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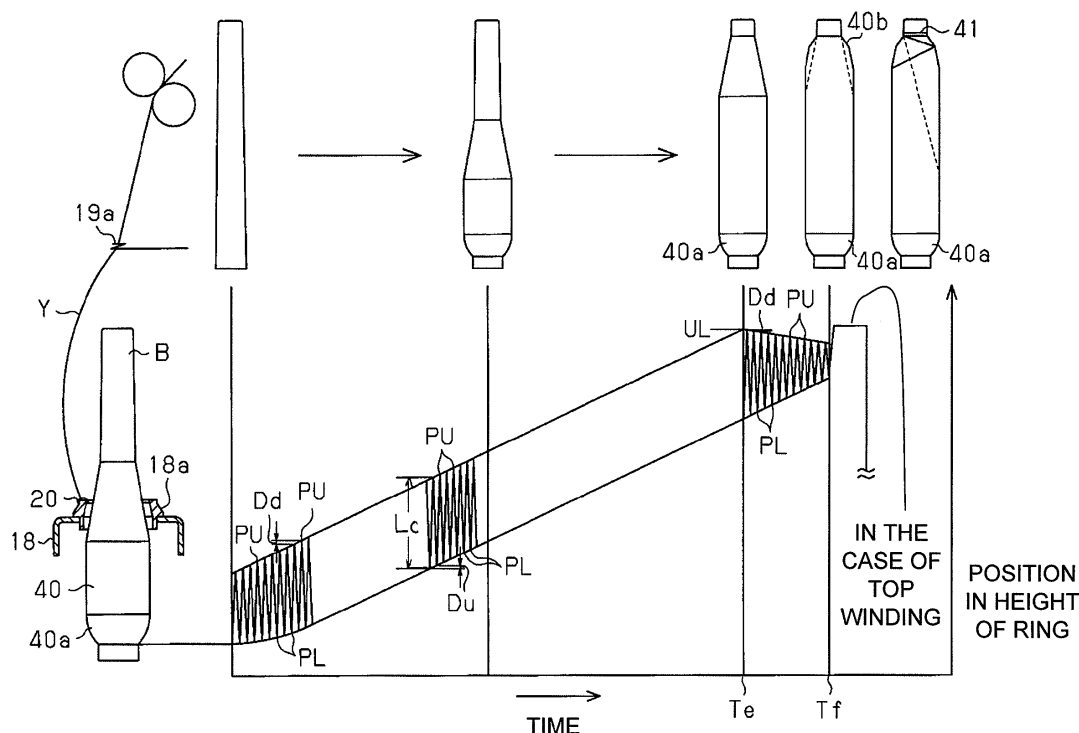
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(54) **Method of forming a cop in a spinning machine**

(57) A method of forming a cop (40) by upward winding yarn (Y) around a bobbin (B) in a spinning machine by means of filling building is characterized by the step of winding the yarn (Y) to an upper limit position (UL) of a ring rail (18) by normal winding operation where upward displacement (Du) of a lower reversal position (PL) of the

ring rail (18) is constantly the same while a chase length (Lc) is kept constant, and the step of increasing winding quantity of the yarn (Y) by lifting/lowering the ring rail (18) so that the chase length (Lc) gradually decreases while an upper reversal position of the ring rail is lowered from the upper limit position of the ring rail.

FIG. 1



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a method of forming a cop in a spinning machine such as a ring spinning machine and a ring twisting machine, and more particularly, to a method of forming a cop in increasing winding quantity at the end of winding operation of the spinning machine which performs filling building.

[0002] In the above spinning machine, winding operation of yarn is performed by means of filling building where the spinning machine gradually lifts a ring rail while repeating the lifting/lowering motion of the ring rail during the operation of the machine.

[0003] As one measures for improving productivity of the ring spinning machine, it is generally demanded to increase a winding quantity of cop (quantity of yarn which is wound around a single bobbin). This is because the increase in a winding quantity of cop leads to decrease in frequency of replacement of the bobbin per production of yarn, which shortens the time for stopping spinning the yarn. In addition, frequency of yarn piecing in rewinding the yarn in a winder is also decreased thereby to improve operation rate of the winder.

