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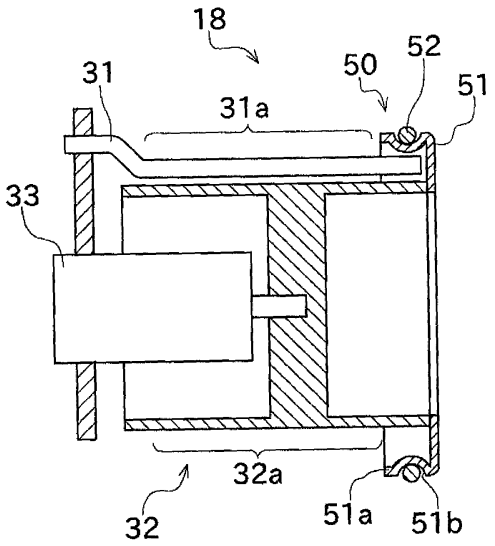
(54) YARN STORAGE DRAWER DEVICE AND YARN WINDER

(57) An object of the invention is to provide a yarn accumulation pull-out device that is able to prevent occurrence of a disorder of an accumulated yarn. A yarn accumulation pull-out device (5) includes a yarn accumulation device (18) and a winding part (8). The yarn accumulation device (18) includes a yarn accumulation roller (32) having a first yarn contact portion (32a), and a yarn stretching member (31) having a second yarn contact portion (31a) and arranged in a direction along a rotation axis of the yarn accumulation roller (32). The yarn accumulation device (18) accumulates a yarn such that the yarn is alternately wound on the first yarn contact portion (32a) and the second yarn contact portion (31a) so as to stretch therebetween. The winding part (8) unwinds a yarn accumulated on the yarn accumulation device (18) by pulling out the yarn in a direction of the rotation axis of the yarn accumulation roller (32).

Fig.4



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Description

TECHNICAL FIELD

[0001] The present invention relates mainly to a configuration of a yarn accumulation pull-out device included in a yarn winding machine.

BACKGROUND ART

[0002] In a spinning machine, a yarn accumulation device that accumulates a yarn by winding the yarn on a yarn accumulator (yam accumulation roller) is known (for example, Patent Document 1).

[0003] In the following, an example of the conventional yarn accumulation device will be briefly described with reference to FIGS. 11 and 12. As shown in FIG. 11, a conventional yarn accumulation device 100 is configured such that a yarn 20 is wound in a spiral shape and accumulated on an outer circumferential surface of a yarn accumulation roller 101. By a roller drive motor 102, yarn accumulation roller 101 is driven in rotation around the axial line thereof which serves as a rotation axis. Driving the yarn accumulation roller 101 into rotation under a state where the yarn is wound on the yarn accumulation roller 101 enables an upstream-side yarn 20a to be sequentially wound onto the outer circumferential surface of the yarn accumulation roller 101.

[0004] The newly coming yarn 20a is wound while pushing away the yarn 20 that is already wound on the yarn accumulation roller 101. The yarn 20 that is pushed away accordingly pushes the yarn 20 located adjacent thereto. In this manner, the yarn 20 existing on the yarn accumulation roller 101 is, while windings thereof are pushing one another, sequentially moved to the side (in FIG. 11, the right side) opposite to the side where the new yarn 20a is wound. In the following description, with respect to the axial direction of the yarn accumulation roller 101, the side (in FIG. 11, the left side) where the yarn is newly wound will be called a proximal end side, and the opposite side (in FIG. 11, the right side) will be called an unwinding side. The outer circumferential surface of the conventional yarn accumulation roller 101 has, in a portion thereof where the yarn 20 is to be wound, a small taper whose diameter decreases toward the unwinding side, in order to facilitate the movement of the yarn 20 toward the unwinding side. In FIG. 11, for convenience of the illustration, there are spaces between the windings of the yarn 20 on the yarn accumulation roller 101. Actually, however, the yarn windings push one another as described above, and thereby the yarn is densely wound on the yarn accumulation roller 101.

[0005] On the other hand, Patent Document 2 discloses a configuration in which a yarn accumulation device is mounted to an automatic winder to thereby prevent interruption of winding of a yarn into a package at a time of yarn joining or at a time of replacing a yarn supply bobbin. Thus, even in a case where a supply of the yarn from the yarn supply bobbin is temporarily stopped at a time of, for example, yarn joining or replacing the yarn supply bobbin, a certain amount of yarn is still accumulated on the yarn accumulation device. Therefore, by winding this yarn existing on the yarn accumulation device, the winding of the yarn on the package can be continued. The yarn accumulation device provided in Patent Document 2 has a configuration different from that of the yarn accumulation device shown in FIG. 11, but is common to the yarn accumulation device shown in FIG. 11 in terms of winding and accumulating the yarn on a circumference of a yarn accumulator (accumulation part).

PRIOR-ART DOCUMENTS

PATENT DOCUMENTS

[0006] Patent Document 1: Japanese Patent Application Laid-Open No. 2010-77576 Patent Document 2: Japanese Patent Application Laid-Open No. 2009-242042

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0007] In the conventional yarn accumulation device 100 as shown in FIG. 11, the yarn 20 is wound on the yarn accumulation roller 101 in such a manner that the yarn 20 squeezes the outer circumferential surface of the yarn accumulation roller 101 in the circumferential direction as shown in FIG. 12. Since the yarn 20 squeezes the yarn accumulation roller 101, the yarn 20 existing on a surface of the yarn accumulation roller 101 is not naturally loosened.

[0008] Here, in the yarn accumulation device 100 shown in FIG. 11, when the speed of rotation of the yarn accumulation roller 101 changes or when the tension of a yarn fluctuates at the upstream side of the yarn accumulation roller 101, the tension of the yarn 20a that is newly wound onto the yarn accumulation roller 101 fluctuates. In a case where the wound yarn 20a has a high tension, the yarn 20a is tightly wound on the yarn accumulation roller 101. In a case where the wound yarn 20a has a low tension, the yarn 20a is loosely wound on the yarn accumulation roller 101. In the conventional yarn accumulation device 100, the yarn existing on the yarn accumulation roller 101 is not loosened. Therefore, a portion tightly wound on the yarn accumulation roller 101 (a portion wound with a high tension) remains tightly wound, while a portion loosely wound thereon (a portion with a low tension) remains loosely wound.

[0009] When the tightly wound portion and the loosely wound portion are mixed on the yarn accumulation roller 101 in this manner, a disorder of the yarn 20 is likely to occur on the yarn accumulation roller 101. A state where the yarn 20 is regularly wound in a spiral shape is considered as a state where the yarn 20 is not disordered. Accordingly, a state where the yarn 20 is disordered

means a state where, for example, a part of the above-mentioned spiral overlaps another part thereof or the pitch of the spiral is irregular.

[0010] For example, in a case where the tightly wound portion and the loosely wound portion are mixed on the yarn accumulation roller 101, the tightly wound yarn portion gets under the loosely wound yarn when adjacent portions of the yarn 20 push each other. This causes a disorder because the portions of the yarn 20 overlap each other.

[0011] Occurrence of a disorder of the yarn 20 wound on the yarn accumulation roller 101 may cause a slaffing (a phenomenon in which a mass of the yarn on the yarn accumulation roller 101 wholly falls off at one time) or a yarn breakage at a time of unwinding the yarn from the yarn accumulation device 100. Even when the slaffing or the yarn breakage does not occur, a disorder of the yarn 20 on the yarn accumulation roller 101 causes a non-uniform tension at a time of unwinding the yarn 20 from the yarn accumulation roller 101. Thus, a problem arises that it is difficult to appropriately control the tension at the downstream side of the yarn accumulation device 100.

[0012] The above-described yarn disorder is not so much of a problem in a case of a small-capacity yarn accumulation device (the yarn accumulation device disclosed in Patent Document 1) for use in a fine spinning machine. However, in an automatic winder, the speed of winding of the yarn is higher than in the fine spinning machine. Therefore, the speed of unwinding of the yarn from the yarn accumulation device is also higher. Accordingly, it is necessary that a yarn accumulation device provided in the automatic winder is configured to accumulate a larger amount of yarn as compared with the fine spinning machine. However, in the yarn accumulation device of the above-described type, the likelihood of occurrence of a disorder of a yarn wound on a yarn accumulator increases as the amount of accumulated yarn increases.

[0013] Therefore, for adaptation to the automatic winder, a yarn accumulation device has been demanded in which a disorder of an accumulated yarn is not likely to occur even when the amount of accumulated yarn increases.

[0014] The present invention has been made in view of the circumstances described above, and a primary object of the present invention is to provide a yarn accumulation pull-out device that is able to prevent occurrence of a disorder of an accumulated yarn.

MEANS FOR SOLVING THE PROBLEMS AND EFFECTS THEREOF

[0015] Problems to be solved by the present invention are as described above, and next, means for solving the problems and effects thereof will be described.

[0016] In an aspect of the present invention, a yarn accumulation pull-out device having the following configuration is provided. The yarn accumulation pull-out device includes a yarn accumulation device and a pull-out device. The yarn accumulation device includes a rotating element having a first yarn contact portion, and a yarn stretching member having a second yam contact portion and arranged in a direction along a rotation axis of the rotating element. The yarn accumulation device is configured to accumulate a yarn such that the yarn is alternately wound on the first yarn contact portion and the second yarn contact portion so as to stretch therebetween. The pull-out device is configured to unwind a yarn accumulated on the yarn accumulation device by pulling out the yarn in a direction of the rotation axis of the rotating element.

[0017] When the rotating element is rotated under a state where the yarn is alternately wound on the rotating element and the yarn stretching member so as to stretch therebetween, the yarn alternately passes the surface of the rotating element and the surface of the yarn stretching member. At this time, "stretching" and "loosening" are given to portions of the yarn located between the rotating element and the yarn stretching member. This enables the yarn to be accumulated with a constant tension and with a constant pitch.

[0018] In the yarn accumulation pull-out device described above, preferably, the second yarn contact portion is in parallel with the rotation axis of the rotating element.

[0019] This allows the yarn to stretch between the rotating element and the yarn stretching member with ease. Moreover, since the circumferential length of the yarn wound on the circumferences of the rotating element and the yarn stretching member is constant, loosening of the yarn can be prevented.

[0020] In the yarn accumulation pull-out device described above, preferably, the yarn stretching member is a rod-like member.

[0021] Making the yarn stretch between the rod-like member and the rotating element in this manner can successfully accumulate the yarn.

[0022] In the yarn accumulation pull-out device described above, preferably, a cross-section of the yarn stretching member as cut along a plane perpendicular to a longitudinal direction thereof has a circular shape.

[0023] Accordingly, in a portion of the yarn stretching member which is in contact with the yam, a surface of the yarn stretching member does not have an angular shape. This can prevent the yarn from being damaged.

[0024] In the yarn accumulation pull-out device described above, preferably, a rotation support portion is provided that supports the yarn stretching member such that the yarn stretching member is rotatable about the center of the circular cross-section.

[0025] Rotatably supporting the yarn stretching member in this manner can reduce a friction generated between the yarn and the yarn stretching member. Therefore, damage to the yarn can be reduced, and heat generation in the yarn stretching member and the yarn can be suppressed.

[0026] In the yarn accumulation pull-out device de-

scribed above, preferably, the rotation support portion includes a resistance applying part that gives a resistance to rotation of the yarn stretching member.

[0027] This can give a resistance to the yarn that is in contact with the yarn stretching member. Accordingly, a proper degree of "stretching" and "loosening" can be given to portions of the yarn located between the rotating element and the yarn stretching member.

[0028] The yarn accumulation pull-out device described above may be configured as follows. The rotation support portion includes a driving part that drives the yarn stretching member in rotation. The driving part sets a circumferential speed of the second yarn contact portion to be lower than a circumferential speed of the first yarn contact portion.

[0029] Rotating the yarn stretching member at a speed lower than the rotating element can give a resistance to the yarn that is in contact with the yarn stretching member. Accordingly, the "stretching" and "loosening" can be given to portions of the yarn located between the rotating element and the yarn stretching member. Since the driving part appropriately controls the speed of rotation of the yarn stretching member, the degree of the above-mentioned "stretching" and "loosening" can be adjusted. Therefore, the state of winding of the yam, the pitch of winding of the yarn, and the like, can be adjusted in accordance with winding conditions of the yarn and the type of the yarn.

[0030] The yarn accumulation pull-out device described above may be configured such that a yarn wound on circumferences of the rotating element and the yarn stretching member is unwound while being guided by a yarn guide that is arranged on an extension of the rotation axis of the rotating element.

[0031] In a yarn accumulation device configured to wind the yarn on the circumference of the rotating element, unwinding the yarn via the yarn guide arranged on an extension of the rotation axis undesirably generates a balloon so that the tension increases because the yarn is thrown around in a space between the yarn guide and the circumference of the rotating element. In this respect, the yarn accumulation device of the present invention is configured to wind the yarn on the circumferences of the yarn stretching member and the rotating element. Therefore, the trajectory of the yarn that is thrown around is not circular. As a result, the yarn is not thrown around so much, and generation of a balloon is suppressed. Thus, an increase in the tension can be prevented.

