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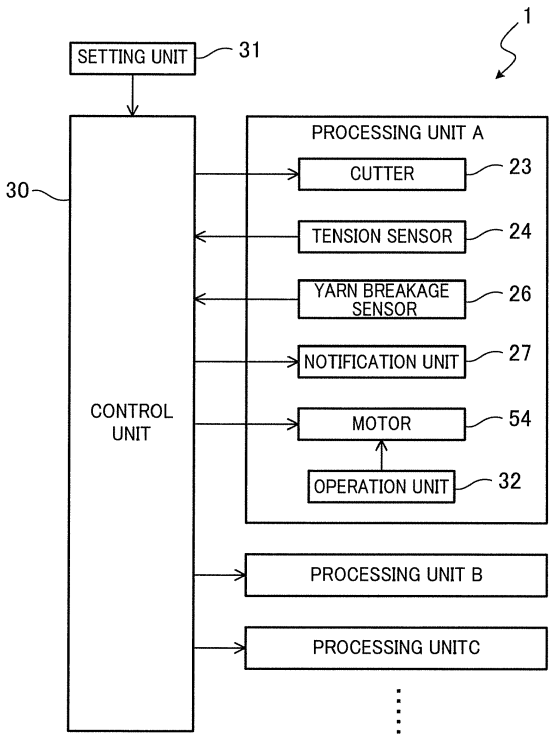
(54) DRAW TEXTURING MACHINE

(57) In a draw texturing machine including a pin-type twisting unit, versatility is improved and yarn threading can be performed irrespective of the proficiency of an operator. The following members are provided: a setting unit 31 which is configured to set a set value regarding a high rotation number for yarn production and a set value regarding a low rotation number lower than the high rotation number, in regard to the rotation number of a pin 41 of the pin-type twisting unit; and an operation unit 32 provided for switching the rotation number of the pin 41 between the high rotation number and the low rotation number.

FIG.2



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a draw texturing machine provided with a pin-type twisting unit.

[0002] For example, Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2002-69763) discloses a pin-type twisting unit (pin-twister-type false-twisting device in Patent Literature 1) which twists a yarn running inside a rotating pin (spinner in Patent Literature 1). In this pin-type twisting unit, rollers are attached to two rotational shafts, respectively, and a cylindrical pin is retained by magnet while being in contact with the circumferential surfaces of the rollers. As at least one of the rotational shafts is rotationally driven by a motor, the pin in contact with the rollers rotates about the shaft, with the result that the yarn running inside the pin is twisted.

[0003] To thread a yarn onto such a draw texturing machine, to begin with, yarn threading to the pin-type twisting unit is performed. Subsequently, yarn threading to members such as a feed roller is performed while the pin-type twisting unit is in operation. At this stage, because yarn breakage tends to occur if the rotation number of the pin is swiftly increased to the rotation number for production, the yarn threading is preferably performed in a state in which the rotation number of the pin is smaller than the rotation number for production. For example, Patent Literature 2 (Japanese Laid-Open Patent Publication No. S50-25839) recites that the rotation number of a motor which rotationally drives a pin is variable, and the rotation number of the motor is arranged to be small at the start.

SUMMARY OF THE INVENTION

[0004] As a drive motor for a pin-type twisting unit, Patent Literature 2 recites a motor in which the rotation number is switchable in stages (FIG. 1 to FIG. 5) and a motor in which the rotation number is changeable in a stepless manner (i.e., continuously) (FIG. 6). However, in the motor of Patent Literature 2 in which the rotation number is switchable in stages, plural set values are fixed and are not changeable at will. Changes in types and production conditions of a yarn cannot therefore be properly handled, and hence the motor lacks versatility. Meanwhile, when a motor in which the rotation number is changeable in stepless is employed, an operator is required to adjust the rotation number. It is difficult for an inexperienced operator to finely adjust the rotation number, with the result that yarn threading tends to be failed.

[0005] In consideration of the above, an object of the present invention is to improve versatility and to facilitate yarn threading irrespective of the proficiency of an operator, in a draw texturing machine including a pin-type twisting unit.

[0006] The present invention relates to a draw texturing machine including: a pin-type twisting unit which includes a cylindrical pin retained while being in contact with circumferential surfaces of rollers attached to two rotational shafts, respectively, and which is configured to twist a yarn running inside the pin by rotating the pin by rotationally driving one of the two rotational shafts by a motor; a setting unit which is configured to set, in regard to a rotation number of the pin, set values regarding at least a high rotation number which is a rotation number in yarn production and a low rotation number which is smaller than the high rotation number; and an operation unit which is provided to switch the rotation number of the pin between the high rotation number and the low rotation number.

[0007] In the present invention, because the setting unit is provided for setting the set values regarding the high rotation number and the low rotation number, the rotation number of the pin (motor) can be changed at will by using the setting unit. It is therefore possible to suitably handle changes in types and production conditions of a yarn. Furthermore, because the rotation number of the pin (motor) is, by the operation unit, switchable between the high rotation number and the low rotation number which are set in advance, fine adjustment of the rotation number by the operator is unnecessary. On this account, according to the present invention, the draw texturing machine has improved versatility, and makes it possible to perform yarn threading irrespective of the proficiency of the operator.

[0008] The present invention is preferably arranged such that acceleration of the pin is settable by using the setting unit.

[0009] When the acceleration of the pin of the pin-type twisting units is too high, yarn breakage tends to occur at the time of acceleration. The limit acceleration, however, varies in accordance with the type and production conditions of the yarn. Because the acceleration of the pin (motor) can be set at will, the occurrence of yarn breakage at the time of acceleration of the pin is restrained irrespective of the type and production conditions of the yarn.

[0010] The present invention is preferably arranged such that the acceleration of the pin is set at 80,000rpm/s or less.

[0011] Although depending on the type of the yarn, occurrence of yarn breakage at the time of acceleration of the pin is suitably restrained when the acceleration of the pin is about 80,000rpm/s or less.

[0012] The present invention is preferably arranged such that the low rotation number is arranged to be equal to or smaller than a half of the high rotation number.

[0013] When the low rotation number is arranged to be equal to or smaller than 1/2 of the high rotation number, the number of twists of the yarn in low-speed rotation is small and yarn shaking is restrained, with the result that yarn threading can be suitably performed.

[0014] The present invention is preferably arranged such that, the rotation number of the pin is switched in

order from a low rotation number to a high rotation number among rotation numbers corresponding to set values set by the setting unit, each time the operation unit is operated.

[0015] With this arrangement, the pin is switched, for example, from the stopped state to the low rotation number and then to the high rotation number, as the operation unit is operated in accordance with the progress of the yarn threading process. It is therefore possible to eliminate mistakes such as erroneous swift acceleration of the pin from the stopped state to the high rotation number.

[0016] The present invention is preferably arranged such that, the rotational direction of at least one of the rotational shafts rotationally driven by the motor is identical with a direction in which the pin is pressed into a gap between the rollers attached to the respective two rotational shafts.

[0017] This arrangement makes it possible to prevent the pin from moving away from the roller attached to the rotational shaft rotationally driven by the motor, with the result that the power of the motor is certainly transmitted to the pin via the roller. The rotation number of the pin is therefore finely controllable.

[0018] In the present invention, preferably, the draw texturing machine includes: a tension sensor which is provided downstream in a yarn running direction of the pin-type twisting unit and is configured to measure tension of the yarn; and a control unit configured to execute predetermined control based on the tension detected by the tension sensor.

[0019] During the yarn threading process of yarn threading to the draw texturing machine, the tension of the yarn may be rapidly changed and yarn breakage may occur. It is possible to suitably perform the yarn threading process while restraining the yarn breakage, by properly executing the predetermined control based on the tension of the yarn.

[0020] The present invention is preferably arranged such that, in connection with the tension of the yarn, predetermined first tension is set as a set value regarding the low rotation number, and the control unit stops acceleration of the motor when the tension measured by the tension sensor is decreased to the first tension while the pin is accelerating from a stopped state.

[0021] Because the tension of the yarn decreases in accordance with the acceleration of the pin of the pin-type twisting unit, the low rotation number can be set based on the tension of the yarn in place of the rotation number. In this case, the rotation number when the tension of the yarn is decreased to the first tension is used as the low rotation number. If the first tension is arranged to be sufficiently low, the occurrence of yarn breakage is restrained even if yarn threading to the feed rollers is performed in low-speed rotation and the tension is rapidly increased.

[0022] In the present invention, preferably, the draw texturing machine further includes a notification unit which is switchable to a notification state of notifying predetermined information to an operator, the control unit switching the notification unit to the notification state when the tension measured by the tension sensor is decreased to the first tension while the pin is accelerating from the stopped state.

[0023] As such, because the decrease of the tension of the yarn to the first tension is notified to the operator by the notification unit, the operator is able to swiftly perform the yarn threading process.

[0024] In the present invention, preferably, the draw texturing machine further includes a notification unit which is switchable to a notification state of notifying predetermined information to an operator, regarding the tension of the yarn, predetermined second tension being set, and the control unit switching the notification unit to the notification state when the tension measured by the tension sensor is decreased to the second tension while the pin is accelerating from the low rotation number.

[0025] To avoid yarn breakage due to increase in tension at the time of yarn threading after the start of acceleration of the rotation number of the pin of the pin-type twisting unit from the low rotation number, it is necessary to perform the yarn threading after the rotation number of the motor becomes sufficiently high and the tension of the yarn is sufficiently lowered. Conventionally, the operator judges, based on motor sound, that the rotation number of the motor becomes sufficiently high. Sound perception, however, is different from individual to individual. If the operator is notified of decrease of the tension measured by the tension sensor to predetermined second tension as described above, the operator is able to perform yarn threading to the feed rollers or the like at a suitable timing, on condition that the second tension is properly set.

[0026] The present invention is preferably arranged such that the control unit stops acceleration of the motor when the tension measured by the tension sensor is decreased to the second tension while the pin is accelerating from the low rotation number.

