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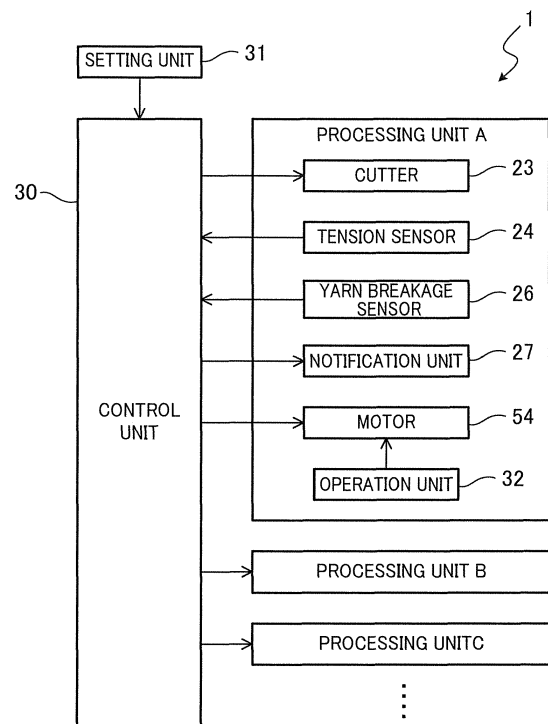
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(54) **DRAW TEXTURING MACHINE**

(57) Rotation of a pin is swiftly stopped at the time of yarn breakage in a draw texturing machine including a pin-type twisting unit. A yarn breakage sensor 26 configured to detect yarn breakage and a control unit 30 configured to control a motor 54 of a pin-type twisting unit 15 are provided. When yarn breakage is detected by the yarn breakage sensor 26, the control unit 30 stops the motor 54.

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.

SUMMARY OF THE INVENTION

[0003] In such a pin-type twisting unit, the pin keeps rotating until the operator stops the rotation of the pin, even after yarn breakage occurs and packages are no longer produced. This causes problems such as wasteful power consumption and reduction in life of members constituting the pin-type twisting unit due to abrasion. Furthermore, because the pin is retained only by the magnets, the pin may be detached and drop off for some reason if the pin keeps rotating after yarn breakage. When the pin drops off, another device may be damaged, or the pin may be lost.

[0004] In consideration of the above, an object of the present invention is to swiftly stop the rotation of a pin at the time of yarn breakage, in a draw texturing machine including a pin-type twisting unit.

[0005] 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 yarn breakage sensor configured to detect yarn breakage; and a control unit configured to control the motor, wherein, the control unit stops the motor when the yarn breakage sensor detects yarn breakage.

[0006] In the present invention, when the yarn breakage sensor detects yarn breakage, the control unit automatically stops the motor of the pin-type twisting unit. It is therefore possible to swiftly stop the rotation of the pin at the time of the occurrence of yarn breakage, without waiting for the stop of the motor by the operator.

[0007] The present invention is preferably arranged such that the draw texturing machine further includes: a tension sensor configured to detect tension of the yarn; and a cutter by which the yarn is cut, wherein, when the tension of the yarn detected by the tension sensor ex-

ceeds a predetermined upper limit value or falls below a predetermined lower limit value, the control unit causes the cutter to cut the yarn and stops the motor.

[0008] When the tension of the yarns is too high or too low, yarn breakage may occur, and the quality of the packages is likely to be deteriorated. As the yarn is cut by the cutter when the tension of the yarn exceeds the predetermined upper limit value or falls below the predetermined lower limit value, the occurrence of sudden yarn breakage and production of low-quality packages are restrained. Furthermore, because the motor of the pin-type twisting unit is stopped at this time, unnecessary rotation of the pin after the yarn is cut is avoided.

[0009] The present invention is preferably arranged such that, when the tension of the yarn detected by the tension sensor exceeds the upper limit value or falls below the lower limit value, the control unit causes the cutter to cut the yarn and then sends a stop instruction to the motor.

[0010] From the perspective of avoidance of unnecessary rotation of the pin, the motor is preferably stopped as soon as possible. However, if the motor starts deceleration before the cutter cuts the yarn, the running speed of the yarns and the rotation speed of the pin become imbalanced, with the result that the pin may be detached on account of inconsistent action of the yarn. For this reason, a stop instruction is sent to the motor after the cutter cuts the yarn as described above. With this arrangement, the motor does not start deceleration before the yarn is cut, and hence detachment of the pin is restrained.