[0004] As a method to increase a winding quantity of cop, there are a way of making the bobbin thinner, a way of devising winding shape of the cop (or a way of forming a contour of the cop whose volume is large) and the like. When a lifting/lowering stroke in each cycle of the lifting/lowering motion of the ring rail is kept constant from the beginning to the end of winding operation, as shown in FIG. 4A, the cop 61 is so formed that truncated cones are formed on the opposite ends of the cylinder, respectively. To increase winding quantity at the beginning of winding operation is conventionally proposed. In this case, as shown in FIG. 4B, the cop 61 is so formed that the lower truncated cone of the cop 61 of FIG. 4A swells radially outward. The Japanese Patent Application Publication No. 2-277827 proposes a method of increasing winding quantity, wherein winding pitch in increasing winding quantity is unchanged from the winding pitch in performing normal winding operation (where winding quantity is not increased) even if the shape of the cop in increasing winding quantity is the same.

[0005] In the above prior art, the increase in winding quantity is performed in the lower region of the cop or at the beginning of winding operation only. As for this reason, it is cited that since the spinning machine which performs the conventional filling building generally includes a ring-rail lifting/lowering mechanism having a heart cam, it is hard to gradually lower the upper reversal position of the ring rail at the end of winding operation.

[0006] When a winding quantity of cop was conventionally increased more than the increase in winding quantity in the lower region of the cop, the diameter of the cop was increased or length of a bobbin to be used was made longer. However, since the diameter of the

cop is restricted by the diameter of the ring of the ring rail in the spinning machine, it is necessary to prepare substitute ring rails whose rings have different diameters for freely changing the diameter of the cop. In addition, when the length of the bobbin is changed, it is necessary to prepare the bobbin of necessary length beforehand. If the length of the bobbin is excessively long, it is necessary to change the frame of the machine.

[0007] The present invention is directed to a method of forming a cop in a spinning machine, wherein a winding quantity of cop is increased even if length of a bobbin is not changed and besides winding operation is performed with the same diameter of the cop.

15 SUMMARY OF THE INVENTION

[0008] In accordance with an aspect of the present invention, a method of forming a cop by upward winding yarn around a bobbin in a spinning machine by means of filling building is characterized by the step of winding the yarn to an upper limit position of a ring rail by normal winding operation where upward displacement of a lower reversal position of the ring rail is constantly the same while a chase length is kept constant, and the step of increasing winding quantity of the yarn by lifting/lowering the ring rail so that the chase length gradually decreases while an upper reversal position of the ring rail is lowered from the upper limit position of the ring rail.

[0009] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The features of the present invention that are believed to be novel are set forth with particularity in the appended claims. The invention together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

FIG. 1 is a schematic view showing change in a ring position with time and a forming state of a cop;

FIG. 2 is a schematic block diagram showing a ring spinning machine;

FIG. 3A is a schematic view explaining shape of a portion of a cop with winding quantity increased at the end of winding operation;

FIG. 3B is a perspective view showing a cop having a portion with winding quantity increased;

FIG. 4A is a front view showing a cop without increase in winding quantity; and

FIG. 4B is a front view showing a cop with prior art increase in winding quantity.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] The following will describe one embodiment of a method of forming a cop in a spinning machine according to the present invention as embodied in a ring spinning machine with reference to FIGs. 1 through 4B. Referring to FIG. 2, a front roller 11 which form a draft part has a rotary shaft 11a and a gear 12 is fitted on the end of the rotary shaft 11a. The rotary shaft 11a is rotated through a gear train (not shown) interposed between the gear 12 and a driving shaft 13 driven by a main motor M. A spindle 14 is rotated through a spindle tape (not shown) stretched between the spindle 14 and a tin pulley 15 fixed to the driving shaft 13. The front roller 11 and the spindle 14 are rotated so that delivery quantity (spinning quantity) of fleece from the front roller 11 and yarn winding quantity of the spindle 14 are constantly the same quantity. The ratio of rotational speed of the front roller 11 to the spindle 14 is set so as to correspond to spinning condition (number of twist). A variable speed type motor is used for the main motor M and is driven through an inverter 16. A sensor S1 is disposed near the gear 12 for outputting pulse signal so as to correspond to rotation of the front roller 11.

[0012] A lifting device is so arranged to lift/lower a ring rail 18 and a lappet angle 19 through a line shaft 17. A snail wire 19a is provided on the lappet angle 19 and yarn Y which is delivered from the front roller 11 is led to a traveler 20 which moves in slide contact with a ring 18a of the ring rail 18 through the snail wire 19a.