[0027] As such, because the rotation number of the motor is maintained at the rotation number when the tension of the yarn is decreased to the second tension, it is possible to perform yarn threading in a state in which the number of twists of the yarn is constant and stable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028]

FIG. 1 is a schematic diagram illustrating the structure of a draw texturing machine of an embodiment of the present invention.

FIG. 2 is a block diagram illustrating the electrical structure of the draw texturing machine.

FIG. 3 is a schematic diagram illustrating the structure of a pin-type twisting unit.

FIG. 4 shows the pin-type twisting unit viewed in the

direction IV in FIG. 3.
FIG. 5 is a flowchart illustrating a yarn threading process.
FIG. 6 is a graph showing transition of the rotation number of a pin of the pin-type twisting unit.
FIGs. 7(a) and 7(b) are schematic diagrams illustrating the steps of the yarn threading process.
FIGs. 8(a) and 8(b) are schematic diagrams illustrating the steps of the yarn threading process.
FIG. 9 is a graph showing transition of the rotation number of a pin of the pin-type twisting unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029] The following will describe an embodiment of the present invention with reference to figures.

(Overall Structure of Draw Texturing Machine)

[0030] FIG. 1 is a schematic diagram illustrating the structure of a draw texturing machine 1 of the embodiment of the present invention. As shown in FIG. 1, the draw texturing machine 1 includes a yarn supplying unit 2 configured to supply yarns Y, a processing part 3 configured to false-twist the yarns Y supplied from the yarn supplying unit 2, and a winding unit 4 configured to wind the yarns Y false-twisted by the processing part 3 so as to form packages P.

[0031] The yarn supplying unit 2 includes a creel stand 10 retaining yarn supply packages Q, and supplies the yarns Y to the processing part 3. In the processing part 3, the following members are provided in this order from the upstream in the yarn running direction along a yarn path: first feed rollers 11; a twist-stopping guide 12; a first heater 13; a cooler 14; a pin-type twisting unit 15; second feed rollers 16; an interlacing device 17; third feed rollers 18; a second heater 19; and fourth feed rollers 20. The winding unit 4 winds, by winding devices 21, the yarns Y false-twisted by the processing part 3, so as to form packages P.

[0032] The draw texturing machine 1 includes a main base 5 and a winding base 6 which are provided to oppose each other and to be spaced apart from each other in the left-right direction in FIG. 1 (hereinafter, the base width direction). The main base 5 and the winding base 6 extend in the direction orthogonal to the plane of FIG. 1 (hereinafter, the frame longitudinal direction). An upper part of the main base 5 is connected to an upper part of the winding base 6 by a supporting frame 7. The apparatuses constituting the processing part 3 are mainly attached to the main base 5 and the supporting frame 7. The main base 5, the winding base 6, and the supporting frame 7 form a working space 8. To put it differently, the main base 5, the winding base 6, and the supporting frame 7 are provided to surround the working space 8, and the yarns Y are arranged to run mainly around the working space 8. An operator performs operations such as yarn threading in the working space 8.

[0033] The draw texturing machine 1 includes units which are termed spans and each of which includes a pair of the main base 5 and the winding base 6 opposing each other. In one span, processing units (which are also termed spindles) in which yarn paths are formed to pass the devices constituting the processing part 3 are lined up in the base longitudinal direction. With this arrangement, in one span, yarns Y running while being lined up in the base longitudinal direction can be simultaneously false-twisted. In the draw texturing machine 1, the spans are provided in a left - right symmetrical manner in the base width direction, with the main base 5 being at the center. (The main base 5 is shared between the left spans and the right spans.) Furthermore, plural spans are provided in the base longitudinal direction. In FIG. 1, the left spans are not shown.

(Processing Part)

[0034] The first feed rollers 11 are rollers for supplying the yarn Y from the yarn supplying unit 2 to the first heater 13. The first feed rollers 11 are provided at an upper part of the winding base 6. The first feed rollers 11 include a drive roller and a driven roller. As the drive roller is rotationally driven while the yarn Y is sandwiched between the drive roller and the driven roller, the yarn Y is fed to the downstream side in the yarn running direction. In one span, the drive rollers are connected to a shared drive shaft. Each driven roller is switchable between a state in which the driven roller is in contact with the corresponding drive roller (i.e., a state of sandwiching and feeding the yarn Y) and a state in which the driven roller is separated from the drive roller (i.e., a state in which yarn threading is possible), by a lever operation by the operator, for example. The second feed rollers 16, the third feed rollers 18, and the fourth feed rollers 20 are similarly arranged.

[0035] The twist-stopping guide 12 is provided to prevent twist of the yarn Y formed by the pin-type twisting unit 15 from being propagated to the upstream in the yarn running direction of the twist-stopping guide 12. The twist-stopping guide 12 is provided between the first feed roller 11 and the first heater 13 with respect to the yarn running direction. The twist-stopping guide 12 is arranged to be movable between a yarn threading position (dotted line in FIG. 1) at a lower end portion of a guide rail 22 and an operation position (full line in FIG. 1) at an upper end portion of the guide rail 22, along the guide rail 22 extending in the up-down direction. To be more specific, the twist-stopping guide 12 is attached to an unillustrated member termed shifter, and as the shifter is moved along the guide rail 22 by an unillustrated cylinder, the twist-stopping guide 12 is moved. For details, see Japanese Unexamined Patent Publication No. 2016-27218, for example.

[0036] The first heater 13 is configured to heat the yarn Y twisted by the pin-type twisting unit 15. The first heater 13 is attached to an upper end portion of the supporting frame 7.

[0037] The cooler 14 is configured to cool the yarn Y heated by the first heater 13. The cooler 14 is provided between the first heater 13 and the pin-type twisting unit 15 in the yarn running direction.

[0038] The pin-type twisting unit 15 is configured to twist the yarn Y. The pin-type twisting unit 15 is provided at an upper part of the main base 5. The pin-type twisting unit 15 will be detailed later.

[0039] The second feed rollers 16 are rollers for sending the yarn Y twisted by the pin-type twisting unit 15 toward the interlacing device 17. The second feed rollers 16 are provided below the pin-type twisting unit 15 in the main base 5. The conveyance speed of conveying the yarn Y by the second feed rollers 16 is higher than the conveyance speed of conveying the yarn Y by the first feed rollers 11. The yarn Y is therefore drawn between the first feed rollers 11 and the second feed rollers 16.

[0040] The interlacing device 17 is configured to interlace the yarn Y by injecting air thereto. The interlacing device 17 is provided below the second feed rollers 16 in the main base 5.

[0041] The third feed rollers 18 are rollers for sending the yarn Y interlaced by the interlacing device 17 toward the second heater 19. The third feed rollers 18 are provided below the interlacing device 17 in the main base 5. The conveyance speed of conveying the yarn Y by the third feed rollers 18 is lower than the conveyance speed of conveying the yarn Y by the second feed rollers 16. The yarn Y is therefore relaxed between the third feed rollers 18 and the second feed rollers 16.

[0042] The second heater 19 is configured to heat the yarn Y supplied from the third feed rollers 18. The second heater 19 is provided below the third feed rollers 18 in the main base 5.

[0043] The fourth feed rollers 20 are provided to feed the yarn Y thermally treated by the second heater 19 toward the winding device 21. The fourth feed rollers 20 are provided at a lower part of the winding base 6. The conveyance speed of conveying the yarn Y by the fourth feed rollers 20 is lower than the conveyance speed of conveying the yarn Y by the third feed rollers 18. The yarn Y is therefore relaxed between the third feed rollers 18 and the fourth feed rollers 20.

[0044] In the processing part 3 arranged as described above, the yarn Y drawn between the first feed rollers 11 and the second feed rollers 16 is twisted by the pin-type twisting unit 15. The twist formed by the pin-type twisting unit 15 is propagated to the twist-stopping guide 12 but is not propagated to the upstream in the yarn running direction of the twist-stopping guide 12. The yarn Y drawn and twisted in this way is heated by the first heater 13 and are then cooled by the cooler 14 and thermally set. The yarn Y having passed the pin-type twisting unit 15 is unwound before the yarn Y reaches the second feed rollers 16. The twist of each yarn Y, however, is thermally fixed as described above. Each of the filaments therefore maintains a wavy false-twisted state. Thereafter, interlacing is performed by the interlacing device 17, and the yarn Y thermally set by the second heater 19 is wound by the winding device 21.

[0045] The draw texturing machine 1 of the present embodiment further includes a cutter 23, a tension sensor 24, a suction unit 25, and a yarn breakage sensor 26 which are provided on the yarn path. The cutter 23 is provided upstream in the yarn running direction of the first feed rollers 11 and cuts the yarn Y. The tension sensor 24 is provided downstream in the yarn running direction of the pin-type twisting unit 15 and is configured to measure the tension of the twisted yarn Y. The suction unit 25 is provided below the third feed rollers 18 in the main base 5, and is used for temporarily sucking and retaining the yarn Y during a yarn threading process. The yarn breakage sensor 26 is provided downstream in the yarn running direction of the fourth feed rollers 20 and is configured to detect yarn breakage by detecting the existence of the yarn Y. The positions of these devices are not limited to these described positions.

[0046] A notification unit 27 is provided at an upper part of the main base 5. The notification unit 27 of the present embodiment is constituted by a lamp. As the state of the lamp is switched to a turn-on state or a flickering state (notification state) in a predetermined case, the operator is notified of predetermined information. The arrangement of the notification unit 27 is not limited to this. The operator may be notified of predetermined information by audio from a speaker or a text displayed on a screen, for example.

(Electric Architecture)

[0047] FIG. 2 is a block diagram illustrating an electric structure of the draw texturing machine 1. As shown in FIG. 2, the draw texturing machine 1 includes a control unit 30 which controls operations of devices of processing units. FIG. 2 shows the devices of only a processing unit A, and processing unit B and other processing units are not detailed.