[0011] The present invention is preferably arranged such that an absolute value of deceleration of the pin when the pin is stopped is larger than an absolute value of acceleration of the pin when the pin is accelerated.

[0012] Because the deceleration of the pin is arranged to be relatively high in this way, the rotation of the pin is swiftly stopped, and the time of unnecessary rotation of the pin after the yarn breakage is shortened.

[0013] 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, wherein, the control unit switches the notification unit to the notification state when stopping the motor.

[0014] This allows the operator to easily recognize that yarn breakage has occurred and the yarn has been cut, and to swiftly start operations for resuming the winding of the yarn.

[0015] The present invention is preferably arranged such that, processing units in each of which a yarn path is formed to pass the pin-type twisting unit and the yarn breakage sensor are provided to be lined up, and the control unit stops the motor of the pin-type twisting unit of a processing unit where yarn breakage is detected by the yarn breakage sensor.

[0016] In the draw texturing machine in which the processing units (termed spindles) are lined up, a com-

mon tangential belt is wound on the drive shafts of the pin-type twisting units of each processing unit, and the pin-type twisting units are driven altogether. On this account, it is not possible to stop the tangential belt even if yarn breakage occurs in one processing unit, and the operator is required to hasten to that processing unit and manually detach the drive shafts of the pin-type twisting units from the tangential belt. In this regard, according to the present invention, when yarn breakage occurs, the control unit automatically stops the motor of the pin-type twisting unit of the corresponding processing unit. The burden on the operator is reduced, and the rotation of the pin is certainly and swiftly stopped.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

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 showing motor control of the pin-type twisting unit during package production.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] The following will describe an embodiment of the present invention with reference to figures.

(Overall Structure of Draw Texturing Machine)

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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)

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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.

[0028] 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.

[0029] 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.

[0030] 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 roller 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.

[0031] 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.

[0032] 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.

[0033] 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 is 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.

[0034] 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.

[0035] 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)

[0036] 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.

[0037] 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)

[0038] 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.

[0039] 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.

[0040] 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.

[0041] 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.

[0042] 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.

[0043] 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).

[0044] 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 transmission of 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.

(Stop Control of Motor)

[0045] In the draw texturing machine 1 arranged as above, yarn breakage may occur in one of the processing units during the production of the packages P (i.e., during the winding of the yarns Y). If the motor 54 (pin 41) of the pin-type twisting unit 15 of that processing unit keeps rotating after the yarn breakage, problems such as wasteful power consumption and reduction in life of members constituting the pin-type twisting unit 15 due to abrasion may occur. Furthermore, because the pin 41 is re-

tained only by the magnets 49 and 50, the pin 41 may be detached and drop off for some reason if the pin 41 keeps rotating after the breakage of the yarn Y. When the pin 41 drops off, another device may be damaged, or the pin 41 may be lost.

[0046] In consideration of the above, in the present embodiment, the pin-type twisting units 15 of the respective processing units are arranged to be individually driven by a motor 54, and the motor 54 of each pin-type twisting unit 15 is automatically stoppable by the control unit 30. FIG. 5 is a flowchart showing motor control of the pin-type twisting unit 15 during package production. The control unit 30 performs control shown in FIG. 5 for the pin-type twisting unit 15 of each processing unit.

[0047] When yarn breakage occurs in one processing unit during production of packages P (YES in the step S1), the occurrence of the yarn breakage is detected by the yarn breakage sensor 26 and a yarn breakage signal is output from the yarn breakage sensor 26 to the control unit 30. Upon receiving the yarn breakage signal, the control unit 30 sends a stop instruction to the motor 54 of the pin-type twisting unit 15 of that processing unit to stop the rotation of the motor 54 (pin 41) (step S2). When stopping the motor 54, the control unit 30 switches the notification unit 27 to a notification state. This allows the operator to recognize that yarn breakage has occurred and the rotation of the pin 41 has been stopped.

[0048] The acceleration and deceleration of the pin 41 can be set at will by the operator by using the setting unit 31. In the present embodiment, the deceleration of the pin 41 when the pin 41 is stopped is set at -80,000rpm/s, whereas the acceleration of the pin 41 when the pin 41 is accelerated is set at 14,000rpm/s. The acceleration and deceleration of the pin 41, however, may be suitably changed.

