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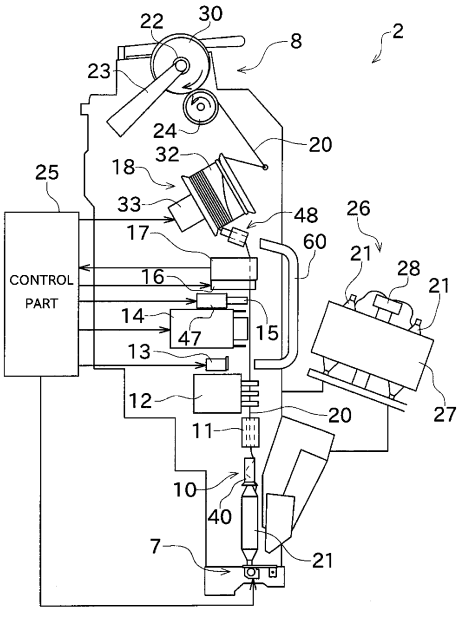
(54) BOBBIN WINDING DEVICE

(57) Provided is a yarn winding machine that is able to improve the degree of freedom in a layout and also able to guide a yarn to a yarn joining device in a short time. Means therefor is as follows. An automatic winder includes a bobbin support part (7), a yarn accumulation device (18), a winding part (8), a yarn joining device (14), and an upper yarn guide part. The bobbin support part (7) supports a yarn supply bobbin (21). The yarn accumulation device (18) accumulates a yarn (20) unwound from the yarn supply bobbin (21). The winding part (8) winds the yarn (20) accumulated on the yarn accumulation device (18), to form a package (30). The upper yarn guide part pulls out a yarn from the yarn accumulation device (18), and guides the yarn to the yarn joining device (14). The upper yarn guide part includes: a guide tube (34) that pulls out the yarn (20) accumulated on the yarn accumulation device (18) and blows off the yarn toward the bobbin support part (7) side; and an upper yarn catch part (13) that catches the yarn (20) blown off by the guide tube (34) and introduces the yarn to the yarn joining device (14).

Fig.1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a yarn winding machine. In more detail, the present invention relates to a configuration for guiding a yarn to a yarn joining device at a time of yarn joining.

BACKGROUND ART

[0002] A yarn winding machine such as an automatic winder is known in which a spun yarn wound on a yarn supply bobbin is rewound on a winding package with removal of defects of the spun yarn.

[0003] When the automatic winder rewinds the yam, a tensile force is applied to the spun yarn unwound from the yarn supply bobbin, and in this condition, the spun yam is guided through a number of yarn guides and the like to a traversing device, and the traversing device traverses the yarn and simultaneously winds the yarn on a surface of the winding package that is rotating. When the yarn supply bobbin becomes empty, this empty yarn supply bobbin is replaced with a new yarn supply bobbin, and then a yarn joining device performs yarn joining, to continue the winding of the yarn into the package.

[0004] In order that the yarn joining device performs the yarn joining, it is necessary that a yarn of the package side and a yarn of the yarn supply bobbin side are guided to the yarn joining device. Conventionally, a suction stream is generated at a distal end of a pipe-shaped yarn guide member to thereby suck and catch a yam, and then the yarn guide member is swung so that the yarn is guided to the yarn joining device.

[0005] A configuration of such a conventional automatic winder will be briefly described with reference to FIG. 19. FIG. 19 is a side view showing an outline of a winder unit 90 included in a conventional automatic winder. The winder unit 90 is configured to rewind a spun yarn 20 of a yarn supply bobbin 21 into a package 30. The winder unit 90 includes a yarn joining device 14 that performs the yarn joining, and yarn guide pipes (an upper yarn guide pipe 91, a lower yarn guide pipe 92).

[0006] The yarn guide pipes 91 and 92 are connected to a negative pressure source (not shown), and configured such that a suction stream is generated at each of a suction port 91a of the upper yarn guide pipe 91 and a suction port 92a of the lower yarn guide pipe 92. The upper yarn guide pipe 91 is configured to swing up and down about a pivot point 91b. Likewise, the lower yarn guide pipe 92 is configured to swing up and down about a pivot point 92b.

[0007] A yarn joining operation performed in the above-described conventional automatic winder will be described. In a case where the yarn positioned between the package 30 and the yarn supply bobbin 21 is discontinued because of, for example, replacement of the yarn supply bobbin 21, the suction port 92a of the lower yarn guide pipe 92 sucks and catches a yarn end of the yarn supply bobbin 21 side. Then, the upper yarn guide pipe 91 is swung up, and additionally the package 30 is rotated in a reverse direction. As a result, a yarn end is pulled out from the package 30 and sucked by the suction port 91a of the upper yarn guide pipe 91. This situation is shown in FIG. 20.

[0008] Then, as shown in FIG. 21, the upper yarn guide pipe 91, which is sucking and holding the yarn (upper yarn) of the package 30 side, is swung down. Thereby, the upper yarn of the package 30 side is introduced to the yarn joining device 14. Then, as shown in FIG. 22, the lower yarn guide pipe 92, which is sucking and holding the yarn (lower yam) of the yarn supply bobbin 21 side, is swung up. Thereby, the lower yarn of the yarn supply bobbin 21 side is introduced to the yarn joining device 14. In this condition, the yarn joining device 14 is actuated so that the yarn joining is performed between the upper yarn and the lower yam, to thereby achieve a continuous state of the yarn between the package 30 and the yarn supply bobbin 21. Performing the yarn joining in the above-described manner enables the winding of the yarn into the package 30 to be continued.

[0009] Such a conventional configuration, in which the yarn end is guided by swinging the yarn guide member (yarn guide pipes 91 and 92), involves a problem of a complicated mechanism because a mechanism for driving and swinging the yarn guide member is required. Additionally, the complicated mechanism results in less freedome in layout design. Moreover, other configuration parts have to be arranged such that they do not interfere with the yarn guide member that is swinging. In this respect as well, the layout is limited. Furthermore, it takes some time for driving and swinging the yarn guide member and guiding the yarn end. Therefore, a long time is required for the yarn joining.

[0010] In this respect, as for a configuration for guiding a yarn to a desired position, a configuration different from the above-described configuration that drives and swings the yarn guide member has been proposed.

[0011] For example, Patent Document 1 discloses a traversing bobbin winding machine including a suction nozzle that sucks in a yarn of the package side by means of negative pressure. This suction nozzle has a longitudinal slit. The yarn sucked into the suction nozzle is drawn out through the longitudinal slit, and guided to a yarn breakage remover (yarn joining device) by a yarn grip member. Since the yarn is drawn out from the suction nozzle through the longitudinal slit, the yarn sucked into the suction nozzle can be guided to the yarn joining device without swinging the suction nozzle itself.

[0012] Patent Document 2 discloses a yarn supply processing device configured such that air is ejected from a blowing nozzle to thereby generate a suction air stream in the vicinity of an inlet port of a weft-yarn measuring and accumulating device so that a yarn end is introduced into a yarn winding tube. This configuration, which generates a suction air stream by ejected air, enables the yarn end to be sucked by the suction air stream, and also enables the yarn end to be guided together with the ejected air to a desired position. Accordingly, it is not necessary to drive any member for guiding the yarn end.

[0013] In a case where the configurations disclosed in Patent Documents 1 and 2 are adopted as a yarn guiding configuration, a yarn guide member (for example, the yarn guide pipes 91 and 92 shown in FIG. 19), which largely swings, can be omitted. This would be able to simplify the structure of the device as a whole, and to improve the degree of freedom in a layout of configuration parts. This also would be able to shorten a time required for guiding the yam, as compared with a case where the yarn guide member is driven to guide the yarn.

PRIOR-ART DOCUMENTS

PATENT DOCUMENTS

[0014]

Patent Document 1: Japanese Patent Application Laid-Open No. 4-213563 (1992)
Patent Document 2: Japanese Patent Application Laid-Open No. 4-241136 (1992)

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0015] Meanwhile, in the configuration disclosed in Patent Document 1, suction air is applied to the suction nozzle having the slit to thereby suck the yarn of a traversing bobbin. In this configuration, air flows into the suction nozzle through the slit. This causes a problem that a suction force exerted at the distal end of the suction nozzle is deteriorated and therefore it is difficult to reliably suck and catch the yarn end. Additionally, in Patent Document 1, an inlet opening of the suction nozzle is enlarged up to the width of the bobbin (this is true also in the suction port 91a of the upper yarn guide pipe 91 shown in FIG. 19). The reason therefor is as follows. Where on the traverse-wound bobbin with respect to the width direction of the bobbin the yarn end to be sucked and caught will be positioned is uncertain. Therefore, in order to reliably suck and catch the yarn end, it is necessary to generate the suction air stream throughout the entire width of the traversing bobbin. However, forming such a large inlet opening results in further deterioration in the suction force of the suction nozzle.

[0016] In this respect, the configuration disclosed in Patent Document 2 includes a feather belt that unsticks the yarn end away from a weft-yarn cheese and guides the yarn end to the inlet port. This configuration merely requires the yarn end transported by the feather belt to be sucked by the inlet port of the weft-yarn measuring and accumulating device. Therefore, it is not necessary to enlarge the width of the inlet port up to the cheese width. Accordingly, the inlet port can be formed with a small opening area. This could maintain the intensity of the suction stream generated in the inlet port, and thus improve the reliability in sucking and catching the yarn. However, the feather belt has a complicated structure, because the feather belt has to be driven in a direction toward and away from the weft-yarn bobbin. Additionally, the feather belt applies scraping to a cheese surface, which may adversely affect the cheese shape. Therefore, it is not preferable to adopt the feather belt in an automatic winder, or the like, that aims to manufacture the cheese (package) itself. Furthermore, the configuration disclosed in Patent Document 2 does not include a yarn joining device, and thus it is impossible to apply Patent Document 2 directly to a yarn winding machine including a yarn joining device.

[0017] The present invention has been made in view of the circumstances described above, and a primary object of the present invention is to provide a yarn winding machine that is able to improve the degree of freedom in a layout and also able to guide a yarn to a yarn joining device in a short time.

MEANS FOR SOLVING THE PROBLEMS AND EFFECTS THEREOF

[0018] Problems to be solved by the present invention are as described above, and next, means for solveing the problems and effects thereof will be described.

[0019] In an aspect of the present invention, a yarn winding machine having the following configuration is provided. The yarn winding machine includes a bobbin support part, a yarn accumulation device, a winding part, a yarn joining device, and a yarn guide part. The bobbin support part supports a yarn supply bobbin. The yarn accumulation device accumulates a yarn unwound from the yarn supply bobbin. The winding part winds a yarn accumulated on the yarn

accumulation device, to form a package. The yarn joining device performs yarn joining between a yarn of the yarn supply bobbin side and a yarn of the yarn accumulation device side, in a case where a yarn is disconnected between the bobbin support part and the yarn accumulation device. The yarn guide part pulls out a yarn from the yarn accumulation device, and guides the yarn to the yarn joining device. The yarn guide part includes a yarn pull-out ejection part, an air ejection part, a yarn catch part, and a yarn catch air-stream generation part. The yarn pull-out ejection part pulls out a yarn accumulated on the yarn accumulation device and blows off the yarn toward the bobbin support part side. The air ejection part generates an air stream in the yarn pull-out ejection part, the air stream being for pulling out and blowing off a yarn. The yarn catch part is arranged between the yarn joining device and the bobbin support part, and configured to catch a yarn blown off by the yarn pull-out ejection part. The yarn catch air-stream generation part generates an air stream in the yarn catch part, the air stream being for catching a yarn and introducing the yarn to the yarn joining device.

[0020] Accordingly, since the yarn is blown off and guided to the yarn joining device by means of ejected air, a configuration for guiding the yarn is simple. As a result, the degree of freedom in a layout of configuration parts is improved. Moreover, since guiding of the yarn to the yarn joining device is completed merely by blowing off the yarn, a time required for an operation for guiding the yarn is shortened and thus the production efficiency of the package is improved. If a yarn is pulled out from a package, it would be necessary to apply a suction stream throughout the entire width of the package in order to reliably catch a yarn end. This results in high energy consumption. On the other hand, in a case where the yarn is pulled out from the yarn accumulation device as described above, it suffices that a suction stream is applied only to a position where a yarn end exists, which is known. This enables the yarn end to be reliably sucked with less energy.

