



(11)

EP 4 556 420 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.05.2025 Bulletin 2025/21

(51) International Patent Classification (IPC):
B65H 54/54 ^(2006.01) **B65H 67/04** ^(2006.01)
B65H 67/06 ^(2006.01)

(21) Application number: **24207174.4**

(52) Cooperative Patent Classification (CPC):
B65H 54/54; B65H 67/04; B65H 67/0417;
B65H 67/068; B65H 2701/31

(22) Date of filing: **17.10.2024**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

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(30) Priority: **16.11.2023 JP 2023194927**
17.05.2024 JP 2024080661

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(54) **WINDING SYSTEM**

(57) To suppress a decrease in package production efficiency of a winding system.

A winding unit 4 includes a plurality of winding devices 21 and a controller 80. The winding device 21 includes a cradle arm 30, a stocker 60, a package storage unit 50, a winding roller 40, and a swing drive unit 82. The swing drive unit 82 is configured to be able to locate the cradle arm 30 at a receiving position where the bobbin Bw is received from the stocker 60 and a discharging position where the bobbin Bw is discharged to the package storage unit 50. The controller 80 is configured to be able to select, independently of one another for each of the plurality of winding devices 21, a predetermined winding mode and a bobbin discharging mode different from the winding mode. In the bobbin discharging mode, the controller 80 causes a bobbin holder 31 of the cradle arm 30 located at the receiving position to receive the bobbin Bw from the stocker 60, and releases the bobbin Bw from the bobbin holder 31 of the cradle arm 30 located at the discharging position without causing the bobbin Bw to wind a yarn Y.

FIG.6

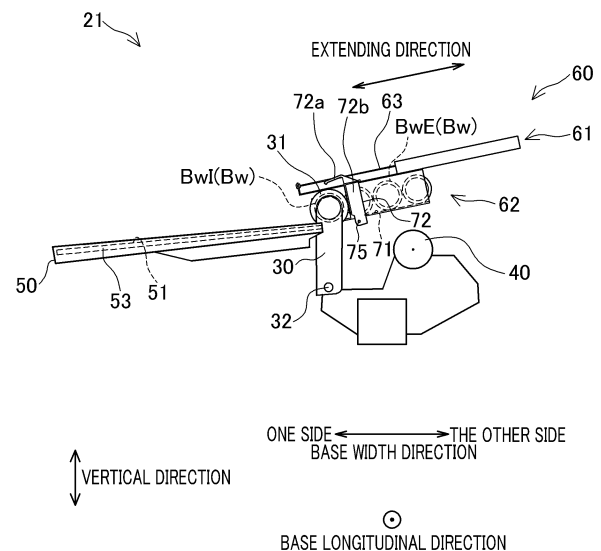
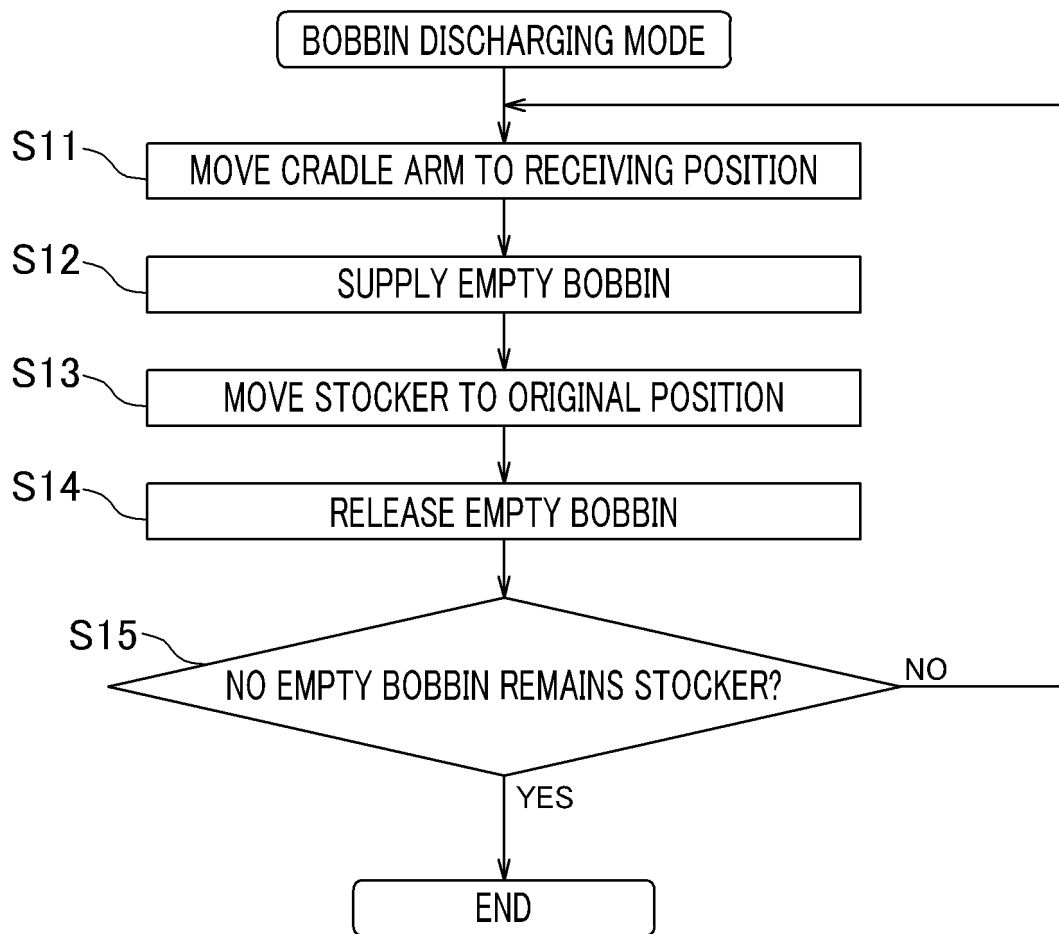


FIG.10



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a winding system.

[0002] JP 7-126931 A discloses a winding system provided in a draw texturing machine (draw texturing machine of JP 7-126931 A), the winding system including a plurality of winding devices (doffing device of JP 7-126931 A). The winding device includes a bobbin supporter (swing arm of JP 7-126931 A) that rotatably supports a bobbin, and a winding roller (friction roller of JP 7-126931 A). The winding device winds a yarn around a bobbin supported by the bobbin supporter to form a package. Describing in detail, the winding device rotationally drives the winding roller in a state where the winding roller is brought into contact with an outer circumference of the bobbin or an outer circumference of the package formed by winding the yarn around the bobbin. Thus, the bobbin rotates with the winding roller, and the yarn is wound around the bobbin to form the package.

[0003] In addition, the winding device of JP 7-126931 A includes a package storage unit (package stocker of JP 7-126931 A) that stores the package delivered from the bobbin supporter, and a stocker (bobbin supplier of JP 7-126931 A) that stores a bobbin to be newly supplied to the bobbin supporter. The fully wound package in which the yarn is wound around the bobbin is delivered from the bobbin supporter to the package storage unit. Then, the bobbin (hereinafter, an empty bobbin) around which the yarn is not wound is newly supplied from the stocker to the bobbin supporter.

[0004] In such a winding device, the production lot may be switched along with, e.g., a change in brand of the package. When the production lot is switched, in general, the type of bobbin (e.g., the color, the pattern, and the like of the bobbin) is changed so as to enables the operator to recognize that the production lot has been switched or in order to avoid mixing with other yarn types in a subsequent process. When the type of bobbin is changed, first, the empty bobbin remaining in the stocker is taken out, and then an empty bobbin of a different type is newly stored in the stocker.

[0005] However, the general winding system as described in JP 7-126931 A is installed with a plurality of winding devices. Then, for each of the plurality of winding devices, it is troublesome for the operator to manually take out the empty bobbin from the stocker. Therefore, the winding device of JP 7-126931 A has a configuration in which an empty bobbin can be automatically discharged from the stocker by, after supplying the empty bobbin in the stocker to the bobbin supporter, moving the bobbin supporter on the package storage unit side without winding the yarn around the empty bobbin, and delivering the empty bobbin to the package storage unit. This reduces time and labor of the operation as compared

with a case where the operator manually takes out the empty bobbin from the stocker.

SUMMARY OF THE INVENTION

[0006] However, in the winding system of JP 7-126931 A, switching between the operation of the winding device for winding the yarn around the bobbin (hereinafter, winding operation) and the operation of the winding device for discharging an empty bobbin (hereinafter, bobbin discharging operation) is collectively performed in all the winding devices. Therefore, even in a case where it becomes necessary to discharge the empty bobbin for only some winding devices of the plurality of winding devices while the plurality of winding devices are executing the winding operation, all the winding devices need to be switched from the winding operation to the bobbin discharging operation. Then, the production of the package is interrupted in all the winding devices until the bobbin discharging operation is completed, and the production efficiency of the package of the winding system is greatly reduced.

[0007] An object of the present invention is to suppress a decrease in package production efficiency of a winding system.

[0008] A winding system of the present invention includes: a plurality of winding devices that wind a yarn around a bobbin to form a package; and a controller that controls the plurality of winding devices, wherein each of the plurality of winding devices includes a bobbin supporter configured to be able to rotatably support the bobbin and to be able to release the bobbin, a stocker that stores the bobbin supplied to the bobbin supporter, a bobbin discharge unit to which the bobbin released from the bobbin supporter is discharged, a winding roller that is rotatable while making contact with the bobbin or the package, and a movement mechanism that can move the bobbin supporter, the movement mechanism is configured to be able to locate the bobbin supporter at a receiving position, which is a position at which the bobbin is received from the stocker, a winding position, which is a position at which the yarn can be started to be wound around the bobbin by rotating the bobbin while making contact with the winding roller, and a discharging position, which is a position at which the bobbin is discharged to the bobbin discharge unit, and the controller is configured to be able to select, independently of one another for each of the plurality of winding devices, as a mode of control of the bobbin supporter and the movement mechanism, a winding mode of causing the bobbin supporter located at the receiving position to receive the bobbin from the stocker, locating the bobbin supporter caused to support the bobbin from the receiving position to the winding position, and causing the bobbin to wind the yarn, and a bobbin discharging mode of causing the bobbin supporter located at the receiving position to receive the bobbin from the stocker, and causing the bobbin supporter located at the discharging position to

release the bobbin without causing the bobbin to wind the yarn.

[0009] According to the present invention, when it becomes necessary to discharge an empty bobbin from the stocker for some winding devices of the plurality of winding devices, only the control mode of the some winding devices can be set to the bobbin discharging mode, and the control mode of the remaining winding devices can be left in the winding mode. Hence, while discharging the empty bobbin from some of the winding devices, the remaining winding devices can be caused to continuously wind the yarn around the bobbin, and a decrease in the package production efficiency of the entire winding system can be suppressed.

[0010] In the winding system of the present invention, it is preferable that, in the bobbin discharging mode, the controller causes the bobbin supporter located at the receiving position to receive the bobbin from the stocker, and releases the bobbin from the bobbin supporter located at the discharging position while maintaining a state where the bobbin and the winding roller are separated from each other.

[0011] According to the present invention, in the bobbin discharging mode, it is possible to discharge an empty bobbin to the bobbin discharge unit while avoiding the empty bobbin and the winding roller from making contact with each other. This can suppress the quality of the empty bobbin from deteriorating due to the contact between the empty bobbin and the winding roller.

[0012] In the winding system of the present invention, the stocker preferably includes a supply mechanism that moves the bobbin between a supply position at which the bobbin is supplied to a bobbin supporter located at the receiving position and a standby position separated from the supply position.

[0013] According to the present invention, it is possible to supply the bobbin from the stocker to the bobbin supporter without moving the bobbin supporter to the stocker side. Therefore, it is not necessary to perform the operation of moving the bobbin supporter to the stocker side when receiving the bobbin and the operation of returning the bobbin supporter to the original position (i.e., the position opposite to the stocker side) thereafter. In other words, it is not necessary to move the bobbin supporter caused to support the empty bobbin. This can reduce the risk of unintentional contact between the empty bobbin supported by the bobbin supporter and the winding roller after the empty bobbin is supplied from the stocker to the bobbin supporter.

[0014] In the winding system of the present invention, it is preferable that the stocker includes a stocker main body that stores the bobbin, and the supply mechanism moves the bobbin between the supply position and the standby position by moving the stocker main body.

[0015] According to the present invention, it is possible to supply the bobbin from the stocker to the bobbin supporter by moving the stocker main body with respect to the bobbin supporter. Therefore, it is not necessary to

move the bobbin supporter caused to support the empty bobbin after the empty bobbin is supplied from the stocker to the bobbin supporter, and it is possible to reduce the risk of unintentional contact between the empty bobbin and the winding roller.

[0016] In the winding system of the present invention, the receiving position and the discharging position are preferably the same position.

