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(72) Inventors:
• **NAKAYAMA, Noboru**
Kyoto-shi, Kyoto 612-8686 (JP)
• **NAKAMURA, Yuta**
Kyoto-shi, Kyoto 612-8686 (JP)

(74) Representative: **Stöckeler, Ferdinand et al**
Schoppe, Zimmermann, Stöckeler
Zinkler, Schenk & Partner mbB
Patentanwälte
Radtkoferstrasse 2
81373 München (DE)

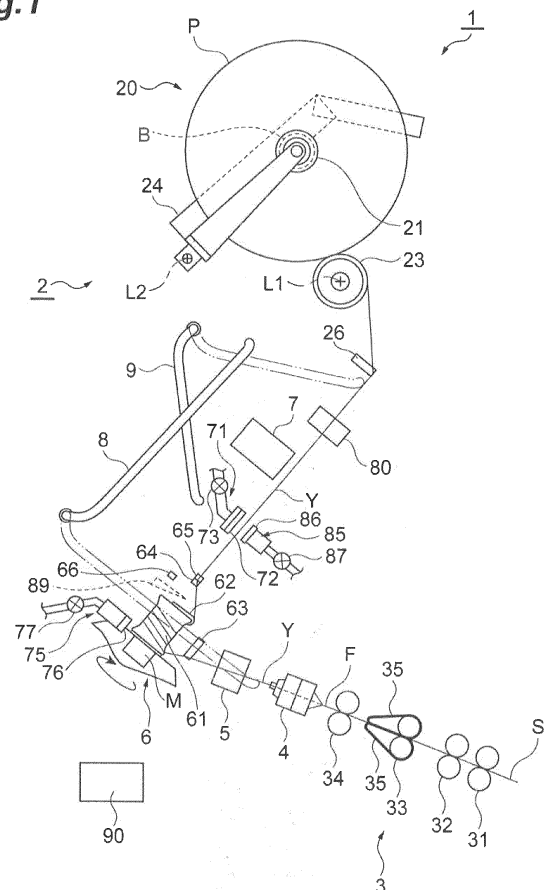
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(71) Applicant: **Murata Machinery, Ltd.**
Kyoto-shi,
Kyoto 601-8326 (JP)

(54) **SPINNING MACHINE AND YARN CATCHING METHOD**

(57) A spinning machine (1) includes: an air spinning device (4) configured to feed yarn (Y); a winding device (20) configured to wind the yarn (Y) to form a package (P); a yarn storing device (6) disposed between the air spinning device (4) and the winding device (20) and having a yarn storing roller (61) having an outer peripheral surface around which the yarn (Y) fed from the air spinning device (4) is wound to be temporarily stored; a first suction device (71) having a first suction inlet (72) disposed at a place along a yarn path between the yarn storing device (6) and the winding device (20), the first suction inlet (72) being configured such that a suction flow is produced at least while the yarn (Y) is traveling from the yarn storing device (6) to the winding device (20); and a second suction device (75) having a second suction inlet (76) disposed to face the yarn storing roller (61).

Fig.1



Description

TECHNICAL FIELD

[0001] The present disclosure relates to a spinning machine and a yarn catching method.

BACKGROUND

[0002] In a yarn winding process in a spinning machine, winding tension is controlled using a yarn storing device. For example, Patent Document 1 (Japanese Unexamined Patent Publication No. 2010-174421) discloses a spinning machine including a spinning device configured to twist a fiber bundle to form yarn, a winding device configured to wind the yarn formed by the spinning device to form a package, a yarn storing device disposed downstream of the spinning device to temporarily store the yarn, and a yarn suction device capable of producing a suction flow at a yarn suction inlet disposed in the vicinity of the outer peripheral surface of the yarn storing device. This spinning machine can efficiently prevent scattering of fiber waste and remove unnecessary yarn from the yarn storing device.

SUMMARY

[0003] In the conventional spinning machine described above, when the yarn is disconnected between the yarn storing device and the winding device, two yarn ends are formed, namely, a yarn end formed on the upstream side of the yarn wound as a package and a yarn end formed on the downstream side of the yarn stored in the yarn storing device. Furthermore, in the conventional spinning machine above, since the operation of the spinning device is stopped when yarn disconnection is detected between the yarn storing device and the winding device, a yarn end is also formed on the upstream side of the yarn stored in the yarn storing device. As a result, in the conventional spinning machine above, the disconnected yarn having two yarn ends remains in the yarn storing device. Since the yarn ends of the disconnected yarn are present in a free state, the disconnected yarn may get entangled with some places in the spinning machine. It is difficult to remove the entangled disconnected yarn by a mechanical method. Furthermore, the disconnected yarn stored in the yarn storing device may be significantly slackened, and portions of the disconnected yarn may overlap one another such that the yarn becomes entangled. Moreover, the disconnected yarn left in the spinning machine may cause trouble in the joining operation or yarn waste may be mixed into the package. An operator temporarily stops the yarn winding operation in the spinning machine, removes the disconnected yarn, and then resumes the winding operation.

[0004] An aspect of the present disclosure is aimed to provide a spinning machine and a yarn catching method capable of easily removing the disconnected yarn.

[0005] A spinning machine according to an aspect of the present disclosure includes a yarn feeding part configured to feed yarn, a winding device configured to wind the yarn to form a package, a yarn storing device disposed between the yarn feeding part and the winding device and having a yarn storing roller having an outer peripheral surface around which the yarn fed from the yarn feeding part is wound to be temporarily stored, a first suction device having a first suction inlet disposed at a place along a yarn path between the yarn storing device and the winding device, the first suction inlet being configured such that a suction flow is produced at least while the yarn is traveling from the yarn storing device to the winding device, and a second suction device having a second suction inlet disposed to face the yarn storing roller.

[0006] A yarn catching method according to an aspect of the present disclosure is performed in a spinning machine including a yarn feeding part configured to feed yarn, a winding device configured to wind the yarn to form a package, a yarn storing device disposed between the yarn feeding part and the winding device and having a yarn storing roller having an outer peripheral surface around which the yarn fed from the yarn feeding part is wound to be temporarily stored, a first suction device having a first suction inlet disposed at a place along a yarn path between the yarn storing device and the winding device, and a second suction device having a second suction inlet disposed to face the yarn storing roller. The yarn catching method includes: producing a suction flow at the first suction inlet at least while the yarn is traveling from the yarn storing device to the winding device; when the yarn is disconnected between the yarn storing device and the winding device, allowing the first suction device to suck a downstream-side end of the yarn at least partially stored in the yarn storing device; and when the yarn is disconnected between the yarn storing device and the winding device, allowing the second suction device to suck an upstream-side end of the yarn at least partially stored in the yarn storing device.

[0007] In the spinning machine and the yarn catching method, when the yarn is disconnected between the yarn storing device and the winding device, for example, the downstream-side end of the yarn (disconnected yarn) at least partially stored in the yarn storing device is caught by the first suction device having the first suction inlet configured such that a suction flow acts on the yarn at least while the yarn is traveling from the yarn feeding part to the winding device, and the upstream-side end of the disconnected yarn is caught by the second suction device. The disconnected yarn caught by the first suction device and the second suction device thus can be easily removed.

[0008] The spinning machine according to an aspect of the present disclosure may further include a transportation device configured to catch the yarn fed from the yarn feeding part and transport the caught yarn to a position between the yarn storing device and the winding

device in a state in which formation of the package by the winding device is suspended. In the spinning machine with this configuration, after the yarn is disconnected between the yarn storing device and the winding device, a yarn end newly fed from the yarn feeding part is transported to the joining device by the transportation device. Thus, the first suction device and the second suction device can be disposed at respective positions suitable for catching the yarn ends of the disconnected yarn.

