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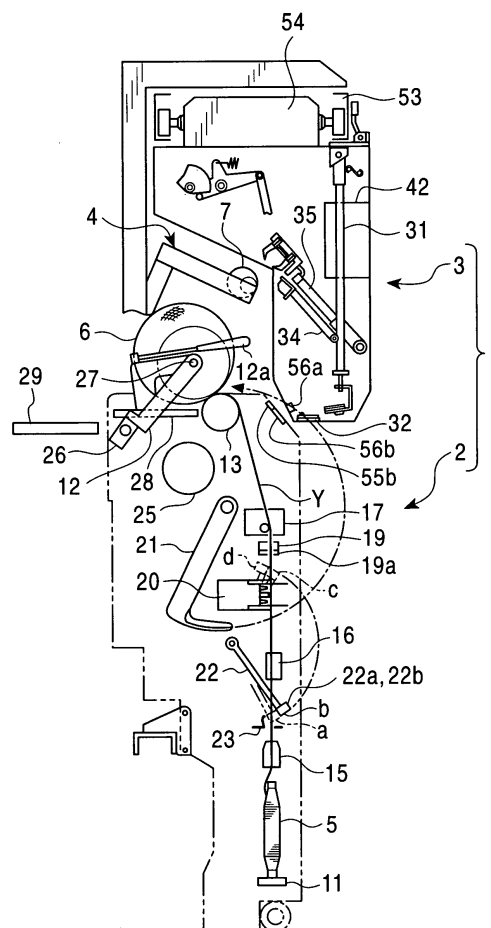
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(54) **Yarn setting method to winding tube in automatic winder and automatic winder**

(57) The object of the present invention is to provide a yarn setting method to the winding tube in the automatic winder and the automatic winder capable of carrying out the setting work of the yarn of the yarn supplying body to the winding tube smoothly and speedily without adding a special device. The automatic winder 1 of the yarn setting method is provided with winding units 2 arranged in a plurality wherein each winding unit 2 includes the lower yarn trapping-leading member 22 for trapping the yarn of the yarn supplying body 5 and leading to the yarn joining device 20, and forms the yarn winding body 6 by winding up the yarn of the yarn supplying body 5 to a winding tube 7. In addition, such automatic winder comprises the doffing device 3 which runs along the plurality of winding units 2, and according to the demand signal from the winding unit 2, arrives at the winding unit 2 which transmitted the demand signal, and by picking up the yarn of the yarn supplying body 5 trapped by the lower yarn trapping-leading member 22, sets the yarn to the winding tube set in the winding unit (Fig. 1).

FIG. 1



Description

Field of the Invention

[0001] The present invention relates to a yarn setting method to a winding tube in an automatic winder, and the automatic winder, specifically to the automatic winder capable of carrying out setting work of a yarn of a yarn supplying body to the winding tube smoothly and speedily without providing a special device.

Background of the Invention

[0002] As a conventional yarn setting method to the winding tube in the automatic winder, a well known method is such that under the state in which the yarn is connected between the yarn supplying body and a yarn winding body, a doffing device picks up and cuts the connected yarn and traps the lower yarn leading to the yarn supplying body, discharges the yarn winding body, and sets a new winding tube at the same time as the setting of the trapped yarn of the yarn supplying body to the winding tube.

[0003] For creating the state in which the yarn is connected from the yarn supplying body to the yarn winding body, when the yarn winding body becomes a full wound, first, to prevent an excess yarn from being wound in by the inertia rotation of the yarn winding body, the yarn is cut, and the yarn leading to the yarn supplying body is sucked by a yarn trap. Next, while being unwound, the yarn leading to the yarn winding body (hereafter referred to as "upper yarn") is sucked by a suction pipe (upper yarn trapping-leading member) and trapped. Moreover, the yarn leading to the yarn supplying body (hereafter referred to as "lower yarn") under the state in which sucked by the yarn trap is trapped by a relay pipe (lower yarn trapping-leading member). The upper yarn trapped by the suction pipe and the lower yarn trapped by the relay pipe are led into a yarn joining device respectively, the yarn is joined. As in the manner stated above, a state in which the yarn is being connected from the yarn supplying body to the yarn winding body is created.

[0004] Since such yarn setting method to the winding tube includes yarn joining operation carried out after the yarn cut, it is not effective. Therefore, according to the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 8-59086 or the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 10-297826 for example, it is presented of a method in which the yarn joining operation in aforementioned manner is not carried out after the first yarn cut (after the yarn cut when a full wound is accomplished), a yarn picking lever at the doffing device side moves to pick up directly the lower yarn of which is being sucked by the yarn trap, and after setting a new winding tube, the lower yarn picked up by the yarn picking lever is set to the winding tube.

[0005] According to the method in which picking up the lower yarn sucked by the yarn trap and setting to the winding tube, the position to pick up the lower yarn is to be located in the lower part of a winding unit and away from the position of the doffing device. Therefore, the accuracy in the position of the yarn picking lever to be advanced from the doffing device to the lower direction is required to be high, and the time required for the yarn picking lever to advance to the lower direction also becomes long.

[0006] Therefore, according to the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 8-59086, it is proposed of a method wherein the lower yarn sucked by the yarn trap is trapped by the relay pipe, and then the lower yarn trapped by the relay pipe is lifted to the proximity of the yarn joining device, and is received by the yarn picking lever at the doffing device side. However, since the lifting operation of the lower yarn by the relay pipe mentioned in such publication is to be carried out after the doffing device which runs along the plurality of winding units, arrives at the winding unit of which the doffing device acts upon, there was a problem in that the time for setting the yarn became long.

[0007] The present invention was made in consideration to aforementioned problems and it is thus the object of the present invention to provide the yarn setting method to the winding tube in the automatic winder and the automatic winder capable of carrying out the setting operation of the yarn of the yarn supplying body smoothly and speedily.

Summary of the Invention

[0008] According to the yarn setting method to a winding tube in an automatic winder relating to the first invention to accomplish aforementioned object, the automatic winder has a plurality of winding units, and each winding unit comprises a yarn joining device, a lower yarn trapping-leading member which moves between a yarn supplying body side and a yarn winding body side to trap the yarn of the yarn supplying body and lead the trapped yarn to the yarn joining device, and an upper yarn trapping-leading member for trapping the yarn of the yarn winding body and leading the trapped yarn to the yarn joining device, and each winding unit forms the yarn winding body by winding up the yarn of the yarn supplying body to the winding tube. Moreover, the automatic winder comprises a doffing device which runs along a plurality of the winding units, and according to the demand signal transmitted from the winding unit, arrives at the winding unit which transmitted the demand signal, receives the yarn of the yarn supplying body trapped by the lower yarn trapping-leading member, and sets the yarn to the winding tube set in the winding unit. In addition, when demanding the operation by the doffing device, the winding unit traps the yarn of the yarn supplying body by the lower yarn trapping-leading mem-

ber, the lower yarn trapping-leading member is moved to the yarn winding body side while trapping the yarn of the yarn supplying body, and then transmits the demand signal.

[0009] According to the first invention, since the moving of the lower yarn to the yarn winding body side by the lower yarn trapping-leading member at the winding unit side is completed before the doffing device arrives at the winding unit, the doffing device is capable of starting the picking operation of the lower yarn immediately after arriving at the winding unit, and as a result, the time required for setting the yarn to the winding tube can be shortened.

[0010] The second invention is an invention according to the first invention in which a cutting device for cutting the yarn connected between the yarn supplying body and the yarn winding body, and a holding means which is located in the upstream side to the yarn cutting device are provided in the winding unit. Moreover, when the yarn winding body becomes full and the yarn is cut by the yarn cutting device, the holding means holds the yarn end at the yarn supplying body side. Then, the lower yarn trapping-leading member traps the yarn of the yarn supplying body between the holding means and the yarn supplying body, the lower yarn trapping-leading member is moved to the yarn winding body side while trapping the yarn of the yarn supplying body, and then the demand signal is transmitted.

[0011] According to the second invention, when the yarn winding body becomes full and the yarn is cut, the lower yarn among the cut yarn is held by the holding means temporarily, and then the lower yarn is trapped by the lower yarn trapping-leading member. As a result, the lower yarn can be held by the lower yarn trapping-leading member reliably.

[0012] The third invention is an invention according to the second invention wherein the holding means is a tension applying device for applying tension to the yarn being wound.

[0013] According to the third invention, the tension applying device for applying tension to the yarn also serves as a holding means for holding the lower yarn after the yarn is cut. Therefore, a suction-typed yarn trap or the like for holding the yarn when the yarn is cut, is not required to be provided separately.

[0014] The fourth invention is an invention according to the second invention or the third invention wherein the lower yarn trapping-leading member is on standby during winding under the state in which the lower yarn trapping mouth of the lower yarn trapping-leading member is located at the yarn supplying body side than the yarn joining device, and when the yarn winding body becomes full and the yarn is cut by the yarn cutting device, the holding means holds the yarn end at the yarn supplying body side, and then the lower yarn trapping-leading member traps the yarn of the yarn supplying body between the holding means and the yarn supplying body, the lower yarn trapping-leading member is then

moved to the yarn winding body side while trapping the yarn of the yarn supplying body, and then the demand signal is transmitted.

[0015] According to the fourth invention, since the lower yarn trapping-leading member is on standby under the state in which the lower yarn trapping mouth is facing downward at the yarn supplying body side than the yarn joining device during winding, the yarn trapping by the lower yarn trapping-leading member can be carried out speedily after the yarn is cut. Moreover, since the yarn held by the holding means is trapped by the lower yarn trapping-leading member being moved from the downward state to the yarn trapping position, a movable guide for guiding the yarn held by the holding means to the lower yarn trapping-leading member is not required to be provided specially. As a result, the structure can be simple.

[0016] The fifth invention is an invention according to any one of the first invention through the fourth invention, wherein a clamp device is provided in the lower yarn trapping-leading member. The clamp device becomes an opened state when the lower yarn trapping-leading member is located at the yarn trapping position for trapping the yarn of the yarn supplying body, and the leading position for leading to the yarn joining device. Moreover, the clamp device becomes clamping state until the lower yarn trapping-leading member reaches the leading position after departing from the yarn trapping position. The lower yarn trapping-leading member is moved to the yarn winding body side until reaching the position in front of the leading position while trapping the yarn of the yarn supplying body, and then the demand signal is transmitted.

[0017] According to the fifth invention, since the lower yarn trapping-leading member including the clamp device is stopped before the leading position for leading into the yarn joining device, the demand signal can be transmitted while the clamp device is under the clamping state, and the yarn of the yarn supplying body is not drew out excessively.

[0018] The automatic winder according to the sixth invention comprises the doffing device which displaces the yarn winding body from the winding unit, sets a new winding tube to the winding unit, attaches the yarn to the new winding tube and is capable of running along a plurality of winding units. Each of the plurality of the winding units comprises the yarn joining device and forms the yarn winding body by drawing up the yarn of the yarn supplying body and winding the yarn to the winding tube. Moreover, the winding unit comprises a first driving means for moving the lower yarn trapping-leading member which transports the yarn of the yarn supplying body toward the yarn joining device, a second driving means for moving the upper yarn trapping-leading member which transports the yarn of the yarn winding body toward the yarn joining device, and a pausing means for stopping the first driving means temporarily when the lower yarn trapping-leading member is located at the

doffing standby position which is the position immediately before the position where the lower yarn trapping-leading member leads the yarn of the yarn supplying body into the yarn joining device. In addition, the doffing device comprises a yarn setting means which picks up the lower yarn of the yarn supplying body of which has been transported to the doffing standby position by the lower yarn trapping-leading member, and sets the yarn of the yarn supplying body to the newly set winding tube.

[0019] According to the sixth invention, since the first driving means is available exclusive for the lower yarn trapping-leading member, when the yarn winding body becomes full and a doffing is demanded, without operating unnecessary members including the upper yarn trapping-leading member, only the lower yarn trapping-leading member can be operated. Therefore, the trapping of the lower yarn after the yarn is cut and the lifting of the trapped lower yarn to the yarn winding body can be carried out speedily, and the doffing demand can be transmitted in early stage after the yarn winding body becomes full. When a stepping motor (pulse motor) is used for the first driving means, according to the ordering pulse number, the lower yarn trapping-leading member can be stopped at any position reliably.

[0020] According to the yarn setting method to the winding tube in the automatic winder relating to the seventh invention, the automatic winder comprises the winding unit including a yarn joining device, the lower yarn trapping-leading member which moves between the yarn supplying body side and the yarn winding body side to trap the yarn of the yarn supplying body and lead the trapped yarn to the yarn joining device, and an upper yarn trapping-leading member which operates with the lower yarn trapping-leading member, traps the yarn of the yarn winding body and leads the trapped yarn to the yarn joining device, and forming the yarn winding body by winding up the yarn of the yarn supplying body to the winding tube. Such winding unit is arranged in a plurality in the automatic winder. Moreover, the automatic winder is provided with the doffing device which runs along the plurality of winding units, and according to the demand signal transmitted from the winding unit, arrives at the winding unit which transmitted the demand signal, receives the yarn of the yarn supplying body trapped by the lower yarn trapping leading means, and sets the yarn to the winding tube set in the winding unit. Furthermore, the operation of the upper yarn trapping-leading member and the yarn joining device is prohibited, the yarn of the yarn supplying body is trapped by the lower yarn trapping-leading member, and the lower yarn trapping-leading member is moved to the yarn winding body, and then the demand signal is transmitted.

[0021] According to the seventh invention, since the moving of the lower yarn to the yarn winding body side by the lower yarn trapping-leading member at the winding unit side is completed before the doffing device arrives at the winding unit, the time required for setting the yarn to the winding tube is reduced. Moreover, since the

upper yarn trapping-leading member and the yarn joining device are unmovable, the upper yarn is not drew out from the yarn winding body and the yarn joining is not carried out, and only the moving of the lower yarn to the yarn winding body side by the lower yarn trapping-leading member is carried out.

