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(11)

EP 1 686 085 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.08.2006 Bulletin 2006/31

(51) Int Cl.:
B65H 49/34 (2006.01)

(21) Application number: **05027792.0**

(22) Date of filing: **19.12.2005**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**
Designated Extension States:
AL BA HR MK YU

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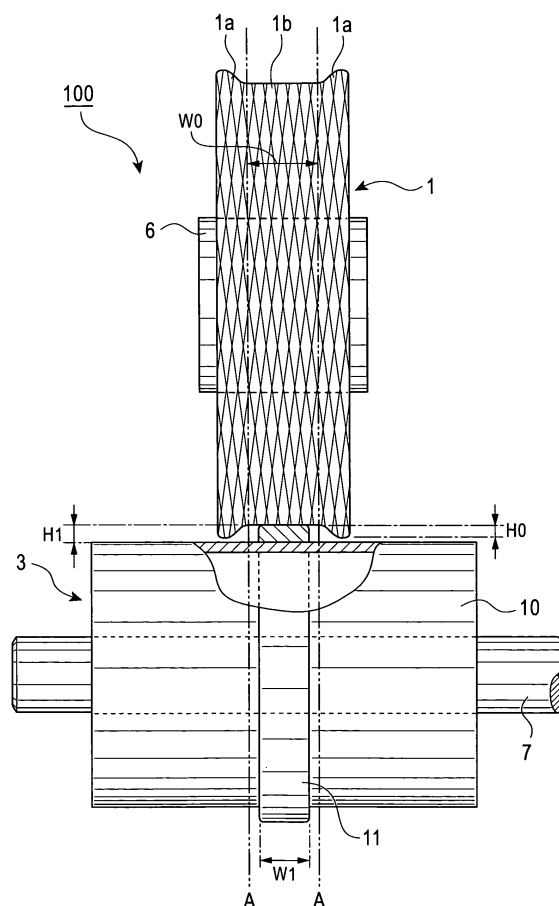
(30) Priority: **01.02.2005 JP 2005025420**

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(54) Method and device for unwinding yarn from package

(57) When an unwinding device based on a friction roller system is used to unwind a yarn from a package while applying unwinding tension to the package, the package may collapse at the opposite ends of the package, resulting in inappropriate unwinding. An unwinding device includes a friction roller 3 that contacts with a peripheral surface of a winding package 1 to rotate the package 1 and a yarn guide roller 4 that guides an elastic yarn 5 unwound and drawn out from the package 1 in the radial direction of the package as a result of rotation of the friction roller 3. A friction belt 11 is provided on an axial part of the friction roller 3 so that the friction roller 3 contacts with only a central portion 1b of the package 1 which is located inside opposite axial ends 1a, 1a of the package 1 and which has a substantially fixed outer diameter, and the friction belt 11 has a larger diameter than a cylinder 10 and is located radially outside the cylinder 10 (Fig. 2).

FIG. 2



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Description

Field of the Invention

[0001] The present invention relates to a technique for a method and device for unwinding a yarn from a package, in which a friction roller is contacted with a peripheral surface of the package to rotate the package, while unwinding the yarn from the package so that the yarn is unwound in the radial direction of the package.

Background of the Invention

[0002] A yarn unwinding device based on a friction roller system is conventionally known which is configured so as to unwind a yarn from a package by contacting a friction roller with a peripheral surface of the package. An example of such an unwinding device is an elastic yarn supply device 10 disclosed in the Unexamined Japanese Patent Application Publication (Tokkai) No. 2002-363834 (the reference numeral corresponds to the Unexamined Japanese Patent Application Publication (Tokkai) No. 2002-363834). As described in the paragraph 0017 of the Unexamined Japanese Patent Application Publication (Tokkai) No. 2002-363834, the elastic yarn supply device 10 is provided with a rotating roller 21 that drives a package 20 for an elastic yarn 11. The elastic yarn package 20 contacts with the rotating roller 21 so as to be subjected to its rotation.

[0003] In a manufacturing stage of the elastic yarn package, "higher yarn layer portions" may be formed at the opposite ends of the elastic yarn package, and the surface of yarn layers in the package may be formed to be convex at the opposite ends so as to project from the surface of the remaining yarn layer part. This occurs when, during an operation of winding a yarn by traversing the yarn in the axial direction of the package, a relatively long time is required to guide the yarn around a turning pint, that is, the time for which yarn is stalled increases at the ends of the package.

[0004] When the friction roller is contacted with the surface of yarn layers in a package with higher yarn layer portions to rotate the package, the contact pressure acting on the higher yarn layer portions may collapse the yarn layers constituting the higher yarn layer portions. This may disturb the vertical arrangement of the overlapping yarn layers in the traversed yarn to be unwound, thus collapsing the yarn layer, or may cause latching in which the vertical relationship among the yarn layers in the yarn to be unwound is reversed. In portions in which the collapse of the package or latching occurs, the yarn is likely to be broken when the yarn is unwound.

[0005] It is an object of the present invention to provide a method and device for unwinding a yarn in which a yarn can be successfully unwound from a package with high yarn layer portions without breaking the yarn.

Summary of the Invention

[0006] A description has been given of the problem to be solved by the present invention. A description will be given below of means for solving the problem.

[0007] According to Claim 1, the present invention provides a method for unwinding a yarn from a package, in which a friction roller is contacted with a peripheral surface of the package to rotate the package, while unwinding the yarn from the package so that the yarn is unwound in the radial direction of the package, the method being characterized in that the package is rotated to unwind the yarn in such a way that opposite ends of the package float from an outer peripheral surface of the friction roller.

[0008] According to Claim 2, the package is an elastic yarn package into which an elastic yarn has been wound, and the friction roller drivingly contacts with a central part of the outer peripheral surface of the package to rotate the package, the central part being located away from opposite end surfaces of the package by a predetermined distance within which the package is expected to collapse.

[0009] According to Claim 3, the predetermined distance is larger than the distance of higher yarn layer portions formed at the opposite ends of the package.

