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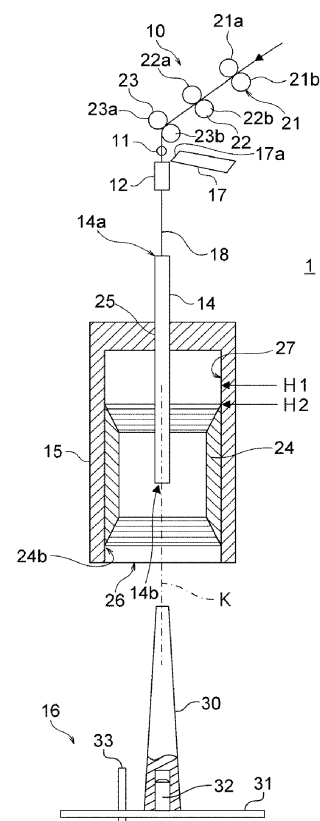
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(54) **POT SPINNING MACHINE**

(57) A pot spinning machine includes a yarn suction pipe (12), a pot (15), and a yarn introduction pipe (14). The yarn suction pipe (12) sucks in a yarn (18) drawn out by a drafting device (10). The pot (15) has a cylindrical shape. The yarn introduction pipe (14) introduces the yarn (18) supplied through the yarn suction pipe (12) into the pot (15). The pot spinning machine (1) includes a yarn-suction-pipe driving section (52). The yarn-suction-pipe driving section (52) supports the yarn suction pipe (12) such that the yarn suction pipe (12) is movable in a direction of a central axis (K) of the pot (15), and is configured to shift a position of the yarn suction pipe (12) between a first position (P1) and a second position (P2) that is closer to the pot (15) than the first position (P1).

FIG. 1



Description

BACKGROUND ART

[0001] A pot spinning machine that uses a pot having a cylindrical shape is known as one of spinning machines. The pot spinning machine rotates the pot at a predetermined number of rotations, introduces yarn (a fiber bundle), which has been drawn out by a drafting device, into the pot through a yarn introduction pipe, and winds the yarn onto an inside wall of the pot to form a cake. After the cake is formed, the pot spinning machine cuts the yarn at a position upstream from the yarn introduction pipe, then inserts a bobbin into the pot, and rewinds the yarn from the inside wall of the pot onto the bobbin.

[0002] The pot spinning machine includes a yarn suction pipe disposed upstream from the yarn introduction pipe, and introduces yarn into the yarn introduction pipe through the yarn suction pipe (refer to Japanese Patent Application Publication No. 62-162027, for example). The yarn suction pipe sucks in yarn, which has been fed from a drafting device, with suction power using swirling airflow. To surely suck in the yarn with less air consumption, the yarn suction pipe is preferably disposed near bottom rollers of the drafting device.

[0003] However, if the yarn suction pipe is disposed near the bottom rollers of the drafting device, the following problem may occur.

[0004] First, a yarn sensor may be disposed in a vicinity of the bottom rollers of the drafting device. In this case, if the yarn suction pipe is disposed near the bottom rollers, the yarn suction pipe may enter a detection area of the yarn sensor and interfere with a detection function of the yarn sensor. In addition, an intake air path of a pneumatic nozzle may be set in the vicinity of the bottom rollers of the drafting device. The pneumatic nozzle sucks in fibers wastes, fly wastes, or broken yarn, which may be generated during spinning, together with intake air. Accordingly, if the yarn suction pipe is disposed near the bottom rollers, the yarn suction pipe may interfere with air suction by the pneumatic nozzle, which leads to a decrease in efficiency of suction of fibers wastes or the like by the pneumatic nozzle. Furthermore, if the yarn suction pipe is disposed near the bottom rollers, a fiber of yarn may wrap around the bottom rollers and contact the yarn suction pipe.

[0005] However, in the widely known pot spinning machine, the yarn suction pipe is firmly secured upstream from the yarn introduction pipe so that the yarn suction pipe is kept in a certain position. If the yarn suction pipe is disposed at a position away from the bottom rollers of the drafting device to put priority on the detection function of the yarn sensor and suction efficiency of the pneumatic nozzle, the yarn suction pipe may have a problem of a decrease in the success rate of yarn suction. Increasing an amount of air injection of the yarn suction pipe can increase the suction power of the yarn suction pipe, but increases air consumption, which leads to energy loss.

If the yarn suction pipe is disposed near the bottom rollers of the drafting device to increase the success rate of yarn suction performed by the yarn suction pipe, the yarn suction pipe may interfere with the function of the yarn sensor or may cause a decrease in suction efficiency of the pneumatic nozzle. Accordingly, it is very difficult to optimize a position of the yarn suction pipe.

[0006] The present disclosure, which has been made in light of the above-mentioned problem, is directed to providing a pot spinning machine that is capable of optimizing a position of a yarn suction pipe.

SUMMARY

[0007] In accordance with an aspect of the present disclosure, there is provided a pot spinning machine that includes a yarn suction pipe, a pot, and a yarn introduction pipe. The yarn suction pipe sucks in a yarn drawn out by a drafting device. The pot has a cylindrical shape. The yarn introduction pipe introduces the yarn supplied through the yarn suction pipe into the pot. The pot spinning machine includes a yarn-suction-pipe driving section. The yarn-suction-pipe driving section supports the yarn suction pipe such that the yarn suction pipe is movable in a direction of a central axis of the pot, and is configured to shift a position of the yarn suction pipe between a first position and a second position that is closer to the pot than the first position.

[0008] Other aspects and advantages of the disclosure will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The 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 illustrating an exemplary configuration of a pot spinning machine according to an embodiment of the present disclosure;

FIG. 2 is a schematic perspective view illustrating an exemplary configuration of a yarn suction pipe and a yarn-suction-pipe driving section according to the embodiment of the present disclosure;

FIG. 3 is a schematic side view of the yarn suction pipe at a suction position;

FIG. 4 is a schematic side view of the yarn suction pipe at a discharge position;

FIG. 5 is a schematic side view of the yarn suction pipe at the suction position, showing an operational

state of the yarn-suction-pipe driving section; and

FIG. 6 is a schematic side view of the yarn suction pipe at the discharge position, showing an operational state of the yarn-suction-pipe driving section.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0010] The following will describe an embodiment of the present disclosure with reference to the accompanying drawings.

<Pot spinning machine>

[0011] FIG. 1 is a schematic view illustrating an exemplary configuration of a pot spinning machine according to an embodiment of the present disclosure.

[0012] FIG. 1 illustrates a simplified configuration of each component of the pot spinning machine, so that the shape and dimension of each component may be different from its actual shape and dimension.

