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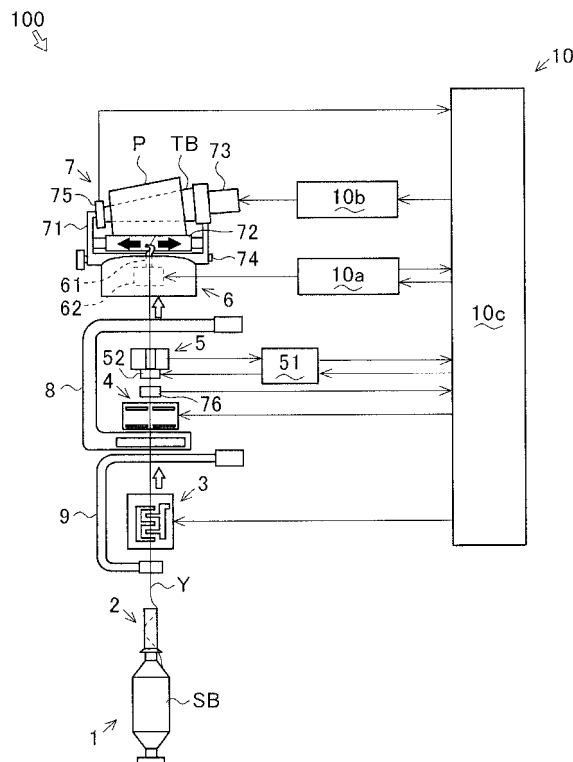
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(54) **Yarn winding machine**

(57) A yarn winding machine (100) includes a bobbin holding section (71) adapted to rotatably hold a bobbin (TB), a yarn information detecting section (5) adapted to detect continuation or discontinuation of a spun yarn (Y) to be wound into the bobbin (TB), a package driving section (73) adapted to rotate the bobbin (TB) or a package (P) formed on the bobbin (TB), and a control section (10) adapted to control the package driving section (73) in accordance with a detection signal from the yarn information detecting section (5). When the yarn information detecting section (5) detects discontinuation of the spun yarn (Y), the control section (10) controls the package driving section (73) to stop rotation of the bobbin (TB) to stop a yarn end (YE) of the spun yarn (Y) at a prescribed position.

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine adapted to form a package by winding a spun yarn.

2. Description of the Related Art

[0002] Conventionally, there is known a yarn winding machine adapted to wind a spun yarn by rotating a bobbin and forming a package on the bobbin (see e.g., Japanese Unexamined Patent Publication No. 2011-144029). The yarn winding machine includes a catching section adapted to catch a yarn end of the package, and a yarn joining section adapted to join yarn ends.

[0003] As illustrated in FIG. 8A, a catching section 8c catches a yarn end YEc by sucking air. The catching section 8c is swung while sucking and holding the yarn end YEc to pull out a spun yarn Yc from a package Pc. The yarn joining section joins a yarn end YEc of the spun yarn Yc pulled out from the package Pc and a yarn end from a yarn supplying bobbin (not illustrated). By joining the yarn end YEc from the package Pc and the yarn end from the yarn supplying bobbin, the yarn winding machine can resume forming of the package Pc. An operation rate of the yarn winding machine is influenced by whether not the catching of the yarn end YEc by the catching section 8c is successful.

[0004] As illustrated in FIG. 8B, if the catching section 8c cannot catch the yarn end YEc, the yarn joining operation cannot be performed. The operation of the yarn winding machine thus needs to be stopped, and the operation rate of the yarn winding machine lowers. As illustrated in FIG. 8C, if the catching section 8c sucks a middle part of the spun yarn Yc, the yarn joining operation cannot be performed. The operation of the yarn winding machine thus needs to be stopped, and the operation rate of the yarn winding machine lowers. As illustrated in FIG. 8D, if the catching section 8c sucks the middle part of the spun yarn Yc and the spun yarn Yc is broken, a waste yarn W is mixed into the package Pc.

BRIEF SUMMARY OF THE INVENTION

[0005] An object of the present invention is to provide a yarn winding machine capable of easily catching a yarn end of a package formed by winding a spun yarn.

[0006] A first aspect of the invention relates to a yarn winding machine adapted to form a package by winding a spun yarn. A yarn winding machine according to an embodiment of the present invention includes a bobbin holding section, a yarn information detecting section, a package driving section, and a control section. The bobbin holding section is adapted to rotatably hold a bobbin.

The yarn information detecting section is adapted to detect continuation or discontinuation of a spun yarn to be wound around the bobbin. The package driving section is adapted to rotate the bobbin or a package formed on the bobbin. The control section is adapted to control the package driving section in accordance with a detection signal from the yarn information detecting section. When the yarn information detecting section detects discontinuation of the spun yarn, the control section controls the package driving section to stop rotation of the package to stop a yarn end of the package at a prescribed position.

[0007] Accordingly, the yarn end of the package can be easily caught.

[0008] A second aspect of the invention relates to the yarn winding machine according to the first aspect. The yarn winding machine according to the embodiment of the present invention includes a catching section. The catching section is adapted to catch the yarn end of the spun yarn. The control section is adapted to control the package driving section to stop rotation of the package to stop the yarn end of the package in proximity of the catching section.

[0009] Accordingly, the yarn end of the package can be easily caught by the catching section.

[0010] A third aspect of the invention relates to the yarn winding machine according to the second aspect. The catching section is adapted to catch the yarn end of the package by sucking air.

[0011] Since the rotation of the package can be stopped to stop the yarn end of the package in proximity to the catching section, even when catching the yarn end by sucking air, the catching section can catch the yarn end while avoiding the sucking of the middle part of the spun yarn.

[0012] A fourth aspect of the invention relates to the yarn winding machine according to the third aspect. An imaginary line connecting a rotational axis of the package and a suction opening of the catching section is provided as a reference, and a catching range is determined to be within a prescribed angle from the imaginary line with the rotational axis of the package as center. The control section is adapted to control the package driving section to stop rotation of the package to stop the yarn end of the package within the catching range.

[0013] The catching range is a range in which a possibility that the yarn end of the package can be caught becomes high. The yarn end of the package can be easily caught by the catching section.

[0014] A fifth aspect of the invention relates to the yarn winding machine according to the fourth aspect. The catching range is a range of about 90 degrees from the imaginary line in a rotating direction and a reverse rotating direction of the package.

[0015] The catching range of about 90 degrees from the imaginary line in the rotating direction and the reverse rotating direction of the package is a range in which the possibility that the catching section can catch the yarn end of the package becomes higher. Accordingly, the

yarn end of the package can be easily caught by the catching section.

[0016] A sixth aspect of the invention relates to the yarn winding machine according to the fourth aspect. The catching range is a range of about 45 degrees from the imaginary line in a rotating direction and a reverse rotating direction of the package.

[0017] The catching range of about 45 degrees from the imaginary line in the rotating direction and the reverse rotating direction of the package is a range in which the possibility that the catching section can catch the yarn end of the package becomes even more higher. Accordingly, the yarn end of the package can be easily caught by the catching section.

[0018] A seventh aspect of the invention relates to the yarn winding machine according to the fourth aspect. The catching range is a range in which the yarn end of the package stops to be substantially along an anti-gravitational direction.

[0019] The catching range in which the yarn end of the package stops to be substantially along the anti-gravitational direction is a range in which the yarn end of the package floats from a surface of the package. Therefore, when the yarn end of the package stops within the catching range, the possibility that the catching section can catch the yarn end of the package becomes higher. Accordingly, the yarn end of the package can be easily caught by the catching section.