[0022] The eighth invention is an invention according to the seventh invention wherein the winding unit comprises a driving drum for rotating and driving the yarn winding body, and accompanying the operation of the upper yarn trapping-leading member, the driving drum rotates in the reverse direction to the winding direction. Moreover, the upper yarn trapping-leading member and the yarn joining device are prohibited from being operated by separating the yarn winding body away from the driving drum to prevent the yarn of the yarn winding body to be trapped by the upper yarn trapping-leading member, and by stopping the lower yarn trapping-leading member from moving to the yarn winding body side at a position before the yarn of the yarn supplying body is led to the yarn joining device by the lower yarn trapping-leading member.

[0023] According to the eighth invention, for separating the yarn winding body from the driving drum, even when the reverse direction rotation of the driving drum which is necessary for the general yarn joining operation is carried out, the yarn winding body is not rotated, and the yarn leading to the yarn winding body is not trapped by the upper yarn trapping-leading member. Moreover, the yarn joining device is prevented from working on the lower yarn, and in addition, the position where the lower yarn trapping-leading member is stopped, is located immediately in front of the position where the yarn is led to the yarn joining device, the lower yarn trapping-leading member is capable of transporting up the lower yarn to the highest position.

[0024] The automatic winder according to the ninth invention comprises a doffing device which displaces the yarn winding body from a winding unit, sets a new winding tube to the winding unit, attaches the yarn to the new winding tube and is capable of running along a plurality of winding units. Each of the plurality of the winding units comprises the yarn joining device and forms the yarn winding body by winding up the yarn of the yarn supplying body. Moreover, the winding unit comprises a driving means for operating by interlocking the lower yarn sucking-leading member for transporting the yarn of the yarn supplying body toward the yarn joining device and the upper yarn sucking-leading member for transporting the yarn of the yarn winding body toward the joining device, the pausing means for stopping the driving means temporarily when the lower yarn sucking-leading member is located at the position immediately before the position for leading the yarn of the yarn supplying body into the yarn joining device, and a lifting means for lifting the yarn winding body so that the yarn of the yarn winding body is not sucked by the upper yarn sucking-leading member. The doffing device comprises a yarn setting means

for picking up the yarn of the yarn supplying body which is transported above by the lower yarn sucking-leading member and setting the yarn of the yarn supplying body to the newly set winding tube.

[0025] According to the ninth invention, only by lifting the yarn winding body from the driving drum by the lifting means, the upper yarn sucking-leading member becomes non-acting, and by the pausing means for the driving means of the upper yarn sucking-leading member and the lower yarn sucking-leading member, the lower yarn is led to a position higher than the yarn joining device by the lower yarn sucking-leading member.

[0026] The tenth invention is an invention according to the ninth invention wherein the driving means is provided independently per each winding unit.

[0027] According to the tenth invention, the upper yarn trapping-leading member and the lower yarn trapping-leading member can be paused per each winding unit.

[0028] The yarn setting method to the winding tube in the automatic winder according to the eleventh invention is characterized in that the automatic winder has a plurality of winding units, and each winding unit comprises the yarn joining device, the lower yarn sucking-leading member which moves between the yarn supplying body side and the yarn winding body side to trap the yarn of the yarn supplying body and lead the trapped yarn to the yarn joining device, and the upper yarn sucking-leading member for trapping the yarn of the yarn winding body and leading the trapped yarn to the yarn joining device, and each winding unit forms the yarn winding body by winding up the yarn of the yarn supplying body to the winding tube. Moreover, the automatic winder comprises the doffing device which runs along a plurality of the winding units, and according to the demand signal transmitted from the winding unit, arrives at the winding unit which transmitted the demand signal, receives the yarn of the yarn supplying body trapped by the lower yarn sucking-leading member, and sets the yarn to the winding tube set in the winding unit. In addition, the lower yarn sucking-leading member becomes an opened state when being located at the yarn trapping position for trapping the yarn of the yarn supplying body and the leading position for leading the yarn of the yarn supplying body to the yarn joining device. The lower yarn sucking-leading member becomes a closed state until reaching the leading position at the yarn winding body side after departing from the yarn trapping position at the yarn supplying body side. Before the doffing device receives the yarn of the yarn supplying body trapped by the lower yarn sucking-leading member to set the yarn to the winding tube, the lower yarn sucking-leading member trapping the yarn of the yarn supplying body is moved to the doffing standby position, which is the position immediately before reaching the leading position.

[0029] According to the eleventh invention, before the doffing device receives the yarn of the yarn supplying

body trapped by the lower yarn sucking-leading member to set the yarn to the winding tube, the lower yarn sucking-leading member which is trapping the yarn of the yarn supplying body is moved to the doffing standby position which is the position immediately before reaching the leading position. Therefore, it is shortened of the time required for the doffing device to receive the yarn of the yarn supplying body trapped by the lower yarn sucking-leading member and to set the yarn to the winding tube. Moreover, since the lower yarn sucking-leading member is moved to the doffing standby position where the lower yarn sucking-leading member becomes closed state and waits the yarn setting operation by the doffing device, when waiting for the yarn setting operation, the sucking operation on the yarn of the yarn supplying body by the lower yarn sucking-leading member is not carried out. As a result, unnecessary sucking operation is not carried out and the energy loss can be prevented, and problems can be prevented from occurring such that by an excess sucking, the yarn of the yarn supplying body is cut.

Brief Description of the Drawings

[0030]

Figure 1 is a side view showing the mechanical structure of the winding unit of the automatic winder. Figure 2 is a front view showing the mechanical structure of the entire automatic winder. Figure 3 is a block diagram showing the control structure of the entire automatic winder. Figure 4 is a view showing the yarn setting procedure to the winding tube during doffing according to the first embodiment of the present invention. Figure 5 is a view showing the yarn setting procedure to the winding tube during doffing according to the first embodiment of the present invention. Figure 6 is a side view showing the mechanical structure of the winding unit of the automatic winder. Figure 7 is a block diagram showing the control structure of the entire automatic winder. Figure 8 is a view showing the yarn setting procedure to the winding tube during doffing according to the second embodiment of the present invention. Figure 9 is a view showing the yarn setting procedure to the winding tube during doffing according to the second embodiment of the present invention. Figure 10 is a view showing the yarn setting procedure to the winding tube during doffing according to the second embodiment of the present invention. Figure 11 is a view showing the yarn setting procedure to the winding tube during doffing according to the third embodiment of the present invention.

Detailed Description of the Preferred Embodiments

[0031] The first embodiment of the present invention

relating to the first invention through the sixth invention and the eleventh invention will now be described in reference to the accompanying drawings. First, referring to Figure 1 through Figure 3, the structure of the automatic winder to be applied in the method of the present invention will be described.

[0032] According to Figure 1 and Figure 2, an automatic winder 1 comprises winding units 2 arranged in a plurality, and a doffing device 3 capable of running along the plurality of winding units 2 and in the arranged direction (depth direction of the page of Figure 1).

[0033] The winding unit 2 winds a yarn Y from a yarn supplying body 5 (yarn supplying bobbin or yarn supplying package) while joining the yarns from a plurality of yarn supplying bodies accordingly, and forms a large yarn winding body 6 (yarn winding package) including the designated yarn amount. The yarn Y unwound from the supply bobbin 5 supported by a tray 11 is wound up to the yarn winding body 6 which is held by a cradle 12 (an embodiment of the winding tube supporting device) and rotated by a traverse drum 13 (an embodiment of the driving drum).

[0034] In the yarn path from the yarn supplying body 5 to the yarn winding body 6, in the order from the lower part to the upper part (in the order from the upstream side to the downstream side), an unwinding assisting device 15 for assisting the unwinding of the yarn Y from the supply bobbin 5, a gate-typed tension applying device (serves also as lower yarn holding means) 16 for applying designated tension to the yarn Y, a yarn joining device 20, a slub catcher or a yarn clearer 19 (an embodiment of the yarn monitoring device) for detecting yarn defects such as a slub, a waxing device 17 for coating wax to the yarn Y, and the traverse drum 13 are provided to construct the winding unit 2. In the lower part of the slub catcher or the yarn clearer 19, a cutter 19a (an embodiment of the yarn cutting device) is attached. When the slub catcher or the yarn clearer 19 detects the yarn defect or when doffing the full tube, according to the yarn defect detected signal or the full wound signal, the cutter 19a cuts the yarn Y connected between the yarn supplying body 5 and the yarn winding body 6.

[0035] For the tension applying device 16, a contacting-typed tension applying device for applying tension by the friction with the yarn, for example, a gate-typed tension applying device which engages a pair of the comb-blades, or the disk-typed tension applying device for applying tension by sandwiching the yarn between a pair of disks, is applied. The applying tension of the tension applying device 16 can be adjusted by the electric signal. For example, in the case the tension applying device 16 is the gate-typed, when the yarn is cut, and a pair of the comb-blades are completely engaged (the opposite state to the opened state), and as a result, the tension applying device 16 can hold the yarn. In the case the tension applying device 16 is a disk-typed, by raising the pressuring force between the disks when the yarn is cut, the yarn can be held.

[0036] For the yarn joining device 20, an air-typed yarn joining device (air splicer) for joining the yarn by working the whirling air flow to the overlapping section of both yarn ends is preferable to be used, however, a device for knotting yarn ends (knotter) can be used.

[0037] A suction pipe 21 (an embodiment of the upper yarn trapping-leading member) which sucks and traps the yarn from the yarn winding body 6 (hereafter referred to as "upper yarn") and then leads into the yarn joining device 20 by the turning movement is provided above the yarn joining device 20. Moreover, a relay pipe 22 (an embodiment of the lower yarn trapping-leading member) which sucks and traps the yarn at the yarn supplying body 5 side which is connected to the yarn supplying body 5 (hereafter referred to as "lower yarn") and leads into the yarn joining device 20 by the turning movement is provided below the yarn joining device 20.

[0038] In the tip of the relay pipe 22, a lower yarn trapping mouth 22a (suction mouth) for sucking and trapping the lower yarn, and a clamp device 22b for switching the lower yarn trapping mouth 22a between closed state and opened state and clamping the lower yarn under the closed state are provided. The relay pipe 22 is turned in the vertical direction by a stepping motor or a pulse motor (first driving means) 49 to be mentioned below, and by the control of the stepping motor or the pulse motor 49, the relay pipe 22 can be located at a lower end position (yarn end trapping position) (a), a standby position (b) which is the downward state below the yarn joining device 20, a doffing standby position (c) which is the upward state above the yarn joining device 20, and a leading position (upper end position) (d) to the yarn joining device 20. The clamp device 22b switches from the closed state to the opened state by hitting a stopper at the yarn end trapping position (a) or the leading position (d). The relay pipe 22 sucks the lower yarn from the lower yarn trapping mouth 22a at the lower end position (a), and releases the clamped yarn end at the leading position (d). The clamp device 22b is maintained under the closed state at the position other than the yarn end trapping position (a) or the leading position (d), and the trapped lower yarn is kept being clamped.

[0039] The suction pipe 21 is coordinately driven with the yarn joining device 20 via a driving motor (second driving means) 46 and a cam mechanism 45 to be mentioned below. Moreover, the suction pipe 21 can be located at the downward standby position where the upper yarn trapping mouth (suction mouth) is located below the yarn joining device 20, and the upward yarn trapping position where the upper yarn trapping mouth is located in the proximity to the position where the yarn winding body 6 and the traverse drum 13 are contacting with one another.

[0040] When the yarn supplying body 5 is changed, the yarn end of the yarn supplying body 5 is blew up, and the yarn end reaches a yarn guide 23 via the unwinding assisting device 15, and is sucked and trapped by the lower yarn trapping mouth 22a of the relay pipe

22 which is located at the yarn end trapping position (a). When joining the yarn, the relay pipe 22 moves from the standby position (b) to the yarn trapping position (a), the clamp device 22b opens, and by the suction from the lower yarn trapping mouth 22a, the yarn end at the yarn supplying body 5 side held by the tension applying device 16 is sucked and trapped to the relay pipe 22. Moreover, the suction pipe 21 turns along the arrow, upward from the solid line position shown in the drawing to the upward yarn trapping position, and sucks and traps the yarn end of the yarn winding body 6 rewound by the rotating in the reverse direction to the winding direction of the traverse drum 13. Then, when the suction pipe 21 turns downward to the solid line position shown in the drawings (downward standby position), and the relay pipe 22 moves to the leading position (d), both the lower yarn and the upper yarn are led to the yarn joining device 20, the lower yarn and the upper yarn are joined by the yarn joining device 20.

[0041] The traverse drum 13 is rotatable in the winding direction or in the reverse direction to such direction by the driving motor 25. A traverse groove is formed on the surface of the traverse drum 13, and the yarn Y to be wound up along the traverse groove carries out the traverse operation. Further, a simple driving drum can be used in place of the traverse drum 13, and a separate traverse device can be provided. The yarn winding body 6 moving with the traverse drum 13 is held by the cradle 12. By the operation of an arm 12a, the cradle 12 is capable of being opened and closed in the depth direction of the page of Figure 1, and the releasing of the full tube and the setting of a new winding tube are also made practicable. The cradle 12 which is holding the yarn winding body 6 can be lifted for a designated interval from the traverse drum 13 by a cradle lifter 26. Moreover, a package brake 27 for stopping the rotating of the yarn winding body 6 which has become free by being lifted is provided at the tip of the cradle 12.

[0042] The yarn winding body 6 released from the cradle 12 is discharged to a transporting device 29 such as a belt conveyor via a package guide 28. The transporting device 29 is provided in the back side of the winding unit 2, along the arranged direction of the winding units 2. The package guide 28 is connected capable of interlocking with the cradle 12, and when the cradle 12 elevates, the package guide 28 inclines toward the direction to be discharged. Moreover, a winding tube accumulating device 4 is provided above the cradle 12 of each winding unit 2, and a winding tube 7 received from the winding tube accumulating device 4 is set to the cradle 12 by the doffing device 3.

