



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
06.07.2016 Bulletin 2016/27

(51) Int Cl.:
B65H 54/42 (2006.01) **B65H 54/46** (2006.01)
B65H 67/08 (2006.01) **D01H 4/48** (2006.01)
D01H 13/16 (2006.01) **D01H 15/00** (2006.01)

(21) Application number: **14839760.7**

(22) Date of filing: **04.02.2014**

(86) International application number:
PCT/JP2014/000572

(87) International publication number:
WO 2015/029275 (05.03.2015 Gazette 2015/09)

(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

- **IMAMURA, Hisakatsu**
Kyoto-shi
Kyoto 612-8686 (JP)
- **MURAYAMA, Kenichi**
Kyoto-shi
Kyoto 612-8686 (JP)
- **IWATA, Shinji**
Kyoto-shi
Kyoto 612-8686 (JP)

(30) Priority: **29.08.2013 JP 2013178503**

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

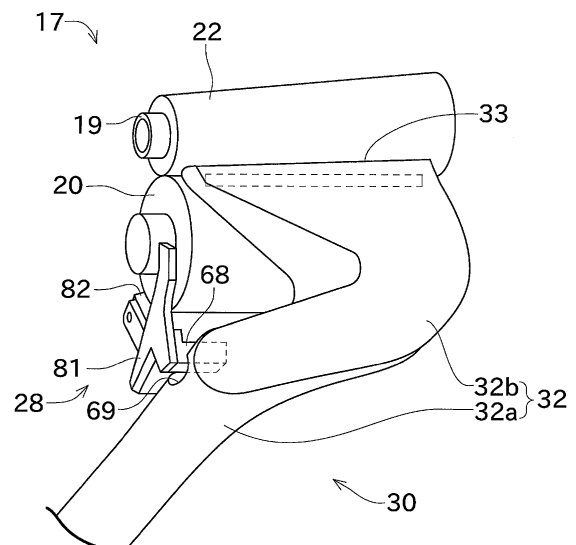
(74) Representative: **Weickmann & Weickmann**
PartmbB
Postfach 860 820
81635 München (DE)

(72) Inventors:
• **OKUGAWA, Shotaro**
Kyoto-shi
Kyoto 612-8686 (JP)

(54) **THREAD PICKUP DEVICE, THREAD TAKEUP DEVICE, AND THREAD SPLICING METHOD**

(57) A yarn pull-out device (28) includes an upper yarn catch and guide device (30) and a detection part (68). The upper yarn catch and guide device (30) has a move and catch part (30a) which moves from a waiting position to a catching position in a winding part (17) side, sucks and catches a wound yarn that is a yarn in the winding part (17) side. A detection part (68) detects the wound yarn caught by the upper yarn catch and guide device (30). The move and catch part (30a) approaches the detection part (68) by moving from the waiting position to the catching position (that is, the detection part (68) is provided in a position other than the position of the move and catch part (30a)), the detection part (68) detects the presence or absence of the wound yarn within the move and catch part (30a) moved to the catching position.

Fig.4



Description

TECHNICAL FIELD

[0001] The present invention relates mainly to a yarn pull-out device that pulls out a yarn from a winding part.

BACKGROUND ART

[0002] A yarn pull-out device is conventionally known that pulls out a yarn end of a package for performing yarn joining or the like. The yarn pull-out device includes a wound yarn catch and guide device and a detection part. The wound yarn catch and guide device sucks and catches the yarn from the package. The detection part detects the yarn caught by the wound yarn catch and guide device. By detecting the yarn by the detection part (or after a predetermined time elapsed from detection) the wound yarn catch and guide device allows the sucking and catching operation to be completed. Patent Documents 1 and 2 disclose this kind of a yarn pull-out device.

[0003] A yarn pull-out device of Patent Document 1 has a suction nozzle that catches a yarn of a package. This suction nozzle is configured to swing. A sensor (detection part) is provided within a suction port of a distal end of a suction nozzle. Patent Document 2 also discloses that a yarn pull-out device has a sensor (detection part) provided at a distal end of a suction mouth that catches a yarn of a package.

PRIOR-ART DOCUMENTS

PATENT DOCUMENTS

[0004]

Patent Document 1: Japanese Patent Application Laid-Open No. 1997-31769

Patent Document 2: Japanese Unexamined Utility Model Application Publication No. 1991-102562

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005] Wiring for the supply of electricity and the input/output of data are connected to a detection part for detecting a yarn. Thus, when the detection part is attached to a wound yarn catch and guide device that is movable, it is necessary to devise the attaching position and the length of wiring and the like so that the wound yarn catch and guide device can move. Even when the attaching position of wiring is devised, loading on wiring is less likely to be prevented. Then, a short lifetime of wiring cannot be prevented. Particularly, a yarn pull-out device in Patent Document 1 significantly involves the above-described problem because a detection part is attached in the farthest position from a pivot shaft (the po-

sition at which a movement distance is the largest).

[0006] A detection part is arranged in a part having a short movement distance (near the pivot shaft or downstream side), and thereby the above-described problem can be reduced. In this case, however, it takes a long time until a wound yarn catch and guide device catches and detects a yarn. This leads to an increase in a time for such as the yarn joining.

[0007] The present invention has been made in view of the circumstances described above, and a primary object of the present invention is to provide a yarn pull-out device capable of quickly detecting a pulled out yarn without applying load on wiring of a detection part for detecting a yarn pulled out from a package.

MEANS FOR SOLVING THE PROBLEMS AND EFFECTS THEREOF

[0008] Problems to be solved by the present invention are as described above, and next, means for solving the problems and effects thereof will be described.

[0009] In a first aspect of the present invention, a yarn pull-out device that pulls out a yarn from a winding part for winding the yarn to form a package is provided. That is, the yarn pull-out device includes a wound yarn catch and guide device and a detection part. The wound yarn catch and guide device has a move and catch part that moves from a waiting position to a catching position in the winding part side, sucks and catches a wound yarn that is a yarn in the winding part side. The detection part detects a wound yarn caught by the wound yarn catch and guide device. The move and catch part approaches the detection part by moving from the waiting position to the catching position. The detection part detects the presence or absence of the wound yarn within the move and catch part that is moved to the catching position.

[0010] Accordingly, the detection part is arranged at the different position from the move and catch part. Thereby, no load is applied to wiring that is connected to the detection part even when the move and catch part is moved. Consideration for load applied to wiring is not necessary and therefore the wound yarn can be detected at any position.

[0011] It is preferable that the yarn pull-out device is configured as follows. That is, the detection part includes a light emitting part and a light receiving part. The light emitting part emits light toward a detecting position within the move and catch part. The light receiving part receives light which is reflected at the detecting position from emitted light from the light emitting part or which is passed through the detecting position from emitted light from the light emitting part. A light passing part for passing through light emitted from the light emitting part is provided in the move and catch part.

[0012] Accordingly, a light sensor is adopted for a detection part and thereby a wound yarn within a move and catch part can be easily detected from outside of the move and catch part.

[0013] It is preferable that the yarn pull-out device is configured as follows. That is, the move and catch part includes a suction port and a pipe part. The suction port approaches an outer circumferential surface of the package and sucks a yarn end of the package. The pipe part is connected to the suction port. The wound yarn catch and guide device further includes a shaft part as a reference point when the suction port approaches the package. The light passing part is provided in the pipe part.

[0014] Accordingly, a position at which a wound yarn passes through is likely to be assumed in the pipe part as compared with the suction port. This can achieve a high accuracy of detection. The light passing part is provided on the pipe part located on the suction port side relative to the shaft part and therefore the yarn end can be detected at an early stage. This can improve the efficiency of winding.

[0015] In the yarn pull-out device, it is preferable that the inside of the pipe part has a guide portion for guiding a wound yarn sucked by the suction port to the detecting position.

[0016] Accordingly, the wound yarn is guided to the detecting position and therefore the accuracy of detection is improved. Particularly, even when the distance between a suction port and a package is changed, a wound yarn can be detected accurately.

[0017] In the yarn pull-out device, it is preferable that the light passing part is a clear plate provided in at least a part of the pipe part.

[0018] Accordingly, leakage of negative pressure out of the pipe part can be prevented. This can prevent a decrease of sucking power and also prevent a sucked wound yarn from going out of the light passing part.

[0019] In the yarn pull-out device, it is preferable that the light passing part is a notch having a through hole provided in at least a part of the pipe part.

[0020] Accordingly, the detection part can directly detect a wound yarn within the move and catch part. This can improve the accuracy of detection.

[0021] It is preferable that the yarn pull-out device is configured as follows. That is, the suction port is a slit-like opening that extends parallel to a rotation axis direction of the package. The pipe part includes a cylindrical portion and a connecting portion. The cylindrical portion has an air passage having a circular cross-section. The connecting portion is connected to the end of the cylindrical portion. The cross-section shape of the cylindrical portion is changed from a circular shape to a slit shape in order to connect the cylindrical portion and the opening. The light passing part is provided in the connecting portion side of the cylindrical portion.

[0022] Accordingly, a light passing part is provided at a position kept out of a connecting portion. This can improve the accuracy of detection. Moreover, the light passing part is provided on a side close to the suction port in the cylindrical portion. This can further shorten a detection time of a wound yarn.

[0023] In the yarn pull-out device, it is preferable that

the light passing part is provided at a circumferential surface of the cylindrical portion, the circumferential surface in a side opposed to the detection part when the wound yarn catch and guide device catches a wound yarn.

[0024] Accordingly, the light passing part is opposed to the detection part when the move and catch part moves to a catching position. This can achieve a simple layout. The light passing part is still opposed to the detection part even when the catching position of the move and catch part is slightly changed due to a package in a lump. This can detect a wound yarn without any troubles.

[0025] In the yarn pull-out device, it is preferable that a reflection part, which is located inside the cylindrical portion and reflects a emitted light, is provided in a side opposite to the light passing part across the detecting position.

[0026] Accordingly, the wound yarn is detected using the reflection light and thereby even colored wound yarn can be detected accurately.

[0027] In the yarn winding device, it is preferable that the detection part is attached to the winding part.

[0028] Accordingly, a detection part is arranged in a winding part, and thereby the distance between the detection part and a package decreases. This can detect whether the wound yarn is caught by a move and catch part or not, at an early stage.

[0029] It is preferable that the yarn winding device is configured as follows. That is, the yarn winding device further includes a yarn feed part and a yarn joining device. The yarn feed part has a yarn for being wound by the winding part. The yarn joining device performs the yarn joining of a wound yarn and a yarn in the yarn feed part side when the yarn is disconnected between the winding part and the yarn feed part. The yarn pull-out device guides the wound yarn to the yarn joining device.

[0030] Accordingly, a time required for the yarn joining can be shortened. Additionally, the minimum required wound yarn is sucked and then a yarn in a package-side is guided to a yarn joining device. This can minimize the amount of yarn which is cut and removed at a time of yarn joining.

[0031] In the yarn winding device, the detection part is preferably attached to a metal part of the winding part.

[0032] This can allow the detection part to be grounded and dissipate heat.

[0033] It is preferable that the yarn winding device is configured as follows. That is, the winding part includes a support part, an auxiliary roller, a driving source, a traverse mechanism and a power transmission mechanism. The support part rotatably supports a package. The auxiliary roller assists the winding of yarn while coming in contact with the package and thereby the package is accordingly rotated. The auxiliary roller is rotated by the driving source. The traverse mechanism traverses a yarn. The power transmission mechanism transmits driving force generated from the driving source to the package, in a state where the package is away from the auxiliary roller, and thereby the package is rotated.