[0013] The line shaft 17 is disposed along the longitudinal direction of the spinning machine and a plurality of screw gears 21 (only one screw gear being shown in FIG. 2) are fitted on the line shaft 17 at predetermined intervals so as to be rotatable with the line shaft 17. The ring rail 18 is supported by a plurality of porker pillars 22 (only one porker pillar being shown in FIG. 2). Each porker pillar 22 is supported by a frame (not shown) of the machine so as to be vertically movable and the porker pillar 22 has formed in the lower region thereof a screw portion 22a. The screw portion 22a is screwed into a nut member 23 which is rotatably supported at a predetermined position in height of the frame. The nut member 23 has a screw gear (not shown) formed on the outer periphery thereof so as to be engaged with the corresponding screw gear 21. The similar lifting/lowering mechanism is arranged for the lappet angle 19, so that the lappet angle 19 is lifted/lowered in synchronization with the ring rail 18.

[0014] The line shaft 17 is connected to a drive shaft of a servomotor 24 serving as a motor through a gear train (not shown). Driving the servomotor 24 is controlled by a controller 25 serving as control means through a servo driver 26. The servomotor 24 is provided with a rotary encoder 27. The line shaft 17 is driven by the ser-

vomotor 24 so that its rotational speed and rotational direction are freely variable. The line shaft 17, the porker pillars 22, the nut members 23, the servomotor 24 and the gear trains form the lifting device. The above structure of the lifting device is basically the same as that of the device disclosed by the Japanese Patent Application Publication No. 7-300728.

[0015] The controller 25 includes a central processing unit (CPU) 29, a program memory (ROM) 30, a working memory (RAM) 31, an input device 32, an input interface 33, an output interface 34, a main motor drive circuit 35 and a servomotor drive circuit 36. The CPU 29 is connected to the inverter 16 through the output interface 34 and the main motor drive circuit 35. The CPU 29 is connected to the servomotor 24 through the output interface 34, the servomotor drive circuit 36 and the servo driver 26.

[0016] The controller 25 is provided with a counter 37. The counter 37 is electrically connected to the rotary encoder 27 and the CPU 29. An up/down counter is used for the counter 37, wherein count value increases when an output pulse from the rotary encoder 27 is input at the time of normal rotation of the servomotor 24 and the count value decreases when the output pulse from the rotary encoder 27 is input at the time of reverse rotation of the servomotor 24.

[0017] The CPU 29 operates based on a predetermined program data stored in the program memory 30. The program memory 30 is formed by a read-only memory (ROM) which stores the above program data and various types of data necessary to the execution of the program data. In the present embodiment, the program data is stored for increasing winding quantity at the beginning and the end of the winding operation. The various types of data include counts of spun yarn, spinning conditions, such as rotational speed of the spindle in spinning operation and the like, and correspondence data, such as number of times of chase of the ring rail 18 for full bobbin.

[0018] In accordance with the spinning conditions, the program memory 30 stores reference pattern of speed change of the main motor M formed from starting of the machine to stop for doffing, and map or relational expression such as reversal position of the ring rail 18 formed from starting of the machine to stop for doffing. In addition, the program memory 30 stores relational expression or map for calculating a chase length Lc in increasing winding quantity from a reference chase length in performing normal winding operation (where winding quantity is not increased). The term "chase length" is intended to mean a single lifting/lowering stroke of a ring rail of the present invention.

[0019] The working memory 31 is formed by a random access memory (RAM) which temporarily stores data input through the input device 32, the result of arithmetic operation executed in the CPU 29 and the like. The input device 32 is used for inputting spinning condition data such as counts of spun yarn, rotational speed of the spin-

dle, a spinning length, a lift length and a reference chase length in spinning operation and the like.

[0020] The CPU 29 is connected to the sensor S1 and the rotary encoder 27 through the input interface 33. The CPU 29 calculates spinning quantity in accordance with output signal from the sensor S1. The CPU 29 recognizes direction of movement of the ring rail 18, namely, upward or downward movement of the ring rail 18 in accordance with output signal from the rotary encoder 27. In addition, the CPU 29 calculates the position of the ring rail 18 in accordance with the count value of the counter 37.

[0021] Operation of the device arranged as described above will now be explained. First, counts of spun yarn and spinning condition data such as rotational speed of the spindle, the spinning length, the lift length, the reference chase length and the like in spinning operation are input through the input device 32. The lifting device, the draft part and the spindle drive system are driven in separates states and in synchronous states.

