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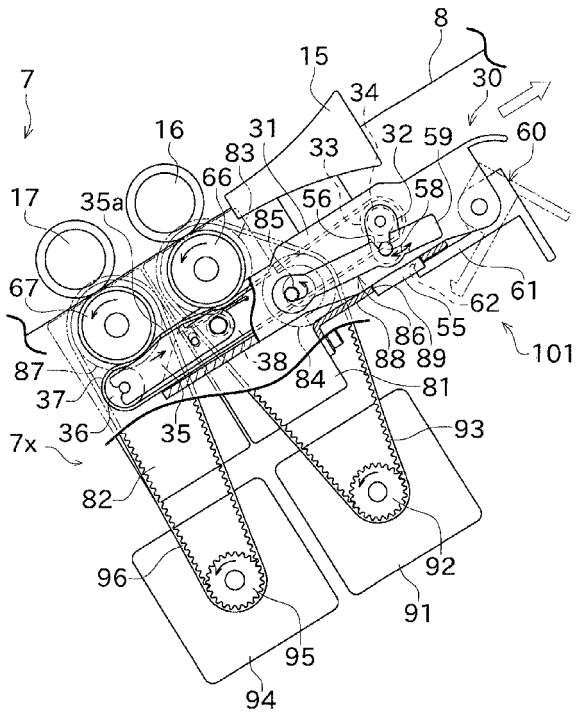
(54) Draft device and spinning machine

(57) A draft device (7) includes four pairs of draft roller pairs, each of the draft roller pairs including a top roller and a bottom roller, the draft device being adapted to draft a fiber bundle (8) by the draft roller pairs by driving the bottom rollers. The draft device (7) includes a cleaning belt (37) and an intermittent feeding device (101). The cleaning belt (37) has a cleaning surface adapted to make contact with a back bottom roller (66) and a third bottom roller (67) to clean such bottom rollers. The intermittent feeding device (101) is adapted to intermittently feed the cleaning belt (37) by receiving power from a back bottom roller driving motor (91) adapted to drive one of the four bottom rollers (the back bottom roller (66)).

FIG. 4



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a configuration for cleaning a draft roller used in a draft device.

2. Description of the Related Art

[0002] Conventionally, a spinning machine includes a draft device adapted to draft a fiber bundle. The draft device includes a plurality of draft roller pairs, each of which includes a top roller and a bottom roller. The draft device is adapted to draft the fiber bundle by rotating the draft roller pairs at different speeds.

[0003] When drafting the fiber bundle with the draft device, fibers of the fiber bundle may attach to a peripheral surface of the draft roller (the top roller or the bottom roller). If a large amount of foreign matters attach to the peripheral surface of the draft roller, quality of a yarn produced in a downstream spinning device may degrade, or yarn breakage or the like may occur. Therefore, to avoid such a problem, a configuration for cleaning the peripheral surface of the draft roller has been conventionally proposed.

[0004] The cleaning device of the draft roller disclosed in Japanese Unexamined Patent Publication No. 2009-13550 includes a cleaning belt having a cleaning surface that makes contact with the peripheral surface of the draft roller to clean the surface. In such a cleaning device, gear teeth of a gear member provided on a roller adapted to support the cleaning belt is fed by one tooth every time a rotation protrusion provided on a middle roller, which is one of the draft rollers, is rotated once. The cleaning belt is thereby intermittently fed.

[0005] A scraper member is provided in a cleaning device of a draft roller disclosed in Japanese Unexamined Patent Publication No. 2006-22443. The scraper member has an acute edge. The acute edge is made to contact with an outer peripheral surface of the draft roller to scrape and clean cotton honeydew, oil solution, and the like attached to the outer peripheral surface of the roller. A suction member is provided below the scraper member. Scraped fly waste and the like are removed by a sucking operation of the suction member.

[0006] In the draft device disclosed in Japanese Unexamined Patent Publication No. 2011-127238, a cleaning belt is arranged below a third bottom roller, which is one of the draft rollers. When the third bottom roller is rotated, the cleaning belt rotates by a frictional force between the cleaning belt and the third bottom roller. The fly waste attached to a surface of the third bottom roller is thereby removed by the cleaning belt.

[0007] In this type of draft device, there is a problem of how to remove the fibers that fell out from the fiber bundle and attached to the peripheral surface of the draft roller during the drafting. If such fibers are attached to the peripheral surface of the draft roller so as to be wound around the peripheral surface, the attached fibers greatly influence the drafting, and the removal of the fibers may become difficult.

[0008] In the configuration described in Japanese Unexamined Patent Publication No. 2009-13550, since the draft roller is cleaned with the intermittently fed cleaning belt, an effect of removing the fibers may be considered to be high. Japanese Unexamined Patent Publication No. 2009-13550 does not disclose how the middle roller adapted to intermittently feed the cleaning belt is rotated. If the middle roller adapted to the drive the cleaning belt is rotated accompanying a rotation of a counterpart roller, slipping of the rollers may be induced from a driving load of the cleaning belt, which may influence the rotation of the middle roller and lower quality of the drafting.

[0009] In the configuration described in Japanese Unexamined Patent Publication No. 2006-22443, the fibers attached to the outer peripheral surface of the roller can be effectively scraped by the stationary scraper member. However, the foreign matters may accumulate on the scraper member and may not be sufficiently removed even by the suction member. As a result, a cleaning effect may not be stably obtained.

[0010] In the configuration described in Japanese Unexamined Patent Publication No. 2011-127238, since the cleaning belt is driven by a frictional force from the third bottom roller, there is hardly any speed difference between the surface of the cleaning belt and the peripheral surface of the roller. Thus, it is difficult to remove the fibers by stripping the fibers from the peripheral surface of the third bottom roller.

BRIEF SUMMARY OF THE INVENTION

[0011] An object of the present invention is to provide a draft device capable of effectively cleaning fibers attached to a peripheral surface of a draft roller without influencing drafting of the fiber bundle.

[0012] According to a first aspect of the present invention, a draft device includes a plurality of draft roller pairs, each of the draft roller pairs including a top roller and a bottom roller arranged to face the top roller, the draft device being adapted to draft a fiber bundle by the draft roller pairs by driving the bottom rollers. The draft device includes a cleaning member and an intermittent feeding section. The cleaning member has a cleaning surface adapted to make contact with the bottom roller to clean such bottom roller. The intermittent feeding section is adapted to intermittently feed the cleaning member by receiving power from a driving source adapted to drive at least one of the bottom rollers.

[0013] Accordingly, the cleaning member adapted to clean the bottom roller can be intermittently fed by reliably receiving the power of the driving source adapted to drive the bottom roller. As a result, the fibers attached to the bottom roller can be effectively cleaned without influenc-

ing the drafting of the fiber bundle. Since a special driving source for intermittent feeding is not required to be provided, a cost of the entire draft device can be suppressed.

[0014] In the above draft device, the cleaning member is preferably a flexible endless belt. Accordingly, the cleaning effect can be improved by continuously cleaning the bottom roller. Since a wide cleaning surface can be ensured, the cleaning effect is less likely to be lowered even if the fibers accumulate on the cleaning member.

[0015] The above draft device preferably includes an urging member adapted to urge the endless belt against the bottom roller. Accordingly, since the cleaning surface of the cleaning member can be stably pressed against the peripheral surface of the bottom roller, the cleaning can be satisfactorily carried out. The cleaning member can also easily respond to changes in a position of the bottom roller.

[0016] The above draft device further includes an intermittent driving roller. The endless belt is wound around the intermittent driving roller. The intermittent driving roller is adapted to intermittently feed the endless belt by rotating intermittently. A plurality of recesses are formed on a peripheral surface of the intermittent driving roller.

[0017] Accordingly, slipping is less likely to occur between the intermittent driving roller and the endless belt. The endless belt can satisfactorily follow the intermittent driving roller that repeatedly stops and rotates. The endless belt thus can be reliably fed intermittently.

[0018] The above draft device includes two belt-supporting rollers arranged at an interval. The endless belt is wound around the two belt-supporting rollers such that the endless belt is arranged to be elliptical.

[0019] Accordingly, since the long endless belt can be arranged in a flat shape, the cleaning member can be made small. Therefore, the cleaning member can be easily arranged also in a narrow space at a periphery of the bottom rollers. Two or more bottom rollers can be easily cleaned with one endless belt.