[0010] According to Claim 4, the present invention provides a device for unwinding a yarn from a package, the device comprising a friction roller that contacts with a peripheral surface of the package to rotate the package and yarn guiding means for guiding a yarn unwound and drawn out from the package in the radial direction of the package as a result of rotation of the friction roller, the device being characterized in that a convex portion is provided on an axial part of the friction roller so that the friction roller contacts with only a central part of the package which is located inside opposite axial ends of the package and which has a substantially fixed outer diameter, the convex portion of the friction roller having a larger diameter than other parts of the friction roller and contacting with the central part of the package.

[0011] According to Claim 5, the friction roller comprises a cylinder, and an annular member which is separate from the cylinder and which is placed radially outside the cylinder, and the annular member is the convex portion of the friction roller.

[0012] According to Claim 6, the present invention provides a device for unwinding a yarn from a package, the device comprising a friction roller that contacts with a peripheral surface of the package to rotate the package and yarn guiding means for guiding a yarn unwound and drawn out from the package in the radial direction of the package as a result of rotation of the friction roller, the device being characterized in that the friction roller is formed so as to be as long as or shorter than an axially central part of the package in an axial direction so that the friction roller contacts with only the central part of the package which is located inside opposite axial ends of the package and which has a substantially fixed outer

diameter.

[0013] The present invention produces the effects described below.

[0014] According to Claim 1, inappropriate unwinding is prevented even when a yarn is unwound while applying unwinding tension.

[0015] According to Claim 2, inappropriate unwinding is prevented even when an elastic yarn is unwound while applying unwinding tension.

[0016] According to Claim 3, inappropriate unwinding is prevented even when a yarn is unwound from a package with higher yarn layer portions while applying unwinding tension to the package.

[0017] According to Claim 4, inappropriate unwinding is prevented even when a yarn is unwound while applying unwinding tension.

[0018] According to Claim 5, an appropriate friction roller can be easily manufactured to the shape of a package (the axial length of the package or the diameter of higher yarn layer portions) from which a yarn is to be unwound.

[0019] According to Claim 6, inappropriate unwinding is prevented even when a yarn is unwound while applying unwinding tension.

Brief Description of the Drawings

[0020]

Figure 1 is a side view showing an unwinding device in accordance with a first embodiment.

Figure 2 is a front view showing the unwinding device in accordance with the first embodiment.

Figure 3 is a front view showing an unwinding device in accordance with a second embodiment.

Figure 4 is a front view showing an unwinding device in accordance with a third embodiment.

Figure 5 is a perspective view showing a core yarn manufacturing unit to which the unwinding device in accordance with the first embodiment is applied.

Detailed Description of the Preferred Embodiments

[0021] A description will be given of three embodiments of an unwinding device for a package with higher yarn layer portions in accordance with the present invention. The unwinding device in accordance with the present invention is based on the friction roller system. A friction roller is contacted with a peripheral surface of a package to rotate the package, thus unwinding and drawing out the yarn from the package. The package from which the yarn is to be unwound is a common package with higher yarn layer portions (the diameter of the package is larger at its axial ends). In the embodiments described below, the friction roller provided in the unwinding device has different configurations.

[0022] With reference to Figures 1 and 2, a description will be given of an unwinding device 100 that is a first

embodiment.

[0023] As shown in Figure 1, the unwinding device 100 comprises a cradle arm 2 that holds a package 1 and a friction roller 3 contacted with a peripheral surface of the package 1. The unwinding device 100 may also comprise a yarn guide roller 4 that guide an elastic yarn 5 unwound from the package 1 (in present embodiment, the yarn guide roller 4 is provided.).

[0024] A main frame (not shown in the drawings) of the unwinding device 100 rotatably supports a roller driving shaft 7 and also supports a cradle support shaft 8. The roller driving shaft 7 is fixed to the axis of the friction roller 3, and the roller driving shaft 7 rotatively drives and rotates the friction roller 3. The cradle arm 2 is U-shaped in a plane view and has bobbin holders 2a provided inside the respective ends (upper right and left portions of the U shape) of the cradle arm 2 to support a bobbin 6 for the package 1. The cradle arm 2 is rotatably supported by the cradle support shaft 8 in its part (lower end of the U shape) located opposite the laterally opposite ends. The package 1 is a package formed by traversing a yarn around an outer periphery of the bobbin 6 in a manufacturing stage of the package.

[0025] In the above configuration, the axial direction of the roller driving shaft 7 is parallel to that of the cradle support shaft 8. The axial direction of the bobbin 6, supported by the bobbin holders 2a, 2a, is also parallel to that of the roller driving shaft 7 and the cradle support shaft 8. Accordingly, the axial direction of the friction roller 3 is parallel to that of the package 1, supported by the cradle arm 2.

[0026] The package 1, supported by the cradle arm 2, can revolve freely around the cradle support shaft 8, and the weight of the package 1 keeps it in contact with the friction roller 3. The peripheral surface of the package 1 is in frictional contact with a peripheral surface of the friction roller 3. The package 1 rotates in unison with the rotation of the friction roller 3.

[0027] The elastic yarn 5 unwound from the package 1 is guided by the yarn guide roller 4 and drawn out in the radial direction of the package 1. The yarn guide roller 4 is placed on the tangent between the friction roller 3 and the package 1 or at a position closer to the package 1 than the tangential direction (the position where the unwound elastic yarn 5 contacts with the peripheral surface of the package 1), in the side view shown in Figure 1 (as viewed from the axial direction of the package 1). In the front view shown in Figure 2 (as viewed from the direction of the tangent between the friction roller 3 and the package 1), the yarn guide roller 4 (not shown in Figure 2) is located in a central part of the package 1 in the axial direction of the package 1.

[0028] As shown in Figure 2, the package 1, from which the yarn is to be unwound by the unwinding device 100, has higher yarn layer portions in which the diameter of the package 1 is larger at its axial ends. The package 1 is divided into the following three parts along its axial direction: opposite axial ends 1a, 1a and a central part

1b. Each of the axial ends 1a of the package 1 includes the higher yarn layer portions. On the other hand, the central part 1b of the package 1 has a substantially fixed outer diameter and includes no the higher yarn layer portions.