[0048] Output signals from the tension sensor 24 and the yarn breakage sensor 26 are sent to the control unit 30. In accordance with the output signals from the tension sensor 24 and the yarn breakage sensor 26, the control unit 30 controls operations of the cutter 23, the notification unit 27, and a later-described motor 54 of the pin-type twisting unit 15. The motor 54 is controllable by the control unit 30 and is switchable by the operator by means of an operation unit 32. A setting unit 31 by which the operator inputs setting values to the control unit 30 is connected to the control unit 30. The setting unit 31 may be formed of, for example, a touch panel, or may be formed of a keyboard, etc.

(Pin-Type Twisting Unit)

[0049] FIG. 3 is a schematic diagram of the pin-type twisting unit 15. FIG. 4 shows the pin-type twisting unit 15 in the direction IV in FIG. 3. The pin-type twisting unit

15 is configured to twist the yarn Y running in a pin 41 as the cylindrical pin 41 rotates about the axis. In FIG. 3, the yarn Y runs upward from below. FIG. 4 does not show a guide member 52.

[0050] The pin-type twisting unit 15 includes two rotational shafts 43 and 44 which are rotatably supported by a supporter 42 via unillustrated bearings. Two rollers 45 and 46 separated from each other in the axial direction are attached to the rotational shaft 43. Two rollers 47 and 48 separated from each other in the axial direction are attached to the rotational shaft 44. The roller 45 and the roller 47 are at the same position in the axial direction, and are slightly separated from each other so as not to be in contact with each other, as shown in FIG. 4. The positional relationship between the roller 46 and the roller 48 is identical with the positional relationship between the roller 45 and the roller 47. The rotational shaft 43 is rotationally driven about the axis by power transmitted from the motor 54.

[0051] The pin 41 is a cylindrical member extending in the axial direction. The yarn Y runs in the pin 41. At an intermediate portion in the axial direction of the pin 41, a magnetic portion 41a is formed to oppose later-described magnets 49 and 50. At one end portion (downstream end portion in the yarn running direction) in the axial direction of the pin 41, a wound portion 41b is internally fixed to extend in the radial direction. The yarn Y is wound once on the wound portion 41b. As the pin 41 rotates about the axis, the yarn Y is twisted.

[0052] The magnet 49 is provided between the roller 45 and the roller 46 in the axial direction. Similarly, the magnet 50 is provided between the roller 47 and the roller 48 in the axial direction. The magnets 49 and 50 are fixed to the supporter 42 via a bracket 51 (see FIG. 4). As the pin 41 is inserted into the gap between the rollers 45 and 47 (46 and 48) so that the magnetic portion 41a of the pin 41 opposes the magnets 49 and 50, the pin 41 is retained by the magnets 49 and 50 as shown in FIG. 4. To be more specific, the pin 41 is retained by the magnets 49 and 50 while the pin 41 is sandwiched between the rollers 45 and 47 (46 and 48) and is in contact with the circumferential surfaces of the rollers 45 and 47 (46 and 48). The pin 41 is not mechanically fixed to another member, and is retained only by the magnet forces of the magnets 49 and 50 and the friction force with the circumferential surfaces of the rollers 45 to 48.

[0053] A ring-shaped guide member 52 is provided upstream of the pin 41 in the yarn running direction. The guide member 52 is fixed to the supporter 42 via an unillustrated bracket. A pipe-shaped guide member 53 is provided downstream in the yarn running direction of the pin 41. The guide member 53 is directly fixed to the supporter 42. The shape and way of fixation of each of the guide members 52 and 53 are not limited to those described above, and may be suitably changed.

[0054] As shown in FIG. 4, when the roller 45 is rotated by rotationally driving the rotation shaft 43, the pin 41 in contact with the circumferential surface of the roller 45 is rotationally driven in the direction opposite to the roller 45. Furthermore, the roller 47 in contact with the circumferential surface of the pin 41 is rotationally driven in the same direction as the roller 45. As the pin 41 is rotationally driven about the axis, the yarn Y is twisted. In this connection, as indicated by arrows in FIG. 4, the rotational direction of the rotation shaft 43 rotationally driven by the power transmitted from the motor 54 is preferably identical with a direction in which the pin 41 is pressed into the gap between the rollers 45 and 47 (46 and 48) attached to the respective rotation shafts 43 and 44. This prevents the pin 41 from moving away from the roller 45 (46), and the power of the motor 54 is certainly transmitted to the pin 41 via the roller 45 (46) .

[0055] The twist of the yarn Y is either S twist or Z twist. These two ways are opposite to each other in terms of the direction of twist. When the direction of twist is switched, the target of the power of the motor 54 is switched from the rotational shaft 43 to the rotational shaft 44. For example, when the power of the motor 54 is transmitted by a belt, the belt wound on the rotational shaft 43 is detached and wound on the rotational shaft 44. Alternatively, despite the roller 45 (46) becomes relatively easily moved away from the pin 41, the motor 54 may be arranged to rotate positively and negatively, and the rotational direction of the pin 41 may be changed to switch the direction of twist of the yarn Y, by switching the rotational direction of the rotational shafts 43 and 44.

(Setting of Rotation Number)

[0056] As detailed later, when yarn threading to the draw texturing machine 1 is carried out, to begin with, yarn threading to the pin-type twisting unit 15 is performed, and then yarn threading to other members such as the feed rollers is performed after the yarn Y is twisted by rotating the pin 41. At this stage, if the rotation number of the pin 41 (motor 54) is swiftly increased to a high rotation number for production after the yarn threading to the pin-type twisting unit 15, yarn breakage tends to occur. For this reason, before the rotation number of the pin 41 (motor 54) is increased to the high rotation number, the rotation number of the pin 41 is temporarily maintained at a low rotation number which is lower than the high rotation number.

[0057] Set values (related to the low rotation number, the high rotation number, and the acceleration of the pin 41) can be set at will by the operator by using the setting unit 31 (see FIG. 2). In the present embodiment, as an example, the pin 41 is arranged so that the low rotation number is 160,000rpm, the high rotation number is 800,000rpm, and the acceleration is 10,000 to 15,000rpm/s. These set values are suitably changeable by using the setting unit 31. Each set value set by the setting unit 31 is input to the control unit 30 and is input to the controller of the motor 54, too. The control unit 30 controls the motor 54 with reference to the set values input by the setting unit 31.

[0058] The operation unit 32 (see FIG. 1 and FIG. 2) is provided in the vicinity of the pin-type twisting unit 15 in the main base 5. In accordance with the pin-type twisting units 15 lined up in the base longitudinal direction, the operation units 32 are lined up in the base longitudinal direction. The operation unit 32 of the present embodiment is constituted by a singe button. The operation unit 32 may not be the button, and may be constituted by a lever or a dial, for example. As the operation unit 32 is operated once (i.e., the button is pressed once) when the pin 41 (motor 54) is in a stopped state, the pin 41 (motor 54) accelerates until reaching the low rotation number. As the operation unit 32 is operated once more (i.e., the button is pressed once more), the pin 41 (motor 54) accelerates until reaching the high rotation number. As the operation unit 32 is operated once more (i.e., the button is pressed once more), the pin 41 (motor 54) returns to the stopped state.

(Yarn Threading Process)

[0059] The following describes the yarn threading process of yarn threading to the draw texturing machine 1. FIG. 5 is a flowchart showing the steps of the yarn threading process. FIG. 6 is a graph showing the transition of the rotation number of the pin 41 of the pin-type twisting units 15. FIGs. 7(a) and 7(b) and FIGs. 8(a) and 8(b) are schematic diagrams of the steps of the yarn threading process. FIG. 6 shows an example of timings to execute the steps shown in FIG. 5, and indicates by a dotted line the transition of the tension of the yarn Y.

[0060] To begin with, the operator threads the yarn Y pulled out from a yarn supply package Q to the pin-type twisting unit 15, and causes the suction unit 25 to suck the yarn Y (step S1, see FIG. 7(a)). At this stage, the yarn Y runs below the cutter 23 and the first feed rollers 11, and reach the suction unit 25 via the pin-type twisting unit 15 and the tension sensor 24. In the yarn threading to the pin-type twisting unit 15, the operator causes the yarn Y to pass through the guide member 52, the pin 41, and the guide member 53 (see FIG. 3) in this order and then positions the pin 41 so that the pin 41 is retained by the magnets 49 and 50 and the rollers 45 to 48.

[0061] Subsequently, the operator operates the operation unit 32 to accelerate the pin 41 from the stopped state until to the low rotation number (step S2). While the pin 41 is accelerating to reach the low rotation number or rotates at the low rotation number, the operator performs yarn threading to the second feed rollers 16 (step S3, see FIG. 7(b)). The drive roller of the second feed rollers 16 is rotationally driven in advance. As the yarn threading is performed so that the yarn Y is sandwiched between the drive roller and the driven roller, the yarn Y is fed to the downstream side in the yarn running direction. (This applies to the yarn threading to the first feed rollers 11 described later.) In other words, after the completion of the step S3, the running yarn Y has been twisted by the pin 41 rotating at the low speed.

[0062] Subsequently, the operator threads the yarn Y to the twist-stopping guide 12 at the yarn threading position, and moves the twist-stopping guide 12 to the operation position by lifting the unillustrated shifter along the guide rail 22 (step S4, see FIG. 8(a)). With this, the yarn Y is threaded to the first feed rollers 11 in the state in which the drive roller is separated from the driven roller, and is caused to pass through the cutter 23. While the twist-stopping guide 12 is being lifted to the operation position, the yarn Y is moved to the yarn path passing the first heater 13 and the cooler 14. The steps S2 to S4 may not be executed in this order. The order of execution of S2 to S4 may be changed, or plural steps may be simultaneously executed.

