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(54) YARN WINDING DEVICE

GARNWICKLUNGSVORRICHTUNG

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

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

2. Description of the Related Art

[0002] Yarn winding devices having a yarn supplying section that supplies a yarn, a yarn accumulating section that accumulates the yarn supplied from the yarn supplying section, and a winding section that unwinds the yarn accumulated in the yarn accumulating section and winds the yarn to form a package are known in the art (For example, see Japanese Patent Application Laid-open No. 2015-000777). In the yarn winding device disclosed in Japanese Patent Application Laid-open No. 2015-000777, a yarn accumulating section includes a yarn accumulating roller on an outer peripheral surface of which the yarn supplied from the yarn supplying section is wound to accumulate the yarn, and a rubber band (a ring member) provided around the outer peripheral surface of the yarn accumulating roller. The rubber band applies appropriate resistance and tension to the yarn when the yarn is pulled from the yarn accumulating roller allowing stable unwinding of the yarn from the yarn accumulating roller.

[0003] In the yarn winding device explained above, when starting the winding of the yarn on the yarn accumulating roller, an operation to pass a yarn end between the outer peripheral surface of the yarn accumulating roller and the ring member (through the radially inner side of the ring member) is required to be performed. By doing so, the yarn pulled from the yarn accumulating roller is surrounded by the ring member provided around the outer peripheral surface of the yarn accumulating roller. However, passing the yarn end between the outer peripheral surface of the yarn accumulating roller and the ring member is a difficult operation; because, the yarn needs to be passed through the ring member after expanding the ring member so that a space for passing the yarn is generated between the ring member and the outer peripheral surface of the yarn accumulating roller. Simplification of the operation is therefore required.

SUMMARY OF THE INVENTION

[0004] The present invention has been made in view of the above discussion and it is an object thereof to provide a yarn winding device in which operation performed at the time of starting winding of a yarn on a yarn accumulating roller can be simplified.

[0005] According to one aspect of the present invention, a yarn winding device includes a yarn supplying section that supplies a yarn; a yarn accumulating section that pulls the yarn from the yarn supplying section and accumulates the yarn; and a winding section that winds the yarn accumulated in the yarn accumulating section and forms a package. The yarn accumulating section includes a yarn accumulating roller for winding and accumulating on an outer peripheral surface thereof the yarn pulled from the yarn supplying section by rotating around a rotation axis, and a ring member that contacts with and applies resistance to the yarn when the yarn on the outer peripheral surface of the yarn accumulating roller is pulled from the yarn accumulating roller by the winding section. Moreover, a concave portion is formed in the outer peripheral surface of the yarn accumulating roller in an area straddling a mounting position of the ring member in a direction parallel to the rotation axis.

[0006] In the yarn winding device, the concave portion is formed in the outer peripheral surface of the yarn accumulating roller in the area straddling the mounting position of the ring member in the direction parallel to the rotation axis. With this configuration, a yarn end can be easily passed through a radially inner side of the ring member by passing the yarn end inside the concave portion from the first side to the second side in a direction parallel to the rotation axis. Consequently, the operation performed at the time of starting winding of the yarn on the yarn accumulating roller can be simplified.

[0007] In the above yarn winding device, the concave portion includes a groove portion that extends in a direction parallel to the rotation axis. With this configuration, because the concave portion includes the groove portion that extends in the direction parallel to the rotation axis, the yarn end can be easily passed through the radially inner side of the ring member, and the operation performed at the time of starting winding of the yarn on the yarn accumulating roller can be further simplified.

[0008] In the above yarn winding device, a retractable member is arranged at a position corresponding to the mounting position of the ring member inside the concave portion, the retractable member has a surface at a same level as the outer peripheral surface of the yarn accumulating roller, and the retractable member is capable of sinking in the concave portion so that the surface enters the concave portion. With this configuration, because the surface of the retractable member is at the same level as the outer peripheral surface of the yarn accumulating roller during yarn winding, a tension applied by the ring member on the yarn that is pulled from the yarn accumulating roller can be uniformly maintained in the circumferential direction. Moreover, because the retractable member is sinkable in the concave portion so that the surface thereof enters the concave portion, by causing the retractable member to sink at the time of starting winding of the yarn on the yarn accumulating roller, the yarn end can be easily passed through the radially inner side of the ring member via the concave portion.

[0009] In the above yarn winding device, the outer peripheral surface of the yarn accumulating roller includes an accumulating area on which the yarn is wound and

accumulated and an unwinding area around which the ring member is wound, and the concave portion is arranged in both the accumulating area and the unwinding area. With this configuration, by passing the yarn end inside the concave portion, the yarn end can be guided up to the upstream side of the yarn accumulating roller. Accordingly, the operation performed at the time of starting winding of the yarn on the yarn accumulating roller can be further simplified.

[0010] In the above yarn winding device, the ring member is elastic and diametrically expandable, a circumferential length of the ring member in a non-expanded state thereof is smaller than a circumferential length of the unwinding area, and the ring member is wound around the yarn accumulating roller in an expanded state. With this configuration, a predetermined tension can be applied on the yarn that is being unwound.

[0011] The above yarn winding device further includes a threader that blows air inside the concave portion from the winding section side to the yarn supplying section side. With this configuration, the yarn end can be blown off in the concave portion and passed through the radially inner side of the ring member when the air is blown in the concave portion by the threader. Accordingly, the operation performed at the time of starting winding of the yarn on the yarn accumulating roller can be further simplified.

[0012] In the above yarn winding device, at the position corresponding to the mounting position of the ring member inside the concave portion, a retractable member having a surface along the outer peripheral surface of the yarn accumulating roller and sinkable so that the surface enters the concave portion is arranged, and the threader includes a pressing member that presses the retractable member and causes it to sink into the concave portion when blowing the air in the concave portion. With this configuration, because the threader includes the pressing member that presses the retractable member and causes it to sink into the concave portion when the air is blown in the concave portion, for example, the operator need not press the retractable member into the concave portion by his / her hands, and the operation performed at the time of starting winding of the yarn to the yarn accumulating roller can be further simplified.

[0013] The above yarn winding device further includes a roller driving section that rotates the yarn accumulating roller; a threader driving section that causes the threader to approach toward / retract from the yarn accumulating roller; and a first controlling section that controls operations of the threader, the roller driving section, and the threader driving section, wherein the first controlling section controls the roller driving section to rotate the yarn accumulating roller up to a rotational position at which the threader can blow the air in the concave portion, controls the threader driving section to advance the threader toward the yarn accumulating roller, and controls the pressing member to press the retractable member and cause it to sink into the concave portion, and controls the threader to blow the air in the concave portion. With this configuration, with cooperative functioning of the threader, the roller driving section, and the threader driving section, the operation of passing the yarn end through the radially inner side of the ring member can be automated. Consequently, the operation performed at the time of starting winding of the yarn on the yarn accumulating roller can be further simplified.

[0014] In the above yarn winding device, the threader blows off a first yarn end, which is a yarn end of a yarn that has been wound around the package, in the concave portion by blowing the air in the concave portion, and the yarn winding device further includes a yarn joining device that joins a disconnected yarn; a yarn feeding section that catches the first yarn end blown off in the concave portion by the threader and feeds the caught first yarn end to the yarn joining device side; and a second controlling section that controls operations of the yarn joining device and the yarn feeding section, wherein the second controlling section, when the threader has blown off the first yarn end in the concave portion, controls the yarn feeding section to catch the first yarn end and feed it to the yarn joining device side, and controls the yarn joining device to join the first yarn end with a second yarn end, which is a yarn end of a yarn on the yarn supplying section side. With this configuration, with cooperative functioning of the yarn joining device and the yarn feeding section, the operation of joining the first yarn end and the second yarn end can be automated. Consequently, the operation performed at the time of starting winding of the yarn on the yarn accumulating roller can be further simplified.

[0015] In the above yarn winding device, the yarn supplying section supports a yarn supplying bobbin. With this configuration, in the yarn winding device in which the yarn supplying bobbin are supported in the yarn supplying section, because variations in the tension when the yarn is unwound from the yarn supplying bobbin is absorbed by the yarn accumulating section, the variations are not conveyed to the winding section. Accordingly, a good quality package that is not affected by the variations in the tension when the yarn is unwound from the yarn supplying bobbin can be formed.

[0016] According to the present invention, the operation performed at the time of starting winding of the yarn on the yarn accumulating roller can be simplified.

[0017] In the above explanation, the meaning of "a plurality of" also includes "a predetermined number of".

[0018] Although the invention has been explained with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the scope of the claims.

[0019] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments

of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a schematic front view of an automatic winder according to an embodiment of the present invention.
FIG. 2 is a schematic side view of a winder unit shown in FIG. 1.
FIG. 3 is a partial cross-sectional view of main parts of the winder unit shown in FIG. 1.
FIG. 4 is a schematic perspective view of the main parts of the winder unit shown in FIG. 1.
FIG. 5 is a schematic cross-sectional view of the main parts of the winder unit shown in FIG. 1.
FIG. 6 is another schematic cross-sectional view of the main parts of the winder unit shown in FIG. 1.
FIG. 7 is a flowchart showing a process flow executed at the time of starting winding of a yarn on a yarn accumulating roller.

DETAILED DESCRIPTION

[0021] Exemplary embodiments of the present invention are explained in detail below with reference to the accompanying drawings. Identical elements or corresponding elements are indicated by the same reference symbols in the drawings and redundant explanation thereof is omitted. The terms "upstream" and "downstream" refer to upstream and downstream in a traveling direction of a yarn during winding, respectively.

[0022] As shown in FIG. 1, an automatic winder 1 includes a plurality of winder units (yarn winding devices) 2 that are arranged side by side, a machine-frame controlling device 3, a yarn-supply bobbin feeder 4, a doffing device 5, and a not shown blower box.

[0023] The machine-frame controlling device 3 communicates with the winder units 2. The operator of the automatic winder 1 can centrally manage the winder units 2 by performing appropriate operations on the machine-frame controlling device 3. The machine-frame controlling device 3 controls operations of the yarn-supply bobbin feeder 4 and the doffing device 5.

[0024] The yarn-supply bobbin feeder 4 sets one yarn supplying bobbin 21 on each of conveying trays 26 and feeds the yarn supplying bobbin 21 set on the conveying tray 26 to each of the winder units 2.

[0025] The doffing device 5 moves to the position of a winder unit 2 in which a package 30 has been fully wound (a state where a prescribed amount of a yarn 20 has been wound) in the winder unit 2, and removes the fully wound package 30. The doffing device 5 sets an empty winding bobbin 22 in the place of the package 30 that has been removed from the winder unit 2.

[0026] A configuration of the winder unit 2 is explained below. As shown in FIG. 2, the winder unit 2 includes a yarn supplying section 6, a yarn accumulating section 18, and a winding section 8. The winder unit 2 unwinds the yarn 20 from the yarn supplying bobbin 21 of the yarn supplying section 6, temporarily accumulates the unwound yarn 20 in the yarn accumulating section 18, and thereafter unwinds the accumulated yarn 20 and winds it onto the winding bobbin 22 to form the package 30.

[0027] The yarn supplying section 6 supplies the yarn 20. The yarn supplying section 6 supports the yarn supplying bobbin 21, which is set on the conveying tray 26, at a predetermined position. The yarn supplying section 6 unwinds the yarn 20 from the yarn supplying bobbin 21. The yarn supplying section 6 discharges the empty yarn supplying bobbin 21 from which all the yarn 20 has been unwound and receives another yarn supplying bobbin 21 from the yarn-supply bobbin feeder 4.

[0028] The yarn accumulating section 18 is arranged between the yarn supplying section 6 and the winding section 8. The yarn accumulating section 18 pulls the yarn 20 from the yarn supplying section 6, and temporarily accumulates the pulled yarn 20 before supplying the yarn 20 to the winding section 8. The yarn accumulating section 18 includes a yarn accumulating roller 32 on which the yarn 20 is wound, and a roller driving motor (a roller driving section) 33 that rotationally drives the yarn accumulating roller 32. The roller driving motor 33 causes the yarn accumulating roller 32 to rotate in a winding direction (forward rotation) so that the yarn 20 from the yarn supplying section 6 is wound. The roller driving motor 33 can cause the yarn accumulating roller 32 to rotate in an opposite direction of the winding direction (reverse rotation) so that the yarn 20 is unwound.

