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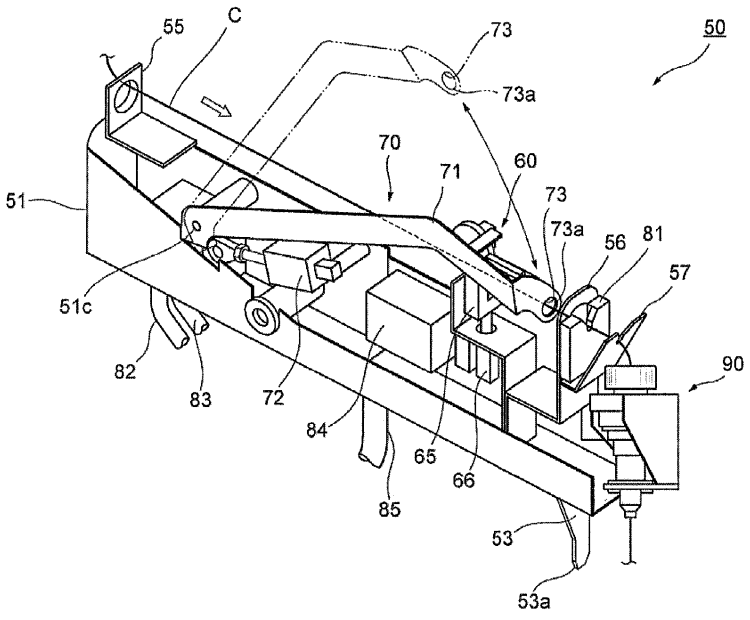
(54) CORE YARN SUPPLYING UNIT, CORE YARN SUPPLYING DEVICE, SPINNING MACHINE, AND CORE YARN SUPPLYING METHOD

(57) A core yarn supplying unit (50) includes a core yarn feeding section (90) arranged to feed out a yarn end of a core yarn (C); a tension applying section (60) adapted to apply a tension to the core yarn (C); and a slack applying section (70) adapted to apply slack to the core yarn (C) between the core yarn feeding section (90) and the tension applying section (60). The tension applying section (60) includes a tension applying mechanism adapted to apply the tension to the core yarn (C), and an operating mechanism adapted to change the tension applying mechanism to a tension applying state and a tension non-applying state.

FIG. 3



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a core yarn supplying unit, a core yarn supplying device, a spinning machine, and a core yarn supplying method.

2. Description of the Related Art

[0002] As a conventional core yarn supplying unit, there is known a core yarn supplying unit including a core yarn feeding section adapted to feed out a yarn end of a core yarn to a draft device, a tension applying section adapted to apply a tension to the core yarn to be supplied to the draft device, and a slack applying section adapted to apply slack to the core yarn between the core yarn feeding section and the tension applying section (see e.g., Japanese Unexamined Patent Publication No. 2012-131591)

[0003] The core yarn supplying unit described above is demanded to reliably feed out the yarn end of the core yarn to a main body unit configured by the draft device and the like at the start of spinning, for example.

BRIEF SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a core yarn supplying unit and a core yarn supplying method capable of reliably feeding out a yarn end of a core yarn, and a core yarn supplying device and a spinning machine including the core yarn supplying unit.

[0005] A core yarn supplying unit of the present invention includes a core yarn feeding section arranged to feed out a yarn end of a core yarn; a tension applying section adapted to apply a tension to the core yarn; and a slack applying section adapted to apply slack to the core yarn between the core yarn feeding section and the tension applying section, wherein the tension applying section includes: a tension applying mechanism adapted to apply the tension to the core yarn, and an operating mechanism adapted to change the tension applying mechanism to a tension applying state and a tension non-applying state.

[0006] In the core yarn supplying unit, the tension to be applied to the core yarn can be changed by changing the tension applying mechanism to the tension applying state and the tension non-applying state. Thus, since the tension to be applied to the core yarn by the tension applying section can be reduced while applying the slack to the core yarn by the slack applying section, the yarn end of the core yarn can be reliably fed out by the core yarn feeding section.

[0007] In the core yarn supplying unit of the present invention, the tension applying mechanism may be provided under the tension non-applying state when the core yarn feeding section feeds out the yarn end of the core yarn to the main body unit. According to such a configuration, since the tension applied to the core yarn is small when the yarn end of the core yarn is fed out, the yarn end of the core yarn can be reliably fed out.

[0008] In the core yarn supplying unit of the present invention, the slack applying section may include a hole through which the core yarn is inserted, the hole having a closed edge. According to such a configuration, the core yarn does not fall out from the hole, and thus the slack is reliably applied to the core yarn. The yarn end of the core yarn thus can be reliably fed out.

[0009] In the core yarn supplying unit of the present invention, the edge may be circular. According to such a configuration, since the core yarn can be smoothly guided by the hole of the slack applying section, the yarn end of the core yarn can be reliably fed out.

[0010] A core yarn supplying device according to the present invention includes the core yarn supplying unit described above; and a core yarn package holding section adapted to hold a core yarn package.

[0011] In the core yarn supplying device, the yarn end of the core yarn unwound from the core yarn package can be reliably fed out.

[0012] The core yarn supplying device of the present invention further includes a tubular core yarn guiding section adapted to guide the core yarn fed out from the core yarn supplying unit, wherein a travelling region of the core yarn is formed inside the core yarn guiding section so as to include a straight line. According to such a configuration, since the yarn end of the core yarn can smoothly travel inside the core yarn guiding section, the yarn end of the core yarn can be reliably fed out.

[0013] A spinning machine according to the present invention includes the core yarn supplying unit described above; a draft device adapted to draft a fiber bundle; a pneumatic spinning device adapted to produce a spun yarn by applying twists to the fiber bundle with the core yarn as a core; and a winding device adapted to wind the spun yarn into a package, wherein the tension applying mechanism is provided under the tension non-applying state when supplying of the core yarn to the pneumatic spinning device is started.

[0014] According to the spinning machine, since the tension applied to the core yarn is small when the supplying of the core yarn to the pneumatic spinning device is started, the yarn end of the core yarn can be reliably fed out from the core yarn supplying unit.

[0015] A core yarn supplying method according to the present invention is a core yarn supplying method for supplying a core yarn from a core yarn package while applying a tension to the unwound core yarn, the method including the steps of: applying a first tension to the core yarn when supplying the core yarn; and applying a second tension smaller than the first tension to the core yarn when feeding out a yarn end of the core yarn.

[0016] In the core yarn supplying method, since the tension applied to the core yarn is small when feeding out the core yarn, the yarn end of the core yarn can be

reliably fed out.

[0017] To advantage, the core yarn supplying method may comprise the step of operating tension applying means for applying the second tension to the core yarn during the feeding out of the yarn end of the core yarn and the step of operating said tension applying means for applying the first tension to the core yarn during the subsequent supplying of the core yarn. For preparing the feeding out of the yarn end of the core yarn, the method may comprise the step of operating clamp means for clamping the yarn end and the step of operating slack applying means for pulling out a core yarn section of the core yarn from the core yarn package. For allowing the feeding out of the yarn end of the core yarn, the method may further comprise the step of operating the clamp means for releasing the yarn end and the step of operating the slack applying means for releasing the pulled out core yarn section. According to a preferred embodiment of the method, the tension applying means is operated to apply the first tension during the pulling out of the core yarn section of the core yarn from the core yarn package. The method may be executed using the core yarn supplying unit and the spinning machine described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

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 perspective view of a core yarn supplying unit of the spinning unit of FIG. 2;
FIG. 4 is a side view of the core yarn supplying unit and a peripheral portion in the spinning unit of FIG. 2;
FIG. 5 is a side view of the core yarn supplying unit and the peripheral portion in the spinning unit of FIG. 2;
FIGS. 6A and 6B are side views of a tension applying section of the core yarn supplying unit of FIG. 3;
FIG. 7 is a partial cross-sectional view of a core yarn feeding section of the core yarn supplying unit of FIG. 3;
FIG. 8 is a view illustrating a positional relationship of the draft device and the core yarn supplying unit in the spinning unit of FIG. 2;
FIG. 9 is a side view of the core yarn supplying unit and the peripheral portion in the spinning unit of FIG. 2; and
FIG. 10 is a side view of the core yarn supplying unit and the peripheral portion in the spinning unit of FIG. 2.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0019] Preferred embodiments of the present invention will be hereinafter described in detail with reference to the drawings. In the drawings, the same reference numerals are denoted for the same or corresponding portions, and redundant description will be omitted.

[0020] As illustrated in FIG. 1, a spinning machine 1 includes a plurality of spinning units 2, a yarn joining cart 3, a blower box 4, and a motor box 5. The plurality of spinning units 2 are arranged in a line. Each spinning unit 2 produces a spun yarn Y from a sliver S and a core yarn C, and winds the spun yarn Y into a package P. The yarn joining cart 3 performs a yarn joining operation in the spinning unit 2 in which the spun yarn Y has been disconnected. The blower box 4 accommodates an air supply source and the like for generating a suction flow, a whirling airflow, or the like at each section of the spinning unit 2. The motor box 5 accommodates a motor and the like for supplying power to each section of the spinning unit 2.

[0021] In the following description, on a travelling path of the sliver S and the spun yarn Y, a side on which the sliver S is supplied is referred to as upstream and a side on which the spun yarn Y is wound is referred to as downstream. A side on which the spun yarn Y travels with respect to the yarn joining cart 3 is referred to as a front side, and a side opposite to the front side is referred to as a back side. In the present embodiment, a work passage (not illustrated) extending in a direction in which the plurality of spinning units 2 are arranged is provided on the front side of the spinning machine 1. Therefore, the operator can perform operation, monitoring, and the like of each spinning unit 2 from the work passage.

