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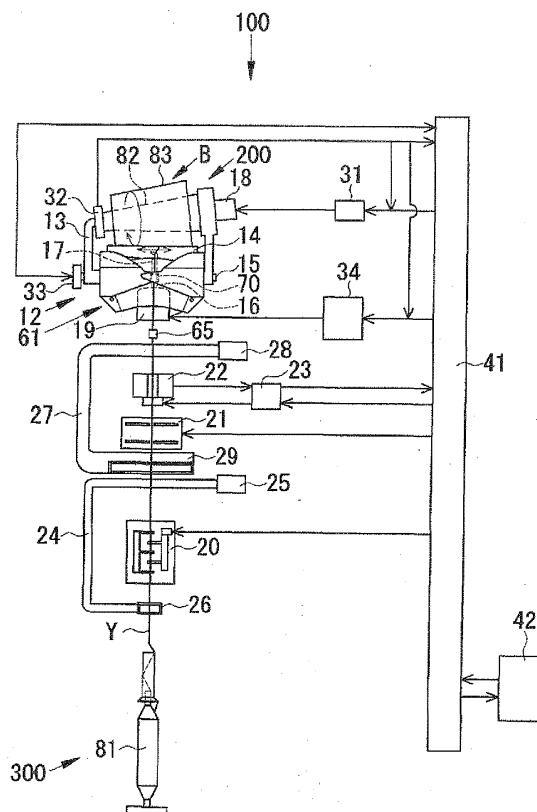
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(54) **Yarn winding device**

(57) A yarn winding device (100) includes a winding section (200) for winding a package (83); a traverse guide (17), driven independent from drive of the package (83),

for traversing a yarn Y to be wound into the package (83); and a traverse detection section (70), arranged at a central part of a traverse width of the traverse guide (17), for detecting presence or absence of the yarn Y.

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a technique of a yarn winding device for winding a yarn into a package. More specifically, the present invention relates to a technique of detecting a traverse defect of the yarn winding device.

2. Description of Related Art

[0002] The yarn winding device has a problem in that a defective package having poor shape or poor unwinding property is formed due to the traverse defect of the yarn. In a conventional yarn winding device, a traverse detection section for detecting the traverse defect of the yarn is arranged. For example, in a drum traverse type yarn winding device, the traverse detection section is arranged only at any one of left and right ends with respect to a central part of the package (see e.g., Japanese Unexamined Patent Publication No. 63-17773).

[0003] The traverse defect in the drum traverse type yarn winding device is mostly any one of (1) traverse defect in which the yarn is not traversed to both ends of the drum and is traversed only at the central part of the drum, and (2) traverse defect in which yarn crossing is poor at a cross portion (branched portion) of a traverse groove and the yarn is turned back in the middle without being traversed to one end of the drum.

[0004] In the traverse defect of (1), the yarn is not traversed to both ends of the drum and thus can be easily detected by arranging the traverse detection section only at any one of left and right ends. In the traverse defect of (2), the yarn is sometimes traversed to any one of left and right ends of the drum, and the yarn might be detected with the traverse detection section even if the traverse detection section is arranged only at one end. However, in the case of the traverse defect of (2), a traverse cycle becomes shorter than the traverse cycle at normal times. Thus, the traverse detection section is arranged only at any one of left and right ends, and a cycle of a detection signal is measured to detect even the traverse defect of (2).

[0005] The drum traverse type yarn winding device is a yarn winding device in which the drive of the package and the traversing of the yarn are cooperatively operating. There is also a yarn winding device in which the drive of the package and the traversing of the yarn are independent. For example, there are known an arm traverse type yarn winding device in which a traverse guide is operated by a reciprocating movement of an arm, and a belt traverse type yarn winding device in which the traverse guide is operated by a reciprocating movement of a belt. In such yarn winding devices, the traverse defect of the yarn cannot be detected even if the traverse de-

tection section is arranged at any one of left and right ends with respect to the central part of the package.

[0006] In other words, in the yarn winding device in which the drive of the package and the traversing of the yarn are independent, the yarn is traversed by independently operating the traverse guide. In such a yarn winding device, the traverse defect occurs from introduction mistake of the yarn to the traverse guide or disengagement of the yarn from the traverse guide. When the yarn is not hooked to the traverse guide, the yarn is beaten at a constant cycle (normal traverse cycle) towards only the right side or only the left side by the outer side of the traverse guide or the arm. This is a traverse defect unique to the yarn winding device in which the drive of the package and the traversing of the yarn are independent, and accounts for most of the traverse defect.

[0007] In the case of such a traverse defect, the yarn is not traversed to any one of left and right ends of the package, but the yarn is traversed to the other end at the normal traverse cycle. Thus, the traverse defect cannot be detected even if the traverse detection section is arranged at any one of left and right ends with respect to the central part of the package and the cycle of the detection signal is measured. Therefore, in such yarn winding devices, the traverse detection section needs to be arranged at both left and right ends with respect to the central part of the package.

[0008] However, if the traverse detection section is arranged at both left and right ends with respect to the central part of the package, a plurality of traverse detection sections are arranged and the cost is increased. Furthermore, in the arm traverse type yarn winding device or the belt traverse type yarn winding device, the traverse width can be changed and packages of various widths can be formed. However, if the traverse detection section is arranged at both left and right ends with respect to the central part of the package, the yarn cannot be detected if the traverse width is changed, and hence the position of the traverse detection section needs to be adjusted in accordance with the change in the traverse width.

BRIEF SUMMARY OF THE INVENTION

[0009] The present invention has been made to solve the problems described above. A first object is to eliminate necessity to arrange a plurality of traverse detection sections and to reduce a cost in a yarn winding device in which drive of a package and traversing of a yarn are independent. A second object is to eliminate necessity of position adjustment of the traverse detection section even when changing the traverse width in the yarn winding device in which the drive of the package and the traversing of the yarn are independent. A third object is to avoid winding of the package to be continued in a traverse defect state, and to prevent a defective package from being formed.

[0010] The problems to be solved by the present invention are as described above, and the means for solv-

ing such problems will be described below.

[0011] In other words, a first aspect of the invention relates to a yarn winding device including a winding section, a traverse guide, and a traverse detection section. The winding section winds a package. The traverse guide is driven independent from the drive of the package, and traverses a yarn to be wound into the package. The traverse detection section is arranged at a central part of a traverse width of the traverse guide, and detects presence or absence of the traversed yarn.

[0012] In a second aspect of the invention, according to the first aspect, the central part of the traverse width of the traverse guide is a region having a width of 1/3 of the traverse width, and the traverse detection section is arranged in the region.

[0013] A third aspect of the invention relates to a yarn winding device including a winding section, a traverse guide, and a traverse detection section. The winding section winds a package. The traverse guide is driven independent from the drive of the package, and traverses a yarn to be wound into the package. The traverse detection section is arranged at a central part of a package width, and detects presence or absence of the traversed yarn.

[0014] In a fourth aspect of the invention, according to the third aspect, the central part of the package width is a region having a width of 1/3 of the package width, and the traverse detection section is arranged in the region.

[0015] In a fifth aspect of the invention, according to any of the first to fourth aspects, the yarn winding device includes a yarn feeding section, a yarn splicing device, a yarn end catching section, and a control section. The yarn feeding section supplies the yarn to be wound into the package. The yarn splicing device carries out the yarn splicing operation of splicing the yarn end from the package and the yarn end from the yarn feeding section. The yarn end catching section carries out the catching operation of catching the yarn end from the package. The control section stops the traversing of the traverse guide when the absence of the yarn is detected by the traverse detection section after the catching operation by the yarn end catching section and the yarn splicing operation by the yarn splicing device are carried out and the traversing of the traverse guide is started.

[0016] In a sixth aspect of the invention, according to the fifth aspect, the yarn winding device further includes a cutting device for cutting the yarn. The control section causes the cutting device to cut the yarn when the absence of the yarn is detected by the traverse detection section after the catching operation by the yarn end catching section and the yarn splicing operation by the yarn splicing device are carried out and the traversing of the traverse guide is started.

[0017] In a seventh aspect of the invention, According to the sixth aspect, the control section again causes the yarn end catching section to carry out the catching operation after stopping the traversing of the traverse guide.

[0018] In an eighth aspect of the invention, according

to any one of the fifth to seventh aspects, the control section stops the operation of the winding section and the traverse guide when the absence of the yarn is detected by the traverse detection section during the continuous operation of the winding section and the traverse guide.

[0019] In a ninth aspect of the invention, according to the sixth or seventh aspect, the control section stops the operation of the winding section and the traverse guide when the cutting device cuts the yarn during the continuous operation of the winding section and the traverse guide.

[0020] In a tenth aspect of the invention, according to any of the first to ninth aspects, the yarn winding device further includes a main guiding plate and an auxiliary guiding plate. The main guiding plate is arranged in proximity to the package, and guides the yarn in the traverse direction. The auxiliary guiding plate guides the yarn to the main guiding plate at the time of the catching operation by the yarn end catching section. The traverse detection section detects the yarn passing between the main guiding plate and the auxiliary guiding plate.

[0021] In an eleventh aspect of the invention, according to any of the first to tenth aspects, the traverse detection section is a reflective sensor.

Moreover, according to another aspect, the traverse detection section includes a light source portion and a light receiving portion, where the light receiving portion receives change in intensity of light that occurs when the yarn to be traversed traverses light radiated from the light source portion, and the presence or absence of yarn can be detected from the change in intensity of the light received by the light receiving portion.

[0022] The present invention has the following effects.