[0022] The CPU 29 controls the driving of the servomotor 24 in synchronization with the main motor M in accordance with the spinning conditions which are input through the input device 32 and are stored in the working memory 31. When the servomotor 24 is driven, the line shaft 17 is rotated through the gear train thereby to rotate the nut member 23 through the screw gear 21. The porker pillar 22 screwed into the nut member 23 is moved upward or downward with the ring rail 18. The ring rail 18 is moved upward at the time of normal rotation of the servomotor 24 and is moved downward at the time of reverse rotation thereof. The yarn Y delivered from the front roller 11 is wound around the bobbin B through the snail wire 19a and the traveler 20 to form a cop 40.

[0023] The CPU 29 lifts/lowers the ring rail 18 so that upward displacement Dd of an upper reversal position PU transferred from lifting process to lowering process of the ring rail 18 is kept constant as shown in FIG. 1 until the ring rail 18 reaches an upper limit position UL from the beginning of the winding operation. The upper limit position UL of the ring rail 18 is determined by width in holding the bobbin B by a gripper (bobbin holder) of a doffing device (not shown) in a doffing operation.

[0024] In the case of normal winding operation where winding quantity is not increased, the CPU 29 controls the driving of the servomotor 24 so as to change rotational direction of the servomotor 24 when the ring rail 18 travels distance corresponding to lifting stroke or lowering stroke per chase previously input so that upward displacement Du of a lower reversal position PL of the ring rail 18 is constantly the same while a chase length Lc is kept constant. Therefore, in the case of normal winding operation, the ring rail 18 is lifted/lowered so that the upward displacement Du of the lower reversal position PL transferred from the lowering process to the lifting process of the ring rail 18 is also kept constant.

[0025] Meanwhile, when a lower portion 40a of the cop 40 where winding quantity is increased at the beginning of the winding operation is formed, the ring rail 18 is lifted/

lowered so that lifting stroke and lowering stroke of the ring rail 18 increase one after another from the beginning of the winding operation until a predetermined number of times of chase. Since the upward displacement Dd of the upper reversal position PU is not changed, the ring rail 18 is lifted/lowered so that the upward displacement Du of the lower reversal position PL changes. In the present embodiment, the ring rail 18 is lifted/lowered so that the contour of the lower portion 40a is a curved surface or that the upward displacement Du of the lower reversal position PL gradually increases.

[0026] When an upper portion 40b (indicated by chain double-dashed line) of the cop 40 where winding quantity is increased at the end of the winding operation is formed, the ring rail 18 is lifted/lowered so that after winding operation is performed to the upper limit position UL by the normal winding operation, the chase length Lc gradually decreases while the upper reversal position PU of the ring rail 18 is lowered from the upper limit position UL. The upward displacement Du of the lower reversal position PL of the ring rail 18 in forming the upper portion 40b, namely in increasing winding quantity in the upper region of the bobbin B, is set the same as the upward displacement Du in the case of normal winding operation. Therefore, the cop 40 is formed so that the upper portion 40b is continuous with a portion of the cop 40 where normal winding operation is performed at the same diameter. As shown in FIG. 3A, angle θ_1 made by a surface of a part of the upper portion 40b formed in continuity with a lower part of the upper portion 40b (the lower part having major diameter of the upper portion 40b) and a plane perpendicular to the axis of the cop 40 is the same as angle α made by the surface of the upper portion of the cop (indicated by solid line) in the case of normal winding operation and the plane perpendicular to the axis of the cop 40.

[0027] The ring rail 18 is lifted/lowered so that downward displacement Dd of the upper reversal position PU of the ring rail 18 in forming the upper portion 40b is kept constant. The downward displacement Dd is set as shown in FIG. 3A so that angle θ_2 made by a surface of an upper part of the upper portion 40b and the axis of the cop 40 ranges from 50° to 55° .

[0028] After the upper portion 40b is completely formed, top winding is performed for winding the yarn Y around the bobbin B at the position higher than the upper limit position UL so that a top portion 41 is formed on the top of the cop 40. The number of turns of the top winding is the same as or less than three times. By performing the winding operation as described above, range of lifting/lowering operation of the ring rail 18a is changed as shown in FIG. 1. More specifically, the upper reversal position PU of the ring rail 18a is moved so as to be located in a straight line whose slope is positive (upward) from the beginning of the winding operation until the time Te the conventional winding operation ends (full bobbin stop), and then is moved so as to be located in a straight line whose slope is negative (downward). On the other

hand, the lower reversal position PL is moved so as to be located in a curve which projects downward in forming the lower portion 40a, in a straight line in forming the middle portion between the portions 40a and 40b (or in performing normal winding operation), and in a production of the above straight line for the middle portion in forming the upper portion 40b.