[0022] As illustrated in FIGS. 1 and 2, each spinning unit 2 includes a draft device 6, a core yarn supplying device 40, a pneumatic spinning device 7, a spun yarn monitoring device 8, a tension sensor 9, a yarn storage device 14, a waxing device 11, and a winding device 12 in this order from the upstream. These devices are directly or indirectly supported by a machine frame 13 such that the upstream is an upper side in a machine height direction (i.e., downstream is a lower side in the machine height direction). In the spinning unit 2, the devices excluding the core yarn supplying device 40 are referred to as a main body unit 30. That is, the main body unit 30 is configured by the draft device 6, the pneumatic spinning device 7, the spun yarn monitoring device 8, the tension sensor 9, the yarn storage device 14, the waxing device 11, the winding device 12, and the machine frame 13.

[0023] The draft device 6 is adapted to draft the sliver S to produce a fiber bundle F. The draft device 6 includes a back roller pair 15, a third roller pair 16, a middle roller pair 18 provided with an apron belt 17 on each roller, and a front roller pair 19 in this order from the upstream. Each of the roller pairs 15, 16, 18, and 19 causes the sliver S supplied from a can (not illustrated) to travel from the

upstream towards the downstream while drafting.

[0024] The core yarn supplying device 40 unwinds the core yarn C from a core yarn package CP, and supplies the core yarn C to the draft device 6. More specifically, the core yarn supplying device 40 supplies the core yarn C to a travelling path of the fiber bundle F from between the middle roller pair 18 and the front roller pair 19. The core yarn C is thus supplied to the pneumatic spinning device 7 together with the fiber bundle F.

[0025] The pneumatic spinning device 7 produces the spun yarn Y by applying twists to the fiber bundle F with the core yarn C as a core. More specifically (although not illustrated), the pneumatic spinning device 7 includes a spinning chamber, a fiber core yarn guide, a whirling airflow generating nozzle, and a hollow guide shaft body. The fiber core yarn guide guides the fiber bundle F supplied from the upstream draft device 6 and the core yarn C to the spinning chamber. The whirling airflow generating nozzle is arranged at a periphery of the travelling path of the fiber bundle F and the core yarn C, and is adapted to generate a whirling airflow in the spinning chamber. This whirling airflow causes a fiber end of the fiber bundle F guided into the spinning chamber to be reversed and to whirl. The hollow guide shaft body is adapted to guide the spun yarn Y from the spinning chamber to outside the pneumatic spinning device 7.

[0026] The spun yarn monitoring device 8 is adapted to monitor the travelling spun yarn Y between the pneumatic spinning device 7 and the yarn storage device 14. When a yarn defect is detected in the spun yarn Y, the spun yarn monitoring device 8 transmits a yarn defect detection signal to a unit control device 10. The spun yarn monitoring device 8 detects, for example, a thickness abnormality of the spun yarn Y and/or foreign substance contained in the spun yarn Y as the yarn defect. The tension sensor 9 measures a tension of the travelling spun yarn Y between the pneumatic spinning device 7 and the yarn storage device 14, and transmits a tension measurement signal to the unit control device 10. The waxing device 11 is adapted to apply wax on the travelling spun yarn Y between the yarn storage device 14 and the winding device 12. The unit control device 10 is provided for each spinning unit 2, and is adapted to control operation of the spinning unit 2 under the control of a machine control device 20, which is a high-order controller.

[0027] The yarn storage device 14 is adapted to store the travelling spun yarn Y between the pneumatic spinning device 7 and the winding device 12. The yarn storage device 14 has a function of stably pulling out the spun yarn Y from the pneumatic spinning device 7, a function of storing the spun yarn Y fed from the pneumatic spinning device 7 to prevent the spun yarn Y from slackening during the yarn joining operation by the yarn joining cart 3 or the like, and a function of adjusting the tension of the spun yarn Y at downstream of the yarn storage device 14 to prevent a fluctuation in the tension of the spun yarn Y at the downstream from being transmitted towards the pneumatic spinning device 7.

[0028] The winding device 12 is adapted to wind the spun yarn Y produced by the pneumatic spinning device 7 around a bobbin B to form the package P. The winding device 12 includes a cradle arm 21, a winding drum 22, and a traverse device 23. The cradle arm 21 rotatably supports the bobbin B. The cradle arm 21 is swingably supported by a supporting shaft 24, and causes a surface of the rotatably supporting bobbin B or a surface of the package P to make contact with a surface of the winding drum 22 at an appropriate pressure. The winding drum 22 is driven by an electric motor (not illustrated) provided in each spinning unit 2 to rotate the bobbin B or the package P making contact with the winding drum 22. The traverse device 23 is driven by a shaft 25 shared among the plurality of spinning units 2, and traverses the spun yarn Y over a prescribed width with respect to the rotating bobbin B or the package P.

[0029] The yarn joining cart 3 travels to the spinning unit 2 in which the spun yarn Y is disconnected to perform the yarn joining operation in the target spinning unit 2. The yarn joining cart 3 includes a yarn joining device 26, a first yarn catching and guiding device 27, and a second yarn catching and guiding device 28. The first yarn catching and guiding device 27 is swingably supported by a supporting shaft 27a, and is adapted to suck and catch a yarn end of the spun yarn Y from the pneumatic spinning device 7 to guide the yarn end to the yarn joining device 26. The second yarn catching and guiding device 28 is swingably supported by a supporting shaft 28a, and is adapted to suck and catch a yarn end of the spun yarn Y from the winding device 12 to guide the yarn end to the yarn joining device 26. The yarn joining device 26 is a splicer, for example, and joins the guided yarn ends.

[0030] As illustrated in FIG. 2, the core yarn supplying device 40 includes a core yarn package holding section 41, a core yarn supplying unit 50, and a core yarn guiding section 43. The core yarn package holding section 41 holds the core yarn package CP with a center line of the core yarn package CP extended in a horizontal and front-back direction. A mono-filament yarn or a false-twisted yarn, for example, is wound as the core yarn C in the core yarn package CP. The mono-filament yarn is a yarn having high rigidity. The false-twisted yarn is a yarn having high stretchability. The core yarn supplying unit 50 has a function of applying a tension to the core yarn C supplied from the core yarn package CP via a guide roller 42, a function of applying slackening to the core yarn C, and a function of feeding the yarn end of the core yarn C. The core yarn guiding section 43 is a tubular member adapted to guide the core yarn C to the draft device 6. A travelling region of the core yarn C is formed inside the core yarn guiding section 43 so as to include a straight line. In the following description, in the travelling path of the core yarn C in the core yarn supplying unit 50, a side on which the core yarn C is supplied from the core yarn package CP to the core yarn supplying unit 50 is referred to as upstream, and a side on which the core yarn C is supplied from the core yarn supplying unit 50 to the draft

device 6 is referred to as downstream.

[0031] As illustrated in FIG. 3, the core yarn supplying unit 50 includes a unit base 51, a tension applying section 60, a slack applying section 70, a core yarn monitoring section 81, and a core yarn feeding section 90. A core yarn guide 55 is arranged most upstream of the unit base 51. The unit base 51 supports the tension applying section 60, the slack applying section 70, the core yarn monitoring section 81, and the core yarn feeding section 90. Between the core yarn guide 55 and the slack applying section 70, the tension applying section 60 applies a tension to the core yarn C to be supplied to the draft device 6. The slack applying section 70 applies slack to the core yarn C between the tension applying section 60 and the core yarn monitoring section 81. The core yarn monitoring section 81 detects a presence and/or an absence of the core yarn C between the slack applying section 70 and the core yarn feeding section 90. The core yarn feeding section 90 feeds the yarn end of the core yarn C to the draft device 6 through the core yarn guiding section 43 at downstream of the core yarn monitoring section 81. Note that, a description "feeding the yarn end of the core yarn C" refers to an operation in which the core yarn feeding section 90 feeds the yarn end of the core yarn C to the main body unit 30. A description "supply the core yarn C" refers to an operation in which the core yarn supplying device 40 continuously supplies the core yarn C to the main body unit 30 (i.e., the operation when spinning is carried out).

[0032] As illustrated in FIG. 4, the core yarn supplying unit 50 further includes a supporting member (supporting section) 52, a first holding member (holding section) 53, and a second holding member (holding section) 54. The supporting member 52 swingably supports the unit base 51 with respect to the draft device 6. More specifically, the supporting member 52 is detachably attached to a draft base 29 of the draft device 6. A distal end portion 52a of the supporting member 52 is rotatably attached to one end of a swing shaft 51a arranged on the unit base 51. That is, one end of the supporting member 52 is supported by the swing shaft 51a. The draft base 29 is a base shared between the draft devices 6 of the pair of adjacent spinning units 2, and supports each roller pair 15, 16, 18, 19 (specifically, the bottom roller of each roller pair 15, 16, 18, 19) of each draft device 6. The draft base 29 is provided with a first hole 29a, a bent portion 29b, and a plurality of second holes 29c. The plurality of second holes 29c are formed between the first hole 29a and the bent portion 29b.

[0033] The first holding member 53 holds the unit base 51 at a core yarn supplying position. More specifically, the first holding member 53 is fixed to the unit base 51. The first holding member 53 holds the unit base 51 at the core yarn supplying position by engaging a distal end portion 53a of the first holding member 53 to the first hole 29a. Note that the core yarn supplying position is a position where the unit base 51 is arranged when the core yarn supplying unit 50 supplies the core yarn C to the draft device 6.

[0034] As illustrated in FIG. 5, the second holding member 54 holds the unit base 51 at one of a plurality of retreated positions. More specifically, the second holding member 54 is swingably supported by a supporting shaft 51b arranged on the unit base 51. The second holding member 54 holds the unit base 51 at the retreated position by engaging a distal end portion 54a of the second holding member 54 to the bent portion 29b. Furthermore, the second holding member 54 holds the unit base 51 at one of other plurality of retreated positions by engaging the distal end portion 54a to one of the plurality of second holes 29c. Note that the retreated position is a position where the unit base 51 is arranged when the core yarn supplying unit 50 is not supplying the core yarn C to the main body unit 30, and is the position where the core yarn feeding section 90 is located away from the draft device 6 than when the unit base 51 is held at the core yarn supplying position.