[0034] Accordingly, a yarn of a package can be caught in a state where the package is away from the auxiliary roller, and therefore a yarn is not stuck to the package. This can reduce the probability of the failure of catching a yarn. Additionally, using a power transmission mechanism can achieve a configuration at the lower cost, as compared with a configuration provided a driving source separately. Furthermore, a rotation speed of a package, a rotation direction and the like can be controlled by controlling the driving source.

[0035] In a second aspect of the present invention, a yarn joining method performed by the yarn winding device is provided. That is, the yarn joining method includes a catching step, a detecting step, a waiting step and a guiding step. In the catching step, a sucking and catching operation, in which the wound yarn catch and guide device approaches the package and then the package is rotated in the reverse direction from the winding direction in order to catch a wound yarn, is performed. In the detecting step, the wound yarn catch and guide device detects sucking and catching of the wound yarn. In the waiting step, the sucking and catching operation is continued until a setting time elapses from the detection of sucking and catching of the wound yarn. In the guiding step, the wound yarn is guided to the yarn joining device after the waiting step is completed.

[0036] Accordingly, the amount of the wound yarn appropriate for being guided to the yarn joining device can be sucked and caught. This can suppress the amount of yarn wasted at a time of yarn joining.

[0037] It is preferable that, the yarn joining method further includes a yarn defect sucking and waiting step, which further waits until a yarn defect is sucked by the wound yarn catch and guide device after the waiting step.

[0038] Accordingly, the yarn defect sucking and waiting step for removing a yarn defect is further performed. This can prevent the yarn defect from remaining on a package.

BRIEF DESCRIPTION OF THE DRAWINGS

[0039]

[FIG. 1] A front elevational view of an automatic winder according to an embodiment of the present invention.

[FIG. 2] A side view of a winding unit.

[FIG. 3] An enlarged side view and an enlarged plan view showing a winding part and a yarn pull-out device therearound.

[FIG. 4] An enlarged perspective view showing a winding part and a yarn pull-out device therearound.

[FIG. 5] A diagram showing a pattern of a detection part.

[FIG. 6] A cross-sectional perspective view and a cross-sectional view of a pipe part in an upper yarn catch and guide device.

[FIG. 7] An enlarged side view showing the first half

of the operation of a winding part at a time of catching an upper yarn.

[FIG. 8] An enlarged side view showing the latter half of the operation of a winding part at a time of catching an upper yarn.

[FIG. 9] A flowchart showing the process at a time of sucking and catching a yarn from a package and guiding to a yarn joining device.

[FIG. 10] An enlarged plan view for explaining an example of the position of a contact roller.

[FIG. 11] An enlarged side view showing a first modification of a winding part.

[FIG. 12] An enlarged plan view showing a second modification of a winding part.

EMBODIMENT FOR CARRYING OUT THE INVENTION

[0040] Next, an automatic winder according to an embodiment of the present invention will be described with reference to the drawings. Fig. 1 is a front elevational view showing a schematic configuration of an automatic winder 1 according to this embodiment.

[0041] As shown in Fig. 1, an automatic winder (yarn winding device) 1 mainly includes a plurality of winding units 10 arranged side by side, a machine controller 12, and a doffing device 13.

[0042] The machine controller 12 can communicate with each of the plurality of winding units 10. An operator of the automatic winder 1 operates the machine controller 12 appropriately and thereby manages the plurality of winding units 10 collectively.

[0043] Each of the winding units 10 is configured to unwind a yarn 14 from a yarn feed bobbin 16, and wind on a wound bobbin 19 while traversing the yarn 14. In the above-described manner, the winding unit 10 forms a package 22.

[0044] Each of the winding units 10 includes a unit control section 50 on one side of the yarn feed bobbin 16, the package 22 and the like (a right side of Fig. 1). The unit control section 50 includes, for example, a CPU and a ROM. A program for controlling each configuration of the winding units 10 is stored in the ROM. The CPU executes the program stored in the ROM.

[0045] When the package 22 reaches full winding (a state where the prescribed amount of yarn is wound) in each of the winding units 10, a doffing device 13 travels to a position of each of the winding units 10, removes the full winding package and sets an empty bobbin 19.

[0046] Next, a configuration of a winding unit 10 will be described with reference to Fig. 2. As shown in Fig. 2, the winding unit 10 includes a yarn feed part 15 and a winding part 17.

[0047] The yarn feed part 15 holds a yarn feed bobbin 16, which is placed on a transport tray (not shown), at a predetermined position. This can appropriately unwind the yarn 14 from the yarn feed bobbin 16. The type of the yarn feed part 15 is not limited to a transport tray type. For example, a magazine type may be used.

[0048] The winding part 17 mainly includes a cradle (support part) 18, a wound bobbin 19 and a winding drum (auxiliary roller) 20.

[0049] The cradle 18 has a pair of a rotation support portions. The cradle 18 can rotatably support the wound bobbin 19 (or a package 22) by tucking the wound bobbin 19 at the rotation support portion. The cradle 18 is configured to switch between a state where a supported package 22 comes in contact with the winding drum 20 and a state where the package 22 is moved away from the winding drum 20.

[0050] The winding drum 20 traverses the yarn 14 onto a surface of the package 22, and also drives the package 22 to rotate. The winding drum 20 is driven in rotation by a drum drive motor (driving source) 21. The winding drum 20 is driven in rotation while being in contact with an outer circumference of the package 22, and thereby the package 22 can be accordingly rotated. A traverse groove (traverse mechanism) having a spiral shape is provided in an outer circumferential surface of the winding drum 20. The yarn 14 wound from a yarn feed bobbin 16 is wound on a surface of a package 22 while being traversed in a constant width by the traverse groove. This can form the package 22 having the constant winding width. Other members arranged in the winding part 17 will be described later.

[0051] Each of the winding units 10 has an unwinding assist device 25, a tension applying device 27, a yarn joining device 38 and a clearer 40 arranged in this order from a yarn feed part 15 side, in a yarn travel path between the yarn feed part 15 and the winding part 17. An upper yarn catch and guide device (wound yarn catch and guide device) 30 and a lower yarn catch and guide device 34 are arranged near the yarn joining device 38. In the following description, an upstream side and a downstream side with respect to a travel direction of the yarn 14 may be simply referred to as "upstream side" and "downstream side".

[0052] The unwinding assist device 25 includes a restricting member 26 that is able to overlies a core tube of a yarn feed bobbin 16. The restricting member 26 having a substantially cylindrical shape is arranged so as to come in contact with a balloon, which is formed at an upper portion of a yarn layer of the yarn feed bobbin 16. The balloon is a portion where the yarn 14 unwound from the yarn feed bobbin 16 is thrown around by the centrifugal force. The restricting member 26 is brought into contact with the balloon, and therefore the yarn 14 comes in contact with the balloon of the yarn 14. This can prevent the yarn 14 from being excessively thrown around. Thus, the yarn 14 can be unwound from the yarn feed bobbin 16 appropriately.

[0053] The tension applying device 27 applies a predetermined tension to the yarn 14 that is traveling. In this embodiment, the tension applying device 27 is configured as a gate type in which a movable comb is arranged relative to a fixed comb. The movable comb is driven such that the combs are brought into an engaged state

with each other. The yarn 14 passes while being bent between the combs having the engaged state, so that an appropriate tension is applied to the yarn 14. This can improve the quality of a package 22. The tension applying device 27 is not limited to the above-described gate type. For example, a disk type tension applying device can also be used.

[0054] The yarn joining device 38 performs yarn joining between the yarn 14 (lower yarn) in a yarn feed part 15 side and the yarn 14 (upper yarn, wound yarn) in a winding part 17 side when the yarn 14 is disconnected between the yarn feed part 15 and the winding part 17 for some reason. In this embodiment, the yarn joining device 38 is configured as a splicer device for twisting yarn ends together using a swirl air stream generated by compressed air. The yarn joining device 38 is not limited to the above-described splicer device. For example, a knoter of machine type can also be used.

[0055] The upper yarn catch and guide device 30 catches an upper yarn when the yarn 14 is disconnected. The upper yarn catch and guide device 30 includes a shaft part 31, a pipe part 32 and a suction port 33. The pipe part 32 can be rotated around the shaft part 31 (a reference point when the suction port 33 approaches a package 22) from a waiting position (a solid line in Fig. 2) of the yarn feed part 15 side to a catching position (a dot-dash line in Fig. 2) of the winding part 17 side, by the control of a unit control section 50. The upper yarn catch and guide device 30 is connected to a negative pressure source (not shown), and generates suction stream in the suction port 33. In this configuration, the suction port 33 catches the upper yarn at the catching position and returns to the waiting position. This can guide the upper yarn to the yarn joining device 38. In this manner, the pipe part 32 and the suction port 33 of the upper yarn catch and guide device 30 move and catch the yarn 14, and therefore the pipe part 32 and the suction port 33 are collectively referred to as a move and catch part 30a. In this embodiment, an end portion of the suction port 33 at one side is extended, and effects thereby will be described later.

[0056] The lower yarn catch and guide device 34 includes a shaft part 35, a pipe part 36 and a lower yarn catch suction port 37, similarly to the upper yarn catch and guide device 30. The lower yarn catch suction port 37 can shift around the shaft part 35 and also generate suction stream, similarly to the suction port 33. In this configuration, the lower yarn catch and guide device 34 can catch a lower yarn and guide it to a yarn joining device 38.

[0057] The clearer 40 has a sensor (not shown). The clearer 40 monitors a yarn thickness signal from the sensor, and thereby detects a yarn defect such as a slab. A cutter 41 is provided near the clearer 40, for immediately cutting the yarn 14 when the clearer 40 detects a yarn defect. The detection results by the sensor may be analyzed in a processing unit within the clearer 40, or may be analyzed in the unit control section 50.

[0058] As a result of the above, the winding unit 10 can wind the yarn 14 on the wound bobbin 19 and form the package 22.

[0059] Next, members included in the winding part 17 will be described with reference to Fig. 3.

[0060] As shown in Fig. 3, the winding part 17 includes not only a winding drum 20, a package 22 or the like, but also an air stream ejection part 60, a contact roller (power transmission mechanism) 64 and a detection part 68. A configuration having an upper yarn catch and guide device 30 and the detection part 68 is referred to as a yarn pull-out device 28.

[0061] The air stream ejection part 60 includes air passages 61 for passing compressed air, and nozzles 62 for ejecting compressed air passed through the air passages 61. The nozzles 62 are arranged at both ends in a winding shaft direction of the package 22, as shown in Fig. 3 (b). Each of the nozzles 62 can eject air stream toward the center portion of the package 22.

[0062] Accordingly, for example, even when the yarn 14 is located at an end portion in the winding shaft direction while separating the package 22 from the winding drum 20, air stream allows the yarn 14 to move into the center portion in the winding shaft direction. This can prevent cob-webbing.

[0063] A surface of a contact roller 64 is made of a soft material (for example, a rubber material such as NBR). The contact roller 64 is a member for rotating the package 22 in a reverse direction by a drum drive motor 21. The contact roller 64 is rotatably connected to one end portion of a first link part 65. Accordingly, the contact roller 64 can be shifted around another end portion of the first link part 65 as a rotation shaft. A second link part 66 is rotatably connected to a middle portion of the first link part 65. The second link part 66 is movable by means of driving force of solenoid, air cylinder or the like.