[0029] The winding section 8 includes a cradle 23 on which the winding bobbin 22 can be mounted and a traversing drum 24 that drives the winding bobbin 22 while traversing the yarn 20. The cradle 23 rotatably supports the winding bobbin 22 (or the package 30). The cradle 23 is pivoted so that an outer peripheral surface of the package 30 mounted thereon is in contact with an outer peripheral surface of the traversing drum 24.

[0030] The traversing drum 24 is rotationally driven by a not shown driving source (an electric motor and the like). The rotation of the traversing drum 24 that is in contact with the outer peripheral surface of the winding bobbin 22 or the package 30 rotationally drives the winding bobbin 22. With this action, the yarn 20 accumulated in the yarn accumulating section 18 is unwound and pulled, and wound on the winding bobbin 22. The traversing drum 24 has a not shown traversing groove formed on the outer peripheral surface thereof. The traversing groove enables the yarn 20 to be traversed by a predetermined width. With this configuration, the yarn 20 can be wound on the winding bobbin 22 while being traversed and the package 30 of a predetermined length and shape can be formed.

[0031] The winder unit 2 includes various devices on a yarn traveling path from the yarn supplying section 6

via the yarn accumulating section 18 to the winding section 8. Specifically, an unwinding assisting device 10, a first blower 11, a second catching section 12, a yarn joining device 13, a first catching section 14, a tension applying section 15, a cutter 16, a yarn monitoring device (a clearer) 17, and a second blower 41 (a yarn feeding section) are arranged sequentially on the yarn path (yarn traveling path) of the yarn 20 in the direction from the yarn supplying section 6 arranged upstream to the yarn accumulating section 18 arranged downstream.

[0032] A balloon is formed above the yarn supplying bobbin 21 by the swaying yarn 20 that is being unwound from the yarn supplying bobbin 21. The unwinding assisting device 10 assists in the unwinding of the yarn 20 by appropriately controlling a size of the balloon by bringing a movable member 27 into contact with the balloon.

[0033] The first blower 11 is an air sucker device arranged at a position downstream of the unwinding assisting device 10 but near the unwinding assisting device 10. The first blower 11 blows compressed air to form an air current that blows off the yarn 20 up to the first catching section 14. Accordingly, in the event of a yarn breakage, for example, a yarn end on the yarn supplying bobbin 21 side can be blown off toward the yarn joining device 13 by the first blower 11.

[0034] Because the yarn 20 from the yarn supplying bobbin 21 that has just been fed to the yarn supplying section 6 is not drawn out adequately enough, the yarn end is difficult to be blown off by the first blower 11 toward the yarn joining device 13. To address this problem, an auxiliary blower 28 is arranged in the yarn supplying section 6 of the winder unit 2.

[0035] The auxiliary blower 28 blows compressed air into the internally hollow conveying tray 26 and the yarn supplying bobbin 21 and generates an air current at an end portion of the yarn supplying bobbin 21 to blow off the yarn 20 from the yarn supplying bobbin 21 toward the first blower 11. The auxiliary blower 28 and the first blower 11 operate in conjunction with each other to reliably convey the yarn end from the yarn supplying bobbin 21 that has just been set in the yarn supplying section 6 toward the yarn joining device 13.

[0036] The second catching section 12 is arranged at a position upstream of the yarn joining device 13 but near the yarn joining device 13. The second catching section 12 is connected to a not shown negative pressure source and generates a suction air current during yarn joining. The second catching section 12 sucks and catches the yarn 20 on the yarn accumulating section 18 side by the action of the suction air current.

[0037] The yarn joining device 13 joins the disconnected yarn 20. The yarn joining device 13 joins the yarn 20 from the yarn supplying bobbin 21 side and the yarn 20 from the yarn accumulating section 18 side when the yarn 20 is cut by the cutter 16 upon detection of a yarn defect by the yarn monitoring device 17, or when the yarn 20 being unwound from the yarn supplying bobbin 21 breaks, or when the yarn 20 is disconnected between the yarn supplying bobbin 21 and the yarn accumulating section 18, such as during replacement of the yarn supplying bobbin 21 or the like. The yarn joining device 13 is arranged at a slightly retracted position from the yarn path. The yarn joining device 13 restores the continuity of the yarn 20 by joining the two yarn ends that are guided thereto. The yarn joining device 13 can be a device that employs a fluid medium, such as compressed air, or a device that has a mechanical structure.

[0038] The first catching section 14 is arranged at a position downstream of the yarn joining device 13 but near the yarn joining device 13. The first catching section 14 is connected to a not shown negative pressure source and it is a cylindrical member having an opening on an end portion thereof. The first catching section 14 includes an advancement and retraction driving section 29. The advancement and retraction driving section 29 causes the first catching section 14 to advance toward and retract from the yarn path.

[0039] When the first catching section 14 is near the yarn path, it sucks and catches the yarn end from the yarn supplying bobbin 21 side that is blown off by the first blower 11 by generating the suction air current on the end portion side thereof. The first catching section 14 sucks and catches the yarn end of the yarn 20 on the yarn supplying bobbin 21 side when the yarn 20 is cut by the cutter 16. Furthermore, the first catching section 14 can suck and remove fly-waste and the like adhering to the traveling yarn 20 by generating the suction air current on the end portion side thereof. The first catching section 14 guides the yarn end to the yarn joining device 13 by retracting from the yarn path in the state in which it has caught the yarn end from the yarn supplying bobbin 21.

[0040] The tension applying section 15 applies a predetermined tension on the traveling yarn 20. The tension applying section 15 is a gate-type structure with movable comb teeth arranged with respect to fixed comb teeth. The tension applying section 15 applies a predetermined resistance to the yarn 20 when the yarn 20 travels between the two sets of comb teeth. The movable comb teeth are moved by, for example, a solenoid, so that the movable comb teeth and the fixed comb teeth are either in an engaged state or in a released state. With this configuration, the tension applied by the tension applying section 15 on the yarn 20 can be adjusted. The configuration of the tension applying section 15 is not particularly limited to the above. Alternatively, for example, a disc-type tension applying section can be used.

[0041] The yarn monitoring device 17 detects a yarn defect, such as slub, contaminant, and the like, by monitoring with an appropriate sensor a thickness and the like of the yarn 20. The cutter 16 is arranged at a position upstream of the yarn monitoring device 17 but near the yarn monitoring device 17. The cutter 16 immediately cuts the yarn 20 when the yarn monitoring device 17 detects a yarn defect.

[0042] The cutter 16 and the yarn monitoring device

17 are housed in one housing 19. The housing 19 is arranged at a position downstream of the tension applying section 15 but near the tension applying section 15. With this configuration, the yarn monitoring device 17 in the housing 19 can monitor the portion of the traveling yarn 20 near the position where the yarn 20 is held (guided) by the tension applying section 15. Accordingly, since practically no shaking of the yarn 20 occurs when the yarn 20 is monitored, a detection accuracy of a defect in the yarn 20 by the yarn monitoring device 17 can be further improved.

[0043] The second blower 41 is an air sucker device arranged at a position upstream of the yarn accumulating section 18 but near the yarn accumulating section 18. The second blower 41 blows compressed air to generate an air current that blows off and conveys the yarn end on the yarn accumulating section 18 side to the second catching section 12. Specifically, the second blower 41 includes a narrow cylindrical guide member 42 through which the yarn 20 is passed, and a bent cylindrical yarn guide member 43. A blowout hole for blowing off the yarn 20 is formed on one end of the guide member 42. The yarn guide member 43 is arranged so that it can approach to the blowout hole of the second blower 41. An opening is formed on either end of the yarn guide member 43 in a longitudinal direction thereof.

[0044] The yarn guide member 43 is arranged such that the opening on one end side thereof is positioned facing the blowout hole of the second blower 41, and the opening on the other end side is positioned facing the second catching section 12. A guiding path is formed inside the yarn guide member 43 that joins the openings at the two ends of the yarn guide member 43. Accordingly, it is possible to detour the yarn monitoring device 17, the tension applying section 15, the yarn joining device 13, and the like. The second blower 41, the yarn guide member 43, and the second catching section 12 together constitute an accumulating side yarn-end catching device 44.

[0045] When the yarn 20 is disconnected between the yarn supplying bobbin 21 and the yarn accumulating section 18, the second blower 41 catches the yarn 20 on the yarn accumulating section 18 side and blows off the yarn 20 so that the yarn 20 enters the guiding path in the yarn guide member 43. Then, the yarn 20 is pulled out along the guiding path and caught by the second catching section 12. Furthermore, a not shown slit is formed over the entire length of the yarn guide member 43 thereby allowing the yarn 20 to be pulled out from inside the yarn guide member 43 via the slit in a state in which the yarn 20 has been caught by the second catching section 12. In this manner, the yarn 20 on the yarn accumulating section 18 side is blown off by the second blower 41 and guided toward the yarn joining device 13.

[0046] Each of the winder units 2 has a separate controlling section (a first controlling section and a second controlling section) 25. The controlling section 25 includes not shown hardware such as a CPU (Central Processing Unit), a ROM (Read-only Memory), a RAM (Random Access Memory), and the like. The RAM stores therein software, such as a control program, and the like. The controlling section 25 controls each of the structural components of the winder unit 2 by the cooperative functioning of the hardware and the software. The controlling section 25 communicates with the machine-frame controlling device 3. This feature enables the machine-frame controlling device 3 to centrally manage the operations of the winder units 2 of the automatic winder 1. The specific processes that are performed by the controlling section 25 are explained in detail in the later-explained process flow performed at the time of starting winding.

[0047] Moreover, the winder unit 2 includes a threader 60. The threader 60 is arranged at a position near the yarn accumulating section 18. The threader 60 is used, as explained later, at the time of starting winding of the yarn 20 on the yarn accumulating roller 32.

[0048] The yarn accumulating section 18, the threader 60, and the second blower 41 are explained in further detail with reference to FIGS. 3 to 6. As mentioned above, the yarn accumulating section 18 includes the yarn accumulating roller 32 and the roller driving motor 33.

[0049] The yarn accumulating roller 32 is made of metal, for example, and has a substantially cylindrical shape. The yarn accumulating roller 32 includes a cylindrical portion 34, and rim portions 35 on either side of the cylindrical portion 34. The rim portions 35 are in continuation with the axial ends of the cylindrical portion 34 and a diameter thereof increases as one goes toward the end of the yarn accumulating roller 32. An outer peripheral surface 32a of the yarn accumulating roller 32 is constituted by an outer peripheral surface 34a of the cylindrical portion 34 and an outer peripheral surface 35a of the rim portion 35.

[0050] As shown in FIG. 4, the yarn accumulating roller 32 is supported by a base member 33a. The base member 33a rotatably supports the yarn accumulating roller 32 and houses the roller driving motor 33. By being rotated about a rotation axis R by the driving power of the roller driving motor 33, the yarn accumulating roller 32 winds and accumulates the yarn 20 pulled from the yarn supplying section 6 on the outer peripheral surface 34a thereof. In the following explanation, the side of the yarn accumulating roller 32 that is near the roller driving motor 33 is referred to as a base side, and the side opposite to the base side is referred to as a tip side.

[0051] As shown in FIG. 4, a magnet 36a is embedded in the base side of the yarn accumulating roller 32. A magnetic sensor 36b that detects the magnet 36a is arranged inside the base member 33a. The magnetic sensor 36b is electrically connected to the controlling section 25. With this configuration, based on the detection of the magnet 36a by the magnetic sensor 36b, the controlling section 25 detects whether the yarn accumulating roller 32 is positioned at a predetermined rotational position (an angular position around the rotation axis R).