[0020] An eighth aspect of the invention relates to the yarn winding machine according to any one of the first to seventh aspects. The yarn winding machine according to the embodiment of the present invention further includes a contact roller. The contact roller is adapted to rotate while making contact with the package. A pressed range is defined as a range in which the yarn end is pressed by the contact roller when the package is rotated after the yarn information detecting section detects discontinuation of the spun yarn. The control section is adapted to control the package driving section to stop rotation of the package to stop the yarn end of the package outside the pressed range.

[0021] The pressed range is a range in which the yarn end is pressed by the contact roller by rotating the package when catching the yarn end of the package. Therefore, if the yarn end of the package is stopped outside the pressed range, the possibility that the catching section can catch the yarn end of the package becomes higher. Accordingly, the yarn end of the package can be easily caught by the catching section.

[0022] A ninth aspect of the invention relates to the yarn winding machine according to any one of the first to eighth aspects. The yarn winding machine according to the embodiment of the present invention further includes a rotational amount detecting section, and a wound amount detecting section. The rotational amount detecting section is adapted to detect a rotational amount of the package. The wound amount detecting section is adapted to detect a wound amount of the package. The

control section is adapted to control the package driving section in accordance with the rotational amount and the wound amount of the package.

[0023] Accordingly, the yarn end of the package can be accurately stopped at an arbitrary position.

[0024] A tenth aspect of the invention relates to the yarn winding machine according to any one of the first to ninth aspects. The package driving section is configured by a servomotor.

[0025] A feedback control can be realized by using the servomotor. Accordingly, the yarn end of the package can be accurately stopped at an arbitrary position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a schematic view illustrating an overall configuration of a yarn winding machine;

FIG. 2 is a side view illustrating a catching operation of a yarn end;

FIG. 3 is a side view illustrating a pull-out operation of the yarn end;

FIG. 4 is a view illustrating a stop position of the yarn end;

FIG. 5 is a view illustrating a stop position of the yarn end;

FIG. 6 is a view illustrating a stop position of the yarn end;

FIG. 7 is a view illustrating a stop position of the yarn end; and

FIG. 8A to FIG. 8D are views illustrating a state during catching of the yarn end in a conventional yarn winding machine.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0027] First, a yarn winding machine 100 according to one embodiment of the present invention will be described.

[0028] FIG. 1 is a schematic view illustrating an overall configuration of the yarn winding machine 100. A white arrow in the drawing indicates a feeding direction of a spun yarn Y.

[0029] The yarn winding machine 100 includes a yarn supplying section 1. A yarn supplying bobbin SB, around which the spun yarn Y is wound, is set in the yarn supplying section 1. The yarn winding machine 100 includes a yarn-unwinding assisting section 2, a tension applying section 3, a yarn joining section 4, a yarn information detecting section 5, a traverse section 6, and a winding section 7, along a feeding direction of the spun yarn Y unwound from the yarn supplying bobbin SB. The yarn winding machine 100 also includes a catching section 8, a guiding section 9, and a control section 10.

[0030] The yarn-unwinding assisting section 2 assists the unwinding of the spun yarn Y wound around the yarn

supplying bobbin SB. The yarn-unwinding assisting section 2 restricts the spun yarn Y unwound from the yarn supplying bobbin SB from spreading by a centrifugal force.

[0031] The tension applying section 3 applies a predetermined tension on the spun yarn Y unwound from the yarn supplying bobbin SB. The tension applying section 3 applies the predetermined tension on the spun yarn Y to enable high-speed winding of the spun yarn Y. Other than a gate-type tensor adapted to apply tension on the spun yarn Y with comb teeth, a disc-type tensor may be used for the tension applying section 3.

[0032] The yarn joining section 4 joins the yarn ends YE of the spun yarn Y. For example, when the spun yarn Y is broken, the yarn joining section 4 joins the yarn ends YE of the disconnected spun yarn Y. Other than an air splicer device adapted to join the yarn ends YE of the spun yarn Y by whirling airflow, a mechanical splicer device and the like may be used for the yarn joining section 4.

[0033] The yarn information detecting section 5 is adapted to detect a defective part of the spun yarn Y. The yarn information detecting section 5 is adapted to detect continuation or discontinuation of the spun yarn Y. The yarn information detecting section 5 irradiates the spun yarn Y with a light emitting diode as a light source, and measures a reflected light quantity from the spun yarn Y to detect presence or absence of the defective part of the spun yarn Y, and the continuation or discontinuation of the spun yarn Y. Specifically, an analyzer 51 analyzes a detection signal from the yarn information detecting section 5 to determine the presence or absence of the defective part of the spun yarn Y, and the continuation or discontinuation of the spun yarn Y. A cutter 52 capable of cutting the spun yarn Y is provided in proximity to the yarn information detecting section 5. A unit control section 10c can also receive information on the discontinuation of the spun yarn Y by a cut signal of the spun yarn Y cut by the cutter 52.

[0034] In addition to abnormality in which a portion of the spun yarn Y is too thick (thick yarn) or too thin (thin yarn), the defective part of the spun yarn Y includes foreign substances contained in the spun yarn Y. The discontinuation of the spun yarn Y is a concept including cases where the spun yarn Y is cut by the cutter 52, where the spun yarn Y is broken when an abnormal tension is applied, and where the spun yarn Y wound around the yarn supplying bobbin SB are all unwound. Other than an optical sensor described above, the yarn information detecting section 5 may be a capacitance sensor or the like.

[0035] The traverse section 6 is adapted to traverse the spun yarn Y to be guided to a package P. The traverse section 6 includes a traverse guide 61 and a traverse guide driving section 62. The traverse guide driving section 62 drives the traverse guide 61 based on a control signal from a traverse guide drive control section 10a. The traverse guide drive control section 10a transmits

the control signal to the traverse guide driving section 62 based on an instruction from the unit control section 10c. The control section 10 has a concept including the traverse guide drive control section 10a and the unit control section 10c.

[0036] The traverse guide 61 is an arm member provided with a hook section adapted to hook the spun yarn Y. The traverse guide 61 reciprocates in a rotational axis direction of a bobbin TB with the spun yarn Y hooked to the hook section (see black arrow in FIG. 1), and traverses the spun yarn Y.

[0037] The traverse guide driving section 62 is mainly configured by a servomotor. The traverse guide driving section 62 reciprocates the traverse guide 61 by forwardly rotating or reversely rotating a rotation shaft of the servomotor. The traverse guide driving section 62 uses a servomotor for a power source, but for example, a stepping motor or the like may also be used, and any type of motor can be used. A direction of the rotation shaft of the servomotor, that is, an attaching direction of the traverse guide 61, is also not limited.

[0038] The traverse section 6 is configured as a so-called arm-type traverse device in which the spun yarn Y is traversed by the reciprocating traverse guide 61. However, other than the arm-type traverse device, a belt-type traverse device, a rotary traverse device, or the like may be used. The yarn winding machine 100 may be a traverse drum-type, which is a structure in which a drum that rotates while making contact with the package P is arranged, and the spun yarn Y is traversed by a guiding groove formed on a surface of the drum.

[0039] The winding section 7 rotates the bobbin TB to wind the spun yarn Y. The winding section 7 includes a bobbin holding section 71, a contact roller 72, and a package driving section 73. The package driving section 73 rotates the bobbin TB based on a control signal from a package drive control section 10b. The package drive control section 10b transmits the control signal to the package driving section 73 based on an instruction from the unit control section 10c. The control section 10 has a concept including the package drive control section 10b and the unit control section 10c.

[0040] The bobbin holding section 71 includes a bearing for detachably gripping the bobbin TB, and rotatably holds the bobbin TB. The bobbin holding section 71 can swing with a swing shaft 74 as center (see arrow in FIG. 2). Even if an outer diameter of the package P becomes large accompanying winding of the spun yarn Y, the bobbin holding section 71 enables the contact roller 72 to push the surface of the package P at a prescribed load.