[0017] According to the present invention, in the bobbin discharging mode, it is not necessary to move the bobbin supporter from when the bobbin supporter located at the receiving position is caused to receive the bobbin to when the bobbin is released from the bobbin supporter located at the discharging position. Therefore, it is possible to further reduce the risk of unintentional contact between the empty bobbin supported by the bobbin supporter and the winding roller.

[0018] In the winding system of the present invention, the stocker and the bobbin discharge unit are preferably arranged on the opposite side in the horizontal direction across the bobbin supporter located at the discharging position.

[0019] According to the present invention, unlike the case where the stocker and the bobbin discharge unit are arranged on the same side in the horizontal direction with respect to the bobbin supporter located at the discharging position, it is unnecessary to arrange the stocker and the bobbin discharge unit in an overlapping manner in the vertical direction. Therefore, the height dimension of the winding device can be suppressed, and the height dimension of the entire winding system can be suppressed.

[0020] In the winding system of the present invention, the stocker main body and the bobbin discharge unit when the bobbin is located at the supply position are preferably connected via the bobbin supporter located at the receiving position.

[0021] According to the present invention, a passage through which the bobbin passes is formed by the stocker main body, the bobbin supporter located at the receiving position, and the bobbin discharge unit. It is possible to efficiently perform discharge of the empty bobbin by causing the bobbin in the stocker to be discharged to the bobbin discharge unit so as to pass through the passage.

[0022] It is preferable that the winding system of the present invention includes a package storage unit that store the package released from the bobbin supporter, and the bobbin discharge unit is the package storage unit.

[0023] According to the present invention, the number of members can be reduced and an increase in size of the winding device can be suppressed as compared with a case where the package storage unit and the bobbin discharge unit are separately installed.

[0024] In the winding system of the present invention, the stocker preferably can store a plurality of the bobbins.

[0025] The present invention is more effective when the stocker is configured to be able to store the plurality of bobbins. That is, it is possible to effectively reduce time

and labor of the operation of discharging the plurality of empty bobbins from the stocker while preventing the plurality of empty bobbins remaining in the stocker from coming into contact with the winding roller and becoming dirty.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a schematic profile of a draw texturing machine according to the present embodiment.

FIG. 2 is a schematic view illustrating a configuration of a winding device.

FIG. 3 is a schematic view of the winding device when the cradle arm is located at a receiving position in the winding mode.

FIG. 4 is a schematic view of the winding device when the cradle arm is located at a winding position in the winding mode.

FIG. 5 is a schematic view of the winding device when the cradle arm is located at a discharging position in the winding mode.

FIG. 6 is a schematic view of the winding device when the cradle arm is located at the receiving position in the bobbin discharging mode.

FIG. 7 is a schematic view of the winding device when the cradle arm is located at the discharging position in the bobbin discharging mode.

FIG. 8 is a block diagram illustrating an electrical configuration of the winding system.

FIG. 9 is a flowchart of the winding mode.

FIG. 10 is a flowchart of the bobbin discharging mode.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0027] Hereinafter, a preferred embodiment of the present invention will be described with reference to the drawings.

(Overall Configuration of Draw Texturing Machine 1)

[0028] FIG. 1 is a profile illustrating a schematic configuration of a draw texturing machine 1 including a winding device 21 according to the present embodiment. Hereinafter, a paper surface perpendicular direction of FIG. 1 is a base longitudinal direction, and a paper surface left-right direction is a base width direction. A direction in which both the base longitudinal direction and the base width direction are orthogonal is a vertical direction in which gravity acts. Hereinafter, the above directions will be appropriately used for description.

[0029] The draw texturing machine 1 is configured to be able to false-twist a yarn Y made of synthetic fiber such as nylon (polyamide fiber). The draw texturing machine 1 includes a yarn supplying unit 2 for supplying the yarn Y, a

processing unit 3 that false-twists the yarn Y supplied from the yarn supplying unit 2, and a winding unit 4 (winding system of the present invention) that winds, around a bobbin Bw, the yarn Y processed by the processing unit 3. A plurality of constituent elements included in the yarn supplying unit 2, the processing unit 3, and the winding unit 4 are arranged in the base longitudinal direction orthogonal to a running surface (paper surface of FIG. 1) of the yarn on which a yarn path from the yarn supplying unit 2 to the winding unit 4 through the processing unit 3 is arranged.

(Yarn Supplying Unit 2)

[0030] The yarn supplying unit 2 includes a creel stand 7 that holds a plurality of yarn supply packages Ps, and supplies the processing unit 3 with a plurality of the yarns Y. The processing unit 3 has a configuration in which a first feed roller 11, a twist-stopping guide 12, a first heater 13, a cooler 14, a false-twisting device 15, a second feed roller 16, an interlacing device 17, a third feed roller 18, a second heater 19, and a fourth feed roller 20 arranged in this order from the upstream in the yarn running direction. The winding unit 4 winds the yarn Y false-twisted by the processing unit 3 around the bobbin Bw with the winding device 21 to form a wound package Pw (package of the present invention).

[0031] The draw texturing machine 1 includes a main base 8 and a winding base 9 arranged at an interval in the base width direction. The main base 8 and the winding base 9 extend in substantially the same length in the base longitudinal direction, and are arranged so as to face each other. An upper part of the main base 8 and an upper part of the winding base 9 are coupled by a supporting frame 10. Each device constituting 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 for an operator to carry out work such as yarn threading on each device. The yarn path is formed such that the yarn Y runs mainly around the working space 22.

[0032] The draw texturing machine 1 includes a unit called a span including a set of the main base 8 and the winding base 9 arranged to face each other. In one span, a plurality of spindles including each device (described in detail later) of the processing unit 3 and the winding unit 4 is arranged so that the plurality of yarns Y running in a state of being aligned in the base longitudinal direction can be simultaneously false-twisted and the plurality of false-twisted yarns Y can be simultaneously wound. Each device of the processing unit 3 and the winding unit 4 may be arranged one by one for one spindle, and some of the devices of the processing unit 3 and the winding unit 4 may be arranged across the plurality of spindles. As an example, twelve spindles are installed on the winding base 9 included in one span, and each of the twelve spindles includes the one winding device 21. In other words, the winding base 9 included in one span is

provided with the twelve winding devices 21. The twelve winding devices 21 are arranged in three stages and four rows. The number of spindles installed on the winding base 9 included in one span is not limited to twelve. For example, sixteen spindles or twenty spindles may be installed on the winding base 9 included in one span, and other numbers of spindles may be installed. The draw texturing machine 1 has a configuration in which the spans are arranged symmetrically with respect to the paper surface about a center line C in the base width direction of the main base 8 as an axis of symmetry (the main base 8 is common in the left and right spans), and a plurality of spans are arrayed in the base longitudinal direction.

(Configuration of Processing Unit 3)

[0033] Next, each constituent element of the processing unit 3 will be described. The first feed roller 11 is for feeding, to the first heater 13, the yarn Y supplied from the yarn supplying unit 2. The first feed roller 11 is disposed above the winding base 9 (see FIG. 1). The first feed rollers 11 are arrayed in one row in the base longitudinal direction.

[0034] The twist-stopping guide 12 is for preventing a twist given to the yarn Y by the false-twisting device 15 described later from propagating to more upstream in the yarn running direction than the twist-stopping guide 12. The twist-stopping guide 12 is disposed downstream in the yarn running direction of the first feed roller 11 and upstream in the yarn running direction of the first heater 13. The twist-stopping guides 12 are individually provided for the plurality of yarns Y supplied from the yarn supplying unit 2, for example, and are arrayed in one row in the base longitudinal direction.

[0035] The first heater 13 is for heating the yarn Y fed from the first feed roller 11, and is installed on the supporting frame 10 (see FIG. 1). A plurality of the first heaters 13 are arranged for the plurality of yarns Y supplied from the yarn supplying unit 2, and are arrayed in one row in the base longitudinal direction.

[0036] The cooler 14 is for cooling the yarn Y heated by the first heater 13. The cooler 14 is disposed downstream in the yarn running direction of the first heater 13 and upstream in the yarn running direction of the false-twisting device 15. A plurality of the coolers 14 are arranged for the plurality of yarns Y supplied from the yarn supplying unit 2, and are arrayed in one row in the base longitudinal direction.

[0037] The false-twisting device 15 is a device for giving the yarn Y a twist. The false-twisting device 15 is disposed immediately downstream in the yarn running direction of the cooler 14. A plurality of the false-twisting devices 15 are arrayed in the base longitudinal direction. For example, twelve false-twisting devices 15 are provided per span.

[0038] The second feed roller 16 is a roller that feeds, toward the interlacing device 17, the yarn Y given a twist

by the false-twisting device 15. The second feed roller 16 is disposed downstream in the yarn running direction of the false-twisting device 15 in the main base 8. The conveyance speed of the yarn Y by the second feed roller 16 is faster than the conveyance speed of the yarn Y by the first feed roller 11. Due to this, the yarn Y is drawn between the first feed roller 11 and the second feed roller 16.

[0039] The interlacing device 17 is a device that gives an interlacement by injecting air to the yarn Y. The interlacing device 17 is disposed below the second feed roller 16 on the main base 8.

[0040] The third feed roller 18 is a roller that feeds, toward the second heater 19, the yarn Y given the interlacement by the interlacing device 17. The third feed roller 18 is disposed below the interlacing device 17 on the main base 8. The conveyance speed of the yarn Y by the third feed roller 18 is slower than the conveyance speed of the yarn Y by the second feed roller 16. Therefore, the yarn Y is relaxed between the second feed roller 16 and the third feed roller 18.

[0041] The second heater 19 is a device for heating the yarn Y fed from the third feed roller 18. The second heater 19 is disposed below the third feed roller 18 on the main base 8. The second heater 19 extends along the vertical direction and is provided one by one in one span.

[0042] The fourth feed roller 20 is a roller that feeds, toward the winding device 21, the yarn Y heat-treated by the second heater 19. The fourth feed roller 20 is disposed at a lower part of the winding base 9. The conveyance speed of the yarn Y by the fourth feed roller 20 is slower than the conveyance speed of the yarn Y by the third feed roller 18. Therefore, the yarn Y is relaxed between the third feed roller 18 and the fourth feed roller 20.

[0043] In the processing unit 3 configured as described above, the yarn Y drawn between the first feed roller 11 and the second feed roller 16 is given a twist by the false-twisting device 15. The twist formed by the false-twisting device 15 propagates up to the twist-stopping guide 12, but does not propagate more upstream in the yarn running direction than the twist-stopping guide 12. The yarn Y given the twist while being drawn is heated and thermally fixed by the first heater 13, and then cooled by the cooler 14. The yarn Y is untwisted downstream from the false-twisting device 15, but a state where each filament is false-twisted in a wave shape is maintained by the thermal fixation. The yarn Y false-twisted by the false-twisting device 15 is given an interlacement by the interlacing device 17 while being relaxed between the second feed roller 16 and the third feed roller 18, and is guided to the downstream in the yarn running direction. Furthermore, the yarn Y is thermally fixed by the second heater 19 while being relaxed between the third feed roller 18 and the fourth feed roller 20. Finally, the yarn Y fed from the fourth feed roller 20 is wound by the winding device 21 to form the wound package Pw.

(Configuration of Winding Unit 4)

[0044] The winding unit 4 includes the plurality of winding devices 21 and a controller 80 (see FIG. 8). The winding device 21 is a device for winding, around the bobbin Bw, the yarn Y fed from the fourth feed roller 20 to form the wound package Pw (package of the present invention). The bobbin Bw is, for example, a tubular member. The winding device 21 of the present embodiment will be described below with reference to FIGS. 2 to 7.

[0045] As illustrated in FIG. 2, the winding device 21 includes a pair of cradle arms 30, a winding roller 40, a package storage unit 50, and a stocker 60. FIG. 2 illustrates a scene in the middle of forming the wound package Pw by the winding device 21.

[0046] The pair of cradle arms 30 are arranged to face each other in the base longitudinal direction. Each of the pair of cradle arms 30 has a bobbin holder 31. Describing in detail, the bobbin holder 31 is rotatably supported at each of leading ends (ends opposite to a base end portion provided with a swing shaft 32 described later) of the pair of cradle arms 30. The pair of cradle arms 30 are configured to be able to clamp the bobbin Bw via the bobbin holder 31. Furthermore, the pair of cradle arms 30 are configured to be able to release the wound package Pw (or the bobbin Bw) from the bobbin holder 31 when the bobbin holder 31 is opened in the base longitudinal direction. Opening and closing of the bobbin holder 31 is driven by an opening/closing drive unit 81 (see FIG. 8). The opening/closing drive unit 81 includes, for example, an air cylinder. That is, the pair of cradle arms 30 are configured to be able to rotatably support the bobbin Bw via the bobbin holder 31 and to be able to release the bobbin Bw by opening the bobbin holder 31. The cradle arm 30 including the bobbin holder 31 corresponds to the bobbin supporter of the present invention.