[0023] According to the first aspect, the traverse detection section is arranged at the central part of the traverse width of the traverse guide in the yarn winding device in which the drive of the package and the traversing of the yarn are independent. Thus, the traverse defect can be detected without arranging a plurality of traverse detection sections. This is because the yarn is continuously beaten towards one end of the package by the traverse guide when the traverse defect occurs because the yarn is not engaged to the traverse guide. That is, since the yarn is beaten in a short cycle (traverse cycle) by the traverse guide, the yarn is traversed only to near the end of the traverse width of the traverse guide and is not traversed to the central part. Therefore, when the traverse defect occurs, the traverse detection section arranged at the central part of the traverse width does not detect the yarn. The traverse defect is thereby detected. Therefore, a plurality of traverse detection sections do not need to be arranged and the cost can be reduced in the yarn winding device in which the drive of the package and the traversing of the yarn are independent. Furthermore, the position adjustment of the traverse detection section does not need to be carried out even when changing the traverse width in the yarn winding device in which

the drive of the package and the traversing of the yarn are independent.

[0024] According to the second aspect, the traverse detection section is arranged in the region having a width of $1/3$ of the traverse width in the yarn winding device in which the drive of the package and the traversing of the yarn are independent, and hence the traverse defect can be detected without arranging a plurality of traverse detection sections. That is, when the traverse defect occurs because the yarn is not engaged to the traverse guide, the yarn is beaten by the traverse guide and is not traversed to the central part of the traverse width. However, the region where the yarn is not traversed due to the traverse defect is not only the exact center. The region where the yarn is not traversed is the region having a width of $1/3$ of the traverse width including the exact center. Thus, the traverse defect can be detected by arranging the traverse detection section in the region having the width of $1/3$ of the traverse width. Therefore, a plurality of traverse detection sections do not need to be arranged and the cost can be reduced in the yarn winding device in which the drive of the package and the traversing of the yarn are independent. Furthermore, the position adjustment of the traverse detection section does not need to be carried out even when changing the traverse width in the yarn winding device in which the drive of the package and the traversing of the yarn are independent.

[0025] According to the third aspect, the traverse detection section is arranged at the central part of the package width in the yarn winding device in which the drive of the package and the traversing of the yarn are independent. The traverse defect thus can be detected without arranging a plurality of traverse detection sections. That is, when the traverse defect occurs because the yarn is not engaged to the traverse guide, the yarn is beaten by the traverse guide in a short cycle (traverse cycle), so that the yarn is traversed only to near the end of the package width and is not traversed to the central part. Thus, the traverse detection section arranged at the central part of the package width does not detect the yarn when the traverse defect occurs. The traverse defect thus can be detected. Therefore, a plurality of traverse detection sections do not need to be arranged and the cost can be reduced in the yarn winding device in which the drive of the package and the traversing of the yarn are independent. Furthermore, the position adjustment of the traverse detection section does not need to be carried out even when changing the traverse width in the yarn winding device in which the drive of the package and the traversing of the yarn are independent.

[0026] According to the fourth aspect, the traverse detection section is arranged in the region having a width of $1/3$ of the package width in the yarn winding device in which the drive of the package and the traversing of the yarn are independent, and hence the traverse defect can be detected without arranging a plurality of traverse detection sections. That is, when the traverse defect occurs because the yarn is not engaged to the traverse guide,

the yarn Y is beaten by the traverse guide, and is not traversed to the central part of the package width. However, the region where the yarn is not traversed due to the traverse defect is not only the exact center. The region where the yarn Y is not traversed is the region having a width of $1/3$ of the package width including the exact center. Thus, the traverse defect can be detected by arranging the traverse detection section in the region having the width of $1/3$ of the package width. Therefore, a plurality of traverse detection sections do not need to be arranged and the cost can be reduced in the yarn winding device in which the drive of the winding bobbin and the traversing of the yarn are independent. Furthermore, the position adjustment of the traverse detection section does not need to be carried out even when changing the traverse width in the yarn winding device in which the drive of the winding bobbin and the traversing of the yarn are independent.

[0027] According to the fifth aspect, the traverse guide stops traversing when absence of the yarn is detected by the traverse detection section after the catching operation by the yarn end catching section and the yarn splicing operation by the yarn splicing device are carried out and the Traversing of the traverse guide is started. Thus, the winding operation can be avoided from being continued in a state where the yarn is not traversed after the yarn splicing operation. A defective package thus can be prevented from being formed.

[0028] According to the sixth aspect, the cutting device cuts the yarn when absence of the yarn is detected by the traverse detection section after the catching operation by the yarn end catching section and the yarn splicing operation by the yarn splicing device are carried out and the traversing of the traverse guide is started. Thus, if the yarn is not traversed after the yarn splicing operation, the yarn is immediately cut, and the winding operation is avoided from being continued. Therefore, a defective package can be prevented from being formed. Since the yarn end is formed on the package side before carrying out the next yarn catching operation, the success rate of catching the next yarn end by the yarn catching device can be improved.

[0029] According to the seventh aspect, after stopping the traversing of the traverse guide, the yarn end catching section again carries out the catching operation of the yarn end from the package cut with the cutting device. By carrying out the catching operation of the yarn end again, the productivity of the yarn winding device can be improved.

[0030] According to the eighth aspect, the winding section and the traverse guide stop the operation when the absence of the yarn is detected by the traverse detection section during the continuous operation of the winding section and the traverse guide. The winding of the package can be avoided from being continued in a state where the yarn is not traversed by the traverse guide.

[0031] According to the ninth aspect, the winding section and the traverse guide stop the operation when the

yarn is cut by the cutting device during the continuous operation of the winding section and the traverse guide. The winding of the package can be avoided from being continued in a state where the yarn is cut.

[0032] According to the tenth aspect, the traverse detection section detects the yarn passing between the main guiding plate and the auxiliary guiding plate. The presence or absence of the yarn guided by the main guiding plate and the auxiliary guiding plate can be detected with The traverse detection section, and thus the detection accuracy is improved.

[0033] According to the eleventh aspect, the reflective sensor is used for the traverse detection section. The traverse detection section is enlarged with the transmissive sensor, but the traverse detection section can be miniaturized with the reflective sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] FIG. 1 is a front schematic view and a block diagram illustrating a yarn winding device according to a first embodiment of the present invention;

[0035] FIG. 2 is a front view of a winding section and a guiding plate;

[0036] FIG. 3 is a side view of the winding section and the guiding plate;

[0037] FIG. 4 is a plan view of the winding section and the guiding plate;

[0038] FIG. 5 is a diagram illustrating a flow of an operation of a start-up operation of the yarn winding device;

[0039] FIG. 6 is a diagram illustrating a flow of an operation of a continuous winding operation of the yarn winding device; and

[0040] FIG. 7 is a front view illustrating a winding section 200 according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0041] Embodiments of the invention will be described below with reference to the drawings.

[0042] A yarn winding device 100 according to a first embodiment of the present invention will be described with reference to FIG. 1 to FIG. 6.

[0043] As illustrated in FIG. 1, the yarn winding device 100 of the present embodiment is a yarn winding device that forms a yarn layer on a winding tube 82 while traversing a yarn Y of a yarn feeding bobbin 81 with a traverse device 12 to form a package 83. A travelling direction of the yarn Y is a direction from a yarn feeding bobbin 81 to the package 83. One yarn winding device 100 is illustrated in FIG. 1, but a plurality of the yarn winding devices 100 may be arranged in line to configure an automatic winder.

[0044] In the present specification, the winding tube 82 and the package 83 are collectively referred to as a winding bobbin B. In other words, the winding bobbin B

not formed with a yarn layer is the winding tube 82, and the winding bobbin B formed with a yarn layer is the package 83.

[0045] The outline of the yarn winding device 100 will be described first. As illustrated in FIG. 1, the yarn winding device 100 includes a winding section 200, a traverse device 12, a guiding plate 61, and a yarn feeding section 300.

[0046] The winding section 200 is a section for winding the yarn Y into the package 83, and includes a cradle 13 and a contact roller 14. The cradle 13 includes a bearing (not illustrated), a winding bobbin drive motor 18, a winding bobbin rotation speed sensor 32, and a winding bobbin diameter sensor 33. The bearing can removably attach the winding bobbin B, and grips both ends of the winding bobbin B in a freely rotatable manner. The cradle 13 can freely oscillate with an oscillating shaft 15 as a center. The cradle 13 oscillates when the yarn Y is wound by the winding bobbin B and the diameter of the winding bobbin B is increased. An appropriate amount of contact between the peripheral surface of the winding bobbin B and the contact roller 14 is thereby maintained.

[0047] The winding bobbin drive motor 18 drives the winding bobbin B. A drive shaft of the winding bobbin drive motor 18 is coupled with the winding bobbin B in a relatively non-rotatable manner (so-called direct drive method) when the winding bobbin B is gripped by the bearing of the cradle 13, and the winding bobbin B is actively and rotatably driven by the winding bobbin drive motor 18 to wind the yarn Y. The contact roller 14 makes contact with the peripheral surface of the winding bobbin B, and is passively rotated.

[0048] The winding bobbin rotation speed sensor 32 detects the number of rotations of the winding bobbin B. The winding bobbin, diameter sensor 33 detects the diameter of the winding bobbin B. The winding bobbin diameter sensor 33 is configured by a rotary encoder, a resolver, or the like, and detects the diameter of the winding bobbin B by detecting an oscillation angle of the cradle 13.

[0049] The traverse device 12 is arranged in proximity to the winding bobbin B (package 83). The yarn Y is wound around the winding bobbin B while being traversed by the traverse device 12. The traverse device 12 includes an arm member 16, a traverse guide 17, and a traverse guide drive motor 19. The traverse guide 17 is a hook-like member that engages with the yarn Y and traverses the yarn Y. The traverse guide 17 is arranged at the distal end of the arm member 16 configured to freely oscillate. The traverse guide drive motor 19 drives the arm member 16 in the direction of the winding width of the winding bobbin B as shown with an arrow in FIG. 1, that is, to reciprocate both ends of a first end (illustrated end on left side) and a second end (illustrated end on right side) of the winding bobbin B to reciprocate the traverse guide 17. In the present embodiment, a servo motor is used for the traverse guide drive motor 19, but a step motor or the like may also be used.

