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(57) A winder unit (2) includes, a yarn supplying section (6), a yarn accumulating device (18), a tension applying section (15), an upstream yarn blowing off section (11), an upstream yarn catching section (14), and a yarn joining device (13). Downstream of the upstream yarn blowing off section (11) on a yarn path, the yarn joining device (13), the upstream yarn catching section (14), the tension applying section (15), and the yarn accumulating device (18) are arranged sequentially from upstream.

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates principally to a yarn winding device that winds a yarn and in which yarn ends of a disconnected yarn can be automatically caught and joined.

2. Description of the Related Art

[0002] Yarn winding devices in which yarn ends of a disconnected yarn are automatically caught and guided to a yarn joining device where the yarn ends are joined are known in the art. Japanese Patent Application Laid-open No. 2012-20853 discloses such a yarn winding device.

[0003] The yarn winding device disclosed in Japanese Patent Application Laid-open No. 2012-20853 is configured as a winder unit of an automatic winder, and includes a support section that supports a yarn supplying bobbin, a yarn accumulating device that winds a yarn supplied by the yarn supplying bobbin, a yarn joining device, a yarn guiding section, a yarn catching section, and a driving section that moves the yarn catching section. The winder unit is configured such that the yarn (lower yarn) from the yarn supplying bobbin is blown up toward the yarn joining device by a lower yarn blowing-up section, and the yarn is caught by the yarn catching section. With this configuration, the yarn can be guided to the yarn joining device in a short time, and an amount of waste yarn produced during yarn joining can be reduced.

[0004] FIG. 8 is a schematic diagram of a winder unit 100 of a conventional automatic winder such as the one disclosed in Japanese Patent Application Laid-open No. 2012-20853. In the conventional winder unit 100, a tension applying device 103 that applies tension on a yarn being wound is arranged between a yarn joining device 101 and a lower yarn blowing section 102. In this configuration, when the lower yarn from the yarn supplying bobbin 104 is blown up toward the yarn joining device 101 by the lower yarn blowing section 102, there is a possibility of the yarn getting caught in the tension applying device 103. When this happens, the yarn catching section 105 fails to catch the yarn unless an operator manually guides the yarn. Consequently, the yarn joining device 101 cannot start the yarn joining operation, and the yarn winding operation comes to a stop. In this manner, in the conventional configuration, the yarn cannot be smoothly guided to the yarn joining device, leading to a decrease in the efficiency of the yarn winding operation.

SUMMARY OF THE INVENTION

[0005] The present invention has been made in view of the above discussion and it is an object thereof to provide a yarn winding device that can blow off the yarn ends so that the ends can be caught by a yarn catching section for joining, and to improve a catching success rate of a yarn catching section.

vide a yarn winding device that can blow off the yarn ends so that the ends can be caught by a yarn catching section for joining, and to improve a catching success rate of a yarn catching section.

[0006] The means to solve the above-mentioned problems and the advantages thereof are given below.

[0007] According to one aspect of the present invention, a yarn winding device includes a yarn supplying section, a yarn accumulating device, a tension applying section, a yarn end blowing off section, a supplied yarn catching section, a yarn joining device, and a package forming section. The yarn supplying section supports a yarn supplying bobbin with a yarn wound thereon. The yarn accumulating device winds and accumulates the yarn from the yarn supplying bobbin supported by the yarn supplying section. The package forming section pulls the yarn from the yarn accumulating device and winds the pulled yarn to form a package. The tension applying section applies tension on the yarn being wound by the yarn accumulating device. The supplied yarn catching section catches a yarn end that is conveyed from the yarn supplying section. The yarn joining device joins the yarn from the yarn supplying bobbin caught by the supplied yarn catching section and the yarn that is wound in the yarn accumulating device. Downstream of the yarn supplying section on a yarn path, the yarn joining device, the supplied yarn catching section, the tension applying section, and the yarn accumulating device are sequentially arranged from upstream. The yarn end blowing off section that conveys the yarn end from the yarn supplying bobbin supported in the yarn supplying section toward the yarn accumulating device is arranged between the yarn supplying section and the yarn joining device. When the yarn supplying bobbin is replaced in the yarn supplying section, the yarn end blowing off section conveys the yarn end of the new yarn supplying bobbin that is supported in the yarn supplying section toward the yarn accumulating device by the action of an air current. The supplied yarn catching section catches the yarn end conveyed by the yarn end blowing off section.

[0008] According to another aspect of the present invention, a yarn winding machine equipped with the above yarn winding device is provided.

[0009] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 is a simplified front view of an overall structure of an automatic winder equipped with a winder unit according to an embodiment of the present invention.

FIG. 2 is a schematic side view of the winder unit equipped in the automatic winder.

FIG. 3 is a partial cross-sectional side view of a yarn joining device and a downstream yarn blowing off section.

FIG. 4 is a cross-sectional side view of an upstream yarn blowing off section and a blowing off assisting section.

FIG. 5 is a drawing showing a yarn end from a yarn supplying bobbin being blown off and caught by an upstream yarn catching section.

FIG. 6 is a drawing showing the yarn end from a yarn accumulating device being caught by a downstream yarn catching section and a yarn joining device performing yarn joining.

FIG. 7 is a schematic side view of a winder unit equipped with a magazine-type bobbin feeder.

FIG. 8 is a drawing showing a yarn from a yarn supplying bobbin side being blown up in a conventional winder unit.

DETAILED DESCRIPTION

[0011] Exemplary embodiments of the present invention are explained in detail below with reference to the accompanying drawings. FIG. 1 is a front view of an overall structure of an automatic winder 1 equipped with winder units 2 according to an embodiment of the present invention.

[0012] The automatic winder (yarn winding machine) 1 shown in FIG. 1 mainly includes plural winder units (yarn winding devices) 2 that are arranged side by side, a main control device 3, a yarn supplying bobbin feeder 4, a doffing device 5, and a not shown blower box.

[0013] The main control device 3 is configured to be able to communicate with each winder unit 2. An operator of the automatic winder 1 can centrally manage the plural winder units 2 by performing appropriate operations on the main control device 3. The main control device 3 also controls operations of the yarn supplying bobbin feeder 4 and the doffing device 5.

[0014] Yarn supplying bobbins 21 are set one by one on a conveying tray 26 of the yarn supplying bobbin feeder 4 and fed to each of the winder units 2.

[0015] The doffing device 5 is configured to move to the position of the winder unit 2 in which a package 30 has been fully wound (a state where a prescribed amount of a yarn 20 has been wound) in the winder unit 2, remove the fully wound package 30, and set an empty winding bobbin 22 in its place.

[0016] A structure of the winder unit 2 is explained next with reference to FIG. 2. FIG. 2 is a schematic side view of the winder unit 2 equipped in the automatic winder 1.

[0017] The winder unit 2 mainly includes a yarn supplying section 6, a yarn accumulating device 18, and a package forming section 8. The winder unit 2 is configured to unwind the yarn (spun yarn) 20 from the yarn supplying bobbin 21 that is fed to the yarn supplying sec-

tion 6, temporarily accumulate the unwound yarn 20 in the yarn accumulating device 18, and thereafter wind the yarn 20 onto the winding bobbin 22 to form the package 30.

[0018] FIG. 2 shows a state of the winder unit 2 during normal winding. The term "normal winding" refers to a state when the yarn 20 is continuous between the yarn supplying bobbin 21 and the package 30, and the yarn 20 is unwound from the yarn supplying bobbin 21 and wound into the package 30. The terms "upstream" and "downstream" in the following explanation refer to, respectively, upstream and downstream with respect to a traveling direction of the yarn 20 during normal winding.

[0019] The yarn supplying section 6 supports the yarn supplying bobbin 21 set on the conveying tray 26 at a predetermined position so that the yarn 20 can be unwound from the yarn supplying bobbin 21 and supplied. The yarn supplying section 6 is configured to discharge the empty yarn supplying bobbin 21 when all the yarn 20 has been unwound from the yarn supplying bobbin 21 and receive a new yarn supplying bobbin 21 from the yarn supplying bobbin feeder 4.

[0020] The yarn accumulating device 18 is arranged between the yarn supplying section 6 and the package forming section 8, and is configured to temporarily accumulate the yarn 20 supplied by the yarn supplying section 6 before supplying the yarn 20 to the package forming section 8. The yarn accumulating device 18 includes a yarn accumulating roller 32 on which the yarn 20 can be wound, and a roller driving motor 33 that rotationally drives the yarn accumulating roller 32.

[0021] The roller driving motor 33 is capable of rotating the yarn accumulating roller 32 both in a winding direction of the yarn 20 from the yarn supplying section 6 and in an opposite direction to the winding direction. In the following explanation, when referring to the rotation of the yarn accumulating roller 32, the rotation in the winding direction of the yarn 20 from the yarn supplying section 6 shall be referred to as forward rotation and the rotation in the opposite direction to the winding direction shall be referred to as reverse rotation.

[0022] The package forming section 8 includes a cradle 23 that is configured so as to enable the winding bobbin 22 to be fitted thereon and a traverse drum 24 that drives the winding bobbin 22 while traversing the yarn 20.

[0023] The cradle 23 is configured to rotatably support the winding bobbin 22 (or the package 30). Moreover, the cradle 23 is configured to bring an outer circumferential surface of the supported package 30 into contact with an outer circumferential surface of the traverse drum 24.

[0024] The traverse drum 24 is driven to rotate by a not shown driving source (electric motor or the like). The rotation of the traverse drum 24 in a state where the traverse drum 24 is in contact with the outer circumferential surface of the winding bobbin 22 or the package 30 drives the rotation of the winding bobbin 22. With this action, the yarn 20 accumulated in the later-explained

yarn accumulating device 18 is unwound and pulled, and wound on the winding bobbin 22. The traverse drum 24 has a not shown traverse groove formed on an outer circumferential surface thereof. The traverse groove enables the yarn 20 to be traversed by a predetermined width. With this configuration, the yarn 20 can be wound on the winding bobbin 22 while being traversed, and the package 30 of a predetermined length and shape can be formed.