[0035] As illustrated in FIGS. 6A and 6B, the tension applying section 60 includes a tension applying mechanism 61 and an operating mechanism 62. As illustrated in FIG. 6A, the tension applying mechanism 61 applies a tension to the core yarn C by guiding the core yarn C in a zigzag manner by a fixed piece 63 and a movable piece 64. The fixed piece 63 is fixed to the unit base 51. A plurality of shafts 63a, on which the core yarn C is to be hooked, is arranged on the fixed piece 63.

[0036] The movable piece 64 is supported to be openable/closable with respect to the fixed piece 63 by a supporting shaft (not illustrated) arranged on the fixed piece 63. The movable piece 64 is urged in an opening direction with respect to the fixed piece 63 by a spring (not illustrated) arranged on the fixed piece 63. The movable piece 64 includes a plurality protrusions 64a so as to project out with respect to the plurality of shafts 63a. As illustrated in FIG. 6B, each protrusion 64a is arranged on the movable piece 64 such that each protrusion 64a is alternately located with each shaft 63a under a state where the movable piece 64 is closed with respect to the fixed piece 63. A hole 64b, through which the core yarn C is inserted, is formed at a distal end portion of each protrusion 64a.

[0037] As illustrated in FIG. 6A, a first tension is applied to the core yarn C under a state where the core yarn C is passed through the fixed piece 63 and the movable piece 64, and the movable piece 64 is opened with respect to the fixed piece 63. A state of the tension applying mechanism 61 in this case is referred to as a tension applying state. As illustrated in FIG. 6B, a second tension smaller than the first tension is applied to the core yarn C under a state where the core yarn C is passed through the fixed piece 63 and the movable piece 64, and the movable piece 64 is closed with respect to the fixed piece 63. A state of the tension applying mechanism 61 in this case is referred to as a tension non-applying state. The second tension also includes a case in which the tension applied to the core yarn C is zero.

[0038] As illustrated in FIG. 6A, the operating mecha-

nism 62 includes an operation member 65 and an air cylinder 66. The operation member 65 is arranged such that a distal end portion 65a of the operation member 65 makes contact with the movable piece 64 from a side opposite to the fixed piece 33. The movable piece 64 urged in the opening direction with respect to the fixed piece 63 is opened/closed with respect to the fixed piece 63 when the operation member 65 is moved by the air cylinder 66. Thus, the operating mechanism 62 changes the tension applying mechanism 61 to the tension applying state and the tension non-applying state.

[0039] As illustrated in FIG. 3, the slack applying section 70 includes an arm 71 and an air cylinder 72. The arm 71 is swingably supported by a supporting shaft 51c arranged on the unit base 51. A hole 73, through which the core yarn C is inserted, is formed at a distal end portion of the arm 71. The hole 73 includes an edge 73a of a closed annular shape (circular shape in the present embodiment) . A material excellent in wear resistance such as ceramic, for example, is used for the edge 73a. The arm 71 is swung to a normal position and a standby position by the air cylinder 72. The normal position is a position where the hole 73 is located on the travelling path of the core yarn C (position of solid line in FIG. 3). The standby position is a position where the hole 73 is located away from the travelling path of the core yarn C to the side opposite to the unit base 51 (position of chain double dashed line in FIG. 3).

[0040] The core yarn monitoring section 81 detects the presence and/or the absence of the core yarn C between the slack applying section 70 and the core yarn feeding section 90. A core yarn guide 56 adapted to guide the core yarn C is arranged upstream of the core yarn monitoring section 81. A core yarn guide 57 adapted to guide the core yarn C is arranged downstream of the core yarn monitoring section 81.

[0041] As illustrated in FIG. 7, the core yarn feeding section 90 includes an air sucker 91 and a clamp cutter 92. A travelling region of the core yarn C is formed inside the core yarn feeding section 90 so as to include a straight line. The air sucker 91 includes a core yarn feeding nozzle block 93, a core yarn feeding nozzle 94, and a tube body 95. The core yarn feeding nozzle 94, which becomes a part of the travelling path of the core yarn C, is arranged inside the core yarn feeding nozzle block 93. The tube body 95, which becomes a part of the travelling path of the core yarn C, is arranged downstream of the core yarn feeding nozzle 94. A compressed air is supplied from outside to the travelling path of the core yarn C. The core yarn feeding section 90 feeds the core yarn C to the core yarn guiding section 43 by action of the compressed air.

[0042] The clamp cutter 92 includes a clamp member 96, a cutter 97, and an air cylinder 98. The clamp member 96 is operated by the air cylinder 98 to clamp the core yarn C at the downstream of the air sucker 91. The cutter 97 is operated by the air cylinder 98 to cut the core yarn C at downstream of the clamp member 96. The clamp cutter 92 is set such that a timing to cut the core yarn C is after a timing to clamp the core yarn C.

[0043] As illustrated in FIG. 8, the core yarn supplying unit 50 is arranged outside a work region R for setting the sliver (the fiber bundle) S to the draft device 6. The work region R is a region on a back side (upstream) of the draft device 6, and is the region for inserting the sliver S to a tubular guiding member 6a arranged in the draft device 6. Under a state where the core yarn supplying unit 50 is located at the core yarn supplying position, the core yarn feeding section 90 and the core yarn guiding section 43 are arranged such that the respective travelling regions of the core yarn C include the same straight line L. An angle θ formed by the straight line L and the travelling path of the fiber bundle F in the draft device 6 is 10 degrees to 70 degrees (preferably, 30 degrees to 50 degrees), when seen from a direction perpendicular to both a rotation center line of each roller constituting each roller pair 15, 16, 18, 19 and the travelling path of the fiber bundle F in the draft device 6. That is, the travelling path of the core yarn C in the core yarn feeding section 90 and the core yarn guiding section 43 merges with the travelling path of the fiber bundle F between the middle roller pair 18 and the front roller pair 19 from a direction inclined by 10 degrees to 70 degrees (preferably, 30 degrees to 50 degrees) with respect to the travelling path of the fiber bundle F in the draft device 6.

[0044] As illustrated in FIG. 3, the core yarn supplying unit 50 further includes a first air supply tube 82, a second air supply tube 83, a relay substrate (substrate, board, circuit board) 84, and a multi-core cable 85. The first air supply tube 82 is pulled out to an outside of the unit base 51, and is removably connected to an air supply tube (not illustrated) of the main body unit 30. The first air supply tube 82 is connected to each of the air cylinder 66 of the tension applying section 60, the air cylinder 72 of the slack applying section 70, and the air cylinder 98 of the clamp cutter 92 via a plurality of pipes (not illustrated) arranged in the unit base 51. The compressed air is thereby supplied from the air supply source of the blower box 4 to each of the air cylinders 66, 72, and 98 through the air supply tube of the main body unit 30.

[0045] The second air supply tube 83 is pulled out to the outside of the unit base 51, and is removably connected to the air supply tube of the main body unit 30. The second air supply tube 83 is connected to the air sucker 91 via a pipe (not illustrated) arranged in the unit base 51. The compressed air is thereby supplied from the air supply source of the blower box 4 to the air sucker 91 through the air supply tube of the main body unit 30.

[0046] The relay substrate 84 is supported by the unit base 51. The relay substrate 84 is electrically connected to each of an electromagnetic valve for operation of the air sucker 91 of the core yarn feeding section 90, an electromagnetic valve for operation of the air cylinder 66 of the tension applying section 60, an electromagnetic valve for operation of the air cylinder 72 of the slack applying section 70, an electromagnetic valve for operation of the air cylinder 98 of the clamp cutter 92, and the core yarn

monitoring section 81 via a plurality of wires (cables) (not illustrated) arranged in the unit base 51.

[0047] The multi-core cable 85 is pulled out to the outside of the unit base 51, and is removably connected to a multi-core cable (not illustrated) of the main body unit 30 via a connector (not illustrated), for example. The multi-core cable 85 is a cable in which a plurality of wires are bundled to input/output electric signals to each section of the core yarn supplying unit 50, and is connected to the relay substrate 84. Each section of the core yarn supplying unit 50 is thus controllled by the unit control device 10 of the main body unit 30.

[0048] When the core yarn C is supplied to the main body unit 30 and the spun yarn Y is produced from the sliver S and the core yarn C (i.e., when the spinning is carried out), the core yarn supplying unit 50 is located at the core yarn supplying position and the tension applying section 60 causes the tension applying mechanism 61 to be in the tension applying state to apply the first tension to the core yarn C, as illustrated in FIG. 4. In this case, the arm 71 of the slack applying section 70 is located at the normal position (i.e., the position where the hole 73 is located on the travelling path of the core yarn C). Thus, the core yarn supplying unit 50 supplies the core yarn C to the draft device 6 while applying the first tension to the core yarn C unwound from the core yarn package CP.

[0049] When the yarn defect is detected by the spun yarn monitoring device 8 and the spinning is interrupted (or when the spinning is terminated), the clamp cutter 92 is operated to clamp and cut the core yarn C, as illustrated in FIG. 9. The yarn end of the core yarn C pulled out from the core yarn package CP is thereby clamped by the clamp cutter 92. Thereafter, the arm 71 of the slack applying section 70 is swung to the standby position, the core yarn C inserted through the hole 73 is pulled up, and the core yarn C is unwound from the core yarn package CP by an amount in which the core yarn C is pulled up.

