(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 453 662 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
13.03.2019 Bulletin 2019/11

(51) Int Cl.:
B65H 67/08 *(2006.01)*

(21) Application number: **18187840.6**

(22) Date of filing: **07.08.2018**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **04.09.2017 JP 2017169758**

(71) Applicant: **Murata Machinery, Ltd.**
Kyoto-shi, Kyoto 601-8326 (JP)

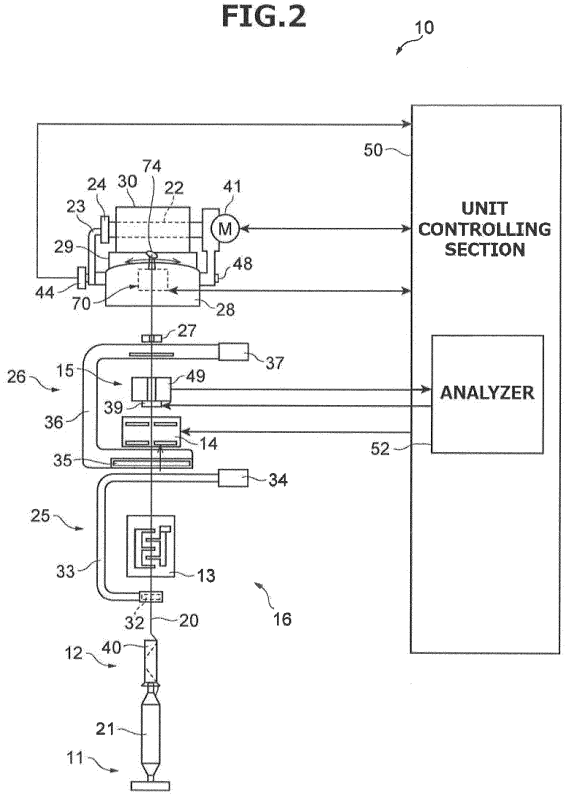
(72) Inventor: **Tanigawa, Yasunobu**
Kyoto-shi, Kyoto 612-8686 (JP)

(74) Representative: **Zimmermann, Tankred Klaus et al**
Schoppe, Zimmermann, Stöckeler
Zinkler, Schenk & Partner mbB
Patentanwälte
Radlkoferstrasse 2
81373 München (DE)

(54) YARN WINDING MACHINE

(57) In a winder unit (10), a cradle (23) rotatably holds a package (30), an angle sensor (44) detects a rotation angle of the cradle (23), and an upper yarn suction port (35) is movable near and away from a surface of the package (30), and catches a yarn end of the package (30). A unit controlling section (50) moves the upper yarn suction port (35) to a position that is at a predetermined distance from the surface of the package (30) based on the rotation angle of the cradle (23) detected by the angle sensor (44) at the time of a lift-up.

FIG.2



EP 3 453 662 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine.

2. Description of the Related Art

[0002] As the conventional yarn winding machine, for example, a yarn winding machine disclosed in Japanese Patent Application Laid-Open No. 2010-13259 is known in the art. In this yarn winding machine, when a yarn is cut during yarn winding operation, a package is first moved away (that is, lifted up) from a contact roller by an air cylinder, a suction mouth is moved by a certain amount so as to come near the surface of the package, and a yarn end of the package is caught by the suction mouth.

[0003] In such a yarn winding machine, accurate adjustment of a lift-up amount (separation distance of the package from the contact roller) is being attempted so that the distance between the surface of the package from the contact roller always remains constant at the time of the lift-up.

SUMMARY OF THE INVENTION

[0004] However, the inventor recognized that, in the yarn winding machine explained above, there is a possibility that a yarn end of a package may not be reliably caught due to a variation in a lift-up amount.

[0005] One object of the present invention is to provide a yarn winding machine capable of reliably catching a yarn end of a package.

[0006] According to one aspect of the present invention, a yarn winding machine includes a holding section that rotatably holds a package; a contact section capable of contacting a surface of the package; a moving section capable of moving the package between a position at which the package is in contact with the contact section and a position at which the package is separated from the contact section; a yarn catching section capable of moving near or away from the surface of the package and catching a yarn end of the package; a surface position information acquiring section that acquires surface position information indicative of a position of the surface of the package; and a control section that controls a movement of the yarn catching section, and, in a separated state in which the package is separated from the contact section by the moving section, moves the yarn catching section near the surface of the package based on the surface position information acquired by the surface position information acquiring section so that a distance of the yarn catching section from the surface of the package is equal to a predetermined distance.

[0007] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is a schematic front view of an automatic winder that includes a winder unit according to an embodiment of the present invention.

FIG. 2 is a schematic front view showing a configuration of the winder unit shown in FIG. 1.

FIG. 3 is a schematic side view showing a layout of structural components near a cradle of the winder unit shown in FIG. 1.

FIG. 4A is a schematic diagram showing a layout of the structural components near the cradle of the winder unit shown in FIG. 1.

FIG. 4B is another schematic diagram showing a layout of the structural components near the cradle of the winder unit shown in FIG. 1.

FIG. 5A is a schematic diagram for explaining a state of the winder unit shown in FIG. 1 at the time of a lift-up.

FTG. 5R is a schematic diagram showing a state of the winder unit following the state shown in FIG. 5A.

FIG. 6A is another schematic diagram for explaining a state of the winder unit shown in FIG. 1 at the time of the lift-up.

FIG. 6B is a schematic diagram showing a state of the winder unit following the state shown in FIG. 6A.

FIG. 7A is a schematic diagram for explaining a state of a winder unit according to a modification at the time of the lift-up.

FIG. 7B is another schematic diagram for explaining a state of the winder unit shown in FIG. 7A at the time of the lift-up.

DETAILED DESCRIPTION

[0009] Exemplary embodiments of the present invention are explained below in detail with reference to the accompanying drawings. Identical or corresponding portions are indicated by the same reference symbols in the drawings and redundant explanation thereof is omitted. In the present invention, terms "upstream" and "downstream" refer to upstream and downstream in a traveling direction of a yarn at the time of yarn winding.

[0010] As shown in FIG. 1, an automatic winder 1 mainly includes a plurality of winder units (yarn winding machines) 10 arranged side-by-side, an automatic doffing device 80, and a machine-frame controlling device 90. Each of the winder units 10 forms a package 30 by winding a yarn 20 that is unwound from a yarn supplying bobbin 21 while traversing the yarn 20.

[0011] When the package 30 is fully wound in a certain winder unit 10, the automatic doffing device 80 moves to a position of this winder unit 10, and removes the fully wound package 30 from the winder unit 10. The automatic doffing device 80 supplies an empty bobbin in the place of the fully wound package 30 in the winder unit 10.

[0012] The machine-frame controlling device 90 mainly includes a setting section 91 and a displaying section 92. The setting section 91 performs setting for each of the winder units 10 according to a setting value input or a control method selected by an operator and the like. The displaying section 92 displays a winding state of the yarn 20 in each of the winder units 10 and details on the encountered errors and the like. The displaying section 92 can be constituted by a touch panel, and the setting section 91 can be combined with the displaying section 92. The setting section 91 changeably sets a later-explained predetermined distance at which an upper yarn suction port 35 comes near a surface of the package 30.

[0013] As shown in FIG. 2, the winder unit 10 mainly includes a winding unit body 16 and a unit controlling section (control section) 50. The unit controlling section 50 includes, for example, a CPU, a RAM, a ROM, an I/O port, and a communication port. The ROM stores therein a computer program to control the structural components of the winding unit body 16. Various structural components (later-explained in detail) of the winding unit body 16 and the machine-frame controlling device 90 are connected to the I/O port and the communication port, and configured so that control information and the like can be communicated therebetween. Accordingly, the unit controlling section 50 can control the operation of the structural components of the winding unit body 16.