[0025] The winder unit 2 includes various devices on a yarn traveling path from the yarn supplying section 6 via the yarn accumulating device 18 to the package forming section 8. Specifically, an unwinding assisting device 10, an upstream yarn blowing off section (yarn end blowing off section) 11, a downstream yarn catching section (winding yarn catching section) 12, a yarn joining device 13, an upstream yarn catching section (supplied yarn catching section) 14, a tension applying section 15, a cutter (cutting section) 16, a clearer (yarn defect detecting device) 17, and a downstream yarn blowing off section (yarn end blowing away section) 48 are arranged sequentially on the yarn traveling path (yarn path) in the direction from the yarn supplying section 6 arranged upstream to the yarn accumulating device 18 arranged downstream.

[0026] The unwinding assisting device 10 assists in the unwinding of the yarn 20 by properly controlling a size of a balloon formed above the yarn supplying bobbin 21 by the swaying yarn 20 that is being unwound from the yarn supplying bobbin 21 by bringing a movable member 27 into contact with the balloon.

[0027] The upstream yarn blowing off section 11 is an air sucker device arranged immediately downstream of the unwinding assisting device 10 that blows compressed air to form an air current that blows off the yarn 20 up to the upstream yarn catching section 14. Accordingly, for example, in the event of a yarn breakage, the yarn end on the yarn supplying bobbin 21 side can be blown off toward the yarn joining device 13 by the action of the upstream yarn blowing off section 11.

[0028] Because the yarn 20 from the yarn supplying bobbin 21 that has just been fed to the yarn supplying section 6 is not drawn out adequately enough, the yarn end cannot be blown off by the upstream yarn blowing off section 11 toward the yarn joining device 13. In consideration of the above problem, a blowing off assisting section 28 is arranged in the yarn supplying section 6 of the winder unit 2. The blowing off assisting section 28 blows compressed air into the hollow-shaped conveying tray 26 and the yarn supplying bobbin 21 and generates an air current at an end portion of the yarn supplying bobbin 21 that can blow off the yarn 20 from the yarn supplying bobbin 21 toward the upstream yarn blowing off section 11. With this configuration, the blowing off assisting section 28 and the upstream yarn blowing off section 11 operate in conjunction with each other to reliably convey the yarn end from the yarn supplying bobbin 21 that has just been set in the yarn supplying section 6

from the yarn supplying bobbin 21 toward the yarn joining device 13.

[0029] The downstream yarn catching section 12 is arranged immediately upstream of the yarn joining device 13. The downstream yarn catching section 12 is connected to a not shown negative pressure source that generates a suction air current. During yarn joining, the downstream yarn catching section 12 sucks and catches the yarn 20 on the yarn accumulating device 18 side by the action of the suction air current.

[0030] The yarn joining device 13 joins the yarn 20 from the yarn supplying bobbin 21 side and the yarn 20 from the yarn accumulating device 18 side when the yarn 20 is cut by the cutter 16 upon detection of a yarn defect by the clearer 17, or when the yarn 20 being unwound from the yarn supplying bobbin 21 breaks, or when the yarn 20 is disconnected between the yarn supplying bobbin 21 and the yarn accumulating device 18, such as during replacement of the yarn supplying bobbin 21 or the like. The yarn joining device 13 is arranged at a slightly retracted position from the yarn path during normal winding. The yarn joining device 13 restores the continuity of the yarn 20 by joining the two yarn ends that are guided thereto. The yarn joining device 13 can be a device that employs a fluid medium, such as compressed air or the like, or a device that has a mechanical structure.

[0031] The upstream yarn catching section 14 is a yarn trap arranged immediately downstream of the yarn joining device 13. The upstream yarn catching section 14 is connected to a not shown negative pressure source and is configured as a cylindrical member having an opening on an end portion thereof. The upstream yarn catching section 14 includes an advancement and retraction driving section 47. The advancement and retraction driving section 47 causes the cylindrical member to advance toward and retract from the yarn path. By generating a suction air current at the end portion of the cylindrical member while the cylindrical member is near the yarn path, the upstream yarn catching section 14 sucks and catches the yarn end from the yarn supplying bobbin 21 that is blown off by the upstream yarn blowing off section 11. The upstream yarn catching section 14 sucks and catches the yarn end of the yarn 20 on the yarn supplying bobbin 21 side when the yarn 20 is cut by the cutter 16. Furthermore, the upstream yarn catching section 14 sucks and removes fluff or the like adhering to the traveling yarn 20 by the suction air current generated on the end portion thereof. The upstream yarn catching section 14 guides the yarn end to the yarn joining device 13 by retracting the cylindrical member from the yarn path with the yarn end from the yarn supplying bobbin 21 caught by the cylindrical member.

[0032] The tension applying section 15 applies a predetermined tension on the traveling yarn 20. The tension applying section 15 according to the present embodiment is configured as a gate-type structure with movable comb teeth arranged with respect to fixed comb teeth and applies a predetermined resistance to the yarn 20 when the

yarn 20 travels between the set of comb teeth. The movable comb teeth are movable by, for example, a solenoid, so that the movable comb teeth and the fixed comb teeth are in an engaged state or a released state. With this configuration, the tension applied on the yarn 20 can be adjusted. The configuration of the tension applying section 15 is not limited to the above; for example, a disc-type tension applying section can be used.

[0033] The clearer 17 is configured to detect a yarn defect, such as slub, contaminant, and the like, by monitoring a thickness or the like of the yarn 20 with an appropriate sensor. The cutter 16 is arranged immediately upstream of the clearer 17 to cut the yarn 20 immediately upon detection of a yarn defect by the clearer 17.

[0034] The cutter 16 and the clearer 17 are housed in a common housing 19. The housing 19 that houses the clearer 17 is arranged immediately downstream of the tension applying section 15. With this configuration, the clearer 17 can monitor the portion of the traveling yarn 20 near where the yarn 20 is held (guided) by the tension applying section 15. Accordingly, since practically no shaking of the yarn 20 occurs in the monitored portion, a detection accuracy of a defect in the yarn 20 by the clearer 17 can be further improved.

[0035] The downstream yarn blowing off section 48 is an air sucker device arranged immediately upstream of the yarn accumulating device 18 that blows away compressed air to generate an air current that blows and conveys the yarn end on the yarn accumulating device 18 side to the downstream yarn catching section 12. Specifically, the downstream yarn blowing off section 48 includes a narrow cylindrical guide member (later-explained guide tube) through which the yarn 20 can be passed. A blowout hole is formed on one end of the guide member. A yarn guiding member 60 that is a bent cylindrical member is arranged so as to approach the blowout hole of the downstream yarn blowing off section 48. An opening is formed on either end of the yarn guiding member 60 in a longitudinal direction thereof. The yarn guiding member 60 is arranged such that the opening on one end thereof is positioned facing the blowout hole of the downstream yarn blowing off section 48 and the opening on the other end thereof is positioned facing the downstream yarn catching section 12. Inside the yarn guiding member 60 is formed therein a guiding path that joins the openings at the two ends, detouring around the clearer 17, the tension applying section 15, the yarn joining device 13, and the like. The downstream yarn blowing off section 48, the yarn guiding member 60, and the downstream yarn catching section 12 together constitute an accumulating side yarn end catching device (yarn accumulating device side yarn end catching device) 50.

[0036] With this configuration, when the yarn 20 is disconnected between the yarn supplying bobbin 21 and the yarn accumulating device 18, the downstream yarn blowing off section 48 catches the yarn 20 on the yarn accumulating device 18 side and blows away the yarn 20 to the guiding path of the yarn guiding member 60.

Then, the yarn 20 is pulled out along the guiding path and caught by the downstream yarn catching section 12. A not shown through-type slit is formed over the entire length of the yarn guiding member 60 that allows the yarn 20 to be pulled out from inside the yarn guiding member 60 with the yarn 20 caught by the downstream yarn catching section 12. In this manner, the yarn 20 on the yarn accumulating device 18 side is blown off by the downstream yarn blowing off section 48 and guided toward the yarn joining device 13.

[0037] A structure for controlling the winder unit 2 is explained below.

[0038] Each winder unit 2 has a separate control section 25. The control section 25 includes not shown hardware, such as a CPU (Central Processing Unit), a ROM (Read-only Memory), a RAM (Random Access Memory), and the like. The RAM has stored therein software, such as control programs and the like. The hardware and the software cooperatively function to control each structural component of the winder unit 2.

[0039] Specifically, the control section 25 performs control so as to drive the roller driving motor 33 to enable forward rotation of the yarn accumulating roller 32 so that the yarn 20 is unwound from the yarn supplying bobbin 21 set in the yarn supplying section 6 and is accumulated in the yarn accumulating device 18. To enable the above process, the control section 25 controls the unwinding assisting device 10 to assist in the unwinding of the yarn 20 and controls the tension applying section 15 to apply appropriate tension on the yarn 20. Furthermore, the control section 25 controls the not shown electric motor that drives the traverse drum 24 so that the yarn 20 is wound on the winding bobbin 22 and the package 30 is formed.

[0040] In the process of the yarn winding operation, the control section 25 performs control so that an accumulated amount of the yarn 20 in the yarn accumulating device 18 is in a predetermined range. The adjustment of the accumulated amount of the yarn 20 is realized by changing a speed of the forward rotation of the roller driving motor 33. That is, the accumulated amount of the yarn 20 can be increased or decreased by adjusting the speed at which the yarn accumulating roller 32 winds the yarn 20 from the yarn supplying section 6 to be faster than or slower than the speed at which the package forming section 8 pulls the yarn 20 from the yarn accumulating roller 32.

[0041] Furthermore, in the process of the yarn winding operation, when a yarn defect is detected by the clearer 17, the control section 25 operates the cutter 16 to cut the yarn 20.