[0047] The pair of cradle arms 30 are configured to be able to swing about the swing shaft 32 extending in the base longitudinal direction. The swing shaft 32 is provided at a base end portion of each of the cradle arms 30. Swing of the pair of cradle arms 30 is driven by a swing drive unit 82 (the movement mechanism of the present invention, see FIG. 8). The swing drive unit 82 includes, for example, an air cylinder.

[0048] The swing drive unit 82 is configured to be able to move the cradle arm 30 between the receiving position (see FIGS. 3 and 6) and the winding position (see FIG. 4). As illustrated in FIG. 3, the receiving position is a position of the cradle arm 30 when the bobbin holder 31 receives the bobbin Bw from the stocker 60. As illustrated in FIG. 4, the winding position is a position of the cradle arm 30 where the yarn Y can be started to be wound around the bobbin Bw by rotating the bobbin Bw while making contact with the winding roller 40. Note that the cradle arm 30 located at the winding position is configured such that as the package diameter of the wound package Pw supported by the bobbin holder 31 increases, the cradle arm

30 swings counterclockwise about the swing shaft 32 as viewed from the near side of the paper surface of FIG. 2, for example. Due to this, as winding of the yarn Y around the bobbin Bw progresses, a center x1 of the wound package Pw is separated from the winding roller 40.

[0049] Furthermore, the swing drive unit 82 is configured to be able to locate the cradle arm 30 at the discharging position (see FIGS. 5 and 7). As illustrated in FIGS. 5 and 7, the discharging position is a position of the cradle arm 30 when discharging the bobbin Bw or the wound package Pw from the bobbin holder 31 to the package storage unit 50. In the present embodiment, the discharging position and the receiving position are the same position.

[0050] The winding roller 40 is configured to be rotationally driven in a fixed direction while making contact with the outer circumference of the bobbin Bw or the wound package Pw, thereby being able to rotate the bobbin Bw to wind the yarn Y. In the present embodiment, the rotation direction of the winding roller 40 is a counterclockwise direction as viewed from the near side of the paper surface of FIG. 5. Rotation of the winding roller 40 is driven by a winding motor 83 (see FIG. 8). As illustrated in FIGS. 5 and 7, the winding roller 40 is disposed on the other side in the base width direction relative to the cradle arm 30 located at the discharging position. Furthermore, as illustrated in FIG. 2 and the like, the winding roller 40 is disposed at a position lower than the stocker 60 in the vertical direction.

[0051] The package storage unit 50 stores the wound package Pw released from the bobbin holder 31 of the cradle arm 30 located at the discharging position. In the present embodiment, the package storage unit 50 can store a maximum of two wound packages Pw. As illustrated in FIGS. 5 and 7, the package storage unit 50 is disposed on one side in the base width direction relative to the cradle arm 30 located at the discharging position. The package storage unit 50 may partially overlap the cradle arm 30 in the base width direction.

[0052] As illustrated in FIG. 2, the package storage unit 50 includes two rails 53 arranged to face each other in the base longitudinal direction. FIG. 2 illustrates only the rail 53 arranged on a nearer side of the paper surface than the wound package Pw stored in the package storage unit 50 in the base longitudinal direction, but actually, the rail 53 is arranged on a farther side of the paper surface than the wound package Pw stored in the package storage unit 50 in the base longitudinal direction. The interval in the base longitudinal direction between the two rails 53 is slightly narrower than the width in the base longitudinal direction of the bobbin Bw, and is larger than the width in the base longitudinal direction of a yarn layer included in the wound package Pw formed by winding the yarn Y around the bobbin Bw. The wound package Pw fed to the package storage unit 50 is supported from below by upper surfaces 51 of the two rails 53. More specifically, both end parts of the bobbin Bw on which the wound package Pw is formed are supported from below by the

upper surfaces 51 of the two rails 53.

[0053] As illustrated in FIG. 2, the package storage unit 50 is inclined downward from the other side (the right side of the paper surface in FIG. 2) toward one side (the left side of the paper surface in FIG. 2) in the base width direction. In other words, the end portion on one side in the base width direction of the package storage unit 50 is located below the end portion on the other side in the base width direction of the package storage unit 50. Similarly, the rail 53 of the package storage unit 50 is inclined downward from the other side to one side in the base width direction. In other words, the end portion on one side in the base width direction of the rail 53 is located below the end portion on the other side in the base width direction of the rail 53. Therefore, the wound package Pw released from the bobbin holder 31 of the cradle arm 30 rolls from the other side to one side in the base width direction along the upper surface 51 of the rail 53 inclined downward. A member (not illustrated) for preventing the wound package Pw from further rolling toward one side in the base width direction is formed in the vicinity of the end portion on one side in the base width direction of the package storage unit 50.

[0054] The package storage unit 50 can store, other than the wound package Pw that is fully wound, the wound package Pw in the middle of winding of the yarn Y in a case where yarn breakage occurs in the middle of the winding of the yarn Y by the winding device 21. Furthermore, the package storage unit 50 can store the bobbin Bw (hereinafter, an empty bobbin BwE) around which the yarn Y is not wound. In other words, in addition to the wound package Pw released from the bobbin holder 31, the empty bobbin BwE released from the bobbin holder 31 is discharged to the package storage unit 50. Therefore, the package storage unit 50 of the present embodiment corresponds to the bobbin discharge unit of the present invention.

[0055] The stocker 60 stores the bobbin Bw to be supplied to the cradle arm 30. In the present embodiment, the stocker 60 can store a maximum of four bobbins Bw. The bobbin Bw stored in the stocker 60 is the empty bobbin BwE. As illustrated in FIG. 2, the stocker 60 extends such that the end portion on one side is lower than the end portion on the other side in the base width direction. Hereinafter, the direction in which the stocker 60 extends is called an extending direction (see FIG. 2 and the like). As illustrated in FIG. 2, the stocker 60 is disposed at a position higher than the package storage unit 50 and the winding roller 40 in the vertical direction. Furthermore, as illustrated in FIGS. 5 and 7, the stocker 60 is disposed on the other side in the base width direction relative to the cradle arm 30 located at the discharging position. In addition, as described above, the package storage unit 50 is disposed on one side in the base width direction relative to the cradle arm 30 located at the discharging position. Therefore, as illustrated in FIGS. 5 and 7, the stocker 60 and the package storage unit 50 are disposed on the opposite side in the horizontal direction

across the cradle arm 30 located at the discharging position.

[0056] As illustrated in FIG. 2, the stocker 60 includes a supply mechanism 61 and a stocker main body 62. The stocker main body 62 is configured to be able to store the bobbin Bw. The supply mechanism 61 moves, between the supply position and the standby position, the bobbin Bw stored in the stocker main body 62. The supply position is a position of the bobbin Bw at which the bobbin Bw is supplied to the bobbin holder 31 of the cradle arm 30 located at the receiving position. Describing specifically, the supply position is a position of a one side bobbin Bw1 when the bobbin Bw (hereinafter, the one side bobbin Bw1) located on the most one side in the base width direction among the plurality of bobbins Bw stored in the stocker main body 62 is supplied to the bobbin holder 31 of the cradle arm 30 located at the receiving position (see FIG. 3). Note that in the present embodiment, the one side bobbin Bw1 is included in the empty bobbin BwE. The standby position is a position of the one side bobbin Bw1 separated from the supply position. In the present embodiment, the standby position is a position separated from the supply position to the other side in the base width direction. Describing additionally, the standby position is a position of the one side bobbin Bw1 when the yarn Y is wound around the bobbin Bw supported by the cradle arm 30, and when the wound package Pw is released from the cradle arm 30 at the discharging position and fed to the package storage unit 50 (see FIGS. 4, 5, and 7).

[0057] In the present embodiment, the supply mechanism 61 moves the one side bobbin Bw1 between the supply position and the standby position by moving the stocker main body 62 in the extending direction. The supply mechanism 61 includes, for example, a piston rod 63 (see FIG. 3) and has an air cylinder that drives movement of the stocker main body 62 by air pressure. However, the supply mechanism 61 is not limited to such a configuration. For example, the supply mechanism 61 may be an electric actuator that has a ball screw and motor-drives movement of the stocker main body 62. The piston rod 63 of the supply mechanism 61 is connected to the stocker main body 62. The supply mechanism 61 is configured to be able to linearly move the stocker main body 62 in both directions of an orientation approaching the cradle arm 30 located at the receiving position and an orientation away from the cradle arm 30 located at the receiving position along the extending direction.

[0058] As illustrated in FIG. 2, the stocker main body 62 includes a supporting surface 71, a regulatory portion 72, and a rotation shaft 75. The supporting surface 71 supports from below the plurality of bobbins Bw stored in the stocker main body 62. As illustrated in FIG. 2, the supporting surface 71 is inclined such that the end portion on one side in the base width direction is located below the end portion on the other side in the base width direction. In other words, the supporting surface 71 extends along the extending direction of the stocker 60. Therefore, the bobbin Bw stored in the stocker main body 62 is movable

from the other side to one side in the base width direction along the inclination of the supporting surface 71.

[0059] The regulatory portion 72 is a member for preventing the bobbin Bw (particularly, the one side bobbin Bw1) stored in the stocker main body 62 from falling off from the end portion on one side of the stocker main body 62. The regulatory portions 72 are arranged to face each other in the base longitudinal direction. The interval in the base longitudinal direction of a pair of the regulatory portions 72 arranged to face each other is larger than the width in the base longitudinal direction of the bobbin Bw. The pair of regulatory portions 72 are rotatable about the rotation shaft 75 along the base longitudinal direction. By rotating about the rotation shaft 75, the pair of regulatory portions 72 can be switched between a regulated state (see FIGS. 2, 4, 5, and 7) in which the bobbin Bw is regulated from falling off the stocker main body 62 and a released state (see FIGS. 3 and 6) in which the regulation is released and the bobbin Bw can be taken out from the stocker main body 62.

[0060] Details will be described below. As illustrated in FIG. 2, each of the regulatory portions 72 includes a claw portion 72a and an arm member 72b. The base end portion of the arm member 72b is connected to the rotation shaft 75. The leading end of the arm member 72b is connected to the claw portion 72a. The claw portion 72a is a plate-like member extending in the base longitudinal direction, for example. As illustrated in FIG. 2, when the regulatory portion 72 is in the regulated state, the one side bobbin Bw1 stored in the stocker main body 62 is regulated from moving to one side in the base width direction by the claw portion 72a. As illustrated in FIG. 3, when the regulatory portion 72 is in the released state, the arm member 72b is in a state of rotating clockwise about the rotation shaft 75 more than the arm member 72b in the regulated state. This releases the regulation of the one side bobbin Bw1 by the claw portion 72a and enables movement to one side in the base width direction.

[0061] For example, the regulatory portion 72 may be configured to switch from the regulated state to the released state by contact between the arm member 72b and the bobbin holder 31, for example. Hereinafter, a specific description will be given. First, the supply mechanism 61 moves the stocker main body 62 in an orientation of approaching the cradle arm 30 located at the receiving position along the extending direction. Then, a part of the arm member 72b abuts on the bobbin holder 31 in the middle of the movement of the stocker main body 62. When the stocker main body 62 is further brought closer to the cradle arm 30 located at the receiving position from this state, the arm member 72b is pushed by the bobbin holder 31. Due to this, the arm member 72b rotates clockwise about the rotation shaft 75 (see FIG. 3). Due to this, the regulatory portion 72 is switched from the regulated state to the released state. Conversely, when the supply mechanism 61 moves the stocker main body 62 in an orientation away from the cradle arm 30 located at the receiving position along the

extending direction, the arm member 72b and the bobbin holder 31 are separated from each other. Here, the arm member 72b is biased counterclockwise about the rotation shaft 75 by a biasing member (not illustrated) such as a spring. Therefore, when the arm member 72b and the bobbin holder 31 are separated from each other, they are biased by the biasing member, and the arm member 72b rotates counterclockwise about the rotation shaft 75 (see FIG. 4). Due to this, the regulatory portion 72 is switched from the released state to the regulated state. However, the regulatory portion 72 is not limited to such a configuration. For example, the regulatory portion 72 may be configured to be switched between the regulated state and the released state by driving a motor not illustrated.

[0062] In the present embodiment, as illustrated in FIGS. 3 and 6, the end portion on one side in the base width direction of the stocker main body 62 when the one side bobbin Bw1 is located at the supply position and the end portion on the other side in the base width direction of the package storage unit 50 are connected via the bobbin holder 31 of the cradle arm 30 located at the receiving position. In other words, the stocker main body 62, the bobbin holder 31 of the cradle arm 30 located at the receiving position, and the package storage unit 50 form a passage through which the bobbin Bw passes.

