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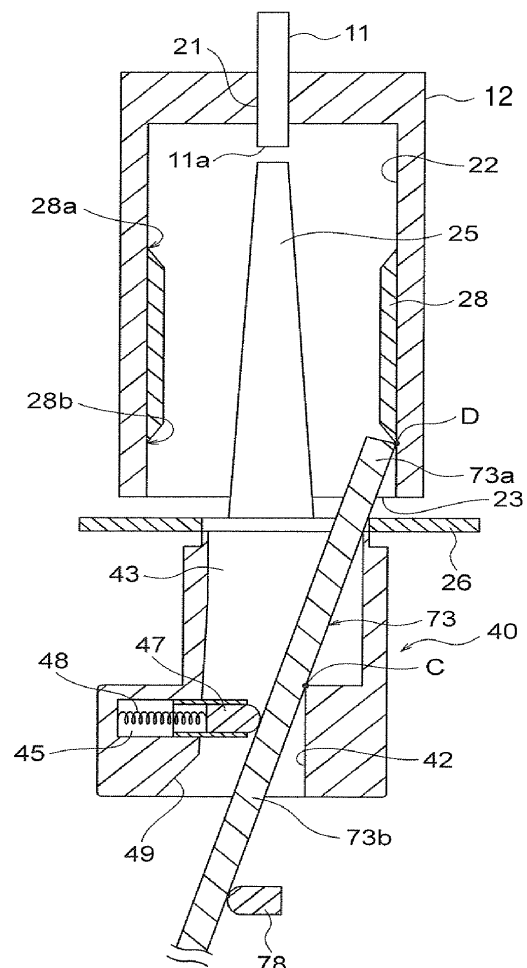
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(54) **POT SPINNING MACHINE**

(57) A pot spinning machine (1) includes an elongated member (73) including a contact end portion (73a) contactable with an inner wall (22) of a pot (12), and a base end portion (73b) supporting the contact end portion (73b), an up-down movement actuator (76) adjusting a position of the contact end portion (73a) in a height direction to a yarn end position (28b) of a yarn (18) deposited on the inner wall (22), a guide member (40) holding the elongated member (73) in a direction that crosses a tilting direction of the elongated member (73) and guiding the elongated member (73), an elastic support member (47, 48) elastically supporting the contact end portion (73a) in the tilting direction, and a tilting movement actuator (78) tilting the elongated member (73) so that the contact end portion (73a) is placed in contact with the inner wall (22) of the pot (12).

FIG. 13



Description

BACKGROUND ART

[0001] The present disclosure relates to a pot spinning machine, more specifically, a pot spinning machine having a structure for rewinding of a yarn when yarn breakage occurs.

[0002] As a type of a spinning machine, a pot spinning machine using a cylindrical pot has been known. Japanese Patent Application Publication No. H11-256434 discloses a pot spinning machine in which a cylindrical bobbin is disposed outward of and coaxially with a yarn introduction tube. In this spinning machine, after a cake is formed by depositing a yarn discharged from the yarn introduction tube on the inner wall of the pot while the yarn is twisted, rewinding of the yarn onto the bobbin starts.

[0003] In a case where yarn breakage occurs during spinning by any causes, rewinding of a yarn onto the bobbin restarts with the yarn lifted from the cake by placing a cutting edge of a yarn detaching element on the cake formed on the inner wall of the pot.

[0004] However, the yarn detaching element is inserted into the pot by lifting the entire yarn detaching element for rewinding of the yarn after yarn breakage in the pot spinning machine of the Publication. Thus, the size of the entire machine becomes large.

[0005] The present disclosure is directed to providing a pot spinning machine having a structure for rewinding of a yarn when yarn breakage occurs made smaller.

SUMMARY

[0006] In accordance with an aspect of the present disclosure, there is provided a pot spinning machine including an elongated member including a contact end portion that is contactable with an inner wall of a pot having an opening, and a base end portion that supports the contact end portion, the elongated member being tiltable, an up-down movement actuator that adjusts a position of the contact end portion in a height direction to a yarn end position of a yarn deposited on an inner wall of the pot, a guide member that holds the elongated member in a direction that crosses a tilting direction of the elongated member and guides the elongated member that is tiltable, an elastic support member that elastically supports the contact end portion in the tilting direction, and a tilting movement actuator that tilts the elongated member so that the contact end portion is placed in contact with the inner wall of the pot.

[0007] Other aspects and advantages of the present disclosure will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The present disclosure 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 a configuration example of an upper part of a pot spinning machine according to a first embodiment of the present disclosure;

FIG. 2 is a schematic view, showing a configuration example of a lower part of the pot spinning machine according to the first embodiment of the present disclosure;

FIG. 3 is a perspective view of a filler holder according to the first embodiment of the present disclosure;

FIG. 4 is a plan view of the filler holder of FIG. 3;

FIG. 5 is a cross-sectional view of the filler holder of FIG. 3;

FIG. 6 is a block diagram showing a configuration example of a drive control system of the pot spinning machine according to the first embodiment of the present invention;

FIG. 7 is a flow chart showing a basic operation of the pot spinning machine of the first embodiment of the present disclosure;

FIG. 8 is a view for describing a movement of a yarn introduction tube shown in FIG. 1;

FIG. 9 is a view for describing the movement of the yarn introduction tube shown in FIG. 1 at a cake forming step;

FIG. 10 is a cross-sectional view for describing rewinding in the pot spinning machine according to the first embodiment of the present disclosure;

FIG. 11 is a cross-sectional view for describing the rewinding in the pot spinning machine according to the first embodiment of the present disclosure;

FIG. 12 is a cross-sectional view for describing the rewinding in the pot spinning machine according to the first embodiment of the present disclosure;

FIG. 13 is a cross-sectional view for describing the rewinding in the pot spinning machine according to the first embodiment of the present disclosure;

FIG. 14 is a cross-sectional view for describing the rewinding in the pot spinning machine according to the first embodiment of the present disclosure;

FIG. 15 is a cross-sectional view for describing rewinding in a conventional pot spinning machine; and

FIG. 16 is a cross-sectional view for describing rewinding in a pot spinning machine according to a second embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0009] The following will describe a first embodiment of the present disclosure with reference to the accompa-

nying drawings.

[0010] Firstly, a pot spinning machine according to the first embodiment will be described.

[0011] FIG. 1 is a schematic view of a pot spinning machine 1 according to the first embodiment, showing a configuration example of a part of the pot spinning machine above a pot.

[0012] As shown in FIG. 1, the pot spinning machine 1 includes a draft device 10, a yarn introduction tube 11, a pot 12, and a bobbin support 13. It is noted that these parts form a spindle station which corresponds to a unit of spinning. Although the pot spinning machine 1 includes a plurality of spindle stations, FIG. 1 shows a configuration of one of the spindle stations.

(Draft device)

[0013] The draft device 10 is disposed above the pot 12. The draft device 10 is a device configured to stretch a yarn material such as roving to predetermined fineness. The draft device 10 includes a plurality of roller pairs, namely, a back roller pair 15, a middle roller pair 16, and a front roller pair 17. The back roller pair 15, the middle roller pair 16 and the front roller pair 17 are disposed in this order in a direction in which the yarn material is transported from the upstream to the downstream.

[0014] A draft device driving member 52, which will be described later, drives each of the back roller pair 15, the middle roller pair 16, and the front roller pair 17 to rotate. When the numbers of rotation per unit time (rpm) of the back roller pair 15, the middle roller pair 16 and the front roller pair 17 are compared, the numbers of rotation of the middle roller pair 16 is greater than that of the back roller pair 15, and the number of rotation of the front roller pair 17 is greater than that of the middle roller pair 16. In such a way, there are differences in the numbers of rotation among the back roller pair 15, the middle roller pair 16, and the front roller pair 17, and the draft device 10 stretches the yarn material finely by using such differences in the number of rotation, i.e., differences in rotation speeds. In the following description, the number of rotation of the roller pair is also referred to as the rotation speed. The number of rotation of the roller pair and the rotation speed of the roller pair are correlated with each other.

(Yarn introduction tube)

[0015] The yarn introduction tube 11 guides a yarn 18, which has been stretched to the predetermined fineness by the draft device 10, into the pot 12. The yarn introduction tube 11 has an elongated tube shape. The yarn introduction tube 11 has a circular shape in cross-section perpendicular to the length direction of the yarn introduction tube 11.

[0016] The yarn introduction tube 11 is disposed coaxially with the pot 12 at a position downstream of the draft device 10. The lower part of the yarn introduction

tube 11 is inserted into the pot 12. The yarn introduction tube 11 guides the yarn 18 supplied through a yarn supply tube 14 from the front roller pair 17 to the pot 12. The yarn 18 stretched by the draft device 10 is drawn into the yarn supply tube 14, for example, by way of swirl flow of air, and is introduced to the yarn introduction tube 11 through the yarn supply tube 14. The yarn 18 introduced to the yarn introduction tube 11 is discharged from a lower end 11a of the yarn introduction tube 11. The yarn introduction tube 11 is movable up and down by a yarn introduction tube moving member 53, which will be described later.

[0017] A yarn sensor 19 is disposed at a position between the front roller pair 17 and the yarn supply tube 14. The yarn sensor 19 may be disposed at a position other than the position between the front roller pair 17 and the yarn supply tube 14. The yarn sensor 19 is a sensor configured to detect a state of the yarn stretched by the draft device 10. In the first embodiment, the yarn sensor 19 detects yarn breakage as an example of a state of a yarn. In the first embodiment, the yarn sensor 19 is provided by an optical sensor including a light emitter 19a and a light receiver 19b. The yarn sensor 19 forms a yarn breakage detection member.

(Pot)

[0018] The pot 12 is used for forming a cake 28 and for rewinding a yarn. The pot 12 has a cylindrical shape. The pot 12 is rotatable about the central axis K of the pot 12. The central axis K of the pot 12 is disposed in parallel with the vertical direction. Thus, one end and the other end in the central axis direction of the pot 12 correspond to the upper direction and lower direction, respectively.

[0019] The pot 12 rotates with an operation of a pot driving member 54, which will be described later. A yarn introduction tube insertion opening 21 is formed on the upper end side of the pot 12. The yarn introduction tube insertion opening 21 is an opening through which the yarn introduction tube 11 is inserted to the pot 12. An opening 23 is formed in the bottom end of the pot 12. The yarn introduction tube insertion opening 21 is opened upwardly and the diameter of the yarn introduction tube insertion opening 21 is smaller than that of the pot 12 at an inner wall 22 (hereinafter referred to as the pot inner diameter) that sets the volume of the pot 12. The opening 23 is opened downward and the diameter of the opening 23 is substantially the same as the pot inner diameter.

[0020] FIG. 2 is a schematic view of the pot spinning machine 1 according to the first embodiment, showing a configuration example of a part of the pot spinning machine 1 below the pot 12.

[0021] A bobbin 25 that has a cylindrical shape and is placed on a bobbin rail 26, the pot 20 in which the bobbin 25 is to be accommodated, an elongated member (filler) 73, and a wagon unit 75 are disposed in the lower part of the pot spinning machine 1. A plurality of bobbins 25 and elongated members 73 are disposed along the bob-

bin rail 26 so as to correspond to the number of the spindle stations.