[0029] The friction roller 3 is composed of a cylindrical drum 10 and a friction belt (for example, a rubber belt) 11 placed radially outside the drum 10. The friction belt 11 is an annular member formed by connecting the opposite ends of a band-like rubber member. The friction belt 11 is fitted around the drum 10.

[0030] In connection with the axial length, the drum 10 is formed to be longer than the package 1, and the friction belt 11 is formed to be shorter than the package 1. Further, the friction roller 3 has a larger outer diameter by the thickness of the friction belt 11 at the position where the friction belt 11 is placed, than in a part in which only the drum 10 is present.

[0031] The friction belt 11 is formed to have an axial length W1 equal to or smaller than the axial length W0 of central part 1b of the package 1. The radially outward projection length H1 of the friction roller 11, that is, the difference between the diameter of the drum 10 and the outer diameter of the friction belt 11 (thickness of the friction belt 11) is larger than the height H0 of the higher yarn layer portion of the package 1, that is, the difference between the maximum diameter of the axial end 1a of the package 1 and the diameter of the central part 1b of the package 1. Here, the package 1 and the friction roller 3 are laid out so that the friction belt 11 is located between boundary surfaces A, A each of which is located between the corresponding axial end 1a and the central part 1b of the package 1.

[0032] In the above configuration, only the central part 1b of the package 1 contacts with the friction belt 11 of the friction roller 3, and no other parts of the package 1 contact with the friction roller 3. Thus, the higher yarn layer portions do not contact with the friction roller 3. This prevents the yarn from being inappropriately unwound.

[0033] Now, with reference to Figure 3, a description will be give of an unwinding device 200 that is a second embodiment. The unwinding device 200 has the same configuration as that of the unwinding device 100 except that a friction roller 103 is used in place of the friction roller 3. The package from which the yarn is to be unwound by the unwinding device 200 is the package 1 having higher yarn layer portions in which the diameter of the package is larger at the axial ends of the package 1. Accordingly, in the description below of the unwinding device 200, focus will be given to the configuration of the friction roller 103. In addition, the same reference numbers as those of the unwinding device 100 are used for those members of the unwinding device 200 which have the same arrangements of the corresponding members of the unwinding device 100. The description of these members is omitted.

[0034] The friction roller 103 is composed of a cylindrical drum 110 and a rubber ring 111 placed radially

outside the drum 110. The rubber ring 111 is an annular member having a circular transverse section, and the rubber ring 11 is fitted around the drum 110. Further, a concave groove 110a is formed in an outer peripheral surface of the drum 110 at an appropriate position in the axial direction, and the concave groove 110a is formed to the shape of the transverse section of the rubber ring 111. The rubber ring 111 is fitted and positioned in the concave groove 110a. The roller driving shaft 107 is fixed to the axis of the friction roller 103 (drum 110).

[0035] In connection with the axial length, the drum 110 is formed to be longer than the package 1, and the rubber ring 111 is formed to be shorter than the package 1. Further, the friction roller 103 has a larger outer diameter by the thickness of the rubber belt 111 at the position where the rubber ring 111 is placed, than in a part in which only the drum 110 is present.

[0036] The rubber ring 111 is formed to have an axial length W2 equal to or smaller than the axial length W0 of central part 1b of the package 1. The radially outward projection length H2 of the rubber ring 111, that is, the difference between the maximum diameter of the drum 110 (not the diameter of the concave groove but of the peripheral surface) and the outer diameter of the rubber ring 111 is larger than the height H0 of the higher yarn layer portion of the package 1, that is, the difference between the maximum diameter of the axial end 1a of the package 1 and the diameter of the central part 1b of the package 1. Here, the package 1 and the friction roller 103 is laid out so that the rubber ring 111 is located between boundary surfaces A, A, each of which is located between the corresponding axial end 1a and the central part 1b of the package 1.

[0037] In the above configuration, only the central part 1b of the package 1 contacts with the rubber ring 111 of the friction roller 103, and no other parts of the package 1 contact with the friction roller 103.

[0038] Now, with reference to Figure 4, a description will be given of an unwinding device 300 that is a third embodiment. The unwinding device 300 has the same configuration as that of the unwinding device 100 except that a friction roller 203 is used in place of the friction roller 3. The package from which the yarn is to be unwound by the unwinding device 300 is the package 1 having higher yarn layer portions in which the diameter of the package 1 is larger at the axial ends of the package 1. Accordingly, in the description below of the unwinding device 300, focus will be given to the configuration of the friction roller 203. In addition, the same reference numbers as those of the unwinding device 100 are used for those members of the unwinding device 300 which have the same arrangements of the corresponding members of the unwinding device 100. The description of these members is omitted.

[0039] The friction roller 203 is a cylindrical drum and is formed to be shorter than that of the package 1 in the axial direction. The roller driving shaft 7 is fixed to the axis of the friction roller 203 (drum 110).

[0040] More specifically, the friction roller 203 is formed to have an axial length $W3$ equal to or smaller than the axial length $W0$ of central part 1b of the package 1. The difference (length $H3$) between the diameter of the friction roller 203 and the diameter of the roller driving shaft 7 is larger than the height $H0$ of the higher yarn layer portion of the package 1, that is, the difference between the maximum diameter of the axial end 1a of the package 1 and the diameter of the central part 1b of the package 1. Here, the package 1 and the friction roller 203 are laid out so that the friction roller 203 is located between the boundary surfaces A, A, each of which is located between the corresponding axial end 1a and the central part 1b of the package 1.

[0041] In the above configuration, the friction roller 203 contacts with only the central part 1b of the package 1, and it does not contact with any other parts (axial ends 1a) of the package 1.

[0042] Now, with reference to Figure 5, a description will be given of a core yarn manufacturing unit 500 to which the unwinding device 100, the first embodiment, is applied. The core yarn manufacturing unit 500 manufactures a core yarn using one spindle, and the core yarn manufacturing unit 500 constitutes a part of a core yarn manufacturing apparatus. The core yarn manufacturing apparatus comprises a large number of core yarn manufacturing units 500, and driving and control mechanisms for the respective core yarn manufacturing units 500. The core yarn manufacturing apparatus can simultaneously manufacture a large number of core yarns using a corresponding number of spindles.