[0020] The draft device includes at least three draft roller pairs arranged in a travelling direction of the fiber bundle. The at least three draft roller pairs are a front roller pair, a middle roller pair, and a third roller pair arranged in this order from downstream in the travelling direction of the fiber bundle. An apron belt is respectively provided for the top roller and the bottom roller of the middle roller pair. The cleaning surface of the endless belt as the cleaning member is provided to make contact with the bottom roller of the third roller pair.

[0021] A distance between the draft rollers arranged upstream in the travelling direction of the fiber bundle is generally longer than the distance between the downstream draft rollers. Therefore, the fibers particularly easily wind around the third roller, which is the draft roller located immediately upstream of the draft roller pair provided with the apron belt. In the above configuration, since the cleaning member cleans the bottom roller of the third roller pair, the fibers can be effectively prevented from winding around the bottom roller.

[0022] In the above draft device, the draft roller pairs are arranged in a direction substantially parallel to the travelling direction of the fiber bundle. The driving section is a motor adapted to drive the bottom roller located most upstream in the travelling direction of the fiber bundle. The intermittent feeding section is adapted to intermittently feed the cleaning member by receiving power from the motor. Accordingly, since the power for intermittently feeding the cleaning member can be received at a close position, a drive transmission path can be simplified.

[0023] In the above draft device, the intermittent feeding section includes an input rotating body, an output rotating body, a reciprocating arm, an eccentric portion, a coupling member, and a one-way clutch. The input rotating body is adapted to receive transmission of power from the driving source. The output rotating body is adapted to drive the cleaning member. The reciprocating arm is swingably supported. The eccentric portion is adapted to integrally rotate with the input rotating body. The coupling member is adapted to couple the eccentric portion and the reciprocating arm. The one-way clutch is provided between the reciprocating arm and the output rotating body. Accordingly, since the endless belt can be intermittently fed in one direction, the fibers attached to the bottom roller can be reliably cleaned.

[0024] The above draft device further includes a draft device main body and a cleaning unit. The draft device main body is adapted to support the draft roller pairs. The cleaning unit is adapted to support the cleaning member. The cleaning unit is provided detachably with respect to the draft device main body. Accordingly, a maintenance operation such as changing the cleaning member can be easily performed.

[0025] In the above draft device, the intermittent feeding section includes an input rotating body, an output rotating body, a reciprocating arm, an eccentric portion, a coupling member, and a one-way clutch. The input rotating body is adapted to receive transmission of power from the driving source. The output rotating body is adapted to drive the cleaning member. The reciprocating arm is swingably supported. The eccentric portion is adapted to integrally rotate with the input rotating body. The coupling member is adapted to couple the eccentric portion and the reciprocating arm. The one-way clutch is provided between the reciprocating arm and the output rotating body. The cleaning unit includes at least the output rotating body, the reciprocating arm, and the one-way clutch.

[0026] Accordingly, the cleaning member and a component group associated with the cleaning member can be collectively handled integrally as a cleaning unit. As a result, the maintenance operation can be efficiently performed.

[0027] According to a second aspect of the present invention, a spinning machine includes a draft device, a spinning device, and a winding device. The spinning device is adapted to produce a spun yarn by spinning the fiber bundle drafted by the draft device using airflow. The

winding device is adapted to wind the spun yarn produced by the spinning device into a package.

[0028] Accordingly, since the fiber bundle is drafted with the cleaned bottom roller, and the spun yarn produced from the fiber bundle is wound into the package, a high quality package can be obtained. Since accumulation of the fibers in the draft device can be suppressed, an operation of the spinning machine is not stopped due to excessive accumulation of the fibers in the draft device, or the like. Therefore, operation efficiency of the spinning machine can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

FIG. 1 is a front view illustrating an overall configuration of a fine spinning machine according to one embodiment of the present invention;
FIG. 2 is a side view of a spinning unit;
FIG. 3 is a cross-sectional view of a spinning device;
FIG. 4 is a side view illustrating a configuration of a periphery of a back bottom roller and a third bottom roller; and
FIG. 5 is a cross-sectional side view illustrating a detached cleaning cassette.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0030] A fine spinning machine (spinning machine) according to one embodiment of the present invention will be described with reference to the drawings.

[0031] A fine spinning machine 1 as the spinning machine illustrated in FIG. 1 includes a plurality of spinning units 2 arranged in line. The fine spinning machine 1 includes a yarn joining cart 3, a blower box 80, and a motor box 5.

[0032] Each spinning unit 2 includes a draft device 7, a spinning device 9, a yarn slack eliminating device (yarn accumulating device) 12, and a winding device 13, arranged in this order from upstream to downstream. "Upstream" and "downstream" respectively refer to upstream and downstream in a travelling direction of a fiber bundle and a spun yarn at the time of spinning. Each spinning unit 2 is adapted to spin a fiber bundle 8 fed from the draft device 7 by the spinning device 9 to produce a spun yarn 10, and the spun yarn 10 is wound into a package 45 by the winding device 13.

[0033] The draft device 7 is arranged in proximity to an upper end of a frame 6 of the fine spinning machine 1. The draft device 7 drafts (stretches) the fiber bundle (a sliver) 8 supplied from a sliver case (not illustrated) through a sliver guide (not illustrated) to a predetermined width. The fiber bundle 8 drafted by the draft device 7 is supplied to the spinning device 9.

[0034] The spinning device 9 twists the fiber bundle 8 supplied from the draft device 7 to produce the spun yarn 10. In the present embodiment, an air-jet spinning device which uses whirling airflow to twist the fiber bundle 8 is adopted as the spinning device 9. As illustrated in FIG. 3, the spinning device 9 includes a nozzle holder 63, a hollow guide shaft body 23, and a fiber guide (fiber guiding section) 22.

[0035] A spinning chamber 26 is formed between the nozzle holder 63 and the hollow guide shaft body 23. The nozzle holder 63 is provided with an air ejecting nozzle 27 for ejecting air into the spinning chamber 26. The fiber guide 22 is provided with an introducing port 21 for introducing the fiber bundle 8 into the spinning chamber 26. The air ejecting nozzle 27 is configured to eject the air into the spinning chamber 26 to generate whirling airflow. The fiber bundle 8 supplied from the draft device 7 is guided into the spinning chamber 26 by the fiber guide 22 having the introducing port 21. In the spinning chamber 26, fibers of the fiber bundle 8 are swung around the hollow guide shaft body 23 by the whirling airflow, to apply the twists to the fiber bundle 8, and the spun yarn 10 is produced. The twisted spun yarn 10 is passed through a yarn passage 29 formed at an axial center of the hollow guide shaft body 23, and fed to an outside of the spinning device 9 from a yarn exit (not illustrated) located downstream of the hollow guide shaft body 23.

[0036] A needle-like guide needle 22a is arranged in the introducing port 21, and a tip of the guide needle 22a is directed towards the spinning chamber 26. The fiber bundle 8 introduced from the yarn introducing port 21 is guided into the spinning chamber 26 via the guide needle 22a. Accordingly, a state of the fiber bundle 8 introduced into the spinning chamber 26 can be stabilized. Since the fiber bundle 8 is guided via the guide needle 22a, even if twists are applied to the fibers in the spinning chamber 26, the twists are prevented from being propagated to the upstream of the fiber guide 22. Accordingly, the twists applied by the spinning device 9 are prevented from influencing the draft device 7.

[0037] The yarn accumulating device 12 is arranged downstream of the spinning device 9. The yarn accumulating device 12 includes a yarn accumulating roller 14 and an electric motor 25 for rotatably driving the yarn accumulating roller 14.

[0038] The yarn accumulating roller 14 can have a prescribed amount of the spun yarn 10 wound around an outer peripheral surface thereof to temporarily accumulate the spun yarn 10. When the yarn accumulating roller 14 is rotated at a predetermined rotation speed with the spun yarn 10 wound around the outer peripheral surface of the yarn accumulating roller 14, the yarn accumulating device 12 can pull out the spun yarn 10 from the spinning device 9 at a predetermined speed and transport the spun yarn 10 towards the downstream.

[0039] The winding device 13 includes a cradle arm 71 supported to be swingable about a supporting shaft 73. The cradle arm 71 can rotatably support a bobbin 48 for winding the spun yarn 10.

[0040] The winding device 13 includes a winding drum

72 and a traverse device 75. The winding drum 72 is adapted to be driven while making contact with an outer peripheral surface of the bobbin 48 or an outer peripheral surface of the package 45. The traverse device 75 includes a traverse guide 76 capable of being engaged with the spun yarn 10. The winding drum 72 is driven by an electric motor (not illustrated) while reciprocating the traverse guide 76 by a driving unit (not illustrated). The winding device 13 rotates the package 45 making contact with the winding drum 72, and the spun yarn 10 is wound into the package 45 while being traversed.