[0043] The doffing device 3 comprises a yarn picking lever 31, a yarn shifting lever 32, an opener 34 and a chucker 35. The yarn picking lever 31 (an embodiment of the yarn setting means) traps the lower yarn of the winding unit 2 and sets the lower yarn y2 to the winding tube 7 which is set to the cradle 12. The yarn shifting lever 32 sets the lower yarn to the winding tube 7 by

interlocking with the yarn picking lever 31 and applying a bunch winding. The opener 34 carries out the releasing and closing operation to the arm 12a of the cradle 12. The chucker 35 clamps the winding tube 7 from the winding tube accumulating device 4 and transports the winding tube 7 to the cradle 12.

[0044] As shown in the control block diagram of Figure 2 and Figure 3, for the control structure of the entire automatic winder 1, each winding unit 2 comprises a unit controller 41 respectively, the doffing device 3 comprises a doffing controller 42, and a plurality of unit controllers 41 and the doffing controller 42 are both connected to a machine body controller 43 via communication network. According to such structure, a doffing demand signal transmitted from the unit controller 41 can be transmitted to the doffing controller 42 via the machine body controller 43. Further, the machine body controller 43 is provided at the end section of the machine body to control over the entire machine body, and is capable of transmitting various setting values from the machine body controller 43 to the unit controller 41 and the doffing controller 42 via the communication network.

[0045] In Figure 3, the stepping motor or the pulse motor (first driving means) 49 for turning and driving the relay pipe 22, the driving motor (second driving means) 46 for rotating and driving the cam of the cam mechanism 45 for operating the yarn joining device 20 and the suction pipe 21 in a designated order, and a driving motor 47 for rotating and driving the traverse drum 13 are connected to the unit controller 41 of the winding unit 2. In the unit controller 41, a pausing means 48 is provided for stopping the relay pipe 22 at the doffing standby position (c) for waiting the doffing by being located at the position immediately before the leading position (d) and in the upward state, other than the downward standby position (b) which is located immediately before the yarn trapping position (a), the yarn end trapping position (lower end position) (a), and the leading position (d). Moreover, the unit controller 41 receives a yarn defect signal from the slub catcher or the yarn clearer 19, transmits the yarn cutting signal to the cutter 19a, carries out elevating or descending control of the cradle lifter 26, and carries out the on-off control of the package brake 27.

[0046] A driving motor 52 for rotating and driving a cam of a cam mechanism 51 which operates the yarn picking lever 31, the yarn shifting lever 32, the opener 34 and the chucker 35 in the designated order, and a driving motor 54 for rotating and driving a wheel 53 for running the doffing device 3 along a plurality of winding units 2, are connected to the doffing controller 42 of the doffing device 3.

[0047] When the yarn winding body 6 of the winding unit 2 becomes a full tube, the winding unit 2 carries out a designated operation to be mentioned below, and after moving the relay pipe (lower yarn trapping-leading member) 22 which traps the lower yarn, to the doffing standby position (c), transmits a doffing demand signal to the doffing device 3. The doffing demand signal in-

cludes a unit number of the winding unit 2. Moreover, the winding unit 2 lights a doffing demand lamp 55b (an embodiment of the doffing demand indicating means) in the manner recognizable by operators. As shown in Figure 2, the doffing demand signal is transmitted from the unit controller 41 to the doffing controller 42 via the machine body controller 43. Moreover, the doffing device 3 runs toward the winding unit 2 which transmits the doffing demand signal, and stops directly above the winding unit 2. Then, as shown in Figure 3, the doffing device 3 and the winding unit 2 communicate communicating means 56a, 56b, and the doffing device 3 and the winding unit 2 carry out operations necessary for doffing. For example, communicating means 56a, 56b can emit and receive the infrared rays.

[0048] Next, the yarn setting procedure to the winding tube 7 during doffing in the automatic winder 1 constructed in aforementioned manner will be described in reference to Figure 4 and Figure 5. Figure 4 shows the procedure to be carried out before the winding unit 2 transmits the doffing demand signal. Figure 5 shows the procedure of which the winding unit 2 and the doffing device 3 carry out jointly.

[0049] First, as shown in Figure 4A, when the yarn length measured from the accumulated value of the pulse corresponding to the rotating speed of the traverse drum 13 (driving drum) reaches the designated length, the yarn winding body 6 is a full tube, and the cutter (yarn cutting device) 19a works to cut the yarn. Then, the upper yarn y1 is wound to the yarn winding body 6, and the part of the lower yarn y2 above the tension applying device 16 hangs down. However, the gate-typed tension applying device 16 for bending the yarn path holds the lower yarn y2. Therefore, the lower yarn y2 between the tension applying device 16 and the unwinding assisting device 15 is held. Accompanying the cutting of the yarn, the traverse drum 13 is slowed down suddenly.

[0050] At approximately the same time with the start of the slowing down of the traverse drum 13, as shown in Figure 4B, the cradle lifter 26 and the package brake 27 are operated, and the rotation of the yarn winding body 6 is stopped under the state in which the yarn winding body 6 is being lifted a little from the traverse drum 13. Then, the cradle lifter 26 is released and the yarn winding body 6 returns to a state in which contacting with the traverse drum 13.

[0051] Moreover, at approximately the same time with the operation of the cradle lifter 26, the relay pipe 22 (lower yarn trapping-leading member) turns to the yarn trapping position (a) from the downward standby position (b). The clamp device 22b which is provided in the lower yarn trapping mouth 22a of the relay pipe 22 opens by hitting the yarn guide 23 which is a stopper, and the lower yarn y2 is sucked and trapped from the lower yarn trapping mouth 22a between the tension applying device 16 and the yarn supplying body 5.

[0052] Next, as shown in Figure 4C, the relay pipe 22

(lower yarn trapping-leading member), while trapping the lower yarn y2, turns to the doffing standby position (c) where the lower yarn trapping mouth 22a facing upward at the yarn winding body 6 side (upper part) than the yarn joining device 20. Then, since the relay pipe 22 stops temporarily at the doffing standby position (c) which is located immediately before the leading position (d) to the yarn joining device 20, the clamp device 22b is still clamping the lower yarn y2. Under such state, the doffing demand signal is transmitted from the unit controller 41 of the winding unit 2 to the doffing controller 42 of the doffing device 3 via the machine body controller 43.

[0053] When the doffing demand signal is transmitted to the doffing controller 42, as shown in Figure 5A, the doffing device 3 which received the doffing demand signal stops directly above the winding unit 2, swings the yarn picking lever 31 (yarn setting means) to the proximity of the winding unit 2 while extending the yarn picking lever 31 to below. The cutter and holding unit 31a at the tip is advanced to the lower yarn y2 trapped by the relay pipe 22, and by holding the lower yarn y2 at the same time it is cut, the lower yarn y2 is trapped again from the relay pipe 22 (lower yarn trapping-leading member) to the yarn picking lever 31. After the relay pipe 22 is located at the doffing standby position (c) where the lower yarn y2 is above the yarn joining device 20, the winding unit 2 transmits the doffing demand signal to call the doffing device 3. Therefore, even when the doffing device 3 is located nearby the winding unit 2 by chance and arrives instantly, the turning operation of the relay pipe 22 (lower yarn trapping-leading member) and the yarn picking lever 31 are not to interfere with one another.

[0054] At approximately the same time with the lower yarn trapping by the yarn picking lever 31, as shown in Figure 5B, the timing the yarn picking lever 31 of the doffing device 3 trapped the lower yarn y2 is transmitted via the communicating means 56a, 56b from the doffing controller 42 to the unit controller 41, and by the control of the unit controller 41, the relay pipe 22 (lower yarn trapping-leading member) of the winding unit 2 turns to the leading position (d), and the clamp device 22b opens to suck the remaining yarn end after the yarn is cut. Along with the operation of the yarn picking lever 31, the opener 34 lifts up while opening the arm 12a of the cradle 12. The package guide 28 also inclines and the yarn winding body 6 released from the cradle 12 is discharged reliably via the package guide 28 onto the belt conveyor 29.

[0055] When the yarn winding body 6 is discharged onto the belt conveyor 29, as shown in Figure 5C, the cradle 13 descends toward the traverse drum 13 while being opened, and is to be located at a position capable of setting the winding tube 7. Further, the cradle 12 can be descended so as to open again at the end of the descending, after being closed once while descending. Then, the chucker 35 clamps the winding tube 7 re-

ceived from the winding tube supplying device, and transports onto the traverse drum 13. The winding tube 7 is set between the bobbin holder of the cradle 12. Next, the yarn picking lever 31 elevates and while elevating, threads the lower yarn y2 to the yarn shifting lever 32, and the lower yarn y2 crosses over between the opened cradle 12 and the winding tube 7, and between the cutter 31a of the yarn picking lever 31 and the yarn shifting lever 32. Then, when the opener 34 closes the cradle 12, the lower yarn y2 is sandwiched at the edge of the winding tube 7 to be set. Next, the package brake 27 is operated for a moment, and the displacement between the winding tube 7 and the bobbin holder is corrected. Further, these series of operations are carried out with the winding tube 7 contacting with the traverse drum 13.

[0056] When threading (attaching the yarn) to the winding tube 7 is completed, as shown in Figure 5D, the doffing device 3 transmits the signal to the winding unit 2 via the communicating means 56a, 56b, the traverse drum 13 is rotated slowly, and a bunch winding is formed at the edge of the winding tube 7. Then, by rotating the traverse drum 13 at a high speed, the winding of the yarn of the yarn supplying body 5 is recommenced. Further, after turning and moving the relay pipe 22 to the leading position (d) in Figure 5B, until the winding is restarted in Figure 5D, the relay pipe 22 is completely returned to the standby position (b) which is a downward state.

[0057] Next, a primitive yarn attaching operation using the doffing device 3 will be described. The primitive yarn attachment is an operation carried out by supplying the first yarn supplying body 5 to the winding position, under the state in which the yarn winding body 6 is not located in the cradle 12.

[0058] The yarn supplying body 5 is supplied to the winding position of the winding unit 2. At the time being, the yarn end of the yarn supplying body 5 is draping down inside the core tube. The relay pipe 22 turns a little from the downward standby position (a) to the yarn trapping position (b). Then, the clamp device 22b hits the stopper and opens, and the lower yarn trapping mouth 22a becomes into a released state. Under this state, the yarn end of the yarn supplying body 5 is blew up toward the upper part, and the relay pipe 22 traps the yarn end. Then, the relay pipe 22 turns to the doffing standby position (c), and stops temporarily. Under this state, the doffing demand signal is transmitted from the unit controller 41 of the winding unit 2 to the doffing controller 42 of the doffing device 3 via the machine body controller 43.

[0059] The doffing device 3 of which received the doffing demand signal stops directly above the winding unit 2, the yarn picking lever 31 is extended to the lower side to pick up the yarn which is trapped by the relay pipe 22. When the cutter and holding unit 31a of the tip of the yarn picking lever 31 receives the yarn from the relay pipe 22, the relay pipe 22 turns to the leading position (d), and the clamp device 22b opens to suck the remain-

ing yarn end after the yarn cut.

[0060] Along with the operation of the yarn picking lever 31, the discharging operation of the yarn winding body 6 is carried out in which the arm 12a of the cradle 12 is lifted while being opened. However, since there is no yarn winding body 6 held by the cradle 12 at the primitive yarn attachment, the yarn winding body 6 is not discharged actually. Next, the cradle 12 descends while being opened, and reaches a position capable of setting the winding tube 7. Then, the chucker 35 clamps the winding tube 7 which is received from the winding tube supplying device, and transports onto the traverse drum 13. The winding tube 7 is set between the bobbin holders of the cradle 12. Then, the yarn picking lever 31 elevates, and threads the lower yarn y2 to the yarn shifting lever 32 while elevating, and between the cutter 31a of the yarn picking lever 31 and the yarn shifting lever 32, the lower yarn y2 is made to cross over between the cradle 12 which is in the opened state, and the winding tube 7. Next, when the opener 34 closes the cradle 12, the lower yarn y2 is sandwiched in the edge of the winding tube 7 to be set. Next, the package brake 27 is operated for a moment, and the displacement between the winding tube 7 and the bobbin holder is corrected. Further, these series of operations are carried out with the winding tube 7 contacting with the traverse drum 13.

[0061] Next, when the yarn attachment to the winding tube 7 is completed, the doffing device 3 transmits a signal to the winding unit 2 via the communicating means 56a, 56b, the traverse drum 13 is rotated slowly, a bunch winding is formed at the edge of the winding tube 7, and then, by rotating the traverse drum 13 at a high speed, the winding of the yarn of the yarn supplying body 5 is recommenced. Further, after turning and moving to the leading position (d) and before recommencing the winding, the returning of the relay pipe 22 to the standby position which is a downward state is completed.

[0062] Likewise, the primitive yarn attaching operation can be carried out by the operation of which is the same at the doffing. Further, an excess movement of the doffing device 3 generates due to each operation being carried out via the common driving motor and the common cam mechanism. However, by making each operation to work separately, an excess movement can be suppressed.

[0063] The first embodiment described above has following effects.

- (1) The doffing device 3 is called after the completion of the preparation in which the winding unit 2 picks up the yarn leading to the yarn supplying body 5 (the lower yarn) to above the yarn joining device 20. Therefore, the yarn picking lever 31 can be extended to the lower direction immediately after the arrival of the doffing device 3, and the time required for the operation for setting the lower yarn y2 to the winding tube 7 by the doffing device 3 can be shortened. Moreover, since such preparation is complet-

ed, even when the doffing device 3 arrives in a short time and the yarn picking lever 31 is lowered, the yarn picking lever 31 and the relay pipe 22 (lower yarn trapping-leading member) are not to interfere with one another, and the interlocking operation of the winding unit 2 and the doffing device 3 is carried out reliably and speedily.

(2) According to the yarn setting procedure to the winding tube, comparing to the case in which the yarn at the yarn supplying body 5 side and the yarn at the yarn winding body 6 side are joined and the joined yarn is picked up to be set on the winding tube 7, a procedure for joining the yarn can be eliminated. Moreover, since the yarn at the yarn supplying body 5 side is trapped by the relay pipe 22 (lower yarn trapping-leading member) and then passed over to the yarn picking lever 31 (yarn setting mean) of the doffing device 3, the position where the yarn picking lever 31 traps the yarn of the relay pipe 22 (lower yarn trapping-leading member) is to be located above the yarn joining device 20. As a result, the working time of the yarn picking lever 31 is shortened and the movement of the yarn picking lever 31 also becomes small. Therefore, the operational accuracy is not required to be especially high.

