
a guiding unit configured to regulate a width of the fiber bundle drafted by the draft roller pairs and guide the fiber bundle;
a spinning unit configured to produce a spun yarn by twisting the fiber bundle drafted by the draft roller pairs;
a movable base unit to which the guiding unit and the spinning unit are mounted;
a driving unit configured to move the movable base unit in parallel with respect to a rotating shaft direction of the draft roller pairs;
a detecting unit configured to detect a position of at least one of the guiding unit, the spinning unit, and the movable base unit; and
a control unit configured to transmit a positional command signal and a speed command signal to the driving unit based on a detection signal from the detecting unit and control a position and a speed of the movable base unit, thereby adjusting a relative positional relation of the guiding unit and the spinning unit with respect to the draft roller pairs and changing a holding position of the fiber bundle held by the draft roller pairs.

3. The spinning machine according to claim 1 or 2, wherein the control unit controls the driving unit to successively reciprocate the movable base unit.

4. The spinning machine according to claim 1 or 2, wherein the control unit controls the driving unit to intermittently feed and move the movable base unit.

5. The spinning machine according to any one of claims 1 to 3, wherein the control unit controls the driving unit to adjust a relative position of the spinning unit with respect to the draft roller pairs at a start time of spinning to an origin position.

6. The spinning machine according to any one of claims 1 to 5, wherein the control unit controls a movement of the movable base unit according to a thickness of the fiber bundle or/and a width dimension in the rotating shaft direction of the draft roller pairs.

7. The spinning machine according to any one of claims 1 to 6, wherein when the draft roller pairs are rotating, the control unit controls the driving unit to operate, and when the draft roller pairs are not rotating, the control unit controls the driving unit to stop.

8. The spinning machine according to any one of claims 1 to 7, wherein when the fiber bundle drafted by the draft roller pairs is larger than a predetermined value, the driving unit is stopped.

9. The spinning machine according to any one of claims 1 to 8, wherein the driving unit is constituted by a stepping motor.

10. The spinning machine according to any one of claims 1 to 9, wherein the spinning unit twists the fiber bundle with swirling airflow and produces the spun yarn.

11. The spinning machine according to any one of claims 1 to 10, further comprising a setting unit configured to set control mode of the driving unit.

12. The spinning machine according to any one of claims 1 to 11, further comprising a winding unit configured to wind the spun yarn around a package.

13. The spinning machine according to any one of claims 1 to 12, further comprising:

a memory unit configured to store a driving amount of the driving unit; and
a storing unit configured to store a durability threshold value of the draft roller pairs,
wherein the control unit changes the holding position of the fiber bundle held by the draft roller pairs based on the driving amount stored in the memory unit and the durability threshold value stored in the storing unit.

Amended claims under Art. 19.1 PCT

1. A spinning machine comprising:

draft roller pairs configured to draft a fiber bundle;
a guiding unit configured to regulate a width of the fiber bundle drafted by the draft roller pairs and guide the fiber bundle;
a spinning unit configured to produce a spun yarn by twisting the fiber bundle drafted by the draft roller pairs;
a movable base unit to which the guiding unit and the spinning unit are mounted;
a driving unit configured to move the movable base unit in parallel with respect to a rotating shaft direction of the draft roller pairs;
a detecting unit configured to detect a position of at least one of the guiding unit, the spinning unit, and the movable base unit; and
a control unit configured to transmit a positional command signal to the driving unit based on a detection signal from the detecting unit and control a position of the movable base unit, thereby adjusting a relative positional relation of the guiding unit and the spinning unit with respect to the draft roller pairs and changing a holding position of the fiber bundle held by the draft roller pairs.

