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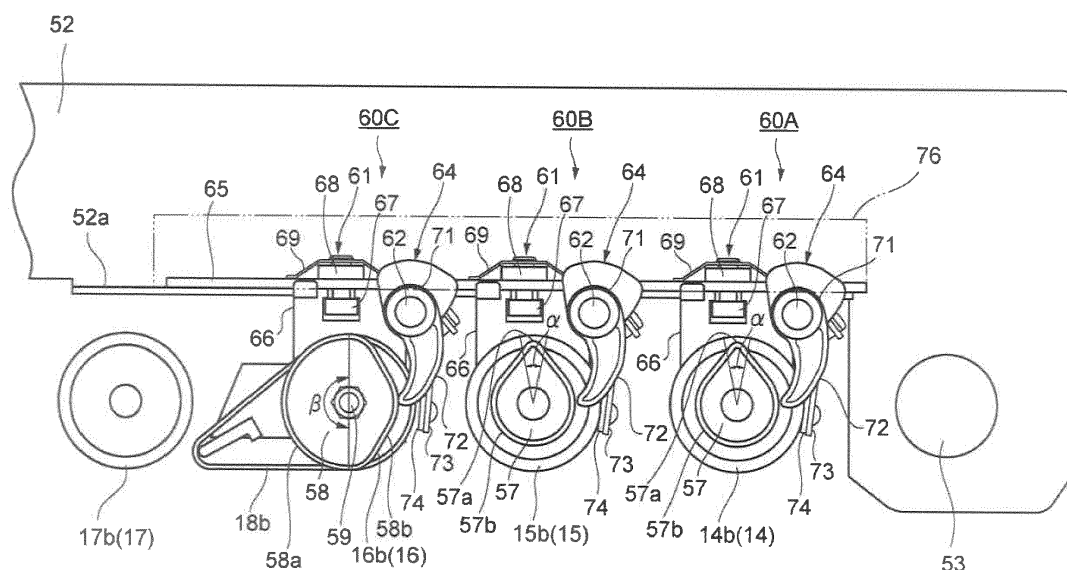
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(54) **DRAFT DEVICE AND SPINNING MACHINE**

(57) To provide a draft device capable of preventing fiber pieces from being accumulated between a top roller and a cleaning module, and a spinning machine equipped with such a draft, device. The draft device includes a plurality of pairs of rollers (14, 15, 16, and 17), and a cleaning module (64) arranged to make contact with and separate from a middle top roller (16b). The

cleaning module (64) is separated from the middle top roller (16b) within a first angle (P) of 50° or more and 300° or less around the rotation shaft of the middle top roller (16b), and is brought into contact with the middle top roller (16b) within a second angle obtained by subtracting the first angle from 360° around the rotation shaft of the middle top roller (16b).

FIG. 4



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a draft device and a spinning machine.

2. Description of the Related Art

[0002] There is known a draft device including a plurality of pairs of rollers each having a bottom roller and a top roller, a plurality of cleaning modules arranged to be able to make contact with and separate from each of the plurality of top rollers, and a plurality of cams adapted to control contacting and separating timing of each of the plurality of cleaning modules (see e.g., JP H0731858 (U)). According to such a draft device, fiber pieces (so-called fluffs, including fiber pieces such as cotton, other natural fibers, synthetic fibers, or the like; the same applies hereinafter) attached to the top roller can be removed.

[0003] In the above-described draft device, all cams are configured to separate the cleaning module from the top roller within an angle of, for example, less than 10° around a rotation shaft of the top roller. Thus, in the top roller having a high rotation speed, the time at which the cleaning module separates from the top roller becomes short, and fiber pieces may be accumulated between the top roller and the cleaning module.

BRIEF SUMMARY OF THE INVENTION

[0004] It is therefore an object of the present invention to provide a draft device capable of preventing fiber pieces from being accumulated between a top roller and a cleaning module, and a spinning machine equipped with such a draft device.

[0005] A draft device of the present invention includes a plurality of pairs of rollers each including a bottom roller and a top roller; a cleaning module arranged to make contact with and separate from at least one of the top rollers; and a control member arranged on a rotation shaft of at least one of the top rollers and adapted to control contacting and separating timing of the cleaning module, wherein the control member is adapted to separate the cleaning module from the top roller within a first angle around the rotation shaft, and to bring the cleaning module into contact with the top roller within a second angle around the rotation shaft, the second angle obtained by subtracting the first angle from 360°, characterized in that the first angle is selected from a range of 50° or more and 300° or less.

[0006] In such a draft device, the cleaning module is separated from the top roller within the first angle of 50° or more and 300° or less around the rotation shaft of the top roller. Thus, even if the rotation speed of the top roller

is high, the time during which the cleaning module separates from the top roller can be ensured, and the fiber pieces can be dropped between the top roller and the cleaning module. Therefore, according to the draft device, the fiber pieces can be prevented from being accumulated between the top roller and the cleaning module. The above-described control member is preferably arranged on the rotation shaft of the top roller including the apron belt.

[0007] In the draft device of the present invention, the control member may be a cam having a fan shape when seen from a direction in which the rotation shaft extends. Thus, even if the rotation speed of the top roller is high, the time during which the cleaning module separates from the top roller can be reliably ensured.

[0008] A draft device of the present invention includes a plurality of pairs of rollers each including a bottom roller and a top roller; a plurality of cleaning modules arranged to make contact with and separate from at least two of the top rollers; and a plurality of control members arranged on a rotation shaft of each of the at least two top rollers, the plurality of control members being adapted to control contacting and separating timing of each of a plurality of cleaning modules, wherein the control member located most upstream in a draft direction is adapted to separate the cleaning module from the top roller within a third angle around the rotation shaft, and the control member located most downstream in the draft direction is adapted to separate the cleaning module from the top roller within a fourth angle around the rotation shaft, characterized in that the fourth angle is greater than the third angle.

[0009] In the draft device, even in the downstream top roller having a rotation speed higher than that of the upstream top roller, the time during which the cleaning module separates from the top roller can be ensured, and the fiber pieces can be dropped between the top roller and the cleaning module. Therefore, according to the draft device, the fiber pieces can be prevented from being accumulated between the top roller and the cleaning module. The fourth angle is preferably selected from a range of 50° or more and 300° or less around the rotation shaft. The third angle may be selected from a range of 50° or more and 300° or less around the rotation shaft.

[0010] In the draft device of the present invention, the control member located most upstream in the draft direction and the control member located most downstream in the draft direction may be cams having different shapes from each other when seen from a direction in which the rotation shaft extends. Thus, the time during which the cleaning module separates from the top roller can be ensured. The above-described control member located most downstream in the draft direction is preferably arranged on the rotation shaft of the top roller including the apron belt.

[0011] In the draft device of the present invention, the control member may be a cam having a control surface adapted to separate the cleaning module from the top

roller, and the control surface may be located on an outer side of an outer peripheral surface of a roller main body of the top roller when seen from a direction in which the rotation shaft extends. The cleaning module is thereby greatly spaced apart from the top roller, and hence even if the fiber pieces are in a lump, for example, such fiber pieces can be dropped between the top roller and the cleaning module.

[0012] In the draft device of the present invention, the cleaning module may be arranged to make contact with and separate from each of the at least two top rollers, the control member may be arranged on the rotation shaft of each of the at least two top rollers, the control member located most downstream in the draft direction may be attached to the rotation shaft by screwing, and the control member located most upstream in the draft direction may be attached to the rotation shaft by press fitting. The number of components can be reduced by using press fitting to attach the control member to the upstream top roller having a low rotation speed. The control member can be reliably attached to the top roller by using screwing to attach the control member to the downstream top roller having a high rotation speed.

[0013] The draft device of the present invention may further include a first supporting section adapted to support the cleaning module, wherein the cleaning module may include a cleaner pad made of rubber or resin, and wherein the first supporting section may swingably support the cleaner pad. Thus, the cleaner pad that can be brought into contact with or separated from each of the top rollers can be realized with a simple configuration.

[0014] The draft device of the present invention may further include a second supporting section adapted to support the top roller, wherein the first supporting section may be supported so that a position of the first supporting section is adjusted toward upstream and downstream in the draft direction by the second supporting section. Thus, for example, when the distance between the adjacent top rollers is changed, the cleaning module can be moved together with the top roller.