[0021] Preferably, the above-described yarn winding machine is configured as follows. The yarn pull-out ejection part is a guide tube that guides a yarn of the yarn supply bobbin side to the yarn accumulation device at a time of yarn winding. The air ejection part is an air ejection nozzle that blasts compressed air to the inside of the guide tube.

[0022] In this configuration, the yarn is accumulated on the yarn accumulation device through the guide tube. Therefore, when, reversely, the yarn is pulled out from the yarn accumulation device, the pulling out of the yarn from the yarn accumulation device can be reliably and smoothly performed by pulling out the yarn through the guide tube. Accordingly, the above-described configuration in which the guide tube also serves as the yarn pull-out ejection part enables the yarn wound on the yarn accumulation device to be reliably and smoothly blown off.

[0023] Preferably, the above-described yarn winding machine includes a deflection guide member that guides a yarn blown off by the yarn pull-out ejection part to the yarn catch part.

[0024] Since the yarn blown off by the yarn pull-out ejection part is guided to the yarn catch part by the deflection guide member, the yarn pull-out ejection part and the yarn catch part can be freely arranged. This improves the degree of freedom in a layout.

[0025] In the above-described yarn winding machine, it is preferable that the deflection guide member is a tube-like member, in which a slit is formed along a longitudinal direction of a tube.

[0026] The deflection guide member having such a tube-like shape allows the yarn to pass through the inside of the tube and thereby reliably guides the yarn to the yarn catch part. Since the slit is formed in the deflection guide member having a tube-like shape, the yarn having been guided to the yarn catch part can be drawn out through the slit. As a result, at a time of normal winding, the yarn is able to travel outside the deflection guide member. This can prevent deterioration in the quality of the yam, which may otherwise be caused by contact with the deflection guide member.

[0027] In the above-described yarn winding machine, it is preferable that the deflection guide member is provided at a position deviated from a travel path through which a yarn travels at a time of yarn winding.

[0028] This prevents the yarn from being in contact with the deflection guide member at a time of the normal winding. Thus, deterioration in the quality of the yarn is prevented.

[0029] Preferably, the above-described yarn winding machine is configured as follows. The yarn winding machine includes a second yarn guide part that guides a yarn of the yarn supply bobbin to the yarn joining device. The second yarn guide part includes a lower yarn blow-up part, a second yarn catch part, and a second yarn catch air-stream generation part. The lower yarn blow-up part is arranged between the bobbin support part and the yarn joining device, and configured to blow off a yarn of the yarn supply bobbin to a position near the yarn joining device. The second yarn catch part is arranged between the yarn joining device and the yarn accumulation device, and configured to catch a yarn blown off by the lower yarn blow-up part. The second yarn catch air-stream generation part generates an air stream in the second yarn catch part, the air stream being for catching a yarn.

[0030] Accordingly, the yarn of the yarn supply bobbin side can be blown off and guided to the yarn joining device. This can further improve the degree of freedom in a layout of configuration parts of the yarn winding machine, and further shorten a time required for the yarn joining.

[0031] Preferably, the above-described yarn winding machine includes a driving part configured to drive the second yarn catch part in a direction toward and away from a yarn travel path.

[0032] This enables the second yarn catch part to be moved to a position (position close to the yarn travel path) that allows the second yarn catch part to easily catch the yarn.

[0033] Preferably, the above-described yarn winding machine is configured as follows. The yarn winding machine includes a control part that controls actuation of the driving part. At a time of normal winding, the control part brings the second yarn catch part close to the yarn travel path, and at a time of yarn joining, the control part drives the second yarn catch part in a direction away from the yarn travel path under a state where a yarn is caught by the second yarn catch part, to thereby introduce the caught yarn to the yarn joining device.

[0034] Accordingly, at a time of the normal winding, the second yarn catch part is located close to the yarn travel path, to make it possible to suck and remove cotton fly, or the like, adhering to the yarn. On the other hand, when the second yarn catch part catches the yam, the second yarn catch part is driven in the direction away from the yarn travel path, and thereby the yarn can be introduced to the yarn joining device.

[0035] Preferably, the above-described yarn winding machine is configured as follows. The yarn winding machine includes a control part that controls the yarn joining device, the yarn pull-out ejection part, and the lower yarn blow-up part. When a new yarn supply bobbin is fed to the bobbin support part, the control part causes the lower yarn blow-up part to blow off a yarn of the new yarn supply bobbin, causes the second yarn catch part to catch the yarn thus blown off, and drives the second yarn catch part in the direction away from the yarn travel path. At or around this time, the control part causes the yarn pull-out ejection part to pull out a yarn accumulated on the yarn accumulation device and blow off the yarn, and causes the yarn catch part to catch the yarn thus blown off. Then, the control part actuates the yarn joining device, to perform yarn joining.

[0036] Accordingly, when the yarn supply bobbin is replaced, the yarn of the yarn supply bobbin side and the yarn of the yarn accumulation device side are guided to the yarn joining device, and thus the yarn joining can be performed.

[0037] Preferably, the above-described yarn winding machine is configured as follows. The yarn winding machine includes a yarn defect detection device and a cutter. The cutter is configured to, at a position at a downstream side of the second yarn catch part, cut a yarn between the yarn supply bobbin and the yarn accumulation device. When the yarn defect detection device detects a yarn defect, the control part actuates the cutter to cut the yarn, causes the second yarn catch part to catch a yarn of the yarn supply bobbin side, and drives the second yarn catch part in the direction away from the yarn travel path. At or around this time, the control part causes the yarn pull-out ejection part to pull out a yarn accumulated on the yarn accumulation device and blow off the yam, and causes the yarn catch part to catch the yarn thus blown off. Then, the control part actuates the yarn joining device, to perform yarn joining.

[0038] Accordingly, after the yarn whose yarn fault has been detected is cut, the yarn of the yarn supply bobbin side and the yarn of the yarn accumulation device side are guided to the yarn joining device, and thus the yarn joining can be performed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0039]

[FIG. 1] A schematic side view of a winder unit included in an automatic winder according to a first embodiment of the present invention.
[FIG. 2] A diagram illustrating a configuration of a yarn accumulation device.
[FIG. 3] A diagram showing a situation where a yarn supply bobbin becomes empty.
[FIG. 4] A diagram showing a situation where a new yarn supply bobbin is fed.
[FIG. 5] A diagram showing a situation where a lower yarn is introduced to a lower yarn blow-up part.
[FIG. 6] A perspective view of an external appearance showing an outline of the lower yarn blow-up part.
[FIG. 7] A partial cross-sectional side view showing a configuration of the lower yarn blow-up part.
[FIG. 8] A diagram showing a situation where a yarn trap sucks and catches the lower yarn.
[FIG. 9] A diagram showing a situation where the lower yarn is introduced to a yarn joining device.
[FIG. 10] A perspective view of an external appearance showing a configuration of a deflection guide member.
[FIG. 11] A diagram showing a situation where an upper yarn is guided by the deflection guide member.
[FIG. 12] A diagram showing a situation where the upper yarn is drawn out from the deflection guide member.
[FIG. 13] A diagram showing a situation where the upper yarn is introduced to the yarn joining device.
[FIG. 14] A diagram showing a modification of the first embodiment.
[FIG. 15] A schematic side view of a winder unit included in an automatic winder according to a second embodiment of the present invention.
[FIG. 16] A diagram illustrating a configuration of a yarn accumulation device included in the winder unit according to the second embodiment.
[FIG. 17] A winder unit included in an automatic winder according to a modification of the second embodiment.
[FIG. 18] A diagram showing a configuration of a yarn accumulation device included in the winder unit according to the modification of the second embodiment.
[FIG. 19] A schematic side view of a winder unit included in a conventional automatic winder.

[FIG. 20] A diagram showing a situation where an upper yarn and a lower yarn are sucked and caught in a conventional winder unit.

[FIG. 21] A diagram showing a situation where the upper yarn is introduced to a yarn joining device in the conventional winder unit.

[FIG. 22] A diagram showing a situation where the lower yarn is introduced to the yarn joining device in the conventional winder unit.

EMBODIMENT FOR CARRYING OUT THE INVENTION

[0040] Hereinafter, some embodiments of the present invention will be described. FIG. 1 is a side view showing an outline of a winder unit 2 included in an automatic winder (yarn winding machine) according to a first embodiment of the present invention. The automatic winder of this embodiment is configured with a number of winder units 2 arranged side by side. This automatic winder includes a machine management device (not shown) and a blower box (not shown). The machine management device collectively manages the winder units 2. The blower box includes a compressed air source and a negative pressure source.

[0041] As shown in FIG. 1, the winder unit 2 mainly includes a bobbin support part 7 and a winding part 8. The winder unit 2 is configured to unwind a yarn (spun yam) 20 from a yarn supply bobbin 21 that is supported on the bobbin support part 7 and rewind the yarn into a package 30. FIG. 1 shows a state of the winder unit 2 at a time of normal winding. In the description herein, the "time of normal winding" indicates a state where the yarn is continuous between the yarn supply bobbin 21 and the package 30 and additionally the yarn is being unwound from the yarn supply bobbin 21 and wound into the package 30.

[0042] The bobbin support part 7 is configured to hold the yarn supply bobbin 21 in a substantially upright state. The bobbin support part 7 is also configured to discharge the yarn supply bobbin 21 that is empty. The winding part 8 includes a cradle 23 and a traverse drum 24. The cradle 23 is configured such that a wound bobbin 22 is mounted thereon. The traverse drum 24 is configured to traverse the yarn 20 and drive the wound bobbin 22.

[0043] The traverse drum 24 is arranged opposed to the wound bobbin 22. The traverse drum 24 is driven in rotation, and thereby the wound bobbin 22 is accordingly rotated. This enables the yarn 20 accumulated on a yarn accumulation device 18, which will be described later, to be wound on the wound bobbin 22. A traverse groove (not shown) is formed in an outer circumferential surface of the traverse drum 24. The traverse groove allows the yarn 20 to be traversed (cross-wound) with a predetermined width. In the above-described configuration, the yarn 20 is wound on the wound bobbin 22 while being traversed, to form the package 30 having a predetermined length and a predetermined shape. In the following description, the terms "upstream side" and "downstream side" mean the upstream side and the downstream side with respect to a direction of traveling of the yarn.

[0044] Each of the winder units 2 includes a control part 25. The control part 25 is composed of hardware such as a CPU, a ROM, and a RAM (not shown), and software such as a control program accumulated in the RAM. The hardware and the software cooperate with each other, to thereby control each configuration part of the winder unit 2. The control part 25 included in each winder unit 2 is configured to communicate with the machine management device. Accordingly, the machine management device can collectively manage operations of the plurality of winder units 2 included in the automatic winder.

[0045] The winder unit 2 also includes various devices provided in a yarn travel path between the bobbin support part 7 and the winding part 8. More specifically, in the yarn travel path, an unwinding assist device 10, a lower yarn blow-up part (yarn sucking and ejecting part) 11, a tension applying device 12, an upper yarn catch part (yarn catch part) 13, a yarn joining device 14, a yarn trap (second yarn catch part) 15, a cutter 16, a clearer (yarn defect detection device) 17, an upper yarn pull-out part 48, and a yarn accumulation device 18, are arranged in this order from the bobbin support part 7 side toward the winding part 8 side.

[0046] The unwinding assist device 10 assists the unwinding of the yarn 20 by bringing a movable member 40 into contact with a balloon, which is generated above the yarn supply bobbin 21 as a result of the yarn 20 being unwound from the yarn supply bobbin 21 and thrown around, and thereby appropriately controlling the size of the balloon.

[0047] The lower yarn blow-up part 11 is an air sucker device arranged between the bobbin support part 7 and the yarn joining device 14 (to be exact, at the immediately downstream side of the unwinding assist device 10). The lower yarn blow-up part 11 is configured to blow up a lower yarn of the yarn supply bobbin 21 side toward the yarn joining device 14 side at a time of yarn joining (details will be given later).

[0048] The tension applying device 12 applies a predetermined tension to the yarn 20 that is traveling. In this embodiment, the tension applying device 12 is configured as a gate type in which a movable comb is arranged relative to a fixed comb. The movable comb is configured to be swung by a rotary type solenoid such that the combs are brought into engagement or disengagement. However, a configuration of the tension applying device 12 is not limited to this. For example, a disk type tension applying device is also adoptable.