[0042] When the yarn 20 is disconnected between the yarn supplying section 6 and the yarn accumulating device 18, the control section 25 performs appropriate control on the upstream yarn blowing off section 11, the upstream yarn catching section 14, the downstream yarn blowing off section 48, the downstream yarn catching section 12, the yarn joining device 13, and the like to join the yarn 20 on the yarn supplying section 6 side and the

yarn 20 on the yarn accumulating device 18 side.

[0043] The control sections 25 arranged individually for each of the winder units 2 are capable of communicating with the main control device 3. This feature enables the main control device 3 to centrally manage the operations of the plural winder units 2 equipped in the automatic winder 1.

[0044] The yarn accumulating device 18 is explained next with reference to FIG. 3. FIG. 3 is a partial cross-sectional side view of the yarn accumulating device 18 and the downstream yarn blowing off section 48.

[0045] As mentioned above, the yarn accumulating device 18 includes the yarn accumulating roller 32 and the roller driving motor 33.

[0046] The yarn accumulating roller 32 is formed as a substantially cylindrical member and is configured so as to enable the yarn 20 to be accumulated by winding the yarn 20 on an outer circumferential surface thereof. The roller driving motor 33 drives the yarn accumulating roller 32 to rotate about an axis thereof. In the following explanation, the side of the yarn accumulating roller 32 that is near the roller driving motor 33 shall be referred to as a base end side and the side opposite to the base end side shall be referred to as a tip end side.

[0047] The yarn accumulating device 18 applies tension on the yarn 20 that is further upstream (the yarn supplying bobbin 21 side) than itself by rotating the yarn accumulating roller 32 with the yarn 20 wound thereon in the forward direction. With this action, the yarn 20 is unwound from the yarn supplying bobbin 21 and wound on the surface of the yarn accumulating roller 32. As shown in FIG. 3, the yarn 20 is guided (by a later-explained guide tube 34 arranged in the downstream yarn blowing off section 48) to the base end side of the yarn accumulating roller 32. Consequently, because the yarn 20 is successively wound, the yarn layer on the tip end side is pushed away from the base end side of the yarn accumulating roller 32. As a result, the yarn 20 on the yarn accumulating roller 32 is pushed by the yarn 20 that is freshly wound and is successively pushed to the tip end side on the surface of the yarn accumulating roller 32. In this manner, the yarn 20 is systematically wound on the outer circumferential surface of the yarn accumulating roller 32 from the base end side in a helical arrangement.

[0048] The yarn 20 on the yarn accumulating roller 32 is pulled downstream via a pulling guide 37 arranged on a line that extends from the central axis of the yarn accumulating roller 32. By pulling the yarn 20 along the line that extends from the central axis of the yarn accumulating roller 32, the yarn 20 can be pulled from the yarn accumulating roller 32 regardless of a rotational state of the yarn accumulating roller 32. That is, the package forming section 8 can unwind the yarn 20 from the yarn accumulating roller 32 and wind the yarn 20 to form the package 30 whether the yarn accumulating roller 32 is rotating in the forward direction or the reverse direction or not rotating at all.

[0049] The yarn accumulating device 18 serves to prevent the propagation of any change in the tension on the yarn 20 that has been unwound from the yarn supplying bobbin 21 to the package forming section 8 side. In this manner, a change in the tension on the yarn 20 being supplied to the package forming section 8 is suppressed, and a good quality package 30 can be formed.

[0050] A concrete structure for generating the compressed air current in the downstream yarn blowing off section 48 is explained below with reference to FIG. 3.

[0051] As shown in FIG. 3, the downstream yarn blowing off section 48 includes the guide tube 34 that is hollow and through which the yarn 20 can be passed. An air blowout nozzle 49 that opens into an inner wall of the guide tube 34 is formed in the guide tube 34. The air blowout nozzle 49 is connected to a compressed air source 46 via appropriate piping. A solenoid valve 51 is arranged between the compressed air source 46 and the air blowout nozzle 49. The solenoid valve 51 is electrically connected to the control section 25. When the control section 25 performs control to open the solenoid valve 51, compressed air is blown from the air blowout nozzle 49 toward the inside of the guide tube 34 and the yarn 20 is blown away toward the yarn guiding member 60 side.

[0052] A concrete structure for generating the compressed air current in the upstream yarn blowing off section 11 and the blowing off assisting section 28 is explained below with reference to FIG. 4. FIG. 4 is a cross-sectional side view of the upstream yarn blowing off section 11 and the blowing off assisting section 28.

[0053] As shown in FIG. 4, the upstream yarn blowing off section 11 includes a hollow tube 41 through which the yarn 20 can be passed. An air blowout nozzle 44 that opens toward downstream of the yarn path is formed in the tube 41. Preferably, the air blowout nozzle 44 is arranged parallel to the yarn path and ends on the upper surface of a step facing downstream, which is formed by an increase of the diameter of the hollow tube 41 in the downstream direction. The air blowout nozzle 44 is connected to the compressed air source 46 via appropriate piping. A solenoid valve 45 is arranged between the compressed air source 46 and the air blowout nozzle 44. The solenoid valve 45 is electrically connected to the control section 25. When the control section 25 performs control to open the solenoid valve 45, compressed air is blown from the air blowout nozzle 44 downstream toward the inside of the tube 41 and the yarn 20 is blown off to the upstream yarn catching section 14 side (yarn accumulating device 18 side).

[0054] The blowing off assisting section 28 includes a nozzle member 29 that is arranged below the yarn supplying section 6. An air blowout nozzle 31 is formed in the nozzle member 29.

[0055] As shown in FIG. 4, a through-type shaft hole 21a is formed in a core member of the yarn supplying bobbin 21. The yarn supplying bobbin 21 can be supported in an upright posture by inserting a lug of the conveying

tray 26 into the lower end of the shaft hole 21a. A through-type communicating hole 26a is also formed in the conveying tray 26. When the yarn supplying bobbin 21 is supported on the conveying tray 26, the communicating hole 26a of the conveying tray 26 and the shaft hole 21a of the yarn supplying bobbin 21 are connected.

[0056] The opening of the air blowout nozzle 31 formed in the nozzle member 29 is arranged so as to face, from the lower side, the lower end of the communicating hole 26a of the conveying tray 26 when the yarn supplying bobbin 21 is set in the yarn supplying section 6.

[0057] The air blowout nozzle 31 is connected to the compressed air source 46 via appropriate piping. A solenoid valve 52 is arranged at a position between the compressed air source 46 and the air blowout nozzle 31. The solenoid valve 52 is electrically connected to the control section 25. When the control section 25 performs control to open the solenoid valve 52, compressed air is blown from the air blowout nozzle 31, via the communicating hole 26a and the shaft hole 21a, from upper end (tip end) of the yarn supplying bobbin 21 toward the upstream yarn blowing off section 11.

[0058] With respect to a new yarn supplying bobbin 21 fed to the yarn supplying section 6, a process of unwinding of a predetermined amount of the yarn 20 from the yarn supplying bobbin 21 and the guiding of the yarn end of the yarn 20 from the upper end of the yarn supplying bobbin 21 into the shaft hole 21a is performed beforehand in the yarn supplying bobbin feeder 4. Accordingly, by operating the blowing off assisting section 28, the yarn end is easily blown up and conveyed to the upstream yarn blowing off section 11, and the upstream yarn blowing off section 11 blows off the yarn end further to the upstream yarn catching section 14 side.

[0059] The operations of catching the yarn ends and joining the yarn ends performed in the winder unit 2 are explained below.

[0060] When the yarn 20 on the yarn accumulating device 18 side and the yarn 20 on the yarn supplying bobbin 21 side are disconnected because of yarn breakage or cutting of the yarn 20 by the cutter 16 or replacement of the yarn supplying bobbin 21 or the like, the yarn ends are caught and guided to the yarn joining device 13, and the yarn joining device 13 performs the yarn joining operation.

[0061] When a disconnection of the yarn 20 is detected, the control section 25 performs control to immediately stop the rotation of the yarn accumulating roller 32 of the yarn accumulating device 18. However, the yarn accumulating roller 32 continues to rotate due to momentum, causing the yarn end on the yarn accumulating device 18 side to be wound on the yarn accumulating roller 32.

[0062] A concrete example of the operation of guiding the yarn end to the yarn joining device 13 is explained below. First, the control section 25 performs control to cause the upstream yarn blowing off section 11 to blow off the yarn 20 on the yarn supplying section 6 side (yarn supplying bobbin 21 side) upward. When a new yarn sup-

plying bobbin 21 is fed to the yarn supplying section 6, the blowing off assisting section 28 also acts substantially simultaneously as explained above and assists in the blowing off of the yarn end performed by the upstream yarn blowing off section 11. As shown in FIG. 5, the yarn 20 blown off by the upstream yarn blowing off section 11 is sucked and caught by the upstream yarn catching section 14 that has been advanced to a position near the yarn path.

[0063] In the automatic winder 1 according to the present embodiment, the tension applying section 15 is not arranged between the upstream yarn blowing off section 11 and the upstream yarn catching section 14, but the tension applying section 15 is arranged further downstream than the upstream yarn catching section 14. In this layout, a distance from the upstream yarn blowing off section 11 to the upstream yarn catching section 14 can be shortened. Furthermore, the yarn 20 from the yarn supplying bobbin 21 that is blown off by the upstream yarn blowing off section 11 does not get caught in the comb teeth or the like of the tension applying section 15. Accordingly, the yarn 20 conveyed by the upstream yarn blowing off section 11 is reliably caught by the upstream yarn catching section 14, leading to a smooth start of the yarn joining operation performed by the yarn joining device 13, and improved production efficiency of the package 30.