[0015] The draft device of the present invention is preferably applied to a configuration in which the draft device includes a pair of back rollers, a pair of third rollers, and pair of middle rollers, and a pair of front rollers as the plurality of pairs of rollers in order from upstream in a draft direction, wherein the cleaning module is arranged with respect to each of top rollers of the pair of back rollers, the pair of third rollers, and the pair of middle rollers, and wherein the control member is arranged on a rotation shaft of each of the top rollers on which the cleaning module is arranged.

[0016] A spinning machine of the present invention includes the above-described draft device, a pneumatic spinning device adapted to produce a yarn by applying twists to the fiber bundle drafted by the draft device, and a winding device adapted to wind the yarn produced by the pneumatic spinning device to form a package.

[0017] In such a spinning machine, the fiber pieces can

be prevented from being accumulated between the top roller and the cleaning module by the draft device.

[0018] According to the present invention, a draft device capable of preventing the fiber pieces from being accumulated between the top roller and the cleaning module, and a spinning machine equipped with such a draft device can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a front view of a spinning machine according to one embodiment of the present invention;

FIG. 2 is a side view of a spinning unit of the spinning machine of FIG. 1;

FIG. 3 is a side view of a draft device of the spinning unit of FIG. 2;

FIG. 4 is a side view of a plurality of cleaning devices when a cleaning module is in a contact state;

FIG. 5 is a side view of the plurality of cleaning devices when the cleaning module is in a separated state;

FIG. 6 is a plan view of the plurality of cleaning devices of FIG. 4; and

FIG. 7 is an exploded perspective view of the cleaning device.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0020] An embodiment of the present invention will be hereinafter described in detail with reference to the accompanying drawings. The same reference numerals are denoted on the same or corresponding portions throughout the drawings, and redundant description will be omitted.

[0021] As illustrated in FIG. 1, a spinning machine 1 includes a plurality of spinning units 2, a yarn joining cart 3, a doffing cart (not illustrated), a first end frame 4, and a second end frame 5. The plurality of the spinning units 2 are arranged in a row. Each of the spinning units 2 is adapted to produce a yarn Y and to wind the yarn Y around a package P. The yarn joining cart 3 is adapted to perform a yarn joining operation in a spinning unit 2 after the yarn Y is cut, or is broken for some reason in such a spinning unit 2. The doffing cart is adapted to doff the package P and to supply a new bobbin B to the spinning unit 2 when the package P is fully-wound in a spinning unit 2.

[0022] The first end frame 4 accommodates, for example, a collecting device adapted to collect fiber waste, yarn waste, and the like generated in the spinning units 2. The second end frame 5 accommodates an air supplying section adapted to adjust air pressure of air (compressed air) to be supplied to the spinning machine 1 and to supply the air to each section of the spinning machine 1, a drive motor adapted to supply power to each section

of the spinning unit 2, and the like. The second end frame 5 is provided with a machine control device 41, a display screen 42, and an input key 43. The machine control device 41 is adapted to intensively manage and control each section of the spinning machine 1. The display screen 42 is capable of displaying information relating to set contents and/or status, or the like of the spinning units 2. An operator can perform a setting operation of the spinning units 2 by performing an appropriate operation with the input key 43.

[0023] As illustrated in FIGS. 1 and 2, each spinning unit 2 includes a draft device 6, a pneumatic spinning device 7, a yarn monitoring device 8, a tension sensor 9, a yarn storage device 11, a waxing device 12, and a winding device 13 in this order from upstream in a travelling direction of the yarn Y. A unit controller 10 is provided for every predetermined number of the spinning units 2 and is adapted to control operations of the spinning units 2.

[0024] The draft device 6 is adapted to draft a sliver (fiber bundle) S. The draft device 6 includes a pair of back rollers 14, a pair of third rollers 15, a pair of middle rollers 16, and a pair of front rollers 17 in this order from upstream in a travelling direction of the sliver S. Each pair of rollers 14, 15, 16, and 17 includes a bottom roller and a top roller. The bottom roller is rotationally driven by the drive motor provided in the second end frame 5 or by a drive motor provided in each spinning unit 2. An apron belt 18a is provided with respect to the bottom roller of the pair of middle rollers 16. An apron belt 18b is provided with respect to the top roller of the pair of middle rollers 16.

[0025] The pneumatic spinning device 7 is adapted to produce the yarn Y by twisting a fiber bundle F, which has been drafted by the draft device 6, with whirling airflow. More specifically (however, not illustrated), the pneumatic spinning device 7 includes a spinning chamber, a fiber guiding section, a whirling airflow generating nozzle and a hollow guide shaft body. The fiber guiding section is adapted to guide into the spinning chamber, the fiber bundle F supplied from the upstream draft device 6. The whirling airflow generating nozzle is arranged at a periphery of a travelling path of the fiber bundle F, and is adapted to generate a whirling airflow in the spinning chamber. With the whirling airflow, each fiber end of a plurality of fibers that form the fiber bundle F is reversed and whirled. The hollow guide shaft body is adapted to guide the yarn Y from the spinning chamber to an outside of the pneumatic spinning device 7.

[0026] The yarn monitoring device 8 is adapted to monitor information on the travelling yarn Y between the pneumatic spinning device 7 and the yarn storage device 11, and to detect presence or absence of a yarn defect based on the information acquired by the monitoring. When detecting the yarn defect, the yarn monitoring device 8 transmits a yarn defect detection signal to the unit controller 10. The yarn monitoring device 8 detects a thickness abnormality of the yarn Y and/or a foreign substance included in the yarn Y, for example, as the yarn defect.

The yarn monitoring device 8 also detects a yarn breakage or the like. The tension sensor 9 is adapted to measure tension of the travelling yarn Y between the pneumatic spinning device 7 and the yarn storage device 11, and to transmit a tension measurement signal to the unit controller 10. When the unit controller 10 determines presence of an abnormality based on a detection result of the yarn monitoring device 8 and/or the tension sensor 9, the yarn Y is cut in the spinning unit 2. Specifically, by stopping air supply to the pneumatic spinning device 7 to interrupt the production of the yarn Y, the yarn Y is cut. Alternatively, the yarn Y may be cut with a separately provided cutter.

[0027] The waxing device 12 is adapted to apply wax to the yarn Y between the yarn storage device 11 and the winding device 13.

[0028] The yarn storage device 11 is adapted to eliminate a slack of the yarn Y between the pneumatic spinning device 7 and the winding device 13. The yarn storage device 11 has a function of stably pulling out the yarn from the pneumatic spinning device 7, a function of preventing the yarn Y from slackening by accumulating the yarn Y fed from the pneumatic spinning device 7 at the time of the yarn joining operation or the like by the yarn joining cart 3, and a function of preventing variation in the tension of the yarn Y at downstream of the yarn storage device 11 from being propagated to the pneumatic spinning device 7.

[0029] The winding device 13 is adapted to wind the yarn Y around a bobbin B to form a package P. The winding device 13 includes a cradle arm 21, a winding drum 22, and a traverse guide 23. The cradle arm 21 is adapted to rotatably support the bobbin B. The cradle arm 21 is swingably supported by a support shaft 24 and is adapted to bring a surface of the bobbin B or a surface of the package P into contact with a surface of the winding drum 22 under appropriate pressure. A drive motor (not illustrated) provided in the second end frame 5 is adapted to simultaneously drive the winding drums 22 each provided in the plurality of the spinning units 2. Accordingly, in each spinning unit 2, the bobbin B or the package P is rotated in a winding direction. The traverse guide 23 of each spinning unit 2 is provided on a shaft 25 shared by the plurality of the spinning units 2. By the drive motor in the second end frame 5 driving the shaft 25 to reciprocate in a direction of a rotational axis of the winding drum 22, the traverse guide 23 traverses the yarn Y in a predetermined width with respect to the rotating bobbin 13 or package P.