[0052] The yarn accumulating roller 32 applies tension on the yarn 20 that is further upstream (the yarn supplying

bobbin 21 side) than the yarn accumulating section 18 by rotating in the forward direction with the yarn 20 wound thereon. With this action, the yarn 20 is unwound from the yarn supplying bobbin 21, and wound on the outer peripheral surface 32a of the yarn accumulating roller 32. The yarn 20 is guided by the guide member 42 of the second blower 41 to the base side of the yarn accumulating roller 32 and wound in a sequence on the outer peripheral surface 32a of the yarn accumulating roller 32 from the base side while the layers of the yarn 20 wound on the tip side are pushed further to the tip side. As a result, the yarn 20 wound on the yarn accumulating roller 32 is pushed toward the tip side by the yarn 20 that has just been wound, and successively fed to the tip side. In this manner, the yarn 20 is systematically and helically wound on the outer peripheral surface 32a of the yarn accumulating roller 32 from the base side.

[0053] As shown in FIG. 3, the yarn 20 wound on the yarn accumulating roller 32 is pulled downstream via a pulling guide 37 arranged on a line that extends from a central axis (the rotation axis R) of the yarn accumulating roller 32. Because of the presence of the yarn accumulating section 18, conveying of variations in the tension of the yarn 20 that has been unwound from the yarn supplying bobbin 21 to the winding section 8 side is suppressed. In this manner, the variations in the tension of the yarn 20 to be supplied to the winding section 8 are suppressed, and a good quality package 30 can be formed.

[0054] A ring member 46 is wound (mounted) on the outer peripheral surface 32a of the yarn accumulating roller 32. The ring member 46 is made of rubber, for example, and has an annular shape. The ring member 46 is mounted on a boundary portion between the outer peripheral surface 34a of the cylindrical portion 34 and the outer peripheral surface 35a of the rim portion 35 on the tip side. The ring member 46 is a tension ring that surrounds the yarn 20 that is pulled from the yarn accumulating roller 32 by the winding section 8 and applies resistance to the yarn 20 by contacting with the yarn 20. The ring member 46 is mounted on the outer peripheral surface 32a with an elastic force that tightens inwardly in a radial direction thereof. With this elastic force, the ring member 46 applies the resistance to the yarn 20 pulled from the yarn accumulating roller 32. The ring member 46 applies an appropriate tension on the yarn 20 pulled from the yarn accumulating roller 32 and stabilizes the unwinding of the yarn 20 from the yarn accumulating roller 32.

[0055] A concave portion 38 is formed in an area straddling a mounting position of the ring member 46 in a direction parallel to the rotation axis R in the outer peripheral surface 32a of the yarn accumulating roller 32. That is, when seen from a radially outer side of the yarn accumulating roller 32, the concave portion 38 intersects the mounting position of the ring member 46 so as to pass through the mounting position of the ring member 46, and a part of the concave portion 38 overlaps with the mounting position of the ring member 46. The concave portion 38 includes a groove portion that extends in a direction parallel to the rotation axis R from one end to the other end of the yarn accumulating roller 32. The concave portion 38 is constituted by a first portion 38a formed in the outer peripheral surface 34a of the cylindrical portion 34 and a second portion 38b formed in the outer peripheral surface 35a of the rim portions 35. The concave portion 38, which includes the groove portion, has, for example, the same cross-sectional shape in the entire longitudinal direction thereof, and is formed in a substantially rectangular cross sectional shape.

[0056] In other words, the outer peripheral surface 32a of the yarn accumulating roller 32 includes an accumulating area R1 on which the yarn 20 is wound and accumulated and an unwinding area R2 around which the ring member 46 is wound (see FIG. 5). The unwinding area R2 is the boundary portion between the outer peripheral surface 34a of the cylindrical portion 34 and the outer peripheral surface 35a of the rim portion 35 on the tip side. The accumulating area R1 is a portion other than the unwinding area R2 on the outer peripheral surface 34a of the cylindrical portion 34. The concave portion 38 is arranged over the accumulating area R1 and the unwinding area R2. Moreover, the ring member 46 is elastic and diametrically expandable. The circumferential length of the ring member 46 in a non-expanded state thereof is smaller than the circumferential length of the unwinding area R2. The ring member 46 is wound around the yarn accumulating roller 32 in a diametrically expanded state.

[0057] A retractable member 48 is arranged in the concave portion 38. The retractable member 48 is arranged at a position corresponding to the mounting position of the ring member 46 but in the concave portion 38 (a position on the radially inner side of the ring member 46). That is, when seen from the radially outer side of the yarn accumulating roller 32, a part of the retractable member 48 overlaps with the mounting position of the ring member 46. As shown in FIGS. 5 and 6, the retractable member 48 is mounted on a bottom surface 39 of the concave portion 38 via a spring member 49. The spring member 49, for example, is a coil spring.

[0058] As shown in FIG. 5, the retractable member 48 constitutes, in a normal state in which no external force other than the spring member 49 is acting thereon, a surface 51 along the outer peripheral surface 32a of the yarn accumulating roller 32. The surface 51 includes a surface 51a that is at the same level as the outer peripheral surface 34a of the cylindrical portion 34 and a surface 51b that is at the same level as the outer peripheral surface 35a of the rim portion 35. In other words, the surface 51a has the same curvature as that of the outer peripheral surface 34a so that it constitutes the same surface as that of the outer peripheral surface 34a when arranged along the outer peripheral surface 34a. In the same manner, the surface 51b has the same curvature as that of the outer peripheral surface 35a so that it constitutes the same surface as that of the outer peripheral surface 35a

when arranged along the outer peripheral surface 35a. Moreover, as shown in FIG. 6, compression of the spring member 49 when the retractable member 48 is pressed towards the bottom surface 39 side enables the retractable member 48 to sink so that the surface 51 enters the concave portion 38.

[0059] The threader 60 includes a cylindrical nozzle 61. As shown in FIGS. 3 to 6, a slit 61s is arranged along a longitudinal direction of the nozzle 61. A first end part 61a of the nozzle 61 is formed in a multi-leveled (stepped) shape in which a part of the first end part 61a projects in a longitudinal direction thereof. In other words, the first end part 61a has a shape that is partially cut in a circumferential direction. The cut out portion is arranged so as to be in continuity with the slit 61s. The first end part 61a has a semi-circular shape in the cross-section perpendicular to the longitudinal direction.

[0060] The nozzle 61 is arranged so that the first end part 61a faces the outer peripheral surface 35a in the tip side of the yarn accumulating roller 32. As shown in FIG. 6, the nozzle 61 blows the compressed air inside the concave portion 38 from the winding section 8 side (the tip side) to the yarn supplying section 6 side (the base side). Accordingly, the nozzle 61 blows off a yarn end of the yarn 20 introduced into a second end part 61b thereof from the first end part 61a thereof, and blows off that yarn end in the second portion 38b of the concave portion 38. Specifically, the nozzle 61 blows off a first yarn end, which is a yarn end of the yarn 20 that has been wound around the package 30, in the second portion 38b of the concave portion 38 so that the first yarn end passes inside the concave portion 38 from the winding section 8 side to the yarn supplying section 6 side.

[0061] As shown in FIG. 3, the nozzle 61 is connected to a compressed air source 53 via piping. A solenoid valve 54 is arranged between the compressed air source 53 and the nozzle 61. The solenoid valve 54 is electrically connected to the controlling section 25. When the solenoid valve 54 is opened, an air current that passes inside the nozzle 61 from the second end part 61b to the first end part 61a is formed by the compressed air supplied from the compressed air source 53.

[0062] The winder unit 2 further includes a threader driving section 62 that moves the nozzle 61 in a direction indicated by an arrow A in FIG. 4 to advance toward / retract from the yarn accumulating roller 32. The threader driving section 62 is constituted by, for example, a slide mechanism that uses an actuator such as an air cylinder or a motor and the like. The threader driving section 62 is electrically connected to the controlling section 25.

[0063] When driven by the threader driving section 62, the nozzle 61 moves between a first position at which the first end part 61a separates from the outer peripheral surface 35a (a position shown in FIG. 5) and a second position at which the first end part 61a is positioned further toward the rotation axis R side of the yarn accumulating roller 32 than the outer peripheral surface 35a (a position shown in FIG. 6). As shown in FIGS. 5 and 6, by moving the nozzle 61 from the first position to the second position in a state in which the yarn accumulating roller 32 is at a predetermined rotational position (when the retractable member 48 and the first end part 61a are facing each other), the first end part 61a presses the retractable member 48 toward the bottom surface 39 side thereby causing the retractable member 48 to sink into the concave portion 38. That is, the first end part 61a also serves as a pressing member that presses and causes the retractable member 48 to sink into the concave portion 38.

[0064] The second blower 41 is arranged so that a suction port 42a of the guide member 42 opposes the outer peripheral surface 32a of the yarn accumulating roller 32. As shown in FIG. 6, by the sucking through the suction port 42a, the second blower 41 catches the first yarn end blown off in the concave portion 38 by the threader 60, and by blowing off the caught first yarn end from the blowout hole toward the yarn guide member 43, the second blower 41 blows off the caught first yarn end to the yarn joining device 13 side.

[0065] As shown in FIG. 3, the guide member 42 is connected to the compressed air source 53 via piping. A solenoid valve 55 is arranged between the compressed air source 53 and the guide member 42. The solenoid valve 55 is electrically connected to the controlling section 25. When the solenoid valve 55 is opened, an air current that passes in the guide member 42 from the suction port 42a to the blowout hole is formed by the compressed air supplied from the compressed air source 53.

[0066] As shown in FIG. 4, a lighting unit 65 is arranged near the threader 60 and the second blower 41. The lighting unit 65 is an LED, for example, and illuminates at least a region around the yarn accumulating roller 32 and the threader 60. The lighting unit 65 is electrically connected to the controlling section 25.

[0067] A process flow executed at the time of starting winding of the yarn 20 on the yarn accumulating roller 32 is explained next with reference to FIG. 7. In the winder unit 2 according to the present embodiment, the yarn joining device 13 is arranged between the yarn supplying section 6 and the yarn accumulating section 18, and not between the yarn accumulating section 18 and the winding section 8. In such a configuration, for example, if the yarn 20 breaks between the yarn accumulating section 18 and the winding section 8 during a yarn winding operation (when an upper yarn breaks) and the like, it is necessary to, after removing the yarn 20 from the yarn accumulating roller 32, join the yarn 20 pulled from the package 30 and the yarn 20 from the yarn supplying section 6 with the yarn joining device 13, and then wind the yarn 20 on the yarn accumulating roller 32. Such an operation (a yarn hooking operation) performed at the time of starting winding of the yarn 20 on the yarn accumulating roller 32 is explained below.

[0068] When the yarn 20 breaks between the yarn accumulating section 18 and the winding section 8 during

the yarn winding operation, for example, the breakage of the yarn 20 is detected as an abnormality by a not shown yarn monitoring sensor (for example, a traversing sensor that monitors the traversing of the yarn 20) arranged between the yarn accumulating section 18 and the winding section 8. When such an abnormality is detected by the yarn monitoring sensor, the controlling section 25 performs control to stop the winding of the yarn 20 by the winder unit 2. Subsequently, the controlling section 25 causes the cutter 16 to cut the yarn 20, and causes the first catching section 14 to catch the yarn end of the yarn 20 on the yarn supplying bobbin 21 side (the second yarn end) cut by the cutter 16 (Step S1).

[0069] Next, the operator cuts the yarn 20 wound on the yarn accumulating roller 32 along the concave portion 38, and removes the yarn 20 from the yarn accumulating roller 32 (Step S2). In the present embodiment, because the concave portion 38 is formed in the outer peripheral surface 32a of the yarn accumulating roller 32, it is possible to cut the yarn 20 by inserting scissors and the like, for example, inside the concave portion 38. Consequently, removal of the yarn 20 from the yarn accumulating roller 32 becomes easy, and damage to the outer peripheral surface 32a of the yarn accumulating roller 32 due to a blade is inhibited.