[0063] When the steps S2 to S4 are completed, if the yarn Y runs stably without the occurrence of yarn breakage, etc., the operator operates the operation unit 32 to accelerate the pin 41 from the low rotation number to the high rotation number (step S5). Subsequently, the operator performs yarn threading to the first feed rollers 11 (step S6, see FIG. 8(b)). To be more specific, the yarn Y is gripped by being sandwiched between the drive roller and the driven roller of the first feed rollers 11, to be in a state of being fed.

[0064] Because the tension of the yarn Y rapidly increases in yarn threading to the first feed rollers 11 (see the transition of the tension shown in FIG. 6), yarn breakage may occur during the yarn threading if the tension is high before the yarn threading. The operator therefore performs the yarn threading to the first feed rollers 11 when it is considered that the rotation number of the pin 41 has been sufficiently increased, the number of twists of the yarn Y has been increased, and the tension of the yarn Y has been lowered. To be more specific, the operator is able to know whether the rotation number of the pin 41 (motor 54) has been sufficiently increased, based on motor sound, for example. The yarn threading to the first feed rollers 11 may be performed when the pin 41 is accelerating to reach the high rotation number or when the pin 41 has reached the high rotation number.

[0065] If there is no particular problem in running of the yarn Y, etc. after the end of the step S6, yarn threading to the third feed rollers 18, the second heater 19, the fourth feed rollers 20, and the winding devices 21 is performed lastly (step S7). In this way, the yarn Y false-twisted by the processing part 3 is wound by the winding unit 4, and a package P is produced.

(Effects)

[0066] The draw texturing machine 1 of the present embodiment includes: the setting unit 31 which is configured to set a set value regarding the high rotation number for yarn production and a set value regarding the low rotation number lower than the high rotation number, in regard to the rotation number of the pin 41 of the pin-type twisting units 15; and the operation unit 32 provided for switching the rotation number of the pin 41 between

the high rotation number and the low rotation number. With this arrangement, because the setting unit 31 is provided for setting the set values regarding the high rotation number and the low rotation number, the rotation number of the pin 41 (motor 54) can be changed at will by using the setting unit 31. It is therefore possible to suitably handle changes in types and production conditions of yarn Y. Furthermore, because the rotation number of the pin 41 (motor 54) is, by the operation unit 32, switchable between the high rotation number and the low rotation number which are set in advance, fine adjustment of the rotation number by the operator is unnecessary. On this account, the draw texturing machine 1 of the present embodiment has improved versatility, and makes it possible to perform yarn threading irrespective of the proficiency of the operator.

[0067] In the present embodiment, the acceleration of the pin 41 can be set by means of the setting unit 31. When the acceleration of the pin 41 of the pin-type twisting units 15 is too high, yarn breakage tends to occur at the time of acceleration. The limit acceleration, however, varies in accordance with the type and production conditions of the yarn Y. Because the acceleration of the pin 41 (motor 54) can be set at will, the occurrence of yarn breakage at the time of acceleration of the pin 41 is restrained irrespective of the type and production conditions of the yarn Y.

[0068] In the present embodiment, the acceleration of the pin 41 is arranged to be 80,000rpm/s or less (to be more specific, about 10,000 to 15,000rpm/s). Although depending on the type of the yarn Y, occurrence of yarn breakage at the time of acceleration of the pin 41 is suitably restrained when the acceleration of the pin 41 is about 80,000rpm/s or less.

[0069] In the present embodiment, the low rotation number of the motor 54 is arranged to be equal to or smaller than 1/2 of the high rotation number. When the low rotation number is arranged to be equal to or smaller than 1/2 of the high rotation number, the number of twists of the yarn Y in low-speed rotation is small and yarn shaking is restrained, with the result that yarn threading can be suitably performed.

[0070] In the present embodiment, the rotation number of the pin 41 is switched in order from a low rotation number to a high rotation number among the rotation numbers corresponding to the set values set by the setting unit 31, each time the operation unit 32 is operated. With this arrangement, the pin 41 is switched, for example, from the stopped state to the low rotation number and then to the high rotation number, as the operation unit 32 is operated in accordance with the progress of the yarn threading process. It is therefore possible to eliminate mistakes such as erroneous swift acceleration of the pin 41 from the stopped state to the high rotation number.

[0071] In the present embodiment, the rotational direction of the rotation shaft 43 rotationally driven by the motor 54 is identical with the direction in which the pin 41 is pressed into the gap between the rollers 45 and 47 (46 and 48) attached to the respective rotation shafts 43 and 44. This arrangement makes it possible to prevent the rollers 45 and 46 attached to the rotational shaft 43 rotationally driven by the motor 54 from moving away from the pin 41, with the result that the power of the motor 54 is certainly transmitted to the pin 41 via the rollers 45 and 46. The rotation number of the pin 41 is therefore finely controllable.

[0072] In the present embodiment, the tension sensor 24 configured to measure the tension of the yarn Y is provided downstream in the yarn running direction of the pin-type twisting unit 15, and the control unit 30 is provided to perform predetermined control based on the tension detected by the tension sensor 24. During the yarn threading process of yarn threading to the draw texturing machine 1, the tension of the yarn Y may be rapidly changed and yarn breakage may occur. It is possible to suitably perform the yarn threading process while restraining the yarn breakage, by properly executing the predetermined control based on the tension of the yarn Y. As specific examples, the following will describe modifications.

(Other Embodiments)

[0073] The following will describe modifications of the above-described embodiment.

(1) In the embodiment above, as each of the set values regarding the low rotation number and the high rotation number of the pin 41 of the pin-type twisting units 15, the rotation number is directly set. Alternatively, the low rotation number and the high rotation number may be indirectly set by set values which are not rotation numbers. For example, as a set value regarding the low rotation number, predetermined first tension may be set for the tension of the yarn Y. This modification will be detailed with reference to FIG. 9. FIG. 9 is a graph showing the transition of the rotation number of the pin 41 of the pin-type twisting units 15. The transition from the stopped state to the low rotation number is shown, and a part of the transition of the tension of the yarn Y is indicated by a dotted line.

[0074] When the operator operates the operation unit 32 while the pin 41 is in the stopped state, the tension of the yarn Y decreases in accordance with the increase of the rotation number of the pin 41, as shown in FIG. 9. When the first tension is set as the set value regarding the low rotation number as described above, if the tension of the yarn Y measured by the tension sensor 24 is decreased to the first tension while the pin 41 is accelerating from the stopped state, the control unit 30 stops the acceleration of the pin 41 (motor 54) to maintain the rotation number of the pin 41 to be constant. The rotation number of the pin 41 in this case is the low rotation number in the

present invention. In this regard, if the first tension is arranged to be sufficiently low, the occurrence of yarn breakage is restrained even if yarn threading to the second feed rollers 16 is performed in low-speed rotation and the tension is rapidly increased (see FIG. 9).

[0075] If the first tension is set as the set value regarding the low rotation number, the control unit 30 preferably switches the notification unit 27 to a notification state when the tension of the yarn Y measured by the tension sensor 24 is decreased to the first tension while the pin 41 is accelerating from the stopped state. As such, because the decrease of the tension of the yarn Y to the first tension is notified to the operator by the notification unit 27, the operator is able to swiftly perform the yarn threading process.

[0076] (2) In the embodiment above, the timing to perform yarn threading to the first feed rollers 11 in the step S6 is judged by the operator based on motor sound. Sound perception, however, is different from individual to individual. On this account, predetermined second tension may be set in regard to the tension of the yarn Y, and the control unit 30 may switch the notification unit 27 to the notification state when the tension measured by the tension sensor 24 is decreased to the second tension while the pin 41 is accelerating from the low rotation number. With this, the operator is able to perform yarn threading to the first feed rollers 11 at a suitable timing, on condition that the second tension is properly set.

[0077] When the second tension is set as the tension of the yarn Y suitable for performing yarn threading to the first feed rollers 11 as described above, the control unit 30 may stop the acceleration of the pin 41 (motor 54) if the tension measured by the tension sensor 24 is decreased to the second tension while the pin 41 is accelerating from the low rotation number. As such, because the rotation number of the pin 41 is maintained at the rotation number when the tension of the yarn Y is decreased to the second tension, it is possible to perform yarn threading to the first feed rollers 11 in a state in which the number of twists of the yarn Y is constant and stable.

(3) In the embodiment above, the notification unit 27 and the operation unit 32 are different units. Alternatively, the operation unit 32 may additionally function as the notification unit 27. For example, when the operation unit 32 is constituted by a button as in the embodiment above, the function as the notification unit may be fulfilled such that the button turns on or flickers.

(4) The control unit 30 may switch the notification unit 27 to the notification state when the pin 41 reaches the high rotation number. To be more specific, the notification unit 27 may be switched to the notification state when the rotation number of the motor 54 reaches the rotation number corresponding to the high rotation number of the pin 41. This increases the success rate of yarn threading to the third feed rollers 18, the fourth feed rollers 20, and the winding devices 21.

(5) In the pin-type twisting units 15 of the embodiment above, only one rotational shaft 43 among the two rotational shafts 43 and 44 is rotationally driven by the motor 54. Alternatively, both of the two rotational shafts 43 and 44 may be rotationally driven. With this arrangement, switching between S twist and Z twist can be easily done without requiring, for example, belt replacement, etc.

(6) The devices constituting the draw texturing machine 1 of the embodiment above may be variously modified. For example, while in the embodiment above the twist-stopping guide 12 is movable by the shifter, the twist-stopping guide 12 may be fixed (see Japanese Laid-Open Patent Publication No. 2011-47074), or the shifter may be manually moved. Furthermore, the cooler 14 and/or the second heater 19 may be omitted.

