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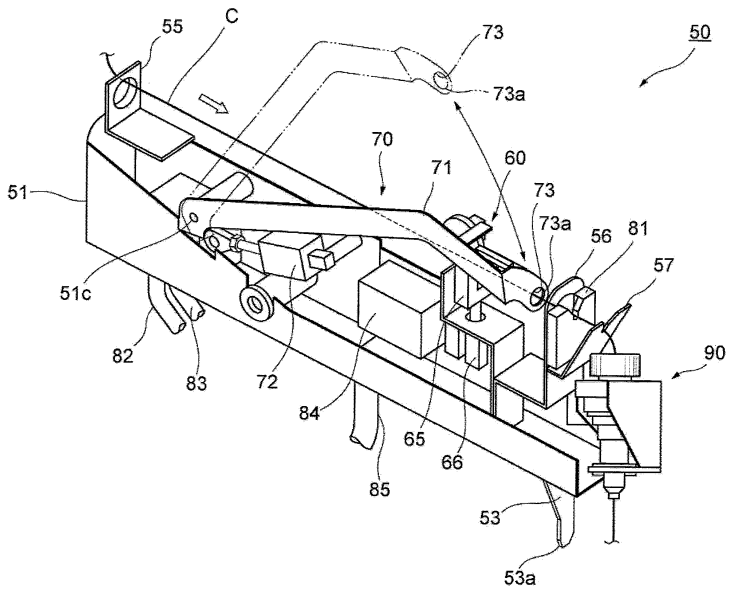
(54) CORE YARN SUPPLYING UNIT AND SPINNING MACHINE

(57) A core yarn supplying unit (50) includes a tension applying section (60); a slack applying section (70); a core yarn feeding section (90); a relay board (84) electrically connected to each of the tension applying section (60), the slack applying section (70), and the core yarn feeding section (90); and a unit base (51) adapted to support the tension applying section (60), the slack applying section (70), and the core yarn feeding section (90), as well as the relay board (84).

FIG. 3



EP 2 966 202 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

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

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).

BRIEF SUMMARY OF THE INVENTION

[0003] The core yarn supplying unit described above is demanded to be easily attached and detached with respect to a main body unit, configured with the draft device, etc., for maintenance, for example.

[0004] It is an object of the present invention to provide a core yarn supplying unit that can be easily attached and detached, and a spinning machine including such a core yarn supplying unit.

[0005] A core yarn supplying unit of the present invention includes a plurality of movable members; a board electrically connected to each of the plurality of the movable members; and a unit base adapted to support the plurality of the movable members and the board.

[0006] In such a core yarn supplying unit, electrical connection with each of the plurality of movable members is concentrated in the board, and thus the electrical connection with the main body unit, for example, can be simplified. Thus, according to the core yarn supplying unit, the attachment and detachment can be facilitated.

[0007] The core yarn supplying unit of the present invention may further include one multicore cable. The multicore cable is connected to the board for input and output of an electric signal with respect to each of the plurality of the movable members and arranged to be drawn out from the unit base. According to such a configuration, for example, simplification of the electrical connection with the main body unit can be suitably realized.

[0008] The core yarn supplying unit of the present invention may further include one first air supplying tube connected to a supplying target, which is at least one of the plurality of the movable members, to supply compressed air to the supplying target and arranged to be drawn out from the unit base. According to such a configuration, simplification of the connection of a compressed air supplying path can be suitably realized.

[0009] The core yarn supplying unit of the present invention may include as the plurality of the movable members: a core yarn feeding section adapted to feed out a yarn end of a core yarn; and a tension applying section adapted to apply a tension to the core yarn. According to such a configuration, the core yarn supplying unit can suitably achieve a function of feeding out the yarn end of the core yarn and a function of applying the tension to the core yarn.

[0010] The core yarn supplying unit of the present invention may further include one second air supplying tube connected to the core yarn feeding section to supply compressed air to the core yarn feeding section and arranged to be drawn out from the unit base. According to such a configuration, the compressed air having different pressures can be supplied to the core yarn feeding section and the movable members other than the core yarn feeding section.

[0011] The core yarn supplying unit of the present invention may further include a supporting section adapted to swingably support the unit base. According to such a configuration, for example, the unit base can be swung to a core yarn supplying position where the core yarn supplying unit is located when supplying the core yarn to the main body unit, and a retreated position where the core yarn supplying unit is located when not supplying the core yarn to the main body unit.

[0012] In the core yarn supplying unit of the present invention, the supporting section may support one end of a swing shaft provided on the unit base. According to such a configuration, an attachment region of the supporting section is located only on one side, and thus a region on an opposite side can be effectively used.

[0013] A spinning machine of 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 around a package, wherein the unit base of the core yarn supplying unit is attachable and detachable with respect to the draft device.

[0014] In the spinning machine, since the core yarn supplying unit is attached with respect to the draft device to which the core yarn is supplied, the configuration of the spinning machine can be simplified.

[0015] The spinning machine of the present invention may further include a holding section adapted to hold the unit base, swingable between the core yarn supplying position and a plurality of retreated positions with respect to the draft device, at any of the core yarn supplying position and the plurality of retreated positions. According to such a configuration, the unit base can be held at any of the core yarn supplying position and the plurality of retreated positions in accordance with when the spinning is carried out, when the spinning is interrupted, and the like.

[0016] In the spinning machine of the present invention, the core yarn supplying unit may be arranged outside a work region for setting the fiber bundle to the draft device. According to such a configuration, the work region is secured, and thus the operation of setting the fiber bundle in the draft device can be efficiently carried out.

[0017] In the core yarn supplying unit according to the present invention, the plurality of movable members are configured such that the core yarn is passed therethrough and so as to act on the core yarn, and the plurality of movable members are arranged to be held at respective yarn passing positions for passing the core yarn therethrough when the core yarn is passed through the plurality of movable members.

[0018] Thus, in the core yarn supplying unit, the plurality of movable members can be held at appropriate positions where the core yarn can be easily passed therethrough. Therefore, in the core yarn supplying device, the core yarn can be easily set.

[0019] In one embodiment, the core yarn supplying unit may further include as the plurality of the movable members: a slack applying section adapted to apply slack to the core yarn; and a clamp section adapted to clamp the core yarn. According to such a configuration, the core yarn supplying unit can suitably achieve a function of applying the slack to the core yarn and a function of clamping the core yarn.

[0020] In one embodiment, the tension applying section may be arranged movable to a tension applying position where the tension applying section applies tension to the core yarn by bending the core yarn, and a tension non-applying position which is the yarn passing position where the core yarn is not bent as much as the core yarn at the tension applying position. According to such a configuration, in the core yarn supplying device, the path of the core yarn passing the tension applying section is formed as a path with few bent areas, for example, and thus the core yarn can be easily set.

[0021] In one embodiment, the slack applying section may be arranged movable to a slack applying position where the tension applying section applies slack to the core yarn by bending the core yarn, and a slack non-applying position which is the yarn passing position where the core yarn is not bent as much as the core yarn at the slack applying position. According to such a configuration, in the core yarn supplying device, the path of the core yarn passing the slack applying section is formed as a path with few bent areas, for example, and thus the core yarn can be easily set.

[0022] In one embodiment, the clamp section may be arranged movable to a clamping position where the clamp section clamps the core yarn, and a non-clamping position which is the yarn passing position and which is a position where the clamp section does not clamp the core yarn. According to such a configuration, the region for passing the core yarn is sufficiently secured when the core yarn is passed through the clamp section in the core yarn supplying device, and thus the core yarn can be easily set.

[0023] In one embodiment, the core yarn supplying unit may further include an operating section adapted to start movement of the plurality of the movable members to the respective yarn passing positions. According to such a configuration, the movement of the plurality of movable members to the respective yarn passing positions can be easily carried out by the operation of the operating section.

[0024] In one embodiment, the operating section may be arranged at a position located downstream in a travelling path of the core yarn. According to such a configuration, for example, the operating section is located on a lower side in the core yarn supplying unit in which the core yarn travels from an upper side towards a lower side, and thus the operation of the operating section can be easily carried out.

[0025] In one embodiment, the operating section may be an alternate type switch. According to such a configuration, an operator can determine whether or not the plurality of movable members are held at the respective yarn passing positions by checking the operating section. Furthermore, the operating section can have a simple configuration.

[0026] A spinning machine according to the present invention includes the core yarn supplying unit; 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, wherein the plurality of movable members are moved to the respective yarn passing positions and held at the respective yarn passing positions if the drafting operation of the draft device and the spinning operation of the pneumatic spinning device are stopped when the core yarn is being passed through the plurality of movable members.

[0027] Thus, in the core yarn supplying unit, the plurality of movable members can be held at an appropriate position where the core yarn can be easily passed therethrough. Therefore, in the spinning device, the core yarn can be easily set in the core yarn supplying unit.

[0028] In one embodiment, the spinning machine includes a control section adapted to control the operations of the core yarn supplying unit, the draft device, and the pneumatic spinning device, wherein the control section may prohibit the drafting operation of the draft device and the spinning operation of the pneumatic spinning device when the plurality of movable members are held at the respective yarn passing positions. According to such a configuration, in the spinning machine, the drafting operation and the spinning operation by an erroneous operation by the operator, and the like, for example, can be prohibited from being performed when the core yarn is being passed through the plurality of movable members.

[0029] In one embodiment, the spinning machine may include a setting section adapted to set a yarn type of a yarn to be produced by the pneumatic spinning device, wherein the control section may prohibit the movement of the plurality of movable members to the respective

yarn passing positions when the yarn type that does not use the core yarn is set in the setting section. According to such a configuration, in the spinning machine, the movement of the plurality of movable members to the respective yarn passing positions by an erroneous operation by the operator, and the like, for example, can be prohibited when the drafting operation and the spinning operation of the yarn that does not use the core yarn are being performed.