[0049] The upper yarn catch part 13 is arranged between the yarn joining device 14 and the bobbin support part 7 (to

be exact, at the immediately upstream side of the yarn joining device 14). The upper yarn catch part 13 is connected to a negative pressure source (yarn catch air-stream generation part) (not shown), and configured to generate a suction air stream to suck and catch an upper yarn of the yarn accumulation device 18 side at a time of yarn joining (details will be given later).

[0050] The yarn trap 15 is arranged between the yarn joining device 14 and the yarn accumulation device 18 (to be exact, at the upstream side of the cutter 16 and at the immediately downstream side of the yarn joining device 14). A distal end of the yarn trap 15 is formed as a tube-like member, which is provided close to the travel path of the yarn 20 and connected to a negative pressure source (second yarn catch air-stream generation part) (not shown). In this configuration, the suction air stream is generated at the distal end of the yarn trap 15, and thereby dusts such as cotton fly adhering to the traveling yarn 20 can be sucked and removed.

[0051] The clearer 17 is configured to detect a yarn defect (yarn fault) such as a stub by, for example, monitoring a yarn thickness of the yarn 20. When the clearer 17 detects a yarn defect, the clearer 17 transmits a disconnection signal to, for example, the control part 25. The disconnection signal instructs to cut and remove the yarn defect. The cutter 16 is arranged near the clearer 17, for immediately cutting the yarn 20 in response to the disconnection signal.

[0052] The yarn joining device 14 performs yarn joining between the lower yarn of the yarn supply bobbin 21 side and the upper yarn of the yarn accumulation device 18 side when the yarn is disconnected between the yarn supply bobbin 21 and the package 30, which occurs, for example, at a time of yarn cutting in which the clearer 17 detects a yarn defect so that the cutter 16 cuts the yarn, at a time of yarn breakage in which the yarn being unwound from the yarn supply bobbin 21 is broken, or at a time of replacing the yarn supply bobbin 21. As the yarn joining device 14, one using fluid such as compressed air, mechanical one, or the like, is adoptable.

[0053] The upper yarn pull-out part 48 is an air sucker device, and includes a guide tube 34 (yarn pull-out ejection part). The guide tube 34 pulls out the upper yarn of the yarn accumulation device 18 side and blows the upper yarn toward the bobbin support part 7 side at a time of yarn joining (details will be given later).

[0054] The yarn accumulation device 18 is configured to temporarily accumulate the yarn 20 unwound from the yarn supply bobbin 21. In this manner, the yarn accumulation device 18 is interposed between the bobbin support part 7 and the winding part 8, and a certain amount of the yarn 20 is accumulated on the yarn accumulation device 18. Accordingly, even when the unwinding of the yarn from the yarn supply bobbin 21 is interrupted for some reason (for example, during the yarn joining operation), the winding part 8 is able to wind the yarn accumulated on the yarn accumulation device 18. Therefore, the winding of the yarn 20 into the package 30 can be continued. Thus, since a winding operation of the winding part 8 is not interrupted by the yarn joining operation or the like, the package 30 can be produced stably at a high speed. Additionally, unlike the conventional yarn winding machine, sucking and catching of the yarn from the package 30 is not performed in every yarn joining operation. This can prevent occurrence of disorder in a surface of the package 30. Moreover, since occurrence of a yarn breakage in the winding part 8 is reduced, falling of the yarn onto an edge surface of the package 30 or occurrence of a failure in the winding shape is prevented.

[0055] A bobbin feeder 26 of magazine type is arranged at the front side of the winder unit 2. The bobbin feeder 26 includes a rotary magazine can 27. The magazine can 27 is configured to hold a plurality of extra yarn supply bobbins 21. The bobbin feeder 26 intermittently drives and rotates the magazine can 27, and thereby feeds a new yarn supply bobbin 21 to the bobbin support part 7. The bobbin feeder 26 includes a yarn end holder 28 for sucking and holding a yarn end of the yarn supply bobbin 21 held on the magazine can 27.

[0056] Next, the yarn accumulation device 18 will be described with reference to FIG. 2. As shown in FIG. 2, the yarn accumulation device 18 mainly includes a yarn accumulation roller 32 and a roller drive motor 33.

[0057] The yarn accumulation roller 32 is a substantially cylindrical member and configured to accumulate the yarn 20 by winding the yarn 20 on an outer circumferential surface thereof. The roller drive motor 33 is configured to drive and rotate the yarn accumulation roller 32 around the central axis thereof. An operation of the roller drive motor 33 is controlled by the control part 25. Herein, an end portion of the yarn accumulation roller 32 at the side where the roller drive motor 33 is arranged will be called a proximal end portion, and the opposite end portion will be called a distal end portion.

[0058] As shown in FIG. 2, a proximal side taper portion 32a is formed in the proximal end portion of the yarn accumulation roller 32. The proximal side taper portion 32a has a tapered shape whose diameter increases toward an end portion. On the other hand, a distal side taper portion 32b is formed in the distal end portion of the yarn accumulation roller 32. The distal side taper portion 32b has a tapered shape whose diameter increases toward an end portion. Forming such taper portions prevents the yarn 20 from slipping off from the end portions of the yarn accumulation roller 32. In the yarn accumulation roller 32, a portion having a cylindrical shape (a portion having a substantially constant diameter) will be called a cylindrical portion 32c. The cylindrical portion 32c also has an extremely small taper for moving the accumulated yarn toward the downstream side.

[0059] The guide tube 34 of the upper yarn pull-out part 48 is arranged near a boundary portion between the proximal side taper portion 32a and the cylindrical portion 32c of the yarn accumulation roller 32 (a configuration of the upper yarn pull-out part 48 will be described later). The guide tube 34 is a tube-like member, and arranged such that one end

portion (suction side end portion 34a) thereof is located close to the surface of the yarn accumulation roller 32. At a time of the normal winding, the yarn of the yarn supply bobbin 21 side is introduced into the guide tube 34 through the other end portion (ejection side end portion 34b) of the guide tube 34, and then pulled out from the suction side end portion 34a toward the surface of the yarn accumulation roller 32. Thus, at a time of the normal winding, the guide tube 34 guides the yarn 20 of the yarn supply bobbin 21 to the surface of the yarn accumulation roller 32.

[0060] The yarn accumulation roller 32 having the yarn 20 wound thereon is rotated in one direction, and thereby a tensile force is applied to the yarn 20 existing at the upstream side (yarn supply bobbin 21 side) of the yarn accumulation device 18. This enables the yarn 20 to be unwound from the yarn supply bobbin 21 and wound on the surface of the yarn accumulation roller 32. As shown in FIG. 2, the yarn 20 is guided to the boundary portion between the proximal side taper portion 32a and the cylindrical portion 32c. Therefore, while the yarn 20 is sequentially wound on the cylindrical portion 32c, the yarn 20 pushes up a preceding yarn layer from the proximal end portion side. As a result, the yarn 20 accumulated on the yarn accumulation roller 32 is pushed by the newly wound yarn 20, and sequentially fed toward the distal end portion side on the surface of the cylindrical portion 32c. In this manner, the yarn 20 is, while being orderly arranged into a spiral shape, regularly wound on the outer circumferential surface of the yarn accumulation roller 32 from the proximal end portion side. In the following description, a rotation of the yarn accumulation roller 32 at a time of the normal winding will be called a "positive rotation", and a rotation of the yarn accumulation roller 32 in a direction opposite to the positive rotation will be called a "reverse rotation".

[0061] On the other hand, the yarn 20 accumulated on the yarn accumulation roller 32 is pulled out from the distal side taper portion 32b of the yarn accumulation roller 32, and fed toward the downstream side (winding part 8 side). In the distal side taper portion 32b, the yarn 20 accumulated on the yarn accumulation roller 32 is pulled out toward the downstream side through a pull-out guide 37 that is arranged on an extension of the central axis of the yarn accumulation roller 32. Since the yarn 20 is pulled out toward the extension of the central axis of the yarn accumulation roller 32, it is possible to pull out the yarn 20 from the yarn accumulation roller 32 irrespective of a state of rotation of the yarn accumulation roller 32. To be specific, in any of the cases where the yarn accumulation roller 32 is in the positive rotation, the yarn accumulation roller 32 is in the reverse rotation, and the rotation of the yarn accumulation roller 32 is stopped, the winding part 8 is able to unwind the yarn 20 from the yarn accumulation roller 32 and wind the yarn 20 into the package 30.

[0062] A rubber band (O-ring) 32d is arranged in a boundary portion between the cylindrical portion 32c and the distal side taper portion 32b of the yarn accumulation roller 32. When the yarn 20 is pulled out from the yarn accumulation roller 32, the yarn 20 passes between the rubber band 32d and the surface of the yarn accumulation roller 32. Due to the distal side taper portion 32b, the rubber band 32d itself is inhibited from being dragged by the yarn and falling off. In the above-described configuration, an adequate tensile force caused by the rubber band 32d fastening the yarn accumulation roller 32 can be applied to the yarn 20 unwound from the yarn accumulation roller 32. This can stabilize the unwinding of the yarn 20. Furthermore, it is possible to unwind the yarn while untangling a mass of the yarn. This can prevent a trouble called slaffing in which a mass of the yarn on the yarn accumulation roller 32 wholly falls off at one time. This also exerts an effect of preventing generation of a balloon, which is otherwise generated by a yarn being thrown around when unwound.

[0063] An upper limit sensor 36 and a lower limit sensor 35 are arranged near the yarn accumulation roller 32. The upper limit sensor 36 detects that the amount of the yarn20 on the yarn accumulation roller 32 reaches a predetermined upper limit value or more. The lower limit sensor 35 detects that the amount of the yarn 20 on the yarn accumulation roller 32 falls below a predetermined lower limit value. Results of detection obtained by the lower limit sensor 35 and the upper limit sensor 36 are sent to the control part 25.

[0064] When it is detected that the amount of yarn accumulated on the yarn accumulation roller 32 falls below the lower limit value, the control part 25 appropriately controls the roller drive motor 33 to increase the speed of rotation of the yarn accumulation roller 32. This increases the speed of winding of the yarn 20 onto the yarn accumulation roller 32. At a time of the normal winding, the speed of rotation of the traverse drum 24 is substantially constant, and therefore the speed of unwinding of the yarn 20 from the yarn accumulation roller 32 into the package 30 side is substantially constant. The control part 25 controls the roller drive motor 33 such that the speed of winding of the yarn 20 onto the yarn accumulation roller 32 is higher than the speed of unwinding of the yarn 20 from the yarn accumulation roller 32. As a result, the amount of the yarn 20 accumulated on the yarn accumulation roller 32 can be gradually increased.

[0065] On the other hand, when it is detected that the amount of yarn accumulated on the yarn accumulation roller 32 reaches the upper limit value or more, the control part 25 appropriately controls the roller drive motor 33 to reduce the speed of rotation of the yarn accumulation roller 32. This reduces the speed of winding of the yarn 20 onto the yarn accumulation roller 32. The control part 25 controls the roller drive motor 33 such that the speed of winding of the yarn 20 onto the yarn accumulation roller 32 is lower than the speed of unwinding of the yarn 20 from the yarn accumulation roller 32. As a result, the amount of the yarn 20 on the yarn accumulation roller 32 can be gradually reduced. The above-described control enables the amount of the yarn 20 accumulated on the yarn accumulation roller 32 to be kept in the range from the lower limit value or more and less than the upper limit value.

[0066] Next, an operation for replacing the yarn supply bobbin 21 will be described.

[0067] When the yarn of the yarn supply bobbin 21 runs out, the yarn remaining on the yarn supply bobbin 21 is fully wound on the yarn accumulation device 18. This causes the yarn to be discontinuous between the yarn supply bobbin 21 (empty bobbin) and the yarn accumulation device 18, as shown in FIG. 3. Thus, in order to continue the winding of the yarn 20, it is necessary to feed a new yarn supply bobbin 21 and then connect a yarn of this new yarn supply bobbin 21 to the yarn accumulated on the yarn accumulation device 18 (yarn joining). Even when the yarn supply bobbin 21 becomes empty, a predetermined amount of the yarn 20 is accumulated on the yarn accumulation device 18. Therefore, it is not necessary to interrupt the winding of the yarn 20 into the package 30 performed in the winding part 8, until the accumulated yarn 20 runs out. In the following, the operation for replacing the yarn supply bobbin 21 will be described in sequence.