Claims

1. A draw texturing machine (1) comprising:

a pin-type twisting unit (15) which includes a cylindrical pin (41) retained while being in contact with circumferential surfaces of rollers (45 to 48) attached to two rotational shafts (43, 44), respectively, and which is configured to twist a yarn (Y) running inside the pin (41) by rotating the pin (41) by rotationally driving one of the two rotational shafts (43, 44) by a motor (54);

a setting unit (31) which is configured to set, in regard to a rotation number of the pin (41), set values regarding at least a high rotation number which is a rotation number in yarn production and a low rotation number which is smaller than the high rotation number; and

an operation unit (32) which is provided to switch the rotation number of the pin (41) between the high rotation number and the low rotation number.

2. The draw texturing machine (1) according to claim 1, wherein, acceleration of the pin (41) is settable by using the setting unit (31).

3. The draw texturing machine (1) according to claim 2, wherein, the acceleration of the pin (41) is set at 80,000rpm/s or less.

4. The draw texturing machine (1) according to any one of claims 1 to 3, wherein, the low rotation number is arranged to be equal to or smaller than a half of the high rotation number.

5. The draw texturing machine (1) according to any one

of claims 1 to 4, wherein, the rotation number of the pin (41) is switched in order from a low rotation number to a high rotation number among rotation numbers corresponding to set values set by the setting unit (31), each time the operation unit (32) is operated.

6. The draw texturing machine (1) according to any one of claims 1 to 5, wherein, the rotational direction of at least one of the rotational shafts (43) rotationally driven by the motor (54) is identical with a direction in which the pin (41) is pressed into a gap between the rollers (45 to 48) attached to the respective two rotational shafts (43, 44).

7. The draw texturing machine (1) according to any one of claims 1 to 6, further comprising:

a tension sensor (24) which is provided downstream in a yarn running direction of the pin-type twisting unit (15) and is configured to measure tension of the yarn (Y); and
a control unit (30) configured to execute predetermined control based on the tension detected by the tension sensor (24).

8. The draw texturing machine (1) according to claim 7, wherein,
in connection with the tension of the yarn (Y), predetermined first tension is set as a set value regarding the low rotation number, and
the control unit (30) stops acceleration of the motor (54) when the tension measured by the tension sensor (24) is decreased to the first tension while the pin (41) is accelerating from a stopped state.

9. The draw texturing machine (1) according to claim 8, further comprising
a notification unit (27) which is switchable to a notification state of notifying predetermined information to an operator,
the control unit (30) switching the notification unit (27) to the notification state when the tension measured by the tension sensor (24) is decreased to the first tension while the pin (41) is accelerating from the stopped state.

10. The draw texturing machine (1) according to any one of claims 7 to 9, further comprising
a notification unit (27) which is switchable to a notification state of notifying predetermined information to an operator,
regarding the tension of the yarn (Y), predetermined second tension being set, and
the control unit (30) switching the notification unit (27) to the notification state when the tension measured by the tension sensor (24) is decreased to the second tension while the pin (41) is accelerating from the low rotation number.

11. The draw texturing machine (1) according to claim 10, wherein, the control unit (30) stops acceleration of the motor (54) when the tension measured by the tension sensor (24) is decreased to the second tension while the pin (41) is accelerating from the low rotation number.

FIG.1

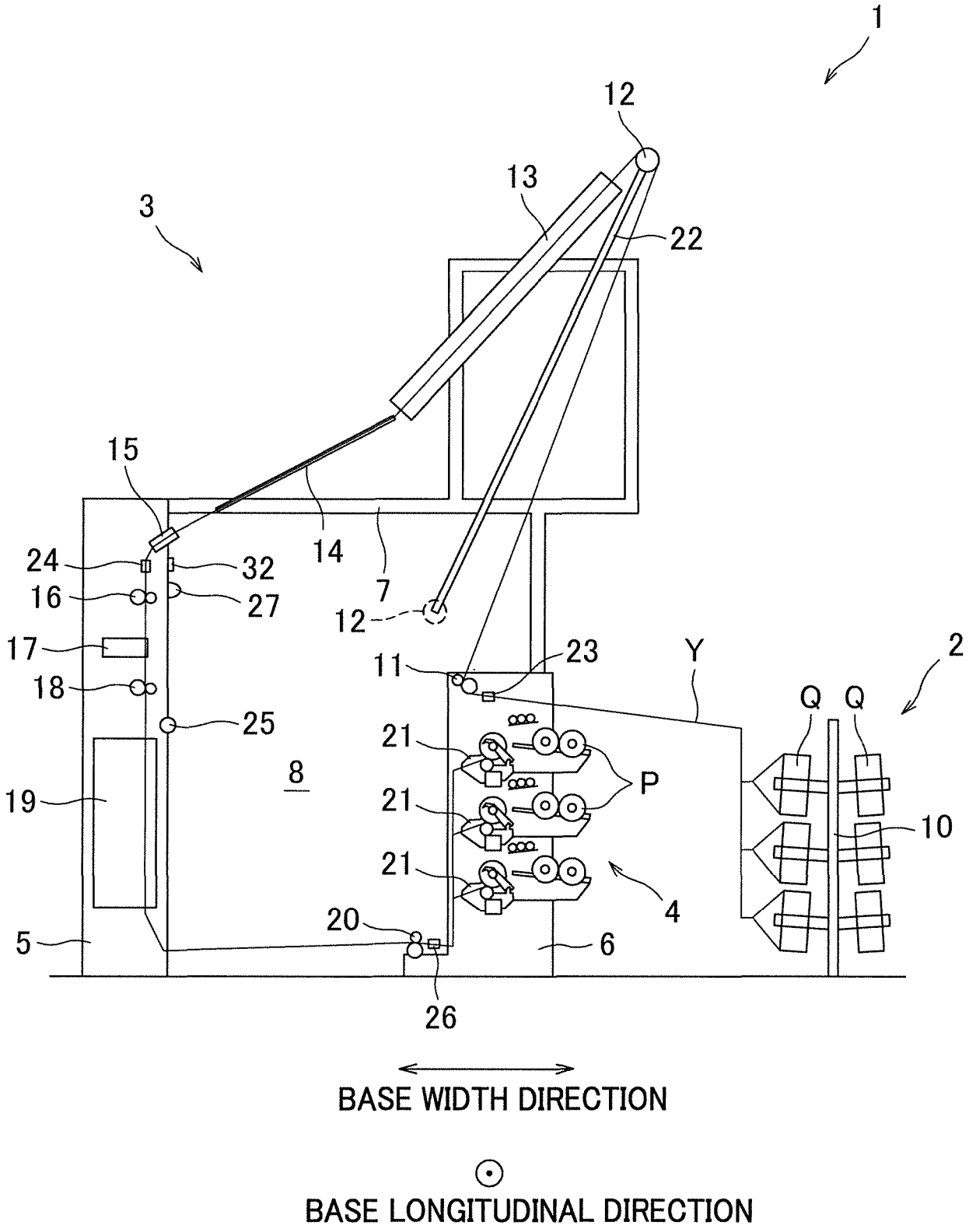

1
12
13
3
22
15
14
7
24
32
16
27
12
17
11
23
Y
2
18
Q
Q
25
21
8
P
19
21
10
21
4
20
5
6
26
BASE WIDTH DIRECTION
BASE LONGITUDINAL DIRECTION

FIG.2

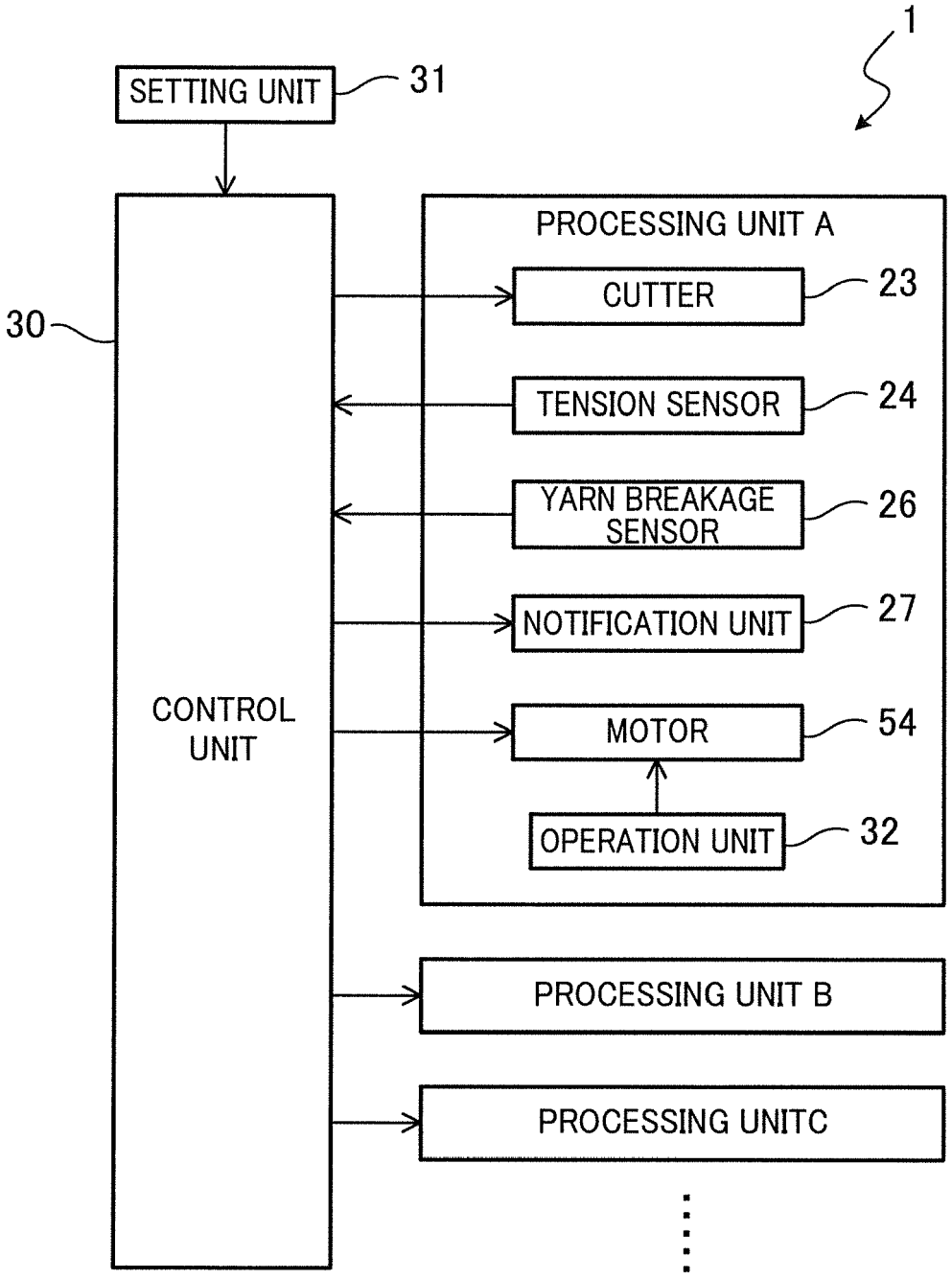

1
SETTING UNIT
31
30
CONTROL UNIT
PROCESSING UNIT A
CUTTER
23
TENSION SENSOR
24
YARN BREAKAGE SENSOR
26
NOTIFICATION UNIT
27
MOTOR
54
OPERATION UNIT
32
PROCESSING UNIT B
PROCESSING UNITC