(Elongated member)

[0022] The bobbin rail 26 is movable up and down in the vertical direction. A slide pipe 71 is disposed along the bobbin rail 26 below the bobbin rail 26. The slide pipe 71 is supported by a slider guide 72 fixed to the bobbin rail 26 so as to be movable in the horizontal direction along the bobbin rail 26. The elongated member 73 is disposed so as to extend through the bobbin rail 26 and is supported by a filler holder 40 to be movable up and down relative to the bobbin rail 26. The elongated member 73 is made of steel, for example, a stainless steel.

[0023] An air cylinder 77 is mounted to the bobbin rail 26. The air cylinder 77 is connected to the slide pipe 71. A pusher 78 is mounted to the slide pipe 71 at a position adjacent to each elongated member 73. Thus, a plurality of pushers 78 are provided. The pushers 78 are configured to move simultaneously in the horizontal direction along the bobbin rail 26 with the movement of the slide pipe 71 along the bobbin rail 26 driven by the air cylinder 77. The pusher 78 corresponds to the tilting movement actuator of the present disclosure.

[0024] The wagon unit 75 moves along the bobbin rail 26 below the elongated members 73. Any elongated member 73 is lifted by using a push up arm 76 that is movable up and down by a servomotor (not shown). The push up arm 76 corresponds to the up-down movement actuator of the present disclosure. The elongated member 73 is positioned inside the pot 20 with the upward movement of the bobbin rail 26 after the wagon unit 75 lifts the elongated member 73.

[0025] FIG. 3 is a perspective view of the filler holder 40, and FIG. 4 is a plan view of the filler holder 40. The filler holder 40 has a groove 41 in which the elongated member 73 is inserted. The filler holder 40 supports the elongated member 73 inserted in the groove 41 so that the elongated member 73 is movable up and down. The groove 41 has a first holder surface 42, a second holder surface 43, and a third holder surface 44. The second holder surface 43 and the third holder surface 44 extend in parallel to the direction in which the bobbin rail 26 (see FIG. 2) extends, and extend in the direction in which the elongated member 73 extends. In other words, the second holder surface 43 and the third holder surface 44 extend in the up-down direction of the pot spinning machine 1 (see FIG. 2). The second holder surface 43 and the third holder surface 44 extend in parallel. The elongated member 73 is movable, sliding on the second holder surface 43 and the third holder surface 44. The filler holder 40 corresponds to the guide member of the present disclosure.

[0026] FIG. 5 is a cross-sectional view of the filler holder 40 taken along the line A-A of FIGS. 3 and 4. The first holder surface 42 is formed below the groove 41, extending perpendicular to the second holder surface 43 and

the third holder surface 44 and in parallel with the direction in which the elongated member 73 extends. Thus, the first holder surface 42 extends in the up-down direction of the pot spinning machine 1. The elongated member 73 is in contact with the first holder surface 42.

[0027] A hole 45 is formed in the lower part of the groove 41, extending in parallel with the second holder surface 43 and the third holder surface 44. The hole 45 extends through the first holder surface 42. A tubular sleeve 46 fitted in the hole 45, an end member 47 fitted in the sleeve 46 and having a generally conical shape in its tip end, and a spring 48 connected to the end member 47 are provided in the hole 45. The spring 48 is a compression spring. The end member 47 and the spring 48 form an elastic support member. The end member 47 serves as a contact member, and the spring 48 serves as an elastic body.

[0028] The spring 48 is fixed to an end portion 45a of the hole 45. The end member 47 is placed in contact with a base end portion 73b of the elongated member 73 by the urging force of the spring 48. The base end portion 73b is pressed against the first holder surface 42 by the end member 47.

[0029] A slanted surface 49 is formed below the hole 45, which extends not in parallel with the first holder surface 42. The slanted surface 49 is formed so that the distance from the lower part of the slanted surface 49 to the first holder surface 42 is greater than that from the upper part of the slanted surface 49 to the first holder surface 42, which results in the groove 41 becoming wider toward the lower side.

[0030] FIG. 6 is a block chart showing a configuration example of a driving control system of the pot spinning machine 1 according to the first embodiment.

[0031] The pot spinning machine 1 includes a controller 51, a draft device driving member 52, a yarn introduction tube moving member 53, a pot driving member 54, a bobbin moving member 55, a rewinder driving member 56, an air cylinder 77, and a wagon unit 75.

(Controller)

[0032] The controller 51 is configured to collectively control the overall operation of the pot spinning machine 1. The controller 51 is electrically connected to the draft device driving member 52, the yarn introduction tube moving member 53, the pot driving member 54, the bobbin moving member 55, and the rewinder driving member 56, and the wagon unit 75 for controlling their respective operations. The yarn sensor 19 is also electrically connected to the controller 51. When yarn breakage occurs in the draft device 10, the yarn sensor 19 generates a signal that is indicative of the yarn breakage and outputs it to the controller 51.

(Draft device driving member)

[0033] The draft device driving member 52 rotates the

back roller pair 15, the middle roller pair 16, and the front roller pair 17 at their predetermined rotation speeds. The draft device driving member 52 operates based on a draft device driving signal from the controller 51 to rotate the back roller pair 15, the middle roller pair 16, and the front roller pair 17.

(Yarn introduction tube moving member)

[0034] The yarn introduction tube moving member 53 moves the yarn introduction tube 11. The yarn introduction tube moving member 53 is configured to move the yarn introduction tube 11 up and down. The yarn introduction tube moving member 53 operates based on a yarn introduction tube moving signal from the controller 51 to move the yarn introduction tube 11 up and down.

(Pot driving member)

[0035] The pot driving member 54 is configured to rotate the pot 12. The pot driving member 54 operates based on a pot driving signal from the controller 51 to rotate the pot 12 about the central axis K of the pot 12.

(Bobbin moving member)

[0036] The bobbin moving member 55 is configured to move the bobbin 25. The bobbin moving member 55 moves the bobbin 25 mounted on the bobbin mounting portion 27 of the bobbin support 13 integrally with the bobbin support 13 and the bobbin rail 26 in the up-down direction. The bobbin moving member 55 operates based on a bobbin moving signal from the controller 51 to move the bobbin 25 in the up-down direction.

(Rewinder driving member)

[0037] The rewinder driving member 56 is configured to operate the rewinder (not shown) for executing the normal rewinding operation. The rewinder driving member 56 operates based on a rewinder driving signal from the controller 51 to operate the rewinder.

<Method of pot spinning>

[0038] The following will describe a method of pot spinning by the pot spinning machine 1 according to the first embodiment.

[0039] FIG. 7 is a flow chart, showing a general operation of the method of pot spinning performed by the pot spinning machine.

[0040] As shown in FIG. 7, the method of pot spinning includes a cake end detection step S1, and an elongated member position adjusting step S2 for a spinning operation. Further, the method of pot spinning operation includes a bobbin disposing step S3, an elongated member contact step S4, a moving step S5, an elongated member retracting step S6, a bobbin disposing step S3A, and a

rewinder driving step S7 for a rewinding operation.

[0041] The cake end detection step S1 corresponds to a step in which the cake lower end portion 28b (see FIG. 1) of the cake 28 is detected when the yarn breakage occurs. The elongated member position adjusting step S2 corresponds to a step in which the position of the elongated member 73 is adjusted in a spindle station where the yarn breakage is detected. The rewinding operation includes a yarn breakage rewinding operation using the elongated member 73 in the spindle station in which the yarn breakage has occurred, and a normal rewinding operation using the rewinder in the spindle station in which the yarn breakage has not occurred. The yarn breakage rewinding operation includes the elongated member contact step S4, the moving step S5, and the elongated member retracting step S6 after the bobbin disposing step S3. The bobbin disposing step S3 is a step in which the bobbin 25 enters the pot 12 and is positioned where the rewinding starts. The elongated member contact step S4 is a step in which the elongated member 73 is pressed against the inner wall 22 of the pot 12 at a position lower than the cake lower end portion 28b. The moving step S5 is a step in which the elongated member 73 is moved toward the cake lower end portion 28b. The elongated member retracting step S6 is a step in which the elongated member 73 is retracted to its original position. The normal rewinding operation includes the rewinder driving step S7 in which the rewinder is driven for executing the rewinding of yarn on the bobbin 25 after the bobbin disposing step S3A. The following will describe the operation of the pot spinning machine 1 in accordance with steps.

[0042] Before the operation of the pot spinning machine 1, the yarn supply tube 14 is disposed close to the yarn introduction tube 11, the bobbin 25 is mounted on the bobbin mounting portion 27 of the bobbin support 13, and the bobbin 25 is retracted to a position lower than the pot 12.

(Stretching operation)

[0043] Firstly, the stretching operation is performed by the draft device 10 shown in FIG. 1. The draft device driving member 52 operates based on a draft device driving signal from the controller 51 to rotate the back roller pair 15, the middle roller pair 16, and the front roller pair 17 at their respective rotation speeds. Thus, a yarn material such as roving is transported with the rotations of the roller pairs 15, 16, 17.

[0044] At that time, the controller 51 sets the rotation speed of the back roller pair 15 lower than that of the middle roller pair 16, and the rotation speed of the middle roller pair 16 lower than that of the front roller pair 17. Accordingly, the yarn material is stretched between the back roller pair 15 and the middle roller pair 16 by the difference in the rotation speed between the back roller pair 15 and the middle roller pair 16. Similarly, the yarn material is stretched between the middle roller pair 16

and the front roller pair 17 by a difference in the rotation speed between the front roller pair 17 and the middle roller pair 16.

[0045] As a result, the yarn material such as roving is stretched to a predetermined fineness while passing through the back roller pair 15, the middle roller pair 16, and the front roller pair 17 in this order. The yarn 18 stretched in this manner is then drawn into the yarn supply tube 14 by way of swirl of air and introduced to the yarn introduction tube 11.

[0046] The controller 51 sends the pot driving signal to the pot driving member 54 to rotate the pot 12 at a predetermined rotation speed before the stretching operation is started.

(Cake forming step)

[0047] Then, the cake forming step is executed using the yarn introduction tube 11 and the pot 12. The yarn introduction tube moving member 53 operates based on the yarn introduction tube moving signal from the controller 51 to move the yarn introduction tube 11 downward at a predetermined amount. The pot driving member 54 operates based on the pot driving signal from the controller 51 to continue rotating the pot 12. When the yarn introduction tube 11 is moved downward, the yarn introduction tube 11 is separated from the yarn supply tube 14. The yarn 18 introduced to the yarn introduction tube 11 from the yarn supply tube 14 is discharged from the lower end 11a of the yarn introduction tube 11.

[0048] The centrifugal force generated by the rotation of the pot 12 acts on the yarn 18 discharged from the lower end 11a of the yarn introduction tube 11, thereby pressing the yarn 18 against and in contact with the inner wall 22 of the pot 12. The yarn 18 pressed against the inner wall 22 of the pot 12 is twisted with the rotation of the pot 12. Thus, the yarn 18 discharged from the lower end 11a of the yarn introduction tube 11 is twisted with the rotation of the pot 12 and deposited on the inner wall 22 of the pot 12 in a twisted state.

[0049] The yarn introduction tube moving member 53 operates based on the yarn introduction tube moving signal to move the position of the yarn introduction tube 11 relatively downward while moving the yarn introduction tube 11 repeatedly reciprocated in the up-down direction at predetermined intervals, as shown in FIG. 8. In this way, the cake 28 is formed on the inner wall 22 of the pot 12. The cake 28 is a layered body formed by the yarn 18 deposited on the inner wall 22 of the pot 12.

[0050] FIG. 9 is a view describing the movement of the yarn introduction tube 11 during the cake forming step. In FIG. 9, the vertical and the horizontal axes represent the position of the yarn introduction tube in the pot central axis direction and time, respectively.