[0064] In this configuration, the second link part 66 is pulled toward the left side of Fig. 3 (a), as shown in Fig. 8 (a) described later, and thereby the contact roller 64 comes in contact with the winding drum 20 and the package 22. In this state, the drum drive motor 21 is driven in the rotation direction during a winding operation, and thereby the package 22 can rotate in a reverse direction.

[0065] Although any material can be used for the contact roller 64, adoption of a soft material as described in this embodiment can prevent damages of the package 22 and the winding drum 20.

[0066] The detection part 68 is configured as a light sensor and determines success or failure in catching the yarn 14 of the package 22 by the suction port 33. The detection part 68 is fixed to the winding part 17 with an appropriate member (details thereof will be described later) and maintained at a constant position irrespective of the rotation of the winding drum 20 and the shifting of the suction port 33.

[0067] The pipe part 32 of an upper yarn catch and guide device 30 has a light passing part (detection window) 69. The light passing part 69 is configured in a man-

ner such that, for example, the recess provided on the surface of the pipe part 32 serves as a transparent plate (a material for passing light, such as acryl or polycarbonate). The light passing part 69 may be flat not forming the recess by cutting out the surface of the pipe part 32 and arranging the transparent plate alternatively. A configuration without the transparent plate may be adoptable. When the transparent plate is arranged, leakage of negative pressure from the pipe part 32 can be prevented. This can prevent the reduction of the suction force. On the other hand, when the transparent plate is not arranged, the detection part 68 can detect a yarn 14 directly. This can improve the accuracy of detection.

[0068] The detailed description of the detection part 68 and the pipe part 32 will be given with reference to Fig. 4 to Fig. 6. As shown in Fig. 4, the winding part 17 includes a detection part mounting plate 81 and a winding part support plate 82.

[0069] The detection part 68 is mounted near an end portion of the front side of the detection part mounting plate 81. The detection part mounting plate 81 is fixed to the winding part support plate 82 with a bolt or the like near an end portion of the back side. The detection part mounting plate 81 and the detection part 68 are supported by the winding part support plate 82.

[0070] The winding part support plate 82 is a metal member for supporting peripheral parts of the winding drum 20. The winding part support plate 82 that is made of metal enables the detection part 68 to be grounded and enables heat to be dissipated. The winding part support plate 82 can support not only the detection part 68 but also other parts. Thereby, a special part for supporting the detection part 68 is not required. This can suppress an increase of the number of parts.

[0071] As shown in Fig. 5 (a), the detection part 68 of this embodiment includes a light emitting part 68a and a light receiving part 68b. The light emitting part 68a emits light toward a position where a yarn 14 is passed within the pipe part 32 (detecting position). The light receiving part 68b receives light that is emitted by the light emitting part 68a and reflected by the yarn 14. The detection part 68 determines the presence or absence of the yarn 14 depending on the intensity of light that is received by the light receiving part 68b. That is, when the light receiving part 68b receives light having the predetermined intensity or more, the detection part 68 determines that the yarn 14 is present (the yarn 14 is caught by a move and catch part 30a successfully).

[0072] Any configuration may be adoptable for the detection part 68. For example, a configuration shown in Fig. 5 (b) to Fig. 5 (d) may be adoptable.

[0073] In an example shown in Fig. 5 (b), the pipe part 32 has a reflection plate 32d within the side opposite to the detection part 68 (the side opposite to the detection part 68 (light passing part 69) across a detecting position). In the example shown in Fig. 5 (b), the light receiving part 68b receives light after light emitted by the light emitting part 68a is reflected by the reflection plate 32d. Here,

in a case that the yarn 14 is present within the pipe part 32, light is shielded by the yarn 14. Thereby, the intensity of light received by the light receiving part 68b is reduced. In this manner, the detection part 68 determines the presence or absence of the yarn 14 (success or failure in catching the yarn 14). By using light shielding of the yarn 14 instead of light reflection by the yarn 14, it is possible to perform above determination even when the yarn is a colored yarn that absorbs light (particularly, black yarn).

[0074] In an example shown in Fig. 5 (c), light is reflected by means of the inside surface of the pipe part 32 instead of the reflection plate 32d. This can determine the presence or absence of the yarn 14 in a simple configuration although the accuracy of detection of the yarn 14 is reduced.

[0075] In Fig. 5 (b) and Fig. 5 (c), the light emitting part 68a and the light receiving part 68b are perpendicular to the longitudinal direction of the yarn 14, however, they may be arranged along the longitudinal direction of the yarn 14. In this case, the yarn 14 shields not only light emitted by the light emitting part 68a but also light reflected by the reflection plate 32d. This leads to a great reduction in the intensity of light. Therefore, the accuracy of determination of the presence or absence of the yarn 14 can be improved.

[0076] In an example shown in Fig. 5 (d), the light emitting part 68a and the light receiving part 68b are arranged across the light passing part 69 (detecting position) of the pipe part 32. Light emitted by the light emitting part 68a is directly received by the light receiving part 68b after the yarn 14 shields light. Accordingly, similarly to the case of Fig. 5 (b) and Fig. 5 (c), using light shielding by the yarn 14 can determine the presence or absence of the yarn 14. In a configuration of Fig. 5 (d), the cost can be reduced since a reflection plate is not required, and the labor of cleaning the reflection plate can be saved.

[0077] The detection part 68 is not limited to a light sensor as long as the yarn 14 within the pipe part 32 is detected. Although a touch sensor or the like may also be used, using the light sensor can easily detect the yarn 14 from the outside.

[0078] Next, details of the pipe part 32 and the light passing part 69 will be described. As shown in Fig. 4, the pipe part 32 has a cylindrical portion 32a and a connecting portion 32b. The cylindrical portion 32a is a portion in a shaft part 31 side and has an air passage having a circular-shaped cross-section. The connecting portion 32b is connected to an end portion on the suction port 33 side of the cylindrical portion 32a. The cross-section shape of the connecting portion 32b is changed from circular to slit in order to connect the cylindrical portion 32a and the suction port 33. The suction port 33 is a slit-like opening that extends parallel to the rotation shaft direction of the package 22.

[0079] In this embodiment, the light passing part 69 is provided on the cylindrical portion 32a of the pipe part 32, to be more specific, on the connecting portion 32b

side of the center portion of the cylindrical portion 32a. Thus, the light passing part 69 is provided on the side close to the suction port 33 of the cylindrical portion 32a. This can reduce time until the yarn 14 is detected. Since the connecting portion 32b has a wide width, the position where the yarn 14 passes through depends on the portion where the suction port 33 catches the yarn 14. Therefore, the light passing part 69 is provided at the position behind the connecting portion 32b, and thereby reduction of the accuracy of detection of the yarn 14 can be prevented.

[0080] As shown in Fig. 4, the light passing part 69 is opposed to the detection part 68 when the suction port 33 is located at the catching position. This can achieve a natural and simple layout. The light passing part 69 is still opposed to the detection part 68 even when the catching position of the suction port 33 is changed slightly due to the package 22 being in a lump. This can detect the yarn 14 without any troubles.

[0081] In Patent Document 1 and 2, a detection part is provided in a suction port in order to quickly detect a yarn sucked and caught by the suction port. However, this configuration puts a burden on wiring that is extended from the detection part each time the suction port shifts, and then wiring is deteriorated. Another configuration, where the detection part is provided at a shaft part 31 or further inside of the shaft part 31 (sucking direction downstream side as an opposite side of the suction port), is conventionally known. However, in this configuration, a yarn is not detected until the yarn sucked and caught by the suction port reaches the shaft part. This involves problems of increasing in a detection time, a waste of yarn and a yarn joining time.

[0082] In this respect, in the configuration of this embodiment, success or failure in catching a yarn 14 can be determined without putting a burden on wiring because a position of a detection part 68 is fixed. The light passing part 69 uncovers the inside of the pipe part 32 (particularly, upstream side of sucking direction) when the suction port 33 is located at the catching position. This can quickly detect the presence or absence of the yarn 14, as compared with a configuration in which the detection part 68 is provided in the shaft part 31.

[0083] As shown in Fig. 6, a guide portion 32c is arranged within the pipe part 32 (cylindrical portion 32a). The guide portion 32c is a plate-like member and arranged on an upstream side in a sucking direction of a light passing part 69. The guide portion 32c is arranged so as to slightly incline relative to a vertical cross-section of the cylindrical portion 32a (such that a side farther from the suction port 33 is located at the sucking direction upstream side). The guide portion 32c includes a first guide portion 321 and a second guide portion 322.

[0084] The first guide portion 321 is provided near an inner edge of a side farther from the suction port 33 (a side opposite to the light passing part 69). The first guide portion 321 sucks the yarn 14 sucked by the suction port 33 and guides to the second guide portion 322.

[0085] The second guide portion 322 is provided in a

side near the suction port 33 (near the light passing part 69). A recess is formed in the second guide portion 322 and thereby guides the yarn 14. This can improve the accuracy of detection of the yarn 14.

[0086] In a case that a recess is formed in the light passing part 69 and a transparent plate is not arranged in a notch, the positional relationship between the detection part 68 and the light passing part 69 is adjusted such that at least a part of the detection part 68 penetrates the light passing part 69 when the suction port 33 catches a yarn of the package 22 (see Fig. 8 (a)). Accordingly, success or failure in catching the yarn 14 can be determined at the position near the suction port 33. As described above, in a case that such as a transparent plate is arranged in a notch, the yarn 14 can be detected with the sufficient accuracy of detection.

[0087] Next, an operation of the winding part 17 when the suction port 33 catches the yarn 14 of the package 22 will be described with reference to Fig. 7 to Fig. 9. The following description of the operation is merely an illustrative example, a part of the process order may be changed and some processes may be simultaneously performed. A part of the process may be omitted and an other process may be added.

[0088] Fig. 7 (a) shows a state during a winding operation by the winding part 17. At this time, the contact roller 64 does not come in contact with neither the wound bobbin 19 nor a winding drum 20.

[0089] After that, in a case that the yarn 14 is disconnected when a yarn defect is detected by the clearer 40 and the yarn 14 being cut by the cutter 41 (in a case of Yes in S101), the unit control section 50 winds the yarn 14 of the winding part 17 side into the package 22 and drives the cradle 18, and thereby the package 22 is moved away from the winding drum 20 (a state shown in Fig. 7 (b)). The unit control section 50 ejects air stream from the nozzle 62 of the air stream ejection part 60 toward the center portion in a winding shaft direction of the package 22. This can prevent cob-webbing. Moreover, the unit control section 50 allows the move and catch part 30a (the pipe part 32 and the suction port 33) to swirl from the waiting position to the catching position in order to catch the yarn 14 of the package 22 (S102, catching step).

[0090] Next, the unit control section 50 drives the second link part 66 by a solenoid or the like, and thereby the contact roller 64 is moved in contact with the package 22 and the winding drum 20 (a state shown in Fig. 8 (a)). Accordingly, driving force of the drum drive motor 21 can be transmitted to the package 22 via the winding drum 20 and the contact roller 64. The contact roller 64 enables a reverse rotation of the package 22 without changing the rotation direction of the winding drum 20. The contact roller 64 may come in contact after a rotation speed is reduced to some extent, in order to prevent damages of the package 22 and the winding drum 20.

[0091] The unit control section 50 generates suction stream in the suction port 33 that is located near the pack-

age 22 before and after a reverse rotation of the package 22. Accordingly, the suction port 33 can catch the yarn 14 of the package 22.

