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(54) YARN WINDING MACHINE AND METHOD FOR MANUFACTURING A PACKAGE

GARNWICKELMASCHINE UND VERFAHREN ZUR HERSTELLUNG EINER SPULE

MACHINE DE BOBINAGE DE FIL ET PROCÉDÉ DE FABRICATION D'UNE BOBINE

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine and a method for manufacturing a package.

2. Description of the Related Art

[0002] As a conventional yarn winding machine, there is known a yarn winding machine including a package driving section adapted to rotationally drive a package, and a traverse device adapted to traverse a yarn to be wound around the package, as described in Japanese Unexamined Patent Publication No. 2007-230708 (Patent Document 1), for example. In the yarn winding machine described in Patent Document 1, creeping is prohibited at start of winding of the package, and the creeping is started when a current diameter of the package becomes equal to or greater than a set diameter.

[0003] In the yarn winding machine, for example, generation of a saddle bag of the package may be prevented by performing creeping. However, a low density portion may be formed in a surface layer of the package by the creeping, thus downgrading outer appearance and a hand feeling (touch) of the package.

[0004] The nearest state of the art regarding the present invention is disclosed in JP H03192072 A. This document already discloses a yarn winding machine comprising a package driving section adapted to rotationally drive a package; a traverse device adapted to traverse a yarn to be wound into the package; and a control section adapted to control the traverse device to perform creeping. In this document, the creeping rate is continuously decreasing.

BRIEF SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a yarn winding machine capable of preventing a low density portion from being formed in a surface layer portion of a package while preventing generation of a saddle bag of the package and a method for manufacturing a package.

[0006] A yarn winding machine according to the present invention includes a package driving section adapted to rotationally drive a package; a traverse device adapted to traverse a yarn to be wound into the package; and a control section adapted to control the traverse device to perform creeping, wherein after a first yarn layer is formed by winding the yarn into the package while performing the creeping under a first creeping rate, a second yarn layer is formed by winding the yarn into the package while performing the creeping under a second creeping rate that is lower than the first creeping rate.

[0007] According to such a yarn winding machine, the creeping is performed to prevent the generation of the saddle bag of the package, and in the surface layer portion of the package, the creeping rate is lowered to prevent the low density portion from being formed. The creeping rate is a value obtained by dividing a creeping amount (amount of change in traverse width in creeping) by a traverse width before the change.

[0008] The yarn winding machine according to the present invention may further include a creeping rate setting section adapted to set the second creeping rate. Thus, for example, when forming the second yarn layer, the yarn can be wound while being creeped under a desired second creeping rate.

[0009] A yarn winding machine according to the present invention includes a package driving section adapted to rotationally drive a package; a traverse device adapted to traverse a yarn to be wound into the package; and a control section adapted to control the traverse device to periodically perform traverse width change to reduce a traverse width in a pulsatile manner accompanying winding of the yarn, wherein after a first yarn layer is formed by winding the yarn into the package while periodically performing the traverse width change under a first changing ratio, a second yarn layer is formed by winding the yarn into the package while periodically performing the traverse width change under a second changing ratio that is lower than the first changing ratio.

[0010] According to such a yarn winding machine, the traverse width change is performed to prevent the generation of the saddle bag of the package, and in the surface layer portion of the package, the changing ratio is lowered to prevent the low density portion from being formed. The changing ratio is an amount of change in a traverse width per unit time in the traverse width change.

[0011] The yarn winding machine according to the present invention further includes a timing setting section adapted to set a timing to start forming the second yarn layer. According to such a structure, for example, an amount of the second yarn layer to be formed can be adjusted to a desired amount.

[0012] In the yarn winding machine according to the present invention, the timing setting section is adapted to set as the timing, a point of time when a yarn layer thickness of the package is at least 90% and less than 100% of a target yarn layer thickness, a point of time when a diameter of the package is at least 90% and less than 100% of a target package diameter, or a point of time when a wound length of the yarn that has been wound into the package is at least 90% and less than 100% of a target winding length. According to such a structure, in the package, the second yarn layer is formed from the point of time when the yarn layer thickness of the package is at least 90% and less than 100% of the target yarn layer thickness, the point of time when the diameter of the package is at least 90% and less than 100% of the target package diameter, or the point of time when the wound length of the yarn is at least 90% and less than 100% of the target winding length.

[0013] A method for manufacturing a package according to the present invention manufactures a package by winding the yarn into the package by the above-described yarn winding machine. Also in this method for manufacturing the package, similarly to the above-described operation effect, the generation of the saddle bag of the package is prevented, and in the surface layer portion of the package, the low density portion can be prevented from being formed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is a schematic view of an automatic winder including a winder unit according to one embodiment;
FIG. 2 is a schematic view and a block diagram illustrating a schematic configuration of the winder unit;
FIG. 3 is a left side view illustrating, in an enlarged manner, proximity of a traverse device of the winder unit;
FIGS. 4A and 4B are views describing creeping by the winder unit;
FIG. 5 is a chart view illustrating an example of an operation of the winder unit; and
FIGS. 6A to 6C are views describing a package manufactured by the winder unit.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0015] Preferred embodiments of the present invention will be hereinafter described in detail with reference to the drawings. In the drawings, the same reference numerals are denoted for the same or corresponding portions, and redundant description will be omitted.

[0016] First, with reference to FIG. 1, an overall configuration of an automatic winder 1 including a winder unit (yarn winding machine) 10 of the present embodiment will be described. In the present specification, "upstream" and "downstream" respectively refer to upstream and downstream in a travelling direction of a yarn at the time of yarn winding.

[0017] As illustrated in FIG. 1, the automatic winder 1 includes a plurality of winder units 10 arranged side by side, an automatic doffing device 80, and a machine control device 90 as main components. Each winder unit 10 is configured to wind a yarn 20 unwound from a yarn supplying bobbin 21 while traversing the yarn 20 to form a package 30. "Traverse" refers to applying reciprocal motion to the yarn being wound. The package 30 is a cross-wound package.

[0018] When the package 30 is fully wound in each winder unit 10, the automatic doffing device 80 travels to a position of the winder unit 10, discharges the fully-wound package 30 from the winder unit 10, and supplies an empty bobbin to the relevant winder unit 10.

[0019] The machine control device 90 includes a setting section 91 and a display section 92. The setting section 91 enables an operator to input a predetermined set value or select an appropriate control method to carry out setting with respect to each winder unit 10. The display section 92 is configured to be able to display winding status of the yarn 20 in each winder unit 10, content of trouble that occurred, and the like. The display section 92 may be configured by a touch panel, and the setting section 91 may be included in the display section 92.

[0020] Next, with reference to FIG. 2, a description will be specifically made on a configuration of the winder unit 10. Each of the winder units 10 includes a winding unit main body 16 and a unit control section 50, as main components.

[0021] The unit control section 50 is configured to include, for example, a Central Processing Unit (CPU), a Random Access Memory (RAM), a Read Only Memory (ROM), an Input-Output (I/O) port, and a communication port. The ROM stores a program for controlling each section of the winding unit main body 16. Each section of the winding unit main body 16 (details are described later) and the machine control device 90 are connected to the I/O port and the communication port. The unit control section 50 is thus configured to be able to communicate the control information and the like. The unit control section 50 thus can control the operation of each section of the winding unit main body 16.

[0022] The winding unit main body 16 includes a yarn unwinding assisting device 12, a tension applying device 13, a yarn joining device 14, and a yarn monitoring device 15 arranged in this order from the upstream on a yarn travelling path between the yarn supplying bobbin 21 and a contact roller 29. A yarn supplying section 11 is arranged at a lower part of the winding unit main body 16. The yarn supplying section 11 is configured to be able to hold the yarn supplying bobbin 21, which has been conveyed by a bobbin conveying system (not illustrated), at a predetermined position.

[0023] The yarn unwinding assisting device 12 assists unwinding of the yarn 20 from the yarn supplying bobbin 21 by lowering a regulating member 40 covering a core tube of the yarn supplying bobbin 21 accompanying the unwinding of the yarn 20 from the yarn supplying bobbin 21. The regulating member 40 is brought into contact with a balloon of the yarn 20 formed at an upper part of the yarn supplying bobbin 21 by rotation and a centrifugal force of the yarn 20 unwound from the yarn supplying bobbin 21 to control the balloon of the yarn 20 to an appropriate size, thus assisting the unwinding of the yarn 20. A sensor (not illustrated) for detecting a chase portion of the yarn supplying bobbin 21 is arranged in proximity to the regulating member 40. When this sensor detects lowering of the chase portion, the yarn unwinding assisting device 12 lowers the regulating member 40 by an air cylinder (not illustrated), for example, following the lowering of the chase portion.

[0024] The tension applying device 13 applies a predetermined tension on the travelling yarn 20. The tension applying device 13 may be a gate-type tension applying device in which movable comb teeth are arranged with respect to fixed comb teeth. The movable comb teeth are swung by a rotary solenoid so that the movable comb teeth are engaged with or released from the fixed comb teeth. A disc-type tension applying device, for example, may be adopted instead of the gate-type tension applying device 13 described above.

[0025] The yarn joining device 14 joins a lower yarn from the yarn supplying bobbin 21 and an upper yarn from the package 30 after the yarn monitoring device 15 detects a yarn defect and cuts the yarn 20, after yarn breakage occurs during unwinding of the yarn 20 from the yarn supplying bobbin 21, and the like. The yarn joining device 14 may be a mechanical-type knotter, or a splicer that uses fluid such as compressed air.