[0032] In the yarn accumulation pull-out device described above, the yarn stretching member may includes a plurality of yarn stretching members.

[0033] By changing the number of yarn stretching members, the number of times the "stretching" and "loosening" are given to the yarn can be changed, and accordingly the pitch of winding can be changed.

[0034] In the yarn accumulation pull-out device described above, preferably, the plurality of yarn stretching members are provided on an imaginary circle centered at the rotation axis of the rotating element.

[0035] Arranging the plurality of yarn stretching members at an equal distance from the rotating element can stabilize the unwinding of the yarn.

[0036] In the yarn accumulation pull-out device described above, preferably, the yarn stretching member includes three yarn stretching members.

[0037] Providing three yarn stretching members is preferable because it can particularly stabilize the unwinding of the yarn from the yarn accumulation device.

[0038] In the yarn accumulation pull-out device described above, preferably, in a cross-section along a plane perpendicular to the rotation axis of the rotating element, each of the three yarn stretching members is arranged at each of the vertices of an imaginary equilateral triangle.

[0039] Arranging the three yarn stretching members in the shape of an equilateral triangle can further stabilize the unwinding of the yarn.

[0040] In the yarn accumulation pull-out device described above, preferably, in a cross-section along a plane perpendicular to the rotation axis of the rotating element, a cross-section of the rotating element has a circular shape and the radius thereof is longer than the length of a perpendicular line extending from the center of gravity perpendicularly to each side of an imaginary triangle whose vertices are defined by the three yarn stretching members.

[0041] Arranging the yarn stretching members in this manner can bring the yarn into contact with the rotating element. Accordingly, the rotating element gives a conveying force to the yarn, and the yarn can be accumulated on the yarn accumulation device.

[0042] In another aspect of the present invention, a yarn winding machine having the following configuration is provided. The yarn winding machine includes the above-described yarn accumulation pull-out device and a yarn supply part that supplies a yarn. The yarn accumulation device is arranged between the yarn supply part and the pull-out device and configured to accumulate a yarn that is supplied from the yarn supply part. The pull-out device serves as a winding part that winds a yarn accumulated on the yarn accumulation device, to form a package.

[0043] The yarn winding machine forms the package by winding the yarn of the yarn accumulation device of the present invention in which the tension of unwinding is stable. Therefore, the package with a high quality can be formed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0044]

[FIG. 1] A side view of a winder unit provided in an automatic winder according to a first embodiment of the present invention.

[FIG. 2] A side view of a yarn accumulation device

according to the first embodiment of the present invention.

[FIG. 3] A schematic cross-sectional view of the yarn accumulation device according to the first embodiment, as sectioned along a plane perpendicular to a rotation axis of a yarn accumulation roller.

[FIG. 4] A side cross-sectional view of the yarn accumulation device according to the first embodiment.

[FIG. 5] A side view of a yarn accumulation device according to a modification of the first embodiment.

[FIG. 6] A side cross-sectional view of the yarn accumulation device according to the modification of the first embodiment.

[FIG. 7] A side cross-sectional view of a yarn accumulation device according to a second embodiment.

[FIG. 8] A schematic cross-sectional view of the yarn accumulation device according to the second embodiment, as sectioned along a plane perpendicular to a rotation axis of a yarn accumulation roller.

[FIG. 9] A schematic cross-sectional view of a yarn accumulation device according to a third embodiment, as sectioned along a plane perpendicular to a rotation axis of a yarn accumulation roller.

[FIG. 10] A schematic cross-sectional view of a yarn accumulation device according to a fourth embodiment, as sectioned along a plane perpendicular to a rotation axis of a yarn accumulation roller.

[FIG. 11] A side view of a conventional yarn accumulation device.

[FIG. 12] A schematic cross-sectional view of the conventional yarn accumulation device, as sectioned along a plane perpendicular to a rotation axis of a yarn accumulation roller.

EMBODIMENT FOR CARRYING OUT THE INVENTION

[0045] Next, embodiments of the present invention will be described. FIG. 1 is a side view showing an outline of a winder unit 2 provided in an automatic winder that is a yarn winding machine according to a first embodiment of the present invention. The automatic winder of this embodiment is configured with a number of winder units 2 arranged side by side. This automatic winder includes a machine management device (not shown) and a blower box (not shown). The machine management device collectively manages the winder units 2. The blower box includes a compressed air source and a negative pressure source.

[0046] As shown in FIG. 1, the winder unit 2 mainly includes a yarn supply part 7 and a yarn accumulation pull-out device 5. The winder unit 2 is configured to unwind a yarn (spun yarn) 20 from a yarn supply bobbin 21 that is supported on the yarn supply part 7 and rewind the yarn 20 into a package 30. FIG. 1 shows a state of the winder unit 2 at a time of normal winding. In the description herein, the "time of normal winding" indicates a state where the yarn is continuous between the yarn supply bobbin 21 and the package 30 and additionally the yarn is being unwound from the yarn supply bobbin 21 and wound into the package 30.

[0047] The yarn supply part 7 is configured to hold the yarn supply bobbin 21, which is for supplying a yam, in a substantially upright state. The yarn supply part 7 is also configured to discharge the yarn supply bobbin 21 that is empty.

[0048] The yarn accumulation pull-out device 5 includes a winding part (pull-out device) 8 and a yarn accumulation device 18. The winding part 8 includes a cradle 23 and a traverse drum 24. The cradle 23 is configured such that a wound bobbin 22 is mounted thereon. The traverse drum 24 is configured to traverse the yarn 20 and drive the wound bobbin 22. The yarn accumulation device 18 is arranged between the winding part 8 and the yarn supply part 7, and configured to temporarily accumulate the yarn supplied from the yarn supply part 7.

[0049] The traverse drum 24 is arranged opposed to the wound bobbin 22. The traverse drum 24 is driven in rotation, and thereby the wound bobbin 22 is accordingly rotated. This enables the yarn 20 accumulated on the yarn accumulation device 18 to be unwound and wound on the wound bobbin 22. A traverse groove (not shown) is formed in an outer circumferential surface of the traverse drum 24. The traverse groove allows the yarn 20 to be traversed (cross-wound) with a predetermined width. In the above-described configuration, the yarn 20 is wound on the wound bobbin 22 while being traversed, to form the package 30 having a predetermined length and a predetermined shape. In the following description, the terms "upstream side" and "downstream side" mean the upstream side and the downstream side with respect to a direction of traveling of the yarn.

[0050] Each of the winder units 2 includes a control part 25. The control part 25 is composed of hardware such as a CPU, a ROM, and a RAM (not shown), and software such as a control program stored in the RAM. The hardware and the software cooperate with each other, to thereby control each configuration part of the winder unit 2. The control part 25 included in each winder unit 2 is configured to communicate with the machine management device. Accordingly, the machine management device can collectively manage operations of the plurality of winder units 2 included in the automatic winder.

[0051] The winder unit 2 also includes various devices that are arranged in a yarn travel path between the yarn supply part 7 and the winding part 8. More specifically, in the yarn travel path, an unwinding assist device 10, a lower yarn blow-up part 11, a first tension applying device 12, an upper yarn catch part 13, a yarn joining device 14, a yarn trap 15, a cutter 16, a clearer (yam defect detection device) 17, an upper yarn pull-out part 48, the yarn accumulation device 18, and a second tension applying device 19, are arranged in this order from the yarn supply part 7 side toward the winding part 8 side.

[0052] The unwinding assist device 10 assists the unwinding of the yarn 20 by bringing a movable member 40 into contact with a balloon, which is generated above

the yarn supply bobbin 21 as a result of the yarn 20 being unwound from the yarn supply bobbin 21 and thrown around, and thereby appropriately controlling the size of the balloon.

[0053] The lower yarn blow-up part 11 is an air sucker device arranged immediately downstream of the unwinding assist device 10. The lower yarn blow-up part 11 is configured to blow up a lower yarn of the yarn supply bobbin 21 side toward the yarn joining device 14 side. When the yarn 20 is disconnected at a location between the yarn supply bobbin 21 and the yarn accumulation device 18, the lower yarn blow-up part 11 can blow up the yarn of the yarn supply bobbin 21 to the yarn joining device 14.

[0054] The first tension applying device 12 applies a predetermined tension to the yarn 20 that is traveling. In this embodiment, the first tension applying device 12 is configured as a gate type in which a movable comb is arranged relative to a fixed comb. When a yarn travels between the combs, a predetermined resistance is applied thereto. The movable comb is movable by means of a solenoid, which allows adjustment of the state of engagement between the combs. The control part 25 controls the solenoid and thereby can adjust the tension that the first tension applying device 12 applies to the yarn. However, a configuration of the first tension applying device 12 is not limited to this. For example, a disk type tension applying device is also adoptable.

[0055] The upper yarn catch part 13 is arranged immediately upstream of the yarn joining device 14. The upper yarn catch part 13 is connected to a negative pressure source (not shown), and configured to generate a suction air stream to suck and catch the yarn of the yarn accumulation device 18 side at a time of yarn joining (details will be given later).

[0056] The yarn trap 15 is arranged upstream of the cutter 16 and immediately downstream of the yarn joining device 14. A distal end of the yarn trap 15 is formed as a tube-like member, which is provided close to the travel path of the yarn 20 and connected to a negative pressure source (not shown). In this configuration, the suction air stream is generated at the distal end of the yarn trap 15, and thereby dusts such as cotton fly adhering to the traveling yarn 20 can be sucked and removed.

[0057] The clearer 17 is configured to detect a yarn defect (yam fault) such as a slub by, for example, monitoring a yarn thickness of the yarn 20. When the clearer 17 detects a yarn defect, the clearer 17 transmits a disconnection signal to, for example, the control part 25. The disconnection signal instructs to cut and remove the yarn defect. The cutter 16 is arranged near the clearer 17, for immediately cutting the yarn 20 in response to the disconnection signal.

[0058] The upper yarn pull-out part 48 is an air sucker device, and configured to, at a time of yarn joining, pull out a yarn accumulated on the yarn accumulation device 18 and blow off the yarn toward a yarn guide member 60 (which will be described later).

[0059] The yarn accumulation device 18 includes a yarn accumulation roller (rotating element) 32 having a substantially cylindrical shape, a yarn stretching member 31 configured to have a yarn stretching between itself and the yarn accumulation roller 32, and a roller drive motor 33 configured to drive the yarn accumulation roller 32 in rotation around the axial line thereof which serves as a rotation axis. The roller drive motor 33 is controlled by the control part 25. In this configuration, driving the yarn accumulation roller 32 in rotation enables the yarn 20 unwound from the yarn supply bobbin 21 to be wound on circumferences of the yarn accumulation roller 32 and the yarn stretching member and temporarily accumulated thereon. The yarn wound on the circumferences of the yarn accumulation roller 32 and the yarn stretching member is pulled out in a direction along the axial line of the yarn accumulation roller 32, and then wound onto the winding part 8. A detailed configuration of the yarn accumulation device 18 will be described later.

[0060] The yarn joining device 14 performs yarn joining between a yarn of the yarn supply bobbin 21 side and a yarn of the yarn accumulation device 18 side when the yarn is disconnected between the yarn supply bobbin 21 and the yarn accumulation device 18, which occurs, for example, at a time of yarn cutting in which the clearer 17 detects a yarn defect so that the cutter 16 cuts the yam, at a time of yarn breakage in which the yarn being unwound from the yarn supply bobbin 21 is broken, or at a time of replacing the yarn supply bobbin 21. As the yarn joining device 14, one using fluid such as compressed air, mechanical one, or the like, is adoptable.

[0061] The second tension applying device 19 applies a predetermined tension to the yarn that has been pulled out from the yarn accumulation device 18, thereby controlling the tension of the yarn 20 at a time when the yarn 20 is wound onto the winding part 8. The second tension applying device 19 is configured as a gate type tenser, which is similar to the first tension applying device. The control part 25 appropriately controls a solenoid of the second tension applying device 19, and thereby can adjust the tension that the second tension applying device 19 applies to the yarn. However, a configuration of the second tension applying device 19 is not limited to this. For example, a disk type tension applying device is also adoptable.

[0062] A bobbin feeder 26 of magazine type is arranged at the front side of the winder unit 2. The bobbin feeder 26 includes a rotary magazine can 27. The magazine can 27 is configured to hold a plurality of extra yarn supply bobbins 21. The bobbin feeder 26 intermittently drives and rotates the magazine can 27, and thereby feeds a new yarn supply bobbin 21 to the yarn supply part 7. The bobbin feeder 26 includes a yarn end holder 28 for sucking and holding a yarn end of the yarn supply bobbin 21 held on the magazine can 27.

[0063] Next, a yarn joining operation performed in the automatic winder of this embodiment will be described.

[0064] The yarn joining device 14 performs the yarn

joining operation when the yarn of the yarn accumulation device 18 side and the yarn of the yarn supply bobbin 21 side are disconnected from each other because of yarn breakage, yarn cutting by the cutter 16, replacement of the yarn supply bobbin 21, or the like. To be specific, firstly, the control part 25 causes the lower yarn blow-up part 11 to blow up the yarn 20 of the yarn supply bobbin 21 side in an upward direction. The yarn 20 thus blown up is sucked and caught by the yarn trap 15. The yarn trap 15 is movable by the yarn trap driver 47. When the yarn trap 15 is moved under a state where the yarn trap 15 sucks and catches a yarn end of the yarn of the yarn supply bobbin 21 side, the yarn of the yarn supply bobbin 21 side can be introduced to the yarn joining device 14.