[0030] In one embodiment, the core yarn supplying unit may include a core yarn feeding section adapted to feed out the yarn end of the core yarn with action of air, wherein the control section may control to inject air from the core yarn feeding section and the pneumatic spinning device when the movable members are held at the respective yarn passing positions. According to such a configuration, in the spinning machine, for example, the yarn end of the core yarn can be fed out to the draft device by the core yarn feeding section after the core yarn is passed through each movable member. Furthermore, the fibers and the like remaining on the travelling path of the core yarn and the fiber bundle can be removed before starting the spinning operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031]

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 a 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

[0032] 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.

[0033] As illustrated in FIG. 1, a spinning machine 1 includes a plurality of spinning units 2, a yarn joining cart 3, a first end frame 4, and a second end frame 5. The plurality of spinning units 2 are arranged in a line. Each spinning unit 2 is adapted to produce a spun yarn Y and to wind the spun yarn Y into a package P. When the spun yarn Y is disconnected or the spun yarn Y is broken for some reason in a spinning unit 2, the yarn joining cart 3 carries out a yarn joining operation at the target spinning unit 2. The first end frame 4 accommodates an air supply source or the like for generating a whirling airflow, at each section of the spinning unit 2 and/or an air suction source or the like for generating a suction flow at each section of the spinning unit 2.

[0034] The second end frame 5 accommodates a drive motor and the like for supplying power to each section of the spinning unit 2. The second end frame 5 includes a machine control device (setting section) E, a display section D, and an input key K. The machine control device E collectively manages and controls each section of the spinning machine 1. The display section D can display information and the like associated with set content and/or a state of the spinning unit 2. When an operator performs an appropriate operation using the input key K, the setting operation of the spinning unit 2 is carried out. The display section D may be a touch panel display. In this case, the input key K may be displayed on the touch panel display.

[0035] In the machine control device E, a yarn type (lot) of the spun yarn Y to be produced in the spinning unit 2 is set. Specifically, the machine control device E displays a screen for carrying out the setting of the yarn type on the display section D. The operator carries out the setting of the yarn type with the input key K based on the screen displayed on the display section D. In the machine control device E, the setting of the yarn type of the spun yarn Y is carried out in accordance with the operation information of the input key K. The machine control device E outputs the information related to the set yarn type to a unit control device 10, to be described later.

[0036] 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.

[0037] 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.

[0038] The draft device 6 is adapted to draft a 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, 19 causes the sliver S supplied from a can (not illustrated) to travel from the upstream towards the downstream while drafting. The operation in which the draft device 6 drafts the sliver S as described above is referred to as "drafting operation".

[0039] 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.

[0040] 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. The operation in which the pneumatic spinning device 7 produces the spun yarn Y as described above is referred to as "spinning operation".

[0041] 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 the 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 the machine control device E, which is a high-order controller.

[0042] 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.

[0043] 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 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.

[0044] 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. For example, the yarn joining device 26 is a yarn joining device that uses air, a piecer that uses a seed yarn, or a knotter that mechanically joins the spun yarn Y.

[0045] 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. Note that, a textured yarn, an air textured yarn (e.g., yarn in which elastic yarn and textured yarn are interlaced, yarn having similar crimping property as the textured yarn), or a spun yarn (generally-used spun yarn) may be used as the core yarn C.

[0046] 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.

[0047] As illustrated in FIG. 3, the core yarn supplying unit 50 includes a unit base 51, a tension applying section 60 (movable member), a slack applying section (movable member) 70, a core yarn monitoring section 81, and a core yarn feeding section (movable member) 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).

[0048] As illustrated in FIGS. 4 and 5, 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, the supporting member 52 supports one end of 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 of the roller pairs 15, 16, 18, and 19 (specifically, the bottom roller of each of the roller pairs 15, 16, 18, and 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.

[0049] 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 core yarn supplying unit 50 is arranged when the core yarn supplying unit 50 supplies the core yarn C to the draft device 6.

[0050] 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. 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 core yarn supplying unit 50 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. This means that the distance from the draft device 6 to the core yarn feeding section 90 of the core yarn supplying unit 50 at the retreated position is greater than the distance from the draft device 6 to the core yarn feeding section 90 of the core yarn supplying unit 50 at the core yarn supplying position.

[0051] As illustrated in FIG. 6A, a tension applying section 60 includes a tension applying mechanism 61 and an operating mechanism 62. 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.

[0052] 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. A plurality of protrusions 64a are arranged on the movable piece 64 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.

[0053] 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.

[0054] As illustrated in FIG. 6A, the operating mechanism 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 63. 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.

[0055] 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).

[0056] 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.

[0057] 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.

[0058] The clamp cutter 92 includes a clamp section 96, a cutter 97, and an air cylinder 98. The clamp section 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 section 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.

[0059] 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 axis 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.

[0060] As illustrated in FIG. 3, the core yarn supplying unit 50 further includes a first air supplying tube 82, a second air supplying tube 83, a relay board (board) 84, and a multicore cable 85. The first air supplying tube 82 is pulled out to an outside of the unit base 51, and is removably connected to an air supplying tube (not illustrated) of the main body unit 30. The first air supplying tube 82 is connected to each of the air cylinder 66 of the tension applying section (supplying target) 60, the air cylinder 72 of the slack applying section (supplying target) 70, and the air cylinder 98 of the clamp cutter (supplying target) 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 first end frame 4 to each of the air cylinders 66, 72, and 98 through the air supplying tube of the main body unit 30.

[0061] The second air supplying tube 83 is pulled out to the outside of the unit base 51, and is removably connected to the air supplying tube of the main body unit 30. The second air supplying tube 83 is connected to the air sucker (supplying target) 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 first end frame 4 to the air sucker 91 through the air supplying tube of the main body unit 30.

[0062] The relay board 84 is supported by the unit base 51. The relay board 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.

[0063] The multicore cable 85 is pulled out to the outside of the unit base 51, and is removably connected to a multicore cable (not illustrated) of the main body unit 30 via a connector (not illustrated), for example. The multicore 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 board 84. Each section of the core yarn supplying unit 50 is thus controlled by the unit control device 10 of the main body unit 30.

[0064] 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. 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.

[0065] 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.

[0066] When the spinning is resumed, the clamp cutter 92 is operated to release the clamping of the yarn end of the core yarn, 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).

[0067] After the spinning is resumed, the core yarn supplying unit 50 returns to the state illustrated in FIG. 3. 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.

[0068] When carrying out maintenance and the like, the core yarn supplying unit 50 is detached from the main body unit 30. More specifically, the multicore cable 85 is detached from the multicore cable of the main body unit 30, and the first air supplying tube 82 and the second air supplying tube 83 are detached from the air supplying tube of the main body unit 30. Thereafter, the supporting member 52 is detached from the draft base 29, so that the core yarn supplying unit 50 can be detached from the main body unit 30. The procedure of the detaching operation is carried out in a reverse order in the case of attaching the core yarn supplying unit 50 to the main body unit 30. The core yarn supplying unit 50 thus can be easily

attached and detached with respect to the main body unit 30 with few operations. 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.

[0069] In the core yarn supplying unit 50 and the spinning machine 1 (the spinning unit 2), the electrical connection with each of the movable members 60, 70, and 90 is concentrated in the relay board 84, and thus the electrical connection between the core yarn supplying unit 50 and the main body unit 30 can be simplified. Therefore, according to the core yarn supplying unit 50 and the spinning machine 1, the attachment and detachment of the core yarn supplying unit 50 with respect to the main body unit 30 can be facilitated.

[0070] The core yarn supplying unit 50 includes the core yarn feeding section 90 adapted to feed out the yarn end of the core yarn C to the draft device 6, and the tension applying section 60 adapted to apply the tension to the core yarn C to be supplied to the draft device 6. Accordingly, the core yarn supplying unit 50 can suitably achieve a function of feeding out the yarn end of the core yarn C to the main body unit 30 and a function of applying the tension to the core yarn C to be supplied to the main body unit 30.

[0071] The core yarn supplying unit 50 further includes one multicore cable 85. The multicore cable 85 is connected to the relay board 84 for input and output of an electric signal with respect to each of the movable members 60, 70, and 90, and arranged to be drawn out from the unit base 51. Accordingly, the simplification of the electrical connection with the main body unit 30 can be suitably realized.

[0072] In the core yarn supplying unit 50, the first air supplying tube 82 is connected to each of the movable members 60, 70, and 92 to supply compressed air to each of the movable members 60, 70, and 92 excluding the air sucker 91, and is arranged to be drawn out from the unit base 51. Furthermore, the second air supplying tube 83 is connected to the air sucker 91 to supply the compressed air to the air sucker 91, and is arranged to be drawn out from the unit base 51. Thus, the compressed air having different pressures can be supplied to the air sucker 91 and each of the movable members 60, 70, and 92. In terms of the compressed air supplying path, the core yarn supplying unit 50 is connected to the outside (main body unit 30) with only the first air supplying tube 82 and the second air supplying tube 83, and thus the simplification of the connection of the compressed air supplying path can be suitably realized.

[0073] In the core yarn supplying unit 50, the supporting member 52 swingably supports the unit base 51 with respect to the draft base 29. Accordingly, the unit base 51 can be swung to the core yarn supplying position where the core yarn supplying unit 50 is located when supplying the core yarn C to the main body unit 30, and a retreated position where the core yarn supplying unit 50 is located when not supplying the core yarn C to the main body unit 30.

[0074] In the core yarn supplying unit 50, one end of the swing shaft 51a provided on the unit base 51 is supported by the supporting member 52. Thus, an attachment region of the supporting member 52 is only on one side, and a region on the opposite side can be effectively used. Specifically, as illustrated in FIG. 1, the core yarn supplying units 50 of the adjacent spinning units 2 can be arranged adjacently. If both ends of the swing shaft 51a are supported, the core yarn supplying unit 50 would be arranged by considering a thickness of the supporting member 52 of each spinning unit 2. Therefore, in this case, the distance between the spinning units 2 becomes greater compared to the present embodiment, thus leading to enlargement of the spinning machine 1.

