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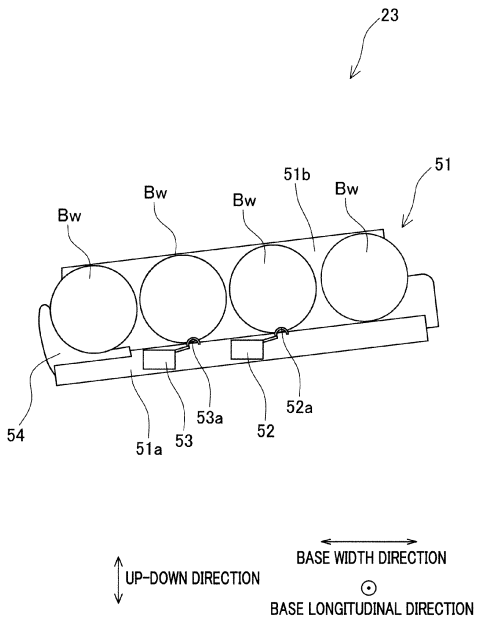
(54) FALSE-TWIST TEXTURING MACHINE INCLUDING EMPTY TAKE-UP TUBE SUPPLIER

(57) An operator, an automatic robot, or the like is prevented from forgetting replenishment of empty take-up tubes to an empty take-up tube supplier, and occurrence of a failure in winding of a yarn by a winding device is prevented. A false-twist texturing machine 1 includes empty bobbin suppliers 23 provided for winding devices, respectively, and configured to supply empty bobbins Bw to each winding device and a control unit. Each empty bobbin supplier 23 includes a stocker portion 51, a first sensor 52, and a second sensor 53. When the first sensor 52 and the second sensor 53 detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is equal to or less than a predetermined number, a control unit 40 generates a notification signal by which the necessity of the replenishment of empty bobbins Bw to the stocker portion 51 is notified.

FIG.4



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a false-twist texturing machine including an empty take-up tube supplier configured to supply an empty take-up tube to a winding device.

[0002] Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2011-47074) discloses a false-twist texturing machine configured to false-twist a yarn. The false-twist texturing machine of Patent Literature 1 includes a yarn supplying unit, a feed roller causing a yarn supplied from the yarn supplying unit to run, a winding device winding the running yarn, and a heater, a cooler, and a false-twisting device that are provided on a yarn path from the yarn supplying unit to the winding device.

[0003] In the false-twist texturing machine, a package is formed in such a way that a yarn supplied from the yarn supplying unit is false-twisted by members such as the false-twisting device and the yarn is then wound onto a take-up tube by the winding device. The completed package is detached from the winding device. After an empty take-up tube on which no yarn is wound is attached to the winding device, winding of another yarn is performed again by the winding device.

[0004] Patent Literature 2 (Japanese Laid-Open Patent Publication No. H10-279188) discloses an empty take-up tube supplier (bobbin replacement device) which is configured to supply an empty take-up tube (empty bobbin) to a winding device such as a false-twist texturing machine. The empty take-up tube supplier is able to accommodate an empty take-up tube therein. When a yarn is wound onto a take-up tube by the winding device and a fully-wound package is formed, the fully-wound package is detached and an empty take-up tube is supplied from an empty take-up tube supplying rail to the winding device.

SUMMARY OF THE INVENTION

[0005] To the empty take-up tube supplier, an empty take-up tube is accordingly supplied by an operator, an automatic robot, or the like. When the empty take-up tube supplier runs out of empty take-up tubes but replenishment of the empty take-up tubes has not been done, the empty take-up tube supplier cannot supply an empty take-up tube to the winding device. To the false-twist texturing machine, a yarn is continuously supplied from the yarn supplying unit. On this account, when no empty take-up tube is supplied to the winding device after a fully-wound package is detached from the winding device, malfunction such as entanglement of the yarn onto the winding device may occur on account of continuous supply of the yarn from the yarn supplying unit.

[0006] In addition to the above, when yarn breakage occurs while the yarn is being wound or yarn threading to the winding device is not successfully done, the winding performed by the winding device may be canceled in the middle and supply of the next empty take-up tube may be requested at an early time. In such a case, when the empty take-up tube supplier does not accommodate empty take-up tubes, the malfunction above may occur. It is therefore very important to grasp the timing to replenish empty take-up tubes to the empty take-up tube supplier.

[0007] In particular, in a false-twist texturing machine having plural winding devices, it is difficult to grasp the timing to replenish empty take-up tubes to each of all empty take-up tube suppliers corresponding to the respective winding devices. On this account, replenishment of empty take-up tubes tends to be forgotten.

[0008] An object of the present invention is to provide a false-twist texturing machine that prevents an operator, an automatic robot, or the like from forgetting to replenish empty take-up tubes to an empty take-up tube supplier and also prevents the occurrence of a failure in winding of a yarn by a winding device.

[0009] The present invention relates to a false-twist texturing machine comprising: winding devices each of which is configured to form a package by winding a yarn onto a take-up tube; empty take-up tube suppliers which are provided for the respective winding devices and each of which supplies an empty take-up tube to each of the winding devices; and a control unit, each of the empty take-up tube suppliers includes a stocker portion capable of accommodating empty take-up tubes and at least one sensor configured to detect that the number of the empty take-up tubes accommodated in the stocker portion is equal to or less than a predetermined number, when the at least one sensor detects that the number of the empty take-up tubes accommodated in the stocker portion is equal to or less than the predetermined number, the control unit generating a notification signal indicating necessity of replenishment of the empty take-up tubes to the stocker portion.

[0010] According to the present invention, because replenishment of empty take-up tubes to the stocker portion is performed based on the notification signal, it is possible to grasp a timing to replenish the empty take-up tubes to each of all empty take-up tube suppliers corresponding to the winding devices. On this account, the operator or the like is prevented from forgetting to replenish empty take-up tubes to an empty take-up tube, and also the occurrence of a failure in winding of a yarn by a winding device is prevented.

[0011] In the present invention, preferably, the at least one sensor includes a first sensor which is configured to detect that the number of the empty take-up tubes accommodated in the stocker portion is equal to or less than a first predetermined number that is the predetermined number and is one or more.

[0012] When the number of winding devices is large, supply of empty take-up tubes to a winding device by the empty take-up tube supplier may not be timely performed if empty take-up tubes are replenished to the stocker por-

tion after the number of empty take-up tubes accommodated in the stocker portion becomes zero. According to the present invention, it is possible to generate the notification signal in advance before the number of empty take-up tubes accommodated in the stocker portion becomes zero. It is therefore possible to prevent the delay of replenishment of empty take-up tubes to the stocker portion.

[0013] In the present invention, preferably, the at least one sensor includes a second sensor which is configured to detect that the number of the empty take-up tubes accommodated in the stocker portion is zero.

[0014] According to the present invention, the notification signal is generated when the number of empty take-up tubes accommodated in the stocker portion becomes zero. Therefore, it is possible to grasp a timing of urgent need of replenishment of empty take-up tubes as the number of empty take-up tubes accommodated in the stocker portion becomes zero.

[0015] In the present invention, preferably, the notification signal includes a priority notification signal which notifies that, when the second sensor detects that the number of the empty take-up tubes accommodated in one of stocker portions of the empty take-up tube suppliers is 0, replenishment of empty take-up tubes to the one of the stocker portions accommodating no empty take-up tube must be prioritized over replenishment to the other stocker portions.

[0016] According to the present invention, because the replenishment of the empty take-up tubes is performed based on the priority notification signal, the replenishment of the empty take-up tubes to the stocker portion in which the number of accommodated empty take-up tubes is zero is prioritized over the replenishment to the other stocker portions. It is therefore possible to avoid a situation in which the supply of take-up tubes from the empty take-up tube supplier to the winding device is not performed.

[0017] In the present invention, preferably, when the number of the empty take-up tubes accommodated in one of the stocker portions is 0, the control unit controls the winding device corresponding to the one of the stocker portions not to perform winding again after the winding device completes formation of the package.

[0018] According to the present invention, when the number of empty take-up tubes accommodated in a stocker portion becomes 0, the winding device corresponding to that stocker portion does not resume the winding after the completion of the formation of the wound package. It is therefore possible to avoid the occurrence of malfunction, that is, entanglement of the yarn onto the winding device that resumed winding in the absence of a take-up tube.

[0019] In the present invention, preferably, the at least one sensor includes two or more sensors, and each of the two or more sensors is a sensor configured to detect that the number of the accommodated take-up tubes is equal to or less than the predetermined number that is different from each other.

[0020] According to the present invention, with two or more sensors, it is possible to grasp the number of empty take-up tubes accommodated in the stocker portion, in a detailed manner. On this account, it is easy to adjust at which timing the necessity of replenishment of empty take-up tubes notified, in accordance with, for example, the situation.

[0021] In the present invention, preferably, the false-twist texturing machine further comprises a notification unit which is capable of performing a notification operation of notifying an operator of the necessity of replenishment of the empty take-up tubes to the stocker portion, the control unit causing the notification unit to perform the notification operation by sending the notification signal to the notification unit.

[0022] According to the present invention, when replenishment of empty take-up tubes to the stocker portion is performed by an operator, the operator is able to grasp, by the notification operation by the notification unit, a timing to replenish the empty take-up tubes.

[0023] In the present invention, preferably, the false-twist texturing machine further comprises an empty take-up tube replenishment robot which is capable of automatically performing a replenishment operation of replenishing the empty take-up tubes to the stocker portion, the control unit causing the empty take-up tube replenishment robot to perform the replenishment operation by sending the notification signal to the empty take-up tube replenishment robot.