[0050] When the spinning is resumed, the clamp cutter 92 is operated to release the clamping of the yarn end of the core yarn C, as illustrated in FIG. 10. The arm 71 of the slack applying section 70 is then swung to the normal position. The tension applying section 60 changes the tension applying mechanism 61 to the tension non-applying state, so that the tension applying mechanism 61 applies the second tension smaller than the first tension to the core yarn C. The air sucker 91 is operated under this state. The yarn end of the core yarn C is thereby fed out to the draft device 6 through the core yarn guiding section 43. As described above, in the tension applying section 60, the tension applying mechanism 61 is in the tension non-applying state when the core yarn feeding section 90 feeds out the yarn end of the core yarn C to the draft device 6 (i.e., when the supplying of the core yarn C to the pneumatic spinning device 7 is started).

[0051] After the spinning is resumed, the state returns to the state illustrated in FIG. 4. That is, the clamp cutter 92 and the air sucker 91 are not operated, and the tension applying section 60 causes the tension applying mechanism 61 to be under the tension applying state to apply the first tension to the core yarn C. When interrupting the spinning and carrying out simple cleaning, the core yarn supplying unit 50 is to be held at the retreated position using the second holding member 54, as illustrated in FIG. 5, without detaching the core yarn supplying unit 50. When resuming the spinning after the cleaning, the holding by the second holding member 54 is released and the core yarn supplying unit 50 is set to the core yarn supplying position using the first holding member 53.

[0052] In the core yarn supplying unit 50, the tension to be applied to the core yarn C can be changed by changing the tension applying mechanism 61 to the tension applying state and the tension non-applying state. Thus, since the tension to be applied to the core yarn C by the tension applying section 60 can be reduced while applying the slack to the core yarn C by the slack applying section 70, the yarn end of the core yarn C can be reliably fed out to the main body unit 30 by the core yarn feeding section 90.

[0053] In the core yarn supplying unit 50, the tension applying mechanism 61 is provided under the tension non-applying state when the core yarn feeding section 90 feeds out the yarn end of the core yarn C to the main body unit 30. Thus, since the tension applied to the core yarn C is small when the yarn end of the core yarn C is fed out, the yarn end of the core yarn C can be reliably fed out to the main body unit 30.

[0054] In the core yarn supplying unit 50, the slack applying section 70 includes the hole 73 through which the core yarn C is inserted, the hole 73 having the closed edge 73a. The core yarn C thus does not fall out from the hole 73, and the slack is reliably applied to the core yarn C. The yarn end of the core yarn C thus can be reliably fed out to the main body unit 30.

[0055] In the core yarn supplying unit 50, the edge 73a is circular. The core yarn C thus can be smoothly guided by the hole 73 of the slack applying section 70, and the yarn end of the core yarn C can be reliably fed out to the main body unit 30.

[0056] In the core yarn supplying device 40, the yarn end of the core yarn C unwound from the core yarn package CP can be reliably fed out to the main body unit 30.

[0057] The core yarn supplying device 40 further includes the tubular core yarn guiding section 43 adapted to guide the core yarn C to the main body unit 30, and the travelling region of the core yarn C is formed inside the core yarn guiding section 43 so as to include a straight line. The yarn end of the core yarn C thus can smoothly travel inside the core yarn guiding section 43, and the yarn end of the core yarn C can be reliably fed out to the main body unit 30. Furthermore, since a pressure loss of air inside the core yarn guiding section 43 is suppressed, the core yarn C can be reliably fed out to the main body unit 30. Moreover, the cleaning can be easily carried out even if oil solution used for spinning is accu-

mulated in the core yarn feeding section 90 and/or the core yarn guiding section 43.

[0058] According to the spinning machine 1, since the tension applied to the core yarn C is small when the supplying of the core yarn C to the pneumatic spinning device 7 is started, the yarn end of the core yarn C can be reliably fed out to the main body unit 30.

[0059] In the core yarn supplying method implemented by the spinning machine 1, the first tension is applied to the core yarn C when supplying the core yarn C to the main body unit 30, and the second tension smaller than the first tension is applied to the core yarn C when feeding out the yarn end of the core yarn C to the main body unit 30.

[0060] In the core yarn supplying method, since the tension of the core yarn C is small when feeding out the yarn end of the core yarn C to the main body unit 30, the yarn end of the core yarn C can be reliably fed out to the main body unit 30.

[0061] One embodiment of the present invention has been described above, but the present invention is not limited to the above embodiment. The operating mechanism 62 is not limited to the configuration described above, and various configurations can be applied. For example, a cam coupled with a motor may be used without using the operation member 65 and the air cylinder 66.

[0062] The shape of the edge 73a of the slack applying section 70 is not limited to a circular shape, and may be a polygonal shape, for example. Furthermore, the edge 73a is not limited to an annular shape, and may be a C-shape, for example. The material of the edge 73a is not limited to ceramic, and may be metal.

[0063] The type of core yarn C may be other than the mono-filament yarn or the false-twisted yarn. For example, the core yarn C may be a multi-filament yarn having lower rigidity than the mono-filament yarn, or may be a yarn having lower crimping property than the false-twisted yarn. Furthermore, the core yarn C may be a textured yarn, an air textured yarn (e.g., yarn in which spandex and textured yarn are interlaced, yarn having similar crimping property as the textured yarn), or a spun yarn (generally-used spun yarn).

[0064] The unit control device 10 and the machine control device 20 merely need to be control devices that directly or indirectly control at least each section of the core yarn supplying unit 50, and arranging positions and the like are not limited. The unit control device 10 may be arranged, not for each spinning unit 2, but for each group of the plurality of spinning units 2.

[0065] The material and the shape of each structure of the spinning machine 1 are not limited to the material and the shape described above, and various materials and shapes can be applied.

[0066] In the spinning machine 1, each device is arranged such that the spun yarn Y supplied from the upper side is wound on the lower side, but each device may be arranged such that the yarn supplied from the lower side is wound on the upper side. Furthermore, in the spinning machine 1, each roller pair of the draft device 6 and the traverse mechanism of the traverse device 23 are driven by the-power from the motor box 5 (i.e., commonly driven for the plurality of spinning units 2). However, each section of the spinning unit 2 (e. g. , the draft device 6, the pneumatic spinning device 7, the winding device 12, or the like) may be independently driven for each spinning unit 2.

[0067] The pneumatic spinning device 7 may further include a needle held by the fiber core yarn guide and arranged to project out into a spinning chamber to prevent the twists of the fiber bundle F from being transmitted to the upstream of the pneumatic spinning device 7. In place of the needle, the pneumatic spinning device 7 may prevent the twists of the fiber bundle F from being propagated towards the upstream of the pneumatic spinning device 7 by a downstream end of the fiber core yarn guide. Moreover, the pneumatic spinning device 7 may include a pair of air jet nozzles adapted to apply twists in opposite directions from each other.

[0068] In the travelling direction of the spun yarn Y, the tension sensor 9 may be arranged upstream of the spun yarn monitoring device 8. In the spinning machine 1, the yarn storage device 14 has a function of pulling out the spun yarn Y from the pneumatic spinning device 7, but the spun yarn Y may be pulled out by a delivery roller and a nip roller. The waxing device 11, the tension sensor 9, and the spun yarn monitoring device 8 may not be arranged in the spinning unit 2.

[0069] Instead of being driven by a driving motor arranged for each spinning unit 2, the winding device 12 may be driven by a common driving source for the plurality of spinning units 2. In this case, when reversely rotating the package P, the cradle arm 21 is moved by an air cylinder (not illustrated) such that the package P moves away from the winding drum 22, and the package P is reversely rotated by a reverse rotation roller (not illustrated) arranged in the yarn joining cart 3.

Claims

1. A core yarn supplying unit (50) comprising:

a core yarn feeding section (90) arranged to feed out a yarn end of a core yarn (C) ;
a tension applying section (60) adapted to apply a tension to the core yarn (C); and
a slack applying section (70) adapted to apply slack to the core yarn (C) between the core yarn feeding section (90) and the tension applying section (60),
characterized in that the tension applying section (60) includes:

a tension applying mechanism (61) adapted to apply the tension to the core yarn (C), and

an operating mechanism (62) adapted to change the tension applying mechanism (61) to a tension applying state and a tension non-applying state.

2. The core yarn supplying unit (50) according to claim 1, wherein the tension applying mechanism (61) is provided under the tension non-applying state when the core yarn feeding section (90) feeds out the yarn end of the core yarn (C).

3. The core yarn supplying unit (50) according to claim 1 or claim 2, wherein the slack applying section (70) includes a hole (73) through which the core yarn (C) is inserted, the hole (73) having a closed edge (73a).

4. The core yarn supplying unit (50) according to claim 3, wherein the edge (73a) is circular.

5. A core yarn supplying device (40) comprising:

the core yarn supplying unit (50) according to any one of claim 1 through claim 4; and
a core yarn package holding section (41) adapted to hold a core yarn package (CP).

6. The core yarn supplying device (40) according to claim 5, further comprising a tubular core yarn guiding section (43) adapted to guide the core yarn (C) fed out from the core yarn supplying unit (50),
wherein a travelling region of the core yarn (C) is formed inside the core yarn guiding section (43) so as to include a straight line (L).

7. A spinning machine (1) comprising:

the core yarn supplying unit (50) according to any one of claim 1 through claim 4;
a draft device (6) adapted to draft a fiber bundle (F);
a pneumatic spinning device (7) adapted to produce a spun yarn (Y) by applying twists to the fiber bundle (F) with the core yarn (C) as a core; and
a winding device (12) adapted to wind the spun yarn (Y) into a package (P),
wherein the tension applying mechanism (61) is provided under the tension non-applying state when supplying of the core yarn (C) to the pneumatic spinning device (7) is started.

8. A core yarn supplying method for supplying a core yarn (C) from a core yarn package (CP) while applying a tension to the unwound core yarn (C), the method comprising the steps of:

applying a first tension to the core yarn (C) when supplying the core yarn (C); and
applying a second tension smaller than the first tension to the core yarn (C) when feeding out a yarn end of the core yarn (C).