[0092] In this embodiment, the package 22 is away from the winding drum 20. This can prevent the yarn 14 from sticking to the package 22, and improve the probability of catching of the yarn 14. The suction port 33 is located between the package 22 and the winding drum 20, and thereby the yarn 14 can be surely caught. Moreover, in the suction port 33 of this embodiment, an edge portion located at the winding drum 20 side is extended. This can further improve the probability of catching of the yarn 14.

[0093] As described above, the move and catch part 30a approaches the detection part 68 by shifting to the catching position. Therefore, the yarn 14 caught by the suction port 33 is detected by the detection part 68 via the light passing part 69. This can check success or failure in catching the yarn 14 at an early stage. When the move and catch part 30a is shifted (moved) to the catching position, it is assumed that "the move and catch part 30a approaches the detection part 68" even in any state, where the move and catch part 30a is standing still before the detection part 68, the move and catch part 30a comes in contact with the detection part 68, and the detection part 68 is located within the move and catch part 30a.

[0094] Next, the unit control section 50 determines whether the detection part 68 detects the yarn 14 or not (S103, detecting step). The unit control section 50 performs a first waiting process (S104, waiting step) and a second waiting process (S105, yarn defect sucking and waiting step) when the detection part 68 detects the yarn 14. The sucking and catching operation of the suction port 33 is continued during the first waiting process and the second waiting process.

[0095] The first waiting process is a process that continues to suck a predetermined amount of the yarn 14, in order to prevent being out of (being not enough) the yarn 14 when the yarn 14 is guided to the yarn joining device 38 by shifting the move and catch part 30a toward the lower side. The second waiting process is a process that continues to suck a predetermined amount of the yarn 14, in order to remove a yarn defect detected by the clearer 40 after sucking (in order to prevent a yarn defect from remaining in the package 22).

[0096] The unit control section 50 releases a sucking and catching operation and guides the yarn 14 to the yarn joining device 38 after the first waiting process and the second waiting process (S106).

[0097] The unit control section 50 allows a lower yarn catch and guide device 34 to shift and catch a lower yarn, simultaneously with catching of an upper yarn, and guide it to the yarn joining device 38. After that, the yarn joining device 38 performs yarn joining between the upper yarn and the lower yarn, and thereby a winding operation is restarted (a state shown in Fig. 8 (b)).

[0098] Next, a position for arranging the contact roller 64 and an effect depending on the position will be de-

scribed with reference to Fig. 10.

[0099] The contact roller 64 is preferably arranged at an end portion, not the center portion in a winding shaft direction, so as not to disturb catching of the yarn 14 by the suction port 33. The contact roller 64 is arranged at an end portion (position A or position C) on a side opposite to the unit control section 50 among end portions in the winding shaft direction. Thereby, a space is formed around the contact roller 64 and the contact roller 64 is positioned at a near side. This can facilitate a mounting/dismounting operation of the contact roller 64.

[0100] The contact roller 64 can be arranged in a front side of the device or a back side of the device. In a case of arranging the contact roller 64 in the front side of the device (position A or position B), a space is formed around the contact roller 64 although catching of the yarn 14 by the suction port 33 is slightly disturbed. This can facilitate the mounting/dismounting operation of the contact roller 64. In a case that the contact roller 64 is arranged in the front side of the device, as shown in Fig. 8 (a), the contact roller 64 comes in contact with the package 22 and the winding drum 20 such that the contact roller 64 is meshed with the package 22 and the winding drum 20. Therefore, the contact roller 64 surely comes in contact with the package 22 and the winding drum 20.

[0101] On the other hand, in a case of arranging the contact roller 64 in the back side of the device (position C or position D), catching of the yarn 14 by the suction port 33 is not disturbed at all although the mounting/dismounting operation of the contact roller 64 is difficult due to a small space around the contact roller 64.

[0102] Therefore, it is preferable that an optimum position is selected depending on such as the positional relationship of the winding part 17, the form of the suction port 33 and the like.

[0103] Next, a first modification of the above-described embodiment will be described with reference to an enlarged side view of Fig. 11. In a description of the first and second modifications, members identical or similar to those of the above-described embodiment will be denoted by the same corresponding reference signs on the drawings, and a description thereof may be sometimes omitted.

[0104] The above-described embodiment is a configuration having one contact roller 64, however, the first modification is a configuration having three contact rollers 64. Also in a configuration having three contact rollers 64, as shown in Fig. 11, the contact rollers 64 enable a reverse rotation of the package 22 without changing a rotation direction of the winding drum 20. Therefore, the odd-number of the contact rollers 64 is preferable.

[0105] Next, a second modification of the above-described embodiment will be described with reference to an enlarged plan view of Fig. 12.

[0106] In the above-described embodiment and the first modification, driving force of the drum drive motor 21 is transmitted to the package 22 by the contact roller 64. In the second modification, driving force of the drum

drive motor 21 is transmitted to the package 22 by a support part relaying power transmission mechanism (power transmission mechanism) 70 via the cradle 18 (in more detail, the rotation support portion). Each part of the support part relaying power transmission mechanism 70 will be described as follows.

[0107] The support part relaying power transmission mechanism 70 includes a power transmission shaft 71, a belt 72, a power transmission shaft 73, a gear 74, a gear 75, a clutch 76 and a power transmission shaft 77.

[0108] The power transmission shaft 71 is a rotation shaft of the winding drum 20 and rotatable integrally with the winding drum 20. Driving force transmitted to the power transmission shaft 71 is transmitted to the power transmission shaft 73 via the belt 72. The power transmission shaft 71 and the power transmission shaft 73 have same rotation direction due to the transmission via the belt 72.

[0109] Driving force transmitted to the power transmission shaft 73 is transmitted to the clutch 76 via the gear 74 mounted to the power transmission shaft 73 and the gear 75 meshes with the gear 74. The power transmission shaft 73 rotates in a reverse direction relative to the power transmission shaft 71 or the like because the gear 75 meshes with the gear 74.

[0110] The clutch 76 can switch between a state where the transmitted driving force is transmitted to the power transmission shaft 77 and a state where the transmitted driving force is not transmitted to the power transmission shaft 77. The power transmission shaft 77 is configured to rotate integrally with a rotation support portion for rotatably supporting the package 22. The power transmission shaft 77 rotates in the same direction as the gear 75 (in a reverse direction relative to the power transmission shaft 71), and thereby the package 22 is rotated in a reverse direction relative to the winding drum 20.

[0111] In the above-described manner, driving force of the drum drive motor 21 can be transmitted to the package 22. The clutch 76 allows the package 22 to quickly rotate in a reverse direction. This can reduce time of yarn joining or the like and improve the efficiency of winding. A support part relaying power transmission mechanism 70 of the second modification is merely illustrative, and there are appropriately changeable components.

[0112] As described above, the above-described yarn pull-out device 28 includes an upper yarn catch and guide device 30 and a detection part 68. The upper yarn catch and guide device 30 has a move and catch part 30a that moves from a waiting position to a catching position in the winding part 17 side, sucks and catches a wound yarn of a yarn in the winding part 17 side. The detection part 68 detects a wound yarn caught by the upper yarn catch and guide device 30. The move and catch part 30a approaches the detection part 68 by moving from the waiting position to the catching position (that is, the detection part 68 is provided in a position other than the position of the move and catch part 30a). The detection part 68 detects the presence or absence of the wound yarn within the move and catch part 30a moved to the

catching position.

[0113] Accordingly, even if the move and catch part 30a is moved, a burden is not put onto wiring connected to the detection part 68 since the detection part 68 is arranged in a position that differs from the move and catch part 30a. Moreover, a wound yarn can be detected at a position near a suction port 33 of the move and catch part 30a because consideration for a burden on wiring is unnecessary. This can reduce time of yarn joining.

[0114] In another aspect of the present invention, the winding part 17 of an automatic winder (yarn winding device) 1 of this embodiment includes a cradle (supporting part) 18, a winding drum (auxiliary roller) 20, a drum drive motor (driving source) 21, a traverse groove (traverse mechanism) of the winding drum 20 and a power transmission mechanism (a contact roller 64 or a support part relaying power transmission mechanism 70). The cradle 18 rotatably supports the package 22. The winding drum 20 comes in contact with the package 22 and assists in winding a yarn 14, and thereby the package 22 is accordingly rotated. The winding drum 20 is rotated by the drum drive motor 21. The traverse groove is for traversing the yarn 14. In a state where the package 22 is away from the winding drum 20, the power transmission mechanism transmits driving force generated from the drum drive motor 21 to the package 22 and thereby the package 22 is rotated.

[0115] Accordingly, the yarn 14 does not stick to the package 22 since the yarn 14 of the package 22 can be caught in a state where the package 22 is away from the winding drum 20. This can reduce the probability of failure in catching the yarn 14. Using the power transmission mechanism enables to achieve the cost reduction, as compared with a configuration having a drum drive motor 21 separately. Moreover, a rotation speed, a rotation direction of the package 22 and the like can be controlled by controlling the drum drive motor 21.

[0116] In the above-described embodiment and the first modification, the power transmission mechanism is the contact roller 64. The contact roller 64 transmits driving force generated from the drum drive motor 21 to the package 22 and thereby the winding drum 20 is rotated by coming in contact with a surface of the winding drum 20.

[0117] Accordingly, driving force by which the winding drum 20 is rotated can be transmitted to the package 22 with a simple configuration.

[0118] In the above-described automatic winder 1, the contact roller 64 is in contact with a surface of the winding drum 20 and a surface of the package 22. This can transmit driving force by which the drum 20 is rotated to the package 22.

[0119] Accordingly, even in a case that the contact roller 64 has a small diameter and a short length, driving force by which the winding drum 20 is rotated can be transmitted to the package 22.

[0120] In the above-described automatic winder 1, the contact roller 64 comes in contact with a surface of an

end portion in a winding shaft direction.

[0121] Accordingly, the contact roller 64 can be arranged in a position where catching of a yarn end of the package 22 is not disturbed.

[0122] The above-described automatic winder 1 includes a unit control section (control part) 50 which controls at least the winding part 17 and is arranged in one side of a winding shaft direction of the package 22. The contact roller 64 comes in contact with a surface of one end portion side, where the unit control section 50 is not arranged, of both end portions in the winding shaft direction of the package 22.

[0123] Accordingly, there is a space since the unit control section 50 (a casing of the unit control section 50) is not located near the contact roller 64. This allows to easily mount/dismount the contact roller 64.

[0124] In the above-described automatic winder 1, it is preferable that the contact roller 64 comes in contact with a surface in a device's front side of the package 22.

[0125] Accordingly, there is a space since wiring or the like does not exist near the contact roller 64. This allows to easily mount/dismount the contact roller 64.

[0126] In the above-described automatic winder 1, the contact roller 64 may come in contact with a surface of a back side of the device of the package 22.

[0127] Accordingly, the contact roller 64 can be arranged in a position where catching the yarn 14 is not disturbed since the yarn 14 is normally caught in a device's front side of the package 22.

[0128] In the above-described automatic winder 1, an odd-number of the contact rollers 64 (for example, one contact roller 64) is preferably arranged.

[0129] Accordingly, the package 22 is rotated in a reverse direction without changing the rotation direction of the winding drum 20.

[0130] In the above-described automatic winder 1, a portion where the contact roller 64 comes in contact with the package 22 is made of soft material.

[0131] This can prevent damages of a surface of the package 22 and the winding drum 20.