(3) As shown in Figure 4A, when cutting the yarn when the yarn winding body 6 becomes full, since the lower yarn y2 after being cut is held by the holding means such as the tension applying device 16, and the relay pipe 22 (lower yarn trapping-leading member) traps the lower yarn y2 by turning and moving, the trapping of the lower yarn y2 by the relay pipe 22 is carried out reliably, and the movable guide or the like for guiding the lower yarn y2 to the relay pipe 22 are not required to be provided exceptionally. As a result, the mechanical structure can be simplified. Furthermore, by carrying out the holding of the lower yarn y2 by the tension applying device 16 capable of maintaining the yarn of a gate-typed or the like, the holding means by the lower yarn suction as the suction-typed yarn trap is not required to be provided separately, and the mechanical structure can be simplified.

(4) As shown in Figure 4A, during the normal winding, the relay pipe 22 (lower yarn trapping-leading member) is located at the standby position (b) with the lower yarn trapping mouth 22a facing downward at the yarn supplying body 5 side (lower part) than the yarn joining device 20. Therefore, just by turning and moving minutely to the yarn trapping position (a) which is the lower end position shown in Figure 4B, the lower yarn y2 can be trapped and the trapping of the lower yarn y2 after the yarn cut can be carried out speedily. Moreover, as shown in Figure 4C, after trapping the lower yarn, when the relay pipe 22 (lower yarn trapping-leading member) turns once from the yarn trapping position (a) to the doffing standby position (c), the relay pipe 22 is capable

of transmitting a doffing demand signal. As a result, the time required to transmit the doffing demand signal after the yarn is cut when a full tube is accomplished can be shortened. Especially, when the relay pipe 22 (lower yarn trapping-leading member) is on standby in the upward position, the relay pipe 22 turns greatly to the downward position to trap the lower yarn y2, and turns greatly even more to the doffing standby position (c) which is the upward position. In other words, the relay pipe 22 is required to turn twice, and the time before transmitting the doffing demand signal after the yarn cut takes a long period of time.

(5) The clamp device 22b is provided at the lower yarn trapping mouth 22a of the relay pipe 22 (lower yarn trapping-leading member). Moreover, the clamp device 22b is closing the lower yarn trapping mouth 22a under the clamping state at the positions other than the yarn trapping position (a) which is the lower end position, and the leading position (d) to the yarn joining device 20. As a result, the clamp device 22b reaches the doffing standby position (c) shown in Figure 4C, transmits a doffing demand signal, and under the state in which waiting the doffing device 3, the lower yarn y2 is being clamped by the clamp device 22b and the lower yarn y2 is not drew out unnecessarily to the relay pipe 22 while waiting the doffing device 3.

(6) As shown in Figure 3, the stepping motor 49 (first driving means) for turning and moving the relay pipe 22 (lower yarn trapping-leading member) is provided separately from the driving motor 47 (second driving means) for operating the suction pipe 21 or the yarn joining device 20. Therefore, as shown in Figure 1, without operating the suction pipe 21 or the like, the relay pipe 22 can be located at any position of the yarn trapping position (a), the standby position (b), the doffing standby position (c), or the leading position (d). Therefore, the trapping of the lower yarn y2 after the yarn is cut, and the lifting of the trapped lower yarn which are carried out by turning and moving only the relay pipe 22, can be carried out speedily, and the time from the accomplishing of the full tube to the transmitting of the doffing demand signal can be shortened. Moreover, when using the stepping motor 49 for the turning and the moving of the relay pipe 22, according to the command pulse number, the relay pipe 22 can be stopped at any position precisely.

[second embodiment]

[0064] The second embodiment according to the seventh invention through the eleventh invention will now be described in reference to the drawings. First, referring to Figure 6 and Figure 7, the structure of the automatic winder of which the method of the present invention is to be applied will be described.

[0065] According to Figure 6, the automatic winder 1 comprises winding units 2 arranged in a plurality, and the doffing device 3 capable of running along the plurality of winding units 2 and in the depth direction of the page. Further, in the second embodiment, for the members including the same function as in the first embodiment, same reference code is to be attached and described.

[0066] The winding unit 2 joins the yarn from the plurality of yarn supplying bobbins 5 (an embodiment of the yarn supplying body) accordingly and forms the large yarn winding body 6. The yarn Y unwound from the yarn supplying body 5 supported by the tray 11 is held by the cradle 12 (an embodiment of the winding tube supporting device), and wound to a yarn winding body 6 which moves along with the traverse drum 13 (an embodiment of the driving drum). The winding unit 2 is constructed with the unwinding assisting device 15 for assisting the unwinding of the yarn from the yarn supplying body 5, the tension applying device 16 for applying designated tension to the yarn Y, the waxing device 17 for coating wax to the yarn Y, the yarn trap 18 (an embodiment of the yarn end trapping means) for sucking the yarn at the yarn supplying body 5 side, the slub catcher or yarn clearer 19 (an embodiment of the yarn monitoring device) for detecting yarn defects of a slub or the like, the yarn joining device 20, and the traverse drum 13, provided in this order from the lower part to the upper part in the yarn path from the yarn supplying body 5 to the yarn winding body 6.

[0067] The cutter 19a (an embodiment of the yarn cutting device) is attached below the slub catcher or yarn clearer 19. When the slub catcher or yarn clearer 19 detects the yarn defect or when doffing the full tube, the cutter 19a cuts the yarn according to the yarn defect detecting signal or the full wound signal.

[0068] The suction pipe 21 (an embodiment of the upper yarn trapping-leading member) which sucks and traps the yarn from the yarn winding body 6 and then leads into the yarn joining device 20 by the turning movement, is provided above the yarn joining device 20. Moreover, the relay pipe 22 (an embodiment of the lower yarn trapping-leading member) which sucks and traps the yarn at the yarn supplying body 5 side connected to the yarn trap 18 from the yarn supplying body 5 and leading into the yarn joining device 20 by the turning movement, is provided below the yarn joining device 20. When exchanging the yarn supplying body 5, the yarn end of the yarn supplying body 5 is blew up, the yarn end reaches the yarn guide 23 via the unwinding assisting device 15, and is sucked and trapped by the relay pipe 22. When joining the yarn, the relay pipe 22 turns downward along the arrow from the solid line position shown in the drawing, and sucks and traps the yarn end of the yarn supplying body 5 which is trapped by the yarn trap 18. Further, the cutter 23a is provided above the yarn guide 23, and the yarn end at the yarn trap 18 side cut by the cutter 23a is sucked and eliminated by the

yarn trap 18. The suction pipe 21 turns upward along the arrow from the solid line position shown in the drawing, and by rotating in the reverse direction to the winding direction of the traverse drum 13, sucks and traps the rewound yarn end. Then, when the suction pipe 21 and the relay pipe 22 returns to the solid line position shown in the drawing, both of the lower yarn y2 and the upper yarn y1 are led to the yarn joining device 20, and the lower yarn y2 and the upper yarn y1 are joined by the yarn joining device 20. In the tip section of the relay pipe 22, the clump device is provided as in the same manner with the first embodiment (the drawing abbreviated). For the clump device, since it is the same as the first embodiment, its description will also be abbreviated.

[0069] The traverse drum 13 is rotatable in the winding direction and in the reverse direction of such winding direction by the driving motor 25. A traverse groove is formed on the surface of the traverse drum 13, and the yarn to be wound along the traverse groove carries out the traverse operation. Further, a simple driving drum can be used in place of the traverse drum 13, and a separate traverse device can be provided. The yarn winding body 6 interlocking with the traverse drum 13 is held by the cradle 12. By the operation of the arm 12a, the cradle 12 is capable of opening and closing in the depth direction of the page, and is capable of releasing the full tube or setting the winding tube 7. The cradle 12 which holds the yarn winding body 6 is capable of being lifted a designated interval from the traverse drum 13 by the cradle lifter 26 (an embodiment of the lifting means). Moreover, the package brake 27 for stopping the rotation of the yarn winding body 6 which has become free by being lifted, is provided at the tip of the cradle 12.

[0070] The yarn winding body 6 released from the cradle 12 is discharged onto the transporting device 29 such as a belt conveyor via the package guide 28. Above the cradle 12 of each winding unit 2, the winding tube accumulating device 4 is provided, and by the doffing device 3 to be mentioned below, the winding tube 7 received from the winding tube accumulating device 4 is set on the cradle 12.

[0071] The doffing device 3 comprises the yarn picking lever 31 (an embodiment of the yarn setting means) for trapping the lower yarn of the winding unit 2 and setting the lower yarn to the winding tube 7, the yarn shifting lever 32 for setting the lower yarn y2 to the winding tube 7 by interlocking with the yarn picking lever 31 and for applying a bunch winding, the yarn inserting lever 33 for inserting the yarn to the slub catcher or yarn clearer 19, the opener 34 for operating the arm 12a of the cradle 12 to open and close, and the chucker 35 for clamping the winding tube 7 from the winding tube accumulating device 4 and transporting to the cradle 12.

[0072] As shown in the control block diagram of Figure 2, the winding unit 2 comprises the unit controller 41, the doffing device comprises the doffing controller 42, and a plurality of unit controllers 41 and the doffing

controller 42 are connected to the machine body controller 43 to control the entire automatic winder 1.

[0073] The driving motor 46 for rotating and driving the cam of the cam mechanism 45 which operates the yarn joining device 20, the suction pipe 21, and the relay pipe 22 in the designated order, and the driving motor 47 for rotating and driving the traverse drum 13 are connected to the unit controller 41 of the winding unit 2. The cam mechanism 45 and the driving motor 46 constructs a driving means A for interlocking the suction pipe 21 and the relay pipe 22 toward the yarn joining device 20. A pausing means 48 for stopping temporarily the series of driving by the driving means A directly before the relay pipe 22 leads the lower yarn y2 to the yarn joining device 20, is provided in the unit controller 41. Moreover, the unit controller 41 receives the yarn defect signal from the slub catcher or yarn clearer 19, transmits the yarn cutting signal to the cutter 19a, carries out the opening and closing control of the suction of the yarn by the yarn trap 18, carries out the elevating or descending control of the cradle lifter 26, and carries out the on-off control of the package brake 27.

[0074] The driving motor 52 for rotating and driving the cam of the cam mechanism 51 for operating the yarn picking lever 31, the yarn shifting lever 32, the yarn inserting lever 33, the opener 34, and the chucker 35 in the designated order, and the driving motor 54 for rotating and driving the wheel 53 for running the doffing device 3 along the plurality of winding units 2, are connected to the doffing controller 42 of the doffing device 3.

[0075] Between the unit controller 41 of the winding unit 2 and the doffing controller 42 of the doffing device 3, the communicating means 56a, 56b for the winding unit 2 from the doffing device 2 are provided (refer to Figure 6 and Figure 7). When the yarn winding body 6 of the winding unit 2 becomes a full tube, the winding unit 2 carries out the designated operation to be mentioned below and then transmits the doffing demand signal. Moreover, the winding unit 2 lights the doffing demand lamp 55b (an embodiment of the doffing demand indicating means). The doffing signal is transmitted from the unit controller 41 via the machine body controller 43 to the doffing controller 42, and the doffing device 3 runs toward the winding unit 2 which transmits the doffing demand signal. Then, the detecting means 55a detects the doffing demanding lamp 55b of the winding unit 2, and the doffing device 3 stops directly above the called winding unit 2. Then, when the designated operation is carried out, the doffing device 3 carries out the operation necessary for the winding unit 2 via the communicating means 56a, 56b.

[0076] Next, the yarn setting procedure to the winding tube 7 during doffing by the automatic winder 1 having aforementioned structure will be described in reference to Figure 8 through Figure 10. Figure 8 and Figure 9 shows the procedure of which the winding unit 2 carries out before doffing. Figure 10 shows the procedure of which the winding unit 2 and the doffing device 3 carry

out in collaboration.

[0077] Referring to Figure 8A, when the yarn length measured from the accumulated value of the pulse corresponding to the rotating speed of the traverse drum 13 (driving drum) reaches the designated length, the yarn winding body 6 is a full tube, and the cutter 19a is operated to cut the yarn. Then, the upper yarn y1 is wound to the yarn winding body 6, and the lower yarn y2 is sucked by the yarn trap 18 opened in advance. Next, the traverse drum 13 is stopped suddenly and becomes a state shown in Figure 8B.

[0078] Referring to Figure 9C, the cradle lifter 26 is operated, the cradle 12 is turned upward, the yarn winding body 6 is lifted from the traverse drum 13, the package brake 27 is operated and the rotation of the yarn winding body 6 is stopped. Next, by the cam mechanism 45 (refer to Figure 7) being driven by the driving motor 46, the suction pipe 21 (upper yarn trapping-leading member) and the relay pipe 22 (lower yarn trapping-leading member) turns to the position shown in the drawing. At the time being, the traverse drum 13 rotates in the reverse direction to the winding direction, and attempts to rotate the yarn winding body 6 in the rewinding direction to reel out the yarn. However, since the yarn winding body 6 is being lifted and the package brake 27 is being operated, the upper yarn y1 is not reeled out, and the sucking and trapping of the upper yarn y1 by the suction pipe 21 becomes non-acting.

[0079] On the other hand, the relay pipe 22 turns to the yarn guide 23, traps the yarn end to be sucked by the yarn trap 18, and the cut excess yarn end is sucked by the yarn trap 18. As shown in Figure 9D, the driving motor 46 drives the cam mechanism 45 (refer to Figure 7) consequently. As a result, the suction pipe 21 and the relay pipe 22 turn toward the yarn joining device 20, and the relay pipe 22 attempts to transport the lower yarn y2 to the yarn joining device 20. At the time being, by the pausing means 48 (refer to Figure 7) of the unit controller 41, the operation of the cam mechanism 45 stops temporarily immediately before the final stage. The pausing position is the position directly before the lower yarn y2 trapped by the relay pipe 22 is led to the yarn shifting lever 20a of the yarn joining device 20. Moreover, the cradle lifter 26 and the package brake 27 are released, and the yarn winding body 6 is contacted against the traverse drum 13. After reaching such state, the winding unit 2 transmits a signal for demanding the doffing device 3, and lights the doffing demand lamp 55b.