[0065] Around this time, the control part 25 puts the yarn accumulation roller of the yarn accumulation device 18 into reverse rotation, and in this condition causes the upper yarn pull-out part 48 to blow off the yarn 20 that has been accumulated on the yarn accumulation device 18. The direction in which the upper yarn pull-out part 48 blows off the yarn 20 is oriented to a position where a yarn guide member 60 having a curved tube-like shape is arranged. The yarn 20 thus blown off is taken into the yarn guide member 60 from one end of the yarn guide member 60 and, along with an air stream, guided to the other end of the yarn guide member 60. An exit from the yarn guide member 60, which is provided at the other end thereof, is oriented toward a position where the upper yarn catch part 13 is arranged. In the above-described configuration, the yarn 20 of the yarn accumulation device 18 side, which has been blown off by the upper yarn pull-out part 48, is sucked and caught by the upper yarn catch part 13. In the yarn guide member 60 having a tube-like shape, a slit extending in a longitudinal direction thereof is formed. Through this slit, the yarn 20 located in the yarn guide member 60 can be drawn out to the outside. The yarn drawn out from the yarn guide member 60 is further sucked by the upper yarn catch part 13, and thereby introduced to the yarn joining device 14. When the yarn of the yarn accumulation device 18 side is introduced to the yarn joining device 14, the control part 25 stops the reverse rotation of the yarn accumulation roller 32.

[0066] Through the above-described operation, the yarn of the yarn supply bobbin 21 side and the yarn of the yarn accumulation device 18 side can be introduced to the yarn joining device 14. In this condition, the control part 25 actuates the yarn joining device 14, to thereby join the yarn of the yarn supply bobbin 21 side and the yarn of the yarn accumulation device 18 side. After the yarn joining operation is completed, the control part 25 restarts normal rotation of the yarn accumulation device 18, to thereby restart the winding of the yarn onto the yarn accumulation device 18.

[0067] As described above, even when the yarn is disconnected at a location between the yarn supply bobbin 21 and the yarn accumulation device 18, the winding of the yarn 20 onto the package 30 in the winding part 8 can be continued without interruption. That is, in the automatic winder of this embodiment, as described above, the yarn accumulation device 18 is interposed between the yarn supply part 7 and the winding part 8, so that a certain amount of the yarn 20 is accumulated on the yarn accumulation device 18. The winding part 8 is configured to wind the yarn accumulated on the yarn accumulation device 18. Therefore, even when the supply of the yarn from the yarn supply bobbin 21 is interrupted for some reason (for example, during the yarn joining operation), the winding of the yarn 20 onto the package 30 can be continued.

[0068] Thus, since a winding operation of the winding part 8 is not interrupted by the yarn joining operation or the like, the package 30 can be produced stably at a high speed. Additionally, since the yarn accumulation device 18 is interposed between the yarn supply bobbin 21 and the winding part 8, the winding in the winding part 8 can be performed without receiving an influence of a fluctuation in the tension occurring at a time of unwinding the yarn from the yarn supply bobbin 21.

[0069] Next, the yarn accumulation device 18 of this embodiment will be described with reference to FIGS. 2 and 3.

[0070] As described above, the yarn accumulation device 18 includes the yarn accumulation roller 32, the yarn stretching member 31, and the roller drive motor 33.

[0071] The yarn stretching member 31, which is shaped into a round rod, is arranged close to the outer circumferential surface of the yarn accumulation roller 32. As shown in FIGS. 2 and 3, the yarn accumulation device of this embodiment is configured such that the yarn 20 is wrapped alternately on the yarn accumulation roller 32 and the yarn stretching member 31 so as to stretch therebetween and thereby the yarn 20 is accumulated while being wound in a substantially spiral shape on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31.

[0072] In this configuration, when the yarn accumulation roller 32 is driven in rotation, a conveying force traveling along the direction of rotation of the yarn accumulation roller 32 can be applied to the yarn 20 that is in contact with the surface of the yarn accumulation roller 32. As a result, when seen along the axial direction of the yarn accumulation roller (FIG. 3), the whole of the yarn 20 wound in a substantially spiral shape on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 can be revolved in the same direction (indicated by the thick-line arrows in FIG. 3) as the direction of rotation of the yarn accumulation roller 32 (indicated by the white arrow in FIG. 3). This enables an upstream-side yarn 20a located upstream of the yarn accumulation device 18 to be sequentially wound onto the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31.

[0073] As shown in FIG. 3, when the yarn accumulation roller 32 is driven in rotation, the yarn 20 accumulated on the yarn accumulation device 18 is, while being in

contact with the yarn accumulation roller 32, conveyed to the downstream side with respect to the direction of rotation of the yarn accumulation roller 32. Then, the yarn 20 once leaves the surface of the yarn accumulation roller 32, and goes toward the yarn stretching member 31. The yarn 20 coming into contact with the yarn stretching member 31 is further conveyed downstream, and again comes into contact with the outer circumferential surface of the yarn accumulation roller 32.

[0074] In this embodiment, the yarn stretching member 31 is fixed and, unlike the yarn accumulation roller, not driven in rotation. Therefore, a frictional resistance is applied to the yarn 20 that is revolved in contact with the yarn stretching member 31. Thus, the yarn 20 leaving the outer circumferential surface of the yarn accumulation roller 32 and going toward the yarn stretching member 31 is in a state of being pressed by the yarn accumulation roller 32. Therefore, the yarn 20 is put into a low-tension state, that is, a loosened state. On the other hand, a part of the yarn 20 leaving the yarn stretching member 31 and going toward the yarn accumulation roller 32 is in the state of being pulled by the yarn accumulation roller 32. Therefore, the yarn 20 is put into a high-tension state, that is, a stretched state.

[0075] In this manner, in the yarn accumulation device 18 of this embodiment, driving and rotating the yarn accumulation roller 32 can give "loosening" and "stretching" to the yarn 20 accumulated thereon. Since the yarn 20 is once loosened and then wound onto the yarn accumulation roller 32 while being stretched, the same effect as an effect obtained by re-winding the yarn is exerted. As shown in FIG. 2, the yarn 20 existing on the yarn accumulation device 18 is wound such that the yarn 20 circles the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 a plurality of times. Accordingly, driving and rotating the yarn accumulation roller 32 enables the above-mentioned "re-winding" to be applied a plurality of times to the yarn 20 existing on the yarn accumulation device 18.

[0076] Even in a case where the yarn has a tightly wound portion (portion with a high tension) and a loosely wound portion (portion with a low tension), such non-uniformity in the tension is quickly removed as a result of the re-winding being repeatedly performed. Thus, the tension is made uniform over the whole of the yarn 20 accumulated on the yarn accumulation device 18. Therefore, even when the tension of the upstream-side yarn 20a located upstream of the yarn accumulation device 18 fluctuates, the tightly wound portion and the loosely wound portion do not remain in the yarn 20 existing on the yarn accumulation device 18. Accordingly, the configuration of the yarn accumulation device 18 of this embodiment enables the yarn 20 to be accumulated with a constant tension without receiving an influence of a fluctuation in the tension of the upstream-side yarn 20a.

[0077] As shown in FIG. 2, a yarn guide 29 is arranged on an extension of the axial line of the yarn accumulation roller 32. The yarn 20 unwound from the yarn accumulation device 18 is wound onto the winding part 8 via the yarn guide 29. Since the yarn 20 is pulled out via the yarn guide 29 that is arranged on the extension of the axial line of the yarn accumulation roller 32, the yarn wound on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 receives a force that pulls the yarn in the direction along the axial line of the yarn accumulation roller 32. Thus, the yarn is unwound in this direction.

[0078] In a case where the yarn is pulled via the yarn guide 29 in the direction that unwinds the yarn in the conventional yarn accumulation device 100 shown in FIG. 11, this pulling force can move only a part of the yarn 20 wound at the most unwinding side on the yarn accumulation roller 101. The pulling force cannot move a part of the yarn 20 wound in a portion near the proximal end side of the yarn accumulation roller 101. This is because, in the conventional yarn accumulation device 100 shown in FIG. 11, the yarn 20 is wound so as to squeeze the yarn accumulation roller 101 and therefore the force pulling the yarn 20 in the direction along the axial line of the yarn accumulation roller 101 cannot be transmitted.

[0079] On the other hand, in the yarn accumulation device 18 of this embodiment, the tension of the accumulated yarn 20 can be made uniform over the whole of the yarn 20 as described above. Therefore, the force pulling the yarn in the direction along the axial line of the yarn accumulation roller 32 can be uniformly transmitted to the whole of the yarn 20 accumulated on the yarn accumulation device 18. In more detail, when the yarn 20 existing on the yarn accumulation roller 32 is pulled out at a predetermined pull-out angle, an oblique pulling force traveling toward the unwinding side is applied to a next-layer yarn (an adjacent yarn with respect to the axial direction of the yarn accumulation roller 32). When the "loosening" is given by the "re-winding", the next-layer yarn is moved toward the unwinding side due to the pulling force, and when the next "stretching" is given, the winding of the next-layer yarn is tightened. A yarn of the further next layer is similarly moved to the unwinding side while the winding thereof is tightened. In this manner, the "re-winding" is repeated, and thereby the pulling force is sequentially propagated.

[0080] This enables the yarn 20 wound on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 to be wholly moved toward the unwinding side due to the pulling force. Since the yarn 20 is moved toward the unwinding side due to the pulling force, the yarn 20a newly wound in an end portion of the yarn accumulation roller 32 at the proximal end side thereof does not have to push away the already-wound yarn 20. That is, in the yarn accumulation device 18 of this embodiment, the windings of the yarn 20 that is wound in a spiral shape do not push one another. Therefore, a disorder of the spiral is not likely to occur. This enables the yarn 20 to be wound and accumulated in an orderly manner.

[0081] Particularly, the pulling force is uniformly trans-

mitted to the whole of the yarn 20 wound in a substantially spiral shape on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31. Therefore, the pitches of the spiral are naturally made uniform in the course of the movement of the spiral yarn 20 toward the unwinding side. In this manner, the configuration of this embodiment enables the yarn 20 to be wound on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 in an orderly manner with uniform pitches.

[0082] As thus far described, in the yarn accumulation device 18 of this embodiment, the tension of the accumulated yarn can be made constant and the yarn can be wound with uniform pitches, irrespective of a fluctuation in the tension of the upstream-side yarn. Therefore, a disorder of the accumulated yarn 20 is not likely to occur. Since a disorder of the yarn 20 is not likely to occur, it is possible to increase the size of the yarn accumulation device 18 so that a large amount of the yarn 20 is accumulated thereon.

[0083] Additionally, since the yarn is accumulated on the yarn accumulation device 18 in an orderly manner without a disorder, the tension at a time of unwinding the yarn from the yarn accumulation device 18 is also stabilized. This enables the winding part 8 to wind the yarn 20 onto the package 30 with a stable tension at the downstream side of the yarn accumulation device 18. Thus, the package 30 with a high quality can be formed.

[0084] Moreover, the yarn accumulation device 18 of this embodiment can suppress generation of a balloon. In the conventional yarn accumulation device 100 as shown in FIG. 11, a balloon is generated at a time when the yarn wound in a spiral shape on the outer circumference of the yarn accumulation roller 101 is pulled out via the yarn guide 29. This balloon means a phenomenon in which, when the yarn wound in a spiral shape on the yarn accumulation roller 101 is pulled out in the direction along the axial line of the yarn accumulation roller 101, the yarn expands outward as a result of being thrown around on the circumference of the yarn accumulation roller 101. When the yarn expands outward as a result of being thrown around, an excessive tension is applied to the yarn 20 due to a centrifugal force, which may cause an instability in the unwinding of the yarn 20 from the yarn accumulation roller 101.

[0085] In this respect, in the yarn accumulation device 18 of this embodiment, the "stretching" and "loosening" are alternately given to the yarn existing on the circumference of the yarn accumulation roller 32. Therefore, the yarn unwound from the yarn accumulation roller 32 is thrown around while a stretched portion and a loosened portion alternately and repeatedly appear. As a result, a balloon generated at a time of unwinding the yarn from the yarn accumulation roller 32 is instable, which can prevent a size increase of the balloon. In this embodiment, when seen along the axial direction of the yarn accumulation roller 32 (FIG. 3), the yarn 20 on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 are wound in a non-circular shape. This suppresses a size increase of the balloon, as compared with a case where the yarn is thrown around in a circular shape (in a case of the conventional yarn accumulation device 100 shown in FIG. 11). In this manner, the yarn accumulation device 18 of this embodiment can suppress generation of the balloon, and thus stabilize the tension at a time of unwinding the yarn 20.

[0086] Patent Document (Japanese Patent Application Laid-Open No. 7-81843 (1995)) discloses yarn tension adjustment means of feed roller type, that includes a feed roller that is positively driven and a guide roller that is rotated accordingly. The yarn tension adjustment means is similar to the yarn accumulation device 18 of this embodiment, in terms of driving a roller under a state where a yarn stretches between the roller and a member adjacent to the roller.