[0013] As illustrated in FIG. 1, a pot spinning machine 1 includes a drafting device 10, a yarn sensor 11, a pneumatic nozzle 17, a yarn suction pipe 12, a yarn introduction pipe 14, a pot 15, and a bobbin support part 16. These elements cooperate to form a single spindle that represents a unit of spinning. The pot spinning machine 1 includes a plurality of spindles, but the following will focus on a configuration of a single spindle.

(Drafting device)

[0014] The drafting device 10 is a device for drawing out a yarn material such as a roving. The drafting device 10 includes multiple pairs of rollers that includes a pair of back rollers 21, a pair of middle rollers 22, and a pair of front rollers 23. The pair of back rollers 21, the pair of middle rollers 22, and the pair of front rollers 23 are arranged in this order from upstream to downstream of a yarn delivery direction. The pair of back rollers 21 includes a back top roller 21a and a back bottom roller 21b. The pair of middle rollers 22 includes a middle top roller 22a and a middle bottom roller 22b. The pair of front rollers 23 includes a front top roller 23a and a front bottom roller 23b.

[0015] The pairs of rollers 21, 22, 23 are rotated by a drafting-device driving section that will be described later. When the rotational speeds of the pairs of rollers 21, 22, 23 are defined by revolutions per minute (rpm), the rpm of the pair of middle rollers 22 is greater than the rpm of the pair of back rollers 21, and the rpm of the pair of front rollers 23 is greater than the rpm of the pair of middle rollers 22. As described above, the rpm of the pairs of rollers 21, 22, 23 are different from each other, and the drafting device 10 draws out a yarn material thinly by using the difference in rpm among the pair of rollers 21, 22, 23, that is, the difference in rotational speed among the pairs of rollers 21, 22, 23.

(Yarn sensor)

[0016] The yarn sensor 11 is a sensor for detecting a state of the yarn in a yarn path extending from the drafting device 10 to the yarn suction pipe 12. The yarn sensor 11 is disposed at a position downstream from the drafting device 10 and upstream from the yarn suction pipe 12 in the yarn delivery direction. The yarn sensor 11 detects a state of yarn such as ballooning of yarn to be sucked into the yarn suction pipe 12, yarn breakage or the like. The yarn ballooning is a phenomenon in which the yarn is swirled by rotation of the pot 15 and forms a balloon. The yarn sensor 11 includes, for example, a light sensor with combination of a light emitter and a light receiver.

(Pneumatic nozzle)

[0017] The pneumatic nozzle 17 is a component of a pneumatic device. The pneumatic nozzle 17 is disposed in a vicinity of the drafting device 10 and takes in air through a nozzle opening 17a that is disposed at a tip of the pneumatic nozzle 17. The nozzle opening 17a opens toward the yarn path extending from the drafting device 10 to the yarn suction pipe 12. The pneumatic nozzle 17 sucks in fibers wastes, fly wastes, or broken yarn, which may be generated during spinning, together with intake air.

(Yarn suction pipe)

[0018] The yarn suction pipe 12 sucks in a yarn 18 supplied from the drafting device 10, and feeds the yarn 18 to the yarn introduction pipe 14. The yarn suction pipe 12 sucks in the yarn 18, which has been drawn out by the drafting device 10, by using swirling airflow. The pot spinning machine 1 further includes a yarn-suction-pipe driving section 52 (see FIG. 2), and the yarn-suction-pipe driving section 52 supports the yarn suction pipe 12 such that the yarn suction pipe 12 is movable in a direction of a central axis K of the pot 15.

(Yarn introduction pipe)

[0019] The yarn introduction pipe 14 introduces the yarn 18, which has been supplied from the drafting device 10 through the yarn suction pipe 12, into the pot 15. The yarn introduction pipe 14 has a long thin tube-like shape. The yarn introduction pipe 14 has a circular cross section in a direction perpendicular to a longitudinal direction of the yarn introduction pipe 14. The yarn introduction pipe 14 is disposed downstream from the drafting device 10, and is coaxial with the yarn suction pipe 12 and the pot 15. The yarn introduction pipe 14 penetrates an upper portion of the pot 15 to be inserted into the pot 15. The yarn introduction pipe 14 has a yarn inlet 14a and a yarn outlet 14b at a top end and a bottom end of the yarn introduction pipe 14, respectively. The yarn 18 is introduced into the yarn introduction pipe 14 through the yarn

inlet 14a and is discharged from the yarn introduction pipe 14 through the yarn outlet 14b. The yarn introduction pipe 14 is disposed such that the yarn introduction pipe 14 is moved by a yarn-introduction-pipe driving section, which is not illustrated, in the direction of the central axis K of the pot 15.

(Pot)

[0020] The pot 15 is used for formation of a cake 24 and yarn rewinding. The pot 15 has a cylindrical shape. The pot 15 is rotatable about the central axis K of the pot 15. The central axis K of the pot 15 is parallel to a vertical direction. Accordingly, one side of the pot 15 is an upper side, and the other side is a lower side in the direction of the central axis K of the pot 15. The pot 15 has a yarn-introduction-pipe insertion port 25 at a top end of the pot 15. The yarn-introduction-pipe insertion port 25 is an opening through which the yarn introduction pipe 14 is inserted into the pot 15. The pot 15 has an opening 26 at a bottom end of the pot 15.

(Bobbin support part)

[0021] The bobbin support part 16 supports a bobbin 30. The bobbin support part 16 includes a bobbin seat 31 and a bobbin attachment portion 32. The bobbin seat 31 has a plate-like shape. The bobbin attachment portion 32 is fixed to the bobbin seat 31. The bobbin attachment portion 32 has a column shape, and protrudes upward from an upper surface of the bobbin seat 31.

[0022] FIG. 2 is a schematic perspective view illustrating an exemplary configuration of the yarn suction pipe and the yarn-suction-pipe driving section according to the embodiment of the present disclosure.

[0023] First, the configuration of the yarn suction pipe 12 will be described.

[0024] The yarn suction pipe 12 is attached to a yarn-suction-pipe rail 60 at a position corresponding to a position of each spindle of the pot spinning machine 1, so that the yarn suction pipes 12 are arranged at a predetermined interval. Each yarn suction pipe 12 includes a yarn suction member 121, an air intake member 122, and a cylindrical member 123. The yarn suction member 121, the air intake member 122, and the cylindrical member 123 are integrally assembled to form the single yarn suction pipe 12.

[0025] The yarn suction member 121 is a member for suction of the yarn 18 with suction power using swirling airflow. The yarn suction member 121 has a suction hole (not illustrated). The suction hole is formed through the yarn suction member 121 in a direction of a central axis of the yarn suction member 121. The air intake member 122 is fixed to an upper surface of the yarn-suction-pipe rail 60. The air intake member 122 is a member for taking air, which is fed through air joints 62 and air pipes 63, into the yarn suction pipe 12. The air taken by the air intake member 122 forms a swirling airflow. The cylindrical

member 123 is coupled to a bottom end of the yarn suction member 121 so as to be coaxial with the yarn suction member 121. The cylindrical member 123 has a communication hole (not illustrated) that communicates with the suction hole of the yarn suction member 121. The yarn suction member 121 sucks in the yarn 18 by using the swirling airflow, and the yarn 18 is fed into the yarn introduction pipe 14 through the suction hole of the yarn suction member 121 and the communication hole of the cylindrical member 123.