[0026] The yarn monitoring device 15 includes a head 49 provided with a sensor (not illustrated) for detecting a thickness of the yarn 20, and an analyzer 52 for processing a yarn thickness signal from the sensor. The yarn monitoring device 15 is configured to detect a yarn defect such as slub by monitoring the yarn thickness signal from the sensor. A cutter 39 is provided in proximity to the head 49 or in the head 49, and immediately cuts the yarn 20 when the yarn monitoring device 15 detects the yarn defect.

[0027] A lower yarn catching member 25 adapted to catch a yarn end of the lower yarn and guide the yarn end to the yarn joining device 14 is arranged below the yarn joining device 14. An upper yarn catching member 26 adapted to catch a yarn end of the upper yarn and guide the yarn end to the yarn joining device 14 is arranged above the yarn joining device 14. The lower yarn catching member 25 includes a lower yarn pipe arm 33, and a lower yarn suction port 32 formed at a distal end of the lower yarn pipe arm 33. The upper yarn catching member 26 includes an upper yarn pipe arm 36, and an upper yarn suction port 35 formed at a distal end of the upper yarn pipe arm 36.

[0028] The lower yarn pipe arm 33 is configured to be swingable with a shaft 34 as a center. The upper yarn pipe arm 36 is configured to be swingable with a shaft 37 as a center. An appropriate negative pressure source is connected to the lower yarn pipe arm 33 and the upper yarn pipe arm 36. The lower yarn pipe arm 33 is configured to generate a suction flow at the lower yarn suction port 32 to suck and catch the yarn end of the lower yarn. The upper yarn pipe arm 36 is configured to generate a suction flow at the upper yarn suction port 35 to suck and catch the yarn end of the upper yarn. A shutter (not illustrated) is respectively arranged at each of a basal end side of the lower yarn pipe arm 33 and a basal end side of the upper yarn pipe arm 36. Each shutter is opened/closed in accordance with a signal from the unit control section 50. Stop and generation of the suction flow from the lower yarn suction port 32 and the upper yarn suction port 35 are thereby controlled.

[0029] The winding unit main body 16 includes a cradle (holding section) 23 adapted to removably hold a winding bobbin 22, and a contact roller 29 rotatable while making contact with a peripheral surface of the winding bobbin 22 or a peripheral surface of the package 30. The winding unit main body 16 includes an arm type traverse device 70 for traversing the yarn 20. The traverse device 70 is arranged in proximity to the cradle 23. The winding unit main body 16 can wind the yarn 20 into the package 30 while traversing the yarn 20 by the traverse device 70. A guide plate 28 is arranged slightly upstream of a traverse area. The guide plate 28 guides the yarn 20 located upstream to the traverse area. A traverse fulcrum 27 made of ceramics is arranged further upstream of the guide plate 28. The traverse device 70 traverses the yarn 20 in a direction indicated with an arrow in FIG. 2 with the traverse fulcrum 27 as a center.

[0030] The cradle 23 can swing with a swing shaft 48 as the center. An increase in a diameter of the package 30 accompanying the winding of the yarn 20 around the winding bobbin 22 can be absorbed by the swinging of the cradle 23. The cradle 23 includes a rotation speed sensor 24 adapted to measure the rotation speed of the package 30.

[0031] A package driving motor (package driving section) 41 configured by a servo motor is attached to the cradle 23. The package driving motor 41 rotationally drives the winding bobbin 22 to wind the yarn 20 around the winding bobbin 22. The package driving motor 41 rotatably drives the package 30 in forward rotation of rotating the package 30 (winding bobbin 22) in a winding direction and in reverse rotation of rotating the package 30 in an unwinding direction, which is a direction opposite to the winding direction. A motor shaft of the package driving motor 41 is coupled with the winding bobbin 22 so as to be relatively non-rotatable when the winding bobbin 22 is supported by the cradle 23 (so-called direct drive type).

[0032] An operation of the package driving motor 41 is controlled by a package drive control section 42. The package drive control section 42 controls the operation and stop of the package driving motor 41 upon receiving an operation signal from the unit control section 50. The package driving motor 41 is not limited to the servo motor, and various types of motors such as a step motor and an induction motor can be adopted.

[0033] An angle sensor 44 for detecting the angle of the cradle 23 is attached to the swing shaft 48. The angle sensor 44 includes a rotary encoder, for example, and transmits an angle signal corresponding to an angle of the cradle 23 to the unit control section 50. Since the angle of the cradle 23 changes as the diameter of the package 30 increases, the diameter of the package 30 can be detected by detecting a swing angle of the cradle 23 with the angle sensor 44. As a configuration for detecting the diameter of the package 30, a sensor using a hall IC, an absolute type encoder, or the like can be

used instead of the angle sensor 44. As a configuration for detecting the diameter of the package 30, an appropriate configuration can be used as long as the diameter of the package 30 can be detected.

[0034] As a method for detecting the diameter of the package 30, a detection method of detecting the diameter of the package 30 based on, for example, a total length of the yarn 20 wound into the package 30, a winding speed of the yarn 20, and a type of the yarn 20 (thickness and the like) may be used. As the method for detecting the diameter of the package 30, a method of measuring a time from start of winding of the yarn 20 into the package 30 may be used. Specifically, for example, the unit control section 50 acquires the winding speed of the yarn 20 and information on the type of the yarn 20 (thickness and the like), and stores in advance a relationship between an elapsed time from the start of winding of the yarn 20 and the diameter of the package 30. The unit control section 50 thus can calculate the diameter of the package 30 based on the elapsed time.

[0035] As the method for detecting the diameter of the package 30, a method of calculating the diameter of the package 30 based on a travelling speed of the yarn 20 on the yarn travelling path between the yarn supplying bobbin 21 and the contact roller 29 may be used. Specifically, the travelling speed of the yarn 20 is detected by the yarn monitoring device 15 or a dedicated yarn speed sensor. The unit control section 50 calculates a winding angle based on the travelling speed and a traverse speed of the yarn 20, and calculates a peripheral speed of the package 30 from the winding angle and the travelling speed. The unit control section 50 then calculates the diameter of the package 30 based on the rotation speed of the package 30 and the peripheral speed of the package 30. When detecting the diameter of the package 30 by calculation, the configuration for detecting the angle of the cradle 23 with the angle sensor 44 and the like may be omitted.

[0036] As illustrated in FIGS. 2 and 3, the traverse device 70 includes a traverse driving motor 76, an output shaft 77, and a traverse arm 74. FIG. 3 is a view seen in an axial direction of the contact roller 29. The rotation in the winding direction of the package 30 is a clockwise direction in FIG. 3, and the rotation in the unwinding direction of the package 30 is a counterclockwise direction in FIG. 3.

[0037] The traverse driving motor 76 is a motor adapted to drive the traverse arm 74, and is configured by a servo motor and the like. An operation of the traverse driving motor 76 is controlled by a traverse control section 78. The traverse driving motor 76 may be other motors such as a step motor or a voice coil motor. A hook-shaped yarn guide section 73, for example, is formed at a distal end of the traverse arm 74. The traverse arm 74 can guide the yarn 20 by the yarn guide section 73. The traverse arm 74 is reciprocated with the yarn 20 guided by the yarn guide section 73, and the yarn 20 is traversed.

[0038] The traverse control section 78 is configured by a hardware and the like by a dedicated microprocessor, and controls the operation and stop of the traverse driving motor 76 upon receiving a signal from the unit control section 50. Power of the traverse driving motor 76 is transmitted to a basal end of the traverse arm 74 via the output shaft 77. When a rotor of the traverse driving motor 76 is forwardly/reversely rotated, the traverse arm 74 reciprocates in a direction perpendicular to the plane of drawing in FIG. 3 (left and right direction in FIG. 2 (winding width direction of the package 30)). FIG. 3 illustrates a state where the traverse arm 74 is located at an end of the traverse.

[0039] The unit control section 50 transmits a drive signal to the package drive control section 42, and controls rotational drive of the package driving motor 41. The unit control section 50 controls a catching operation of the lower yarn catching member 25 and the upper yarn catching member 26 (swinging of the lower yarn pipe arm 33 and the upper yarn pipe arm 36). The unit control section 50 controls the opening/closing of the shutter arranged on the lower yarn pipe arm 33 and the upper yarn pipe arm 36, and controls the stop and generation of the suction flow from the lower yarn suction port 32 and the upper yarn suction port 35.

[0040] In the present embodiment, the traverse control section 78 includes a creeping control section (control section) 78x, and the unit control section 50 includes a creeping rate switching section (control section) 50x. The creeping control section 78x controls the traverse device 70 to perform creeping. The creeping is a process of periodically changing the traverse width. Specifically, the creeping is a process of periodically performing a change of reducing in a pulsatile manner (temporarily) an actual traverse width from a set traverse width with elapse of time (the rotation of the package 30) .

[0041] When forming a first yarn layer 30a by winding the yarn 20 into the package 30 (see FIG. 6C), the creeping control section 78x performs a first creeping control of performing the creeping under a normal creeping rate (first creeping rate). After the first creeping control is performed and the first yarn layer 30a is formed, when forming a second yarn layer 30b by winding the yarn 20 into the package 30 (see FIG. 6C), the creeping control section 78x performs a second creeping control of performing the creeping under a winding end creeping rate (second creeping rate) that is lower than the normal creeping rate. The winding end creeping rate may be 0%, in which case, the creeping is not performed.