[0024] According to the present invention, when replenishment of empty take-up tubes to the stocker portion is automatically done by the empty take-up tube replenishment robot, the timing of the replenishment operation can be suitably controlled.

[0025] In the present invention, preferably, the at least one sensor includes a third sensor which is capable of detecting that the number of the empty take-up tubes accommodated in the stocker portion is at the maximum, and when the third sensor detects that the number of the empty take-up tubes accommodated in the stocker portion is at the maximum, the control unit controls the empty take-up tube replenishment robot not to perform the replenishment operation.

[0026] According to the present invention, when the replenishment of empty take-up tubes to the stocker portion is automatically done by the empty take-up tube replenishment robot, it is possible to prevent the replenishment operation from being performed when the maximum number of empty take-up tubes are accommodated in the stocker portion. It is therefore possible to prevent the empty take-up tubes from overflowing from the stocker portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

FIG. 1 is a profile of a false-twist texturing machine related to an embodiment.

FIG. 2 shows the false-twist texturing machine viewed in the direction II in FIG. 1.

FIG. 3 is a schematic diagram of a winding unit.

FIG. 4 is a schematic diagram of an empty bobbin supplier.

FIG. 5 is a block diagram illustrating the electrical structure of the false-twist texturing machine.

FIG. 6 is a block diagram illustrating the electrical structure of a false-twist texturing machine of a modification.

FIG. 7 is a schematic diagram of an empty bobbin supplier of a modification.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] The following will describe an embodiment of the present invention with reference to figures.

(Overall Structure of False-Twist Texturing Machine 1)

[0029] FIG. 1 is a profile showing the overall structure of a false-twist texturing machine 1 of the present embodiment. Hereinafter, a vertical direction to the sheet of FIG. 1 is defined as a base longitudinal direction, and a left-right direction to the sheet is defined as a base width direction. A direction orthogonal to the base longitudinal direction and the base width direction is defined as the up-down direction (vertical direction) in which the gravity acts. These definitions of the directions will be suitably used hereinbelow.

[0030] The false-twist texturing machine 1 can perform false twisting of yarns Y made of, for example, synthetic fibers such as nylon (polyamide fibers). The false-twist texturing machine 1 includes a yarn supplying unit 2 for supplying the yarns Y, a processing unit 3 which performs false twisting of the yarns Y supplied from the supplying unit 2, a winding unit 4 which winds the yarns Y processed by the processing unit 3 onto winding bobbins Bw (take-up tubes of the present invention), and a control unit 40 (see FIG. 5). The yarn supplying unit 2, the processing unit 3, and the winding unit 4 include structural elements (described later), and the structural elements are provided to form plural lines in a base longitudinal direction orthogonal to a yarn running surface (surface orthogonal to the direction in which FIG. 1 is viewed) in which yarn paths are provided to reach the winding unit 4 from the yarn supplying unit 2 via the processing unit 3.

[0031] The yarn supplying unit 2 includes a creel stand 7 retaining yarn supply packages Ps, and supplies the yarns Y to the processing unit 3. In the processing unit 3, the following members are provided in this order from the upstream in a yarn running direction: first feed rollers 11; a twist-stopping guide 12; a first heater 13; a cooler 14; a false-twisting device 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 the yarns Y for which the false winding has been performed at the processing unit 3 onto the winding bobbins Bw by winding devices 21, and forms wound packages Pw (packages of the present invention).

[0032] The false-twist texturing machine 1 includes a main base 8 and a winding base 9 which are placed apart from each other in the base width direction. The main base 8 and the winding base 9 are provided to extend in a substantially same length in the base longitudinal direction, and placed to oppose each other. An upper part of the main base 8 is connected to an upper part of the winding base 9 by a supporting frame 10. Each device forming the processing unit 3 is mainly attached to the main base 8 or the supporting frame 10. The main base 8, the winding base 9, and the supporting frame 10 form a working space 22 in which an operator performs an operation such as the yarn threading to each device. The yarn paths are formed so that the yarns Y mainly run around the working space 22.

[0033] The false-twist texturing machine 1 includes units which are termed spans, each of which includes a pair of the main base 8 and the winding base 9 placed to oppose each other. In one span, each device is placed so that the yarns Y running while being aligned in the base longitudinal direction can be false-twisted at the same time. For example, twelve winding devices 21 are provided for one winding base 9 (as shown in FIG. 2). In the false-twist texturing machine 1, the spans are placed in a left-right symmetrical manner to the sheet, with a center line C of the base width direction of the main base 8 as a symmetry axis (main base 8 is shared between the left span and the right span), and the spans are aligned in the base longitudinal direction.

(Processing Unit)

[0034] The following will describe each element of the processing unit 3. Each first feed roller 11 sends the yarns Y supplied from the yarn supplying unit 2 to the first heater 13. The first feed rollers 11 are placed above the winding base 9 (as shown in FIG. 1). The first feed rollers 11 are aligned in the base longitudinal direction.

[0035] Each twist-stopping guide 12 prevents twisting which has been applied to the yarn Y at the later-described false-twisting device 15 from being propagated to the upstream of each twist-stopping guide 12 in the yarn running direction. The twist-stopping guides 12 are placed downstream of the first feed rollers 11 in the yarn running direction, and placed upstream of the first heater 13 in the yarn running direction. The twist-stopping guides 12 are, for example, provided for the yarns Y supplied from the yarn supplying unit 2, respectively, and aligned in the base longitudinal direction.

[0036] Each first heater 13 heats the yarns Y sent from the first feed rollers 11, and are placed at the supporting frame 10 (as shown in FIG. 1). The first heaters 13 are provided for the yarns Y supplied from the yarn supplying unit 2, and aligned in the base longitudinal direction.

[0037] Each cooler 14 cools the yarns Y heated at each first heater 13. The coolers 14 are placed downstream of each first heater 13 in the yarn running direction, and placed upstream of the false-twisting devices 15 in the yarn running direction. The coolers 14 are provided for the yarns Y supplied by the yarn supplying unit 2, and aligned in the base longitudinal direction.

[0038] Each false-twisting device 15 is configured to twist the yarn Y. The false-twisting devices 15 are placed directly downstream of the coolers 14 in the yarn running direction. The false-twisting devices 15 are aligned in the base longitudinal direction. For example, twelve false-twisting devices 15 are provided in one span.

[0039] The second feed rollers 16 are rollers for sending the yarn Y twisted by the false-twisting device 15 toward the interlacing device 17. The second feed rollers 16 are provided on the downstream side in the yarn running direction of the false-twisting device 15 in the main base 8. 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 8.

[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 roller 18 are provided below the interlacing device 17 in the main base 8. 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 second feed rollers 16 and the third feed rollers 18.

[0042] The second heater 19 is a device for heating the yarns Y supplied from the third feed rollers 18. The second heater 19 is provided below the third feed rollers 18 in the main base 8. The second heater 19 extends along the vertical direction, and one second heater 19 is provided in one span.

[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 9. 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 unit 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 false-twisting device 15. The twist formed by the false-twisting device 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 which is twisted and drawn is heated at each first heater 13 and thermally set. After that, the yarn Y is cooled at each cooler 14. The yarn Y is untwisted at the downstream of the false-twisting device 15. However, each filament is maintained to be wavy in shape on account of the thermal setting described above. After being false-twisted by the false-twisting device 15, the yarn Y is interlaced by the interlacing device 17 while being relaxed between the second feed rollers 16 and the third feed rollers 18, and then the yarn Y is guided to the downstream side in the yarn running direction. Furthermore, the yarn Y is thermally set at the second heater 19 while being relaxed between the third feed roller 18 and the fourth feed roller 20. Finally, the yarn Y sent from each fourth feed roller 20 is wound by each winding device 21, and form each wound package Pw.

(Structure of Winding Unit 4)

[0045] The structure of the winding unit 4 will be described with reference to FIG. 2 and FIG. 3. As shown in FIG. 3, the winding unit 4 includes winding devices 21 configured to form wound packages Pw by winding the yarns Y onto winding bobbins Bw, empty bobbin suppliers 23 (empty take-up tube suppliers of the present invention), and storage units 24. The empty bobbin suppliers 23 and the storage units 24 are provided for the respective winding devices 21. Each winding device 21 includes a single cradle 31 that rotatably supports the winding bobbin Bw. The winding bobbin Bw which is supported by the cradle 31 is rotationally driven by, for example, an unillustrated motor. By rotationally driving the winding bobbin Bw, the winding device 21 winds the yarn Y onto the winding bobbin Bw and forms the wound package Pw.

[0046] The empty bobbin supplier 23 is a device for supplying, to the winding device 21, an empty winding bobbin Bw on which no yarn Y is wound. The empty winding bobbin Bw (hereinafter, empty bobbin Bw) is equivalent to an empty take-up tube of the present invention. The empty bobbin supplier 23 will be detailed later.

[0047] The storage unit 24 is configured to store a fully-wound package Pw formed by the winding device 21. When the formation of the wound package Pw is completed, the winding bobbin Bw supported by the cradle 31 is detached from the winding device 21 as the cradle 31 rotates about the rotational axis extending in the base longitudinal direction, and the wound package Pw is then supplied to the storage unit 24. For example, the storage unit 24 is able to store three wound packages Pw at the maximum. When, for example, yarn breakage occurs while the winding device 21 is winding the yarn Y, the wound package Pw may be supplied to the storage unit 24 even though the formation of the package has not been completed.