[0026] Next, the configuration of the yarn-suction-pipe driving section 52 will be described.

[0027] The yarn-suction-pipe driving section 52 supports the yarn suction pipe 12 such that the yarn suction pipe 12 is movable in the direction of the central axis K of the pot 15 (up-down direction), and is configured to shift a position of the yarn suction pipe 12 between a first position and a second position that is closer to the pot 15 than the first position. In this embodiment, for example, the first position and the second position are described as a suction position and a discharge position, respectively.

[0028] FIG. 3 is a schematic side view of the yarn suction pipe at the suction position, and FIG. 4 is a schematic side view of the yarn suction pipe at the discharge position.

[0029] The yarn-suction-pipe driving section 52 places the yarn suction pipe 12 at a suction position P1 when the yarn 18 fed from the drafting device 10 is sucked into the yarn suction pipe 12. In contrast, the yarn-suction-pipe driving section 52 places the yarn suction pipe 12 at a discharge position P2 when the yarn 18 sucked into the yarn suction pipe 12 is discharged from the yarn suction pipe 12 through the yarn introduction pipe 14 into the pot 15.

[0030] The suction position P1 is set to a position suitable for yarn suction and in a vicinity of the front bottom roller 23b, as illustrated in FIG. 3, so that the yarn suction pipe 12 sucks in the yarn 18 surely together with intake air while reducing air consumption. When the yarn suction pipe 12 is placed at the suction position P1, a distance L1 between the front bottom roller 23b and the yarn suction pipe 12 is preferably set to approximately 1 mm.

[0031] In contrast, the discharge position P2 is set to a position suitable for yarn discharge and closer to the pot 15 than the suction position P1. Accordingly, the discharge position P2 is set to a position that is lower than the suction position P1 (downstream of the yarn delivery direction), as illustrated in FIG. 4, i.e., a position away from the front bottom roller 23b. If the discharge position P2 is defined by a positional relationship between the yarn suction pipe 12 and the yarn sensor 11, the discharge position P2 is preferably set to a position outside the detection area of the yarn sensor 11. Alternatively, if the discharge position P2 is defined by a positional relationship between the yarn suction pipe 12 and the pneumatic nozzle 17, the discharge position P2 is preferably set to a position outside an intake air path of the pneu-

matic nozzle 17. The intake air path of the pneumatic nozzle 17 is a stream of intake air that is formed across the yarn path between the front bottom roller 23b and the yarn suction pipe 12 when the air is taken by the pneumatic nozzle 17 through the nozzle opening 17a. When the yarn suction pipe 12 is placed at the discharge position P2, a distance L2 between the front bottom roller 23b and the yarn suction pipe 12 is preferably set to 4 mm or more.

[0032] The yarn-suction-pipe driving section 52 includes a mechanism for elevating the yarn suction pipes 12, and as illustrated in FIG. 2, the yarn-suction-pipe driving section 52 includes a fixed rail 66, rods 67, springs 68, stoppers 69, contact members 70, and an elevating rail 71. The fixed rail 66 is fixed below the yarn-suction-pipe rail 60. Each of the rods 67 is supported by the fixed rail 66 such that the rod 67 is movable up and down. Each of the springs 68 is attached to the rod 67. Each of the stoppers 69 is attached to the rod 67 at a position different from a position of the spring 68. Each of the contact members 70 is attached to a bottom end portion 67b of the rod 67. The elevating rail 71 is movable in the up-down direction.

[0033] The fixed rail 66 is a rail-shaped member that extends in a longitudinal direction of the yarn-suction-pipe rail 60. The fixed rail 66 has guide holes (not illustrated) that each support the rod 67 such that the rod 67 is movable in the up-down direction. As necessary, a bearing is attached to the guide hole. The fixed rail 66 is disposed between the springs 68 and the stoppers 69 in a direction of the central axis of each rod 67. The fixed rail 66 has a relief hole or cutout for preventing a position interference of the fixed rail 66 with the cylindrical member 123 of the yarn suction pipe 12.

[0034] The rod 67 is disposed parallel to the cylindrical member 123 of the yarn suction pipe 12. The rod 67 is fixed to the yarn-suction-pipe rail 60 at a top end 67a of the rod 67. Accordingly, when the rod 67 is moved up and down while being supported by the fixed rail 66, the yarn-suction-pipe rail 60 and the yarn suction pipe 12 are moved up and down together with the rod 67. The rod 67 has a bottom end portion 67b that is partially larger in diameter.

[0035] Each of the springs 68 is wound around a shaft of the rod 67. The spring 68 is constituted by a compression coil spring. A top end of the spring 68 is pressed against a bottom surface of the fixed rail 66, and a bottom end of the spring 68 is pressed against the bottom end portion 67b of the rod 67. The force of the spring 68 functions as an urging force to urge the rod 67 downward, and this urging force presses the stopper 69 against an upper surface of the fixed rail 66.

[0036] The stopper 69 is fixed to the shaft of the rod 67. The stopper 69 is pressed against the fixed rail 66 by the urging force of the spring 68, so that the stopper 69 specifies (determines) a position of the rod 67 and therefore positions of the yarn-suction-pipe rail 60 and the yarn suction pipe 12 in the up-down direction.

[0037] The contact member 70 is a portion which the elevating rail 71 contacts. The contact member 70 protrudes downward from the bottom end portion 67b of the rod 67. A protruding length of the contact member 70 with respect to the position of the bottom end portion 67b of the rod 67 is adjustable. The protruding length of the contact member 70 is adjusted by a mechanism in which, for example, a threaded hole (not illustrated) may be formed in the bottom end portion 67b of the rod 67 along a central axis of the rod 67 and external threads (not illustrated) matching with the threaded hole may be formed in the contact member 70. According to this adjustment mechanism, the external threads of the contact member 70 are screwed into the threaded hole of the rod 67, so that this adjustment mechanism allows rotation of the contact member 70 in this state and is capable of adjusting the protruding length of the contact member 70 according to the direction and amount of the rotation of the contact member 70. The provision of such an adjustment mechanism allows the adjustment (fine adjustment) of the suction position P1.