[0014] The winding unit body 16 includes on a yarn traveling path present between the yarn supplying bobbin 21 and a contact roller (contact section) 29, sequentially from the yarn supplying bobbin 21, a yarn unwinding assisting device 12, a tension applying device 13, a yarn joining device 14, and a yarn monitoring device 15. A yarn supplying section 11 is arranged below the winding unit body 16. The yarn supplying section 11 is configured such that the yarn supplying bobbin 21 conveyed by a not-shown bobbin conveying system can be held at a predetermined position.

[0015] The yarn unwinding assisting device 12 assists the unwinding of the yarn 20 from the yarn supplying bobbin 21 by causing a regulating member 40 that covers a core tube of the yarn supplying bobbin 21 to move down in coordination with the unwinding of the yarn 20 from the yarn supplying bobbin 21. The regulating member 40 touches a balloon of the yarn 20 formed on an upper part of the yarn supplying bobbin 21 by the rotation of the yarn 20 unwound from the yarn supplying bobbin 21 and the centrifugal force, and controls the balloon of the yarn 20 up to an appropriate size, thereby assisting the unwinding of the yarn 20. A not-shown sensor is provided near the regulating member 40 to detect a chase portion of the yarn supplying bobbin 21. When the sensor detects the lowering of the chase portion, the yarn unwinding assisting device 12 lowers the regulating member 40, for example, by using a not-shown air cylinder following the lowering of the chase portion.

[0016] The tension applying device 13 applies a predetermined tension to the traveling yarn 20. As the tension applying device 13, for example, a gate-type device with movable comb teeth arranged with respect to fixed comb teeth can be used. The movable comb teeth can be pivoted by a rotary-type solenoid so that the movable comb teeth and the fixed comb teeth are either in an engaged state or a released state. Note that, other than the gate-type device, for example, a disk-type tension applying device 13 can be used.

[0017] When the yarn is cut after the yarn monitoring device 15 detects a yarn defect, or when the yarn breaks during unwinding thereof from the yarn supplying bobbin 21 and the like, the yarn joining device 14 performs joining of a lower yarn from the yarn supplying bobbin 21 and an upper yarn from the package 30. As such a yarn joining device that performs joining of the upper yarn and the lower yarn, a mechanical knotter, or a device that uses a fluid such as a compressed air and the like can be used.

[0018] The yarn monitoring device 15 includes a head 49 on which a not-shown sensor that detects the thickness of the yarn 20 is arranged, and an analyzer 52 that processes a yarn thickness signal transmitted by the sensor. The yarn monitoring device 15 detects the yarn defect such as a slub by monitoring the yarn thickness signal transmitted by the sensor explained above. A cutter 39 that cuts the yarn 20 immediately when the yarn monitoring device 15 detects the yarn defect is provided near the head 49.

[0019] A lower yarn catching member 25 that catches a yarn end of the lower yarn and guides the yarn end to the yarn joining device 14 is arranged below the yarn joining device 14. An upper yarn catching member 26 that catches a yarn end of the upper yarn and guides the yarn end to the yarn joining device 14 is arranged above the yarn joining device 14. The lower yarn catching member 25 includes a lower yarn pipe arm 33 and a lower yarn suction port 32 formed at a tip end of the lower yarn pipe arm 33. The upper yarn catching member 26 includes an upper yarn pipe arm 36 and the upper yarn suction port (yarn catching member) 35 that is formed at a tip end of the upper yarn pipe arm 36.

[0020] In the lower yarn catching member 25, the lower yarn pipe arm 33 is pivotably supported by a support shaft 34. In the lower yarn catching member 25, a driving section such as a stepping motor drives the lower yarn pipe arm 33 to pivot around the support shaft 34. Accordingly, the lower yarn catching member 25 moves among a standby position, a yarn catching position at which the lower yarn suction port 32 catches the yarn end of the lower yarn, and a yarn guiding position at which the caught yarn end is guided to the yarn joining device 14. In the lower yarn catching member 25, the unit controlling section 50 controls the movement of the lower yarn suc-

tion port 32 by controlling the driving of the driving section.

[0021] In the upper yarn catching member 26, the upper yarn pipe arm 36 is pivotably supported by a support shaft 37. In the upper yarn catching member 26, a driving section such as a stepping motor drives the upper yarn pipe arm 36 to pivot around the support shaft 37 whereby the upper yarn suction port 35 moves near or away from the surface of the package 30. Accordingly, the upper yarn catching member 26 moves among a standby position, a yarn catching position at which the upper yarn suction port 35 catches the yarn end of the package 30 (in other words, the yarn end positioned on the package 30 or the yarn end of the yarn that is connected to the package 30), and a yarn guiding position at which the caught yarn end is guided to the yarn joining device 14. In the upper yarn catching member 26, the unit controlling section 50 controls the movement of the upper yarn suction port 35 by controlling the driving of the driving section.

[0022] An appropriate negative pressure source is respectively connected to each of the lower yarn pipe arm 33 and the upper yarn pipe arm 36. By generating a suction current in the lower yarn suction port 32, the lower yarn pipe arm 33 can suck and catch the yarn end of the lower yarn. By generating a suction current in the upper yarn suction port 35, the upper yarn pipe arm 36 can suck and catch the yarn end of the upper yarn. A not-shown shutter is arranged on base end sides of the lower yarn pipe arm 33 and the upper yarn pipe arm 36. Each of these shutters opens / closes in accordance with a signal received from the unit controlling section 50. Accordingly, the generation of the suction current in the lower yarn suction port 32 and the upper yarn suction port 35 and stopping thereof is controlled.

[0023] The winding unit body 16 includes a cradle 23 that detachably supports a winding bobbin 22 and the contact roller 29 capable of contacting the winding bobbin 22 or a peripheral surface (surface) of the package 30. The winding unit body 16 includes near the cradle 23 an arm-type traversing device 70 that traverses the yarn 20. In the winding unit body 16, the yarn 20 can be wound around the package 30 while being traversed by the traversing device 70. A guide plate 28 is arranged upstream of the traversing location. The guide plate 28 guides the yarn 20 on the upstream side to the traversing location. A traverse fulcrum 27 that is made of ceramic is arranged further upstream of the guide plate 28. The traversing device 70 traverses the yarn 20 in a direction of the arrow shown in FIG. 2 by using the traverse fulcrum 27 as the supporting point.

[0024] The cradle 23 is a holding section that rotatably holds the package 30. The cradle 23 (holding section) includes a pivoting shaft 48, and is pivotable around the pivoting shaft 48. The cradle 23 pivots and absorbs an increase in the yarn layer diameter of the package 30 that occurs following the winding of the yarn 20 on the winding bobbin 22. A rotational speed sensor 24 that measures the rotational speed of the package 30 is arranged corresponding to the cradle 23.

[0025] A package driving motor (package driving section) 41 that is constituted by a servo motor is arranged on the cradle 23. The package driving motor 41 rotationally drives the winding bobbin 22 and winds the yarn 20 onto the winding bobbin 22. The package driving motor 41 rotationally drives the package 30 (winding bobbin 22) to perform a normal rotation in which a winding direction is a rotation direction. The package driving motor 41 rotationally drives the package 30 (winding bobbin 22) to perform a reverse rotation in which an unwinding direction (a direction opposite to the winding direction) is the rotation direction. Operation of the package driving motor 41 is controlled by the unit controlling section 50. The unit controlling section 50 controls the operation of the package driving motor 41 and stopping thereof. The package driving motor 41 is not limited to the servo motor, and various types of motors such as a step motor and an induction motor can be employed.

[0026] The traversing device 70 includes a traversing arm 74 that is driven by a traverse driving motor such as a servo motor. In the traversing device 70, the traversing arm 74 traverses the yarn 20 by performing a reciprocating swinging motion in a winding width direction of the package 30. Operation of the traverse driving motor is controlled by the unit controlling section 50.

