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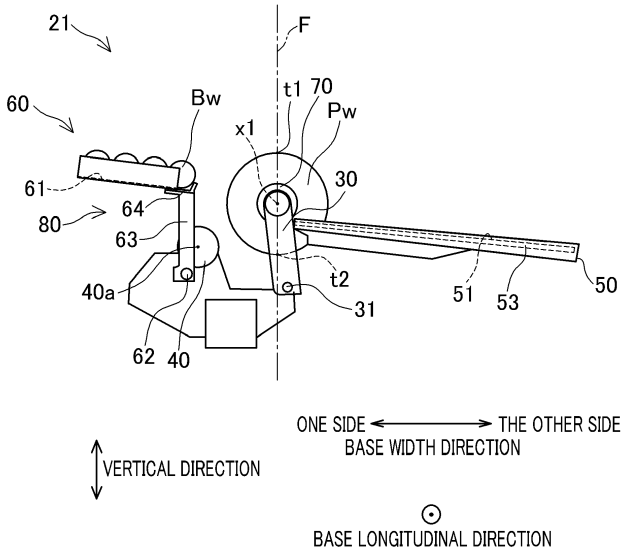
(54) WINDING DEVICE AND WINDING SYSTEM

(57) An object of the present invention is to suppress the increase of height of a winding device.

A winding device 21 includes cradle arms 30, a package storage unit 50, a stocker 60 including a first supporting surface 61, and a contact roller 40. The stocker 60 is provided on one side of a vertical plane F while the package storage unit 50 is provided on the other side of the vertical plane F. The contact roller 40 is provided on one side of the vertical plane F, and the position of the contact roller 40 is lower than that of the stocker 60. In the vertical direction, the first supporting surface 61 is below an upper end t1 of a virtual maximum circumferential surface of a wound package Pw supported by the cradle arms 30 at a release position. In the vertical direction, a rotational center 40a of the contact roller 40 is above a lower end t2 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position.

FIG.3



EP 4 242 154 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a winding device and a winding system including the winding device.

[0002] Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2011-47074) discloses a false-twist texturing machine configured to perform false twisting of a yarn. The false-twist texturing machine of Patent Literature 1 includes a yarn supplying unit configured to supply a yarn, a winding device configured to perform winding of the yarn, a heater provided on a yarn path from the yarn supplying unit to the winding device, a cooler, and a false-twisting device. The winding device includes a cradle which rotatably supports a bobbin holder, and is configured to form a package by winding the yarn onto a bobbin attached to the bobbin holder.

[0003] When the formation of a fully-wound package is completed in the winding device, the fully-wound package is detached from the cradle and a new empty bobbin is supplied to the cradle. Patent Literature 2 discloses a winding device including (i) a stocker (an empty bobbin supply path in Patent Literature 2) which stores empty bobbins supplied to a cradle and (ii) a package storage unit (a package tray in Patent Literature 2) which stores fully-wound packages taken out from the cradle. After one fully-wound package is detached from the cradle and sent to the package storage unit, one empty bobbin stored in the stocker is supplied to the cradle. As a result, the replacement of a bobbin is completed.

[0004] According to Patent Literature 2 (Japanese Laid-Open Patent Publication No. H10-279188), both of the stocker and the package storage unit are provided on one side of the cradle in a direction orthogonal to the axial direction of a bobbin holder. In addition to this, the stocker is provided above the package storage unit. With this arrangement, each fully-wound package detached from the cradle passes under the stocker and then reaches the package storage unit.

SUMMARY OF THE INVENTION

[0005] In regard to the above, when one fully-wound package detached from the cradle is sent to the package storage unit in a structure in which the distance between the stocker and the package storage unit in a vertical direction is short, this fully-wound package may make contact with the stocker. In this case, this fully-wound package is prevented from moving toward the package storage unit, and/or the quality of packages is decreased. Therefore, the distance between the stocker and the package storage unit in the vertical direction needs to be long enough to avoid the contact between the stocker and each fully-wound package supplied to the package storage unit.

[0006] However, when the distance between the stocker and the package storage unit in the vertical direction is long, the height of the entire winding device is large. According to Patent Literature 1, winding devices are aligned to form plural stages in the vertical direction. In this case, the larger the number of these stages is, the larger the height of the entire false-twist texturing machine is. Furthermore, stockers and packages storage unit of the winding devices are provided above the winding devices aligned to form the stages so that it is difficult for an operator to replenish the stocker with empty bobbins and to take each fully-wound package out from the package storage unit.

[0007] An object of the present invention is to suppress the increase of height in a winding device.

[0008] A winding device of the present invention includes: a cradle which is able to rotatably support a bobbin holder and which is movable between a winding start position and a release position, formation of at least one package starting at the winding start position by winding a yarn on at least one bobbin attached to the bobbin holder, the at least one package being released from the bobbin holder at the release position; a package storage unit configured to store the at least one package released from the cradle at the release position; a stocker which has a first supporting surface and which is configured to store the at least one bobbin supplied to the cradle, the first supporting surface supporting the at least one bobbin from below; and a contact roller which rotates while being in contact with an outer circumferential surface of the at least one package, the stocker being provided on one side of a vertical plane passing an axial center of the bobbin holder supported by the cradle at the release position, the package storage unit being provided on the other side of the vertical plane, the contact roller being provided on the one side of the vertical plane, the position of the contact roller being lower than the position of the stocker, the first supporting surface of the stocker being, in a vertical direction, below an upper end of a virtual maximum circumferential surface of the at least one package which is supported by the cradle at the release position and whose diameter is a predetermined maximum, and a rotational center of the contact roller being, in the vertical direction, above a lower end of the virtual maximum circumferential surface of the at least one package supported by the cradle at the release position.

[0009] According to the present invention, the stocker is provided on the one side of the vertical plane passing the axial center of the bobbin holder supported by the cradle at the release position. Meanwhile, the package storage unit is provided on the other side of the vertical plane. With this arrangement, one fully-wound package released from the cradle at the release position is sent to the package storage unit without a possibility that this fully-wound package makes contact with the stocker. In the winding device structured as described above, in the vertical direction, the first supporting surface of the stocker is below the upper end of the virtual maximum circumferential surface of the at least one package supported by the cradle at the release position, and the rotational

center of the contact roller whose position is lower than that of the stocker is above the lower end of the virtual maximum circumferential surface of the at least one package supported by the cradle at the release position. It is therefore possible to suppress the increase of height of the winding device, without preventing the fully-wound package from being sent to the package storage unit.

[0010] In the winding device of the present invention, preferably, the stocker is able to store bobbins, and an upper end of each of at least one of the bobbins stored in the stocker is, in the vertical direction, below the upper end of the virtual maximum circumferential surface of the at least one package supported by the cradle at the release position.

[0011] According to the present invention, in the vertical direction, a large part of the stocker is below the upper end of the virtual maximum circumferential surface of the at least one package supported by the cradle at the release position. It is therefore possible to further suppress the increase of height of the winding device.

[0012] In the winding device of the present invention, preferably, the cradle is movable between the winding start position and the release position by swinging about a swing axis extending in an axial direction of the bobbin holder, the package storage unit includes a second supporting surface which supports, from below, the at least one package which is released from the cradle, and the second supporting surface is, in the vertical direction, above the swing axis and below a center of the at least one package supported by the cradle at the release position.