[0038] The elevating rail 71 is an elongated member that extends in the longitudinal direction of the yarn-suction-pipe rail 60, and is disposed below the fixed rail 66. The elevating rail 71 faces the contact member 70 in the up-down direction. The elevating rail 71 is preferably constituted by a yarn-introduction-pipe rail that supports the yarn introduction pipe 14. The yarn-introduction-pipe rail is one component of the yarn-introduction-pipe driving section that moves (elevates) the yarn introduction pipe 14 in the up-down direction, and is driven by a driving mechanism (not illustrated) to move together with the yarn introduction pipe 14 in the up-down direction. The elevating rail 71 constituted by the yarn-introduction-pipe rail helps reduction of the number of parts of the pot spinning machine 1, in comparison with the elevating rail 71 formed separately from the yarn-introduction-pipe rail. Further, the yarn-introduction-pipe driving section includes the driving mechanism for moving the yarn introduction pipe 14 together with the yarn-introduction-pipe rail in the up-down direction, so that the yarn-introduction-pipe driving section is capable of driving the yarn-suction-pipe driving section 52 by using the driving force of the driving mechanism. In this embodiment, the elevating rail 71 is constituted by the yarn-introduction-pipe rail. Therefore, the elevating rail 71 is stated as the yarn-introduction-pipe rail 71 in the following description. The yarn-introduction-pipe rail 71 is disposed such that the yarn-introduction-pipe rail 71 is moved in the up-down direction, for example, by the driving mechanism including a driving source, such as a cylinder or motor.

[0039] Next, the operation of the pot spinning machine according to the embodiment of the present disclosure will be described.

[0040] The operation of the pot spinning machine 1 includes a draw-out step S1, a cake forming step S2, and a rewinding step S3.

[0041] The draw-out step S1 is a step for drawing out

a yarn material, such as a roving. The cake forming step S2 is a step for winding the yarn, which has been drawn out at the draw-out step S1, onto the inside wall 27 of the pot 15 to form the cake 24. The rewinding step S3 is a step for rewinding the yarn of the cake 24 onto the bobbin 30. The operation of the pot spinning machine 1 at each step will be explained in the following description. The pot spinning machine 1 includes a controller (not illustrated), and the controller controls operation of each part of the pot spinning machine 1 to execute the operation of the pot spinning machine 1 described in the following.

(Draw-out step)

[0042] At the draw-out step S1, the pair of back rollers 21, the pair of middle rollers 22, and the pair of front rollers 23 of the drafting device 10 each rotate at a predetermined rpm to draw out and deliver a yarn material, such as a roving, into a predetermined thickness. The yarn 18 drawn out in this way is sucked into the yarn suction pipe 12 and then introduced into the yarn introduction pipe 14 through the yarn inlet 14a.

[0043] Before the draw-out step S1 starts, the yarn suction pipe 12 is placed at the suction position P1 by the upward movement of the yarn-introduction-pipe rail 71. In this case, the operation of the yarn-suction-pipe driving section 52 is as follows.

[0044] First, the yarn-introduction-pipe rail 71 moves up and contacts the contact member 70 at an upper surface of the yarn-introduction-pipe rail 71. The yarn-introduction-pipe rail 71 pushes up the rod 67 against an urging force of the spring 68. Accordingly, the upward pushing of the rod 67 compresses the spring 68, so that the stopper 69 comes away from the fixed rail 66. The rod 67 is moved up together with the yarn-suction-pipe rail 60 and the yarn suction pipe 12. Accordingly, the yarn suction pipe 12 moves from the discharge position P2 to the suction position P1. The upward movement of the yarn-introduction-pipe rail 71 stops when the yarn suction pipe 12 reaches the suction position P1. At that time, the yarn outlet 14b of the yarn introduction pipe 14 is located at a predetermined winding-start-height H1 (see FIG. 1). The winding-start-height H1 is a height at which the yarn 18 discharged from the yarn outlet 14b of the yarn introduction pipe 14 starts winding on the inside wall 27 of the pot 15.

[0045] When the draw-out step S1 starts after the yarn suction pipe 12 is placed at the suction position P1, as illustrated in FIG. 5, the yarn suction member 121 of the yarn suction pipe 12 is placed in the vicinity of the front bottom roller 23b of the drafting device 10. Accordingly, the yarn suction pipe 12 surely sucks in the yarn 18, fed from the pair of front rollers 23, with less air consumption. However, if the cake forming step S2 is performed with the yarn suction pipe 12 placed at the suction position P1, this may be detrimental, such as an interference with the detection function of the yarn sensor 11 or a decrease in the suction efficiency of the pneumatic nozzle 17.

[0046] Thus, the yarn suction pipe 12 is placed at the discharge position P2 by the downward movement of the yarn-introduction-pipe rail 71 when the yarn 18 is sucked into the yarn suction pipe 12 (when a predetermined time has passed since the draw-out step S1 starts). In this case, the operation of the yarn-suction-pipe driving section 52 is as follows.

[0047] First, the yarn-introduction-pipe rail 71 moves down, so that the urging force of the spring 68 pushes down the rod 67. The rod 67 is moved down together with the yarn-suction-pipe rail 60 and the yarn suction pipe 12. The downward movement of the yarn suction pipe 12 stops when the stopper 69 contacts the fixed rail 66. Accordingly, the yarn suction pipe 12 moves from the suction position P1 to the discharge position P2. At this time, the yarn outlet 14b of the yarn introduction pipe 14 is placed at a predetermined deposit-start-height H2 (see FIG. 1). The deposit-start-height H2 is a height at which the yarn 18 discharged from the yarn outlet 14b of the yarn introduction pipe 14 starts being deposited on the inside wall 27 of the pot 15 to form the cake 24.

[0048] When the cake forming step S2 is performed after the yarn suction pipe 12 is placed at the discharge position P2 in this way, as illustrated in FIG. 6, the yarn suction member 121 of the yarn suction pipe 12 is placed at a position away from the front bottom roller 23b of the drafting device 10. Accordingly, the yarn suction pipe 12 is placed at a position outside the detection area of the yarn sensor 11, so that the yarn suction pipe 12 does not interfere with the detection function of the yarn sensor 11. Further, the yarn suction pipe 12 is placed at a position outside the intake air path of the pneumatic nozzle 17, so that the suction efficiency of the pneumatic nozzle 17 does not decrease. The placement of the yarn suction pipe 12 at the discharge position P2 enables a pneumatic device including the pneumatic nozzle 17 to fully function, thereby enabling a rapid suction of a yarn bundle if a yarn breakage occurs, while preventing generation of yarn defects and reducing the occurrence of a yarn breakage. Furthermore, a sufficient distance between the front bottom roller 23b and the yarn suction pipe 12 is secured in case of a fiber of the yarn wrapping around the front bottom roller 23b. This makes it difficult for the fiber wrapping around the front bottom roller 23b to contact the yarn suction pipe 12, thereby reducing damage to the front bottom roller 23b or the yarn suction pipe 12. When the yarn suction pipe 12 is placed at the discharge position P2, a wrapping angle of the yarn 18 relative to the yarn suction member 121 is small in comparison with a case where the yarn suction pipe 12 is placed at the suction position P1. This enables sufficient twisting to increase the strength of the yarn 18 located upstream from the yarn suction member 121, thereby reducing the occurrence of a yarn breakage.