2. A spinning machine comprising:

draft roller pairs configured to draft a fiber bundle;
a guiding unit configured to regulate a width of the fiber bundle drafted by the draft roller pairs and guide the fiber bundle;
a spinning unit configured to produce a spun yarn by twisting the fiber bundle drafted by the draft roller pairs;
a movable base unit to which the guiding unit and the spinning unit are mounted;
a driving unit configured to move the movable base unit in parallel with respect to a rotating shaft direction of the draft roller pairs;
a detecting unit configured to detect a position of at least one of the guiding unit, the spinning unit, and the movable base unit; and
a control unit configured to transmit a positional command signal and a speed command signal to the driving unit based on a detection signal from the detecting unit and control a position and a speed of the movable base unit, thereby adjusting a relative positional relation of the guiding unit and the spinning unit with respect to the draft roller pairs and changing a holding position of the fiber bundle held by the draft roller pairs.

3. The spinning machine according to claim 1 or 2, further comprising a first guiding unit arranged upstream of the draft roller pairs in a feeding direction of the fiber bundle and provided not movable with respect to the draft roller pairs,
wherein the guiding unit mounted to the movable base unit is arranged between the plurality of the draft roller pairs arranged along the feeding direction of the fiber bundle, and
the control unit controls the driving unit to successively reciprocate the movable base unit.

4. The spinning machine according to claim 1 or 2, wherein the control unit controls the driving unit to intermittently feed and move the movable base unit.

5. The spinning machine according to any one of claims 1 to 3, wherein the control unit controls the driving unit to adjust a relative position of the spinning unit with respect to the draft roller pairs at a start time of spinning to an origin position.

6. The spinning machine according to any one of claims

1 to 5, wherein the control unit controls a movement of the movable base unit according to a thickness of the fiber bundle or/and a width dimension in the rotating shaft direction of the draft roller pairs.

7. The spinning machine according to any one of claims 1 to 6, wherein when the draft roller pairs are rotating, the control unit controls the driving unit to operate, and when the draft roller pairs are not rotating, the control unit controls the driving unit to stop.

8. The spinning machine according to any one of claims 1 to 7, wherein when the fiber bundle drafted by the draft roller pairs is larger than a predetermined value, the driving unit is stopped.

9. The spinning machine according to any one of claims 1 to 8, wherein the driving unit is constituted by a stepping motor.

10. The spinning machine according to any one of claims 1 to 9, wherein the spinning unit twists the fiber bundle with swirling airflow and produces the spun yarn.

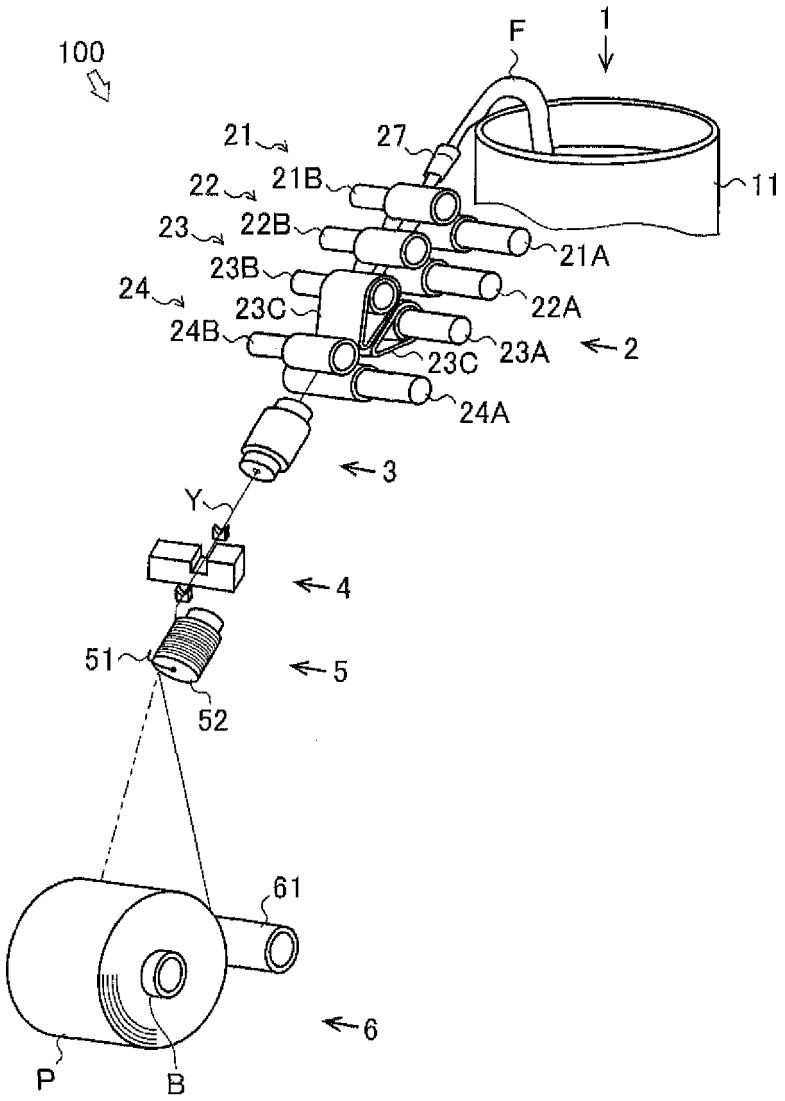
11. The spinning machine according to any one of claims 1 to 10, further comprising a setting unit configured to set control mode of the driving unit.