[0051] Referring to FIG. 9, the yarn introduction tube 11 moves downward to the position P1 firstly, moves upward to a position P2, moves downward to a position P3, and moves upward to a position P4. In other words, the

yarn introduction tube 11 repeatedly reciprocates in the up-down direction. A period of time T1 from the arrival of the yarn introduction tube 11 at the position P1 to the arrival of the yarn introduction tube 11 at the position P3, and a period of time T2 from the arrival of the yarn introduction tube 11 at the position P2 to the arrival of the yarn introduction tube 11 at the position P4 each correspond to one cycle. The position P3 is positioned lower than the position P1 and the position P4 is positioned lower than the position P2 so that the position of the yarn introduction tube 11 is shifted relatively lower. The difference H1 between the position P1 and the position P3 in the up-down direction, and the difference H2 between the position P2 and the position P4 in the up-down direction each correspond to a displacement of the yarn introduction tube 11 per cycle. That is, the yarn introduction tube 11 moves downward by a predetermined displacement while repeatedly reciprocating in the up-down direction at a predetermined cycle. Such movement of the yarn introduction tube 11 continues until the yarn introduction tube 11 reaches the position Pm. In this case, the position P1 specifies the end 28a of the cake 28 where the winding starts (shown in FIG. 1) and the position Pm specifies the end 28b of the cake 28 where the winding is completed (shown in FIG. 1). The ends 28a and 28b may be referred to as the cake upper end and the cake lower end, respectively.

[0052] The controller 51 sends the yarn introduction tube moving signal to the yarn introduction tube moving member 53 to move the yarn introduction tube 11 as shown in FIGS. 8 and 9. Thus, the cake 28 is formed in a shape shown in FIG. 8 on the inner wall 22 of the pot 12. In the first embodiment, the cake forming step further includes the following step after the cake 28 is formed with the movement of the yarn introduction tube 11.

[0053] The controller 51 moves the yarn introduction tube 11 by a predetermined amount Lh downward after the yarn introduction tube 11 reaches the position Pm. Thus, the yarn portion 18a which serves as the starting point for the rewinding of the yarn on the bobbin 25 is deposited on the inner wall 22 of the pot 12 in an area 22a closer to the opening 23 than the cake lower end portion 28b of the cake 28, as shown in FIG. 8. The yarn portion 18a may include a single layer or a plurality of layers. In a case where the yarn portion 18a includes a single layer, the yarn cut takes place at a stage where the yarn introduction tube 11 is lowered from the position Pm to the position Pn. In the case where the yarn portion 18a includes a plurality of layers, the yarn cut takes place at a stage where at least one cycle of movement of the yarn introduction tube 11, in which the yarn introduction tube 11 is lowered from the position Pm to the position Pn and then lifted to a position upper than the position Pn, is finished. The cake lower end portion 28b corresponds to the yarn end position.

[0054] Here, the difference between the yarn cut and the yarn breakage will be described.

[0055] The yarn cut is an operation that is intentionally

performed when a predetermined amount of the yarn 18 is deposited on the inner wall 22 of the pot 12. On the other hand, yarn breakage is a failure in which the yarn 18 is broken by any causes before a predetermined amount of the yarn 18 is deposited on the inner wall 22 of the pot 12.

[0056] The yarn cut takes place under the control of the controller 51. Specifically, the controller 51 controls the draft device driving member 52 to stop the rotations of the back roller pair 15 and the middle roller pair 16 while continuing the rotation of the front roller pair 17. This operation forcefully cuts the yarn 18 at a position downstream of the middle roller pair 16.

(Cake end detection step)

[0057] In a case where the yarn breakage occurs before the cake forming step is completed, the cake end detection step S1 is executed. The cake end detection step S1 is executed in each pot 12 where the yarn breakage occurs. When the yarn breakage is detected, the yarn sensor 19 generates a yarn breakage signal and outputs it to the controller 51. At this time, the controller 51 detects the position of the cake lower end portion 28b of the cake 28 based on a timing when the yarn breakage signal is input to the controller 51. Referring to FIG. 9, during the period of time T1 between the arrival of the yarn introduction tube 11 at the position P1 and the arrival of the yarn introduction tube 11 at the position P3, the position P1 corresponds to the cake lower end portion 28b when the yarn breakage occurs at a position higher than the position P1, and the position of the yarn introduction tube 11 when the yarn breakage occurs corresponds to the cake lower end portion 28b when the yarn breakage occurs while the yarn introduction tube 11 is moving downward to the position P3 after reaching the position P1. The controller 51 detects the cake lower end portion 28b in the pot 12 by determining which period of time the yarn breakage signal is input.

[0058] It is noted that the formation of the cake 28 stops in a pot 12 where the yarn breakage has occurred but the formation of the cake 28 continues in a pot 12 where the yarn breakage has not occurred until the cake forming step is completed. (Elongated member position adjustment step)

[0059] Then, at the elongated member position adjusting step S2, the controller 51 sends a driving signal to the wagon unit 75 (see FIG. 2) to move the wagon unit 75 to the pot 12 where the yarn breakage has occurred. The wagon unit 75 having reached the pot 12 where the yarn breakage has occurred moves the push up arm 76 upward to lift the elongated member 73 by receiving the driving signal from the controller 51. At this time, the elongated member 73 is positioned so that a contact end portion 73a of the elongated member 73 is at the same height of the cake lower end portion 28b in the pot 12 at the start of the elongated member contact step S4, which will be described later. The push up arm 76 moves down-

ward after the elongated member 73 is lifted. The end member 47 is pressed against the elongated member 73 by the urging force of the spring 48 of the filler holder 40. Thus, the elongated member 73 is held and supported by the first holder surface 42 and the end member 47. In this way, the elongated member 73 is held at a predetermined height and does not move downward by the gravity.

[0060] The base end portion 73b of the elongated member 73 (see FIG. 5) is held and is elastically supported by the first holder surface 42 and the end member 47, and the elongated member 73 is held, being slidable on the second holder surface 43 and the third holder surface 44, by the first holder surface 42 and the end member 47 in a direction that crosses a direction in which the elongated member 73 tilts, with the result that the elongated member 73 is stably supported.

(Rewinding operation)

[0061] The rewinding operation takes place after the cake forming step is completed. In the following FIGS. 8, and 11 through 14, the pot 12 where the yarn breakage has been detected at the cake end detection step S1 is shown.

(Bobbin disposing step)

[0062] The bobbin disposing step S3 is executed in the pot 12 where the yarn breakage has been detected at the cake forming step. At the bobbin disposing step S3, the bobbin 25 is disposed in the pot 12 through the opening 23 with the operation of the pot driving member 54 (see FIG. 6). The pot driving member 54 operates based on the pot driving signal from the controller 51 to continue the rotation of the pot 12. The bobbin moving member 55 operates based on the bobbin moving signal from the controller 51 to move the bobbin support 13 upward. Thus, the bobbin 25 mounted on the bobbin mounting portion 27 (see FIG. 1) moves upward together with the bobbin support 13, as shown in FIG. 10, which will be described later.

[0063] As shown in FIGS. 10 and 11, the bobbin 25 enters the pot 12 through the opening 23 of the pot 12. On the other hand, the yarn introduction tube moving member 53 operates based on the yarn introduction tube moving signal from the controller 51 to move the yarn introduction tube 11 upward. Thus, the yarn introduction tube 11 is retracted to a position where the lower end portion 11a of the yarn introduction tube 11 is not placed in contact with the bobbin 25 in the pot 12 before the bobbin 25 enters the pot 12.

[0064] Since the elongated member 73 is lifted in the pot 12 where the yarn breakage has been detected at the cake end detection step S1, the elongated member 73 enters the pot 12 together with the bobbin 25 and the contact end portion 73a of the elongated member 73 is lifted to the height of the cake lower end portion 28b, as

shown in FIG. 11.

(Yarn breakage rewinding)

[0065] In a case where the yarn breakage has occurred at the cake forming step, normal rewinding cannot be executed because the yarn portion 18a is not properly formed. In the pot 12 where the yarn breakage has occurred, in many cases, the end of the broken yarn is positioned lower than the cake 28 and is stuck to the inner wall 22 of the pot 12 by way of the centrifugal force. Therefore, the following yarn breakage rewinding will be executed.

(Elongated member contact step)

[0066] The elongated member contact step S4 is executed at the yarn breakage rewinding. The air cylinder 77 (see FIG. 2) operates, driven by the controller 51 (see FIG. 6), to move the slide pipe 71 in a direction along the bobbin rail 26, so that the pushers 78 move in the horizontal direction along the bobbin rail 26 simultaneously.

[0067] As shown in FIG. 12, the elongated member 73 entering the pot 12 is pushed by the pusher 78 and tilts with the upper end C of the first holder surface 42 of the filler holder 40 as a pivot point. At this time, a point where it is pushed by the pusher 78 corresponds to a point of effort. The base end portion 73b of the elongated member 73 tilts while pushing the end member 47. Thus, the elongated member 73 is held by the second holder surface 43 and the third holder surface 44 so that the elongated member 73 pivots with the elongated member 73 guided by the second holder surface 43 and the third holder surface 44. Since the slanted surface 49 is formed, the elongated member 73 does not interfere in the groove 41. The end member 47 moves while pressing to compress the spring 48 with the end member 47 pressed by the base end portion 73b of the elongated member 73. In other words, the end member 47 and the spring 48 elastically support the base end portion 73b relative to the filler holder 40.

[0068] As shown in FIG. 13, the tilted elongated member 73 is placed in contact with the contact point D in the inner wall 22 of the pot 12. Then, the height of the contact point D is a few millimeters lower than the cake lower end portion 28b. When the elongated member 73 further tilts, pushed by the pusher 78, as shown in FIG. 14, the elongated member 73 is separated from the upper end C and the contact point D becomes the pivot point.

[0069] When the contact end portion 73a of the elongated member 73 is pressed against the inner wall 22 of the pot 20 so that the contact point D is positioned a few millimeters lower than the cake lower end portion 28b of the cake, an end of the broken yarn in the pot 12 comes into contact with the contact end portion 73a, with the result that the yarn starts winding around the bobbin 25 disposed coaxially with the central axis K of the pot 12 (see FIG. 1). Accordingly, in the pot 12 where the yarn

breakage has occurred, rewinding of the yarn on the bobbin 25 starts with the end of the broken yarn in the pot 12 as a starting point by the elongated member contact step S4.

[0070] Since a starting position for the rewinding of the broken yarn in the pot 12 is lower than the cake lower end portion 28b, the position changes in the up-down direction depending on the progress of forming the cake 28. Therefore, the position of the contact point D changes in the up-down direction depending on the progress of forming the cake 28. Referring to FIG. 14, characters X1 and Y1 represent the dimension from the pusher 78 to the contact point D and the dimension from the end member 47 to the contact point D, respectively, when the contact end portion 73a of the elongated member 73 takes the contact point D as the pivot point. At this time, the point of effort corresponds to a point where the pusher 78 is in contact with the elongated member 73, the pivot point corresponds to the contact point D, and the point of load corresponds to a point where the base end portion 73b of the elongated member 73 is in contact with the end member 47. The contact load of the elongated member 73 at the point of effort is substantially determined depending on a ratio of X1 to Y1.