[0043] The core yarn manufacturing unit 500 comprises an elastic yarn supply device that supplies the elastic yarn 5, constituting a core fiber, a fiber bundle manufacturing device that manufactures a fiber bundle 505 from a sliver 504, and a spinning device that covers the periphery of the elastic yarn 5 with the fiber bundle 505 to manufacture a core yarn 512. In the description below, expressions such as upstream side and downstream side are used on the basis of the direction in which the sliver 504, the fiber bundle 505, and the core yarn 512 are fed.

[0044] The elastic yarn supply device is the unwinding device 100 provided with the package 1 around which the elastic yarn 5 is wound.

[0045] The fiber bundle manufacturing device comprises a can (not shown in the drawing) serving as a supplying source of the sliver 504 and a draft device 506 that drafts (draws) the sliver 504 to form and to arrange a fiber bundle 505. The draft device 506 comprises four roller pairs, that is, a back roller pair 507, a third roller pair 508, a second roller pair 509, and a front roller pair 510, arranged in this order along the direction in which the sliver 504 is conveyed. An apron belt is wound around the rollers of the second roller pair 509 to enlarge a nip area for the sliver 504.

[0046] The elastic yarn 5 is supplied to between the front roller pair 510 and the second roller pair 509 of the draft device 506 so as to join the fiber bundle 505. The

following are provided on a route for the elastic yarn 5 which extends from the unwinding device 100 to the draft device 506: a funnel portion 560 into which the elastic yarn 5 is inserted, an air sucker device 558, an elastic yarn detecting sensor 532, a clamp cutter device 533, and an elastic yarn supply guide cylinder 559. The elastic yarn 5 is supplied to the draft device 506 through these devices.

[0047] A pneumatic spinning device 513 as the above spinning device is provided downstream side of the draft device 506. The pneumatic spinning device 513 contains a pneumatic spinning nozzle that carries out spinning by causing whirling currents of compressed air to act on the elastic yarn 11 supplied from the unwinding device 100 and on the fiber bundle 505 drafted by the draft device 506. The pneumatic spinning device 513 manufactures a core yarn 12 composed of the elastic yarn 11 as a core fiber and covered with the fibers of the fiber bundle 5.

[0048] A delivery roller 514 is provided downstream side of the pneumatic spinning device 513 to exert a feeding force on the core yarn 512 manufactured by the pneumatic spinning device 513. A winding device 516 is provided downstream side of the delivery roller 514 to wind the core yarn 512 around a package 515. Further, the following are arranged on a route for the core yarn 512 which extends from the delivery roller 514 to the package 515: a slab catcher (thickness defect detector) 517 that detects yarn defects and a cutter 563 that cuts the core yarn 512 on the basis of the detection of a yarn defect carried out by the slab catcher 517.

[0049] A summary will be given of the unwinding device for a package in accordance with the present invention.

[0050] The unwinding device for a package, corresponding to a first device invention, comprises a friction roller that contacts with a peripheral surface of the package to rotate the package and yarn guiding means for guiding the yarn unwound and drawn out from the package in the radial direction of the package as a result of rotation of the friction roller. Further, a convex portion is provided on an axial part of the friction roller so that the friction roller contacts with only a central part of the package which is located inside opposite axial ends of the package and which has a substantially fixed outer diameter, the convex portion of the friction roller having a larger diameter than other parts of the friction roller and contacting with the central part of the package.

[0051] In the first and second embodiments, the yarn guiding means is the yarn guide roller 4. In the first and second embodiments, the package 1 is divided into the following three parts along the axial direction, that is, the opposite axial ends 1a, 1a and the central part 1b. The central part 1b of the package 1 has a substantially fixed outer diameter. The friction roller 3 in the first embodiment comprises the friction belt 11 placed radially outside the drum 10 and serving as the convex portion. The friction roller 103 in the second embodiment comprises the rubber ring 111 placed radially outside the drum 110 and

serving as the convex portion.

[0052] The convex portion need not necessarily be separated from the drum 10, 110, like the friction belt 11 on the drum 10 or the rubber ring 111 on the drum 110. The convex portion may be integrated with the drum 10, 110. Further, the present embodiment uses the elastic yarn but is not limited to it provided that the unwinding device configured as described above is used.

[0053] Thus, the higher yarn layer portions of the package do not contact with the friction roller. This prevents inappropriate unwinding even when a yarn is unwound while applying unwinding tension.

[0054] An unwinding device for a package corresponding to a second device invention is the first device invention configured as described below. The friction roller is composed of a cylinder and an annular member which is separate from the cylinder and which is placed radially outside the cylinder. The annular member is the convex portion of the friction roller.

[0055] In the first embodiment, the cylinder is the drum 10 and the annular member is the friction belt 11. In the second embodiment, the cylinder is the drum 110 and the annular member is the rubber ring 111.

[0056] Thus, in the friction roller having the convex portion, the convex portion is separate from the cylinder. This allows an appropriate friction roller to be manufactured to the shape (the axial length or the diameter of the higher yarn layer portions) of the package from which the yarn is to be unwound.

[0057] An unwinding device for a package corresponding to a third device invention comprises a friction roller that contacts with a peripheral surface of the package to rotate the package and yarn guiding means for guiding a yarn unwound and drawn out from the package in the radial direction of the package as a result of rotation of the friction roller. The friction roller is formed so as to be as long as or shorter than an axially central part of the package in the axial direction so that the friction roller contacts with only the central part of the package which is located inside opposite axial ends of the package and which has a substantially fixed outer diameter.

[0058] In the third embodiment, the yarn guiding means is the yarn guide roller 4. In the third embodiment, the package 1 is divided into the following three parts along the axial direction, that is, the opposite axial ends 1a, 1a and the central part 1b. The central part 1b of the package 1 has a substantially fixed outer diameter. The friction roller 203 in the third embodiment is formed to be shorter than the central part 1b of the package 1 in the axial direction.