12. The spinning machine according to any one of claims 1 to 11, further comprising a winding unit configured to wind the spun yarn around a package.

13. The spinning machine according to any one of claims 1 to 12, further comprising:

a memory unit configured to store a driving amount of the driving unit; and
a storing unit configured to store a durability threshold value of the draft roller pairs,
wherein the control unit changes the holding position of the fiber bundle held by the draft roller pairs based on the driving amount stored in the memory unit and the durability threshold value stored in the storing unit.

Fig. 1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P
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Fig. 2

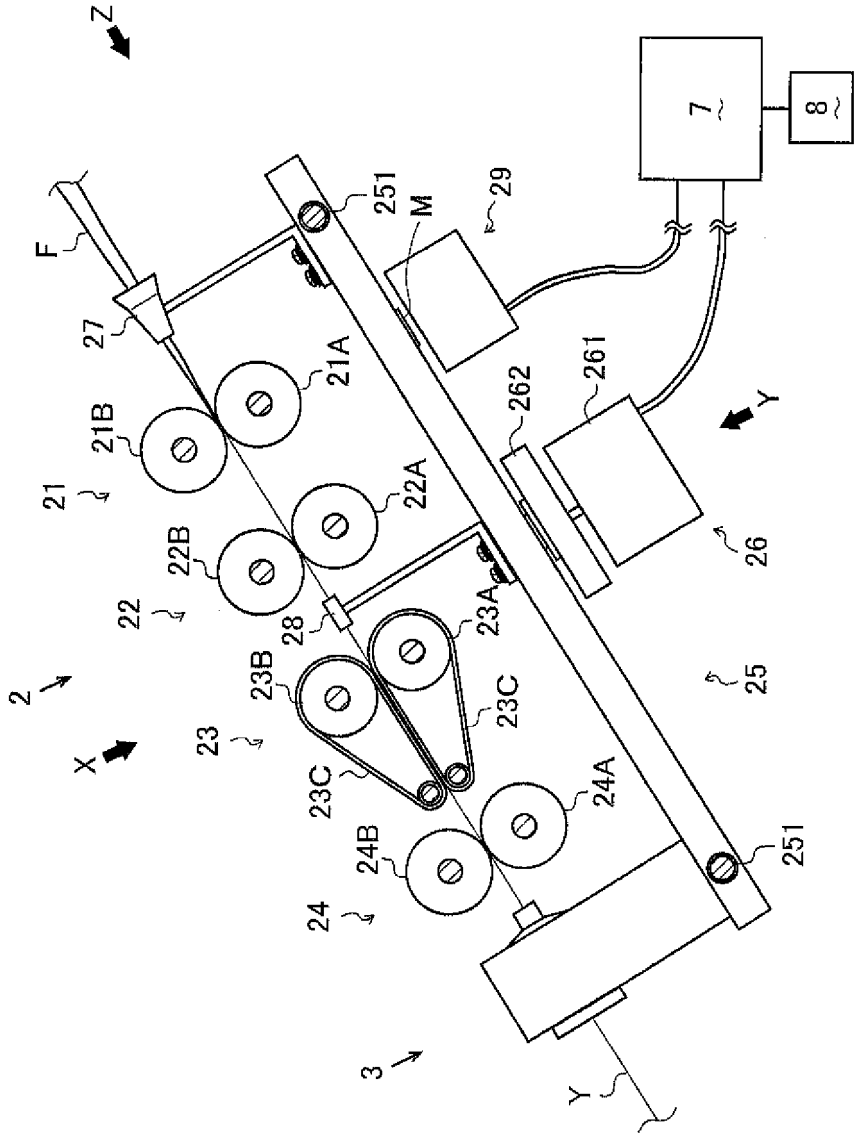
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Fig. 3