[0030] After the yarn Y is cut, or the yarn Y is broken for some reason in a spinning unit 2, the yarn joining cart 3 travels to such a spinning unit 2 to perform the yarn joining operation. The yarn joining cart 3 includes a yarn joining device 26, a suction pipe 27, and a suction mouth 28. The suction pipe 27 is swingably supported by a support shaft 31, and is adapted to catch the yarn Y from the pneumatic spinning device 7 and to guide the caught yarn Y to the yarn joining device 26. The suction mouth

28 is swingably supported by a support shaft 32, and is adapted to catch the yarn Y from the winding device 13 and to guide the caught yarn Y to the yarn joining device 26. The yarn joining device 26 is adapted to join the guided yarns Y together. The yarn joining device 26 is a splicer using the compressed air, a piecer using a seed yarn, a knotter adapted to join the yarns Y together in a mechanical manner, or the like.

[0031] When the yarn joining cart 3 performs the yarn joining operation, the package P is rotated in an unwinding direction (reversely rotated). At this time, the cradle arm 21 is moved by an air cylinder (not illustrated) such that the package P is located away from the winding drum 22, and the package P is reversely rotated by a reversely-rotating roller (not illustrated) provided in the yarn joining cart 3.

[0032] The above-described draft device 6 will be more specifically described. As illustrated in FIG. 3, the pair of back rollers 14 includes a back bottom roller 14a and a back top roller 14b facing each other with a travelling path of the sliver S therebetween. The pair of third rollers 15 includes a third bottom roller 15a and a third top roller 15b facing each other with a travelling path of the sliver S therebetween. The pair of middle rollers 16 includes a middle bottom roller 16a and a middle top roller 16b facing each other with a travelling path of the sliver S therebetween. An apron belt 18a is provided with respect to the middle bottom roller 16a. An apron belt 18b is provided with respect to the middle top roller 16b. The pair of front rollers 17 includes a front bottom roller 17a and a front top roller 17b facing each other with a travelling path of the sliver S therebetween.

[0033] Each of the pairs of rollers 14, 15, 16, and 17 causes the sliver S supplied from a can (not illustrated) to travel from the upstream towards the downstream while drafting, and supplies the fiber bundle F (drafted sliver S) to the pneumatic spinning device 7. Hereinafter, the direction along the travelling path of the sliver S is referred to as "draft direction". The upstream side in the draft direction is simply referred to as "upstream side" and the downstream side in the draft direction is simply referred to as "downstream side".

[0034] Each of the bottom rollers 14a, 15a, 16a, and 17a is rotatably supported by a base 51. Each of the bottom rollers 14a, 15a, 16a, and 17a is driven and rotated at a rotation speed different from one another so that the rotation speed becomes faster toward the downstream side. Each of the top rollers 14b, 15b, 16b, and 17b is rotatably supported by a cradle (second supporting section) 52. Each of the top rollers 14b, 15b, 16b, and 17b is driven and rotated by being brought into contact with each of the bottom rollers 14a, 15a, 16a, and 17a at a predetermined pressure. Note that the cradle 52 rotatably supports each of the top rollers 14b, 15b, 16b, and 17b of the draft device 6 arranged in each of the pair of adjacent spinning units 2.

[0035] In the base 51, the positions of the back bottom roller 14a and the third bottom roller 15a can be adjusted

along the draft direction. In the cradle 52, the positions of the back top roller 14b and the third top roller 15b can be adjusted along the draft direction. Thus, the distance between the adjacent pair of rollers 14, 15 and the distance between the adjacent pair of rollers 15, 16 can be adjusted according to the fiber length of the fiber bundle F to be drafted.

[0036] A swing shaft 53 is provided at the upstream end of the cradle 52. The swing shaft 53 swingably supports the cradle 52 between a contact position where each of the top rollers 14b, 15b, 16b, and 17b makes contact with each of the bottom rollers 14a, 15a, 16a, and 17a, and a separated position where each of the top rollers 14b, 15b, 16b, and 17b is separated from each of the bottom rollers 14a, 15a, 16a, and 17a. A handle 54 used when the operator carries out the swinging operation of the cradle 52 is provided at the downstream end of the cradle 52. When the cradle 52 is swung to the contact position, a hook 55 provided at the lower end of the handle 54 engages with a fixed roller 56 provided at the downstream end of the base 51, and a state where each of the top rollers 14b, 15b, 16b, and 17b is brought into contact with each of the bottom rollers 14a, 15a, 16a, and 17a at a predetermined pressure is maintained.

[0037] The draft device 6 includes a plurality of cleaning devices 60A, 60B, and 60C. As illustrated in FIGS. 4, 5, and 6, each of the cleaning devices 60A, 60B, and 60C includes a supporting mechanism (first supporting section) 61 and a cleaning module 64. Each supporting mechanism 61 is attached to the cradle 52. Each cleaning module 64 is swingably supported by the supporting mechanism 61 at one end thereof.

[0038] The cleaning devices 60A, 60B, and 60C have a similar configuration with respect to one another, and thus the configuration of the cleaning device 60A will be described below, and the description on the configuration of the cleaning devices 60B and 60C will be omitted.

[0039] As illustrated in FIG. 7, the supporting mechanism 61 includes a mechanism main body 66 and a swing shaft 62. The mechanism main body 66 swingably supports the swing shaft 62. As illustrated in FIG. 6, an attachment member 65 having a long hole 65a extending in the draft direction is fixed to an attachment surface 52a of the cradle 52. As illustrated in FIGS. 4 and 5, the mechanism main body 66 is arranged on a side on which the back top roller 14b is arranged with respect to the attachment member 65. A resin washer 68 and a plate spring 69 are arranged on a side opposite to the side on which the back top roller 14b is arranged with respect to the attachment member 65. As illustrated in FIG. 7, in such a state, a pin 67 is inserted to a through hole 66a of the mechanism main body 66, the long hole 65a of the attachment member 65, and the resin washer 68 from the side on which the back top roller 14b is arranged, and a distal end portion 67a of the pin 67 is engaged to an engagement hole 69a of the plate spring 69. As illustrated in FIGS. 4, 5, and 6, a cover 76 adapted to cover the distal end portion 67a of the pin 67, the resin washer 68,

and the plate spring 69 in each of the cleaning device 60A, 60B, and 60C is attached to the attachment member 65.

[0040] The supporting mechanism 61 is attached to the attachment member 65 with the rotation shaft of the back top roller 14b arranged in a positioning recess 66b provided in the mechanism main body 66 (see FIG. 7). The position of the supporting mechanism 61 can be adjusted to the upstream side and the downstream side in the draft direction along the long hole 65a of the attachment member 65 while being subjected to a predetermined friction resistance by the urging force of the plate spring 69. That is, the supporting mechanism 61 is supported so as to be able to adjust its position to the upstream side and the downstream side in the draft direction by the cradle 52. The resin washer 68 has a function of preventing deformation of the plate spring 69.

[0041] As illustrated in FIG. 7, the cleaning module 64 includes a module main body 71, a cam follower 72, a supporting member 73, and a cleaner pad 74. The module main body 71 is integrally formed with the cam follower 72, and is swingably supported by the swing shaft 62. The supporting member 73 is a plate-shaped member, and is fixed to the module main body 71 by a bolt 75. The cleaner pad 74 is made of rubber or resin. The cleaner pad 74 is attached to the supporting member 73 by fitting a plurality of protrusions 74a formed on the cleaner pad 74 into a plurality of engagement holes 73a formed in the supporting member 73. The cleaner pad 74 is swingably supported by the supporting mechanism 61 via the supporting member 73 and the like. A swing shaft 62 is passed through the inner side of a coil spring 63. The coil spring 63 is arranged to urge the cleaner pad 74 in a direction of approaching the back top roller 14b (see FIG. 4) between the mechanism main body 66 and the module main body 71.

[0042] As illustrated in FIGS. 4 and 5, a first cam (control member) 57 is attached to the rotation shaft of the back top roller 14b by press fitting. By way of example, a projection formed on the inner side surface of the first cam 57 is press fitted into the recess formed on the end face of the rotation shaft of the back top roller 14b to attach the first cam 57 to the rotation shaft of the back top roller 14b. The first cam 57 controls the contacting and separating timing of the cleaning module 64 (i.e., cleaning module 64 of cleaning device 60A) arranged so as to be able to make contact with and separate from the back top roller 14b.