(Structure of Empty Bobbin Supplier 23)

[0048] Now, the structure of the empty bobbin supplier 23 will be described with reference to FIG. 4. The empty bobbin supplier 23 is a device configured to supply an empty bobbin Bw to the winding device 21 after a wound package Pw is detached from the winding device 21 and supplied to the storage unit 24. Each empty bobbin supplier 23 includes a stocker portion 51 capable of accommodating four empty bobbins Bw, a first sensor 52, a second sensor 53, and a leading end portion 54.

[0049] The stocker portion 51 has a supporting member 51a and side walls 51b. The supporting member 51a supports empty bobbins Bw from below and is inclined downward toward the side in the base width direction on which the winding device 21 is provided. The length in the base longitudinal direction of the supporting member 51a is arranged to be slightly longer than the length along the axial center of the empty bobbin Bw. The side walls 51b extend upward from one end portion and the other end portion in the base longitudinal direction of the supporting member 51a, respectively. Although FIG. 4 shows only the side wall 51b that is, for a viewer of the figure, on the far side of the empty bobbins Bw supported by the supporting member 51a, actually the other side wall 51b is provided on the near side of the empty bobbins Bw. In the present embodiment, the stocker portion 51 is able to accommodate four empty bobbins Bw at the maximum. In the present embodiment, replenishment of empty bobbins Bw to the stocker portion 51 is manually done by an operator. Each empty bobbin Bw replenished to the stocker portion 51 by the operator moves toward the side in the base width direction on which the winding device 21 is provided, along the supporting member 51a that is inclined downward. The first empty bobbin Bw to be accommodated in the stocker portion 51 moves along the inclination of the supporting member 51a and is then accommodated at an end portion of the stocker portion 51, which is on the side in the base width direction on which the winding device 21 is provided. After the first empty bobbin Bw is accommodated in the stocker portion 51, the subsequent second to fourth empty bobbins Bw move along the inclination of the stocker portion 51, with the result that the second, third, and fourth empty bobbins Bw are positioned next to the first empty bobbin Bw, in this order. Hereinafter, the empty bobbin Bw that is closest to the winding device 21 will be referred to as a first empty bobbin Bw, the empty bobbin Bw that is second closest to the winding device 21 will be referred to as a second empty bobbin Bw, the empty bobbin Bw that is third closest to the winding device 21 will be referred to as a third empty bobbin Bw, and the empty bobbin Bw that is fourth closest to the winding device 21 will be referred to as a fourth empty bobbin Bw.

[0050] The first sensor 52 is a microswitch having a detection piece 52a which slightly protrudes upward from the bottom surface of the supporting member 51a. The second sensor 53 is a microswitch having a detection piece 53a which slightly protrudes upward from the bottom surface of the supporting member 51a. The first sensor 52 is in an ON state when the empty bobbin Bw is in contact with the detection piece 52a, and is in an OFF state when the empty bobbin Bw is not in contact with the detection piece 52a. The second sensor 53 is in an ON state when the empty bobbin Bw is in contact with the detection piece 53a, and is in an OFF state when the empty bobbin Bw is not in contact with the detection piece 53a. The first sensor 52 and the second sensor 53 may not be microswitches, and may be infrared light sensors configured to detect empty bobbins Bw by applying infrared light thereto.

[0051] The detection piece 52a of the first sensor 52 is positioned to be in contact with the third empty bobbin Bw. On this account, when the first sensor 52 is in the ON state, the number of empty bobbins Bw accommodated in the stocker portion 51 is three or more. Meanwhile, when the first sensor 52 is in the OFF state, the number of accommodated empty bobbins Bw is two or less. As such, the first sensor 52 of the present embodiment is able to detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is two or less, and is equivalent to a first sensor of the present invention.

[0052] The detection piece 53a of the second sensor 53 is positioned to be in contact with the second empty bobbin Bw. On this account, when the second sensor 53 is in the ON state, the number of empty bobbins Bw accommodated in the stocker portion 51 is two or more. Meanwhile, when the second sensor 53 is in the OFF state, the number of accommodated empty bobbins Bw is one or less. The second sensor 53 of this case is able to detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is one that is a predetermined number or less, and can be regarded as a first sensor of the present invention.

[0053] In addition to the above, based on the timing to switch on and off the second sensor 53, the control unit 40 is able to determine whether the number of empty bobbins Bw accommodated in the stocker portion 51 is one or 0. The following will describe how the control unit 40 determines the number of accommodated empty bobbins Bw based on the detection by the second sensor 53.

[0054] The empty bobbins Bw are supplied from the empty bobbin supplier 23 to the winding device 21 one by one. Once the empty bobbin Bw is supplied from the empty bobbin supplier 23 to the winding device 21, the next supply of the empty bobbin Bw is not performed until the formation of the wound package Pw is completed and the wound package Pw is detached from the winding device 21. For example, the control unit 40 measures in advance, as a predetermined time, a period of time from the supply of the empty bobbin Bw from the empty bobbin supplier 23 to the winding device 21 to the supply of the next empty bobbin Bw to the winding device 21 after the completion of the formation of the wound package Pw and the detachment of the wound package Pw from the

winding device 21. The predetermined time may not be measured by the control unit 40, and may be input by an operator in advance.

[0055] When the second sensor 53 is in the OFF state and was switched off during the immediately preceding predetermined time, the control unit 40 determines that the number of empty bobbins Bw accommodated in the stocker portion 51 became one from two during the immediately preceding predetermined time. The control unit 40 is therefore able to determine that the number of empty bobbins Bw accommodated in the stocker portion 51 is one.

[0056] Meanwhile, when the second sensor 53 has been in the OFF state for at least the predetermined time, the control unit 40 determines that, after the number of empty bobbins Bw accommodated in the stocker portion 51 became one from two, the empty bobbin Bw was further supplied to the winding device 21 and the number of accommodated bobbins Bw became 0. The control unit 40 is therefore able to determine that the number of empty bobbins Bw accommodated in the stocker portion 51 is 0. As such, the second sensor 53 of the present embodiment is able to detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is 0, and is equivalent to a second sensor of the present invention.

[0057] In the present embodiment, when the first sensor 52 does not detect the empty bobbin Bw whereas the second sensor 53 detects the empty bobbin Bw, it is determined that the number of empty bobbins Bw accommodated in the stocker portion 51 is two.

[0058] The leading end portion 54 is provided at a leading end of the stocker portion 51, which is on the side in the base width direction on which the winding device 21 is provided. An empty bobbin Bw moving along the supporting member 51a which is inclined downward makes contact with the leading end portion 54. In this way, supply of the bobbin to the winding device 21 from the leading end of the stocker portion 51 on the side on which the winding device 21 is provided is prohibited.

[0059] The following will describe how an empty bobbin Bw is supplied from the empty bobbin supplier 23 to the winding device 21. While the yarn Y is being wound by the winding device 21, the empty bobbin supplier 23 is at a standby position where the leading end portion 54 is able to prohibit the movement of the empty bobbin Bw (see FIG. 3). When the wound package Pw formed by the winding device 21 is detached from the winding device 21 by the rotation of the cradle 31, the empty bobbin supplier 23 moves to a supply position where an empty bobbin Bw can be supplied to the winding device 21. To be more specific, the empty bobbin supplier 23 moves to the supply position where the cradle 31 is provided, by rotating about a rotational axis (not illustrated) that is below the stocker portion 51 and extends along the base longitudinal direction. As the empty bobbin supplier 23 moves to the supply position, the prohibition of the movement of the empty bobbin Bw by the leading end portion 54 is canceled, and hence the empty bobbin Bw passes through the leading end of the stocker portion 51 on the side on which the winding device 21 is provided, and reaches the cradle 31. The empty bobbin Bw is then supported by the cradle 31. This is the end of the supply of the empty bobbin Bw from the empty bobbin supplier 23 to the winding device 21. The empty bobbin supplier 23 is rotationally driven by an unillustrated motor.

[0060] The false-twist texturing machine 1 of the present embodiment includes a notification unit 61 which is capable of performing a notification operation of notifying an operator of the necessity of the replenishment of empty bobbins Bw to the stocker portion 51 (see FIG. 5). The notification unit 61 is, for example, a display electrically connected to each empty bobbin supplier 23. The notification unit 61 performs the notification operation by displaying, on the display, a message that empty bobbins Bw need to be replenished to the stocker portion 51. A timing at which the notification unit 61 performs the notification operation will be described later.

(Electric Structure)

[0061] FIG. 5 is a block diagram illustrating an electric structure of the false-twist texturing machine 1. The control unit 40 controls the elements that are the yarn supplying unit 2, the processing unit 3, and the winding unit 4. For the sake of space, FIG. 5 shows that the control unit 40 is connected to one winding device 21 and one empty bobbin supplier 23 among the winding devices 21 and the empty bobbin suppliers 23. In reality, the control unit 40 is connected to the other winding devices 21 and the other empty bobbin suppliers 23, too. The control unit 40 may be provided for each of the winding devices 21 and each of the empty bobbin suppliers 23.

[0062] The control unit 40 is electrically connected to the first sensor 52, the second sensor 53, and the notification unit 61. Information indicating whether the first sensor 52 and the second sensor 53 of the empty bobbin supplier 23 are in the ON state or the OFF state, i.e., information indicating whether the first sensor 52 and the second sensor 53 detect empty bobbins Bw, is supplied to the control unit 40. Based on the information supplied from the first sensor 52 and the second sensor 53, the control unit 40 causes the notification unit 61 to perform the notification operation at a timing set in advance.