[0042] The creeping rate switching section 50x switches the creeping rate of the creeping performed by the creeping control section 78x. That is, the creeping rate switching section 50x switches execution of the first creeping control and the second creeping control. When a full-package rate of the current package 30 reaches a rate at which the creeping is set to be switched to winding end creeping (hereinafter simply referred to as a "winding end creeping switching full-package rate"), the creeping rate switching section 50x transmits a winding end creep-

ing switching command to the traverse control section 78, and switches the creeping rate from the normal creeping rate to the winding end creeping rate (to be described in detail later). The full-package rate is a percentage of the diameter of the package 30 at a certain point of time with respect to a final target diameter of the package 30 set in advance.

[0043] FIG. 4A is a view describing the creeping performed by the creeping control section 78x, and FIG. 4B is a partially enlarged view of FIG. 4A. In FIG. 4A, a vertical axis indicates time T, and a horizontal axis indicates traverse width H. FIG. 4A illustrates a part of a path of the yarn 20 to be wound into the package 30 in a planarly developed manner.

[0044] As illustrated in FIG. 4A, a creeping amount is an amount of change (reduction amount) in the traverse width H in the creeping. A creeping time is a time during which the traverse width H is being changed in the creeping. For example, within the creeping time, the traverse width H is reduced from the set traverse width accompanying the winding of the yarn 20, and after the traverse width H is reduced from the set traverse width by the creeping amount, the traverse width H is increased until it returns to the set traverse width.

[0045] The creeping rate is a value obtained by dividing the creeping amount by the set traverse width before the change. Lowering the creeping rate means reducing a degree of reduction of the traverse width H (lower a degree of creeping), or not reducing the traverse width H with respect to the set traverse width. The creeping amount becomes small within a constant creeping time by lowering the creeping rate, and hence a reduction amount ΔH of the traverse width H per unit time ΔT (see FIG. 4B) becomes small.

[0046] The creeping control section 78x and the creeping rate switching section 50x as described above are, in other words, configured as below. That is, the creeping control section 78x periodically executes the traverse width change of reducing the traverse width H in a pulsatile manner accompanying the winding of the yarn 20. The creeping control section 78x periodically executes the traverse width change under the first changing ratio when forming the first yarn layer 30a. When forming the second yarn layer 30b after forming the first yarn layer 30a, the creeping control section 78x periodically executes the traverse width change under the second changing ratio that is lower than the first changing ratio. The creeping rate switching section 50x switches the changing ratio of the traverse width change executed by the creeping control section 78x. When a full-package rate of the current package 30 reaches the winding end creeping switching full-package rate, the creeping rate switching section 50x transmits a winding end creeping switching command to the traverse control section 78, and switches the changing ratio from the first changing ratio to the second changing ratio. The changing ratio is the amount of change ΔH in the traverse width H per unit time ΔT.

[0047] The normal creeping rate and the winding end creeping rate are set by the setting section 91 of the machine control device 90. The setting section 91 functions as a creeping rate setting section, and individually or collectively sets the normal creeping rate and the winding end creeping rate of each winder unit 10.

[0048] The timing to start forming the second yarn layer 30b of the package 30 is set by the setting section 91 of the machine control device 90. The setting section 91 functions as a timing setting section, and individually or collectively sets the timing to start forming the second yarn layer 30b of the package 30 of each winder unit 10.

[0049] The timing to start forming the second yarn layer 30b is a point of time immediately before the end of winding of the package 30, and is a point of time at which the full-package rate of the current package 30 has reached the winding end creeping switching full-package rate in the present embodiment. For example, the timing to start forming the second yarn layer 30b may be a point of time when a yarn layer thickness of the package 30 is at least 90% and less than 100% of a target yarn layer thickness set in advance, specifically, a point of time when the yarn layer thickness is 99% of the target yarn layer thickness. For example, the timing to start forming the second yarn layer 30b may be a point of time when a diameter of the package 30 is at least 90% and less than 100% of a target package diameter set in advance, specifically, a point of time when the diameter is 99% of the target package diameter. The yarn layer thickness and the diameter of the package 30 can be acquired by using the method for detecting the diameter of the package 30 described above. The yarn layer thickness of the package 30 can be calculated by, for example, subtracting a diameter of the winding bobbin 22 from the diameter of the package 30. Information related to the diameter of the winding bobbin 22 is set in advance from the setting section 91 by the operator.

[0050] For example, the timing to start forming the second yarn layer 30b may be a point of time when a wound length of the yarn 20 wound into the package 30 is at least 90% and less than 100% of a target winding length set in advance, specifically, 99% of the target winding length. The wound length of the yarn 20 can be detected using a contactless photoelectric length detecting device. A sensor for detecting a pulse for every one rotation of the contact roller 29 may be arranged in the winder unit 10, and the wound length may be calculated by counting the number of pulses with the unit control section 50.

[0051] The unit control section 50 controls the package drive control section 42 and the traverse control section 78. The traverse control section 78 controls a winding type of the yarn 20 of the first yarn layer 30a and the second yarn layer 30b. The traverse control section 78 performs a control to form the first yarn layer 30a by at least one of random winding, step precision winding, and precision winding. The traverse control section 78 performs a control to form the second yarn layer 30b by at least one of step precision winding and precision winding.

[0052] The random winding is a winding type of winding the yarn 20 into the package 30 at a constant winding angle. In the random winding, a ratio between the winding speed and the traverse speed of the yarn 20 is constant, and the number of windings (number of times the package 30 rotates during the traverse for one reciprocation) changes with the change in the diameter of the package 30. In the yarn layer formed by the random winding, hardness and the density of the yarn layer can be maintained constant.

[0053] The step precision winding is a winding type of winding the yarn 20 into the package 30 while maintaining the winding angle within a certain range close to a predetermined angle (standard winding angle) by switching the number of windings in a step-like manner. In the step precision winding, the following control is repeated, that is, when the number of windings approaches a critical number of windings in which the ribbon winding occurs, the number of windings is changed from the state where the number of windings is maintained within a certain range to the state where the number of windings does not become the critical number of windings by rapidly changing the winding angle (traverse jump), and then the state of the number of windings is returned to the state where the number of windings is maintained within the certain range. According to the step precision winding, a ribbon winding region is not formed at all, and the yarn 20 can be wound with yarn diamonds formed by winding the yarn 20 into the package 30 aligned (adjacent yarn diamonds arranged at an equal pitch).

[0054] The precision winding is a winding type of maintaining the number of windings to a constant value and winding the yarn 20 into the package 30 regardless of a size of the diameter of the package 30. In the precision winding, the traverse angle is reduced with increase in the diameter of the package 30. In the precision winding, the ratio of an angular speed of the package 30 and an angular speed of the traverse is constant. According to the precision winding, the ribbon winding region is not formed at all, and the yarn 20 can be wound with the yarn diamonds of the package 30 aligned.

[0055] Next, a description will be made on a creeping method (manufacturing method of the package 30) performed in the winder unit 10 with reference to the flowchart of FIG. 5.

[0056] First, in the setting section 91 of the machine control device 90, a winding end creeping switching full-package rate is set (step S1). The winding end creeping switching full-package rate can be set with the yarn layer thickness of the package 30, the diameter of the package 30, or the wound length of the yarn 20 wound into the package 30 as a reference, as described above. In the setting section 91, the winding end creeping rate is set (step S2). Steps S1 and S2 can be performed in any order.

[0057] Next, the unit control section 50 determines whether or not the yarn 20 is currently being wound into the package 30 (step S3). When the yarn 20 is not currently being wound, the process ends. When the yarn 20 is currently being wound, the unit control section 50 determines whether or not the package 30 is a full package (step S4). When the package 30 is already a full package, the winding is stopped and the process ends (step S5).

[0058] When the package 30 is not a full package, the creeping rate switching section 50x determines whether or not the winding end creeping switching command has been transmitted to the creeping control section 78x (step S6). When the winding end creeping switching command has not been transmitted to the creeping control section 78x, the creeping rate switching section 50x determines whether or not the current full-package rate is equal to or greater than the winding end creeping switching full-package rate (step S7) . When the current full-package rate is equal to or greater than the winding end creeping switching full-package rate, the winding end creeping switching command is transmitted to the creeping control section 78x from the creeping rate switching section 50x (step S8) .

[0059] Upon receiving the winding end creeping switching command (YES in step S6 or after step S8), the creeping control section 78x sets the current creeping rate to the winding end creeping rate (step S10). When the current full-package rate is not equal to or greater than the winding end creeping switching full-package rate (NO in step S7), the current creeping rate is set to the normal creeping rate by the creeping control section 78x (step S11). After step S10 or step S11, the creeping operation of the traverse device 70 is updated, and the process returns to step S3 (step S12).

[0060] As described above, the first yarn layer 30a is formed by winding the yarn 20 into the package 30 while performing the creeping under the normal creeping rate. Thereafter, when the full-package rate reaches the winding end creeping switching full-package rate, the yarn 20 is wound into the package 30 while the creeping is performed under the winding end creeping rate lower than the normal creeping rate. The second yarn layer 30b is thereby formed in the surface layer portion of the package 30.

[0061] FIG. 6A is a view illustrating a surface layer of a package 30' formed by performing the creeping under the normal creeping rate without switching the creeping rate. FIG. 6B is a view illustrating the surface layer of the package 30 formed by the present embodiment. FIG. 6C is a cross-sectional view illustrating the surface layer portion of the package 30 formed by the present embodiment. The winding type of the package 30' is the step precision winding.

[0062] In the package 30', the creeping is performed under the normal creeping rate from the start of winding to the end of winding. In the package 30' , the traverse width H is greatly changed as compared to when the creeping is performed under the winding end creeping rate, and hence the pitch at which the yarn 20 is arranged is greatly changed, as illustrated in FIG. 6A. Therefore, the arranged yarn 20 overlaps or the pitch of the yarn 20

differs, and hence a low density portion exists (hard portion exists) when an outer circumferential surface of the package 30' is touched with hand.