[0041] The contact roller 72 rotates accompanying the rotation of the rotating package P. The contact roller 72 adjusts a shape of the package P by pressing the surface of the package P. The contact roller 72 is a substantially cylindrical rotating body, but may also be a conical rotating body, for example, and may be of any shape.

[0042] The package driving section 73 is mainly configured by a servomotor. The package driving section 73

drives the servomotor to rotate the bobbin TB and the package P formed on the bobbin TB. The package driving section 73 uses a servomotor as the power source, but for example, a stepping motor or the like may also be used, and any type of motor can be used. Advantages of using the servomotor for the power source of the package driving section 73 will be described later.

[0043] The winding section 7 is configured such that the package P is rotated by the package driving section 73, and the contact roller 72 is rotated accompanying the rotation of the package P. However, the contact roller 72 may be rotated by the package driving section 73, and the package P may be rotated accompanying the rotation of the contact roller 72.

[0044] When the spun yarn Y becomes discontinuous, the catching section 8 catches the yarn end (upper yarn) YE of the spun yarn Y wound into the package P. The catching section 8 is swung while sucking and holding the yarn end YE to pull out the spun yarn Y from the package P. Specifically, when the yarn joining operation is started, the catching section 8 is swung such that a suction opening 8m moves from a standby position to a proximity of the package P (see arrow in FIG. 2), and catches the yarn end YE by sucking air from the suction opening 8m. The catching section 8 is swung such that the suction opening 8m moves from the proximity of the package P to an upstream of the yarn joining section 4 while sucking and holding the yarn end YE (see arrow in FIG. 3), and pulls out the spun yarn Y from the package P. In this case, the package driving section 73 reversely rotates the bobbin TB and the package P (see arrow in FIG. 3). Other than the suction arm-type described above, the catching section 8 may have a configuration in which a slit is provided in a fixed suction pipe to pull out the spun yarn Y.

[0045] When the spun yarn Y becomes discontinuous, the guiding section 9 catches the yarn end (lower yarn) YE of the spun yarn Y wound around the yarn supplying bobbin SB. The guiding section 9 is swung while sucking and holding the yarn end YE to unwind the spun yarn Y from the yarn supplying bobbin SB. Specifically, the guiding section 9 catches the yarn end YE by sucking air from a suction opening 9m. The guiding section 9 is swung such that the suction opening 9m moves from the proximity of the yarn supplying bobbin SB to a downstream of the yarn joining section 4 while sucking and holding the yarn end YE (see arrow in FIG. 3), and unwinds the spun yarn Y from the yarn supplying bobbin SB.

[0046] The yarn end YE of the spun yarn Y arranged at a prescribed position by the catching section 8 and the yarn end YE of the spun yarn Y arranged at a prescribed position by the guiding section 9 are joined by the yarn joining section 4. Accordingly, the yarn winding machine 100 can resume forming of the package P. An operation rate of the yarn winding machine 100 is influenced by whether or not the catching of the yarn end YE by the catching section 8 is successful.

[0047] Next, a description will be made on character-

istics of the yarn winding machine 100 configured so that the catching of the yarn end YE by the catching section 8 is successful.

[0048] The yarn winding machine 100 can control a rotating state of the package P until the rotation of the package P completely stops. Therefore, the yarn winding machine 100 can control the package driving section 73 so that the yarn end YE of the spun yarn Y wound into the package P stops at the prescribed position.

[0049] Specifically, when the yarn information detecting section 5 detects discontinuation of the spun yarn Y, the yarn winding machine 100 stops the rotation of the package P. The conventional yarn winding machine shields the servomotor power source of the package driving section 73 to stop the rotation of the package P. The yarn winding machine 100 according to the present embodiment appropriately adjusts a command pulse to be transmitted to a driver (not illustrated) to stop the rotation of the package P while controlling the rotating state of the package P. The yarn winding machine 100 may include a braking device such as an electromagnetic brake for the package driving section 73 to stop the rotation of the package P.

[0050] Furthermore, after stopping the rotation of the package P, the yarn winding machine 100 may rotate the package P again to stop the yarn end YE at an arbitrary position. Since the control section 10 can freely control the rotating state of the package P, the yarn end YE can be stopped at an arbitrary position by a simple control program. The configuration in which after stopping the rotation of the package P, the package P is rotated again to stop the yarn end YE at an arbitrary position is also encompassed within a technical scope of the invention.

[0051] The yarn winding machine 100 can stop the rotation of the package P to stop the yarn end YE of the package P at the prescribed position. Accordingly, the catching section 8 can easily catch the yarn end YE of the package P.

[0052] In the yarn winding machine 100 of the present embodiment, "prescribed position" refers to the proximity of the catching section 8. More specifically, "prescribed position" refers to the proximity of the suction opening 8m when catching the yarn end YE (see FIG. 2).

[0053] The yarn winding machine 100 can stop the rotation of the package P to stop the yarn end YE of the package P in proximity to the catching section 8. Accordingly, the yarn end YE of the package P can be easily caught by the catching section 8.

[0054] The catching section 8 catches the yarn end YE by sucking air. The conventional yarn winding machine has a possibility that the catching section 8 sucks the middle part of the spun yarn Y (see FIG. 8C and FIG. 8D). Since the yarn winding machine 100 can stop the rotation of the package P to stop the yarn end YE of the package P in proximity to the catching section 8, the catching section 8 can be prevented from sucking the middle part of the spun yarn Y.

[0055] Next, the "proximity to the catching section 8"

will be more specifically described. The "proximity to the catching section 8" refers to a range in which the possibility that the yarn end YE can be caught by the catching section 8 becomes high. The range in which the possibility that the yarn end YE can be caught by the catching section 8 becomes high is referred to as a catching range Aa.

[0056] As illustrated in FIG. 4, an imaginary line IL connecting a rotational axis A of the package P and the suction opening 8m of the catching section 8 is provided as a reference, and the catching range Aa is defined to be a range within a prescribed angle α from the imaginary line IL with the rotation axis A of the package P as center. In the yarn winding machine 100 according to the present embodiment, the prescribed angle α is about 90 degrees. A value of about 90 degrees is a value obtained by repeating substantive experiments with the probability of success of the catching of the yarn end YE by the catching section 8 as a parameter.

[0057] The yarn winding machine 100 can stop the rotation of the package P to stop the yarn end YE of the package P within the catching range Aa. The catching range Aa is a range in which the possibility that the yarn end YE of the package P can be caught is high. A range of about 90 degrees from the imaginary line IL in the rotating direction (winding direction) and the reverse rotating direction (unwinding direction) of the package P is a range in which the possibility that the yarn end YE of the package P can be caught becomes higher. Accordingly, the yarn end YE of the package P can be easily caught by the catching section 8.

[0058] In order to further improve the probability of success of the catching of the yarn end YE by the catching section 8, the catching range Aa is preferably reduced. Specifically, as illustrated in FIG. 5, the prescribed angle α is about 45 degrees. The value of about 45 degrees is a value obtained by repeating substantive experiments with the probability of success of the catching of the yarn end YE by the catching section 8 as a parameter.

[0059] A range of about 45 degrees from the imaginary line IL in the rotating direction and the reverse rotating direction of the package P is a range in which the possibility that the yarn end YE of the package P can be caught is the highest. Accordingly, the yarn end YE of the package P can be easily caught by the catching section 8.