(Notification Operation)

[0063] The following will describe the timing at which the control unit 40 causes the notification unit 61 to perform the notification operation.

[0064] When the first sensor 52 detects that the number of empty bobbins Bw accommodated in the stocker portion 51 is two or less, the control unit 40 generates a notification signal by which the necessity of replenishment of empty bobbins Bw to the stocker portion 51 is notified. The control unit 40 then causes the notifi-

cation unit 61 to perform the notification operation by sending the notification signal to the notification unit 61.

[0065] When the second sensor 53 detects that the number of empty bobbins Bw accommodated in the stocker portion 51 is one or less, the control unit 40 generates another notification signal. The control unit 40 then causes the notification unit 61 to perform the notification operation again by sending the notification signal to the notification unit 61. In this case, the control unit 40 may differentiate the notification operation performed by the notification unit 61 when the number of empty bobbins Bw accommodated in the stocker portion 51 is two or less from the notification operation performed by the notification unit 61 when the number of accommodated empty bobbins Bw is one or less. To be more specific, the control unit 40 changes the content of display by the notification unit 61 that is a display, in accordance with the number of empty bobbins Bw accommodated in the stocker portion 51.

[0066] When the second sensor 53 detects that the number of empty bobbins Bw accommodated in the stocker portion 51 is 0, the control unit 40 generates a priority notification signal. The priority notification signal is a notification signal for performing notification in such a way that, when it is detected that the number of empty bobbins Bw accommodated in one of the stocker portions 51 of the empty bobbin suppliers 23 is 0, replenishment of empty bobbins Bw to that stocker portion 51 accommodating no empty bobbin Bw must be prioritized over the replenishment to the other stocker portions 51. The control unit 40 then causes the notification unit 61 to perform the notification operation by sending the priority notification signal to the notification unit 61.

[0067] The control unit 40 controls the notification operations performed by the notification unit 61 such that the notification operation performed by the notification unit 61 when the priority notification signal is sent is discerned from the notification operation performed by the notification unit 61 when a normal notification signal which is not the priority notification signal is sent. For example, the control unit 40 differentiates the content of display on the notification unit 61 that is a display, between the case where the priority notification signal is sent and the case where the normal notification signal is sent.

[0068] As described above, when the first sensor 52 does not detect the empty bobbin Bw whereas the second sensor 53 detects the empty bobbin Bw, it is detected that the number of empty bobbins Bw accommodated in the stocker portion 51 is two. In addition to the notification operation, the control unit 40 may control the notification unit 61 so that information indicating that the number of empty bobbins Bw accommodated in the stocker portion 51 is two is displayed on the display. When the first sensor 52 detects that the number of empty bobbins Bw accommodated in the stocker portion operating is three or more, the control unit 40 may control the notification unit 61 so that information indicating that the number of empty bobbins Bw accommodated in the stocker portion 51 is three or more is displayed on the display, in addition to the notification operation.

[0069] When the second sensor 53 detects that the number of empty bobbins Bw accommodated in the stocker portion 51 is 0, the control unit 40 controls the winding device 21 corresponding to that stocker portion 51 not to perform winding again after the completion of the formation of the wound package Pw.

(Effects)

[0070] In the false-twist texturing machine 1 of the present embodiment, when the first sensor 52 and the second sensor 53 detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is equal to or less than a predetermined number, the control unit 40 generates a notification signal by which the necessity of the replenishment of empty bobbins Bw to the stocker portion 51 is notified. In the present embodiment, the predetermined number is two, one, or zero. By sending the notification signal to the notification unit 61, the control unit 40 causes the notification unit 61 to perform the notification operation of notifying an operator of the necessity of the replenishment of empty bobbins Bw to the stocker portion 51. With this arrangement, when replenishment of empty bobbins Bw to the stocker portion 51 is performed by an operator, the operator is able to grasp, by the notification operation by the notification unit 61, a timing to replenish the empty bobbins Bw to each of all empty bobbin suppliers 23 corresponding to the winding devices 21. On this account, the operator or the like is prevented from forgetting to replenish empty bobbins Bw to the stocker portion 51 of the empty bobbin supplier 23n and also the occurrence of a failure in winding of a yarn Y by the winding device 21is prevented.

[0071] In the present embodiment, the empty bobbin supplier 23 includes the first sensor 52 configured to detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is two or less and the second sensor 53 configured to detect that the number of accommodated empty bobbins Bw is one or less. With this arrangement, the control unit 40 is able to generate the notification signal in advance before the number of empty bobbins Bw accommodated in the stocker portion 51 becomes 0. It is therefore possible to prevent the delay of replenishment of empty bobbins Bw to the stocker portion 51.

[0072] In the present embodiment, the empty bobbin supplier 23 includes the second sensor 53 configured to detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is 0. This makes it possible to generate the notification signal when the number of empty bobbins Bw accommodated in the stocker portion 51 becomes 0. On this account, it is possible to grasp a timing of urgent need of replenishment of empty bobbins Bw as the number of empty bobbins Bw accommodated in the stocker portion 51 becomes 0.

[0073] In the present embodiment, when it is detected that the number of empty bobbins Bw accommodated in one of the stocker portions 51 is 0, the control unit 40 generates the priority notification signal for the stocker portion 51 in which the number of accommodated empty bobbins Bw is 0. With this arrangement, because the replenishment of the empty bobbins Bw is performed based on the priority notification signal, the replenishment of the empty bobbins Bw to the stocker portion 51 in which the number of accommodated empty bobbins Bw is 0 is prioritized over the replenishment to the other stocker portions 51. It is therefore possible to avoid a situation in which the supply of empty bobbins Bw from the empty bobbin supplier 23 to the winding device 21 is not performed.

[0074] In the present embodiment, when the number of empty bobbins Bw accommodated in the stocker portion 51 is 0, the control unit 40 controls the winding device 21 corresponding to that stocker portion 51 not to perform winding again after the completion of the formation of the wound package Pw. With this arrangement, when the number of empty bobbins Bw accommodated in a stocker portion 51 becomes 0, the winding device 21 corresponding to that stocker portion 51 does not resume the winding after the completion of the formation of the wound package Pw. It is therefore possible to avoid the occurrence of malfunction that is entanglement of the yarn Y onto the winding device 21 that resumed winding in the absence of the winding bobbin Bw.

[0075] In the present embodiment, there are two sensors (the first sensor 52 and the second sensor) which correspond to different predetermined numbers, respectively, and which detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is equal to or less than those predetermined numbers, respectively. With these two sensors, it is possible to grasp the number of empty bobbins Bw accommodated in the stocker portion 51, in a detailed manner. On this account, it is easy to adjust at which timing the necessity of replenishment of empty bobbins Bw is notified, in accordance with, for example, the situation.

(Modifications)

[0076] The following will describe modifications of the above-described embodiment. The members identical with those in the embodiment above will be denoted by the same reference numerals, and the explanations thereof are not repeated.

[0077] In the embodiment above, the control unit 40 causes the notification unit 61 to perform the notification operation by sending the notification signal to the notification unit 61. Alternatively, the control unit 40 may send the notification signal to a device different from the notification unit 61. For example, in a false-twist texturing machine 101, a control unit 140 sends a notification signal to an empty bobbin replenishment robot 161 (equivalent to an empty take-up tube replenishment robot of the present invention) (see FIG. 6). The empty bobbin replenishment robot 161 is a device capable of automatically performing a replenishment operation of replenishing empty bobbins Bw to a stocker portion 51. For example, the empty bobbin replenishment robot 161 is able to perform reciprocal movement along the base longitudinal direction, and is able to automatically replenish empty bobbins Bw to each stocker portion 51 by moving members such as a robotic arm and a conveyor. The control unit 140 causes the empty bobbin replenishment robot 161 to perform the replenishment operation of replenishing empty bobbins Bw by sending a notification signal thereto. With this arrangement, when replenishment of empty bobbins Bw to the stocker portion 51 is automatically done by the empty bobbin replenishment robot 161, the timing of the replenishment operation can be suitably controlled.

[0078] In addition to the above, in the false-twist texturing machine 101 having the empty bobbin replenishment robot 161, a empty bobbin supplier 123 may include a third sensor 154 which is configured to detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is at the maximum (see FIG. 7). A detection piece 154a of the third sensor 154 is positioned to be in contact with the fourth empty bobbin Bw. When the third sensor 154 is in the ON state, the number of empty bobbins Bw accommodated in the stocker portion 51 is four. Meanwhile, when the third sensor 154 is in the OFF state, the number of accommodated empty bobbins Bw is three or less. The third sensor 154 in this case is able to detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is three that is a predetermined number or less, and can be regarded as the first sensor of the present invention. Furthermore, the third sensor 154 is able to detect that the number of accommodated empty bobbins Bw is the maximum four, and is equivalent to a third sensor of the present invention.

[0079] The control unit 140 controls the empty bobbin replenishment robot 161 not to perform the replenishment operation when the third sensor 154 detects that the stocker portion 51 stores the maximum number of empty bobbins Bw. With this arrangement, when the replenishment of empty bobbins Bw to the stocker portion 51 is automatically done by the empty bobbin replenishment robot 161, it is possible to prevent the replenishment operation from being performed when the maximum number of empty bobbins Bw are accommodated in the stocker portion 51. It is therefore possible to prevent the empty bobbins Bw from overflowing from the stocker portion 51.