[0013] According to the present invention, in the vertical direction, the second supporting surface of the package storage unit is above the swing axis of the cradle and below the center of the at least one package supported by the cradle at the release position. It is therefore possible to suppress the increase of height of the winding device due to the package storage unit.

[0014] In the winding device of the present invention, preferably, the second supporting surface is above the lower end of the virtual maximum circumferential surface of the at least one package supported by the cradle at the release position in the vertical direction.

[0015] According to the present invention, in the vertical direction, the position of the second supporting surface of the package storage unit is arranged to be as high as possible within a range lower than the center of the package supported by the cradle at the release position. It is therefore possible to further suppress the increase of height of the winding device due to the package storage unit.

[0016] In the winding device of the present invention, preferably, the package storage unit includes a second supporting surface which supports, from below, the at least one package which is released from the cradle, and the second supporting surface is, in the vertical direction, above the lower end of the virtual maximum circumferential surface of the at least one package supported by the cradle at the release position and below a center of the at least one package supported by the cradle at the release position.

[0017] According to the present invention, in the vertical direction, the second supporting surface of the package storage unit is above the lower end of the virtual maximum circumferential surface of the at least one package supported by the cradle at the release position and below the center of the at least one package supported by the cradle at the release position. It is therefore possible to suppress the increase of height of the winding device due to the package storage unit.

[0018] Preferably, the winding device of the present invention further includes a bobbin supplying unit configured to supply each of the bobbins from the stocker to the cradle.

[0019] Typically, when each of the bobbins is supplied to the cradle in such a way that the entire stocker swings about a rotational axis extending in the axial direction of the bobbin holder, the stocker passes above where the stocker was. In this case, a space for allowing the stocker to swing needs to be provided above the winding device. This increases the actual height of the winding device. According to the present invention, the bobbin supplying unit configured to supply the cradle with each of the bobbins stored in the stocker is provided to be independent from the stocker. It is therefore possible to suppress the increase of height of the winding device as compared to the case where the entire stocker swings.

[0020] In the winding device of the present invention, preferably, the package storage unit is able to store packages and is inclined downward in a direction away from the vertical plane.

[0021] According to the present invention, even when the packages are released from the cradle and sent to the package storage unit, each of the packages is sent in order in the direction away from the vertical plane along the inclined package storage unit. It is therefore unnecessary to provide a device for sending, in order to store the packages in the package storage unit, each of the packages in the direction away from the vertical plane. As a result, the increase of height of the winding device is suppressed.

[0022] A winding system of the present invention is structured so that winding devices each of which is identical with the above-described winding device of the present invention are aligned to form plural stages in the vertical direction.

[0023] When the winding devices are used in the present invention, the increase of height of each of the winding devices provided to form the stages in the vertical direction is suppressed. Therefore, the increase of height from the highest one of the stages to the lowest one of the stages is also suppressed. This allows an operator to easily access stockers and package storage units of some winding devices provided at a high position in the vertical direction. Because of this, the operator easily replenishes each stocker with an empty bobbin and takes

a fully-wound package out from each package storage unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is a profile of a false-twist texturing machine of an embodiment.
FIG. 2 is a schematic diagram of a winding device.
FIG. 3 is a schematic diagram of the winding device when a cradle arm is at a release position.
FIG. 4 is a schematic diagram of the winding device when a stocker is at a bobbin supply position.
FIG. 5 is a schematic diagram of the winding device when the cradle arm is moved back to a winding start position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] The following will describe an embodiment of the present invention with reference to figures.

(Overall Structure of False-Twist Texturing Machine 1)

[0026] 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 a vertical direction in which the gravity acts. These definitions of the directions will be suitably used hereinbelow.

[0027] The false-twist texturing machine 1 is able to perform false twisting of yarns Y made of, e.g., synthetic fibers such as nylon (polyamide fibers). The false-twist texturing machine 1 includes a yarn supplying unit 2 provided for supplying yarns Y, a processing unit 3 configured to perform false twisting of the yarns Y supplied from the supplying unit 2, and a winding unit 4 configured to wind the yarns Y processed by the processing unit 3 onto bobbins Bw. The yarn supplying unit 2, the processing unit 3, and the winding unit 4 include structural elements, 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 extend to the winding unit 4 from the yarn supplying unit 2 via the processing unit 3.

[0028] The yarn supplying unit 2 includes a creel stand 7 retaining yarn supply packages Ps, and is configured to supply 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: each first feed roller 11; each twist-stopping guide 12; each first heater 13; each cooler 14; each 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. The winding unit 4 includes a winding system 5 formed of winding devices 21 which are aligned to form plural stages (four in the present embodiment) in the vertical direction. The winding system 5 is configured to wind the yarns Y for which the false winding has been performed in the processing unit 3 onto the winding bobbins Bw by means of winding devices 21, and to form wound packages Pw.

[0029] The false-twist texturing machine 1 includes a main base 8 and a winding base 9 which are spaced 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 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 yarn threading to each device. The yarn paths are formed so that the yarns Y mainly run around the working space 22.

[0030] 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 provided to oppose each other. In one span, each device is provided so that the yarns Y running while being aligned in the base longitudinal direction are simultaneously false-twisted. For example, sixteen winding devices 21 provided to form four stages and four columns are provided for the winding base 9 included in one span. In the false-twist texturing machine 1, the spans are provided in a left-right symmetrical manner to the sheet, with a center line C of the base width direction of each main base 8 as a symmetry axis (each 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)

[0031] The following will describe each structural element of the processing unit 3. The first feed rollers 11 are configured to send the yarns Y supplied from the yarn supplying unit 2 to the first heaters 13. The first feed rollers 11 are provided above the winding base 9 (see FIG. 1). The first feed rollers 11 are aligned in the base longitudinal direction.

[0032] The twist-stopping guides 12 prevent twisting which has been applied to the yarns Y in the later-described false-twisting devices 15 from being propagated to the upstream of the twist-stopping guides 12 in the yarn running direction. The twist-stopping guides 12 are provided downstream of the first feed rollers 11 in the yarn running direction and upstream of the first heaters 13 in the yarn running direction. The twist-stopping guides 12 are, e.g., provided for the respective yarns Y

supplied from the yarn supplying unit 2, and aligned in the base longitudinal direction.

[0033] The first heaters 13 are configured to heat the yarns Y sent from the first feed rollers 11, and are provided at the supporting frame 10 (see 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.

[0034] The coolers 14 are configured to cool the yarns Y heated in the first heaters 13. The coolers 14 are provided downstream of the first heaters 13 in the yarn running direction and upstream of the false-twisting devices 15 in the yarn running direction. The coolers 14 are provided for the yarns Y supplied from the yarn supplying unit 2, and aligned in the base longitudinal direction.

[0035] The false-twisting devices 15 are configured to twist the yarns Y. The false-twisting devices 15 are provided 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, sixteen false-twisting devices 15 are provided in one span.