[0080] In Figure 10E, the detecting means 55a of the doffing device 3 detects the doffing demand lamp 55b of the winding unit 2 and stops directly above the winding unit 2. The yarn picking lever 31 (yarn setting means) is swung to the winding unit 2 side while extending to the lower part, the cutter and holding unit 31a at the tip is advanced to the lower yarn y2 trapped by the relay pipe 22, and by cutting and holding the lower yarn y2 at the same time, the lower yarn y2 is trapped again from

the relay pipe 22 to the yarn picking lever 31. At the same time, the opener 34 opens the arm 12a of the cradle 12, and discharges the yarn winding body 6 onto the belt conveyor 29 via the package guide 28. The cradle 12 descends toward the traverse drum 13 while being opened, and reaches to the position where the winding tube 7 can be set. Then, the chucker 35 clamps the winding tube 7 of the winding tube accumulating device 4, and transports onto the traverse drum 13. In this process, the pause by the pausing means 48 (refer to Figure 7) of the unit controller 41 is released, and the cam mechanism 45 rotates to the final stage by the driving motor 46. However, the lower yarn y2 is not led to the yarn joining device 20 (the upper yarn y1 is also not led), and with the yarn joining by the yarn joining device 20 not carried out, the cycle of the yarn joining is completed.

[0081] In Figure 10F, the yarn picking lever 31 elevates, and while elevating, the lower yarn y2 is threaded to the yarn shifting lever 32, and the lower yarn y2 is to cross over between the opened cradle 12 and the winding tube 7, and between the cutter 31a of the yarn picking lever 31 and the yarn shifting lever 32. Next, when the opener 34 closes the cradle 12, the lower yarn y2 is sandwiched between the edge of the winding tube 7 and the cradle 12 to be set. Moreover, the yarn inserting lever 33 advances to the position shown in the drawing, opens the guide plate 19b of the slub catcher or yarn clearer 19, and inserts the lower yarn y2 to the slub catcher or yarn clearer 19. Under this state, by the communicating means 56a, 56b (refer to Figure 7), the doffing device 3 rotates the traverse drum 13 slowly, a bunch winding is formed at the edge of the winding tube 7 and then the traverse drum 13 is rotated at a high speed to restart the winding of the yarn supplying body 5.

[third embodiment]

[0082] According to the yarn setting procedure to the winding tube during doffing relating to aforementioned second embodiment of the present invention, the setting operation of the yarn of the yarn supplying body to a winding tube 107 in an automatic winder 101 which winds one yarn winding body 106 from one yarn supplying body 105, can be carried out smoothly and speedily. Such winding is carried out when rewinding a died package.

[0083] In Figure 11A, the yarn winding starts from a yarn supplying body 105 to a winding tube 107. In Figure 11B, the remaining yarn layer of the yarn supplying body 105 is detected by a penetration sensor 108 or the like, and when the remaining yarn layer becomes thin, a cutter 119a is operated and the winding up is stopped. The lower yarn y2 is sucked and trapped by a yarn trap 118. Then, the lower yarn y2 is cut by a cutter (not shown in the drawings), and the yarn supplying body 105 is discharged.

[0084] In Figure 11C, a new yarn supplying body 105 is supplied. A suction pipe 121 and a relay pipe 122 are

turned in the direction to separate from a yarn joining device 120. The yarn end of the yarn supplying body 105 is blown up above a yarn guide 123. The yarn end of the yarn supplying body 105 is sucked and trapped by the relay pipe 122 which arrived at the position of the yarn guide 123. At the time being, the yarn winding body 106 is being lifted from the traverse drum 113, and the yarn end of the yarn winding body 106 is not sucked and trapped by the suction pipe 121.

[0085] In Figure 11D, the suction pipe 121 and the relay pipe 122 turn toward the direction to pass the yarn joining device 120, however, stop immediately before the lower yarn which is to be trapped by the relay pipe 122 is led to the yarn joining device 120. The lower yarn y2 of the yarn supplying body 105 is picked up to above the yarn joining device 120, and is sucked and held by the relay pipe 122. Under this state, in the manner described in Figure 10, the doffing device is called, and the discharging of the yarn winding body 106, the setting of the winding tube 107, and the setting of the lower yarn y2 to the winding tube 107 are carried out.

[0086] When forming one yarn winding body 106 from one yarn supplying body 105 as shown in Figure 11, in the process of setting the yarn to the winding tube 107, the yarn of which is other than one package is prevented from being mixed, and it can proceed to the next winding speedily.

[fourth embodiment]

[0087] The yarn setting procedure to the winding tube in Figure 11 can be applied also to the automatic winder for winding to one yarn winding body from two yarn supplying bodies. When the first yarn supplying body becomes empty, the second yarn supplying body is supplied and the yarn ends are joined by carrying out the general yarn joining operation. At the end of the winding of the second yarn supplying body, the yarn is set to the winding tube under the procedure shown in Figure 7. In such yarn setting, the yarn of which is other than two packages is prevented from being mixed, and it can proceed to the next winding speedily.

[0088] The second embodiment through the fourth embodiment described above has following effects.

(1) The doffing device is called after the preparation wherein the winding unit picks up the yarn at the yarn supplying body side (lower yarn) to above the yarn joining device, is completed. As a result, the time required for the operation to set the lower yarn to the winding tube by the doffing device can be shortened.

(2) According to the yarn setting procedure to the winding tube of the second embodiment, comparing to the case in which the yarn at the yarn supplying body side and the yarn at the yarn winding body side are joined and the joined yarn is picked up to set to the winding tube, a procedure for joining the yarn is

abbreviated. Moreover, since the yarn is delivered to the yarn picking lever (yarn setting means) of the doffing device after the yarn at the yarn supplying body side is trapped by the relay pipe (lower yarn trapping-leading member), the position where the yarn picking lever (yarn setting means) traps the yarn of the relay pipe (lower yarn trapping-leading member) is to be located above the yarn joining device, the operation time of the yarn picking lever (yarn setting means) becomes short and the movement of the yarn picking lever (yarn setting means) also becomes small. As a result, the operational accuracy is not required to be high.

(3) According to the yarn setting procedure to the winding tube relating to the third embodiment and the fourth embodiment, in the case of forming one yarn winding body from one yarn supplying body or two yarn supplying bodies, under the state in which the yarn of the other yarn supplying body is not mixed, the yarn setting procedure to the winding tube is completed. Therefore, the yarn setting procedure during doffing can be carried out smoothly and speedily.

(4) The automatic winder of which the second embodiment through the fourth embodiment are to be applied, has a simple structure by comprising the pausing means for stopping temporarily the driving means which operate the relay pipe (lower yarn sucking-leading member) and the suction pipe (upper yarn sucking-leading member) together, immediately before the position where the relay pipe (lower yarn sucking-leading member) transports the yarn of the yarn supplying body toward the yarn joining device, and the cradle lifter (lifting means) for lifting the yarn winding body so that the yarn of the yarn winding body is not sucked by the suction pipe (upper yarn sucking-leading member). As a result, the yarn setting procedure can be carried out smoothly and speedily.

[0089] Further, the embodiments are not to be limited to aforementioned embodiments, and for example, it can be changed in the following manner and can be carried out.

(1) Referring to the first embodiment and the second embodiment, the yarn picking lever as a yarn setting means can be of anything for trapping and leading the lower yarn, and it is not to be limited for swinging the cylinder for expanding and contracting the rod and it can be constructed with a link mechanism. Moreover, the setting of the lower yarn to the winding tube set to the cradle is not to be limited to sandwiching the yarn between the edge of the winding tube and the cradle, and it can be for threading to the edge of the winding tube, or winding to the winding tube.

(2) According to the second embodiment, for a

method for making the suction pipe (upper yarn sucking-leading member) and the yarn joining device to be unmovable, the lifting of the yarn winding body is preferable. However, it is not to be limited to such case, and it can be of preventing the yarn from being trapped to the suction pipe by rotating the traverse drum in the winding direction, or stopping the suction by the suction pipe.

[0090] As in the manner stated above in a detail, according to the yarn setting method to the winding tube relating the first through the fifth, the seven, and the eighth invention, the lower yarn is transported above the yarn joining device by the lower yarn trapping-leading member at the winding unit side, and then the doffing demand signal is transmitted. As a result, there is an effect in that the yarn setting procedure to the winding tube by the yarn setting means of the doffing device can be carried out smoothly and speedily.

[0091] As in the manner stated above in a detail, according to the automatic winder relating to the sixth, the ninth and the tenth invention, the trapping operation and the lifting operation of the lower yarn by the lower yarn leading trapping means are made capable of being carried out reliably and independently of operations of other means by a simple mechanical structure. As a result, there is an effect in that the yarn setting procedure can be carried out smoothly and speedily.

Claims

1. A yarn setting method to a winding tube in an automatic winder wherein the automatic winder comprises:

winding units arranged in a plurality of which each winding unit includes a yarn joining device, a lower yarn trapping-leading member which moves between a yarn supplying body side and a yarn winding body side to trap a yarn of the yarn supplying body and lead the trapped yarn to the yarn joining device, and an upper yarn trapping-leading member for trapping the yarn of the yarn winding body and leading the trapped yarn to the yarn joining device, and each winding unit forms the yarn winding body by winding the yarn of the yarn supplying body to the winding tube; and

a doffing device which runs along the plurality of winding units, and according to a demand signal from the winding unit, arrives at the winding unit which transmitted the doffing signal, and receives the yarn of the yarn supplying body trapped by the lower yarn trapping-leading member to set the yarn to the winding tube set to the winding unit;

wherein when demanding an operation by the doffing device, the winding unit traps the yarn of the yarn supplying body by the lower yarn trapping-leading member, moves the lower yarn trapping-leading member to the yarn winding body side while trapping the yarn of the yarn supplying body, and then transmits the demand signal.

2. A yarn setting method to a winding tube in an automatic winder according to claim 1 wherein the winding unit comprises a cutting device for cutting the yarn connected between the yarn supplying body and the yarn winding body and a holding means which is located in the upstream side to the yarn cutting device, and when the yarn winding body becomes full and the yarn is cut by the yarn cutting device, the holding means holds the yarn end at the yarn supplying body side, and then the lower yarn trapping-leading member traps the yarn of the yarn supplying body between the holding means and the yarn supplying body, the lower yarn trapping-leading member is moved to the yarn winding body side while trapping the yarn of the yarn supplying body, and then the demand signal is transmitted.
3. A yarn setting method to a winding tube in an automatic winder according to claim 2 wherein the holding means is a tension applying device for applying tension to the yarn being wound.
4. A yarn setting method to a winding tube in an automatic winder according to claim 2 or claim 3 wherein the lower yarn trapping-leading member is on standby under the state in which the lower yarn trapping mouth of the lower yarn trapping-leading member is located to the yarn supplying body side than the yarn joining device during winding, and when the yarn winding body becomes full and the yarn is cut by the yarn cutting device, the holding means holds the yarn end at the yarn supplying body side, and then the lower yarn trapping-leading member is moved to the yarn trapping position where the lower yarn trapping mouth is located to the yarn supplying body side than the yarn joining device, the lower yarn trapping-leading member traps the yarn of the yarn supplying body between the holding means and the yarn supplying body, the lower yarn trapping-leading member is moved to the yarn winding body side while trapping the yarn of the yarn supplying body and then the demand signal is transmitted.
5. A yarn setting method to a winding tube in an automatic winder according to any one of claim 1 through claim 4 wherein a clamp device is provided in the lower yarn trapping-leading member and the clamp device becomes an opened state when the lower yarn trapping-leading member is located at

the yarn trapping position for trapping the yarn of the yarn supplying body and the leading position for leading the yarn of the yarn supplying body into the yarn joining device, and the clamp device becomes a clamping state until the lower yarn trapping-leading member reaches the leading position after departing from the yarn trapping position, and the lower yarn trapping-leading member is moved toward the yarn winding body side until reaching the position which is located in front of the leading position while trapping the yarn of the yarn supplying body, and then the demand signal is transmitted.

6. An automatic winder comprising a doffing device for displacing a yarn winding body, setting a new winding tube, attaching a yarn to a new winding tube, and capable of running along a plurality of winding units of which each winding unit includes a yarn joining device and forms the yarn winding body by winding the yarn of a yarn supplying body to the winding tube;

wherein the winding unit comprises a first driving means for moving a lower yarn trapping-leading member which transports the yarn of the yarn supplying body toward the yarn joining device, a second driving means for moving an upper yarn trapping-leading member which transports the yarn of the yarn winding body toward the yarn joining device, and a pausing means for stopping temporarily a first driving means when the lower yarn trapping-leading member reaches a doffing standby position which is the position immediately before leading the yarn of the yarn supplying body into the yarn joining device, and

the doffing device comprises a yarn setting means for picking up the lower yarn of the yarn supplying body of which the lower yarn trapping-leading member transported to the doffing standby position and setting the yarn of the yarn supplying body to a newly set winding tube.

7. A yarn setting method to a winding tube in an automatic winder wherein the automatic winder comprising:

winding units arranged in a plurality wherein each winding unit includes a yarn joining device, a lower yarn trapping-leading member which moves between a yarn supplying body side and a yarn winding body side to trap a yarn of the yarn supplying body and lead the trapped yarn to the yarn joining device, and an upper yarn trapping-leading member for trapping the yarn of the yarn winding body and leading the trapped yarn to the yarn joining device, and forms the yarn winding body by winding the yarn of the yarn supplying body to a winding tube; and

a doffing device which runs along the plurality of winding units, and according to a demand signal from the winding unit, arrives at the winding unit which transmitted a doffing signal, receives the yarn of the yarn supplying body trapped by the lower yarn trapping-leading member to set the yarn to the winding tube set to the winding unit;

wherein the winding unit prohibits the operation of the upper yarn trapping-leading member and the yarn joining device, traps the yarn of the yarn supplying body by the lower yarn trapping-leading member, and after moving the lower yarn trapping-leading member to the yarn winding body side, transmits the demand signal.