9. The method of claim 8, comprising the step of operating a tension applying section (60) for applying the second tension to the core yarn (C) during the feeding out of the yarn end of the core yarn (C) and the step of operating said tension applying section (60) for applying the first tension to the core yarn (C) during the subsequent supplying of the core yarn (C).

10. The method of claim 8 or 9, comprising, for preparing the feeding out of the yarn end of the core yarn (C), the step of operating a clamp member (96) for clamping the yarn end and the step of operating a slack applying section (70) for pulling out the core yarn (C) from the core yarn package (CP).

11. The method of claim 10, further comprising, for allowing the feeding out of the yarn end of the core yarn (C), the step of operating said clamp member (96) for releasing the yarn end and the step of operating said slack applying section (70) for releasing the pulled out core yarn (C).

12. The method of claim 11, wherein said tension applying section (60) is operated to apply the first tension during the pulling out of the core yarn (C) from the core yarn package (CP).

FIG. 1

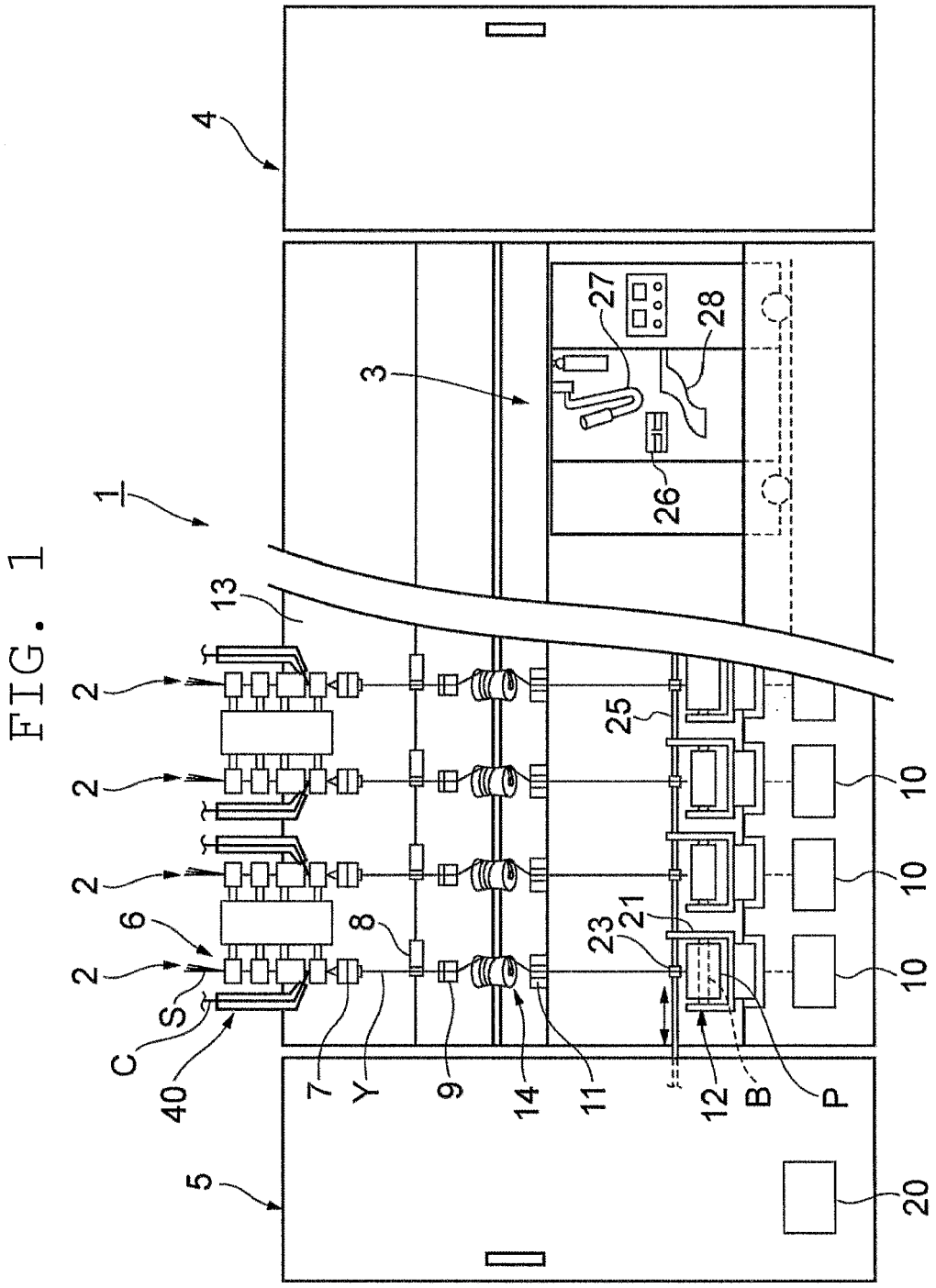
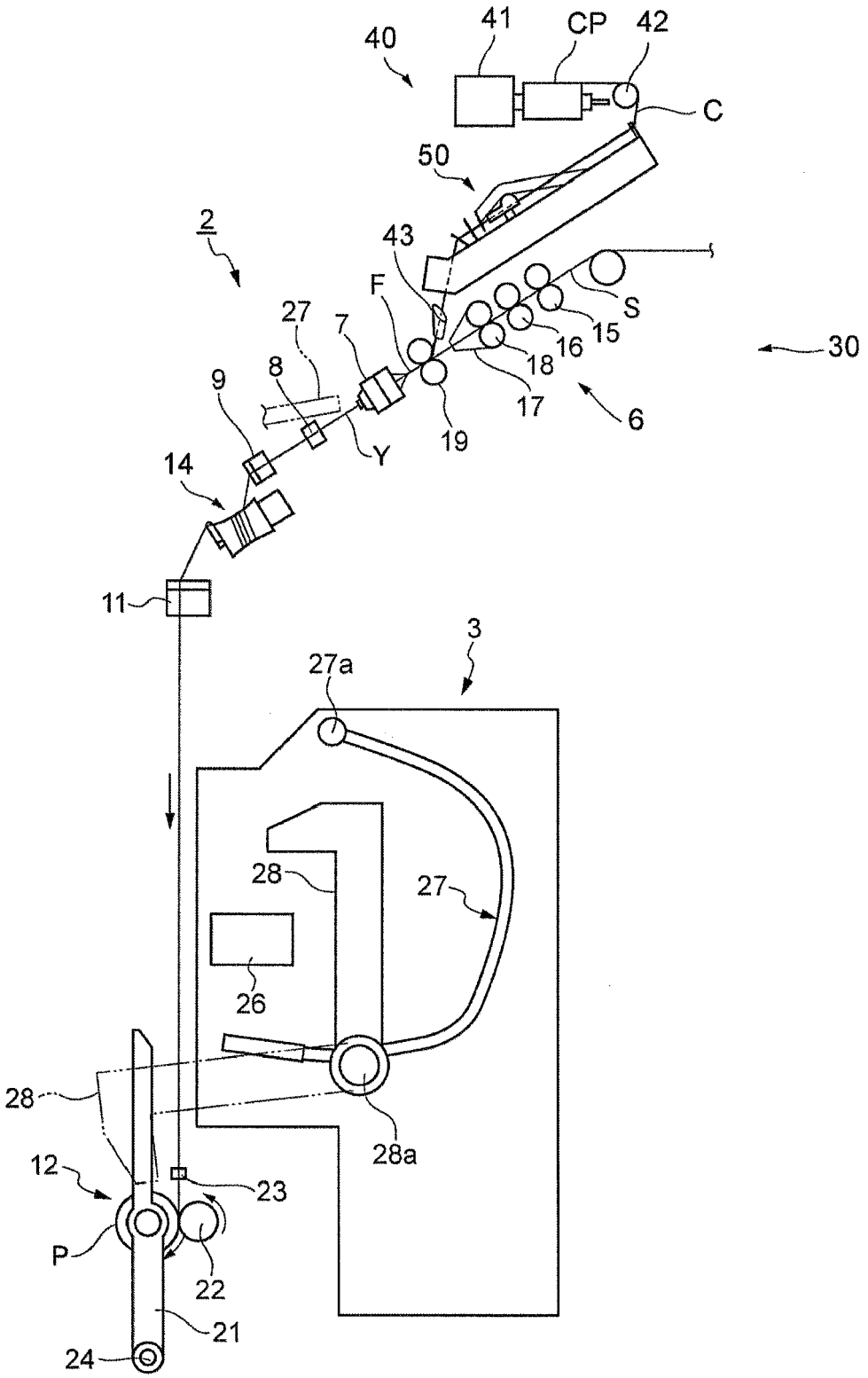