[0070] At Step S2, if the winder unit 2 further includes a cutting device to cut the yarn 20 wound on the yarn accumulating roller 32, instead of the operator cutting the yarn 20, the yarn 20 wound on the yarn accumulating roller 32 can be automatically cut and removed from the yarn accumulating roller 32 by the cutting device that is controlled by the controlling section 25. In this case, following Step S3 can be performed automatically after Step S2.

[0071] Subsequently, the operator operates a not shown switch. Following the operation of the switch, the controlling section 25 performs control on the roller driving motor 33 to rotate the yarn accumulating roller 32 up to a predetermined rotational position at which the threader 60 can blow off the first yarn end in the concave portion 38 (Step S3). Specifically, the yarn accumulating roller 32 is rotated up to a rotational position at which the magnetic sensor 36b detects the magnet 36a. Accordingly, as shown in FIGS. 4 to 6, the first end part 61a of the nozzle 61 faces the surface 51b of the retractable member 48, and the suction port 42a of the guide member 42 faces the concave portion 38.

[0072] Subsequently, the controlling section 25 performs control on the threader driving section 62 to advance the nozzle 61 of the threader 60 from the first position toward the second position whereby the nozzle 61 approaches the yarn accumulating roller 32, and performs control on the first end part 61a to press the retractable member 48 and cause it to sink in the concave portion 38 (Step S4). Then, the controlling section 25 causes the solenoid valve 54 to open to form the air current that flows from the second end part 61b to the first end part 61a in the nozzle 61 of the threader 60 (Step S5). Next, the controlling section 25 causes the solenoid valve 55 to open to form the air current that flows from the suction port 42a to the blowout hole in the guide member 42 of the second blower 41 (Step S6).

[0073] Subsequently, the controlling section 25 turns on the lighting unit 65 (Step S7). With this action, the region around the concave portion 38 and the nozzle 61 is illuminated. However, the sequence of steps from Steps S4 to S7 can be suitably changed, and at least a part of Steps S4 to S7 can be performed simultaneously.

[0074] Next, the operator pulls the yarn 20 from the package 30 and introduces the first yarn end, which is the yarn end of the yarn 20 that has been pulled, into the second end part 61b of the nozzle 61 (Step S8). In the present embodiment, because the region around the concave portion 38 and the nozzle 61 is illuminated by the lighting unit 65, the operation of introducing the first yarn end into the second end part 61b becomes easier.

[0075] At Step S8, when the first yarn end is introduced into the second end part 61b, the first yarn end is blown off in the concave portion 38 from the first end part 61a of the nozzle 61 (Step S9). With this action, the first yarn end passes inside the concave portion 38 from the winding section 8 side to the yarn supplying section 6 side. The first yarn end passed over to the yarn supplying section 6 side at Step S9 is sucked from the suction port 42a and caught by the second blower 41 (Step S10).

[0076] After the first yarn end is caught, the air current that flows from the winding section 8 side to the yarn supplying section 6 side in the concave portion 38 is formed. A force by the action of the air current acts on the yarn 20 thereby causing the yarn 20 to slip out from the slit 61s of the nozzle 61, as indicated by a dotted line in FIG. 6. In the present embodiment, because the first end part 61a of the nozzle 61 has the stepped shape, and a part from which the yarn 20 slips out remains in the first end part 61a, the yarn 20 can easily slip out through the slit 61s even when the first end part 61a is in contact with the retractable member 48. With this configuration, it is possible to prevent tangling of the yarn 20 in the ring member 46 because of being flapped inside the slit 61s.

[0077] Moreover, at Step S8, if the winder unit 2 further includes an introducing device for introducing the first yarn end into the second end part 61b, instead of the operator introducing the first yarn end, the controlling section 25 can perform control on the introducing device to automatically introduce the first yarn end into the second end part 61b.

[0078] Next, the operator visually checks whether the first yarn end has been caught by the second blower 41, and if the first yarn end has been caught by the second blower 41, operates a not shown switch once again. Following the operation of the switch, the controlling section 25 pulls the yarn 20 from the package 30 by causing the traversing drum 24 to rotate in the opposite direction of the winding direction, and causes the second blower 41 to blow off the first yarn end toward the yarn joining device

13 side (Step S11). However, the visual check or the operation of the switch performed by the operator can be omitted, and Step S11 can be automatically executed subsequent to Step S10.

[0079] Subsequently, the controlling section 25 performs control on the yarn joining device 13 to join the first yarn end and the second yarn end (Step S12). However, before executing Step S12, the controlling section 25 causes the solenoid valve 54 to close, thereby blocking the supply of the compressed air to the nozzle 61. The controlling section 25 also causes the solenoid valve 55 to close, thereby blocking the supply of the compressed air to the guide member 42.

[0080] Then, the controlling section 25 performs control on the threader driving section 62 to retract the nozzle 61 from the second position toward the first position to separate the nozzle 61 from the yarn accumulating roller 32. The controlling section 25 also causes the yarn accumulating roller 32 to start the accumulation of the yarn 20 thereon by rotating the yarn accumulating roller 32 in the winding direction. In this manner, the winding of the yarn 20 by the winder unit 2 is restarted.

[0081] As explained above, in the winder unit 2, the concave portion 38 is formed in the area straddling the mounting position of the ring member 46 in the direction parallel to the rotation axis R in the outer peripheral surface 32a of the yarn accumulating roller 32. With this configuration, a yarn end can be easily passed through the radially inner side of the ring member 46 by passing the yarn end inside the concave portion 38 from a first side (a tip side) to a second side (a base side) in the direction parallel to the rotation axis R. Consequently, the operation performed at the time of starting winding of the yarn 20 on the yarn accumulating roller 32 can be simplified.

[0082] In the winder unit 2, because the concave portion 38 includes the groove portion that extends in the direction parallel to the rotation axis R, a yarn end can be easily passed through the radially inner side of the ring member 46, and the operation performed at the time of starting winding of the yarn 20 on the yarn accumulating roller 32 can be further simplified.

[0083] In the winder unit 2, the surface 51 is formed along the outer peripheral surface 32a of the yarn accumulating roller 32 at a position corresponding to the mounting position of the ring member 46 in the concave portion 38. Moreover, the retractable member 48 that is sinkable in the concave portion 38 so that the surface 51 thereof enters the concave portion 38 is arranged in the concave portion 38. With this configuration, because the retractable member 48 has the surface 51 that is at the same level as that of the outer peripheral surface 32a of the yarn accumulating roller 32 at the time of yarn winding, the tension applied by the ring member 46 on the yarn 20 that is pulled from the yarn accumulating roller 32 can be uniformly maintained in the circumferential direction. Moreover, because the retractable member 48 is sinkable so that the surface 51 enters the concave portion 38, by causing the retractable member 48 to sink at the time of starting winding of the yarn 20 on the yarn accumulating roller 32, the yarn end can be easily passed through the radially inner side of the ring member 46 via the concave portion 38.

[0084] In the winder unit 2, the outer peripheral surface 32a of the yarn accumulating roller 32 includes the accumulating area R1 on which the yarn 20 is wound and accumulated and the unwinding area R2 around which the ring member 46 is wound, and the concave portion 38 is arranged over the accumulating area R1 and the unwinding area R2. Therefore, the yarn end can be guided to the upstream side of the yarn accumulating roller 32 by passing the yarn end inside the concave portion 38. With this configuration, the operation performed at the time of starting winding of the yarn 20 on the yarn accumulating roller 32 can be further simplified.

[0085] In the winder unit 2, the ring member 46 is elastic and diametrically expandable. The circumferential length of the ring member 46 in the non-expanded state thereof is smaller than the circumferential length of the unwinding area R2. Moreover, the ring member 46 is wound around the yarn accumulating roller 32 in the diametrically expanded state. With this configuration, a predetermined tension can be applied on the yarn 20 being unwound.

[0086] The winder unit 2 further includes the threader 60 that blows the air from the winding section 8 side to the yarn supplying section 6 side inside the concave portion 38. Therefore, when the air is blown in the concave portion 38 by the threader 60, a yarn end can be blown off in the concave portion 38 and passed through the radially inner side of the ring member 46. With this configuration, the operation performed at the time of starting winding of the yarn 20 on the yarn accumulating roller 32 can be further simplified.

[0087] In the winder unit 2, the threader 60 includes the first end part 61a of the nozzle 61 as the pressing member that presses the retractable member 48 and causes it to sink into the concave portion 38 when blowing off the air in the concave portion 38. Therefore, for example, there is no need for the operator to manually press the retractable member 48 and cause it to sink into the concave portion 38. Accordingly, the operation performed at the time of starting winding of the yarn 20 on the yarn accumulating roller 32 can be further simplified.

[0088] In the winder unit 2, the controlling section 25 performs control on the roller driving motor 33 to rotate the yarn accumulating roller 32 up to the rotational position at which the threader 60 can blow the air in the concave portion 38 (Step S3). The controlling section 25 performs control on the threader driving section 62 to advance the threader 60 to a position near the yarn accumulating roller 32 and performs control on the first end part 61a of the nozzle 61 so as to press the retractable member 48 and cause it to sink into the concave section 38 (Step S4). The controlling section 25 causes the threader 60 to blow the air in the concave portion 38 (Step S9). In this manner, with cooperative functioning of the

threader 60, the roller driving motor (the roller driving section) 33, and the threader driving section 62, the operation of passing the first yarn end through the radially inner side of the ring member 46 can be automated. Consequently, the operation at the time of starting winding of the yarn 20 on the yarn accumulating roller 32 can be further simplified.

[0089] In the winder unit 2, when the threader 60 has blown off the first yarn end in the concave portion 38, the controlling section 25 performs control on the second blower 41 to catch and feed the first yarn end (Steps S10 and S11), and performs control on the yarn joining device 13 to join the first yarn end and the second yarn end, which is a yarn end of the yarn 20 from the yarn supplying section 6 side (Step S12). In this manner, with cooperative functioning of the yarn joining device 13 and the second blower 41, the operation of joining the blown first yarn end and the second yarn end can be automated. Consequently, the operation at the time of starting winding of the yarn 20 on the yarn accumulating roller 32 can be further simplified.

[0090] Exemplary embodiments of the present invention are explained above. The present invention, however, is not limited to the above embodiments.

[0091] In the above embodiments, a case in which the yarn 20 may break between the yarn accumulating section 18 and the winding section 8 during the yarn winding operation is explained as an example; however, the above embodiments can be applied to a case that requires changing a type of the yarn 20 (when changing a package). In other words, when changing the package, the package 30 is devoid of the yarn 20 and the yarn accumulating roller 32 is also devoid of the yarn 20. In this case, the operator cuts the yarn 20 between the package 30 and the yarn supplying bobbin 21, after directly winding on the package 30 approximately a few laps of the yarn 20 from the yarn supplying bobbin 21, for example. Next, by executing Steps S3 to S12, the first yarn end, which is a yarn end of the yarn 20 from the package 30 side, and the second yarn end, which is a yarn end of the yarn 20 from the yarn supplying section 6 side, can be joined by the yarn joining device 13. In this case, however, by operating the auxiliary blower 28, the first blower 11, and the first catching section 14, and the like in conjunction with each other, the second yarn end is caught by the first catching section 14 in parallel to executing Steps S3 to S12 explained above, or even before executing those steps.

[0092] The present embodiment can include, instead of the second blower 41, a movable yarn feeding section that conveys the first yarn end in a nipped state by moving to the second catching section 12.

[0093] In the above embodiments, the yarn supplying section 6 is not limited to the one that transports the yarn supplying bobbin 21 by mounting of the tray. That is, the yarn supplying section 6 can be a magazine-type bobbin feeder. In this configuration, when the bobbin feeder feeds a new yarn supplying bobbin 21 into the yarn supplying section 6, the bobbin feeder can pull the yarn end from the yarn supplying bobbin 21 and convey the yarn end to the first blower 11. The auxiliary blower 28 can be omitted in this case.

[0094] In the above embodiments, traversing of the yarn 20 is performed by the traversing drum 24 in the winding section 8. The winding section 8 is not limited to such a configuration. An arm-type or a belt-type traverse mechanism can be used for traversing the yarn 20. Moreover, in the above embodiments, the yarn 20 can be wound into a cheese-shaped package 30 or a cone-shaped package 30. The material and shape of various components explained above are not limited to those mentioned above, and it is possible to adopt various materials and shapes.