[0075] In the spinning machine 1, since the core yarn supplying unit 50 is attached with respect to the draft device 6 to which the core yarn C is supplied first in the main body unit 30, the configuration of the spinning machine 1 can be simplified. Moreover, the core yarn C can be reliably supplied to the draft device 6.

[0076] In the spinning machine 1, the first holding member 53 holds the unit base 51 at the core yarn supplying position, and the second holding member 54 holds the unit base 51 at one of the plurality of retreated positions. Accordingly, the unit base 51 can be held at any of the core yarn supplying position and the plurality of retreated positions in accordance with when the spinning is carried out, when the spinning is interrupted, and the like. Each of the retreated positions can be used differently in accordance with operation content (cleaning and/or dissembling, etc.) and/or a height of the operator.

[0077] In the spinning machine 1, the core yarn supplying unit 50 is arranged outside the work region R for setting the fiber bundle F to the draft device 6. According to such a configuration, the work region R is secured, and thus the operation of inserting the sliver S into the draft device 6, etc., can be efficiently carried out.

[0078] As illustrated in FIG. 4, the core yarn supplying unit 50 further includes an operating section 58. (In FIGS. 5, 9, and 10, the illustration of the operating section 58 is omitted). The operating section 58 is a so-called alternate type switch. The alternate type switch is a switch that can be switched between an ON state and an OFF state, and in which the ON state or the OFF state is maintained after the switching. For example, in the alternate type switch, even if the operator operates the switch (operating section) to obtain the ON state, and thereafter, releases a hand from the operating section, the ON state is maintained. Any type of the operating section 58 may be used as long as the ON state or the OFF state after the switching can be maintained, and the ON state or the OFF state can be determined by checking the operating

section 58. The operating section 58, for example, may be a type in which a lamp is lighted, or may be a push-ON push-OFF type in which the ON state is maintained when pushed once, and the ON state is switched to the OFF state when pushed once more.

[0079] The operating section 58, for example, is arranged on a unit frame 100a of the core yarn feeding section 90, and is located downstream of the travelling path of the core yarn C. The operating section 58 is connected to the relay board 84 via a wire (not illustrated) arranged in the unit base 51. When the operating section 58 is operated, the electric signal is transmitted to the unit control device 10 via the relay board 84. The unit control device 10 operates the electromagnetic valve for operation of the air cylinder 72 of the slack applying section 70, and the electromagnetic valve for operation of the air cylinder 98 of the clamp cutter 92 based on the electric signal. In other words, the operating section 58 is a switch for starting the movement of the arm 71 of the slack applying section 70 and the clamp section 96 to the respective yarn passing positions.

[0080] Specifically, when the operating section 58 is operated to the ON state, an electric signal indicating the ON state is output to the unit control device 10 via the relay board 84. Upon receiving the electric signal, the unit control device 10 operates the electromagnetic valve for operation of the air cylinder 72 of the slack applying section 70 and the electromagnetic valve for operation of the air cylinder 98 of the clamp cutter 92, if use of the core yarn C in the spun yarn Y to be produced is set in information (lot information) related to the yarn type output from the machine control device E. The arm 71 of the slack applying section 70 is thereby swung to a slack non-applying position (yarn passing position), and held at the slack non-applying position. The clamp section 96 is moved to a non-clamping position (yarn passing position), and held at the non-clamping position.

[0081] When the operating section 58 is operated to the OFF state, an electric signal indicating the OFF state is output to the unit control device 10 via the relay board 84. The unit control device 10 having received the electric signal operates the electromagnetic valve for operation of the air cylinder 72 of the slack applying section 70 and the electromagnetic valve for operation of the air cylinder 98 of the clamp cutter 92. The arm 71 of the slack applying section 70 is thereby swung to the slack applying position, and the clamp section 96 is moved to the clamping position.

[0082] If the use of the core yarn C in the spun yarn Y to be produced is not set in the information related to the yarn type output from the machine control device E, the unit control device 10 prohibits the operation even if the electric signal indicating the ON state is output from the operating section 58. In other words, the unit control device 10 prohibits the movement of the arm 71 of the slack applying section 70 and the clamp section 96 to the respective yarn passing positions when producing the spun yarn Y that does not use the core yarn C. When the operation (the drafting operation, the spinning operation, or the like) associated with the production of the spun yarn Y is being carried out, the unit control device 10 prohibits the above operation even if the electric signal indicating the ON state is output from the operating section 58.

[0083] Next, a description will be made on the operation of the spinning machine 1. When the operation (the drafting operation, the spinning operation, or the like) associated with the production of the spun yarn Y is being carried out, the tension applying mechanism 61 is located at a tension applying position and a tension is applied to the core yarn C, as illustrated in FIGS. 6A and 6B. In this case, the arm 71 of the slack applying section 70 is located at the slack non-applying position. The clamp section 96 is located at the non-clamping position (i.e., state where a clamp pin and a clamp block, which are not illustrated, are separated). Thus, the core yarn supplying unit 50 supplies the core yarn C to the draft device 6 while applying the tension to the core yarn C unwound from the core yarn package CP.

[0084] When the yarn defect is detected by the spun yarn monitoring device 8 and the operation associated with the production of the spun yarn Y is interrupted or terminated, the clamp section 96 is moved to the clamping position (i.e., state where the clamp pin and the clamp block make contact with one another) to clamp the core yarn C. Thereafter, the core yarn C clamped by the clamp section 96 is cut by the cutter 97. The yarn end of the core yarn C pulled out from the core yarn package CP is thereby clamped by the clamp section 96. Thereafter, the arm 71 of the slack applying section 70 is swung to the slack applying 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 the amount in which the core yarn C is pulled up. The tension applying mechanism 61 is moved to the tension non-applying position.

[0085] When the operation associated with the production of the spun yarn Y is resumed without the core yarn C being removed from the core yarn supplying device 40, the clamp section 96 is moved from the clamping position to the non-clamping position, and the clamping of the yarn end of the core yarn C is released. The arm 71 of the slack applying section 70 is then swung from the slack applying position to the slack non-applying position. The tension applying mechanism 61 is held at the tension non-applying position, and is in a state of not applying tension to the core yarn C. The core yarn feeding section 90 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. After the yarn end of the core yarn C is fed out, the feeding operation of the core yarn feeding section 90 is stopped, and the tension applying mechanism 61 is moved to the tension applying position to apply tension to the core yarn C.

[0086] When the operation associated with the production of the spun yarn Y is started (resumed) from the state where the core yarn C is once removed from the core

yarn supplying device 40, the core yarn C is set in the core yarn supplying device 40 before the relevant operation is started. The core yarn C is passed through the travelling region of the core yarn C formed inside of the core yarn guide 55, each protrusion 64a and each hole 64b of the tension applying mechanism 61, the hole 73 of the slack applying section 70, the core yarn guide 56, the core yarn monitoring section 81, the core yarn guide 57, and the core yarn feeding section 90. In this case, the tension applying mechanism 61 of the tension applying section 60 is located at the tension non-applying position. The arm 71 of the slack applying section 70 is located at the slack applying position, and the clamp section 96 is located at the clamping position.

[0087] When the operating section 58 is operated to be switched to the ON state, the arm 71 of the slack applying section 70 and the clamp section 96 are moved to the respective yarn passing positions. Specifically, as illustrated in FIG. 10, the arm 71 of the slack applying section 70 is swung from the slack applying position to the slack non-applying position, and held at the slack non-applying position. The path of the core yarn C passing through the hole 73 of the slack applying section 70 thereby becomes a path with few bent areas. In particular, the path of the core yarn C from the core yarn guide 55 to the core yarn guide 57 is substantially linear since the tension applying mechanism 61 is held at the tension non-applying position serving as an initial position. The clamp section 96 is moved from the clamping position to the non-clamping position, and held at the non-clamping position. The region for passing the core yarn C is thus sufficiently secured inside the core yarn feeding section 90.

[0088] After the yarn end of the core yarn C is passed to the inside of the core yarn feeding section 90, when the operating section (not illustrated) of the spinning unit 2 including such a core yarn feeding section 90 is operated, the unit control device 10 controls the operation of the core yarn feeding section 90. More specifically, the unit control device 10 controls the core yarn feeding section 90 such that air is injected to the travelling region of the core yarn C from the core yarn feeding nozzle of the core yarn feeding nozzle block 93. The yarn end of the core yarn C is thereby fed out to the draft device 6. The injection of the air from the core yarn feeding nozzle may be carried out before start of the operation related to the production of the spun yarn Y to remove fibers and the like remaining in the travelling region of the core yarn C. When the operating section (not illustrated) of the spinning unit 2 is operated, the unit control device 10 may control the pneumatic spinning device 7 such that air is injected from the nozzle (e. g. , the whirling airflow generating nozzle) in the pneumatic spinning device 7 in addition to the core yarn feeding nozzle. The fibers and the like remaining in a travelling path of the fiber bundle F are thereby removed together with the fibers and the like remaining in the travelling region of the core yarn C. A timing at which the air is injected from the core yarn feeding nozzle and the nozzle in the pneumatic spinning device 7 may be the same or may have a time difference.

[0089] When the operating section 58 is operated and the arm 71 of the slack applying section 70 and the clamp section 96 are held at the respective yarn passing positions, that is, when the operating section 58 is in the ON state, the unit control device 10 does not start the operation related to the production of the spun yarn Y even if a predetermined operation for starting the operation is carried out. In other words, the unit control device 10 prohibits the operation related to the production of the spun yarn Y when the arm 71 of the slack applying section 70 and the clamp section 96 are held at the respective yarn passing positions.

[0090] When the operating section 58 is switched to the OFF state, the unit control device 10 moves the arm 71 of the slack applying section 70 to the slack applying position, and moves the clamp section 96 to the clamping position. The unit control device 10 also permits the operation related to the production of the spun yarn Y.

[0091] As described above, in the core yarn supplying device 40 according to the present embodiment, when the core yarn C is passed through the slack applying section 70 and the clamp section 96, the slack applying section 70 and the clamp section 96 are moved to the respective yarn passing positions and held thereat. Thus, in the core yarn supplying device 40, the slack applying section 70 and the clamp section 96 can be held at appropriate positions where the core yarn C can be easily passed therethrough. Therefore, in the core yarn supplying device 40, the core yarn C can be easily set.