[0050] In the following description, the width in which the yarn Y is traversed by the traverse guide 17 is referred to as "traverse width". The traverse width can be changed by increasing or decreasing the angle at which the traverse guide drive motor 19 is rotated. The direction in which the yarn Y is traversed, that is, the direction from the first end towards the second end of the winding bobbin B and the direction from the second end towards the first end of the winding bobbin B is referred to as "traverse direction".

[0051] As illustrated in FIG. 2, FIG. 3, and FIG. 4, the guiding plate 61 is arranged in proximity to the traverse device 12. The guiding plate 61 is arranged on an upstream side of the yarn Y in the travelling direction with respect to the traverse guide 17. The guiding plate 61 includes a main guiding plate 62, a first auxiliary guiding plate 63, and a second auxiliary guiding plate 64. The main guiding plate 62 is a member for guiding the yarn Y in the traverse direction, and is arranged at a position proximate to the traverse guide 17. The main guiding plate 62 has an edge for guiding the yarn Y formed to an arcuate shape.

[0052] The first auxiliary guiding plate 63 and the second auxiliary guiding plate 64 are members for guiding the yarn Y onto the main guiding plate 62 when a catching operation of the yarn end is carried out by an upper yarn catching guiding portion 27, to be described later. The first auxiliary guiding plate 63 is formed from a first end (illustrated end on left side in FIG. 2) towards a central part of the main guiding plate 62. As illustrated in FIG. 4, the first auxiliary guiding plate 63 forms a gap with the main guiding plate 62 through which the yarn Y passes in the traverse direction. The edge for guiding the yarn Y of the first auxiliary guiding plate 63 is formed to become lower from the first end side towards the central part of the main guiding plate 62, and when tension is applied on the yarn Y in contact with the edge, the yarn Y slides along the edge to come closer to the central part of the main guiding plate 62.

[0053] The second auxiliary guiding plate 64 is formed from a second end (illustrated end on right side in FIG. 2) towards the central part of the main guiding plate 62. As illustrated in FIG. 4, the second auxiliary guiding plate 64 also forms a gap with the main guiding plate 62 through which the yarn Y passes in the traverse direction. A distal end of the second auxiliary guiding plate 64 and a distal end of the first auxiliary guiding plate 63 are overlapped with a gap through which the yarn Y passes. The edge for guiding the yarn Y of the second auxiliary plate 64 is formed to become lower from the second end side towards the central part of the main guiding plate 62, and when tension is applied on the yarn Y in contact with the edge, the yarn Y slides along the edge to come closer to the central part of the main guiding plate 62. A guide 65 that acts as a traverse supporting point of the yarn Y to be traversed by the traverse device 12 is arranged on the lower side of the guiding plate 61.

[0054] The guiding plate 61 includes a traverse detec-

tion section 70. The traverse detection section 70 detects the presence or absence of the yarn Y guided by the guiding plate 61. Specifically, the traverse detection section 70 detects the presence or absence of the yarn Y passing between the main guiding plate 62 and the first auxiliary guiding plate 63. The main guiding plate 62 is formed with a transparent hole (not illustrated) on a center line of the traverse width. The traverse detection section 70 detects the presence or absence of the yarn Y passing between the main guiding plate 62 and the first auxiliary guiding plate 63 at the central part of the traverse width of the traverse guide 17 through the transparent hole.

[0055] The traverse detection section 70 is a reflective sensor. The traverse detection section 70 includes a light source portion for irradiating an object with pulse-shaped light, and a light receiving portion for receiving the reflected light from the object. The light source portion and the light receiving portion are arranged in parallel. The reflective sensor detects the presence or absence of the object by change in intensity of the reflected light. The traverses detection section 70 of the present embodiment is directed to between the main guiding plate 62 and the first auxiliary guiding plate 63, so that the majority of the pulse-shaped light from the light source portion is reflected at the first auxiliary guiding plate 63. The majority of the light received by the light receiving portion is light reflected at the first auxiliary guiding plate 63. A pulse-shaped detection signal corresponding to the intensity of the light received by the light receiving portion is transmitted to a unit control section 41, to be described later.

[0056] In a state where the yarn Y is normally traversed, the yarn Y is traversed between the main guiding plate 62, and the first auxiliary guiding plate 63 and the second auxiliary guiding plate 64. When the yarn Y is traversed, and crossed in the front of the traverse detection section 70, the light reflected at the yarn Y is received by the light receiving portion, and change in the intensity of the light received by the light receiving portion occurs. The pulse-shaped detection signal corresponding to the change in the intensity of light is transmitted to the unit control section 41, to be described later. The traverse detection section 70 detects the presence or absence of the yarn Y by the change in intensity of the detection signal. In the unit control section 41, determination is made that the yarn Y is normally traversed if there is change in the intensity of the detection signal from the traverse detection section 70.

[0057] A reflective sensor is used for the traverse detection section 70 in the present embodiment, but a transmissive sensor may also be used. The transmissive sensor includes a light source portion for applying a pulse-shaped light, and a light receiving portion arranged facing the light source portion to directly receive the light from the light source portion. If the yarn Y exists between the light source portion and the light receiving portion, the intensity of the light received by the light receiving portion changes. The presence or absence of the yarn Y is de-

tected based on the pulse-shaped detection signal corresponding to the change in the intensity of the light.

[0058] However, the transmissive sensor requires a substantially U-shaped supporting member or the like for supporting the light source portion and the light receiving portion since the light source portion and the light receiving portion need to be facing each other. In the present embodiment, the transmissive sensor has a problem in that it is difficult to miniaturize the traverse detection section 70 since the traverse detection section 70 is to be arranged at the central part in the traverse width. Thus, the reflective sensor is preferably used for the traverse detection section 70.

[0059] In the reflective sensor used in the present embodiment, the light from the outside generally causes a disturbance and malfunction may occur. However, the traverse detection section 70 of the present embodiment is directed to between the main guiding plate 62 and the first auxiliary guiding plate 63. Thus, the main guiding plate 62 and the first auxiliary guiding plate 63 shield the light from the outside, and hence, malfunction due to the disturbance is less likely to occur. In this regard as well, the reflective sensor is preferably used for the traverse detection section. 70.

[0060] As illustrated in FIG. 1, the yarn feeding section 300 is a section for supplying the yarn Y to be wound around the winding bobbin B. The yarn feeding bobbin 81 is attached to the yarn feeding section 300. A tension applying device 20, a yarn splicing device 21, and a yarn clearer 22 serving as a cutting device are arranged in order from the yarn feeding section 300 side in the yarn travelling path between the yarn feeding section 300 and the contact roller 14. The tension applying device 20 applies appropriate tension on the yarn Y. The yarn clearer 22 detects the thickness of the yarn Y passing through the portion of the detection section with a sensor, and analyzes a signal from the sensor with an analyzer 23 to detect a yarn defect such as slub. In the yarn clearer 22, there is arranged a cutter for cutting (clearer cut) the yarn Y when the yarn defect is detected or for cutting (additional cut) the yarn Y to interrupt the winding due to traverse defect although the yarn defect is not found. The yarn splicing device 21 carries out a yarn splicing operation for yarn splicing yarn ends of a lower yarn from the yarn feeding bobbin 81 and an upper yarn from the winding bobbin B at the time of yarn cut by the yarn clearer 22 or at the time of yarn breakage of the yarn Y from the yarn feeding bobbin 81.

[0061] On the lower side of the yarn splicing device 21, there is arranged a lower yarn catching and guiding section 24 for sucking and catching the lower yarn from the yarn feeding bobbin 81 and guiding the lower yarn to the yarn splicing device 21. On the upper side of the yarn splicing device 21, there is arranged an upper yarn catching and guiding section 27 serving as a yarn end catching section for sucking and catching the upper yarn from the winding bobbin B and guiding the upper yarn to the yarn splicing device 21. The lower yarn catching and guiding

section 24 is formed in a pipe shape, and is arranged to be vertically swingable with a shaft 25 as a center and has a suction mouth 26 at the distal end side. The upper yarn catching and guiding section 27 is also formed in a pipe shape, and is arranged to be vertically swingable with a shaft 28 as a center and has a mouth 29 at the distal end side. A negative pressure source is connected to the lower yarn catching and guiding section 24 and the upper yarn catching and guiding section 27 to cause a suction effect at the suction port 26 and the mouth 29 at the distal ends.

[0062] Next, the configuration for controlling the operation of the yarn winding device 100 will be described. In the present embodiment, as illustrated in FIG. 1, the winding bobbin drive motor 18 for driving the winding bobbin B and the traverse guide drive motor 19 for driving the traverse guide 17 are separately and independently arranged, and the drive of the winding bobbin B and the traverse guide 17 is controlled separately and independently. The yarn winding device 100 includes the unit control section 41 for individually controlling each yarn winding device 100. A winding bobbin drive control section 31 and a traverse control section 34 are connected to the unit control section 41. The winding bobbin drive control section 31 controls the drive and stop of the winding bobbin drive motor 18 based on a control signal from the unit control section 41. The traverse control section 34 controls the drive and stop of the traverse guide drive motor 19 based on a control signal from the unit control section 41.

[0063] The yarn clearer 22, the yarn splicing device 21, the lower yarn catching and guiding section 24, and the upper yarn catching and guiding section 27 serving as the yarn end catching section are connected to the unit control section 41. The unit control section 41 controls the yarn cutting operation by the yarn clearer 22 to cut the yarn Y when the winding is interrupted due to detection of the yarn defect or when the winding is interrupted due to traverse defect although the yarn defect is not found. The unit control section 41 controls the yarn splicing operation, by the yarn splicing device 21 for yarn splicing the yarn ends of the lower yarn from the yarn feeding bobbin 81 and the upper yarn from the winding bobbin B at the time of yarn cut by the yarn clearer 22 or at the time of yarn breakage of the yarn Y from the, yarn feeding bobbin 81- The unit control section 41 controls the catching operation of the yarn ends by the lower yarn catching and guiding section 24 and the upper yarn catching and guiding section 27, and the guiding operation of guiding the yarn ends to the yarn splicing device 21.