[0095] In the above embodiments, the concave portion 38 includes the groove portion that extends in the direction parallel to the rotation axis R from the first end to the second end of the yarn accumulating roller 32. However, the groove portion can extend in a direction that intersects the rotation axis R and can be arranged in a central part of the yarn accumulating roller 32. Moreover, the concave portion 38 can be arranged in a circular area and the like on the outer peripheral surface 32a of the yarn accumulating roller 32. In brief, the concave portion 38 can be arranged in any area as long as the area straddles the mounting position of the ring member 46 in the direction parallel to the rotation axis R.

[0096] In the above embodiments, because the retractable member 48 is mounted on the bottom surface 39 of the concave portion 38 via the spring member 49, the retractable member 48 can sink so that the surface 51 thereof enters the concave portion 38. However, the retractable member 48 can be made sinkable so that the surface 51 thereof enters the concave portion 38 by adopting another mechanism. For example, the retractable member 48 can be made of elastic material.

[0097] In the present embodiments, the first end part 61a of the nozzle 61 presses the retractable member 48 and causes it to sink into the concave portion 38; however, other mechanisms can be adopted to press the retractable member 48 and cause it to sink into the concave portion 38, or the operator can manually press the retractable member 48 and cause it to sink into the concave portion 38.

[0098] In the above embodiments, the threader 60 can be omitted. In this case, for example, the operator can manually pass the first yarn end inside the concave portion 38 to pass the first yarn end through the radially inner side of the ring member 46. Even in such a configuration, because of the presence of the concave portion 38, the first yarn end can be passed through the radially inner side of the ring member 46 more easily than the conventional configuration. Moreover, the retractable member 48 can be omitted.

[0099] In the above embodiments, a case in which the yarn end is passed from the tip side to the base side of the yarn accumulating roller 32 is cited as an example.

Depending on the configuration of the winder unit 2, it may be required to pass the yarn end from the base side to the tip side of the yarn accumulating roller 32. According to the present invention, even in such cases, the yarn end can be passed through the radially inner side of the ring member 46 more easily by passing the yarn end inside the concave portion 38 from the base side to the tip side of the yarn accumulating roller 32.

Claims

1. A yarn winding device (2) comprising:

a yarn supplying section (6) that supplies a yarn (20);
a yarn accumulating section (18) that pulls the yarn (20) from the yarn supplying section (6) and accumulates the yarn (20); and
a winding section (8) that winds the yarn (20) accumulated in the yarn accumulating section (18) and forms a package (30), wherein
the yarn accumulating section (18) includes

a yarn accumulating roller (32) for winding and accumulating on an outer peripheral surface (32a) thereof the yarn (20) pulled from the yarn supplying section (6) by rotating around a rotation axis (R), and
a ring member (46) adapted to contact with and apply resistance to the yarn (20) when the yarn (20) on the outer peripheral surface (32a) of the yarn accumulating roller (32) is pulled from the yarn accumulating roller (32) by the winding section (8), **characterized in that**
a concave portion (38) is formed in the outer peripheral surface (32a) of the yarn accumulating roller (32) in an area straddling a mounting position of the ring member (46) in a direction parallel to the rotation axis (R).

2. The yarn winding device (2) as claimed in Claim 1, **characterized in that** the concave portion (38) includes a groove portion that extends in a direction parallel to the rotation axis (R).

3. The yarn winding device (2) as claimed in Claims 1 or 2, **characterized in that** a retractable member (48) is arranged at a position corresponding to the mounting position of the ring member (46) inside the concave portion (38), the retractable member (48) has a surface at a same level as the outer peripheral surface (32a) of the yarn accumulating roller (32), and the retractable member (48) is capable of sinking in the concave portion (38) so that the surface enters the concave portion (38).

4. The yarn winding device (2) as claimed in any one of Claims 1 to 3, **characterized in that**
the outer peripheral surface (32a) of the yarn accumulating roller (32) includes an accumulating area (R1) on which the yarn (20) is wound and accumulated and an unwinding area (R2) around which the ring member (46) is wound, and
the concave portion (38) is arranged in both the accumulating area (R1) and the unwinding area (R2).

5. The yarn winding device (2) as claimed in Claim 4, **characterized in that**
the ring member (46) is elastic and diametrically expandable,
a circumferential length of the ring member (46) in a non-expanded state thereof is smaller than a circumferential length of the unwinding area (R2), and
the ring member (46) is wound around the yarn accumulating roller (32) in an expanded state.

6. The yarn winding device (2) as claimed in any one of Claims 1 to 5 further **characterized by** comprising a threader (60) that blows air inside the concave portion (38) from the winding section (8) side to the yarn supplying section (6) side.

7. The yarn winding device (2) as claimed in Claim 6, **characterized in that**
at the position corresponding to the mounting position of the ring member (46) inside the concave portion (38), a retractable member (48) having a surface along the outer peripheral surface (32a) of the yarn accumulating roller (32) and sinkable so that the surface enters the concave portion (38) is arranged, and
the threader (60) includes a pressing member (61a) that presses the retractable member (48) and causes it to sink into the concave portion (38) when blowing the air in the concave portion (38).

8. The yarn winding device (2) as claimed in Claim 7 further **characterized by** comprising:

a roller driving section (33) adapted to rotate the yarn accumulating roller (32);
a threader driving section (62) adapted to cause the threader (60) to approach toward / retract from the yarn accumulating roller (32); and
a first controlling section (25) adapted to control operations of the threader (60), the roller driving section (33), and the threader driving section (62), wherein
the first controlling section (25)

is adapted to control the roller driving section (33) to rotate the yarn accumulating roller (32) up to a rotational position at which the threader (60) can blow the air in the concave portion (38),

is adapted to control the threader driving section (62) to advance the threader (60) toward the yarn accumulating roller (32), and is adapted to control the pressing member (61a) to press the retractable member (48) and cause it to sink into the concave portion (38), and
is adapted to control the threader (60) to blow the air in the concave portion (38).

9. The yarn winding device (2) as claimed in any one of Claims 6 to 8, **characterized in that**
the threader (60) is adapted to blow off a first yarn end, which is a yarn end of a yarn that has been wound around the package (30), in the concave portion (38) by blowing the air in the concave portion (38),
the yarn winding device (2) further comprising:

a yarn joining device (13) adapted to join a disconnected yarn;
a yarn feeding section (41) is adapted to catch the first yarn end blown off in the concave portion (38) by the threader (60) and feeds the caught first yarn end to the yarn joining device (13) side; and
a second controlling section (25) is adapted to control operations of the yarn joining device (13) and the yarn feeding section (41), wherein

the second controlling section (25)

when the threader (60) has blown off the first yarn end in the concave portion (38), is adapted to control the yarn feeding section (41) to catch the first yarn end and feed it to the yarn joining device (13) side, and
is adapted to control the yarn joining device (13) to join the first yarn end with a second yarn end, which is a yarn end of a yarn on the yarn supplying section (6) side.

10. The yarn winding device (2) as claimed in any one of Claims 1 to 9, **characterized in that** the yarn supplying section (6) supports a yarn supplying bobbin (21).

Patentansprüche

1. Garnwickelvorrichtung (2), welche aufweist:

einen Garnzuführabschnitt (6), der ein Garn (20) zuführt;
einen Garnspeicherabschnitt (18), der das Garn (20) von dem Garnzuführabschnitt (6) zieht und das Garn (20) speichert;
einen Wickelabschnitt (8), der das in dem Garnspeicherabschnitt (8) gespeicherte Garn (20) aufwickelt und eine Packung (30) bildet, wobei der Garnspeicherabschnitt (18) enthält:

eine Garnspeicherrolle (32), um auf deren Außenumfangsfläche (32a) das von dem Garnzuführabschnitt (6) abgezogene Garn (20) durch Drehung um eine Drehachse (R) zu wickeln und zu speichern, und
ein Ringelement (46), das zum Kontakt mit dem und zur Widerstandsausübung auf das Garn (20) ausgelegt ist, wenn das Garn (20) auf der Außenumfangsfläche (32a) der Garnspeicherrolle (32) von der Garnspeicherrolle (32) durch den Wickelabschnitt (8) abgezogen wird, **dadurch gekennzeichnet, dass**
ein konkaver Abschnitt (38) in der Außenumfangsfläche (32a) der Garnspeicherrolle (32) in einem eine Montageposition des Ringelements (46) überspannenden Bereich in Richtung parallel zur Drehachse (R) ausgebildet ist.

2. Die Garnwickelvorrichtung (2) nach Anspruch 1, **dadurch gekennzeichnet, dass** der konkave Abschnitt (38) einen Nutabschnitt enthält, der sich in Richtung parallel zur Drehachse (R) erstreckt.

3. Die Garnwickelvorrichtung (2) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** ein einziehbares Element (48) an einer der Montageposition des Ringelements (46) entsprechenden Position innerhalb des konkaven Abschnitts (38) angeordnet ist, wobei das einziehbare Element (48) eine Oberfläche auf gleicher Höhe wie die Außenumfangsfläche (32a) der Garnspeicherrolle (32) aufweist, und das einziehbare Element (48) in dem konkaven Abschnitt (28) versenkbar ist, so dass die Oberfläche in den konkaven Abschnitt (38) eintritt.

4. Die Garnwickelvorrichtung (2) nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass**
die Außenumfangsfläche (32a) der Garnspeicherrolle (32) einen Speicherbereich (R1) enthält, auf dem das Garn gewickelt und gespeichert wird, sowie einen Abwickelbereich (R2), um den das Ringelement (46) herum gewickelt ist, und
der konkave Abschnitt (38) in sowohl dem Speicherbereich (R1) auch als dem Abwickelbereich (R2) angeordnet ist.

5. Die Garnwickelvorrichtung (2) nach Anspruch 4, **dadurch gekennzeichnet, dass**
das Ringelement (46) elastisch und diametral dehnbar ist,
eine Umfangslänge des Ringelements (46) in dessen nicht gedehntem Zustand kleiner ist als eine Um-

fangslänge des Abwickelbereichs (R2), und
das Ringelement (46) im gedehnten Zustand um die Garnspeicherrolle (32) herum gewickelt ist.

6. Die Garnwickelvorrichtung (2) nach einem der Ansprüche 1 bis 5, die ferner **dadurch gekennzeichnet ist, dass** sie einen Einfädler (60) aufweist, der Luft in dem konkaven Abschnitt (38) von der Wickelabschnitt (8)-Seite zur Garnzuführabschnitt (6)-Seite bläst.

7. Die Garnwickelvorrichtung (2) nach Anspruch 6, **dadurch gekennzeichnet, dass**
an der der Montageposition des Ringelements (46) entsprechenden Position innerhalb des konkaven Abschnitts (38) ein einziehbares Element (48) angeordnet ist, das eine Oberfläche entlang der Außenumfangsfläche (32a) der Garnspeicherrolle (32) aufweist und versenkbar ist, so dass die Oberfläche in den konkaven Abschnitt (38) eintritt, und
der Einfädler (60) ein Druckelement (61a) enthält, das auf das einziehbare Element (48) drückt und bewirkt, dass es in den konkaven Abschnitt (38) einsinkt, wenn die Luft in den konkaven Abschnitt (38) geblasen wird.