[0063] As illustrated in FIG. 8, the controller 80 is electrically connected to the opening/closing drive unit 81, the swing drive unit 82, the winding motor 83, the supply mechanism 61, and the like provided in each of the plurality of winding devices 21, and is configured to be able to control them. The controller 80 is configured to be able to select the winding mode and a bobbin discharging mode different from the winding mode as modes of open/close control of the bobbin holder 31 by the opening/closing drive unit 81 and swing control of the cradle arm 30 by the swing drive unit 82. The controller 80 is configured to be able to select the winding mode and the bobbin discharging mode independently of each other for each of the plurality of winding devices 21. The winding mode and the bobbin discharging mode will be described below with reference to FIGS. 3 to 10.

(Winding Mode)

[0064] First, the winding mode will be described below with reference to FIGS. 3 to 5 and 9. FIG. 9 is a flowchart of the winding mode. In the winding mode, first, the controller 80 controls drive of the swing drive unit 82 so as to move the cradle arm 30 to the receiving position (see FIG. 3) (step S1).

[0065] Next, the controller 80 controls drive of the opening/closing drive unit 81 and the supply mechanism 61 so as to supply the empty bobbin BwE from the stocker 60 to the bobbin holder 31 of the cradle arm 30 located at the receiving position (step S2). Describing in detail, the controller 80 controls the opening/closing drive unit 81 so as to open the bobbin holder 31 of the cradle arm 30 located at the receiving position. Thereafter, the control-

ler 80 moves the stocker main body 62 so as to approach the cradle arm 30 located at the receiving position. Due to this, the regulatory portion 72 is switched from the regulated state to the released state, and the one side bobbin Bw1 is supplied from the stocker main body 62 to the bobbin holder 31 (see FIG. 3). Thereafter, the controller 80 controls the opening/closing drive unit 81 so as to close the bobbin holder 31. Due to this, the bobbin Bw supplied from the stocker main body 62 is supported by the bobbin holder 31.

[0066] Subsequently, the controller 80 controls drive of the supply mechanism 61 so as to move the stocker main body 62 to the original position (e.g., the position of the stocker main body 62 illustrated in FIG. 4) (step S3). The original position mentioned here refers to the position of the stocker main body 62 when the bobbin Bw on the most one side in the base width direction among the bobbins Bw remaining in the stocker main body 62 is located at the standby position.

[0067] Thereafter, the controller 80 controls drive of the swing drive unit 82 so as to move the cradle arm 30 located at the receiving position to the winding position (see FIG. 4) (step S4). Then, the controller 80 controls drive of the winding motor 83 so as to rotate the winding roller 40 in a state where the bobbin Bw supported by the bobbin holder 31 is in contact with the winding roller 40 (step S5). This starts winding of the yarn Y around the bobbin Bw.

[0068] When the winding of the yarn Y around the bobbin Bw is completed and the wound package Pw is fully wound, the controller 80 controls drive of the swing drive unit 82 so as to move the cradle arm 30 to the discharging position (see FIG. 5) (step S6).

[0069] Subsequently, the controller 80 controls drive of the opening/closing drive unit 81 so as to open, in the base longitudinal direction, the bobbin holder 31 of the cradle arm 30 located at the discharging position and release the wound package Pw from the bobbin holder 31 (step S7). Due to this, the wound package Pw released from the bobbin holder 31 is discharged to the package storage unit 50.

[0070] Next, the controller 80 judges whether or not the production of the wound package Pw has been completed (step S8). "The production of the wound package Pw has been completed" means, for example, that the production of a predetermined number of wound packages Pw has been completed. The controller 80 may judge that the production of the wound package Pw has been completed also in a case where it becomes necessary to switch the production lot in a hurry in the middle of the production of the wound package Pw of a predetermined production lot.

[0071] If the controller 80 judges that the production of the wound package Pw has not been completed (S8: NO), the process returns to step S1. However, in the present embodiment, since the discharging position (see FIG. 5) and the receiving position (see FIG. 3) are the same position, the operation of moving the cradle arm 30

located at the discharging position to the receiving position is unnecessary. Therefore, in the present embodiment, step S1 is not performed after step S8, and actually step S2 is performed after step S8.

[0072] When the controller 80 judges that the production of the wound package Pw has been completed (S8: YES), the winding mode ends.

(Bobbin Discharging Mode)

[0073] Next, the bobbin discharging mode will be described below with reference to FIGS. 6, 7, and 10. FIG. 10 is a flowchart of the bobbin discharging mode. In the bobbin discharging mode, first, the controller 80 controls drive of the swing drive unit 82 so as to move the cradle arm 30 to the receiving position (see FIG. 6) (step S11).

[0074] Next, the controller 80 controls drive of the opening/closing drive unit 81 and the supply mechanism 61 so as to supply the empty bobbin BwE from the stocker 60 to the bobbin holder 31 of the cradle arm 30 located at the receiving position (step S12). Details of the control of the opening/closing drive unit 81 and the supply mechanism 61 at the time of handover of the bobbin Bw from the stocker 60 to the bobbin holder 31 are similar to those described in step S2.

[0075] Subsequently, the controller 80 controls drive of the supply mechanism 61 so as to move the stocker main body 62 to the original position (e.g., the position of the stocker main body 62 illustrated in FIG. 7) (step S13). The original position mentioned here refers to the position of the stocker main body 62 when the bobbin Bw on the most one side among the bobbins Bw remaining in the stocker main body 62 is located at the standby position.

[0076] Subsequently, the controller 80 controls the opening/closing drive unit 81 so as to release the bobbin Bw from the bobbin holder 31 of the cradle arm 30 located at the discharging position (see FIG. 7) without winding the yarn Y around the bobbin Bw (step S14). In step S14, the controller 80 preferably controls the opening/closing drive unit 81 so as to release the bobbin Bw from the bobbin holder 31 of the cradle arm 30 located at the discharging position while maintaining the state where the bobbin Bw and the winding roller 40 are separated from each other. Describing specific control, the controller 80 controls drive of the opening/closing drive unit 81 so as to open in the base longitudinal direction the bobbin holder 31 of the cradle arm 30 located at the discharging position and release the empty bobbin BwE from the bobbin holder 31. Due to this, the empty bobbin BwE released from the bobbin holder 31 is discharged to the package storage unit 50. Here, in the present embodiment, since the receiving position (see FIG. 6) and the discharging position (see FIG. 7) are the same position, the operation of moving the cradle arm 30 located at the receiving position to the discharging position is unnecessary. Therefore, in steps S12 to S14, the controller 80 controls the swing drive unit 82 so as to stop the cradle arm 30 located at the receiving position.

[0077] Next, the controller 80 judges whether or not the empty bobbin BwE remains in the stocker 60 (step S15). For example, the controller 80 judges whether or not the discharging operation (step S14) of the empty bobbin BwE has been executed as many times as the maximum storage quantity (four in the present embodiment) of the bobbins Bw of the stocker 60. If determining that the discharging operation of the empty bobbin BwE has been executed the same number of times as the maximum storage quantity of the bobbins Bw of the stocker 60, the controller 80 judges that no empty bobbin BwE remains in the stocker 60. On the other hand, if determining that the discharging operation of the empty bobbin BwE has not been executed the same number of times as the maximum storage quantity of the bobbins Bw of the stocker 60, the controller 80 judges that the empty bobbin BwE remains in the stocker 60. If the controller 80 judges that the empty bobbin BwE remains in the stocker 60 (S15: NO), the process returns to step S11. However, in the present embodiment, since the discharging position (see FIG. 7) and the receiving position (see FIG. 6) are the same position, the operation of moving the cradle arm 30 located at the discharging position to the receiving position is unnecessary. Therefore, in the present embodiment, step S11 is not performed after step S15, and actually step S12 is performed after step S15.

[0078] If the controller 80 judges that no empty bobbin BwE remains in the stocker 60 (S15: YES), the bobbin discharging mode ends.

(Effects)

[0079] The winding unit 4 of the present embodiment includes the plurality of winding devices 21 and the controller 80. Each of the plurality of winding devices 21 includes the cradle arm 30 configured to be able to rotatably support the bobbin Bw and to be able to release the bobbin Bw. The cradle arm 30 includes the bobbin holder 31. Furthermore, each of the plurality of winding devices 21 includes the stocker 60 that store the bobbin Bw to be supplied to the bobbin holder 31, the package storage unit 50 to which the bobbin Bw released from the bobbin holder 31 is discharged, the winding roller 40 that is rotatable while making contact with the bobbin Bw or the wound package Pw, and the swing drive unit 82 that can move the cradle arm 30. The swing drive unit 82 is configured to be able to cause the cradle arm 30 to be located at the receiving position, which is a position where the bobbin Bw is received from the stocker 60, the winding position, which is a position where the yarn Y can be started to be wound around the bobbin Bw by rotating the bobbin Bw while making contact with the winding roller 40, and the discharging position, which is a position where the bobbin Bw is discharged to the package storage unit 50. The controller 80 is configured to be able to select, independently of each other for each of the plurality of winding devices 21, the predetermined winding mode and the bobbin discharging mode different

from the winding mode independently of each other for each of the plurality of winding devices 21, as modes of control of the bobbin holder 31 of the cradle arm 30 and the swing drive unit 82. In the winding mode, the controller 80 causes the bobbin holder 31 of the cradle arm 30 located at the receiving position to receive the bobbin Bw from the stocker 60, and moves the cradle arm 30 caused to support the bobbin Bw from the receiving position to the winding position. In the bobbin discharging mode, the controller 80 causes the bobbin holder 31 of the cradle arm 30 located at the receiving position to receive the bobbin Bw from the stocker 60, and releases the bobbin Bw from the bobbin holder 31 of the cradle arm 30 located at the discharging position without causing the bobbin Bw to wind the yarn Y.

[0080] According to the present embodiment, when it becomes necessary to discharge the empty bobbin BwE from the stocker 60 for some of the plurality of winding devices 21, only the control mode of the some winding devices 21 can be set to the bobbin discharging mode, and the control mode of the remaining winding devices 21 can be left in the winding mode. Hence, while discharging the empty bobbin BwE from some of the winding devices 21, the remaining winding devices 21 can be caused to continuously wind the yarn Y around the bobbin Bw, and the production efficiency of the wound package Pw as the entire winding unit 4 can be suppressed from decreasing.

[0081] In the winding unit 4 of the present embodiment, in the bobbin discharging mode, the controller 80 causes the bobbin holder 31 of the cradle arm 30 located at the receiving position to receive the bobbin Bw from the stocker 60, and releases the bobbin Bw from the bobbin holder 31 of the cradle arm 30 located at the discharging position while maintaining the state where the bobbin Bw and the winding roller 40 are separated from each other.

[0082] According to the present embodiment, in the bobbin discharging mode, the empty bobbin BwE can be discharged to the package storage unit 50 while avoiding the empty bobbin BwE and the winding roller 40 from making contact with each other. This can suppress the quality of the empty bobbin BwE from deteriorating due to the contact between the empty bobbin BwE and the winding roller 40. This will be described in detail below.

[0083] In general, a lubricant such as an oil can be given to the yarn Y in advance for smooth running of the yarn Y. When such the yarn Y is wound around the bobbin Bw, the yarn Y comes into contact with the winding roller 40, whereby part of the oil and the like can adhere to the winding roller 40 and accumulated. However, when the empty bobbin BwE and the winding roller 40 come into contact with each other at the time of discharging the empty bobbin BwE, the surface of the empty bobbin BwE may be contaminated by the oil adhering to the winding roller 40. In addition, by contact between the empty bobbin BwE and the winding roller 40 that is rotating, the empty bobbin BwE, can have a contact mark or the empty bobbin BwE can be recessed. The empty bobbin BwE discharged from the stocker 60 along with the

switching of the production lot is generally reused at another opportunity, but the empty bobbin BwE having a dirty surface needs the surface to be cleaned before reuse, which increases time and labor of the operation. In particular, when the contact mark occurring on the surface of the empty bobbin BwE is severe or when the empty bobbin BwE is greatly recessed, the empty bobbin BwE cannot be reused and must be discarded. In order to solve such a problem, in the present embodiment, the bobbin Bw is released from the bobbin holder 31 of the cradle arm 30 located at the discharging position while maintaining the state where the bobbin Bw and the winding roller 40 are separated from each other in the bobbin discharging mode. This can suppress quality deterioration of the empty bobbin BwE when discharging the empty bobbin BwE from the stocker 60.

[0084] In the winding unit 4 of the present embodiment, the stocker 60 includes the supply mechanism 61 that moves the bobbin Bw between the supply position where the bobbin Bw is supplied to the bobbin holder 31 of the cradle arm 30 located at the receiving position and the standby position separated from the supply position. This can supply the bobbin Bw from the stocker 60 to the bobbin holder 31 of the cradle arm 30 without moving the cradle arm 30 to the stocker 60 side. Therefore, it is not necessary to perform the operation of moving the cradle arm 30 to the stocker 60 side when receiving the bobbin Bw, and the operation of returning the cradle arm 30 to the original position (i.e., the position opposite to the stocker 60 side) thereafter. In other words, it is not necessary to move the cradle arm 30 caused to support the empty bobbin BwE. This can reduce the risk that the empty bobbin BwE supported by the cradle arm 30 and the winding roller 40 unintentionally come into contact with each other after the empty bobbin BwE is supplied from the stocker 60 to the cradle arm 30.