[0071] In FIG. 15, an example of a conventional pot spinning machine is shown. In FIG. 15, parts and members identical or similar to those in the first embodiment are designated by the same numerals and characters. In the conventional pot spinning machine, the pivot point E of the elongated member 73 is fixed to a portion of the base end portion 73b between the contact end portion 73a of the elongated member 73 and the position where the pusher 78 presses the elongated member 73. At this time, the contact point D serves as the point of load and the contact load of the elongated member 73 at the point of effort is substantially determined depending on a ratio of X2 to Y2.

[0072] In a case where the contact point D moves up and down in relation to a change in the rewinding start position, the change in the contact load of the elongated member 73 (shown in FIG. 14) in the pot spinning machine 1 (see FIG. 1) of the first embodiment is smaller than that in the conventional pot spinning machine shown in FIG. 15.

[0073] In the pot 12 of the first embodiment shown in FIG. 14 and the pot 12 of the conventional pot spinning machine shown in FIG. 15, the height to which the elongated member 73 is lifted changes when the position of the contact point D changes in the up-down direction due to a change in the rewinding start point in the up-down direction. Thus, a distance in which the elongated member 73 is pressed horizontally for placing the elongated member 73 in contact with the inner wall 22 of the pot 12, that is, a required stroke length, changes.

[0074] In a configuration in which the pivot point E of the elongated member 73 is fixed as in the conventional pot spinning machine shown in FIG. 15, the stroke length of the pusher 78 is constant in accordance with the sliding

movement of the slide pipe 71 (see FIG. 2). As a result, when the required stroke length changes, the contact end portion 73a of the elongated member 73 fails to be in contact with the inner wall 22 if the stroke length of the pusher 78 is shorter than the required stroke length. If the stroke length of the pusher 78 is greater than the required stroke length, the contact end portion 73a is pressed strongly against the inner wall 22 of the end portion, which generates an excessive contact load and may cause the elongated member 73 to be deformed.

[0075] On the other hand, in the pot 12 of the first embodiment shown in FIG. 14, an excessive stroke length is compensated by the compression of the spring 48 even if the stroke length of the pusher 78 is set greater than the required stroke length. Since the contact load of the elongated member 73 is changed depending on the compression of the spring 48, an excessive contact load is less likely to be directly applied to the elongated member 73 even if the stroke length of the pusher 78 is set greater than the required stroke length. As a result, the deformation of the elongated member 73 is less likely to occur.

(Elongated member retracting step)

[0076] The elongated member retracting step S6 (FIG. 7) is executed when all yarn forming the cake 28 is rewound on the bobbin 25. The controller 51 moves the bobbin rail 26 downward by sending a bobbin moving signal to the bobbin moving member 55. Then, the controller 51 moves the elongated member 73 downward, which has been lifted, by sending a driving signal to the wagon unit 75 to lower the push up arm 76. Thus, the rewinding of the broken yarn completes.

(Normal rewinding)

[0077] In the pot 12 where the yarn breakage has not been detected during the cake forming step, the bobbin disposing step S3A for the normal rewinding is executed, as shown in FIG. 7. The bobbin disposing step S3A is the same operation as the above-described bobbin disposing step S3 and executed simultaneously with the bobbin disposing step S3.

[0078] Then, the rewinder driving step S7 (FIG. 7) is executed. With the rewinder (not shown) in contact with the yarn portion 18a (FIG. 8), the yarn portion 18a starts being wound on the bobbin 25 disposed coaxially with the central axis K (FIG. 1) of the pot 12. Accordingly, the rewinding of the yarn on the bobbin 25 starts with the yarn portion 18a discharged into the pot 12 as the starting point in the pot 12 where the yarn breakage has not occurred.

[0079] By the above-described operation, the bobbin 25 having a cop is obtained. The bobbin 25 on which a cop is mounted is removed from the bobbin mounting portion 27. After an empty bobbin 25 is mounted on the bobbin mounting portion 27, the same operations as those described above are performed.

[0080] As has been described, the pot spinning machine 1 of the first embodiment includes the elongated member 73 that includes the contact end portion 73a contactable with the inner wall 22 of the pot 12 having the opening 23 and the base end portion 73b supporting the contact end portion 73a, the push up arm 76 that adjusts the height of the contact end portion 73a to the yarn end position of the end of the yarn 18 deposited on the inner wall 22 of the pot 12, the second holder surface 43 and the third holder surface 44 of the filler holder 40 that hold the elongated member 73 in the direction that crosses the tilting direction of the elongated member 73 and guide the elongated member 73 that is tiltable, the end member 47 and the spring 48 that elastically support the contact end portion 73a in the tilting direction, and the pusher 78 that tilts the elongated member 73 so that the contact end portion 73a of the elongated member 73 is placed in contact with the inner wall 22 of the pot. This permits downsizing the structure for rewinding the broken yarn when the yarn breakage occurs.

[0081] Since the end member 47 and the spring 48 elastically supports the contact end portion 73a in the tilting direction by elastically supporting the base end portion 73b relative to the filler holder 40, an excessive contact load is less likely to be applied when the elongated members 73 are placed in contact with their associated inner walls 22 of the pots 12.

[0082] The elastic support member includes the end member 47 in contact with the elongated member 73 and the spring 48 urging the end member 47 toward the elongated member 73, so that the elongated member 73 may be elastically supported with a simple structure.

[0083] Further, the pusher 78 tilts the elongated members 73 disposed in the plurality of the pots 12 simultaneously. This permits starting the rewinding of the yarn on the bobbins 25 in all the pots 12 where the yarn breakage has occurred simultaneously. The elongated member 73 provided for each pot 12 is elastically supported in the tilting direction by the end member 47 and the spring 48 which are independently provided, so that excessive contact load at the contact of the contact end portion 73a of the elongated member 73 with the inner wall 22 of the pot 12 is less likely to occur even if the rewinding start position for the rewinding the broken yarn varies for each pot 12.

[0084] Although the second holder surface 43 and the third holder surface 44 of the filler holder 40 are fixed in the first embodiment, the second holder surface 43 and the third holder surface 44 may include an elastic body such as a compression spring and an extension spring. In the configuration in which the second holder surface 43 and the third holder surface 44 include the elastic body, the elongated member 73 that is tiltable is guided by holding the elongated member 73 by the urging force of the elastic body in the direction that crosses the tilting direction, and the position in the height direction and the tilting of the elongated member 73 are elastically supported. This elastic body serves as the position support

member.

[0085] In this configuration in which the second holder surface 43 and the third holder surface 44 of the filler holder 40 include the elastic body that elastically supports the position in the height direction and the tilting of the elongated member 73, the position in the height direction and the tilting of the elongated member 73 of the elongated member 73 is held by the elastic body that is provided separately from the elastic support member for compensating the excessive stroke length, so that the elongated member 73 may be more stably held.

[0086] According to the first embodiment, the elongated member 73 is made of iron such as stainless steel. In other words, the elongated member 73 is provided by a magnetic body. The first holder surface 42 need not necessarily be a normal plane as in the first embodiment, but may include a magnet portion that generates an attraction force between the first holder surface 42 and the elongated member 73 made of stainless steel.

[0087] Accordingly, the elongated member 73 may be more stably held by a configuration in which the elongated member 73 is formed of the magnetic body and the first holder surface 42 of the filler holder 40 includes the magnet portion that prevents the elongated member 73 from falling with an attraction force generated between the elongated member 73 and the first holder surface 42.

[0088] Although the spring 48 is disposed in the hole 45 in the first embodiment, the spring 48 may be provided in the first holder surface 42 and the first holder surface 42 may be pressed against the elongated member 73. The spring 48 may be provided by other types of spring such as an extension spring. Although the end member 47 and the spring 48 serves as the elastic support member in the first embodiment, the elastic support member may be provided only by the end member 47 that includes an elastic body such as a compression spring. Although the end portion of the end member 47 has a conical shape in the above-described embodiment, the shape of the end member 47 may be changed in any shape as long as it is contactable with the elongated member. For example, the end portion of the end member 47 may have a flat surface, or a hemispherical shape.

[0089] Although the elongated member 73 is made of iron such as stainless steel in the first embodiment, the material of the elongated member 73 is not limited thereto. For example, the elongated member 73 may be made of non-ferrous metal having adequate strength such as copper and aluminum alloy.

[0090] In the first embodiment, the height of the elongated member 73 is adjusted to the height of the cake lower end portion 28b at the bobbin disposing step S3, but the height of the elongated member 73 may be changed as long as the rewinding of the broken yarn may be executed.

Second embodiment

[0091] The following will describe the configuration of

a pot spinning machine according to a second embodiment. In the second embodiment, parts and members identical or similar to those shown in FIGS. 1 through 15 are designated by the identical numerals and characters and detailed description thereof will be omitted.

[0092] The configuration of the pot spinning machine 1 of the second embodiment differs from the first embodiment in that the end portion of the elongated member is elastically supported relative to the base end portion.

[0093] FIG. 16 schematically shows the elongated member 73 according to the second embodiment. The contact end portion 73a of the elongated member 73 is elastically supported by the base end portion 73b with a compression spring 73c. The compression spring 73c corresponds to the elastic support member. The base end portion 73b of the elongated member 73 is supported by a fixed pivot point E. Other configurations are the same as those of the first embodiment.

[0094] The following will describe the operation of the pot spinning machine according to the second embodiment.

[0095] The elongated member 73 tilts and the contact end portion 73a is placed in contact with the contact point D in the inner wall 22 of the pot 12 with the pusher 78 pressing the base end portion 73b of the elongated member 73.

[0096] Even if the stroke length of the pusher 78 is set greater than the required stroke length, the contact end portion 73a may be moved in a direction to release the load pressing the contact point D relative to the base end portion 73b with the compression and the deformation of the compression spring 73c. The contact end portion 73a is elastically supported relative to the base end portion 73b, so that the contact end portion 73a is elastically supported in the tilting direction of the elongated member 73. Accordingly, the excessive stroke length of the pusher 78 is compensated. The excessive contact load is less likely to be applied to the elongated member 73, so that the deformation of the elongated member 73 is less likely to occur.

[0097] Since the contact end portion 73a is elastically supported in the tilting direction with the contact end portion 73a elastically supported relative to the base end portion 73b by the compression spring 73c, the excessive contact load is less likely to be applied to the elongated member 73, so that the deformation of the elongated member 73 is less likely to occur.

[0098] Although the contact end portion 73a of the elongated member 73 is elastically supported relative to the base end portion 73b by the compression spring 73c in the second embodiment, members elastically supporting the contact end portion 73a are not limited to the compression spring. For example, any elastic members such as a plate spring and a rubber may be used for elastically supporting the contact end portion 73a. The contact end portion 73a and the compression spring 73c forming the elastic support member may be replaced with a member in which the end portion and the elastic support

member are integrally formed and that is made of an elastic member having a certain strength.

[0099] A pot spinning machine (1) includes an elongated member (73) including a contact end portion (73a) contactable with an inner wall (22) of a pot (12), and a base end portion (73b) supporting the contact end portion (73b), an up-down movement actuator (76) adjusting a position of the contact end portion (73a) in a height direction to a yarn end position (28b) of a yarn (18) deposited on the inner wall (22), a guide member (40) holding the elongated member (73) in a direction that crosses a tilting direction of the elongated member (73) and guiding the elongated member (73), an elastic support member (47, 48) elastically supporting the contact end portion (73a) in the tilting direction, and a tilting movement actuator (78) tilting the elongated member (73) so that the contact end portion (73a) is placed in contact with the inner wall (22) of the pot (12).