[0036] The second feed roller 16 is configured to send the yarns Y twisted by the false-twisting devices 15 toward the interlacing device 17. The second feed roller 16 is provided downstream of the false-twisting devices 15 in the yarn running direction in the main base 8. The conveyance speed of conveying the yarns Y by the second feed roller 16 is higher than the conveyance speed of conveying the yarns Y by the first feed rollers 11. The yarns Y are therefore drawn between the first feed rollers 11 and the second feed roller 16.

[0037] The interlacing device 17 is configured to interlace the yarns Y by injecting air thereto. The interlacing device 17 is provided below the second feed roller 16 in the main base 8.

[0038] The third feed roller 18 is configured to send the yarns Y interlaced by the interlacing device 17 toward the second heater 19. The third feed roller 18 is provided below the interlacing device 17 in the main base 8. The conveyance speed of conveying the yarns Y by the third feed roller 18 is lower than the conveyance speed of conveying the yarns Y by the second feed roller 16. The yarns Y are therefore relaxed between the second feed roller 16 and the third feed roller 18.

[0039] The second heater 19 is configured to heat the yarns Y sent from the third feed roller 18. The second heater 19 is provided below the third feed roller 18 in the main base 8. The second heater 19 extends along an up-down direction, and is provided for each of the spans.

[0040] The fourth feed roller 20 is configured to send the yarns Y thermally treated by the second heater 19 toward the winding devices 21. The fourth feed roller 20 is provided at a lower part of the winding base 9. The conveyance speed of conveying the yarns Y by the fourth feed roller 20 is lower than the conveyance speed of conveying the yarns Y by the third feed roller 18. The yarns Y are therefore relaxed between the third feed roller 18 and the fourth feed roller 20.

[0041] In the processing unit 3 arranged as described above, the yarns Y drawn between the first feed rollers 11 and the second feed roller 16 are twisted by the false-twisting devices 15. The twist formed by the false-twisting devices 15 is propagated to the twist-stopping guides 12, but is not propagated to the upstream of the twist-stopping guides 12 in the yarn running direction. The yarns Y which are twisted and drawn are heated in the first heaters 13 and thermally set. After that, the yarns Y are cooled in the coolers 14. The yarns Y are untwisted at the downstream of the false-twisting devices 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 devices 15, the yarns Y are interlaced by the interlacing device 17 while being relaxed between the second feed roller 16 and the third feed roller 18. Subsequently, the yarns Y are guided to the downstream side in the yarn running direction. The yarns Y are then thermally set in the second heater 19 while being relaxed between the third feed roller 18 and the fourth feed roller 20. Finally, the yarns Y sent from the fourth feed roller 20 are wound by the winding devices 21, and the wound packages Pw are formed.

(Winding Unit 4)

[0042] The winding unit 4 includes the winding devices 21. The winding devices 21 are configured to form the wound packages Pw by winding the yarns Y sent from the fourth feed roller 20 onto the bobbins Bw.

[0043] As shown in FIG. 2, each winding device 21 includes a pair of cradle arms 30 (cradle of the present invention), a contact roller 40, a package storage unit 50, and a stocker 60. FIG. 2 shows one wound package Pw which is being formed by the winding device 21.

[0044] The pair of cradle arms 30 are provided to oppose each other in the base longitudinal direction. The pair of cradle arms 30 are able to rotatably support a bobbin holder 70. The pair of cradle arms 30 are able to sandwich a bobbin Bw through the bobbin holder 70. The pair of cradle arms 30 are movable between a winding start position and a release position by rotating about a swing axis 31 extending in the base longitudinal direction which is the axial direction of the bobbin holder 70. As shown in FIG. 5, when the pair of cradle arms 30 are at the winding start position, the formation of a wound package Pw (package of the present invention) is started by winding a yarn Y onto the bobbin Bw attached to the bobbin holder 70. As shown in FIG. 3, when the pair of cradle arms 30 are at the release position, the cradle arms 30 release the wound package Pw from the bobbin holder 70 and send the released wound package Pw to the package storage unit 50. Each cradle arm 30 is structured (see FIG. 2 and FIG. 3) so that, as the diameter of the wound package Pw supported by the cradle arms 30 increases, a center x1 of the wound package Pw approaches the package storage unit 50 in the base width

direction. The center x1 of the wound package Pw supported by the cradle arms 30 is substantially identical with an axial center of the bobbin holder 70.

[0045] The contact roller 40 is rotationally driven in the same direction while being in contact with an outer circumferential surface of the bobbin Bw or wound package Pw. Because of this, the bobbin Bw is rotated so that the yarn Y is wound onto the bobbin Bw. The contact roller 40 is driven by an unillustrated motor. As shown in FIG. 3, the contact roller 40 is provided on one side of a vertical plane F passing the axial center of the bobbin holder 70 supported by the cradle arms 30 at the release position. In the present embodiment, the vertical plane F is in parallel to the vertical direction and the base longitudinal direction. In the present embodiment, one side of the vertical plane F indicates one side (the left side of the sheet of FIG. 3) of the vertical plane F in the base width direction. As shown in FIG. 3, the position of the contact roller 40 is lower than that of the stocker 60 in the vertical direction. As shown in FIG. 3, in the vertical direction, a rotational center 40a of the contact roller 40 is above a lower end t2 of a virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. The virtual maximum circumferential surface of the wound package Pw indicates a circumferential surface of the wound package Pw when the diameter of the wound package Pw is the maximum (i.e., the maximum winding diameter) determined based on the specifications of the winding device 21. The specifications of the winding device 21 set the maximum diameter of the wound package Pw to, e.g., 250 mm. For the sake of convenience, a lower end of a circumferential surface of the fully-wound package Pw is denoted by t2 in FIG. 3. However, the lower end t2 of the virtual maximum circumferential surface of the wound package Pw may be lower than the lower end of the circumferential surface of the fully-wound package Pw.

[0046] The package storage unit 50 is configured to store each wound package Pw released from the cradle arms 30 at release position. In the present embodiment, the package storage unit 50 is able to store two wound packages Pw at maximum. As shown in FIG. 3, the package storage unit 50 is provided on the other side of the vertical plane F. In the present embodiment, the other side of the vertical plane F indicates the other side (the right side of the sheet of FIG. 3) of the vertical plane F in the base width direction.

[0047] As shown in FIG. 2, the package storage unit 50 includes two rails 53 provided to oppose each other in the base longitudinal direction. The distance between the two rails 53 is slightly shorter than the length of the bobbin Bw in the base longitudinal direction, and is longer than the length of the wound package Pw in the base longitudinal direction. In this regard, the wound package Pw is formed by winding the yarn Y onto the bobbin Bw. A top surface of each rail 53 is provided with a second supporting surface 51 which supports each wound package Pw, which is released from the cradle arms 30, from below. To be more specific, the two second supporting surfaces 51 support the wound package Pw from below by supporting both ends of each bobbin Bw on which the wound package Pw is formed. As shown in FIG. 3, in the vertical direction, the second supporting surfaces 51 are above the lower end t2 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position and below the center x1 of the wound package Pw supported by the cradle arms 30 at the release position.