8. A yarn setting method to a winding tube in an automatic winder according to claim 7 wherein the winding unit comprises a driving drum for rotating and driving the yarn winding body, the driving drum rotates in the reverse direction to winding direction accompanying the movement of the upper yarn trapping-leading member, and the upper yarn trapping-leading member and the yarn joining device are prohibited from being operated by separating the yarn winding body away from the driving drum to prevent the yarn of the yarn winding body to be trapped by the upper yarn trapping-leading member, and by stopping the lower yarn trapping-leading member from moving to the yarn winding body side at a position before the yarn of the yarn supplying body is led to the yarn joining device by the lower yarn trapping-leading member.

9. An automatic winder comprising:

a doffing device for displacing a yarn winding body, setting a new winding tube, attaching a yarn to a new winding tube, provided capable of running along the plurality of winding units of which each winding unit includes a yarn joining device and forms the yarn winding body by winding up the yarn of a yarn supplying body; wherein the winding unit comprises a driving means for operating a lower yarn sucking-leading member which transports the yarn of the yarn supplying body toward the yarn joining device and an upper yarn sucking-leading member which transports the yarn of the yarn winding body toward the yarn joining device, a pausing means for stopping the driving means temporarily when the lower yarn sucking-leading member is located at a position immediately before a position for leading the yarn of the yarn supplying body into the yarn joining device, and a lifting means for lifting the yarn winding body so that the yarn of the yarn winding body is not

sucked by the upper yarn sucking-leading member; and

the doffing device comprises a yarn setting means for picking up the yarn of the yarn supplying body of which is transported above by the lower yarn sucking-leading member, and setting the yarn of the yarn supplying body to the newly set winding tube.

10. An automatic winder according to claim 9 wherein the driving means is provided independently per each winding unit.

11. A yarn setting method to a winding tube in an automatic winder wherein the automatic winder comprises:

winding units arranged in a plurality of which each winding unit includes a yarn joining device, a lower yarn sucking-leading member which moves between a yarn supplying body side and a yarn winding body side to trap a yarn of the yarn supplying body and lead the trapped yarn to the yarn joining device, and an upper yarn sucking-leading member for trapping the yarn of the yarn winding body and leading the trapped yarn to the yarn joining device, and each winding unit forms the yarn winding body by winding the yarn of the yarn supplying body to a winding tube; and

a doffing device which runs along the plurality of winding units, and according to a demand signal from the winding unit, arrives at the winding unit which transmitted the demand signal, and receives the yarn of the yarn supplying body trapped by the lower yarn sucking-leading member to set the yarn to the winding tube set to the winding unit;

wherein the lower yarn sucking-leading member becomes an opened state when being located at a yarn trapping position for trapping the yarn of the yarn supplying body and a leading position for leading the yarn of the yarn supplying body to the yarn joining device, and becomes a closed state until reaching the leading position at the yarn winding body side after departing from the yarn trapping position at the yarn supplying body side; and before the doffing device receives the yarn of the yarn supplying body trapped by the lower yarn sucking-leading member to set the yarn to the winding tube, the lower yarn sucking-leading member which is trapping the yarn of the yarn supplying body is moved to a doffing standby position immediately before reaching the leading position.