[0085] In the winding unit 4 of the present embodiment, the stocker 60 includes the stocker main body 62 that stores the bobbin Bw. Then, the supply mechanism 61 moves the bobbin Bw between the supply position and the standby position by moving the stocker main body 62. This can supply the bobbin Bw from the stocker 60 to the bobbin holder 31 of the cradle arm 30 by moving the stocker main body 62 with respect to the cradle arm 30. Therefore, after the empty bobbin BwE is supplied from the stocker 60 to the cradle arm 30, the cradle arm 30 caused to support the empty bobbin BwE does not need to be moved, and the risk of unintentional contact between the empty bobbin BwE and the winding roller 40 can be reduced.

[0086] Furthermore, in the winding unit 4 of the present embodiment, the receiving position and the discharging position of the cradle arm 30 are the same position. According to this, in the bobbin discharging mode, it is not necessary to move the cradle arm 30 from when the bobbin holder 31 of the cradle arm 30 located at the receiving position is caused to receive the bobbin Bw to when the bobbin Bw is released from the bobbin holder

31 of the cradle arm 30 located at the discharging position. This can further reduce the risk of unintentional contact between the empty bobbin BwE supported by the cradle arm 30 and the winding roller 40.

[0087] In the winding unit 4 of the present embodiment, the stocker 60 and the package storage unit 50 are arranged on the opposite side in the horizontal direction across the cradle arm 30 located at the discharging position. According to this, unlike the case where the stocker 60 and the package storage unit 50 are arranged on the same side in the horizontal direction with respect to the cradle arm 30 located at the discharging position, it is unnecessary to arrange the stocker 60 and the package storage unit 50 in an overlapping manner in the vertical direction. Therefore, the height dimension of the winding device 21 can be suppressed. In particular, the winding unit 4 of the present embodiment has a configuration in which the winding devices 21 are arranged in a plurality of stages (four stages in the present embodiment) in the vertical direction. Therefore, the suppression of the height dimension of the winding device 21 leads to the suppression of the height dimension of the entire winding unit 4. In addition, by suppressing the height dimension of the winding device 21, there is also an advantage that the operator can easily access the winding device 21 in the upper stage among the winding devices 21 in the plurality of stages. This facilitates maintenance of the winding device 21 and replenishment of the empty bobbin BwE to the stocker 60.

[0088] In the winding unit 4 of the present embodiment, the stocker main body 62 and the package storage unit 50 when the one side bobbin Bw1 is located at the supply position are connected via the bobbin holder 31 of the cradle arm 30 located at the receiving position. According to this, the stocker main body 62, the bobbin holder 31 of the cradle arm 30 located at the receiving position, and the package storage unit 50 form the passage through which the bobbin Bw passes. The empty bobbin BwE in the stocker 60 is discharged to the package storage unit 50 so as to pass through the passage, whereby the empty bobbin BwE can be efficiently discharged.

[0089] Furthermore, in the winding unit 4 of the present embodiment, the bobbin discharge unit of the present invention from which the bobbin Bw released from the bobbin holder 31 is discharged is the package storage unit 50. This can reduce the number of members as compared with the case of separately installing the package storage unit 50 and the bobbin discharge unit, and can suppress the increase in size of the winding device 21.

[0090] In the winding unit 4 of the present embodiment, the stocker 60 can store the plurality of bobbins Bw. The present invention is more effective when the stocker 60 is configured to be able to store the plurality of bobbins Bw. That is, it is possible to effectively reduce time and labor of the operation of discharging the plurality of empty bobbins BwE from the stocker 60 while preventing the plurality of empty bobbins BwE remaining in the stocker 60

from coming into contact with the winding roller 40 and becoming dirty.

(Modifications)

[0091] Next, modifications in which changes are added to the embodiment will be described. However, those having similar configurations to those of the embodiment described above are given the same reference signs, and the description thereof will be appropriately omitted.

[0092] In the embodiment described above, the package storage unit 50 stores the empty bobbin BwE released from the bobbin holder 31. However, the bobbin discharge unit for storing the empty bobbin BwE released from the bobbin holder 31 may be provided separately from the package storage unit 50. The bobbin discharge unit needs not be configured to be able to store the empty bobbin BwE, and may be a part to which the empty bobbin BwE released from the bobbin holder 31 is discharged. For example, the bobbin discharge unit may be a conveyor or the like for conveying the empty bobbin BwE released from the bobbin holder 31 to a predetermined place.

[0093] In the embodiment described above, the stocker 60 can store the maximum of four bobbins Bw. However, the stocker 60 may be able to store a maximum of five or more bobbins Bw, or may be able to store any number of bobbins Bw of a maximum of three or less. In the embodiment described above, the package storage unit 50 can store the maximum of two wound packages Pw. However, the package storage unit 50 may be able to store a maximum of three or more wound packages Pw, or may be able to store a maximum of one wound package Pw.

[0094] In the embodiment described above, the pair of cradle arms 30 are swingable between the receiving position and the winding position. However, the bobbin supporter of the present invention is not limited to the configuration of the embodiment described above. For example, the bobbin supporter may have a configuration in which a bobbin holder supporting member (not illustrated) that rotatably supports the bobbin holder 31 configured to be able to support the bobbin Bw and to be able to release the bobbin Bw translates between the receiving position and the winding position. In this case, the movement mechanism of the present invention is configured to be able to translate the bobbin holder supporting member between the receiving position and the winding position, and is configured to be able to locate the bobbin holder supporting member in the discharging position.

[0095] In the embodiment described above, the receiving position and the discharging position are the same position. However, the receiving position and the discharging position may be different positions. In this case, in the bobbin discharging mode, the controller 80 preferably moves the cradle arm 30 from the receiving position to the discharging position while maintaining the state where

the bobbin Bw supported by the bobbin holder 31 and the winding roller 40 are separated from each other. After releasing the bobbin Bw from the bobbin holder 31 of the cradle arm 30 located at the discharging position, the controller 80 controls drive of the swing drive unit 82 so as to move the cradle arm 30 to the receiving position.

[0096] In the embodiment described above, the supply mechanism 61 moves the one side bobbin Bw1 in the stocker main body 62 between the standby position and the supply position by moving the stocker main body 62 along the extending direction. However, the present invention is not limited to such a configuration. For example, the supply mechanism 61 may include a lower supporting portion (not illustrated) that supports from below only the one side bobbin Bw1 of the plurality of bobbins Bw stored in the stocker main body 62. In this case, the supply mechanism 61 moves the one side bobbin Bw1 between the standby position and the supply position by moving only the lower supporting portion of the stocker main body 62 together with the one side bobbin Bw1. Alternatively, the stocker 60 may include a handover arm (not illustrated) for handing over the one side bobbin Bw1 in the stocker main body 62 to the bobbin holder 31 of the cradle arm 30 located at the receiving position. In this case, the supply mechanism 61 moves the one side bobbin Bw1 between the standby position and the supply position by swinging the handover arm.

[0097] The winding device 21 of the embodiment described above has a configuration in which the stocker main body 62 moves with respect to the cradle arm 30 stopped at the receiving position, whereby the bobbin holder 31 is caused to receive the bobbin Bw from the stocker 60. However, the winding device may have a configuration in which the stocker main body 62 is fixedly arranged, and the bobbin holder 31 is caused to receive the bobbin Bw from the stocker main body 62 by swinging the cradle arm 30 to the stocker main body 62 side.

[0098] In the embodiment described above, the stocker 60 and the package storage unit 50 are arranged on the opposite side in the horizontal direction across the cradle arm 30 located at the discharging position. However, the stocker 60 and the package storage unit 50 may be arranged on the same side with respect to the cradle arm 30 located at the discharging position.

[0099] In the embodiment described above, after supplying the empty bobbin BwE from the stocker 60 to the bobbin holder 31 in step S12 of the bobbin discharging mode, the controller 80 controls drive of the supply mechanism 61 so as to move the stocker main body 62 to the original position (position in FIG. 7) (see step S13 in FIG. 10). This is because, in the configuration of the stocker 60 of the embodiment described above, the empty bobbin BwE cannot be detached from the stocker main body 62 unless the stocker main body 62 is moved to the original position of the stocker main body 62 after the bobbin holder 31 is caused to receive the empty bobbin BwE. However, step S13 needs not be performed as long as the stocker 60 has a configuration that can detach the

empty bobbin BwE from the stocker main body 62 even without moving the stocker main body 62 to the original position. In this case, after the empty bobbin BwE is supplied from the stocker 60 to the bobbin holder 31, the bobbin holder 31 is opened in the base longitudinal direction in a state where the stocker main body 62 and the bobbin holder 31 are connected, whereby the empty bobbin BwE released from the bobbin holder 31 is discharged to the package storage unit 50. According to this, it is not necessary to return the stocker main body 62 to the original position every time one empty bobbin BwE is discharged from the bobbin holder 31, and the plurality of empty bobbins BwE in the stocker main body 62 can be collectively discharged to the package storage unit 50. Therefore, the efficiency of discharging the empty bobbin BwE is improved.

[0100] In the embodiment described above, one controller 80 is provided for the plurality of winding devices 21, but the present invention is not limited to this. For example, the controller 80 may be configured to include a plurality of controllers respectively provided in the plurality of winding devices 21, and a central controller (not illustrated) that collectively manages the plurality of controllers 80.

[0101] In the embodiment described above, the controller 80 may set any one or a plurality of winding devices 21 of the plurality of spindles to the bobbin discharging mode and set one or a plurality of winding devices 21 of the remaining spindles to the winding mode. Specifically, when it becomes necessary to switch the production lot only for the winding devices 21 of some spindles of the plurality of spindles, the controller 80 sets the winding devices 21 of the some spindles to the bobbin discharging mode and sets the winding devices 21 of remaining spindles to the winding mode. Since thus eliminates the need for stopping winding of the yarn Y around the bobbin Bw for the winding devices 21 of the spindles for which the production lot needs not be switched, a decrease in the production efficiency of the wound package Pw can be suppressed.

[0102] In the embodiment described above, the controller 80 determines whether or not the discharging operation (step S14) of the empty bobbins BwE is executed the same number of times as the maximum storage quantity of the bobbins Bw of the stocker 60, and judges whether or not the empty bobbin BwE remains in the stocker 60 based on the determination result (step S15). However, the means by which the controller 80 judges whether or not the empty bobbin BwE remains in the stocker 60 is not limited to the above configuration. For example, the controller 80 may judge whether or not the empty bobbin BwE remains based on a detection signal of the empty bobbin BwE by a sensor (not illustrated) provided in the stocker 60.

[0103] The winding unit 4 of the embodiment described above is provided in the draw texturing machine 1. However, the winding unit 4 of the present invention is applicable not only to the draw texturing machine 1 but also to a

re-winder.

Claims

1. A winding system (4) comprising:

a plurality of winding devices (21) that wind a yarn (Y) around a bobbin (Bw) to form a package (Pw); and
 a controller (80) that controls the plurality of winding devices (21),
 wherein
 each of the plurality of winding devices (21) includes
 a bobbin supporter (30) configured to be able to rotatably support the bobbin (Bw) and to be able to release the bobbin (Bw),
 a stocker (60) that stores the bobbin (Bw) supplied to the bobbin supporter (30),
 a bobbin discharge unit (50) to which the bobbin (Bw) released from the bobbin supporter (30) is discharged,
 a winding roller (40) that is rotatable while making contact with the bobbin (Bw) or the package (Pw), and
 a movement mechanism (82) that can move the bobbin supporter (30),
 the movement mechanism (82) is configured to be able to locate the bobbin supporter (30) at a receiving position, which is a position at which the bobbin (Bw) is received from the stocker (60),
 a winding position, which is a position at which the yarn (Y) can be started to be wound around the bobbin (Bw) by rotating the bobbin (Bw) while making contact with the winding roller (40), and
 a discharging position, which is a position at which the bobbin (Bw) is discharged to the bobbin discharge unit (50), and
 the controller (80) is configured to be able to select, independently of one another for each of the plurality of winding devices (21),
 as a mode of control of the bobbin supporter (30) and the movement mechanism (82),
 a winding mode of causing the bobbin supporter (30) located at the receiving position to receive the bobbin (Bw) from the stocker (60), locating the bobbin supporter (30) caused to support the bobbin (Bw) from the receiving position to the winding position, and causing the bobbin (Bw) to wind the yarn (Y), and
 a bobbin discharging mode of causing the bobbin supporter (30) located at the receiving position to receive the bobbin (Bw) from the stocker

(60), and causing the bobbin supporter (30) located at the discharging position to release the bobbin (Bw) without causing the bobbin (Bw) to wind the yarn (Y).