[0049] When the tension of the yarn Y is too high or too low, yarn breakage may occur, and/or the quality of the package P is likely to be deteriorated. On this account, even when yarn breakage does not occur in a processing unit (NO in the step S1), the control unit 30 drives the cutter 23 of that processing unit to cut the yarn Y (step S4) if the tension detected by the tension sensor 24 exceeds a predetermined upper limit value or falls below a predetermined lower limit value (YES in the step S3). This prevents the occurrence of sudden yarn breakage and production of low-quality packages P. The upper limit value and the lower limit value described above can be set at will by the operator by using the setting unit 31.

[0050] When the pin 41 of the pin-type twisting unit 15 keeps rotating after the yarn Y is cut, various problems described above may occur, in the same manner as in the occurrence of yarn breakage. On this account, immediately after causing the cutter 23 to cut the yarn Y, the control unit 30 sends a stop instruction to the motor 54 to stop the rotation of the motor 54 (pin 41) (step S5). When stopping the motor 54, the control unit 30 switches the notification unit 27 to a notification state. This allows the operator to recognize that the yarn Y has been cut

and the rotation of the pin 41 has been stopped.

[0051] When yarn breakage does not occur and the tension of the yarn Y falls within an allowable range between the lower limit value and the upper limit value in a processing unit, the yarn Y false-twisted by the processing part 3 is wound by the winding unit 4, and a high-quality package P is formed.

(Effects)

[0052] In the present embodiment, when the yarn breakage sensor 26 detects yarn breakage, the control unit 30 automatically stops the motor 54 of the pin-type twisting unit 15. It is therefore possible to swiftly stop the rotation of the pin 41 at the time of the occurrence of yarn breakage, without waiting for the stop of the motor 54 by the operator.

[0053] In the present embodiment, when the tension of the yarn Y detected by the tension sensor 24 exceeds the predetermined upper limit value or falls below the predetermined lower limit value, the control unit 30 causes the cutter 23 to cut the yarn Y and stops the motor 54 of the pin-type twisting unit 15. When the tension of the yarn Y is too high or too low, yarn breakage may occur, and the quality of the package P is likely to be deteriorated. As the yarn Y is cut by the cutter 23 when the tension of the yarn Y exceeds the predetermined upper limit value or falls below the predetermined lower limit value, the occurrence of sudden yarn breakage and production of a low-quality package P are restrained. Furthermore, because the motor 54 of the pin-type twisting unit 15 is stopped at this time, unnecessary rotation of the pin 41 after the yarn Y is cut is avoided.

[0054] In the present embodiment, when the tension of the yarn Y detected by the tension sensor 24 exceeds the upper limit value or falls below the lower limit value, the control unit 30 sends a stop instruction to the motor 54 of the pin-type twisting unit 15 after causing the cutter 23 to cut the yarn Y. From the perspective of avoidance of unnecessary rotation of the pin 41, the motor 54 is preferably stopped as soon as possible. However, if the motor 54 starts deceleration before the cutter 23 cuts the yarn Y, the running speed of the yarn Y and the rotation speed of the pin 41 become imbalanced, with the result that the pin 41 may be detached on account of inconsistent action of the yarn Y. For this reason, a stop instruction is sent to the motor 54 after the cutter 23 cuts the yarn Y as described above. With this arrangement, the motor 54 does not start deceleration before the yarn Y is cut, and hence detachment of the pin 41 is restrained.

[0055] In the present embodiment, the absolute value of the deceleration of the pin 41 when the pin 41 of the pin-type twisting unit 15 is stopped is larger than the absolute value of the acceleration of the pin 41 when the pin 41 is accelerated. Because the deceleration of the pin 41 is arranged to be relatively high in this way, the rotation of the pin 41 is swiftly stopped, and the time of unnecessary rotation of the pin 41 after the yarn breakage

is shortened.

[0056] In the present embodiment, the notification unit 27 which is switchable to the notification state of notifying predetermined information to the operator is further provided, and when the motor 54 of the pin-type twisting unit 15 is stopped, the control unit 30 switches the notification unit 27 to the notification state (a state in which a lamp turns on or flickers). This allows the operator to easily recognize that yarn breakage has occurred and the yarn Y has been cut, and to swiftly start operations for resuming the winding of the yarn Y.