8. Die Garnwickelvorrichtung (2) nach Anspruch 7, welche ferner **dadurch gekennzeichnet, dass** sie aufweist:

einen Rollenantriebsabschnitt (33), der dazu ausgelegt ist, die Garnspeicherrolle (32) zu drehen;
einen Einfädlerantriebsabschnitt (62), der dazu ausgelegt ist, zu bewirken, dass sich der Einfädler (60) zu der Garnspeicherrolle (32) hin annähert / sich von dieser zurückzieht; und
einen erste Steuerabschnitt (25), der dazu ausgelegt ist, den Betrieb des Einfädlers (60), des Rollenantriebsabschnitts (33) und des Einfädlerantriebsabschnitts (62) zu steuern, wobei
der erste Steuerabschnitt (25)

dazu ausgelegt ist, den Rollenantriebsabschnitt (33) anzusteuern, um die Garnspeicherrolle (32) bis zu einer Drehposition zu drehen, bei der der Einfädler (60) Luft in den konkaven Abschnitt (38) blasen kann,
dazu ausgelegt ist, den Einfädlerantriebsabschnitt (32) anzusteuern, um den Einfädler (60) zu der Garnspeicherrolle (32) hin auszufahren, und ausgelegt ist, um das Druckelement (61a) anzusteuern, um auf das einziehbare Element (48) zu drücken und zu bewirken, dass es in dem konkaven Abschnitt (38) einsinkt, und
dazu ausgelegt ist, den Einfädler (60) anzusteuern, um die Luft in den konkaven Abschnitt (38) zu blasen.

9. Die Garnwickelvorrichtung (2) nach einem der Ansprüche 6 bis 8, **dadurch gekennzeichnet, dass**
der Einfädler (60) dazu ausgelegt ist, in dem konkaven Abschnitt (38) ein erstes Garnende, das ein Garnende eines Garns ist, das um die Packung (30) gewickelt worden ist, durch Blasen der Luft in den konkaven Abschnitt (38) weg zu blasen,
wobei die Garnwickelvorrichtung (2) ferner aufweist:

eine Garnverbindungsvorrichtung (13), die dazu ausgelegt ist, ein getrenntes Garn zu verbinden;
einen Garnzuführabschnitt (41), der dazu ausgelegt ist, das erste Garnende, das in dem konkaven Abschnitt (38) durch den Einfädler (60) weggeblasen ist, aufzufangen und das aufgefangene erste Garnende zu der Garnverbindungsvorrichtung (13)-Seite hin zu fördern; und
einen zweiten Steuerabschnitt (25), der dazu ausgelegt ist, den Betrieb der Garnverbindungsvorrichtung (13) und des Garnzuführabschnitts (41) zu steuern, wobei

der zweite Steuerabschnitt (25)

wenn der Einfädler (60) das erste Garnende in dem konkaven Abschnitt (38) weggeblasen hat, dazu ausgelegt ist, den Garnzuführabschnitt (41) anzusteuern, um das erste Garnende aufzufangen und es zur Garnverbindungsvorrichtung (13)-Seite hin zu fördern; und
dazu ausgelegt ist, die Garnverbindungsvorrichtung (13) anzusteuern, um das erste Garnende mit einem zweiten Garnende zu verbinden, das ein Garnende eines Garns an der Garnzuführabschnitt (6)-Seite ist.

10. Die Garnwickelvorrichtung (2) nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass** der Garnzuführabschnitt (6) eine Garnzuführspule (21) trägt.

Revendications

1. Dispositif de bobinage de fil (2), comprenant:

une section d'alimentation de fil (6) qui fournit un fil (20) ;
une section d'accumulation de fil (18) qui tire le fil (20) de la section d'alimentation de fil (6) et accumule le fil (20) ; et
une section de bobinage (8) qui enroule le fil (20) accumulé dans la section d'accumulation de fil (18) et forme un paquet (30),
où
la section d'accumulation de fil (18) comprend

un rouleau d'accumulation de fil (32) pour enrouler et accumuler sur une surface extérieure périphérique (32a) de celui-ci le fil (20) tiré de la section d'alimentation de fil (6) en tournant autour d'un axe de rotation (R), et
un membre annulaire (46) adapté pour contacter le fil et pour appliquer de la résistance au fil (20) quand le fil (20) sur la surface extérieure périphérique (32a) du rouleau d'accumulation de fil (32) est tiré du rouleau d'accumulation de fil (32) par la section de bobinage (8), **caractérisé en ce que**
une partie concave (38) est formée dans la surface extérieure périphérique (32a) du rouleau d'accumulation de fil (32) dans une région chevauchant une position de montage du membre annulaire (46) dans un sens parallèle à l'axe de rotation (R).

2. Dispositif de bobinage de fil (2) selon la revendication 1,
caractérisé en ce que la partie concave (38) comprend une partie de rainure qui s'étend dans un sens parallèle à l'axe de rotation (R).

3. Dispositif de bobinage de fil (2) selon les revendications 1 ou 2,
caractérisé en ce qu'un membre rétractable (48) est arrangé à une position correspondant à la position de montage du membre annulaire (46) dans la partie concave (38), le membre rétractable a une surface au même niveau que la surface extérieure périphérique (32a) du rouleau d'accumulation de fil (32) et le membre rétractable (48) est capable de plonger dans la partie concave (38) de sorte que la surface entre dans la partie concave (38).

4. Dispositif de bobinage de fil (2) selon une des revendications 1 à 3,
caractérisé en ce que
la surface extérieure périphérique (32a) du rouleau d'accumulation de fil (32) comprend une région d'accumulation (R1) sur laquelle le fil est enroulé et accumulé et une région de déroulement (R2) autour de laquelle le membre annulaire (46) est enroulé, et la partie concave (38) est arrangée dans la région d'accumulation (R1) et dans la région de déroulement (R2).

5. Dispositif de bobinage de fil (2) selon la revendication 4,
caractérisé en ce que
le membre annulaire (46) est élastique et extensible de manière diamétrique, une longueur circonférentielle du membre annulaire (46) dans une condition non étendue de celui-ci est plus petite qu'une longueur circonférentielle de la région de déroulement (R2), et
le membre annulaire (46) est enroulé autour du rouleau d'accumulation de fil (32) dans une condition étendue.

6. Dispositif de bobinage de fil (2) selon une des revendications 1 à 5,
caractérisé en outre en ce qu'il comprend un enfile (60) qui souffle de l'air dans la portion concave (38) du côté section de bobinage (8) vers le côté section d'alimentation de fil (6).

7. Dispositif de bobinage de fil (2) selon la revendication 6,
caractérisé en ce que
à la position correspondant à la position de montage du membre annulaire (46) dans la partie concave (38), un membre rétractable (48) ayant une surface le long de la surface extérieure périphérique (32a) du rouleau d'accumulation de fil (32) et plongeable de sorte que la surface entre dans la partie concave (38) est arrangé, et l'enfile (60) comprend un membre presseur (61a) qui presse le membre rétractable (48) et fait qu'il plonge dans la partie concave (38) quand l'air est soufflée dans la partie concave (38).

8. Dispositif de bobinage de fil (2) selon la revendication 7, **caractérisé en outre en ce qu'**il comprend :

une section d'entraînement de rouleau (33) adaptée pour tourner le rouleau d'accumulation de fil (32),
une section d'entraînement d'enfile (62) adaptée pour faire que l'enfile (60) s'approche du/s'éloigne du rouleau d'accumulation de fil (32) ; et
une première section de contrôle (25) adaptée pour contrôler les opérations de l'enfile (60), la section d'entraînement de rouleau (33) et la section d'entraînement d'enfile (62), où
la première section de contrôle (25)
est adaptée pour contrôler la section d'entraînement de rouleau (33) pour tourner le rouleau d'accumulation de fil (32) jusqu'à une position rotative où l'enfile (60) peut souffler l'air dans la partie concave (38),
est adaptée pour contrôler la section d'entraînement d'enfile (62) pour avancer l'enfile (60) envers le rouleau d'accumulation de fil (32), et est adaptée pour contrôler le membre presseur (61a) pour presser le membre rétractable (48) et pour faire qu'il plonge dans la partie concave (38), et
est adaptée pour contrôler l'enfile (60) pour souffler l'air dans la partie concave (38).

9. Dispositif de bobinage de fil (2) selon une des revendications 6 à 8,
caractérisé en ce que

l'enfile (60) est adapté pour enlever en soufflant une première extrémité de fil qui est une extrémité de fil d'un fil qui a été enroulé autour du paquet (30), dans la partie concave (38), en soufflant l'air dans la partie concave (38),
le dispositif de bobinage de fil (2) comprenant en outre :

un dispositif de liaison de fil (13) adapté pour lier un fil déconnecté ;
une section d'alimentation de fil (41) est adaptée pour attraper la première extrémité du fil enlevée en soufflant dans la partie concave (38) par l'enfile (60) et
guide la première extrémité de fil attrapée vers le côté dispositif de liaison de fil (13) ; et
une deuxième section de contrôle (25) est adaptée pour contrôler les opérations du dispositif de liaison de fil (13) et la section d'alimentation de fil (41), où la deuxième section de contrôle (25) quand l'enfile (60) a enlevé en soufflant la première extrémité de fil dans la partie concave (38), est adaptée pour contrôler la section d'alimentation de fil (41) pour attraper la première extrémité de fil et pour fournir cette extrémité au côté dispositif de liaison de fil (13), et
est adapté pour contrôler le dispositif de liaison de fil (13) pour lier la première extrémité de fil à une deuxième extrémité de fil, qui est une extrémité de fil d'un fil sur le côté section d'alimentation de fil (6).

10. Dispositif de bobinage de fil (2) selon une des revendications 1 à 9, **caractérisé en ce que** la section d'alimentation de fil (6) supporte une bobine de bobinage de fil (21).