[0049] The upper surface of the yarn-introduction-pipe rail 71 is in contact with the contact member 70 in FIG. 6; however, when the yarn introduction pipe 14 moves down together with the yarn-introduction-pipe rail 71 at

the cake forming step S2 that will be described later, the upper surface of the yarn-introduction-pipe rail 71 is placed away from the contact member 70, as illustrated in FIG. 2. In this case, the yarn suction pipe 12 is positioned at the discharge position P2 by a contact of the stopper 69 with the upper surface of the fixed rail 66.

[0050] At the cake forming step S2, the yarn-introduction-pipe driving section drives the yarn introduction pipe 14 to reciprocate in the up-down direction at a predetermined cycle, thereby moving the position of the yarn introduction pipe 14 downward in stages. Accordingly, the yarn 18 is wound and deposited onto the inside wall 27 of the pot 15, while shifting its winding position, to form the cake 24. The formation of the cake 24 ends when the yarn cutting is performed. For yarn cutting, the rotation of the pair of back rollers 21 and the rotation of the pair of middle rollers 22 are both stopped with the pair of front rollers 23 rotating. This makes the yarn 18 forcibly cut downstream from the pair of middle rollers 22.

[0051] At the rewinding step S3, the yarn-introduction-pipe rail 71 moves up to move the yarn introduction pipe 14 upward, and the bobbin seat 31 moves up to move the bobbin 30 and a yarn loosening member 33 upward. This places the bobbin 30 in the pot 15. The yarn loosening member 33 touches a tail end 24b of the cake 24 on the winding end side at a top end of the yarn loosening member 33. Accordingly, the yarn of the cake 24 is loosened, and starts to wind onto the bobbin 30 from the inside wall 27 of the pot 15. After the whole yarn of the cake 24 is rewound onto the bobbin 30, the bobbin seat 31 moves down to move the bobbin 30 and the yarn loosening member 33 downward.

[0052] After that, the bobbin 30 wound with the yarn is removed from the bobbin attachment portion 32, and an empty bobbin 30 is attached to the bobbin attachment portion 32. The yarn suction pipe 12 is placed at the suction position P1 before the next draw-out step S1 starts. Subsequently, the above-described same operation is repeated.

<Advantageous effect of embodiment>

[0053] As described above, the pot spinning machine 1 according to the embodiment of the present disclosure includes the yarn-suction-pipe driving section 52, and the yarn-suction-pipe driving section 52 supports the yarn suction pipe 12 such that the yarn suction pipe 12 is movable in the direction of the central axis K of the pot 15, and shifts the position of the yarn suction pipe 12 between the suction position P1 and the discharge position P2. This configuration enables the yarn suction pipe 12 to be placed at the suction position P1 suitable for suction of the yarn 18, which has been drawn out by the drafting device 10, into the yarn suction pipe 12, and also to be placed at the discharge position P2 suitable for discharge of the yarn 18 into the pot 15. Therefore, this optimizes the position of the yarn suction pipe 12.

[0054] According to the embodiment of the present dis-

closure, the yarn-suction-pipe driving section 52 is configured to move the yarn suction pipe 12 from the discharge position P2 to the suction position P1 by using the driving force of the yarn-introduction-pipe driving section. This allows the configuration of the pot spinning machine 1 to be simplified in comparison with a yarn-suction-pipe driving section 52 provided with a dedicated driving mechanism.

[0055] According to the embodiment of the present disclosure, the pot spinning machine 1 includes the spring 68 that restores the yarn suction pipe 12 from the suction position P1 to the discharge position P2 by applying an urging force to the yarn suction pipe 12. This configuration ensures that the yarn suction pipe 12 is restored to the discharge position P2, in comparison with a case where the pot spinning machine is configured to restore the yarn suction pipe 12 from the suction position P1 to the discharge position P2 under the weight of the yarn suction pipe 12.

[0056] According to the embodiment of the present disclosure, the discharge position P2 is set to a position outside the detection area of the yarn sensor 11, so that the yarn suction pipe 12 does not interfere with the detection function of the yarn sensor 11 while the yarn 18 is discharged from the yarn introduction pipe 14 into the pot 15.

[0057] According to the embodiment of the present disclosure, the discharge position P2 is set to a position outside the intake air path of the pneumatic nozzle 17, so that the suction efficiency of the pneumatic nozzle 17 does not decrease while the yarn 18 is discharged from the yarn introduction pipe 14 into the pot 15.

<Modifications>

[0058] The technical scope of the present disclosure is not limited to the above embodiment, and may be modified or improved embodiments as long as those embodiments provide specific advantageous effects that can be achieved by constituent features of the present disclosure or their combinations.

[0059] For example, the yarn suction pipe 12 is formed separately from the yarn introduction pipe 14 in the above-described embodiment; however, the yarn suction pipe 12 may be formed integrally with the yarn introduction pipe 14. If this configuration is adopted, the discharge position P2 of the yarn suction pipe 12 is not set to a constant position, but may be shifted by elevation of the yarn introduction pipe 14.

[0060] In the above-described embodiment, the spring 68 serves as the urging member of the present disclosure; however, the urging member may be an elastic member, such as rubber. Alternatively, the yarn suction pipe 12 may be restored (move down) from the suction position P1 to the discharge position P2 under the weight of the yarn suction pipe 12, instead of using the urging member. However, the urging member is preferably used for secure restoring of the yarn suction pipe 12 to the

discharge position P2.

[0061] A pot spinning machine includes a yarn suction pipe (12), a pot (15), and a yarn introduction pipe (14). The yarn suction pipe (12) sucks in a yarn (18) drawn out by a drafting device (10). The pot (15) has a cylindrical shape. The yarn introduction pipe (14) introduces the yarn (18) supplied through the yarn suction pipe (12) into the pot (15). The pot spinning machine (1) includes a yarn-suction-pipe driving section (52). The yarn-suction-pipe driving section (52) supports the yarn suction pipe (12) such that the yarn suction pipe (12) is movable in a direction of a central axis (K) of the pot (15), and is configured to shift a position of the yarn suction pipe (12) between a first position (P1) and a second position (P2) that is closer to the pot (15) than the first position (P1).

of claims 1 to 3, **characterized in that**

the pot spinning machine further includes a yarn sensor (11) for detecting a state of the yarn (18) in a yarn path extending from the drafting device (10) to the yarn suction pipe (12), and the second position (P2) is set to a position outside a detection area of the yarn sensor (11).

5. The pot spinning machine (1) according to any one of claims 1 to 4, **characterized in that** the pot spinning machine (1) further includes a pneumatic nozzle (17) that is disposed in a vicinity of the drafting device (10) and takes in air, and the second position (P2) is set to a position outside an intake air path of the pneumatic nozzle (17).