FIG.3

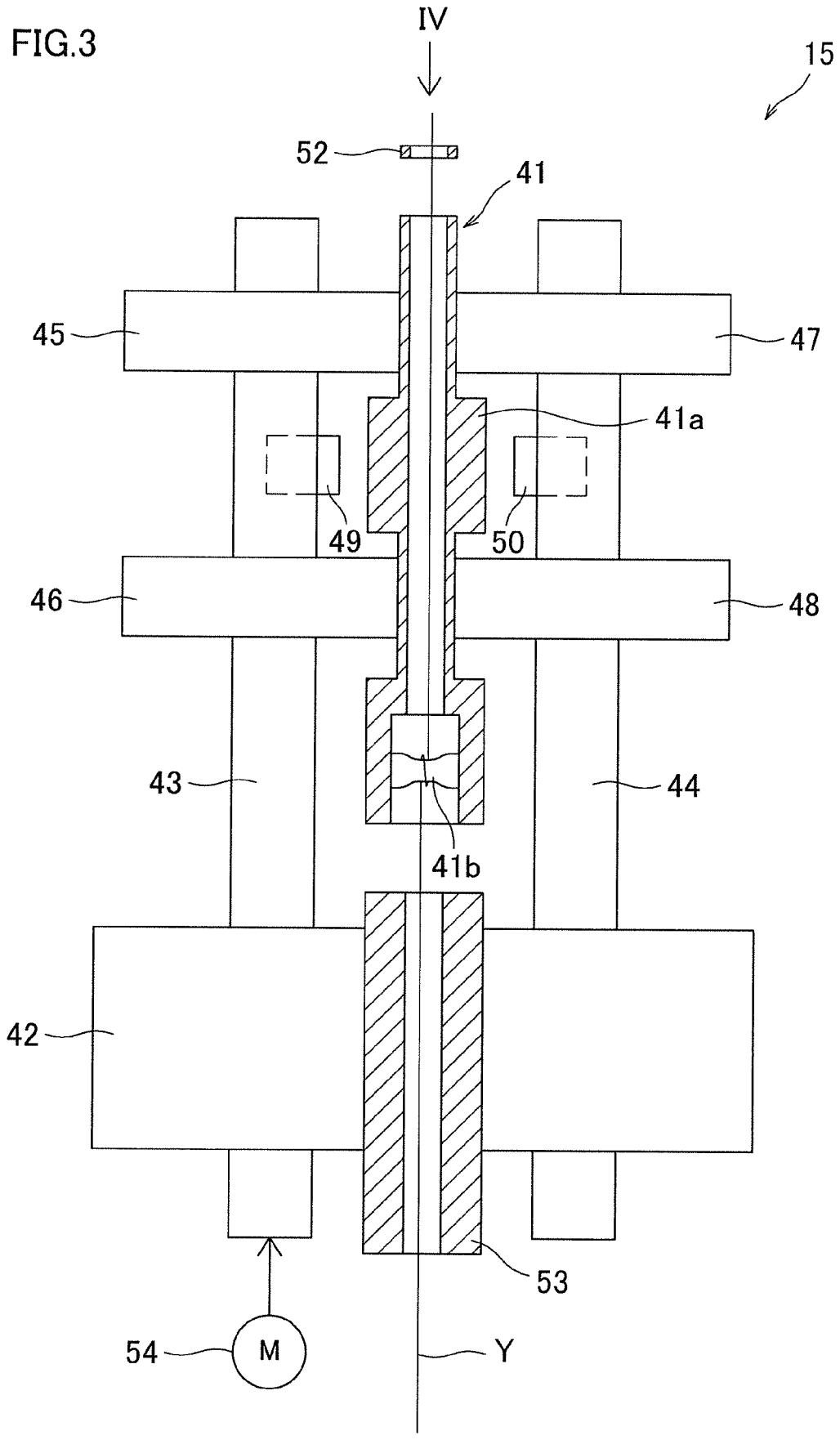


FIG.4

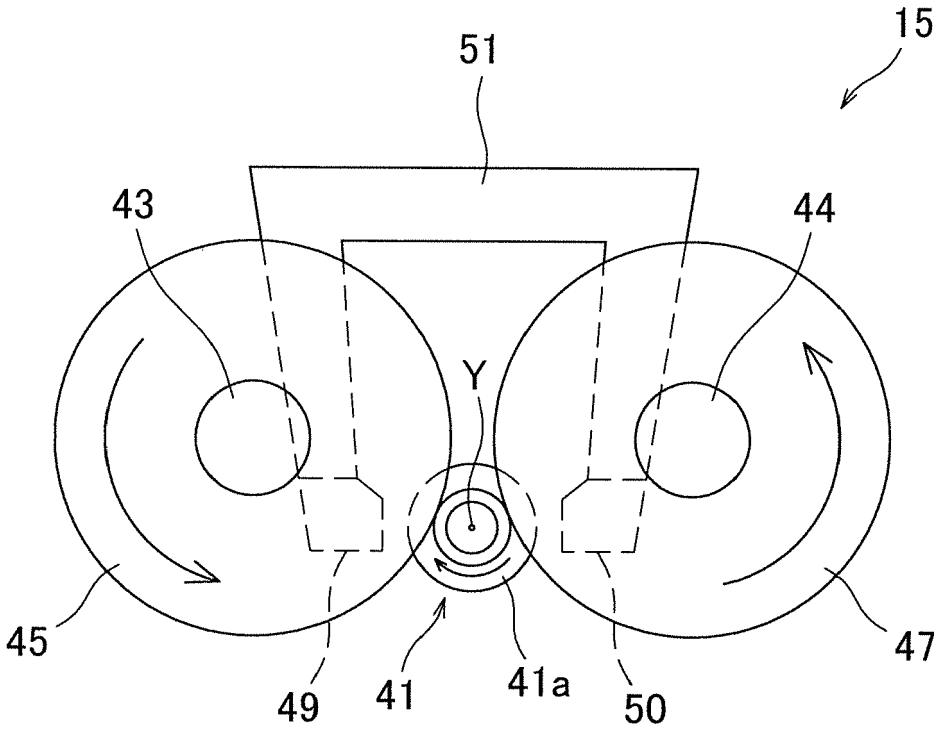


FIG.5

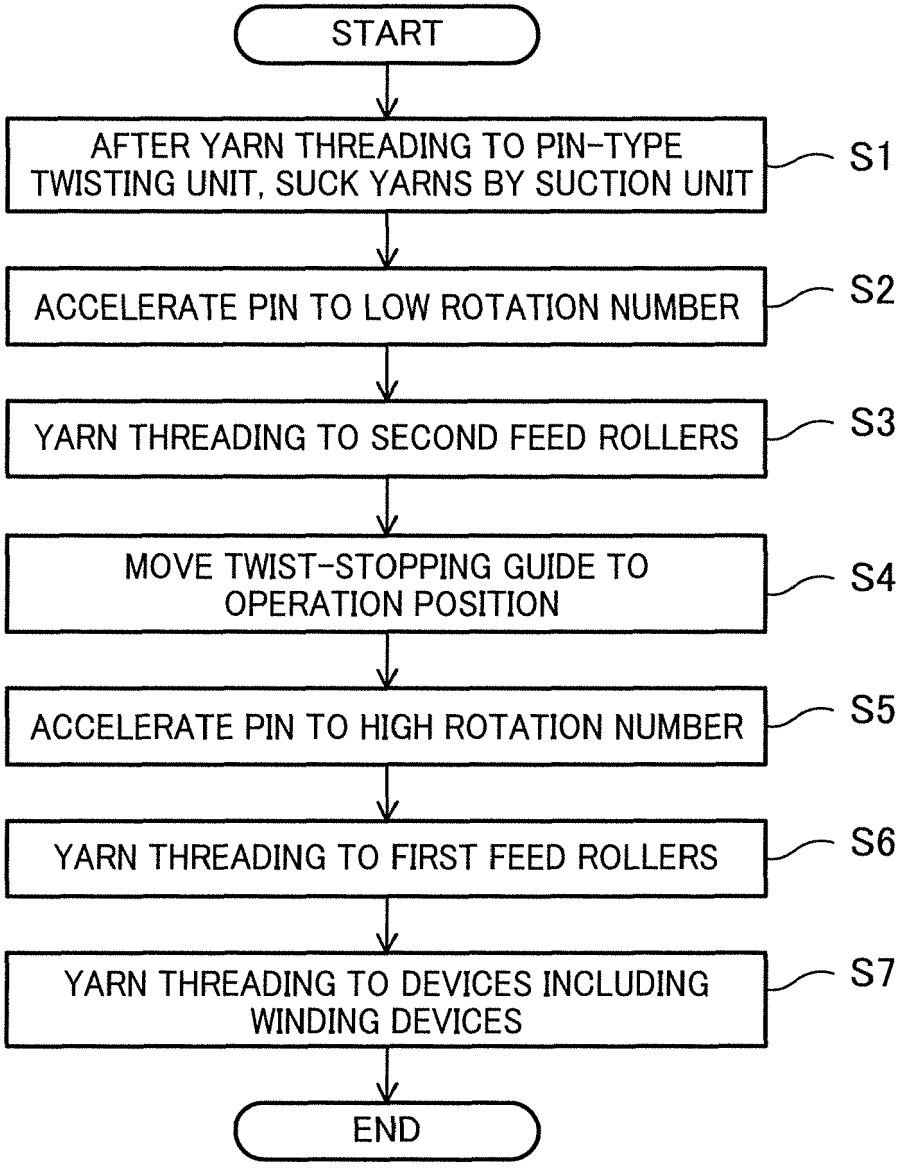

START
AFTER YARN THREADING TO PIN-TYPE TWISTING UNIT, SUCK YARNS BY SUCTION UNIT
S1
ACCELERATE PIN TO LOW ROTATION NUMBER
S2
YARN THREADING TO SECOND FEED ROLLERS
S3
MOVE TWIST-STOPPING GUIDE TO OPERATION POSITION
S4