[0043] The first cam 57 includes a first control surface 57a that separates the cleaner pad 74 from the back top roller 14b by the following of the cam follower 72. The first control surface 57a separates the cleaner pad 74 from the back top roller 14b within an angle α of 5° or more and 10° or less around the rotation shaft of the back top roller 14b. A region 57b other than the first control surface 57a of the outer peripheral surface of the first cam 57 is formed to be spaced apart from the cam follower 72, and causes the cleaner pad 74 to make contact

with the back top roller 14b.

[0044] When the first cam 57 is rotated with the back top roller 14b, the cleaning module 64 is swung around the swing shaft 62, and the contact (see FIG. 4) and the separation (see FIG. 5) of the cleaner pad 74 with respect to the back top roller 14b are repeated. The fiber pieces attached to the back top roller 14b attach to the cleaner pad 74 when the cleaner pad 74 is brought into contact with the back top roller 14b. The fiber pieces attached to the cleaner pad 74, for example, drop by its own weight when the cleaner pad 74 is separated from the back top roller 14b. The cleaning device 60A removes the fiber pieces from the back top roller 14b in such a manner.

[0045] The first cam 57 is also fixed to the rotation shaft of the third top roller 15b by press fitting. The first cam 57 controls the contact and separating timing of the cleaning module 64 (i.e., the cleaning module 64 of the cleaning device 60B) arranged to be able to make contact with and separate from the third top roller 15b. The cleaning device 60B removes the fiber pieces from the third top roller 15b in such a manner.

[0046] A second cam (control member) 58 is attached to the rotation shaft of the middle top roller 16b with a bolt 59 (i.e., by screwing). The second cam 58 controls the contacting and separating timing of the cleaning module 64 (i.e., the cleaning module 64 of the cleaning device 60C) arranged to be able to make contact with and separate from the apron belt 18b of the middle top roller 16b.

[0047] The second cam 58 includes a second control surface (control surface) 58a that separates the cleaner pad 74 from the apron belt 18b of the middle top roller 16b by the following of the cam follower 72. The second control surface 58a separates the cleaner pad 74 from the apron belt 18b of the middle top roller 16b within an angle (first angle) β of about 180° around the rotation shaft of the middle top roller 16b. A region 58b other than the second control surface 58a of the outer peripheral surface of the second cam 58 is formed to be spaced apart from the cam follower 72, and causes the cleaner pad 74 to make contact with the apron belt 18b of the middle top roller 16b. The region 58b causes the cleaner pad 74 to make contact with the apron belt 18b of the middle top roller 16b within an angle (second angle) of about 180° around the rotation shaft of the middle top roller 16b.

[0048] The second cam 58 has a fan shape when seen from a direction in which the rotation shaft of the middle top roller 16b extends. The second control surface 58a of the second cam 58 is located on the outer side of the outer peripheral surface of the roller main body of the middle top roller 16b by an amount corresponding to the thickness of the apron belt 18b, for example, when seen from the direction in which the rotation shaft of the middle top roller 16b extends.

[0049] When the second cam 58 is rotated with the middle top roller 16b, the cleaning module 64 is swung around the swing shaft 62, and the contact (see FIG. 4) and the separation (see FIG. 5) of the cleaner pad 74

with respect to the apron belt 18b are repeated. The fiber pieces attached to the apron belt 18b attach to the cleaner pad 74 when the cleaner pad 74 is brought into contact with the apron belt 18b. The fiber pieces attached to the cleaner pad 74, for example, drops by its own weight when the cleaner pad 74 is separated from the apron belt 18b. The cleaning device 60C removes the fiber pieces from the apron belt 18b in such a manner.

[0050] Comparing the first cam 57 and the second cam 58, the shape of the first cam 57 and the shape of the second cam 58 are different from each other when seen from the direction in which the rotation shaft of each of the top rollers 14b, 15b, and 16b extends. The contacting and separating timing controlled by the first cam 57, and the contacting and separating timing controlled by the second cam 58 are different from each other. The angle β (fourth angle around the rotation shaft of the middle top roller 16b) at which the second cam 58 separates the cleaner pad 74 from the apron belt 18b is greater than the angle α (third angle around the respective rotation shaft of the back top roller 14b and the third top roller 15b) at which the first cam 57 separates the cleaner pad 74 from the back top roller 14b and the third top roller 15b.

[0051] As described above, in the draft device 6, the cleaning module 64 is separated from the apron belt 18b within the angle of about 180° around the rotation shaft of the middle top roller 16b. Thus, even if the rotation speed of the middle top roller 16b is high, the time during which the cleaning module 64 separates from the apron belt 18b can be ensured, and the fiber pieces can be dropped between the apron belt 18b and the cleaning module 64. Therefore, according to the draft device 6, the fiber pieces can be prevented from being accumulated between the apron belt 18b and the cleaning module 64.

[0052] In the draft device 6, the second cam 58 has a fan shape when seen from a direction in which the rotation shaft of the middle top roller 16b extends. Thus, even if the rotation speed of the middle top roller 16b is high, the time during which the cleaning module 64 separates from the apron belt 18b can be reliably ensured.

[0053] In the draft device 6, the angle β at which the second cam 58 separates the cleaner pad 74 from the apron belt 18b is greater than the angle α at which the first cam 57 separates the cleaner pad 74 from the back top roller 14b and the third top roller 15b. Thus, even in the middle top roller 16b, which rotation speed is higher than the back top roller 14b and the third top roller 15b, the time during which the cleaning module 64 separates from the apron belt 18b can be ensured, and the fiber pieces can be dropped between the apron belt 18b and the cleaning module 64.

[0054] In the draft device 6, the shape of the first cam 57 and the shape of the second cam 58 are different from each other when seen from the direction in which the rotation shaft of each of the top rollers 14b, 15b, and 16b extends. Thus, the time during which the cleaning module 64 separates from each of the top rollers 14b, 15b, and

16b can be reliably ensured.

[0055] In the draft device 6, the second control surface 58a of the second cam 58 is located on the outer side of the outer peripheral surface of the roller main body of the middle top roller 16b when seen from the direction in which the rotation shaft of the middle top roller 16b extends. The cleaning module 64 is thereby greatly spaced apart from the apron belt 18b, so that even if the fiber pieces are in a lump, such fiber pieces can be dropped between the apron belt 18b and the cleaning module 64.

[0056] In the draft device 6, the second cam 58 is attached to the rotation shaft of the middle top roller 16b by screwing, and the first cam 57 is attached to the respective rotation shaft of the back top roller 14b and the third top roller 15b by press fitting. The number of components can be reduced by using press fitting to attach the first cam 57 to each of the back top roller 14b and the third top roller 15b having a low rotation speed. The second cam 58 can be reliably attached to the middle top roller 16b by using screwing to attach the second cam 58 to the middle top roller 16b having a high rotation speed. However, the first cam 57 may also be attached to at least one of the back top roller 14b or the third top roller 15b by screwing.

[0057] In the draft device 6, the cleaning module 64 is swingably supported by the supporting mechanism 61 at one end thereof. Thus, the cleaning module 64 that can be brought into contact with or separated from each of the top rollers 14b, 15b, and 16b can be realized with a simple configuration. In the draft device 6, the cleaner pad 74 of the cleaning module 64 is attached to the plate-shaped supporting member 73, so that the cleaner pad 74 can be stably brought into contact with each of the top rollers 14b, 15b, and the apron belt 18b.

[0058] In the draft device 6, the position of the supporting mechanism 61 can be adjusted to the upstream side and the downstream side in the draft direction by the cradle 52. Thus, for example, when adjusting the distance between the adjacent pairs of rollers 14, 15 and the distance between the adjacent pairs of rollers 15, 16 according to the fiber length of the fiber bundle F to be drafted, the cleaning module 64 corresponding to each of the top rollers 14b, 15b can be moved with the back top roller 14b and the third top roller 15b.

[0059] One embodiment of the present invention has been described above, but the present invention is not limited to the above-described embodiment.