[0009] In the spinning machine according to an aspect of the present disclosure, the yarn storing device may include a driving part configured to rotate the yarn storing roller in a winding direction in which the yarn storing roller is rotated when the yarn is wound around the outer peripheral surface of the yarn storing roller and in a removing direction in which the yarn storing roller is rotated when the yarn is removed from the yarn storing roller. The second suction inlet of the second suction device may be disposed such that a direction of velocity of the outer peripheral surface when the yarn storing roller rotates in the removing direction matches a direction of suction of the second suction inlet. In the spinning machine with this configuration, the disconnected yarn unwound from the yarn storing roller can be sucked without increasing a suction force of the second suction inlet in the second suction device.

[0010] In the spinning machine according to an aspect of the present disclosure, when the yarn is disconnected between the yarn storing device and the winding device, the first suction device may suck a downstream-side end of the yarn at least partially stored in the yarn storing device, and the second suction device may suck an upstream-side end of the yarn at least partially stored in the yarn storing device. In the spinning machine with this configuration, both ends of the disconnected yarn can be caught. As a result, entangling of the yarn due to portions of the disconnected yarn overlapping one another can be avoided, or the disconnected yarn can be prevented from being left in the spinning machine.

[0011] The spinning machine according to an aspect of the present disclosure may further include a yarn take-off guide configured to completely draw the downstream-side end of the yarn from the first suction device. In this configuration, the disconnected yarn drawn from the first suction device by the yarn take-off guide can be sucked by the second suction device, so that the disconnected yarn can be easily removed.

[0012] The spinning machine according to an aspect of the present disclosure may further include a control part configured to control the yarn storing device and the yarn take-off guide such that the downstream-side end of the yarn is completely drawn from the first suction device simultaneously with rotation of the yarn storing roller in a removing direction or after start of the rotation. The disconnected yarn is thus completely drawn from the first suction device, so that the disconnected yarn can be sucked and removed from the yarn storing roller by the second suction inlet of the second suction device.

[0013] The spinning machine according to an aspect of the present disclosure may further include a joining device configured to perform joining operation of joining the yarn fed by the yarn feeding part and the yarn wound by the winding device. The control part may control the yarn feeding part, the yarn storing device, the joining device, and the winding device. The control part may start the joining operation by the joining device after the yarn storing roller is rotated in the removing direction and the yarn disconnected between the yarn storing device and the winding device and left on the yarn storing roller is sucked and removed by the second suction device, and may start winding of the yarn by the winding device after the joining operation is completed. In the spinning machine with this configuration, the joining operation is performed and the winding operation is started in a state in which the disconnected yarn is not left in the yarn storing device. As a result, trouble can be prevented from occurring in the joining operation, or yarn waste can be prevented from being mixed into the package.

[0014] The spinning machine according to an aspect of the present disclosure may further include a blowing device configured to blow air toward the first suction inlet. In the spinning machine with this configuration, when the yarn is disconnected between the yarn storing device and the winding device, the blowing device blows the air toward the first suction inlet to further ensure that the yarn end of the disconnected yarn is sucked by the first suction inlet.

[0015] The spinning machine according to an aspect of the present disclosure may include an air spinning device configured to form the yarn by twisting fiber bundle with an air flow. In the spinning machine including the air spinning device, when the yarn is disconnected between the yarn storing device and the winding device, generation of the yarn by the air spinning device is stopped and therefore a yarn end is formed on the upstream side of the yarn storing device. Therefore, by providing the first suction device and the second suction device as described above, entanglement of the disconnected yarn can be avoided.

[0016] The spinning machine according to an aspect of the present disclosure may further include a cutting device configured to cut the yarn caught by the first suction device and the second suction device. In the spinning machine with this configuration, the disconnected yarn cut into two pieces can be sucked and removed by the first suction device and the second suction device, respectively.

[0017] In the spinning machine according to an aspect of the present disclosure, the yarn storing device may be disposed below the winding device in a vertical direction. When the yarn storing device is disposed below the winding device, it is more likely that the downstream-side end of the yarn disconnected between the yarn storing device and the winding device hangs down, and portions of the yarn overlaps such that the yarn becomes entangled, or the cut yarn is left in the spinning machine. In the spinning

machine with this configuration, the disconnected yarn is caught by the first suction device and the second suction device, thereby avoiding the troubles described above.

[0018] According to an aspect of the present disclosure, the disconnected yarn can be easily removed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a schematic configuration diagram illustrating a configuration of a spinning machine of an embodiment.

FIG. 2 is a plan view of the yarn storing device in FIG. 1 as viewed from above a rotation axis.

FIG. 3 is a functional block diagram of the spinning machine in FIG. 1.

FIG. 4 is a flowchart illustrating an operation performed after disconnection of yarn in the spinning machine of an embodiment.

DETAILED DESCRIPTION

[0020] Preferred embodiments of an aspect of the present disclosure will be described in detail below with reference to the accompanying drawings. In the description of the drawings, the same or corresponding elements are denoted by the same reference signs and an overlapping description will be omitted.

[0021] As illustrated in FIG. 1, a spinning machine 1 includes spinning units 2 and a control part 90. The spinning units 2 are arranged in a row. Each spinning unit 2 drafts sliver (fiber bundle) S to form fiber bundle F, twists the fiber bundle F using a swirl air flow to form yarn Y, and winds the yarn Y around a bobbin B to form a package P. The control part 90 controls the operation of the spinning machine 1.

[0022] The control part 90 is configured with, for example, a machine control device and a plurality of unit controllers. The machine control device is a host controller for a plurality of unit controllers. The unit controllers are provided for a predetermined number (one or more) of spinning units 2 and each control the corresponding spinning unit 2. The control performed by the control part 90 will be detailed later. The control part 90 may be configured only with unit controllers.

[0023] Hereinafter, the upstream side in the traveling direction of sliver S, fiber bundle F, and yarn Y during winding of a package P is referred to as "upstream side" and the downstream side in the traveling direction is referred to as "downstream side". One side in a horizontal direction perpendicular to the arrangement direction of a plurality of spinning units 2 (for example, the working passage side) is referred to as "front side", and the other side in the horizontal direction is referred to as "rear side". The upper side in the vertical direction with respect to the installation surface of the spinning machine 1 is re-

ferred to as "upper side" and the lower side in the vertical direction is referred to as "lower side".

[0024] Each spinning unit 2 includes, in order from the upstream side toward the downstream side, a drafting device (yarn feeding part) 3, an air spinning device (yarn feeding part) 4, a yarn monitoring device 5, a yarn storing device 6, a joining device 7, a yarn sensor 80, and a winding device 20. Each spinning unit 2 further includes a first catch guide device 8, a second catch guide device 9, a first suction device 71, a second suction device 75, and a blowing device 85. As an example, the traveling direction of the sliver S, the fiber bundle F, and the yarn Y from the drafting device 3 to the yarn storing device 6 is the direction from the front side toward the rear side and is inclined to the upper side relative to the horizontal direction. The traveling direction of the yarn Y from the yarn storing device 6 to the winding device 20 is the direction from the lower side toward the upper side and inclined to the front side relative to the vertical direction. In each spinning unit 2, the traveling direction of yarn Y is switched at the yarn storing device 6.