[0064] The detection signal from the traverse detection section 70 is transmitted to the traverse control section 34. The traverse control section 34 detects the presence or absence of the yarn Y traversed between the main guiding plate 62, and the first auxiliary guiding plate 63 and the second auxiliary guiding plate 64 based on the detection signal. A rotation speed signal of the winding bobbin B detected by the winding bobbin rotation speed

sensor 32 is transmitted to the unit control section 41, the winding bobbin drive control section 31, and the traverse control section 34. A diameter signal of the winding bobbin B detected by the winding bobbin diameter sensor 33 is transmitted to the unit control section 41, and transferred from the unit control section 41 to the winding bobbin drive control section 31 and the traverse control section 34.

[0065] The unit control section 41 is connected to a machine control section 42. The machine control section 42 collectively controls a plurality of yarn winding devices 100 configuring the automatic winder. The unit control section 41, the machine control section 42, the winding bobbin drive control section 31, and the traverse control section 34 include a CPU serving as a calculating portion, an ROM, RAM serving as a storage portion, or the like. The ROM stores control software for causing hardware such as CPU to operate as a control section.

[0066] Next, the control of the yarn winding device 100 having the above configuration will be described according to FIG. 5 and FIG. 6.

[0067] First, the start-up operation will be described. The start-up operation is carried out when starting the winding of the yarn Y with respect to an empty winding tube 82. Alternatively, it is carried out when resuming the winding of the yarn Y with respect to the winding bobbin B when yarn cut by the yarn clearer 22 or yarn breakage of the yarn Y from the yarn feeding bobbin 81 occurs during the winding. In the start-up operation, the rotation of the winding bobbin B is accelerated from the stopped state to a high speed rotation in continuous winding operation, to be described later. A case in which the yarn cut by the yarn clearer 22 occurs will be described below by way of example.

[0068] Describing with reference to FIG. 1, the lower yarn from the yarn feeding bobbin 81 is near the lower yarn catching and guiding section 24 when yarn cut by the yarn clearer 22 occurs. The yarn end of the upper yarn from the winding bobbin B is wound around the winding bobbin B. The traverse guide 17 of the traverse device 12 is moved, to the second end (illustrated end on right side) side of the winding bobbin B. The traverse guide 17 is moved to the second end side of the winding bobbin B so as not to become an obstacle when guiding the upper yarn from the winding bobbin B to the yarn splicing device 21. An opening 171 of the traverse guide 17 is also directed towards the yarn Y so that the yarn Y can be easily engaged to the hook-like traverse guide 17. immediately after the traverse is resumed.

[0069] The unit controls section 41 controls the catching operation by the lower yarn catching and guiding section 24 and the upper yarn catching and guiding section 27 so that the lower yarn from the yarn feeding bobbin 81 is sucked and caught by the lower yarn catching and guiding section 24 and the upper yarn from the winding bobbin B is sucked and caught by the upper yarn catching and guiding section 27. The unit control section 41 controls the guiding operation by the lower yarn catching and

guiding section 24 and the upper yarn catching and guiding section 27 to guide the lower yarn to the yarn splicing device 21 by the lower yarn catching and guiding section 24, and guide the upper yarn to the yarn splicing device 21 by the upper yarn catching and guiding section 27. The unit control section 41 controls the yarn splicing operation by the yarn splicing device 21 when the upper yarn and the lower yarn are guided to the yarn splicing device 21 to yarn splice the yarn ends of the lower yarn from the yarn feeding bobbin 81 and the upper yarn from the winding bobbin B.

[0070] In a state where the yarn splicing of the yarn ends of the lower yarn from the yarn feeding bobbin 81 and the upper yarn from the winding bobbin B is completed, the yarn Y is not on the inner side of the guiding plate 61. The yarn Y is in a state of riding on the outer side of the guiding plate 61 (near side in the plane of drawing in FIG. 2, illustrated lower side in FIG. 4). The yarn Y is engaged to the guide 65 that is the traverse supporting point.

[0071] With reference to FIG. 5, when the unit control section 41 starts the start-up operation (step 3101), the rotation drive of the winding bobbin B starts, and the winding of the yarn Y starts. The traverse detection section 70 starts the detection of the yarn Y (step S102). The traverse device 12 starts the reciprocating movement of the traverse guide 17.

[0072] As described above, the traverse guide 17 is moved to the second end (illustrated end on right side) side of the winding bobbin B during the yarn splicing operation by the yarn splicing device 21. When the reciprocating movement of the traverse guide 17 starts from such a position, the traverse guide 17 first moves in the illustrated left direction in FIG. 2 and FIG. 4. Thereafter, the traverse guide 17 repeats the reciprocating movement in the illustrated right direction and the illustrated left direction.

[0073] When the traverse guide 17 is moved in the illustrated left direction, the traverse guide 17 makes contact with the yarn Y and moves the yarn Y in the illustrated left direction. The yarn Y is wound around the winding bobbin B and thus is applied with tension. The edge for guiding the yarn Y of the first auxiliary guiding plate 63 is formed such that the yarn Y comes closer to the central part of the main guiding plate 62 when tension is applied on the yarn Y. Thus, the traverse guide 17 is moved in the illustrated left direction, and the force that is against thereto acts on the yarn Y. The yarn Y thus enters from the opening 171 of the traverse guide 17 to engage therewith.

[0074] With the movement of the traverse guide 17 in the illustrated left direction in FIG. 4, the yarn Y engaged to the traverse guide 17 moves on the outer side of the second auxiliary guiding plate 64 in the direction of the arrow D1 of FIG. 4. In such a state, the traverse detection section 70 does not detect the yarn Y.

[0075] With the movement of the traverse guide 17 in the illustrated right direction in FIG. 4, the yarn Y enters

between the first auxiliary guiding plate 63 and the second auxiliary guiding plate 64 since tension is applied, and moves in the direction of the arrow D2 of FIG. 4. In this state as well, the traverse detection section 70 does not detect the yarn Y.

[0076] Furthermore, with the movement of the traverse guide 17 in the illustrated left direction in FIG. 4, the yarn Y enters between the main guiding plate 62 and the first auxiliary guiding plate 63 since tension is applied, and moves in the direction of the arrow D3 of FIG. 4. When the yarn Y passes the front of the traverse detection section 70, the traverse detection section 70 detects the yarn Y. When the traverse detection section 70 detects the yarn Y within a predetermined time from the start of the start-up operation (Yes in step S103), the unit control section 41 determines that the traverse defect does not occur and the start-up operation is successful (step S104). Thereafter, when the number of rotations of the winding bobbin B reaches the number of rotations in the continuous winding operation, the operation shifts to the continuous winding operation (step S105), and the start-up operation is terminated.

[0077] The control of the case where the traverse defect does not occur in the start-up operation and the start-up operation is successful is as described above. The control of the case where the traverse defect has occurred in the start-up operation and the start-up operation has failed will be described below.

[0078] Similarly to the above, when the unit control section 41 starts the start-up operation (step S101), the rotation drive of the winding bobbin B starts and the winding of the yarn Y starts. The traverse detection section 70 starts the detection of the yarn Y (step S102). The traverse device 12 starts the reciprocating movement of the traverse guide 17.

[0079] As described above, the traverse guide 17 is moved to the second end (illustrated end on right side) side of the winding bobbin B during the yarn splicing operation by the yarn splicing device 21. When the reciprocating movement of the traverse guide 17 starts from such a position, the traverse guide 17 first moves in the illustrated left direction in FIG. 2 and FIG. 3. Thereafter, the traverse guide 17 repeats the reciprocating movement in the illustrated right direction and the illustrated left direction.

[0080] In the case where the start-up operation is successful, the yarn Y is engaged to the traverse guide 17 when the traverse guide 17 is moved in the illustrated left direction. However, even if the traverse guide 17 repeats the reciprocating movement in the illustrated right direction and the illustrated left direction, the yarn Y may not be engaged to the traverse guide 17, and the traverse guide 17 and the arm member 16 may merely beat the yarn Y continuously towards one end of the winding bobbin B. In such a traverse defect, the yarn Y does not pass the front of the traverse detection section 70. The traverse detection section 70 thus does not detect the yarn Y.

[0081] If the traverse detection section 70 does not de-

tect the yarn Y within a predetermined time from the start of the start-up operation (No in step S103), the unit control section 41 determines that the traverse defect has occurred and that the start-up operation has failed (step S106). Then, the traversing is immediately stopped (step S107), the yarn Y is cut (step S108), and the start-up operation is terminated.

[0082] After the start-up operation has failed and the start-up operation is terminated, the unit control section 41 immediately controls the catching operation by the lower yarn catching and guiding section 24 and the upper yarn catching and guiding section 27 to cause the lower yarn catching and guiding section 24 to suck and catch the lower yarn from the yarn feeding bobbin 81 and to cause the upper yarn catching and guiding section 27 to suck and catch the upper yarn from the winding bobbin B. The unit control section 41 also controls the guiding operation by the lower yarn catching and guiding section 24 and the upper yarn catching and guiding section 27 to cause the lower yarn catching and guiding section 24 to guide the lower yarn to the yarn splicing device 21 and to cause the upper yarn catching and guiding section 27 to guide the upper yarn to the yarn splicing device 21. When the upper yarn and the lower yarn are guided to the yarn splicing device 21, the unit control section 41 controls the yarn splicing operation by the yarn splicing device 21 to yarn splice the yarn ends of the lower yarn from the yarn feeding bobbin 81 and the upper yarn from the winding bobbin B. The unit control section 41 then starts the next start-up operation.

[0083] After the yarn Y is once engaged to the traverse guide 17, the yarn Y may sometimes disengage from the traverse guide 17. Although it depends on the position where the yarn Y disengages from the traverse guide 17, the yarn Y may disengage from the traverse guide 17 after the yarn Y once passes the front of the traverse detection section 70 and the traverse detection section 70 detects the yarn Y.