[0080] When causing the empty bobbin replenishment robot 161 to perform the replenishment operation, the control unit 140 may continue the replenishment operation until the third sensor 154 detects that the maximum number of empty bobbins Bw are accommodated. With this arrangement, when the replenishment of empty bobbins Bw to the stocker portion 51 is automatically done

by the empty bobbin replenishment robot 161, it is possible to replenish the maximum number of empty bobbins Bw by a single replenishment operation.

[0081] In the embodiment above, the third sensor 154 may be provided. In this case, when the third sensor 154 detects that the stocker portion 51 stores the maximum number of empty bobbins Bw, the control unit 40 may cause the notification unit 61 to give a notification indicating that replenishment of empty bobbin Bw to the stocker portion cannot be done.

[0082] In the embodiment above, the second sensor 53 may be positioned to be able to detect the first empty bobbin Bw when one or more empty bobbin Bw is accommodated in the stocker portion 51. In this case, the second sensor 53 is a sensor detecting that the number of empty bobbins Bw accommodated in the stocker portion 51 is one or more, or is 0. In other words, in this case, the second sensor 53 is equivalent to the second sensor of the present invention.

[0083] In the present invention, the empty bobbin supplier 23 may have four sensors. In this case, the four sensors are provided at four positions where the first, second, third, and fourth empty bobbins Bw are detectable when four empty bobbins Bw are accommodated in the stocker portion 51, respectively. Alternatively, the empty bobbin supplier 23 may have only one sensor.

[0084] In the embodiment above, the control unit 40 may generate a notification signal only when the first sensor 52 detects that the number of empty bobbins Bw accommodated in the stocker portion 51 is two or less. The control unit 40 may generate a notification signal only when the second sensor 53 detects that the number of empty bobbins Bw accommodated in the stocker portion 51 is one or less. Moreover, the control unit 40 may generate a notification signal only when the second sensor 53 detects that the number of empty bobbins Bw accommodated in the stocker portion 51 is 0. In any case, the control unit 40 generates a notification signal and causes the notification unit 61 to perform the notification operation when one of or both of the first sensor 52 and the second sensor 53 detect that the number of empty bobbins Bw accommodated in the stocker portion 51 is equal to or less than a predetermined number. A timing at which the control unit 40 generates a notification signal is set in advance at a timing at which the replenishment of empty bobbins Bw is most unlikely to be forgotten, in accordance with the number of empty bobbin suppliers 23 per false-twist texturing machine 1, a current situation such as the number of operators in charge of replenishment of empty bobbins Bw, etc.

[0085] In the embodiment above, when the second sensor 53 detects that the number of empty bobbins Bw accommodated in the stocker portion 51 is 0, the control unit 40 generates a priority notification signal. Alternatively, when the second sensor 53 detects that the number of empty bobbins Bw accommodated in the stocker portion 51 is 0, the control unit 40 may generate a normal notification signal that is not the priority notification signal.

[0086] In the present embodiment, the stocker portion 51 is able to accommodate four empty bobbins Bw. In this regard, the stocker portion 51 may be able to accommodate two or three empty bobbins Bw, or may be able to accommodate 5 or more empty bobbins Bw. The sensors may be provided in accordance with the number of empty bobbins Bw accommodatable in the stocker portion 51. For example, when the stocker portion 51 is able to accommodate n (n=two or more) empty bobbins Bw, n sensors may be provided. In this case, the n sensors are provided at n positions where the first to n-th empty bobbins Bw are detectable when n empty bobbins Bw are accommodated in the stocker portion 51, respectively. Alternatively, when the stocker portion 51 is able to accommodate n empty bobbins Bw, the number of provided sensors may be any number from one to n-1.

[0087] In the embodiment above, the notification unit 61 is a display electrically connected to each empty bobbin supplier 23. Alternatively, the notification unit 61 may be a lamp attached to each empty bobbin supplier 23, for example. In this case, the control unit 40 turns on the lamp of the notification unit 61 corresponding to the stocker portion 51 in which the number of accommodated empty bobbins Bw becomes equal to or less than a predetermined number, by sending a notification signal to the notification unit 61. An operator is able to understand that replenishment of empty bobbins Bw is necessary at the stocker portion 51 of the empty bobbin supplier 23 corresponding to the lamp having been turned on. The control unit 40 may differentiate the color of the lamp turned on by the notification unit 61 between a case where a priority notification signal is sent to the notification unit 61 and a case where a normal notification signal that is not the priority notification signal is sent to the notification unit 61. This makes it possible to discern whether the notification operation by the notification unit 61 is performed in response to the priority notification signal or in response to the normal notification signal that is not the priority notification signal.

[0088] The notification unit 61 may be a device outputting sound, for example. In this case, the notification unit 61 may be attached to each empty bobbin supplier 23, or may be a single notification unit 61 shared between plural empty bobbin suppliers 23. When the notification unit 61 is attached to each empty bobbin supplier 23, the control unit 40 causes the notification unit 61 corresponding to the stocker portion 51 in which the number of accommodated empty bobbins Bw becomes equal to or less than a predetermined number to generate sound, by sending a notification signal to the notification unit 61. When the notification unit 61 is a single notification unit 61 shared between plural empty bobbin suppliers 23, the control unit 40 causes the notification unit 61 to generate sound notifying the stocker portion 51 in which the number of empty bobbins Bw accommodated becomes equal to or less than a predetermined number, by sending a notification signal to the notification unit 61. The control

unit 40 may differentiate the sound pattern generated by the notification unit 61 between a case where a priority notification signal is sent to the notification unit 61 and a case where a normal notification signal that is not the priority notification signal is sent to the notification unit 61. This makes it possible to discern whether the notification operation by the notification unit 61 is performed in response to the priority notification signal or in response to the normal notification signal that is not the priority notification signal.

Claims

1. A false-twist texturing machine (1, 101) comprising:

winding devices (21) each of which is configured to form a package (Pw) by winding a yarn (Y) onto a take-up tube (Bw);
empty take-up tube suppliers (23, 123) which are provided for the respective winding devices (21) and each of which supplies an empty take-up tube (Bw) to each of the winding devices (21); and
a control unit (40, 140),
each of the empty take-up tube suppliers (23, 123) includes a stocker portion (51) capable of accommodating empty take-up tubes (Bw) and at least one sensor (52, 53, 154) configured to detect that the number of the empty take-up tubes (Bw) accommodated in the stocker portion (51) is equal to or less than a predetermined number,
when the at least one sensor (52, 53, 154) detects that the number of the empty take-up tubes (Bw) accommodated in the stocker portion (51) is equal to or less than the predetermined number, the control unit (40, 140) generating a notification signal indicating necessity of replenishment of the empty take-up tubes (Bw) to the stocker portion (51).

2. The false-twist texturing machine (1, 101) according to claim 1, wherein, the at least one sensor (52, 53, 154) includes a first sensor (52, 53, 154) which is configured to detect that the number of the empty take-up tubes (Bw) accommodated in the stocker portion (51) is equal to or less than a first predetermined number that is the predetermined number and is one or more.

3. The false-twist texturing machine (1, 101) according to claim 1 or 2, wherein, the at least one sensor (52, 53, 154) includes a second sensor (53) which is configured to detect that the number of the empty take-up tubes (Bw) accommodated in the stocker portion (51) is 0.

4. The false-twist texturing machine (1, 101) according to claim 3, wherein, the notification signal includes a priority notification signal which notifies that, when the second sensor (53) detects that the number of the empty take-up tubes (Bw) accommodated in one of stocker portions (51) of the empty take-up tube suppliers (23, 123) is 0, replenishment of empty take-up tubes (Bw) to the one of the stocker portions (51) accommodating no empty take-up tube (Bw) must be prioritized over replenishment to the other stocker portions (51).

5. The false-twist texturing machine (1, 101) according to claim 3 or 4, wherein, when the number of the empty take-up tubes (Bw) accommodated in one of the stocker portions (51) is 0, the control unit (40, 140) controls the winding device (21) corresponding to the one of the stocker portions (51) not to perform winding again after the winding device (21) completes formation of the package (Pw).

6. The false-twist texturing machine (1, 101) according to any one of claims 1 to 5, wherein,

the at least one sensor (52, 53, 154) includes two or more sensors (52, 53, 154), and
each of the two or more sensors (52, 53, 154) is a sensor (52, 53, 154) configured to detect that the number of the accommodated take-up tubes (Bw) is equal to or less than the predetermined number that is different from each other.