[0060] In order to improve the probability of success of the catching of the yarn end YE by the catching section 8, the influence of gravity may be taken into consideration. Specifically, as illustrated in FIG. 6, the range in which the yarn end YE of the package P stops to be substantially along the anti-gravitational direction is defined as the catching range Aa. When the yarn end YE stops to be substantially along the anti-gravitational direction, the yarn end YE is not wound around the package P but is floating from the surface of the package P. The arrow illustrated in FIG. 6 indicates a gravitational direction and a direction of the yarn end YE.

[0061] The range in which the yarn end YE of the pack-

age P stops to be substantially along the anti-gravitational direction is the range in which the yarn end YE of the package P floats from the surface of the package P. When the yarn end YE of the package P stops within the catching range Aa, the possibility that the catching section 8 can catch the yarn end YE of the package P becomes high. Accordingly, the yarn end YE of the package P can be easily caught by the catching section 8.

[0062] The yarn winding machine 100 can move the package P away from the contact roller 72 (see e.g., Japanese Unexamined Patent Publication No. 2010-13259). In the yarn winding machine 100, even if the package P is rotated before catching the yarn end YE with the catching section 8, the contact roller 72 does not press the yarn end YE. In a case where the package P cannot be moved away from the contact roller 72, the following configuration is preferable.

[0063] As illustrated in FIG. 7, it is important to stop the rotation of the package P to stop the yarn end YE of the package P outside a pressed range Sa. The pressed range Sa is a range in which the yarn end YE is pressed by the contact roller 72 when the package P is rotated before catching of the yarn end YE of the package P.

[0064] Specifically, the yarn winding machine 100 reversely rotates (rotates in a direction opposite to the winding direction) the package P before the catching section 8 catches the yarn end YE (see FIG. 3). If the yarn end YE stops within the pressed range Sa, the yarn end YE is pressed by the contact roller 72 and attached to the surface of the package P. Therefore, if the yarn end YE of the package P stops outside the pressed range Sa, the possibility that the catching section 8 can catch the yarn end YE of the package P becomes higher. Accordingly, the yarn end YE of the package P can be easily caught by the catching section 8.

[0065] Next, a configuration for enabling the rotation of the package P to be stopped such that the yarn end YE of the package P is stopped at an arbitrary position will be described.

[0066] The package driving section 73 includes an angle phase detecting section (encoder, not illustrated) (rotational amount detecting section) capable of detecting an angle phase of a rotational axis of the servomotor. The angle phase of the rotational axis of the package driving section 73 has a correlation with the yarn end YE of the package P. Therefore, the control section 10 can recognize the number of rotations of the package P until the yarn end YE reaches the package P. The control section 10 can indirectly obtain the position of the yarn end YE of the package P based on an angle phase signal from the package driving section 73.

[0067] When receiving information on the discontinuation of the spun yarn Y based on the signal from the yarn information detecting section 5 or the cutter 52, the control section 10 can calculate at which position the yarn end YE from the package P can be stopped by determining the rotational amount of the package driving section 73 in accordance with the distance from the yarn infor-

mation detecting section 5 or the cutter 52 to the package P, the outer diameter of the package P, and the angle phase signal from the package driving section 73.

[0068] If there is a possibility that the yarn end YE stops beyond the catching range Aa in the control for stopping the rotation of the package P, the control section 10 controls the package driving section 73 to shorten a braking time of the package P to stop the yarn end YE within the catching range Aa. If there is a possibility that the yarn end YE stops before the catching range Aa in the control for stopping the rotation of the package P, the control section 10 controls the package driving section 73 to extend the braking time of the package P to stop the yarn end YE within the catching range Aa.

[0069] Next, a specific configuration and a control manner will be further described.

[0070] The yarn winding machine 100 includes a rotation speed detecting section (rotational amount detecting section) 75 in the bobbin holding section 71 (see FIG. 1). The rotation speed detecting section 75 detects a pulse signal from a rotating pulse board, and transmits the pulse signal to the control section 10. The control section 10 calculates the number of rotations (rotation speed) (rotational amount) of the package P (the bobbin TB) based on the pulse signal received per unit time.

[0071] Furthermore, the yarn winding machine 100 includes a wound amount detecting section 76. The wound amount detecting section 76 detects a pulse signal from the travelling spun yarn Y, and transmits the pulse signal to the control section 10. The control section 10 can calculate the length of the wound spun yarn Y by integrating the received pulse signals. The control section 10 calculates the outer diameter of the package P from the length of the wound spun yarn Y. Specifically, the control section 10 can calculate the outer diameter of the package P based on the length of the wound spun yarn Y and a type (yarn count) of the spun yarn Y. The control section 10 stores in advance the outer diameter of the package P corresponding to the length of the wound spun yarn Y and the type (the yarn count) of the spun yarn Y to simplify a calculation process of the outer diameter of the package P.

[0072] The control section 10 can control the package driving section 73 to stop the yarn end YE at an arbitrary position in accordance with a travelling amount of the spun yarn Y (the distance from the yarn information detecting section 5 or the cutter 52 to the package P, a period of time required for the yarn end YE to travel from the yarn information detecting section 5 to the package P and/or a travelling speed when the yarn end YE travels from the yarn information detecting section 5 to the package P), the outer diameter of the package P, and the rotational amount of the package P.

[0073] The wound amount detecting section may be, for example, an angle sensor such as an analog sensor or an absolute sensor to be attached to the bobbin holding section 71. The wound amount detecting section as the angle sensor can detect a swing angle of the bobbin hold-

ing section 71. The swing angle of the bobbin holding section 71 has a correlation with the outer diameter of the package P. The wound amount detecting section can indirectly detect the outer diameter of the package P by detecting the swing angle of the bobbin holding section 71.

[0074] The wound amount detecting section may be a timer for measuring a winding time of the spun yarn Y. The control section 10 can calculate the length of the wound spun yarn Y based on the measured winding time. The control section 10 calculates the outer diameter of the package P from the length of the wound spun yarn Y. The control section 10 stops a timer function while the winding of the spun yarn Y is interrupted to accurately measure the winding time of the spun yarn Y.

[0075] In another embodiment, the yarn winding machine 100 may have a speed detecting section adapted to calculate the travelling speed of the spun yarn Y and arranged on a travelling path of the spun yarn Y. In this case, the control section 10 can calculate a winding angle from the travelling speed of the spun yarn Y and a driving speed of the traverse guide 61. Accordingly, the control section 10 can calculate the outer diameter of the package P from the winding angle, a peripheral speed of the package P, and the number of rotations of the package P.

[0076] The yarn winding machine 100 can control the package driving section 73 in accordance with the rotation speed (the number of rotations) (the rotational amount) of the package P and the wound amount (used synonymously as the outer diameter of the package P). Accordingly, the yarn winding machine 100 can accurately stop the yarn end YE of the package P at an arbitrary position.

[0077] In the yarn winding machine 100, since the package driving section 73 uses the servomotor as the power source, the feedback control can be realized. Accordingly, the yarn winding machine 100 can accurately stop the yarn end YE of the package P at an arbitrary position.