[0084] In such a case, the traverse guide 17 and the arm member 16 continuously beat the yarn end Y towards one end of the winding bobbin B. When such a state is realized, the traverse defect occurs in which the yarn Y is traversed only in proximity to the end of the traverse width of the traverses guide 17 and is not traversed to the central part. When such a traverse defect occurs, the traverse detection section 70 arranged at the central part of the traverse width is less likely to detect the yarn Y.

[0085] When the traverse detection section 70 detects the yarn Y within a predetermined time but shortly enters a state in which the traverse detection, section 70 does not detect the yarn Y (No in step S103), the unit control section 41 determines that the traverse defect has occurred and that the start-up operation has failed (step S106). Then, the traversing is immediately stopped (step S107), the yarn Y is cut (step S108), and the start-up operation is terminated.

[0086] Thereafter, similarly to the above, the unit control section 41 immediately controls the catching opera-

tion and the guiding operation by the lower yarn catching and guiding section 24 and the upper yarn catching and guiding section 27, controls the yarn splicing operation by the yarn splicing device 21, and starts the next start-up operation.

[0087] The traverse defect is sometimes resolved by continuing the start-up operation even if the traverse defect has occurred. In the present embodiment, however, when the traverse defect occurs, determination is immediately made that the start-up operation has failed, and the traversing is immediately stopped and the yarn Y is cut. The operation then shifts to the yarn splicing operation and the next start-up operation. Therefore, when determined that the start-up operation has failed, the operation shifts to the next start-up operation at an early stage to improve the probability of the start-up operation being successful, improve the productivity of the yarn winding device 100, and improve the quality of the package 83.

[0088] Next, the continuous winding operation will be described with reference to FIG. 6. The continuous winding operation is carried out following the start-up operation when the traverse defect does not occur in the start-up operation and the start-up operation is successful.

[0089] When the unit control section 41 starts the continuous winding operation, (step S201), the rotation drive of the winding bobbin B becomes constant in the high speed rotation region and the yarn Y is wound at high speed. The traverse detection section 70 starts the detection of the yarn Y in the continuous winding operation (step S202). The traverse guide 17 repeats the reciprocating movement in the illustrated right direction and the illustrated left direction. When the yarn Y passes the front of the traverse detection section 70 while being engaged to the traverse guide 17, the traverse detection section 70 detects the yarn Y. If the traverse detection section 70 detects the yarn Y during the continuous winding operation, (Yes in step S203), the unit control section 41 determines that the traverse defect has not occurred and the continuous winding operation is normally carried out, and continues the continuous winding operation (step S204).

[0090] The unit control section 41 detects the diameter of the winding bobbin B by detecting an oscillation angle of the cradle 13 based on the detection signal from the winding bobbin diameter sensor 33. When the diameter of the winding bobbin B reaches the diameter of full-wound, determination is made that the package 83 is completed and the winding is terminated (Yes in step S205). When the diameter of the winding bobbin B has not reached the diameter of full-wound, determination is made that the package 83 is incomplete and the winding is continued (No in step S205). The traverse detection section 70 repeatedly carries out the detection of the yarn Y in the continuous winding operation (step S203).

[0091] The control of the case where the traverse defect does not occur in the continuous winding operation and the winding of the package 83 is successful is as

described above. The control of the case where the traverse defect occurs in the continuous winding operation will be described below.

[0092] Similarly to the above, when the unit control section 41 starts the continuous winding operation (step S201), the rotation drive of the winding bobbin B becomes constant in the high speed rotation region and the yarn Y is wound at high speed. The traverse detection section 70 starts the detection of the yarn Y in the continuous winding operation (step S202). The traverse guide 17 repeats the reciprocating movement in the illustrated right direction and the illustrated left direction. When the yarn Y passes the front of the traverse detection section 70 while being engaged to the traverse guide 17, the traverse detection section 70 detects the yarn Y.

[0093] During the continuous winding operation, the yarn Y may sometimes disengage from the traverse guide 17 due to tension fluctuation of the yarn Y or the like. When the yarn Y disengages from the traverse guide 17, the traverse guide 17 and the arm member 16 continuously beat the yarn end Y towards one end of the winding bobbin B. When such a state is realized, the traverse defect occurs in which the yarn Y is traversed only in proximity to the end of the traverse width of the traverse guide 17 and is not traversed to the central part. When such a traverse defect occurs, the traverse detection section 70 arranged at the central part of the traverse width is less likely to detect the yarn Y.

[0094] When the traverse detection section 70 no longer detects the yarn Y during the continuous winding operation (No in step S203), the unit control section 41 determines that the traverse defect has occurred and the continuous winding operation has failed. The unit control section 41 immediately cuts the yarn Y with the yarn clearer 22, stops the winding section 200 and the traverse device 12, and stops the continuous winding operation (step S206). The unit control section 41 displays an alarm to notify a manager that the continuous winding operation has failed (step S207), and terminates the continuous winding operation.

[0095] The continuous winding operation is terminated when the traverse defect occurs during the continuous winding operation because the yarn Y is wound at high speed during the continuous winding operation. When the traverse defect occurs while winding the yarn Y at high speed, a great amount of traverse defective yarn Y is wound around the winding bobbin B even in a short period of time after the occurrence of the traverse defect. A long period of time is required to suck and collect such great amount of traverse defective yarn Y by the upper yarn catching and guiding section 27, and again carry out the yarn splicing operation to resume the winding of the winding bobbin B. This does not improve the productivity of the package 83. Therefore, the continuous winding operation is terminated without shifting to the yarn splicing operation when the traverse defect occurs during the continuous winding operation.

[0096] The yarn winding device 100 according to the

first embodiment described above has the following effects.

[0097] In the yarn winding device 100 in which the drive of the winding bobbin B and the traversing of the yarn Y are independent, the traverse detection section 70 is arranged at the central part of the traverse width of the traverse guide 17. Thus, the traverse defect can be detected without arranging a plurality of traverse detection sections 70. This is because the yarn Y is continuously beaten towards one end of the winding bobbin B by the traverse guide 17, the arm member 16, and the like if the traverse defect occurs when the yarn Y is not engaged to the traverse guide 17. That is, since the yarn Y is beaten in a short cycle (traverse cycle) by the traverse guide 17, the arm member 16, or the like, the yarn Y is traversed only in proximity to the end of the traverse width of the traverse guide 17 and is not traversed to the central part. Therefore, when the traverse defect occurs, the traverse detection section 70 arranged at the central part of the traverse width no longer detects the yarn Y. Accordingly, the traverse defect can be detected. In the yarn winding device 100 in which the drive of the winding bobbin B and the traversing of the yarn Y are independent, a plurality of traverse detection sections 70 do not need to be arranged and the cost can be reduced. Furthermore, in the yarn winding device 100 in which the drive of the winding bobbin B and the traversing of the yarn Y are independent, the position adjustment of the traverse detection section 70 does not need to be carried out even if the traverse width is changed.

[0098] The traverse guide 17 stops the traversing when absence of the yarn Y is detected by the traverse detection section 70 after the catching operation by the lower yarn catching and guiding section 24 and the upper yarn catching and guiding section 27 and the yarn splicing operation by the yarn splicing device 21 are carried out and the traverse of the traverse guide 17 is started. Thus, the winding operation can be avoided from being continued when the yarn Y cannot be traversed after the yarn splicing operation. A defective package thus can be prevented from being formed.

[0099] The yarn clearer 22 cuts the yarn Y when absence of the yarn Y is detected by the traverse detection section 70 after the catching operation by the lower yarn catching and guiding section 24 and the upper yarn catching and guiding section 27 and the yarn splicing operation by the yarn splicing device 21 are carried out and the traversing of the traverse guide 17 is started. Thus, if the yarn Y cannot be traversed after the yarn splicing operation, the yarn Y is immediately cut and the winding operation can be avoided from being continued. A defective package thus can be prevented from being formed. Furthermore, the success rate of catching the next yarn end by the upper yarn catching and guiding section 27 is improved since the yarn end from the winding bobbin B is formed before the next yarn catching operation is carried out.

[0100] After stopping the traversing of the traverse

guide 17, the upper yarn catching and guiding section 27 again carries out the catching operation of the yarn end from the winding bobbin B cut with the yarn clearer 22. The productivity of the yarn winding device 100 can be improved by again carrying out the catching operation of the yarn end.

[0101] The traverse detection section 70 detects the yarn Y traversed between the main guiding plate 62, and the first auxiliary guiding plate 63 and the second auxiliary guiding plate 64. The detection accuracy is improved since the yarn Y traversed near the traverse detection section 70 is detected.

[0102] A reflective sensor is used for the traverse detection section 70. The traverse detection section 70 is enlarged in the transmissive sensor, but the traverse detection section 70 can be miniaturized in the reflective sensor.

[0103] If absence of the yarn Y is detected by the traverse detection section 70 during the continuous winding operation, the winding section 200 and the traverse device 12 are stopped, and the continuous winding operation is stopped. The winding of the winding bobbin B can be avoided from being continued in a state where the yarn Y is not traversed by the traverse guide 17.

[0104] Next, the yarn winding device 100 according to a second embodiment of the present invention will be described with reference to FIG. 7. In the first embodiment, the traverse detection section 70 is arranged on a center line of the traverse width. In the second embodiment, the traverse detection section 70 is arranged in a region having a width of 1/3 of the traverse width, as illustrated in FIG. 7. The traverse defect can be detected by arranging the traverse detection section 70 in the region having a width of 1/3 of the traverse width without arranging a plurality of traverse detection sections 70.

[0105] That is, when the traverse defect occurs because the yarn Y is not engaged to the traverse guide 17, the yarn Y is beaten by the arm member 16 or the like, and is not traversed to the central part of the traverse width. However, the region where the yarn Y is not traversed due to the traverse defect is not only the exact center. The region where the yarn Y is not traversed is the region having a width of 1/3 of the traverse width including the exact center. Thus, the traverse defect can be detected by arranging the traverse detection section 70 in the region having the width of 1/3 of the traverse width.