[0132] In the second modification, a power transmission mechanism is a support relaying power transmission mechanism 70 which transmits driving force of the drum drive motor 21 to the package 22 via a cradle 18 (in more detail, a rotation support portion).

[0133] Accordingly, driving force can be transmitted such that a surface of the package 22 and the winding drum 20 does not come in contact with the contact roller 64. This can prevent damages of a surface of the package 22.

[0134] In the above-described automatic winder 1, the support part relaying power transmission mechanism 70 includes a clutch 76 which can switch transmission and non-transmission of driving force from the drum drive motor 21.

[0135] Accordingly, for example, the package 22 is quickly rotated in a reverse direction. This can reduce time of yarn joining or the like and improve the efficiency

of winding.

[0136] In the above-described configuration, in a state where the package 22 is away from the winding drum 20, a space formed thereby includes an air stream ejection part 60 which ejects air stream from an end portion in a winding shaft direction of the package 22 toward the center portion of the package 22.

[0137] This can prevent cob-webbing, and thereby the probability of failure in catching the yarn 14 of the winding part 17 side can be further reduced.

[0138] The above-described automatic winder 1 includes a yarn feed part 15, a yarn joining device 38 and an upper yarn catch and guide device (yarn catch and guide device) 30. The yarn feed part 15 has a yarn feed bobbin 16 in which the yarn 14 for being wound by the winding part 17 is wound. The yarn joining device 38 joins the yarn 14 of the winding part 17 side with that of the yarn feed part 15 side when the yarn 14 is disconnected between the winding part 17 and the yarn feed part 15. The upper yarn catch and guide device 30 catches the yarn 14 of the winding part 17 side and guides to the yarn joining device 38.

[0139] Accordingly, in a configuration of the present invention, a continuous catching of the yarn 14 can be prevented due to the low probability of failure in catching the yarn 14. Therefore, the high efficiency of winding can be achieved.

[0140] The above-described automatic winder 1 includes a detection part 68 which determines success or failure in catching an upper yarn by the upper yarn catch and guide device 30. The detection part 68 is fixed to the winding part 17 and then detects the presence or absence of the yarn 14 within the upper yarn catch and guide device 30 when the upper yarn catch and guide device 30 catches the upper yarn.

[0141] Accordingly, success in catching the upper yarn can be immediately detected and thereby a suction port 33 is quickly moved toward the yarn joining device 38 side. Therefore, time of yarn joining can be reduced and the efficiency of winding can be improved.

[0142] In the above-described automatic winder 1, the upper yarn catch and guide device 30 includes a suction port 33 which sucks and catches a yarn of the winding part 17 side at a location between the package 22 and the winding drum 20. A part of end portions of the suction port 33 is extended. The extended part is located in the winding drum 20 side at a time of catching a yarn of the winding part 17 side.

[0143] This can further reduce the probability of failure in catching a yarn of the winding part 17 side.

[0144] While some preferred embodiments and modifications of the present invention have been described above, the above-described configurations can be changed, for example, as follows.

[0145] In the above-described configurations, the contact roller 64 comes in contact with the package 22 and the winding drum 20. Instead of the package 22, a member for rotating integrally with the package 22 (a wound

bobbin 19, a power transmission shaft 77 or the like) may be adoptable. Also, instead of the winding drum 20, a member rotating integrally with the winding drum 20 (power transmission shaft 71 or the like) may be adoptable.

[0146] Although the above description shows that a traverse is performed by the winding drum 20 having a traverse groove, a traversing device of arm type, belt type or rotary type is adoptable. In this case, a roller without a traverse groove may be used as an auxiliary roller.

[0147] The present invention is not limited to an automatic winder, but also applied to another yarn winding device such as a rewinding machine and a fine spinning machine (for example, an air spinning machine or an open end spinning machine).

DESCRIPTION OF THE REFERENCE NUMERALS

[0148]

1	automatic winder
28	yarn pull-out device
30	upper yarn catch and guide device (wound yarn catch and guide device)
30a	move and catch part
31	shaft part
32	pipe part
32a	cylindrical portion
32b	connecting portion
32c	guide portion
32d	reflection plate
33	suction port
50	unit control section
68	detection part
68a	light emitting part
68b	light receiving part
69	light passing part

Claims

1. A yarn pull-out device for pulling out a yarn from a winding part that winds the yarn to form a package comprising:

a wound yarn catch and guide device including a move and catch part for sucking and catching a wound yarn that is a yarn in the winding part side by moving from a waiting position to a catching position in the winding part side; and a detection part for detecting the wound yarn caught by the wound yarn catch and guide device;

the move and catch part that approaches the detection part by moving from the waiting position to the catching position, the detection part that detects the presence

- or absence of the wound yarn inside the move and catch part moved to the catching position.
2. The yarn pull-out device according to claim 1, wherein the detection part includes:
- a light emitting part for emitting light to a detecting position within the move and catch part; and a light receiving part for receiving light that is emitted by the light emitting part and reflected at the detecting position, or that is emitted by the light emitting part and passed through the detecting position,
- a light passing part at which light emitted by the light emitting part is passed through is provided in the move and catch part.
3. The yarn pull-out device according to claim 2, wherein the move and catch part includes:
- a suction port for sucking a yarn end of the package by approaching an outer circumferential surface of the package; and
- a pipe part connected to the suction port,
- the wound yarn catch and guide device further includes a shaft part as a reference point when the suction port approaches the package,
- the light passing part is provided on the pipe part.
4. The yarn pull-out device according to claim 3, wherein a guide portion for guiding a wound yarn that is sucked by the suction port to the detecting position is provided within the pipe part.
5. The yarn pull-out device according to claim 4, wherein the light passing part is a transparent plate provided in at least a part of the pipe part.
6. The yarn pull-out device according to claim 4, wherein the light passing part is a notch provided in at least a part of the pipe part so as to penetrate through the pipe part.
7. The yarn pull-out device according to claims 5 or 6, wherein the suction port is a slit-like opening that extends parallel to a rotation axis direction of the package, the pipe part includes:
- a cylindrical portion having a circular cross-section to which an air passage is formed; and
- a connecting portion connected to an end portion of the cylindrical portion, the connecting portion having a cross-section of which changes from circular to slit in order to connect the cylindrical portion and the opening,
- the light passing part is provided on the connecting portion side of the cylindrical portion.
8. The yarn pull-out device according to claim 7, wherein the light passing part is provided on a circumferential surface of the cylindrical portion, the circumferential surface on a side opposed to the detection part when the wound yarn catch and guide device catches a wound yarn.
9. The yarn pull-out device according to claim 8, wherein a reflection part for reflecting a emitted light is provided within the cylindrical portion, on a side opposed to the light passing part across the detecting position.
10. A yarn winding device including the yarn pull-out device and the winding part according to any one of claims 1 to 9, wherein the detection part is mounted to the winding part.
11. The yarn winding device according to claim 10, further comprising:
- a yarn feed part for arranging a yarn for being wound by the winding part; and
- a yarn joining device for joining a wound yarn with a yarn on the yarn feed part side when the yarn is disconnected between the winding part and the yarn feed part,
- wherein the yarn pull-out device guides the wound yarn to the yarn joining device.
12. The yarn winding device according to claims 10 or 11, wherein the detection part is mounted to a metal part of the winding part.
13. The yarn winding device according to any one of claims 10 to 12, wherein the winding part includes:
- a support part for rotatably supporting a package;
- an auxiliary roller for assisting a yarn winding while coming in contact with the package, and causing the package to be accordingly rotated;
- a driving source for causing the auxiliary roller to be rotated;

a traverse mechanism for traversing a yarn; and
a power transmission mechanism for transmitting a driving force generated from the driving source to the package and thereby rotating the package, in a state where the package is away from the auxiliary roller.

14. A yarn joining method performed by the yarn winding device according to any one of claims 11 to 13, comprising:

a catching step for performing a sucking and catching operation, in which the wound yarn catch and guide device approaches and then the package is rotated in the reverse direction from the winding direction, in order to catch a wound yarn;
a detection step for detecting for sucking and catching of the wound yarn by the wound yarn catch and guide device;
a waiting step for continuing the sucking and catching operation until a setting time elapses from a detection of sucking and catching of the wound yarn; and
a guiding step for guiding the wound yarn to the yarn joining device after completion of the waiting step.

15. The yarn joining method according to claim 14, wherein
a yarn defect sucking and waiting step for further waiting until a yarn defect is sucked by the wound yarn catch and guide device after the waiting step.