[0092] In the present embodiment, the arm 71 of the slack applying section 70 may be movable to the slack applying position where the slack applying section 70 applies slack to the core yarn C by bending the core yarn C, and the slack non-applying position which is the yarn passing position and which is a position where the core yarn is not bent as much as the core yarn at the slack applying position. The arm 71 of the slack applying section 70 is held at the yarn passing position when the core yarn C is passed through. Thus, in the core yarn supplying device 40, the path of the core yarn C passing through the hole 73 of the slack applying section 70 can be formed as a path with few bent areas, and thus the core yarn C can be easily passed. In particular, if the hole is closed as in the case of the hole 73 of the slack applying section 70, the core yarn is normally difficult to be passed through compared to a hole provided with a slit and the like. The core yarn C can be easily passed by adopting the configuration of the present embodiment.

[0093] In the present embodiment, the clamp section 96 is movable to the clamping position where the clamp section 96 clamps the core yarn C, and a non-clamping position which is the yarn passing position and a position where the clamp section 96 does not clamp the core yarn C. The clamp section 96 is held at the yarn passing position when the core yarn C is passed through. Thus, in the core yarn supplying device 40, the region for passing

the core yarn C is sufficiently secured when passing the core yarn C through the travelling region of the core yarn C formed inside of the core yarn feeding section 90 in the clamp section 96, and thus the core yarn C can be easily passed.

[0094] In the present embodiment, the core yarn supplying device 40 includes the operating section 58 adapted to start the movement of the slack applying section 70 and the clamp section 96 to the respective yarn passing positions. Thus, the movement of the slack applying section 70 and the clamp section 96 to the respective yarn passing positions can be easily carried out by the operation of the operating section 58. In particular, in the present embodiment, the operating section 58 may be arranged at the position located downstream of the travelling path of the core yarn C. The operating section 58 is thus located at a lower part of the core yarn supplying device 40, and thus the operator operating from the work passage can easily operate the operating section 58.

[0095] In the present embodiment, the operating section 58 is an alternate type switch. Thus, the operator can determine whether or not the arm 71 of the slack applying section 70 and the clamp section 96 are held at the respective yarn passing positions by checking the operating section 58. Furthermore, the operating section 58 can have a simple configuration.

[0096] In the present embodiment, the spinning unit 2 includes the unit control device 10 adapted to control the operation of the core yarn supplying device 40, the draft device 6, and the pneumatic spinning device 7. When the arm 71 of the slack applying section 70 and the clamp section 96 are held at the respective yarn passing positions, the unit control device 10 prohibits the drafting operation of the draft device 6, the spinning operation of the pneumatic spinning device 7,etc. Thus, in the spinning unit 2, the drafting operation and the spinning operation by an erroneous operation by the operator, and the like, for example, can be prohibited from being performed when the yarn passing operation of the core yarn C is carried out.

[0097] In the present embodiment, the yarn type of the spun yarn Y to be produced in the pneumatic spinning device 7 is set in the machine control device E. If the yarn type that does not use the core yarn C is set in the machine control device E, the unit control device 10 prohibits the movement of the arm 71 of the slack applying section 70 and the clamp section 96 to the respective yarn passing positions. Thus, in the spinning unit 2, the movement of the arm 71 of the slack applying section 70 and the clamp section 96 to the respective yarn passing positions by the erroneous operation by the operator, and the like, for example, can be prohibited when the drafting operation and the spinning operation of the spun yarn Y that does not use the core yarn C are being performed.

[0098] In the present embodiment, in the spinning unit 2, the core yarn supplying device 40 includes the core yarn feeding section 90 adapted to feed the yarn end of the core yarn C with the action of the air. The unit control device 10 controls to inject the air from the core yarn feeding nozzle of the core yarn feeding section 90 and the nozzle in the pneumatic spinning device 7 when the arm 71 of the slack applying section 70 and the clamp section 96 are held at the respective yarn passing positions. Thus, in the spinning unit 2, after the core yarn C is passed through the arm 71 of the slack applying section 70 and the clamp section 96, the yarn end of the core yarn C can be easily fed out to the draft device 6 by the core yarn feeding section 90. Furthermore, the fibers, etc., remaining on the travelling path of the core yarn C and the fiber bundle F can be removed before starting the spinning operation and the like.

[0099] The present invention is not limited to the embodiment described above. In the embodiment described above, a mode has been described by way of example in which the tension applying mechanism 61 of the tension applying section 60 is located at the yarn passing position (the tension non-applying position) in the initial state where the air cylinder 66 is not operated, i.e., the state where the core yarn C is to be set in the core yarn supplying device 40. The tension applying mechanism 61 may be located at the tension applying position in the initial state. In this case, the unit control device 10 may operate the electromagnetic valve for the operation of the air cylinder 66 such that the tension applying mechanism 61 is moved to the yarn passing position (the tension non-applying position) and held at the yarn passing position when the operating section 58 is switched to the ON state. In other words, when the operating section 58 is switched to the ON state, the unit control device 10 operates the electromagnetic valve for the operation of the air cylinder 72 of the slack applying section 70, the electromagnetic valve for the operation of the air cylinder 98 of the clamp cutter 92, and the electromagnetic valve for the operation of the air cylinder 66 of the tension applying section 60.

[0100] In the embodiment described above, a mode has been described by way of example in which the core yarn supplying device 40 includes the tension applying mechanism 61 of the tension applying section 60, the arm 71 of the slack applying section 70, and the clamp section 96 as the movable members adapted to act on the core yarn C. However, the core yarn supplying device 40 may further include other movable members adapted to act on the core yarn C other than the sections described above. In this case, when setting the core yarn C in the core yarn supplying device 40, the other movable members may be moved to the respective yarn passing positions and held at the respective yarn passing positions.

[0101] When setting the core yarn C in the core yarn supplying device 40, all the movable members that act on the core yarn C may not necessarily be moved to the respective yarn passing positions and held at each of the yarn passing positions. In other words, the unit control device 10 may operate the drive source (e.g., the electromagnetic valve of each of the air cylinders 66, 72, and 98, and the like) of each movable member such that any

of the plurality of movable members can be moved to the respective yarn passing positions and held at the respective yarn passing positions.

[0102] In the embodiment described above, the operating section 58 is arranged in the core yarn supplying unit 50 (the core yarn supplying device 40), but the operating section 58 may be arranged in the draft device 6 and the like, for example. In other words, the operating section 58 may be arranged at any position of the spinning unit 2 as long as the operator can operate the operating section 58.

[0103] One embodiment of the present invention has been described above, but the present invention is not limited to the above embodiment. In the spinning machine 1, the unit base 51 is attachable and detachable with respect to the draft base 29, but the unit base 51 may be attachable and detachable with respect to other portions of the main body unit 30. For example, the unit base 51 may be attachable and detachable with respect to the machine frame 13. In this case as well, it can be said that the unit base 51 is attachable and detachable with respect to the draft device 6.

[0104] In the spinning machine 1, the core yarn supplying unit 50 includes the second air supplying tube 83 in addition to the first air supplying tube 82. However, if the pressure of the compressed air used in the air sucker 91 is the same as the pressure of the compressed air used in each air cylinder 66, 72, 98, the second air supplying tube 83 may not be arranged and the first air supplying tube 82 may be connected to the air sucker 91. Similarly, if a regulator is arranged in the core yarn supplying unit 50, the second air supplying tube 83 may not be arranged, and the first air supplying tube 82 may be connected to the air sucker 91 via the regulator. Furthermore, the first air supplying tube 82 merely needs to be connected to at least one supplying target. For example, the first air supplying tube 82 may be connected to only the air cylinder 66 of the tension applying section 60. In this case, the slack applying section 70 and the clamp cutter 92 are to be driven with a drive means (e.g., motor or the like) different from the air cylinder.

[0105] In the spinning machine 1, the supporting member 52 supports one end of the swing shaft 51a, but the supporting member 52 may support both ends of the swing shaft 51a. 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.

[0106] The unit control device 10 and the machine control device E 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.

[0107] 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 second end frame 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.

[0108] 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 propagated towards 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.

[0109] 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 with 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.

[0110] 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) **characterized by**:

a plurality of movable members (60, 70, 90);
a board (84) electrically connected to each of the plurality of the movable members (60, 70, 90); and
a unit base (51) adapted to support the plurality of the movable members (60, 70, 90) and the board (84).

2. The core yarn supplying unit (50) according to claim 1, further **characterized by** one multicore cable (85) connected to the board (84) for input and output of an electric signal with respect to each of the plurality

of the movable members (60, 70, 90) and arranged to be drawn out from the unit base (51).

3. The core yarn supplying unit (50) according to claim 1 or claim 2, further **characterized by** one first air supplying tube (82) connected to a supplying target, which is at least one of the plurality of the movable members (60, 70, 90), to supply compressed air to the supplying target and arranged to be drawn out from the unit base (51).

4. The core yarn supplying unit (50) according to any one of claim 1 through claim 3, **characterized by** comprising as the plurality of the movable members (90, 60):

a core yarn feeding section (90) adapted to feed out a yarn end of a core yarn (C); and
a tension applying section (60) adapted to apply a tension to the core yarn (C).

5. The core yarn supplying unit (50) according to claim 4, further **characterized by** one second air supplying tube (83) connected to the core yarn feeding section (90) to supply compressed air to the core yarn feeding section (90) and arranged to be drawn out from the unit base (51).

6. The core yarn supplying unit (50) according to any one of claim 1 through claim 5, further **characterized by** a supporting section (52) adapted to swingably support the unit base (51).

7. The core yarn supplying unit (50) according to any one of claim 1 through claim 6, **characterized in that** the plurality of the movable members (60, 70, 90) are arranged to be held at respective yarn passing positions where the core yarn (C) is passed through the plurality of the movable members (60, 70, 90) when the core yarn (C) is passed through the plurality of the movable members (60, 70, 90, 96).