FIG. 2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CP
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C
50
2
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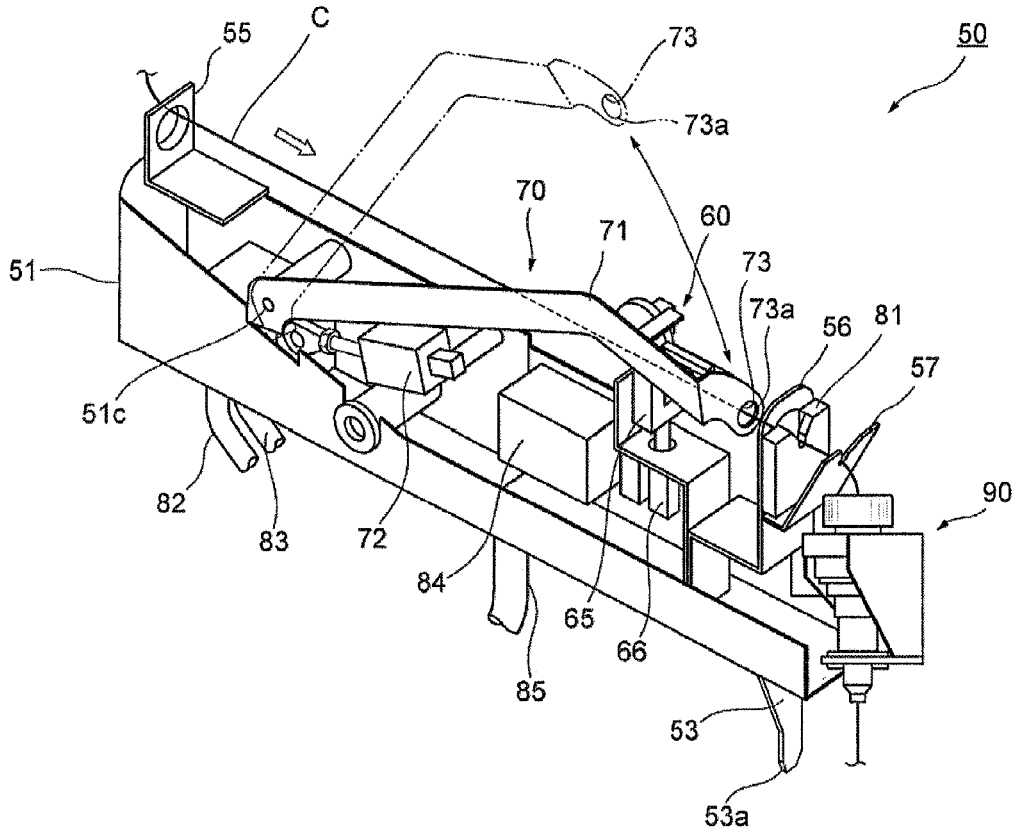
F
27
7
8
9
Y
19
17
18
16
15
S
30
6
14
11
3
27a
28
27
26
28
28a
12
23
P
22
21
24

FIG. 3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C
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90
85
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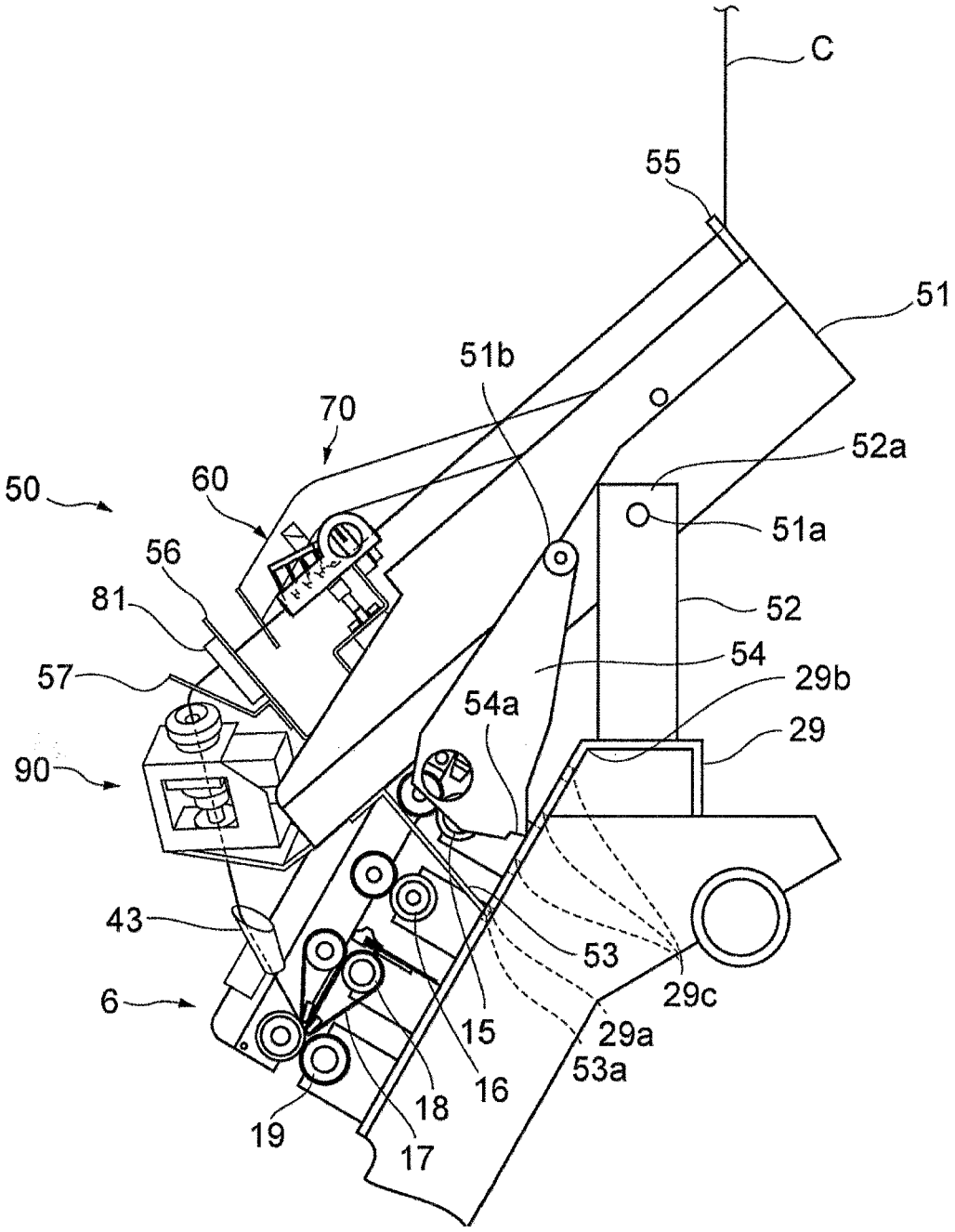
53a

FIG. 4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29
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43
53
29c
6
15
29a
53a
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18
19
17

FIG. 5

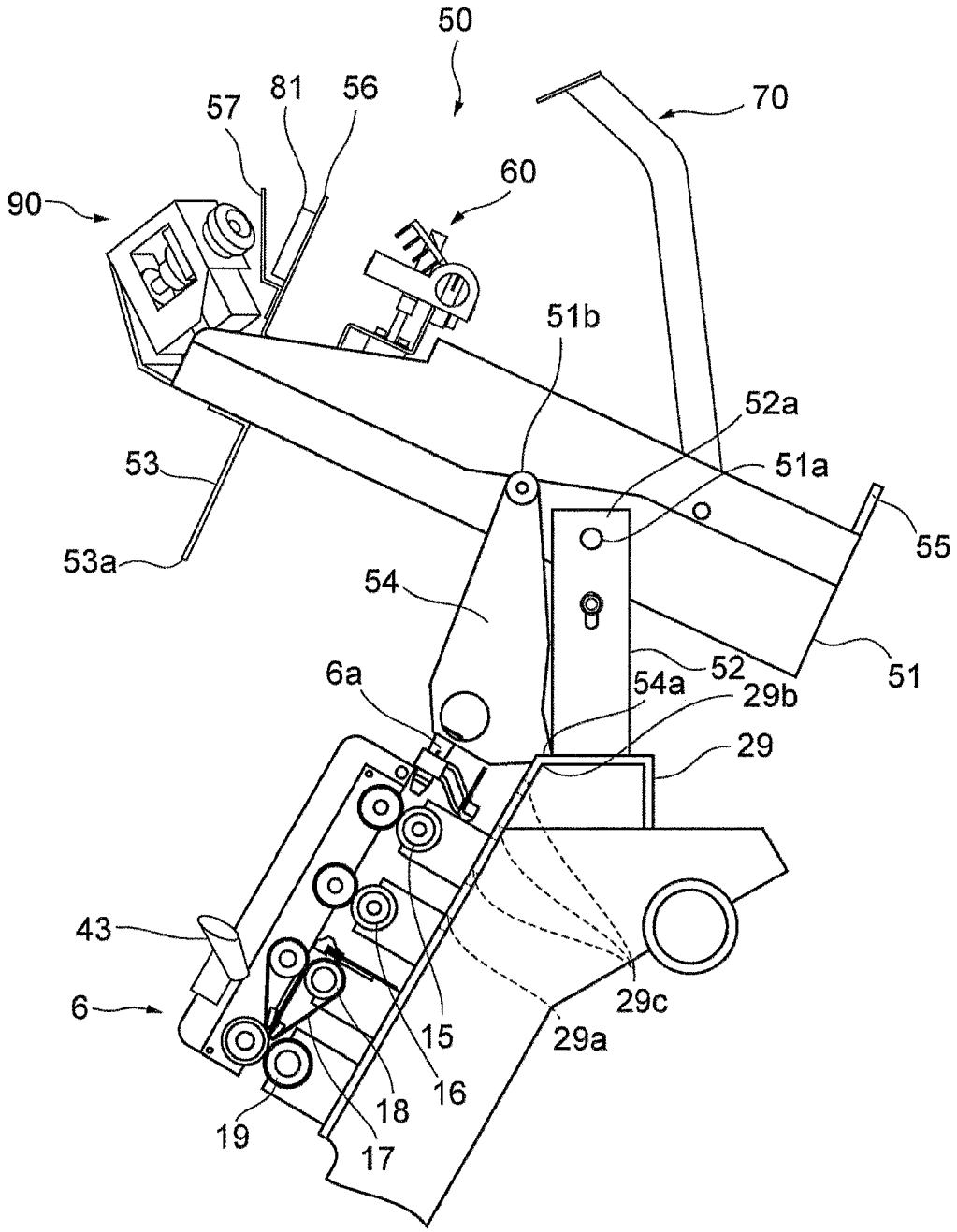
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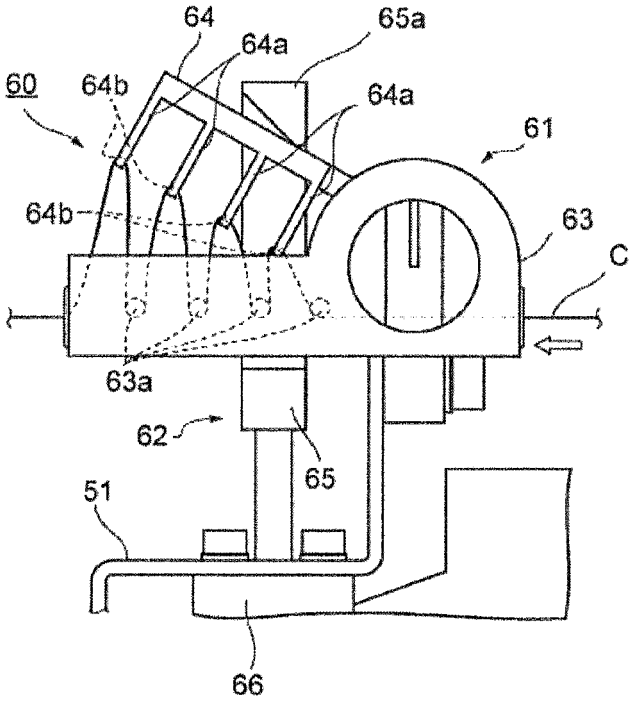
FIG. 6A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66