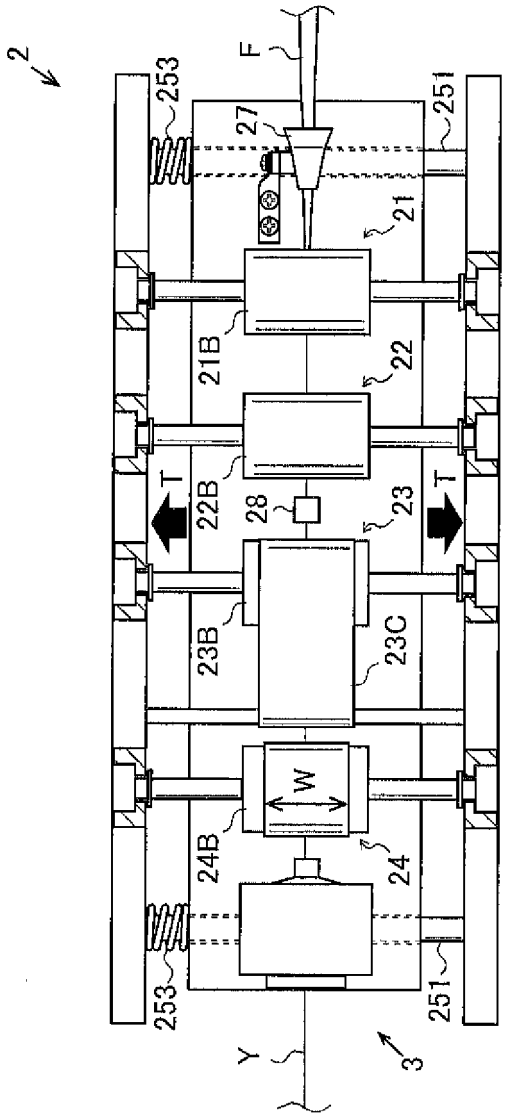

Fig. 4

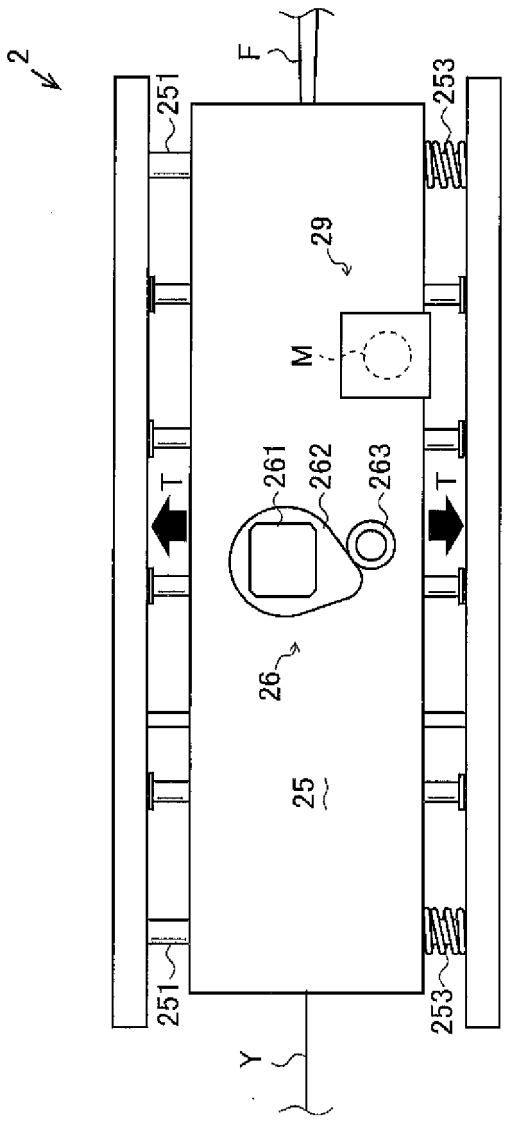

Fig. 5

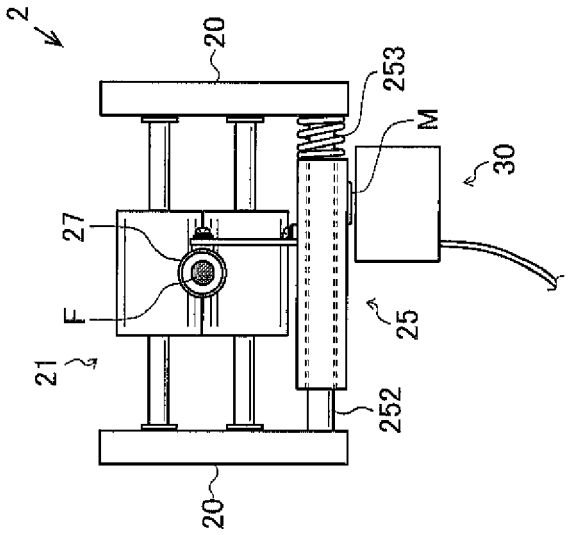