7. The false-twist texturing machine (1, 101) according to any one of claims 1 to 6, further comprising

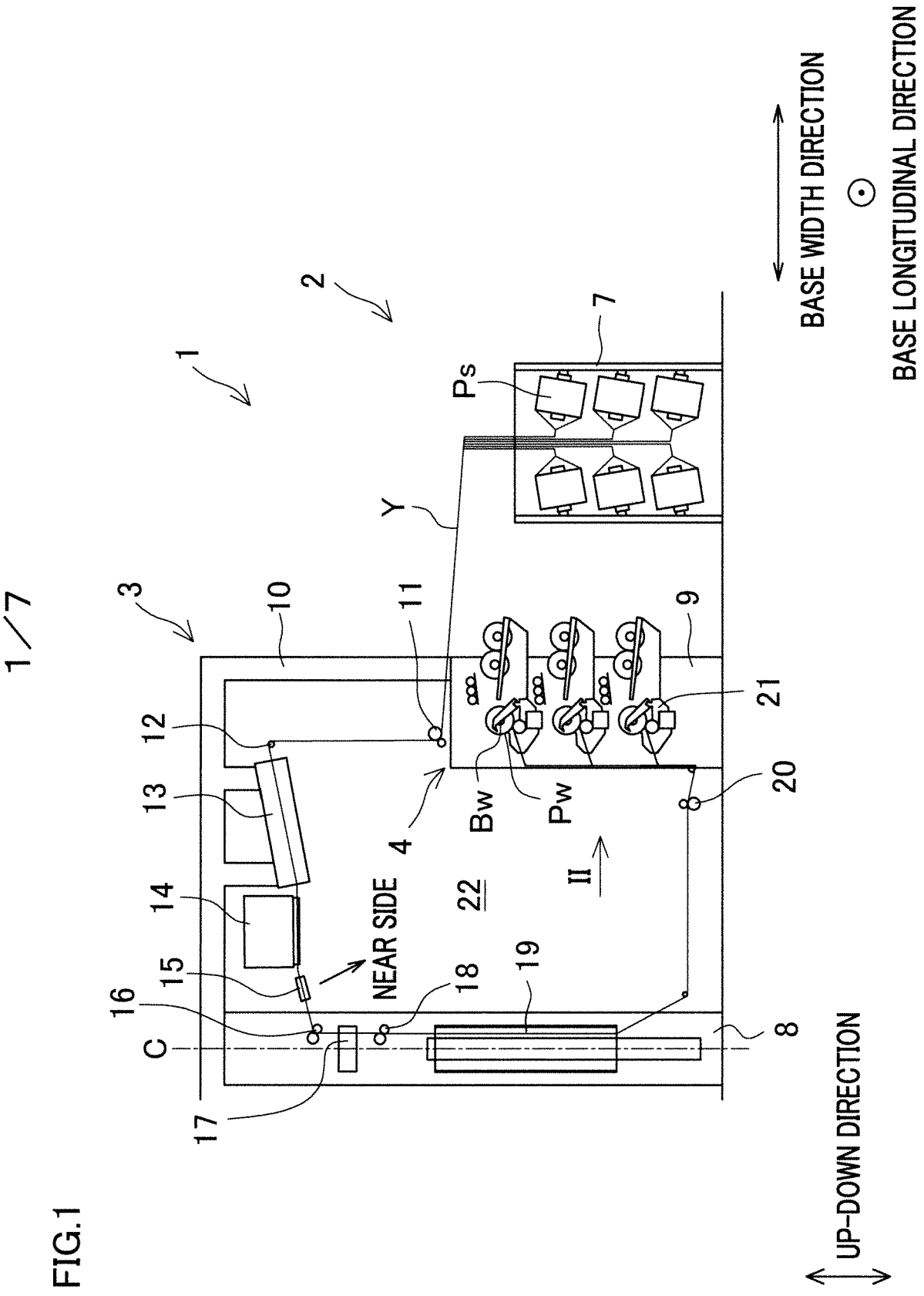
a notification unit (61) which is capable of performing a notification operation of notifying an operator of the necessity of replenishment of the empty take-up tubes (Bw) to the stocker portion (51),
the control unit (40, 140) causing the notification unit (61) to perform the notification operation by sending the notification signal to the notification unit (61).

8. The false-twist texturing machine (1, 101) according to any one of claims 1 to 6, further comprising

an empty take-up tube replenishment robot (161) which is capable of automatically performing a replenishment operation of replenishing the empty take-up tubes (Bw) to the stocker portion (51),
the control unit (40, 140) causing the empty take-up tube replenishment robot (161) to perform the replenishment operation by sending the notification signal to the empty take-up tube replenishment robot (161).

9. The false-twist texturing machine (1, 101) according to claim 8, wherein,

the at least one sensor (52, 53, 154) includes a third sensor (154) which is capable of detecting that the number of the empty take-up tubes (Bw) accommodated in the stocker portion (51) is at the maximum, and
when the third sensor (154) detects that the number of the empty take-up tubes (Bw) accommodated in the stocker portion (51) is at the maximum, the control unit (40, 140) controls the empty take-up tube replenishment robot (161) not to perform the replenishment operation.


1/7
FIG.1
1
2
3
4
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Ps
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Bw
Pw
II
C
NEAR SIDE
BASE WIDTH DIRECTION
BASE LONGITUDINAL DIRECTION
UP-DOWN DIRECTION