Claims

1. A pot spinning machine (1) comprising:
 - a yarn suction pipe (12) that sucks in a yarn (18) drawn out by a drafting device (10);
 - a pot (15) having a cylindrical shape; and
 - a yarn introduction pipe (14) that introduces the yarn (18) supplied through the yarn suction pipe (12) into the pot (15), **characterized in that** the pot spinning machine (1) includes a yarn-suction-pipe driving section (52), and the yarn-suction-pipe driving section (52) supports the yarn suction pipe (12) such that the yarn suction pipe (12) is movable in a direction of a central axis (K) of the pot (15), and is configured to shift a position of the yarn suction pipe (12) between a first position (P1) and a second position (P2) that is closer to the pot (15) than the first position (P1).
2. The pot spinning machine (1) according to claim 1, **characterized in that** the pot spinning machine (1) further includes a yarn-introduction-pipe driving section (71) that is configured to move the yarn introduction pipe (14) in the direction of the central axis (K) of the pot (15), and the yarn-suction-pipe driving section (52) moves the yarn suction pipe (12) from the second position (P2) to the first position (P1) by using a driving force of the yarn-introduction-pipe driving section (71).
3. The pot spinning machine (1) according to claim 1 or 2, **characterized in that** the yarn-suction-pipe driving section (52) includes an urging member (68) that restores the yarn suction pipe (12) from the first position (P1) to the second position (P2) by applying an urging force to the yarn suction pipe (12).
4. The pot spinning machine (1) according to any one