[0057] In the present embodiment, processing units in each which a yarn path is formed to pass the pin-type twisting unit 15 and the yarn breakage sensor 26 are provided to be lined up, and the control unit 30 stops the motor 54 of the pin-type twisting unit 15 of a processing unit in which yarn breakage is detected by the yarn breakage sensor 26. In the draw texturing machine 1 in which the processing units are lined up, a common tangential belt is wound on the drive shafts of the pin-type twisting units 15 of each processing unit, and the pin-type twisting units 15 are driven altogether. On this account, it is not possible to stop the tangential belt even if yarn breakage occurs in one processing unit, and the operator is required to hasten to that processing unit and manually detach the drive shafts of the pin-type twisting units 15 from the tangential belt. In this regard, according to the present embodiment, when yarn breakage occurs, the control unit 30 automatically stops the motor 54 of the pin-type twisting unit 15 of the corresponding processing unit. The burden on the operator is reduced, and the rotation of the pin 41 is certainly and swiftly stopped.

(Other Embodiments)

[0058] The following will describe modifications of the above-described embodiment.

(1) In the embodiment above, the yarn breakage sensor 26 is provided in addition to the tension sensor 24, and yarn breakage is detected by the yarn breakage sensor 26. Alternatively, because the tension sensor 24 is able to detect yarn breakage, the yarn breakage sensor 26 may be omitted and the tension sensor 24 may detect yarn breakage. In this case, the tension sensor 24 functions as the yarn breakage sensor of the present invention.

(2) In the present embodiment, when the tension detected by the tension sensor 24 exceeds the upper limit value or falls below the lower limit value, a stop instruction is sent to the motor 54 of the pin-type twisting unit 15 after the cutter 23 cuts the yarn Y. Alternatively, a stop instruction may be sent to the motor 54 at the same time as or immediately before the cutter 23 cuts the yarn Y.

(3) In the embodiment above, the notification unit 27 is switched to the notification state at the time of yarn breakage or yarn cutting. In this regard, this switch-

ing of the notification unit 27 to the notification state at the time of yarn breakage or yarn cutting is not mandatory, and the notification unit 27 may be omitted.

(4) 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) 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.

(5) 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 yarn breakage sensor (26) configured to detect yarn breakage; and
a control unit (30) configured to control the motor (54),
wherein,
the control unit (30) stops the motor (54) when the yarn breakage sensor (26) detects yarn breakage.

2. The draw texturing machine (1) according to claim 1, further comprising:

a tension sensor (24) configured to detect tension of the yarn (Y); and
a cutter (23) by which the yarn (Y) is cut,

wherein,

when the tension of the yarn (Y) detected by the tension sensor (24) exceeds a predetermined upper limit value or falls below a predetermined lower limit value, the control unit (30) causes the cutter (23) to cut the yarn (Y) and stops the motor (54).

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3. The draw texturing machine (1) according to claim 2, wherein, when the tension of the yarn (Y) detected by the tension sensor (24) exceeds the upper limit value or falls below the lower limit value, the control unit (30) causes the cutter (23) to cut the yarn (Y) and then sends a stop instruction to the motor (54).

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4. The draw texturing machine (1) according to any one of claims 1 to 3, wherein, an absolute value of deceleration of the pin (41) when the pin (41) is stopped is larger than an absolute value of acceleration of the pin (41) when the pin (41) is accelerated.

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5. The draw texturing machine (1) according to any one of claims 1 to 4, further comprising a notification unit (27) which is switchable to a notification state of notifying predetermined information to an operator, wherein, the control unit (30) switches the notification unit (27) to the notification state when stopping the motor (54).

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6. The draw texturing machine (1) according to any one of claims 1 to 5, wherein, processing units in each of which a yarn path is formed to pass the pin-type twisting unit (15) and the yarn breakage sensor (26) are provided to be lined up, and the control unit (30) stops the motor (54) of the pin-type twisting unit (15) of a processing unit where yarn breakage is detected by the yarn breakage sensor (26).