[0041] The yarn joining cart 3 includes a splicer (yarn joining device) 43, a suction pipe 44, and a suction mouth 46. When yarn breakage or yarn cut occurs in a spinning unit 2, the yarn joining cart 3 travels on a rail 41 provided at a lower part of the frame 6 to the target spinning unit 2 and stops. The suction pipe 44 sucks and catches a yarn end from the spinning device 9 while being swung vertically with a shaft as the center and guides the yarn end to the splicer 43. The suction mouth 46 sucks and catches a yarn end from the package 45 supported by the winding device 13 while being swung vertically with a shaft as the center, and guides the yarn end to the splicer 43. The splicer 43 joins the guided yarn ends.

[0042] A yarn clearer 52 is arranged at a position between the spinning device 9 and the yarn accumulating device 12. The spun yarn 10 spun by the spinning device 9 is passed through the yarn clearer 52 before being wound by the yarn accumulating device 12. The yarn clearer 52 monitors the travelling spun yarn 10 with a sensor (not illustrated), and when a yarn defect of the spun yarn 10 (a portion in which abnormality is found in thickness or the like of the spun yarn 10, or foreign substances contained the spun yarn 10) is detected, the yarn clearer 52 transmits a yarn defect detection signal to a unit controller (not illustrated).

[0043] Upon receiving the yarn defect detection signal, the unit controller immediately cuts the spun yarn 10 with a cutter 57, stops the draft device 7, the spinning device 9, and the like, and also stops the winding in the winding device 13. The unit controller transmits a control signal to the yarn joining cart 3, and the yarn joining cart 3 travels to front of the spinning unit 2. The yarn joining cart 3 guides the yarn end from the spinning device 9 and the yarn end from the package 45 to the splicer 43 with the suction pipe 44 and the suction mouth 46, respectively, and carries out a yarn joining operation by the splicer 43. According to such a yarn joining operation, the yarn defect is removed, and the winding of the spun yarn 10 into the package 45 can be resumed. The cutter 57 may be omitted, and the spun yarn 10 may be cut as if being torn off by stopping the driving of the draft device 7 while continuing the driving of the winding device 13. Supply of air to the spinning device 9 may be stopped and the spun yarn 10 may be cut by interrupting the production of the spun yarn 10.

[0044] Next, the draft device 7 will be described.

[0045] The draft device 7 includes a tubular sliver guide 15 adapted to introduce the fiber bundle 8, and a plurality of draft rollers. Two draft rollers as one set form a draft roller pair. The draft device 7 of the present embodiment includes four draft roller pairs, i.e., a back roller pair including draft rollers 16 and 66, a third roller pair including draft rollers 17 and 67, a middle roller pair including draft rollers 19 and 69, and a front roller pair including draft rollers 20 and 70, arranged in this order from the upstream.

[0046] In each draft roller pair, a draft roller on a front side of the fine spinning machine 1 is referred to as a top roller, and a draft roller on a rear side of the fine spinning machine 1 is referred to as a bottom roller. The top rollers are, in the order from the upstream, a back top roller 16, a third top roller 17, a middle top roller 19 provided with a rubber apron belt 18, and a front top roller 20. The bottom rollers are, in the order from the upstream, a back bottom roller 66, a third bottom roller 67, a middle bottom roller 69 provided with an apron belt 68, and a front bottom roller 70.

[0047] An outer peripheral surface of each of the top rollers 16, 17, 19, and 20 is made of an elastic member such as rubber. Each of the top rollers 16, 17, 19, and 20 is rotatably supported via a bearing (not illustrated) and the like with an axial line thereof as a center. Each of the bottom rollers 66, 67, 69, and 70 is a metal roller, and is rotatably driven with an axial line thereof as the center. In each draft roller pair, the top roller and the bottom roller are arranged to face one another.

[0048] The draft device 7 includes an urging means (not illustrated) adapted to urge the top rollers 16, 17, 19, and 20 towards the bottom rollers 66, 67, 69, and 70. The outer peripheral surface of the top rollers 16, 17, 19, and 20 thus elastically make contact with the outer peripheral surface of the bottom rollers 66, 67, 69, and 70, respectively. When the bottom rollers 66, 67, 69, and 70 are rotatably driven, the top rollers 16, 17, 19, and 20 also rotate accompanying the rotation of the bottom rollers 66, 67, 69, and 70.

[0049] The draft device 7 nips (sandwiches) the fiber bundle 8 between the rotating top rollers 16, 17, 19, and 20 and the bottom rollers 66, 67, 69, and 70, and transports the fiber bundle 8 towards the downstream. In the draft device 7, the rotation speed of the downstream draft roller pair is faster. Therefore, the fiber bundle 8 is stretched (drafted) while being transported between the draft roller pair and the draft roller pair, and a width of the fiber bundle 8 becomes narrower towards the downstream.

[0050] Since a degree to which the fiber bundle 8 is drafted can be changed by appropriately setting the rotation speed of each of the bottom rollers 66, 67, 69, and 70, the fiber bundle 8 drafted to a desired width can be supplied to the spinning device 9. Accordingly, the spun yarn 10 of a desired yarn count (thickness) can be spun by the spinning device 9.

[0051] Next, a configuration for driving the back bottom roller 66 and the third bottom roller 67, and a configuration

for cleaning the peripheral surface of the back bottom roller 66 and the third bottom roller 67 will be described with reference to FIG. 4 and FIG. 5.

[0052] The draft device 7 includes a first supporting plate 81 adapted to support the back bottom roller 66 and a second supporting plate 82 adapted to support the third bottom roller 67. Although not illustrated in FIG. 4, the supporting plates 81 and 82 are attached to the frame 6 of the fine spinning machine 1.

[0053] The back bottom roller 66 is rotatably supported by an upper part of the first supporting plate 81. A coupling pulley 83 is fixed to a roller shaft of the back bottom roller 66. The coupling pulley 83 can integrally rotate with the back bottom roller 66. A cleaning input pulley (an input rotating body) 84 is rotatably supported by the first supporting plate 81. The cleaning input pulley 84 is arranged at a position farther than the back bottom roller 66 and at a position closer than a back bottom roller driving motor 91, to be described later, when seen from a travelling path of the fiber bundle 8. An eccentric pin (an eccentric portion) 85 protrudes from an end surface of a pulley shaft of the cleaning input pulley 84. One end of an elongate link member (a coupling member) 86 is rotatably coupled to the eccentric pin 85.

[0054] The back bottom roller driving motor (a driving source) 91 is arranged below the first supporting plate 81 (a side located away from the travelling path of the fiber bundle 8). An output pulley 92 is fixed to an output shaft of the back bottom roller driving motor 91. The output pulley 92, the coupling pulley 83, and the cleaning input pulley 84 are configured as pulleys with teeth. The three pulleys 92, 83, and 84 are coupled to one another by being wound with a driving belt 93, which is an endless belt with teeth.

[0055] The third bottom roller 67 is rotatably supported by an upper part of the second supporting plate 82 (a portion on a side located close to the travelling path of the fiber bundle 8). A coupling pulley 87 is fixed to a roller shaft of the third bottom roller 67. The coupling pulley 87 can be integrally rotated with the third bottom roller 67.

[0056] A third bottom roller driving motor 94 is arranged below the second supporting plate 82 (a side located away from the travelling path of the fiber bundle 8). An output pulley 95 is fixed to an output shaft of the third bottom roller driving motor 94. The output pulley 95 and the coupling pulley 87 are configured as pulleys with teeth. The two pulleys 95 and 87 are coupled to one another by being wound with a driving belt 96, which is an endless belt with teeth.

[0057] A plate-shaped cleaning supporting frame 88 is fixed to the first supporting plate 81. An attachment hole 89 is formed as a through hole in the cleaning supporting frame 88. A protrusion 55 of a housing 31 of a cleaning cassette 30, to be described later, can be inserted into the attachment hole 89. The cleaning supporting frame 88 also supports the sliver guide 15 adapted to guide the fiber bundle 8 to the draft device 7.