Claims

1. A pot spinning machine (1), **characterized by** comprising:

an elongated member (73) including a contact end portion (73a) that is contactable with an inner wall (22) of a pot (12) having an opening, and a base end portion (73b) that supports the contact end portion (73b), the elongated member (73) being tiltable;

an up-down movement actuator (76) that adjusts a position of the contact end portion (73a) in a height direction to a yarn end position (28b) of a yarn (18) deposited on the inner wall (22) of the pot (12);

a guide member (40) that holds the elongated member (73) in a direction that crosses a tilting direction of the elongated member (73) and guides the elongated member (73) that is tiltable;

an elastic support member (47, 48) that elastically supports the contact end portion (73a) in the tilting direction; and

a tilting movement actuator (78) that tilts the elongated member (73) so that the contact end portion (73a) of the elongated member (73) is placed in contact with the inner wall (22) of the pot (12).

2. The pot spinning machine (1) according to claim 1, **characterized in that**

the elastic support member (47, 48) elastically supports the contact end portion (73a) in the tilting direction by elastically supporting the base end portion (73b) relative to the guide member (40).

3. The pot spinning machine (1) according to claim 2,

characterized in that

the elastic support member (47, 48) includes a contact member (47) in contact with the elongated member (73), and an elastic body (48) urging the contact member (47) toward the elongated member (73).

4. The pot spinning machine (1) according to claim 1, **characterized in that**

the elastic support member (47, 48) elastically supports the contact end portion (73a) in the tilting direction by elastically supporting the contact end portion (73a) relative to the base end portion (73b).

5. The pot spinning machine (1) according to any one of claims 1 through 4, **characterized in that** the guide member (40) includes a position support member that elastically supports the position in the height direction and the tilting of the elongated member (73).

6. The pot spinning machine (1) according to any one of claims 1 through 5, **characterized in that** the pot spinning machine (1) includes a plurality of elongated members (73) and a plurality of pots (12), each of the elongated members (73) being provided for each of the pots (12), and the tilting movement actuator (78) tilts the plurality of the elongated members (73) simultaneously.

7. The pot spinning machine (1) according to any one of claims 1 through 6, **characterized in that** the elongated member (73) is provided by a magnetic body, and the guide member (40) includes a magnet portion that prevents the elongated member 73 from falling with an attraction force generated between the elongated member (73) and the guide member (40).