FIG. 6B

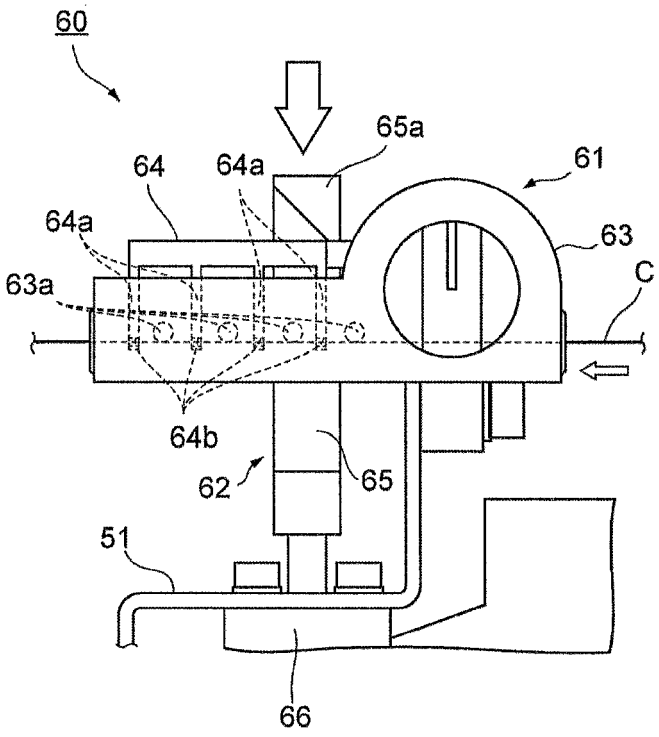
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FIG. 7