FIG. 1

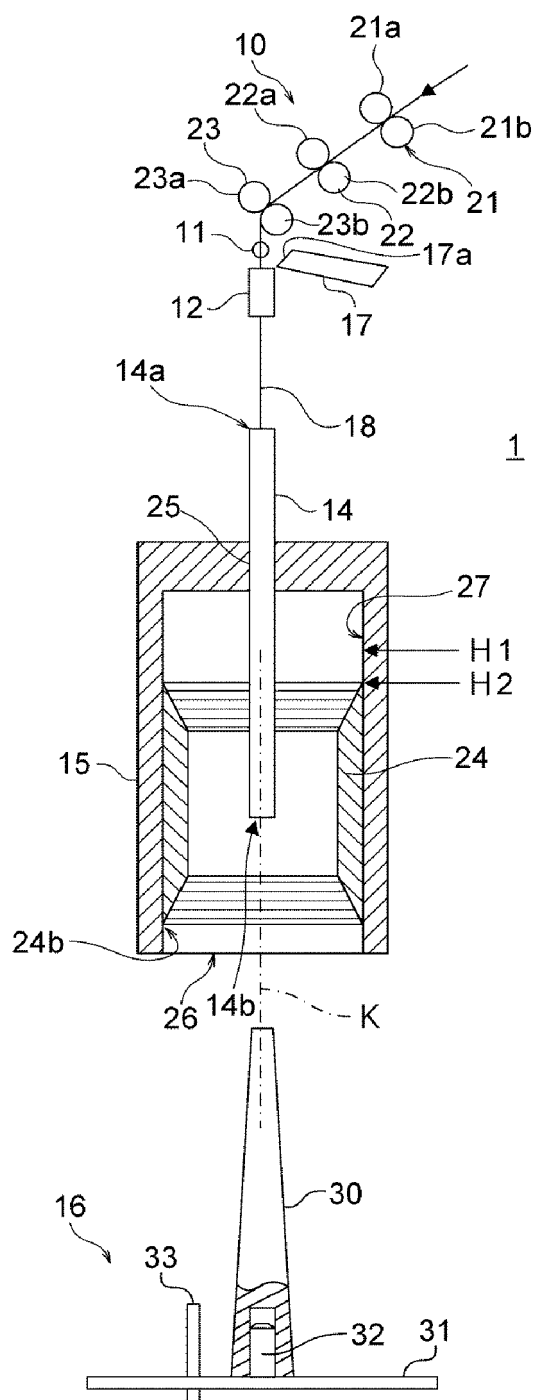


FIG. 2

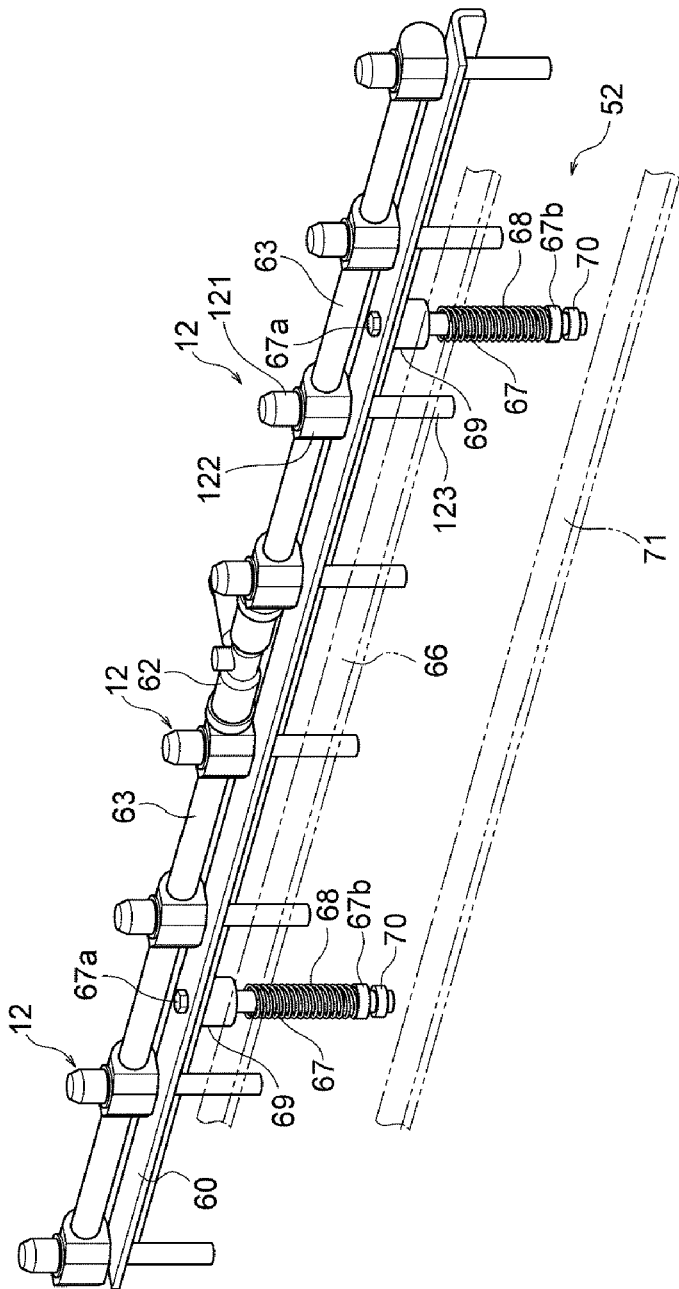


FIG. 3

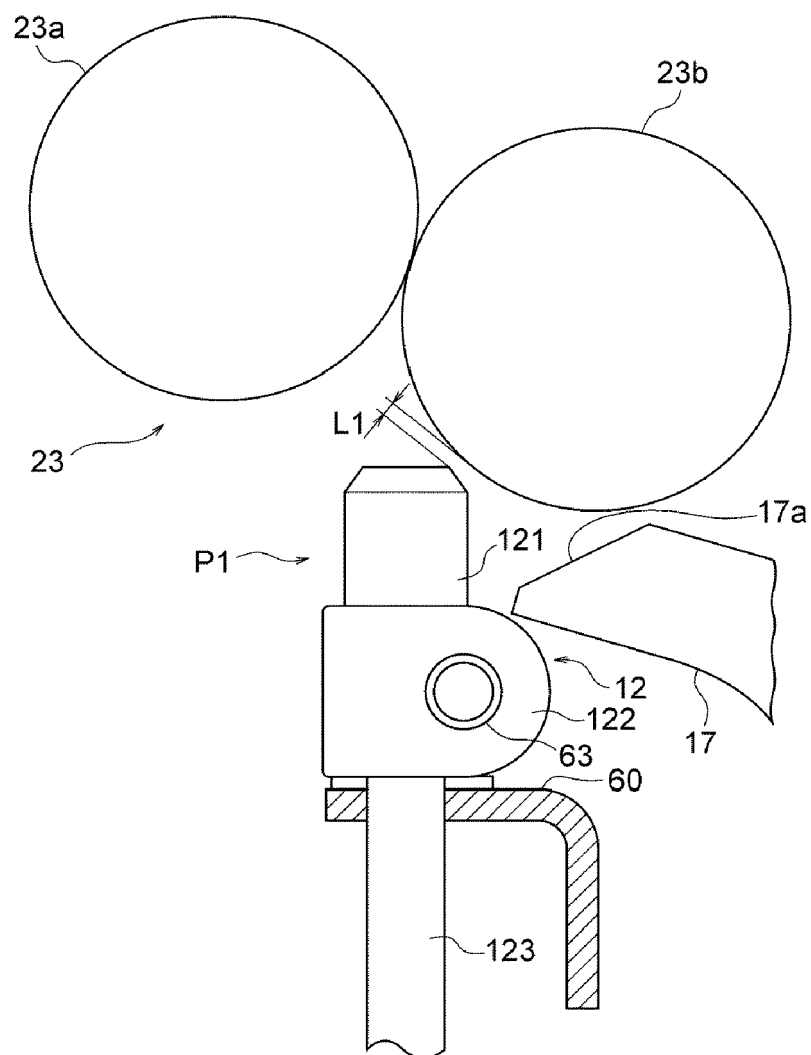


FIG. 4

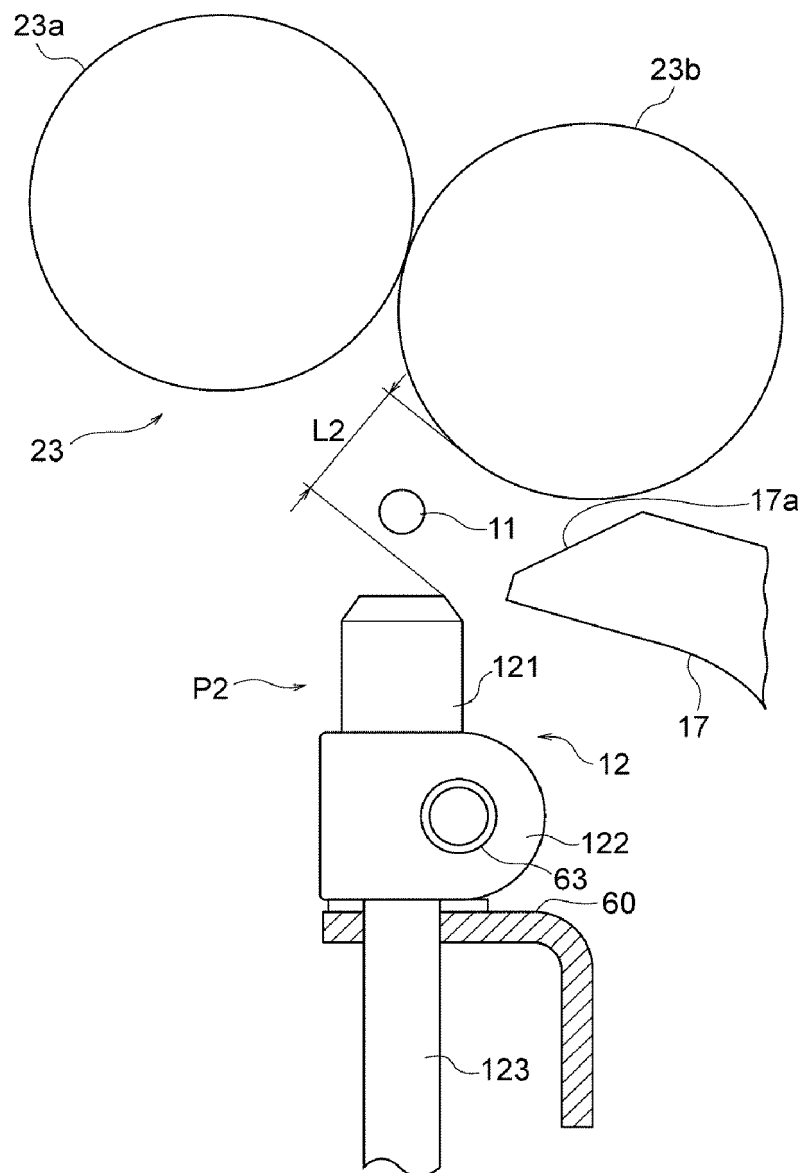


FIG. 5

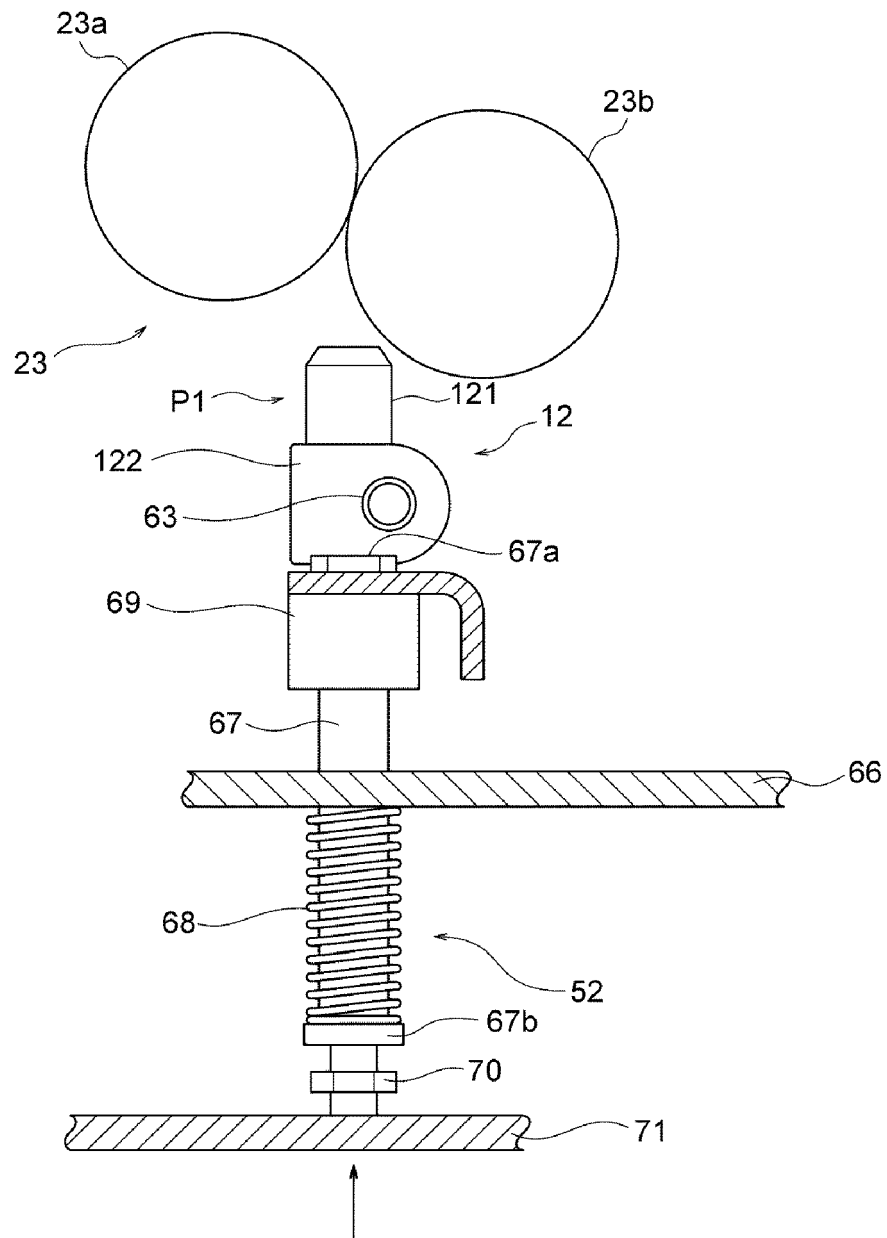
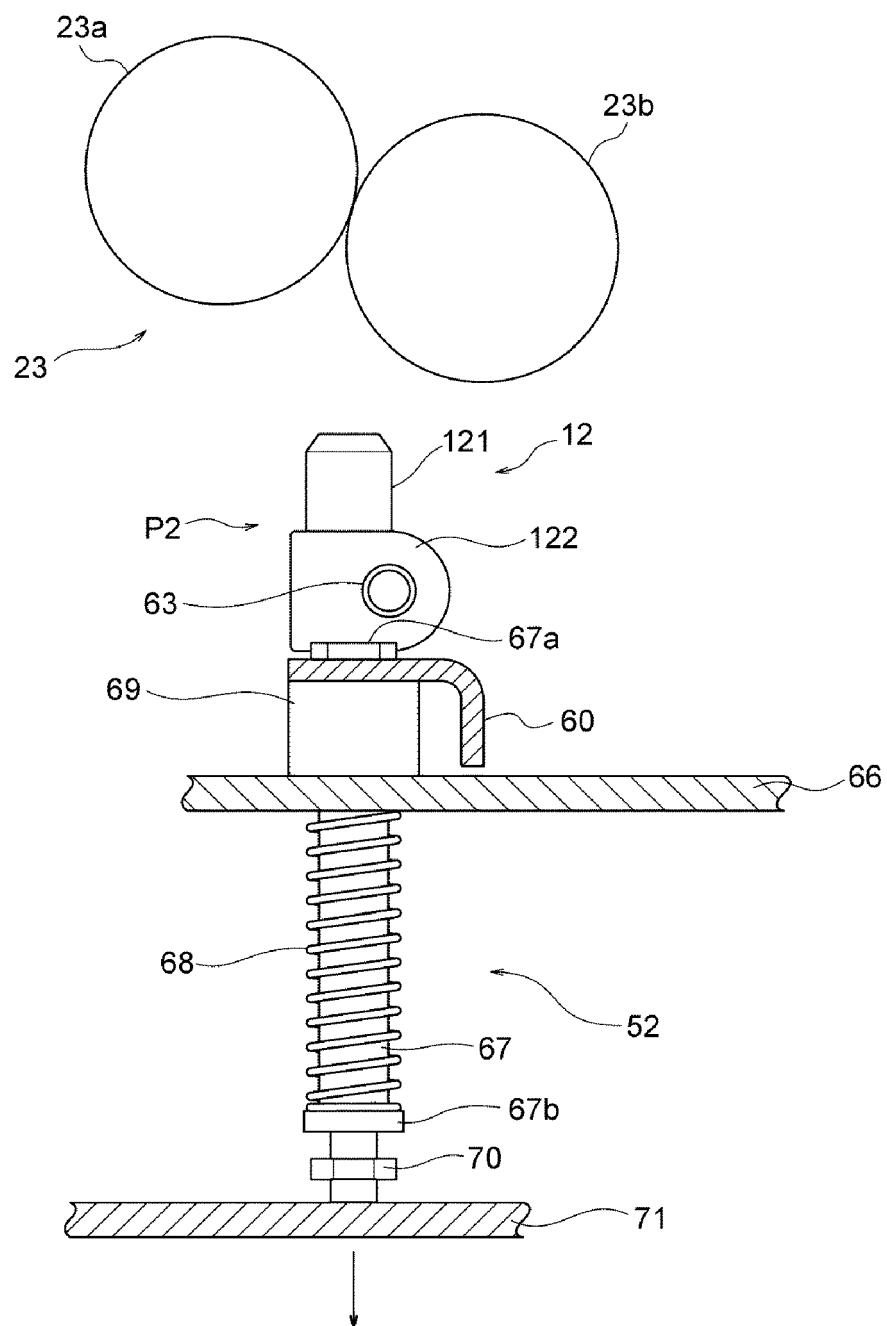


FIG. 6





EUROPEAN SEARCH REPORT

Application Number
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Place of search Munich		Date of completion of the search 11 September 2020	Examiner Humbert, Thomas
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