[0063] As illustrated in FIGS. 6B and 6C, the package 30 according to the present embodiment is manufactured by being wound by the winder unit 10, and has the following configuration. The package 30 includes the first yarn layer 30a formed by the yarn 20 wound while being creeped under the normal creeping rate, and the second yarn layer 30b arranged on the first yarn layer 30a and formed by the yarn 20 wound while being creeped under the winding end creeping rate. In other words, the package 30 includes the first yarn layer 30a formed by the yarn 20 wound while the traverse width change being periodically performed under the first changing ratio, and the second yarn layer 30b arranged on the first yarn layer 30a and formed by the yarn 20 wound while the traverse width change being periodically performed under the second changing ratio.

[0064] The first yarn layer 30a of the package 30 is formed by at least one of random winding, step precision winding, and precision winding. The second yarn layer 30b of the package 30 is formed by at least one of step precision winding and precision winding. As illustrated in FIG. 6B, the second yarn layer 30b of the package 30 is exposed to the outside, and a yarn (yarn diamonds of the surface layer) 30s of an uppermost layer in the second yarn layer 30b is arranged at an equal pitch.

[0065] Therefore, according to the winder unit 10, after the first yarn layer 30a is formed by winding the yarn 20 into the package 30 while performing the creeping under the normal creeping rate, the second yarn layer 30b is formed by winding the yarn 20 into the package 30 while performing the creeping under the winding end creeping rate. Generation of saddle bag of the package 30 can be prevented by performing the creeping during the winding. The creeping rate may be set low at the second yarn layer 30b, which is located close to the surface layer portion of the full package, to prevent the low density portion from being formed.

[0066] In other words, according to the winder unit 10, after the first yarn layer 30a is formed by winding the yarn 20 into the package 30 while periodically performing the traverse width change under the first changing ratio, the second yarn layer 30b is formed by winding the yarn 20 into the package 30 while periodically performing the traverse width change under the second changing ratio lower than the first changing ratio. The generation of the saddle bag of the package 30 can be prevented by performing the traverse width change during the winding. The changing ratio of the traverse width change may be set low at the second yarn layer 30b, which is located close to the surface layer portion of the full package, to prevent the low density portion from being formed.

[0067] As a result, the yarn diamonds of the surface layer portion of the package 30 are aligned to improve outer appearance, and regardless of a difference in full-package diameter and/or a weight of the package 30, the surface layer portion of the package 30 at the time of full package can be reliably wound with the aligned yarn diamonds. The package 30 may be, for example, a soft wound package used for dying. In this case, the creeping rate is basically set high in the soft wound package to soften edge portions, and hence drawbacks at the time of handling the package 30 are less likely to occur even if the creeping rate is made low at the end of winding.

[0068] In the winder unit 10, the winding end creeping rate is set by the setting section 91. Thus, the creeping can be performed with the desired winding end creeping rate to form the second yarn layer 30b.

[0069] In the winder unit 10, the winding end creeping switching full-package rate, which is the timing to start forming the second yarn layer 30b, is set by the setting section 91. Thus, the amount of the second yarn layer 30b to be formed (yarn length and/or thickness in the second yarn layer 30b) can be desirably adjusted.

[0070] In the winder unit 10, the point of time when the yarn layer thickness of the package 30 is at least 90% and less than 100% of the target yarn layer thickness, the point of time when the diameter of the package 30 is at least 90% and less than 100% of the target package diameter, or the point of time when the wound length of the yarn 20 that has been wound into the package 30 is at least 90% and less than 100% of the target winding length is set as the timing to start forming the second yarn layer 30b. In this case, the formation of the second yarn layer 30b is not started from an early stage, and hence the yarn layer of different density can be prevented from becoming thick and thus forming pattern windings.

[0071] The package 30 includes the first yarn layer 30a formed by the yarn 20 wound while being creeped under the normal creeping rate, and the second yarn layer 30b arranged on the first yarn layer 30a and formed by the yarn 20 wound while being creeped under the winding end creeping rate that is lower than the normal creeping rate. According to the package 30, similarly to the above-described operation effect, the creeping is performed to prevent the generation of the saddle bag of the package 30, and in the surface layer portion located close to the full package, the creeping rate is lowered to prevent the low density portion from being formed.

[0072] In other words, the package 30 includes the first yarn layer 30a formed by the yarn 20 wound while the traverse width change being periodically performed under the first changing ratio, and the second yarn layer 30b arranged on the first yarn layer 30a and formed by the yarn 20 wound while the traverse width change being periodically performed under the second changing ratio that is lower than the first changing ratio. According to the package 30, similarly to the above-described operation effect, the traverse width change is performed to prevent the generation of the saddle bag of the package 30, and in the surface layer portion located close to the full package, the changing ratio of the traverse width change is lowered to prevent the low density portion from being formed.

[0073] In the package 30, the yarn 30s of the uppermost layer in the second yarn layer 30b is arranged at an equal pitch. In this case, a package 30 with satisfactory outer appearance and hand feeling can be provided.

[0074] In the package 30, the first yarn layer 30a is formed by at least one of the random winding, the step precision winding, and the precision winding, and the second yarn layer 30b is formed by at least one of the step precision winding and the precision winding. In this case, a package 30 with satisfactory outer appearance and hand feeling can be provided. In particular, in the package 30, the creeping or the traverse width change is performed in the second yarn layer 30b formed by the step precision winding or the precision winding, but the pitch of the yarn 20 to be arranged can be prevented from becoming uneven and the yarn diamonds can be aligned.

[0075] A method for manufacturing the package 30 winds the yarn 20 by the winder unit 10 to manufacture the package 30. Also in this manufacturing method, similarly to the above-described operation effect, the generation of the saddle bag of the package 30 can be prevented, and the low density portion can be prevented from being formed in the surface layer portion of the package 30.

[0076] One embodiment of the present invention has been described above, but the present invention is not limited to the above-described embodiment. In the above-described embodiment, the package 30 is directly rotationally driven by the package driving motor 41, but in the present invention, the contact roller 29 may be rotationally driven and the package 30 may be rotated accompanying the rotation of the contact roller 29.

[0077] In the above-described embodiment, when forming the second yarn layer 30b, the changing ratio (the amount of change ΔH of the traverse width H per unit time ΔT) of the traverse width change may be lowered by increasing the creeping time under the condition at which the creeping amount is constant as compared to when forming the first yarn layer 30a.

[0078] In the above-described embodiment, when forming the second yarn layer 30b, the number of times to change the traverse width H per predetermined time may be reduced (extend the period (frequency) of change of the traverse width H) as compared to when forming the first yarn layer 30a. In this case as well, similarly to the above-described operation effect, the generation of the saddle bag of the package 30 can be prevented by the traverse width change, and the low density portion can be prevented from being formed in the surface layer portion.

[0079] In the above-described embodiment, the creeping control section 78x and the creeping rate switching section 50x are separately provided. However, the creeping control section 78x and the creeping rate switching section 50x may be provided integrally. In the above-described embodiment, the unit control section 50, the package drive control section 42, and the traverse control section 78 are separately arranged, but at least one of the package drive control section 42 and the traverse control section 78 may be collectively (integrally) arranged within the unit control section 50. The setting section 91 may be arranged in the unit control section 50 of each winder unit 10, and the setting section 91 may function as the creeping rate setting section and the timing setting section. In the above-described embodiment, the first creeping rate is not necessarily a constant rate, and may change depending on the yarn layer to be formed.

Claims

1. A yarn winding machine (10) comprising:

a package driving section (41) adapted to rotationally drive a package (30);
a traverse device (70) adapted to traverse a yarn (20) to be wound into the package (30); and
a control section (78x) adapted to control the traverse device (70) to perform creeping, **characterized in that**
after a first yarn layer (30a) is formed by winding the yarn (20) into the package (30) while performing the creeping under a first creeping rate, a second yarn layer, being a surface yarn layer (30b) is formed by winding the yarn (20) into the package (30) while performing the creeping under a second creeping rate that is lower than the first creeping rate, or while performing no creeping;
and by comprising a timing setting section (91) adapted to set a timing to start forming the second yarn layer (30b);
wherein the timing setting section (91) is adapted to set as the timing, a point of time when a yarn layer thickness of the package (30) is at least 90% and less than 100% of a target yarn layer thickness, a point of time when a diameter of the package (30) is at least 90% and less than 100% of a target package diameter, or a point of time when a wound length of the yarn (20) that has been wound into the package (30) is at least 90% and less than 100% of a target winding length.

2. A yarn winding machine (10) according to claim 1, **characterized by** a creeping rate setting section (91) adapted to set the second creeping rate.

3. A yarn winding machine (10) comprising:

a package driving section (41) adapted to rotationally drive a package (30);
a traverse device (70) adapted to traverse a yarn (20) to be wound into the package (30); and
a control section (78x) adapted to control the traverse device (70) to periodically perform

traverse width change to reduce a traverse width in a pulsatile manner accompanying winding of the yarn (20), **characterized in that**
after a first yarn layer (30a) is formed by winding the yarn (20) into the package (30) while periodically performing the traverse width change under a first changing ratio, a second yarn layer, being a surface yarn layer (30b) is formed by winding the yarn (20) into the package (30) while periodically performing the traverse width change under a second changing ratio that is lower than the first changing ratio or while performing no traverse width change; and by comprising a timing setting section (91) adapted to set a timing to start forming the second yarn layer (30b);
wherein the timing setting section (91) is adapted to set as the timing, a point of time when a yarn layer thickness of the package (30) is at least 90% and less than 100% of a target yarn layer thickness, a point of time when a diameter of the package (30) is at least 90% and less than 100% of a target package diameter, or a point of time when a wound length of the yarn (20) that has been wound into the package (30) is at least 90% and less than 100% of a target winding length.