[0087] However, the yarn tension adjustment means is configured to pull out the wound yarn in a direction of a tangent line of an outer circumferential surface of the feed roller. A technical idea thereof is completely different from that of the yarn accumulation device 18 of this embodiment in which the yarn is unwound in the direction along the axial line of the yarn accumulation roller 32. That is, in the configuration in which the yarn is pulled out in the direction of the tangent line of the outer circumferential surface of the roller, it is necessary that the speed of winding the yarn onto the roller and the speed of pulling out the yarn from the roller are always coincident with each other. However, in the configuration in which the yarn is unwound in the direction along the axial line of the roller as illustrated in this embodiment, it is possible to pull out the yarn from the roller irrespective of the speed of rotation of the roller (irrespective of the speed of winding of the yarn onto the roller). Because of such properties, the yarn accumulation device 18 of this embodiment is able to unwind the yarn toward the winding part 8 located downstream even under a state where the yarn is not wound from the upstream side in the yarn joining operation or the like (when the rotation of the yarn accumulation roller 32 is stopped).

[0088] Next, the yarn accumulation device 18 of this embodiment will be described in more detail with reference to FIG. 4.

[0089] The yarn accumulation roller 32 is made of a metal and configured as a roller-shaped member. To be specific, the yarn accumulation roller 32 is formed such that its cross-section along a plane perpendicular to the axial direction has a circular contour. At least a part of the yarn accumulation roller 32 is configured as a first yarn contact portion 32a having a cylindrical shape (or a columnar shape). A yarn is in contact with an outer circumferential surface of the first yearn contact portion 32a. The yarn accumulation roller 32 is driven in rotation under a state where the yarn is in contact with the first yarn contact portion 32a, and thereby the yarn wound on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 can be revolved as de-

scribed above.

[0090] As described above, in the conventional yarn accumulation device 100 shown in FIG. 11, the yarn existing on the yarn accumulation roller 101 is moved toward the unwinding side. Therefore, it is necessary that a small taper whose diameter is reduced at the unwinding side is formed in the yarn accumulation roller 101. This is because, in the configuration shown in FIG. 11, a force that moves the yarn to the unwinding side is only a force exerted when the yarn 20a newly wound at the proximal end side pushes away the old yarn 20 and therefore the movement of the yarn 20 becomes less easy at a location more distant from the proximal end side (closer to the unwinding side). However, winding the yarn 20 in such a tapered portion involves a problem that the yarn 20 wound thereon is loosened as the yarn 20 moves to the unwinding side.

[0091] In this respect, in the yarn accumulation device 18 of this embodiment, the pulling force is uniformly applied to the whole of the accumulated yarn 20 as described above, and thereby the whole of the yarn 20 can be moved toward the unwinding side. Accordingly, in the yarn accumulation device 18 of this embodiment, the yarn 20 can be moved toward the unwinding side even when the yarn accumulation roller 32 has no taper. Therefore, in the yarn accumulation device 18 of this embodiment, the first yarn contact portion 32a is formed into a cylindrical shape having a uniform diameter (having no taper). This prevents the yarn 20 wound on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 from being loosened even when the yarn is moved to the unwinding side.

[0092] In the yarn stretching member 31, a second yarn contact portion 31a that is in contact with the yarn 20 is formed with an elongated shape. More specifically, the yarn stretching member 31 is shaped into a round rod, and its cross-section is circular when sectioned along a plane perpendicular to the longitudinal direction of the round rod. An outer circumferential surface of the round rod serves as the second yarn contact portion 31a.

[0093] In the above-described configuration, the yarn accumulation device 18 of this embodiment is configured so as to accumulate the yam 20 in such a manner that the yarn 20 stretches between the first yarn contact portion 32a of the yarn accumulation roller 32 and the second yarn contact portion 31 a of the yarn stretching member 31.

[0094] Considering the length of the yarnn accumulation roller 32 with respect to the rotation axis O direction thereof (the length thereof with respect to the lateral direction in FIG. 4), the length of the first yarn contact portion 32a and the length of the second yarn contact portion 31 a are substantially coincident with each other. Therefore, the first yarn contact portion 32a of the yarn accumulation roller 32 can be utilized to the full for accumulating the yarn.

[0095] The longitudinal direction of the yarn stretching member 31 (the longitudinal direction of the second yarn contact portion 31a) is in parallel with the axial line of the yarn accumulation roller 32. This enables the yarn 20 to stretch between the yarn stretching member 31 and the yarn accumulation roller 32 with ease. Since the yarn stretching member 31 and the yarn accumulation roller 32 are arranged in parallel with each other, the yarn 20, which is revolved under the state of stretching between the yarn accumulation roller 32 and the yarn stretching member 31, always has a constant circumferential length. Thus, even when the yarn accumulated on the yarn accumulation device 18 is moved toward the unwinding side, the circumferential length is not changed. Therefore, no loosening occurs in the yarn 20.

[0096] In the vicinity of the yarn accumulation roller 32, an accumulated amount sensor that detects the amount of the yarn 20 accumulated on the yarn accumulation device 18 is arranged, though not shown. A result of detection by the accumulated amount sensor is sent to the control part 25.

[0097] When it is detected that the amount of yarn existing on the yarn accumulation device 18 falls below a lower limit, the control part 25 appropriately controls the roller drive motor 33 to increase the speed of rotation of the yarn accumulation roller 32. This increases the speed of winding of the yarn 20 onto the yarn accumulation device 18, and as a result, the amount of the yarn 20 accumulated on the yarn accumulation device 18 can be gradually increased. On the other hand, when it is detected that the amount of yarn existing on the yarn accumulation device 18 becomes equal to or more than a upper limit, the control part 25 appropriately controls the roller drive motor 33 to reduce the speed of rotation of the yarn accumulation roller 32. This reduces the speed of winding of the yarn 20 onto the yarn accumulation device 18, and as a result, the amount of the yarn 20 accumulated on the yarn accumulation device 18 can be gradually reduced. The above-described control allows the amount of the yarn 20 accumulated on the yarn accumulation device 18 to be kept equal to or more than the lower limit amount and less than the upper limit.

[0098] The yarn accumulation device 18 of this embodiment further has a tension applying part 50 that is provided in end portions of the yarn accumulation roller 32 and the yarn stretching member 31 at the unwinding side. The tension applying part includes a ring-shaped frame 51 and a rubber ring 52.

[0099] The ring-shaped frame 51, which has a ring-like shape, is fixed to the end portion of the yarn accumulation roller 32 at the unwinding side such that the center of the ring-shaped frame 51 is coincident with the axial line of the yarn accumulation roller 32. This configuration causes the ring-shaped frame 51 to be rotated integrally with the yarn accumulation roller 32.

[0100] As shown in FIG. 4, the ring-shaped frame 51 has a flange portion 51a that protrudes toward the proximal end side. The diameter of the flange portion 51 a is set longer than a distance from the central axis of the

yarn accumulation roller 32 to a yarn contact surface of the yarn stretching member 31. As shown in FIG. 4, the yarn stretching member 31 is arranged with its end portion at the unwinding side being located inside the flange portion 51a with respect to the radial direction thereof.

[0101] The flange portion 51a has a recess 51b formed in an outer circumferential surface thereof. The rubber ring (rubber band) 52 is attached to the recess 51b. The rubber ring 52 is configured to squeeze the recess 51b to a proper degree.

[0102] The yarn accumulation device 18 of this embodiment is configured such that the yarn 20 unwound from the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 is pulled out through a space between the flange portion 51a and the rubber ring 52. In this configuration, when the yarn 20 is pulled out from the yarn accumulation device 18, a resistance is given to the yarn 20 because it is tucked between the flange portion 51a and the rubber ring 52. Therefore, a proper tension can be applied to the yarn 20 that is being pulled out. Giving a resistance to the yarn 20 as described above can prevent the yarn 20 from being excessively thrown around, and thus can suppress generation of a balloon.

[0103] As thus far described, the yarn accumulation pull-out device 5 of this embodiment includes the yarn accumulation device 18 and the winding part 8. The yarn accumulation device 18 includes the yarn accumulation roller 32 having the first yarn contact portion 32a, and the yarn stretching member 31 having the second yarn contact portion 31a and arranged in the direction along the rotation axis of the yarn accumulation roller 32. The yarn accumulation device 18 accumulates a yarn in such a manner that the yarn is alternately wound on the first yarn contact portion 32a and the second yarn contact portion 31a so as to stretch therebetween. The winding part 8 unwinds the yarn accumulated on the yarn accumulation device 18 by pulling out the yarn in the direction of the rotation axis of the yarn accumulation roller 32.

[0104] When the yarn accumulation roller 32 is rotated under such a state where the yarn 20 is alternately wound on the yarn accumulation roller 32 and the yarn stretching member 31 so as to stretch therebetween, the yarn 20 alternately passes the surface of the yarn accumulation roller 32 and the surface of the yarn stretching member 31. At this time, the "stretching" and "loosening" are given to portions of the yarn 20 located between the yarn accumulation roller 32 and the yarn stretching member 31. This enables the yarn 20 to be accumulated with a constant tension and with a constant pitch.

[0105] In the yarn accumulation pull-out device 5 of this embodiment, the second yarn contact portion 31a is in parallel with the rotation axis of the yarn accumulation roller 32.

[0106] This allows the yarn 20 to stretch between the yarn accumulation roller 32 and the yarn stretching member 31 with ease. Moreover, since the circumferential length of the yarn 20 wound on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 is constant, loosening of the yarn 20 can be prevented.

[0107] In the yarn accumulation pull-out device 5 of this embodiment, the yarn stretching member 31 is a rod-like member.

[0108] Making the yarn stretch between the rod-like member and the yarn accumulation roller 32 in this manner can successfully accumulate the yarn.

[0109] In the yarn accumulation pull-out device 5 of this embodiment, a cross-section of the yarn stretching member as cut along a plane perpendicular to the longitudinal direction thereof has a circular shape.

[0110] Accordingly, in a portion of the yarn stretching member which is in contact with the yarn, the surface of the yarn stretching member does not have an angular shape. This can prevent the yarn from being damaged.

[0111] In the yarn accumulation pull-out device 5 of this embodiment, the yarn 20 wound on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 are unwound while being guided by the yarn guide 29 that is arranged on an extension of the rotation axis of the yarn accumulation roller 32.

[0112] In a yarn accumulation device configured to wind the yarn 20 on the circumference of the yarn accumulation roller 32, unwinding the yarn via the yarn guide 29 arranged on an extension of the rotation axis undesirably generates a balloon so that the tension increases because the yarn is thrown around in a space between the yarn guide 29 and the circumference of the yarn accumulation roller 32. In this respect, the yarn accumulation device 18 of this embodiment is configured to wind the yarn on the circumferences of the yarn stretching member 31 and the yarn accumulation roller 32. Therefore, the trajectory of the yarn 20 that is thrown around is not circular. As a result, the yarn 20 is not thrown around so much, and generation of a balloon is suppressed. Thus, an increase in the tension can be prevented.

[0113] The automatic winder of this embodiment includes the yarn accumulation pull-out device 5 described above, and the yarn supply part 7 that supplies the yarn 20. The yarn accumulation device 18 is arranged between the yarn supply part 7 and the winding part 8, and accumulates the yarn 20 that is supplied from the yarn supply part 7. The winding part 8 winds the yarn 20 accumulated on the yarn accumulation device 18, to form a package.

[0114] The automatic winder forms the package 30 by winding the yarn of the yarn accumulation device 18 of this embodiment in which the tension of unwinding is stable. Therefore, the package 30 with a high quality can be formed.

[0115] Next, a modification of the first embodiment will be described with reference to FIGS. 5 and 6. A yarn accumulation device 181 included in a yarn accumulation pull-out device according to this modification does not have the tension applying part 50 provided in the yarn accumulation device of the first embodiment. Even in a

configuration in which the tension applying part 50 is not provided in this manner, the effects of the present invention such as the suppression of a balloon and the prevention of a yarn disorder, which are exerted due to the yarn stretching member 31, can be obtained. In the yarn accumulation roller 32 of the yarn accumulation device 181, a tapered portion 32c is formed in an end portion of the first yarn contact portion 32a at the unwinding side. The tapered portion 32c is formed such that its diameter increases toward the end portion side. The tapered portion 32c can prevent the yarn existing on the yarn accumulation roller 32 from falling off at one time from the end portion of the yarn accumulation roller 32 at the unwinding side.

[0116] Next, a second embodiment of the present invention will be described with reference to FIGS. 7 and 8. In the following description, configuration parts identical or similar to those of the above-described first embodiment will be denoted by the same reference numerals as those of the first embodiment, and descriptions thereof will be omitted.

[0117] In the first embodiment described above, the yarn stretching member 31 is fixed, and therefore there is a possibility that an excessive friction may occur between the yarn stretching member 31 and the yarn 20 to cause damage to the yarn 20 or heat generation in the yarn stretching member 31 and the yarn 20.