8. The core yarn supplying unit (50) according to claim 7, further **characterized by** comprising as the plurality of the movable members:

a slack applying section (70) adapted to apply slack to the core yarn (C); and
a clamp section (96) adapted to clamp the core yarn (C).

9. The core yarn supplying unit (50) according to claim 8, **characterized in that** the slack applying section (70) is arranged movable to a slack applying position where the slack applying section (70) applies slack to the core yarn (C) by bending the core yarn (C), and a slack non-applying position which is the yarn passing position and which is a position where the core yarn (C) is not bent as much as the core yarn (C) at the slack applying position.

10. The core yarn supplying unit (50) according to claim 8 or claim 9, **characterized in that** the clamp section (96) is arranged movable to a clamping position where the clamp section (96) clamps the core yarn (C) and a non-clamping position which is the yarn passing position and which is a position where the clamp section (96) does not clamp the core yarn (C).

11. The core yarn supplying unit (50) according to any one of claim 7 through claim 10, further **characterized by** an operating section (58) adapted to start movement of the plurality of the movable members (60, 70, 90) to the respective yarn passing positions.

12. A spinning machine (1) comprising:

the core yarn supplying unit (50) according to any one of claim 1 through claim 11;
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 (13) adapted to wind the spun yarn (Y) around a package (P),
characterized in that the unit base (51) of the core yarn supplying unit (50) is attachable and detachable with respect to the draft device (6).

FIG. 1

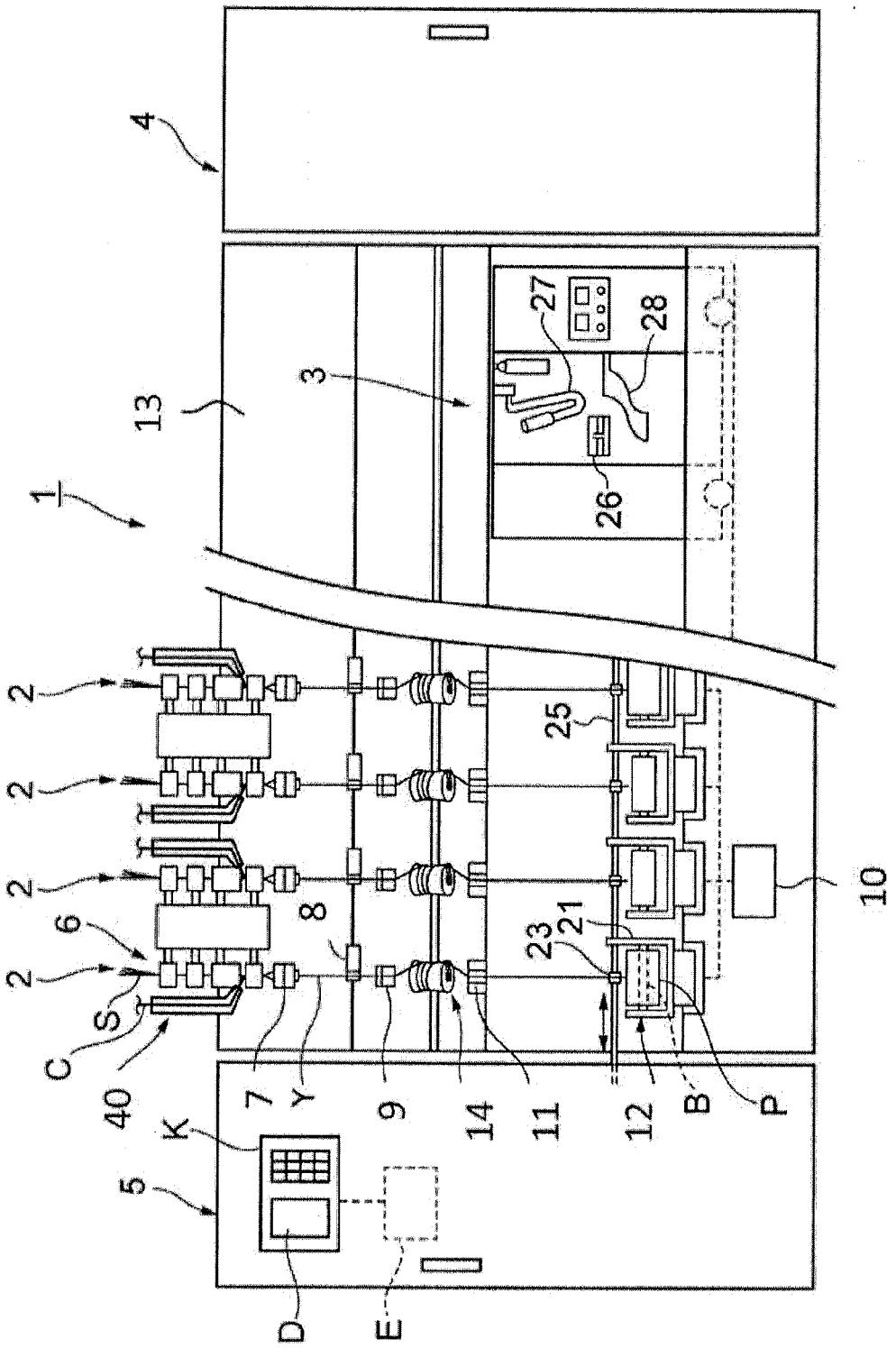


FIG. 2

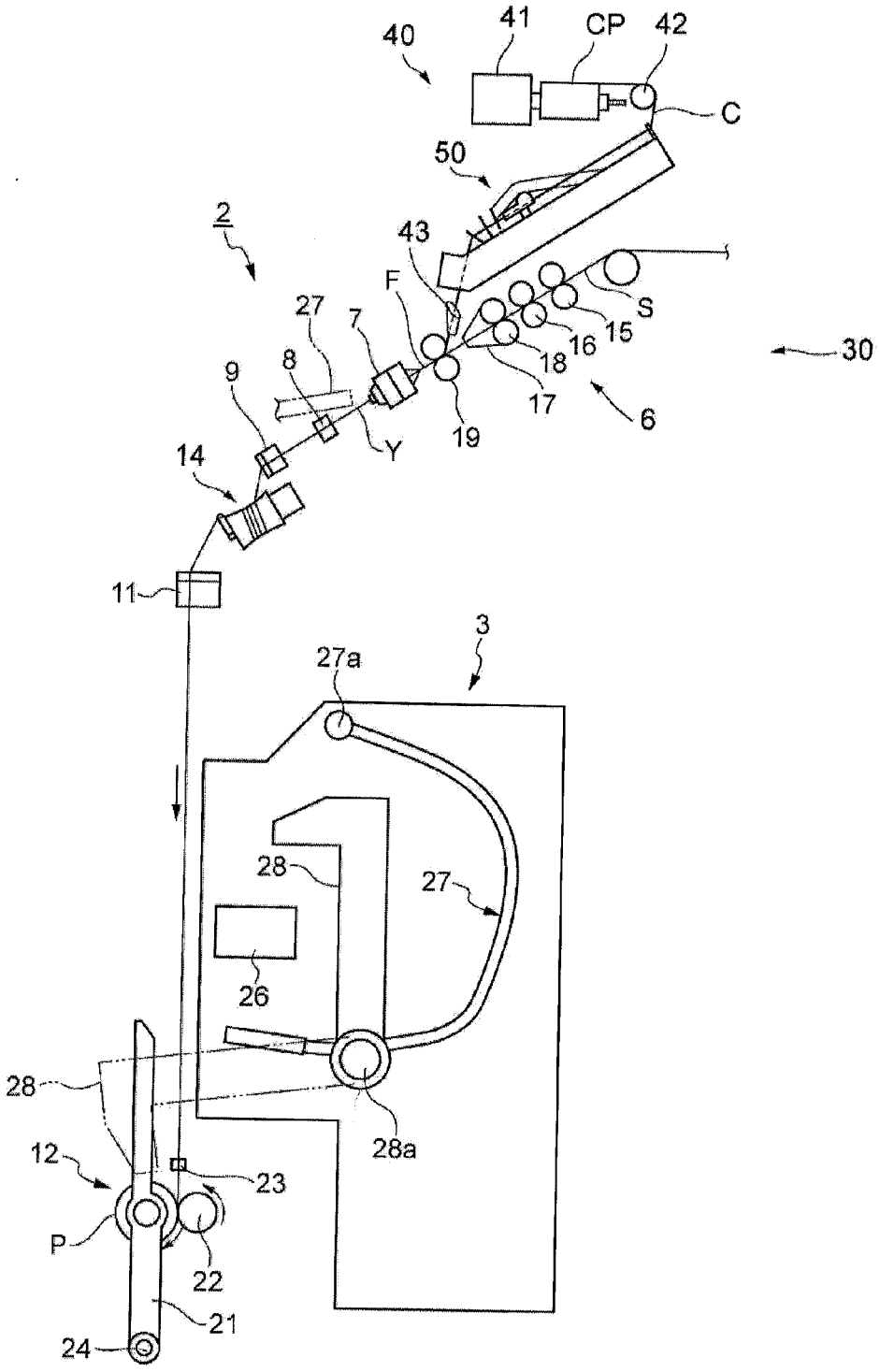

40
41
CP
42
C
50
2
43
F
27
7
8
9
14
11
Y
19
17
18
16
15
S
6
30
3
27a
28
27
26
28
28a
12
23
P
22
21
24