[0027] Next, a configuration of the cradle 23 is further explained in detail with reference to FIG. 3.

[0028] As shown in FIG. 3, the winding unit body 16 includes a rotating plate 17 that is rotatable around the pivoting shaft 48. The cradle 23 can rotate integrally with the rotating plate 17 around the pivoting shaft 48. A spring 18 that is configured to act as a tension spring for gradually reducing the contact pressure and an air cylinder 60 are connected to the rotating plate 17. A predetermined rotational torque can be applied to the cradle 23 by using the spring 18 and the air cylinder 60.

[0029] The air cylinder 60 is driven by the compressed air. The air cylinder 60 is configured as a double acting-type cylinder that includes a piston 601 therein. The compressed air of an air pressure P1 is supplied to a cylinder chamber that is located near to the rotating plate 17 side of the piston 601. The compressed air of an air pressure P2 is supplied to a cylinder chamber located away from the rotating plate 17 side of the piston 601. A solenoid valve 61 is connected to a pipe that is provided to supply to the air cylinder 60 the compressed air of the air pressure P2. The air pressure P2 is controlled by the solenoid valve 61 based on a control signal that is input by the unit controlling section 50.

[0030] In the configuration shown in FIG. 3, because, when the air pressure P2 decreases, a pulling force by which the cradle 23 is pulled by the air cylinder 60 increases, a torque required to rotate the cradle 23 around the pivoting shaft 48 toward a front side of the winding unit body 16 increases. Because the contact roller 29 is arranged more on the front side of the winding unit body 16 than the pivoting shaft 48, the contact pressure between the package 30 and the contact roller 29 can be

increased by decreasing the air pressure P2. On the contrary, because, when the air pressure P2 increases, the pulling force by which the cradle 23 is pulled by the air cylinder 60 weakens, the torque required to rotate the cradle 23 around the pivoting shaft 48 toward a back side of the winding unit body 16 increases. Accordingly, it is possible to separate (lift up) the package 30 from a surface of the contact roller 29.

[0031] Based on the configuration explained above, by causing the cradle 23 to pivot, the air cylinder 60 can move the package 30. In other words, the air cylinder 60 can pivot the cradle 23 that holds the package 30 around the pivoting shaft 48 to move the package 30 between a position at which the package 30 is in contact with the contact roller 29 and a position at which the package 30 separates from the contact roller 29. The air cylinder 60 is a moving section that moves the package 30.

[0032] An angle sensor 44 that detects a rotation angle of the cradle 23 (a rotation angle of the cradle 23 around the pivoting shaft 48) is arranged on the pivoting shaft 48 of the cradle 23. The angle sensor 44 is constituted by, for example, a rotary encoder, and transmits to the unit controlling section 50 an angle signal that corresponds to the rotation angle of the cradle 23.

[0033] As shown in FIGS. 4A and 4B, because the rotation angle of the cradle 23 changes as the package 30 starts acquiring thickness because of the winding, the diameter of the package 30 can be grasped by detecting the rotation angle by using the angle sensor 44 at the time of a non-lift-up in which the lift up is not performed. Moreover, as shown in FIGS. 5A and 6A, because the rotation angle of the cradle 23 changes in accordance with the lift-up amount (separation distance of the package 30 from the contact roller 29), the lift-up amount can be grasped by detecting the rotation angle by using the angle sensor 44 at the time of the lift-up. Therefore, by adding the lift-up amount to the diameter of the package 30 detected by the angle sensor 44 at the time of the non-lift-up, a position of the surface of the package 30 at the time of the lift-up can be grasped. In the present embodiment, the angle sensor 44 constitutes a surface position information acquiring section that acquires surface position information indicative of the position of the surface of the package 30, and the rotation angle of the cradle 23 corresponds to the surface position information.

[0034] Referring again to FIG. 3, the unit controlling section 50 controls the driving of the air cylinder (moving section) 60 and rotates the cradle 23, and controls the movement of the package 30 between the position at which the package 30 is in contact with the contact roller 29 and the position at which the package 30 is separated from the contact roller 29. The unit controlling section 50 controls the catching operation of the lower yarn catching member 25 and the upper yarn catching member 26 (pivoting of the lower yarn pipe arm 33 and the upper yarn pipe arm 36). The unit controlling section 50 controls the opening / closing of the shutters arranged in the lower yarn pipe arm 33 and the upper yarn pipe arm 36, and controls the generation of the suction current in the lower yarn suction port 32 and the upper yarn suction port 35 and stopping thereof.

[0035] Particularly, in the present embodiment, for example, when a yarn is cut when the yarn monitoring device 15 detects the yarn defect, or when a yarn breaks during the unwinding of the yarn from the yarn supplying bobbin 21 (hereinafter "yarn cutting and the like"), the unit controlling section 50 controls the driving of the air cylinder 60 to rotate the cradle 23, lifts up the package 30 to the position at which the package 30 is separated from the contact roller 29 to attain a separated state. In the separated state (at the time of the lift-up), based on the rotation angle detected by the angle sensor 44, the unit controlling section 50 controls the pivoting of the upper yarn pipe arm 36 so that the upper yarn suction port 35 moves up to a position at the predetermined distance from the surface of the package 30. The predetermined distance is stored in the unit controlling section 50. The predetermined distance can be a fixed value or a variable value. The predetermined distance is changeably set (can be changed as desired) by the setting section 91.

[0036] Next, operation performed by the unit controlling section 50 when the yarn cutting and the like occurs is explained in detail.

[0037] For example, when the yarn cutting and the like occurs during the winding operation, the package driving motor 41 is controlled, and the normal rotation of the package 30 is slowed down and stopped. The driving of the air cylinder 60 is controlled, and the package 30 is lifted up. During the lift-up, the rotation angle of the cradle 23 is detected by the angle sensor 44, and the upper yarn pipe arm 36 is pivoted so that the upper yarn suction port 35 comes near the package 30 based on the detected rotation angle. Accordingly, the upper yarn suction port 35 moves to the position at the predetermined distance from the surface of the package 30 to be in the separated state.

[0038] As an example of a control performed to move the upper yarn suction port 35, specifically, first, based on the rotation angle detected by the angle sensor 44 immediately before the lift-up, the position of the surface of the package 30 is grasped immediately before the lift-up. A rotational driving amount of the upper yarn pipe arm 36 that is required to move the upper yarn suction port 35 to the position at the predetermined distance from the surface of the package 30 immediately before the lift-up (hereinafter, "reference rotational driving amount") is calculated based on the grasped position of the package 30 surface. Subsequently, the lift-up amount is grasped based on the rotation angle detected by the angle sensor 44 at the time of the lift-up. A rotational driving amount further required for the upper yarn pipe arm 36 to maintain the approach when the package 30 is lifted up (hereinafter, "rotational driving amount to be increased") is calculated by using the grasped lift-up amount and a predetermined coefficient. Then, the upper yarn pipe arm

36 is pivoted by applying a driving amount calculated by adding the rotational driving amount to be increased to the reference rotational driving amount. As a result, even when the lift-up amount varies, the position of the package 30 surface can be tracked according to that lift-up amount, and the upper yarn suction port 35 can be moved to the position at the predetermined distance from the surface of the package 30.

[0039] Simultaneously with the movement of the upper yarn suction port 35, the shutter of the upper yarn pipe arm 36 is opened and the suction current is generated in the upper yarn suction port 35. Simultaneously, the package driving motor 41 is controlled to start the reverse rotation of the package 30. Accordingly, the yarn end of the package 30 that is in the lift-up state and rotating reversely is caught by the upper yarn suction port 35 that is at the position at the predetermined distance from the surface of the package 30.