[0058] The cleaning cassette (a cleaning unit) 30 is arranged to be inserted between the back bottom roller 66 and the third bottom roller 67, which are to be cleaned, and the back bottom roller driving motor 91 and the third bottom roller driving motor 94 adapted to drive the draft rollers 66 and 67, respectively. The cleaning cassette 30 includes the housing 31, a swing arm (a reciprocating arm) 32, a driving roller (a belt-supporting roller, an intermittent driving roller, or an output rotating body) 33, a one-way clutch 34, a driven roller supporting arm 35, a driven roller (belt-supporting roller) 36, and a cleaning belt (a cleaning member) 37.

[0059] The housing 31 is made from synthetic resin or metal in an elongate shape when seen in an axial line direction of the draft rollers 16 and 17. The housing 31 is formed in a box-shape opened at a portion facing the back bottom roller 66 and the third bottom roller 67. The protrusion 55 having a shape substantially corresponding to the attachment hole 89 of the cleaning supporting frame 88 is formed at a bottom of the housing 31. The housing 31 (the cleaning cassette 30) can be attached to the cleaning supporting frame 88 by inserting the protrusion 55 into the attachment hole 89.

[0060] A hooking member 60 adapted to fix the housing 31 to the cleaning supporting frame 88 is attached to the housing 31. The hooking member 60 includes a sandwiching arm 61, and is configured to sandwich the cleaning supporting frame 88 between the sandwiching arm 61 and the housing 31. A claw portion 62 capable of being hooked to an edge of the attachment hole 89 is formed at a tip-end of the sandwiching arm 61. An urging spring (not illustrated) adapted to urge the sandwiching arm 61 and the claw portion 62 in a direction of approaching the housing 31 is attached to the hooking member 60.

[0061] FIG. 4 illustrates a state in which the cleaning cassette 30 is installed in the draft device 7. In this state, the protrusion 55 of the housing 31 is inserted into the attachment hole 89 of the cleaning supporting frame 88. Furthermore, the claw portion 62 on a tip-end side of the sandwiching arm 61 of the hooking member 60 is inserted into the attachment hole 89, and the claw portion 62 hooks the cleaning supporting frame 88 by an urging force of the urging spring. The cleaning cassette 30 thus can be fixed so as not to move with respect to the cleaning supporting frame 88.

[0062] When performing a maintenance operation, an operator hooks a finger on the hooking member 60 and swings the hooking member 60 as illustrated with a chain line in FIG. 4 to pull out the claw portion 62 from the attachment hole 89. Furthermore, the cleaning cassette 30 can be detached from the draft device 7 by pulling out the housing 31 towards a side opposite to the travelling direction of the fiber bundle 8 (i.e., a direction of an outlined arrow in FIG. 4) while lifting the housing 31 so as to remove the protrusion 55 from the attachment hole 89. FIG. 5 illustrates a cross-sectional view of the detached cleaning cassette 30.

[0063] The swing arm 32 is swingably supported by a side surface of the housing 31 (a side surface located in

a direction substantially parallel to the travelling direction of the fiber bundle 8) as illustrated in FIG. 4. A tip-end portion of the swing arm 32 is coupled to the eccentric pin 85 via the link member 86. When the cleaning input pulley 84 is rotated, the swing arm 32 is swung so as to reciprocate at a small stroke accompanying a change in a position of the eccentric pin 85.

[0064] A C-shaped recess 56, in which an upper side is opened, is formed in the link member 86 to be coupled with the swing arm 32. A coupling pin 58 is fixed to the tip-end of the swing arm 32. The swing arm 32 is made from a material capable of being elastically deformed to a certain degree (synthetic resin in the present embodiment). The coupling pin 58 is fitted while deforming the recess 56 to couple the link member 86 and the swing arm 32. As the link member 86 can be detachably provided with respect to the swing arm 32, the cleaning cassette 30 can be easily attached to and detached from the draft device 7.

[0065] When seen from the eccentric pin 85, the link member 86 includes an extended portion 59 formed to further extend from the recess 56. By applying a force with a finger to push down the extended portion 59, the operator can easily remove the coupling pin 58 from the recess 56 and decouple the link member 86 and the swing arm 32.

[0066] The driving roller 33 is rotatably supported by the housing 31 such that an arm axis of the swing arm 32 and the axial line of the driving roller 33 are matched. The driving roller 33 has a slightly wider width (length) extending in the roller axis direction than the back bottom roller 66 and the third bottom roller 67. As illustrated in FIG. 5, axially elongate grooves (recesses) 33a are formed at an equal interval in a peripheral direction on a peripheral surface of the driving roller 33.

[0067] The one-way clutch 34 is interposed between the swing arm 32 and the driving roller 33. The one-way clutch 34 transmits a rotation in one direction of the swing arm 32 (specifically, clockwise in FIG. 4) to the driving roller 33, and does not transmit a rotation opposite thereto (counterclockwise in FIG. 4) to the driving roller 33. The driving roller 33 thus can be intermittently driven.

[0068] A driven roller supporting arm 35 is an arm-shaped member formed in an elongate shape. A first tip-end of the driven roller supporting arm 35 is swingably supported by the housing 31. A portion of a second tip-end of the driven roller supporting arm 35 is arranged to project out from the housing 31. An urging spring 38 is a torsion coil spring attached to the driven roller supporting arm 35. The urging spring 38 urges the second tip-end of the driven roller supporting arm 35 in a direction of approaching (direction of rising) towards the third bottom roller 67 by the spring force thereof.

[0069] As illustrated in FIG. 5, a contacting surface 35a is formed at a middle portion in a longitudinal direction of the driven roller supporting arm 35. The contacting surface 35a pushes an inner peripheral surface of the cleaning belt 37 upward (outside) accompanying the swing of the driven roller supporting arm 35 by an action of the urging spring 38 to push a cleaning surface of the cleaning belt 37 against the back bottom roller 66 and the third bottom roller 67.

[0070] As illustrated in FIG. 4, a position where the contacting surface 35a pushes up the cleaning belt 37 is a position located between the back bottom roller 66 and the third bottom roller 67. Therefore, the cleaning belt 37 can be made to contact with the back bottom roller 66 and the third bottom roller 67 at a wide area while being slightly curved in a zigzag manner. The back bottom roller 66 and the third bottom roller 67 thus can be satisfactorily cleaned with the cleaning belt 37.

[0071] A driven roller 36 is rotatably supported by the second tip-end of the driven roller supporting arm 35. A diameter of the driven roller 36 is substantially equal to a diameter of the driving roller 33. The driven roller 36 has a slightly wider width (length) extending in the roller axis direction than the back bottom roller 66 and the third bottom roller 67.

[0072] The cleaning belt 37 is an endless member having a slightly wider width (length) extending in a roller axis direction than the back bottom roller 66 and the third bottom roller 67. The cleaning belt 37 is wound around the driving roller 33 and the driven roller 36 such that the cleaning belt 37 is substantially elliptical in side view. The cleaning belt 37 thus has a flat shape substantially parallel to the travelling path of the fiber bundle 8.

[0073] Since the spring force of the urging spring 38 acts on the driven roller supporting arm 35, the driven roller 36 is pushed up. As a result, an outer peripheral surface (the cleaning surface) of the cleaning belt 37 is pushed against the peripheral surface of the back bottom roller 66 and the third bottom roller 67 at an appropriate force.

[0074] The cleaning belt 37 is flatly supported by two rollers (the driving roller 33 and the driven roller 36), and the cleaning belt 37 can be pushed against both the back bottom roller 66 and the third bottom roller 67 in a balanced manner with the action of the urging spring 38. In the draft device 7, in order to change the interval (a gauge) between the draft roller pairs according to a type and/or an application of the fibers to be spun, the position of the bottom rollers 66, 67, 69, and/or 70 is sometimes adjusted. According to the present embodiment, even if the back bottom roller 66 and the third bottom roller 67 are displaced in the travelling direction of the fiber bundle 8, the flat-shaped cleaning belt 37 can be stably made in contact and a satisfactory cleaning effect can be exerted.

[0075] In the draft device 7 having the above configuration, the first supporting plate 81, the second supporting plate 82, the back bottom roller driving motor 91, the third bottom roller driving motor 94, the coupling pulleys 83 and 87, the driving belts 93 and 96, and the like configure a draft device main body 7x for supporting and driving the bottom roller adapted to draft the fiber bundle 8 (the back bottom roller 66 and the third bottom roller 67). The

cleaning input pulley 84, the link member 86, the swing arm 32, the driving roller 33, the one-way clutch 34, and the like configure an intermittent feeding device (intermittent feeding section) 101 adapted to intermittently feed the cleaning belt 37.