FIG. 3

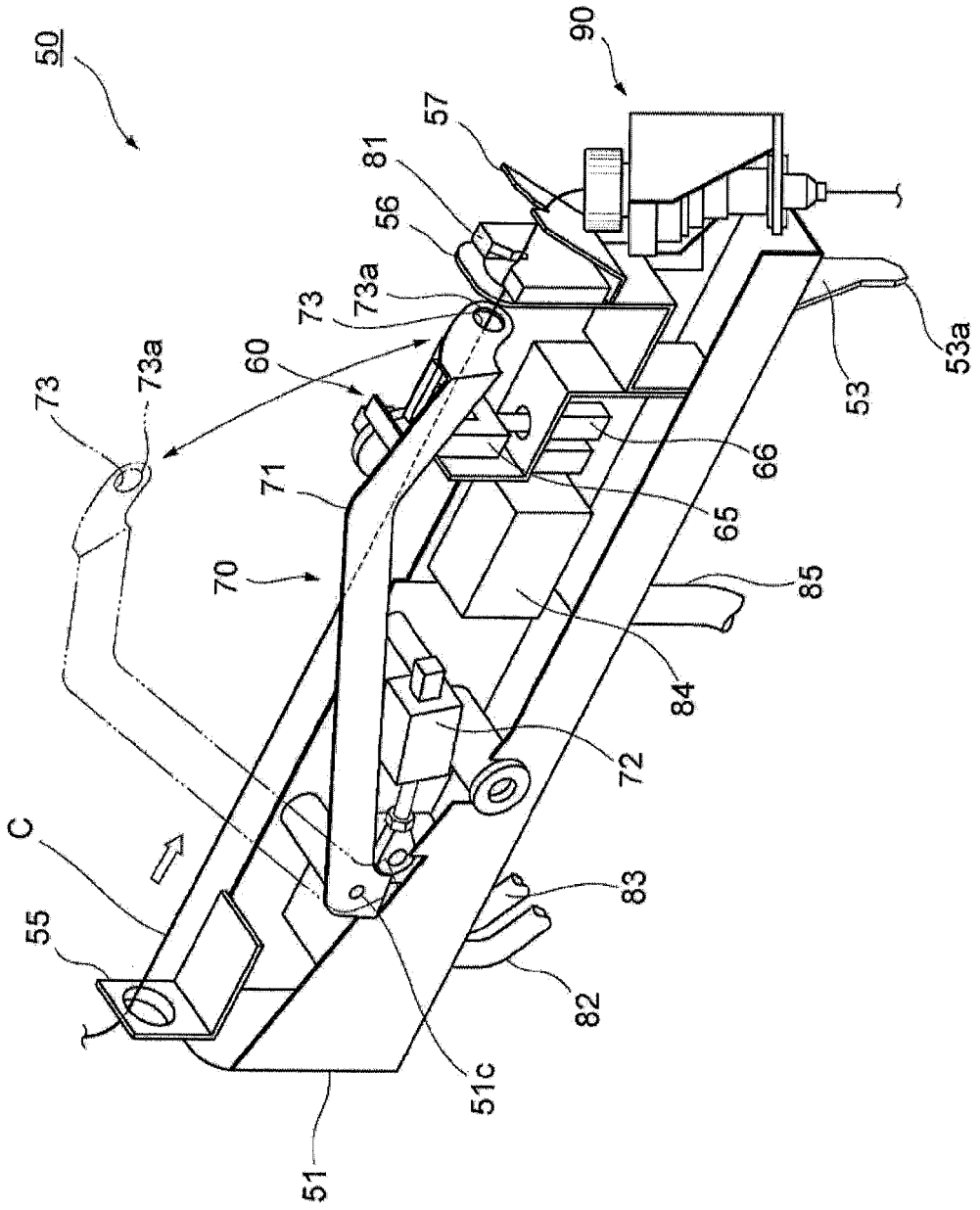

50
90
57
81
56
73a
73
60
73a
73
71
70
66
65
85
84
72
53
53a
C
55
83
82
51c
51

FIG. 4

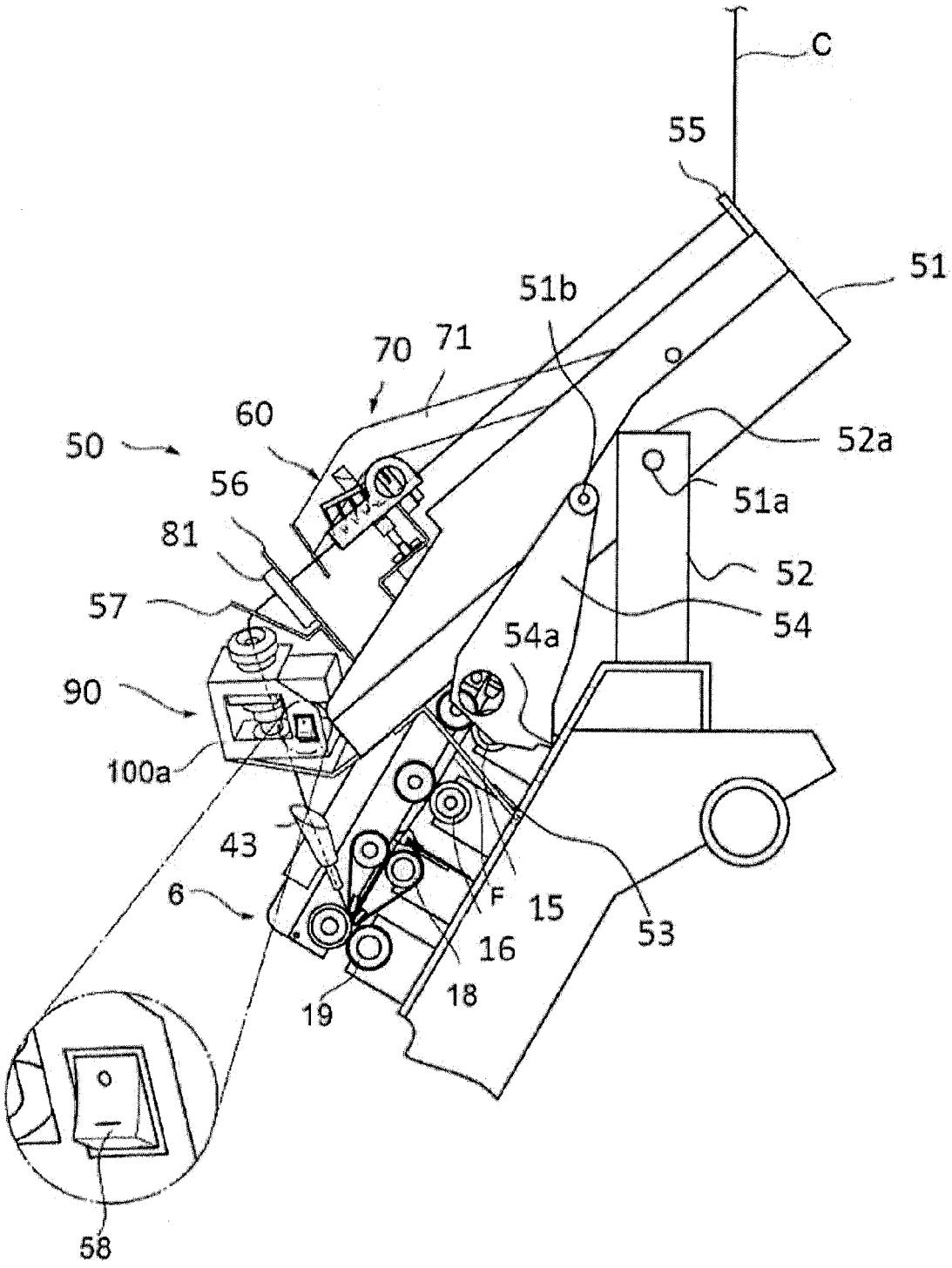

C
55
51
51b
70
71
60
50
56
81
57
90
100a
43
6
F
15
16
18
19
53
52a
51a
52
54
54a
58

FIG. 5

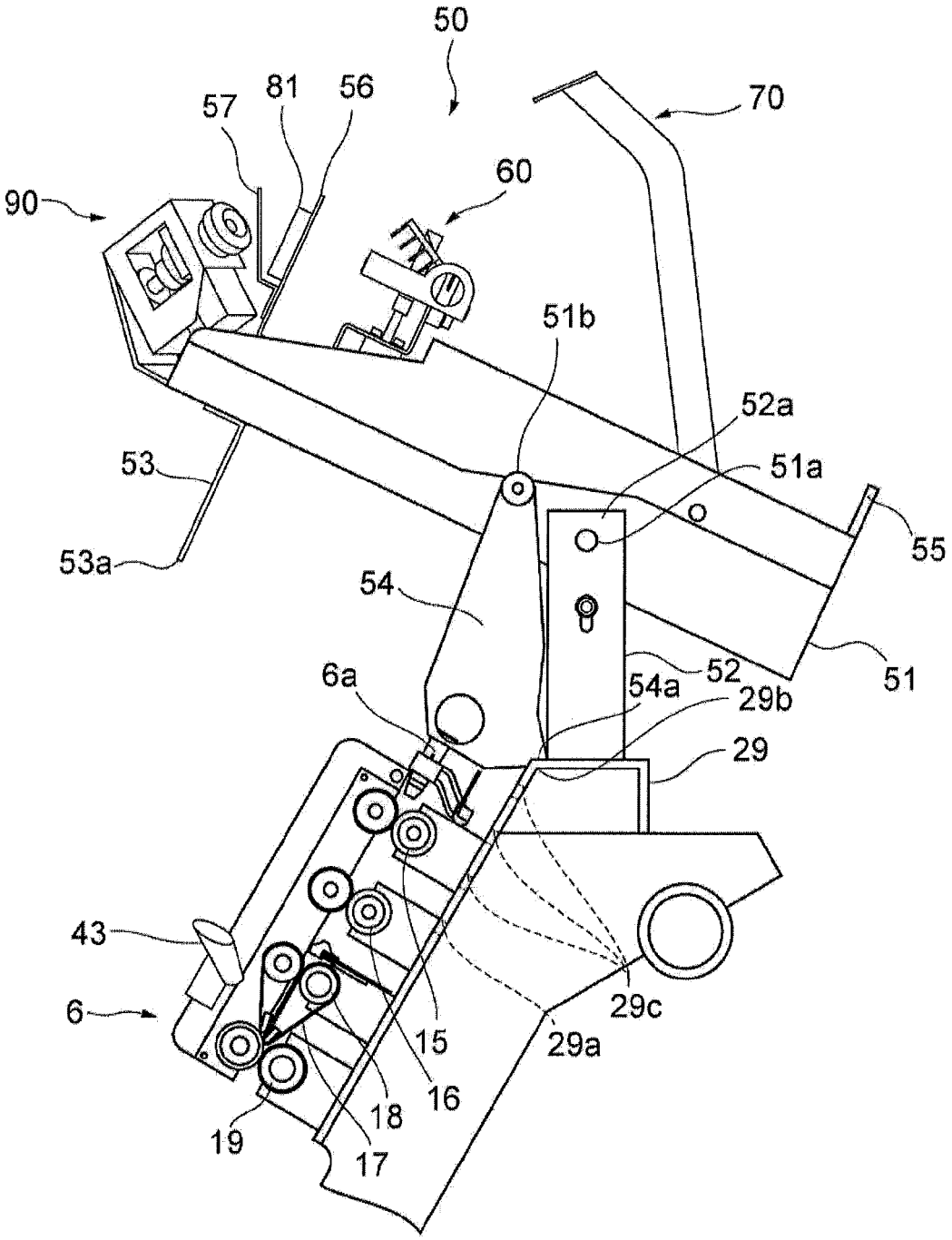

50
57
81
56
70
60
90
51b
52a
53
51a
53a
55
54
52
51
6a
54a
29b
29
43
6
29c
15
29a
16
18
19
17