[0025] The drafting device 3 drafts the sliver S to form the fiber bundle F and feeds the fiber bundle F to the air spinning device 4. The drafting device 3 includes, in order from the upstream side toward the downstream side, a back roller pair 31, a third roller pair 32, a middle roller pair 33, and a front roller pair 34. An apron belt 35 is stretched around each of the rollers of the middle roller pair 33.

[0026] The air spinning device 4 twists the fiber bundle F from the drafting device 3 using a swirl air flow to form the yarn Y. The air spinning device 4 includes a nozzle block (not illustrated in the drawings) and a hollow guide shaft (not illustrated in the drawings). In the nozzle block, the fiber bundle F fed from the drafting device 3 is guided to the inside and meanwhile, a swirl air flow acts on the fiber bundle F. The twisted fiber bundle F passes through the inside of the hollow guide shaft and is discharged to the outside. The production and stopping of the swirl air flow is controlled by, for example, the unit controller.

[0027] The yarn monitoring device 5 monitors information on the traveling yarn Y and detects whether there is a yarn defect based on the monitored information. When detecting a yarn defect, the yarn monitoring device 5 transmits a yarn defect detection signal to the control part 90.

[0028] The yarn storing device 6 is disposed between the air spinning device 4 and the winding device 20 to temporarily store the yarn Y fed from the air spinning device 4 by winding the yarn Y around a yarn storing roller 61. The yarn storing device 6 is disposed below the winding device 20 in the vertical direction. The yarn storing device 6 includes a yarn storing roller 61 and a hooking member 62.

[0029] The yarn storing roller 61 is rotated by an electric motor (driving part) M. The electric motor M rotates the yarn storing roller 61 in a winding direction in which the yarn storing roller 61 is rotated (forward rotation) when

the yarn Y is wound around the outer peripheral surface of the yarn storing roller 61 and in a removing direction in which the yarn storing roller 61 is rotated (reverse rotation) when the yarn Y is removed from the yarn storing roller 61. The hooking member 62 is mounted on the downstream end of the yarn storing roller 61 and is rotatable relative to the yarn storing roller 61. A magnetic force acts upon the hooking member 62 to interfere with rotation of the hooking member 62 relative to the yarn storage roller 61. Therefore, in a state in which a certain tension or higher is not exerted on the yarn Y, the hooking member 62 rotates integrally with the yarn storing roller 61, so that the yarn Y is wound (stored) around the yarn storing roller 61. In a state in which a certain tension or higher is exerted on yarn Y, the hooking member 62 rotates relative to the yarn storing roller 61, so that the yarn Y is unwound from the yarn storing roller 61. The yarn storing device 6 stores the yarn Y in this way to accommodate variations in tension exerted on the yarn Y on the downstream side of the yarn storing device 6 and stably draw (feed out) the yarn Y from the air spinning device 4.

[0030] A first guide 63 is disposed upstream of the yarn storing device 6. The first guide 63 guides the yarn Y traveling from the upstream side to the yarn storing device 6. The first guide 63 is provided so as to be movable. Before the winding of a package P by the winding device 20 is started, the yarn Y newly fed from the air spinning device 4 is caught by the first catch guide device 8 and guided to a joining position. Subsequently, before joining operation is performed, the first guide 63 moves to pull the yarn Y from the air spinning device 4 toward the yarn storing device 6.

[0031] A second guide 64, a third guide 65, and a fourth guide (yarn take-off guide) 66 are disposed downstream of the yarn storing device 6. The second guide 64 and the third guide 65 guide the yarn Y traveling from the yarn storing device 6 to the downstream side. The second guide 64 is provided so as to be movable and can guide the yarn Y to the third guide 65. The fourth guide 66 is provided so as to be movable. The fourth guide 66 moves to allow the yarn Y to be hooked on the hooking member 62 or allows the yarn Y to be removed from the hooking member 62.

[0032] Since the operation of the air spinning device 4 stops when the yarn Y is disconnected between the yarn storing device 6 and the winding device 20, the yarn Y is also disconnected between the yarn storing device 6 and the air spinning device 4. As a result, disconnected yarn YD is generated which is at least partially stored in the yarn storing device 6 and has an upstream-side yarn end and a downstream-side yarn end. The downstream-side end YD2 of the disconnected yarn YD is sucked by the first suction device 71. The fourth guide 66 completely draws (pulls out) the downstream-side end YD2 from the first suction device 71.

[0033] The joining device 7 performs joining operation of joining the yarn Y from the air spinning device 4 and

the yarn Y from the package P when the yarn Y is cut or disconnected or the yarn Y breaks for some reason. The joining device 7 is a splicer that twists yarn ends together using a swirl air flow. The joining device 7 may be a mechanical knotter. Each of the first catch guide device 8 and the second catch guide device 9 can swing about its base end portion. For example, when joining operation is to be performed, the first catch guide device (transportation device) 8 swings downward to catch the yarn Y from the air spinning device 4 using a suction air flow and thereafter swings upward to guide (transport) the yarn Y from the air spinning device 4 to the joining device 7 disposed between the yarn storing device 6 and the winding device 20. When joining operation is to be performed, the second catch guide device 9 swings upward to catch the yarn Y from the package P using a suction air flow and thereafter swings downward to guide the yarn Y from the package P to the joining device 7. The joining device 7 connects the guided yarns Y.

[0034] The yarn sensor 80 is disposed between the joining device 7 and the winding device 20 to detect whether the yarn Y is fed to the winding device 20. Information on the absence/presence of the yarn Y as detected by the yarn sensor 80 is output to the control part 90.

[0035] The winding device 20 winds the yarn Y drawn from the air spinning device 4 by the yarn storing device 6 onto a bobbin B to form a package P. The winding device 20 includes a drum 23, a pair of bobbin holders 21, and a cradle 24. A yarn guide 26 is disposed upstream of the winding device 20. The yarn guide 26 guides the yarn Y traveling from the upstream to the drum 23.

[0036] The drum 23 makes contact with the bobbin B to rotate the bobbin B. In a state in which yarn Y is wound around the bobbin B, the drum 23 is in contact with the package P to rotate the package P. The drum 23 is rotatably supported by a frame (not illustrated in the drawings) and rotated around a rotation axis L1 by a drum driving part (not illustrated in the drawings) provided for each spinning unit 2. The surface of the drum 23 has a traverse groove (not illustrated in the drawings). Accordingly, the yarn Y is traversed when the yarn Y is wound onto the bobbin B.

[0037] The cradle 24 is provided so as to be swingable about a swinging axis L2. The cradle 24 swings about the swinging axis L2 to accommodate increase in diameter of the package P accompanying winding of the yarn Y onto the bobbin B. A pair of bobbin holders 21 are provided on the cradle 24 to rotatably hold both ends of the bobbin B.

[0038] The first suction device 71 has a first suction inlet 72 disposed at a place along a yarn path between the yarn storing device 6 and the winding device 20. The first suction inlet 72 is configured such that a suction flow is produced at least while the yarn Y is traveling from the yarn storing device 6 to the winding device 20. A suction flow is produced at the first suction inlet 72 while the spinning unit 2 continues to form a package P and while joining operation is performed even when formation of a

package P is suspended. In other words, when there is a possibility that disconnected yarn YD may be formed, a suction flow is produced at the first suction inlet 72. Conversely, when there is no possibility that disconnected yarn YD is formed, a suction flow at the first suction inlet 72 may be stopped. For example, when the operation of the spinning unit 2 is stopped, for example, due to maintenance of the spinning unit 2, or when the package P is full and the spinning unit 2 waits for doffing operation, a suction flow may not be produced at the first suction inlet 72.