[0040] After the yarn end of the package 30 is sucked and caught, by pivoting the upper yarn pipe arm 36, the upper yarn suction port 35 is moved toward the yarn joining position. Accordingly, the yarn end of the package 30 is guided to the yarn joining device 14, and the reverse rotation of the package 30 is slowed down and then stopped. The yarn joining device 14 starts the yarn joining of the lower yarn caught by the lower yarn suction port 32 and the upper yarn caught by the upper yarn suction port 35. After the yarn joining is completed, the suction current that is flowing in the upper yarn suction port 35 is stopped by closing the shutter of the upper yarn pipe arm 36.

[0041] In such a configuration, because of various conditions (for example, contact pressure settings with respect to the contact roller 29, unevenness of components among spindles, or time-dependent change), the lift-up amount may vary as shown in FIGS. 5A and 6A. When such variation occurs, in the winder unit 10, at the time of the lift-up, the upper yarn suction port 35 is moved based on the rotation angle of the cradle 23. Therefore, even when the lift-up amount varies, such variation can be tolerated (absorbed), and the upper yarn suction port 35 can be reliably moved to the position at the predetermined distance from the surface of the package 30 as shown in FIGS. 5B and 6B. At the time of the lift-up, the upper yarn suction port 35 can come near the package 30 according to the lift-up amount, and an appropriate clearance with respect to the package 30 can be ensured. Because the lift-up amount is detected every time the lift-up is performed, effect of the variation in the lift-up amount can be suppressed. A yarn end finding position at which the yarn end of the package 30 is caught can be controlled more precisely. Therefore, according to the winder unit 10, the yarn end of the package 30 can be caught reliably. Thus, yarn end finding efficiency and time efficiency can be improved, and the production efficiency, too, can be improved.

[0042] In the winder unit 10, the cradle 23 is pivotable around the pivoting shaft 48. The air cylinder 60 causes the cradle 23 to pivot around the pivoting shaft 48 so as to move the package 30 between the position at which the package 30 is in contact with the contact roller 29 and the position at which the package 30 is separated from the contact roller 29. As the surface position information indicative of the position of the surface of the package 30, the rotation angle of the cradle 23 is detected by the angle sensor 44. According to such a configuration, even if the lift-up amount varies, the lift-up amount can be accurately grasped based on the detection result of the angle sensor 44. Therefore, by causing the upper yarn suction port 35 to move based on the detection result of the angle sensor 44, the upper yarn suction port 35 can be reliably moved to the position at the predetermined distance from the surface of the package 30.

[0043] In the winder unit 10, the air cylinder 60 is driven by the compressed air. In such a configuration, the responsiveness related to the lift-up can be increased. Moreover, in such a configuration, because variation in the lift-up amount tends to be significant, the effect explained above in which the yarn end of the package 30 can be reliably caught is particularly promising.

[0044] The winder unit 10 includes the package driving motor 41 that rotationally drives the package 30. When catching the yarn end of the package 30 by using the upper yarn suction port 35 in the separated state, the unit controlling section 50 controls the package driving motor 41 so as to rotate the package 30 in the direction opposite to the winding direction. Accordingly, the yarn end of the package 30 can be caught more reliably.

[0045] In the winder unit 10, the predetermined distance is changeably set by the setting section 91. Accordingly, the predetermined distance can be set and changed as desired. In the present embodiment, the predetermined distance is a distance between the surface of the package 30 and the upper yarn suction port 35 that is lifted upward to perform sucking and catching. This distance can be stipulated as a minimum distance between any one end portion among the left and right end portions of the package 30 and an end portion of the upper yarn suction port 35 in the same orientation. Moreover, this distance can be stipulated as a minimum distance between a center of the package 30 in a width direction thereof and a center of the upper yarn suction port 35 in a width direction thereof.

[0046] Furthermore, in the winder unit 10, because the diameter and the surface position of the package 30 can be grasped based on the rotation angle of the cradle 23 detected by the angle sensor 44, an optical-type fixed length device can be omitted.

[0047] Exemplary embodiments of the present invention are explained above. However, the present invention is not limited to the embodiments explained above.

[0048] The above embodiments can include a warning section that outputs a warning based on the rotation angle detected by the angle sensor 44 in the separated state (the surface position information acquired by the surface position information acquiring section). For example, if

the rotation angle detected by the angle sensor 44 is larger than an upper limit threshold, or is smaller than a lower limit threshold, the variation of the rotation angles detected by the angle sensor 44 exceeds a predetermined range, and the like, time-dependent change in the lift-up amount can be grasped. Accordingly, by outputting the warning in such a case, attention can be called to that time-dependent change. It becomes possible to determine whether wearing out is present or maintenance is needed in any component such as the air cylinder 60 and the like. For example, as the warning section, an alarm device and the like that outputs an alarm can be used. As an example, when the rotation angle detected by the angle sensor 44 is smaller than the lower limit threshold, an alarm that indicates that the lift-up amount is insufficient can be generated. Alternatively, a message for the warning section can also be displayed on the displaying section 92. In such a configuration, the displaying section 92 operates as the warning section.

[0049] In the above embodiments, the angle sensor 44 is included as the surface position information acquiring section; however, instead of or in addition to the angle sensor 44, the configuration can include a distance sensor that is arranged on the upper yarn suction port 35 and detects the distance up to the surface of the package 30 as the surface position information. For example, as shown in FIG. 7, a distance sensor 81, which is an optical sensor and the like that emits light along an opening direction of the upper yarn suction port 35, is arranged on the upper yarn suction port 35 (in the figure, on a portion near the upper yarn suction port 35 of the upper yarn catching member 26). The distance sensor 81 detects the distance up to the surface of the package 30, and acquires the position of the surface of the package 30. According to such a configuration, even when the lift-up amount varies, the lift-up amount can be accurately grasped based on the detection result of the distance sensor 81. By causing the upper yarn suction port 35 to move based on the detection result of the distance sensor 81, the upper yarn suction port 35 can be reliably moved to the position at the predetermined distance from the surface of the package 30. Note that, the distance sensor is not particularly limited to a certain configuration, and various known distance sensors can be used.

[0050] In the above embodiments, the configuration in which the package 30 is moved by the air cylinder 60 is cited as an example. However, a configuration in which the package 30 is moved by a hydraulic cylinder and the like can be used. In the above embodiments, the unit controlling section 50 controls the generation of the suction current in the upper yarn suction port 35 and stopping thereof by controlling the opening / closing operation of the shutter; however, the shutter can always be in an open state. In such a configuration, for example, it becomes possible to simplify the control performed by the unit controlling section 50. In the above embodiments, the package 30 is directly rotationally driven by the package driving motor 41; however, the contact roller 29 can be driven and the package 30 can be rotated following the rotation of the contact roller 29.

[0051] The method explained in the above embodiments to detect the diameter of the package 30 at the time of non-lift-up is not limited to such method, and the diameter of the package 30 can be detected by using methods cited as an example below. As an example, a dedicated yarn speed sensor is arranged on the yarn traveling path to detect the traveling speed of the yarn 20. A winding angle is calculated by the unit controlling section 50 based on the traveling speed and the traversing speed of the yarn 20, and the circumferential speed of the package 30 is calculated based on the winding angle and the traveling speed of the yarn 20. Then, the diameter of the package 30 can be calculated based on the rotational speed of the package 30 and the circumferential speed of the package 30. Moreover, as another example, the diameter of the package 30 can be calculated based on the total length of the yarn 20 that is wound on the package 30, the winding speed of the yarn 20, and the type of the yarn 20 (thickness and the like).