4. A method for manufacturing a package (30) by winding the yarn (20) into the package (30), **characterized in that**
after a first yarn layer (30a) is formed by winding the yarn (20) into the package (30) while performing the creeping under a first creeping rate, a second yarn layer, being a surface yarn layer (30b) is formed by winding the yarn (20) into the package (30) while performing the creeping under a second creeping rate that is lower than the first creeping rate, or while performing no creeping;
wherein a timing to start forming the second layer is set to a point of time when a yarn layer thickness of the package (30) is at least 90% and less than 100% of a target yarn layer thickness, a point of time when a diameter of the package (30) is at least 90% and less than 100% of a target package diameter, or a point of time when a wound length of the yarn (20) that has been wound into the package (30) is at least 90% and less than 100% of a target winding length.

5. A method for manufacturing a package (30) by winding the yarn (20) into the package (30) wherein a traverse width change is periodically performed to reduce a traverse width in a pulsatile manner accompanying winding of the yarn (20), **characterized in that**
after a first yarn layer (30a) is formed by winding the yarn (20) into the package (30) while periodically performing the traverse width change under a first changing ratio, a second yarn layer, being a surface yarn layer (30b) is formed by winding the yarn (20) into the package (30) while periodically performing the traverse width change under a second changing ratio that is lower than the first changing ratio or while performing no traverse width change;
wherein a timing to start forming the second layer is set to a point of time when a yarn layer thickness of the package (30) is at least 90% and less than 100% of a target yarn layer thickness, a point of time when a diameter of the package (30) is at least 90% and less than 100% of a target package diameter, or a point of time when a wound length of the yarn (20) that has been wound into the package (30) is at least 90% and less than 100% of a target winding length.

Patentansprüche

1. Garnwickelmaschine (10), welche aufweist:

einen Packungsantriebsabschnitt (41), der dazu ausgelegt ist, eine Packung (30) drehend anzutreiben;
eine Traversiervorrichtung (70), die dazu ausgelegt ist, ein Garn (20) zu traversieren, um es zu der Packung (30) zu wickeln; und
einen Steuerabschnitt (78x), der dazu ausgelegt ist, die Traversiervorrichtung (70) zur Durchführung von Kriechen (Atmen) zu steuern, **dadurch gekennzeichnet, dass**
nachdem eine erste Garnschicht (30a) durch Wickeln des Garns (20) zu der Packung (30) gebildet ist, während das Kriechen unter einer ersten Kriechrate durchgeführt wird, eine zweite Garnschicht, die eine Oberflächen-Garnschicht (30b) ist, durch Wickeln des Garns (20) zu der Packung (30) gebildet wird, während das Kriechen unter einer zweiten Kriechrate durchgeführt wird, die langsamer als die erste Kriechrate ist, oder während kein Kriechen durchgeführt wird;
und dass sie einen Zeitsetzabschnitt (91) aufweist, der dazu ausgelegt ist, eine Zeitgebung zum Start der Bildung der zweiten Garnschicht (30b) zu setzen;
wobei der Zeitsetzabschnitt (91) ausgelegt ist, um als die Zeitgebung einen Zeitpunkt, wenn eine Garnschichtdicke der Packung (30) wenigstens 90% und kleiner als 100% einer Soll-Garnschichtdicke ist, einen Zeitpunkt, wenn ein Durchmesser der Packung (30) wenigstens 90% und kleiner als 100% eines Soll-Packungsdurchmessers ist, oder einen Zeitpunkt, wenn eine gewickelte Länge des Garns (20), das zu der Packung (30) gewickelt worden ist, wenigstens 90% und kleiner als 100% einer Soll-Wickellänge ist, zu setzen.

2. Garnwickelmaschine (10) nach Anspruch 1, **gekennzeichnet durch** einen Kriechratensetzabschnitt (91), der dazu ausgelegt ist, die zweite Kriechrate zu setzen.

3. Garnwickelmaschine (10), welche aufweist:

einen Packungsantriebsabschnitt (41), der dazu ausgelegt ist, eine Packung (30) drehend anzutreiben;
eine Traversiervorrichtung (70), die dazu ausgelegt ist, ein Garn (20) zu traversieren, um es zu der Packung (30) zu wickeln; und
einen Steuerabschnitt (78x), der dazu ausgelegt ist, die Traversiervorrichtung (70) zu steuern, um periodisch eine Traversierbreitenänderung durchzuführen, um eine Traversierbreite einhergehend mit dem Wickeln des Garns (20) pulsierend zu verkleinern,
dadurch gekennzeichnet, dass
nachdem eine erste Garnschicht (30a) durch Wickeln des Garns (20) zu der Packung (30) gebildet ist, während die Traversierbreitenänderung unter einem ersten Änderungsverhältnis periodisch durchgeführt wird, eine zweite Garnschicht, die eine Oberflächen-Garnschicht (30b) ist, durch Wickeln des Garns (20) zu der Packung (30) gebildet wird, während die Traversierbreitenänderung unter einem zweiten Änderungsverhältnis periodisch durchgeführt wird, das kleiner ist als das erste Änderungsverhältnis, oder während keine Traversierbreitenänderung durchgeführt wird; und
dass sie einen Zeitsetzabschnitt (91) aufweist, der dazu ausgelegt ist, eine Zeitgebung zum Start der Bildung der zweiten Garnschicht (30b) zu setzen; wobei der Zeitsetzabschnitt (91) ausgelegt ist, um als die Zeitgebung einen Zeitpunkt, wenn eine Garnschichtdicke der Packung (30) wenigstens 90% und kleiner als 100% einer Soll-Garnschichtdicke ist, einen Zeitpunkt, wenn ein Durchmesser der Packung (30) wenigstens 90% und kleiner als 100% eines Soll-Packungsdurchmessers ist, oder einen Zeitpunkt, wenn eine gewickelte Länge des Garns (20), das zu der Packung (30) gewickelt worden ist, wenigstens 90% und kleiner als 100% einer Soll-Wickellänge ist, zu setzen.

4. Verfahren zur Herstellung einer Packung (30) durch Wickeln des Garns (20) zu der Packung (30), **dadurch gekennzeichnet, dass**
nachdem eine erste Garnschicht (30a) durch Wickeln des Garns (20) zu der Packung (30) gebildet ist, während das Kriechen unter einer ersten Kriechrate durchgeführt wird, eine zweite Garnschicht, die eine Oberflächen-Garnschicht (30b) ist, durch Wickeln des Garns (20) zu der Packung (30) gebildet wird, während das Kriechen unter einer zweiten Kriechrate durchgeführt wird, die langsamer als die erste Kriechrate ist, oder während kein Kriechen durchgeführt wird;
wobei eine Zeitgebung zum Start der Bildung der zweiten Schicht auf einen Zeitpunkt, wenn eine Garnschichtdicke der Packung (30) wenigstens 90% und kleiner als 100% einer Soll-Garnschichtdicke ist, einen Zeitpunkt, wenn ein Durchmesser der Packung (30) wenigstens 90% und kleiner als 100% eines Soll-Packungsdurchmessers ist, oder einen Zeitpunkt, wenn eine gewickelte Länge des Garns (20), das zu der Packung (30) gewickelt worden ist, wenigstens 90% und kleiner als 100% einer Soll-Wickellänge ist, gesetzt wird.

5. Verfahren zur Herstellung einer Packung (30) durch Wickeln des Garns (20) zu der Packung (30), wobei eine Traversierbreitenänderung periodisch durchgeführt wird, um einhergehend mit dem Wickeln des Garns (20) eine Traversierbreite pulsierend zu verkleinern,
dadurch gekennzeichnet, dass
nachdem eine erste Garnschicht (30a) durch Wickeln des Garns (20) zu der Packung (30) gebildet ist, während die Traversierbreitenänderung unter einem ersten Änderungsverhältnis periodisch durchgeführt wird, eine zweite Garnschicht, die eine Oberflächen-Garnschicht (30b) ist, durch Wickeln des Garns (20) zu der Packung (30) durchgeführt wird, während die Traversierbreitenänderung unter einem zweiten Änderungsverhältnis periodisch durchgeführt wird, das kleiner als das erste Änderungsverhältnis ist, oder während keine Traversierbreitenänderung durchgeführt wird; wobei eine Zeitgebung zum Start der Bildung der zweiten Schicht auf einen Zeitpunkt, wenn eine Garnschichtdicke der Packung (30) wenigstens 90% und kleiner als 100% einer Soll-Garnschichtdicke ist, einen Zeitpunkt, wenn ein Durchmesser der Packung (30) wenigstens 90% und kleiner als 100% eines Soll-Packungsdurchmessers ist, oder einen Zeitpunkt, wenn eine gewickelte Länge des Garns (20), das zu der Packung (30) gewickelt worden ist, wenigstens 90% und kleiner als 100% einer Soll-Wickellänge ist, gesetzt wird.