[0048] As shown in FIG. 3, the package storage unit 50 is inclined downward in a direction away from the vertical plane F and in the base width direction, i.e., provided so that one end of the package storage unit 50 is higher than the other end of the package storage unit 50 in the base width direction. The second supporting surfaces 51 of the package storage unit 50 are inclined downward in the same manner as the package storage unit 50, i.e., provided so that one end of each second supporting surface 51 is higher than the other end of each second supporting surface 51 in the base width direction. With this arrangement, each wound package Pw released from the cradle arms 30 rolls down from one side to the other side in the base width direction of the second supporting surfaces 51 inclined downward. A stopper (not illustrated) provided for preventing each wound package Pw from falling off from the package storage unit 50 in the base width direction is formed at the other end of the package storage unit 50 in the base width direction.

[0049] When yarn breakage occurs while the winding device 21 performs winding of the yarn Y, the package storage unit 50 stores a wound package Pw on which the yarn Y is wound halfway in addition to each fully-wound package Pw.

[0050] The stocker 60 is configured to store each bobbin Bw supplied to the cradle arms 30. In the present embodiment, the stocker 60 is able to store four bobbins Bw at maximum. Each bobbin Bw stored in the stocker 60 is an empty bobbin Bw on which no yarn Y is wound. As shown in FIG. 3, the stocker 60 is provided on one side of the vertical plane F. The position of the stocker 60 is higher than that of the package storage unit 50 and that of the contact roller 40 in the vertical direction.

[0051] The stocker 60 has a first supporting surface 61 which supports each bobbin Bw from below. As shown in FIG. 3, in the vertical direction, the first supporting surface 61 is below an upper end t1 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. At least one upper end of at least one bobbin Bw stored in the stocker 60 is below the upper end t1 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. In the present embodiment, when the stocker 60 stores four bobbins Bw, upper ends of the bobbins Bw are below the upper end t1 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 except a bobbin Bw provided

on one side of other bobbins Bw in the base width direction.

[0052] The stocker 60 is provided not to overlap, in the base width direction, the wound package Pw supported by the cradle arms 30 configured to move from the winding start position to the release position in accordance with the winding of the yarn Y.

[0053] The winding device 21 further includes a bobbin supplying unit 80 configured to supply each bobbin Bw to the cradle arms 30 from the stocker 60. The bobbin supplying unit 80 includes an arm member 63 extending in the vertical direction and a bobbin supporter 64 formed at an upper end part of the arm member 63. The arm member 63 is swingable about a rotational axis 62 which is provided at a lower end part of the arm member 63 and which extends in the base longitudinal direction. The bobbin supporter 64 is able to support a single bobbin Bw. The bobbin supporter 64 is able to regulate the movement of this bobbin Bw toward the other side of the bobbin supporter 64 in the base width direction. The bobbin supporter 64 is connected to the first supporting surface 61. The bobbin supporter 64 is swingable together with the arm member 63.

[0054] As shown in FIG. 3 and FIG. 4, when the stocker 60 supplies one bobbin Bw to the cradle arms 30, the arm member 63 viewed in the base longitudinal direction rotates clockwise about the rotational axis 62. When the first supporting surface 61 supports plural bobbins Bw and the arm member 63 swings together with the bobbin supporter 64, a bobbin Bw provided on the other side of other bobbins Bw in the base width direction moves to the bobbin supporter 64 to be supported by the bobbin supporter 64. The bobbin Bw supported by the bobbin supporter 64 swings together with the arm member 63 and the bobbin supporter 64, and is supplied (see FIG. 4) to the bobbin holder 70 supported by the cradle arms 30. After the supply of the bobbin Bw to the cradle arms 30 is completed, the arm member 63 and the bobbin supporter 64 move back to the original position, i.e., a position where the bobbin supporter 64 is connected to the first supporting surface 61 (see FIG. 5). The arm member 63 is swung by, e.g., an unillustrated motor.

(Replacement Operation of Bobbin)

[0055] The following will describe a series of steps of (i) the detachment of a fully-wound package Pw from the cradle arms 30 to the supply of an empty bobbin Bw and (ii) the cradle arms 30, with reference to FIG. 2 to FIG. 5. In this regard, these steps are executed in the winding device 21 of the present embodiment.

[0056] To begin with, a yarn Y is wound onto a bobbin Bw supported by the cradle arms 30 at the winding start position. Because of this, the formation of the wound package Pw is started. When the fully-wound package Pw is formed, the cradle arms 30 rotate about the swing axis 31 so as to move to the release position (see FIG. 3). Subsequently, the fully-wound package Pw is released from the cradle arms 30.

[0057] The fully-wound package Pw released from the cradle arms 30 at the release position is then sent from one side to the other side in the base width direction of the inclined package storage unit 50 as shown in FIG. 4. After that, as the arm member 63 rotates about the rotational axis 62 together with the bobbin supporter 64 as shown in FIG. 4, one of bobbins Bw stored in the stocker 60 is supplied to the cradle arms 30 at the release position. In this regard, the one of the bobbins Bw is provided on the other side of other bobbins Bw in the base width direction.

[0058] Subsequently, the cradle arms 30 supporting this empty bobbin Bw on which no yarn Y is wound move from the release position to the winding start position by rotating about the swing axis 31 as shown in FIG. 5. After that, the winding of the yarn Y is performed again for the bobbin Bw supported by the cradle arms 30.

(Effects)

[0059] Each winding device 21 of the present embodiment includes the cradle arms 30 which are movable between the winding start position and the release position, the package storage unit 50, the stocker 60 including the first supporting surface 61, and the contact roller 40. The stocker 60 is provided on one side of the vertical plane F passing the axial center of the bobbin holder 70 supported by the cradle arms 30 at the release position. Meanwhile, the package storage unit 50 is provided on the other side of the vertical plane F. The contact roller 40 is provided on one side of the vertical plane F, and the position of the contact roller 40 is lower than that of the stocker 60. In the vertical direction, the first supporting surface 61 of the stocker 60 is below the upper end t1 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. In the vertical direction, the rotational center 40a of the contact roller 40 is above the lower end t2 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. In the present embodiment, the stocker 60 is provided on one side of the vertical plane F while the package storage unit 50 is provided on the other side of the vertical plane F. With this arrangement, the fully-wound package Pw released from the cradle arms 30 at the release position is sent to the package storage unit 50 without a possibility that the fully-wound package Pw makes contact with the stocker 60. In the winding device 21 structured as described above, in the vertical direction, the first supporting surface 61 of the stocker 60 is below the upper end t1 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position, and the rotational center 40a of the contact roller 40 is above the lower end t2 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. It is therefore

possible to suppress the increase of height of the winding device 21, without preventing the fully-wound package Pw from being sent to the package storage unit 50.

[0060] In the winding device 21 of the present embodiment, the stocker 60 is able to store plural bobbins Bw. In the vertical direction, at least one upper end of at least one bobbin Bw stored in the stocker 60 is below the upper end t1 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. With this arrangement, in the vertical direction, a large part of the stocker 60 is below the upper end t1 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. It is therefore possible to further suppress the increase of height of the winding device 21.