Claims

1. A yarn winding machine comprising:

- a bobbin holding section (71) adapted to rotatably hold a bobbin (TB),
 - a yarn information detecting section (5) adapted to detect continuation or discontinuation of a spun yarn (Y) to be wound into the bobbin (TB),
 - a package driving section (73) adapted to rotate the bobbin (TB) or a package (P) formed on the bobbin (TB), and
 - a control section (10) adapted to control the package driving section (73) in accordance with a detection signal from the yarn information detecting section (5),
- wherein when the yarn information detecting

- section (5) detects discontinuation of the spun yarn (Y), the control section (10) is adapted to control the package driving section (73) to stop rotation of the package (P) to stop a yarn end (YE) of the package (P) at a prescribed position.
2. The yarn winding machine according to claim 1, further comprising a catching section (8) adapted to catch the yarn end (YE) of the spun yarn (Y), wherein the control section (10) is adapted to control the package driving section (73) to stop rotation of the package (P) to stop the yarn end (YE) of the package (P) in proximity of the catching section (8).
 3. The yarn winding machine according to claim 2, wherein the catching section (8) is adapted to catch the yarn end (YE) of the package (P) by sucking air.
 4. The yarn winding machine according to claim 3, wherein an imaginary line (IL) connecting a rotational axis (A) of the package (P) and a suction opening (8m) of the catching section (8) is provided as a reference, and a catching range (Aa) is determined to be within a prescribed angle (α) from the imaginary line (IL) with the rotational axis (A) of the package (P) as center, and the control section (10) is adapted to control the package driving section (73) to stop rotation of the package (P) to stop the yarn end (YE) of the package (P) within the catching range (Aa).
 5. The yarn winding machine according to claim 4, wherein the catching range (Aa) is a range of about 90 degrees from the imaginary line (IL) in a winding direction and an unwinding direction of the package (P).
 6. The yarn winding machine according to claim 4, wherein the catching range (Aa) is a range of about 45 degrees from the imaginary line (IL) in a winding direction and an unwinding direction of the package (P).
 7. The yarn winding machine according to claim 4, wherein the catching range (Aa) is a range in which the yarn end (YE) of the package (P) stops to be substantially along an anti-gravitational direction.
 8. The yarn winding machine according to any one of claim 1 through claim 7, further comprising a contact roller (72) adapted to rotate while making contact with the package (P), wherein a pressed range (Sa) is defined as a range in which the yarn end (YE) is pressed by the contact roller (72) when the package (P) is rotated after the yarn information detecting section (5) detects discontinuation of the spun yarn (Y), and the control section (10) is adapted to control the package driving section (73) to stop rotation of the package (P) to stop the yarn end (YE) of the package (P) outside the pressed range (Sa).
 9. The yarn winding machine according to any one of claim 1 through claim 8, further comprising:
 - a rotational amount detecting section (75) adapted to detect a rotational amount of the package (P), and
 - a wound amount detecting section (76) adapted to detect a wound amount of the package (P), wherein the control section (10) is adapted to control the package driving section (73) in accordance with the rotational amount and the wound amount of the package (P).
 10. The yarn winding machine according to any one of claim 1 through claim 9, wherein the package driving section (73) is a servomotor.