FIG.1

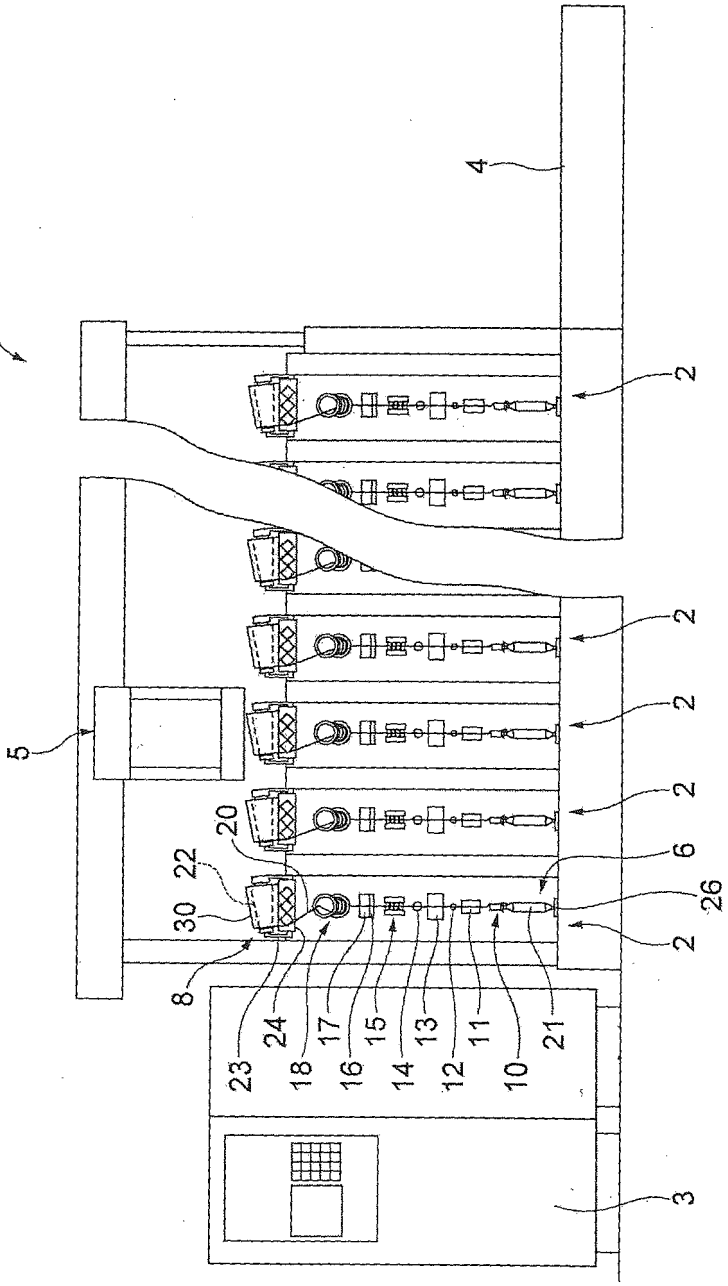


FIG.2

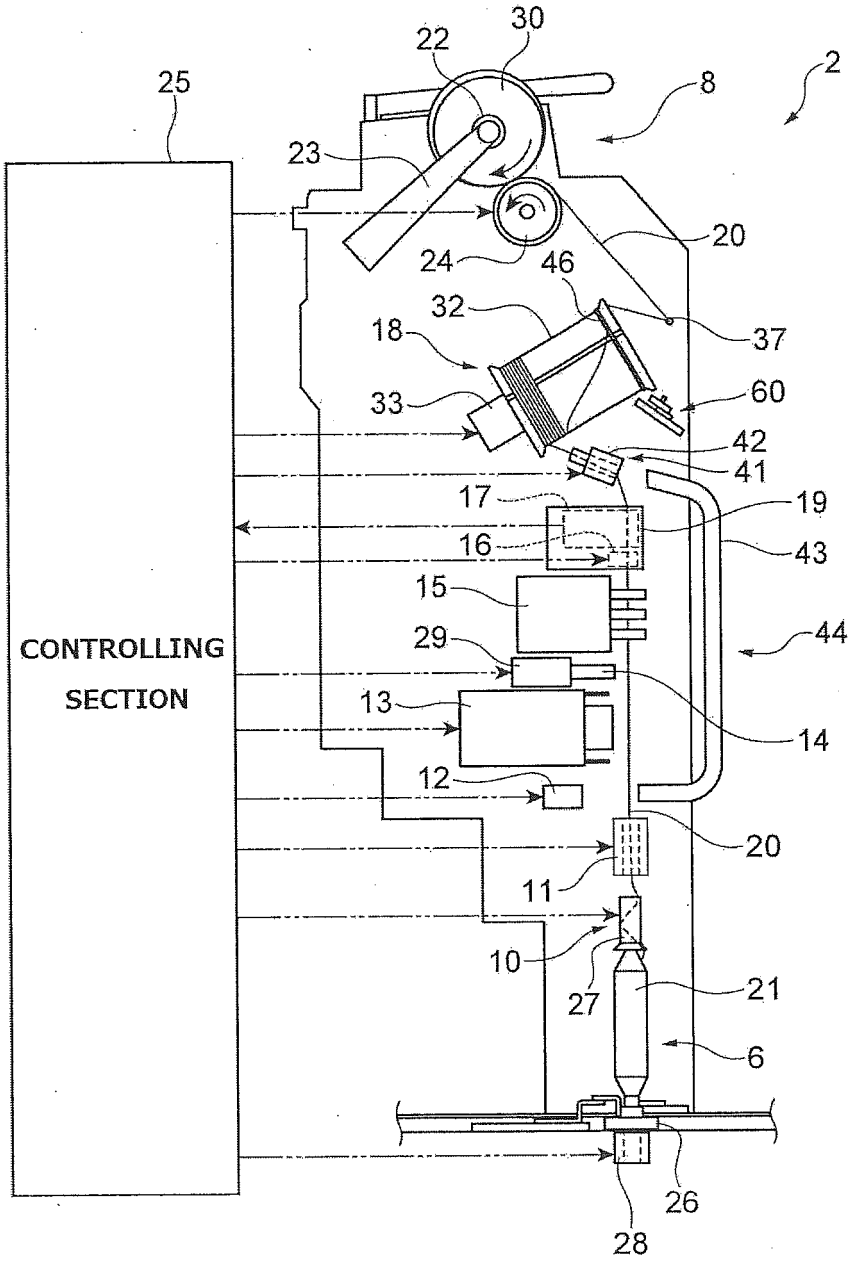

CONTROLLING SECTION
25
22
30
8
2
23
20
24
46
32
37
18
60
33
42
41
17
19
16
43
15
44
29
13
14
12
20
11
10
27
21
6
26
28

FIG.3

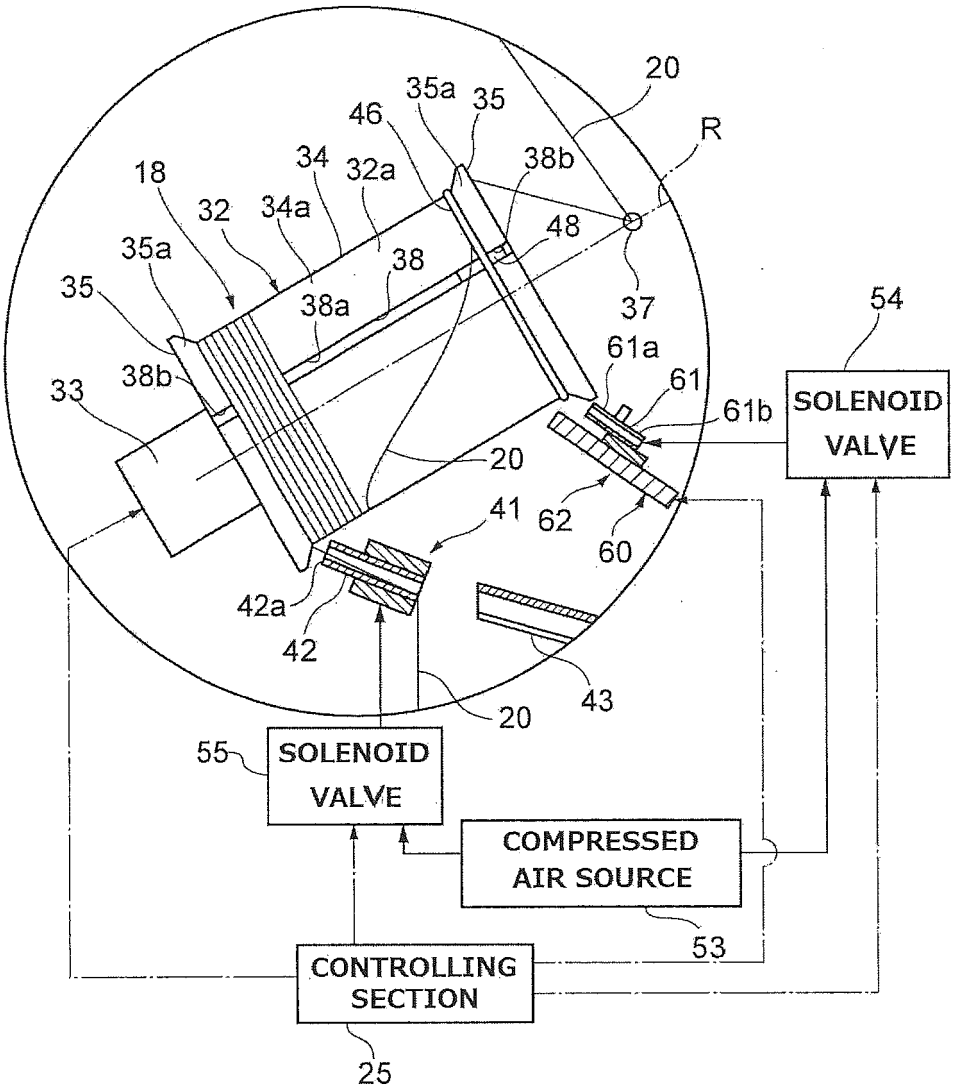

20
35a
35
46
R
34
32a
38b
18
32
34a
48
35a
38
35
38a
37
54
61a
38b
61
33
61b
SOLENOID VALVE
20
41
62
60
42a
42
43
20
55
SOLENOID VALVE
COMPRESSED AIR SOURCE
53
CONTROLLING SECTION
25

FIG.4

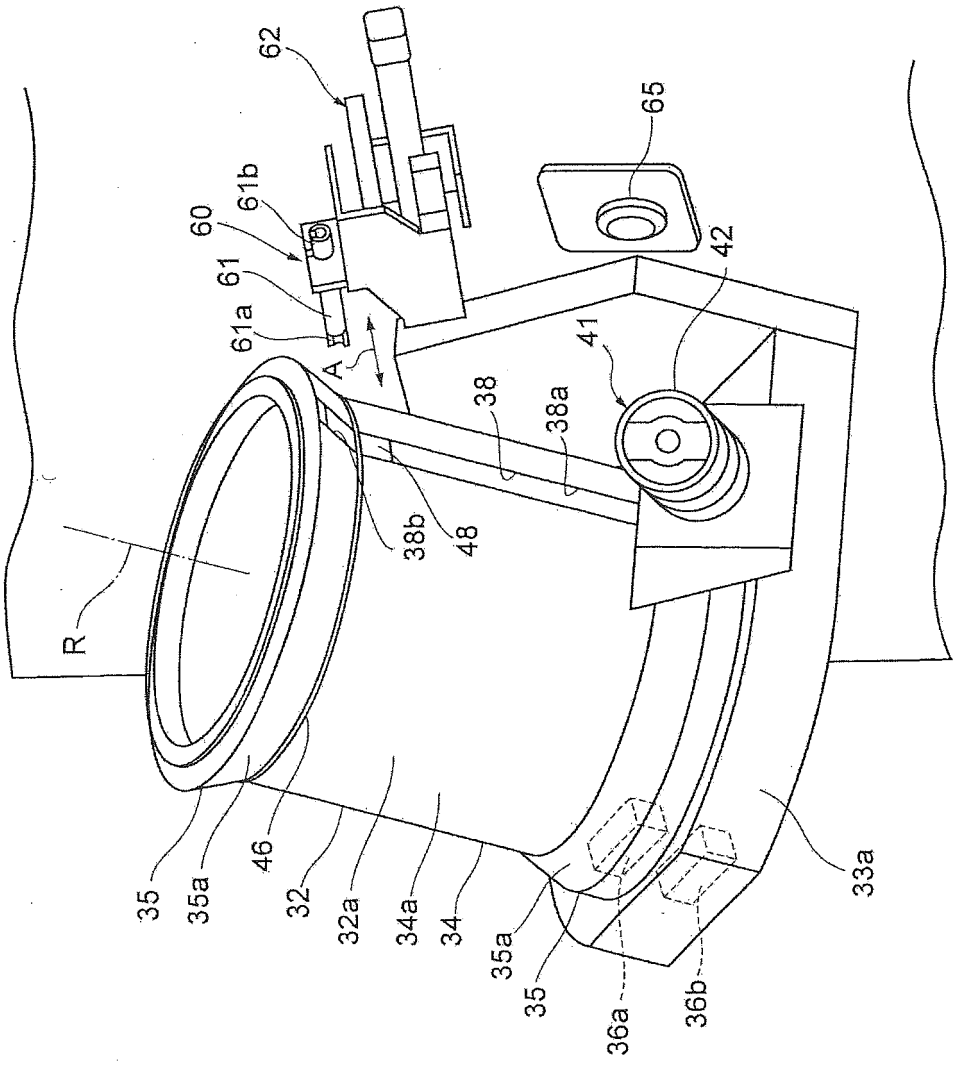

62
65
60
61b
61
61a
A
42
41
38
38a
38b
48
R
35
35a
46
32
32a
34a
34
35a
35
36a
36b
33a