Fig. 6

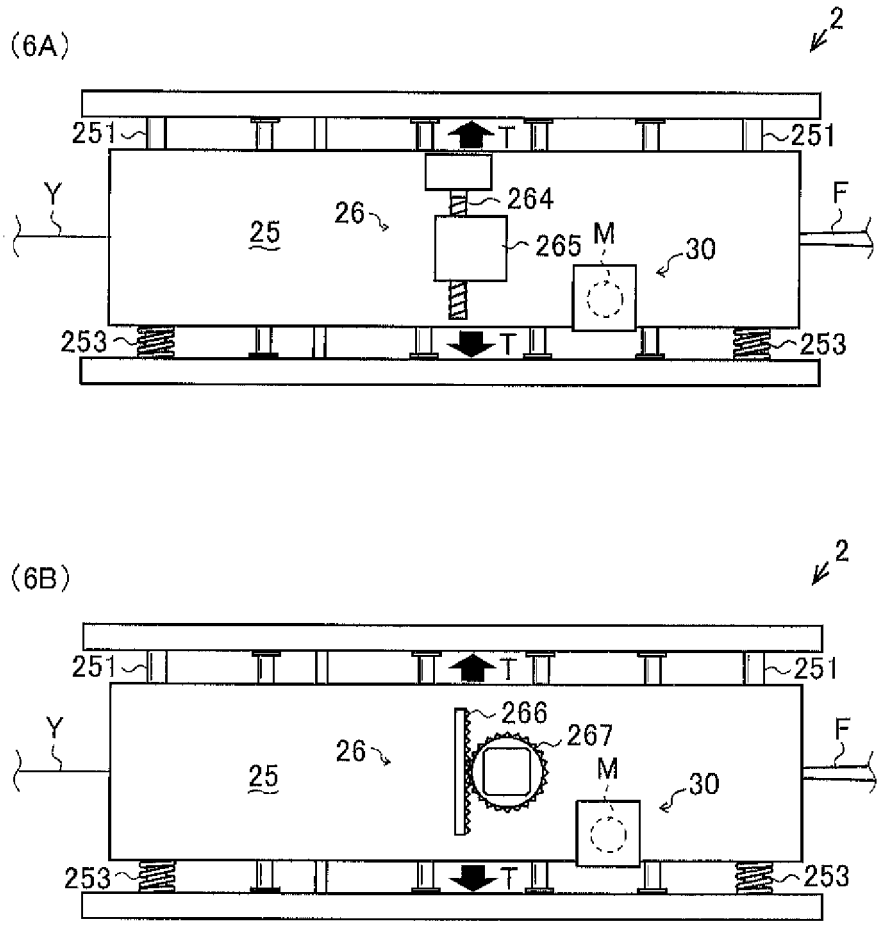
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Fig. 7