Revendications

1. Une machine de bobinage de fil (10), comprenant :

une section d'entraînement de paquet (41) adaptée pour entraîner un paquet (30) de manière rotative ;
un dispositif de va-et-vient (70) adapté pour le déplacement en va-et-vient d'un fil (20) à être enroulé dans le paquet (30) ; et
une section de contrôle (78x) adaptée pour con-

trôler le dispositif de va-et-vient (70) pour réaliser une respiration, **caractérisé en ce que**
après la formation d'une première couche de fil (30a) par l'enroulement du fil (20) dans le paquet (30) tout en réalisant la respiration avec une première vitesse de respiration, une deuxième couche de fil qui est une couche de fil de surface (30b) est formée en enroulant le fil (20) dans le paquet (30) tout en réalisant la respiration avec une deuxième vitesse qui est inférieure à la première vitesse de respiration, ou tout en réalisant aucune respiration ;
et en comprenant une section de réglage de chronométrage (91) adaptée pour régler un chronométrage pour commencer à former la deuxième couche de fil (30b) ;
où la section de réglage de chronométrage (91) est adaptée pour fixer en tant que chronométrage un point dans le temps où une épaisseur de couche de fil du paquet (30) est d'au moins 90 % et de moins de 100 % d'une épaisseur de couche de fil cible, un point dans le temps où un diamètre du paquet (30) est d'au moins 90 % et de moins de 100 % d'un diamètre de paquet cible ou un point dans le temps où une longueur enroulée du fil (20) qui a été enroulé dans le paquet (30) est d'au moins 90 % et de moins de 100 % d'une longueur d'enroulement cible.

2. Une machine de bobinage de fil (10) selon la revendication 1, **caractérisée par** une section de réglage de vitesse de respiration (91) adaptée pour régler la deuxième vitesse de respiration.

3. Une machine de bobinage de fil (10) comprenant :

une section d'entraînement de paquet (41) adaptée pour entraîner un paquet (30) de manière rotative ;
un dispositif de va-et-vient (70) adapté pour le déplacement en va-et-vient d'un fil (20) à être enroulé dans le paquet (30) ; et
une section de contrôle (78x) adaptée pour contrôler le dispositif de va-et-vient (70) afin qu'il effectue périodiquement un changement de largeur de déplacement en va-et-vient pour réduire une largeur de déplacement en va-et-vient d'une manière pulsatile lors de l'enroulement du fil (20), **caractérisé en ce que** après la formation d'une première couche de fil (30a) par l'enroulement du fil (20) dans le paquet (30) tout en effectuant périodiquement le changement de la largeur de déplacement en va-et-vient sous un premier rapport de changement, une deuxième couche de fil, qui est une couche de fil de surface (30b), est formée en enroulant le fil (20) dans le paquet (30) tout en effectuant périodiquement le changement de la largeur de déplacement en va-et-vient sous un deuxième rapport de changement inférieur au premier rapport de changement ou lorsqu'il n'y a pas de changement de largeur de déplacement en va-et-vient ; et en comprenant une section de réglage de chronométrage (91) adaptée pour régler un chronométrage pour commencer à former la deuxième couche de fil (30b) ;
où la section de réglage de chronométrage (91) est adaptée pour fixer en tant que chronométrage un point dans le temps où une épaisseur de couche de fil du paquet (30) est d'au moins 90 % et de moins de 100 % d'une épaisseur de couche de fil cible, un point dans le temps où un diamètre du paquet (30) est d'au moins 90 % et de moins de 100 % d'un diamètre de paquet cible ou un point dans le temps où une longueur enroulée du fil (20) qui a été enroulé dans le paquet (30) est d'au moins 90 % et de moins de 100 % d'une longueur d'enroulement cible.

4. Un procédé pour fabriquer un paquet (30) en enroulant le fil (20) dans le paquet (30) **caractérisé en ce que**
après qu'une première couche de fil (30a) a été formée par enroulement du fil (20) dans le paquet (30) tout en effectuant la respiration avec une première vitesse de respiration, une deuxième couche de fil, qui est une couche de fil de surface (30b), est formée en enroulant le fil (20) dans le paquet (30) tout en effectuant la respiration avec une deuxième vitesse de respiration inférieure à la première vitesse de déplacement, ou tout en effectuant aucune respiration ;
où un chronométrage pour commencer à former la deuxième couche est fixé pour un point dans le temps où une épaisseur de couche de fil du paquet (30) est d'au moins 90 % et de moins de 100 % d'une épaisseur de couche de fil cible, un point dans le temps où un diamètre du paquet (30) est d'au moins 90 % et de moins de 100 % d'un diamètre de paquet cible ou un point dans le temps où une longueur enroulée du fil (20) qui a été enroulé dans le paquet (30) est d'au moins 90 % et de moins de 100 % d'une longueur d'enroulement cible.

5. Un procédé pour fabriquer un paquet (30) en enroulant le fil (20) dans le paquet (30) où un changement de largeur de déplacement en va-et-vient est effectué périodiquement pour réduire une largeur de déplacement en va-et-vient d'une manière pulsatile lors de l'enroulement du fil (20),
caractérisé en ce que
après la formation d'une première couche de fil (30a) par l'enroulement du fil (20) dans le paquet (30) tout en effectuant périodiquement le changement de la largeur de déplacement en va-et-vient sous un premier rapport de changement, une deuxième couche de fil, qui est une couche de fil de surface (30b), est

formée en enroulant le fil (20) dans le paquet (30) tout en effectuant périodiquement le changement de la largeur de déplacement en va-et-vient sous un deuxième rapport de changement inférieur au premier rapport de changement ou lorsqu'il n'y a pas de changement de largeur de déplacement en va-et-vient ;
où un chronométrage pour commencer à former la deuxième couche est fixé pour un point dans le temps où une épaisseur de couche de fil du paquet (30) est d'au moins 90 % et de moins de 100 % d'une épaisseur de couche de fil cible, un point dans le temps où un diamètre du paquet (30) est d'au moins 90 % et de moins de 100 % d'un diamètre de paquet cible ou un point dans le temps où une longueur enroulée du fil (20) qui a été enroulé dans le paquet (30) est d'au moins 90 % et de moins de 100 % d'une longueur d'enroulement cible.