[0076] The cleaning input pulley 84 of the intermittent feeding device 101 is mechanically coupled to an output shaft of the back bottom roller driving motor 91 adapted to drive the back bottom roller 66 by the driving belt 93. In order to intermittently feed the cleaning belt 37 for cleaning the two bottom rollers 66 and 67 located upstream, the intermittent feeding device 101 receives power from the driving source of the back bottom roller 66 located most upstream. Since the intermittent feeding device 101 can receive the power for intermittent feeding from a close position, the drive transmission path can be simplified.

[0077] Next, the driving of the back bottom roller 66 and the third bottom roller 67, and the intermittent feeding of the cleaning belt 37 accompanying the driving in the draft device 7 will be described.

[0078] When a drive signal is transmitted to the back bottom roller driving motor 91, and the output pulley 92 is driven, the coupling pulley 83 coupled to the output pulley 92 via the driving belt 93 is rotated, and the back bottom roller 66 is rotatably driven. The back top roller 16 is rotated accompanying the rotation of the back bottom roller 66.

[0079] When a drive signal is transmitted to the third bottom roller driving motor 94 and the output pulley 95 is driven, the coupling pulley 87 coupled to the output pulley 95 via the driving belt 96 is rotated, and the third bottom roller 67 is rotatably driven. The third top roller 17 is rotated accompanying the rotation of the third bottom roller 67.

[0080] Therefore, the fiber bundle 8 can be fed to the downstream draft roller pair while drafting the fiber bundle 8 between the two draft roller pairs.

[0081] Accompanying the rotation of the output pulley 92 of the back bottom roller driving motor 91, the cleaning input pulley 84 coupled to the output pulley 92 via the driving belt 93 is rotated. Therefore, the position of the eccentric pin 85 provided on the pulley shaft of the cleaning input pulley 84 is changed, and hence the swing arm 32 coupled to the eccentric pin 85 via the link member 86 is swung. Specifically, the swing arm 32 makes one reciprocating swing within a predetermined angular range every time the cleaning input pulley 84 makes one rotation.

[0082] When the swing arm 32 is swung clockwise in FIG. 4, the one-way clutch 34 transmits the swing to the driving roller 33. When the swing arm 32 is swung counterclockwise in FIG. 4, the one-way clutch 34 shuts the transmission of the swing. The driving roller 33 is thus intermittently rotated clockwise in FIG. 4, and the cleaning belt 37 can be intermittently fed.

[0083] The cleaning belt 37 is intermittently fed as described above while being pushed against the back bottom roller 66 and the third bottom roller 67 by the urging spring 38. Thus, when the cleaning belt 37 is stopped, the peripheral surface of the back bottom roller 66 and the third bottom roller 67 are rubbed against the surface of the cleaning belt 37. As a result, the fibers can be stripped from the peripheral surface of the back bottom roller 66 and the third bottom roller 67. When the cleaning belt 37 is fed, the stripped fibers can be transferred to the cleaning belt 37. The stopping and feeding of the cleaning belt 37 are alternately repeated to effectively remove the fibers on the peripheral surface of the back bottom roller 66 and the third bottom roller 67. As a result, the fibers can be prevented from winding around the back bottom roller 66 and the third bottom roller 67.

[0084] As described above, the draft device 7 of the present embodiment includes a plurality of (four) draft roller pairs including the top rollers 16, 17, 19, and 20, and the bottom rollers 66, 67, 69, and 70 arranged to respectively face the top rollers 16, 17, 19, and 20. By driving the bottom rollers 66, 67, 69, and 70, the draft device 7 drafts the fiber bundle 8 by the draft roller pairs. The draft device 7 includes the cleaning belt 37 and the intermittent feeding device 101. The cleaning belt 37 has the cleaning surface. The cleaning surface makes contact with the back bottom roller 66 and the third bottom roller 67 to clean the back bottom roller 66 and the third bottom roller 67. The intermittent feeding device 101 receives power from the back bottom roller driving motor 91 adapted to drive one of the four bottom rollers (the back bottom roller 66) to intermittently feed the cleaning belt 37.

[0085] The cleaning belt 37 adapted to clean the bottom roller corresponding to the driving side of the draft roller pair (the back bottom roller 66 and the third bottom roller 67) thus can be intermittently fed by reliably receiving the power of the back bottom roller driving motor 91 adapted to drive the back bottom roller 66. As a result, the fibers attached to the back bottom roller 66 and the third bottom roller 67 can be effectively cleaned without influencing the drafting of the fiber bundle 8. Since a special driving source for intermittent feeding is not required to be provided, the cost of the entire draft device 7 can be suppressed.

[0086] In the draft device 7 of the present embodiment, the cleaning belt 37 is configured as a flexible endless belt. Accordingly, the back bottom roller 66 and the third bottom roller 67 are continuously cleaned, and the cleaning effect can be improved. Furthermore, since a wide (large) cleaning surface can be ensured, the cleaning effect is less likely to be lowered even if the fibers accumulate on the cleaning belt 37.

[0087] The draft device 7 of the present embodiment includes the urging spring 38 adapted to push the cleaning belt 37 against the back bottom roller 66 and the third bottom roller 67. Since the cleaning surface of the cleaning belt 37 can be stably pushed against the peripheral surface of the back bottom roller 66 and the third bottom roller 67, the cleaning can be satisfactorily carried out.

Even if the position of the back bottom roller 66 and the third bottom roller 67 are changed for changing the gauge, the cleaning effect is less likely to be lowered.

[0088] The draft device 7 of the present embodiment includes the driving roller 33. The cleaning belt 37 is wound around the driving roller 33. The cleaning belt 37 is intermittently fed by intermittently rotating the driving roller 33. The plurality of grooves 33a are formed on the peripheral surface of the driving roller 33.

[0089] Since slipping is less likely to occur between the driving roller 33 and the cleaning belt 37, the cleaning belt 37 can satisfactorily follow the driving roller 33, which repeatedly stops and rotates. Thus, the cleaning belt 37 can be reliably fed intermittently.

[0090] The draft device 7 of the present embodiment includes two belt-supporting rollers (the driving roller 33 and the driven roller 36) arranged at an interval. The cleaning belt 37 is wound around the driving roller 33 and the driven roller 36 such that the cleaning belt 37 is arranged to be elliptical.

[0091] Since the long cleaning belt 37 can be arranged in a flat shape, the cleaning member of the back bottom roller 66 and the third bottom roller 67 can be made small. Therefore, the cleaning belt 37 can be easily arranged also in a narrow space at a periphery of the bottom rollers 66, 67, 69, and 70 (below the back bottom roller 66 and the third bottom roller 67). The two bottom rollers 66 and 67 can be easily cleaned with one cleaning belt 37.

[0092] The draft device 7 of the present embodiment includes four draft roller pairs arranged in a travelling direction of the fiber bundle 8. The four draft roller pairs include three draft roller pairs, i.e., a front roller pair (the draft roller pair including the front top roller 20 and the front bottom roller 70), a middle roller pair (the draft roller pair including the middle top roller 19 and the middle bottom roller 69), and a third roller pair (the draft roller pair including the third top roller 17 and the third bottom roller 67) arranged in this order from the downstream in the travelling direction of the fiber bundle 8. The apron belts 18 and 68 are respectively provided for the middle top roller 19 and the middle bottom roller 69 of the middle roller pair. The cleaning surface of the cleaning belt 37 makes contact with the third bottom roller 67 of the third roller pair.

[0093] The distance between the draft rollers located upstream in the travelling direction of the fiber bundle 8 is generally longer than the distance between the downstream draft rollers. Therefore, the fibers particularly easily attach on the third roller pair located immediately upstream of the middle roller pair (the third top roller 17 and the third bottom roller 67) provided with the apron belts 18 and 68. Since the cleaning belt 37 cleans the third bottom roller 67, the fibers can be effectively prevented from winding around the bottom roller.

[0094] In the draft device 7 of the present embodiment, four draft roller pairs are lined in the travelling direction of the fiber bundle 8. The intermittent feeding device 101 receives the power from the back bottom roller driving motor 91 adapted to drive the bottom roller of the draft roller pair located most upstream in the travelling direction of the fiber bundle 8 (the draft roller pair including the back top roller 16 and the back bottom roller 66) to intermittently feed the cleaning belt 37. Since the power for intermittently feeding the cleaning belt 37 can be acquired at a close position, the drive transmission path can be simplified.