[0059] Thus, the higher yarn layer portions do not contact with the friction roller. This prevents inappropriate unwinding even when a yarn is unwound while applying unwinding tension.

[0060] Now, a description will be given of a method for unwinding a yarn from a package in accordance with the present invention.

[0061] A method for unwinding a yarn from a package

which method corresponds to a first method invention uses an unwinding device based on a friction roller system and comprises the steps described below. In a first step, a friction roller is contacted with a peripheral surface of the package. In a second step, the friction roller is driven to rotate the package, while unwinding the yarn from the package so that the yarn is unwound in the radial direction of the package. In particular, the friction roller contacts with the peripheral surface of the package in such a way that the opposite ends of the package float from an outer peripheral surface of the friction roller.

[0062] In this case, the friction roller may be contacted with the peripheral surface of the package in any part of the package except its opposite ends. For example, any part of the package except its opposite ends, that is, any part within the central part of the package, may be used as a contacting part with the friction roller regardless of whether it is located at a central position of the package or closer to one of the opposite ends than to the axially central position. That is, the contact between the friction roller and the package may be similar to a point contact rather than a line contact, along the axis of the package. Of course, a line contact may be achieved in which the entire central part of the package except the opposite ends contacts with the friction roller.

[0063] With the above configuration, the higher yarn layer portions do not contact with the friction roller. This prevents inappropriate unwinding even when a yarn is unwound while applying unwinding tension.

[0064] A method for unwinding a yarn from a package which method corresponds to a second method invention is the first method invention configured as described below. The package is an elastic yarn package into which an elastic yarn has been wound. The friction roller drivingly contacts with a central part of the outer peripheral surface of the package to rotate the package, the central part being located away from opposite end surfaces of the package by a predetermined distance within which the package is expected to collapse.

[0065] Even with an elastic yarn package in which package is more likely collapse than in the case of normal yarns, the above configuration prevents the higher yarn layer portions of the package from contacting with the friction roller. This prevents inappropriate unwinding even when a yarn is unwound while applying unwinding tension.

[0066] A method for unwinding a yarn from a package which method corresponds to a third method invention is the second method invention configured as described below. The predetermined distance is larger than the length of higher yarn layer portions formed at the opposite ends of the package.

[0067] Even if a package with higher yarn layer portions, higher yarn layer portions, in which the collapse of the package or latching is likely to occur, do not contact with the friction roller. This prevents inappropriate unwinding even when a yarn is unwound from a package with the higher yarn layer portions while applying unwind-

ing tension to the package.

Claims

1. A method for unwinding a yarn from a package, in which a friction roller is contacted with a peripheral surface of the package to rotate the package, while unwinding the yarn from the package so that the yarn is unwound in the radial direction of the package, the method being **characterized in that** the package is rotated to unwind the yarn in such a way that opposite ends of the package float from an outer peripheral surface of the friction roller. 5
2. A method for unwinding a yarn from a package according to Claim 1, **characterized in that** the package is an elastic yarn package into which an elastic yarn has been wound, and the friction roller drivingly contacts with a central part of the outer peripheral surface of the package to rotate the package, the central part being located away from opposite end surfaces of the package by a predetermined distance within which the package is expected to collapse. 10 15 20 25
3. A method for unwinding a yarn from a package according to Claim 2, **characterized in that** the predetermined distance is larger than the length of higher yarn layer portions formed at the opposite ends of the package. 30
4. A device for unwinding a yarn from a package, the device comprising a friction roller that contacts with a peripheral surface of the package to rotate the package and yarn guiding means for guiding a yarn unwound and drawn out from the package in the radial direction of the package as a result of rotation of the friction roller, the device being **characterized in that** a convex portion is provided on an axial part of the friction roller so that the friction roller contacts with only a central part of the package which is located inside opposite axial ends of the package and which has a substantially fixed outer diameter, the convex portion of the friction roller having a larger diameter than other parts of the friction roller and contacting the central part of the package. 35 40 45
5. A device for unwinding a yarn from a package according to 4, **characterized in that** the friction roller comprises a cylinder, and an annular member which is separate from the cylinder and which is placed radially outside the cylinder, and the annular member is the convex portion of the friction roller. 50 55
6. A device for unwinding a yarn from a package, the device comprising a friction roller that contacts with

a peripheral surface of the package to rotate the package and yarn guiding means for guiding a yarn unwound and drawn out from the package in the radial direction of the package as a result of rotation of the friction roller, the device being **characterized in that** the friction roller is formed so as to be as long as or shorter than an axially central portion of the package in an axial direction so that the friction roller contacts with only the central part of the package which is located inside opposite axial ends of the package and which has a substantially fixed outer diameter.