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FIG. 1

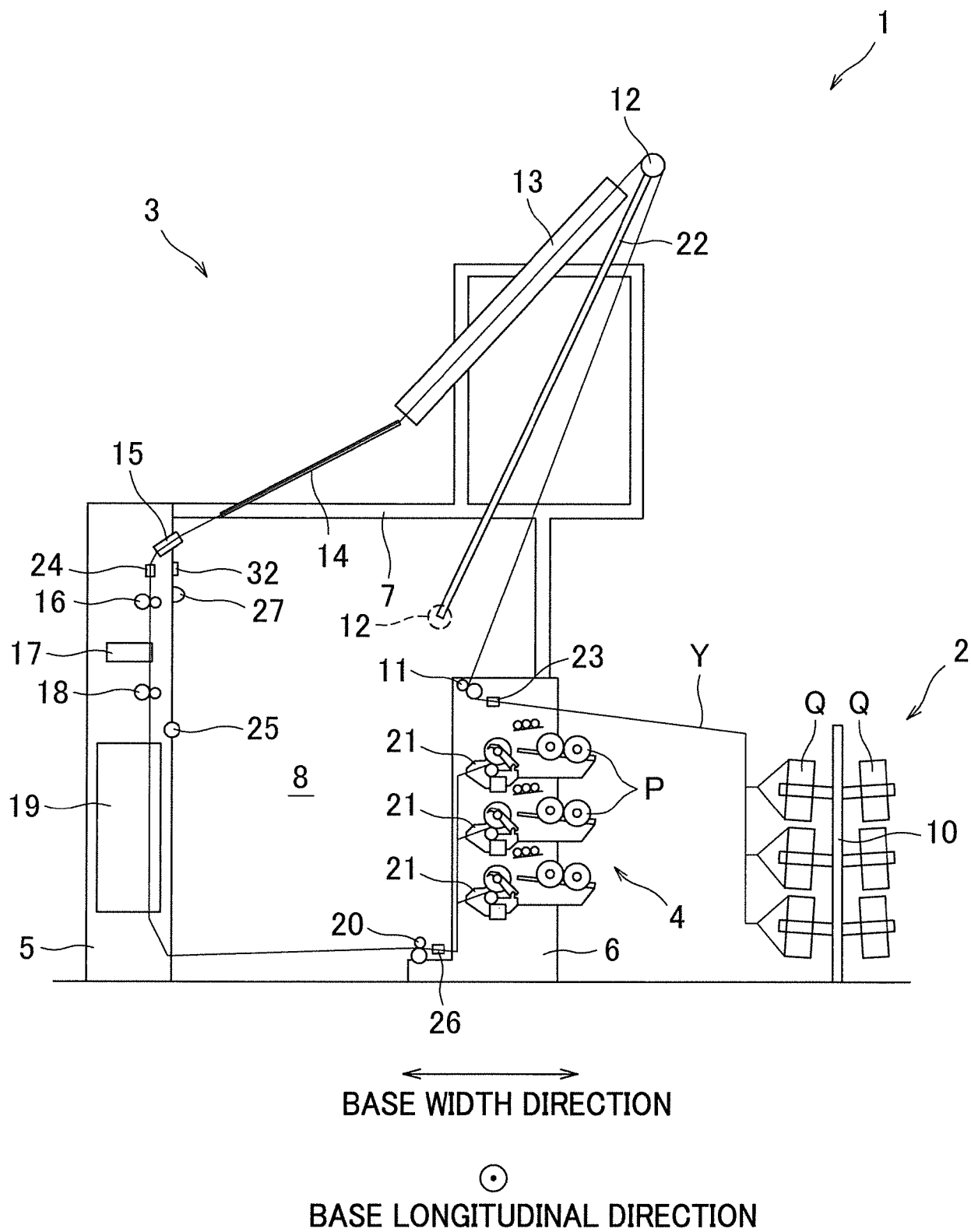


FIG.2