FIG. 6A

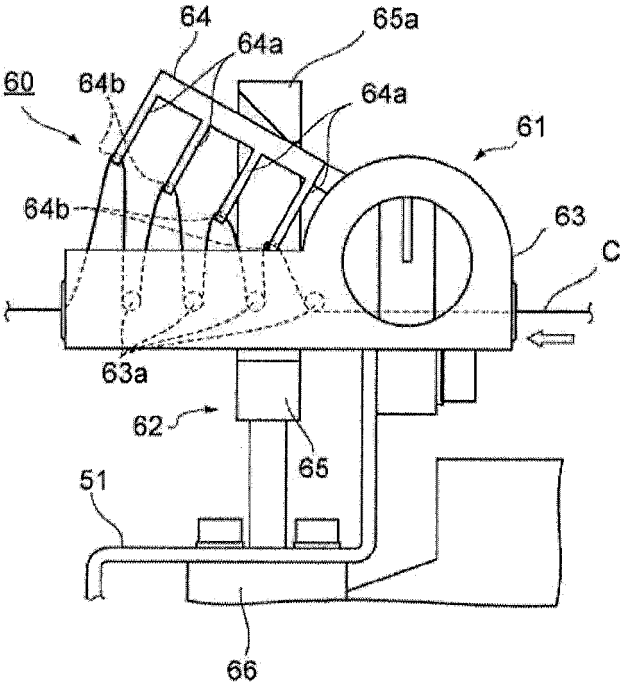

64
64a
65a
60
64b
64a
61
64b
63
C
63a
62
65
51
66

FIG. 6B

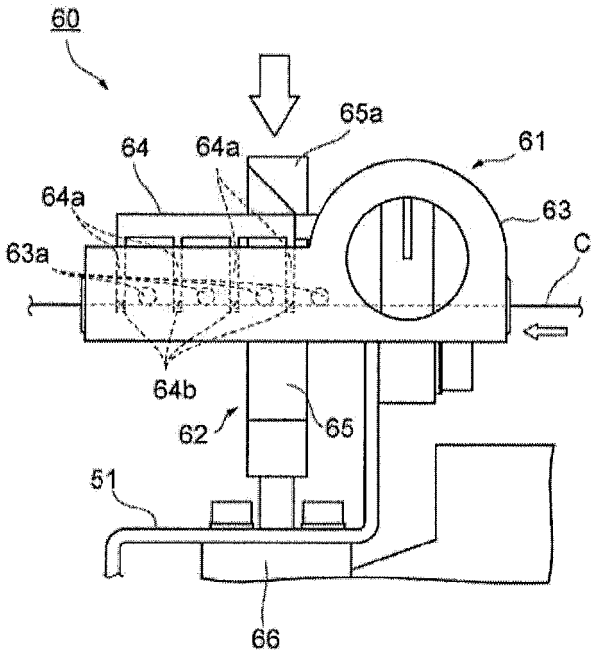

60
65a
64
64a
61
64a
63
63a
C
64b
62
65
51
66

FIG. 7

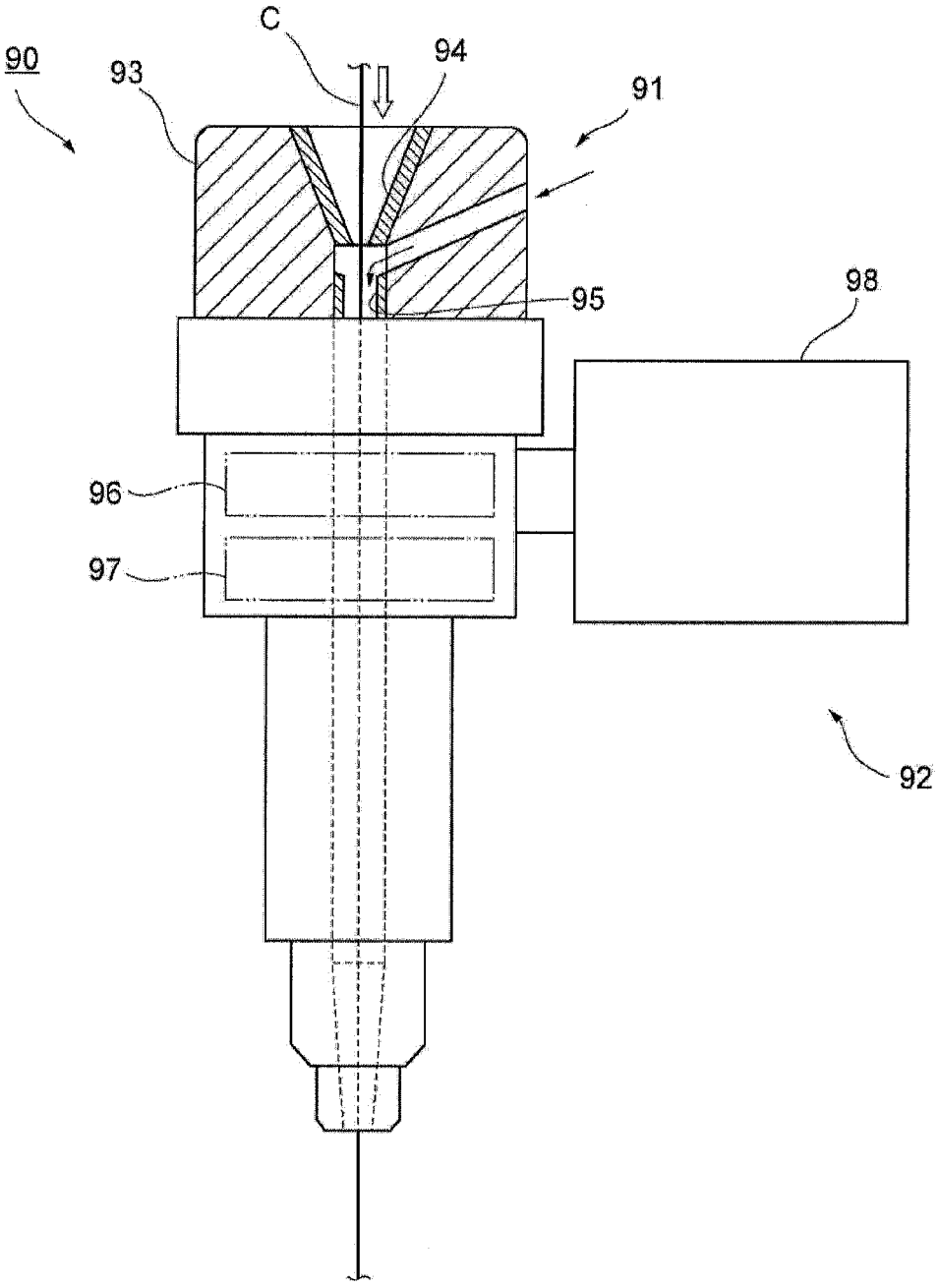


FIG. 8

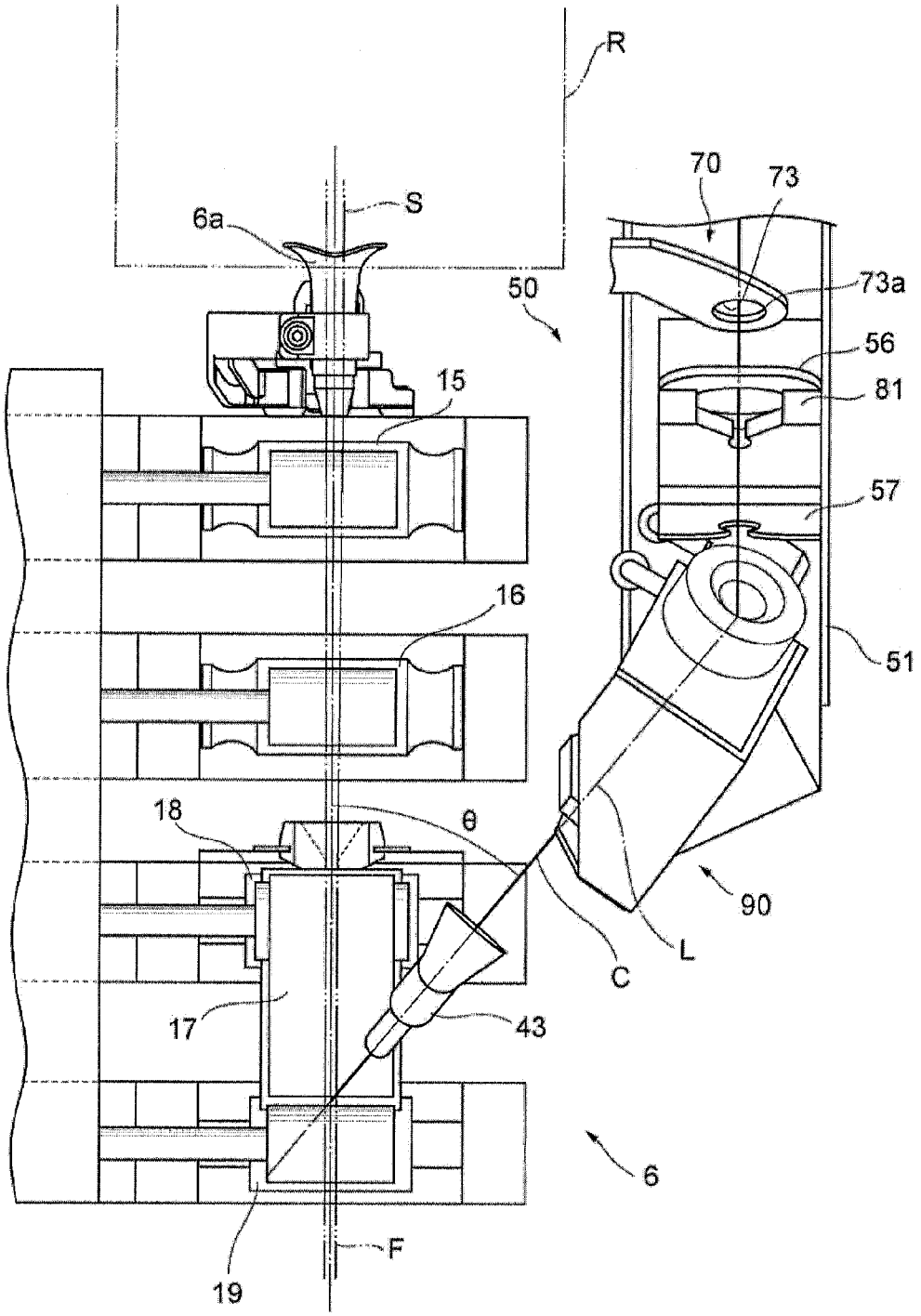


FIG. 9

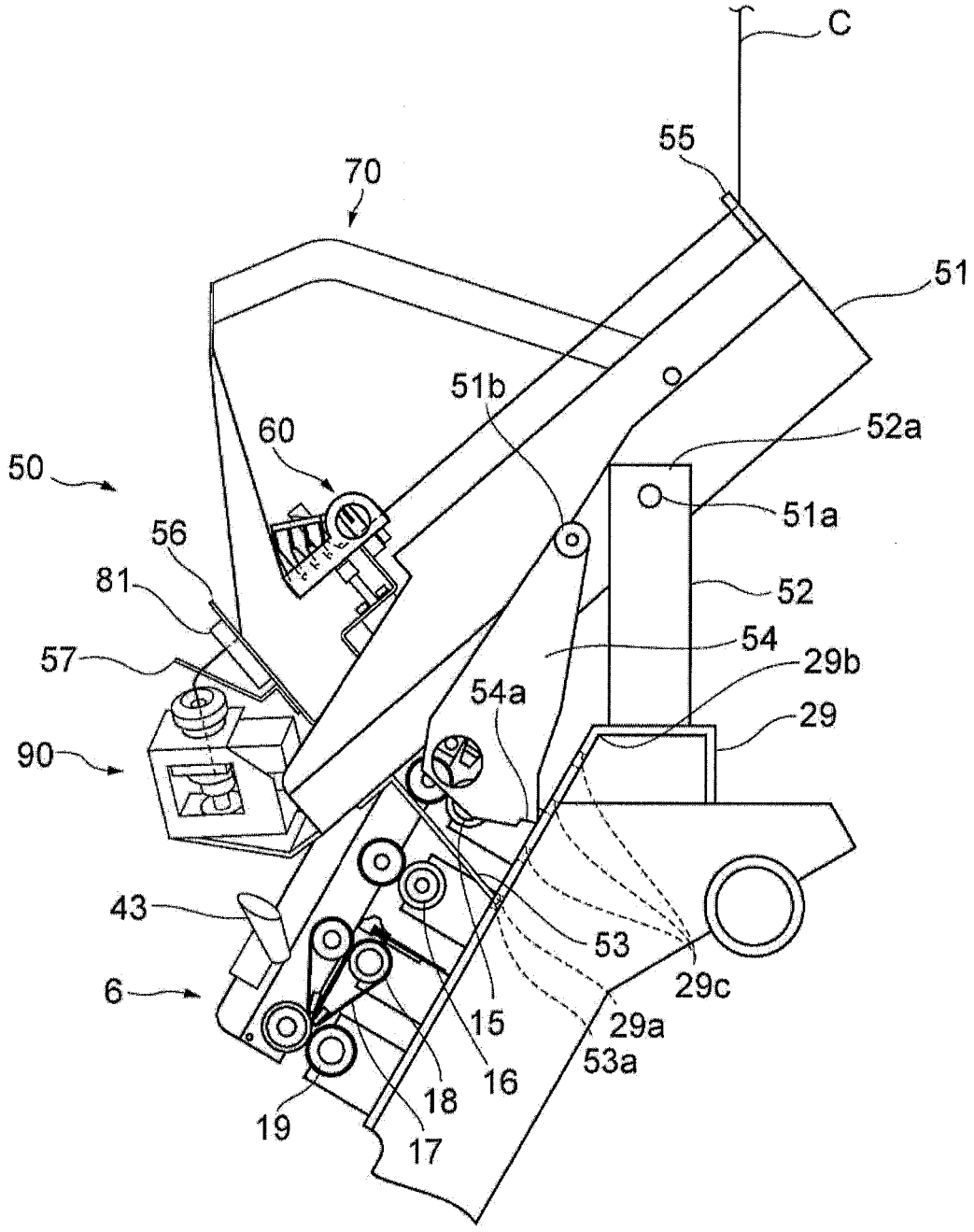