[0106] In this case, a plurality of traverse detection sections 70 do not need to be arranged and the cost can be reduced in the yarn winding device 100 in which the drive of the winding bobbin B and the traversing of the yarn Y are independent. Furthermore, the position adjustment of the traverse detection section 70 does not need to be carried out even when changing the traverse width.

[0107] The yarn Y to be traversed uses the guide 65 as the traverse supporting point. The width in which the yarn Y is traversed becomes wider the farther away from the guide 65 (towards the downstream side in the yarn

travelling direction). Thus, the region where the yarn Y is not traversed due to the traverse defect also becomes wider the farther away from the guide 65 (towards the downstream side in the yarn travelling direction). That is, as illustrated in FIG. 7, the region closer to the contact roller 14 of the region from the guide 65 to the contact roller 14 has wider region where the yarn Y is not traversed when the traverse defect occurs. Between the guide 65 and the contact roller 14, the traverse detection section 70 is preferably arranged in the region of 1/3 on the contact roller 14 side, and more preferably arranged in the region of 1/4 on the contact roller 14 side.

[0108] Therefore, as illustrated in FIG. 7, the traverse detection section 70 is preferably arranged in the region having a width of 1/3 of the traverse width and in a region from 1/3 to 1/4 on the contact roller 14 side between the guide 65 and the contact roller 14.

[0109] Next, the yarn winding device 100 according to a third embodiment of the present invention will be described. In the third embodiment, the position of arranging the traverse detection section 70 is on the center axis of the width of the winding bobbin B (package 83) rather than the center line of the traverse width. By arranging the traverse detection section 70 on the center axis of the width of the winding bobbin B (package 83), the traverse defect can be detected without arranging a plurality of traverse detection sections 70.

[0110] That is, when the traverse defect occurs because the yarn Y is not engaged to the traverse guide 17, the yarn Y is beaten by the arm member 16 or the like in a short cycle (traverse cycle), and hence the yarn Y is traversed only near the end of the width of the winding bobbin B (package 83) and is not traversed to the central part. Thus, the traverse detection section 70 arranged on the center axis of the width of the winding bobbin B (package 83) does not detect the yarn Y when the traverse defect occurs. The traverse defect thus can be detected. Therefore, a plurality of traverse detection sections 70 do not need to be arranged and the cost can be reduced in the yarn winding device in which the drive of the winding bobbin B and the traversing of the yarn Y are independent. Furthermore, the position adjustment of the traverse detection section 70 does not need to be carried out even when changing the traverse width.

[0111] Next, the yarn winding device 100 according to a fourth embodiment of the present invention will be described. In the third embodiment, the traverse detection section 70 is arranged on the center line of the width of the winding bobbin B (package 83). In the fourth embodiment, the traverse detection section 70 is arranged in a region having a width of 1/3 of the width of the winding bobbin B (package 83) - By arranging the traverse detection section 70 in a region having a width of 1/3 of the width of the winding bobbin B (package 83), the traverse defect can be detected without arranging a plurality of traverse detection sections 70.

[0112] That is, when the traverse defect occurs because the yarn Y is not engaged to the traverse guide

17, the yarn Y is beaten by the arm member 16 or the like, and is not traversed to the central part of the width of the winding bobbin B (package 83). However, the region where the yarn Y is not traversed due to the traverse defect is not only the exact center. The region where the yarn Y is not traversed is the region having a width of 1/3 of the width of the winding bobbin B (package 83) including the exact center. Thus, the traverse defect can be detected by arranging the traverse detection section 70 in the region having the width of 1/3 of the width of the winding bobbin B (package 83).

[0113] In this case, a plurality of traverse detection sections 70 do not need to be arranged and the cost can be reduced in the yarn winding device 100 in which the drive of the winding bobbin B and the traversing of the yarn Y are independent. Furthermore, the position adjustment of the traverse detection section 70 does not need to be carried out even when changing the traverse width in the yarn winding device 100 in which the drive of the winding bobbin B and the traversing of the yarn Y are independent.

[0114] The yarn Y to be traversed uses the guide 65 as the traverse supporting point. The width in which the yarn Y is traversed becomes wider the farther away from the guide 65 (towards the downstream side in the yarn travelling direction). Thus, the region where the yarn Y is not traversed due to the traverse defect also becomes wider the farther away from the guide 65 (towards the downstream side in the yarn travelling direction). That is, the region closer to the contact roller 14 of the region from the guide 65 to the contact roller 14 has wider region where the yarn Y is not traversed when the traverse defect occurs. Between the guide 65 to the contact roller 14, the traverse detection section 70 is preferably arranged in the region of 1/3 on the contact roller 14 side, and more preferably arranged in the region of 1/4 on the contact roller 14 side (see FIG. 7).

[0115] Therefore, the traverse detection section 70 is preferably arranged in the region having a width of 1/3 of the width of the winding bobbin B (package 83) and in a region from 1/3 to 1/4 on the contact roller 14 side between the guide 65 and the contact roller 14.

[0116] The embodiments of the present invention have been described above, but the present invention is not limited to the embodiments described above and various modifications may be made. The configuration for controlling the operation of the yarn winding device 100 is not limited to the embodiments, and for example, the winding bobbin drive control section 31 and the traverse control section 34 may be arranged in the unit control section 41.

[0117] The drive of the winding bobbin B is directly carried out by the winding bobbin drive motor 18, but the drive roller may be brought into contact with the surface of the winding bobbin B to drive the winding bobbin B. The shape of the contact roller 14 is a cone shape in which the diameter of both ends is different, but may be a cylindrical shape in which the diameter of both ends is

the same.

[0118] The traverse device 12 is configured such that the longitudinal direction of the arm member 16 is parallel with respect to the installing direction (up and down direction) of the yarn winding device 100, but may be configured such that the longitudinal direction of the arm member 16 is vertical with respect to the installing surface of the yarn winding device 100. The traverse device 12 is configured such that the arm member 16 is reciprocated by the traverse guide drive motor 19, but an endless timing belt may be arranged in proximity to the contact roller 14, the traverse guide 17 may be attached to the timing belt, and the timing belt may be reciprocated by a pulse motor or the like.

[0119] In the embodiment described above, the diameter of the winding bobbin B is detected by the winding bobbin diameter sensor 33, but other configurations may be adopted as long as the diameter of the winding bobbin B can be detected. For example, the diameter of the winding bobbin B can be calculated by measuring the amount of yarn Y wound around the winding bobbin B.

[0120] In step S103 of the embodiment described above, the timing to detect the yarn Y is described as within a predetermined time from the start of the start-up operation, but determination may be made based on the number of traversing of the traverse guide 17 rather than on the elapsed time.

[0121] In the embodiment described above, an example has been described in which the traverse device 12 is applied to an automatic winder, but the traverse device 12 of the present embodiment can also be applied to other yarn winding devices such as a fine spinning machine.

Claims

1. A yarn winding device (100) **characterized by** comprising:

a winding section (200) for winding a package;
a traverse guide (17), driven independent from drive of the package, for traversing a yarn to be wound into the package; and
a traverse detection section (70), arranged at a central part of a traverse width of the traverse guide (17), for detecting presence or absence of the traversed yarn.

2. The yarn winding device (100) according to claim 1, **characterized in that** the central part of the traverse width of the traverse guide (17) is a region having a width of 1/3 of the traverse width; and the traverse detection section (70) is arranged in the region.
3. A yarn winding device (100) **characterized by** comprising:

a winding section (200) for winding a package;
a traverse guide (17), driven independent from drive of the package, for traversing a yarn to be wound into the package; and
a traverse detection section (70), arranged at a central part of a package width, for detecting presence or absence of the traversed yarn.

4. The yarn winding device (100) according to claim 3, **characterized in that** the central part of the package width is a region having a width of 1/3 of the package width, and the traverse detection section (70) is arranged in the region.

5. The yarn winding device (100) according to any one of claims 1 to 4, **characterized by** further comprising:

a yarn feeding section (300) for supplying the yarn to be wound into the package;
a yarn splicing device (21) for carrying out a yarn splicing operation of splicing a yarn end from the package and a yarn end from the yarn feeding section (300);
a yarn end catching section (27) for carrying out a catching operation of catching the yarn end from the package; and
a control section (41) for stopping the traversing of the traverse guide (17) when the absence of the yarn is detected by the traverse detection section (70) after the catching operation by the yarn end catching section (27) and the yarn splicing operation by the yarn splicing device (21) are carried out and the traversing of the traverse guide (17) is started.

6. The yarn winding device (100) according to claim 5, **characterized by** further comprising:

a cutting device (22) for cutting the yarn; wherein the control section (41) causes the cutting device (22) to cut the yarn when the absence of the yarn is detected by the traverse detection section (70) after the catching operation by the yarn end catching section (27) and the yarn splicing operation by the yarn splicing device (21) are carried out and the traversing of the traverse guide (17) is started.

7. The yarn winding device (100) according to claim 6, **characterized in that** the control section (41) again causes the yarn end catching section (27) to carry out the catching operation after stopping the traversing of the traverse guide (17).

8. The yarn winding device (100) according to any one of claims 5 to 7, **characterized in that** the control section (41) stops operation of the winding sections.

(200) and the traverse guide (17) when the absence of the yarn is detected by the traverse detection section (70) during continuous operation of the winding section (200) and the traverse guide (17).

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9. The yarn winding device (100) according to claim 6 or 7, **characterized in that** the control section (41) stops operation of the winding section (200) and the traverse guide (17) when the cutting device (22) cuts the yarn during continuous operation of the winding section (200) and the traverse guide (17).