Fig.1

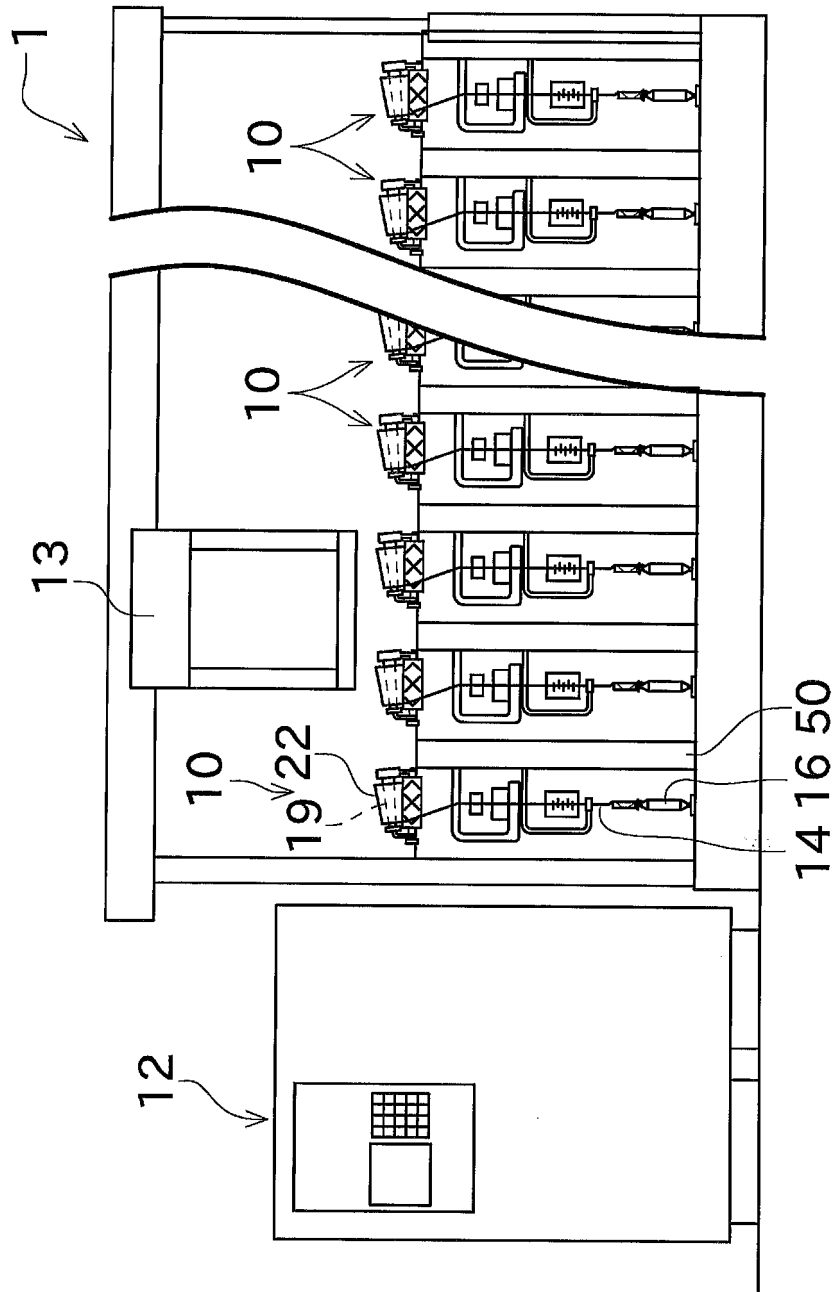


Fig.2

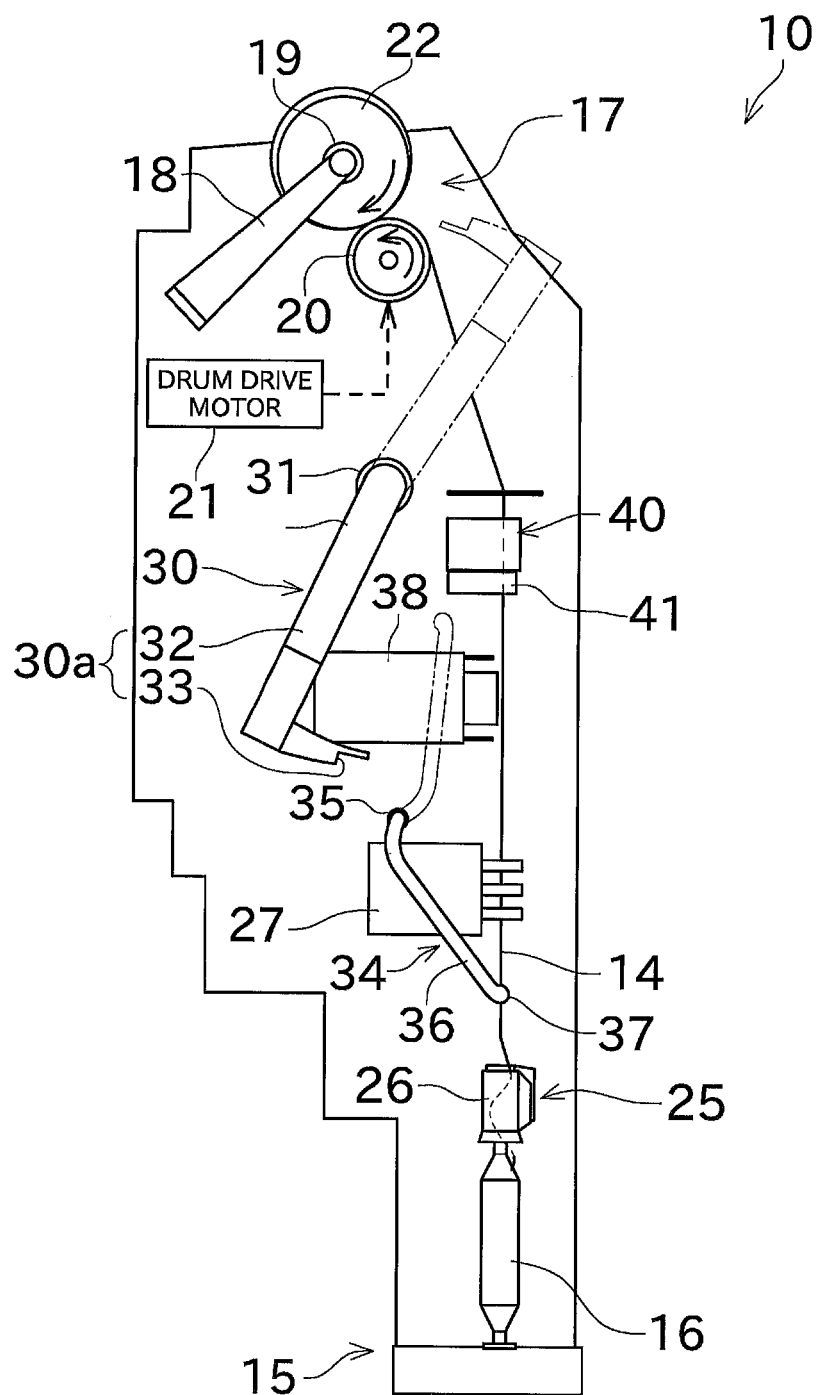


Fig.4

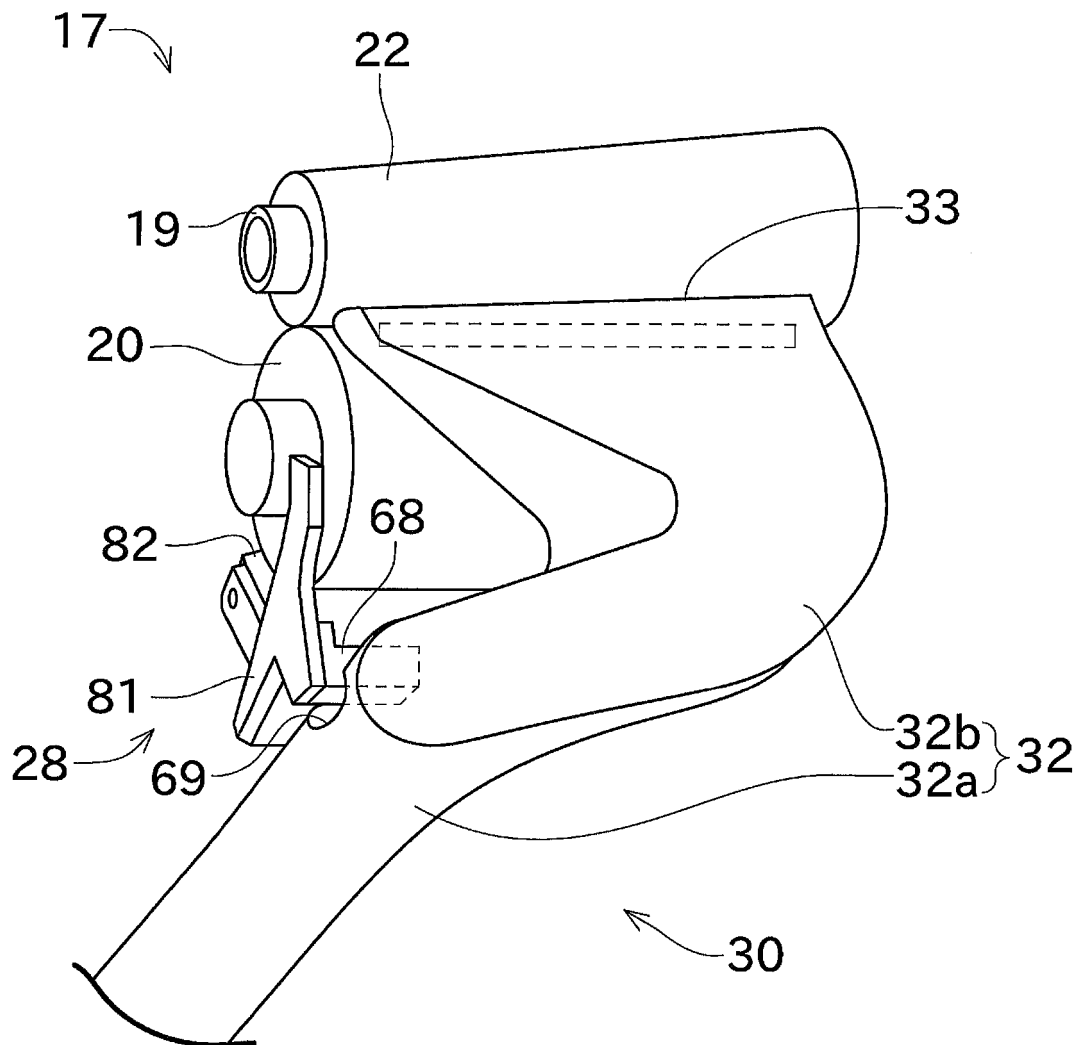


Fig.5

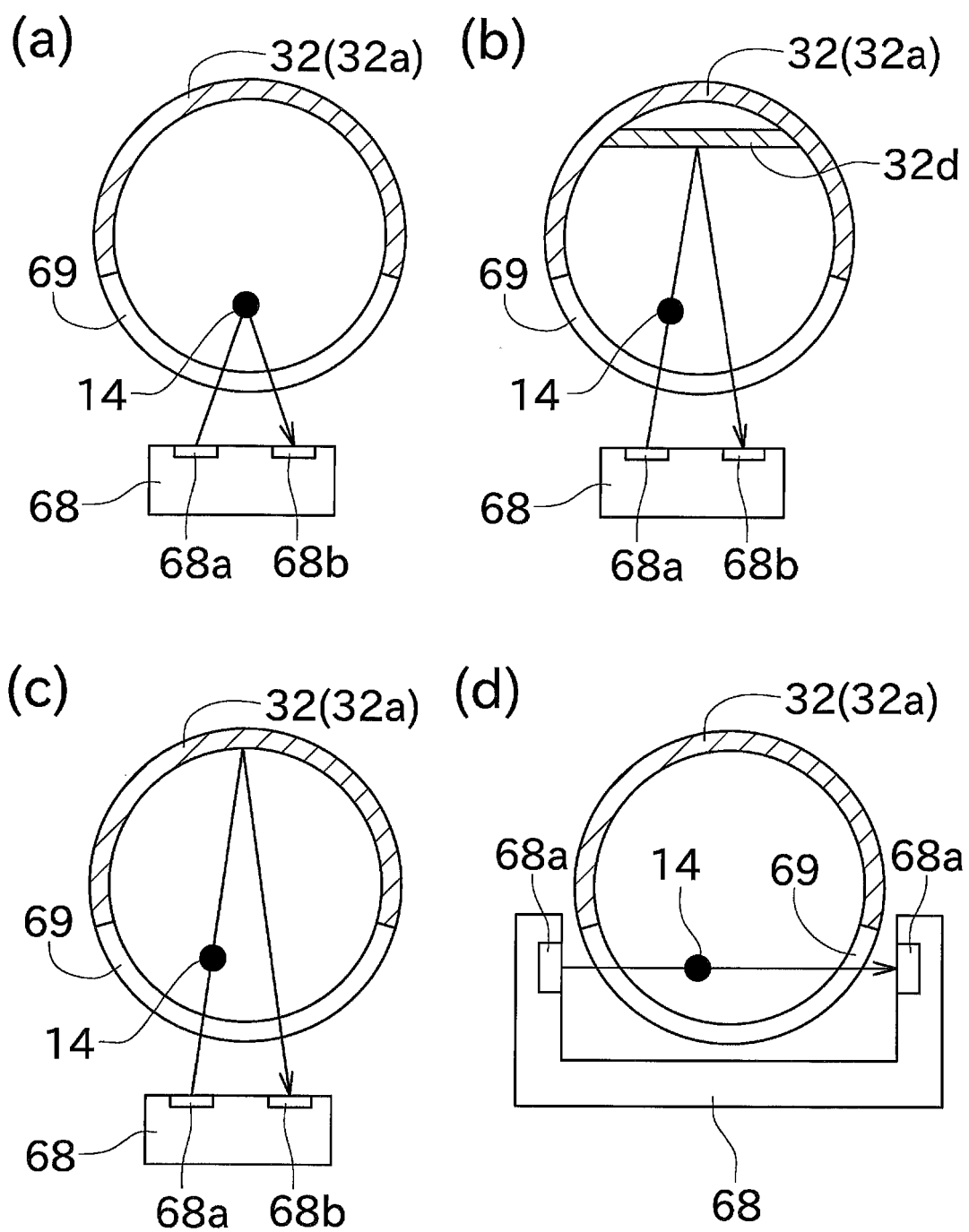
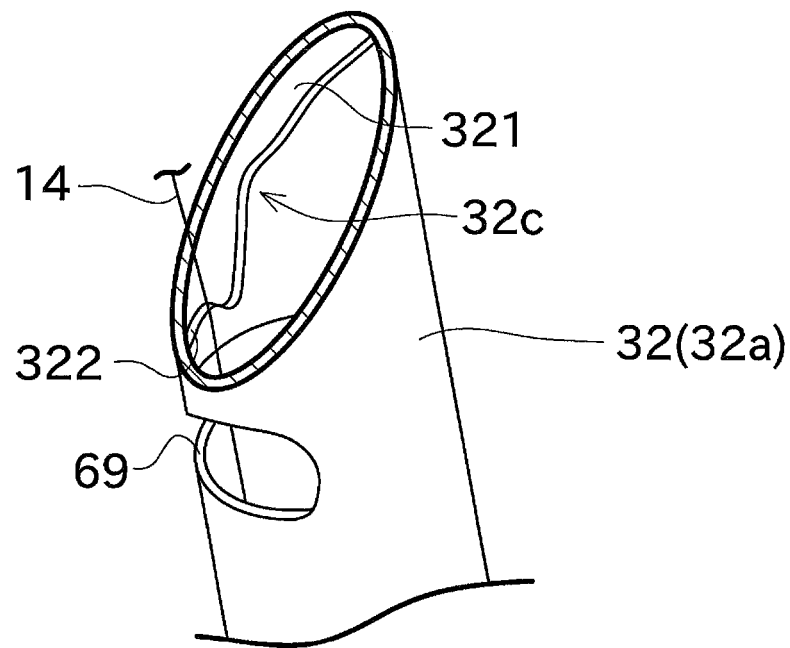