FIG. 1

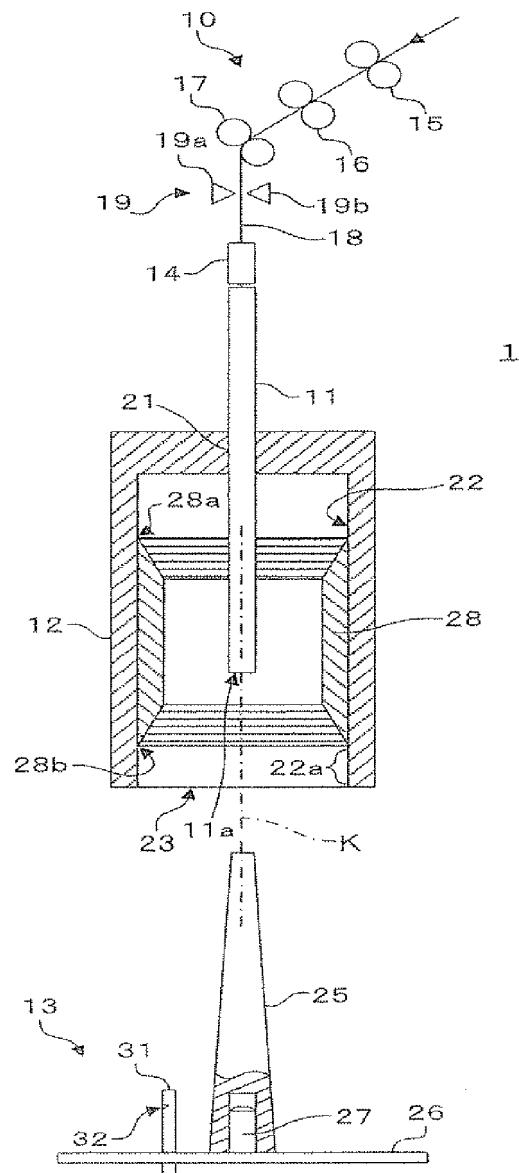


FIG. 2

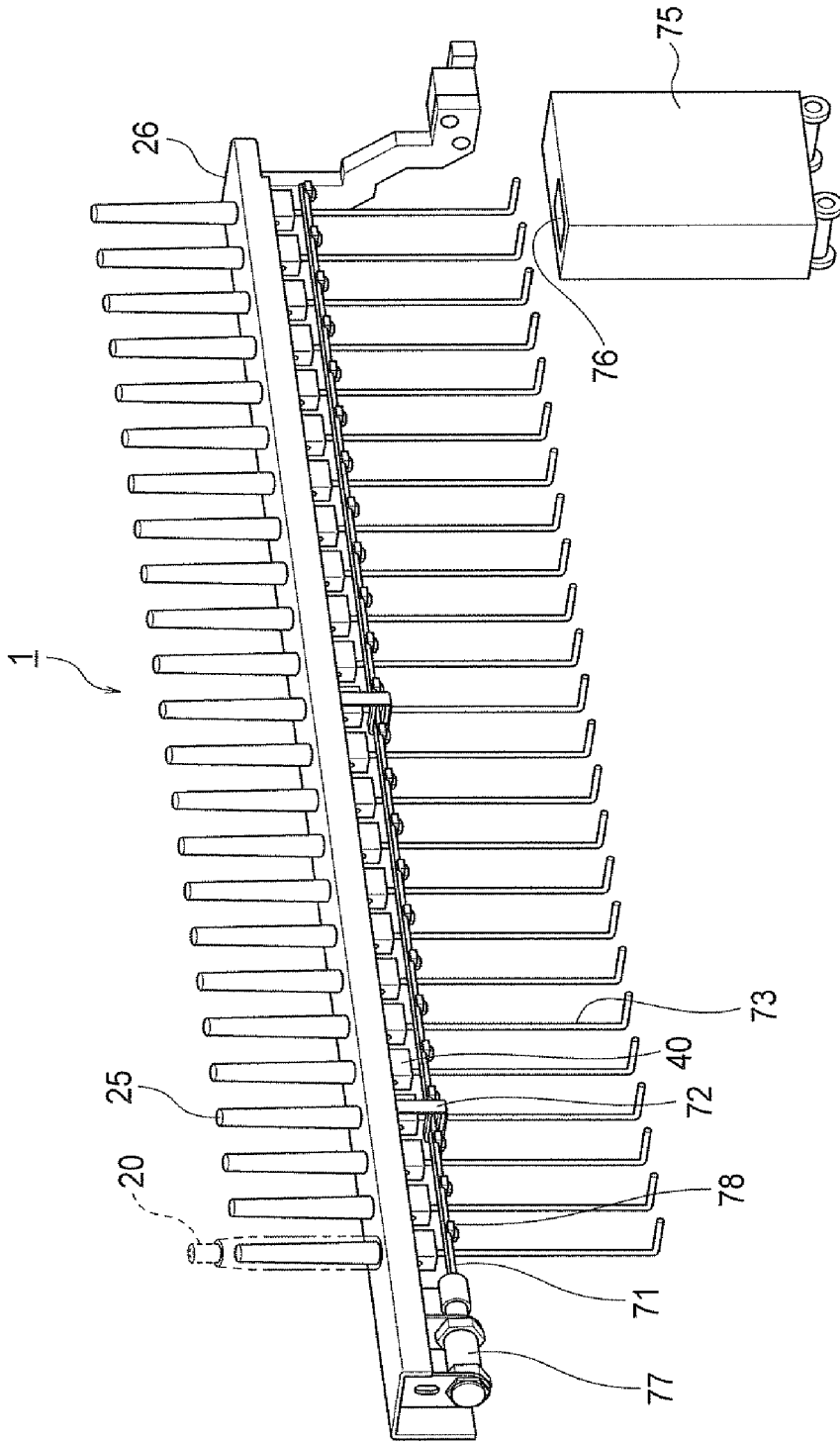


FIG. 3

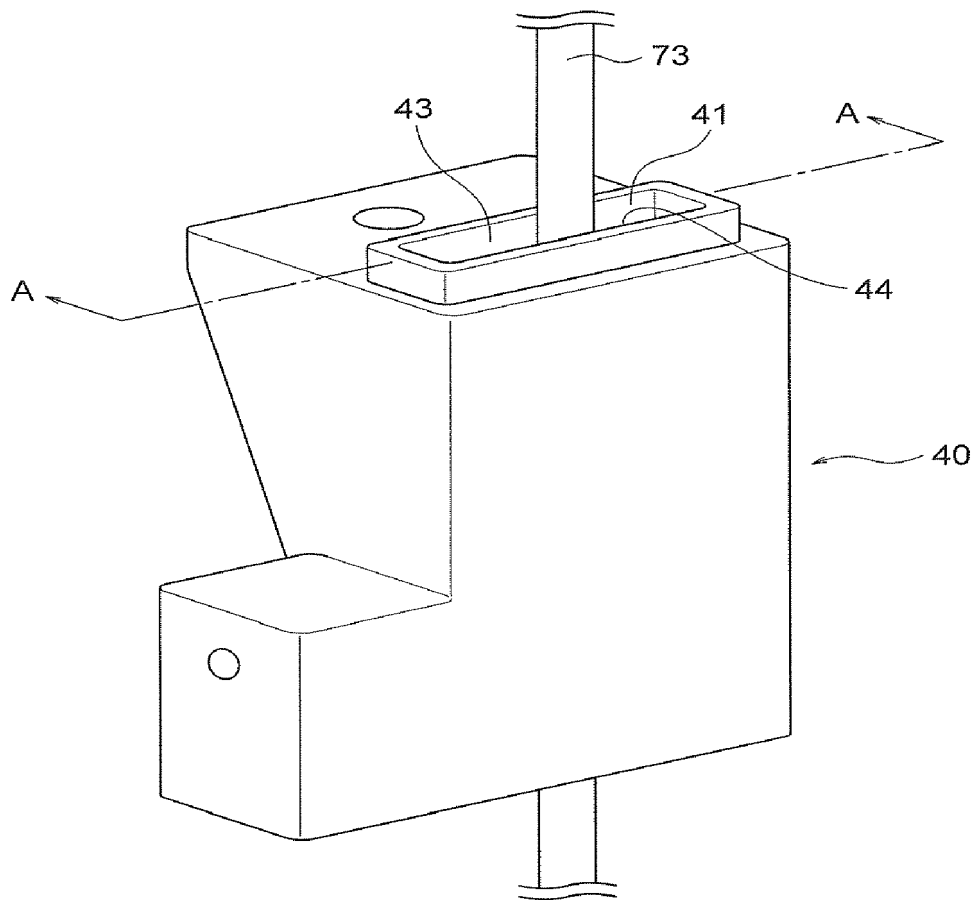


FIG.4

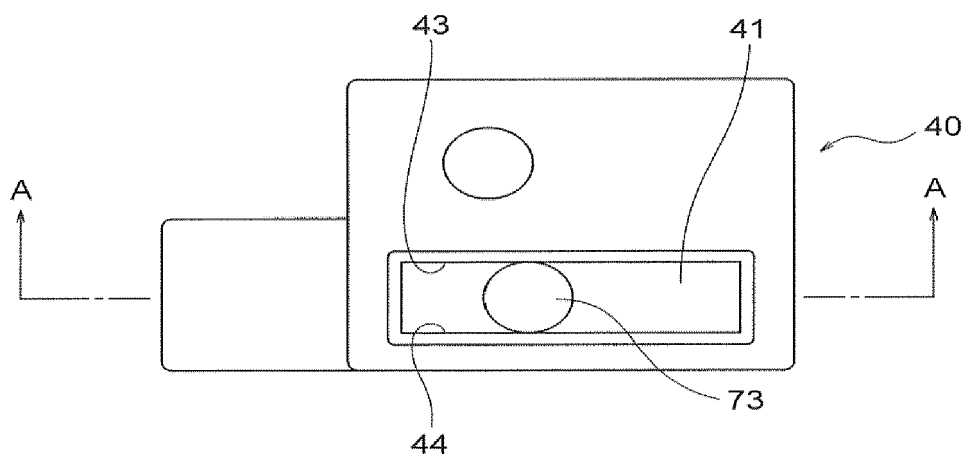


FIG.5

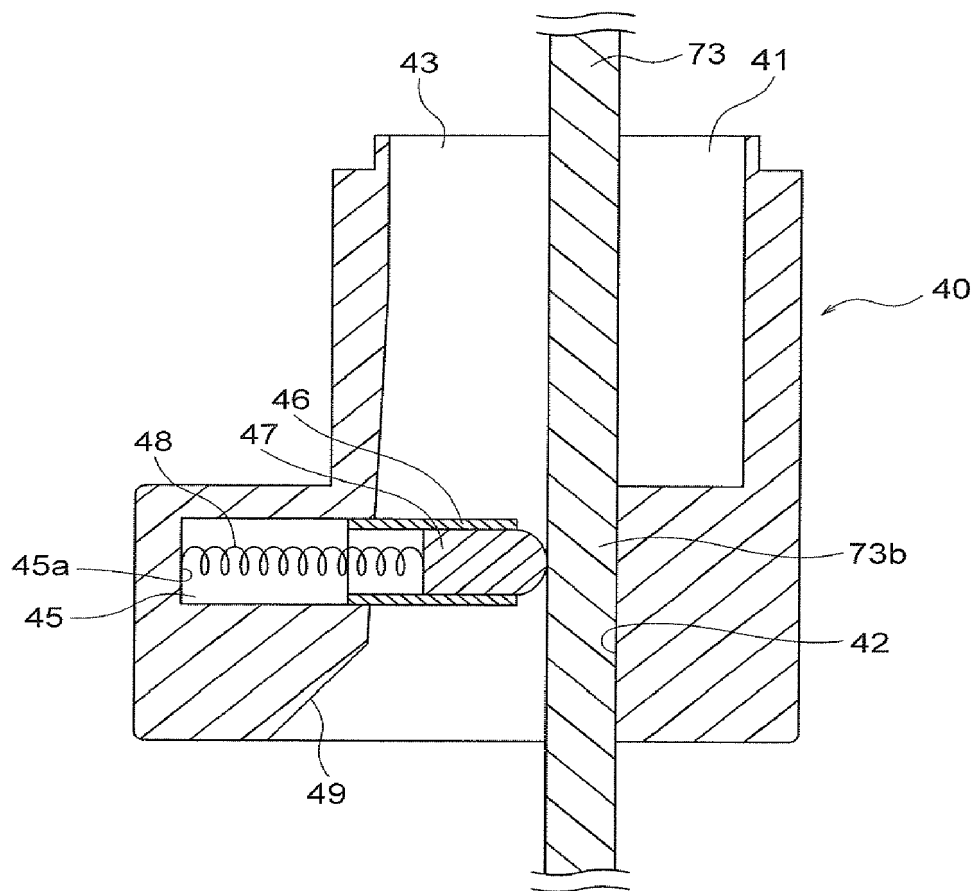


FIG. 6

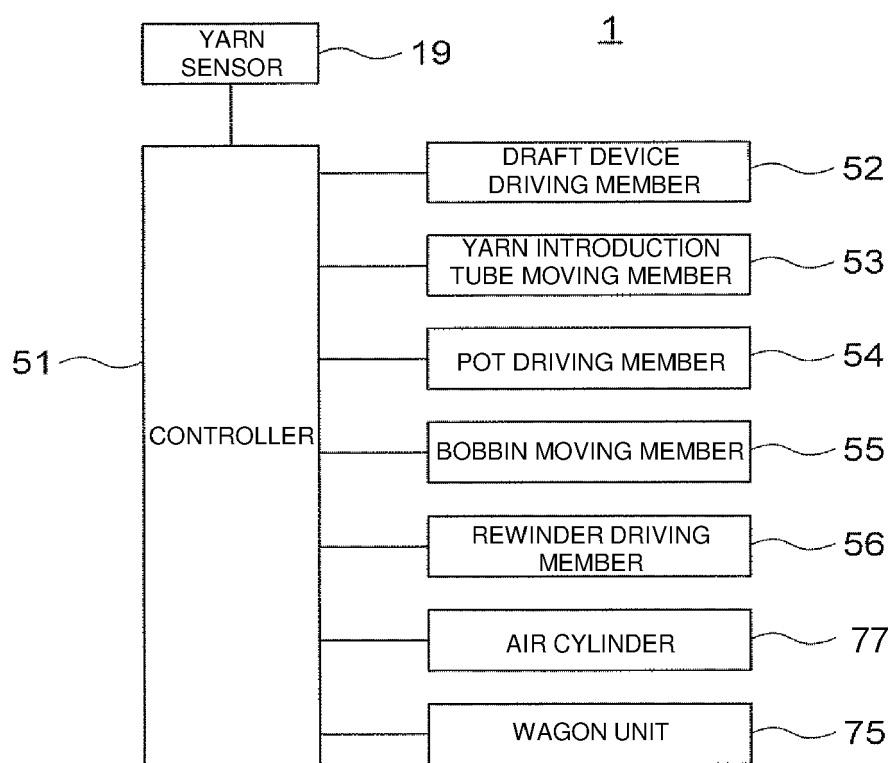


FIG. 7

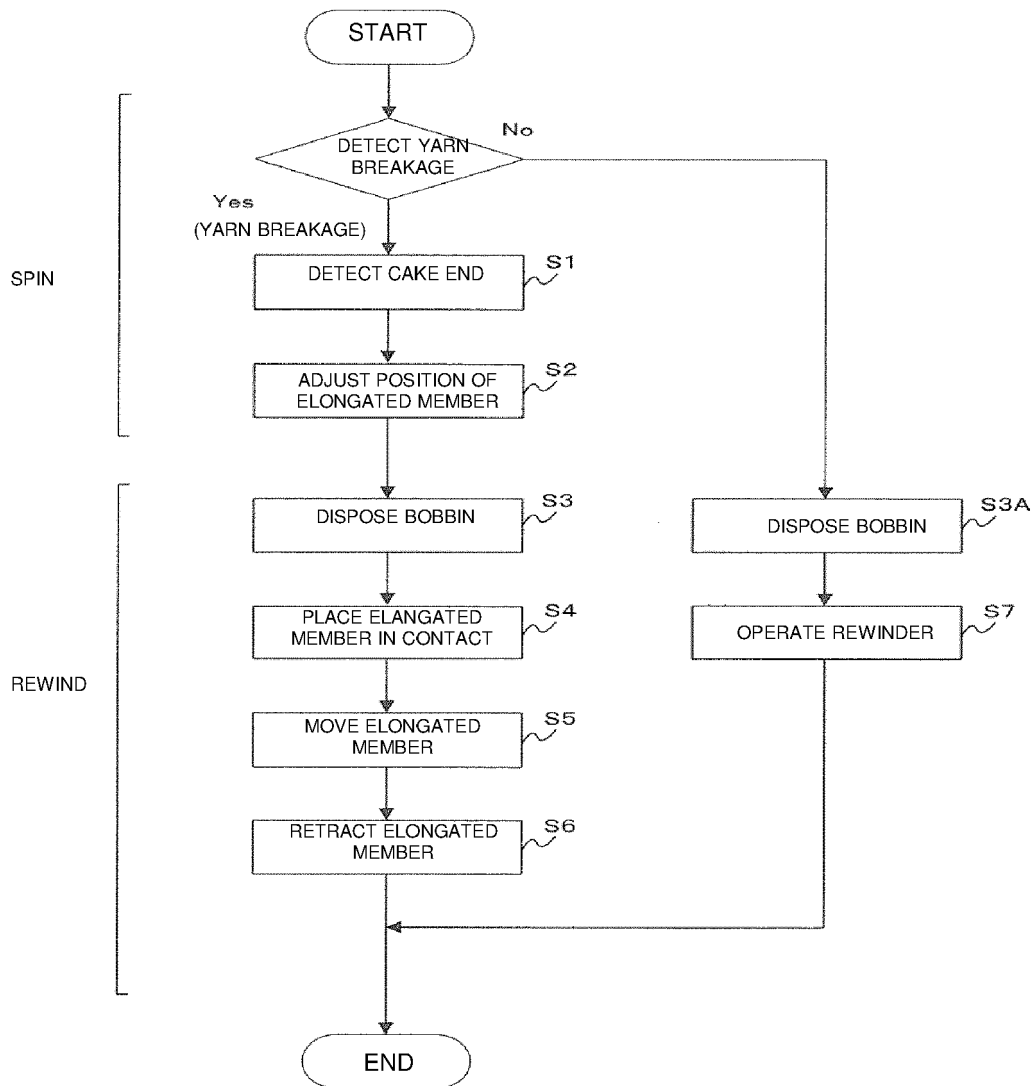


FIG. 8

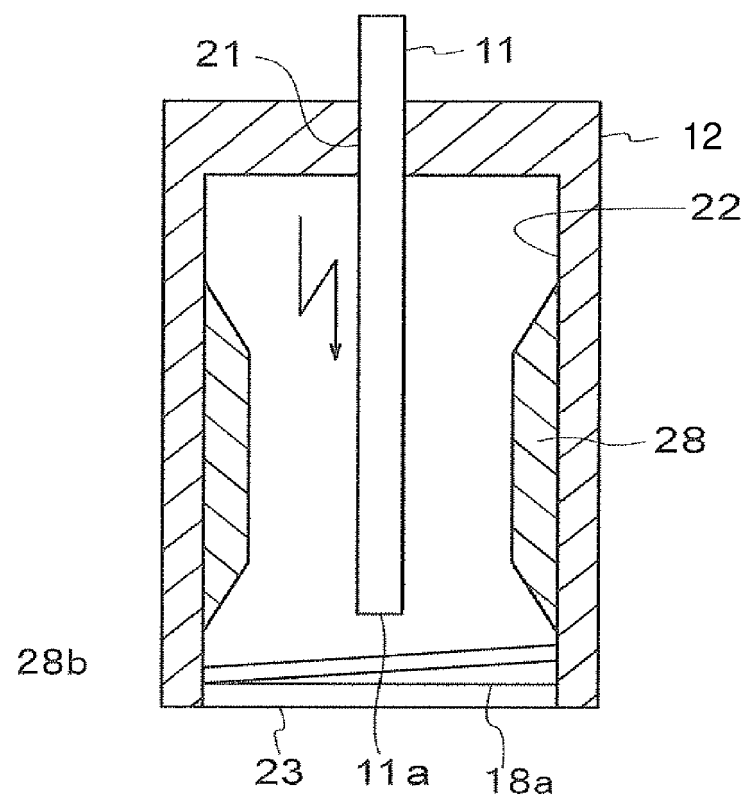