[0061] In the winding device 21 of the present embodiment, the cradle arms 30 are movable between the winding start position and the release position by swinging about the swing axis 31. The package storage unit 50 includes the second supporting surfaces 51 which support each wound package Pw, which is released from the cradle arms 30, from below. In the vertical direction, the second supporting surfaces 51 are above the lower end t2 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position and below the center x1 of the wound package Pw supported by the cradle arms 30 at the release position. With this arrangement, in the vertical direction, the position of the second supporting surfaces 51 is arranged to be as high as possible within a range lower than the center x1 of the wound package Pw supported by the cradle arms 30 at the release position. It is therefore possible to further suppress the increase of height of the winding device 21 due to the package storage unit 50.

[0062] The winding device 21 of the present embodiment further includes the bobbin supplying unit 80 configured to supply each bobbin Bw to the cradle arms 30 from the stocker 60. Typically, when each bobbin Bw is supplied to the cradle arms 30 in such a way that the entire stocker 60 swings about a rotational axis extending in the axial direction of the bobbin holder 70, the stocker 60 passes above where the stocker 60 was. In this case, a space for allowing the stocker 60 to swing needs to be provided above the winding device 21. This increases the actual height of the winding device 21. In the present embodiment, the bobbin supplying unit 80 configured to supply the cradle arms 30 with each bobbin Bw stored in the stocker 60 is provided to be independent from the stocker 60. It is therefore possible to suppress the increase of height of the winding device 21 as compared to the case where the entire stocker 60 swings.

[0063] In the winding device 21 of the present embodiment, the package storage unit 50 is able to store plural wound packages Pw and is inclined downward in a direction away from the vertical plane F and in the base width direction. With this arrangement, even when plural wound packages Pw are released from the cradle arms 30 and sent to the package storage unit 50, each wound package Pw is sent in order in the direction away from the vertical plane F and in the base width direction along the inclined package storage unit 50. It is therefore unnecessary to provide a device for sending, in order to store these wound packages Pw in the package storage unit 50, each wound package Pw in the direction away from the vertical plane F and in the base width direction. As a result, the increase of height of the winding device 21 is suppressed.

[0064] In the winding system 5 of the present embodiment, the winding devices 21 are provided to form four stages in the vertical direction. When the winding devices 21 of the present invention are used, the increase of height of each of the winding devices 21 provided to form four stages in the vertical direction is suppressed. Therefore, the increase of height from winding devices 21 on the highest stage to winding devices 21 on the lowest stage is also suppressed. This allows an operator to easily access the stockers 60 and package storage units 50 of winding devices 21 provided at a high position in the vertical direction. Because of this, the operator easily replenishes each stocker 60 with empty bobbins Bw and takes fully-wound packages Pw out from each package storage unit 50.

(Modifications)

[0065] 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.

[0066] In the embodiment above, in the vertical direction, at least one upper end of at least one of plural bobbins Bw stored in the stocker 60 is below the upper end t1 of the virtual maximum circumferential surface of a wound package Pw supported by the cradle arms 30 at the release position. However, in the vertical direction, upper ends of all bobbins Bw stored in the stocker 60 may be above the upper end t1 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. In this case, in the vertical direction, the first supporting surface 61 is below the upper end t1 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position.

[0067] In the embodiment above, each bobbin Bw stored in the stocker 60 is supplied to the cradle arms 30 in such a way that the arm member 63 of the bobbin supplying unit 80 rotates about the rotational axis 62 together with the bobbin supporter 64. However, each winding device 21 may not include the bobbin supplying unit 80. In this case, each bobbin Bw stored in the stocker 60 may be supplied to the cradle arms 30 in such a way that the entire stocker 60 swings downward about a rotational axis which is provided at a lower portion of the

stocker 60 and which extends in the axial direction of the bobbin holder 70. Alternatively, the stocker 60 may not move and each bobbin Bw may be received from the stocker 60 in such a way that the cradle arms 30 rotate about the swing axis 31.

[0068] In the embodiment above, in the vertical direction, the second supporting surfaces 51 are above the lower end t2 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. However, the second supporting surfaces 51 may be below the lower end t2 of the virtual maximum circumferential surface of the wound package Pw supported by the cradle arms 30 at the release position. In this case, the second supporting surfaces 51 are preferably above the swing axis 31 of the cradle arms 30.

[0069] In the embodiment above, the cradle arms 30 are movable between the winding start position and the release position by swinging about the swing axis 31. However, the cradle arms 30 may move between the winding start position and the release position in a different manner. For example, the cradle arms 30 may be moved along unillustrated rails.

[0070] In the embodiment above, the position of the stocker 60 is higher than that of the package storage unit 50 in the vertical direction. However, the position of the stocker 60 may be lower than that of the package storage unit 50 in the vertical direction.

[0071] In the embodiment above, the winding device 21 is applied to the false-twist texturing machine 1. However, the winding device 21 of the present invention is applicable not only to the false-twist texturing machine 1 but also to a re-winder.

[0072] The winding devices 21 of the embodiment above are provided to form four stages in the vertical direction. However, the winding devices 21 may be provided to form two or three stages, five or more stages, or one stage in the vertical direction. In the embodiment above, the winding devices 21 of the false-twist texturing machine 1 are aligned to form pleural stages in the vertical direction. However, winding devices of other textile machines such as re-winders may be provided to form plural stages in the vertical direction.

Claims

1. A winding device (21) comprising: a cradle (30) which is able to rotatably support a bobbin holder (70) and which is movable between a winding start position and a release position, formation of at least one package (Pw) starting at the winding start position by winding a yarn on at least one bobbin (Bw) attached to the bobbin holder (70), the at least one package (Pw) being released from the bobbin holder (70) at the release position;

a package storage unit (50) configured to store the at least one package (Pw) released from the cradle (30) at the release position;

a stocker (60) which has a first supporting surface (61) and which is configured to store the at least one bobbin (Bw) supplied to the cradle (30), the first supporting surface (61) supporting the at least one bobbin (Bw) from below; and

a contact roller (40) which rotates while being in contact with an outer circumferential surface of the at least one package (Pw),

the stocker (60) being provided on one side of a vertical plane (F) passing an axial center of the bobbin holder (70) supported by the cradle (30) at the release position, the package storage unit (50) being provided on the other side of the vertical plane (F),

the contact roller (40) being provided on the one side of the vertical plane (F), the position of the contact roller (40) being lower than the position of the stocker (60),

the first supporting surface (61) of the stocker (60) being, in a vertical direction, below an upper end (t1) of a virtual maximum circumferential surface of the at least one package (Pw) which is supported by the cradle (30) at the release position and whose diameter is a predetermined maximum, and

a rotational center (40a) of the contact roller (40) being, in the vertical direction, above a lower end (t2) of the virtual maximum circumferential surface of the at least one package (Pw) supported by the cradle (30) at the release position.

2. The winding device (21) according to claim 1, wherein, the stocker (60) is able to store bobbins (Bw), and an upper end of each of at least one of the bobbins (Bw) stored in the stocker (60) is, in the vertical direction, below the upper end (t1) of the virtual maximum circumferential surface of the at least one package (Pw) supported by the cradle (30) at the release position.