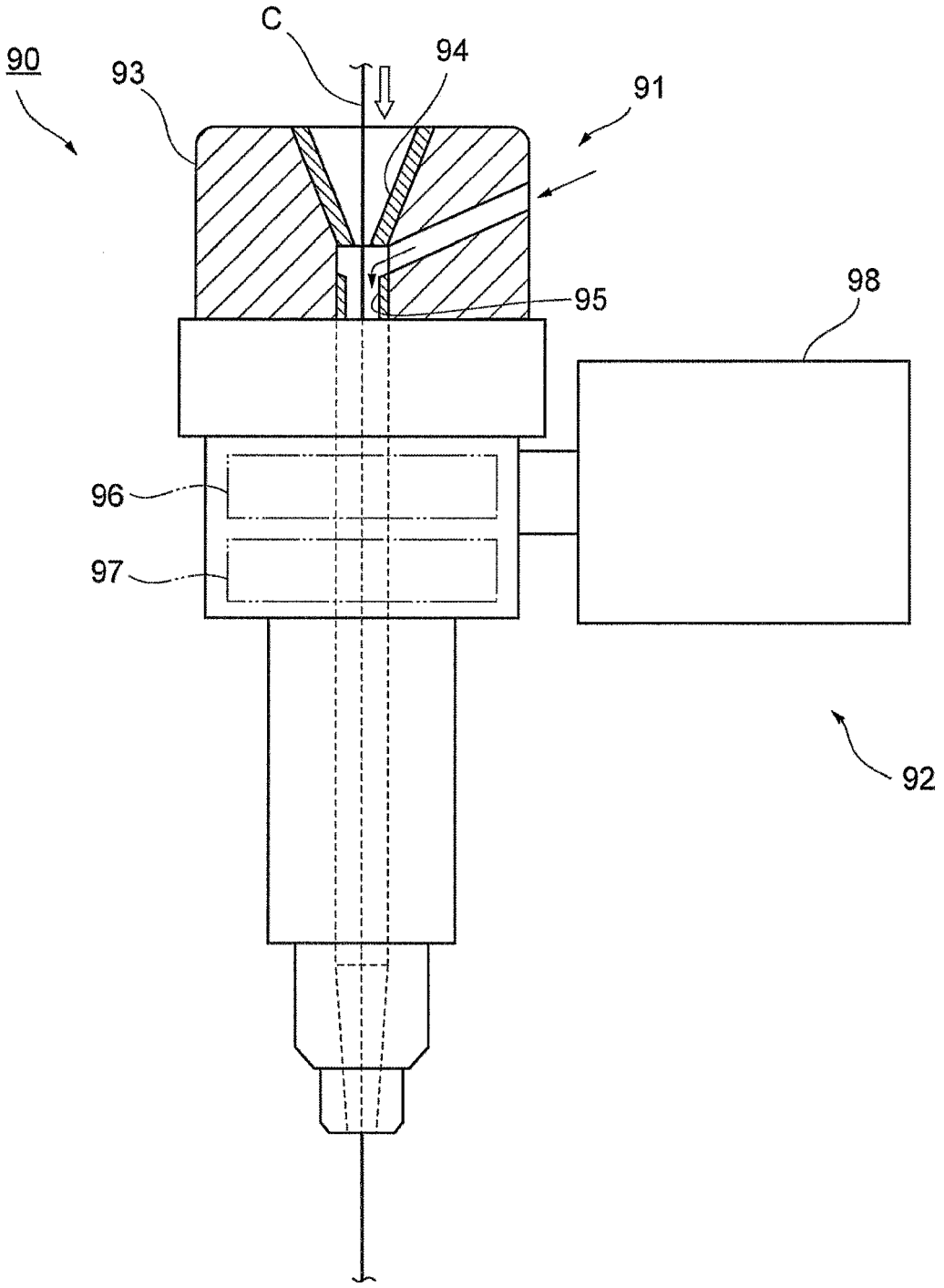

FIG. 8

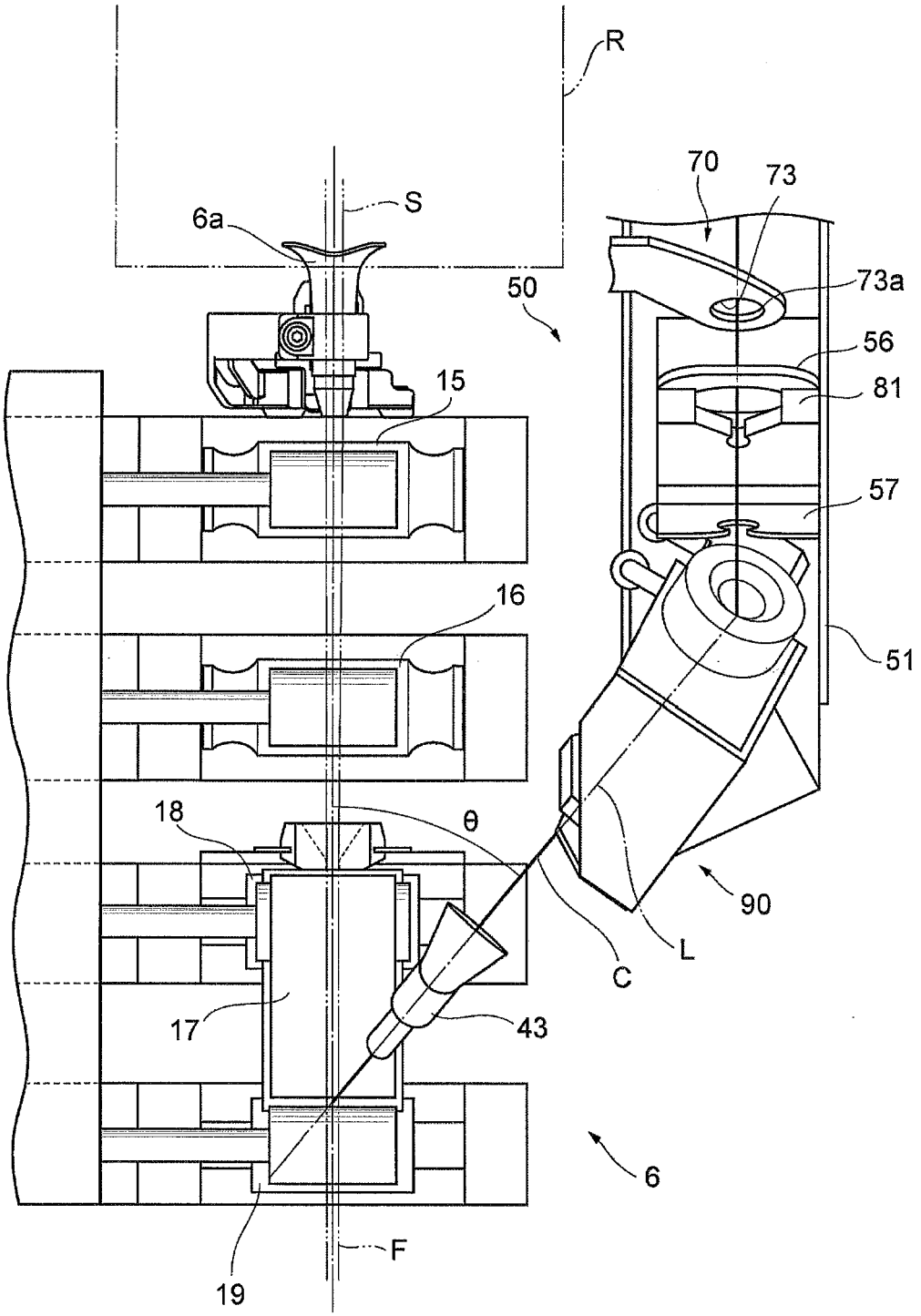

FIG. 9

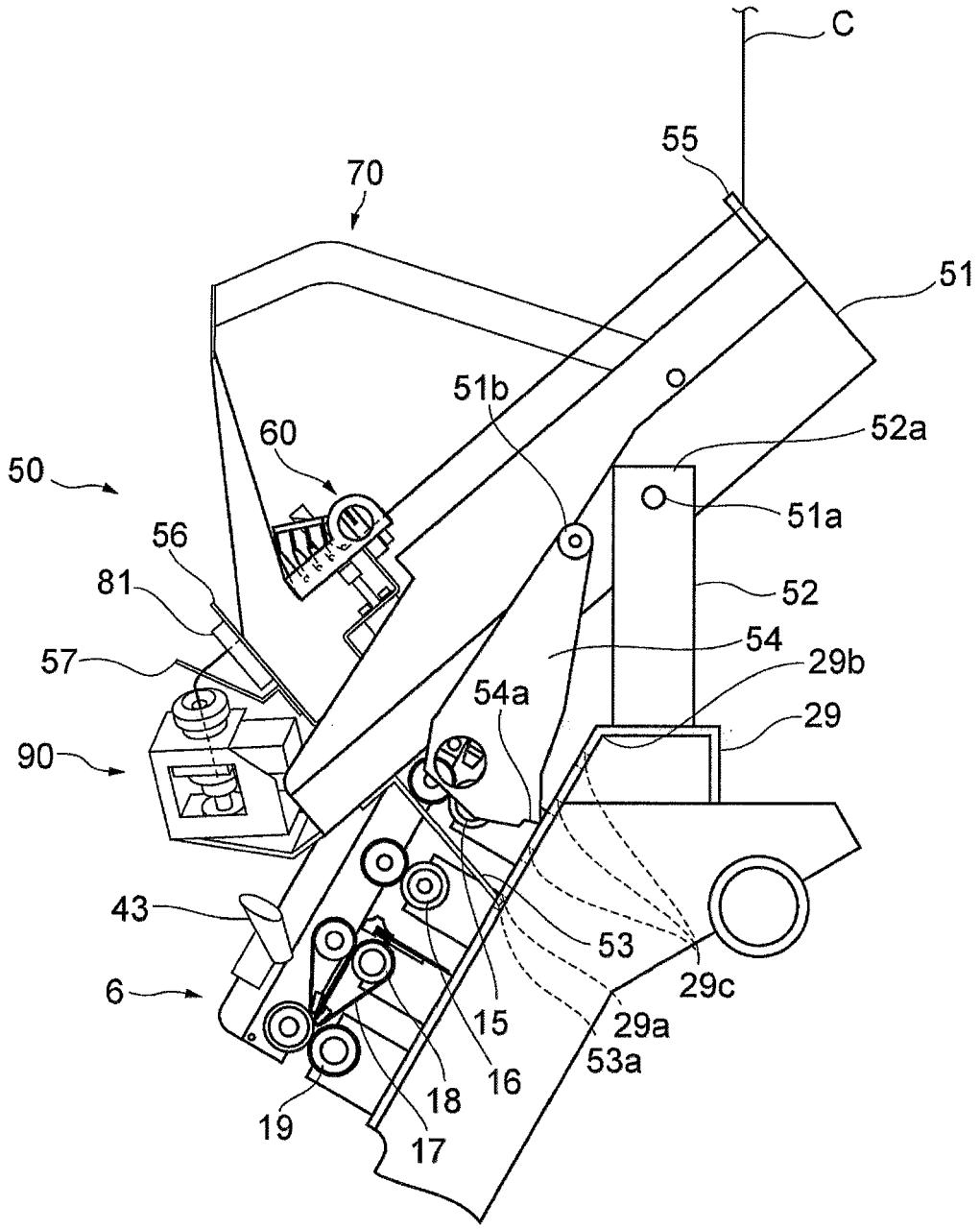
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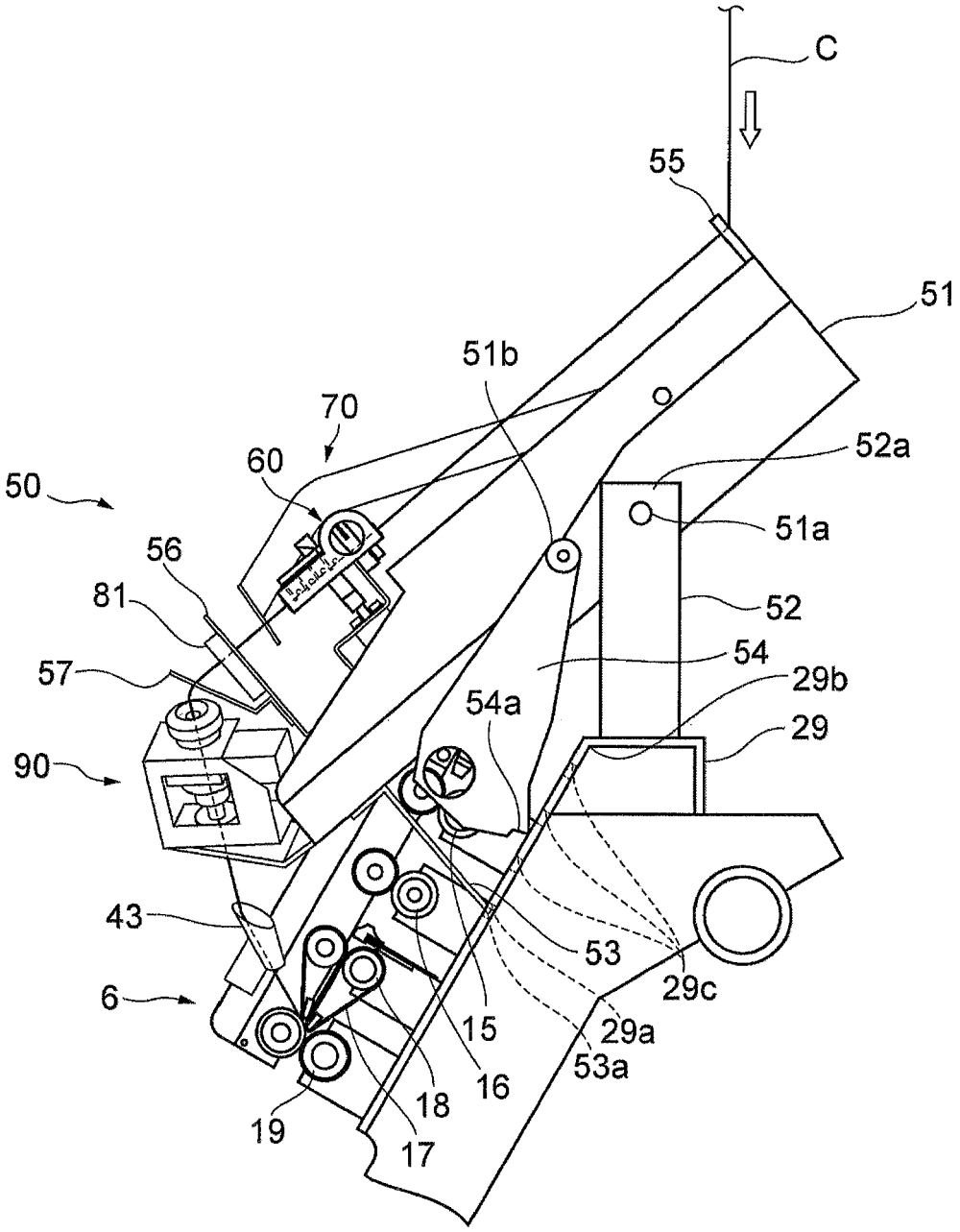
FIG. 10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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 2349

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	JP 2012 131591 A (MURATA MACHINERY LTD) 12 July 2012 (2012-07-12)	1,3-6	INV. B65H59/32
Y	* the whole document *	1-12	D01H1/115
X	JP 2008 156796 A (MURATA MACHINERY LTD) 10 July 2008 (2008-07-10)	8	
Y	* the whole document *	1-12	
A	US 5 056 734 A (UCHIDA HIROSHI [JP] ET AL) 15 October 1991 (1991-10-15) * column 1, line 8; figures 1,2,6 * * column 3, line 1 - column 4, line 39 *	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

D01H
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 January 2016	Wendl, Helen

CATEGORY OF CITED DOCUMENTS

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25-01-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2012131591 A	12-07-2012	CN 102534878 A	04-07-2012
		CN 202499946 U	24-10-2012
		JP 2012131591 A	12-07-2012
JP 2008156796 A	10-07-2008	NONE	
US 5056734 A	15-10-1991	DE 3734471 A1	21-04-1988
		IT 1218170 B	12-04-1990
		US 5056734 A	15-10-1991

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Patent documents cited in the description

- JP 2012131591 A **[0002]**