FIG.5

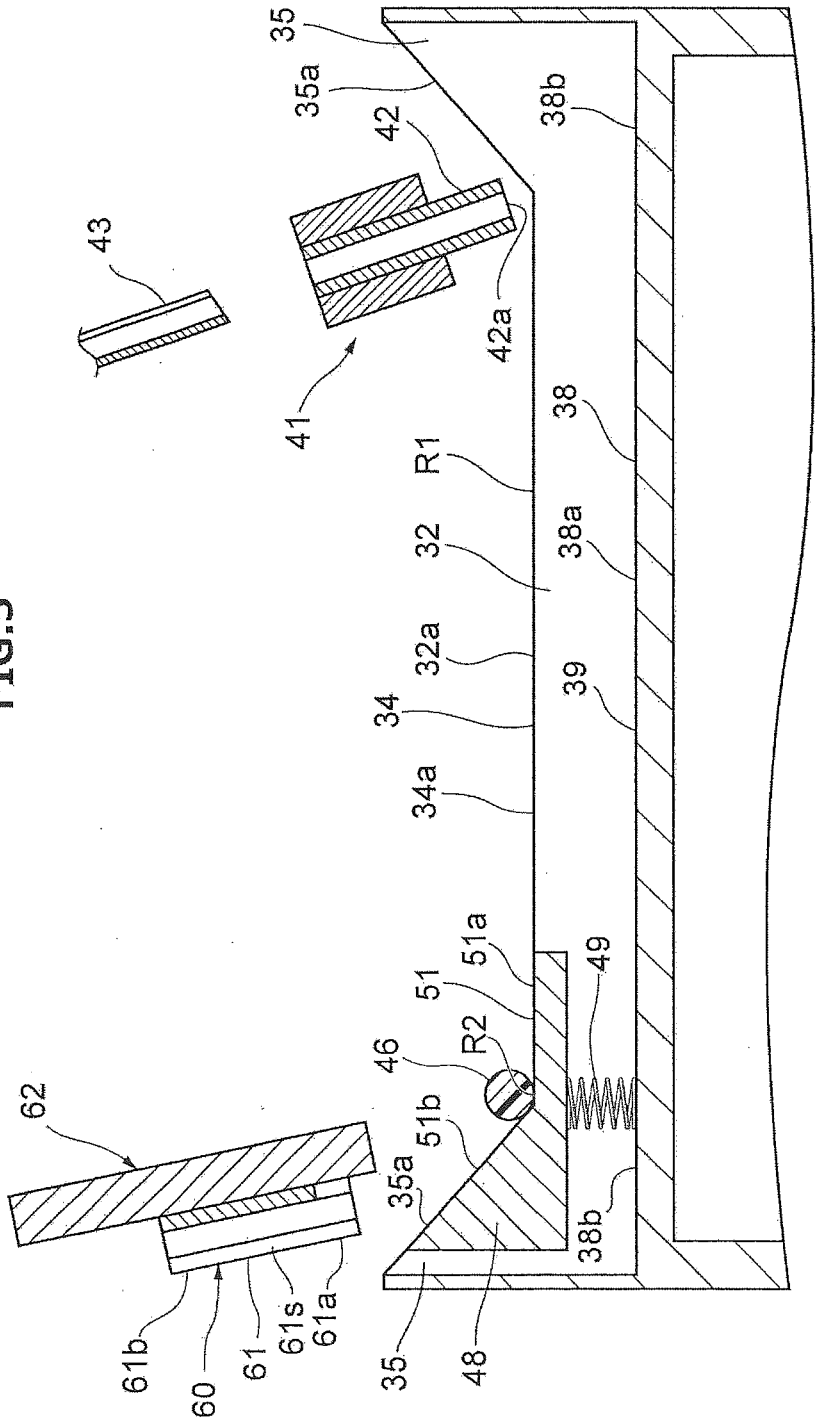

35
35a
42
38b
43
42a
41
38
R1
32
38a
32a
39
34
34a
51a
49
51
R2
46
62
51b
35a
38b
61b
60
61
61s
61a
35
48

FIG.6

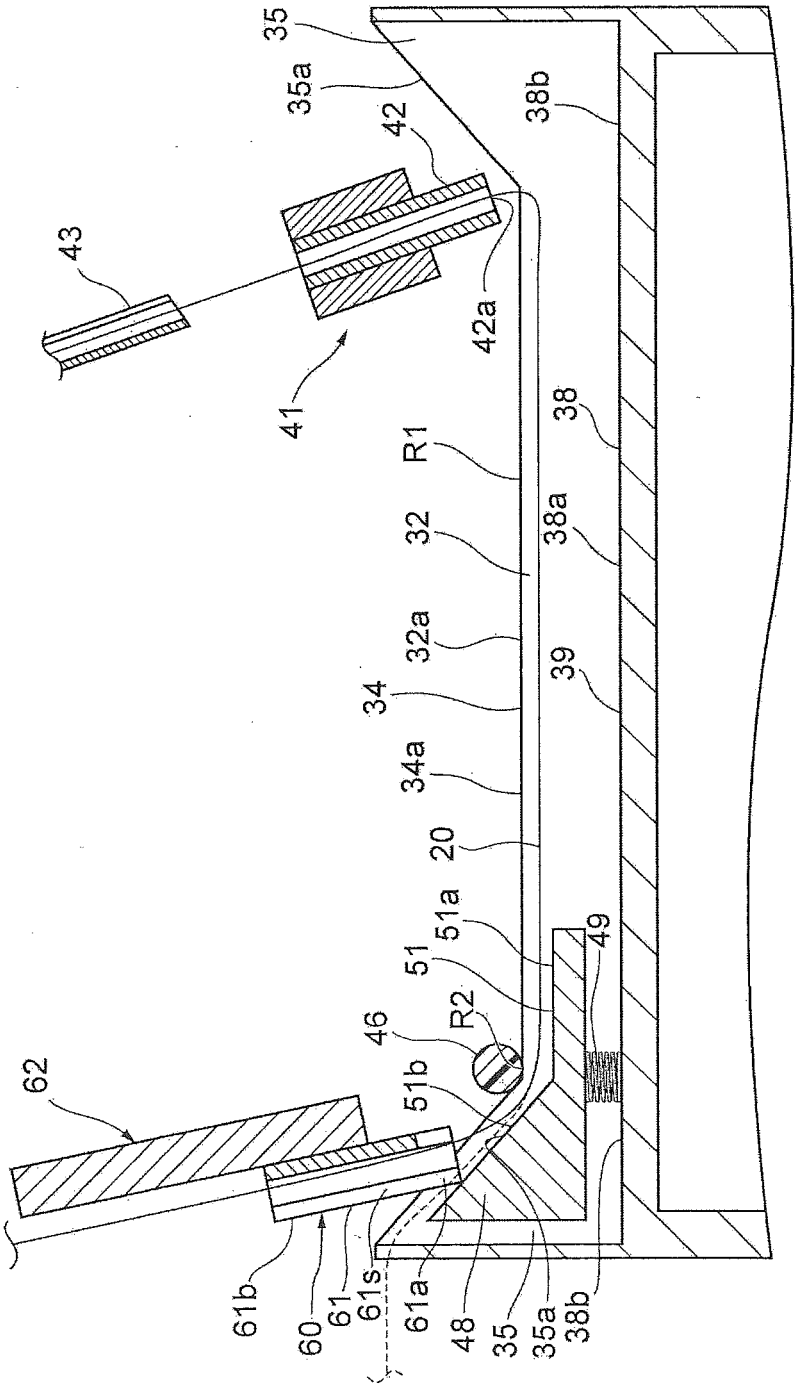
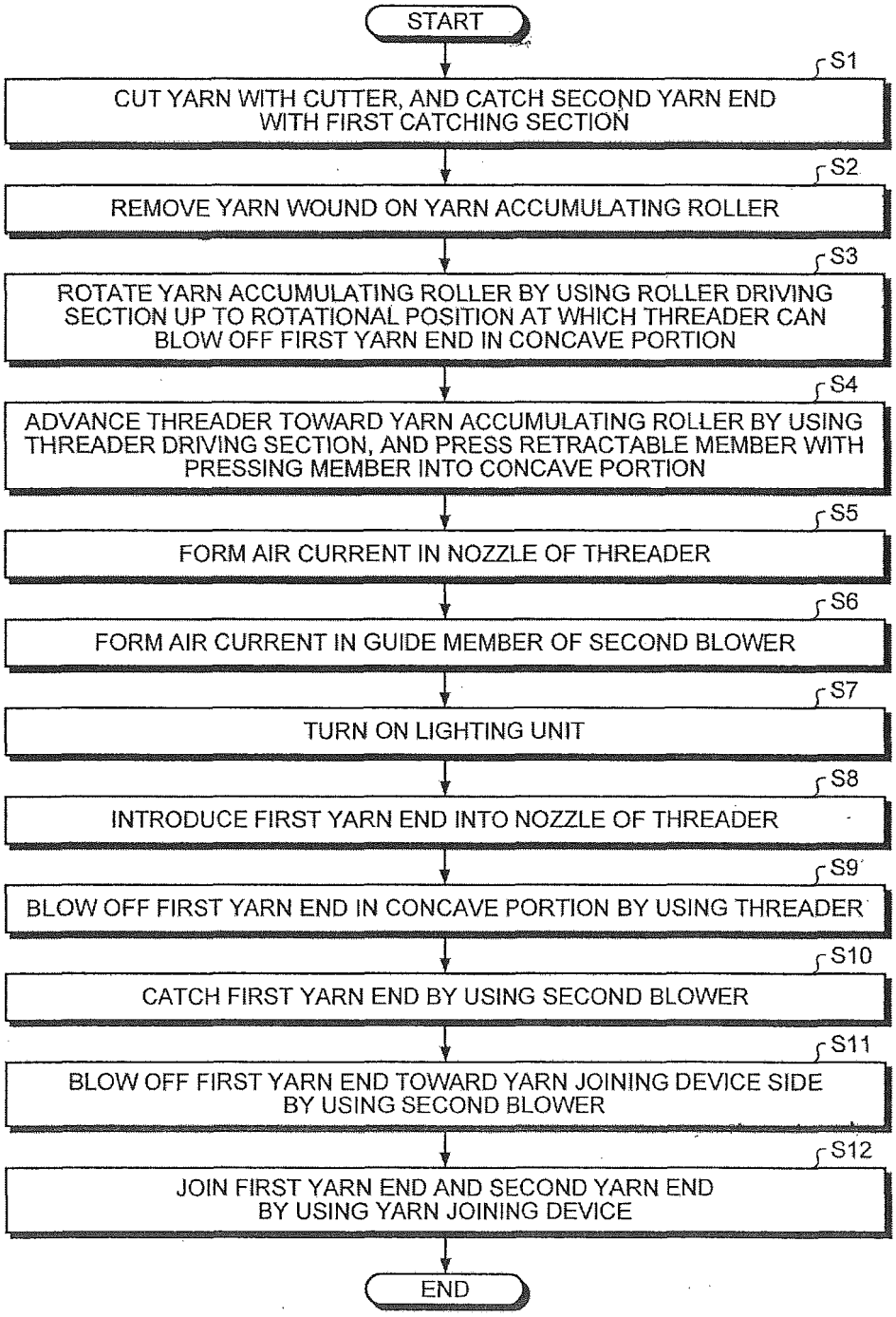

35
35a
42
38b
43
42a
41
R1
38
32
38a
32a
39
34
34a
20
51a
51
49
R2
46
62
51b
61b
60
61
61s
61a
48
35
35a
38b

FIG.7


START
S1
CUT YARN WITH CUTTER, AND CATCH SECOND YARN END WITH FIRST CATCHING SECTION
S2
REMOVE YARN WOUND ON YARN ACCUMULATING ROLLER
S3
ROTATE YARN ACCUMULATING ROLLER BY USING ROLLER DRIVING SECTION UP TO ROTATIONAL POSITION AT WHICH THREADER CAN BLOW OFF FIRST YARN END IN CONCAVE PORTION
S4
ADVANCE THREADER TOWARD YARN ACCUMULATING ROLLER BY USING THREADER DRIVING SECTION, AND PRESS RETRACTABLE MEMBER WITH PRESSING MEMBER INTO CONCAVE PORTION
S5
FORM AIR CURRENT IN NOZZLE OF THREADER
S6
FORM AIR CURRENT IN GUIDE MEMBER OF SECOND BLOWER
S7
TURN ON LIGHTING UNIT
S8
INTRODUCE FIRST YARN END INTO NOZZLE OF THREADER
S9
BLOW OFF FIRST YARN END IN CONCAVE PORTION BY USING THREADER
S10
CATCH FIRST YARN END BY USING SECOND BLOWER
S11
BLOW OFF FIRST YARN END TOWARD YARN JOINING DEVICE SIDE BY USING SECOND BLOWER
S12
JOIN FIRST YARN END AND SECOND YARN END BY USING YARN JOINING DEVICE
END

REFERENCES CITED IN THE DESCRIPTION

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