FIG. 9

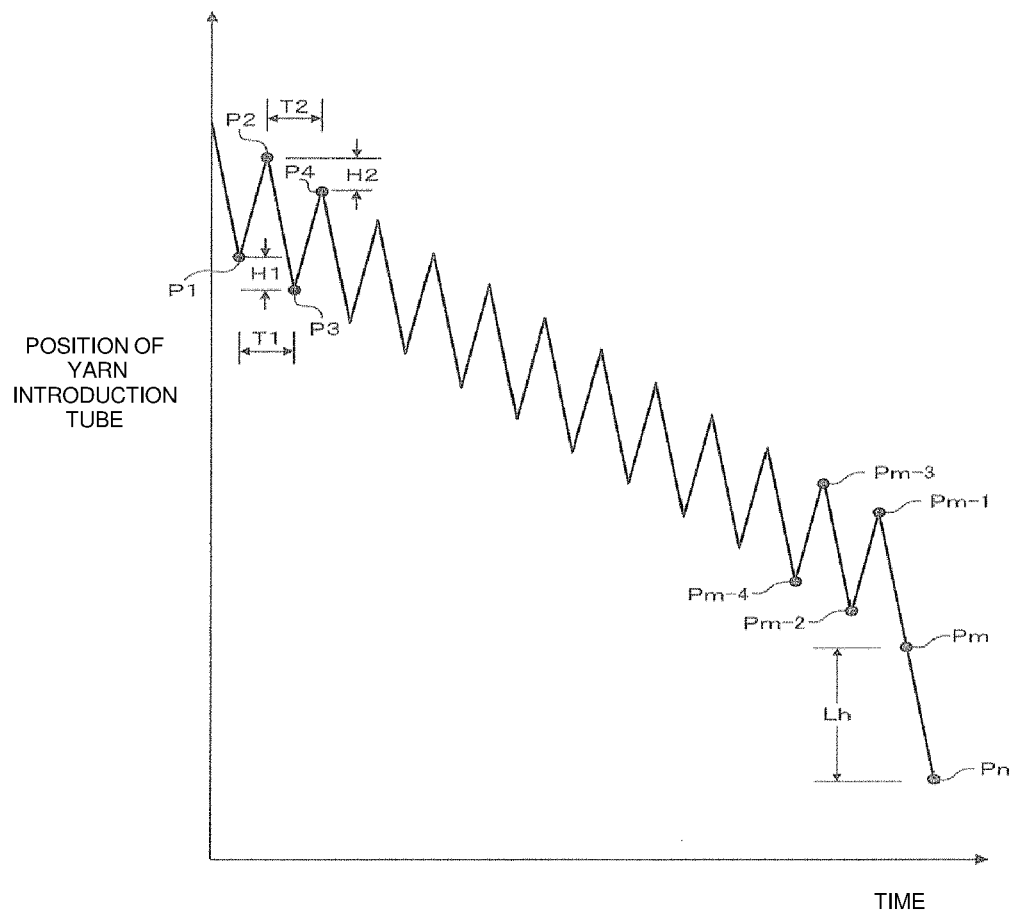


FIG.10

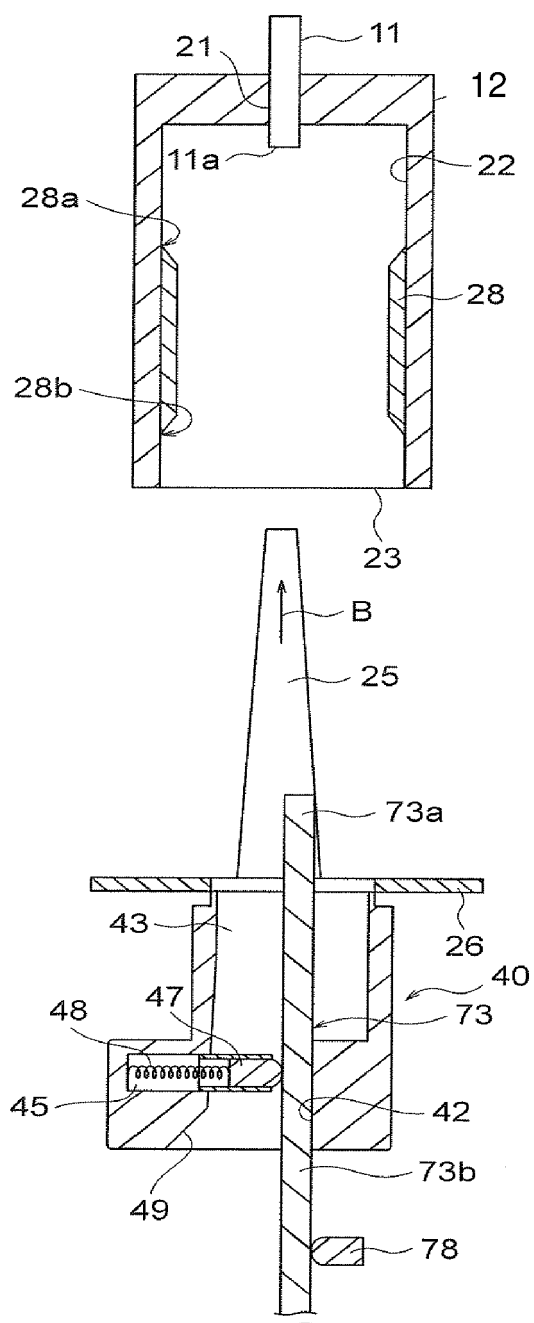


FIG. 11

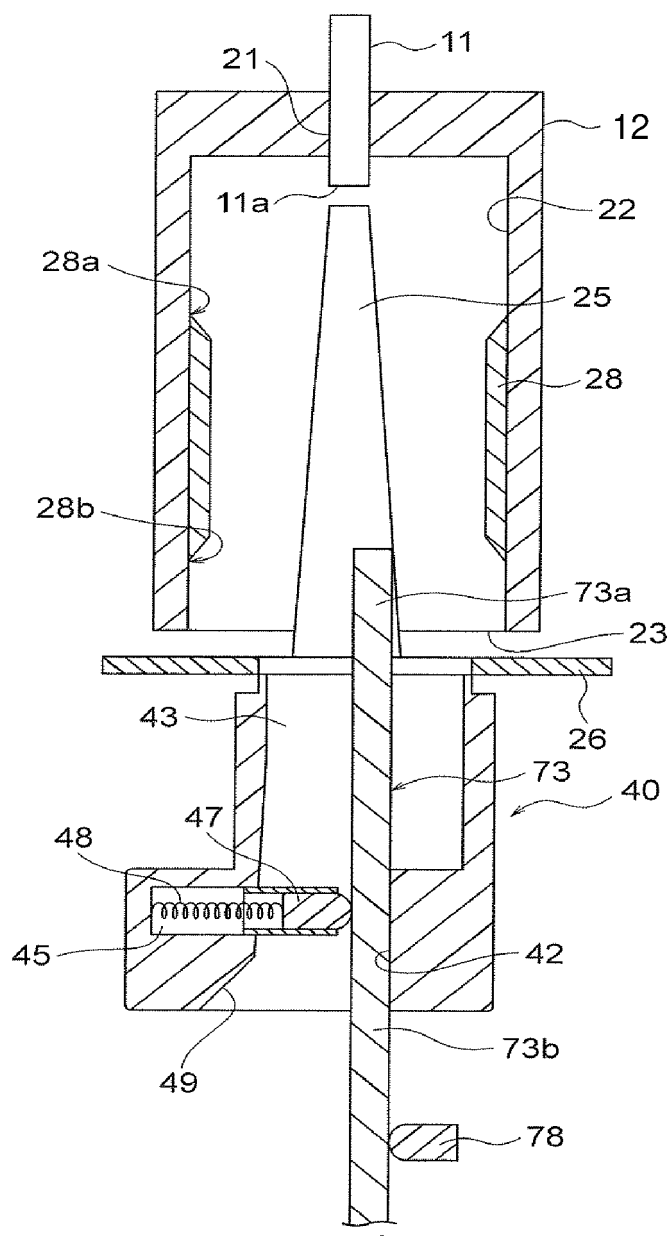


FIG. 12

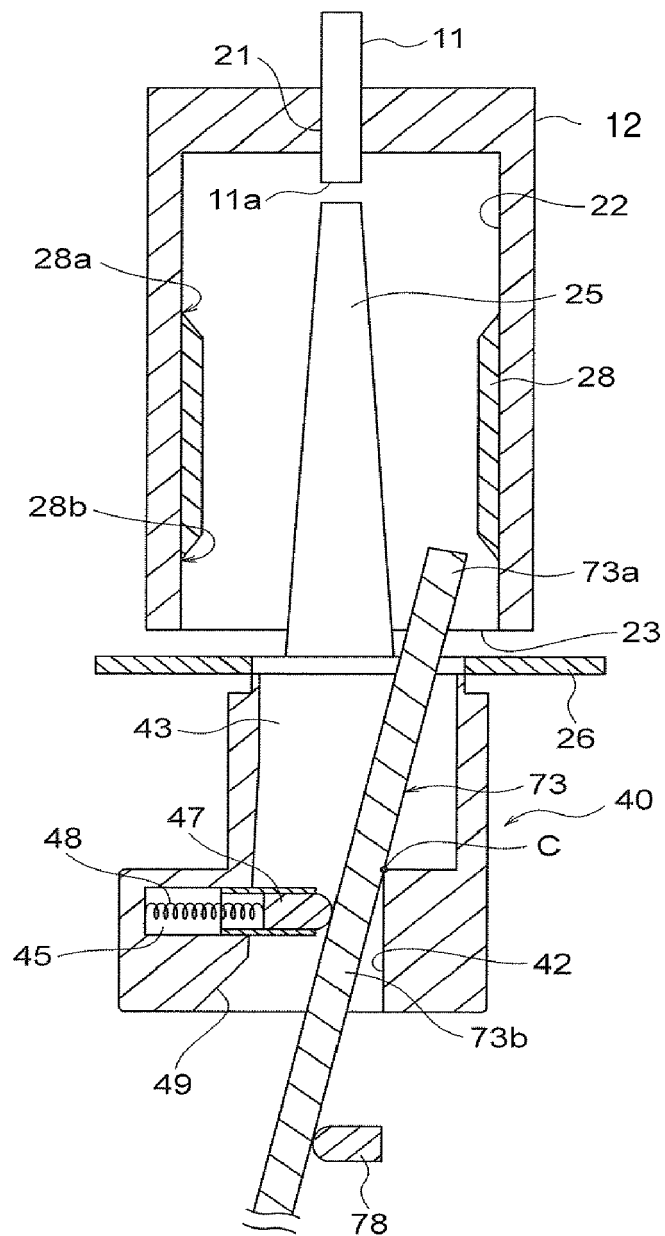


FIG. 13

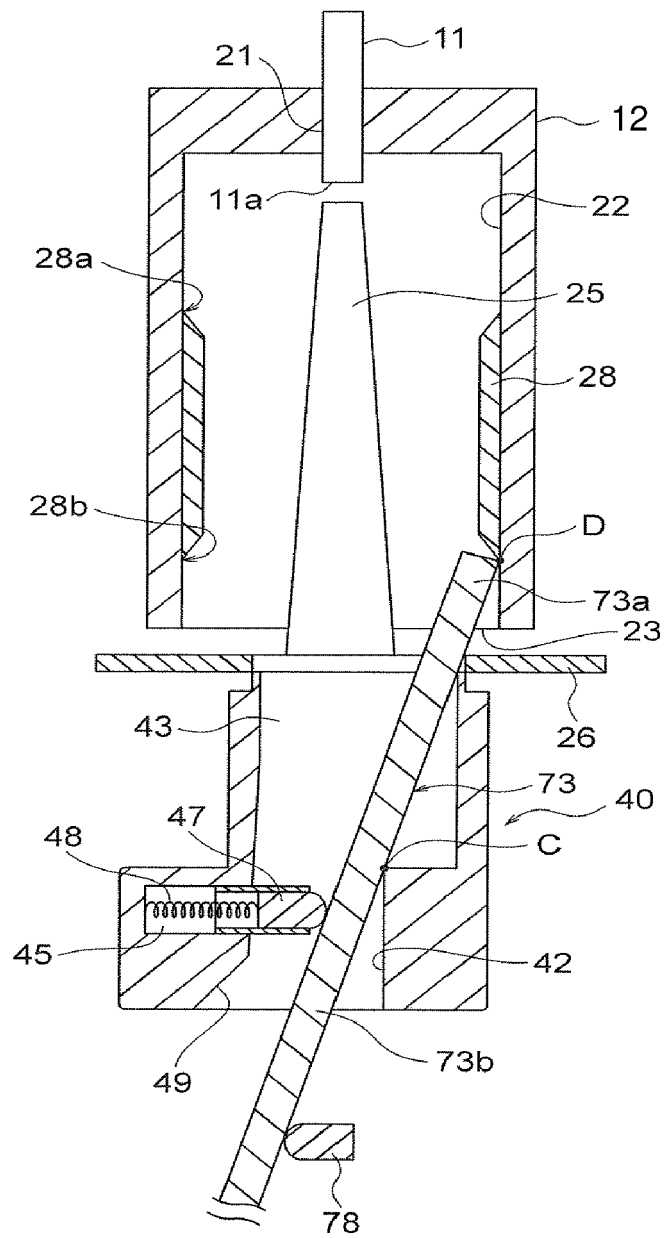


FIG. 14

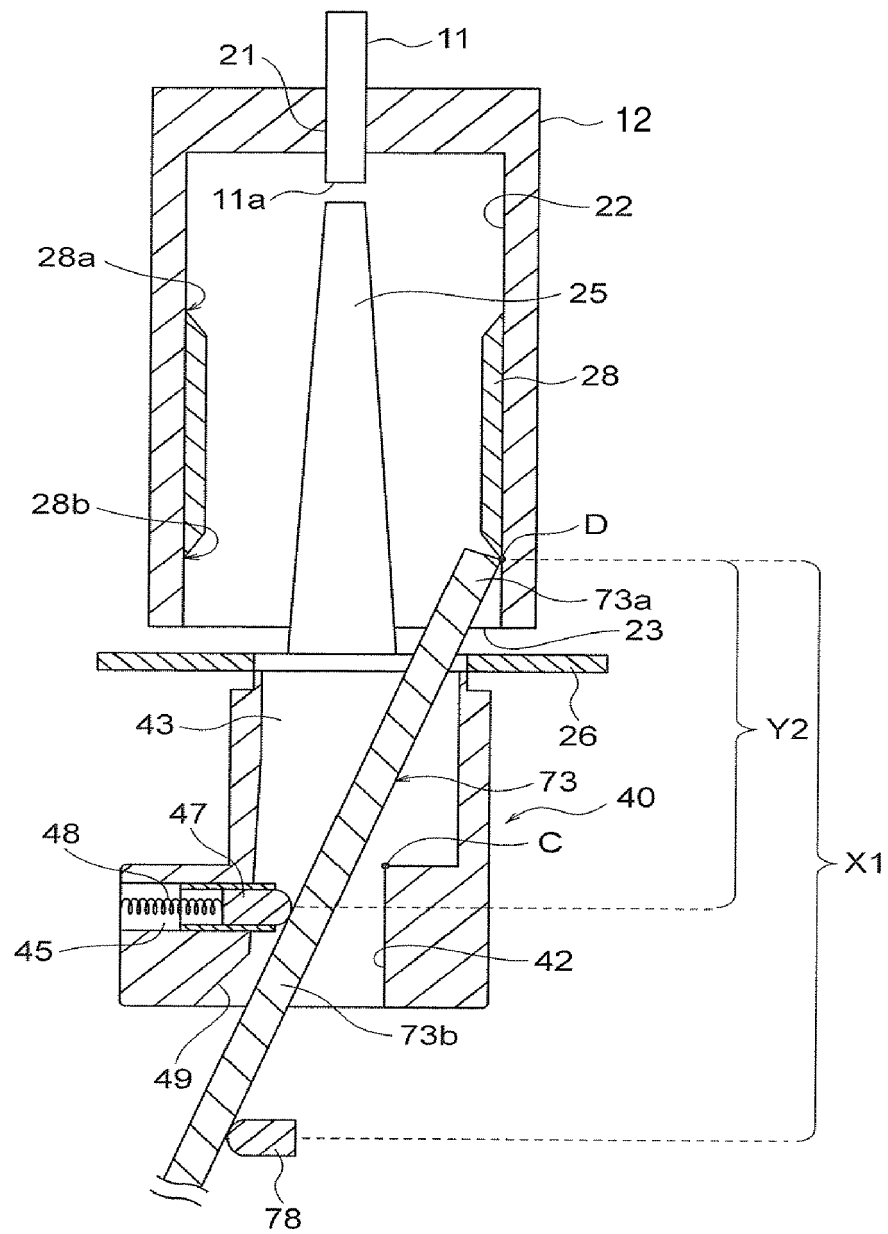


FIG. 15

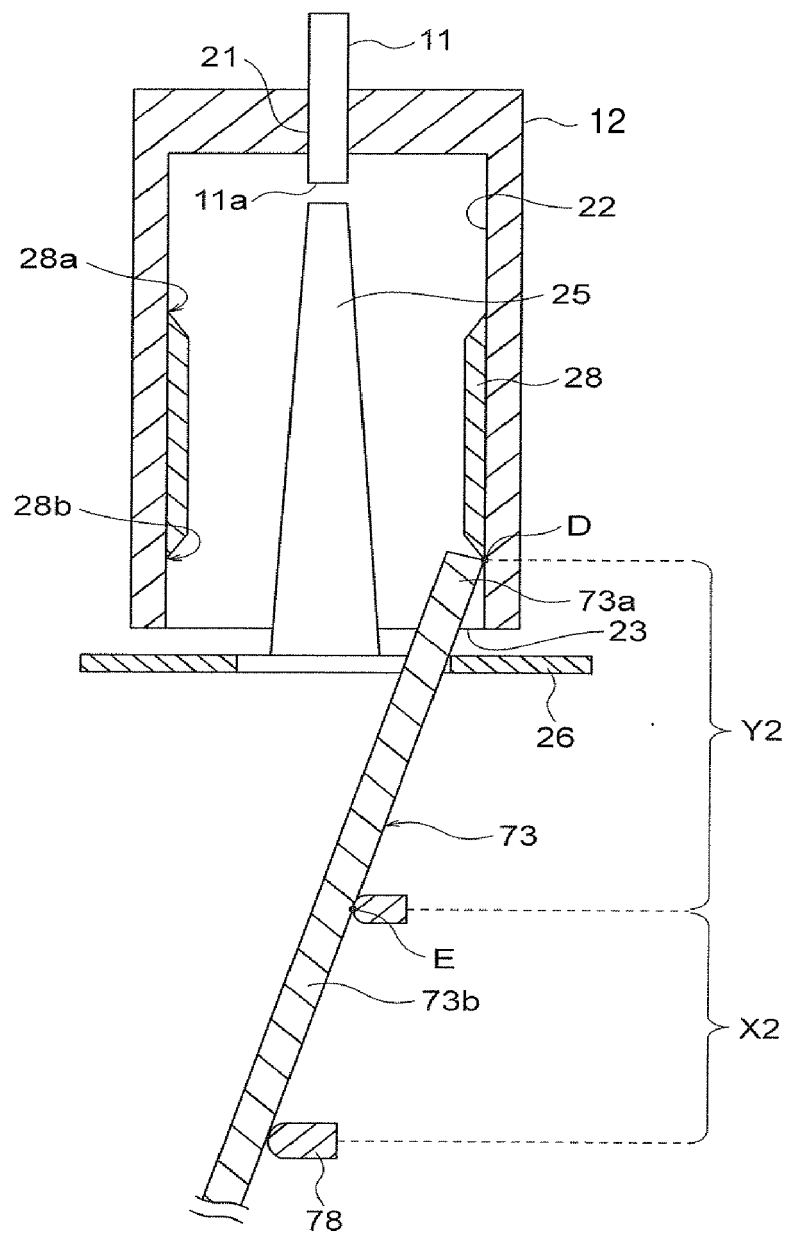
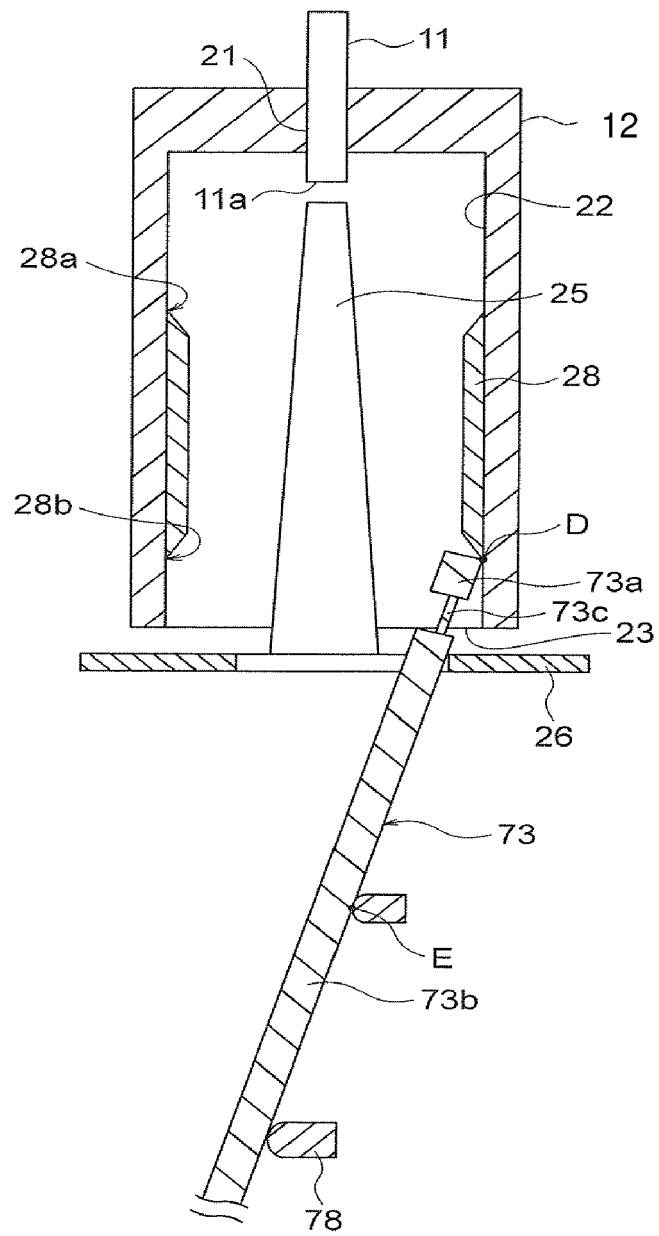


FIG. 16





EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
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			D01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 October 2020	Examiner Humbert, Thomas
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 20 17 7035

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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