ACCELERATE PIN TO HIGH ROTATION NUMBER
S5
YARN THREADING TO FIRST FEED ROLLERS
S6
YARN THREADING TO DEVICES INCLUDING WINDING DEVICES
S7
END

FIG.6

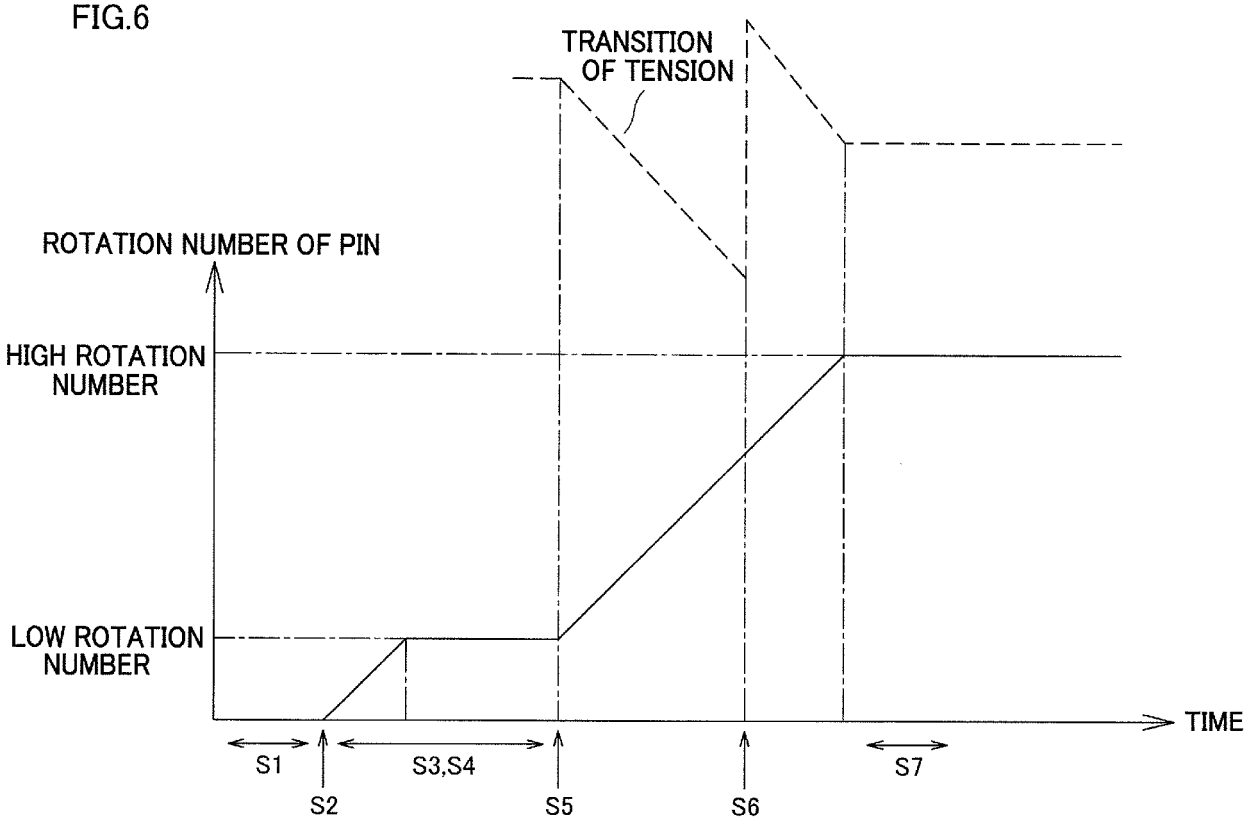
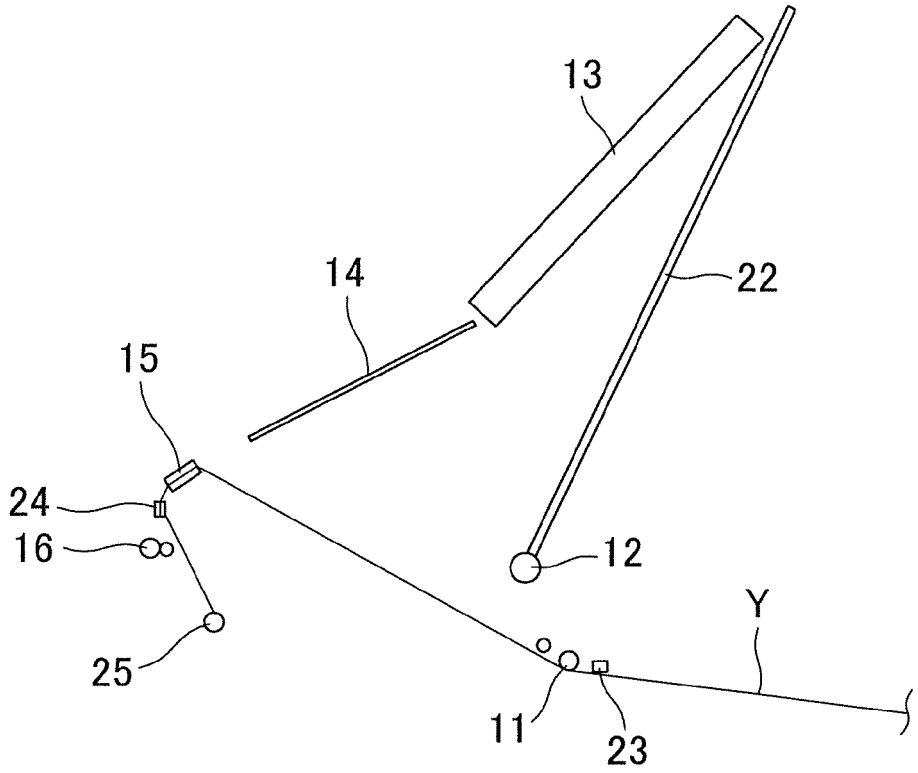

TRANSITION OF TENSION
ROTATION NUMBER OF PIN
HIGH ROTATION NUMBER
LOW ROTATION NUMBER
TIME
S1
S2
S3,S4
S5
S6
S7

FIG.7

(a)



(b)