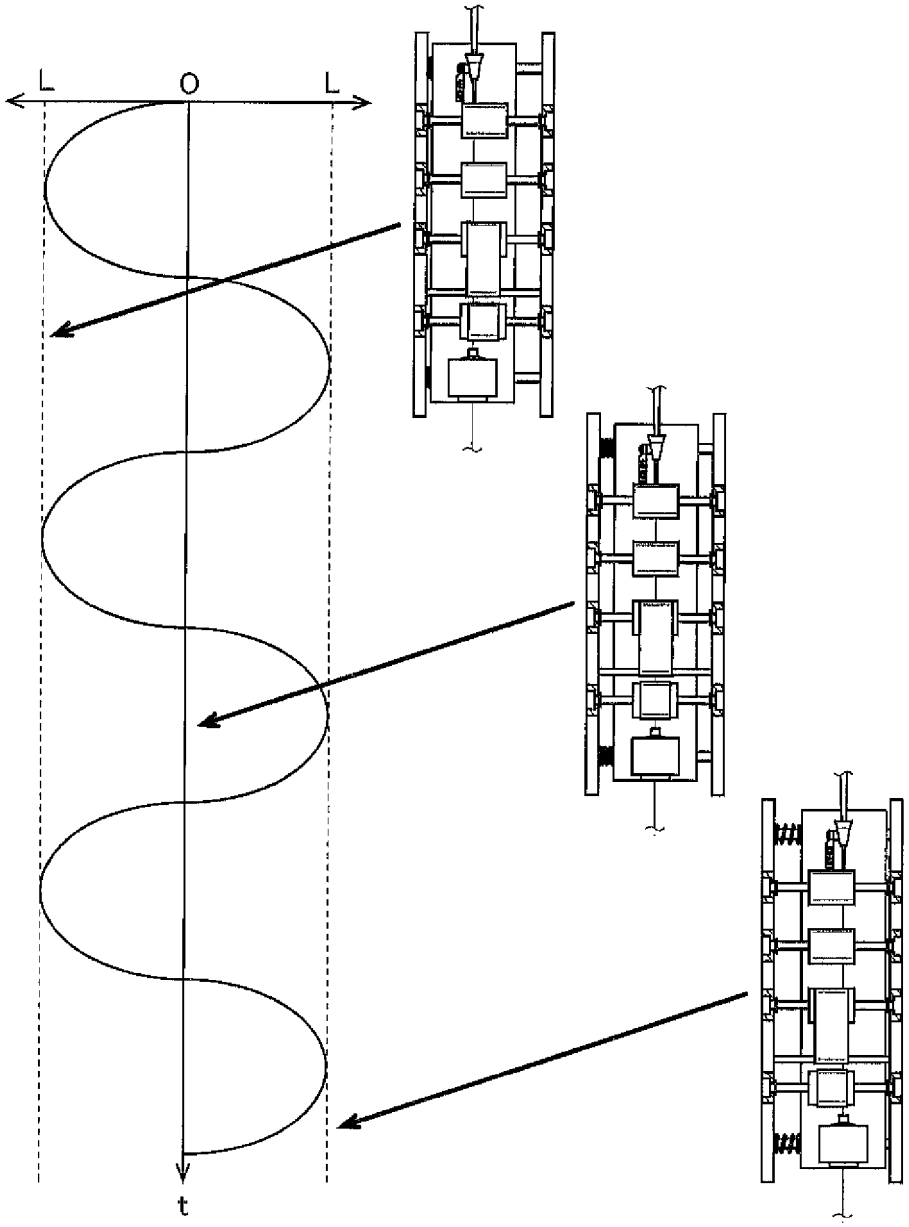


Fig. 8