[0068] Firstly, the control part 25 drives the bobbin support part 7, to discharge the empty bobbin. Then, the control part 25 drives the magazine can 27 of the bobbin feeder 26, to feed a new yarn supply bobbin 21 to the bobbin support part 7. At this time, as shown in FIG. 4, the new yarn supply bobbin 21 is fed with an inclined attitude. As described above, the yarn end of the yarn supply bobbin 21 held on the magazine can 27 is sucked and held by the yarn end holder 28. Therefore, a situation is created in which the yarn 20 stretches between the yarn end holder 28 and the yarn supply bobbin 21 fed from the magazine can 27. In the following description, when particularly needed, the yarn 20 of the yarn supply bobbin 21 side will be referred to as a lower yarn 20a.

[0069] Then, as shown in FIG. 5, the control part 25 drives the bobbin support part 7, to make the new yarn supply bobbin 21 stand upright, and also drives a yarn displacement member 43 that is arranged near the lower yarn blow-up part 11. The yarn displacement member 43 is engageable with the lower yarn 20a existing between the yarn supply bobbin 21 and the yarn end holder 28, and movable toward the lower yarn blow-up part 11. When the yarn displacement member 43 is driven while being engaged with the lower yarn 20a, the yarn displacement member 43 displaces the lower yarn 20a toward the lower yarn blow-up part 11, as shown in FIG. 5.

[0070] The lower yarn blow-up part 11 is in the shape of a block as shown in a perspective view of an external appearance of FIG. 6. The block has a yarn introduction hole 41 and a slit 42 that communicates with the yarn introduction hole 41. The lower yarn 20a is displaced by the yarn displacement member 43, and introduced into the yarn introduction hole 41 through the slit 42.

[0071] Here, the lower yarn blow-up part 11 will be described in more detail with reference to a partial cross-sectional side view of FIG. 7. As shown in FIG. 7, an air ejection nozzle 44 that communicates with the yarn introduction hole 41 is formed in the lower yarn blow-up part 11. The air ejection nozzle 44 is a circular hole having an elongated shape. The air ejection nozzle 44 is connected to an appropriate compressed air source 46 via an electromagnetic valve 45. The electromagnetic valve 45 is controlled by the control part 25. In the above-described configuration, when the control part 25 puts the electromagnetic valve 45 into an open state, compressed air is supplied through the air ejection nozzle 44 into the yarn introduction hole 41.

[0072] An ejection port of the air ejection nozzle 44 is formed such that air is ejected toward the downstream side with respect to the direction of traveling of the yarn 20. Accordingly, when the compressed air is ejected through the air ejection nozzle 44, an air stream flowing toward the downstream side (upward in FIG. 7) with respect to the direction of traveling of the yarn 20 is generated in the yarn introduction hole 41. As a result, the lower yarn 20a introduced into the yarn introduction hole 41 is blown off toward the downstream side by the air stream.

[0073] Here, the description of the operation for replacing the yarn supply bobbin 21 will be resumed. After the yarn displacement member 43 introduces the lower yarn 20a into the yarn introduction hole 41, the control part 25 cuts the lower yarn 20a between the yarn supply bobbin 21 and the yarn end holder 28 by means of a cutter (not shown), and additionally opens the electromagnetic valve 45 to supply the compressed air to the air ejection nozzle 44. As a result, an air stream flowing toward the downstream side is generated in the yarn introduction hole 41. This air stream blows off the lower yarn 20a toward the downstream side.

[0074] The yarn trap 15 described above is arranged at the downstream side of the lower yarn blow-up part 11. The suction stream is generated at the distal end of the yarn trap 15. The lower yarn 20a blown off by the lower yarn blow-up part 11 is sucked and caught by the yarn trap 15. This situation is shown in FIG. 8.

[0075] A yarn trap driver 47 is arranged near the yarn trap 15. The yarn trap driver 47 is configured to drive the yarn trap 15 in a direction toward and away from the yarn travel path. An operation of the yarn trap driver 47 is controlled by the control part 25. After the yarn trap 15 sucks and catches the lower yarn 20a, the control part 25 actuates the yarn trap driver 47 to thereby drive the yarn trap 15 in the direction away from the yarn travel path. Thereby, the lower yarn 20a is introduced to the yarn joining device 14, as shown in FIG. 9. In the above-described manner, the lower yarn 20a can be introduced to the yarn joining device 14 by means of the lower yarn blow-up part 11 and the yarn trap 15. Accordingly, it can be considered that the lower yarn blow-up part 11, the yarn trap 15, and the negative pressure source that generates the suction air stream in the yarn trap 15, form a lower yarn guide part (second yarn guide part).

[0076] As thus far described, the lower yarn 20a is blown off and guided to the downstream side of the yarn joining device 14 by means of the air stream. This enables the lower yarn to be quickly guided with a simple configuration, as

compared with, for example, a lower yarn guide member (the lower yarn guide pipe 92 shown in FIG. 19) included in the conventional winder unit. After an operation for guiding the lower yarn 20a to the yarn joining device 14 is completed, the control part 25 puts the electromagnetic valve 45 into a closed state. This can prevent wasteful consumption of the compressed air.

[0077] Around a time of performing the above-described control for guiding the lower yarn 20a to the yarn joining device 14, the control part 25 performs a control for guiding the yarn of the yarn accumulation device 18 side to the yarn joining device 14. A specific description will be given below. In the following description, when particularly needed, the yarn 20 of the yarn accumulation device 18 side will be referred to as an upper yarn 20b.

[0078] Firstly, the upper yarn pull-out part 48 will be described with reference to FIG. 2. The upper yarn pull-out part 48 includes the above-mentioned guide tube 34 (yarn pull-out ejection part) and an air ejection nozzle (air ejection part) 49 that communicates with the inside of the guide tube 34. The air ejection nozzle 49 is a circular hole having an elongated shape. The air ejection nozzle 49 is connected to the appropriate compressed air source 46 via an electromagnetic valve 51. The electromagnetic valve 51 is controlled by the control part 25. In the above-described configuration, when the control part 25 puts the electromagnetic valve 51 into an open state, compressed air is supplied through the air ejection nozzle 49 into the guide tube 34.

[0079] An ejection port of the air ejection nozzle 49 is formed such that air is ejected toward the ejection side end portion 34b (such that air is ejected in a direction away from the surface of the yarn accumulation roller 32). Accordingly, when the compressed air is ejected through the air ejection nozzle 49, an air stream flowing toward the ejection side end portion 34b is generated in the guide tube 34. As a result, air is ejected from the ejection side end portion 34b. On the other hand, along with the air stream generated in the guide tube 34, a suction stream is generated in the opposite end portion (suction side end portion 34a).

[0080] To guide the upper yarn 20b of the yarn accumulation device 18 side to the yarn joining device 14, the control part 25 puts the electromagnetic valve 51 into the open state so that the compressed air is supplied through the air ejection nozzle 49 into the guide tube 34. Under this condition, the control part 25 appropriately controls the roller drive motor 33, thereby causing reverse rotation of the yarn accumulation roller 32. As a result, a yarn end is unwound from the proximal end portion side of the cylindrical portion 32c of the yarn accumulation roller 32. This yarn end is sucked by the suction stream generated in the suction side end portion 34a of the guide tube 34, and introduced into the guide tube 34.

[0081] In the conventional automatic winder as shown in FIG. 19, it is necessary that the suction port 91a of the upper yarn guide pipe 91 for sucking and catching a yarn end of a yarn wound into the package 30 is enlarged with respect to a width direction of the package. The reason therefor is as follows. Since the yarn is traversed when being wound on the surface of the package 30, where on the package 30 with respect to the width direction thereof the yarn end of the yarn wound into the package 30 is positioned is uncertain after the clearer 17 detects a yarn defect so that the cutter 16 cuts the yarn or after the yarn of the yarn supply bobbin 21 is fully wound. Therefore, in order to reliably suck and catch the yarn end, it is necessary to generate the suction stream throughout the entire width of the package 30.

[0082] In this respect, in the automatic winder of this embodiment, the yarn 20 is regularly wound on the yarn accumulation roller 32 while being orderly arranged from the boundary portion between the cylindrical portion 32c and the proximal side taper portion 32a. This is achieved because, at a time of the normal winding, the guide tube 34 guides the yarn of the yarn supply bobbin 21 side to the boundary portion between the cylindrical portion 32c and the proximal side taper portion 32a. Accordingly, after the clearer 17 detects a yarn defect so that the cutter 16 cuts the yarn or after the yarn of the yarn supply bobbin 21 is fully wound, the yarn end of the yarn wound on the yarn accumulation roller 32 is always positioned near the boundary portion between the cylindrical portion 32c and the proximal side taper portion 32a. Therefore, by generating the suction stream only in this boundary portion, the yarn end can be reliably sucked. That is, by generating the suction stream in the guide tube 34, the yarn end can be reliably sucked. Thus, in the automatic winder of this embodiment including the yarn accumulation device 18, unlike the conventional configuration, an enlarged suction port for sucking the upper yarn is not required. This enables a suction stream sufficient for sucking the upper yarn to be generated by less energy.

[0083] The yarn end sucked into the guide tube 34 is, along with the air stream generated in the guide tube 34, blown out from the ejection side end portion 34b. Air ejection from the ejection side end portion 34b is oriented toward a position where a yarn inlet 61 of a deflection guide member 60 is arranged.

[0084] As shown in a perspective view of FIG. 10, the deflection guide member 60 is a curved tube-like member having the yarn inlet 61 at one end side thereof and a yarn outlet 62 at the other end side thereof. Air ejected from the ejection side end portion 34b of the guide tube 34 flows through the yarn inlet 61 into the deflection guide member 60, and is guided through a curved path while passing through the inside of the curved deflection guide member 60, and then is discharged through the yarn outlet 62 to the outside of the deflection guide member 60. Accordingly, the upper yarn 20b blown out together with the ejected air from the upper yarn pull-out part 48 is, along with an air stream flowing in the curved path inside the deflection guide member 60, guided from the yarn inlet 61 to the yarn outlet 62, as shown in FIG. 11.

[0085] The yarn outlet 62 leads to a position where the upper yarn catch part 13 is arranged. The upper yarn catch

part 13 is connected to the negative pressure source (not shown) and configured such that a suction stream is generated in a suction stream generation port that is provided at the distal end of the upper yarn catch part 13. A movable lid 13a is arranged in the suction stream generation port of the upper yarn catch part 13. The lid 13a is driven by the control part 25, and switched between a state where the suction stream generation port is closed and a state where the suction stream generation port is open.

[0086] Around a time when the upper yarn pull-out part 48 pulls out the upper yarn 20b from the yarn accumulation device 18, the control part 25 drives the lid 13a to open the suction stream generation port of the upper yarn catch part 13, so that a suction stream is generated in the upper yarn catch part 13. In the above-described configuration, the upper yarn 20b guided to the yarn outlet 62 of the deflection guide member 60 can be sucked and held by the upper yarn catch part 13. When it is not necessary to generate a suction stream in the upper yarn catch part 13, the control part 25 performs a control to close the suction stream generation port with the lid 13a. This can prevent air from flowing into the upper yarn catch part 13, and therefore can prevent wasteful consumption of energy. Here, instead of controlling the presence or absence of a suction air stream by opening and closing a lid, for example, an air flow may be controlled by means of an electromagnetic valve.

[0087] As shown in FIG. 10, the deflection guide member 60 has a slit 63 through which the outside and inside of the deflection guide member 60 are communicated with each other. The slit 63 is formed along a longitudinal direction of the tube-like deflection guide member 60, and connects the yarn inlet 61 and the yarn outlet 62 to each other. In this embodiment, the deflection guide member 60 has a substantially U-like shape, and the slit 63 is formed along an inner portion of this U-like shape.

[0088] Since such a slit 63 is formed in the deflection guide member 60, when the upper yarn 20b guided to the yarn outlet 62 is sucked and caught by the upper yarn catch part 13, the upper yarn 20b is drawn out through the slit 63 to the outside of the deflection guide member 60, as shown in FIG. 12.