[0029] As shown in FIG. 3B, the cop 40 formed by the above cop forming method includes the lower portion 40a located on the lower side of the cop 40 and the upper portion 40b located on the upper side thereof. Therefore, a winding quantity of cop is increased for the upper portion 40b. Although increasing quantity of a winding quantity of cop depends on bobbin length, diameter of the cop (ring diameter), thickness of spun yarn and the like, it is estimated to be on the order of 5 to 15%.

[0030] According to the embodiment, the following advantageous effects are obtained.

(1) When a cop formation is performed by means of filling building, the yarn is wound to the upper limit position UL by normal winding operation where the upward displacement Du of the lower reversal position PL of the ring rail 18 is constantly the same while the chase length Lc is kept constant, and then winding quantity of the yarn is increased by lifting/lowering the ring rail 18 so that the chase length Lc gradually decreases while the upper reversal position PU of the ring rail 18 is lowered from the upper limit position UL. Therefore, a winding quantity of the cop 40 is increased more than conventional one even if length of the bobbin B is not changed and besides winding operation is performed with the same diameter of the cop. Consequently, frequency of replacement of the bobbin per production of yarn is decreased without increasing number of kinds of the bobbin B (the lengths of the bobbins being different), which shortens the time for stopping spinning the yarn in the spinning machine. In addition, when the yarn is rewound in a winder, frequency of yarn piecing and frequency of replacement of spinning cop per production of yarn are decreased thereby to improve operation rate of the winder.

(2) The upward displacement Du of the lower reversal position PL of the ring rail 18 in forming the upper portion 40b is set the same as that of the ring rail 18 in the case of the normal winding operation. Therefore, winding operation is performed so that the diameter of the lower part of the upper portion 40b is continuous with that of the winding portion of the cop 40 in the case of the normal winding operation at the same diameter, so that the winding quantity is increased compared to the case where the diameter of the lower part of the upper portion 40b gradually decreases.

(3) The ring rail 18 is lifted/lowered so that downward

displacement Dd of the upper reversal position PU of the ring rail 18 in forming the upper portion 40b is kept constant. Therefore, the visible outline of a section of the upper portion 40b in cutting off the upper portion 40b along a plane including the axis of the bobbin B is formed in a linear shape, which makes it hard to cause sloughing compared to the case where the visible outline is formed in a curvilinear shape. The term "sloughing" is intended to mean phenomenon that the yarn sloughs off the cop in a circular manner when the cop is rewound in a winding process.

(4) After forming the upper portion 40b, top winding is performed for winding the yarn Y around the bobbin B at the position higher than the upper limit position UL in the case of the normal winding operation. Therefore, the top portion 41 serves to prevent sloughing, so that the quantity of the upper portion 40b is increased compared to the case where the top winding is not performed.

(5) Since the lifting device is formed so that an exclusive servomotor 24 rotates the line shaft 17 in a normal or reverse direction to lift/lower the ring rail 18, it is easy to change the reversal position of the ring rail 18 for changing the chase length Lc in forming the upper portion 40b at the end of the winding operation.

[0031] The present invention is not limited to the above embodiment, but may be embodied in the following examples.

[0032] When the upper portion 40b is formed, it is only necessary to lift/lower the ring rail 18 so that the chase length Lc gradually decreases while the upper reversal position PU of the ring rail 18 is lowered from the upper limit position UL. It is allowed to lift/lower the ring rail 18 so that the downward displacement Dd of the upper reversal position PU of the ring rail 18 is not kept constant but continuously increases. In this case, the surface of the upper part of the upper portion 40b is formed in a curved surface which projects radially outward, so that the winding quantity of the upper portion 40b is increased. It is also allowed to lift/lower the ring rail 18 so that the downward displacement Dd of the upper reversal position PU of the ring rail 18 does not continuously increase but stepwise increases.

[0033] When the upper portion 40b is formed, it is allowed to lift/lower the ring rail 18 so that the upward displacement Du of the lower reversal position PL of the ring rail 18 is not the same as the upward displacement Du in the case of normal winding operation but gradually increases. When the ring rail 18 is lifted/lowered so that the upward displacement Du gradually increases, however, the diameter of the cop 40 is gradually decreased. Therefore, it is preferable that the upward displacement Du is set the same as that in the case of normal winding

operation to increase the winding quantity.