[0064] Furthermore, the upstream yarn catching section 14 is configured to approach and retract from the yarn path by the advancement and retraction driving section 47. When the yarn 20 from the yarn supplying bobbin 21 is blown off by the upstream yarn blowing off section 11, the control section 25 controls the advancement and retraction driving section 47 to move the upstream yarn catching section 14 to a position (near the yarn path) at which the upstream yarn catching section 14 can catch the yarn 20 easily. With this control, a catching success rate of the yarn 20 can be further improved. After the yarn 20 is caught by the upstream yarn catching section 14, the control section 25 controls the advancement and retraction driving section 47 to move the upstream yarn catching section 14 to a position that is separated from the yarn path. With this control, as shown in FIG. 6, the caught yarn 20 can be smoothly guided to the yarn joining device 13.

[0065] During normal winding, the upstream yarn catching section 14 generates the suction air current on the tip end thereof while being positioned at a position that is separated from the yarn path. Accordingly, when the yarn 20 is cut by the cutter 16, the yarn end formed on the yarn supplying bobbin 21 side due to the cutting of the yarn 20 is immediately sucked and caught by the upstream yarn catching section 14. In this instance, the blowing off of the yarn by the upstream yarn blowing off section 11 becomes unnecessary.

[0066] Around the time when the yarn end on the yarn supplying bobbin 21 side is guided to the yarn joining device 13, the control section 25 performs control to

cause reverse rotation of the yarn accumulating roller 32 of the yarn accumulating device 18, blow compressed air in the downstream yarn blowing off section 48, and generate the air current. By this action, the yarn end wound in the yarn accumulating device 18 is unwound, sucked and caught by the downstream yarn blowing off section 48, and is blown away by the downstream yarn blowing off section 48. The yarn 20 is conveyed along the yarn guiding member 60 and sucked and caught by the downstream yarn catching section 12. Substantially simultaneously with the above action, the yarn 20 is pulled outside from the yarn guiding member 60 via the not shown slit formed in the yarn guiding member 60. With this action, as shown in FIG. 6, the yarn 20 on the yarn accumulating device 18 side is guided and introduced into the yarn joining device 13. When the yarn 20 on the yarn accumulating device 18 side is guided to the yarn joining device 13, the control section 25 performs control to stop the reverse rotation of the yarn accumulating roller 32.

[0067] In this state, the control section 25 controls the operation of the yarn joining device 13 to join the yarn 20 on the yarn supplying bobbin 21 side caught by the upstream yarn catching section 14 and the yarn 20 on the yarn accumulating device 18 side caught by the downstream yarn catching section 12. When the yarn joining operation ends, the control section 25 once again starts the forward rotation of the yarn accumulating roller 32 and resumes winding of the yarn 20 in the yarn accumulating device 18.

[0068] In this manner, even if the yarn 20 is disconnected between the yarn supplying bobbin 21 and the yarn accumulating device 18, winding of the yarn 20 to form the package 30 by the package forming section 8 can be continued without interruption. That is, in the automatic winder 1 according to the present embodiment, the yarn accumulating device 18 is arranged between the yarn supplying section 6 and the package forming section 8, and a certain amount of the yarn 20 is accumulated in the yarn accumulating device 18. The package forming section 8 is configured to wind the yarn 20 accumulated in the yarn accumulating device 18. Hence, even if the supply of the yarn 20 from the yarn supplying bobbin 21 is interrupted for some reason (for example, when catching of the yarn ends and joining operation are being performed), winding of the yarn 20 to form the package 30 can be continued. Furthermore, during the yarn joining operation, the yarn end is pulled from the yarn accumulating device 18 and not from the package 30, and thereby the disturbance of the yarn 20 present on the surface of the package 30 can be prevented.

[0069] However, there is a limit to the amount of the yarn 20 that can be accumulated in the yarn accumulating device 18. Hence, to avoid interruption in winding of the yarn 20 by the package forming section 8, it is necessary to complete the above-explained operations of catching the yarn ends and joining the yarn ends before all the yarn 20 in the yarn accumulating device 18 is wound on

the package forming section 8 side. This is accomplished by the automatic winder 1 according to the present embodiment in which the catching success rate of the yarn end from the yarn supplying bobbin 21 by the upstream yarn catching section 14 is improved as explained above, and furthermore, the yarn 20 on the yarn supplying bobbin 21 side does not get tangled in the tension applying section 15. Consequently, a frequency of re-catching or the like is reduced, the yarn joining operation by the yarn joining device 13 is performed smoothly, and accumulating of the yarn 20 can be resumed quickly. Hence, the function of the yarn joining device 13 can be adequately demonstrated and the production efficiency of the package 30 by the package forming section 8 and a product quality can be improved.

[0070] As explained above, the winder unit 2 according to the present embodiment includes the yarn supplying section 6, the yarn accumulating device 18, the tension applying section 15, the upstream yarn blowing off section 11, the upstream yarn catching section 14, and the yarn joining device 13. The yarn supplying section 6 supports the yarn supplying bobbin 21 with the yarn 20 wound thereon. The yarn accumulating device 18 winds the yarn 20 from the yarn supplying bobbin 21 that is supported in the yarn supplying section 6. The tension applying section 15 applies tension on the yarn 20 that is being wound in the yarn accumulating device 18. The upstream yarn blowing off section 11 conveys the yarn end from the yarn supplying bobbin 21 toward the yarn accumulating device 18 by the action of the air current. The upstream yarn catching section 14 catches the yarn end conveyed by the upstream yarn blowing off section 11. The yarn joining device 13 joins the yarn 20 from the yarn supplying bobbin 21 that is caught by the upstream yarn catching section 14 and the yarn 20 that is wound in the yarn accumulating device 18. The upstream yarn catching section 14 is configured to convey the yarn end from the newly replaced yarn supplying bobbin 21 that is supported in the yarn supplying section 6 toward the yarn accumulating device 18 by the action of the air current. Downstream of the upstream yarn blowing off section 11 on the yarn path, the yarn joining device 13, the upstream yarn catching section 14, the tension applying section 15, and the yarn accumulating device 18 are arranged sequentially from upstream.

[0071] With this configuration, a distance for which the yarn 20 needs to be blown off by the upstream yarn blowing off section 11 can be shortened because the tension applying section 15 is not arranged between the upstream yarn blowing off section 11 and the upstream yarn catching section 14. Consequently, the catching success rate of the yarn 20 by the upstream yarn catching section 14 can be improved. Furthermore, when the yarn end of the newly replaced yarn supplying bobbin 21 is blown off by the upstream yarn blowing off section 11, the yarn 20 does not get caught in the tension applying section 15, and the yarn end can be reliably caught by the upstream yarn catching section 14. Hence, the yarn joining oper-

ation can be smoothly performed by the yarn joining device 13, and the production efficiency of the package 30 can be improved.

[0072] In the winder unit 2 according to the present embodiment, the upstream yarn catching section 14 can be advanced toward and retracted from the yarn path.

[0073] With this configuration, when the upstream yarn blowing off section 11 blows off the yarn end from the yarn supplying bobbin 21, the blown off yarn end can be easily caught by the upstream yarn catching section 14 that has been advanced to a position near the yarn path. On the other hand, when retracted to a position that is separated from the yarn path, the upstream yarn catching section 14 can be kept from hindering winding of the yarn 20 by the yarn accumulating device 18.

[0074] In the winder unit 2 according to the present embodiment, the yarn accumulating device 18 is configured to wind the yarn 20 supplied by the yarn supplying section 6. The winder unit 2 further includes the package forming section 8 that pulls the yarn 20 from the yarn accumulating device 18 and winds the pulled yarn 20 to form the package 30.

[0075] With this configuration, the effect of a change in the tension while the yarn 20 is being unwound from the yarn supplying bobbin 21 is absorbed by the yarn accumulating device 18. Furthermore, yarn joining can be performed without having to reverse rotate or stop the rotation of the package 30 in the package forming section 8. Consequently, a uniform tension can be maintained on the yarn 20 that is wound by the package forming section 8, and a good quality package 30 can be formed. Furthermore, the yarn 20 from the package 30 is not sucked and caught every time the yarn joining operation is performed. Consequently, the disturbance of the yarn 20 present on the surface of the package 30 can be prevented.

[0076] In the winder unit 2 according to the present invention, the clearer 17 that detects defects in the yarn 20 is arranged between the yarn accumulating device 18 and the tension applying section 15 and near the tension applying section 15.

[0077] With this configuration, the clearer 17 can detect the defect in the portion of the yarn 20, which is held by the tension applying section 15, that is near a point where tension is applied. Hence, the defect can be detected by the clearer 17 in the portion of the yarn 20 that is not affected by disturbances, such as shaking or the like, and where the tension is stabilized. Consequently, the defect can be accurately detected.

[0078] The winder unit 2 according to the present embodiment further includes the cutter 16 and the accumulating side yarn end catching device 50. The cutter 16 cuts the yarn 20 when the clearer detects a defect in the yarn 20. The accumulating side yarn end catching device 50 pulls the yarn end from the yarn accumulating device 18 that is rotating in the reverse direction when the yarn 20 is cut by the cutter 16. The accumulating side yarn end catching device 50 includes the downstream yarn

blowing off section 48, the downstream yarn catching section 12, and the yarn guiding member 60. The downstream yarn blowing off section 48 sucks and catches the yarn end wound in the yarn accumulating device 18, and blows away the caught yarn end by the action of the air current. The yarn guiding member 60 guides the yarn end that is blown away by the downstream yarn blowing off section 48. The downstream yarn catching section 12 is arranged upstream of the yarn joining device 13 on the yarn path. The yarn joining device 13 is configured to join the yarn 20 from the yarn supplying bobbin 21 caught by the upstream yarn catching section 14 and the yarn 20 from the yarn accumulating device 18 caught by the downstream yarn catching section 12. The yarn guiding member 60 detours the yarn end around the tension applying section 15 and the yarn joining device 13 and guides the yarn end to the downstream yarn catching section 12.