[0089] The upper yarn 20b drawn out from the deflection guide member 60 is further sucked by the upper yarn catch part 13, and thereby the upper yarn 20b can be introduced to the yarn joining device 14, as shown in FIG. 13. As described above, the guide tube 34, the air ejection nozzle 49, the deflection guide member 60, the upper yarn catch part 13, and the negative pressure source that generates a suction air stream in the upper yarn catch part 13, achieve a configuration for guiding the upper yarn 20b to the upstream side of the yarn joining device 14. Accordingly, it can be considered that the guide tube 34, the air ejection nozzle 49, the deflection guide member 60, the upper yarn catch part 13, and the negative pressure source, form an upper yarn guide part (yarn guide part).

[0090] As thus far described, the air stream is used to blow off the upper yarn 20b and guide the upper yarn 20b to the upstream side of the yarn joining device 14. This enables the upper yarn to be quickly guided with a simple configuration, as compared with, for example, an upper yarn guide member (the upper yarn guide pipe 91 shown in FIG. 19) included in the conventional winder unit. Therefore, a time required for the yarn joining operation is shortened, and thus the production efficiency of the package 30 is improved.

[0091] After an operation for guiding the upper yarn 20b to the yarn joining device 14 is completed, the control part 25 stops the reverse rotation of the yarn accumulation roller 32 and additionally puts the electromagnetic valve 51 into a closed state. Then, the control part 25 closes the lid 13a of the upper yarn catch part 13. Then, the control part 25 actuates the yarn joining device 14, thus performing yarn joining between the upper yarn 20b and the lower yarn 20a.

[0092] After the yarn joining is completed, the control part 25 starts positive rotation of the yarn accumulation roller 32, thus starting to unwind the yarn from the new yarn supply bobbin 21. Around a time of starting the positive rotation of the yarn accumulation roller 32, the control part 25 drives the yarn trap 15 to a position close to the yarn travel path, and restarts to suck and remove cotton fly. Additionally, the control part 25 opens the lid 13a of the upper yarn catch part 13 for a short time. Thereby, a piece of the yarn (the upper yarn having been cut in the yarn joining) caught by the upper yarn catch part 13 is sucked and removed. Thus, the normal winding operation shown in FIG. 1 can be restarted.

[0093] As described above, the upper yarn 20b is drawn out from the inside of the deflection guide member 60. Accordingly, at a time of the normal winding (the state shown in FIG. 1), the yarn 20 does not pass through the inside of the deflection guide member 60. Here, if the yarn 20 passed through the inside of the deflection guide member 60 during the normal winding operation, the yarn 20 might be in contact with the deflection guide member 60 and thus damaged to deteriorate the quality of the yarn. In this respect, in the above-described configuration, the yarn 20 is not in contact with deflection guide member 60 during the normal winding operation. Therefore, deterioration in the quality of the yarn is prevented.

[0094] As shown in FIG. 1 and the like, the deflection guide member 60 is not connected with other members. More specifically, the deflection guide member 60 is arranged such that the yarn inlet 61 of the deflection guide member 60 is spaced apart from the upper yarn pull-out part 48. Likewise, the deflection guide member 60 is arranged such that the yarn outlet 62 of the deflection guide member 60 is spaced apart from the upper yarn catch part 13. In this manner, a space is formed between the deflection guide member 60 and the other members. In other words, the deflection guide member 60 is arranged at a position deviated from the yarn travel path. Therefore, the yarn 20 drawn out from the deflection guide member 60 is able to travel without any contact with the deflection guide member 60. In this point as

well, damage to the yarn 20 which may be caused by contact with the deflection guide member 60 is prevented at a time of the normal winding. Thus, deterioration in the quality of the yarn is prevented.

[0095] Here, the traversing bobbin winding machine disclosed in the Patent Document 1 also includes a suction nozzle having a slit. However, in the configuration of Patent Document 1, negative pressure is used to suck a yarn and guide the yarn to the yarn joining device. Thus, there is a possibility that air may flow into the suction nozzle through the slit and a suction force generated in the distal end of the suction nozzle may be deteriorated. On the other hand, in the automatic winder of this embodiment, a suction stream is directly generated near the yarn accumulation device 18 by means of ejected air. Therefore, even though the slit 63 is formed in the deflection guide member 60, a problem such as deterioration in a suction force does not occur. Moreover, in this embodiment, the deflection guide member 60 is a tube-like member. Therefore, air ejected from the upper yarn pull-out part 48 can be successfully guided from the yarn inlet 61 to the yarn outlet 62.

[0096] Furthermore, as described above, the yarn 20 is blown off and guided. Therefore, a member driven into large movement, such as the yarn guide pipes 91 and 92 shown in FIG. 19, is not necessary. Accordingly, the configuration of the automatic winder is simplified, and additionally the degree of freedom in a layout of configuration parts is increased. Furthermore, in this embodiment, a path through which the upper yarn 20b is guided is curved because of the deflection guide member 60. Therefore, even though a direction in which the yarn is blown out from the upper yarn pull-out part 48 is not oriented to the position where the upper yarn catch part 13 is arranged, the upper yarn 20b can be guided to the upper yarn catch part 13. Thus, devising the shape of the deflection guide member 60 allows a free layout of the positions of the upper yarn pull-out part 48 and the upper yarn catch part 13.

[0097] Next, an operation performed in a case where the clearer 17 detects a yarn defect will be described.

[0098] When the clearer 17 detects a yarn defect at a time of the normal winding as shown in FIG. 1, the control part 25 actuates the cutter 16 to cut the yarn 20. At this time, a yarn end at the upstream side of the cutter 16 is sucked and caught by the yarn trap 15 that is arranged at the immediately upstream side of the cutter 16. On the other hand, a yarn end at the downstream side of the cutter 16 is wound on the yarn accumulation roller 32 that is in positive rotation. As a result, a portion of the yarn containing the yarn defect is wound to the proximal end portion side of the yarn accumulation roller 32.

[0099] At this time, the state of the lower yarn 20a and the upper yarn 20b is similar to the state shown in FIG. 8. However, in a case where the cutter 16 cuts the yarn 20, the end of the yarn having been cut is directly sucked and caught by the yarn trap 15. Therefore, the operation for blowing the lower yarn 20a upward by the lower yarn blow-up part 11 is not necessary. In this point, this operation is different from the operation for replacing the yarn supply bobbin 21.

[0100] Then, the yarn trap 15 is driven in the direction away from the yarn travel path, and thereby the lower yarn 20a sucked and caught by the yarn trap 15 is introduced to the yarn joining device 14 (similar to the state shown in FIG. 9). Around this time, the yarn accumulation roller 32 is put into reverse rotation, and at the same time the electromagnetic valve 51 is put into the open state. Additionally, the lid 13a is opened. Thus, the upper yarn 20b is introduced to the yarn joining device 14 (similar to the state shown in FIG. 13). Under this condition, the reverse rotation of the yarn accumulation roller 32 is continued for a predetermined time period. Thereby, the portion containing the yarn defect, which has been wound on the yarn accumulation roller 32, is pulled out and sucked by the upper yarn catch part 13. Thus, the portion containing the yarn defect detected by the clearer 17 can be removed. Then, the control part 25 actuates the yarn joining device 14, to perform yarn joining.

[0101] As described above, also in the yarn joining operation performed upon detection of a yarn defect, the upper yarn 20b is blown off and guided by means of ejected air. This enables the upper yarn 20b to be quickly guided with a simple configuration, as compared with the upper yarn guide member (the upper yarn guide pipe 91 shown in FIG. 19) included in the conventional winder unit. Moreover, in the yarn joining operation performed upon detection of a yarn defect, the lower yarn 20a can be guided to the yarn joining device 14 simply by driving the yarn trap 15 under a state where the lower yarn 20a is sucked and caught by the yarn trap 15. Therefore, in a case where a yarn defect is detected, the lower yarn 20a is easily and quickly guided. In this manner, also in a case where a yarn defect is detected, a time required for the yarn joining operation is shortened, and thus the production efficiency of the package 30 is improved.

[0102] As thus far described, the automatic winder of this embodiment includes the bobbin support part 7, the yarn accumulation device 18, the winding part 8, the yarn joining device 14, and the upper yarn guide part. The bobbin support part 7 supports the yarn supply bobbin 21. The yarn accumulation device 18 accumulates the yarn 20 unwound from the yarn supply bobbin 21. The winding part 8 winds the yarn 20 accumulated on the yarn accumulation device 18, to form the package 30. The yarn joining device 14 performs yarn joining between a yarn of the yarn supply bobbin 21 side and a yarn of the yarn accumulation device 18 side, in a case where the yarn 20 is disconnected between the bobbin support part 7 and the yarn accumulation device 18. The upper yarn guide part pulls out a yarnfrom the yarn accumulation device 18 and guides the yarn to the yarn joining device 14. The upper yarn guide part includes the guide tube 34, the air ejection nozzle 49, the upper yarn catch part 13, and the negative pressure source. The guide tube 34 pulls out the yarn 20 accumulated on the yarn accumulation device 18, and blows off the yarn 20 toward the bobbin support part 7 side. The air ejection nozzle 49 generates an air stream in the guide tube 34, the air stream being for pulling out and

blowing off the yarn. The upper yarn catch part 13 is arranged between the yarn joining device 14 and the bobbin support part 7, and catches the yarn 20 blown off by the guide tube 34. The negative pressure source generates an air stream in the upper yarn catch part 13, the air stream being for catching the yarn and introducing the yarn to the yarn joining device 14.

[0103] Accordingly, since the upper yarn 20b is blown off and guided to the yarn joining device 14 by means of ejected air, the configuration for guiding the upper yarn 20b is simple. As a result, the degree of freedom in a layout of configuration parts is improved. Moreover, since guiding of the upper yarn 20b to the yarn joining device 14 is completed merely by blowing off the upper yarn 20b, a time required for the operation for guiding the upper yarn 20b is shortened and thus the production efficiency of the package 30 is improved. Furthermore, in a case where the upper yarn 20b is pulled out from the yarn accumulation device 18 as described above, it suffices that the suction stream is applied only to a position where the yarn end exists, which is known. This enables the yarn end to be reliably sucked with less energy.

[0104] The automatic winder of this embodiment is configured as follows. At a time of yarn winding, the guide tube 34 guides the yarn 20 of the yarn supply bobbin 21 side to the yarn accumulation device 18. The air ejection nozzle 49 blasts compressed air to the inside of the guide tube 34.

[0105] In this configuration, the yarn 20 is accumulated on the yarn accumulation device 18 through the guide tube 34. Therefore, when, reversely, the yarn is pulled out from the yarn accumulation device 18, the pulling out of the yarn from the yarn accumulation device can be reliably and smoothly performed by pulling out the yarn through the guide tube 34. Accordingly, the above-described configuration in which the guide tube 34 also serves as a yarn pull-out ejection part enables the yarn 20 wound on the yarn accumulation device 18 to be reliably and smoothly blown off.

[0106] The automatic winder of this embodiment further includes the deflection guide member 60 that guides the upper yarn 20b, which has been blown off by the guide tube 34, to the upper yarn catch part 13.

[0107] Since the upper yarn 20b blown off by the guide tube 34 is guided to the upper yarn catch part 13 by the deflection guide member 60, the guide tube 34 and the upper yarn catch part 13 can be freely arranged. This improves the degree of freedom in a layout.

[0108] In the automatic winder of this embodiment, the deflection guide member 60 is a tube-like member, in which the slit 63 is formed along a longitudinal direction of a tube.

[0109] The deflection guide member 60 having such a tube-like shape allows the upper yarn 20b to pass through the inside of the tube and thereby reliably guides the upper yarn 20b to the upper yarn catch part 13. Since the slit 63 is formed in the deflection guide member 60 having a tube-like shape, the upper yarn 20b having been guided to the upper yarn catch part 13 can be drawn out through the slit 63. As a result, at a time of the normal winding, the yarn 20 is able to travel outside the deflection guide member 60. This can prevent deterioration in the quality of the yarn 20, which may otherwise be caused by contact with the deflection guide member 60.

[0110] In the automatic winder of this embodiment, the deflection guide member 60 is provided at a position deviated from the travel path through which the yarn 20 travels at a time of the yarn winding.

[0111] This prevents the yarn 20 from being in contact with the deflection guide member 60 at a time of the normal winding. Thus, deterioration in the quality of the yarn 20 is prevented.