FIG. 1

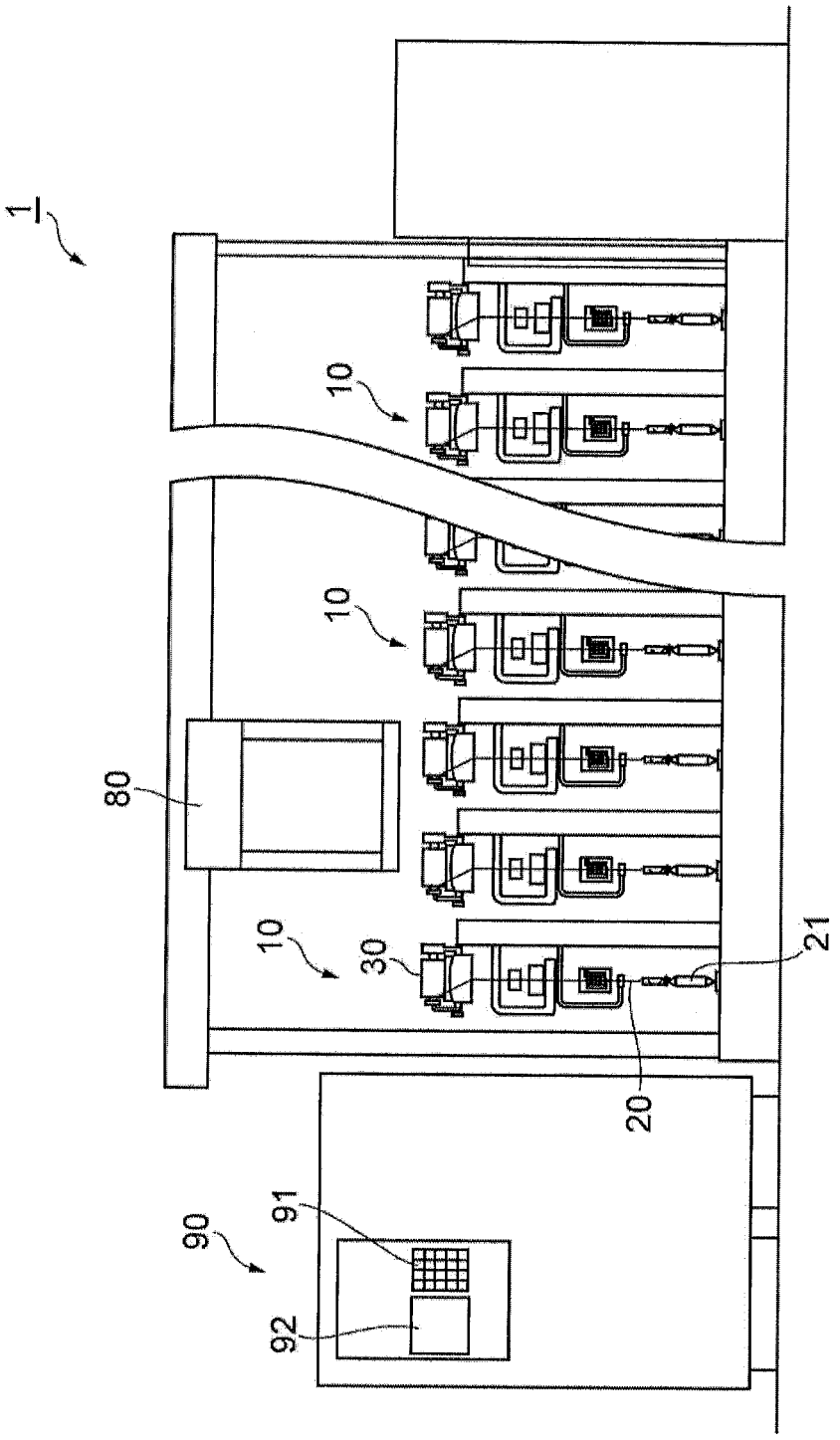


FIG. 2

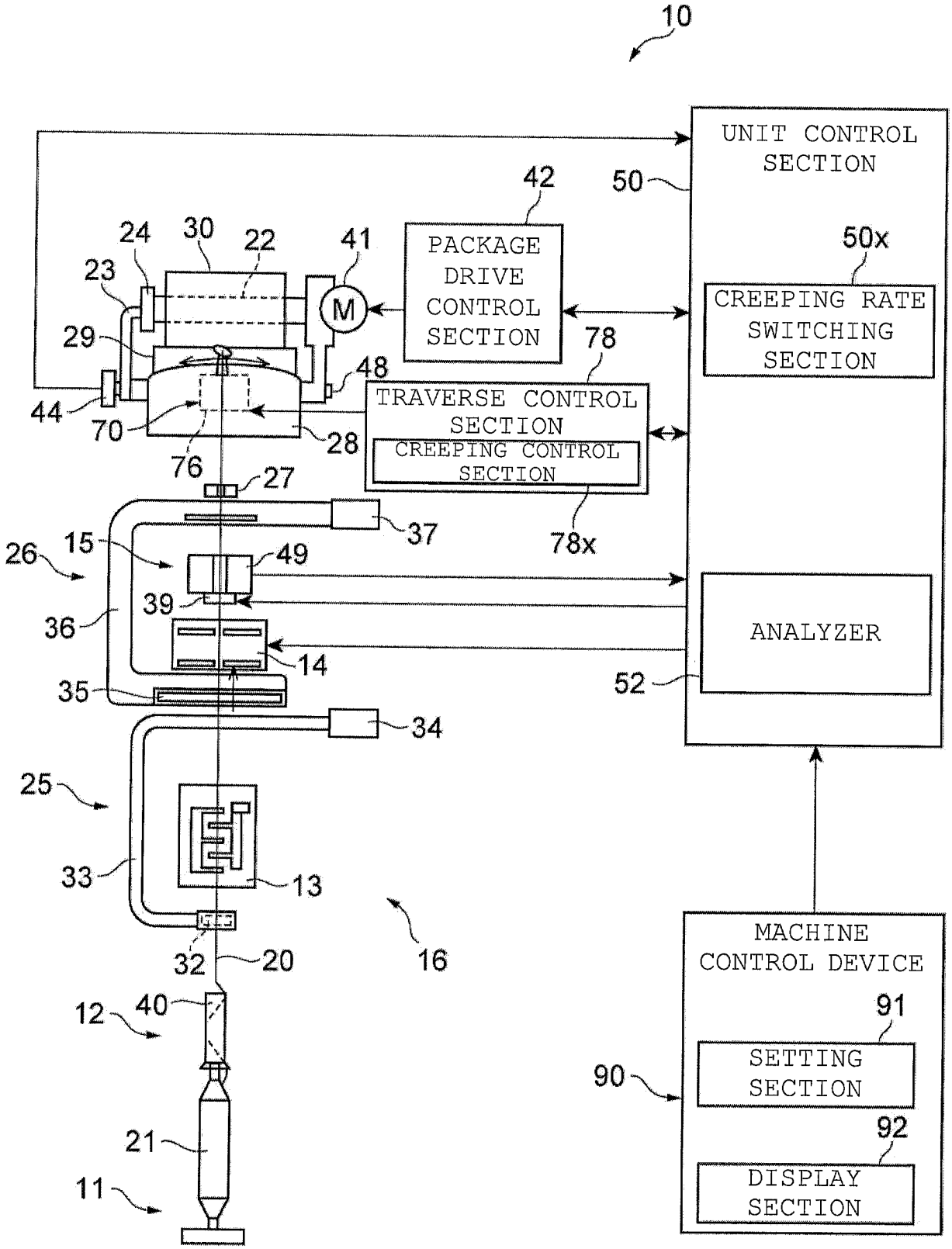

10
UNIT CONTROL SECTION
50
42
PACKAGE DRIVE CONTROL SECTION
50x
CREEPING RATE SWITCHING SECTION
78
TRAVERSE CONTROL SECTION
CREEPING CONTROL SECTION
78x
ANALYZER
52
MACHINE CONTROL DEVICE
91
SETTING SECTION
90
92
DISPLAY SECTION
M
24
30
22
41
23
29
48
44
70
28
76
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11