3. The winding device (21) according to claim 1 or 2, wherein, the cradle (30) is movable between the winding start position and the release position by swinging about a swing axis extending in an axial direction of the bobbin holder (70),

the package storage unit (50) includes a second supporting surface (51) which supports, from below, the at least one package (Pw) which is released from the cradle (30), and

the second supporting surface (51) is, in the vertical direction, above the swing axis and below a center of the at least one package (Pw) supported by the cradle (30) at the release position.

4. The winding device (21) according to claim 3, where-

in, the second supporting surface (51) is above the lower end (t2) of the virtual maximum circumferential surface of the at least one package (Pw) supported by the cradle (30) at the release position in the vertical direction.

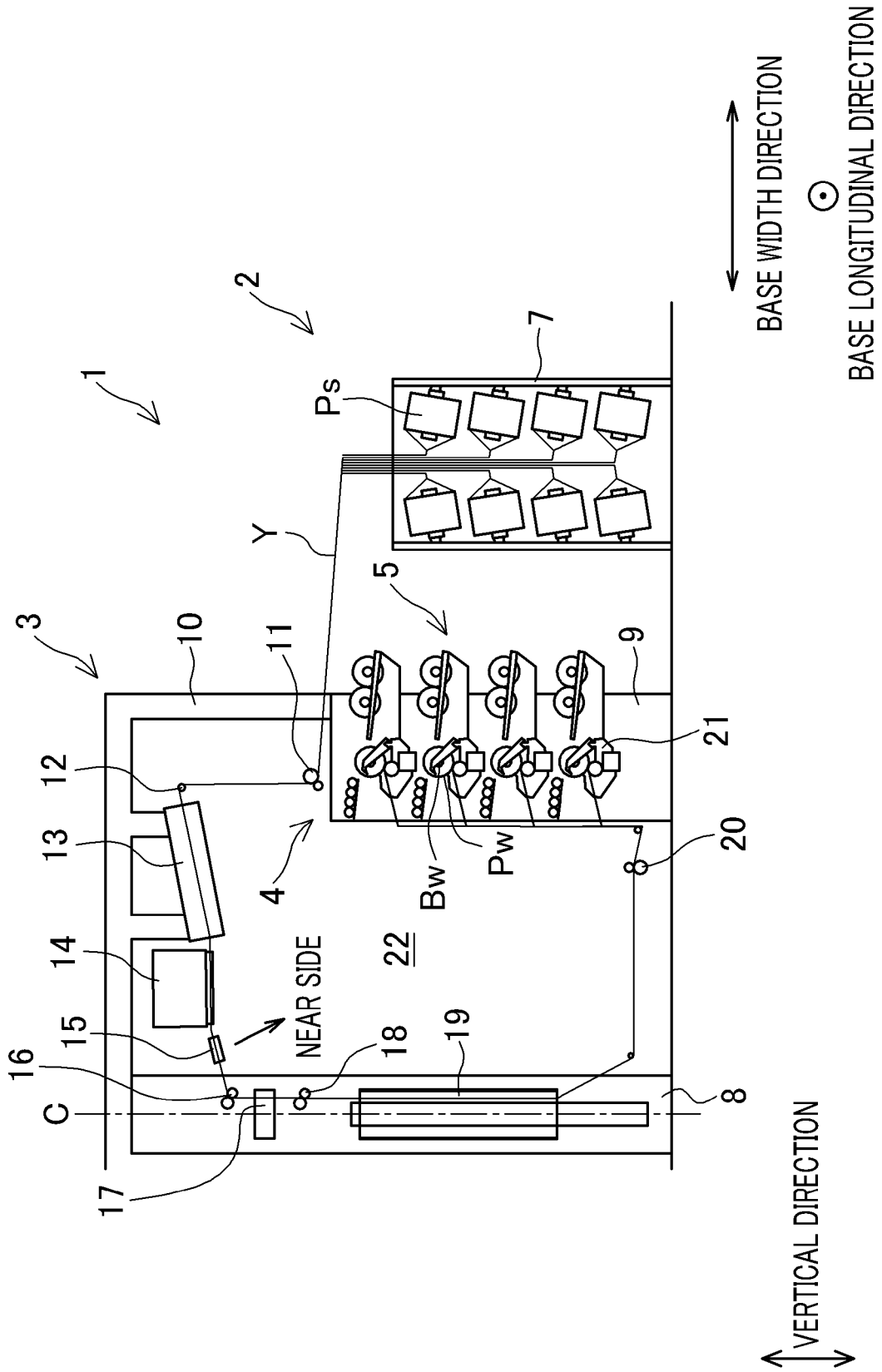
5. The winding device (21) according to claim 1 or 2, wherein, the package storage unit (50) includes a second supporting surface (51) which supports, from below, the at least one package (Pw) which is released from the cradle (30), and
the second supporting surface (51) is, in the vertical direction, above the lower end (t2) of the virtual maximum circumferential surface of the at least one package (Pw) supported by the cradle (30) at the release position and below a center of the at least one package (Pw) supported by the cradle (30) at the release position.

6. The winding device (21) according to any one of claims 1 to 5, further comprising a bobbin supplying unit (80) configured to supply each of the bobbins (Bw) from the stocker (60) to the cradle (30).

7. The winding device (21) according to any one of claims 1 to 6, wherein, the package storage unit (50) is able to store packages (Pw) and is inclined downward in a direction away from the vertical plane (F).

8. A winding system (5) structured so that winding devices (21) each of which is identical with the winding device (21) according to any one of claims 1 to 7 are aligned to form plural stages in the vertical direction.