[0060] The cleaning module of the present invention can be arranged to be able to make contact with and separate from at least one top roller (including apron belt). When arranging the cleaning module so as to be able to make contact with and separate from each of at least two top rollers, the configuration (e.g., shape of cam, etc.) related to the contacting and separating timing merely needs to differ at least for the control member located on the most upstream side and the control member located on the most downstream side in the plurality of control members adapted to control the contacting and separat-

ing timing of the cleaning module. Therefore, in all of the plurality of control members, the configuration (e.g., shape of cam, etc.) related to the contacting and separating timing may be different.

[0061] In the above-described embodiment, the second cam 58 has been configured to separate the cleaning module 64 from the apron belt 18b within the angle P of about 180° around the rotation shaft of the middle top roller 16b, and to bring the cleaning module 64 into contact with the apron belt 18b within the angle of about 180° around the rotation shaft of the middle top roller 16b, but the control member of the present invention corresponding to the second cam 58 may be configured as below. In other words, the control member of the present invention may be configured to separate the cleaning module from the top roller within the first angle of 50° or more and 300° or less around the rotation shaft of the top roller, and to bring the cleaning module into contact with the top roller within the second angle obtained by subtracting the first angle from 360° around the relevant rotation shaft. The first angle is preferably selected from a range of 100° or more and 250° or less, and more preferably selected from a range of 150° or more and 200° or less.

[0062] In the above-described embodiment, the second control surface 58a of the second cam 58 is located on the outer side of the outer peripheral surface of the roller main body of the middle top roller 16b when seen from the direction in which the rotation shaft of the middle top roller 16b extends, but the second control surface 58a of the second cam 58 may be located on the outer peripheral surface of the roller main body of the middle top roller 16b or on the inner side of such outer peripheral surface.

[0063] In the above-described embodiment, the cleaner pad 74 is attached to the supporting member 73 by fitting each protrusion 74a of the cleaner pad 74 into each engagement hole 73a of the supporting member 73, but the cleaner pad 74 may be attached to the supporting member 73 by other means such as adhesion. In the above-described embodiment, the width of the cleaner pad 74 is illustrated to have substantially the same width as the width of each top roller (including apron belt). However, the width of the cleaner pad 74 merely needs to be greater than the width of the sliver S to be drafted at each top roller (including apron belt), and the width of the downstream cleaner pad 74 may be smaller than the width of the upstream cleaner pad 74.

[0064] The pneumatic spinning device 7 may further include a needle held by a fiber guiding section and arranged so as to protrude into a spinning chamber to prevent twists of the fiber bundle F from being propagated to the upstream of the pneumatic spinning device 7. Alternatively, instead of such a needle, the pneumatic spinning device 7 may prevent the twists of the fiber bundle F from being propagated to the upstream of the pneumatic spinning device 7 by a downstream end portion of the fiber guiding section. Furthermore, instead of the above-described configuration, the pneumatic spinning

device 7 may include a pair of air-jet nozzles respectively adapted to twist the fiber bundle F in directions opposite from each other.

[0065] In the spinning unit 2, the yarn storage device 11 has a function of pulling out the yarn Y from the pneumatic spinning device 7, but the yarn Y may be pulled out from the pneumatic spinning device 7 with a delivery roller and a nip roller. In a case of pulling out the yarn Y from the pneumatic spinning device 7 with the delivery roller and the nip roller, a slack tube adapted to absorb the slack of the yarn Y with suction airflow, a mechanic compensator, or the like may be provided instead of the yarn storage device 11.

[0066] In the spinning unit 2, each device is arranged such that the yarn Y supplied on the upper side is wound on the lower side in the machine height direction, but each device may be arranged such that the yarn Y supplied on the lower side is wound on the upper side.

[0067] In the draft device 6, the swing shaft 53 is arranged on the side of the pair of back rollers 14 (i.e., upstream), but the swing shaft 53 may be arranged on the side of the pair of front rollers 17 (i.e., downstream).

[0068] Furthermore, in the spinning machine 1, at least one of the bottom rollers of the draft device 6 and the traverse guide 23 are driven by the power from the second end frame 5 (i.e., commonly driven for the plurality of spinning units 2). However, each device of the spinning unit 2 (e.g., the draft device 6, the pneumatic spinning device 7, the winding device 13, or the like) may be independently driven for each spinning unit 2.

[0069] In the travelling direction of the yarn Y, the tension sensor 9 may be arranged upstream of the yarn monitoring device 8. The unit controller 10 may be provided for every spinning unit 2. In the spinning unit 2, the waxing device 12, the tension sensor 9, and the yarn monitoring device 8 may be omitted.

[0070] FIG. 1 illustrates that the spinning machine 1 winds a cheese package P, but the spinning machine 1 can also wind a conical package P. In a case of the conical package P, a slack of the yarn Y occurs by traversing the yarn Y, but the slack can be absorbed with the yarn storage device 11. A material and a shape of each component are not limited to the above-mentioned material and shape, and various materials and shapes can be adopted.

Claims

1. A draft device comprising:

- a plurality of pairs of rollers (14, 15, 16, 17) each including a bottom roller (14a, 15a, 16a, 17a) and a top roller (14b, 15b, 16b, 17b);
- a cleaning module (64) arranged to make contact with and separate from at least one of the top rollers; and
- a control member (58) arranged on a rotation

- shaft of at least one of the top rollers and adapted to control contacting and separating timing of the cleaning module (64),
 wherein the control member (58) is adapted to separate the cleaning module (64) from the top roller within a first angle (α , P) around the rotation shaft, and to bring the cleaning module into contact with the top roller within a second angle around the rotation shaft, the second angle obtained by subtracting the first angle from 360° ,
characterized in that
 the first angle is selected from a range of 50° or more and 300° or less.
2. The draft device according to claim 1, wherein the control member is arranged on the rotation shaft of the top roller (16b) including an apron belt (18b).
 3. The draft device according to claim 1 or 2, wherein the control member is a cam having a fan shape when seen from a direction in which the rotation shaft extends.
 4. The draft device according to claim 1, comprising:
 - a plurality of cleaning modules (64) arranged to make contact with and separate from at least two of the top rollers; and
 - a plurality of control members (57, 58) arranged on a rotation shaft of each of the at least two top rollers, the plurality of control members (57, 58) being adapted to control contacting and separating timing of each of a plurality of cleaning modules,
 wherein the first angle (α) around the rotation shaft within which the control member (57) located most upstream in a draft direction separates the cleaning module from the top roller is smaller than the first angle (β) around the rotation shaft within which the control member (58) located most downstream in the draft direction separates the cleaning module from the top roller.
 5. A draft device comprising:
 - a plurality of pairs of rollers (14, 15, 16, 17) each including a bottom roller (14a, 15a, 16a, 17a) and a top roller (14b, 15b, 16b, 17b);
 - a plurality of cleaning modules (64) arranged to make contact with and separate from at least two of the top rollers; and
 - a plurality of control members (57, 58) arranged, on a rotation shaft of each of the at least two top rollers, the plurality of control members (57, 58) being adapted to control contacting and separating timing of each of a plurality of cleaning modules,
 wherein the control member (57) located most upstream in a draft direction is adapted to separate the cleaning module from the top roller within a third angle (α) around the rotation shaft, and
 the control member (58) located most downstream in the draft direction is adapted to separate the cleaning module from the top roller within a fourth angle (β) around the rotation shaft,
characterized in that
 the fourth angle (β) is greater than the third angle (α).
 6. The draft device according to claim 5, wherein the control member (57) located most upstream in the draft direction and the control member (58) located most downstream in the draft direction are cams having different shapes from each other when seen from a direction in which the rotation shaft extends.
 7. The draft device according to claim 5 or 6, wherein the cleaning module is arranged to make contact with and separate from each of the at least two top rollers, the control member is arranged on the rotation shaft of each of the at least two top rollers, the control member (58) located most downstream in the draft direction is attached to the rotation shaft by screwing, and the control member (57) located most upstream in the draft direction is attached to the rotation shaft by press fitting.
 8. The draft device according to any one of claims 5 to 7, wherein the control member located most downstream in the draft direction is arranged on the rotation shaft of the top roller (16b) including an apron belt (18b).
 9. The draft device according to any one of claims 5 to 8, wherein the fourth angle (β) is selected from a range of 50° or more and 300° or less around the rotation shaft.
 10. The draft device according to any one of claims 1 to 9, wherein
 the control member is a cam having a control surface (58a) adapted to separate the cleaning module from the top roller, and
 the control surface is located on an outer side of an outer peripheral surface of a roller main body of the top roller when seen from a direction in which the rotation shaft extends.
 11. The draft device according to any one of claims 1 to 10, further comprising a first supporting section (61) adapted to support the cleaning module, wherein the cleaning module includes a cleaner pad (74) made of rubber or resin, and

wherein the first supporting section swingably supports the cleaner pad.