[0039] The first suction device 71 is fixed to, for example, a frame (not illustrated in the drawings) such that the first suction inlet 72 is unmovable. The first suction inlet 72 is connected to a suction source (not illustrated in the drawings). The suction force of the first suction inlet 72 is turned on/off through control of opening/closing of a shutter 73 by the control part 90. When the yarn Y is disconnected between the yarn storing device 6 and the winding device 20, the first suction device 71 sucks the downstream-side end YD2 (see FIG. 2) of the disconnected yarn YD. The shutter 73 is provided between the suction source and the first suction inlet 72. The suction force of the first suction inlet 72 may be turned on/off by controlling the operation of the suction source by the control part 90, instead of providing the shutter 73. During the time when power of the spinning machine 1 is on, a suction flow may be always produced at the first suction inlet 72. In this case, the control to turn off the suction force of the first suction inlet 72 is not performed.

[0040] The second suction device 75 has a second suction inlet 76 disposed to face the outer peripheral surface of the yarn storing roller 61 of the yarn storing device 6. When the yarn sensor 80 does not detect the yarn Y (when the yarn Y is disconnected), sucking by the second suction device 75 is started, and the second suction inlet 76 sucks the disconnected yarn YD. The second suction inlet 76 is disposed at a position where suction force acts on the outer peripheral surface of the yarn storing roller 61 so that the yarn Y wound around the outer peripheral surface can be sucked. The second suction inlet 76 is connected to a suction source (not illustrated in the drawings). The suction force of the second suction inlet 76 is turned on/off through control of opening/closing of a shutter 77 by the control part 90. As illustrated in FIG. 2, the second suction inlet 76 is disposed so as to be positioned on an extension line in the tangent direction to the yarn storing roller 61 and in the rotating direction (removing direction) of the yarn storing roller 61 in reverse rotation when removing the disconnected yarn YD stored in the yarn storing roller 61. The second suction inlet 76 is disposed such that a direction of velocity of the outer peripheral surface of the yarn storing roller 61 when the yarn storing roller 61 rotates in the removing direction matches a direction of suction of the second suction inlet 76. When the yarn Y is disconnected between the yarn storing device 6 and the winding device 20, the second suction device 75 sucks the upstream-side end YD1 of

the disconnected yarn YD.

[0041] The blowing device 85 is disposed to face the first suction inlet 72 with the yarn path interposed. The blowing device 85 has a blowing port 86 to blow the compressed air toward the first suction inlet 72. The blowing port 86 is connected to a compressed air source (not illustrated in the drawings). The blowing of the air from the blowing port 86 is turned on/off through control of opening/closing of a solenoid valve of a shutter 87 by the control part 90. When the yarn Y is disconnected between the yarn storing device 6 and the winding device 20, the blowing device 85 blows the compressed air to the first suction inlet 72 to assist the first suction device 71 to catch the disconnected yarn YD. That is, the blowing device 85 blows the compressed air to feed the yarn Y to the first suction inlet 72. The blowing device 85 also prevents slacking of the yarn Y that may occur immediately after joining operation by blowing the compressed air toward the yarn Y immediately after the joining operation.

[0042] The control part 90 is an electronic control unit including a central processing unit (CPU), a read only memory (ROM), and a random access memory (RAM), etc. The control part 90 executes various controls by loading a program stored in the ROM into the RAM and running the program on the CPU.

[0043] When receiving a yarn defect detection signal from the yarn monitoring device 5 or when receiving information that there is no yarn Y detected by the yarn sensor 80, the control part 90 stops the operation of the drafting device 3 and the air spinning device 4 to suspend feeding of the yarn Y in order to disconnect the yarn Y. The control part 90 may, for example, allow a cutter in the yarn monitoring device 5 to operate in order to disconnect the yarn Y. Alternatively, a dedicated cutter for cutting the yarn Y may be provided, and the control part 90 may control the cutter to cut the yarn Y.

[0044] As illustrated in FIG. 3, the control part 90 mainly uses information input from the yarn sensor 80 and controls the air spinning device 4, the yarn storing device 6, the joining device 7, the first catch guide device 8, the second catch guide device 9, the fourth guide 66, the first suction device 71, the second suction device 75, and the blowing device 85 to complete the joining operation while removing the disconnected yarn YD.

[0045] The control part 90 controls the yarn storing device 6 and the fourth guide 66 such that the downstream-side end YD2 of the disconnected yarn YD is completely drawn from the first suction inlet 72 simultaneously with reverse rotation of the yarn storing roller 61 in the direction in which the disconnected yarn YD left on the yarn storing roller 61 is removed (unwound) or after the start of the reverse rotation. As used herein, "the downstream-side end YD2 of the disconnected yarn YD is completely drawn from the first suction inlet 72" means that the downstream-side end YD2 of the disconnected yarn YD is drawn to the position where a suction flow produced at the first suction inlet 72 does not act on the disconnected yarn YD. After reversely rotating the yarn storing roller

61 and having the downstream-side end YD2 of the disconnected yarn YD sucked and removed by the second suction device 75, the control part 90 starts joining operation by the joining device 7, and after the joining operation is completed, starts winding of the yarn Y by the winding device 20.

[0046] The yarn catching method carried out in the joining operation performed after the yarn Y is disconnected between the yarn storing device 6 and the winding device 20 will now be described in detail with reference to FIG. 4.

[0047] When the yarn Y is disconnected between the yarn storing device 6 and the winding device 20, the downstream-side end YD2 is formed on the downstream side of the disconnected yarn YD stored in the yarn storing device 6. The control part 90 detects the disconnection of the yarn Y between the yarn storing device 6 and the winding device 20 (step S1). Specifically, the control part 90 determines the disconnection of the yarn Y between the yarn storing device 6 and the winding device 20, based on the information that there is no yarn Y detected by the yarn sensor 80. When detecting the disconnection of the yarn Y between the yarn storing device 6 and the winding device 20, the control part 90 stops the operation of the drafting device 3 and the air spinning device 4 (step S2). Stopping the operation of the drafting device 3 and the air spinning device 4 causes formation of the upstream-side end YD1 of the disconnected yarn YD. The first suction device 71, configured such that a suction flow is produced at least while the yarn Y is traveling from the yarn storing device 6 to the winding device 20, catches the disconnected yarn YD (step S3). When the yarn sensor 80 detects the disconnection of the yarn Y, the control part 90 actuates the blowing device 85 to assist the first suction device 71 to suck the disconnected yarn YD. The assistance by the blowing device 85 may be omitted. The control part 90 stops the rotation of the yarn storing roller 61 (step S4).

[0048] Subsequently, the control part 90 starts suction by the second suction device 75 (step S5). Specifically, the control part 90 performs control to open the shutter 77. The control part 90 starts reverse rotation of the yarn storing roller 61 (step S6) and allows the second suction device 75 to catch the disconnected yarn YD (step S7). The disconnected yarn YD is thus caught by the first suction device 71 and the second suction device 75. More specifically, the downstream-side end YD2 of the disconnected yarn YD is sucked by the first suction device 71 and the upstream-side end YD1 is sucked by the second suction device 75.