[0118] Accordingly, the yarn accumulation device 182 included in the yarn accumulation pull-out device of this embodiment is configured such that the yarn stretching member 31 is freely rotatable. A specific configuration is as follows. In this embodiment, similarly to the first embodiment, the yarn stretching member 31 is configured as a round rod having a circular cross-section. As shown in FIG. 7, the yarn accumulation device 182 of this embodiment includes a rotation support portion 53 that supports the yarn stretching member 31 such that the yarn stretching member 31 is freely rotatable about, as a rotation axis, an axis passing through the center of the circular cross-section.

[0119] In this configuration, when the yarn accumulation roller 32 is driven in rotation, as shown in FIG. 8, along with the yarn 20 revolved on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31, the yarn stretching member 31 is also rotated accordingly. This can reduce a resistance acting on the yarn 20 that is in contact with the yarn stretching member 31, as compared with a case where the yarn stretching member 31 is fixed. As a result, damage to the yarn 20 can be suppressed, and heat generation in the yarn 20 and the yarn stretching member 31 can be prevented.

[0120] In a case where the rotation of the yarn stretching member 31 is completely free, a resistance cannot be given to the yarn that is revolved while being in contact with the yarn stretching member 31. This makes it impossible to give the "loosening" and "stretching" to the yarn 20. Therefore, the rotation support portion 53 of this embodiment includes a resistance applying part that gives a rotation resistance to the rotation of the yarn stretching member 31. The resistance applying part can be configured as, for example, a torque limiter. Such a configuration can give a resistance to the yarn 20 while suppressing damage to the yarn 20.

[0121] Alternatively, the above-described resistance applying part may be configured as a variable brake mechanism that is able to appropriately change the rotation resistance to be given to the rotation of the yarn stretching member 31. In such a case, it is further preferable that the variable brake mechanism is controllable by the control part 25. This can adjust a resistance to be given to the yarn 20 that is in contact with the yarn stretching member 31. More specifically, since the strengths of the "loosening" and "stretching" can be adjusted, the state of winding of the yarn 20 on the yarn accumulation device 18 and the pitch of winding of the yarn 20 can be adjusted in accordance with winding conditions of the yarn 20 and the type of the yarn 20.

[0122] As thus far described, in the yarn accumulation device 182 included in the yarn accumulation pull-out device of this embodiment, the rotation support portion 53 is provided that supports the yarn stretching member 31 such that the yarn stretching member 31 is rotatable about the center of the circular cross-section thereof.

[0123] Rotatably supporting the yarn stretching member 31 in this manner can reduce a friction generated between the yarn 20 and the yarn stretching member 31. Therefore, damage to the yarn can be reduced, and heat generation in the yarn stretching member and the yarn can be suppressed.

[0124] In the yarn accumulation device 182 included in the yarn accumulation pull-out device of this embodiment, the rotation support portion 53 has the resistance applying part that gives a resistance to the rotation of the yarn stretching member 31.

[0125] This can give a resistance to the yarn 20 that is in contact with the yarn stretching member 31. Accordingly, a proper degree of "stretching" and "loosening" can be given to portions of the yarn 20 located between the yarn accumulation roller 32 and the yarn stretching member 31.

[0126] Next, a modification of the second embodiment described above will be described.

[0127] In a case where the yarn stretching member 31 is rotatably supported as illustrated in the second embodiment described above, it may be acceptable that the rotation support portion 53 includes, instead of the resistance applying part that gives a rotation resistance to the yarn stretching member 31, a driving part that drives the yarn stretching member 31 in rotation. It is further preferable that an operation of the driving part is controllable by the control part 25. In such a configuration, by appropriately controlling the driving part so as to change the speed of rotation of the yarn stretching member 31, a resistance to be given to the yarn that is in contact with the yarn stretching member can be adjusted. More specifically, since the strengths of the "loosening" and

"stretching" can be adjusted, the state of winding of the yarn 20 on the yarn accumulation device 18 and the pitch of winding of the yarn 20 can be adjusted in accordance with winding conditions of the yarn 20 and the type of the yarn 20.

[0128] However, when the circumferential speed of a portion (the second yarn contact portion 31 a) of the yarn stretching member 31 which is in contact with the yarn is higher than the circumferential speed of the first yarn contact portion 32a of the yarn accumulation roller 32, a resistance cannot be given to the yarn 20 that is in contact with the yarn stretching member 31. Accordingly, in a configuration in which the rotation support portion 53 includes a driving part as described above, the driving part controls the driving such that the circumferential speed of the second yarn contact portion 31a is lower than the circumferential speed of the first yarn contact portion 32a.

[0129] As described above, in the yarn accumulation device included in the yarn accumulation pull-out device according to this modification, the rotation support portion 53 includes the driving part that drives the yarn stretching member 31 in rotation. The driving part sets the circumferential speed of the second yarn contact portion 31a to be lower than the circumferential speed of the first yarn contact portion 32a.

[0130] Rotating the yarn stretching member 31 at a speed lower than the yarn accumulation roller 32 can give a resistance to the yarn 20 that is in contact with the yarn stretching member 31. Accordingly, the "stretching" and "loosening" can be given to portions of the yarn located between the yarn accumulation roller 32 and the yarn stretching member 31. Since the driving part appropriately controls the speed of rotation of the yarn stretching member 31, the degree of the above-described "stretching" and "loosening" can be adjusted. Therefore, the state of winding of the yarn 20, the pitch of winding of the yarn 20, and the like, can be adjusted in accordance with winding conditions of the yarn 20 and the type of the yarn 20.

[0131] In another possible configuration, the amount of yarn wound on the yarn accumulation device may be estimated based on a drive torque of the driving part that drives the yarn stretching member 31 in rotation. When the amount of the wound yarn increases, the drive torque also increases, and when the amount of the wound yarn decreases, the drive torque also decreases. Accordingly, by detecting the magnitude of the drive torque, the amount of yarn accumulated on the yarn accumulation device can be estimated. Therefore, it is not necessary to provide an extra sensor for measuring the amount of yarn.

[0132] Next, a third embodiment of the present invention will be described with reference to FIG. 9. In the following description, configuration parts identical or similar to those of the above-described first embodiment will be denoted by the same reference numerals as those of the first embodiment, and descriptions thereof will be omitted.

[0133] As shown in FIG. 9, a yarn accumulation device 183 included in a yarn accumulation pull-out device according to this embodiment has a plurality of yarn stretching members 31. In this manner, the number of the yarn stretching members 31 is not limited to one, and a plurality of the yarn stretching members 31 may be provided.

[0134] When the number of the yarn stretching members 31 increases, the number of times the "re-winding" acts on the yarn 20 accumulated on the yarn accumulation device 183 increases. As a result, the whole of the yarn 20 is easily moved toward the unwinding side. In a case where the yarn 20 is easily moved toward the unwinding side, there is a tendency that the yarn 20 wound in a substantially spiral shape on the circumferences of the yarn accumulation roller 32 and the yarn stretching member 31 has a coarse pitch of the spiral.

[0135] As a result of the coarse pitch of the spiral, the amount of the yarn 20 that can be accumulated on the yarn accumulation device 183 is reduced. In the other way around, the amount of the yarn 20 accumulated on the yarn accumulation device 183 can be adjusted by changing the number of the yarn stretching members 31. Accordingly, in order to increase the amount of the accumulated yarn 20, the number of the yarn stretching members 31 is reduced, and in order to reduce the amount of the accumulated yarn 20, the number of the yarn stretching members 31 is increased.

[0136] Experiments conducted by the inventors of the present application reveal that a configuration having three yarn stretching members 31 can most effectively prevent generation of a balloon. Therefore, from the viewpoint of preventing generation of a balloon and stabilizing the unwinding of the yarn from the yarn accumulation device 183, it is most preferable that the number of the yarn stretching members 31 is three.

[0137] Additionally, from the viewpoint of stably unwinding the yarn 20 from the yarn accumulation device 183, the three yarn stretching members 31 are arranged at an equal distance from the yarn accumulation roller 32. More specifically, in a cross-section (FIG. 9) along a plane perpendicular to the axial line of the yarn accumulation roller 32, the three yarn stretching members 31 are arranged on an imaginary circle 70 centered at the axial line of the yarn accumulation roller.

[0138] Moreover, similarly from the viewpoint of stably unwinding the yarn 20 from the yarn accumulation device 183, the three yarn stretching members 31 are arranged at regular intervals in a cross-section (FIG. 9) along a plane perpendicular to the axial line of the yarn accumulation roller.

[0139] Because of the above, in the yarn accumulation device 183 of this embodiment, the three yarn stretching members 31 are arranged such that, in a cross-section (FIG. 9) along a plane perpendicular to the axial line of the yarn accumulation roller 32, each of the three yarn stretching members 31 serves as each of the vertices of an imaginary equilateral triangle 71 whose center of gravity is located on the axial line of the yarn accumulation

roller 32.

[0140] Since the yarn accumulation roller 32 cannot exert the conveying force without being in contact with the yarn 20, the yarn accumulation roller 32 is arranged so as to be in contact with portions of the yarn located between the yarn stretching members 31. To be more specific, in a cross-section (FIG. 9) along a plane perpendicular to the axial line of the yarn accumulation roller, a radius R1 of the yarn accumulation roller is set longer than a length L1 of a perpendicular line extending from the center of gravity perpendicularly to each side of the imaginary equilateral triangle 71 described above (in other words, the yarn accumulation roller 32 interferes with each side of the equilateral triangle 71 described above). This allow the surface of the yarn accumulation roller 32 to be in contact with the yarn 20. Therefore, the yarn 20 can be conveyed by the rotation of the yarn accumulation roller 32, and the yarn can be accumulated on the yarn accumulation device 183.

[0141] As thus far described, in the yarn accumulation device 183 included in the yarn accumulation pull-out device of this embodiment, a plurality of the yarn stretching members 31 are provided.

[0142] In this manner, by changing the number of the yarn stretching members 31, the number of times the "stretching" and "loosening" are given to the yarn 20 can be changed, and accordingly the pitch of winding can be changed.

[0143] In the yarn accumulation device 183 included in the yarn accumulation pull-out device of this embodiment, the plurality of yarn stretching members 31 are provided on the imaginary circle 70 centered at the rotation axis of the yarn accumulation roller 32.

[0144] Arranging the plurality of yarn stretching members 31 at an equal distance from the yarn accumulation roller can stabilize the unwinding of the yarn 20.

[0145] In the yarn accumulation device 183 included in the yarn accumulation pull-out device of this embodiment, three yarn stretching members 31 are provided.

[0146] Providing three yarn stretching members can suppress generation of a balloon and can particularly stabilize the unwinding of the yarn 20 from the yarn accumulation device 183.

[0147] In the yarn accumulation device 183 included in the yarn accumulation pull-out device of this embodiment, each of the three yarn stretching members 31 are arranged at each of the vertices of the imaginary equilateral triangle 71 in a cross-section along a plane perpendicular to the rotation axis of the yarn accumulation roller 32.

[0148] Arranging the three yarn stretching members 31 in the shape of an equilateral triangle can further stabilize the unwinding of the yarn.

[0149] In the yarn accumulation device 183 included in the yarn accumulation pull-out device of this embodiment, in a cross-section along a plane perpendicular to the rotation axis of the yarn accumulation roller 32, a cross-section of the yarn accumulation roller 32 has a circular shape and its radius R1 is longer than the length L1 of the perpendicular line extending from the center of gravity perpendicularly to each side of the imaginary triangle 71 whose vertices are defined by the three yarn stretching members 31.

[0150] Arranging the yarn stretching members 31 in this manner can bring the yarn 20 into contact with the yarn accumulation roller 32. Accordingly, the yarn accumulation roller 32 gives a conveying force to the yarn 20, and the yarn 20 can be accumulated on the yarn accumulation device 183.

[0151] Next, a fourth embodiment of the present invention will be described with reference to FIG. 10. In the following description, configuration parts identical or similar to those of the above-described first embodiment will be denoted by the same reference numerals as those of the first embodiment, and descriptions thereof will be omitted.

[0152] As shown in FIG. 10, a yarn accumulation device 184 included in a yarn accumulation pull-out device according to this embodiment has a plurality of yarn accumulation rollers 32. To be specific, in a cross-section (FIG. 10) along a plane perpendicular to the rotation axis of the yarn accumulation roller 32, the yarn accumulation rollers 32 are arranged such that each of them serves as each of the vertices of a regular hexagon. Additionally, three yarn stretching members 31 are provided at appropriate positions outside the regular hexagon.

[0153] The yarn accumulation device 184 accumulates the yarn 20 such that the yarn 20 is wound from the outside of a nonagon that connect the six yarn accumulation rollers 32 and the three yarn stretching members 31. Also in such a configuration having a plurality of the yarn accumulation rollers 32, when the yarn accumulation rollers 32 are driven in rotation in the same direction at an equal speed, a resistance is given to the yarn that is in contact with the yarn stretching member 31. Thus, the "loosening" and "stretching" can be given to the yarn 20. Accordingly, even such a configuration having a plurality of the yarn accumulation rollers 32 can exert the same effects as the effects of the first to third embodiments described above.

[0154] While some preferred embodiments of the present invention and modifications thereof have been described above, the above-described configurations can be changed, for example, as follows.