FIG. 1

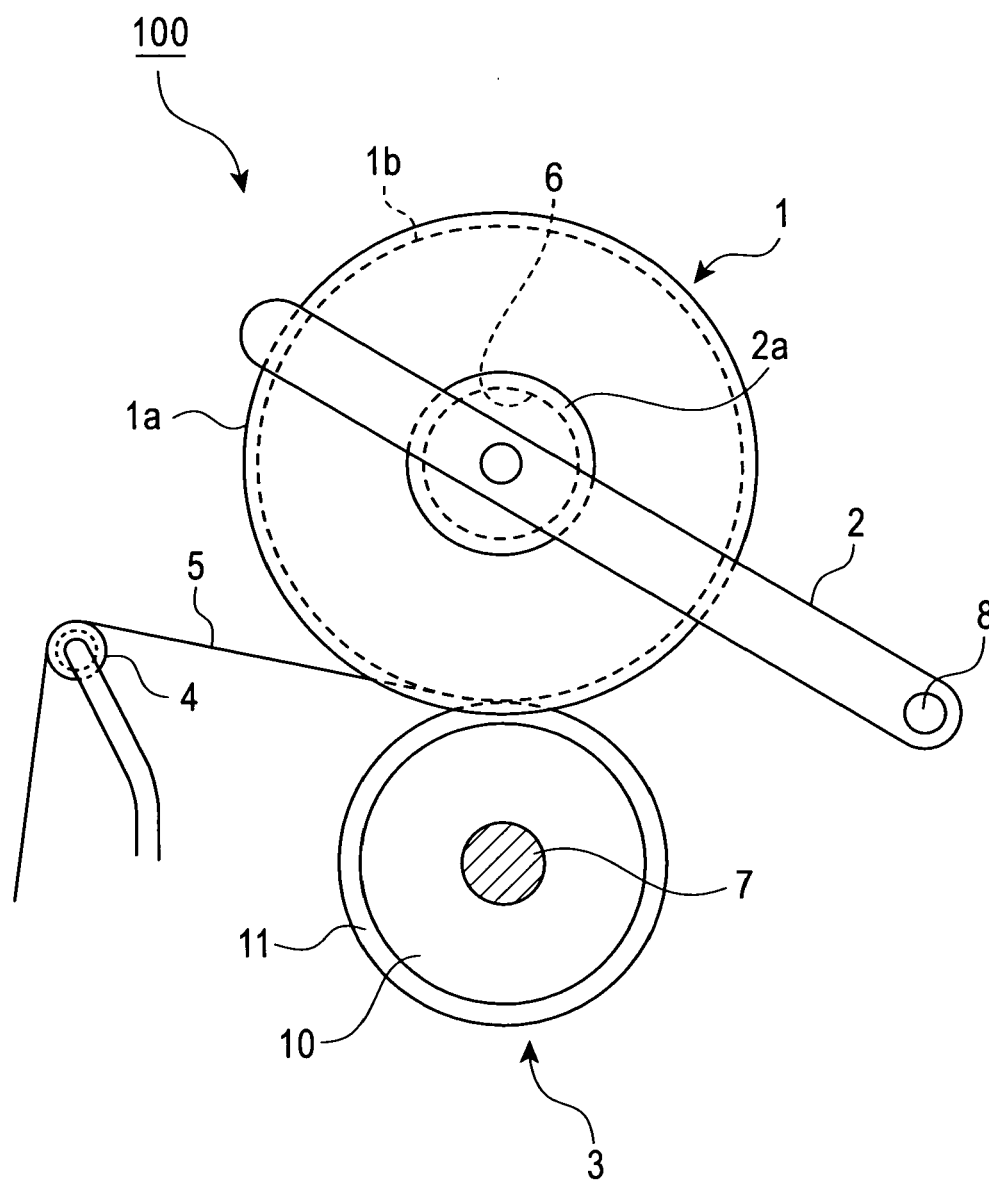


FIG. 2

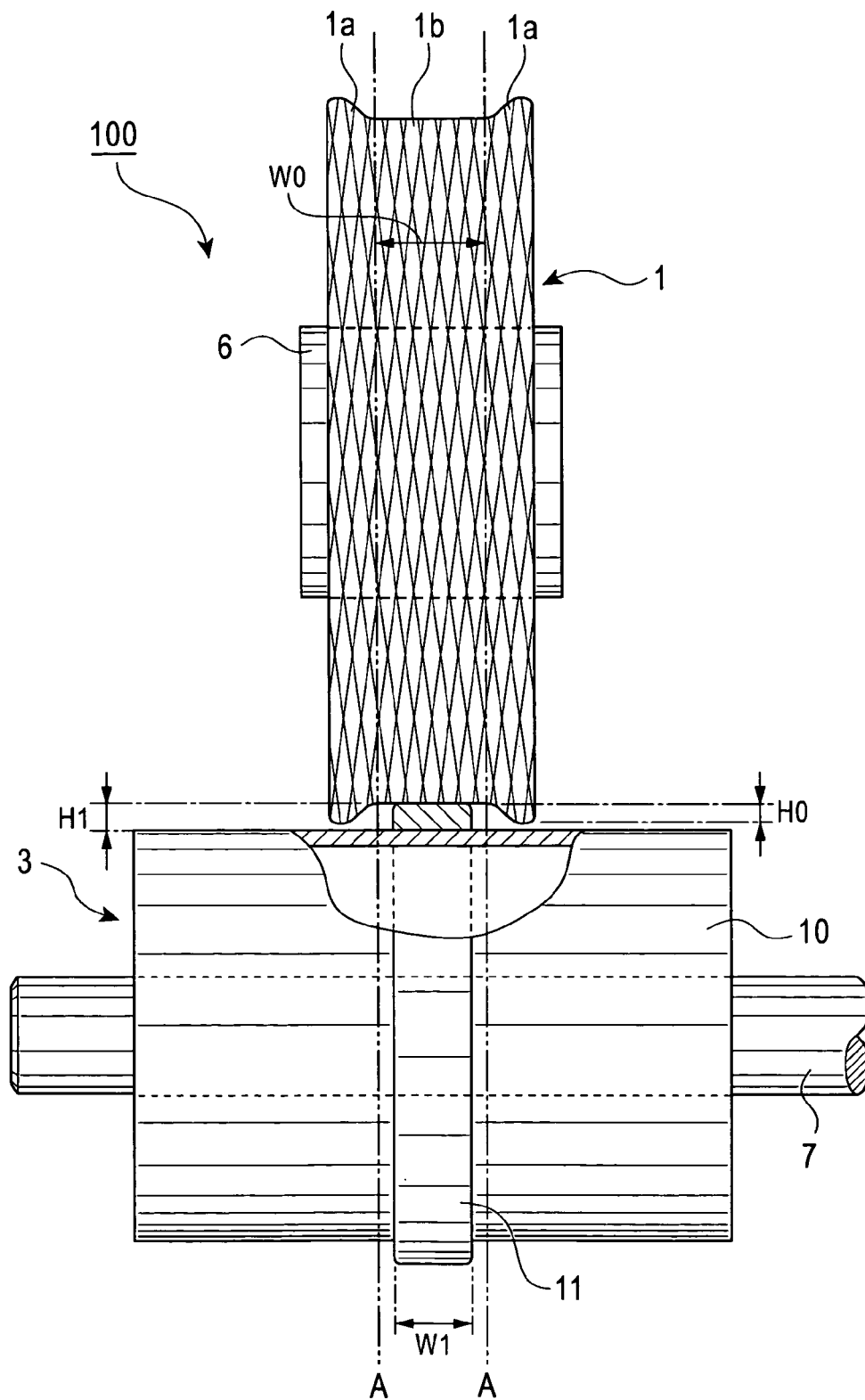