[0049] In this state, the control part 90 starts to move the fourth guide 66 such that the downstream-side end YD2 of the disconnected yarn YD sucked by the first suction device 71 is completely drawn from the first suction inlet 72 (step S8). The downstream-side end YD2 of the disconnected yarn YD thus moves to the yarn storing device 6, and the disconnected yarn YD is then sucked from the upstream-side end YD1 by the second suction device 75 (step S9). Through the operation at step S1 to

step S9, the disconnected yarn YD can be sucked and removed. Although steps S1 to S9 are performed in order in the description above, some steps may be performed almost simultaneously.

[0050] In a state in which the disconnected yarn YD is thus sucked and removed, the control part 90 controls the second catch guide device 9 such that yarn Y on the winding device 20 side is guided to the joining device 7. Subsequently, the control part 90 resumes the operation of the drafting device 3 and the air spinning device 4 and controls the first catch guide device 8 such that yarn Y fed from the air spinning device 4 is guided to the joining device 7. The control part 90 controls the joining device 7 to perform joining operation of joining the yarn end of the yarn Y guided by the first catch guide device 8 and the yarn end of the yarn Y guided by the second catch guide device 9. The control part 90 controls the winding device 20 to start winding of the yarn Y simultaneously with or after completion of the joining operation.

[0051] The yarn catching method described above is performed, for example, by loading a yarn catching control program stored in the ROM and the like into the RAM and running the program on the CPU. Such a yarn catching control program may be stored in a non-transitory storage medium readable by an electronic control unit (computer). Examples of the non-transitory storage medium include compact disc, flexible disk, hard disk, magneto-optical disk, digital video disk, magnetic tape, and semiconductor memory.

[0052] The operation effects of the spinning machine 1 in an embodiment described above will now be described. In the spinning machine 1 in the present embodiment, the downstream-side end YD2 of the disconnected yarn YD is caught by the first suction device 71 having the first suction inlet 72 configured such that a suction flow is produced at least while the yarn Y is traveling from the yarn storing device 6 to the winding device 20. The upstream-side end YD1 of the disconnected yarn YD is caught by the second suction device 75 having the second suction inlet 76 disposed to face the yarn storing roller 61. This prevents the disconnected yarn YD caught by the first suction device 71 and the second suction device 75 from being entangled around parts arranged near the yarn storing device 6. The disconnected yarn YD can be readily removed manually. The disconnected yarn YD caught by the first suction device 71 and the second suction device 75 may be cut, for example, by a cutter, and the disconnected yarn YD may be sucked and removed by the first suction device 71 and/or the second suction device 75.

[0053] In the spinning machine 1 in the foregoing embodiment, as illustrated in FIG. 2, the second suction inlet 76 of the second suction device 75 is disposed so as to be positioned on the extension line in the rotation direction (reverse rotation direction illustrated in FIG. 2) of the yarn storing roller 61 in reverse rotation when removing the yarn Y (disconnected yarn YD) stored in the yarn storing roller 61, and in the tangent direction. The dis-

connected yarn YD thus can be sucked and removed from the yarn storing roller 61 without relatively increasing the suction force of the second suction device 75.

[0054] In the spinning machine 1 in the foregoing embodiment, both ends of the disconnected yarn YD are caught by the first suction device 71 and the second suction device 75, respectively. This can avoid entanglement of the disconnected yarn YD due to portions of the disconnected yarn YD being overlapped with one another or avoid the disconnected yarn YD being left in the spinning unit 2.

[0055] The spinning machine 1 in the foregoing embodiment includes the fourth guide 66 to completely draw the downstream-side end YD2 from the first suction device 71 that sucks the downstream-side end YD2 of the disconnected yarn YD. The downstream-side end YD2 of the disconnected yarn YD, which both ends are temporarily caught, is completely drawn from the first suction device 71. This enables the second suction device 75 to suck and remove the disconnected yarn YD.

[0056] In the spinning machine 1 in the foregoing embodiment, the yarn storing device 6 and the fourth guide 66 are controlled such that the downstream-side end YD2 of the disconnected yarn YD is completely drawn from the first suction device 71 simultaneously with rotation (reverse rotation) of the yarn storing roller 61 in the removing direction or after the start of the reverse rotation. Accordingly, the disconnected yarn YD completely drawn from the first suction inlet 72 of the first suction device 71 can be guided to the second suction inlet 76 of the second suction device 75.

[0057] In the spinning machine 1 in the foregoing embodiment, after the yarn storing roller 61 of the yarn storing device 6 is reversely rotated and the second suction device 75 sucks and removes the disconnected yarn YD, the joining operation by the joining device 7 is started. After the joining operation is completed, the winding of yarn Y by the winding device 20 is started. Thus, the joining operation and the winding operation are performed in a state in which the disconnected yarn YD is not left in the yarn storing device 6. As a result, trouble can be prevented from occurring in the joining operation, or yarn waste can be prevented from being mixed into the package P.

[0058] The spinning machine 1 in the foregoing embodiment includes the blowing device 85 to blow the air toward the first suction inlet 72. This facilitates suction of the disconnected yarn YD by the first suction inlet 72. However, the blowing device 85 may be eliminated.

[0059] In the spinning machine 1 in the foregoing embodiment, the first catch guide device 8 is provided, separately from the first suction device 71. After the yarn Y is disconnected, when the feeding of the yarn Y from the spinning device 4 is started (in a state in which formation of the package P by the winding device 20 is suspended), the first catch guide device 8 catches the yarn Y fed from the air spinning device 4 and guides (transports) the caught yarn Y to the joining device 7.

[0060] Although the embodiment according to an aspect of the present disclosure has been described above, an aspect of the present disclosure is not limited to the foregoing embodiment.

[0061] In the spinning machine 1 in the foregoing embodiment, an example in which the yarn storing device 6 is disposed below the winding device 20 in the vertical direction, that is, an example in which the yarn Y travels from the lower side to the upper side has been described by way of example. However, an aspect of the present disclosure may be applied to a spinning machine having a configuration in which the devices are disposed such that the yarn storing device 6 is disposed above the winding device 20 and the yarn Y fed from the upper side is wound at the lower side. In the spinning machine according to the modification in which the yarn storing device 6 is disposed above the winding device 20, even when the yarn Y is disconnected between the yarn storing device 6 and the winding device 20, the downstream-side end YD2 of the disconnected yarn YD rarely hangs down. Therefore, it is less likely that the disconnected yarn YD overlaps and thus the disconnected yarn YD is entangled or the disconnected yarn YD is left in the spinning unit 2.

[0062] In the foregoing embodiment, the disconnected yarn YD is sucked and removed using the second suction device 75. However, the disconnected yarn YD may be collected using in combination, a waste yarn collecting device or the like provided in the vicinity of the yarn storing device 6.

[0063] In the foregoing embodiment, the fourth guide 66 is used as means for releasing one of both ends of the disconnected yarn YD caught by the first suction device 71 and the second suction device 75. However, an aspect of the present disclosure is not limited to this example. As indicated by the dashed line in FIG. 1, a cutting device 89 may be separately provided for cutting the disconnected yarn YD between the downstream-side end YD2 and the upstream-side end YD1 of the disconnected yarn YD. If the disconnected yarn YD having both ends caught by the first suction device 71 and the second suction device 75 is cut, one of the cut disconnected yarn YD can be sucked and removed by the first suction device 71 and the other disconnected yarn YD can be sucked and removed by the second suction device 75.