[0052] In the above embodiments, at the time of the lift-up, after causing the package 30 to perform the reverse rotation at once, the package 30 can be caused to perform the normal rotation, or after the package 30 is caused to perform the normal rotation at once, the package 30 can be caused to perform the reverse rotation. In the above embodiments, at the time of the lift-up, for a predetermined set time period, the package 30 can be caused to perform the normal rotation or the reverse rotation at a rotational speed at which the yarn end of the package 30 can be pulled away. In such configurations, the yarn end can be easily pulled away from the package 30. In the above embodiments, the setting section 91 can be arranged in the winder unit 10.

[0053] According to one aspect of the present invention, a yarn winding machine includes a holding section that rotatably holds a package; a contact section capable of contacting a surface of the package; a moving section capable of moving the package between a position at which the package is in contact with the contact section and a position at which the package is separated from the contact section; a yarn catching section capable of moving near or away from the surface of the package and catching a yarn end of the package; a surface position information acquiring section that acquires surface position information indicative of a position of the surface of the package; and a control section that controls a movement of the yarn catching section, and, in a separated state in which the package is separated from the contact section by the moving section, moves the yarn catching section near the surface of the package based on the surface position information acquired by the surface position information acquiring section so that a distance of the yarn catching section from the surface of the package is equal to a predetermined distance.

[0054] In the above yarn winding machine, in the separated state (at the time of a lift-up) in which the package

is separated from the contact section, the yarn catching section is moved based on the acquired surface position information. Therefore, even if the lift-up amount varies, the variation can be tolerated and the yarn catching section can be reliably moved to a position at the predetermined distance from the surface of the package. Therefore, the yarn end of the package can be reliably caught.

[0055] In the above yarn winding machine, the holding section can include a pivoting shaft and can be pivotable around the pivoting shaft. The moving section can pivot the holding section around the pivoting shaft to move the package between the position at which the package is in contact with the contact section and the position at which the package is separated from the contact section. The surface position information acquiring section can be an angle sensor that detects a rotation angle of the holding section around the pivoting shaft as the surface position information. With this configuration, even if the lift-up amount varies, the lift-up amount can be precisely grasped based on the detection result of the angle sensor. Therefore, by causing the yarn catching section to move based on the detection result of the angle sensor, the yarn catching section can be reliably moved to the position at the predetermined distance from the surface of the package.

[0056] In the above yarn winding machine, the surface position information acquiring section can be a distance sensor that is attached to the yarn catching section and detects a distance thereof from the surface of the package as the surface position information. With this configuration, even when the lift-up amount varies, the lift-up amount can be precisely grasped based on the detection result of the distance sensor. Therefore, by causing the yarn catching section to move based on the detection result of the distance sensor, the yarn catching section can be reliably moved to the position at the predetermined distance from the surface of the package.

[0057] In the above yarn winding machine, the moving section can be driven by compressed air. When the moving section is driven by the compressed air, the variation in the lift-up amount tends to be significant. Therefore, the effect explained above in which the yarn end of the package is reliably caught is particularly promising in such a configuration.

[0058] The above yarn winding machine can include a package driving section that rotationally drives the package. The control section can control the package driving section to rotate the package in a direction opposite to a winding direction when catching the yarn end of the package by using the yarn catching section in the separated state. With this configuration, the yarn end of the package can be more reliably caught.

[0059] The above yarn winding machine can include a warning section that outputs a warning based on the surface position information acquired by the surface position information acquiring section in the separated state. Based on the surface position information acquired by the surface position information acquiring section in the separated state, time-dependent change in the lift-up amount can be grasped. Therefore, by outputting a warning based on the surface position information acquired by the surface position information acquiring section in the separated state, attention can be called to that time-dependent change.

[0060] The above yarn winding machine can include a setting section for setting and changing the predetermined distance. With this configuration, the predetermined distance can be set and changed as desired.

[0061] According to the present invention, it is possible to provide a yarn winding machine capable of reliably catching a yarn end of a package.

[0062] In the above explanation, the meaning of "a plurality of" also includes "a predetermined number of".

[0063] Although the invention has been explained with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the scope of the claims.

Claims

1. A yarn winding machine (10) comprising:

a holding section (23) configured to rotatably hold a package (30);
a contact section (29) capable of contacting a surface of the package (30);
a moving section (60) capable of moving the package (30) between a position at which the package (30) is in contact with the contact section (29) and a position at which the package (30) is separated from the contact section (29);
a yarn catching section (35) capable of moving near or away from the surface of the package (30) and catching a yarn end of the package (30);
a surface position information acquiring section (44, 81) configured to acquire surface position information indicative of a position of the surface of the package (30); and
a control section (50) configured to control a movement of the yarn catching section (35), and, in a separated state in which the package (30) is separated from the contact section (29) by the moving section (60), to move the yarn catching section (35) near the surface of the package (30) based on the surface position information acquired by the surface position information acquiring section (44, 81) so that a distance of the yarn catching section (35) from the surface of the package (30) is equal to a predetermined distance.

2. The yarn winding machine (10) as claimed in Claim

1, wherein
the holding section (23) includes a pivoting shaft (48) and is pivotable around the pivoting shaft (48),
the moving section (60) is configured to pivot the holding section (23) around the pivoting shaft (48) to move the package (30) between the position at which the package (30) is in contact with the contact section (29) and the position at which the package (30) is separated from the contact section (29), and
the surface position information acquiring section (44) is an angle sensor that is configured to detect a rotation angle of the holding section (23) around the pivoting shaft (48) as the surface position information.

3. The yarn winding machine (10) as claimed in Claim 1 or 2, wherein the surface position information acquiring section (81) is a distance sensor that is attached to the yarn catching section (35) and is configured to detect a distance thereof from the surface of the package (30) as the surface position information.

4. The yarn winding machine (10) as claimed in any one of Claims 1 to 3, wherein the moving section (60) is configured to be driven by compressed air.

5. The yarn winding machine (10) as claimed in any one of Claims 1 to 4 comprising:

a package driving section (41) configured to rotationally drive the package (30), wherein
the control section (50) is configured to control the package driving section (41) to rotate the package (30) in a direction opposite to a winding direction when catching the yarn end of the package (30) by using the yarn catching section (35) in the separated state.

6. The yarn winding machine (10) as claimed in any one of Claims 1 to 5 comprising:

a warning section (92) configured to output a warning based on the surface position information acquired by the surface position information acquiring section (44, 81) in the separated state.

7. The yarn winding machine (10) as claimed in any one of Claims 1 to 6, comprising:

a setting section (91) for setting and changing the predetermined distance.