Fig.6
(a)



(b)

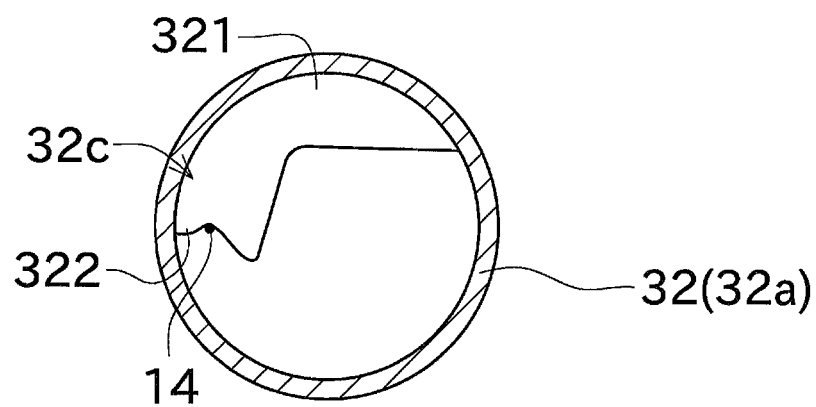
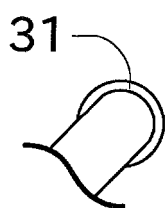
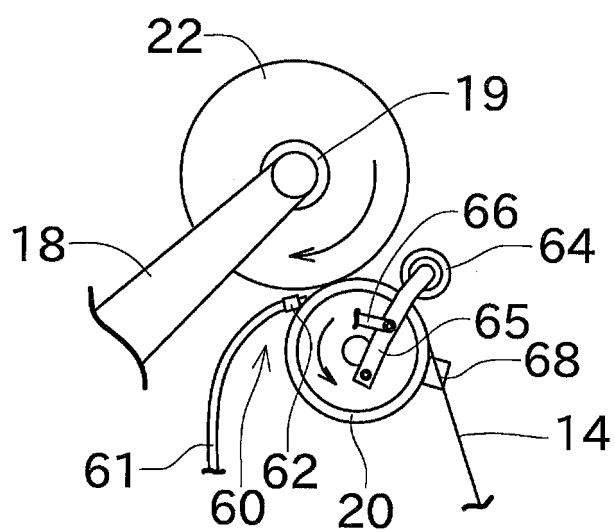


Fig.7

(a)



(b)

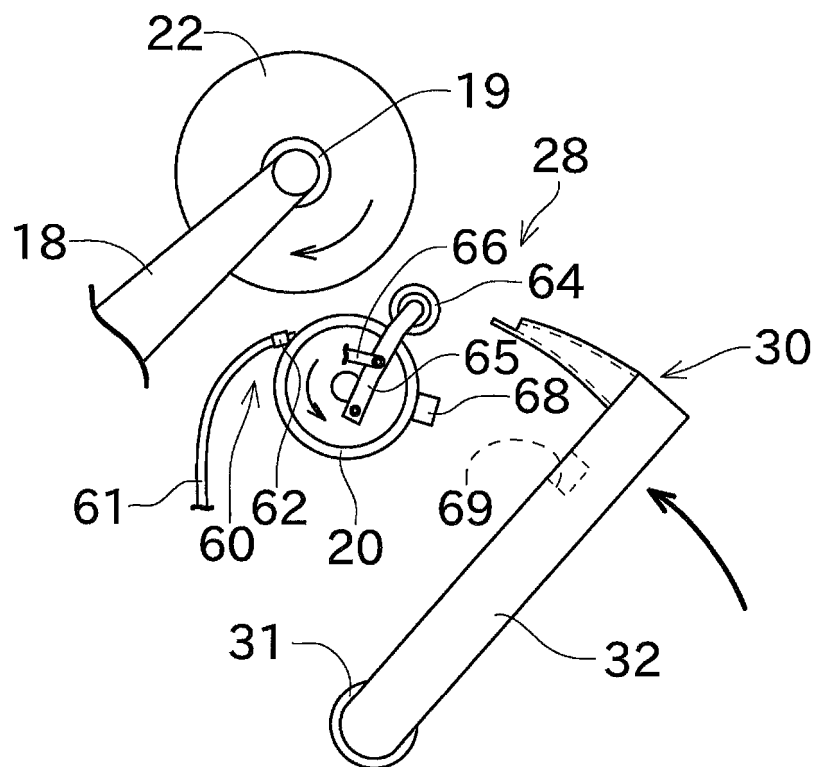
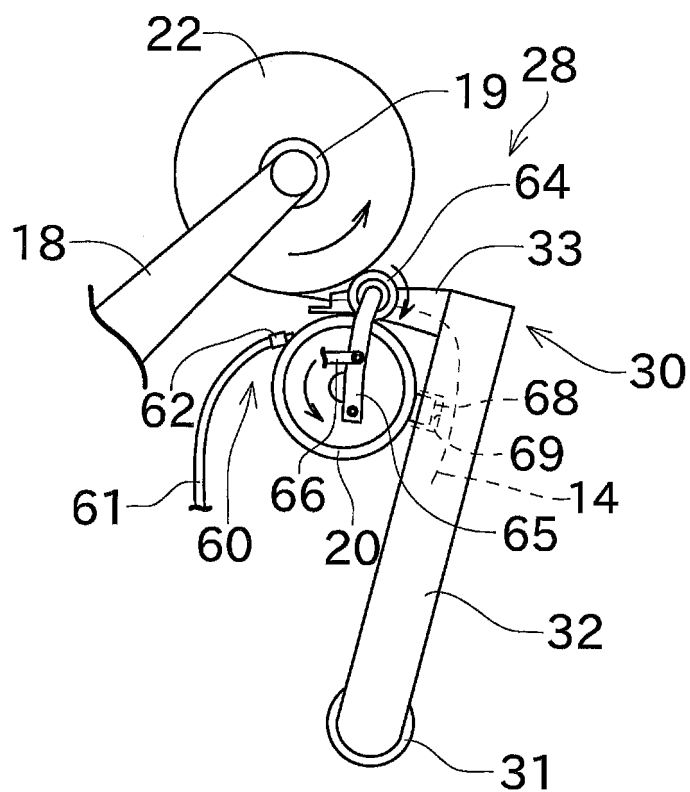


Fig.8

(a)



(b)