12. The draft device according to claim 11, further comprising a second supporting section (52) adapted to support the top roller, wherein the first supporting section is supported so that a position of first supporting section is adjusted toward upstream and downstream in the draft direction by the second supporting section. 5 10
13. The draft device according to any one of claims 1 to 12, comprising a pair of back rollers (14), a pair of third rollers (15), a pair of middle rollers (16), and a pair of front rollers (17) as the plurality of pairs of rollers in order from upstream in a draft direction, wherein the cleaning module (64) is arranged with respect to each of top rollers (14a, 15a, 16a) of the pair of back rollers, the pair of third rollers, and the pair of middle rollers, and wherein the control member (57, 58) is arranged on a rotation shaft of each of the top rollers (14a, 15a, 16a) on which the cleaning module is arranged. 15 20
14. A spinning machine comprising: 25
- the draft device (6) according to any one of claims 1 to 13;
- a pneumatic spinning device (7) adapted to produce a yarn by applying twists to a fiber bundle drafted by the draft device; and 30
- a winding device (13) adapted to wind the yarn produced by the pneumatic spinning device to form a package. 35

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FIG. 1

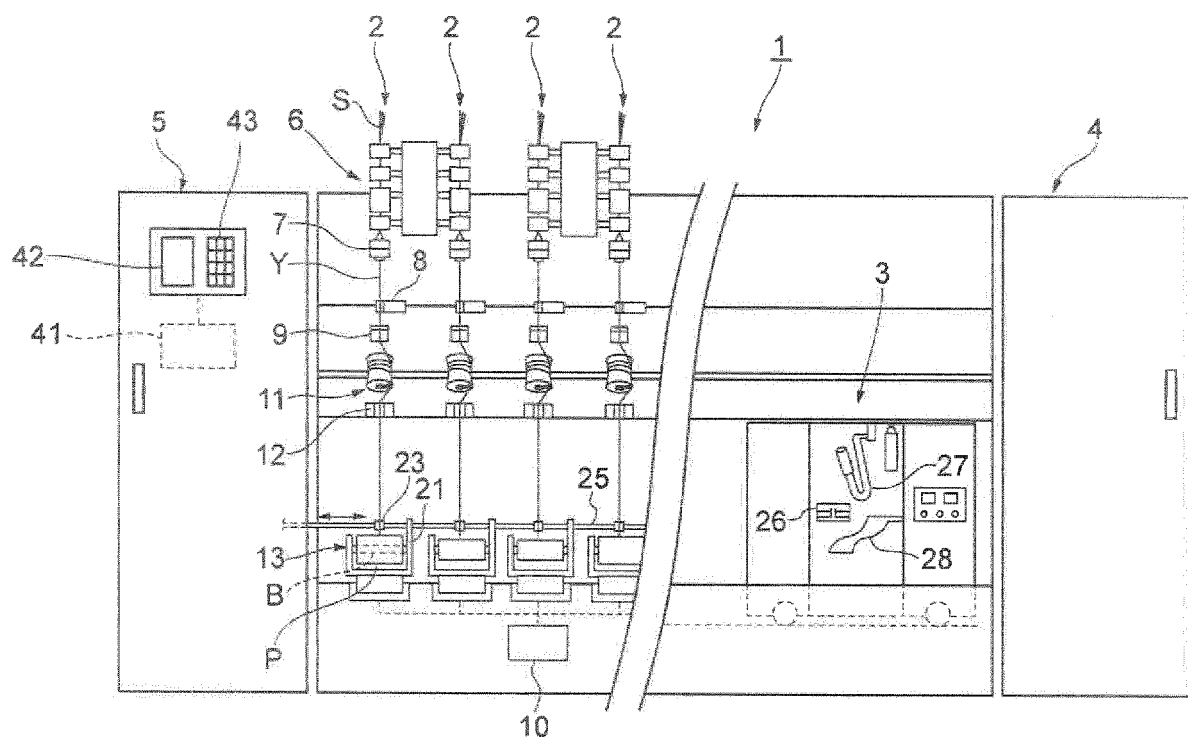


FIG. 2

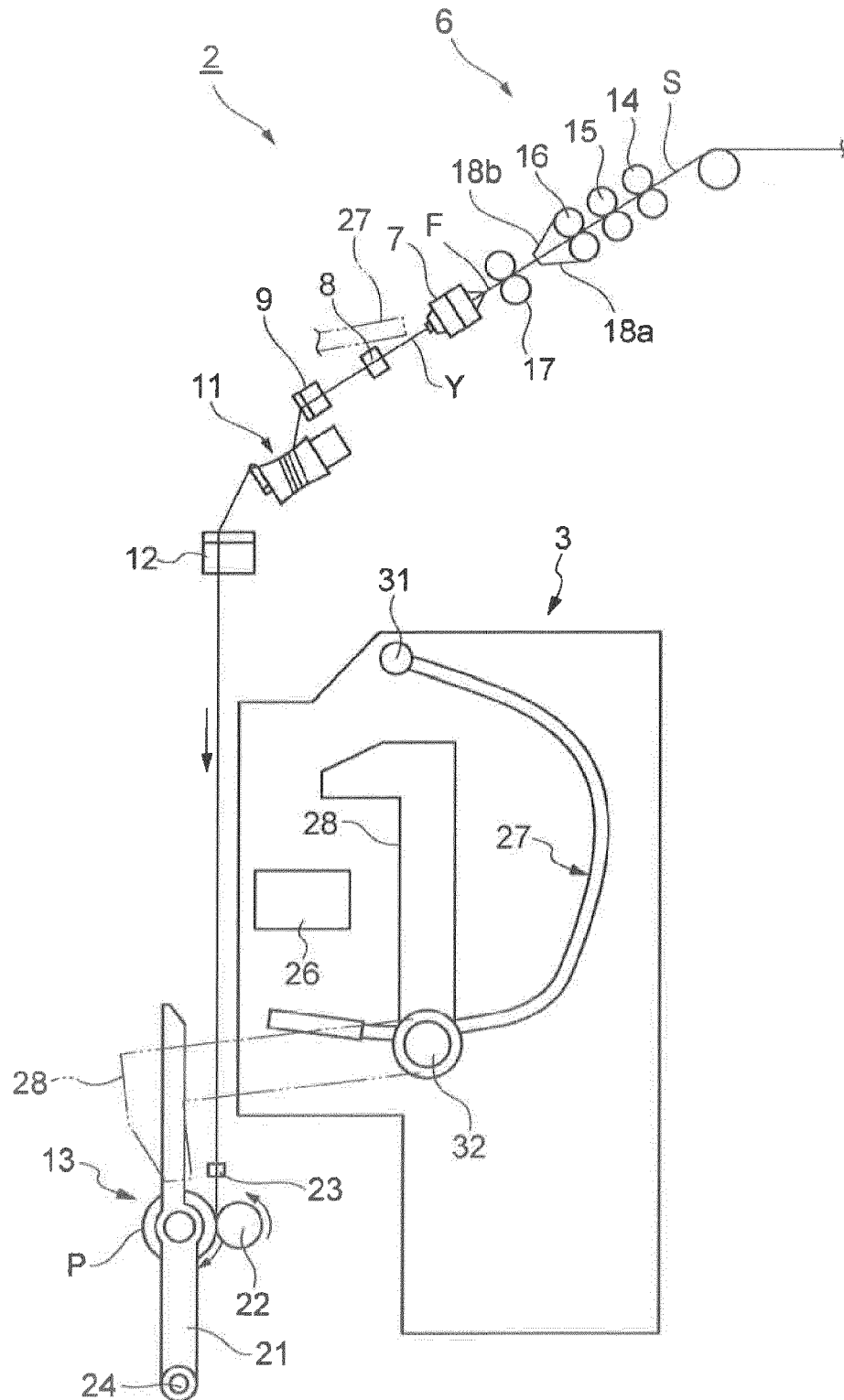


FIG. 3

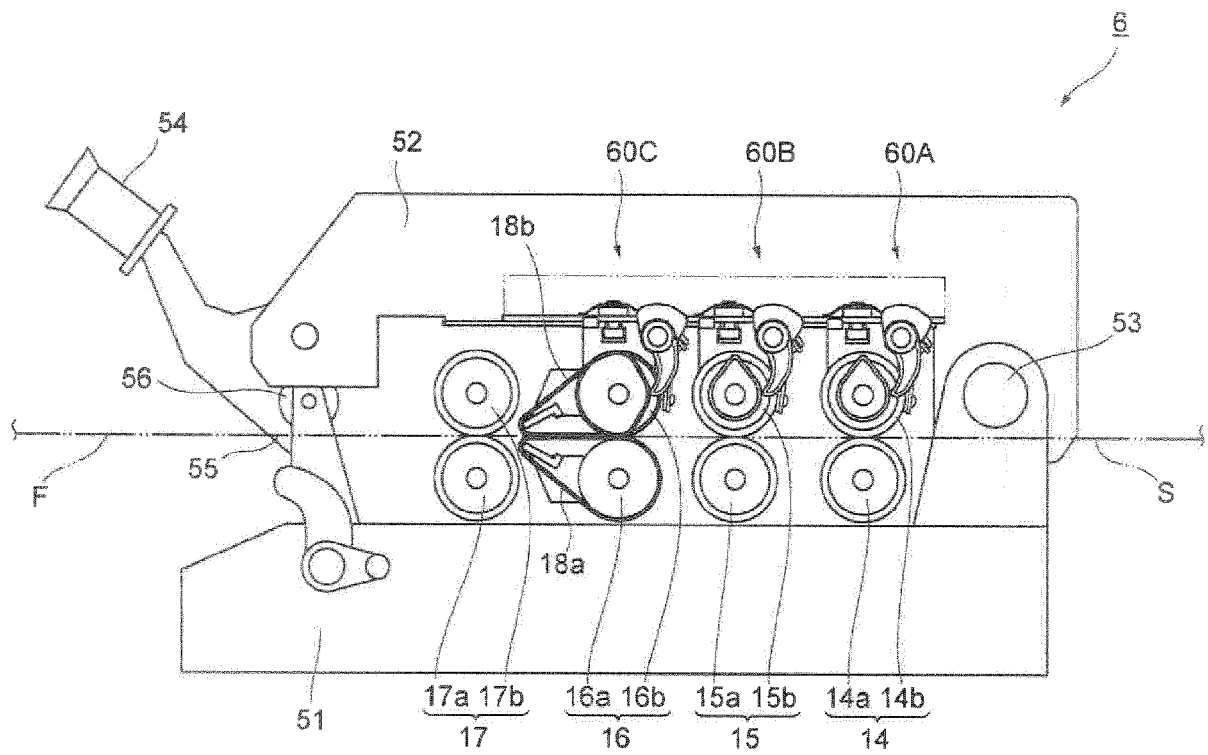


FIG. 4

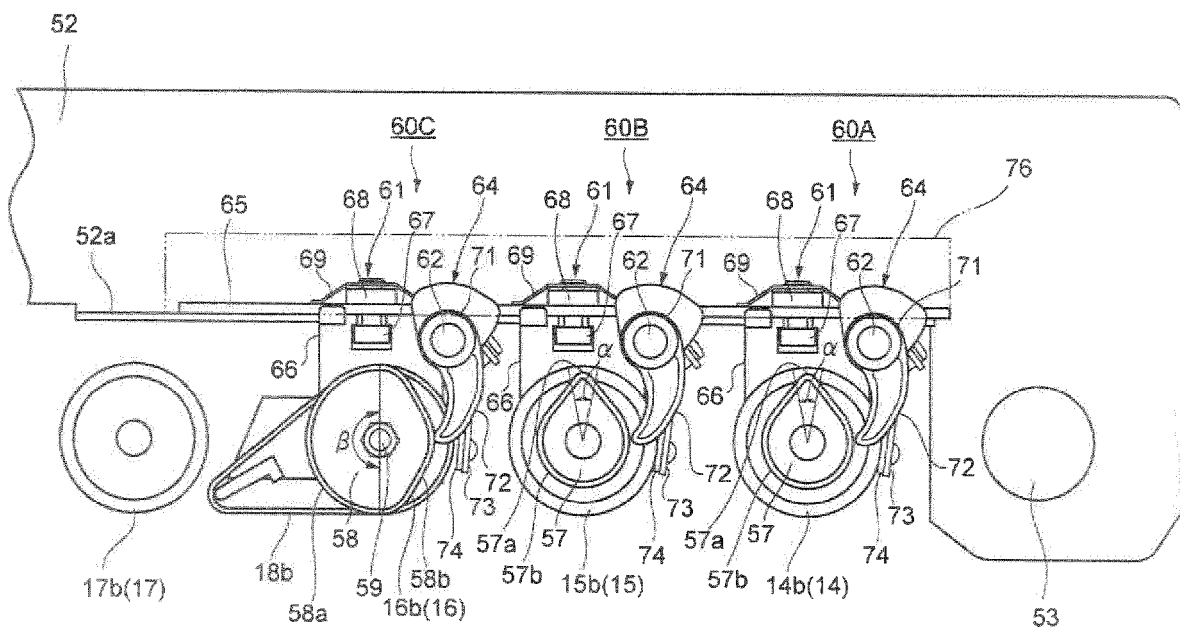


FIG. 5

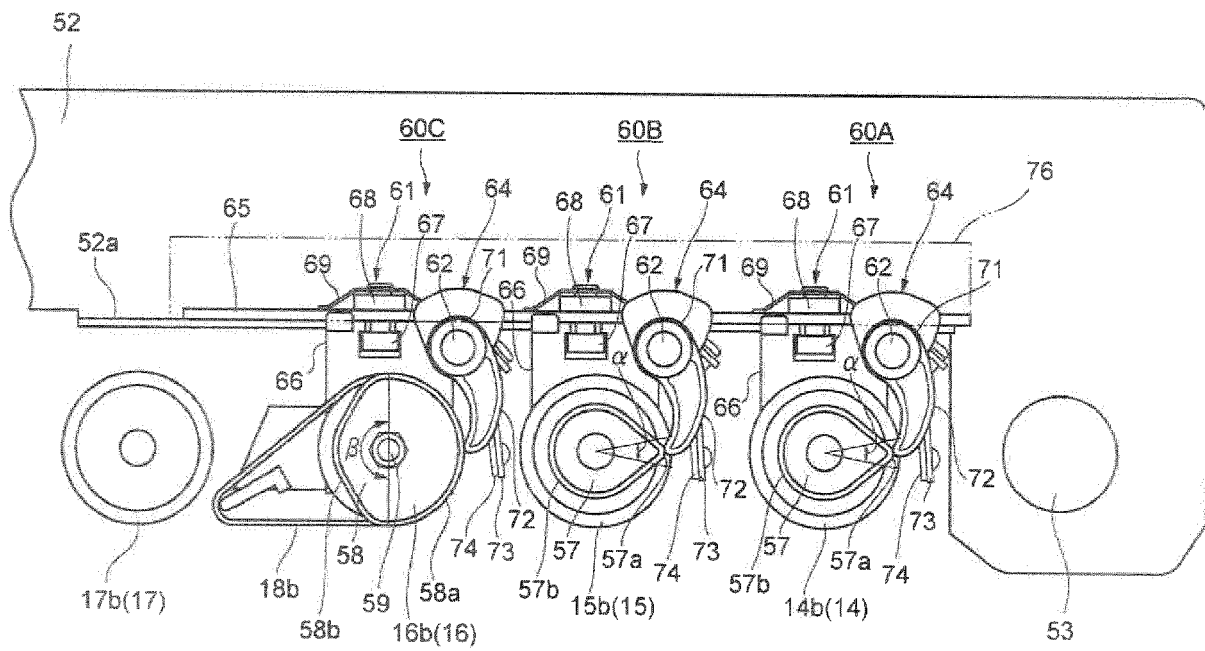


FIG. 6

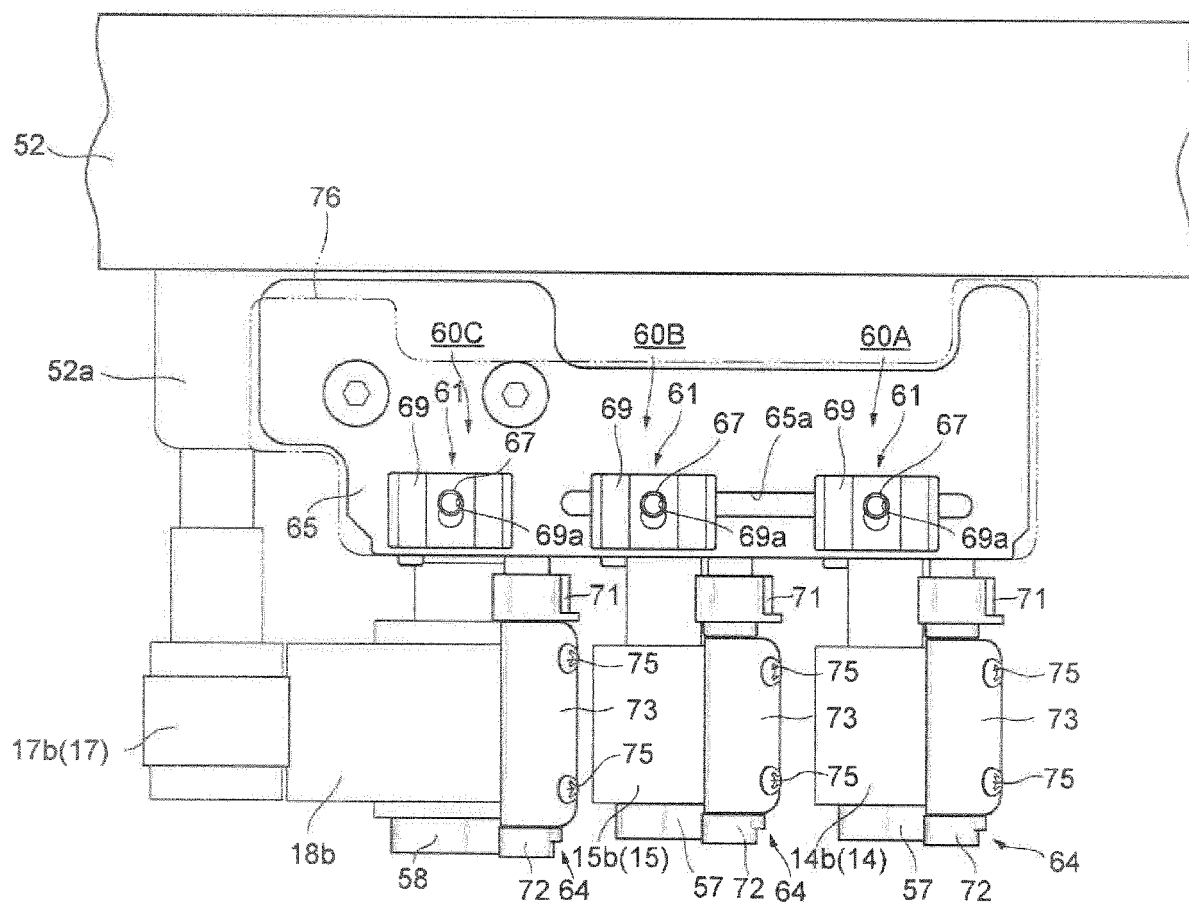
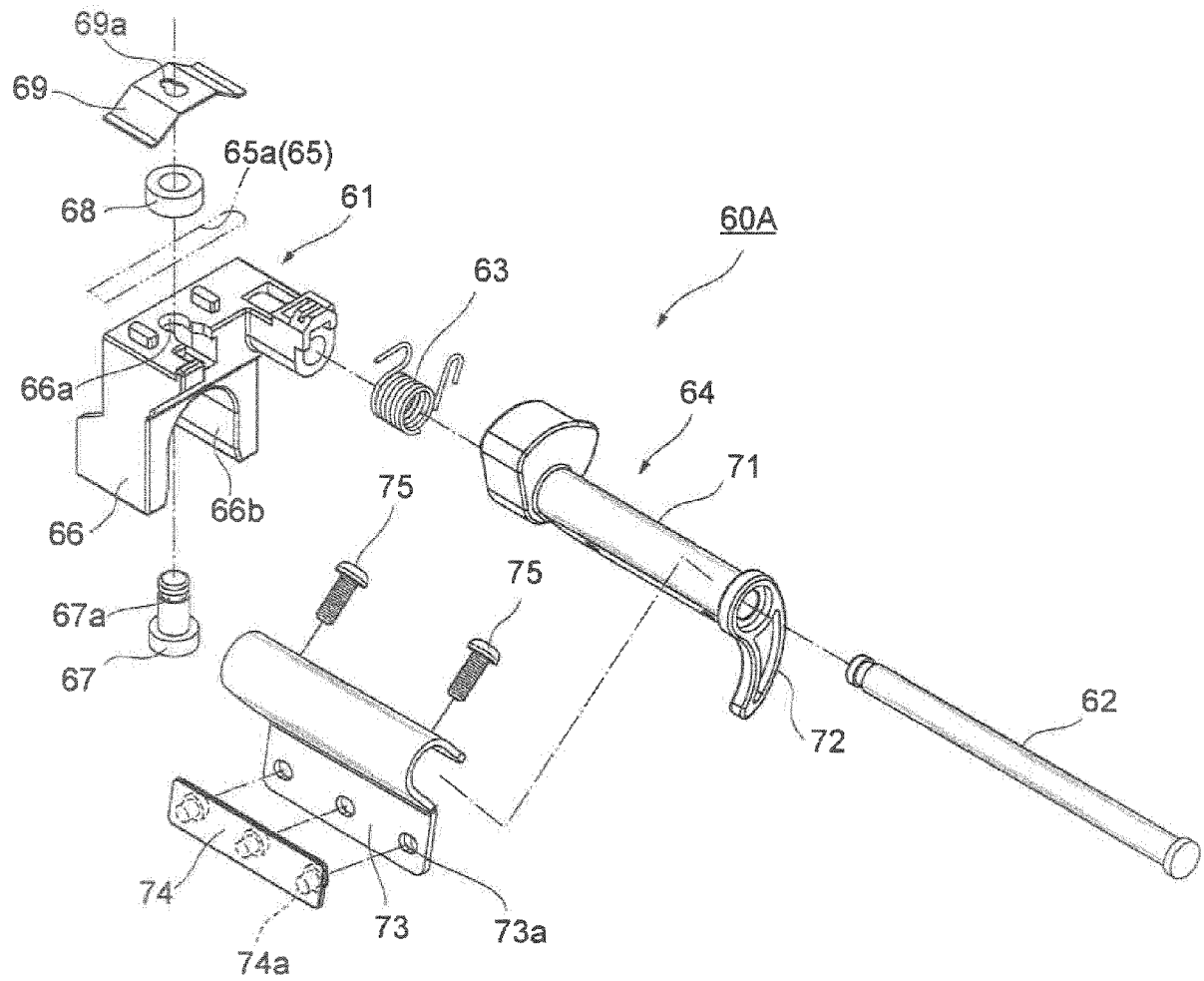


FIG. 7





EUROPEAN SEARCH REPORT

Application Number
EP 16 15 8489

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Y,D	JP H07 31858 U (UNKNOWN) 16 June 1995 (1995-06-16)	1	INV. D01H5/62
A	* abstract; figures 1,2 * * paragraph [0004] - paragraph [0006] * * paragraph [0011] * * paragraph [0013] * * paragraph [0018] *	2-14	
Y	DE 11 30 336 B (FERDINAND REITERER; LOUIS WINDISCH) 24 May 1962 (1962-05-24)	1	
A	* paragraph [0006] * * paragraph [0020] - paragraph [0023] * * figure 1 *	2-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			D01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 July 2016	Examiner Humbert, Thomas
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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29-07-2016

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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