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2. The winding system (4) according to claim 1, wherein in the bobbin discharging mode, the controller (80) causes the bobbin supporter (30) located at the receiving position to receive the bobbin (Bw) from the stocker (60), and releases the bobbin (Bw) from the bobbin supporter (30) located at the discharging position while maintaining a state where the bobbin (Bw) and the winding roller (40) are separated from each other.

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3. The winding system (4) according to claim 1 or 2, wherein

the stocker (60) includes a supply mechanism (61) that moves the bobbin (Bw) between a supply position at which the bobbin (Bw) is supplied to the bobbin supporter (30) located at the receiving position and a standby position separated from the supply position.

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4. The winding system (4) according to claim 3, wherein

the stocker (60) includes a stocker main body (62) that stores the bobbin (Bw), and the supply mechanism (61) moves the bobbin (Bw) between the supply position and the standby position by moving the stocker main body (62).

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5. The winding system (4) according to claim 3 or 4, wherein the receiving position and the discharging position are the same position.

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6. The winding system (4) according to any one of claims 1 to 5 comprising:

a package storage unit (50) that stores the package (Pw) released from the bobbin supporter (30), wherein the bobbin discharge unit is the package storage unit (50).

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7. The winding system (4) according to any one of claims 1 to 6, wherein the stocker (60) can store a plurality of the bobbins (Bw).