[0095] In the draft device 7 of the present embodiment, the intermittent feeding device 101 includes the cleaning input pulley 84, the driving roller 33, the swing arm 32, the eccentric pin 85, the link member 86, and the one-way clutch 34. The driving force of the back bottom roller driving motor 91 is transmitted to the cleaning input pulley 84. The driving roller 33 drives the cleaning belt 37. The swing arm 32 is swingably supported. The eccentric pin 85 is integrally rotated with the cleaning input pulley 84. The link member 86 couples the eccentric pin 85 and the swing arm 32. The one-way clutch 34 is arranged between the swing arm 32 and the driving roller 33.

[0096] Accordingly, since the intermittent feeding in one direction of the cleaning belt 37 can be realized, the fibers attached to the back bottom roller 66 and the third bottom roller 67 can be reliably cleaned.

[0097] The draft device 7 of the present embodiment includes the draft device main body 7x and the cleaning cassette 30. The draft device main body 7x supports the draft roller pair. The cleaning cassette 30 supports the cleaning belt 37. The cleaning cassette 30 is configured to be detachably mounted to the draft device main body 7x. The maintenance operation such as replacement of the cleaning belt 37 thus can be easily performed.

[0098] In the draft device 7 of the present embodiment, at least the driving roller 33, the swing arm 32, and the one-way clutch 34 are arranged in the cleaning cassette 30. Accordingly, the cleaning belt 37 and a component group associated with the cleaning belt 37 can be collectively handled integrally as the cleaning cassette 30. As a result, the maintenance operation can be efficiently performed.

[0099] The fine spinning machine 1 of the present embodiment includes the draft device 7, the spinning device 9, and the winding device 13. The spinning device 9 is adapted to spin the fiber bundle 8 drafted by the draft device 7 using airflow to produce the spun yarn 10. The winding device 13 winds the spun yarn 10 produced by the spinning device 9 into the package 45.

[0100] Accordingly, since the fiber bundle 8 is drafted with the back bottom roller 66 and the third bottom roller 67 which have been cleaned, and the spun yarn 10 produced from the fiber bundle 8 is wound into the package 45, a high quality package 45 can be obtained. Since accumulation of the fibers in the draft device 7 can be suppressed, the operation of the fine spinning machine 1 is not stopped due to an excessive accumulation of the fibers in the draft device 7, or the like. Therefore, operation efficiency of the fine spinning machine 1 can be improved.

[0101] The preferred embodiments of the present invention have been described above, but the structures described above may be modified as below.

[0102] Instead of providing the protruding eccentric pin 85 on the pulley shaft of the cleaning input pulley 84, a recessed eccentric recess may be provided at an appropriate position of the cleaning input pulley 84, and a pin attached to one end of the link member 86 may be inserted into the eccentric recess to be coupled. A relationship of the recess and the coupling pin may be reversed also in a coupling structure of the link member 86 and the swing arm 32.

[0103] Instead of or in addition to having the link member 86 and the swing arm 32 detachable, the eccentric pin 85 and the link member 86 may be made detachable.

[0104] The configuration for transmitting an output rotation of the back bottom roller driving motor 91 to the back bottom roller 66 and the intermittent feeding device 101 is not limited to the endless driving belt 93, and may be realized using other drive transmission member (e.g., a gear or the like).

[0105] Instead of the back bottom roller driving motor 91, the power input to the intermittent feeding device 101 may be obtained from the third bottom roller driving motor 94. The motor adapted to drive the back bottom roller 66 and the third bottom roller 67 may be shared, and the intermittent feeding device 101 may receive the power from such a motor.

[0106] Instead of forming the axially elongate grooves 33a lined in the peripheral direction on the peripheral surface of the driving roller 33, a plurality of circular recesses may be formed, for example.

[0107] A target of cleaning with the cleaning belt 37 is not limited to both of the back bottom roller 66 and the third bottom roller 67, and may be one of the back bottom roller 66 and the third bottom roller 67. In order to clean the middle bottom roller 69 (the apron belt) and/or the front bottom roller 70, the above-described cleaning belt 37 may be used. Furthermore, three or more bottom rollers may be cleaned with one cleaning belt 37.

[0108] The spinning device is not limited to the configuration of applying twists with the air ejecting nozzle 27 adapted to generate the whirling airflow in one direction as in the embodiment described above, and various spinning methods may be adopted. For example, the spinning device may include a pair of nozzles adapted to generate whirling airflows in opposite directions, such that twists in opposite directions may be simultaneously applied to the fiber bundle. The spinning device may be a spinning device of another type.

[0109] A yarn feeding device including a pair of rollers may be arranged at a position between the spinning device 9 and the yarn accumulating device 12 in the yarn travelling direction.

[0110] In the embodiment described above, in the spinning unit 2, the spun yarn 10 travels from top to bottom in a machine height direction. However, in the spinning unit, the spun yarn may travel from the bottom to the top in the machine height direction.

Claims

1. A draft device including a plurality of draft roller pairs, each of the draft roller pairs including a top roller (16, 17, 19, 20) and a bottom roller (66, 67, 69, 70), the draft device being adapted to draft a fiber bundle (8) by the draft roller pairs by driving bottom rollers (66, 67, 69, 70), the draft device comprising:

   a cleaning member (37) having a cleaning surface adapted to make contact with at least one of the bottom rollers (66, 67, 69, 70) to clean such bottom roller (66, 67, 69, 70), and
   an intermittent feeding section (101) adapted to intermittently feed the cleaning member (37) by receiving power from a power source (91) adapted to drive at least one of the bottom rollers (66, 67, 69, 70).

2. The draft device according to claim 1, wherein the cleaning member (37) is a flexible endless belt.

3. The draft device according to claim 2, further comprising an urging member (38) adapted to urge the endless belt against at least one of the bottom rollers (66, 67, 69, 70).

4. The draft device according to claim 2 or claim 3, further comprising an intermittent driving roller (33) around which the endless belt is wound and adapted to intermittently feed the endless belt by rotating intermittently,
   wherein a plurality of recesses are formed on a surface of the intermittent driving roller (33).

5. The draft device according to any one of claim 2 through claim 4, further comprising two belt-supporting rollers (33, 36) arranged at a prescribed interval, wherein the endless belt is wound around the two belt-supporting rollers (33, 36) such that the endless belt is arranged to be elliptical.

6. The draft device according to any one of claim 2 through claim 5, further comprising at least three draft roller pairs arranged in a travelling direction of the fiber bundle (8), the three draft roller pairs being a front roller pair (20, 70), a middle roller pair (19, 69), and a third roller pair (17, 67) arranged in this order from downstream in the travelling direction of the fiber bundle (8),
   wherein an apron belt (18, 68) is respectively provided for the top roller (19) and the bottom roller (69) of the middle roller pair, and
   the cleaning surface of the endless belt as the cleaning member (37) is provided to make contact with

the bottom roller (67) of the third roller pair (17, 67).

7. The draft device according to claim 6, wherein the draft roller pairs are arranged in a direction substantially parallel to the travelling direction of the fiber bundle (8),
the driving source (91) is a motor adapted to drive the bottom roller (66) located most upstream in the travelling direction of the fiber bundle (8), and
the intermittent feeding section (101) is adapted to intermittently feed the cleaning member (37) by receiving power from the motor.

8. The draft device according to any one of claim 1 through claim 7, further comprising:

a draft device main body (7x) adapted to support the draft roller pairs, and
a cleaning unit (30) adapted to support the cleaning member (37),
wherein the cleaning unit (30) is provided detachably with respect to the draft device main body (7x).

9. The draft device according to any one of claim 1 through claim 8, wherein the intermittent feeding section (101) includes:

an input rotating body (84) adapted to receive transmission of power from the driving source (91),
an output rotating body (33) adapted to drive the cleaning member (37),
a swingably-supported reciprocating arm (32),
an eccentric portion (85) adapted to integrally rotate with the input rotating body (84),
a coupling member (86) adapted to couple the eccentric portion (85) and the reciprocating arm (32), and
a one-way clutch (34) provided between the reciprocating arm (32) and the output rotating body (33).

10. The draft device according to claim 9, wherein the cleaning unit (30) includes at least the output rotating body (33), the reciprocating arm (32), and the one-way clutch (34).

11. A spinning machine comprising:

the draft device (7) according to any one of claim 1 through claim 10,
a spinning device (9) adapted to produce a spun yarn (10) by spinning the fiber bundle (8) drafted by the draft device (7) using airflow, and
a winding device (13) adapted to wind the spun yarn (10) produced by the spinning device (9) into a package (45).