FIG. 1

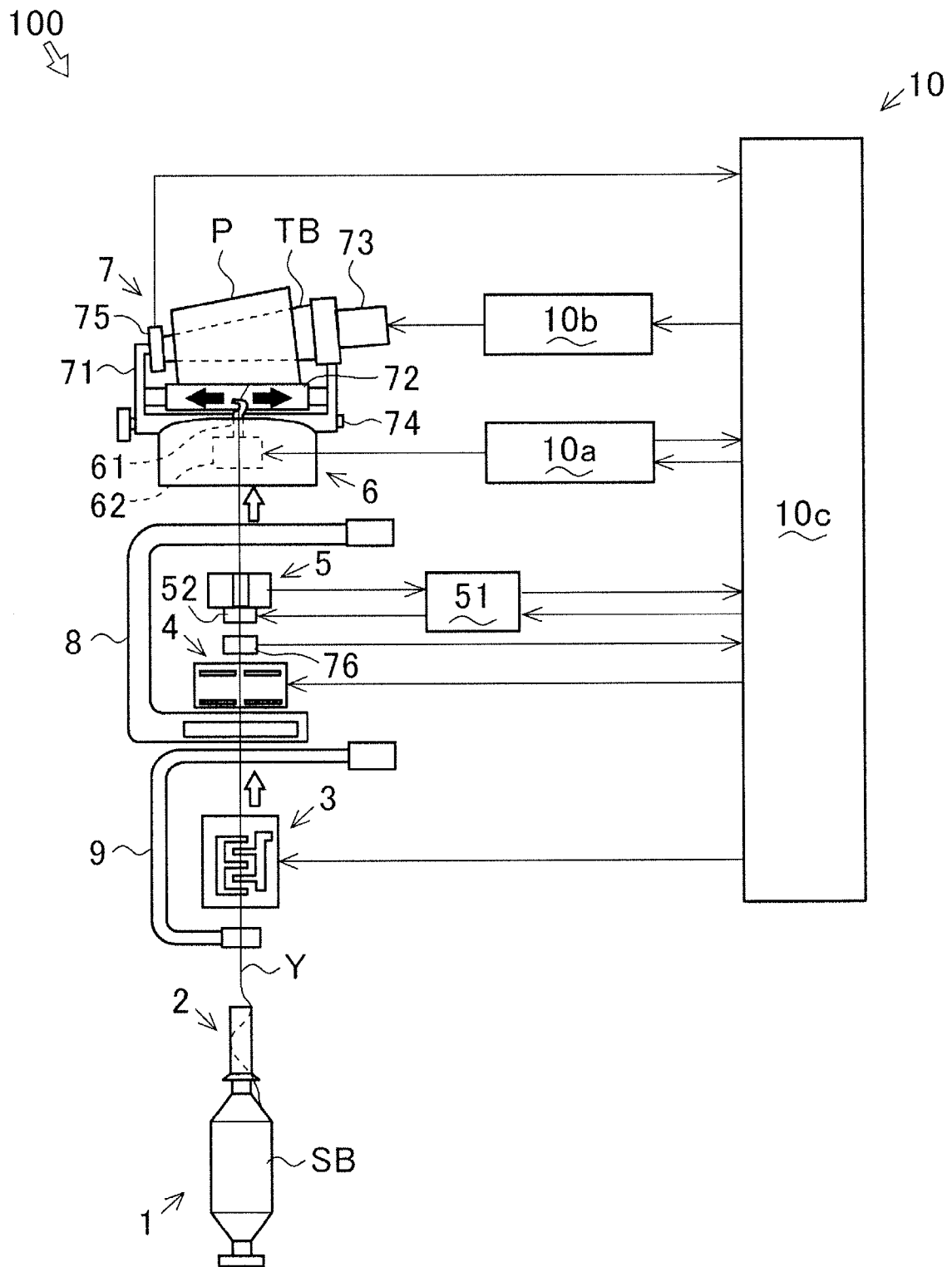


FIG. 2

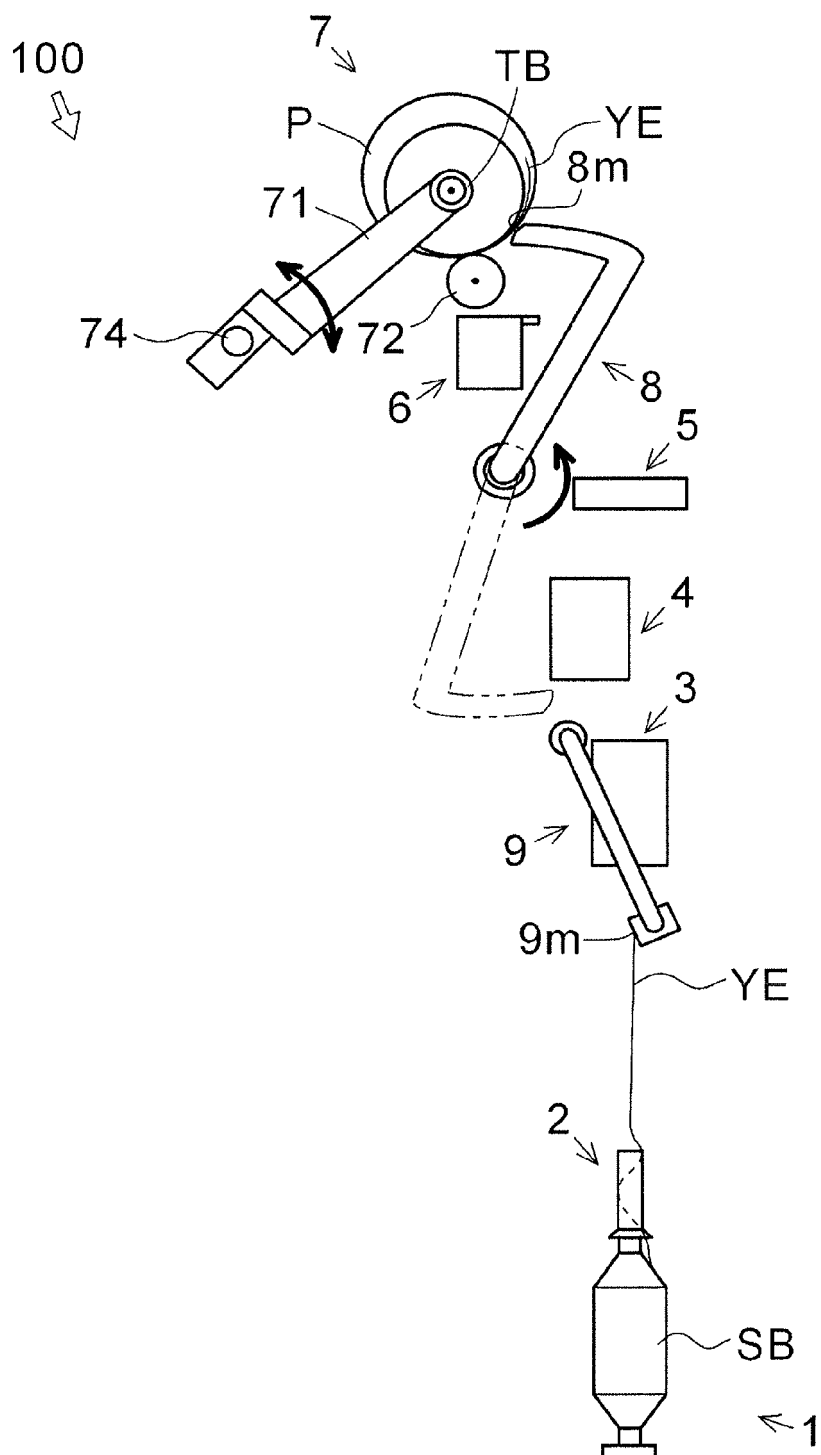


FIG. 3

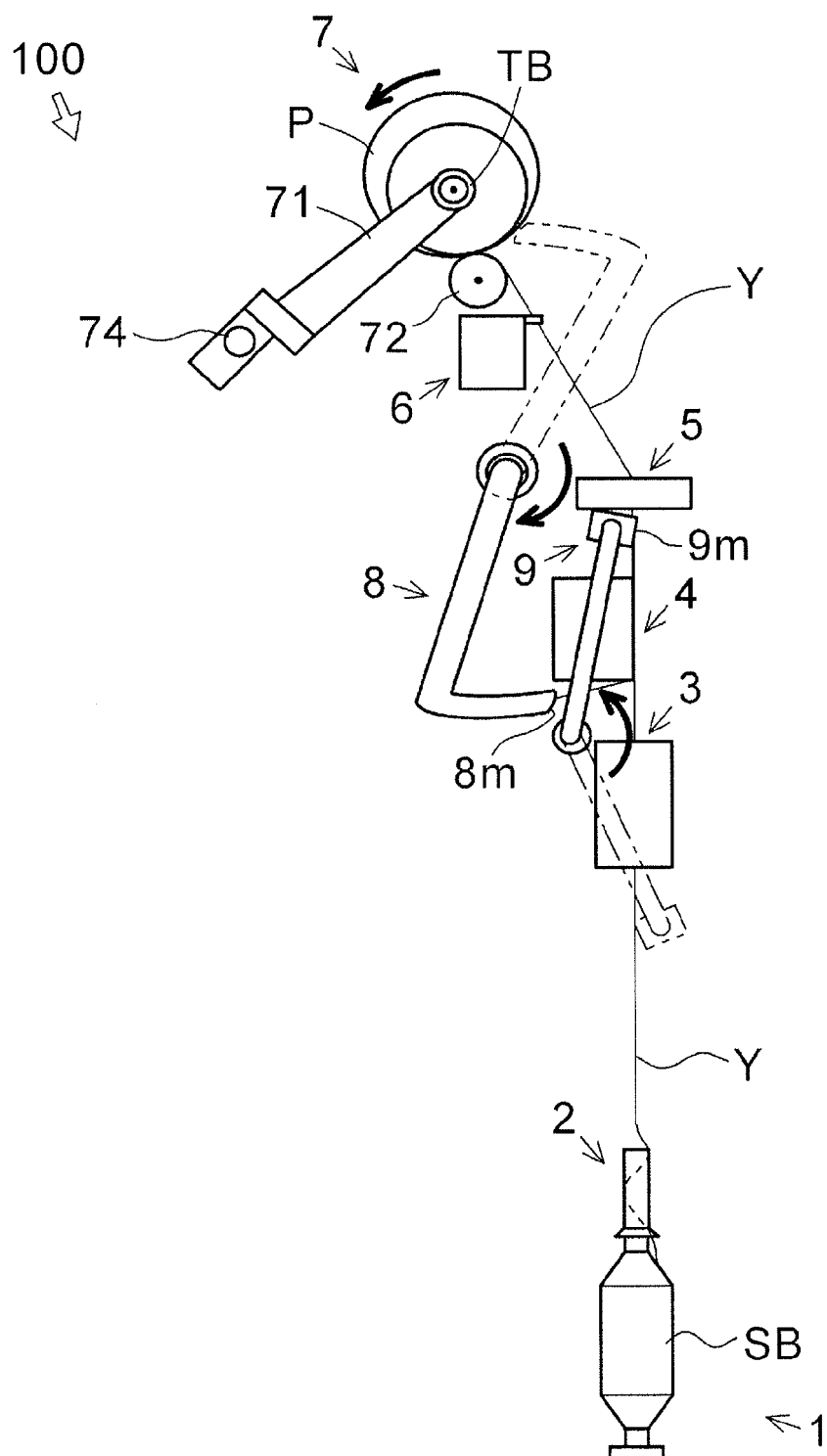


FIG. 4

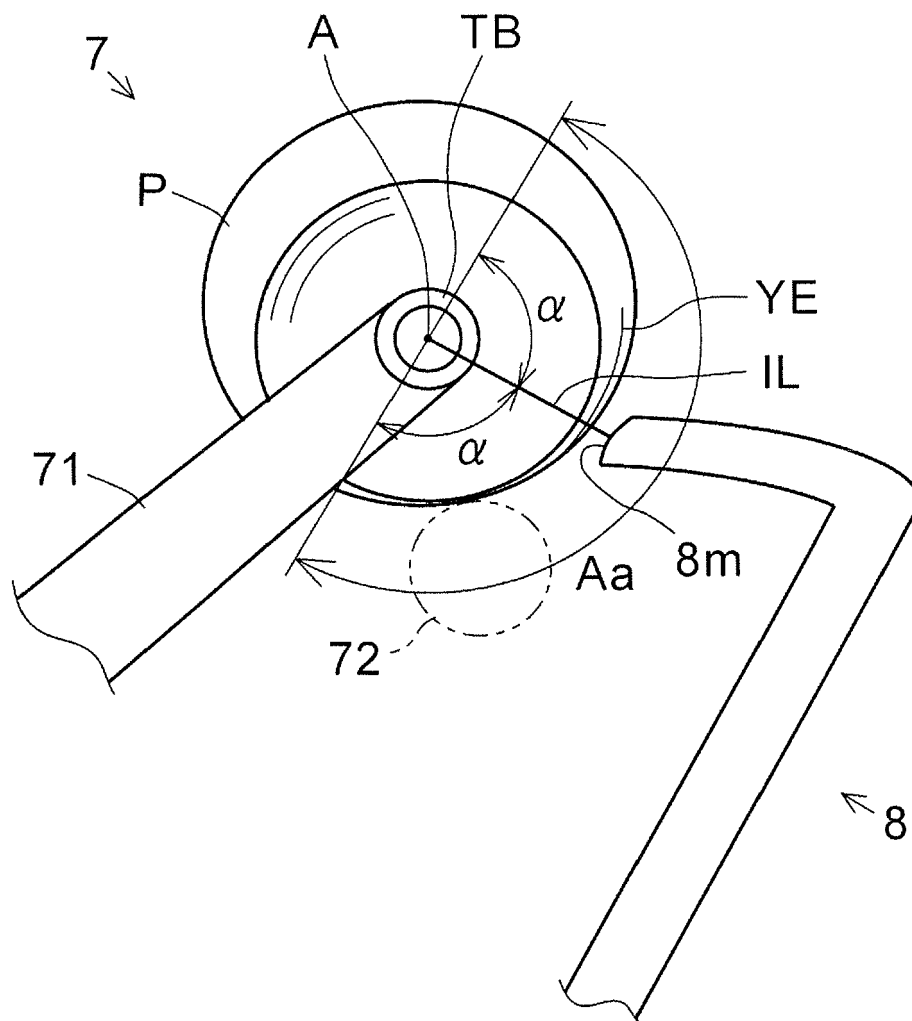


FIG. 5