FIG. 3

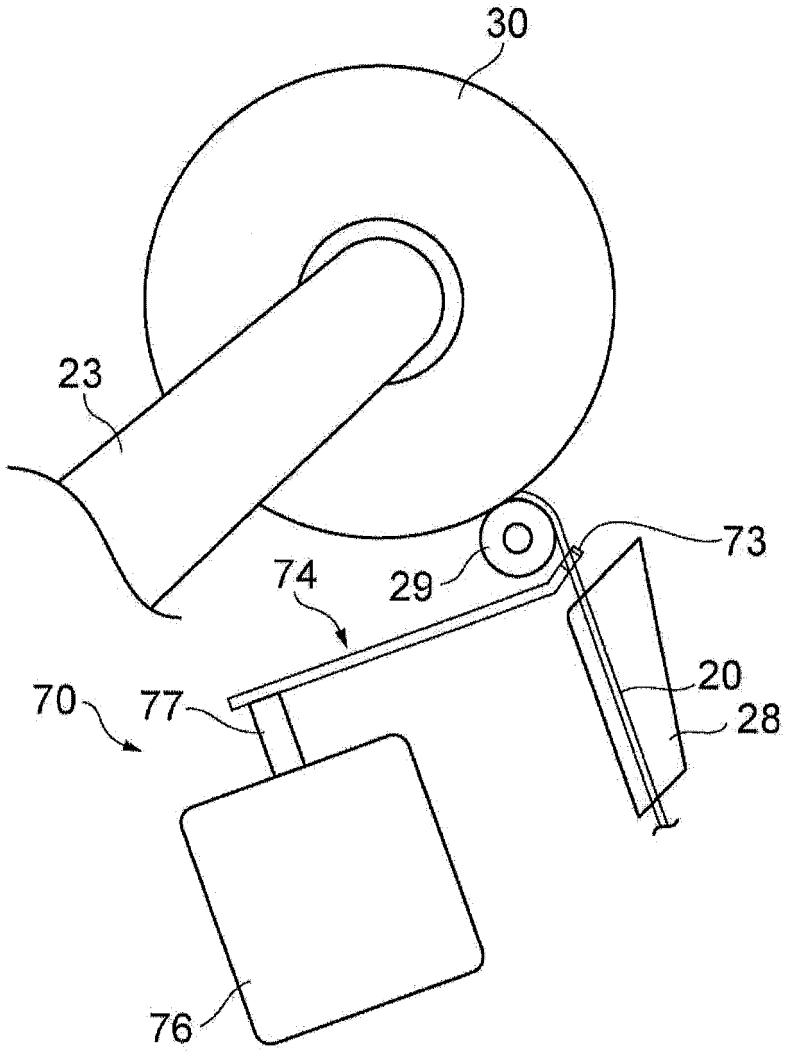


FIG. 4A

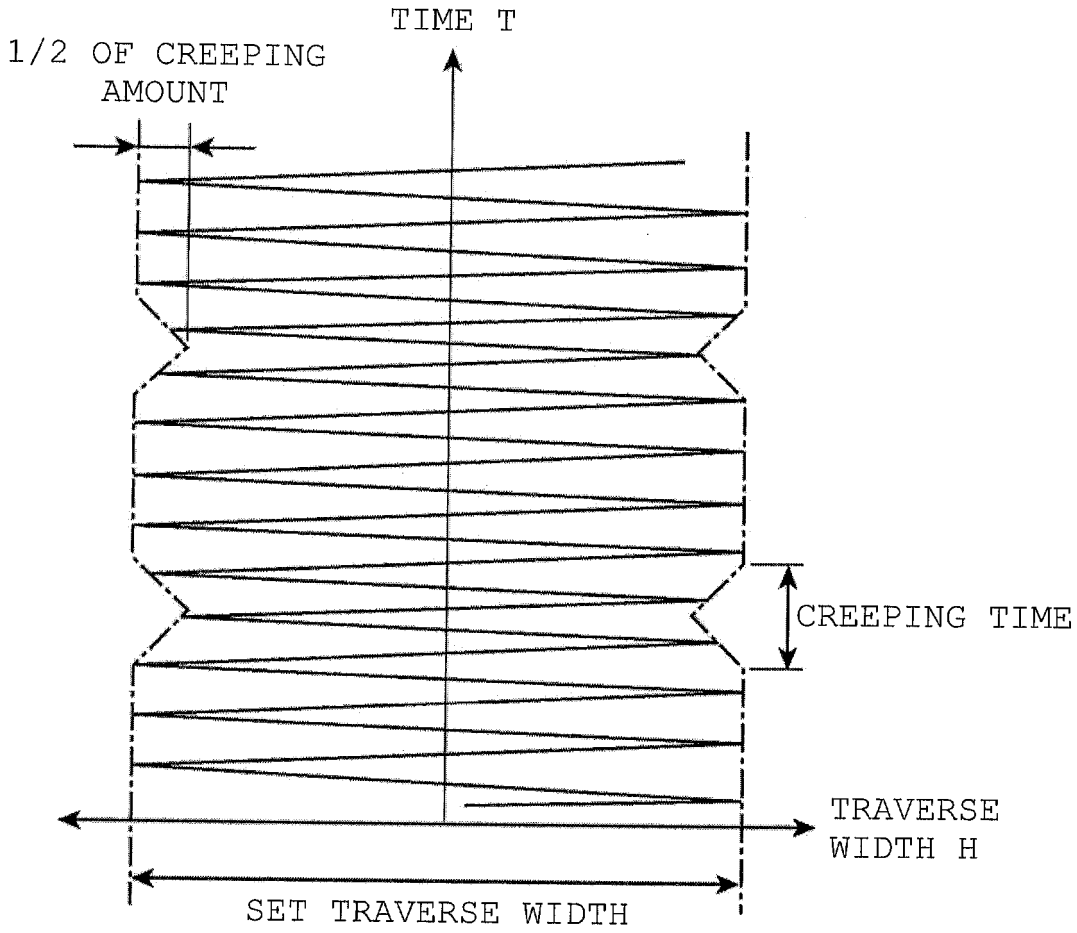

TIME T
1/2 OF CREEPING AMOUNT
CREEPING TIME
TRAVERSE WIDTH H
SET TRAVERSE WIDTH

FIG. 4B

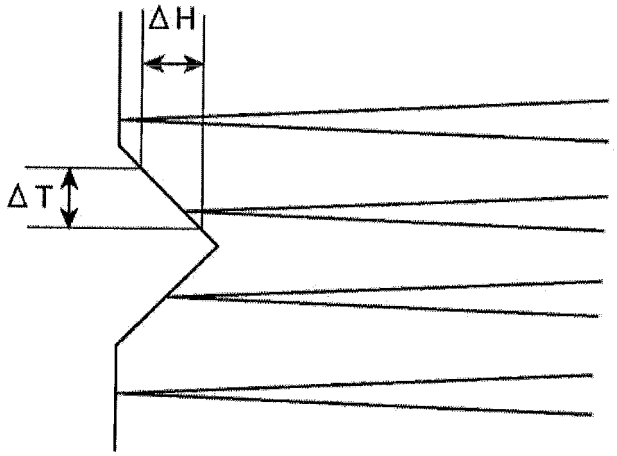

ΔH
ΔT

FIG. 5

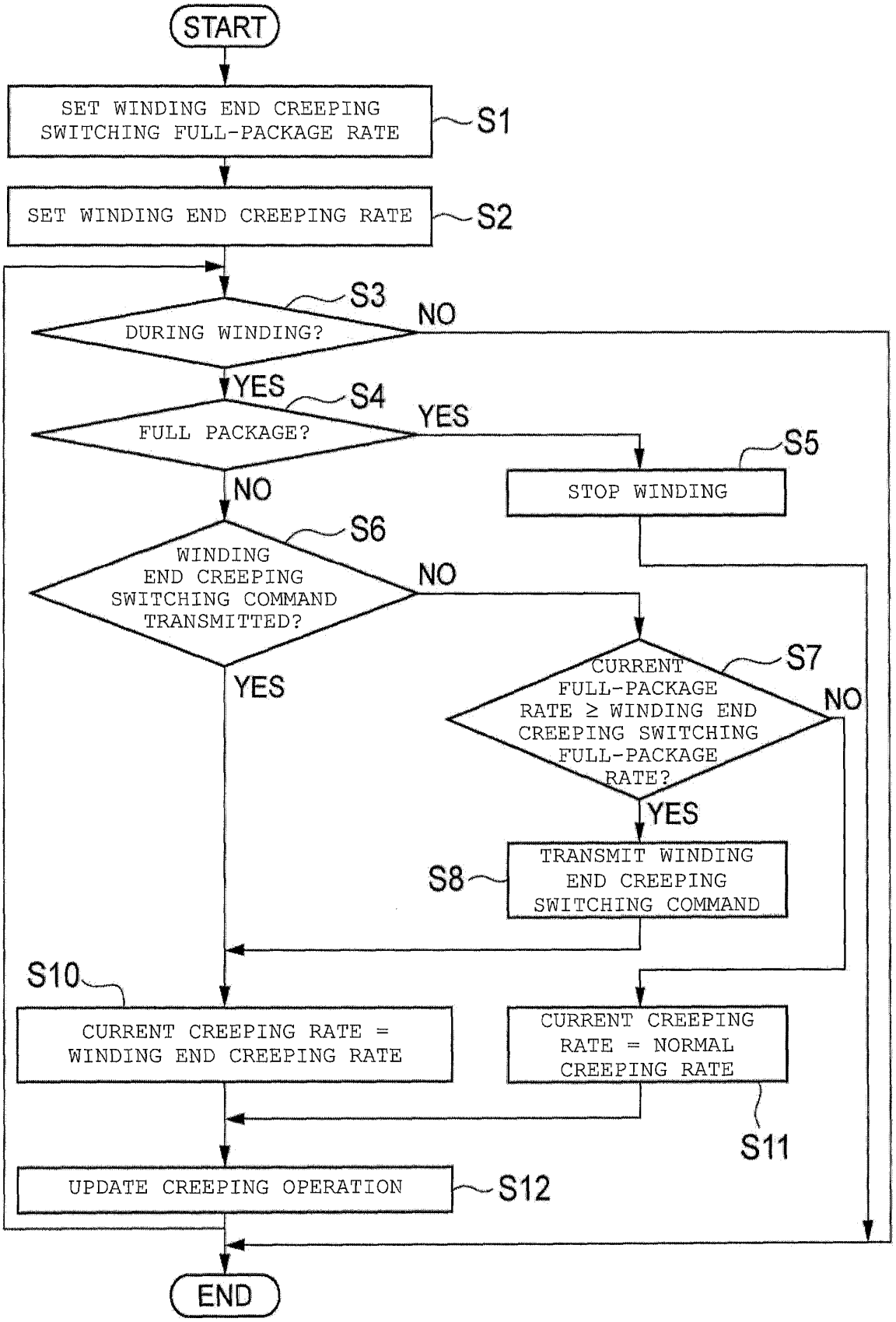

START
SET WINDING END CREEPING SWITCHING FULL-PACKAGE RATE
S1
SET WINDING END CREEPING RATE
S2
S3
DURING WINDING?
NO
YES
S4
FULL PACKAGE?
YES
S5
STOP WINDING
NO
S6
WINDING END CREEPING SWITCHING COMMAND TRANSMITTED?
NO
YES
S7
CURRENT FULL-PACKAGE RATE ≥ WINDING END CREEPING SWITCHING FULL-PACKAGE RATE?
NO
YES
S8
TRANSMIT WINDING END CREEPING SWITCHING COMMAND
S10
CURRENT CREEPING RATE = WINDING END CREEPING RATE
CURRENT CREEPING RATE = NORMAL CREEPING RATE
S11
UPDATE CREEPING OPERATION
S12
END

FIG. 6A

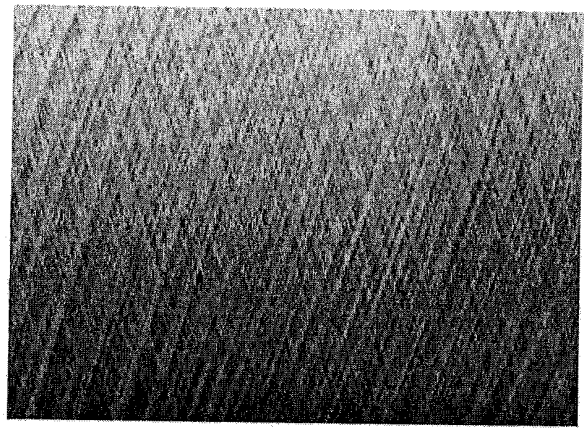


FIG. 6B

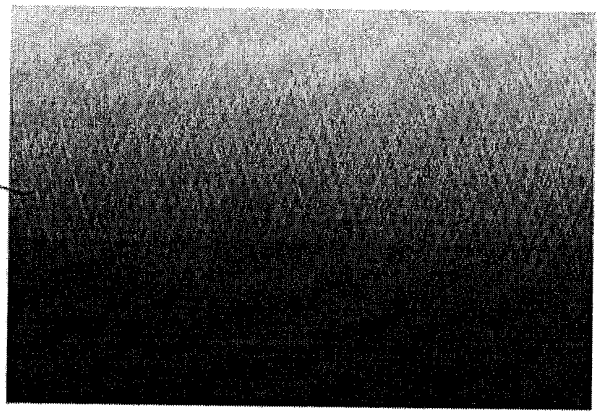
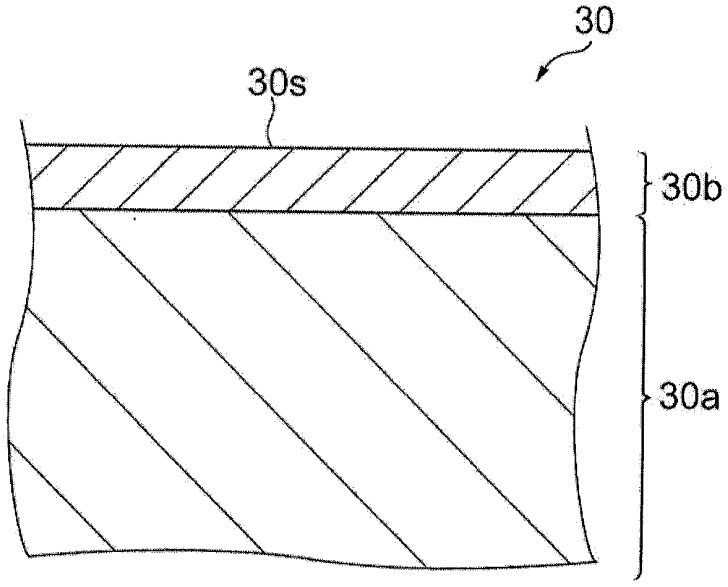


FIG. 6C



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2007230708 A **[0002]**
- JP H03192072 A **[0004]**