FIG. 3

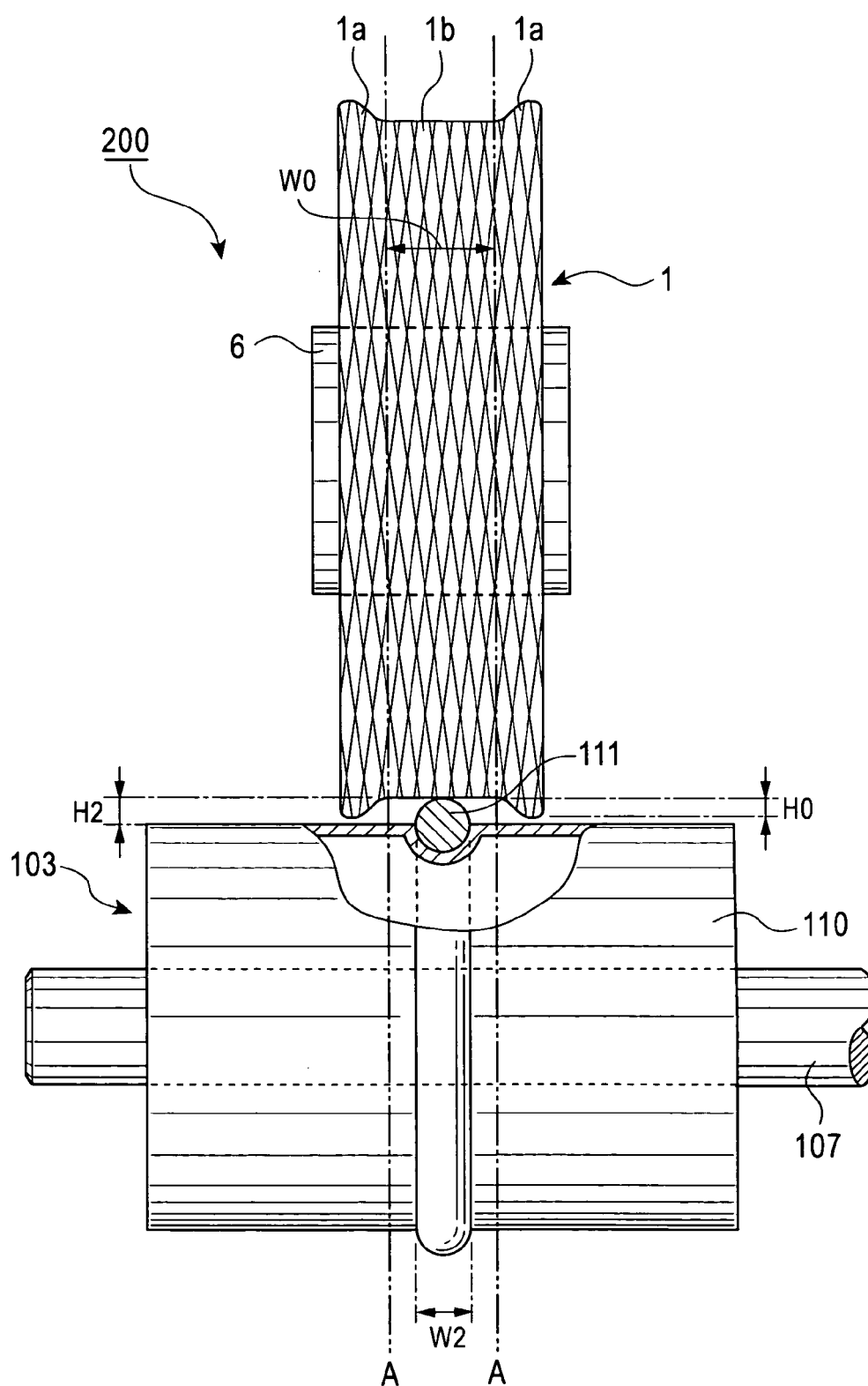
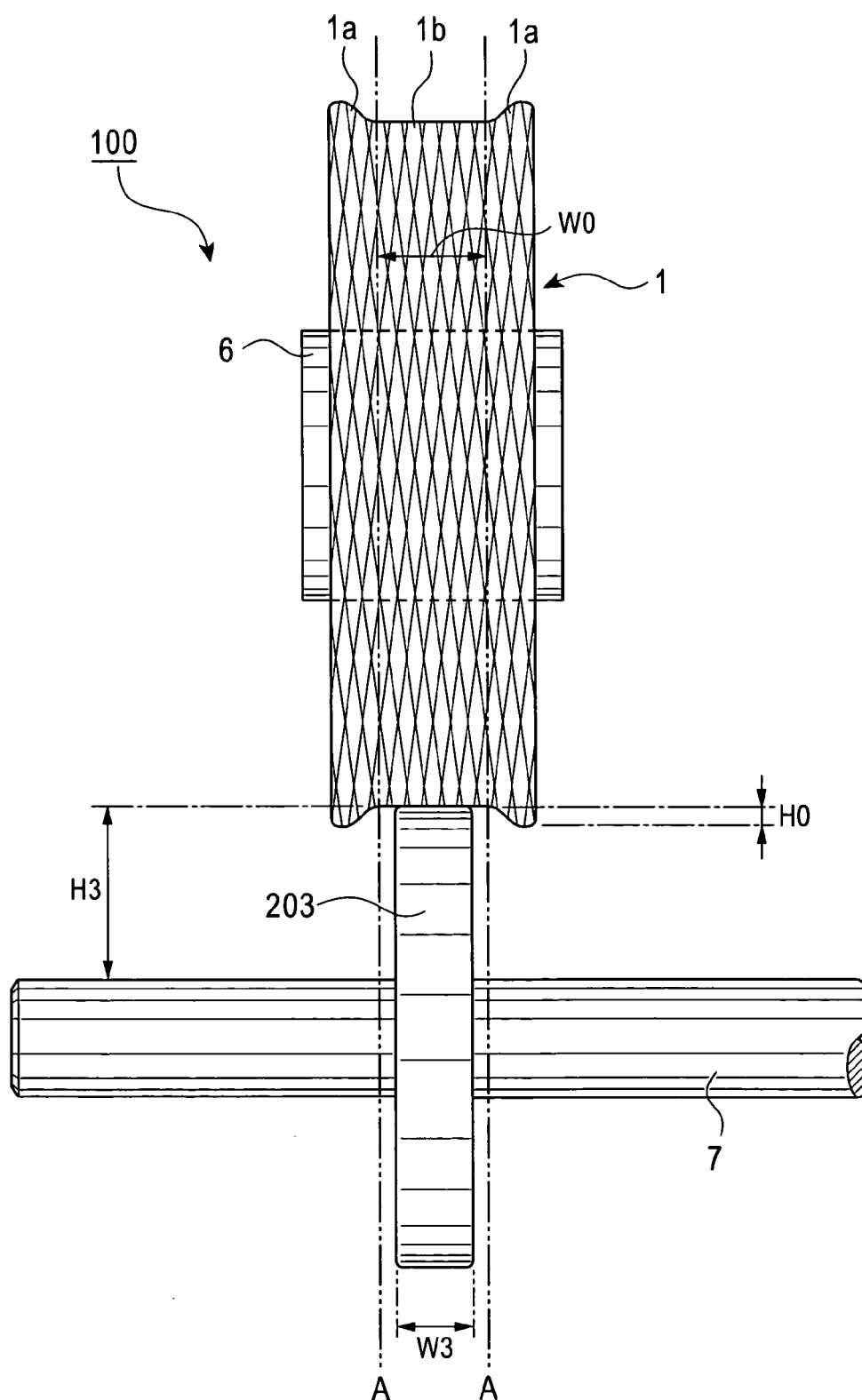