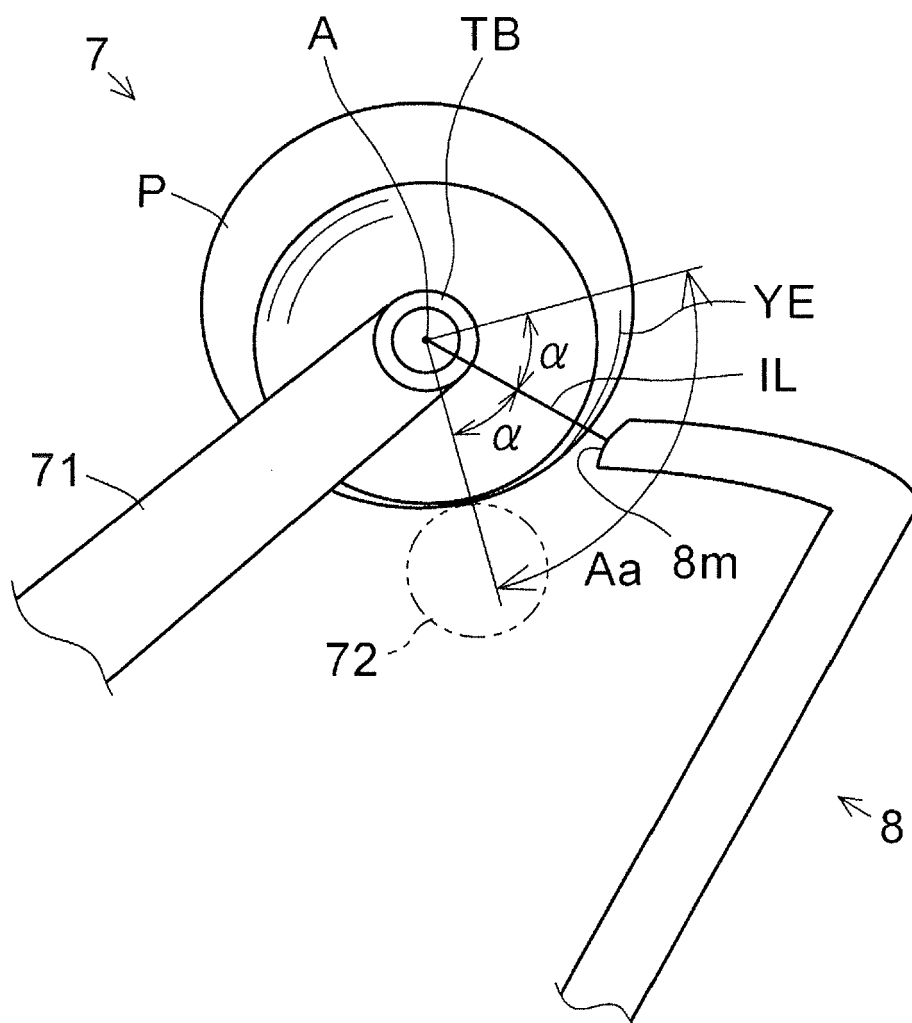


FIG. 6

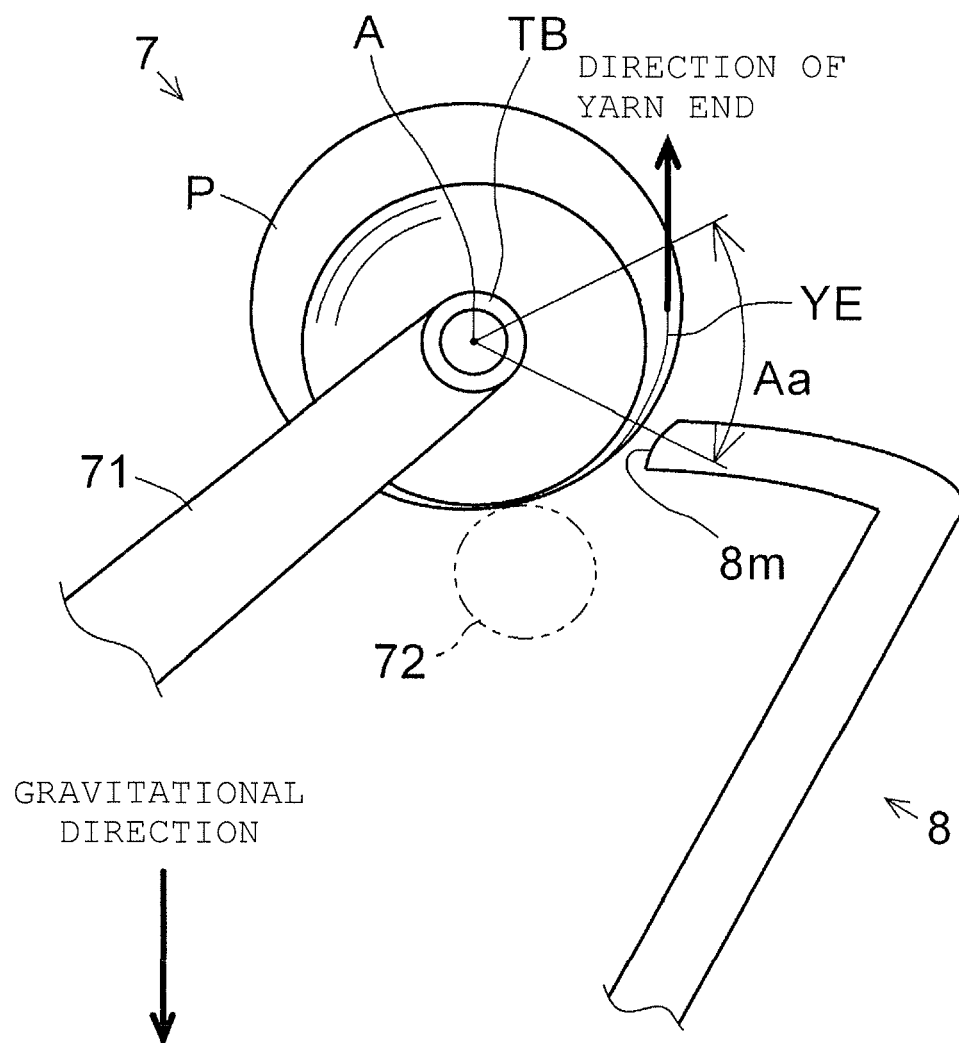


FIG. 7

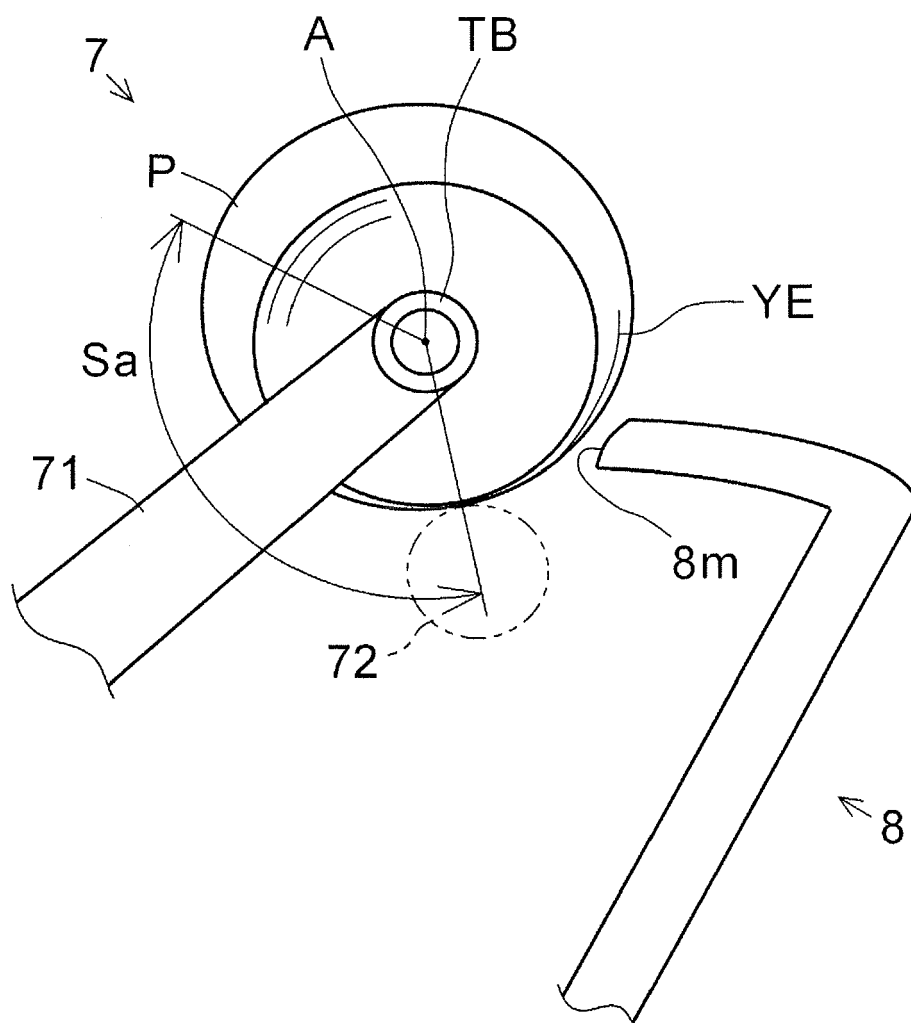


FIG. 8A

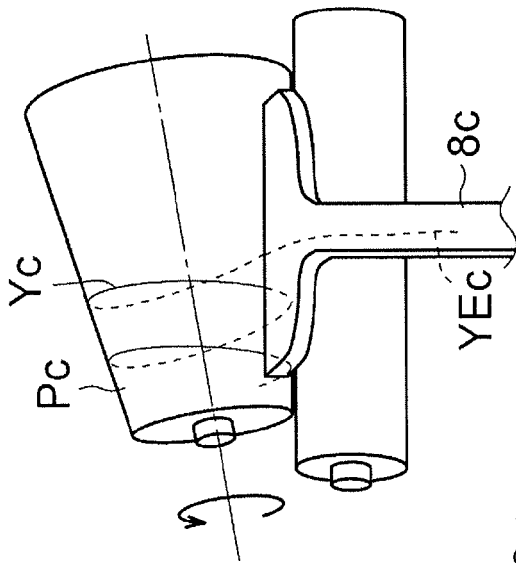


FIG. 8B