FIG.1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BASE LONGITUDINAL DIRECTION
VERTICAL DIRECTION
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7
8
9
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16
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Ps
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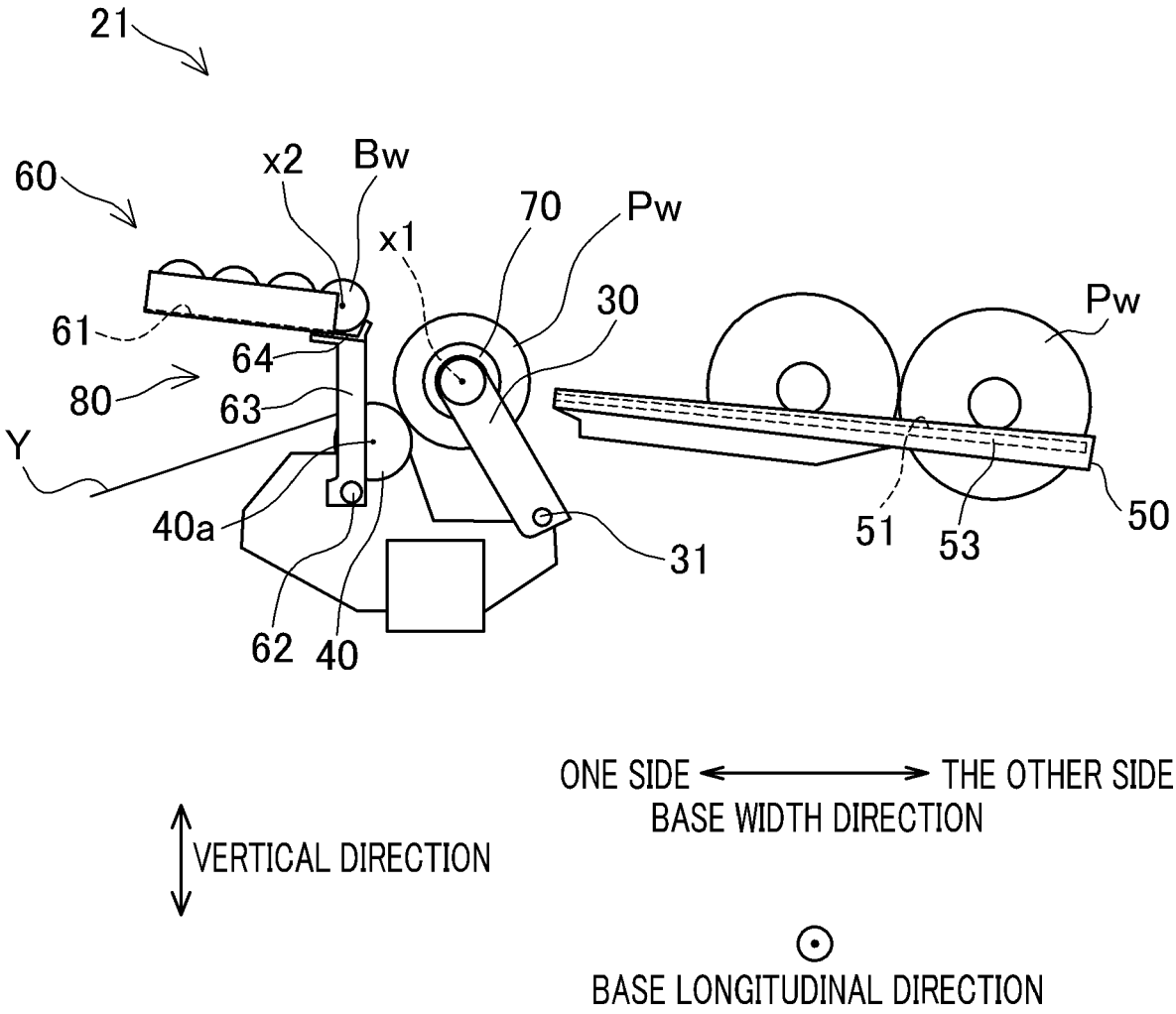
Bw
Pw
C

FIG.2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Bw
70
Pw
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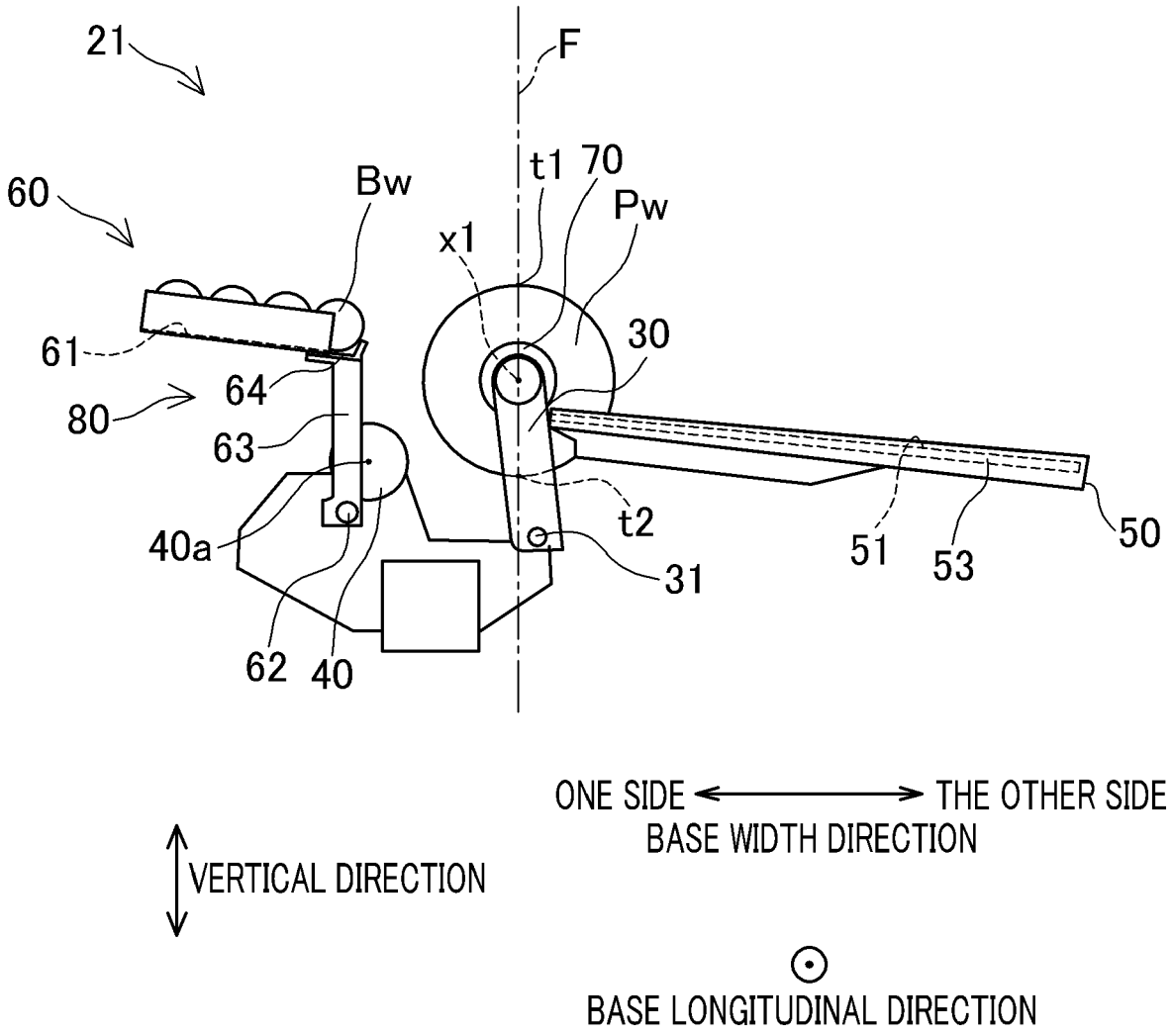
ONE SIDE
THE OTHER SIDE
BASE WIDTH DIRECTION
VERTICAL DIRECTION
BASE LONGITUDINAL DIRECTION

FIG.3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Bw
t1
70
Pw
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80
63
t2
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40a
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ONE SIDE
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BASE WIDTH DIRECTION
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BASE LONGITUDINAL DIRECTION