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10. The yarn winding device (100) according to any one of claims 1 to 9, **characterized by** further comprising:

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a main guiding plate (62), arranged in proximity to the package, for guiding the yarn in a traverse direction; and

an auxiliary guiding plate (63) for guiding the yarn to the main guiding plate (62) during the catching operation by the yarn end catching section (27); wherein

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the traverse detection section (70) detects the yarn passing between the main guiding plate (62) and the auxiliary guiding plate (63).

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11. The yarn winding device (100) according to any one of claims 1 to 10, **characterized in that** the traverse detection section (70) is a reflective sensor.

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12. The yarn winding device (100) according to any one of claims 1 to 11, **characterized in that** the traverse detection section (70) includes a light source portion and a light receiving portion, the light receiving portion receiving change in intensity of light that occurs when the yarn to be traversed traverses light radiated from the light source portion, and the presence or absence of the yarn being detected from the change in intensity of the light received by the light receiving portion.

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FIG. 1

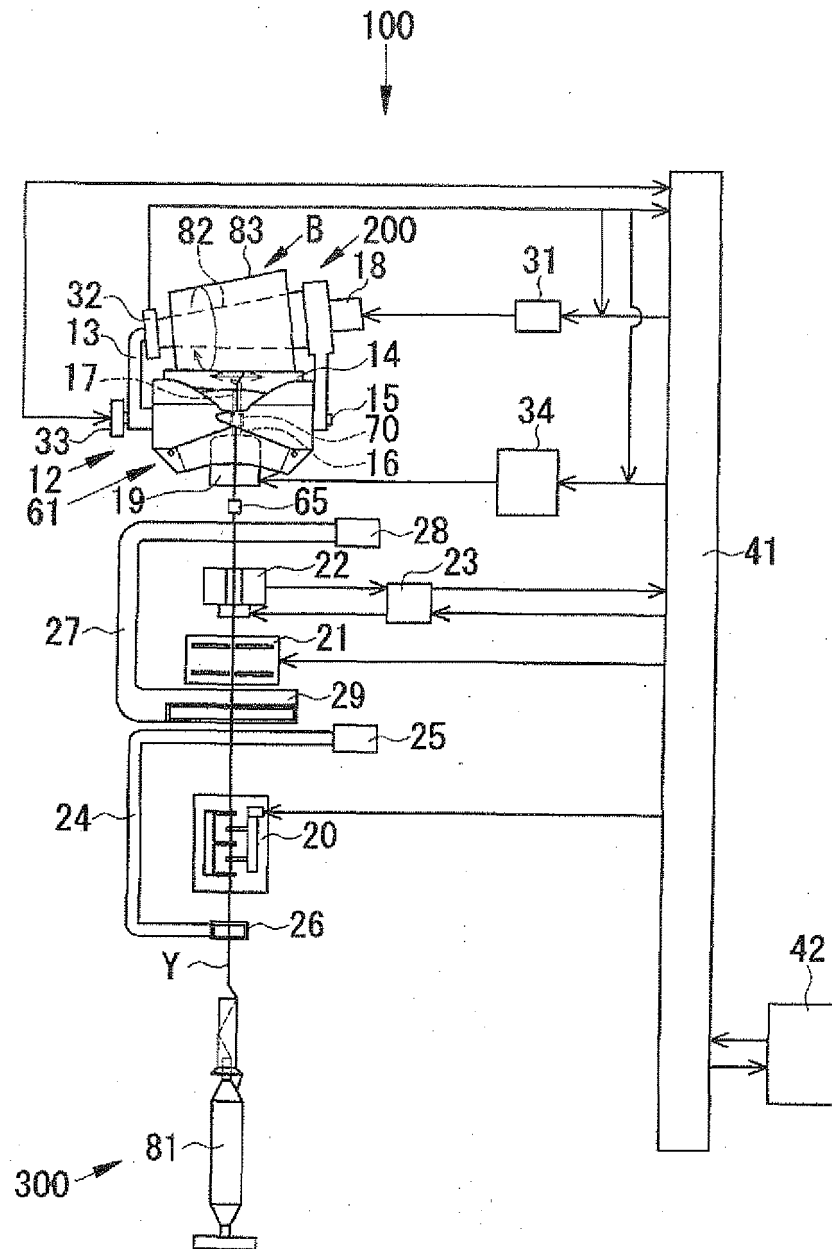


FIG. 2

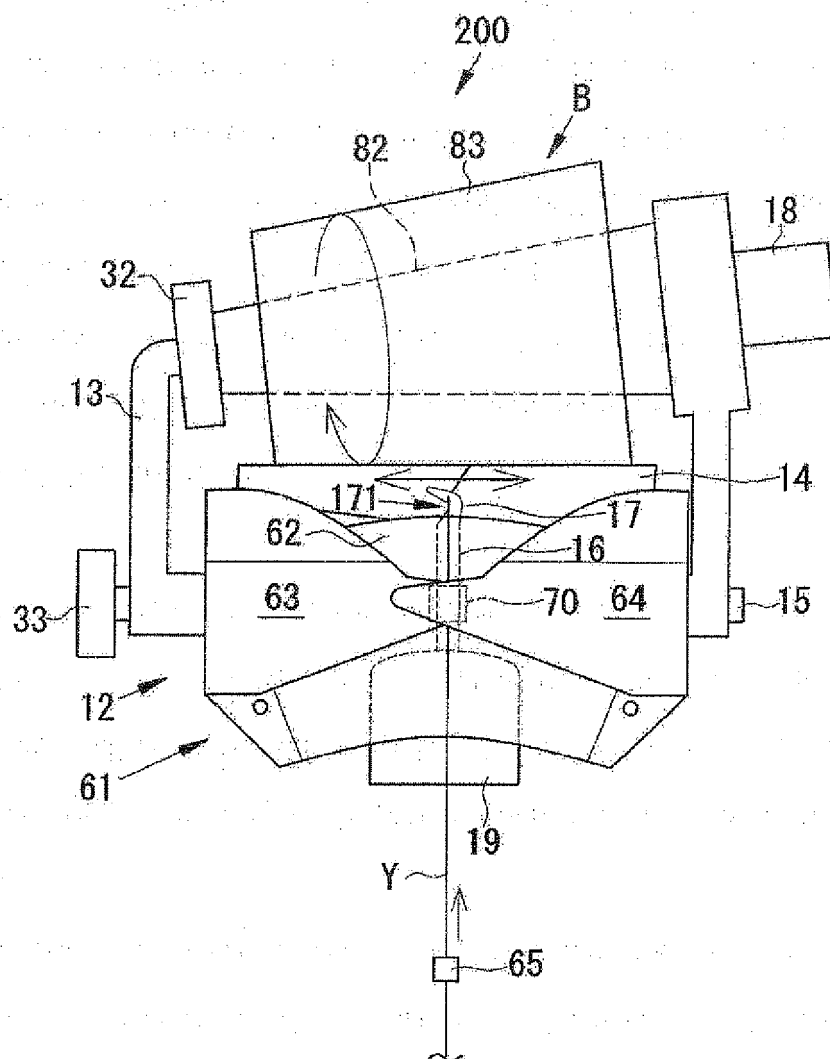


FIG. 3

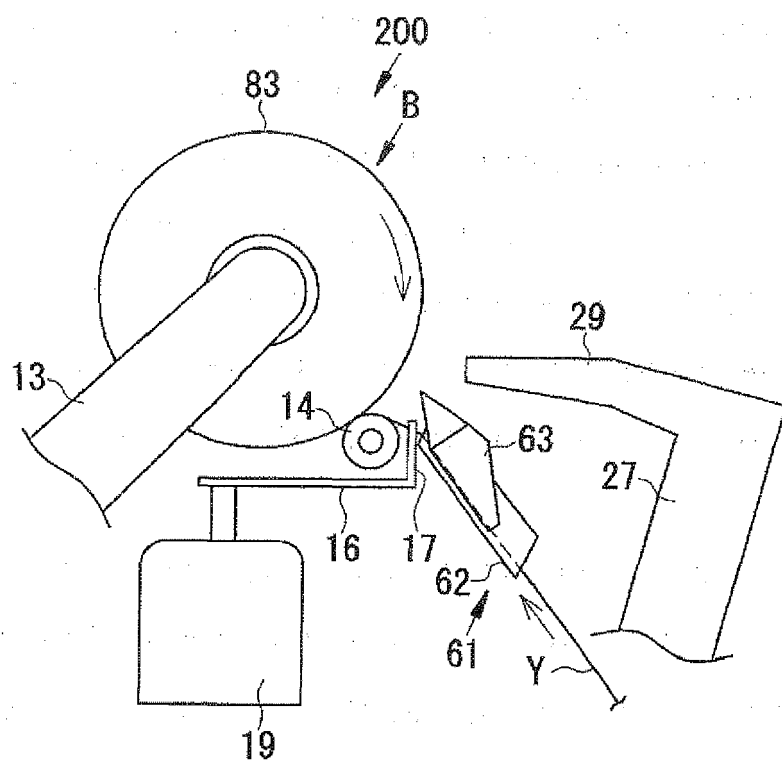


FIG. 4

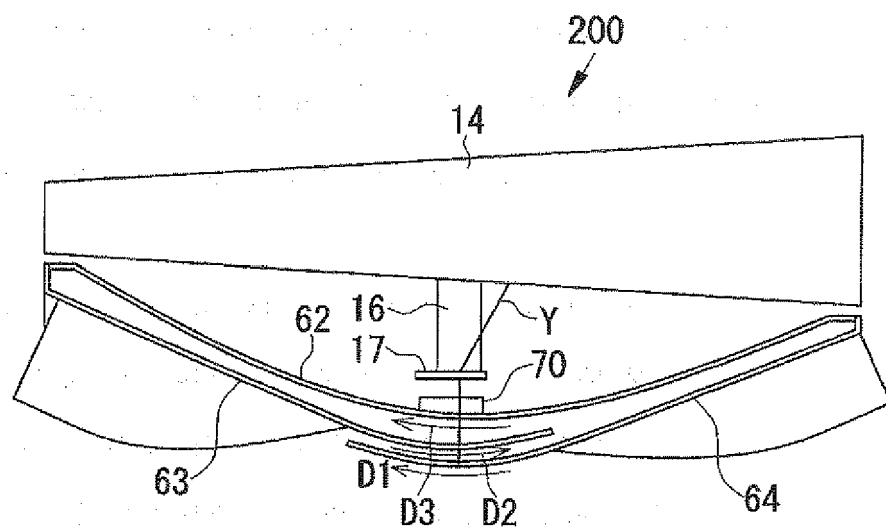


FIG. 5

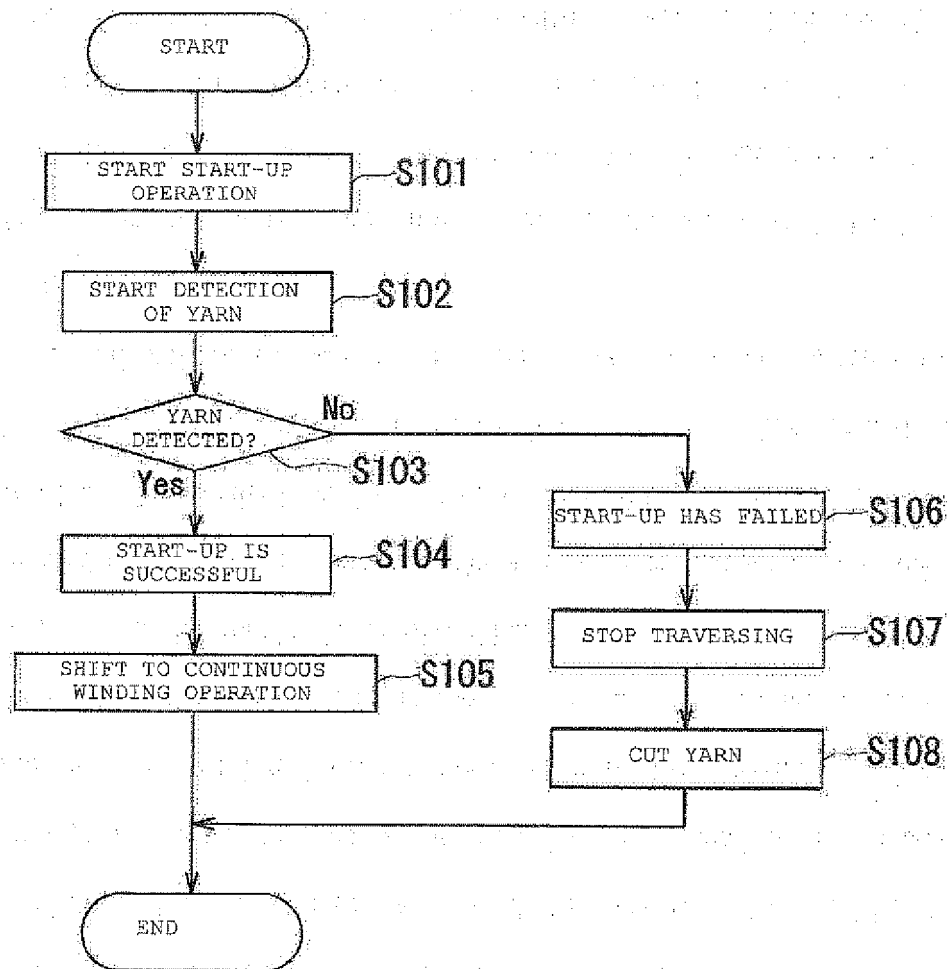


FIG. 6

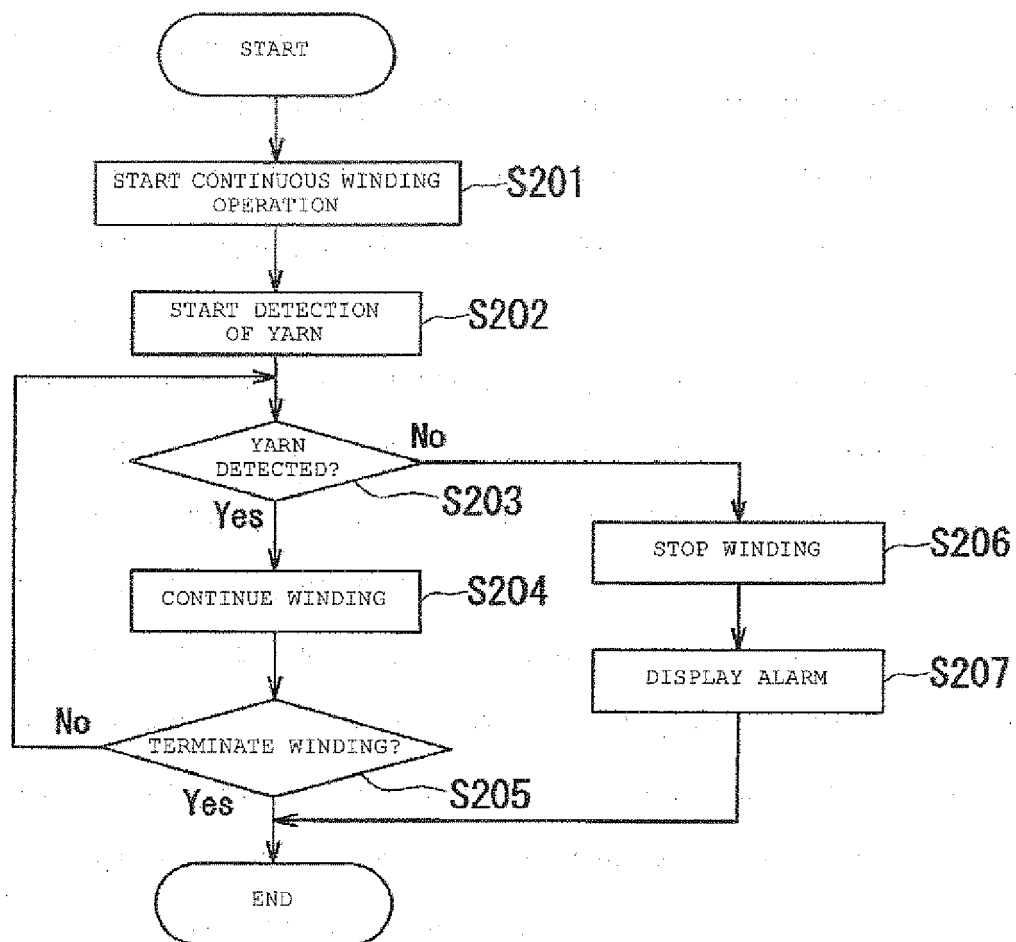
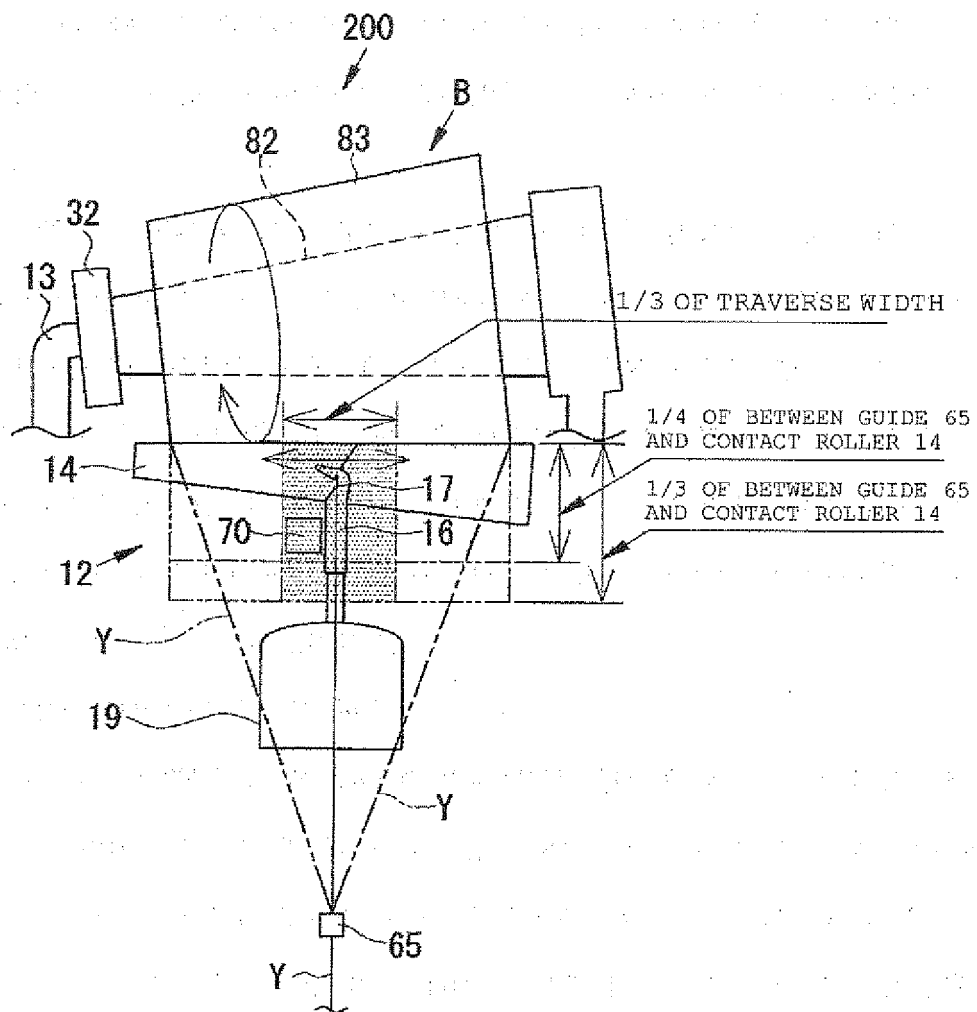


FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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