[0034] The top winding need not be performed.

[0035] The lifting device which lifts/lowers the ring rail 18 may be formed so as to transmit rotation of the front roller 11 to the line shaft 17 through a gear train as that disclosed by the Japanese Patent Application Publication No. 2-277827, instead of driving the line shaft 17 by the servomotor 24 for the lifting device. In this case, switchover between normal rotation and reverse rotation of the line shaft 17 is performed through an electromagnetic clutch provided in the gear train.

[0036] The drive system of the spindle 14 is not limited to the belt driving but may be what is called a single spindle driving system where a motor is provided for each spindle. The spindle 14 may be also driven by a tangential belt rather than by a belt using the chin pulley 15.

[0037] Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein but may be modified within the scope of the appended claims.

[0038] A method of forming a cop by upward winding yarn around a bobbin in a spinning machine by means of filling building is characterized by the step of winding the yarn to an upper limit position of a ring rail by normal winding operation where upward displacement of a lower reversal position of the ring rail is constantly the same while a chase length is kept constant, and the step of increasing winding quantity of the yarn by lifting/lowering the ring rail so that the chase length gradually decreases while an upper reversal position of the ring rail is lowered from the upper limit position of the ring rail.

Claims

1. A method of forming a cop (40) by upward winding yarn (Y) around a bobbin (B) in a spinning machine by means of filling building, **characterized by:**

winding the yarn (Y) to an upper limit position (UL) of a ring rail (18) by normal winding operation where upward displacement (Du) of a lower reversal position (PL) of the ring rail (18) is constantly the same while a chase length (Lc) is kept constant; and increasing winding quantity of the yarn (Y) by lifting/lowering the ring rail (18) so that the chase length (Lc) gradually decreases while an upper reversal position (PU) of the ring rail (18) is lowered from the upper limit position (UL) of the ring rail (18).

2. The method according to claim 1, wherein upward displacement (Du) of the lower reversal position (PL) of the ring rail (18) in increasing the winding quantity is set the same as that (Du) of the ring rail (18) in the case of the normal winding operation.

3. The method according to claim 1, wherein upward displacement (Du) of the lower reversal position (PL) of the ring rail (18) in increasing the winding quantity is set to gradually increase.

4. The method according to any one of claims 1 through 3, wherein the ring rail (18) is lifted/lowered so that downward displacement (Dd) of the upper reversal position (PU) of the ring rail (18) in increasing the winding quantity is kept constant.

5. The method according to any one of claims 1 through 3, wherein the ring rail (18) is lifted/lowered so that downward displacement (Dd) of the upper reversal position (PU) of the ring rail (18) in increasing the winding quantity continuously increases.

6. The method according to any one of claims 1 through 3, wherein the ring rail (18) is lifted/lowered so that downward displacement (Dd) of the upper reversal position (PU) of the ring rail (18) in increasing the winding quantity stepwise increases.

7. The method according to any one of claims 1 through 6, further comprising:

performing top winding for winding the yarn (Y) around the bobbin (B) at the position higher than the upper limit position (UL) in the normal winding operation after the winding quantity increasing step.

8. The method according to any one of claims 1 through 7, wherein the ring rail (18) is lifted/lowered by a lifting device which includes an exclusive motor (24) for rotating a line shaft (17) in a normal or reverse direction.