FIG. 1

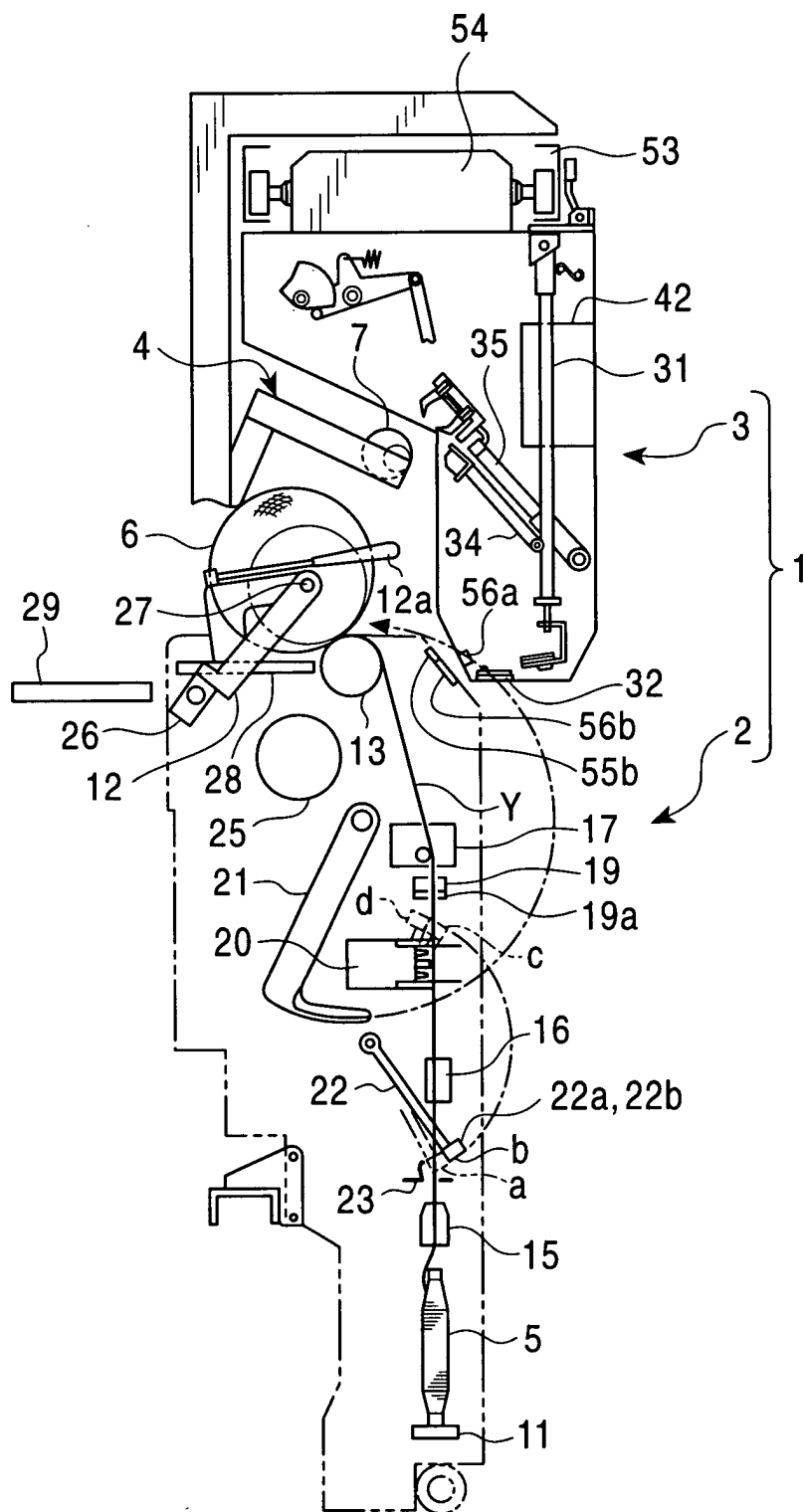


FIG. 2

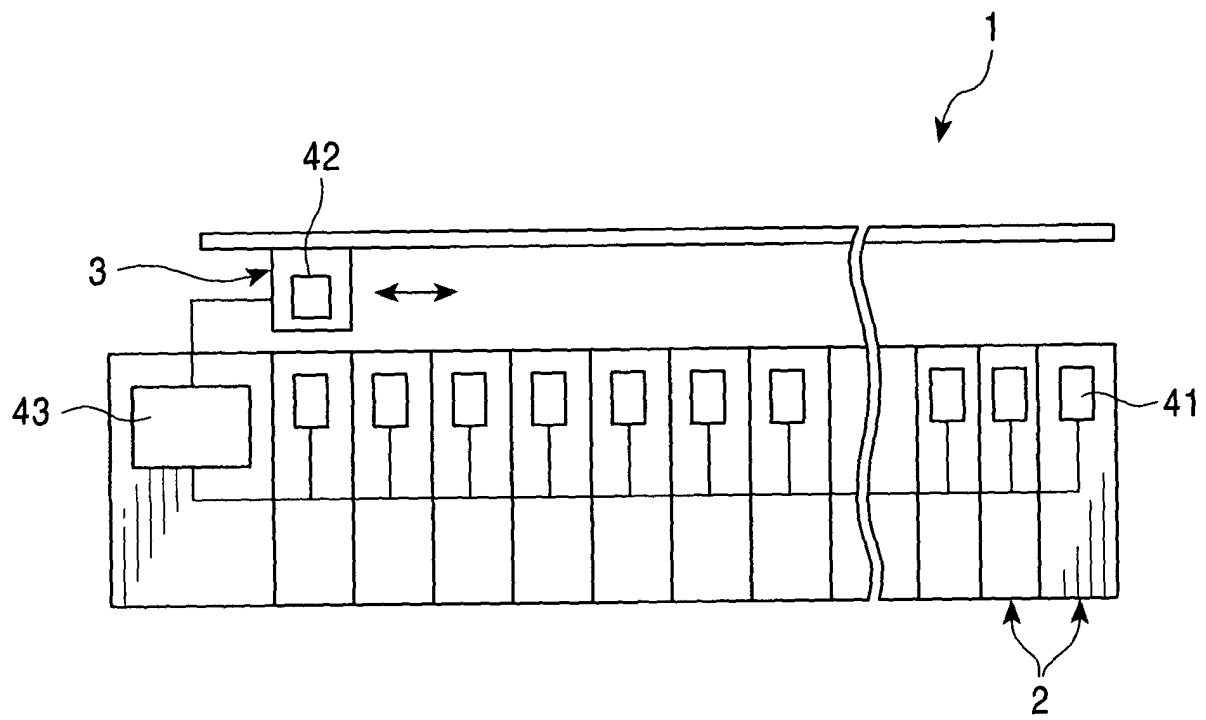


FIG. 3

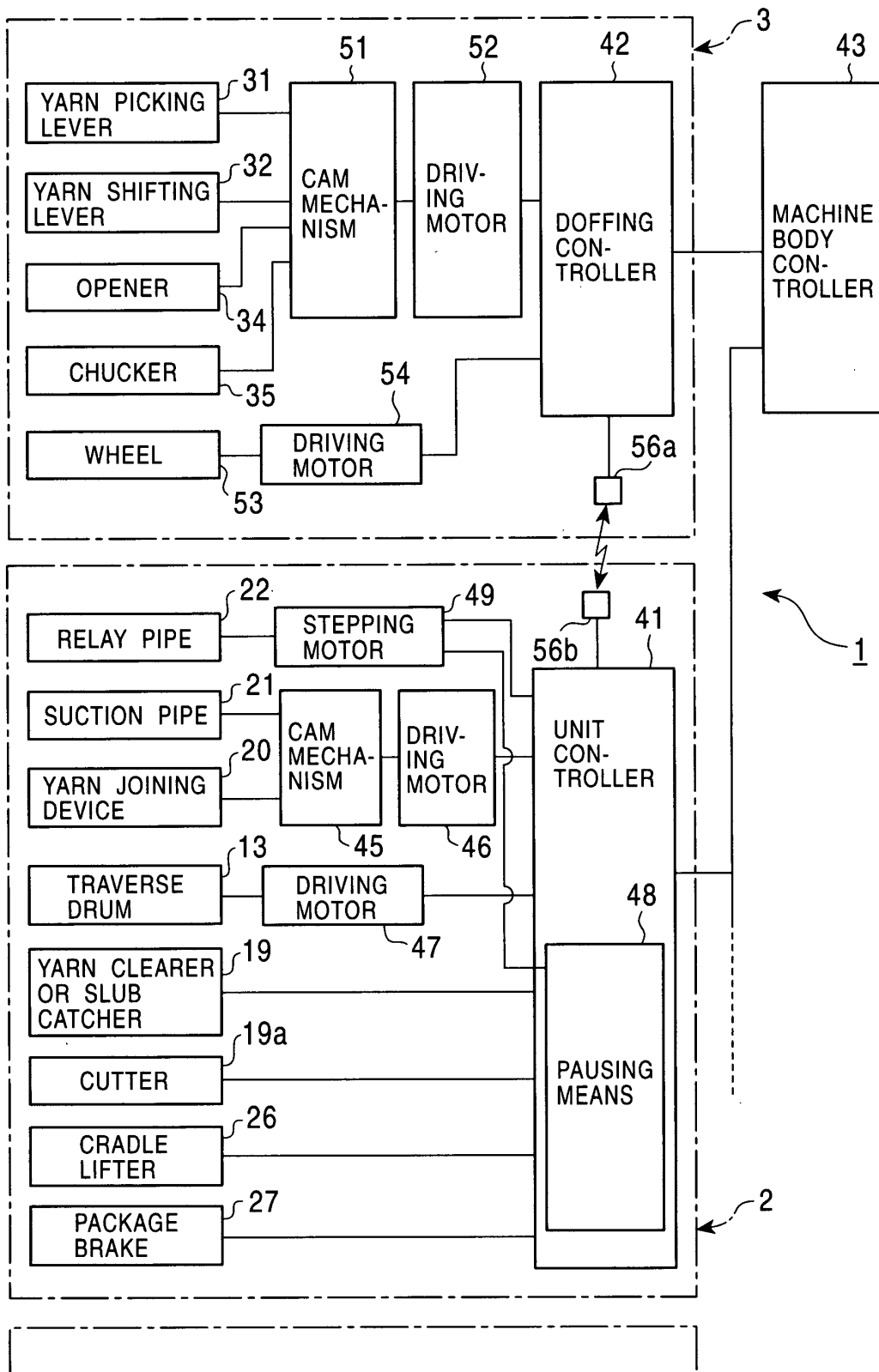


FIG. 4A

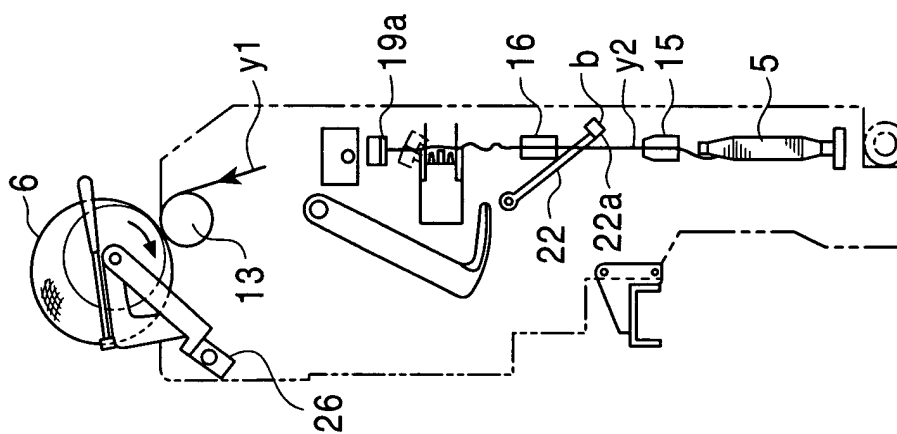


FIG. 4B

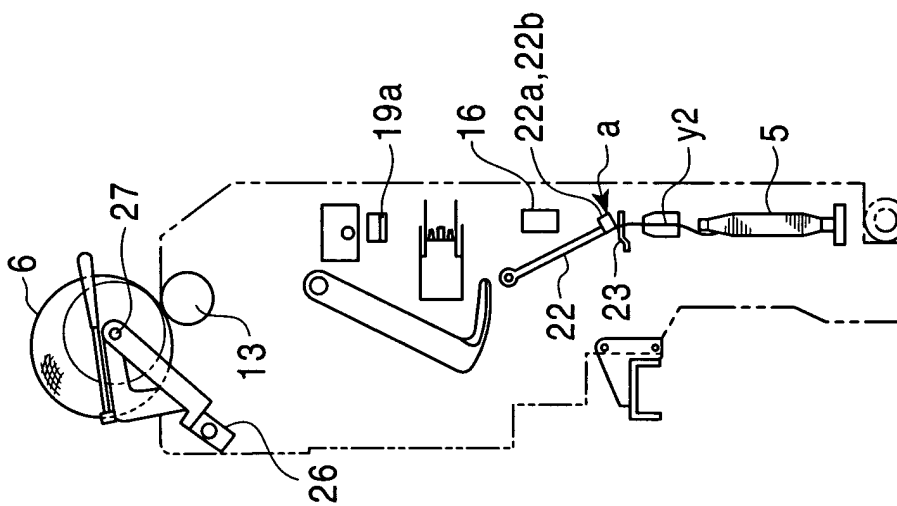


FIG. 4C

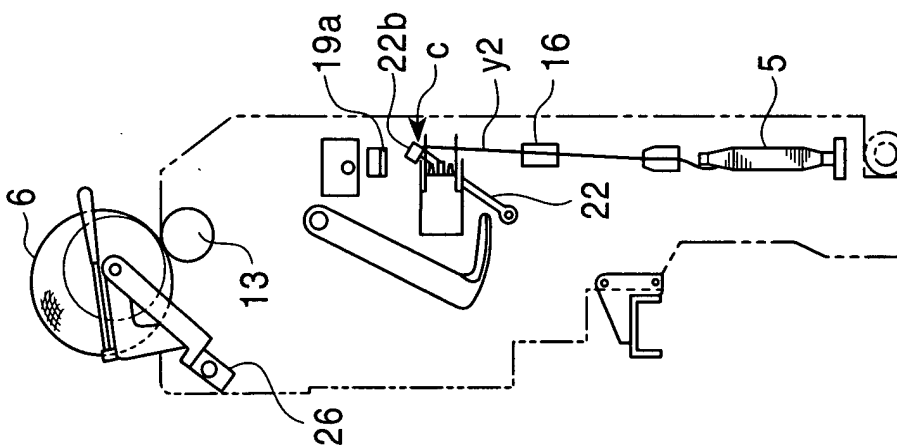


FIG. 5A

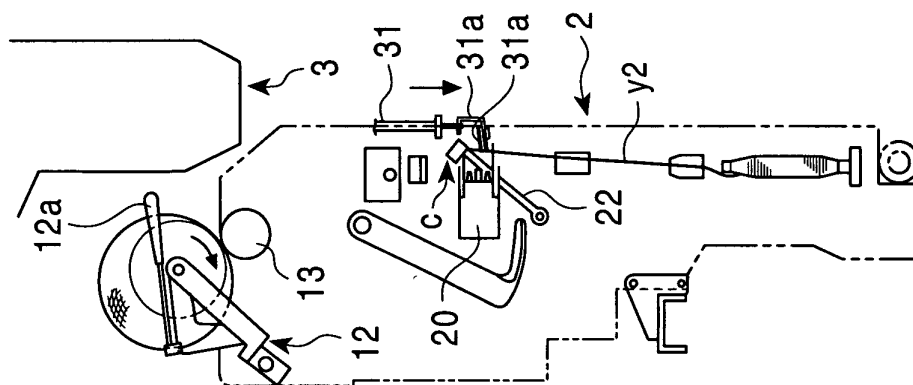


FIG. 5B

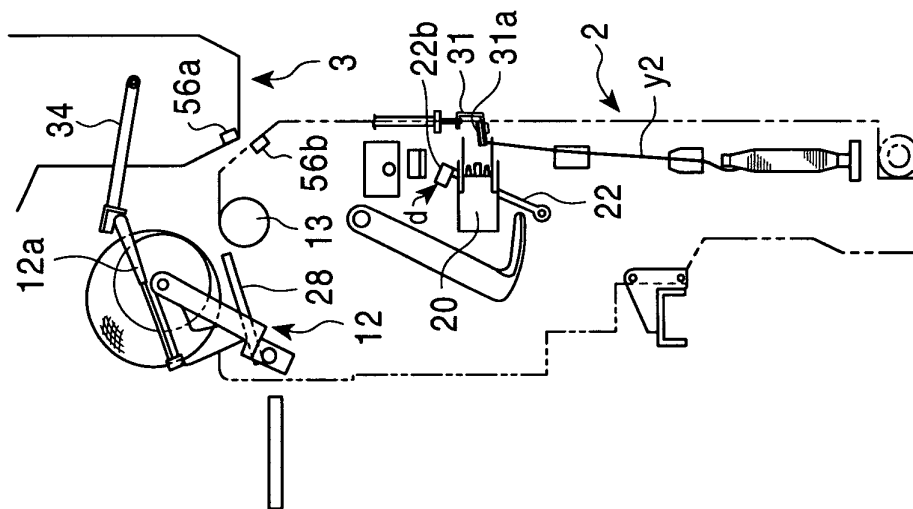


FIG. 5C

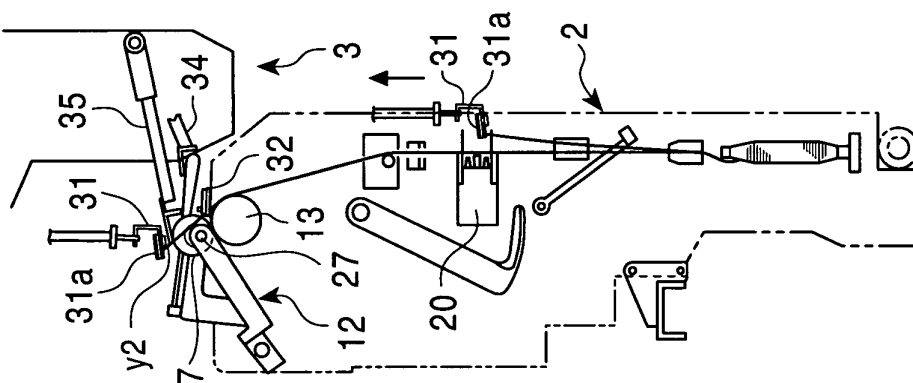


FIG. 5D

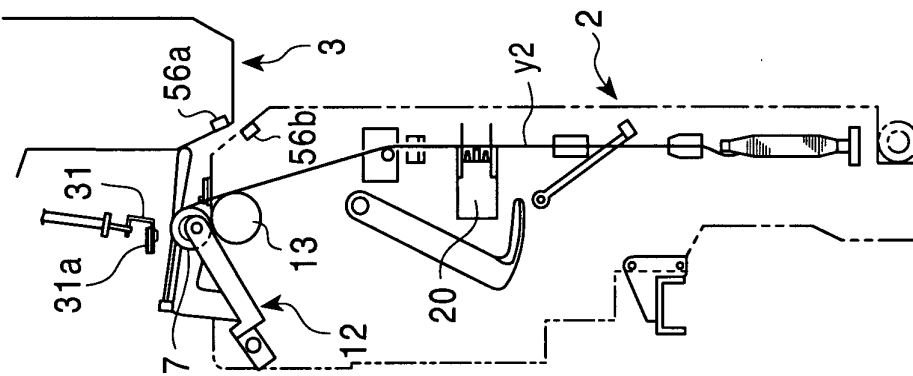


FIG. 6

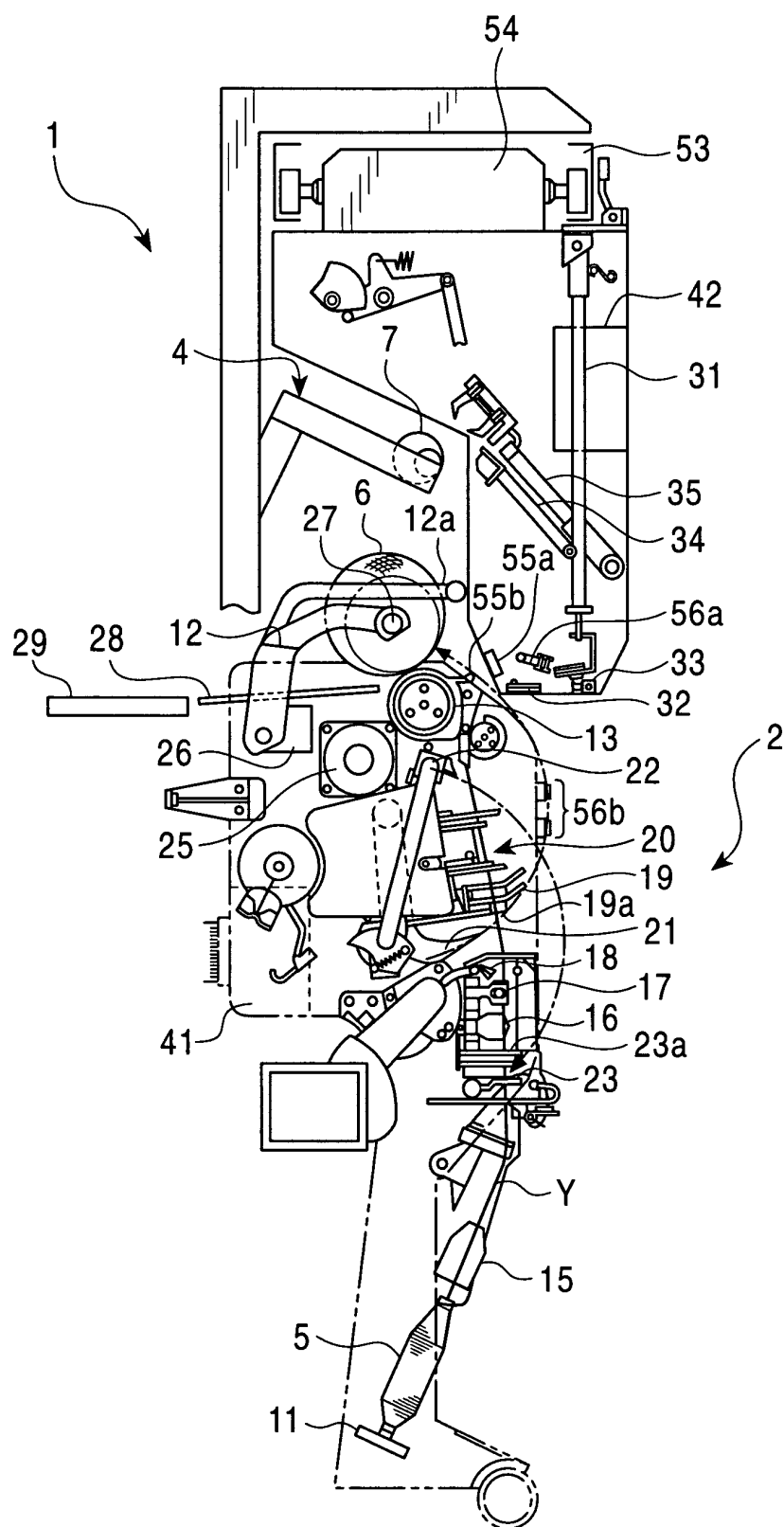