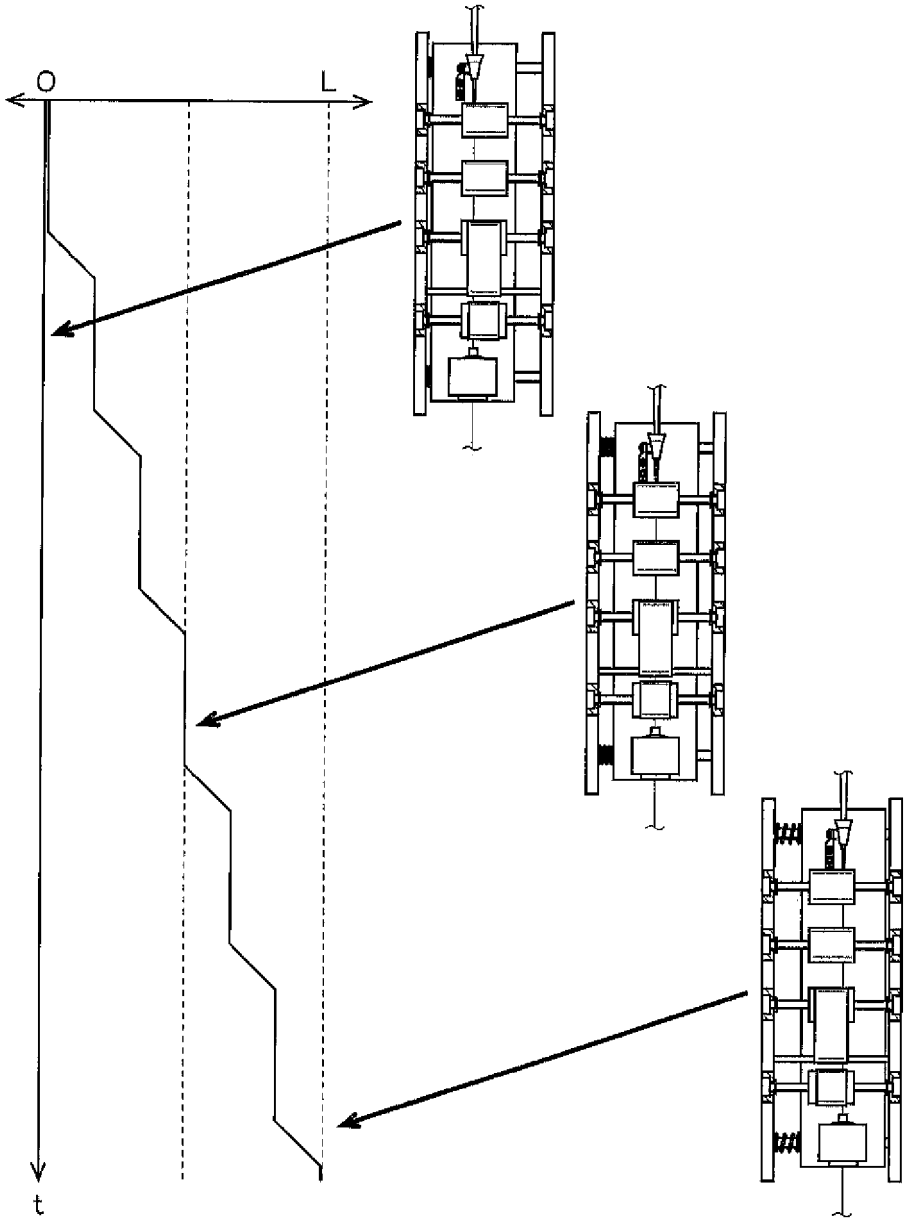
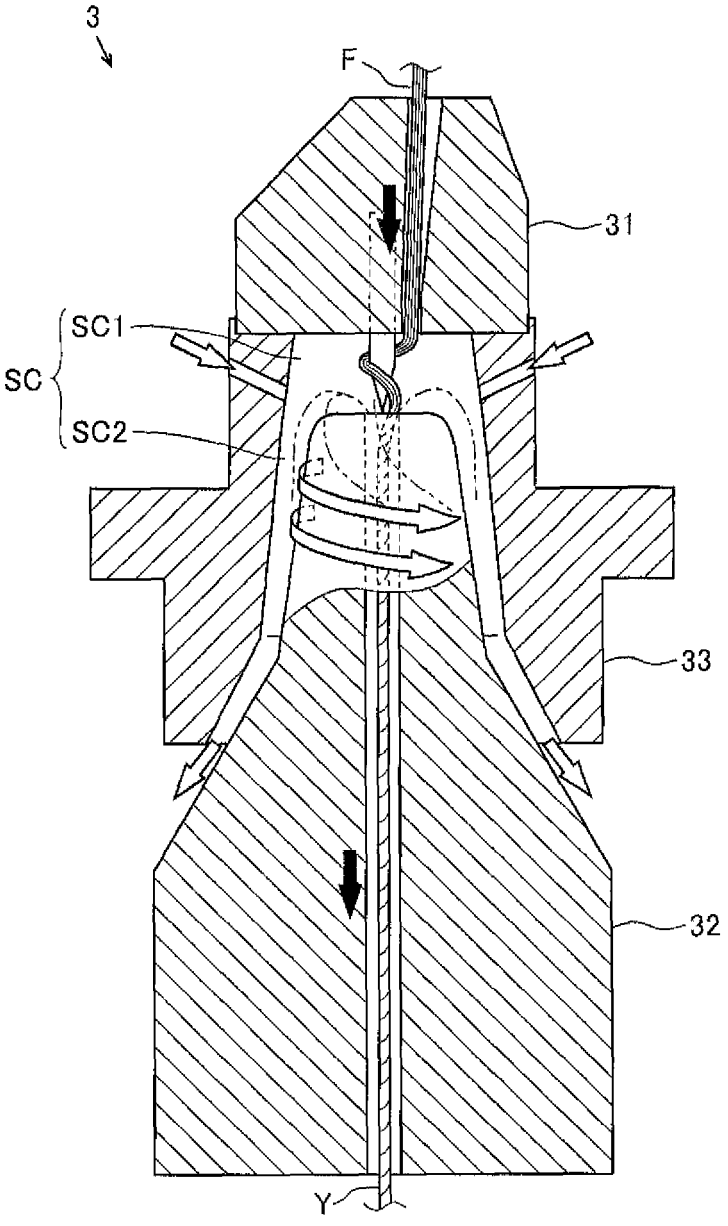