FIG. 1

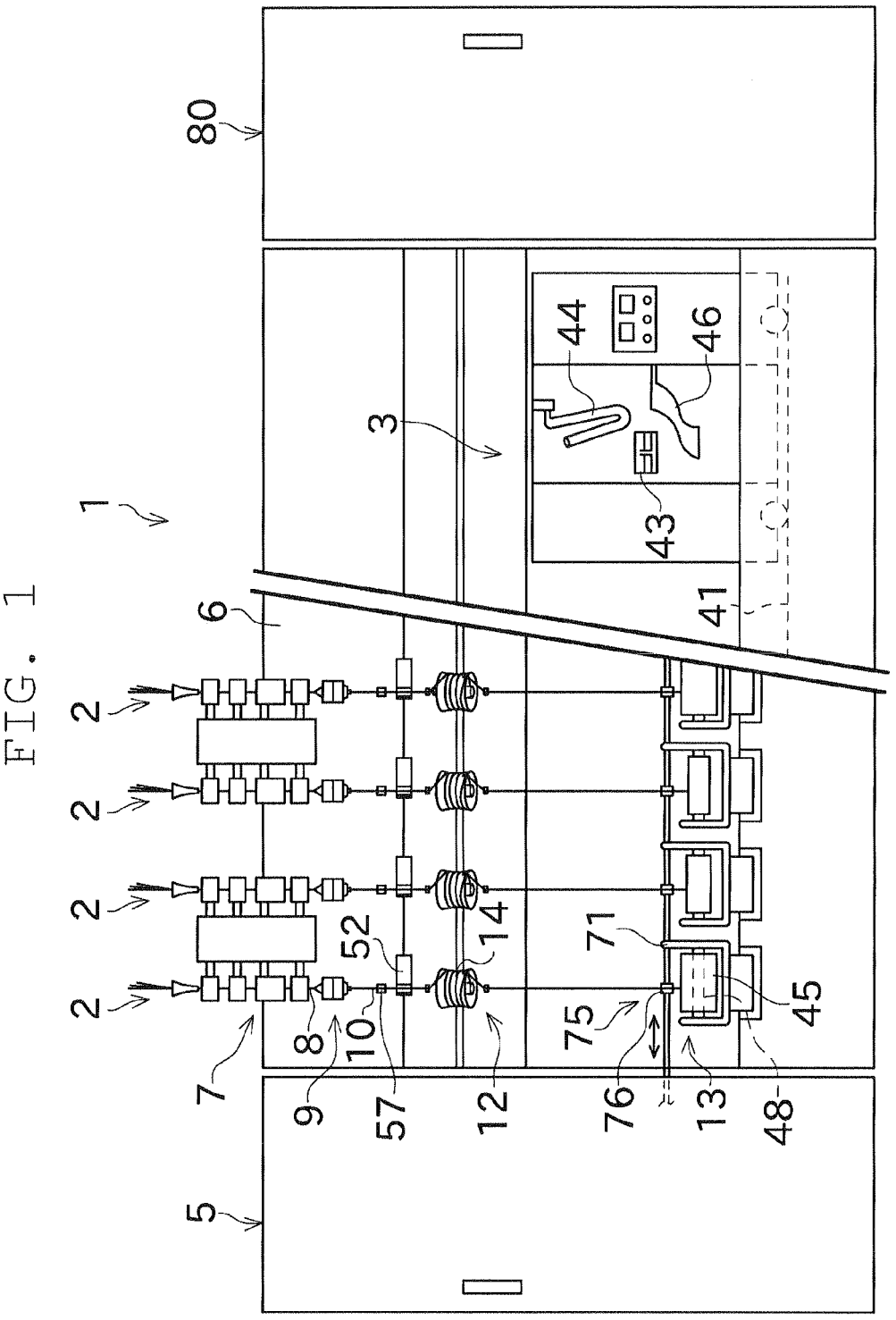

FIG. 2

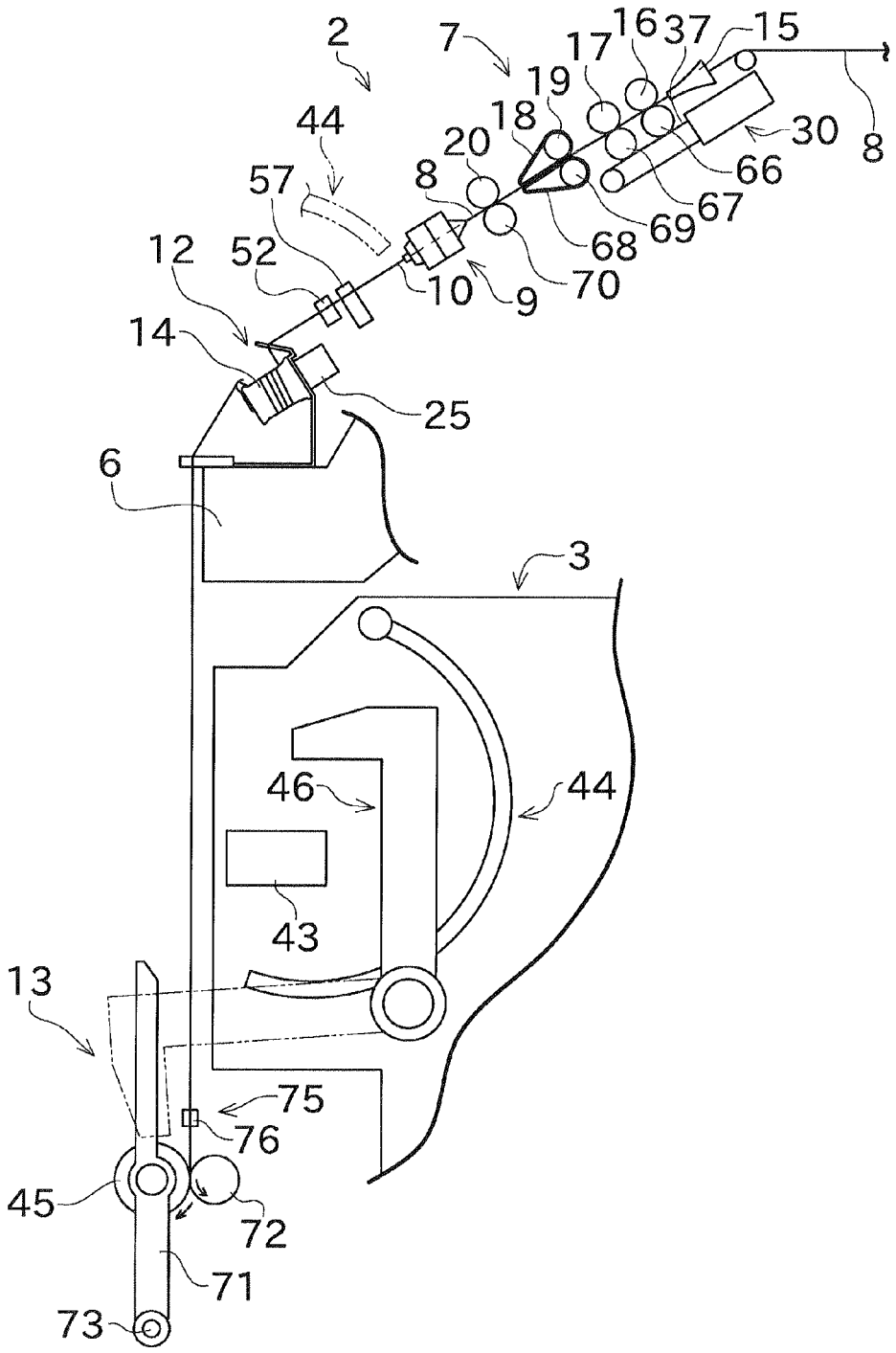
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FIG. 3