FIG. 7

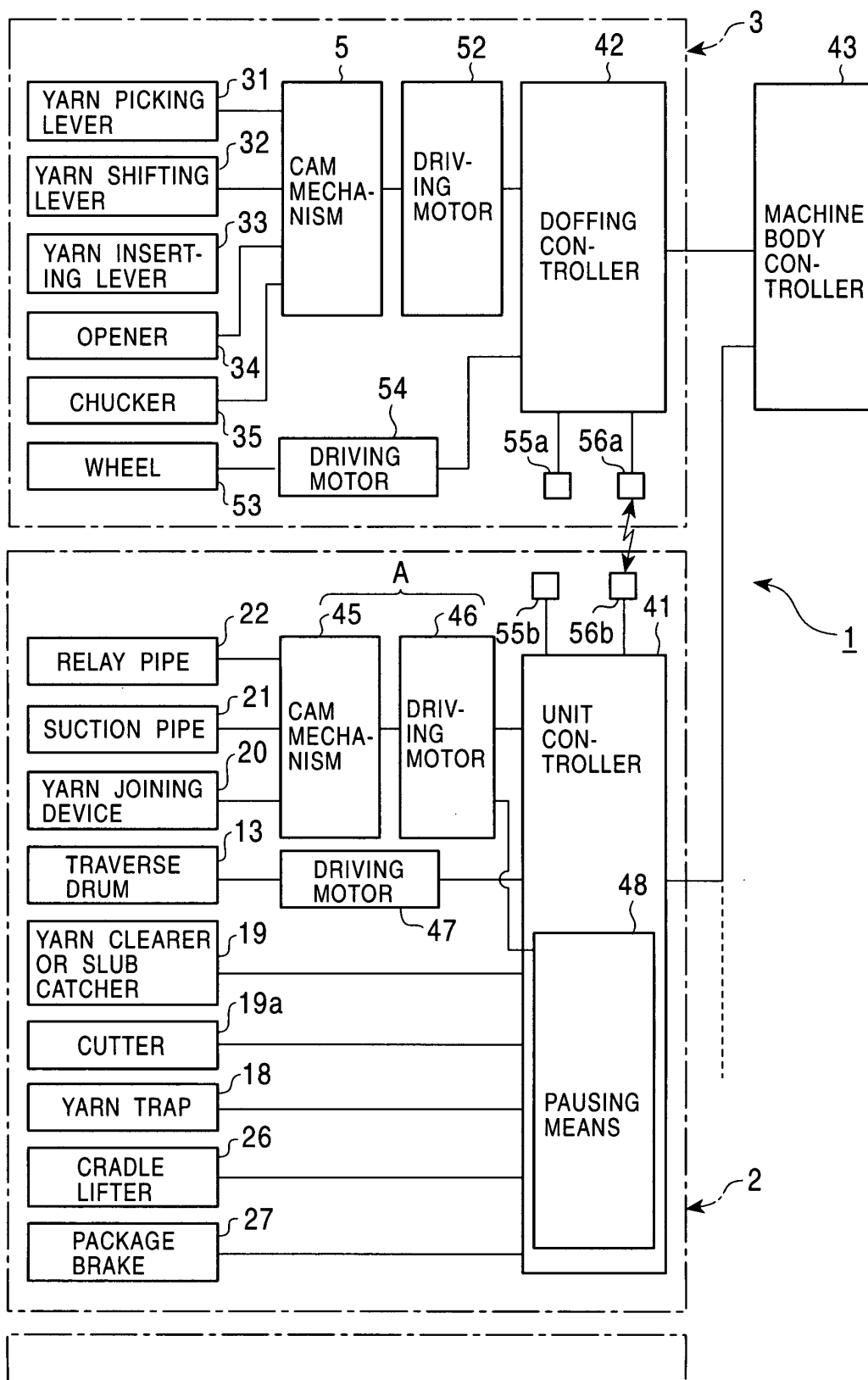


FIG. 8A

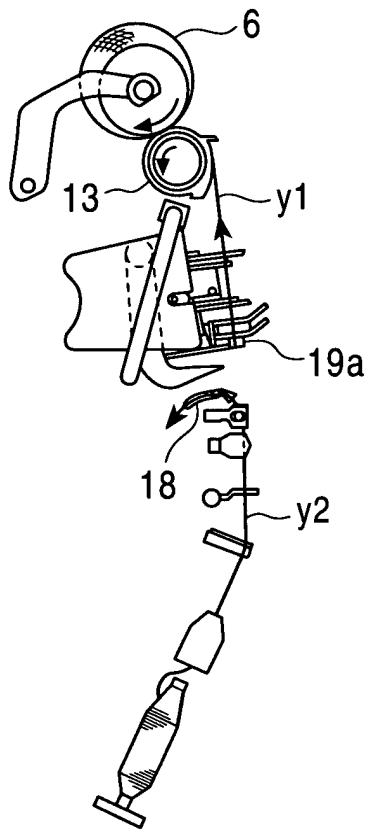


FIG. 8B

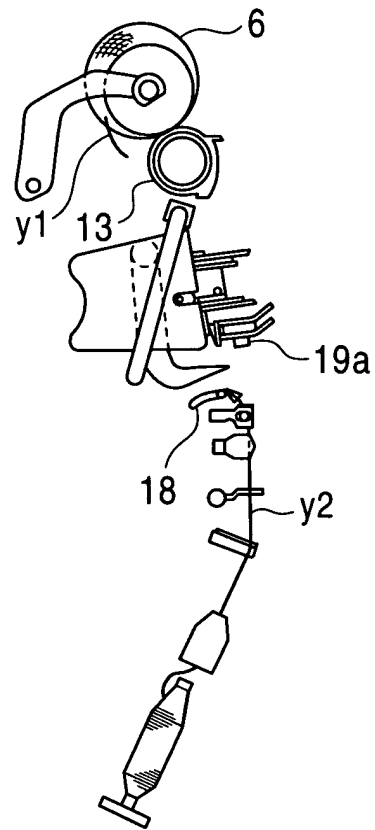


FIG. 9C

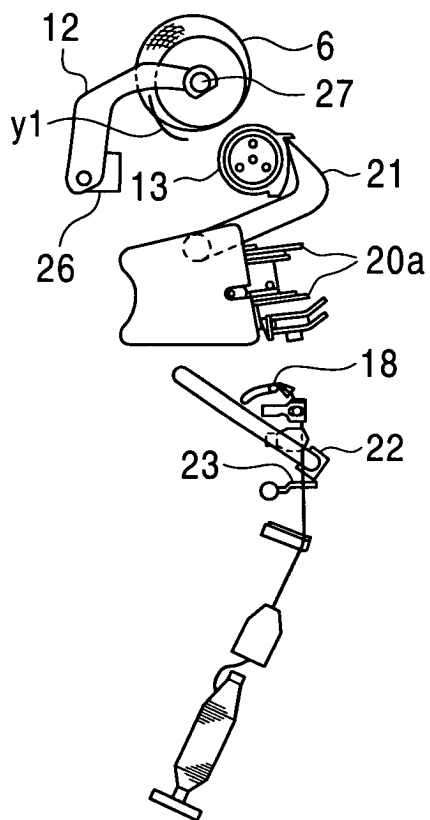


FIG. 9D

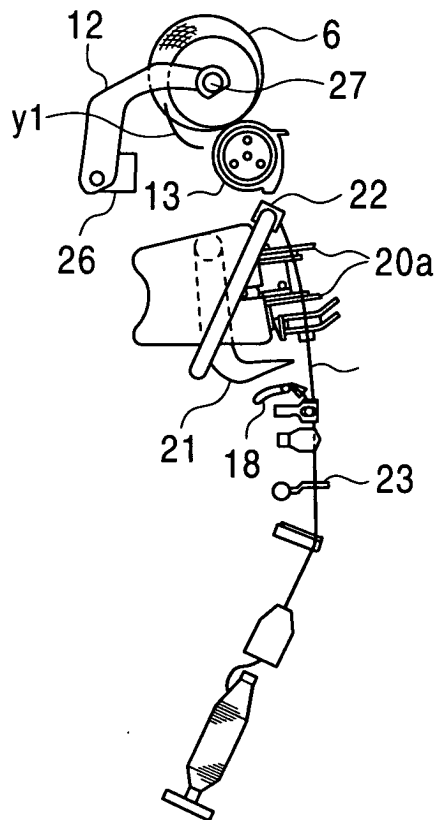


FIG. 10E

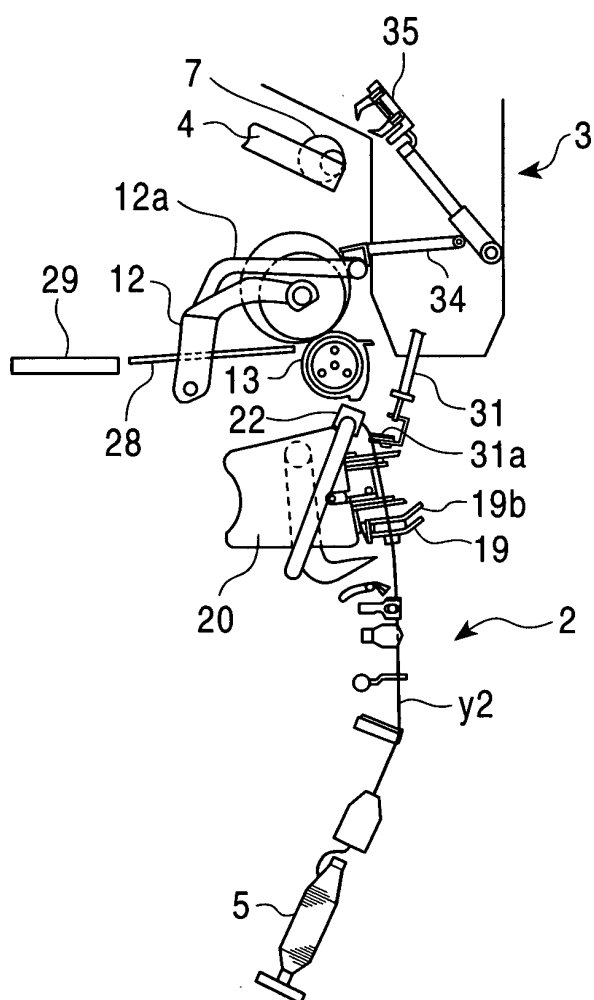


FIG. 10F

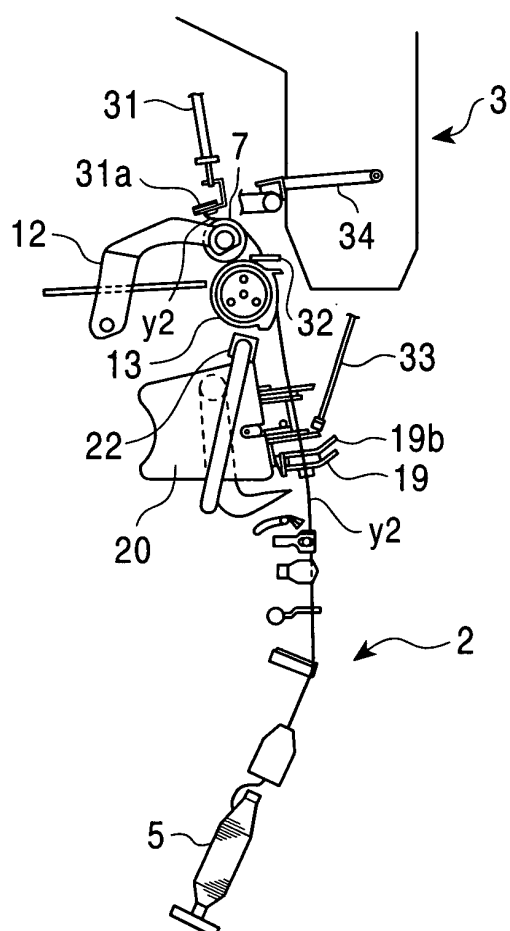


FIG. 11A

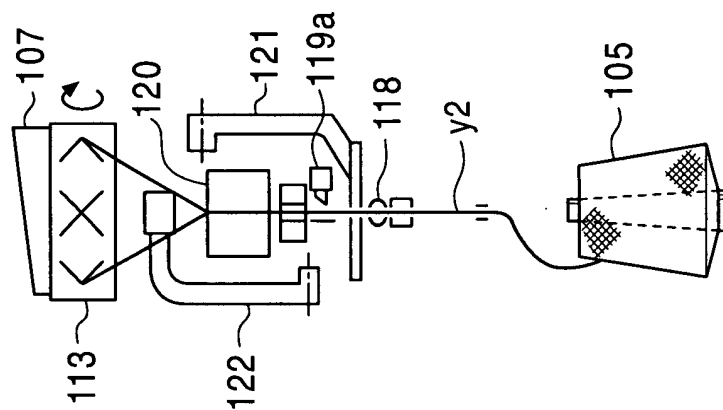


FIG. 11B

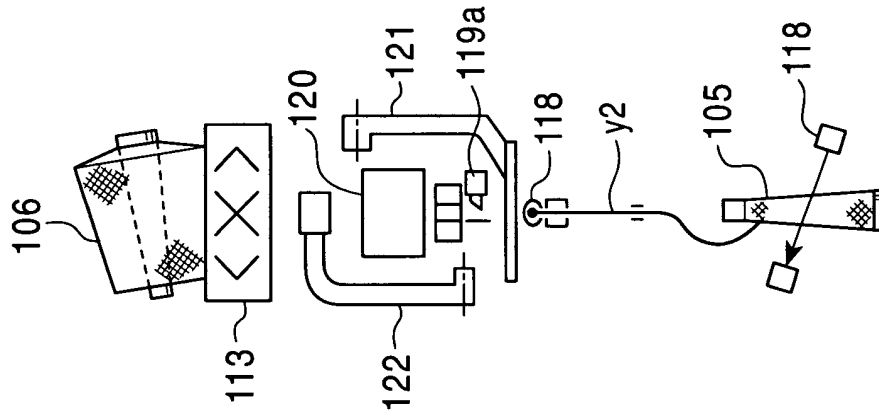


FIG. 11C

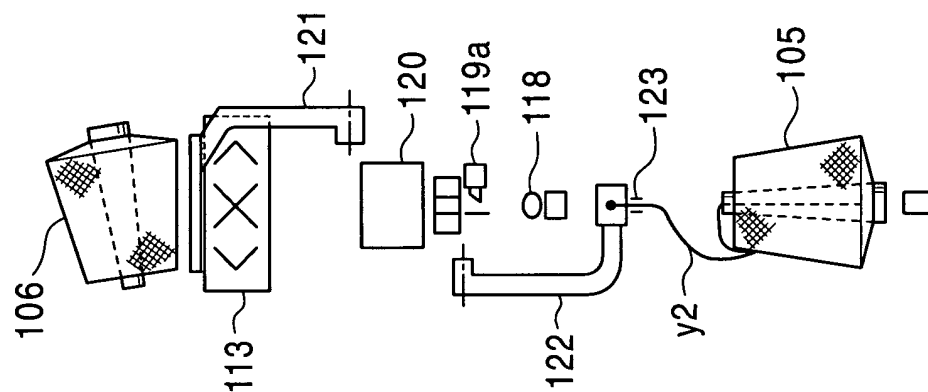


FIG. 11D