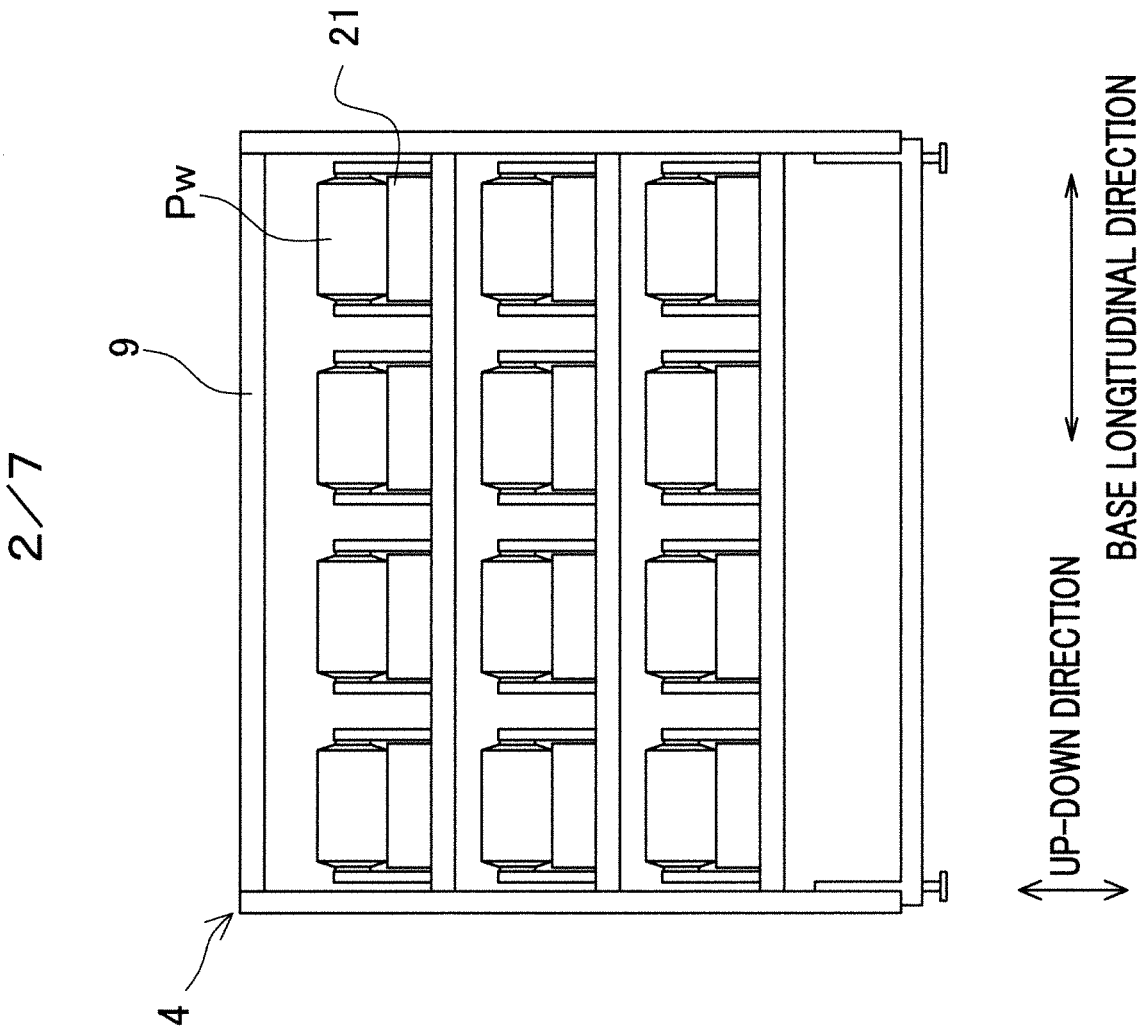


FIG.2

FIG.3

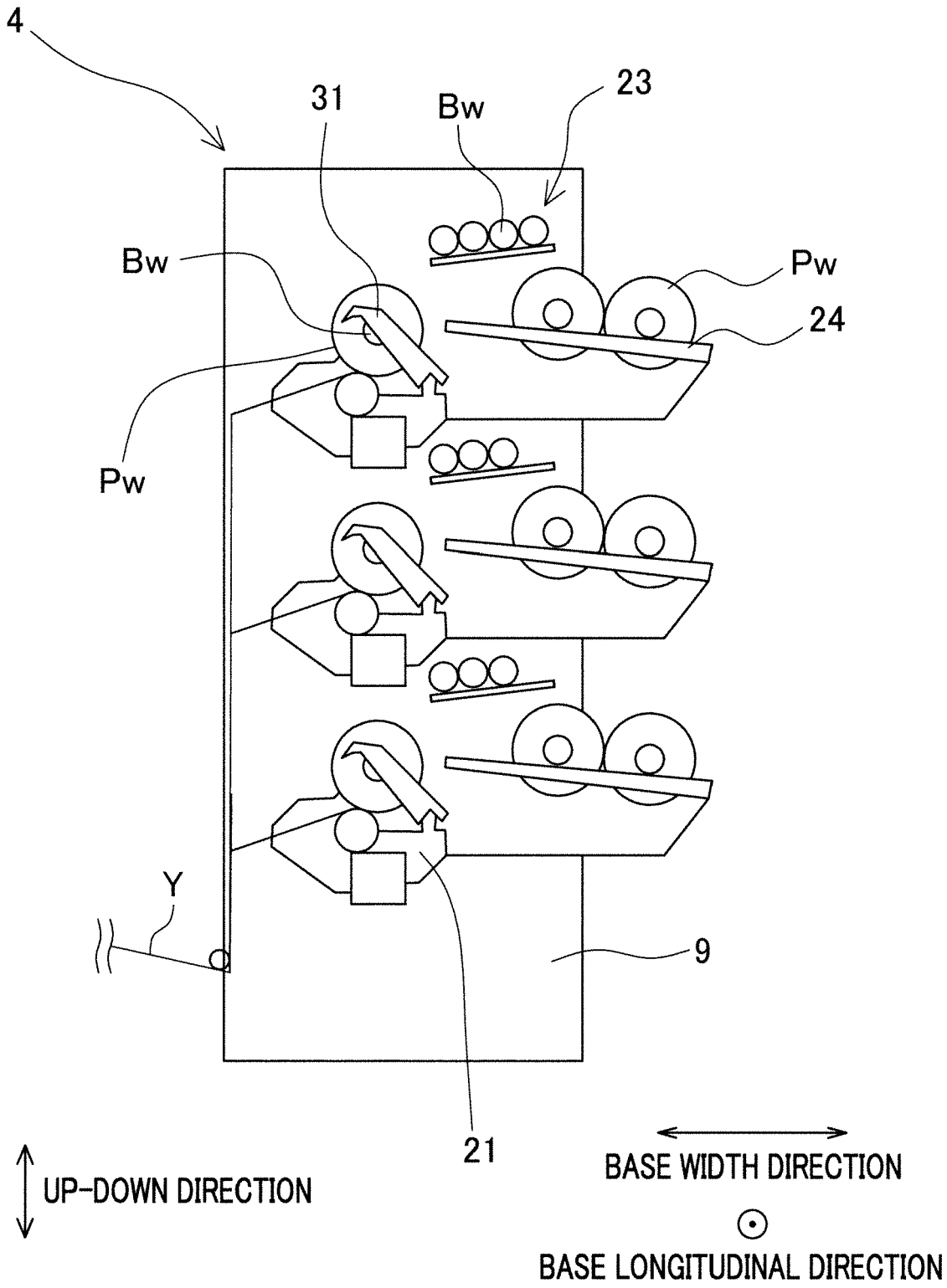
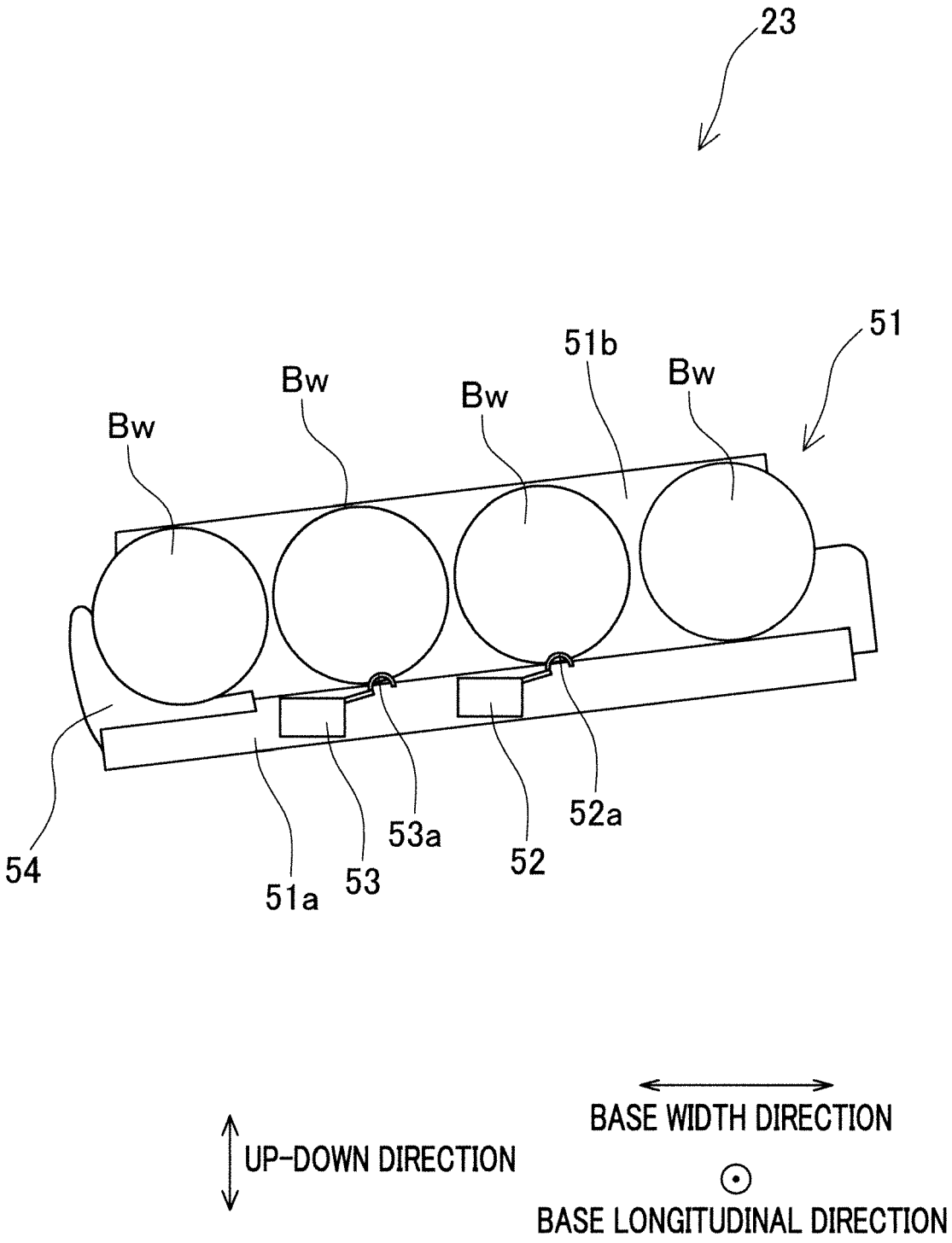

4
31
Bw
23
Bw
Pw
24
Pw
Y
9
21
UP-DOWN DIRECTION
BASE WIDTH DIRECTION
BASE LONGITUDINAL DIRECTION

FIG.4


23
51
51b
Bw
Bw
Bw
Bw
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51a
53
53a
52
52a
UP-DOWN DIRECTION
BASE WIDTH DIRECTION
BASE LONGITUDINAL DIRECTION