[0155] In the first embodiment, the axial line of the yarn accumulation roller 32 and the longitudinal direction of the yarn stretching members 31 are in parallel with each other. However, this is not limiting. It may be acceptable that the yarn stretching member 31 extends slightly obliquely. Additionally, the shape of the yarn stretching member 31 is not limited to a linear shape, and it may be a curve shape. That is, it suffices that the yarn 20 stretches between the yarn accumulation roller 32 and the yarn stretching member 31 in an appropriate manner. The shape of the yarn stretching members 31, the position where the yarn stretching members 31 is arranged, the

direction in which the yarn stretching members 31 is arranged, and the like, can be appropriately changed.

[0156] In the embodiments described above, a cross-section of the yarn stretching member 31 as cut along a plane perpendicular to the longitudinal direction thereof has a circular shape. However, this is not limiting, and a non-circular shape is also acceptable. For example, the cross-section may have a D-like shape. Here, in order to avoid damaging the yarn 20, it is preferable that a cross-section of a portion of the yarn stretching member 31 which is in contact with the yarn 20 has a contour with no sharp portion.

[0157] In the embodiments described above, the rotating element is the yarn accumulation roller. However, the rotating element is not limited to such a roller-shaped member. A rotating element whose cross-section along a plane perpendicular to the rotation axis has a non-circular shape may be adoptable.

[0158] It is not always necessary that each winder unit 2 includes the control part 25, and instead a plurality of winder units may be controlled by a single control part. In the configuration described above, the single control part 25 collectively controls a plurality of members. However, this is not limiting. For example, an individual control part may be provided corresponding to each member to be controlled.

[0159] In the described configuration, the control part 25 is composed of hardware and software. However, it may be acceptable that the function of the control part 25 is partially or wholly implemented by hardware dedicated therefor.

[0160] In the embodiments described above, the winder unit 2 feeds the yarn supply bobbin 21 by means of the bobbin feeder 26 of magazine type. However, this configuration is not limiting. For example, in a possible alternative configuration, a tray having the yarn supply bobbin 21 set thereon may be transported along an appropriate path, to thereby feed the yarn supply bobbin 21 to the winder unit 2.

[0161] In the embodiments described above, the winding part 8 is configured to traverse the yarn 20 by means of the traverse drum 24. Instead, for example, an arm-type traverse mechanism may be adopted to traverse the yarn 20.

[0162] In the embodiments described above, the automatic winder is configured to guide a yarn by blowing off the yarn toward the yarn joining device 14. However, this is not limiting. For example, it may be also acceptable that the automatic winder is configured to suck and catch the yarn of the yarn supply bobbin 21 and the yarn existing on the yam accumulation roller 32 and guide the yarns thus sucked and caught to the yarn joining device 14 by means of appropriate drive means.

[0163] The second tension applying device 19 may be omitted in a case where, as shown in FIG. 2, the yarn accumulation device 18 includes the tension applying part 50 and the tension of the yarn wound onto the winding part 8 can be successfully controlled only by the tension applying part 50.

[0164] The present invention is not limited to an automatic winder, and the present invention is applicable to other types of yarn winding machines including a yarn joining device.

DESCRIPTION OF THE REFERENCE NUMERALS

[0165]

5	yarn accumulation pull-out device
8	winding part (pull-out device)
18	yarn accumulation device
31	yarn stretching member
31a	second yarn contact portion
32	yarn accumulation roller (rotating element)
32a	first yarn contact portion

Claims

1. A yarn accumulation pull-out device comprising:

a yarn accumulation device including a rotating element having a first yarn contact portion and a yarn stretching member having a second yarn contact portion and arranged in a direction along a rotation axis of the rotating element, the yarn accumulation device being configured to accumulate a yarn such that the yarn is alternately wound on the first yarn contact portion and the second yarn contact portion so as to stretch therebetween; and

a pull-out device configured to unwind a yarn accumulated on the yarn accumulation device by pulling out the yarn in a direction of the rotation axis of the rotating element.

2. The yarn accumulation pull-out device according to claim 1, wherein
the second yarn contact portion is in parallel with the rotation axis of the rotating element.

3. The yarn accumulation pull-out device according to claim 1 or 2, wherein
the yarn stretching member is a rod-like member.

4. The yarn accumulation pull-out device according to claim 3, wherein
a cross-section of the yarn stretching member as cut along a plane perpendicular to a longitudinal direction thereof has a circular shape.

5. The yarn accumulation pull-out device according to claim 4, wherein
a rotation support portion is provided, the rotation support portion being configured to support the yarn stretching member such that the yarn stretching

member is rotatable about the center of the circular cross-section.

6. The yarn accumulation pull-out device according to claim 5, wherein
the rotation support portion includes a resistance applying part that gives a resistance to rotation of the yarn stretching member.

7. The yarn accumulation pull-out device according to claim 5, wherein
the rotation support portion includes a driving part that drives the yarn stretching member in rotation,
the driving part sets a circumferential speed of the second yarn contact portion to be lower than a circumferential speed of the first yarn contact portion.

8. The yarn accumulation pull-out device according to claim 1, wherein
a yarn wound on circumferences of the rotating element and the yarn stretching member is unwound while being guided by a yarn guide that is arranged on an extension of the rotation axis of the rotating element.

9. The yarn accumulation pull-out device according to claim 1, wherein
the yarn stretching member comprises a plurality of yarn stretching members.

10. The yarn accumulation pull-out device according to claim 9, wherein
the plurality of yarn stretching members are provided on an imaginary circle centered at the rotation axis of the rotating element.

11. The yarn accumulation pull-out device according to claim 9 or 10, wherein
the yarn stretching member comprises three yarn stretching members.

12. The yarn accumulation pull-out device according to claim 11, wherein
in a cross-section along a plane perpendicular to the rotation axis of the rotating element, each of the three yarn stretching members is arranged at each of the vertices of an imaginary equilateral triangle.

13. The yarn accumulation pull-out device according to claim 11, wherein
in a cross-section along a plane perpendicular to the rotation axis of the rotating element, a cross-section of the rotating element has a circular shape and the radius thereof is longer than the length of a perpendicular line extending from the center of gravity perpendicularly to each side of an imaginary triangle whose vertices are defined by the three yarn stretching members.

14. A yarn winding machine comprising:

the yarn accumulation pull-out device according to any one of claims 1 to 13; and
a yarn supply part that supplies a yarn,
the yarn accumulation device being arranged between the yarn supply part and the pull-out device and configured to accumulate a yarn that is supplied from the yarn supply part,
the pull-out device serving as a winding part that winds a yarn accumulated on the yarn accumulation device, to form a package.

Fig.1

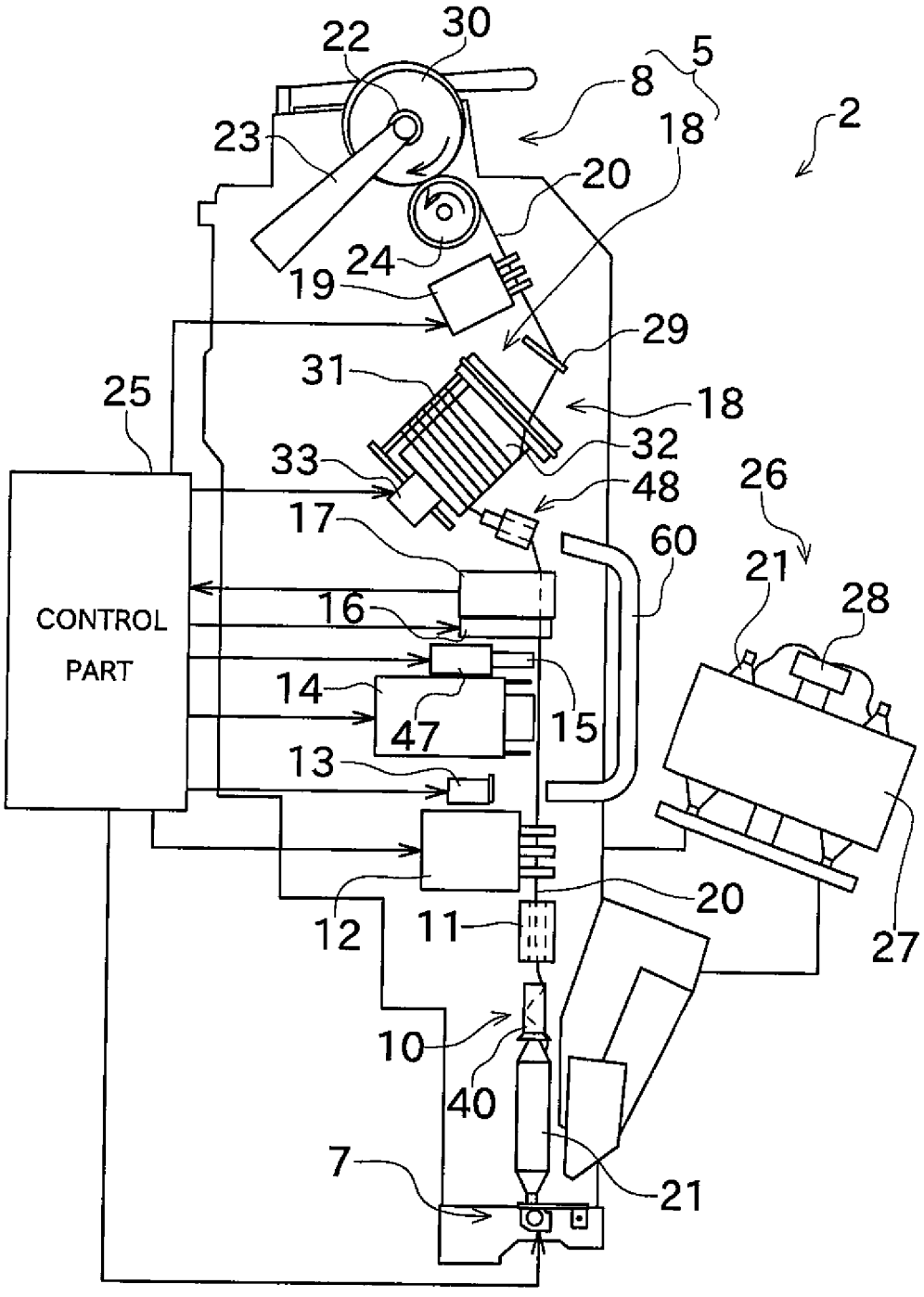
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Fig.2