[0064] The winding device 20 is not limited to the type in which the drum 23 is rotationally driven to rotate the bobbin B in contact with the drum 23. Alternatively, the bobbin B may be rotationally driven to rotate the drum 23 in contact with the bobbin B (package P). In other words, the drum 23 may be any drum that rotates in contact with the bobbin B (package P). The surface of the drum 23 may not have a traverse groove, and a traverse device separately provided may traverse the yarn Y when the yarn Y is wound onto the bobbin B.

[0065] In the spinning unit 2, the traveling direction of yarn Y is switched in the yarn storing device 6. However, the traveling direction of the yarn Y may not be switched in the yarn storing device 6. A delivery roller and a nip

roller may be disposed between the air spinning device 4 and the yarn storing device 6 in order to draw yarn Y from the air spinning device 4. The yarn monitoring device 5 may be disposed between the yarn storing device 6 and the winding device 20.

[0066] In the foregoing embodiment, the first suction device 71 has the first suction inlet 72 configured such that a suction flow is produced at least while the yarn Y is traveling from the yarn storing device 6 to the winding device 20. However, the first suction device 71 may have the first suction inlet 72 that is always in a sucking state. That is, the spinning machine may include a yarn feeding part configured to feed yarn, a winding device configured to wind the yarn to form a package, a yarn storing device disposed between the yarn feeding part and the winding device and having a yarn storing roller having an outer peripheral surface around which the yarn fed from the yarn feeding part is wound to be temporarily stored, a first suction device having a first suction inlet disposed at a place along a yarn path between the yarn storing device and the winding device and always provided in a sucking state, and a second suction device having a second suction inlet disposed to face the yarn storing roller.

[0067] At least some of the embodiments described above may be combined as desired.

[0068] A spinning machine according to an aspect of the present disclosure includes a yarn feeding part configured to feed yarn, a winding device configured to wind the yarn to form a package, a yarn storing device disposed between the yarn feeding part and the winding device and having a yarn storing roller having an outer peripheral surface around which the yarn fed from the yarn feeding part is wound to be temporarily stored, a transportation device configured to catch the yarn fed from the yarn feeding part and transport the caught yarn to a position between the yarn storing device and the winding device in a state in which formation of the package by the winding device is suspended, a first suction device having a first suction inlet disposed at a place along a yarn path between the yarn storing device and the winding device, and a second suction device having a second suction inlet disposed to face the yarn storing roller.

[0069] A yarn catching method according to an aspect of the present disclosure is performed in a spinning machine including a yarn feeding part configured to feed yarn, a winding device configured to wind the yarn to form a package, a yarn storing device disposed between the yarn feeding part and the winding device and having a yarn storing roller having an outer peripheral surface around which the yarn fed from the yarn feeding part is wound to be temporarily stored, a transportation device configured to catch the yarn fed from the yarn feeding part and transport the caught yarn to a position between the yarn storing device and the winding device in a state in which formation of the package by the winding device is suspended, a first suction device having a first suction inlet disposed at a place along a yarn path between the

yarn storing device and the winding device, and a second suction device having a second suction inlet disposed to face the yarn storing roller. The yarn catching method includes: when the yarn is disconnected between the yarn storing device and the winding device, allowing the first suction device to suck a downstream-side end of the yarn at least partially stored in the yarn storing device; and when the yarn is disconnected between the yarn storing device and the winding device, allowing the second suction device to suck an upstream-side end of the yarn at least partially stored in the yarn storing device.

[0070] In the spinning machine and the yarn catching method, when the yarn is disconnected between the yarn storing device and the winding device, for example, the downstream-side end of the disconnected yarn is caught by the first suction device provided separately from the transportation device, and the upstream-side end of the disconnected yarn is caught by the second suction device. The disconnected yarn caught by the first suction device and the second suction device thus can be easily removed.

Claims

1. A spinning machine (1) comprising:

a yarn feeding part (3, 4) configured to feed yarn (Y);
a winding device (20) configured to wind the yarn (Y) to form a package (P);
a yarn storing device (6) disposed between the yarn feeding part (3, 4) and the winding device (20) and having a yarn storing roller (61) having an outer peripheral surface around which the yarn (Y) fed from the yarn feeding part (4) may be wound to be temporarily stored;
a first suction device (71) having a first suction inlet (72) disposed at a place along a yarn path between the yarn storing device (6) and the winding device (20), the first suction inlet (72) being configured to produce a suction flow at least while the yarn (Y) is traveling from the yarn storing device (6) to the winding device (20); and
a second suction device (75) having a second suction inlet (76) disposed to face the yarn storing roller (61).

2. The spinning machine (1) according to claim 1 further comprising a transportation device (8) configured to catch the yarn (Y) fed from the yarn feeding part (4) and transport the caught yarn (Y) to a position between the yarn storing device (6) and the winding device (20) in a state in which formation of the package (P) by the winding device (20) is suspended.

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

wherein

the yarn storing device (6) includes a driving part (M) configured to rotate the yarn storing roller (61) in a winding direction in which the yarn storing roller (61) is rotated when the yarn (Y) is wound around the outer peripheral surface of the yarn storing roller (61) and in a removing direction in which the yarn storing roller (61) is rotated when the yarn (Y) is removed from the yarn storing roller (61), and the second suction inlet (76) of the second suction device (75) is disposed such that a direction of velocity of the outer peripheral surface when the yarn storing roller (61) rotates in the removing direction matches a direction of suction of the second suction inlet (76) .

4. The spinning machine (1) according to any one of claims 1 to 3, wherein when the yarn (Y) is disconnected between the yarn storing device (6) and the winding device (20), the first suction device (71) is configured to suck a downstream-side end of the yarn (Y) at least partially stored in the yarn storing device (6), and the second suction device (75) is configured to suck an upstream-side end of the yarn (Y) at least partially stored in the yarn storing device (6).
5. The spinning machine (1) according to claim 4 further comprising a yarn take-off guide (66) configured to completely draw the downstream-side end of the yarn (Y) from the first suction device (71) .
6. The spinning machine (1) according to claim 5 further comprising a control part (90) configured to control the yarn storing device (6) and the yarn take-off guide (66) such that the downstream-side end of the yarn (Y) is completely drawn from the first suction device (81) simultaneously with rotation of the yarn storing roller (61) in a removing direction or after start of the rotation.
7. The spinning machine (1) according to claim 6 further comprising a joining device (7) configured to perform a joining operation of joining the yarn (Y) fed by the yarn feeding part (3, 4) and the yarn (Y) wound by the winding device (20), wherein the control part (90) is configured to control the yarn feeding part (3, 4), the yarn storing device (6), the joining device (7), and the winding device (20), and the control part (90) is configured to start the joining operation by the joining device (7) after the yarn storing roller (61) is rotated in the removing direction and the yarn (Y) disconnected between the yarn storing device (6) and the winding device (20) and left on the yarn storing roller (61) is sucked and removed by the second suction device (75), and to start winding of the yarn (Y) by the winding device (20) after the joining operation is completed.