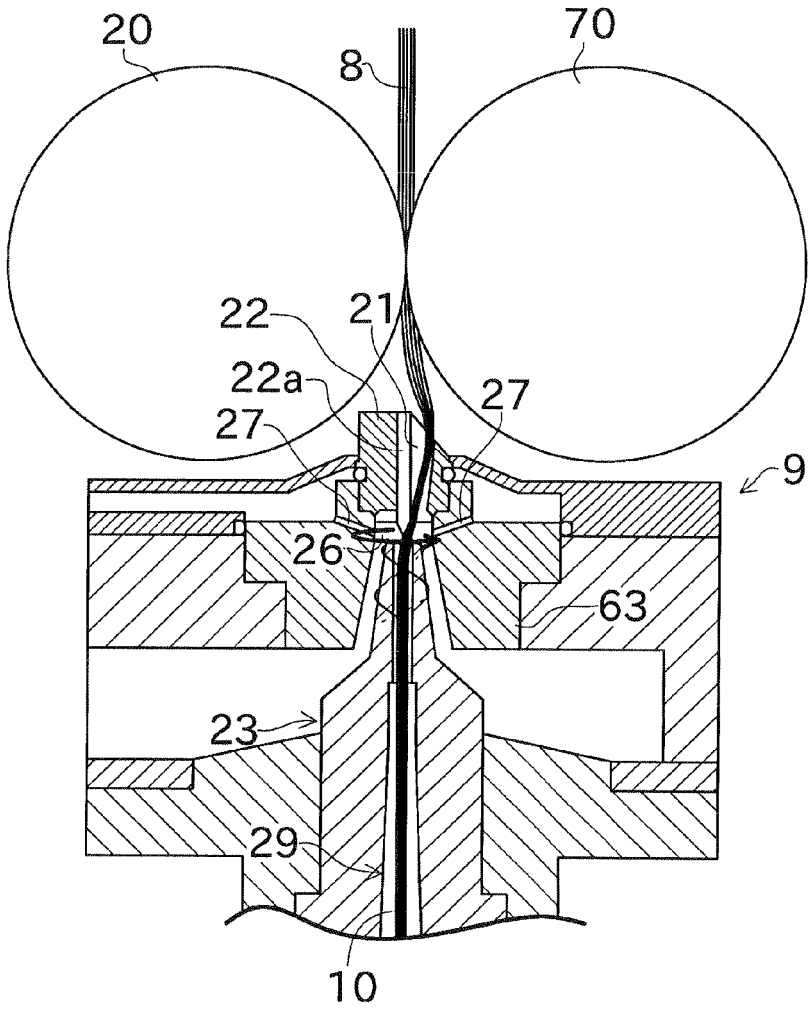

FIG. 4

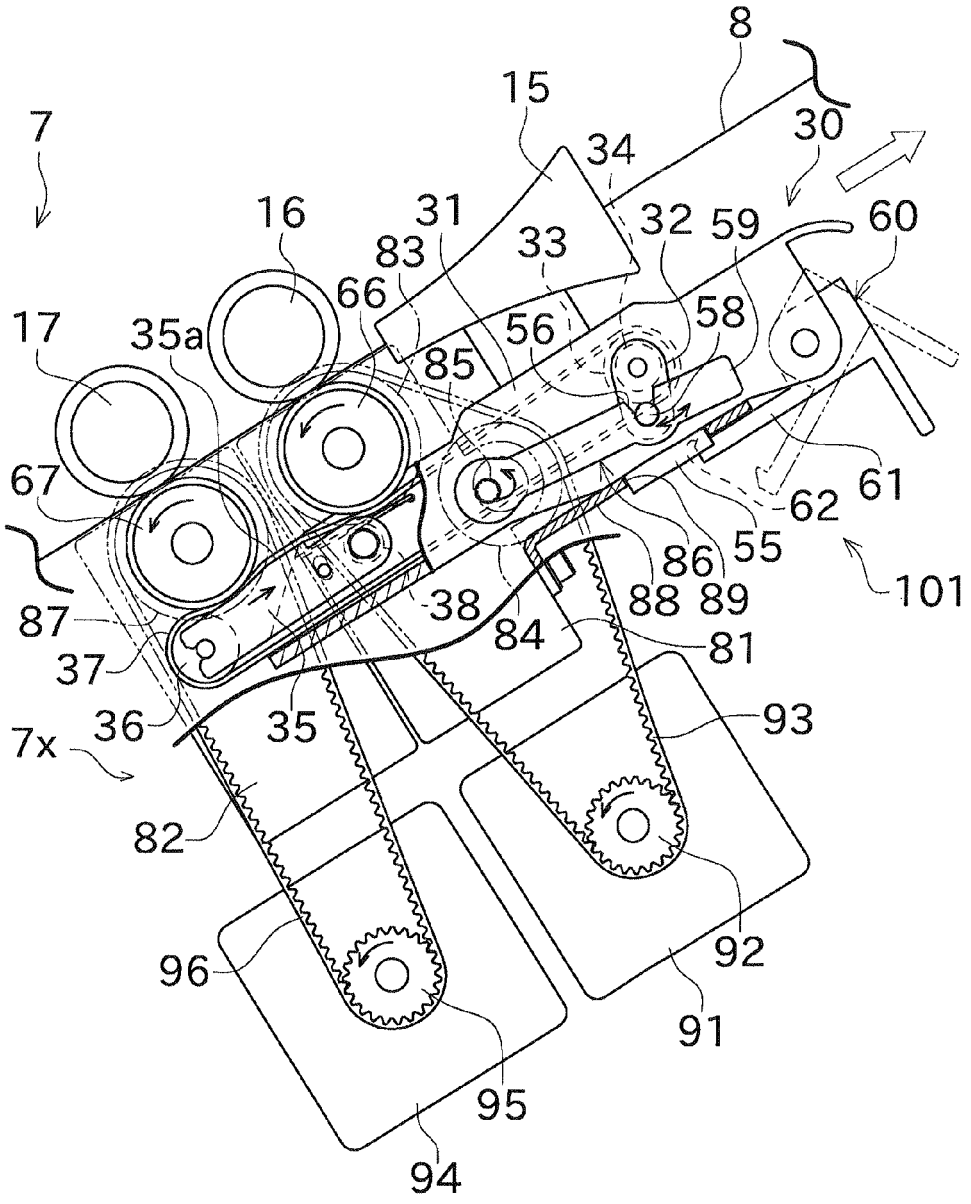
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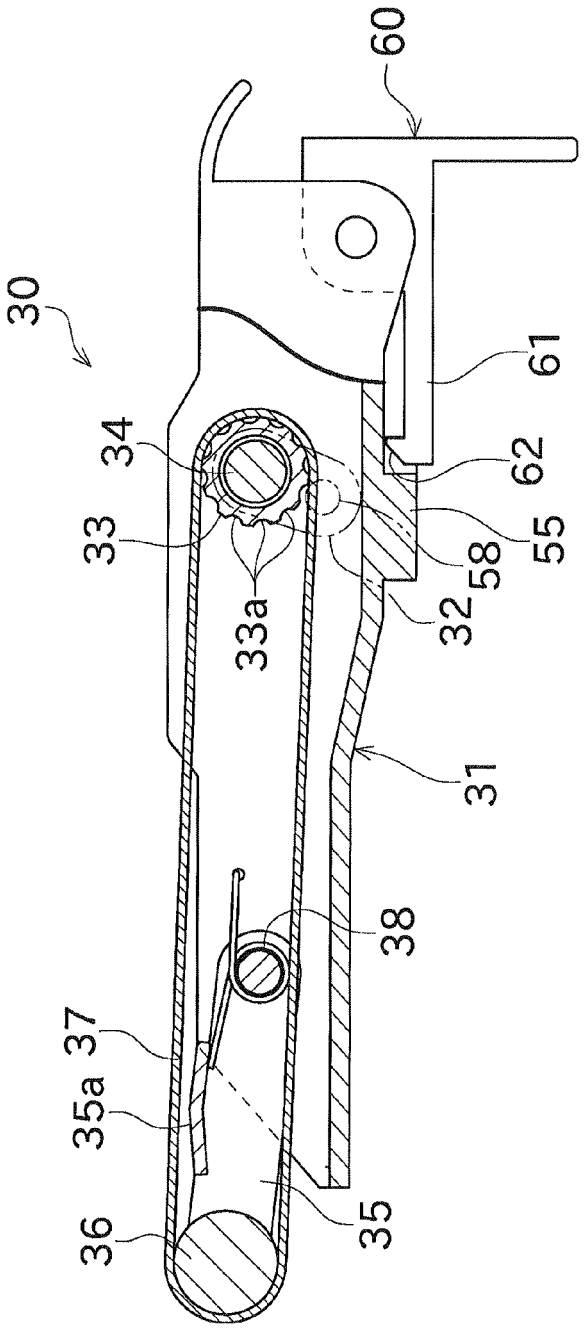
FIG. 5



REFERENCES CITED IN THE DESCRIPTION

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