[0112] The automatic winder of this embodiment includes the lower yarn guide part that guides the lower yarn 20a of the yarn supply bobbin 21 side to the yarn joining device 14. The lower yarn guide part includes the lower yarn blow-up part 11, the yarn trap 15, and the negative pressure source. The lower yarn blow-up part 11 is arranged between the bobbin support part 7 and the yarn joining device 14, and configured to blow off the lower yarn 20a of the yarn supply bobbin 21 side to a position near the yarn joining device 14. The yarn trap 15 is arranged between the yarn joining device 14 and the yarn accumulation device 18, and configured to catch the lower yarn 20a blown off by the lower yarn blow-up part 11. The negative pressure source generates an air stream in the yarn trap 15, the air stream being for catching the lower yarn 20a.

[0113] Accordingly, the yarn of the yarn supply bobbin 21 side can be blown off and guided to the yarn joining device 14. This can further improve the degree of freedom in a layout of configuration parts of the yarn winding machine, and further shorten a time required for the yarn joining.

[0114] The automatic winder of this embodiment includes the yarn trap driver 47 that drives the yarn trap 15 in the direction toward and away from the yarn travel path.

[0115] This enables the yarn trap 15 to be moved to a position (position close to the yarn travel path) that allows the yarn trap 15 to easily catch the yarn 20.

[0116] The automatic winder of this embodiment includes the control part 25 that controls actuation of the yarn trap driver 47. At a time of the normal winding, the control part 25 brings the yarn trap 15 close to the yarn travel path, and at a time of the yarn joining, the control part 25 drives the yarn trap 15 in the direction away from the yarn travel path under a state where the yarn 20 is caught by the yarn trap 15, to thereby introduce the caught yarn 20 to the yarn joining device 14.

[0117] Accordingly, at a time of the normal winding, the yarn trap 15 is located close to the yarn travel path, to make it possible to suck and remove cotton fly, or the like, adhering to the yarn 20. On the other hand, when the yarn trap 15

catches the yam, the yarn trap 15 is driven in the direction away from the yarn travel path, and thereby the yarn 20 can be introduced to the yarn joining device.

[0118] The automatic winder of this embodiment includes the control part 25 that controls the yarn joining device 14, the upper yarn pull-out part 48, and the lower yarn blow-up part 11. When a new yarn supply bobbin 21 is fed to the bobbin support part 7, the control part 25 causes the lower yarn blow-up part 11 to blow off the lower yam 20a of the new yarn supply bobbin 21 side, causes the yam trap 15 to catch the yarn thus blown off, and drives the yarn trap 15 in the direction away from the yarn travel path. At or around this time, the control part 25 causes the upper yarn pull-out part 48 to pull out the upper yarn 20b from the yarn accumulation device 18 and blow off the upper yarn 20b, and causes the upper yarn catch part 13 to catch the yarn thus blown off. Then, the control part 25 actuates the yarn joining device 14, to perform the yarn joining.

[0119] Accordingly, when the yarn supply bobbin 21 is replaced, the lower yarn 20a of the yarn supply bobbin 21 side and the upper yarn 20b of the yarn accumulation device 18 side are guided to the yarn joining device 14, and thus the yarn joining can be performed.

[0120] The automatic winder of this embodiment includes the clearer 17 and the cutter 16. The cutter 16 is configured to, at a position at the downstream side of the yarn trap 15, cut the yarn between the yarn supply bobbin 21 and the yarn accumulation device 18. When the clearer detects a yarn defect, the control part 25 actuates the cutter to cut the yarn, causes the yarn trap 15 to catch the lower yarn 20a of the yarn supply bobbin 21 side, and drives the yarn trap 15 in the direction away from the yarn travel path. At or around this time, the control part 25 causes the upper yarn pull-out part 48 to pull out the upper yarn 20b of the yarn accumulation device 18 side and blow off the upper yarn 20b, and causes the upper yarn catch part 13 to catch the yarn thus blown off. Then, the control part 25 actuates the yarn joining device 14, to perform the yarn joining.

[0121] Accordingly, after the yarn whose yarn fault has been detected is cut, the yarn of the yarn supply bobbin side and the yarn of the yarn accumulation device side are guided to the yarn joining device, and thus the yarn joining can be performed.

[0122] Next, a modification of the above-described first embodiment will be described. In a description of the modification given below, configuration parts identical or similar to those of the above-described first embodiment will be denoted by the same reference numerals as those of the first embodiment, and descriptions thereof will be omitted. In this modification, as shown in FIG. 14, the lower yarn blow-up part 11 is omitted and instead a lower yarn guide pipe 92 is provided. In this modification, the lower yarn guide pipe 92 guides the lower yarn 20a to the yarn joining device 14. A configuration of the lower yarn guide pipe 92 is similar to the configuration of the lower yarn guide pipe 92 included in the conventional automatic winder shown in, for example, FIG. 19. Therefore, a description thereof will be omitted.

[0123] A configuration of this modification is also possible, in which the lower yarn 20a is guided to the yarn joining device 14 by means of the conventional yarn guide member (yarn guide pipe 92). In this configuration as well, the upper yarn 20b is guided to the yarn joining device 14 by means of ejected air. Therefore, as compared with the conventional configuration (the configuration shown in FIG. 19) in which both the upper yarn 20b and the lower yarn 20a are guided by means of the yarn guide pipes 91 and 92, a simple configuration is achieved and additionally a time required for the yarn joining is shortened.

[0124] Next, a second embodiment of the present invention will be described. In a description of the modification given below, configuration parts identical or similar to those of the above-described first embodiment will be denoted by the same reference numerals as those of the first embodiment, and descriptions thereof will be omitted.

[0125] As shown in FIG. 15, a winder unit 100 included in an automatic winder according to this embodiment includes a yarn accumulation device of different type from that of the above-described first embodiment. In the following, this yarn accumulation device 64 will be described with reference to FIG. 16.

[0126] As shown in FIG. 16, the yarn accumulation device 64 includes a rotation shaft casing 70, a yarn accumulation part 71, and a yarn guide part 72. The rotation shaft casing 70 includes a cylindrical tube portion 78 that is open at the upper side thereof, and a flange portion 79 that is formed at an open end portion of the tube portion 78. The upper yarn pull-out part 48 is arranged at the immediately upstream side of the yarn accumulation device 64.

[0127] The yarn accumulation part 71 is arranged above the flange portion 79. The yarn accumulation part 71 includes a support plate 81 having a disk shape, a plurality of rod members 82 that protrude upward from the support plate 81, and a mounting plate 83 having a disk shape to which distal end portions of the plurality of rod members 82 are connected. The yarn accumulation part 71 is arranged such that there is a gap between the support plate 81 and the flange portion 79. A winding tube 75, which will be described later, is rotatable within the gap.

[0128] The plurality of rod members 82 are arranged side by side at regular intervals on the circumference of a circle that is perpendicular to the vertical direction. These rod members 82 define a substantially cylindrical shape of the yarn accumulation part 71. The yarn 20 is wound on an outer circumferential portion of the yarn accumulation part 71 having a substantially cylindrical shape defined by the plurality of rod members 82. Thereby, the yarn 20 is accumulated on the yarn accumulation part 71.

[0129] The yarn guide part 72 is arranged within the rotation shaft casing 70. In the rotation shaft casing 70, an

introduction hole 80 is formed in a lower portion (at the end opposite to the yarn accumulation part 71 side) of the tube portion 78. The guide tube 34 of the upper yarn pull-out part 48 is connected to the introduction hole 80. The yarn 20 pulled out from the yarn supply bobbin 21 is guided to the introduction hole 80 by the guide tube 34, and led through the introduction hole 80 to the yarn guide part 72.

[0130] Within the tube portion 78, the rotation shaft casing 70 and a rotation shaft 73 are arranged. The rotation shaft 73 is mounted to the yarn accumulation part 71 in a relatively rotatable manner. A servomotor (yarn accumulation driving part) 55 is incorporated between the rotation shaft 73 and the tube portion 78, and thus positive rotation and reverse rotation of the rotation shaft 73 are allowed. A yarn passage 74 in the shape of an axial hole is provided at the center of the rotation shaft 73.

[0131] A winding tube (winding means) 75 having a cylindrical shape is fixed to one end of the rotation shaft 73 (an end portion thereof opposite to the introduction hole 80 side). The winding tube 75 is slightly inclined upward, and obliquely extends out through the gap between the rotation shaft casing 70 (flange portion 79) and the support plate 81. A part of a distal end portion of the winding tube 75 slightly protrudes out from the rotation shaft casing 70. The winding tube 75 is rotatable integrally with the rotation shaft 73. The inside of the winding tube 75 is connected to the yarn passage 74.

[0132] In the above-described configuration, the yarn 20 is led through the introduction hole 80 of the yarn guide part 72 into the rotation shaft casing 70, and then passes through the yarn passage 74 and the inside of the winding tube 75, and then is discharged from the distal end of the winding tube 75. As a result, the yarn 20 is guided to a side surface portion of the yarn accumulation part 71. Accordingly, when the servomotor 55 is driven in a positive direction, the winding tube 75 is rotated together with the rotation shaft 73, thus winding the yarn 20 around the side surface portion.

[0133] In the yarn accumulation part 71, each of the plurality of rod members 82 is arranged such that it is inclined more inward of the yarn accumulation part 71 at a location farther from its end at the support plate 81 side and closer to its end at the mounting plate 83 side. Such inclination of the rod member 82 causes the yarn wound on the yarn accumulation part 71 to move upward in a sliding manner. Accordingly, when the winding tube 75, which will be described later, continuously wind the yarn 20, the yarn wound on the inclined portion moves upward. Thus, in the side surface portion formed of the rod members 82, the yarn 20 is accumulated while being orderly arranged into a spiral shape.

[0134] Similarly to the above-described first embodiment, the upper yarn pull-out part 48 includes the guide tube 34 and the air ejection nozzle 49. As shown in FIG. 16, the air ejection nozzle 49 is connected to the electromagnetic valve 51 that is controlled by the control part 25. The electromagnetic valve 51 is connected to the compressed air source 46. An air ejection port of the air ejection nozzle 49 is formed such that air is ejected toward the upstream side with respect to the direction of traveling of the yarn.

[0135] In the second embodiment, to pull out the yarn from the yarn accumulation device 64, the control part 25 stops the servomotor 55 and puts the electromagnetic valve 51 into the open state, to generate an air stream in the guide tube 34. Thereby, the yarn can be pulled out from the yarn accumulation device 64.

[0136] As shown in FIG. 16, the guide tube 34 is formed with an appropriate curve. A distal end portion of the guide tube 34 having such a curve is oriented to a position where the yarn inlet 61 of the deflection guide member 60 is arranged. Accordingly, the yarn pulled out from the yarn accumulation device 64 can be introduced to the deflection guide member 60. In this second embodiment as well, the above-described configuration enables the upper yarn of the yarn accumulation device 64 side to be guided to the yarn joining device 14.

[0137] Next, a modification of the above-described second embodiment will be described. In this modification, the deflection guide member is omitted as shown in FIG. 17, and the guide tube 34 has a cylindrical shape without any curve as shown in FIG. 18. Furthermore, the distal end of the guide tube 34 is oriented toward the yarn supply bobbin 21. This configuration allows the yarn accumulated on the yarn accumulation device 64 to be pulled out to the immediately upstream side without being curved.

[0138] To be specific, in the above-described first and second embodiments, the yarn travel path is bent due to the guide tube 34, and thereby the yarn 20 of the yarn supply bobbin 21 is guided to the yarn accumulation device. When the yarn travel path is bent in this manner, the traveling yarn may be in contact with the guide tube 34 and damaged. In this modification, however, the yarn travel path is not bent by the guide tube 34. Therefore, damage to the yarn can be minimized.

[0139] Particularly, in the yarn accumulation device 64 of the second embodiment, the yarn introduction hole 80 is formed in the upstream end portion (lower end portion) of the yarn accumulation device 64, so that the yarn is pulled out through the introduction hole 80. Therefore, it is easy to adopt such a configuration that the yarn is pulled out straight toward the downstream side. In the yarn accumulation device 18 of the first embodiment, on the other hand, the yarn is pulled out from the circumferential surface of the yarn accumulation roller 32 that is arranged in an inclined manner. Therefore, it is not easy to adopt such a configuration that the yarn is pulled out toward the downstream side. Accordingly, in a case of pulling out the yarn straight toward the downstream side as described above, it is preferable to adopt the yarn accumulation device 64 of the second embodiment.