[0079] With this configuration, the yarn end on the yarn accumulating device 18 side can be quickly pulled to the yarn joining device 13 side by the action of the air current. Furthermore, the yarn end on the yarn accumulating device 18 side is detoured around the tension applying section 15 and the yarn joining device 13 before being caught by the downstream yarn catching section 12. Consequently, the yarn end can be reliably caught by the downstream yarn catching section 12 without the yarn 20 from the yarn accumulating device 18 side getting caught in the tension applying section 15 or the like. Hence, the yarn joining operation by the yarn joining device 13 can be started smoothly and the production efficiency of the package 30 can be improved.

[0080] In the winder unit 2 according to the present embodiment, the yarn supplying section 6 is configured to support the yarn supplying bobbin 21 that is set on the conveying tray 26. The yarn supplying section 6 includes the blowing off assisting section 28 that conveys the yarn end from the yarn supplying bobbin 21 toward the upstream yarn blowing off section 11 by the action of the air current.

[0081] With this configuration, in the yarn supplying section 6 that is of a replaceable tray type, the yarn end is received by the upstream yarn blowing off section 11 by the action of the air current generated by the blowing off assisting section 28 and conveyed to and caught by the upstream yarn catching section 14.

[0082] The automatic winder 1 according to the present embodiment includes the winder unit 2.

[0083] With this configuration, the automatic winder 1 that has a high winding efficiency of the yarn 20 can be realized.

[0084] Exemplary embodiments of the present invention are explained above. The structure explained above however can be modified as follows.

[0085] The yarn accumulating device 18 can be omitted from the above embodiment and the yarn 20 from the yarn supplying section 6 can be directly wound by the package forming section 8. In this case, when the

yarn 20 is disconnected, the yarn 20 can be caught from the package forming section 8 and guided to the yarn joining device 13. The package forming section 8 corresponds to the yarn accumulating device in this case. By rotating the package 30 in the package forming section 8 in the winding direction or reverse direction, the yarn 20 from the package 30 side can be pulled, or allowed to be caught by the downstream yarn catching section 12 and guided to the yarn joining device 13.

[0086] Instead of the accumulating side yarn end catching device 50 that conveys the yarn end from the yarn accumulating device 18 by the action of the air current, a moving-type yarn end catching device can be used that conveys the yarn end by, for example, nipping the yarn end and moving to the downstream yarn catching section 12 with the nipped yarn end.

[0087] The yarn supplying section 6 is not limited to the tray transport type explained in the present embodiment. As shown in FIG. 7, a winder unit 200 can be configured in which new yarn supplying bobbins 21 can be fed from a magazine-type bobbin feeder 35. In this configuration, when the bobbin feeder 35 feeds a new yarn supplying bobbin 21 into the yarn supplying section 6, the bobbin feeder 35 can pull the yarn end from the yarn supplying bobbin 21 and convey the yarn end to the upstream yarn blowing off section 11. The blowing off assisting section 28 can be omitted in this case.

[0088] In the package forming section 8, the traverse drum 24 is cited as an example of a mechanism that can be used to traverse the yarn 20. Other traversing methods, such as using an arm-type or belt-type traverse mechanism, can be adopted.

[0089] According to one aspect of the present invention, a yarn winding device includes a yarn supplying section, a yarn accumulating device, a tension applying section, a yarn end blowing off section, a supplied yarn catching section, a yarn joining device, and a package forming section. The yarn supplying section supports a yarn supplying bobbin with a yarn wound thereon. The yarn accumulating device winds and accumulates the yarn from the yarn supplying bobbin supported by the yarn supplying section. The package forming section pulls the yarn from the yarn accumulating device and winds the pulled yarn to form a package. The tension applying section applies tension on the yarn being wound by the yarn accumulating device. The supplied yarn catching section catches a yarn end that is conveyed from the yarn supplying section. The yarn joining device joins the yarn from the yarn supplying bobbin caught by the supplied yarn catching section and the yarn that is wound in the yarn accumulating device. Downstream of the yarn supplying section on a yarn path, the yarn joining device, the supplied yarn catching section, the tension applying section, and the yarn accumulating device are sequentially arranged from upstream. The yarn end blowing off section that conveys the yarn end from the yarn supplying bobbin supported in the yarn supplying section toward the yarn accumulating device is arranged between the yarn sup-

plying section and the yarn joining device. When the yarn supplying bobbin is replaced in the yarn supplying section, the yarn end blowing off section conveys the yarn end of the new yarn supplying bobbin that is supported in the yarn supplying section toward the yarn accumulating device by the action of an air current. The supplied yarn catching section catches the yarn end conveyed by the yarn end blowing off section.

[0090] With the above configuration, a distance for which the yarn needs to be blown off by the yarn end blowing off section can be shortened because the tension applying section is not arranged between the yarn end blowing off section and the supplied yarn catching section. Consequently, a success rate of the supplied yarn catching section in catching the blown away yarn can be improved. Furthermore, when the yarn end of a newly replaced yarn supplying bobbin is blown off by the yarn end blowing off section, the yarn end can be reliably caught by the supplied yarn catching section without the yarn getting caught in the tension applying section. Hence, a yarn joining operation by the yarn joining device can be started smoothly and a winding efficiency can be improved.

[0091] In the yarn winding device, it is preferable that the supplied yarn catching section is arranged such that it can be advanced to and retracted from the yarn path.

[0092] With this configuration, when the yarn end blowing off section blows off the yarn end from the yarn supplying bobbin, the supplied yarn catching section can easily catch the blown yarn end by being advanced to a position near the yarn path. On the other hand, by being retracted to a position that is separated from the yarn path, the supplied yarn catching section can be kept from hindering winding of the yarn by the yarn accumulating device.

[0093] It is preferable that the yarn winding device has the following configuration. That is, the yarn accumulating device accumulates the yarn by winding the yarn supplied by the yarn supplying section.

[0094] With this configuration, the effect of a change in the tension while the yarn is being unwound from the yarn supplying bobbin is absorbed by the yarn accumulating device. Furthermore, yarn joining can be performed without having to reverse rotate or stop the rotation of the package in the package forming section. Consequently, a uniform tension can be maintained on the yarn that is wound by the package forming section, and a good quality package can be formed. Furthermore, the yarn from the package is not sucked and caught every time the yarn joining operation is performed. Consequently, the disturbance of the yarn present on the surface of the package can be prevented.

[0095] The yarn winding device further includes a yarn defect detecting device that detects a defect of the yarn and that is arranged between the yarn accumulating device and the tension applying section, at a position near the tension applying section.

[0096] With this configuration, detection of the defect

is performed in the portion of the yarn that is held by the tension applying section and where tension is applied. Hence, the defect can be detected in the portion of the yarn that is not affected by disturbances, such as shaking or the like, and where the tension is stabilized. Consequently, the defect can be accurately detected.

[0097] It is preferable that the yarn winding device has the following configuration. That is, the yarn winding device includes a cutting section and a yarn accumulating device side yarn end catching device. The cutting section cuts the yarn when the yarn defect detecting device detects a defect in the yarn. The yarn accumulating device side yarn end catching device pulls the yarn end from the yarn accumulating device that is rotating in a direction opposite to a winding direction, when the cutting section cuts the yarn. The yarn accumulating device side yarn end catching device includes a yarn end blowing away section, a yarn guiding member, and a winding yarn catching section. The yarn end blowing away section sucks and catches the yarn end wound in the yarn accumulating device and blows away the caught yarn end by the action of an air current. The yarn guiding member guides the yarn end blown away by the yarn end blowing away section. The winding yarn catching section catches the yarn end guided by the yarn guiding member. The winding yarn catching section is arranged upstream of the yarn joining device on the yarn path. The yarn joining device joins the yarn from the yarn supplying bobbin that is caught by the supplied yarn catching section and the yarn from the yarn accumulating device that is caught by the winding yarn catching section. The yarn guiding member detours the yarn end around the tension applying section and the yarn joining device to guide the yarn end to the winding yarn catching section.

[0098] With this configuration, the yarn end on the yarn accumulating device side can be quickly pulled to the yarn joining device side by the action of the air current. Furthermore, the yarn end on the yarn accumulating device side is detoured around the tension applying section and the yarn joining device before being caught by the winding yarn catching section. Consequently, the yarn end can be reliably caught by the winding yarn catching section without the yarn from the yarn accumulating device side getting caught in the tension applying section or the like. Hence, the yarn joining operation by the yarn joining device can be started smoothly and the winding efficiency can be improved.

[0099] It is preferable that the yarn winding device has the following configuration. That is, the yarn supplying section supports the yarn supplying bobbin that is set on a conveying tray. Moreover, the yarn supplying section includes a blowing off assisting section that conveys the yarn end from the yarn supplying bobbin toward the yarn end blowing off section by the action of an air current.

[0100] With this configuration, in the yarn supplying section that is of a replaceable tray type, the yarn end is received by the yarn end blowing off section by the action of the air current generated by the blowing off assisting

section and conveyed to and caught by the supplied yarn catching section.

[0101] According to another aspect of the present invention, a yarn winding machine equipped with the above yarn winding device is provided.

[0102] With this configuration, a yarn winding machine with a high yarn winding efficiency can be provided.

[0103] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

Claims

1. A yarn winding device (2) comprising:

a yarn supplying section (6) that supports a yarn supplying bobbin (21) with a yarn wound thereon;

a yarn accumulating device (18) that winds and accumulates the yarn from the yarn supplying bobbin (21) supported by the yarn supplying section (6);

a package forming section (8) that pulls the yarn from the yarn accumulating device (18) and winds the pulled yarn to form a package;

a tension applying section (15) that applies tension on the yarn being wound by the yarn accumulating device (18);

a supplied yarn catching section (14) that catches a yarn end that is conveyed from the yarn supplying section (6);

a yarn joining device (13) that joins the yarn from the yarn supplying bobbin (21) caught by the supplied yarn catching section (14) and the yarn that is wound in the yarn accumulating device (18), **characterized in that**

downstream of the yarn supplying section (6) on a yarn path, the yarn joining device (13), the supplied yarn catching section (14), the tension applying section (15), and the yarn accumulating device (18) are sequentially arranged from upstream.