FIG.4

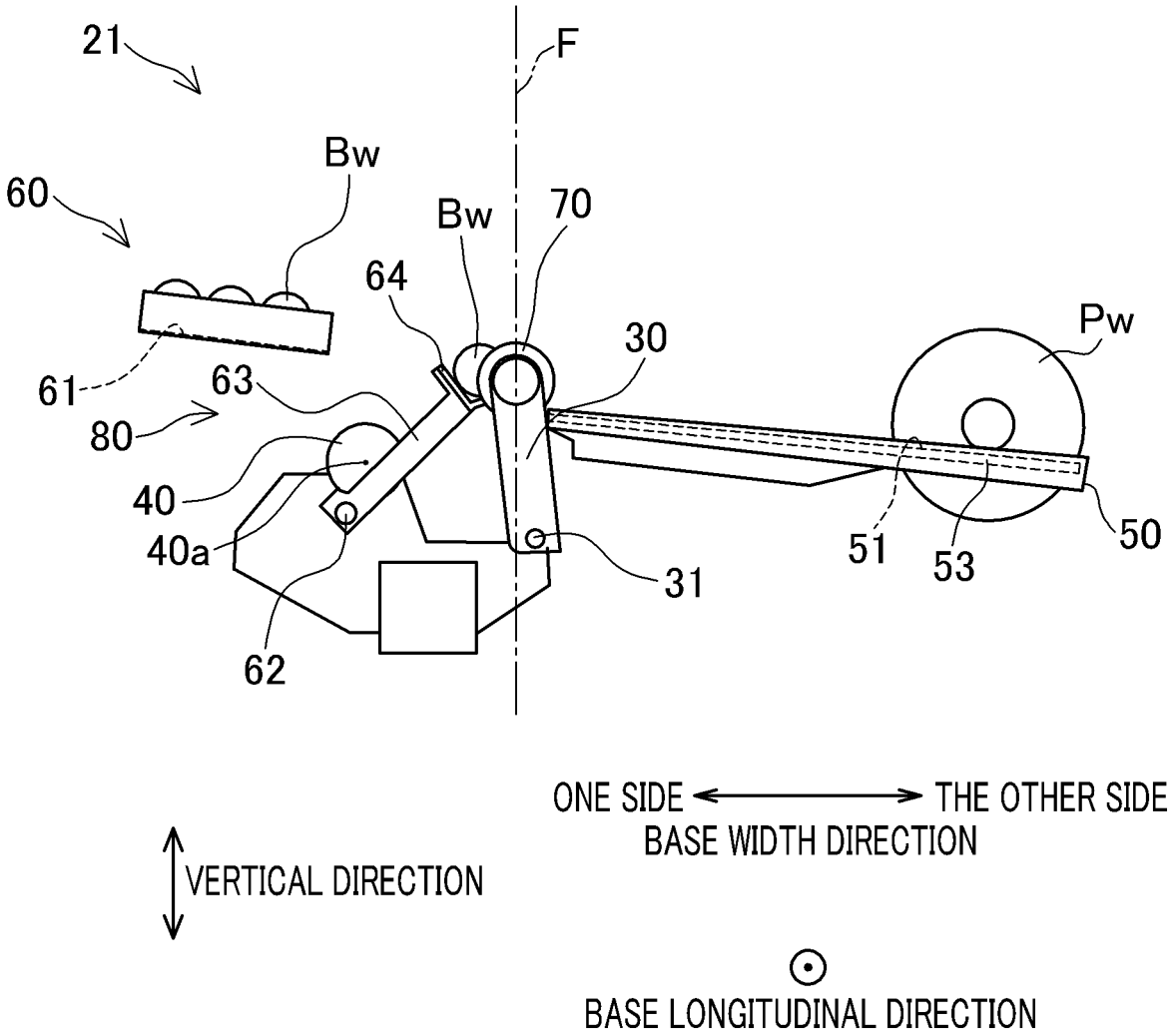
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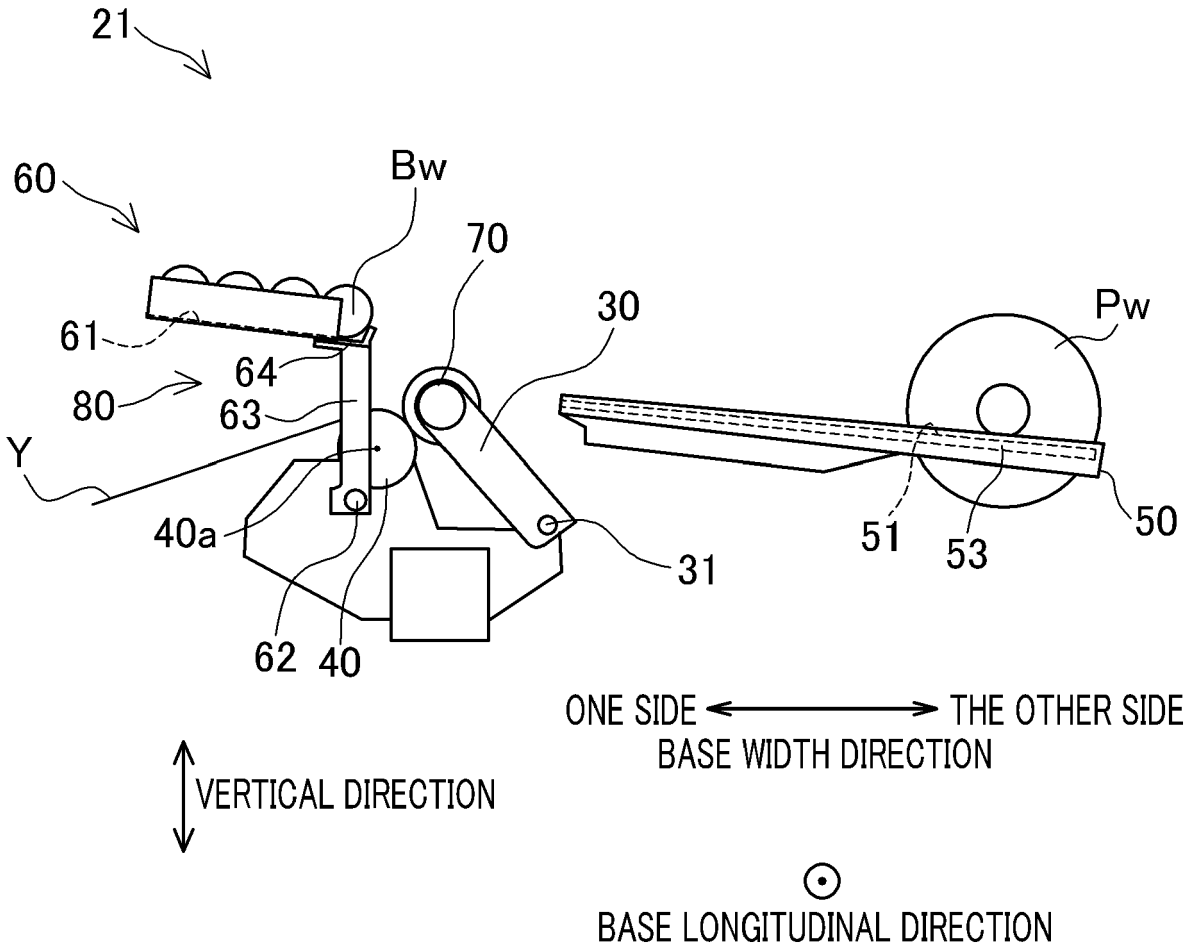
FIG.5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ONE SIDE
THE OTHER SIDE
BASE WIDTH DIRECTION
VERTICAL DIRECTION
BASE LONGITUDINAL DIRECTION

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EUROPEAN SEARCH REPORT

Application Number
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			B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 July 2023	Guisan, Thierry

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