[0140] In this modification, the deflection guide member is omitted, and therefore it is necessary to additionally provide

a configuration part for guiding the yarn pulled out from the yarn accumulation device 64 to the yarn joining device 14. Thus, in this embodiment, an upstream yarn trap 115 is provided instead of the upper yarn catch part 13 included in the winder unit of the first and second embodiments described above. Similarly to the yarn trap 15 provided at the downstream side, the upstream yarn trap 115 is also connected to the negative pressure source, so that a suction stream is generated in a distal end portion of the upstream yarn trap 115. The upstream yarn trap 115 is driven in a direction toward and away from the yarn travel path by a yarn trap driver 147.

[0141] At a time of normal winding, the control part moves the upstream yarn trap 115 to a position close to the yarn travel path. Thereby, similarly to the yarn trap 15 provided at the downstream side, the upstream yarn trap 115 is able to such and remove cotton fly.

[0142] To pull out the yarn from the yarn accumulation device 64, the control part 25 stops the servomotor 55 and puts the electromagnetic valve 51 into the open state, to generate an air stream in the guide tube 34. Thereby, the yarn can be blown off from the yarn accumulation device 64 straight toward the upstream side. The yarn thus blown off toward the upstream side is sucked by the suction stream that is generated by the upstream yarn trap, and caught by the upstream yarn trap. Under this condition, the control part retracts the upstream yarn trap. In the above-described configuration, the yarn pulled out from the yarn accumulation device 64 can be guided to the yarn joining device 14.

[0143] Next, another modification of the above-described second embodiment will be described. In the yarn accumulation device 64 of the second embodiment, the rod members 82 are inclined in order that the yarn is wound while being orderly arranged in the yarn accumulation part 71. However, such a configuration causes a problem that the yarn wound on the rod members 82 is loosened as the yarn moves upward. Accordingly, instead of inclining the rod members, a member that actively transfers the yarn upward may be provided. For example, it may be acceptable that a yarn in a yarn accumulation part is actively transferred upward by means of a roller member.

[0144] While some preferred embodiments of the present invention and modifications thereof have been described above, the above-described configurations can be changed, for example, as follows.

[0145] In the above-described first embodiment, to pull out the yarn from the yarn accumulation device 18, the roller drive motor 33 causes reverse rotation of the yarn accumulation roller 32. However, in a case where the upper yarn pull-out part 48 pulling out the upper yarn 20b exerts a sufficiently strong force, it may be acceptable to merely put the roller drive motor 33 into a neutral mode.

[0146] In the foregoing description of the embodiments, because the description is given based on the drawings, the lower yarn 20a is firstly guided and then the upper yarn 20b is guided. However, this is not limiting. The upper yarn 20b may be firstly guided. In the conventional configuration shown in FIG. 19, if the lower yarn 20a and the upper yarn 20b are simultaneously guided, a problem arises that the two yarn guide pipes 91 and 92 interfere with each other. Therefore, the upper yarn and the lower yarn cannot be simultaneously guided. However, in the configurations of the above-described embodiments or modifications thereof, the number of yarn guide pipes is at most one. Therefore, the problem of interference between yarn guide pipes does not occur. Accordingly, the automatic winders according to the above-described embodiments or modifications thereof, the lower yarn 20a and the upper yarn 20b can be simultaneously guided.

[0147] In the above, the yarn trap 15 can be driven in the direction toward and away from the yarn travel path. However, this configuration may be omitted, and instead the yarn trap 15 may be fixed at a position away from the yarn travel path (position that allows the lower yarn 20a to be introduced to the yarn joining device 14). However, such a configuration cannot bring the yarn trap 15 close to the yarn travel path at a time of the normal winding. Therefore, it is difficult to strongly apply the suction stream to the yarn 20, and there is a possibility that cotton fly adhering to the yarn 20 cannot be reliably removed. Such a configuration also involves a possibility that, when a yarn defect is detected so that the yarn 20 is cut, a yarn end of the lower yarn cannot be caught. Accordingly, it is preferable that the yarn trap 15 can be driven in the direction toward and away from the yarn travel path, as described in the embodiments above.

[0148] The shape of the deflection guide member 60 is not limited to the one adopted in the above-described embodiments. Any appropriate shape is adoptable, as long as the air ejected from the upper yarn pull-out part 48 can be appropriately guided to the upper yarn catch part 13. For example, in a case where it is possible to arrange the upper yarn catch part 13 at a position to which air ejected from the upper yarn pull-out part 48 is oriented, the upper yarn 20b can be guided to the upper yarn catch part 13 without the deflection guide member 60. In such a case, therefore, the deflection guide member 60 can be omitted.

[0149] It is not always necessary that each winder unit 2 includes the control part 25, and instead a plurality of winder units may be controlled by a single control part. In the description give above, the single control part 25 collectively controls a plurality of members. However, this is not limiting. For example, an individual control part may be provided corresponding to each member to be controlled.

[0150] The control part 25 is composed of hardware and software. However, it may be acceptable that the function of the control part 25 is partially or wholly implemented by hardware dedicated therefor.

[0151] In the above-described embodiments, the yarn supply bobbin 21 is fed to the winder unit 2 by means of the bobbin feeder 26 of magazine type. However, this configuration is not limiting. For example, in a possible alternative configuration, a tray having the yarn supply bobbin 21 set thereon may be transported along an appropriate path, to

thereby feed the yarn supply bobbin 21 to the winder unit 2.

[0152] In the above-described embodiments, the winding part 8 is configured to traverse the yarn 20 by means of the traverse drum 24. Instead, for example, an arm-type traverse mechanism may be adopted to traverse the yarn 20.

[0153] The present invention is not limited to an automatic winder, and the present invention is applicable to other types of yarn winding machines including a yarn joining device.

DESCRIPTION OF THE REFERENCE NUMERALS

[0154]

2	winder unit
7	bobbin support part
8	winding part
11	lower yarn blow-up part
12	upper yarn catch part (yarn catch part)
14	yarn jointing device
15	yarn trap (second yarn catch part)
17	clearer (yarn fault detection device)
18	yarn accumulation device
25	control part
34	guide tube
49	air ejection nozzle
48	upper yarn pull-out part (yarn pull-out ejection part)
60	deflection guide member

Claims

1. A yarn winding machine comprising:

a bobbin support part that supports a yarn supply bobbin;
a yarn accumulation device that accumulates a yarn unwound from the yarn supply bobbin;
a winding part that winds a yarn accumulated on the yarn accumulation device, to form a package;
a yarn joining device that performs yarn joining between a yarn of the yarn supply bobbin side and a yarn of the yarn accumulation device side, in a case where a yarn is disconnected between the bobbin support part and the yarn accumulation device; and
a yarn guide part that guides a yarn accumulated on the yarn accumulation device to the yarn joining device,
wherein the yarn guide part includes:

a yarn pull-out ejection part that pulls out a yarn accumulated on the yarn accumulation device and blows off the yarn toward the bobbin support part side;
an air ejection part that generates an air stream in the yarn pull-out ejection part, the air stream being for pulling out and blowing off a yam;
a yarn catch part arranged between the yarn joining device and the bobbin support part, and configured to catch a yarn blown off by the yarn pull-out ejection part; and
a yarn catch air-stream generation part that generates an air stream in the yarn catch part, the air stream being for catching a yarn and introducing the yarn to the yarn joining device.

2. The yarn winding machine according to claim 1, wherein
the yarn pull-out ejection part is a guide tube that guides a yarn of the yarn supply bobbin side to the yarn accumulation device at a time of yarn winding,
the air ejection part is an air ejection nozzle that blasts compressed air to the inside of the guide tube.

3. The yarn winding machine according to claim 1, further comprising a deflection guide member that guides a yarn blown off by the yarn pull-out ejection part to the yarn catch part.

4. The yarn winding machine according to claim 3, wherein
the deflection guide member is a tube-like member, in which a slit is formed along a longitudinal direction of a tube.

5. The yarn winding machine according to claim 4, wherein
the deflection guide member is provided at a position deviated from a travel path through which a yarn travels at a time of yarn winding.

6. The yarn winding machine according to any one of claims 1 to 5, comprising a second yarn guide part that guides a yarn of the yarn supply bobbin to the yarn joining device, wherein
the second yarn guide part includes:

a lower yarn blow-up part arranged between the bobbin support part and the yarn joining device, and configured to blow off a yarn of the yarn supply bobbin toward the yarn joining device side;
a second yarn catch part arranged between the yarn joining device and the yarn accumulation device, and configured to catch a yarn blown off by the lower yarn blow-up part; and
a second yarn catch air-stream generation part that generates an air stream in the second yarn catch part, the air stream being for catching a yarn.

7. The yarn winding machine according to claim 6, comprising a driving part configured to drive the second yearn catch part in a direction toward and away from a yarn travel path.

8. The yarn winding machine according to claim 7, comprising a control part that controls actuation of the driving part, wherein
at a time of normal winding, the control part brings the second yarn catch part close to the yarn travel path, and
at a time of yarn joining, the control part drives the second yarn catch part in a direction away from the yarn travel path under a state where a yarn is caught by the second yarn catch part, to thereby introduce the caught yarn to the yarn joining device.

9. The yarn winding machine according to claim 8, comprising a control part that controls the yarn joining device, the yarn pull-out ejection part, and the lower yarn blow-up part, wherein
when a new yarn supply bobbin is fed to the bobbin support part, the control part causes the lower yarn blow-up part to blow off a yarn of the new yarn supply bobbin, causes the second yarn catch part to catch the yarn thus blown off, and drives the second yarn catch part in the direction away from the yarn travel path,
at or around this time, the control part causes the yarn pull-out ejection part to pull out a yarn accumulated on the yarn accumulation device and blow off the yam, and causes the yarn catch part to catch the yarn thus blown off, and
then, the control part actuates the yarn joining device, to perform yarn joining.

10. The yarn winding machine according to claim 8, comprising:

a yarn defect detection device; and
a cutter configured to, at a position at a downstream side of the second yarn catch part, cut a yarn between the yarn supply bobbin and the yarn accumulation device,
wherein
when the yarn defect detection device detects a yarn defect,
the control part actuates the cutter to cut the yam, causes the second yarn catch part to catch a yarn of the yarn supply bobbin side, and drives the second yarn catch part in the direction away from the yarn travel path,
at or around this time, the control part causes the yarn pull-out ejection part to pull out a yarn accumulated on the yarn accumulation device and blow off the yam, and causes the yarn catch part to catch the yarn thus blown off, and
then, the control part actuates the yarn joining device, to perform yarn joining.