FIG.1

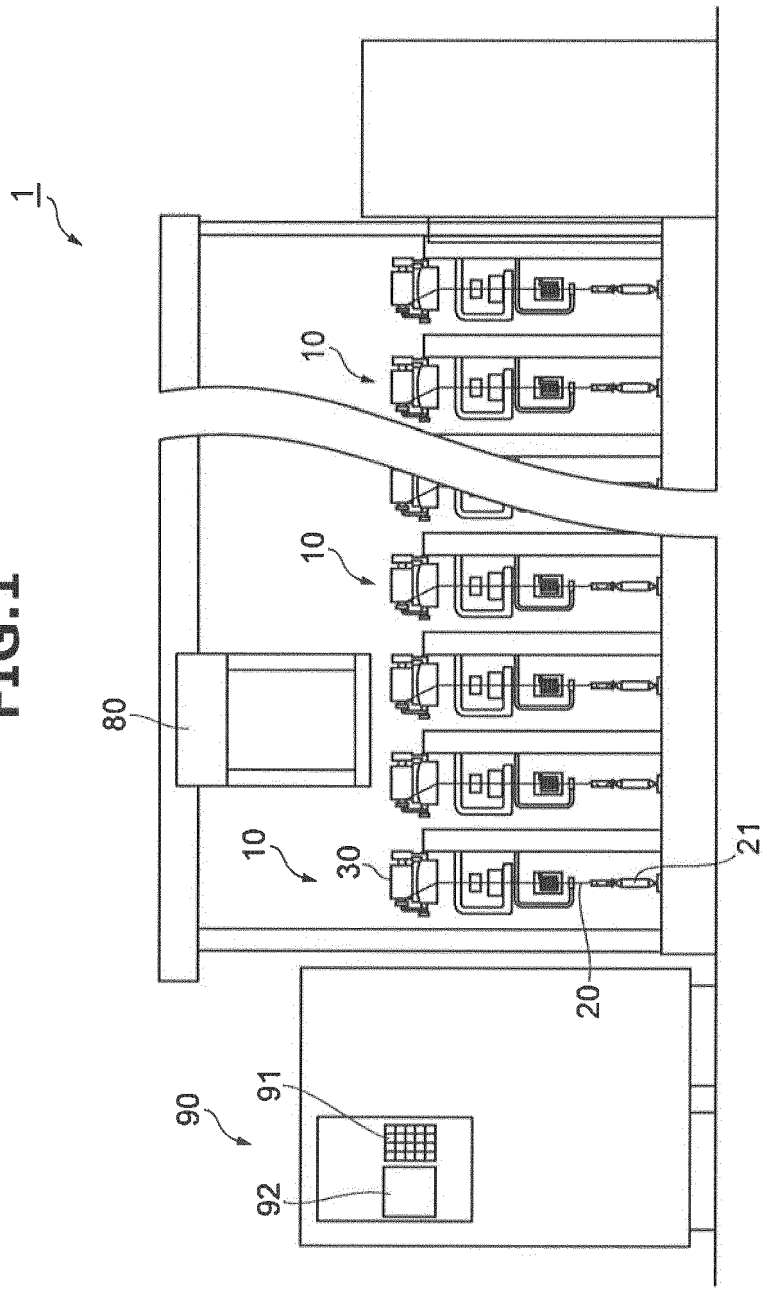


FIG.2

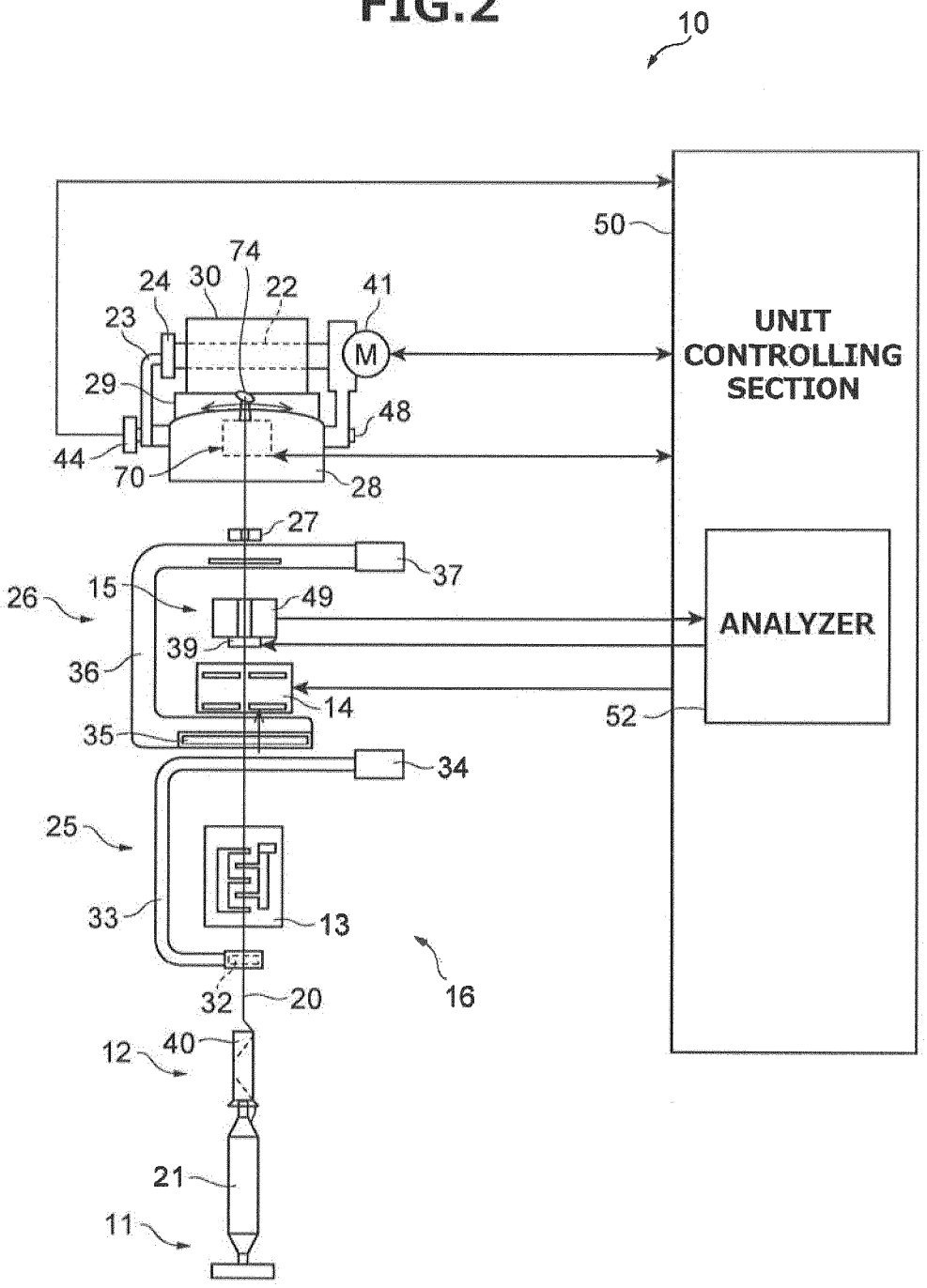

10
50
UNIT CONTROLLING SECTION
ANALYZER
52
74
24
30
22
41
23
M
29
48
44
70
28
27
37
26
15
49
39
36
14
35
34
25
33
13
16
32
20
12
40
21
11