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FIG.1

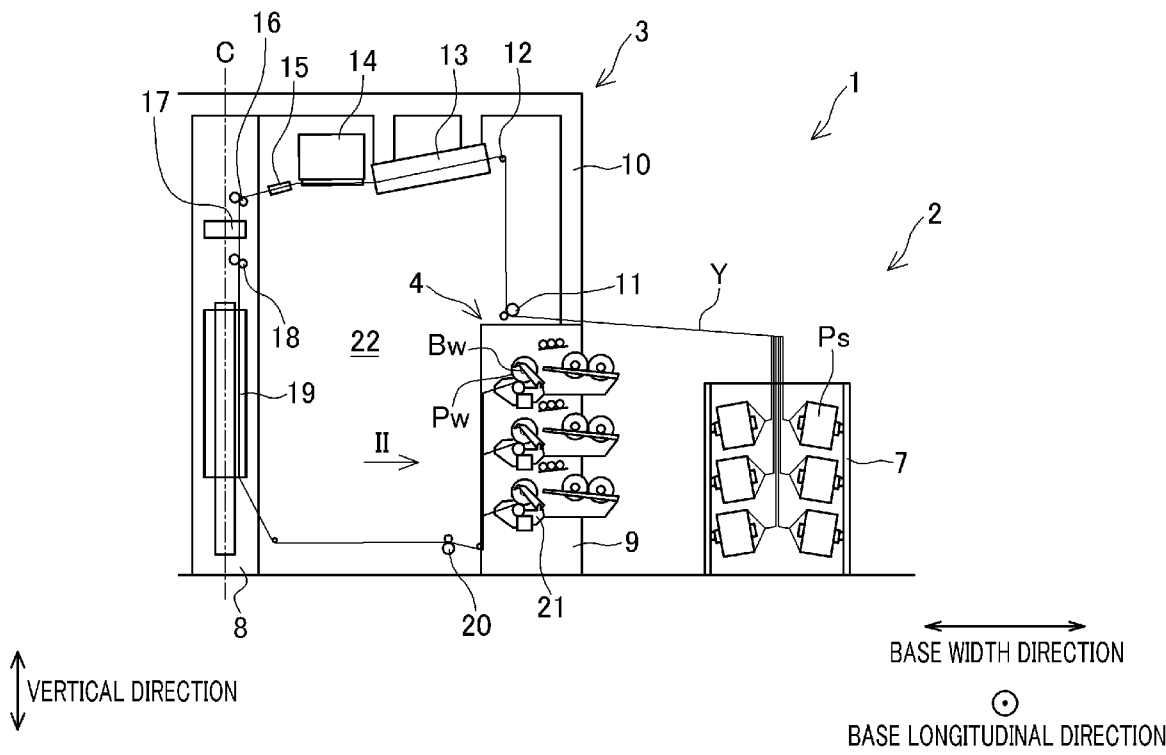


FIG.2

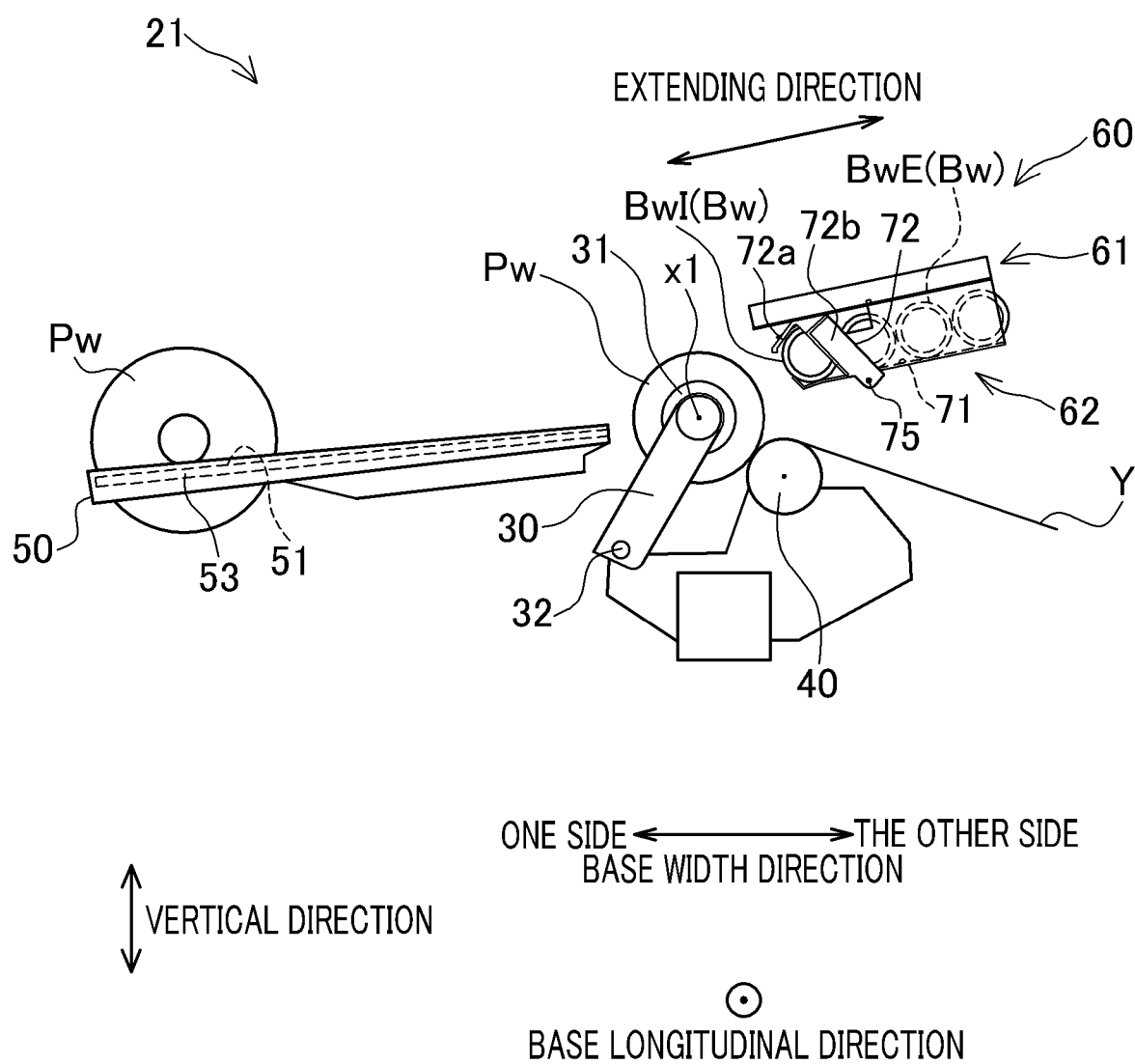


FIG.3

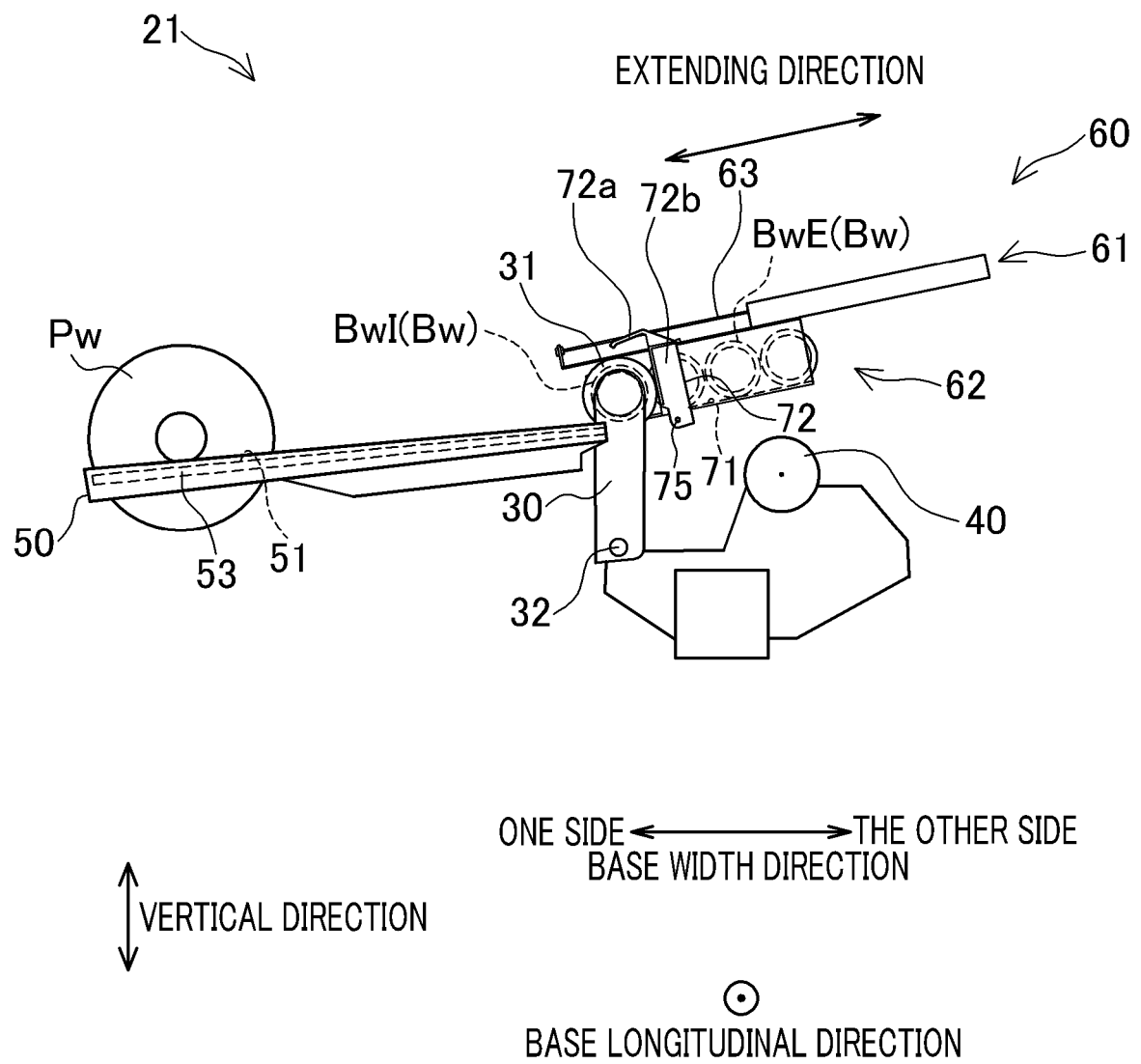


FIG.4

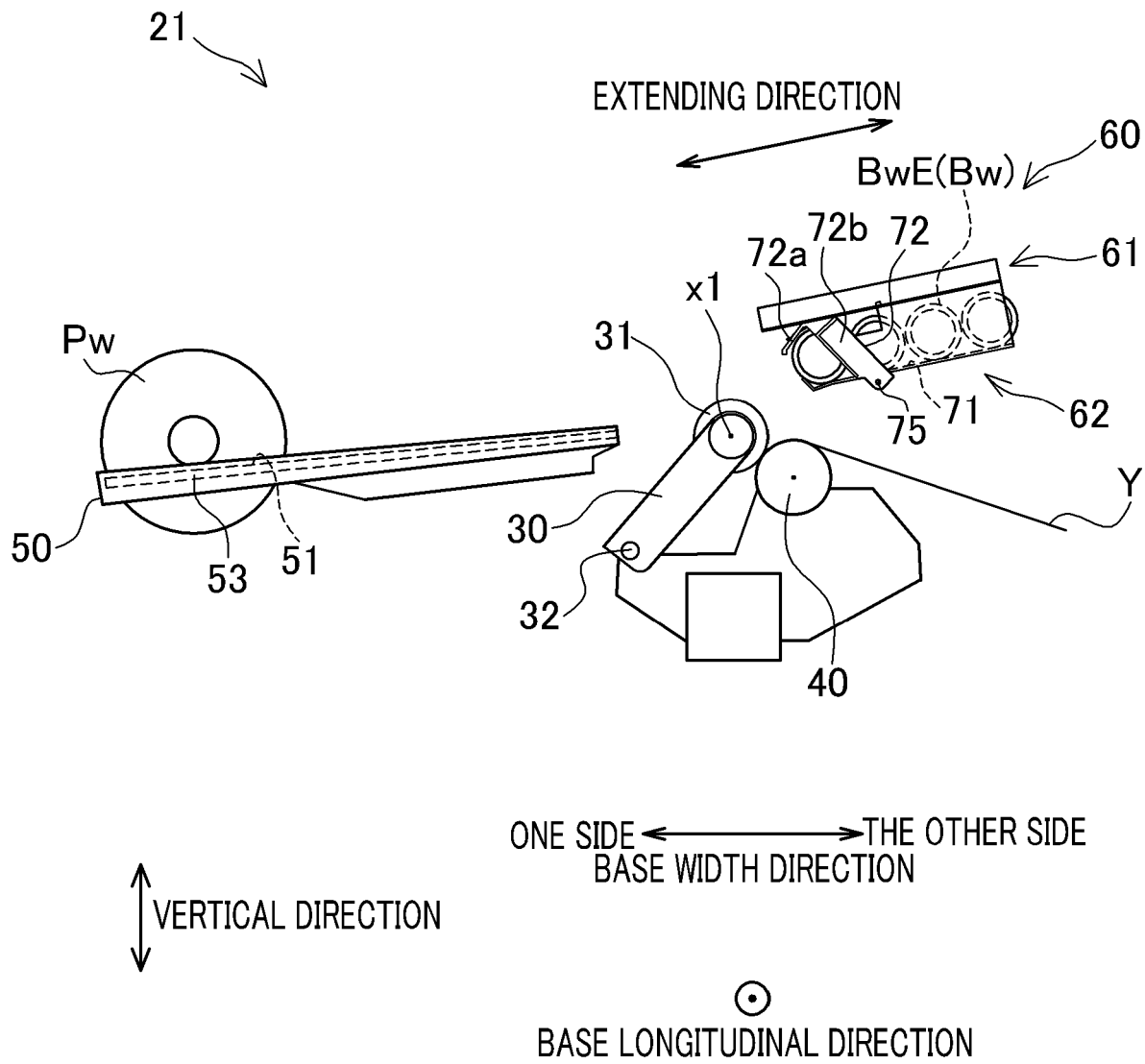


FIG.5

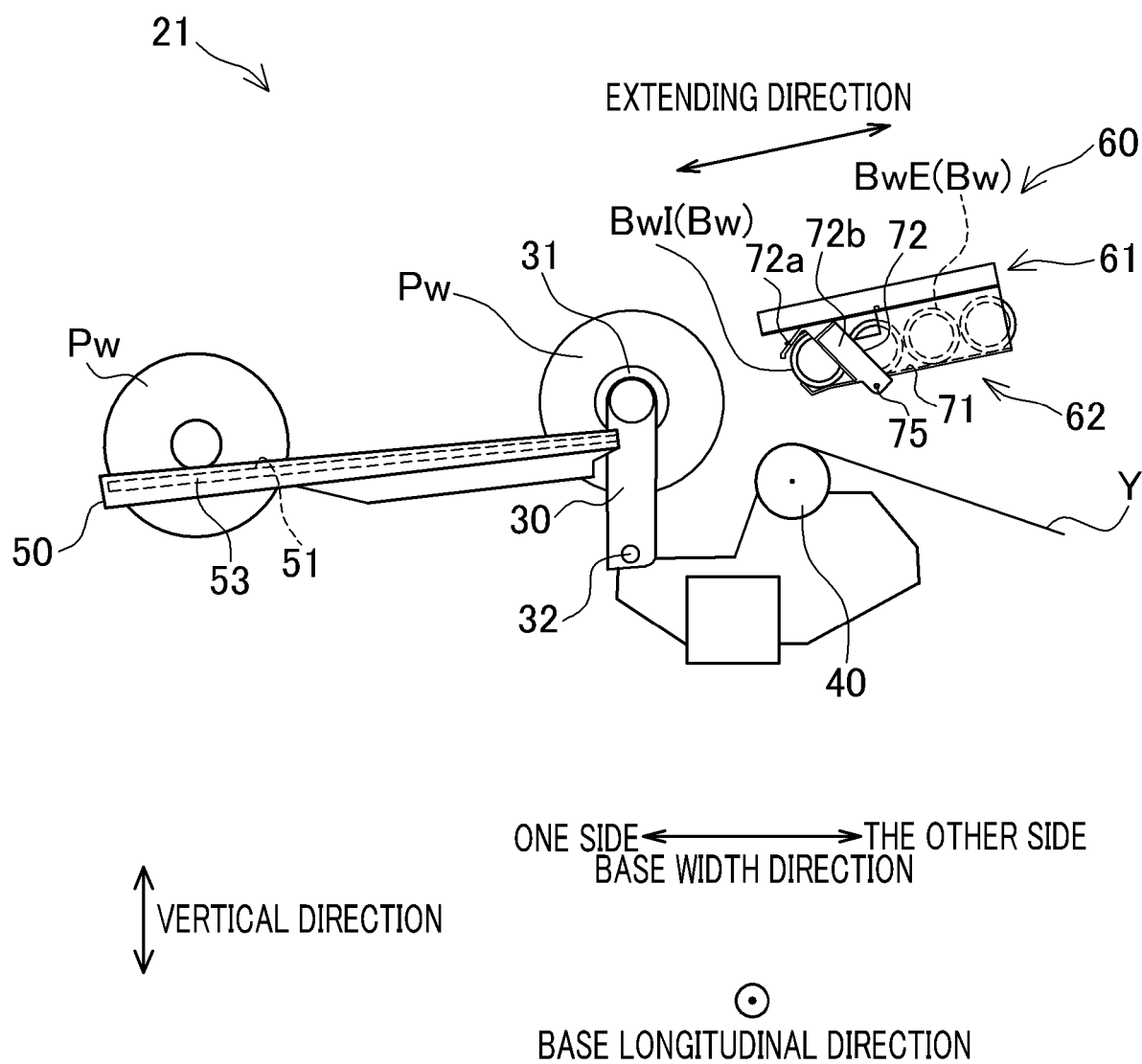


FIG.6

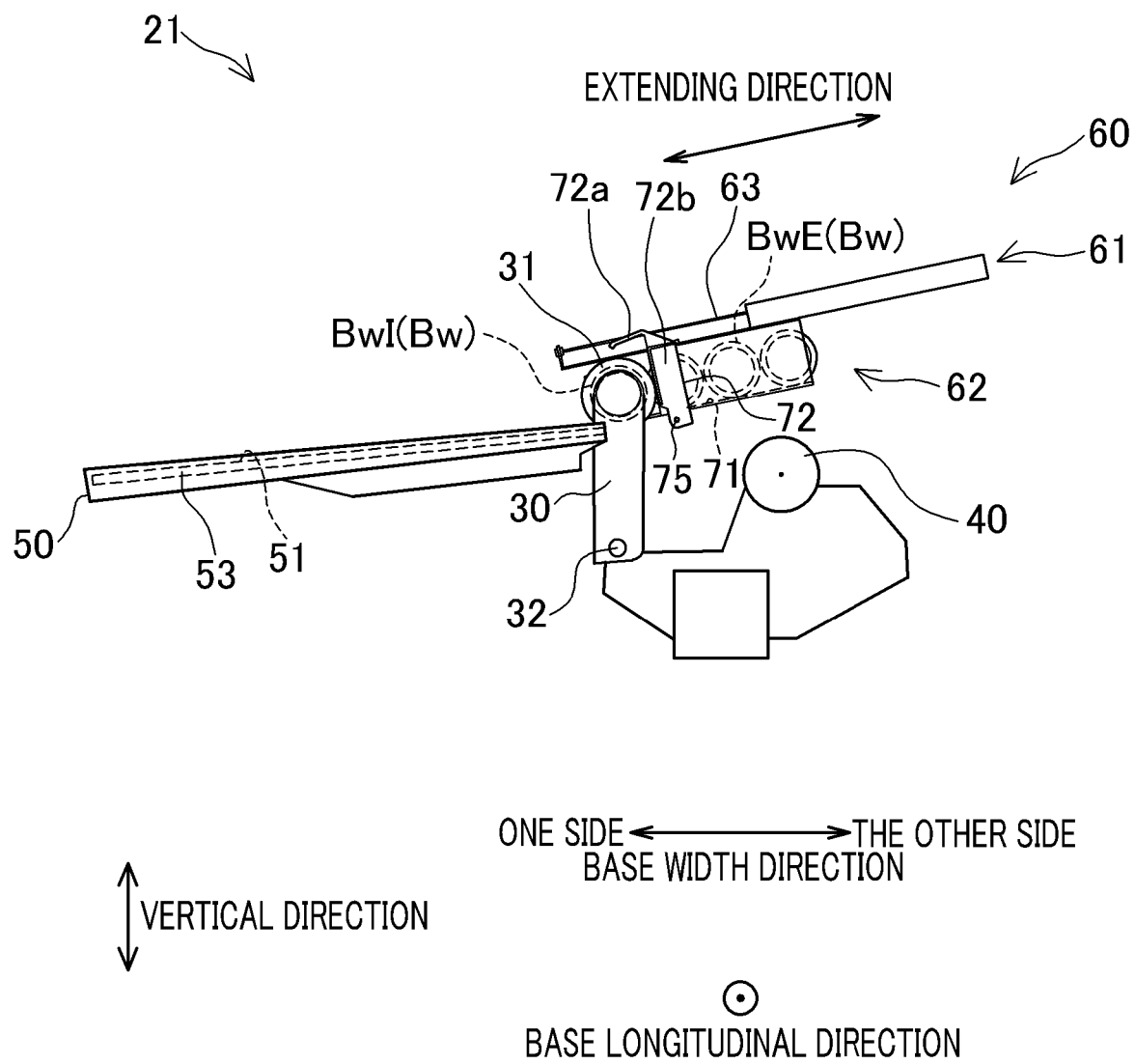


FIG.7

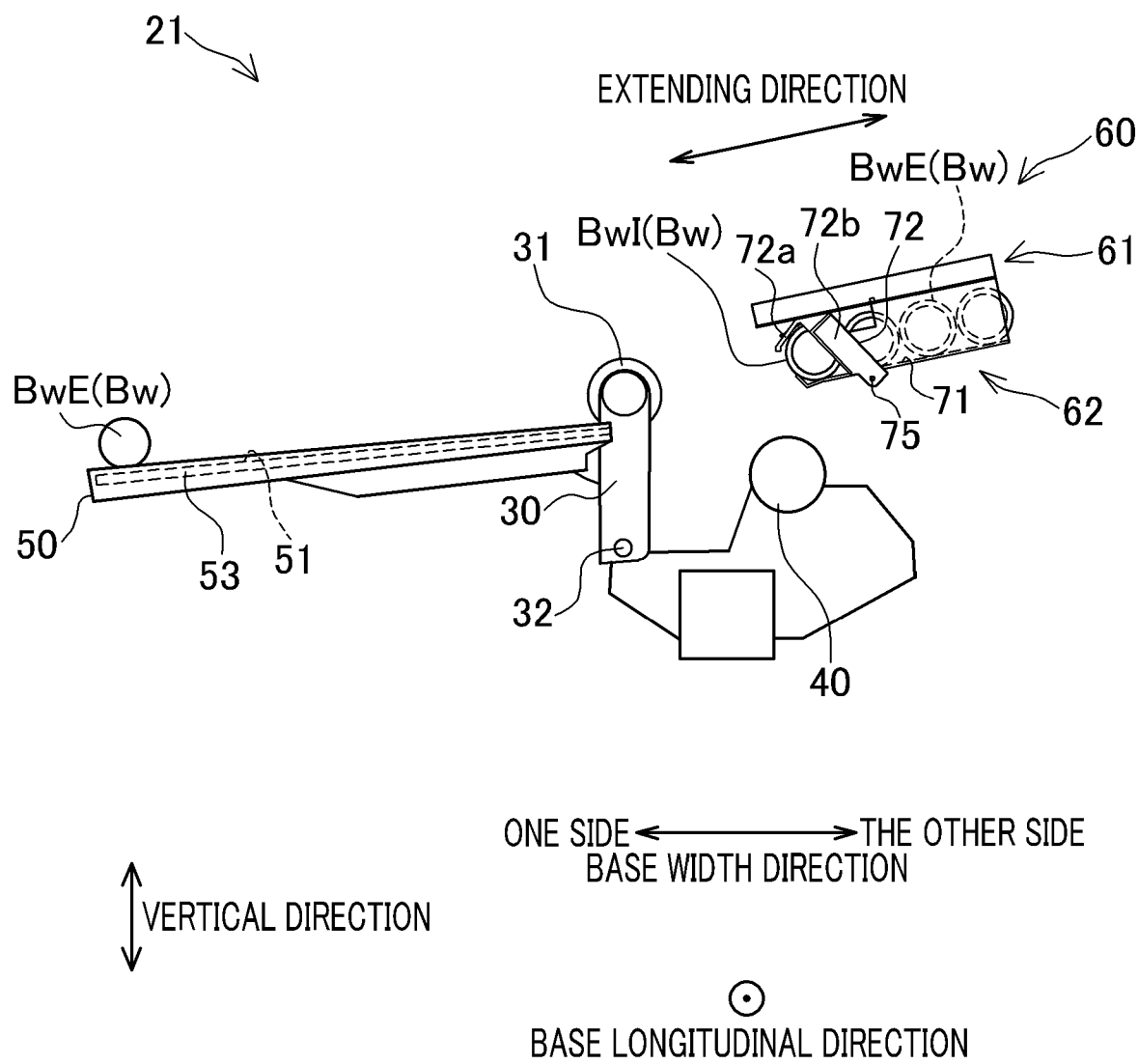


FIG.8

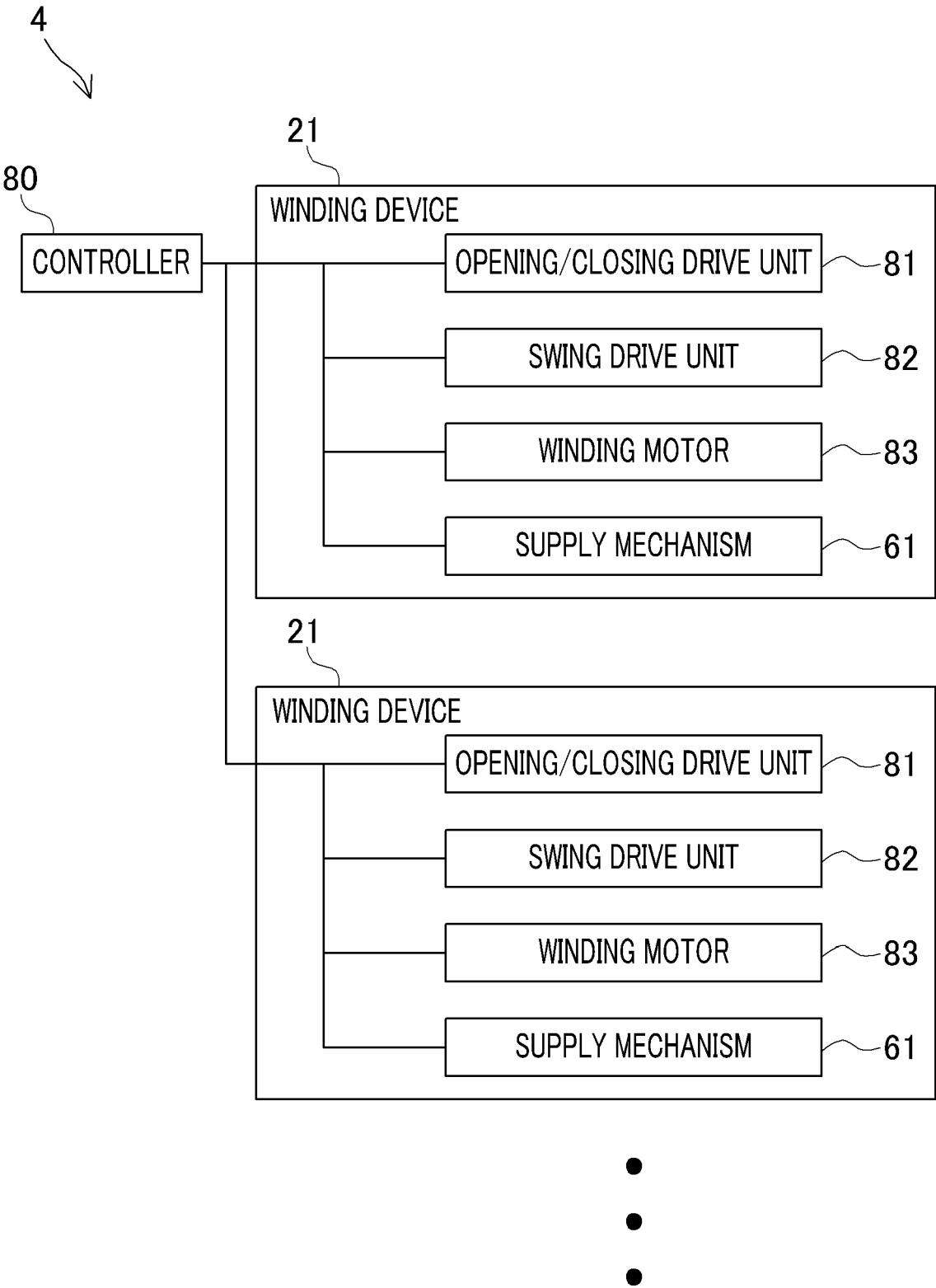


FIG.9

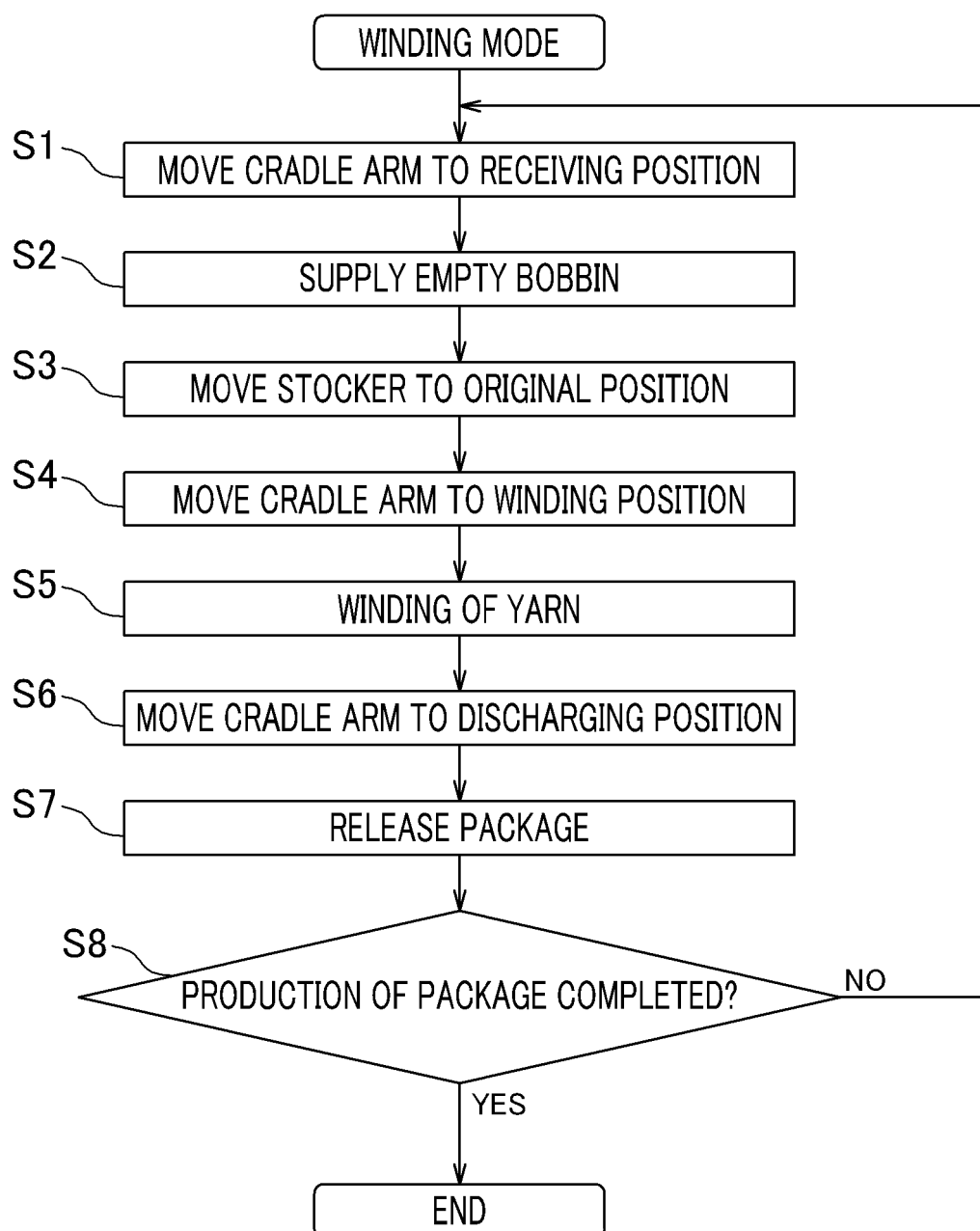
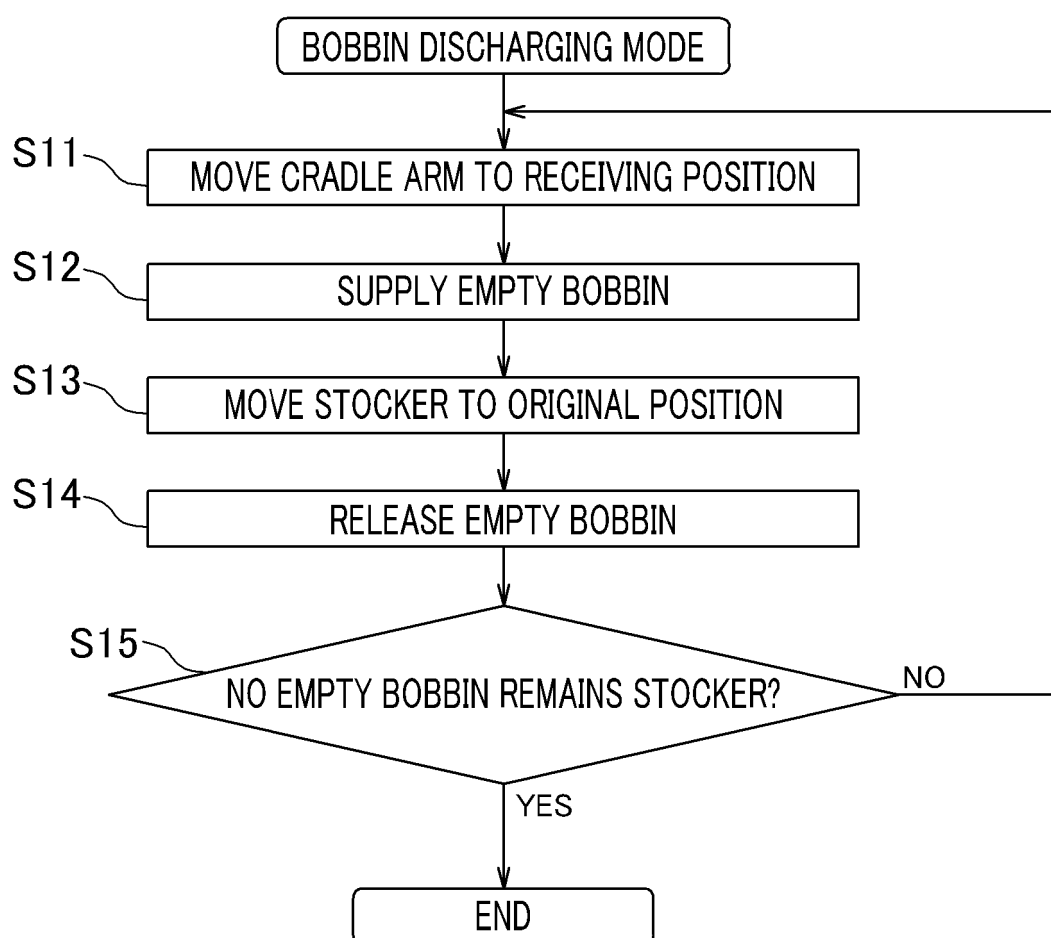


FIG.10





EUROPEAN SEARCH REPORT

Application Number

EP 24 20 7174

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			TECHNICAL FIELDS SEARCHED (IPC)
			B65H D01H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		26 March 2025	Guisan, Thierry
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26 - 03 - 2025

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		JP 2023162756 A	09-11-2023
		TW 202342838 A	01-11-2023

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

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