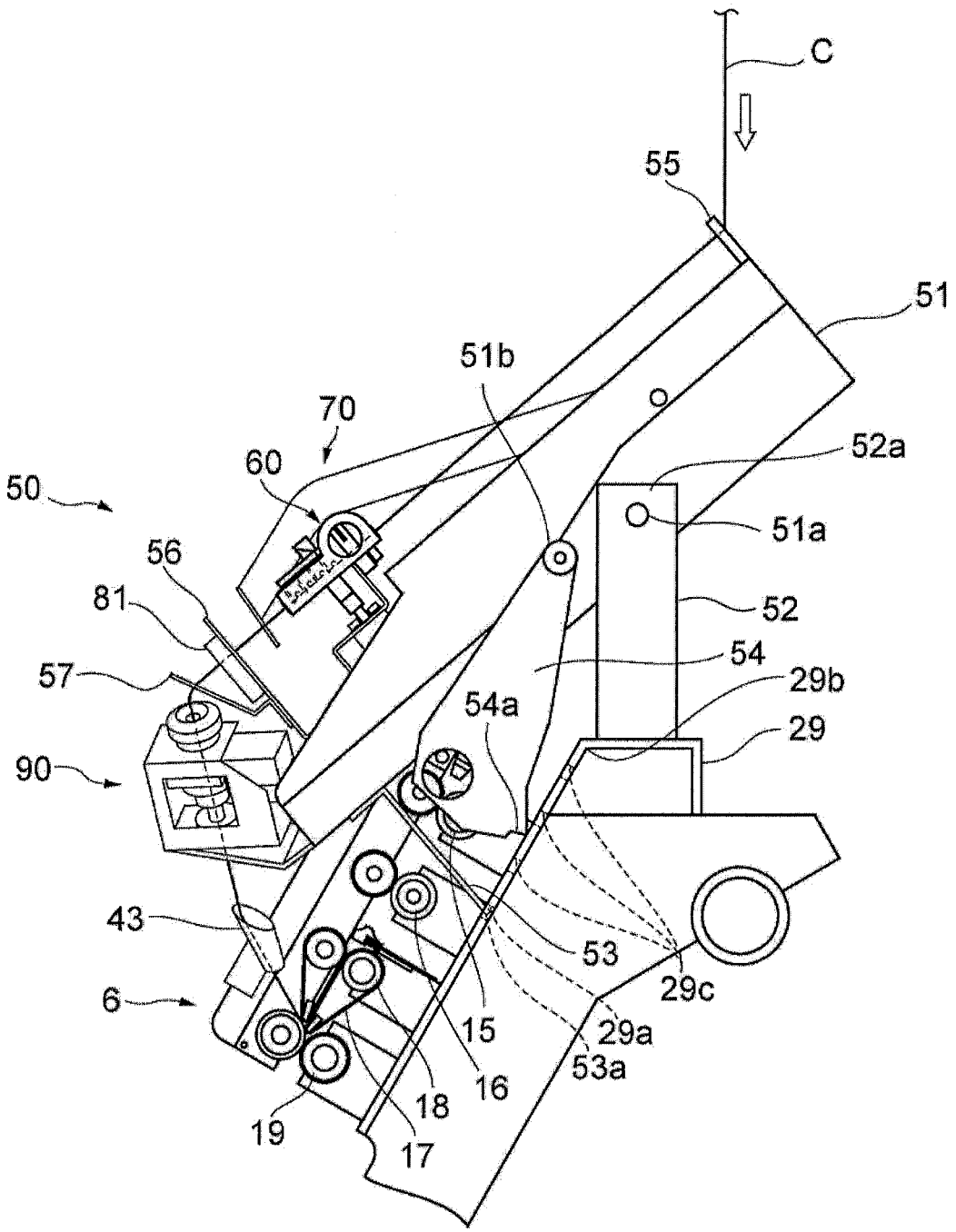

C
55
70
51
51b
52a
60
50
51a
56
52
81
54
57
29b
54a
29
90
43
53
29c
6
15
29a
53a
16
18
19
17

FIG. 10


C
55
51
51b
70
60
50
52a
51a
56
81
52
54
57
29b
54a
29
90
43
53
29c
6
15
29a
53a
16
18
19
17

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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