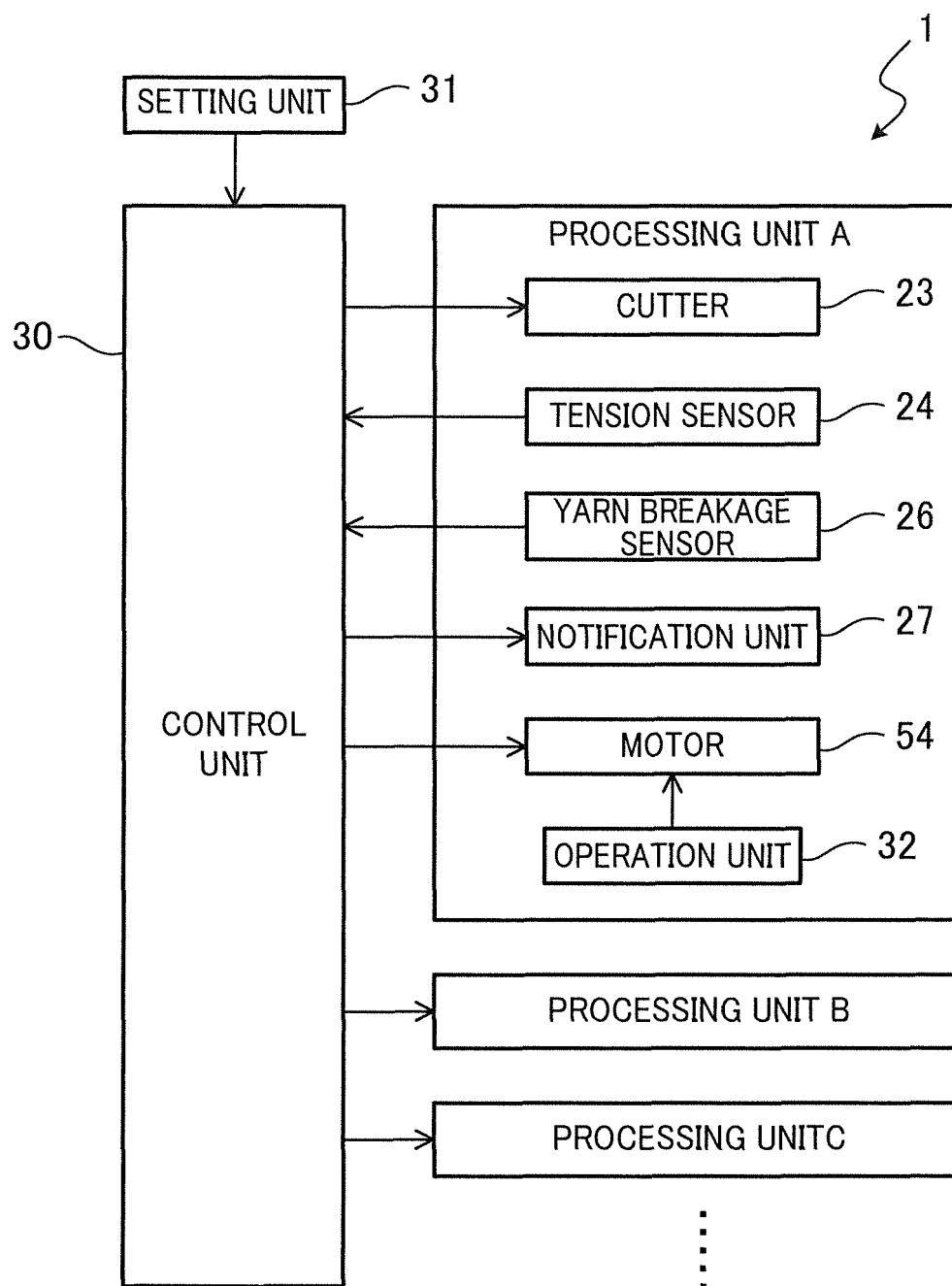


FIG.3

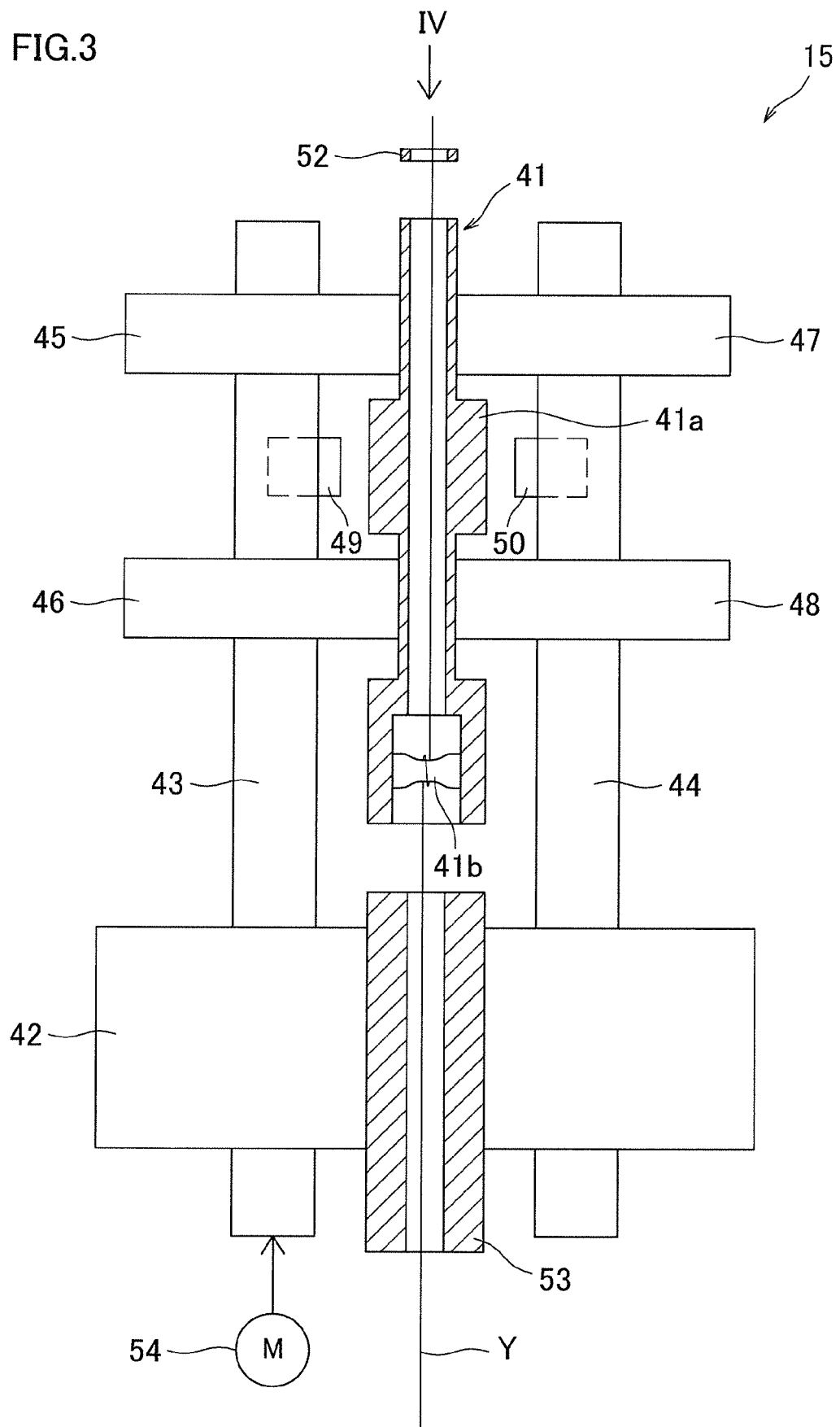


FIG.4