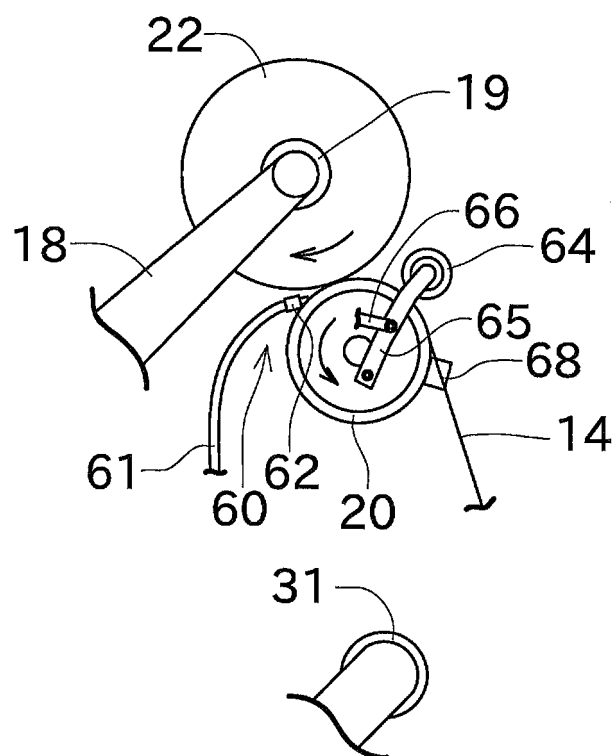


Fig.9

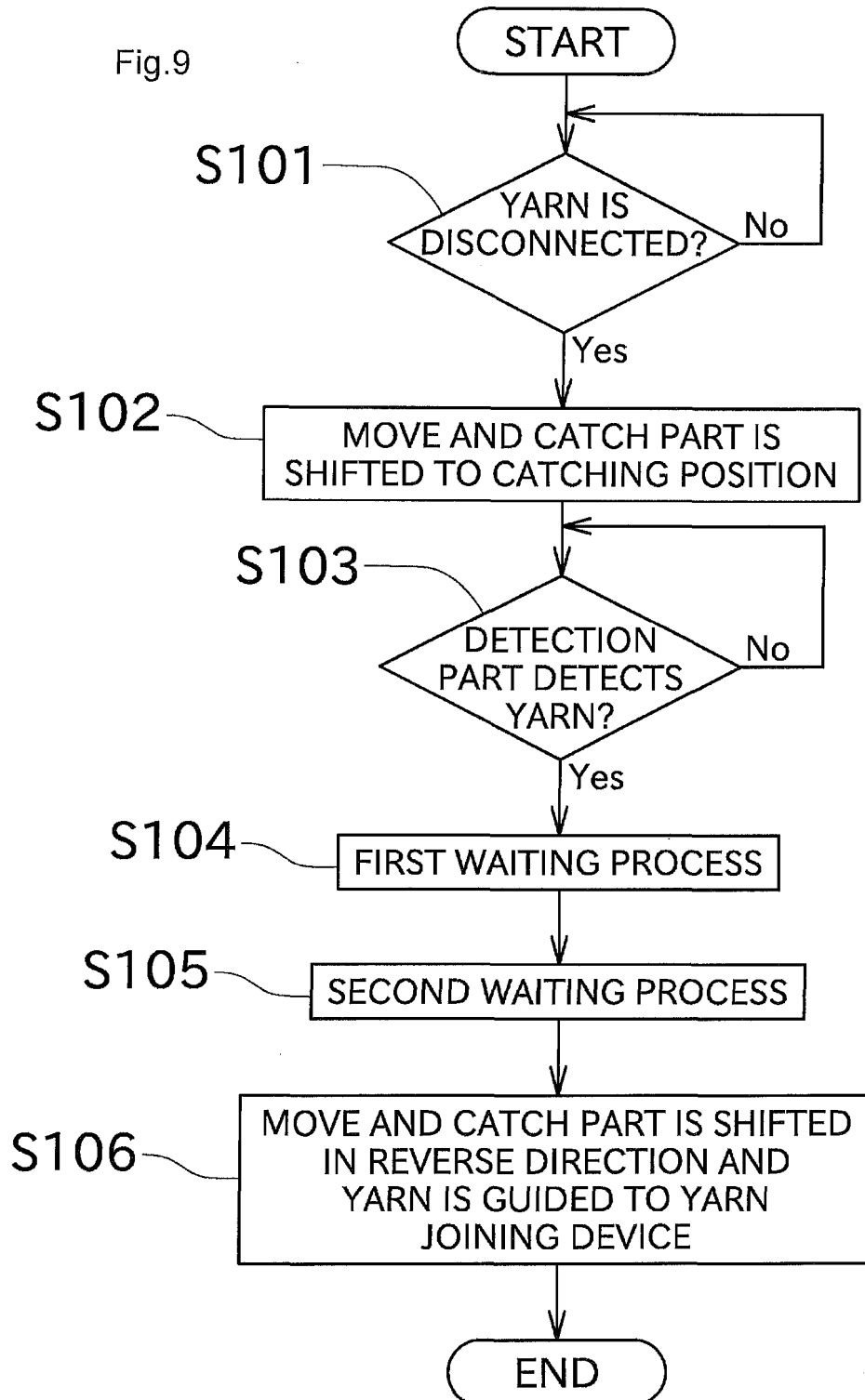


Fig.10

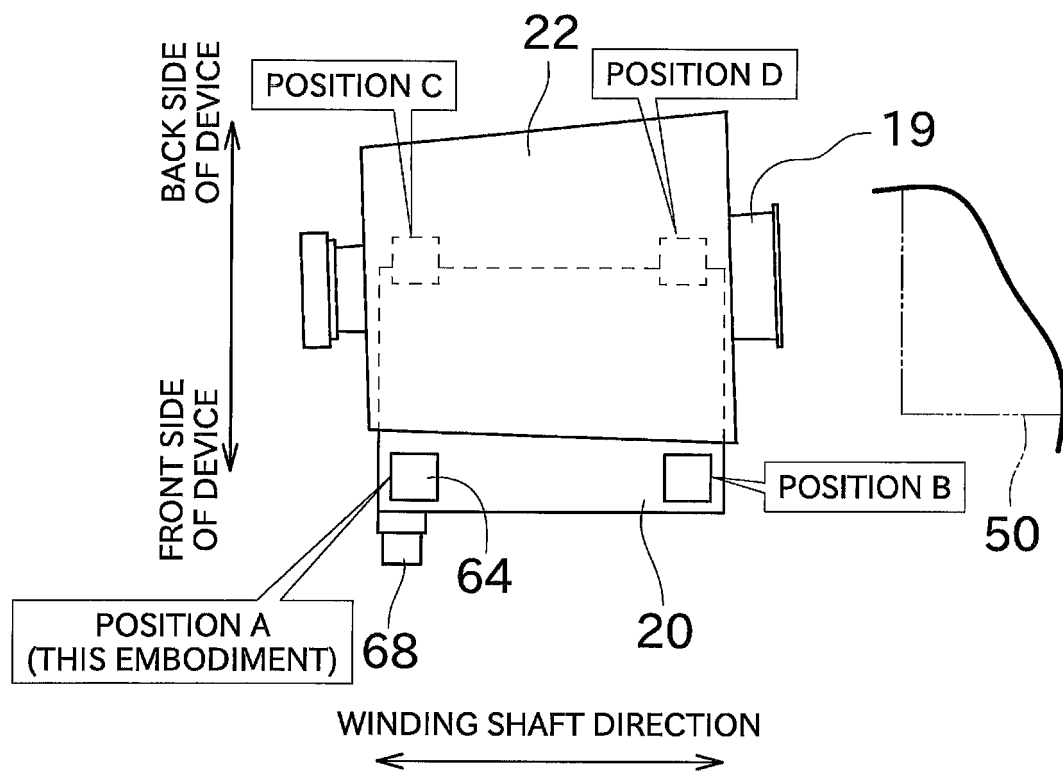


Fig.11

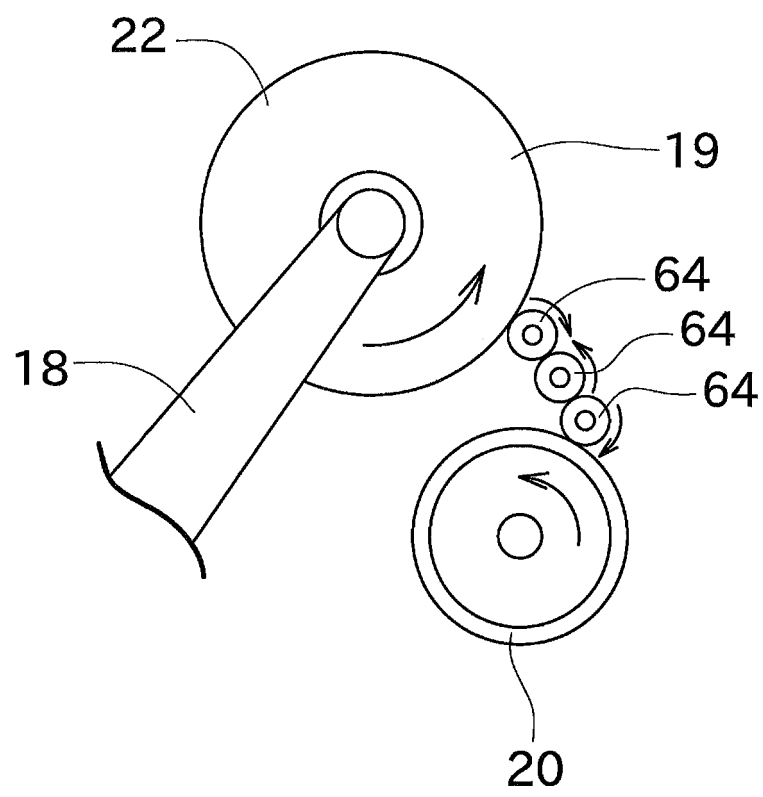
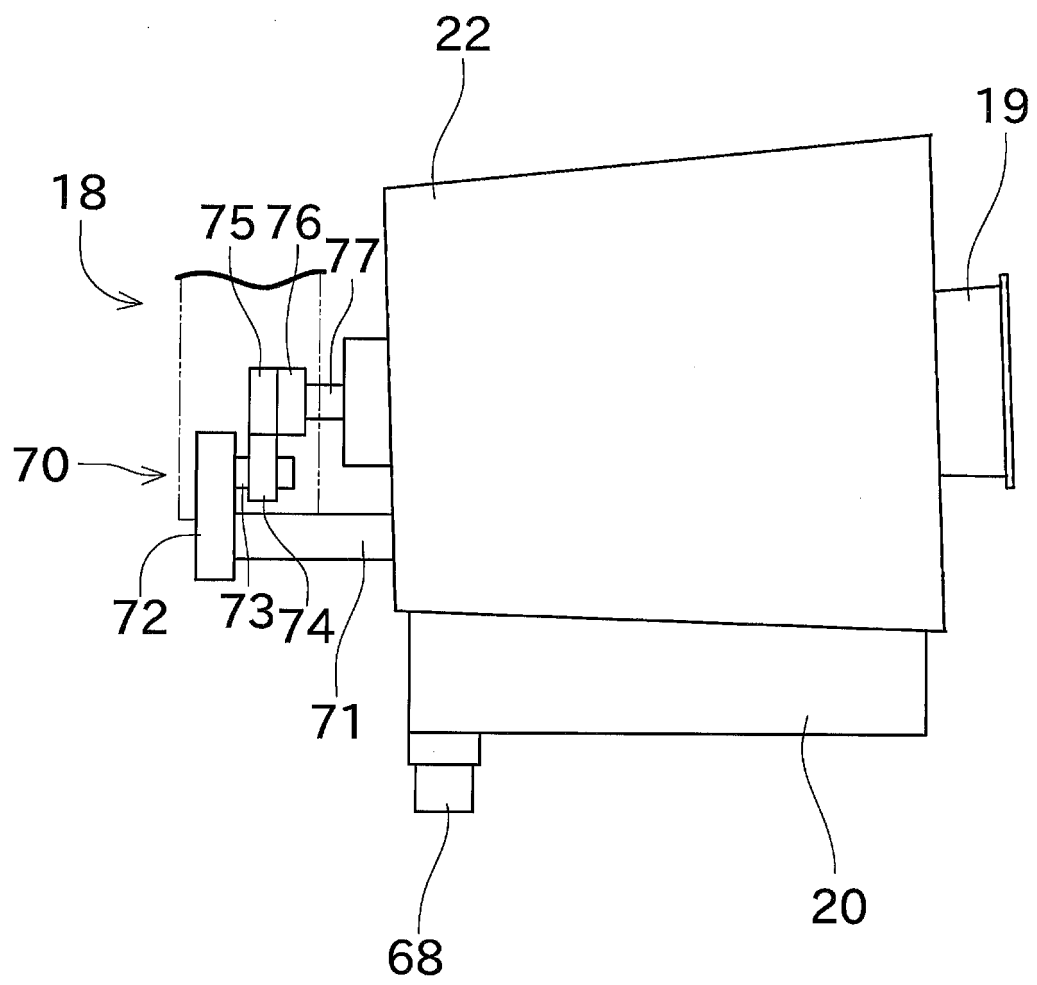


Fig.12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/000572

A. CLASSIFICATION OF SUBJECT MATTER

B65H54/42(2006.01)i, B65H54/46(2006.01)i, B65H67/08(2006.01)i, D01H4/48(2006.01)i, D01H13/16(2006.01)i, D01H15/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65H54/42, B65H54/46, B65H67/00-67/08, D01H1/00-17/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014

Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2005-232612 A (Murata Machinery Ltd.),	1
Y	02 September 2005 (02.09.2005),	2-4
A	paragraphs [0016] to [0017], [0020], [0035] (Family: none)	5-15
Y	JP 10-167575 A (W. Schlafhorst AG & Co.),	2-4
	23 June 1998 (23.06.1998),	
	paragraph [0024]; fig. 1	
	& US 5918828 A & DE 19650934 A	
Y	JP 8-175763 A (Murata Machinery Ltd.),	4
	09 July 1996 (09.07.1996),	
	paragraph [0017]; fig. 2	
	(Family: none)	

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
02 April, 2014 (02.04.14)

Date of mailing of the international search report
15 April, 2014 (15.04.14)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/000572

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 3-167327 A (Murata Machinery Ltd.), 19 July 1991 (19.07.1991), fig. 1 (Family: none)	1
A	JP 4-235864 A (Murata Machinery Ltd.), 24 August 1992 (24.08.1992), fig. 6 (Family: none)	1

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

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 9031769 A [0004]
- JP 3102562 A [0004]