8. The spinning machine (1) according to any one of claims 1 to 7 further comprising a blowing device (85) configured to blow air toward the first suction inlet (72).
9. The spinning machine (1) according to any one of claims 1 to 8 comprising an air spinning device (4) configured to form the yarn (Y) by twisting fiber bundle with an air flow.
10. The spinning machine (1) according to any one of claims 1 to 9 further comprising a cutting device (89) configured to cut the yarn (Y) caught by the first suction device (71) and the second suction device (75).
11. The spinning machine (1) according to any one of claims 1 to 10, wherein the yarn storing device (6) is disposed below the winding device (20) in a vertical direction.
12. A yarn catching method performed in a spinning machine (1) including a yarn feeding part (3, 4) configured to feed yarn (Y), a winding device (20) configured to wind the yarn (Y) to form a package (P), a yarn storing device (6) disposed between the yarn feeding part (3, 4) and the winding device (20) and having a yarn storing roller (61) having an outer peripheral surface around which the yarn (Y) fed from the yarn feeding part (3, 4) is wound to be temporarily stored, a first suction device (71) having a first suction inlet (72) disposed at a place along a yarn path between the yarn storing device (6) and the winding device (20), and a second suction device (75) having a second suction inlet (76) disposed to face the yarn storing roller (61), the yarn catching method comprising:

producing a suction flow at the first suction inlet (72) at least while the yarn (Y) is traveling from the yarn storing device (6) to the winding device (20);

when the yarn (Y) is disconnected between the yarn storing device (6) and the winding device (20), allowing the first suction device (71) to suck a downstream-side end of the yarn (Y) at least partially stored in the yarn storing device (6); and when the yarn (Y) is disconnected between the yarn storing device (6) and the winding device (20), allowing the second suction device (75) to suck an upstream-side end of the yarn (Y) at least partially stored in the yarn storing device (6).