2. The yarn winding device (2) as claimed in Claim 1, further comprising a yarn end blowing off section (11) that conveys the yarn end from the yarn supplying bobbin (21) supported in the yarn supplying section (6) toward the yarn accumulating device (18) and that is arranged between the yarn supplying section (6) and the yarn joining device (13), **characterized in that**

when the yarn supplying bobbin (21) is replaced in the yarn supplying section (6), the yarn end blowing

off section (11) conveys the yarn end of the new yarn supplying bobbin (21) that is supported in the yarn supplying section (6) toward the yarn accumulating device (18) by the action of an air current, and the supplied yarn catching section (14) catches the yarn end conveyed by the yarn end blowing off section (11).

3. The yarn winding device (2) as claimed in Claim 1 or Claim 2, **characterized in that** the supplied yarn catching section (14) is arranged such that the supplied yarn catching section (14) can be advanced to and retracted from the yarn path.
4. The yarn winding device (2) as claimed in any one of Claims 1 to 3, further **characterized by** comprising a yarn defect detecting device (17) that detects a defect of the yarn and that is arranged between the yarn accumulating device (10) and the tension applying section (15), near the tension applying section (15).
5. The yarn winding device (2) as claimed in claim 4, further comprising:
 - a cutting section (16) that cuts the yarn when the yarn defect detecting device (17) detects a defect in the yarn; and
 - a yarn accumulating device side yarn end catching device (50) that pulls the yarn end from the yarn accumulating device (18) that is rotating in a direction opposite to a winding direction, when the cutting section (16) cuts the yarn, **characterized in that** the yarn accumulating device side yarn end catching device (50) includes
 - a yarn end blowing away section (48) that sucks and catches the yarn end wound in the yarn accumulating device (18) and blows away the caught yarn end by the action of an air current;
 - a yarn guiding member (60) that guides the yarn end blown away by the yarn end blowing away section (48); and
 - a winding yarn catching section (12) that catches the yarn end guided by the yarn guiding member (60),
 wherein the winding yarn catching section (12) is arranged upstream of the yarn joining device (13) on the yarn path, the yarn joining device (13) joins the yarn from the yarn supplying bobbin (21) that is caught by the supplied yarn catching section (14) and the yarn from the yarn accumulating device (18) that is caught by the winding yarn catching section (12), and the yarn guiding member (60) detours the yarn end around the tension applying section (15) and the yarn joining device (13) to guide the yarn

end to the winding yarn catching section (12).

6. The yarn winding device (2) as claimed in any one of Claims 1 to 5, **characterized in that** the yarn supplying section (6) supports the yarn supplying bobbin (21) that is set on a conveying tray (26), and the yarn supplying section (6) includes a blowing off assisting section (28) that conveys the yarn end from the yarn supplying bobbin (21) toward the yarn end blowing off section (21) by the action of an air current.
7. A yarn winding machine comprising the yarn winding device (2) as claimed in any one of Claims 1 to 6.