FIG. 4



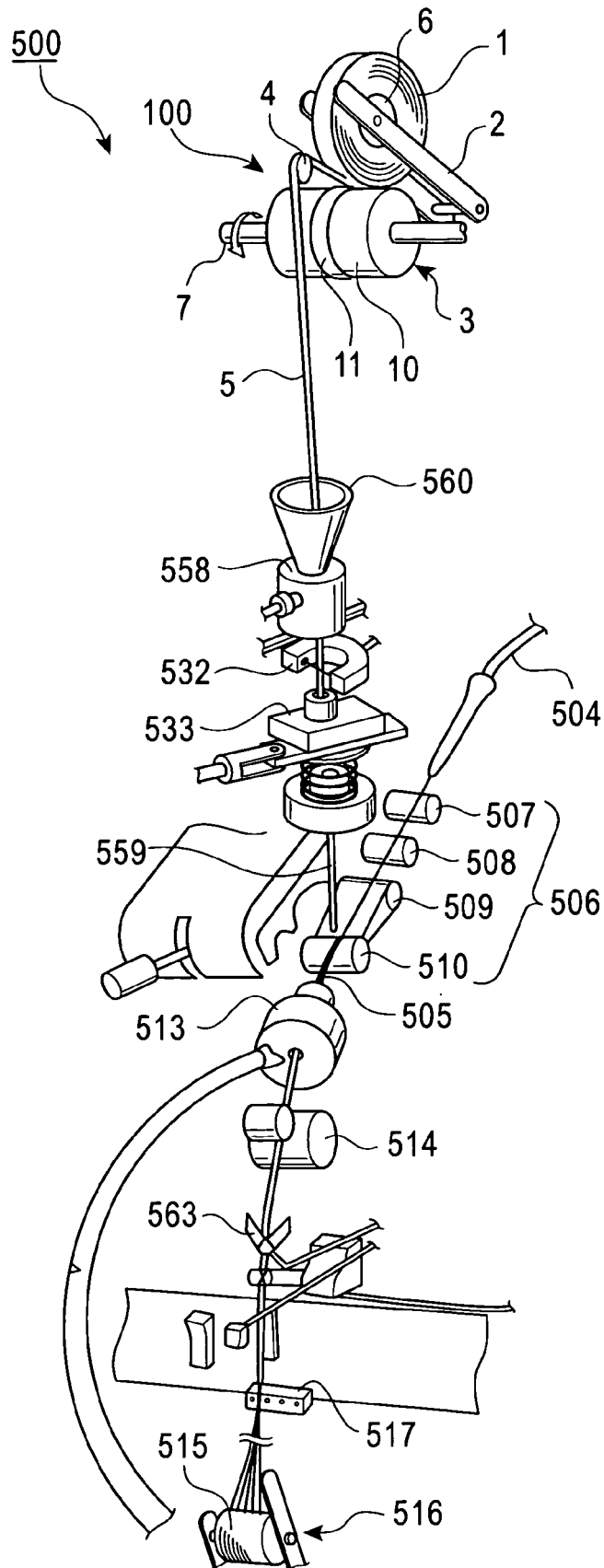


FIG. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 02 7792

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 296 02 916 U1 (ZINSER TEXTILMASCHINEN GMBH, 73061 EBERSBACH, DE) 4 April 1996 (1996-04-04) * page 1, line 11, paragraph 3 - line 17 * * page 2, line 23 - page 3, line 29 * * figures 1,2 * * claims 1-5 *	1-4,6	B65H49/34
A	----- DE 40 42 073 A1 (KARL MAYER TEXTILMASCHINENFABRIK GMBH, 6053 OBERTSHAUSEN, DE; KARL MAY) 2 July 1992 (1992-07-02) * column 4, line 25 - line 30; figure 3 *	1,4,6	
A	----- DE 30 42 957 A1 (MEMMINGER GMBH) 1 July 1982 (1982-07-01) * figures 1-3 * -----	1,4,6	
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Place of search Munich		Date of completion of the search 24 January 2006	Examiner Kising, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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