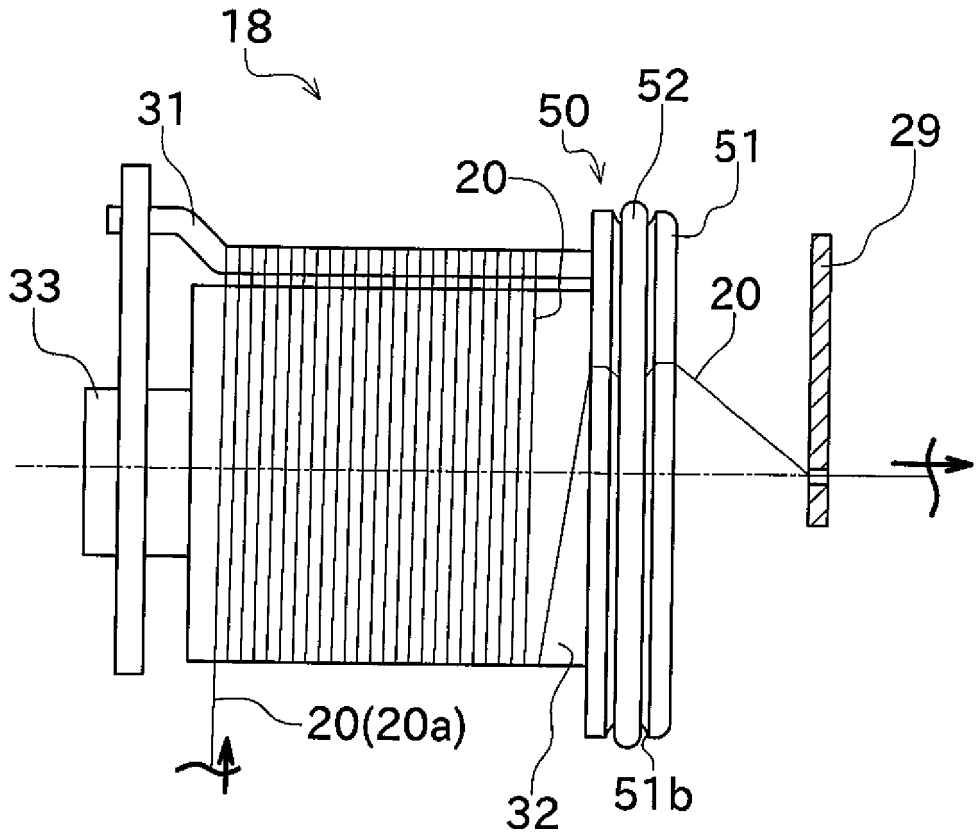

Fig.3

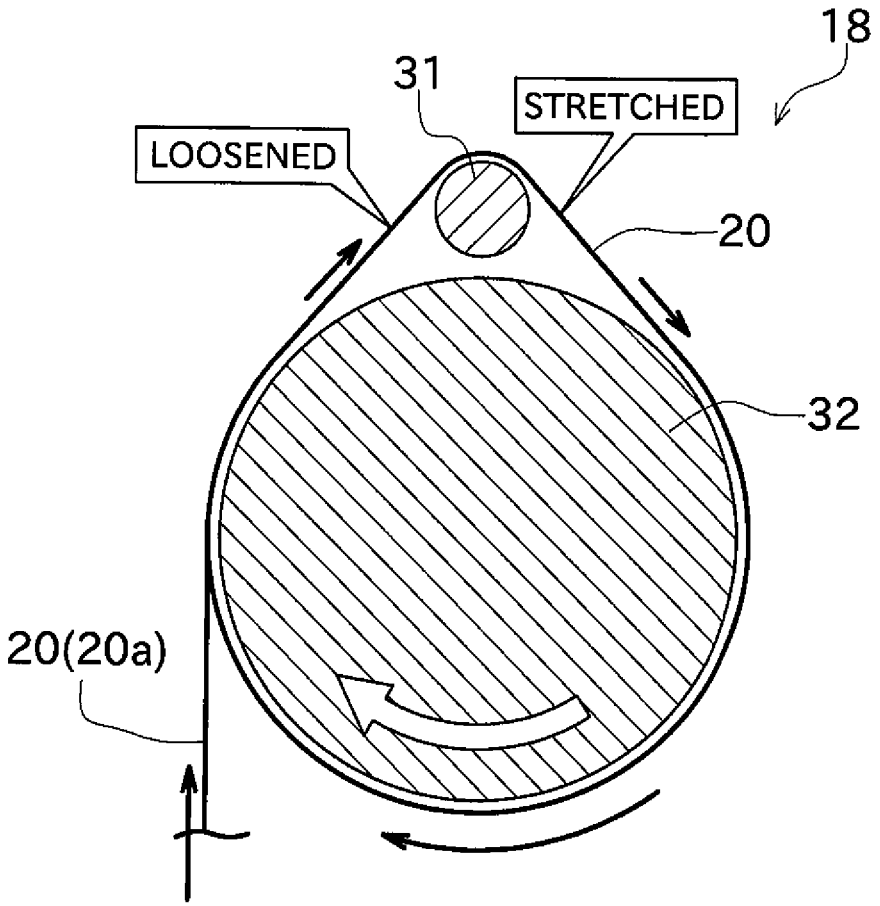

Fig.4

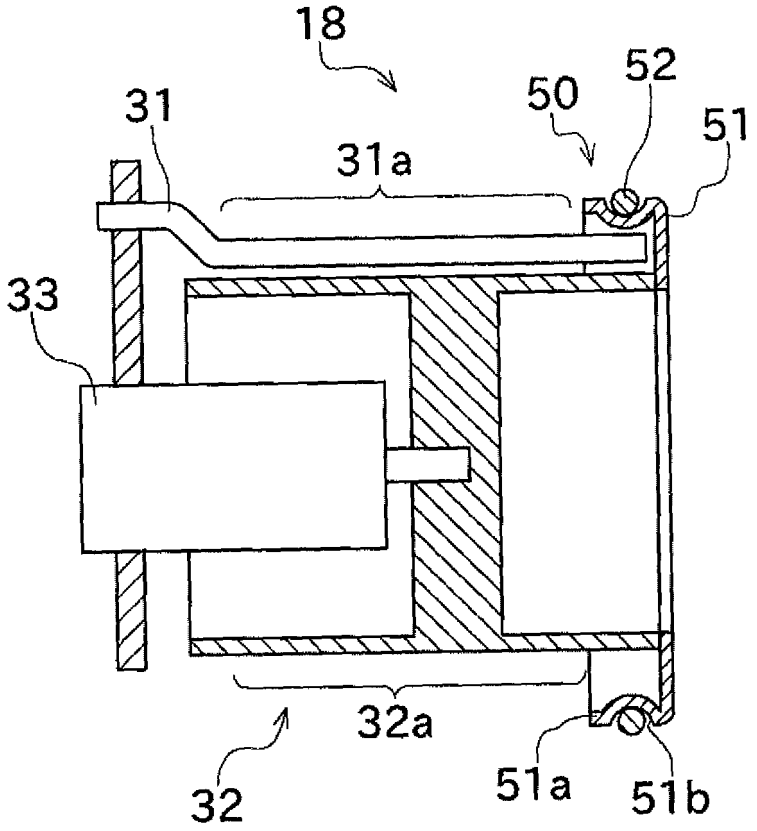

Fig.5

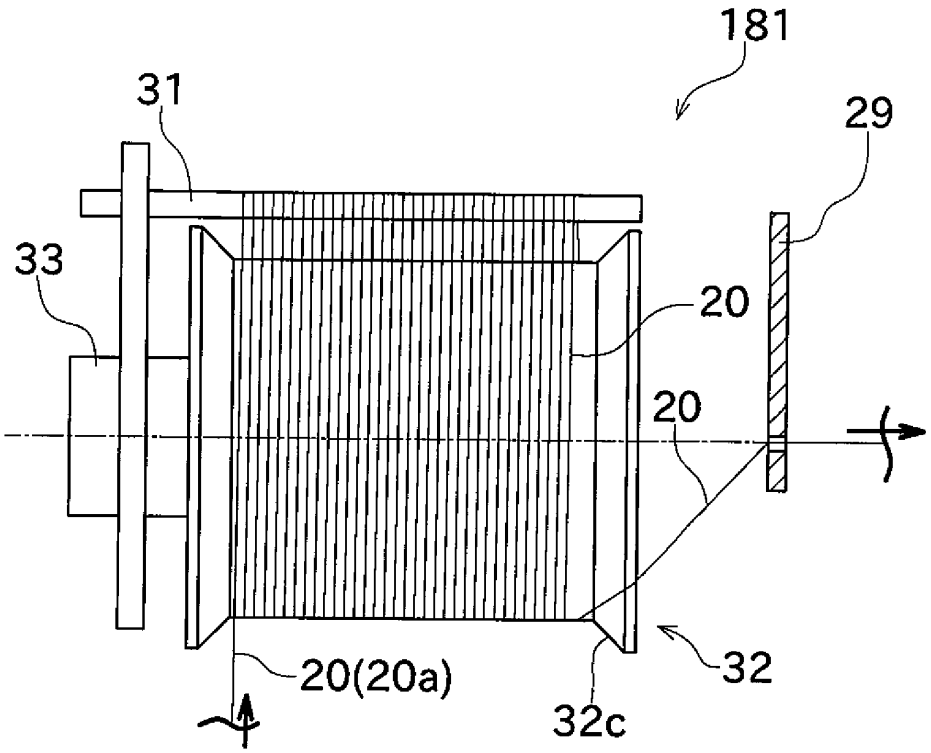

Fig.6

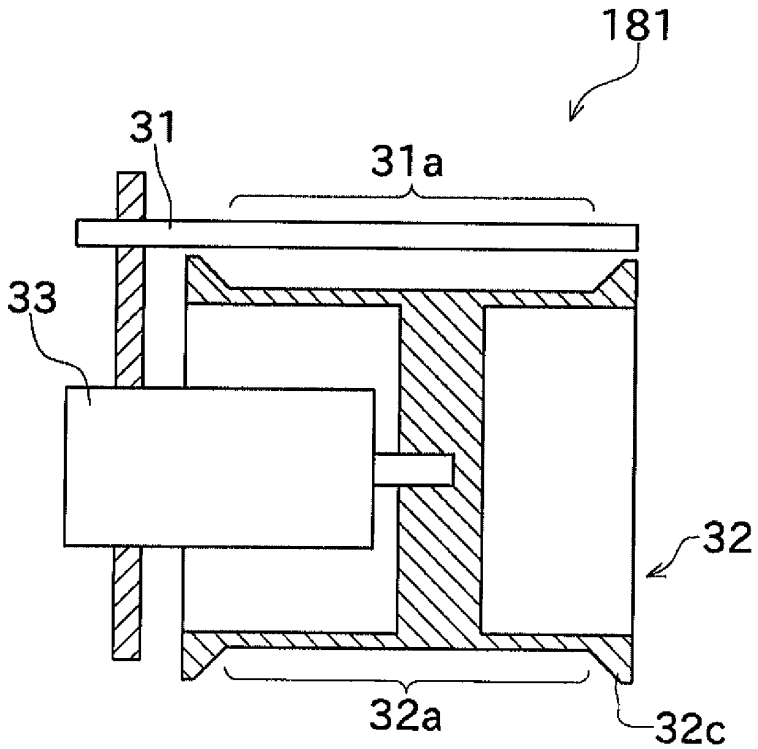

Fig.7

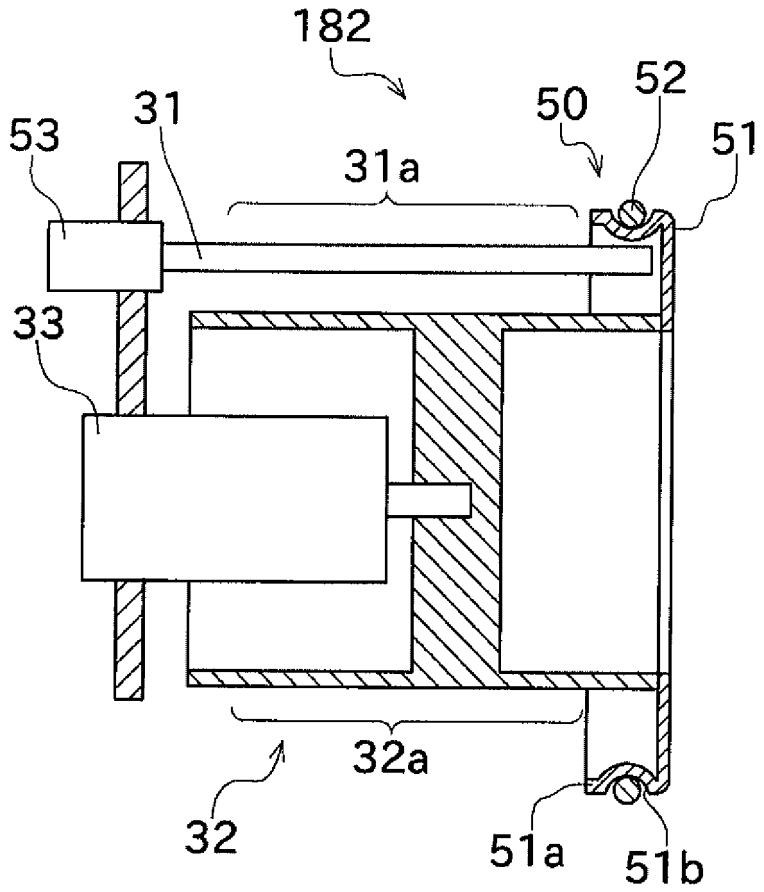

Fig.8

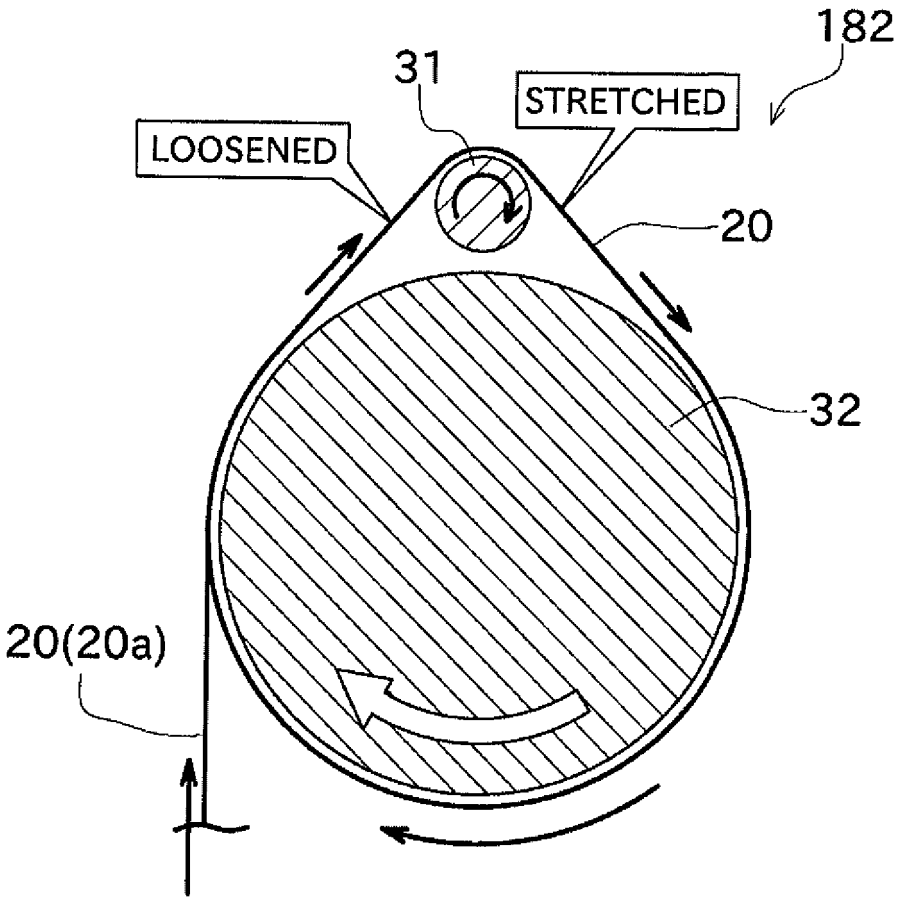

Fig.9

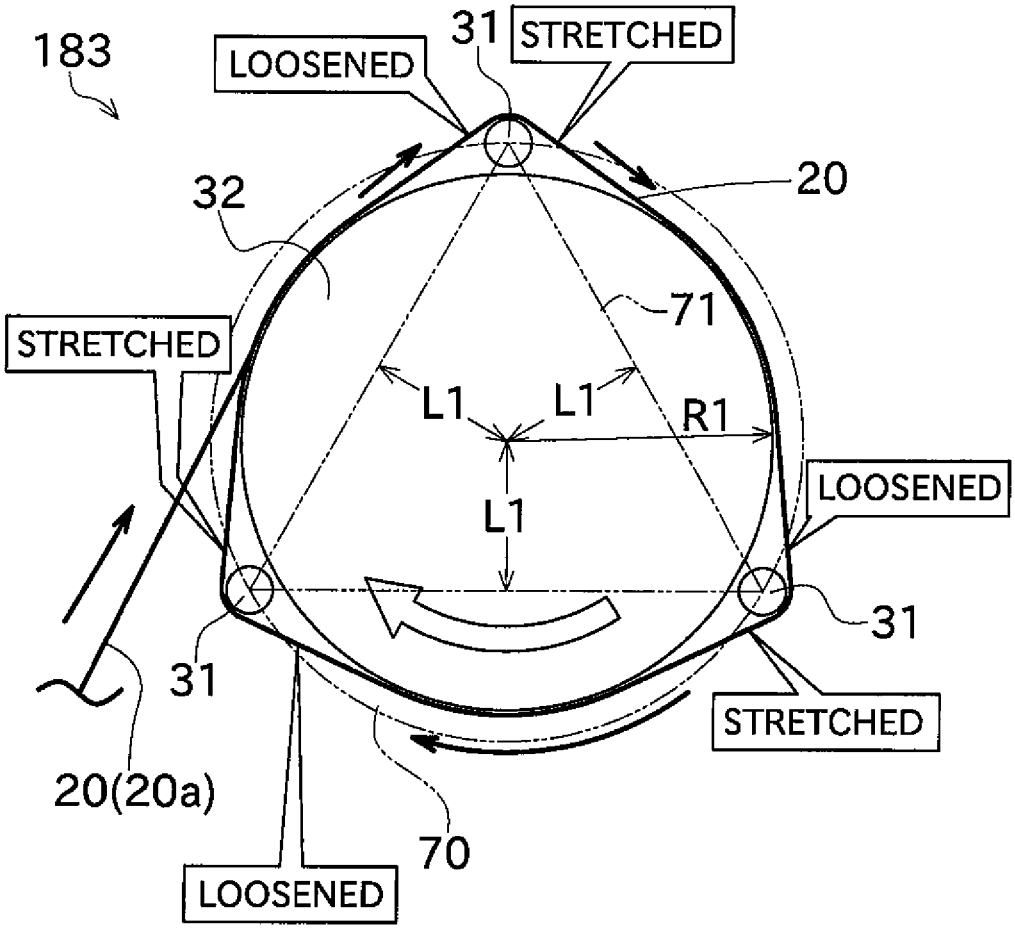
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Fig.10

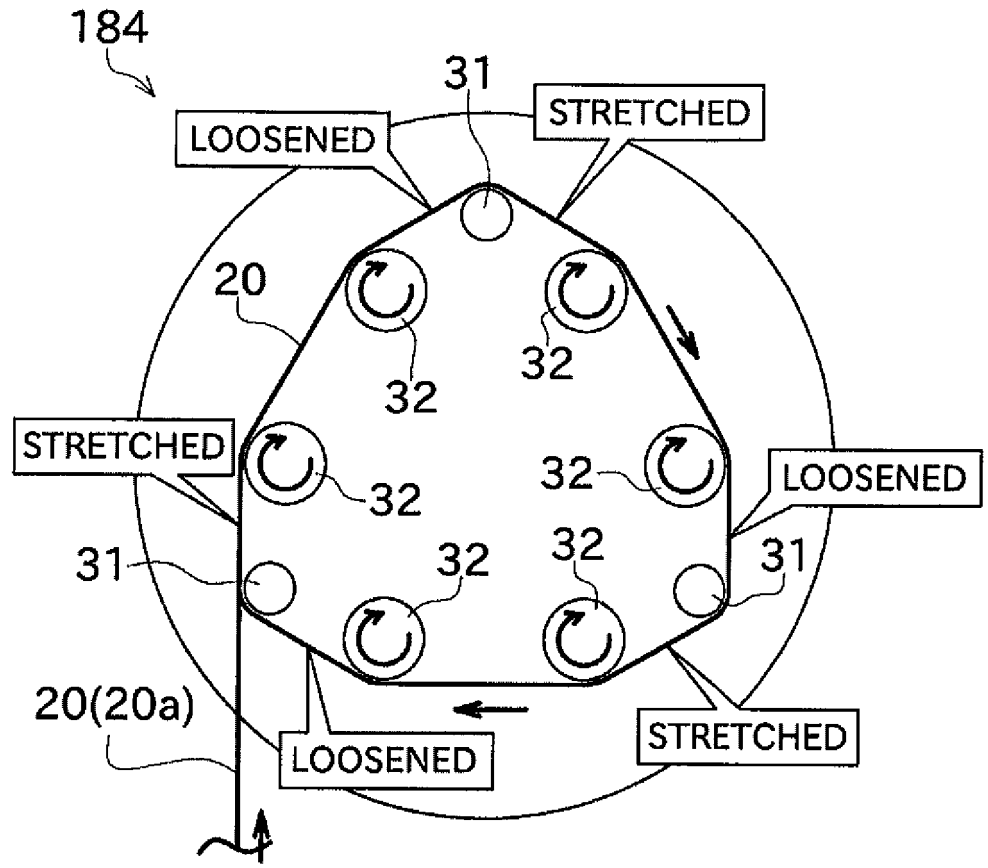
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Fig.11

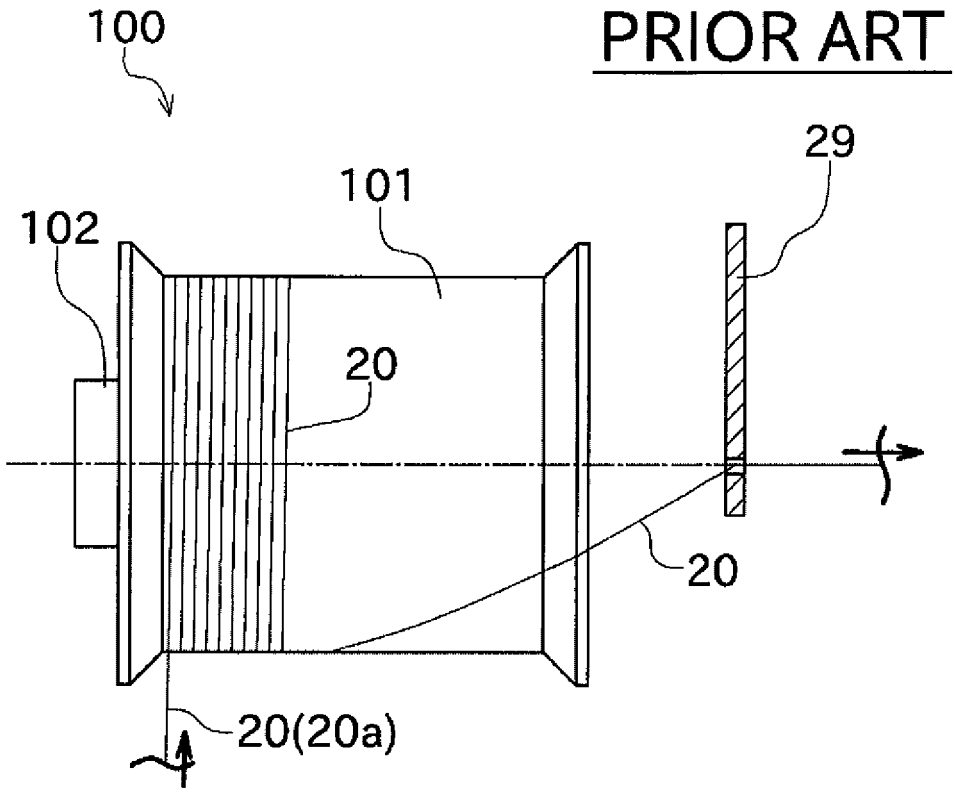
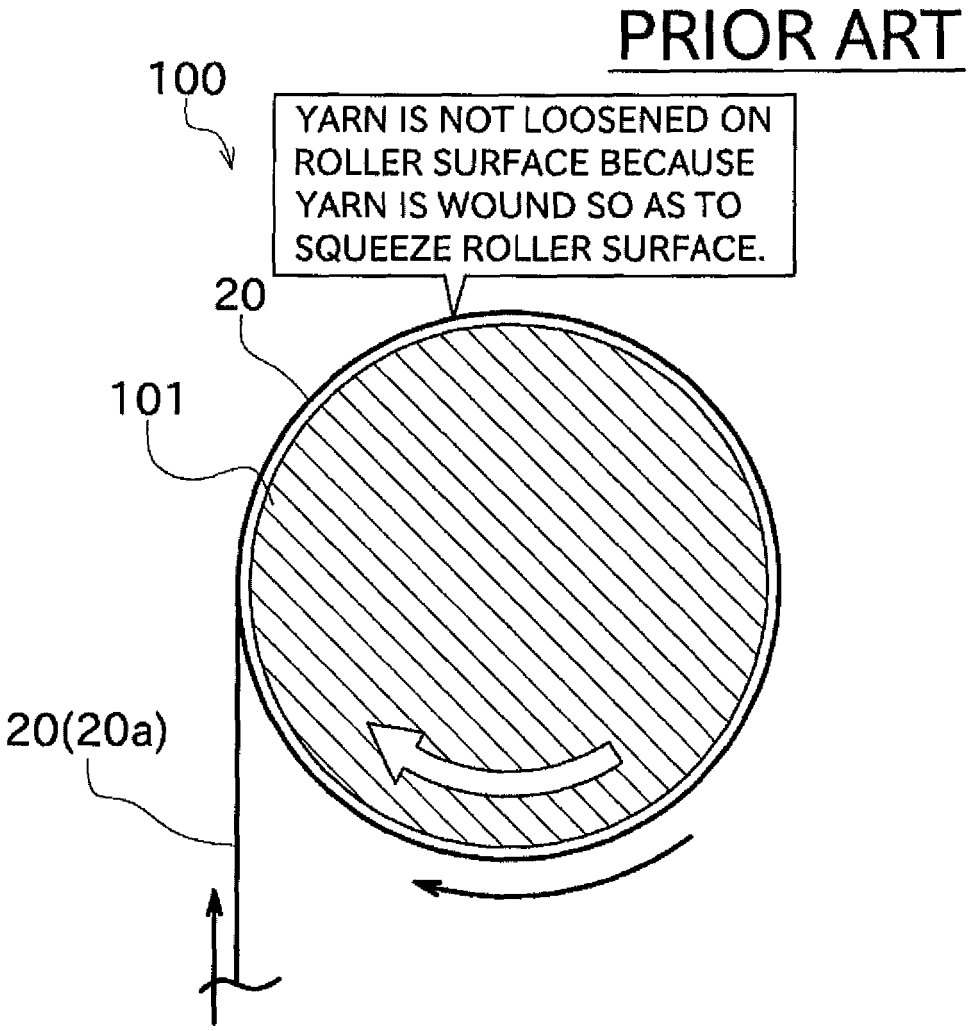


Fig.12


PRIOR ART
100
YARN IS NOT LOOSENED ON ROLLER SURFACE BECAUSE YARN IS WOUND SO AS TO SQUEEZE ROLLER SURFACE.
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101
20(20a)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/004997

A. CLASSIFICATION OF SUBJECT MATTER
B65H51/22(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65H51/22

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2011
Kokai Jitsuyo Shinan Koho	1971-2011	Toroku Jitsuyo Shinan Koho	1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 56-155154 A (Lucke Apparate-Bau GmbH), 01 December 1981 (01.12.1981), page 2, upper right column, line 14 to page 3, upper left column, line 2 & US 4383655 A	1-5,8-9, 11-12,14 6-7,10,13
X A	JP 55-61563 A (Lucke Apparate-Bau GmbH), 09 May 1980 (09.05.1980), page 3, lower left column, line 13 to page 4, lower right column, line 4; fig. 2 & US 4277867 A	1-5,8-9, 11-12,14 6-7,10,13
A	DE 586421 C1 (Adolf Heinrich Junkers), 20 October 1933 (20.10.1933), fig. 2 (Family: none)	1-14

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

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"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 September, 2011 (30.09.11)	11 October, 2011 (11.10.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010077576 A **[0006]**
- JP 2009242042 A **[0006]**
- JP 7081843 A **[0086]**