FIG.1

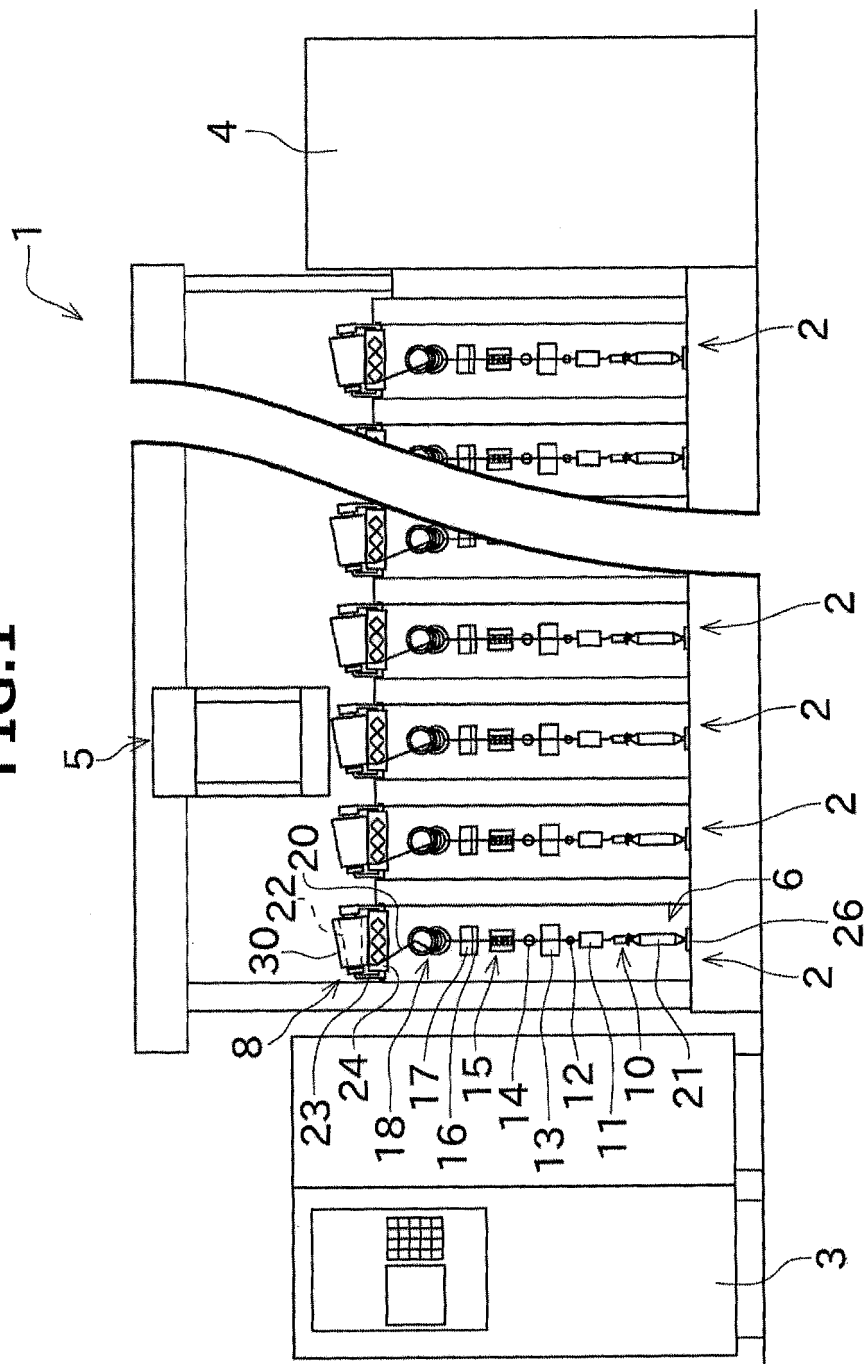


FIG.2

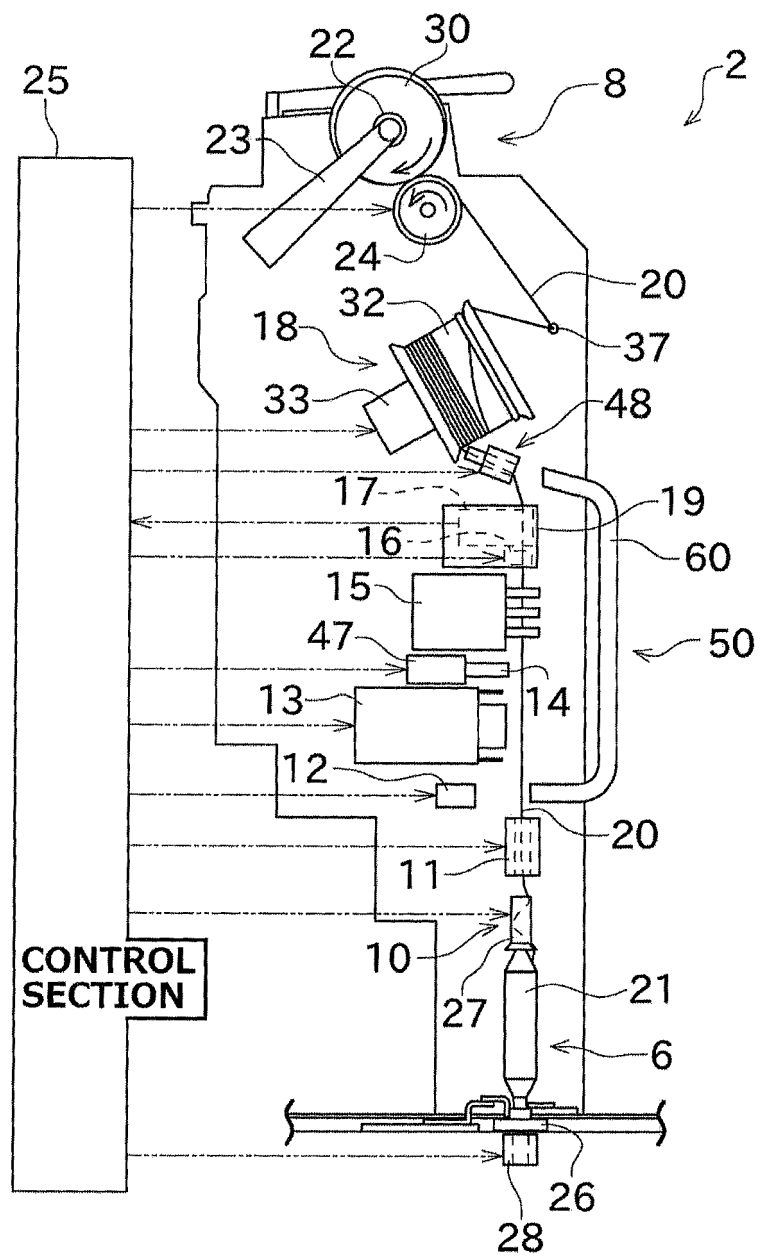


FIG.3

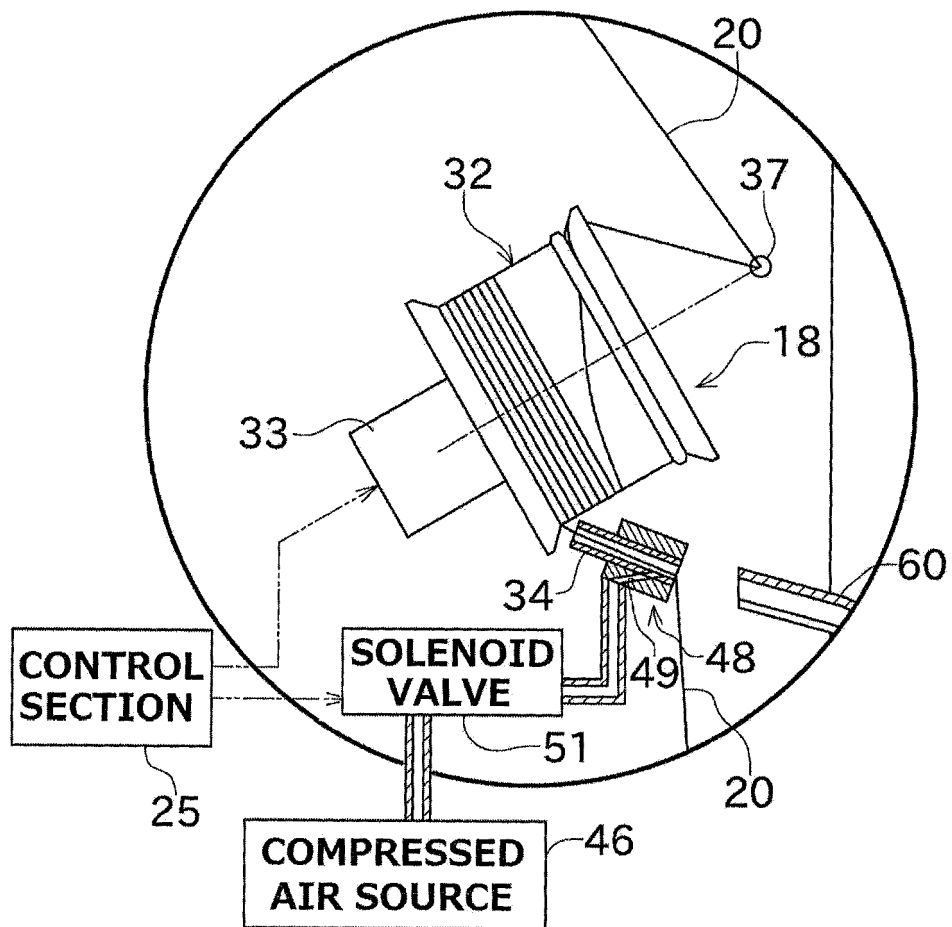


FIG.4

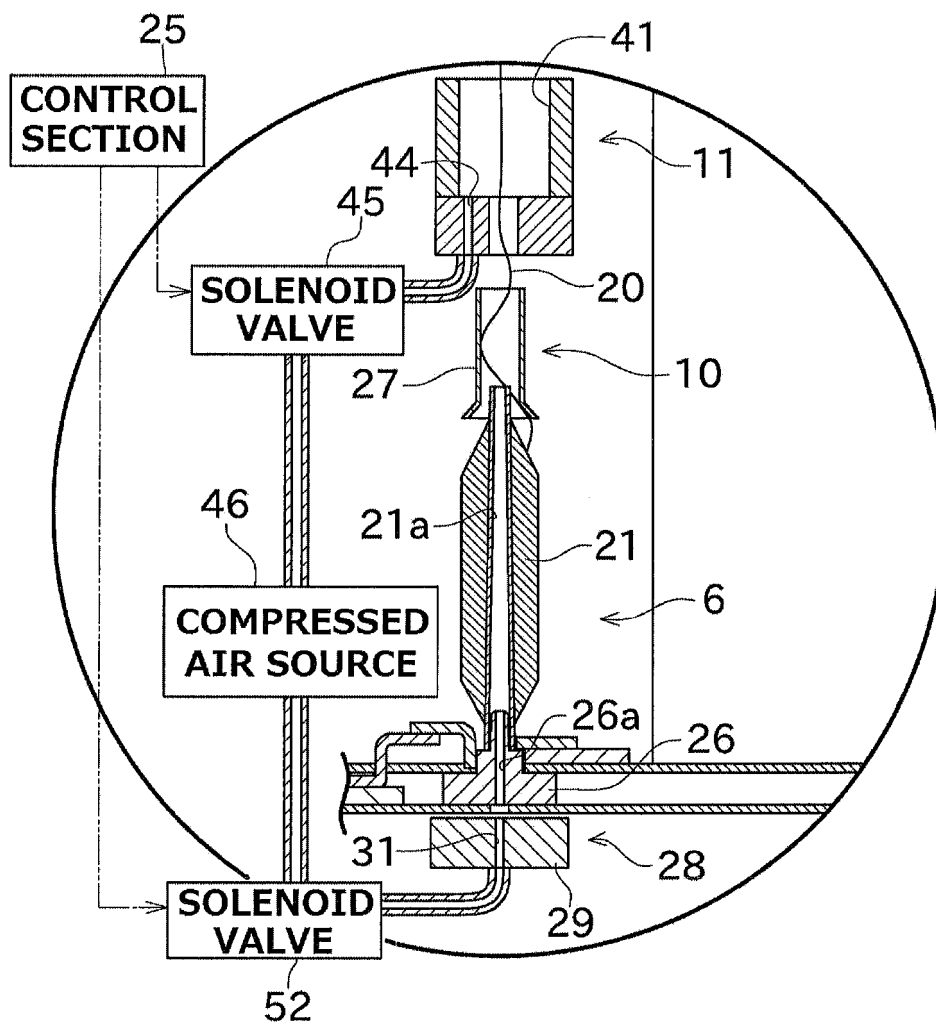


FIG.5

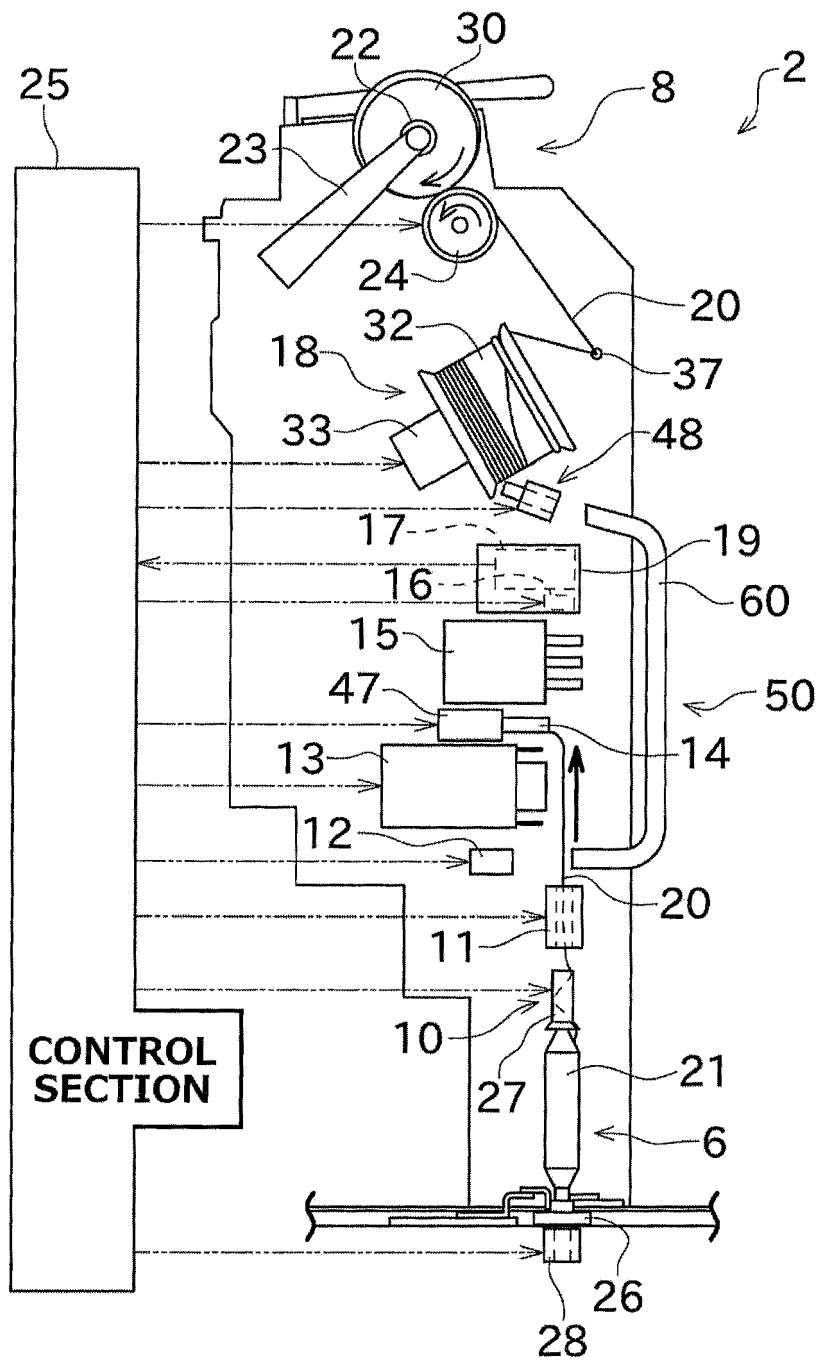


FIG.6

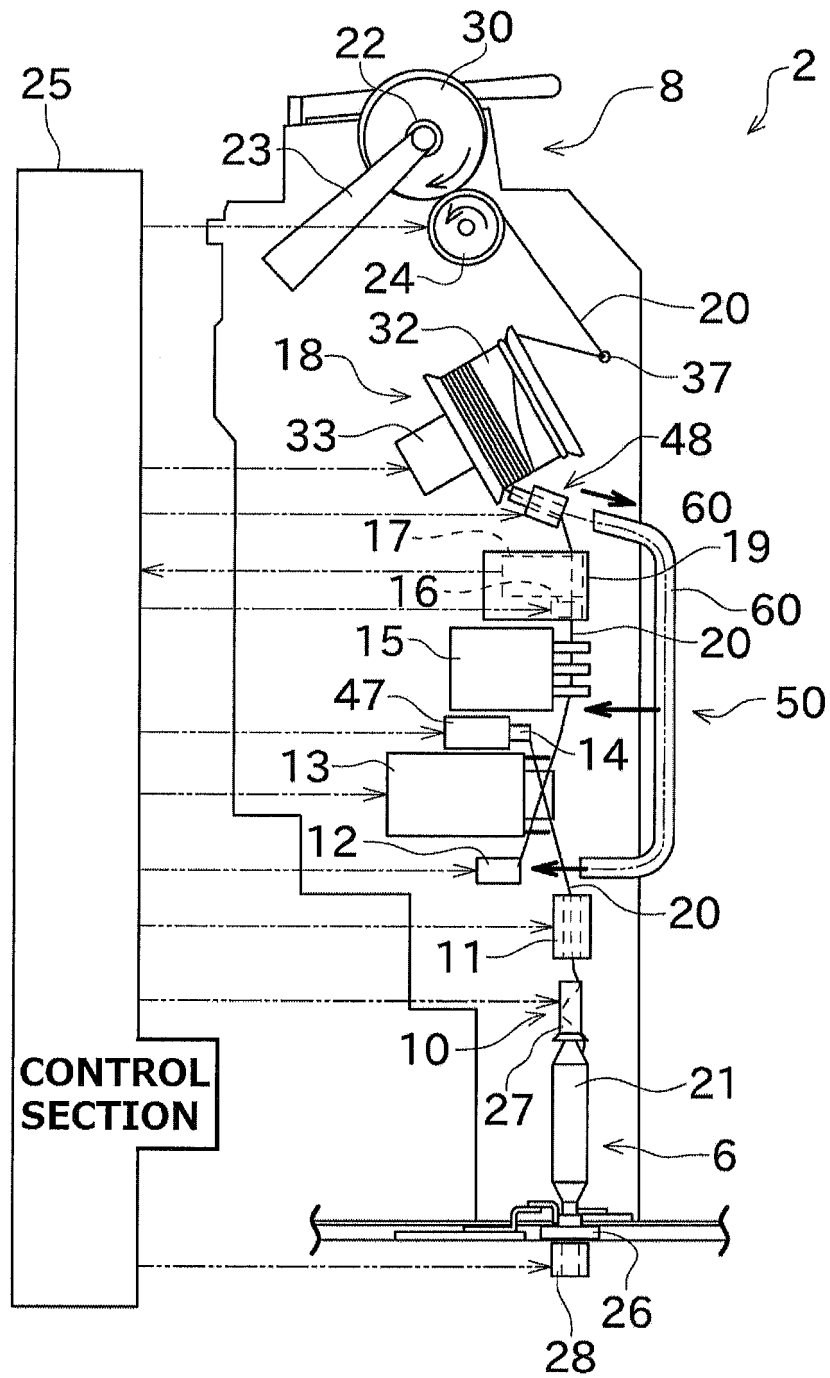


FIG.7

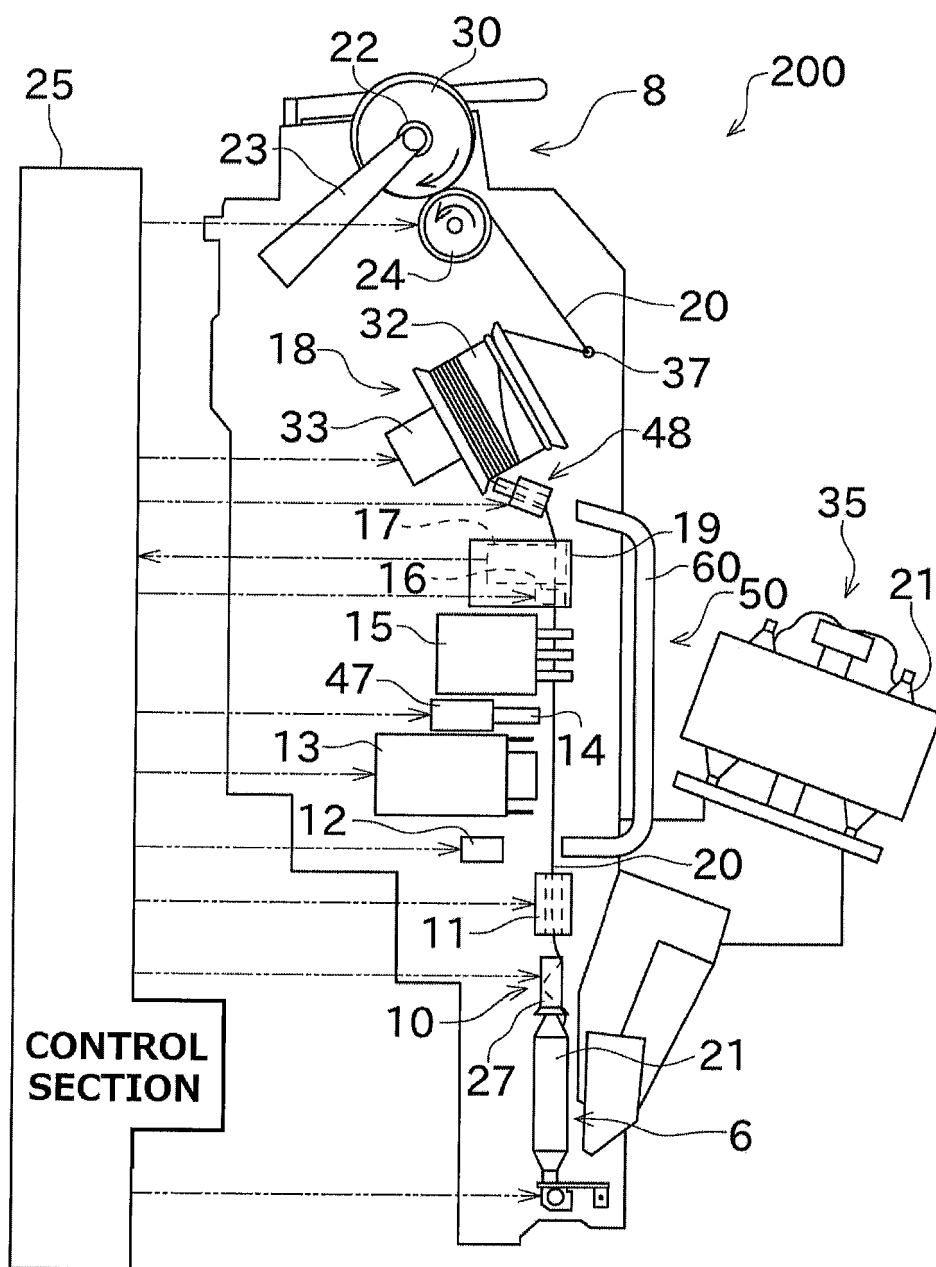
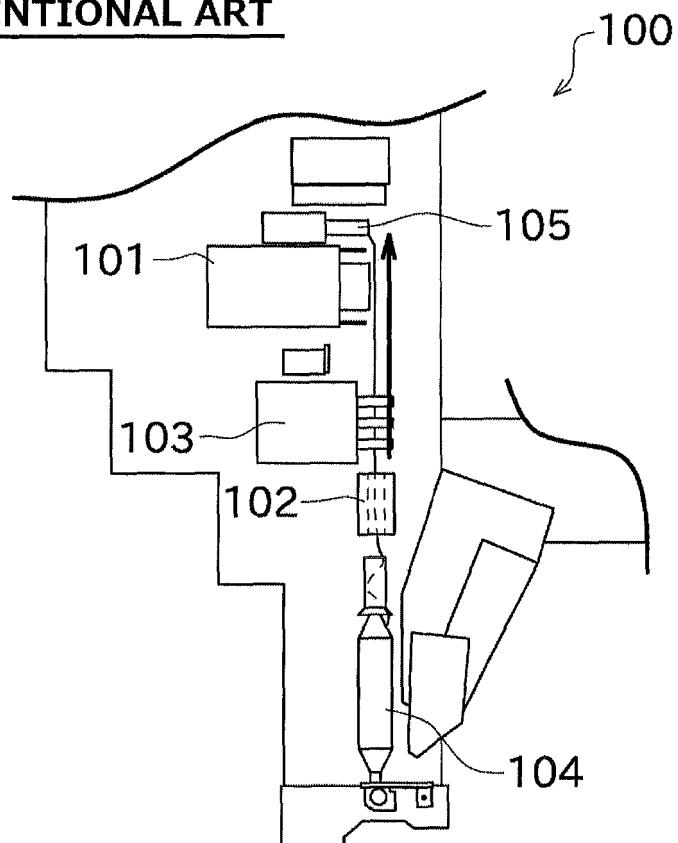


FIG.8

CONVENTIONAL ART





EUROPEAN SEARCH REPORT

Application Number
EP 15 17 0163

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	JP 2012 020853 A (MURATA MACHINERY LTD) 2 February 2012 (2012-02-02) * figure 1 * -----	1-7	INV. B65H51/22 B65H59/10 B65H67/08
			TECHNICAL FIELDS SEARCHED (IPC)
			B65H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 12 February 2016	Examiner Pussemier, Bart
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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12-02-2016

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

REFERENCES CITED IN THE DESCRIPTION

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- JP 2012020853 A [0002] [0003] [0004]