Fig. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/071227

A. CLASSIFICATION OF SUBJECT MATTER
D01H13/22(2006.01)i, *D01H5/56*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D01H1/00-17/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2012
Kokai Jitsuyo Shinan Koho 1971-2012 Toroku Jitsuyo Shinan Koho 1994-2012

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2006-509114 A (Maschinenfabrik Rieter AG.), 16 March 2006 (16.03.2006), paragraphs [0004] to [0022]; fig. 1, 2 & EP 1573098 A1 & WO 2004/053214 A1 & CN 1732296 A	1-13
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 14960/1990(Laid-open No. 106373/1991) (Toyoda Automatic Loom Works, Ltd.), 01 November 1991 (01.11.1991), specification, page 3, line 10 to page 9, line 14 (Family: none)	1-13

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 October, 2012 (10.10.12)	23 October, 2012 (23.10.12)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/071227

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2009-227413 A (Murata Machinery Ltd.), 08 October 2009 (08.10.2009), paragraph [0075]; fig. 1 (Family: none)	9
Y	JP 2010-174387 A (Murata Machinery Ltd.), 12 August 2010 (12.08.2010), paragraphs [0025], [0026]; fig. 1 (Family: none)	12

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2011099192 A **[0005]**
- JP 8291429 A **[0005]**
- JP 5086510 A **[0099]**
- JP 2006161171 A **[0099]**