FIG.3

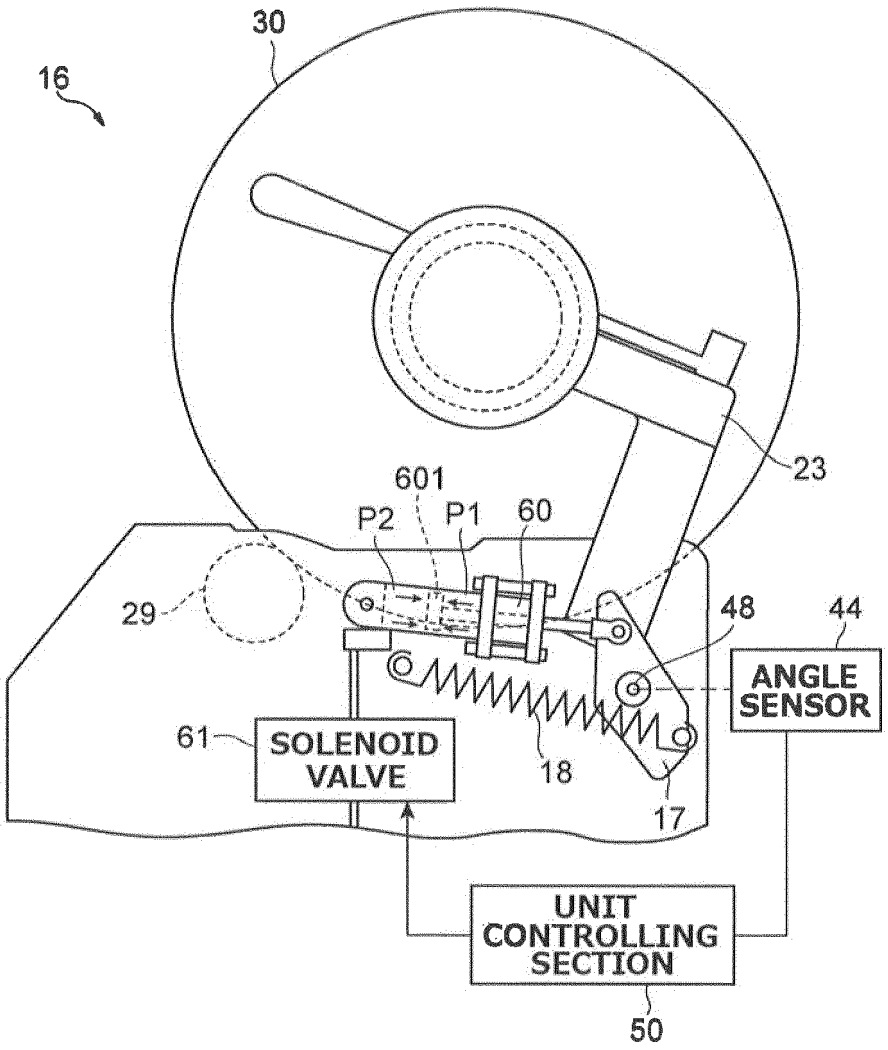

30
16
23
601
P2
P1
60
29
48
44
ANGLE SENSOR
61
SOLENOID VALVE
18
17
UNIT CONTROLLING SECTION
50

FIG.4A

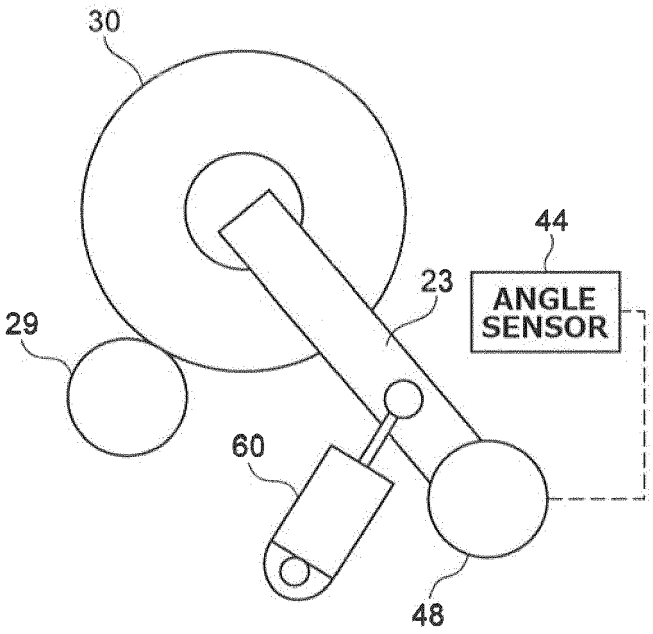


FIG.4B

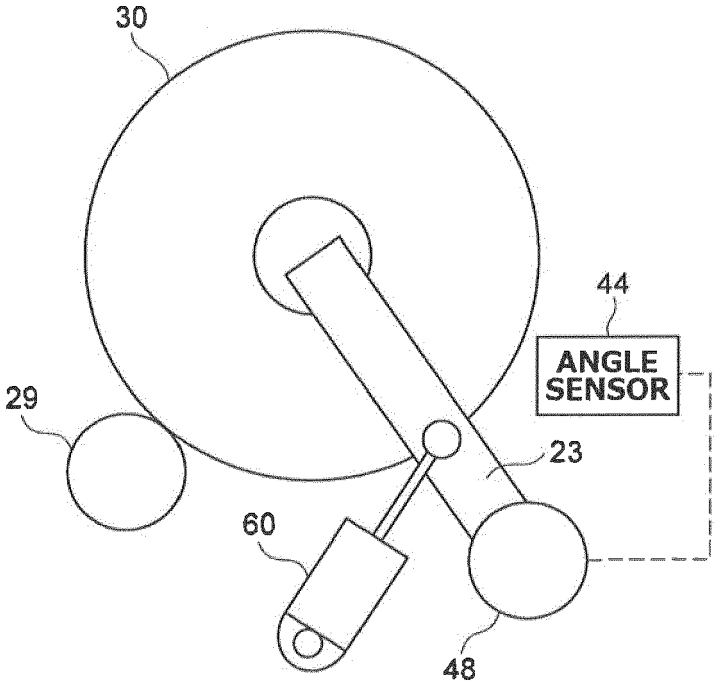


FIG.5A

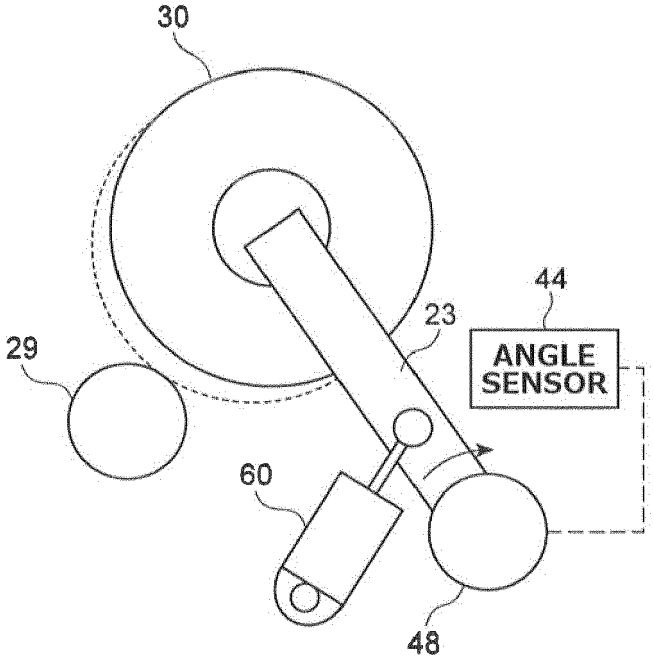


FIG. 5B

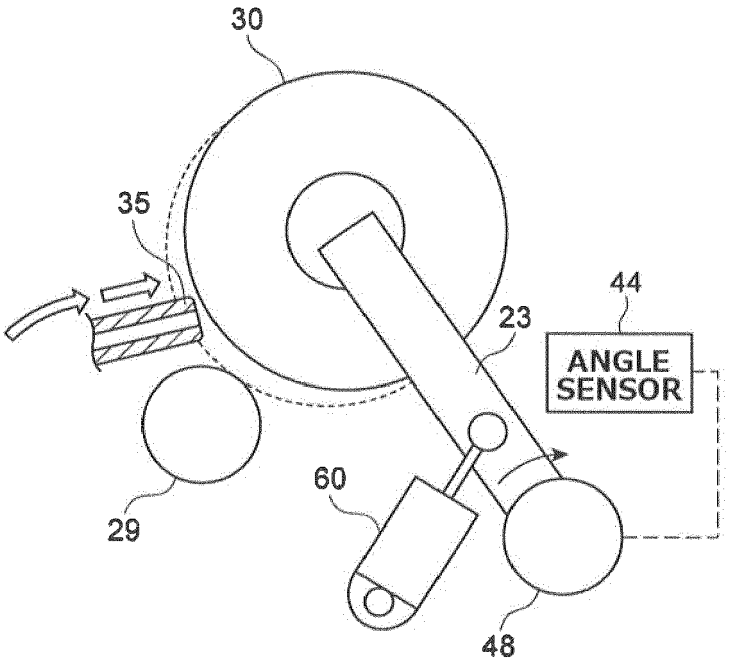


FIG.6A

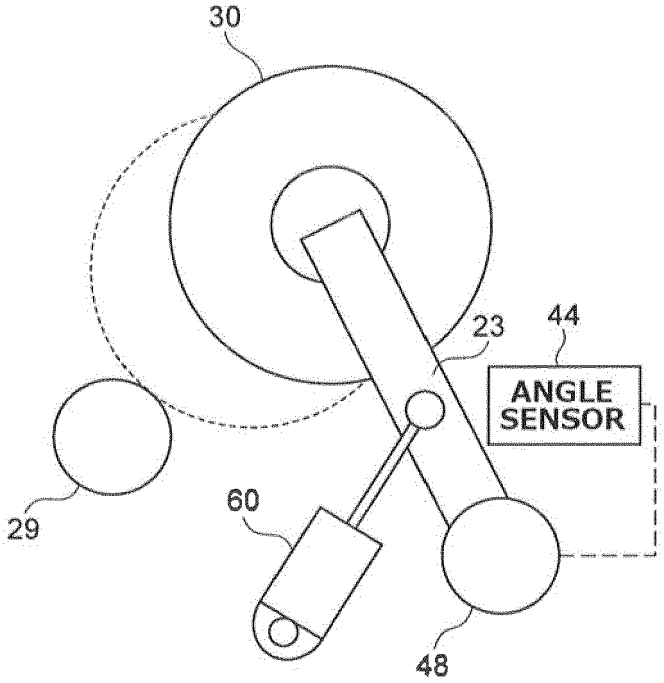


FIG.6B

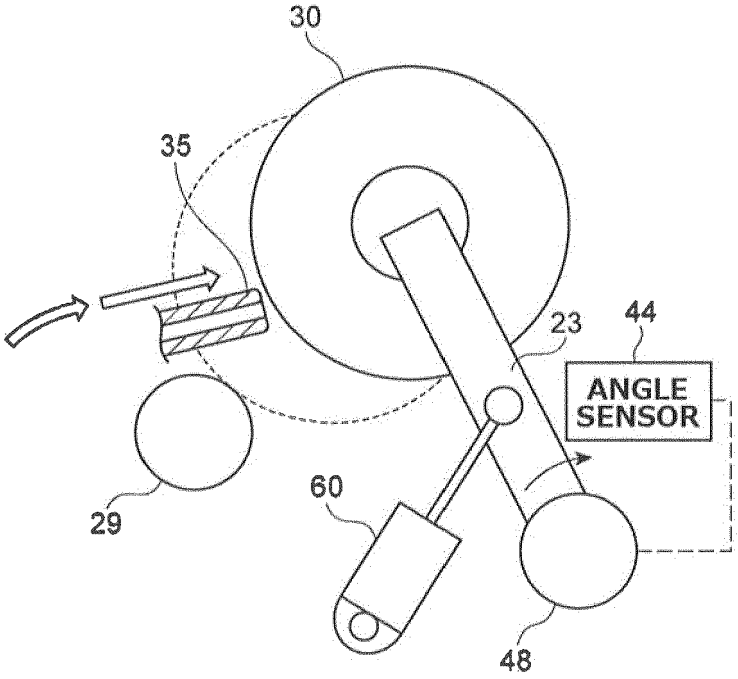


FIG.7A

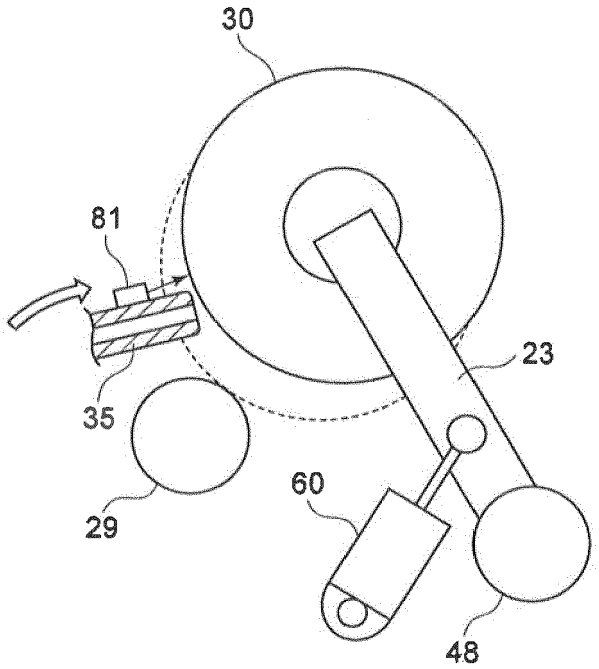
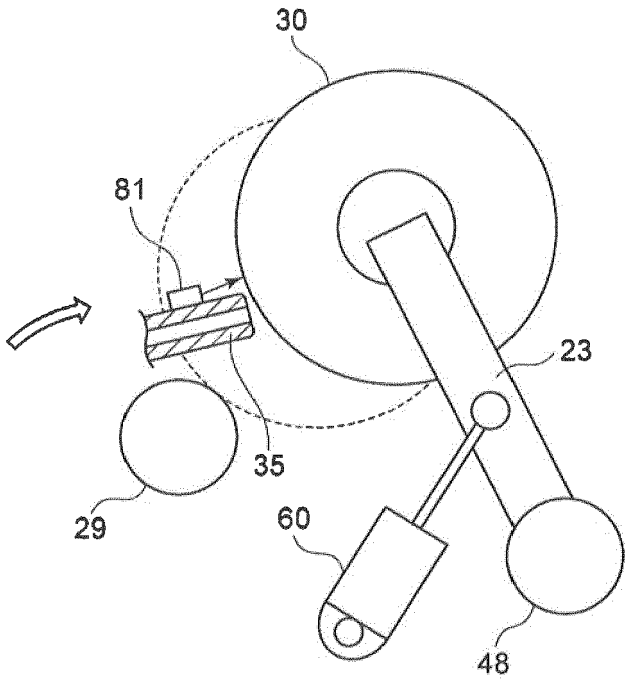


FIG.7B



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 18 7840

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	DE 38 27 345 A1 (STAHLECKER FRITZ [DE]; STAHLECKER HANS [DE]) 1 March 1990 (1990-03-01) * column 1, lines 23-40 * * column 2, line 17 - column 4, line 9; figures * -----	1,3-7 2	INV. B65H67/08
X Y	EP 3 081 518 A1 (MURATA MACHINERY LTD [JP]) 19 October 2016 (2016-10-19) * paragraphs [0090], [0091]; figures * -----	1,4-7 2,3	