FIG.5

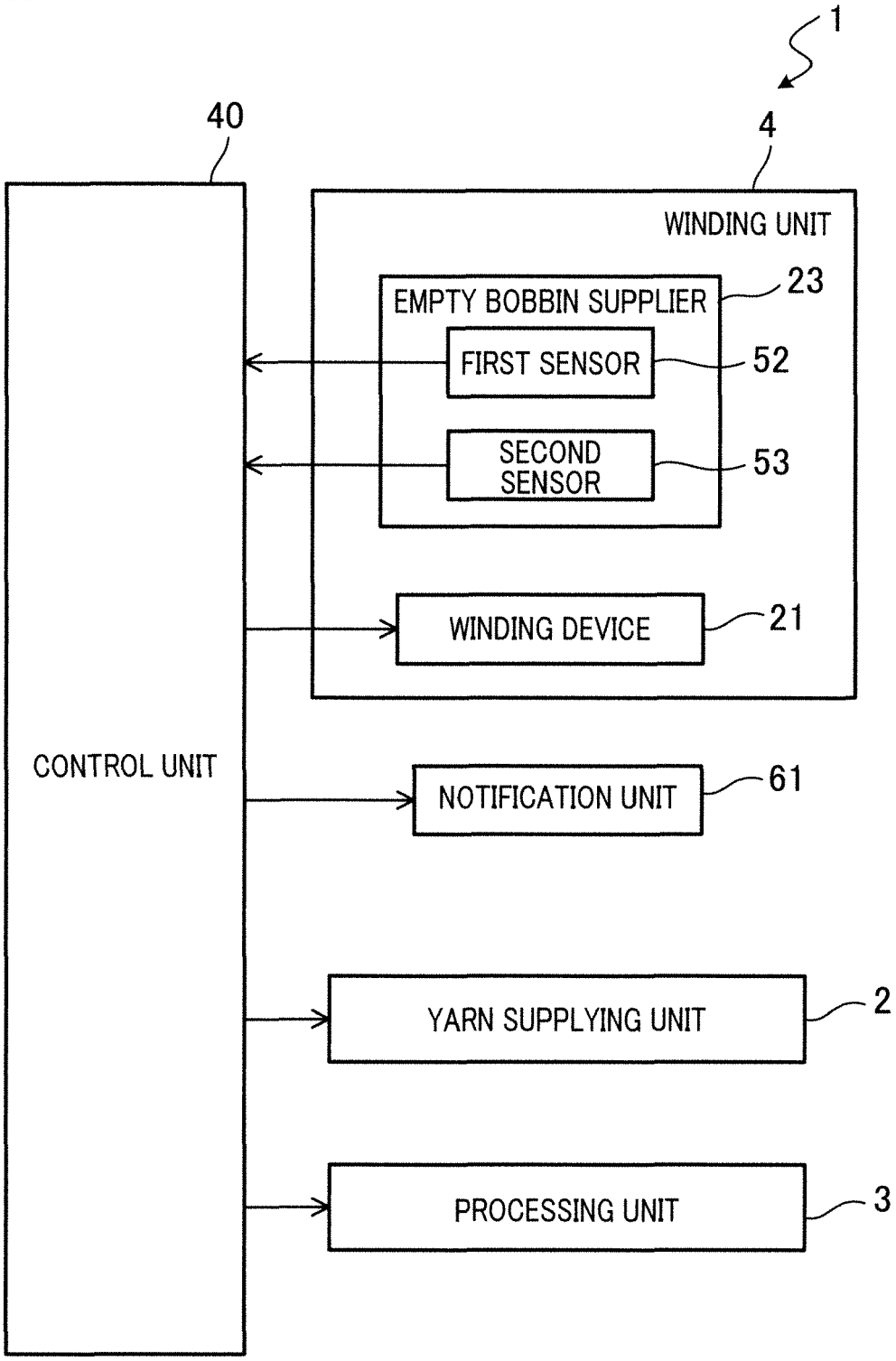
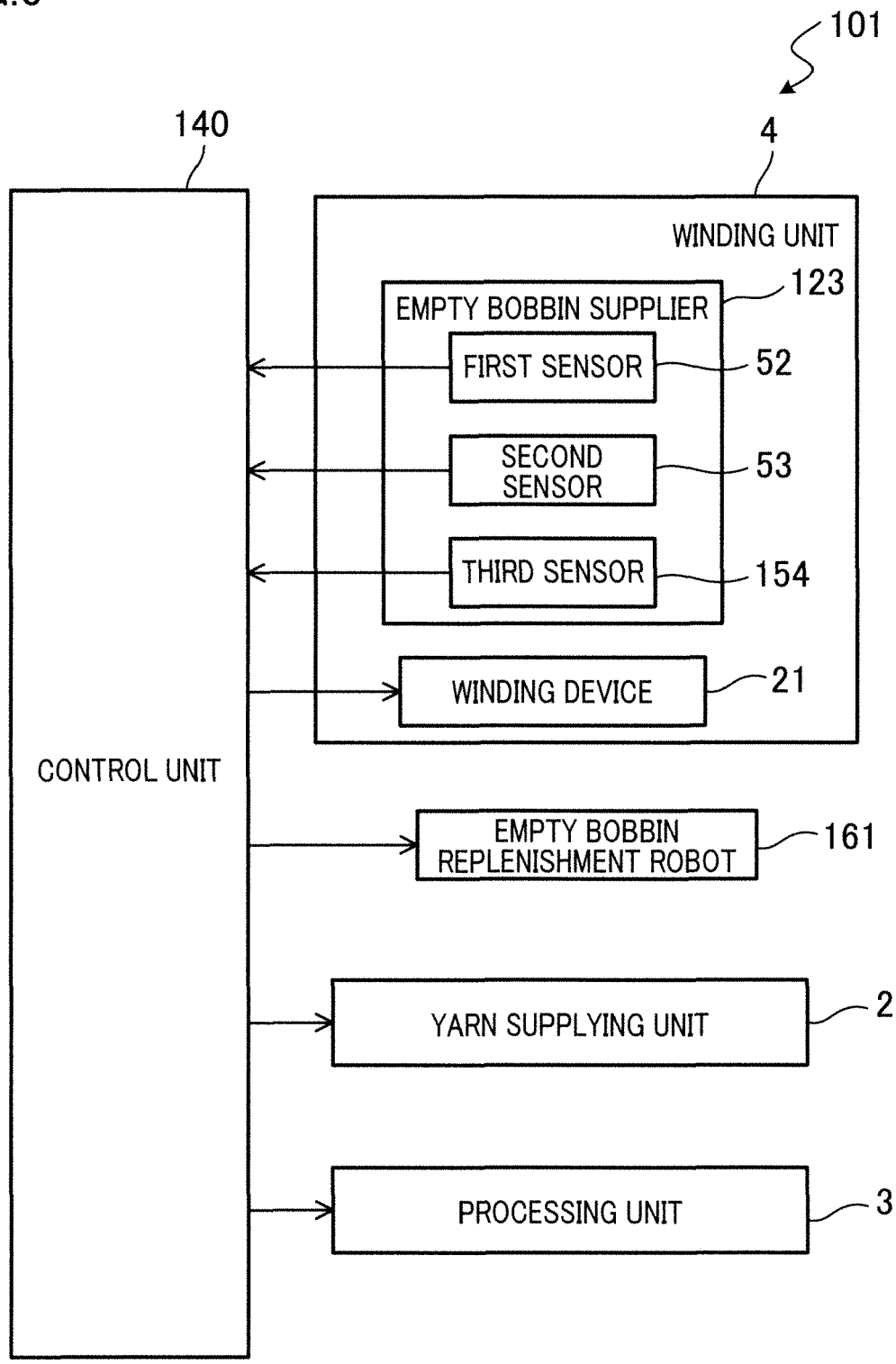

1
40
4
WINDING UNIT
EMPTY BOBBIN SUPPLIER
23
FIRST SENSOR
52
SECOND SENSOR
53
WINDING DEVICE
21
CONTROL UNIT
NOTIFICATION UNIT
61
YARN SUPPLYING UNIT
2
PROCESSING UNIT
3

FIG.6


101
140
4
WINDING UNIT
123
EMPTY BOBBIN SUPPLIER
FIRST SENSOR
52
SECOND SENSOR
53
THIRD SENSOR
154
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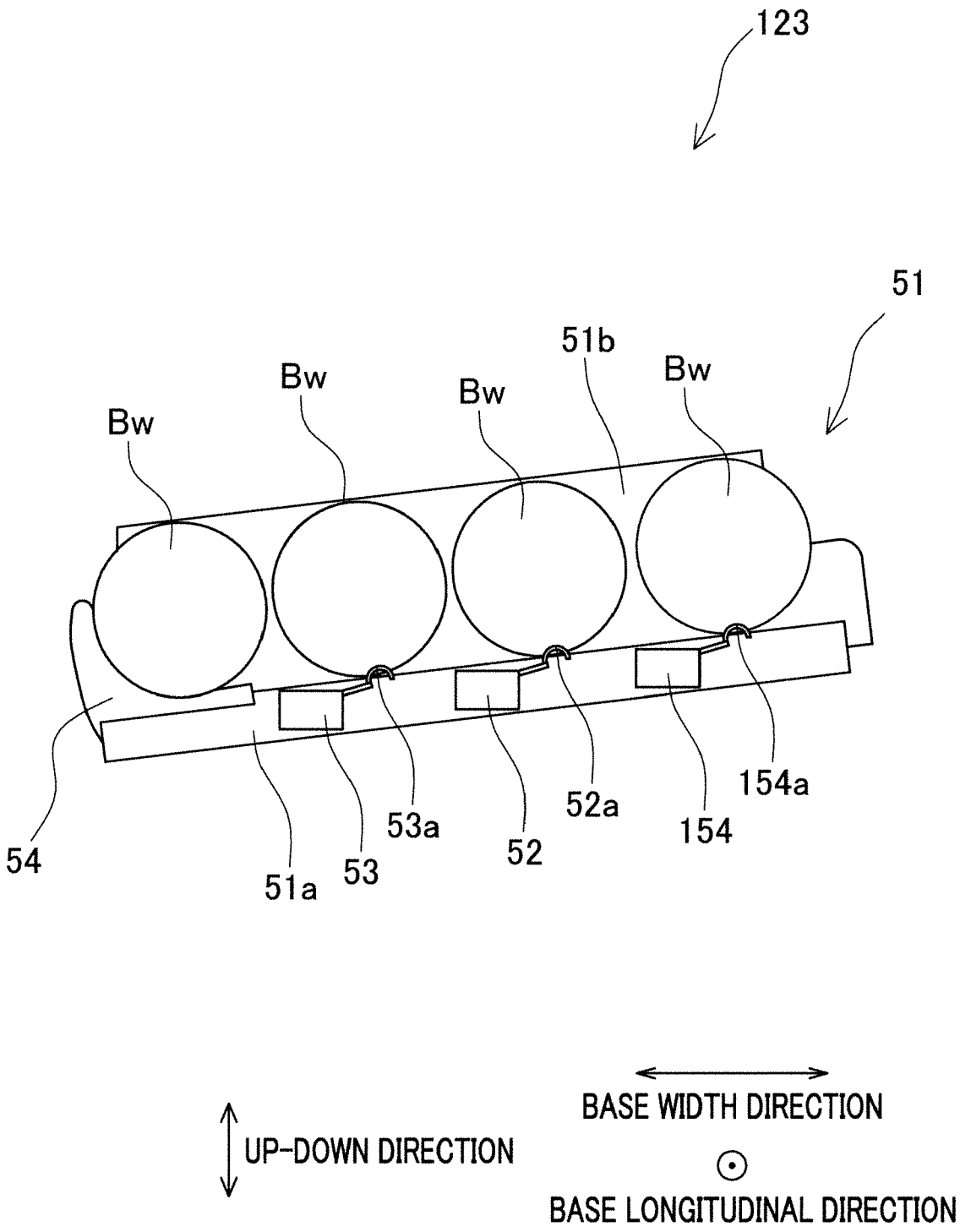
CONTROL UNIT
EMPTY BOBBIN REPLENISHMENT ROBOT
161
YARN SUPPLYING UNIT
2
PROCESSING UNIT
3

FIG.7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51b
Bw
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53
53a
52
52a
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154a
UP-DOWN DIRECTION
BASE WIDTH DIRECTION
BASE LONGITUDINAL DIRECTION

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 5093

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 October 2022	Lemmen, René

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 17 5093

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