Fig. 1

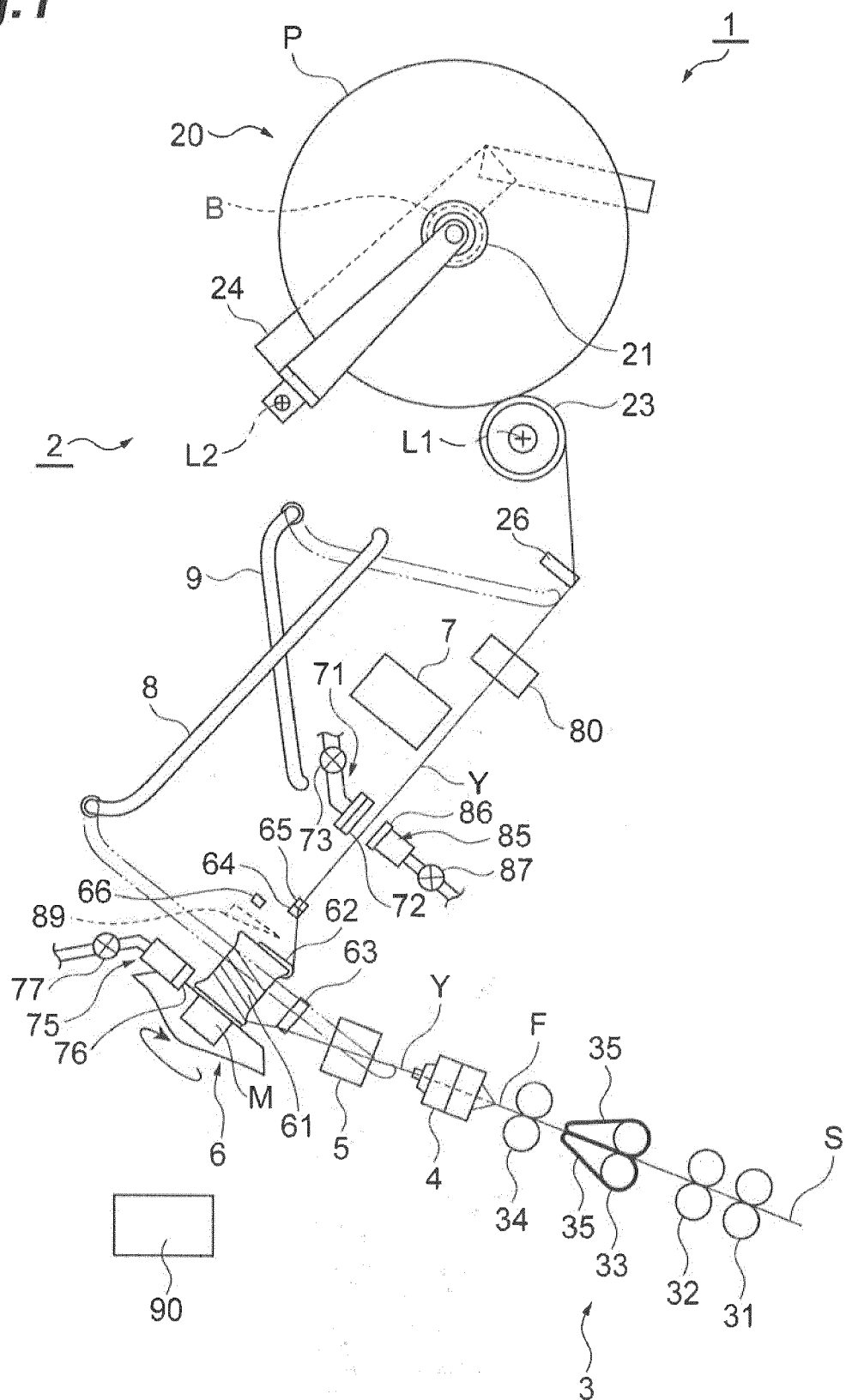


Fig.2

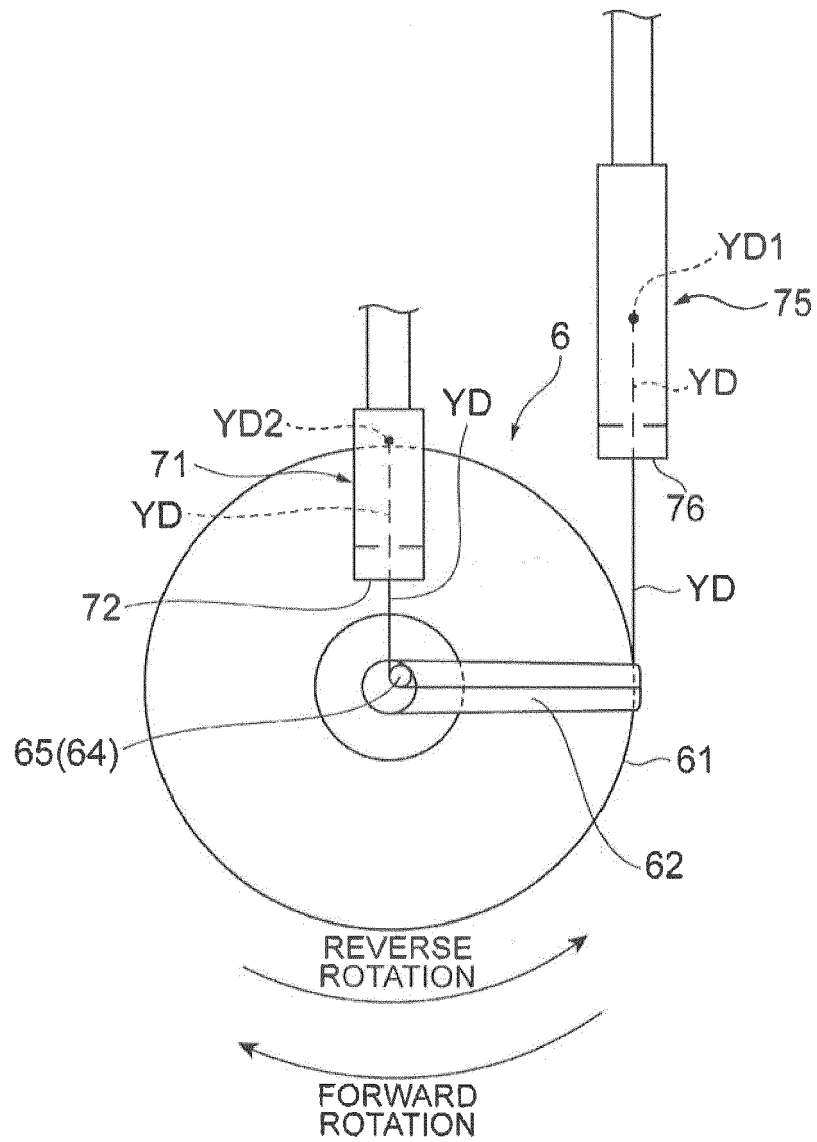


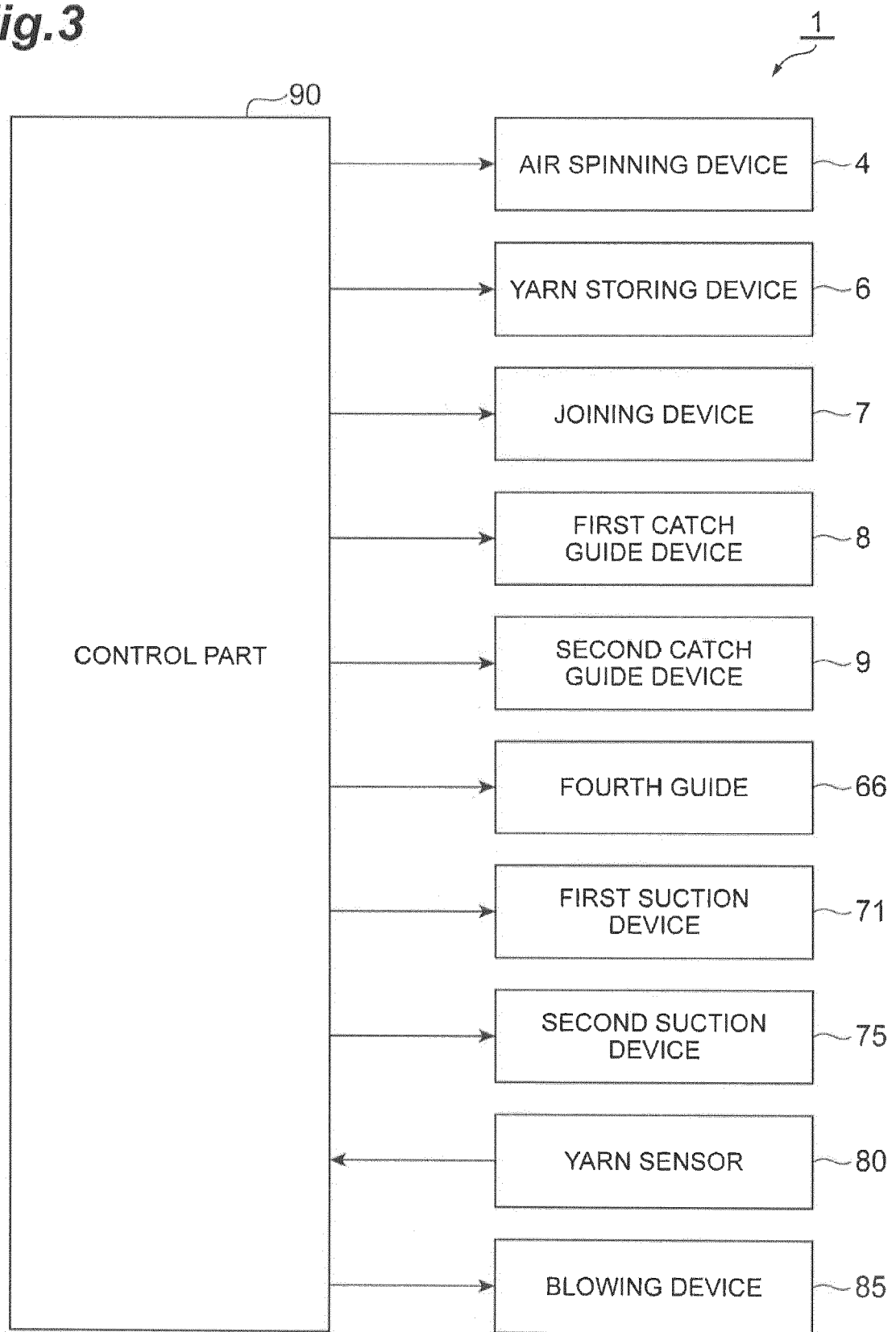
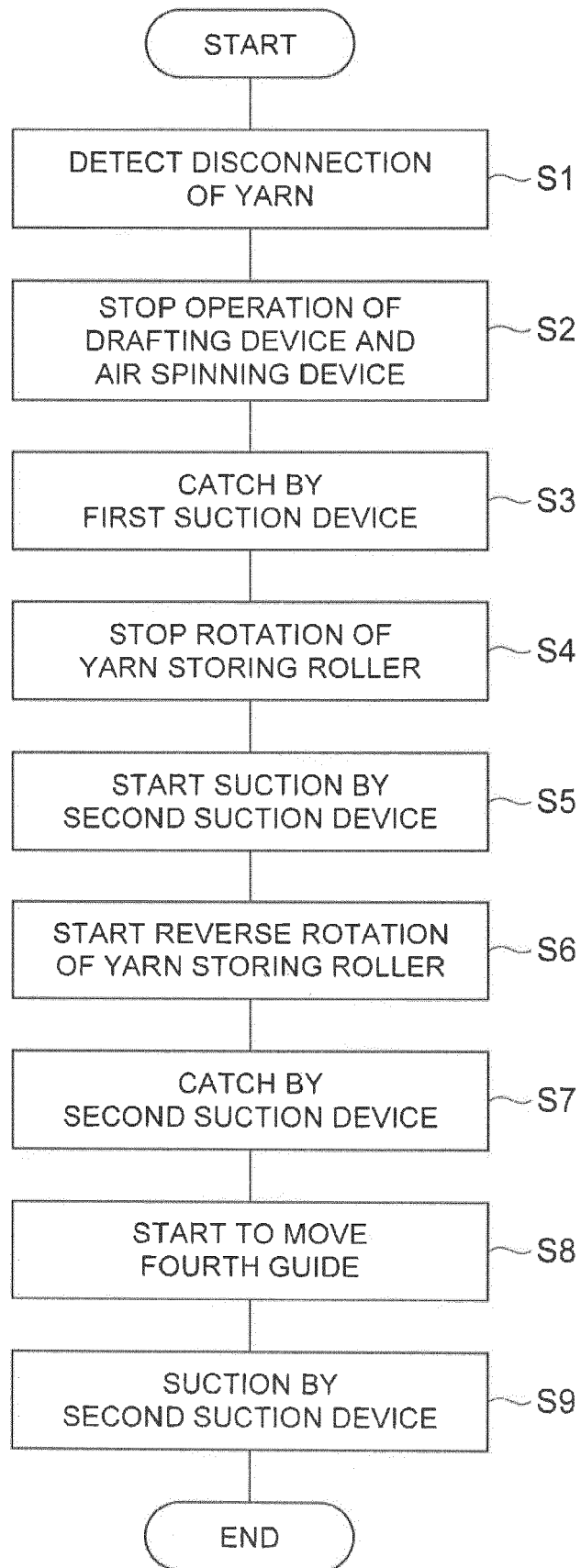
Fig.3

Fig.4



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