X	DE 20 2007 011864 U1 (OERLIKON TEXTILE GMBH & CO KG [DE]) 25 October 2007 (2007-10-25) * paragraphs [0015], [0016], [0021] - [0023], [0040], [0043], [0004], [0049], [0050], [0054]; figures * -----	1,3,5	
Y,D	JP 2010 013259 A (MURATA MACHINERY LTD) 21 January 2010 (2010-01-21) * paragraphs [0014], [0015]; figures * -----	2	TECHNICAL FIELDS SEARCHED (IPC)
Y	EP 1 717 183 A1 (RIETER CZ AS [CZ]) 2 November 2006 (2006-11-02) * paragraph [0032]; figures * -----	3	B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 January 2019	Lemmen, René

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 18 7840

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

30-01-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3827345 A1	01-03-1990	NONE	
EP 3081518 A1	19-10-2016	CN 106048797 A	26-10-2016
		EP 3081518 A1	19-10-2016
		JP 2016204062 A	08-12-2016
DE 202007011864 U1	25-10-2007	NONE	
JP 2010013259 A	21-01-2010	NONE	
EP 1717183 A1	02-11-2006	CN 1899940 A	24-01-2007
		CZ 304394 B6	16-04-2014
		EP 1717183 A1	02-11-2006

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2010013259 A **[0002]**