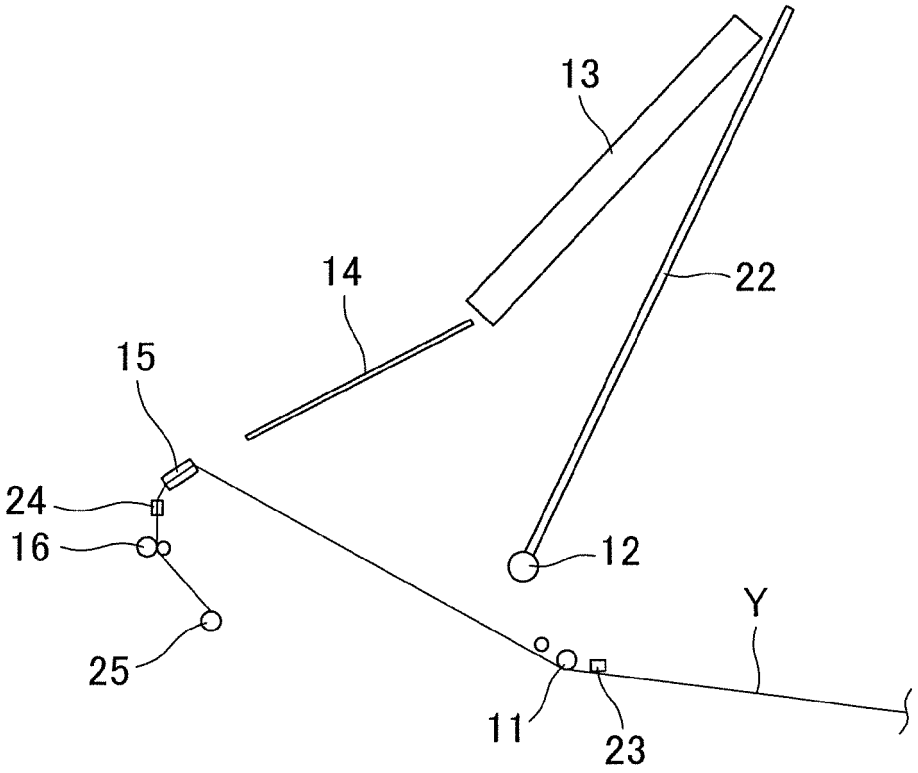
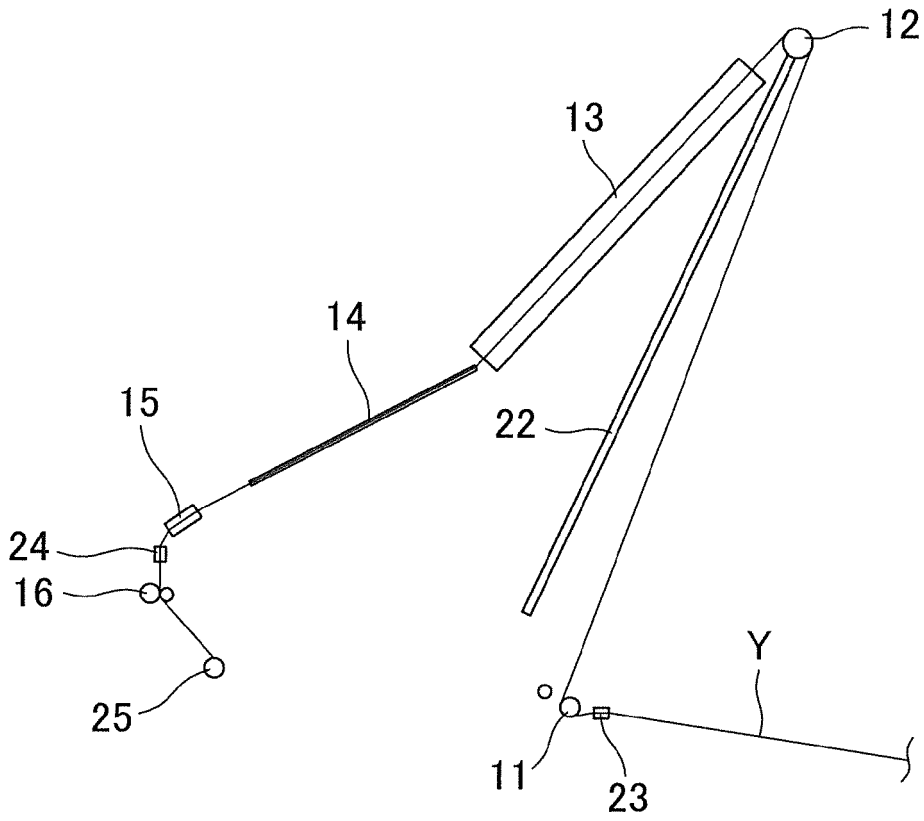


FIG.8

(a)



(b)

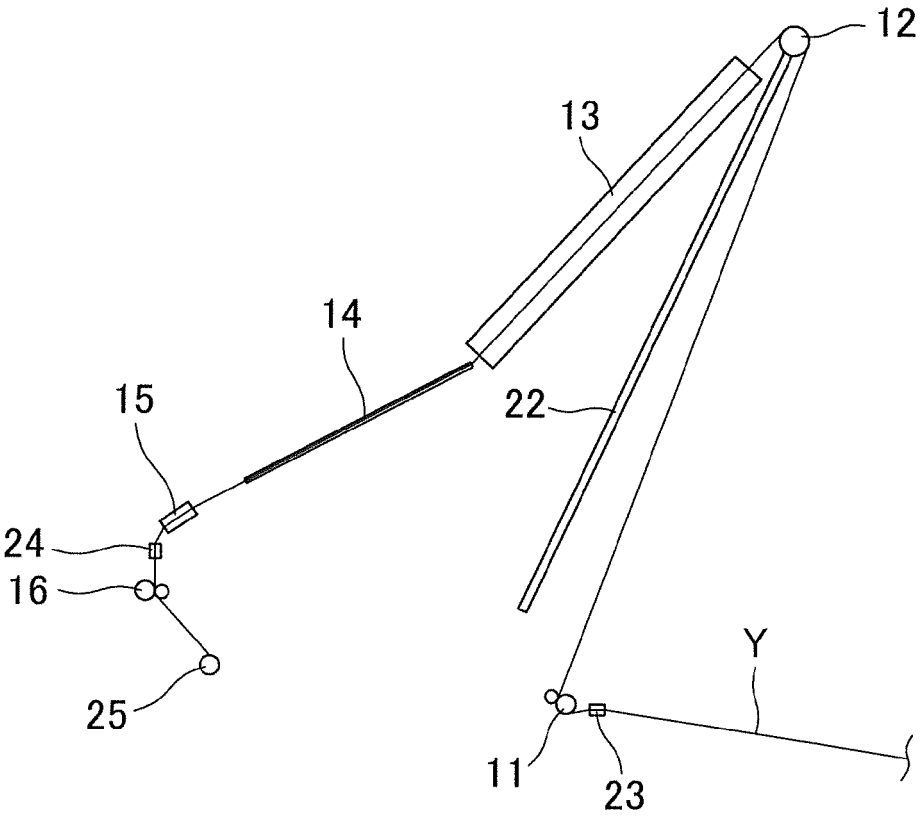
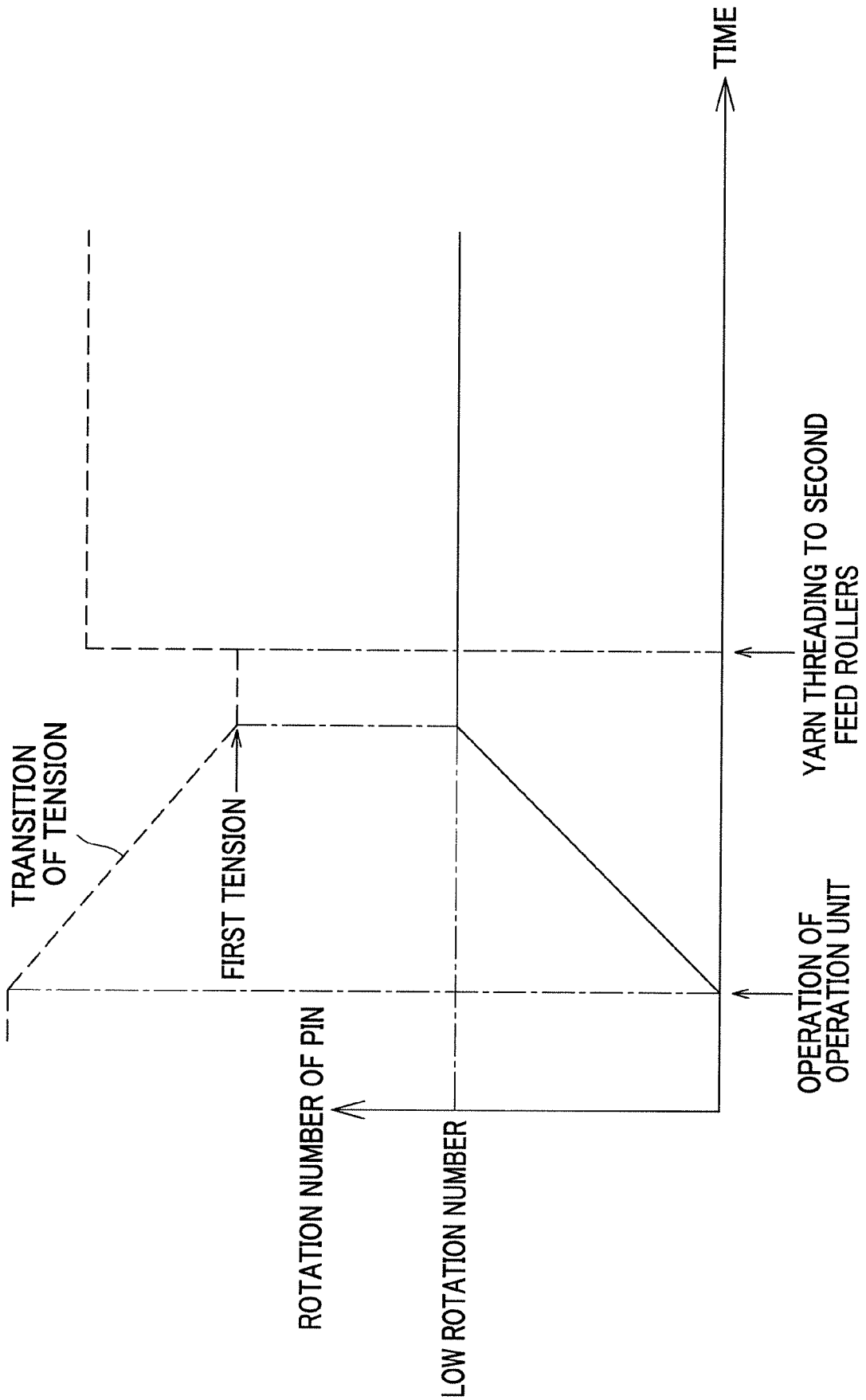


FIG.9


TIME
YARN THREADING TO SECOND FEED ROLLERS
OPERATION OF OPERATION UNIT
TRANSITION OF TENSION
FIRST TENSION
ROTATION NUMBER OF PIN
LOW ROTATION NUMBER

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 15 7701

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 662 531 A (CARROLL PATRICK P) 16 May 1972 (1972-05-16) * column 2, lines 9-75; figures 1,2 * * claims 1,2 * -----	1-11	INV. D02G1/02 D02G1/04 D02G1/06
X	US 3 392 519 A (WALTER PARKER) 16 July 1968 (1968-07-16) * column 1, lines 21-25 * * column 2, lines 9-11 * * column 2, lines 59-72; claims 1,5,6 * -----	1-11	

TECHNICAL FIELDS SEARCHED (IPC)

D02G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 June 2019	Van Beurden-Hopkins

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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05-06-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3662531 A	16-05-1972	NONE	
US 3392519 A	16-07-1968	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- JP 2002069763 A **[0002]**
- JP S5025839 B **[0003]**
- JP 2016027218 A **[0035]**
- JP 2011047074 A **[0077]**