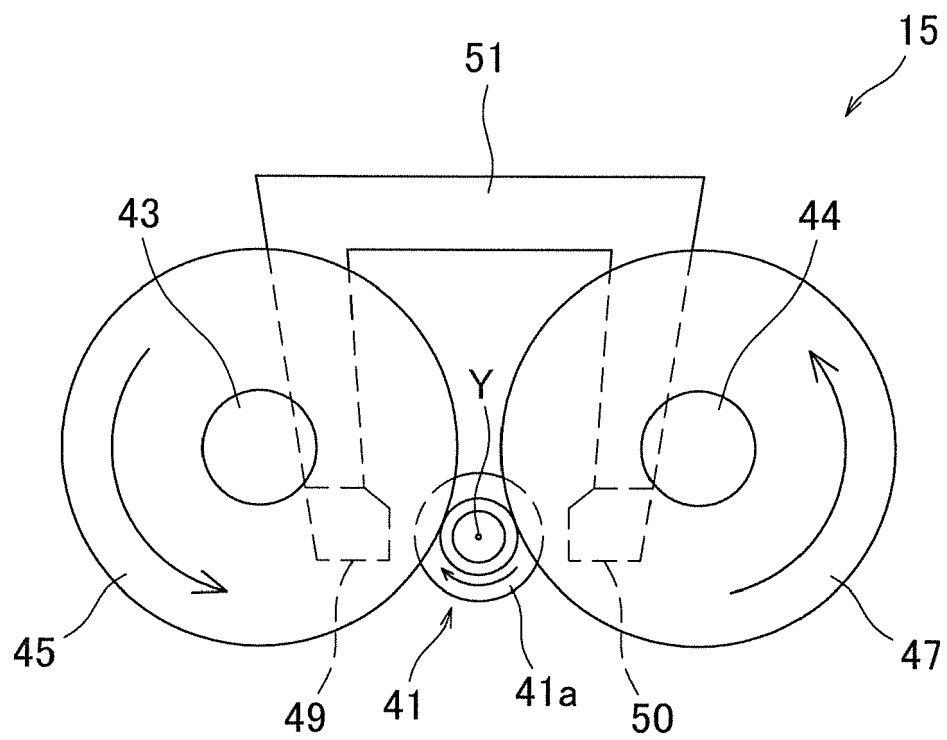
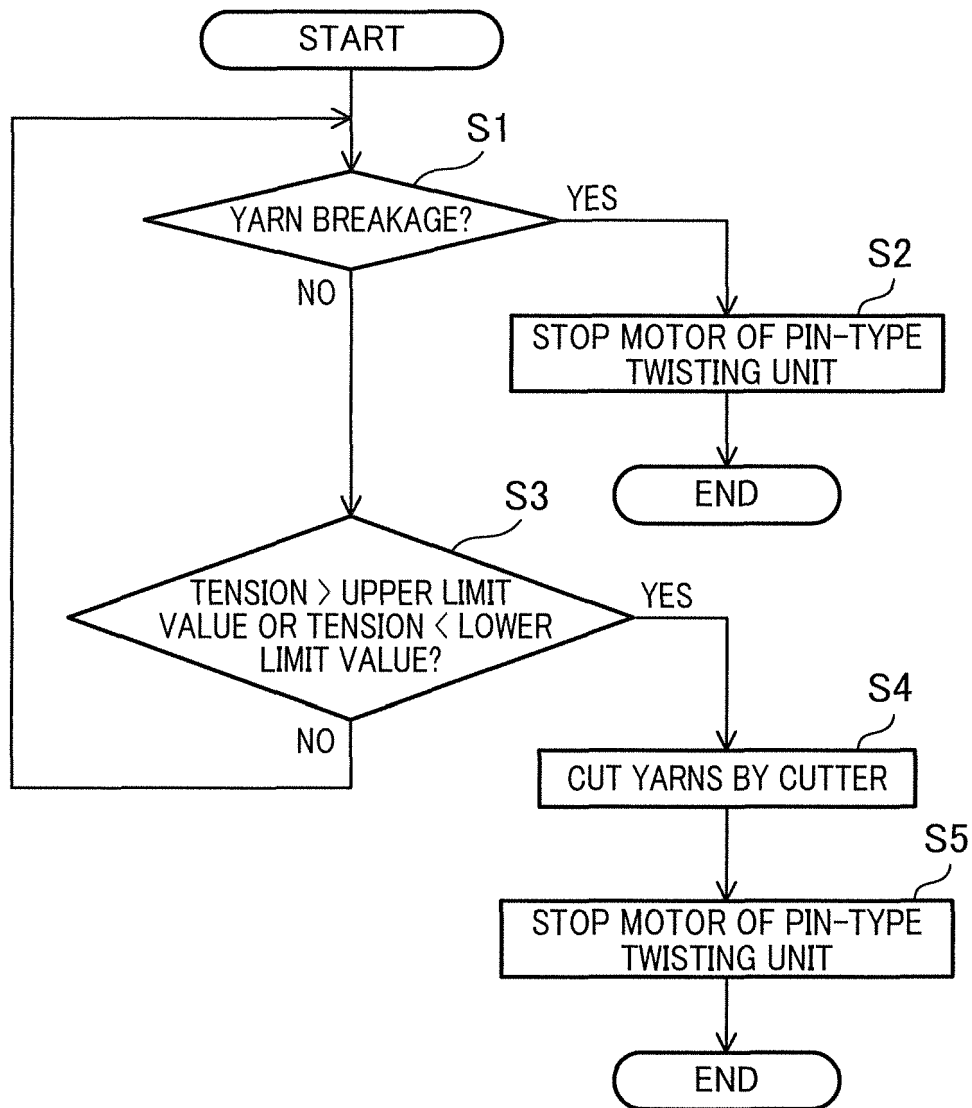


FIG.5





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Application Number
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