FIG. 1

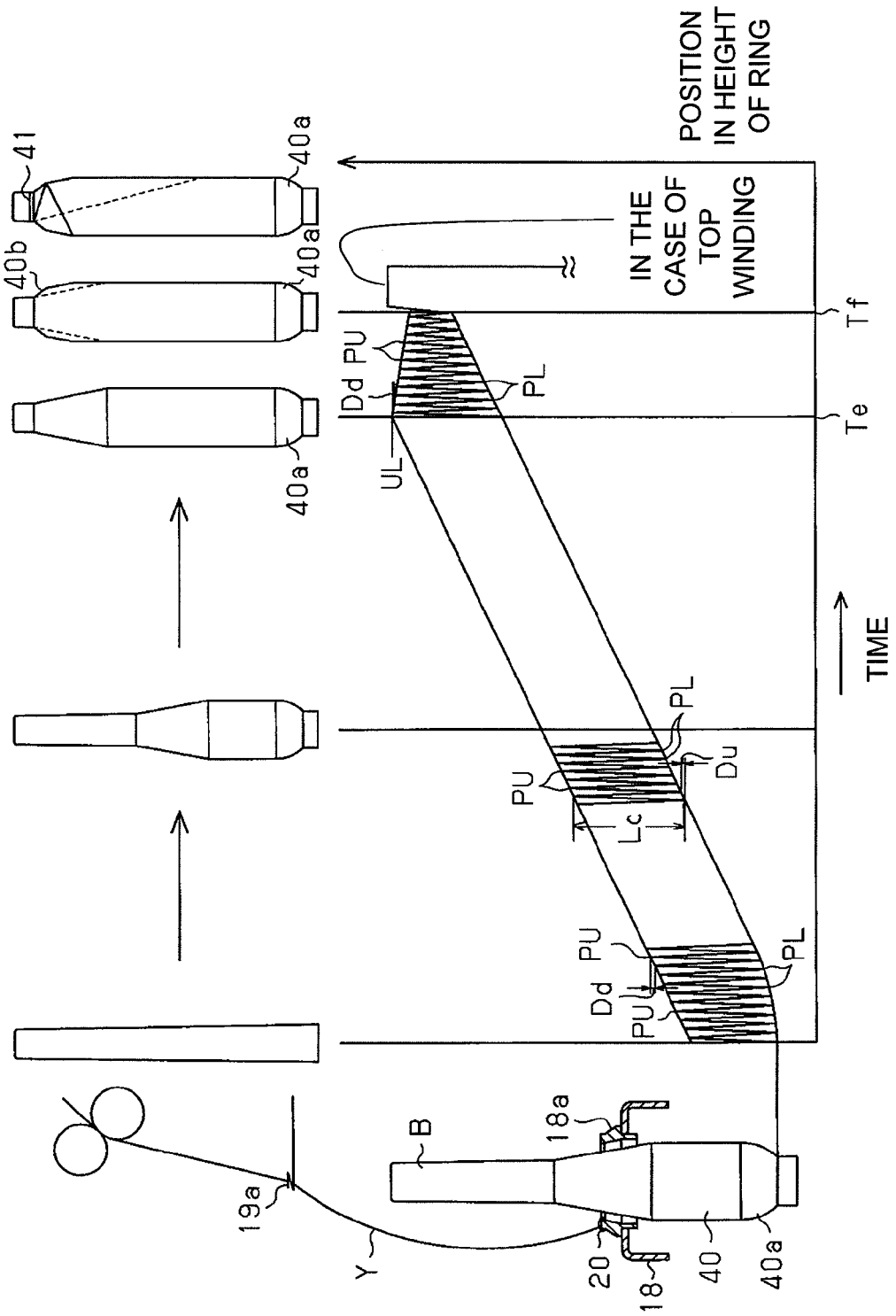


FIG. 2

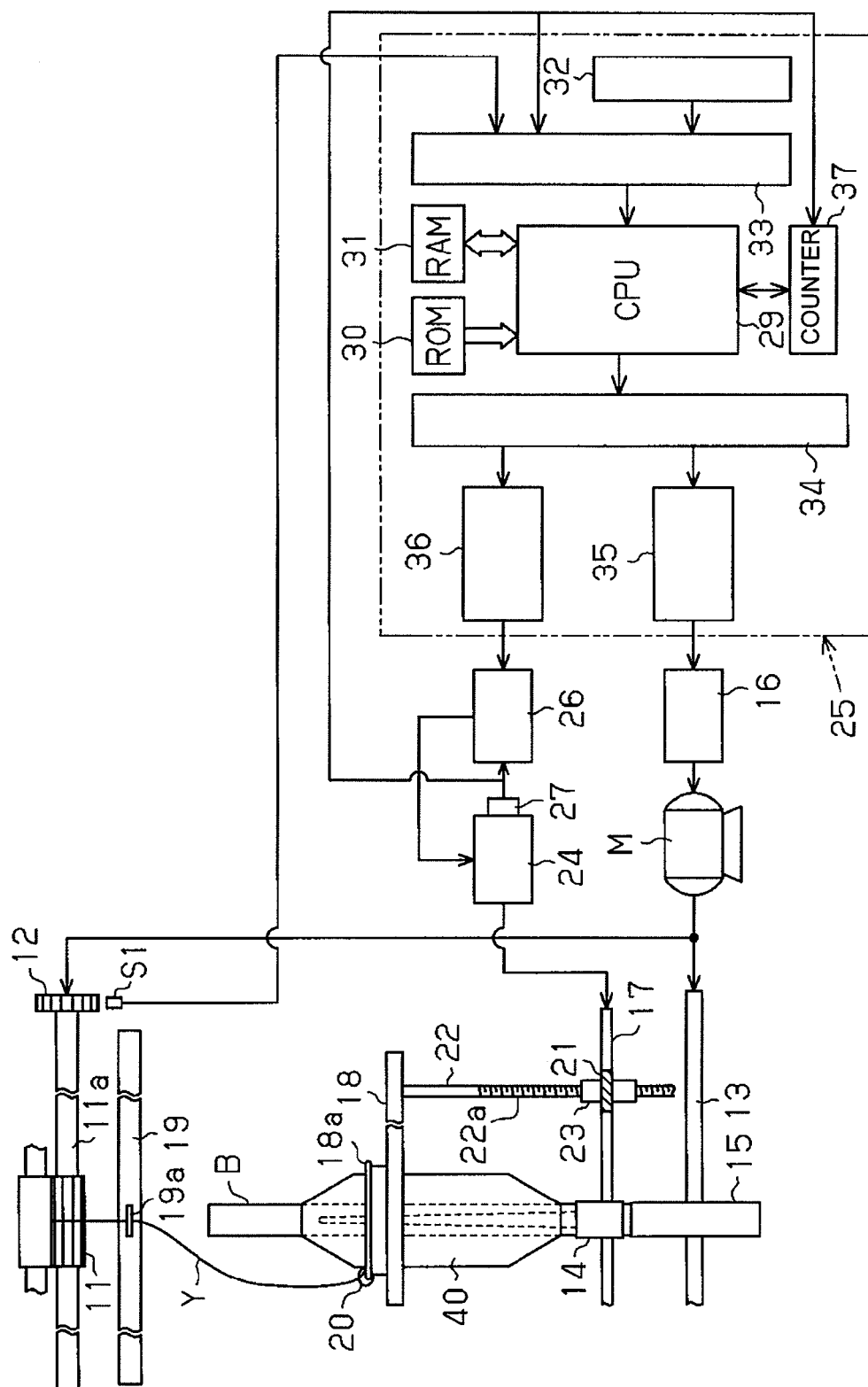


FIG. 3A

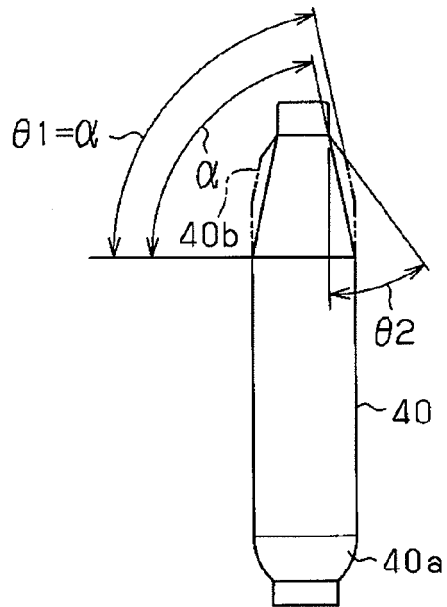


FIG. 3B

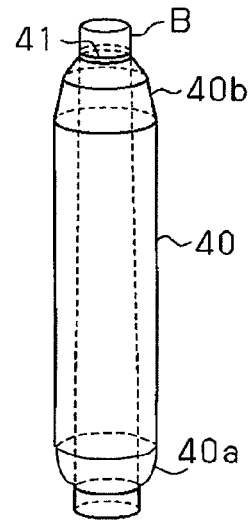


FIG. 4A

(PRIOR ART)

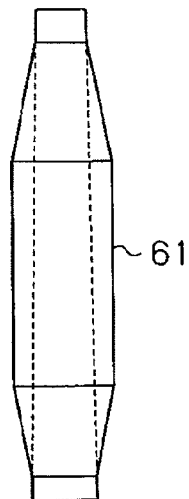
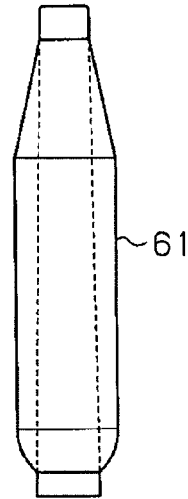


FIG. 4B

(PRIOR ART)



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2277827 A [0004] [0035]
- JP 7300728 A [0014]