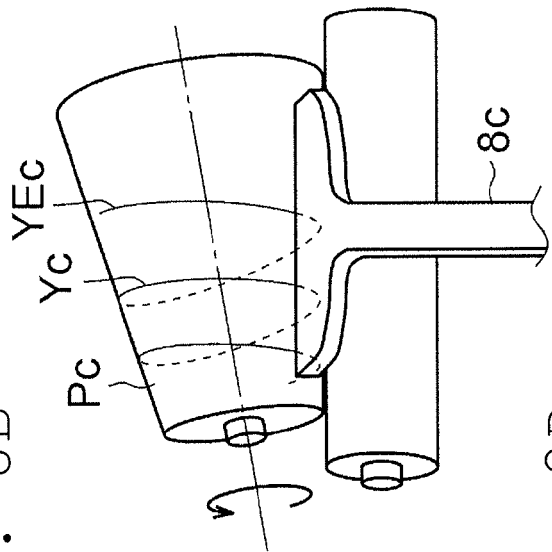


FIG. 8C

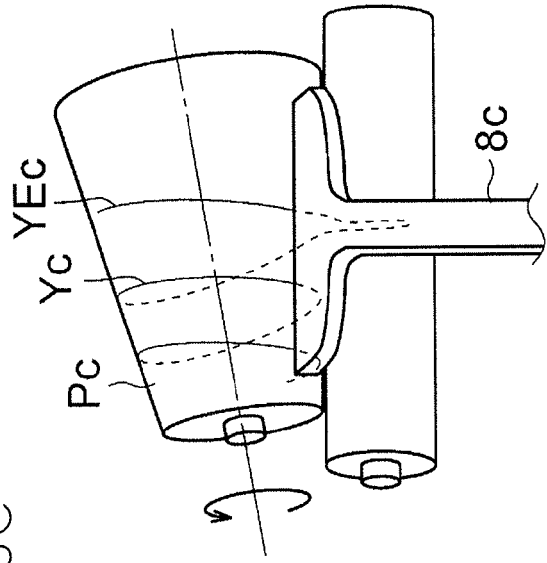
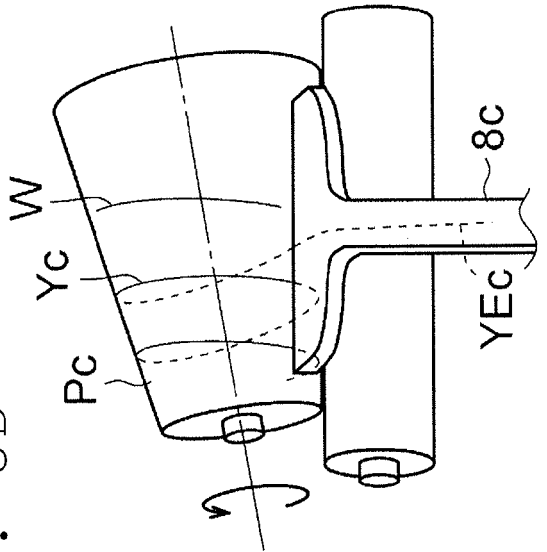


FIG. 8D



REFERENCES CITED IN THE DESCRIPTION

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