Fig.1

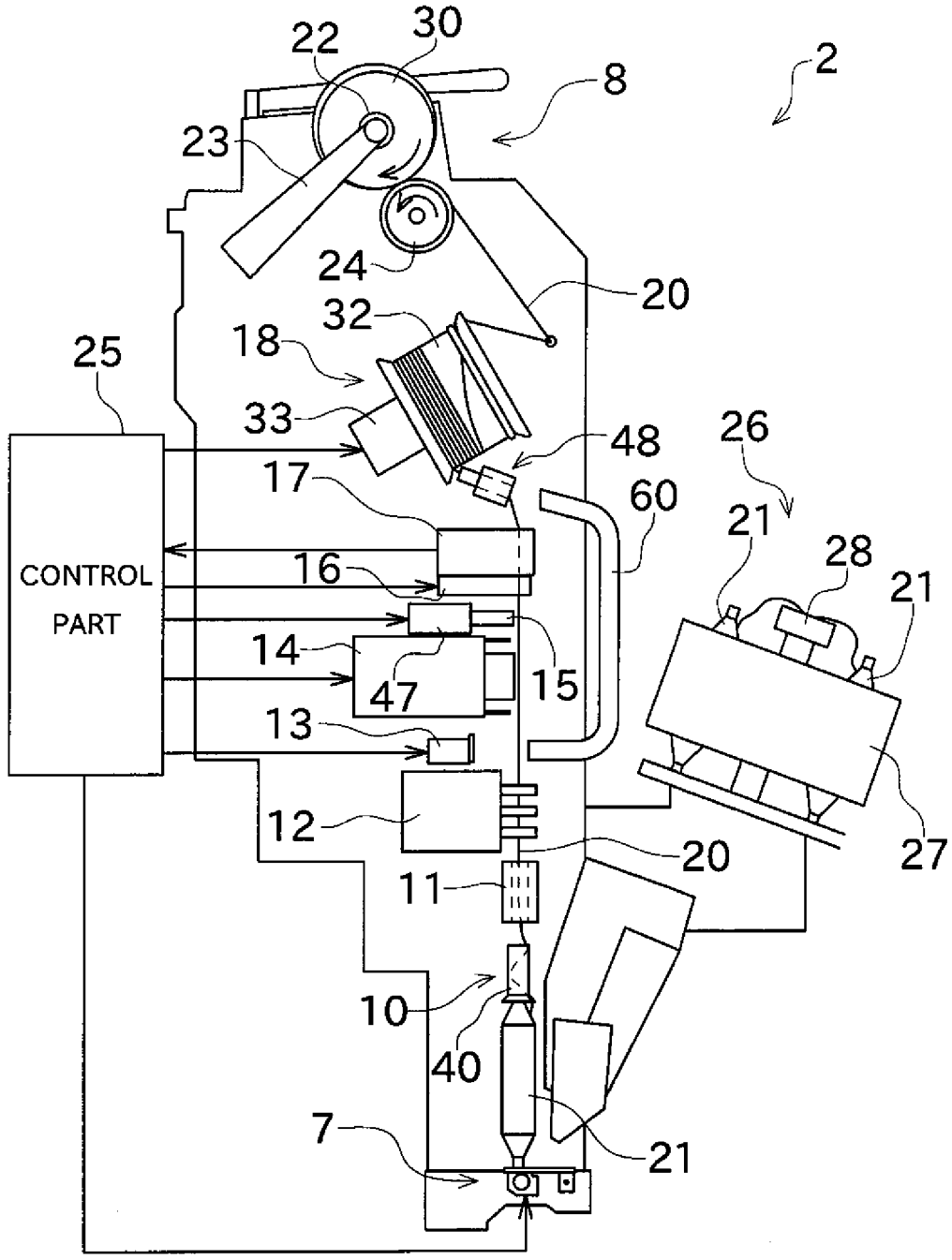
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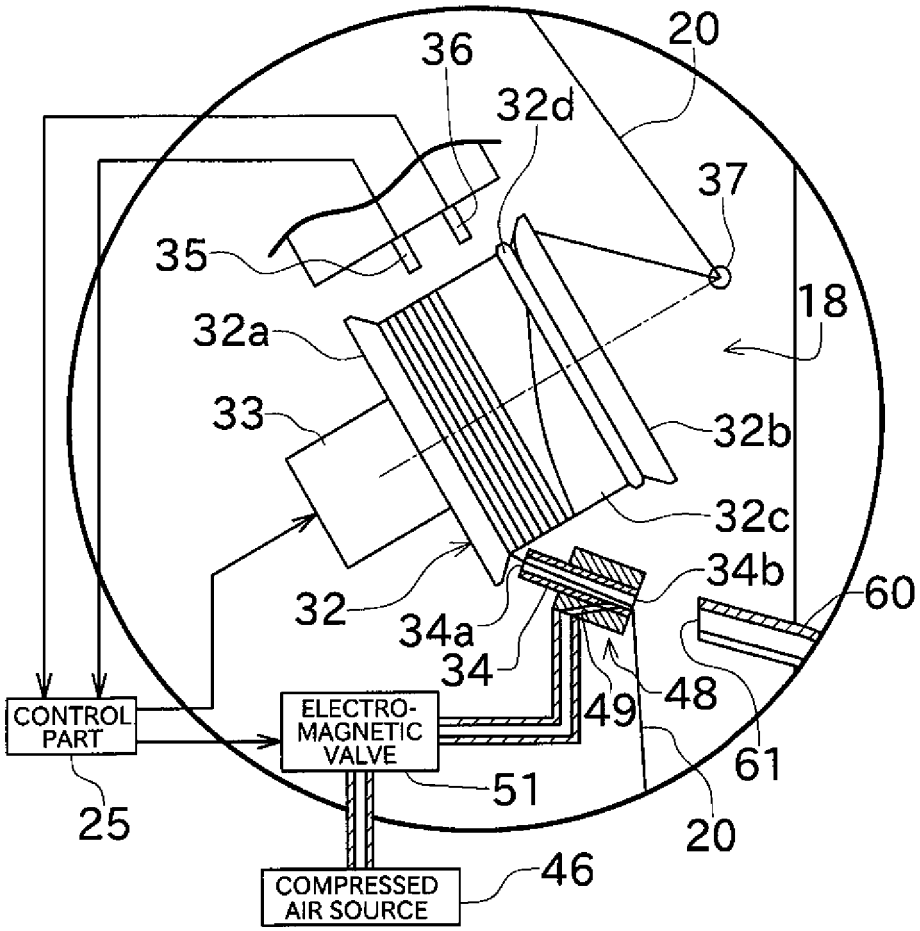
Fig.2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34b
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CONTROL PART
ELECTRO-MAGNETIC VALVE
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46
COMPRESSED AIR SOURCE

Fig.3

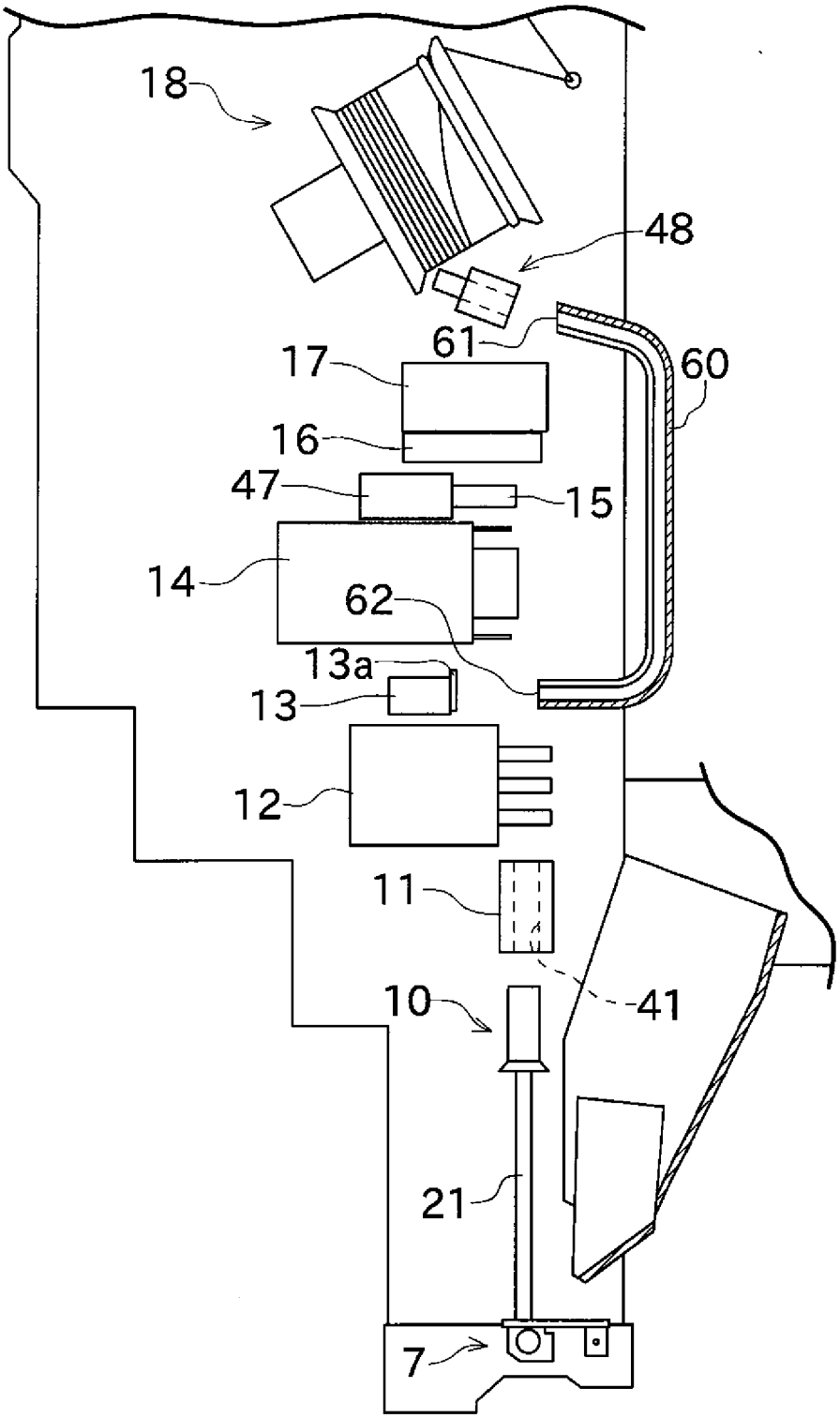

Fig.4

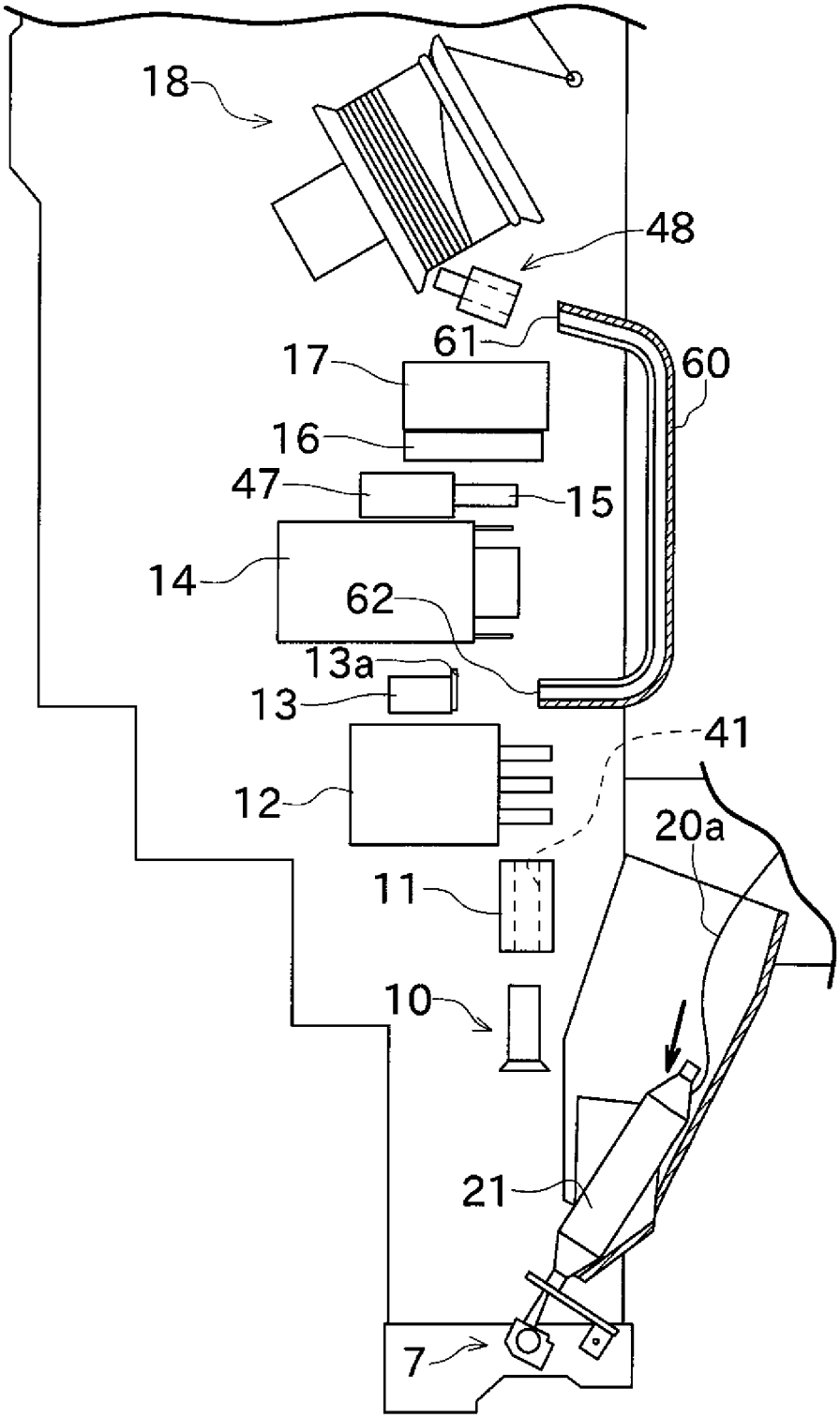

Fig.5

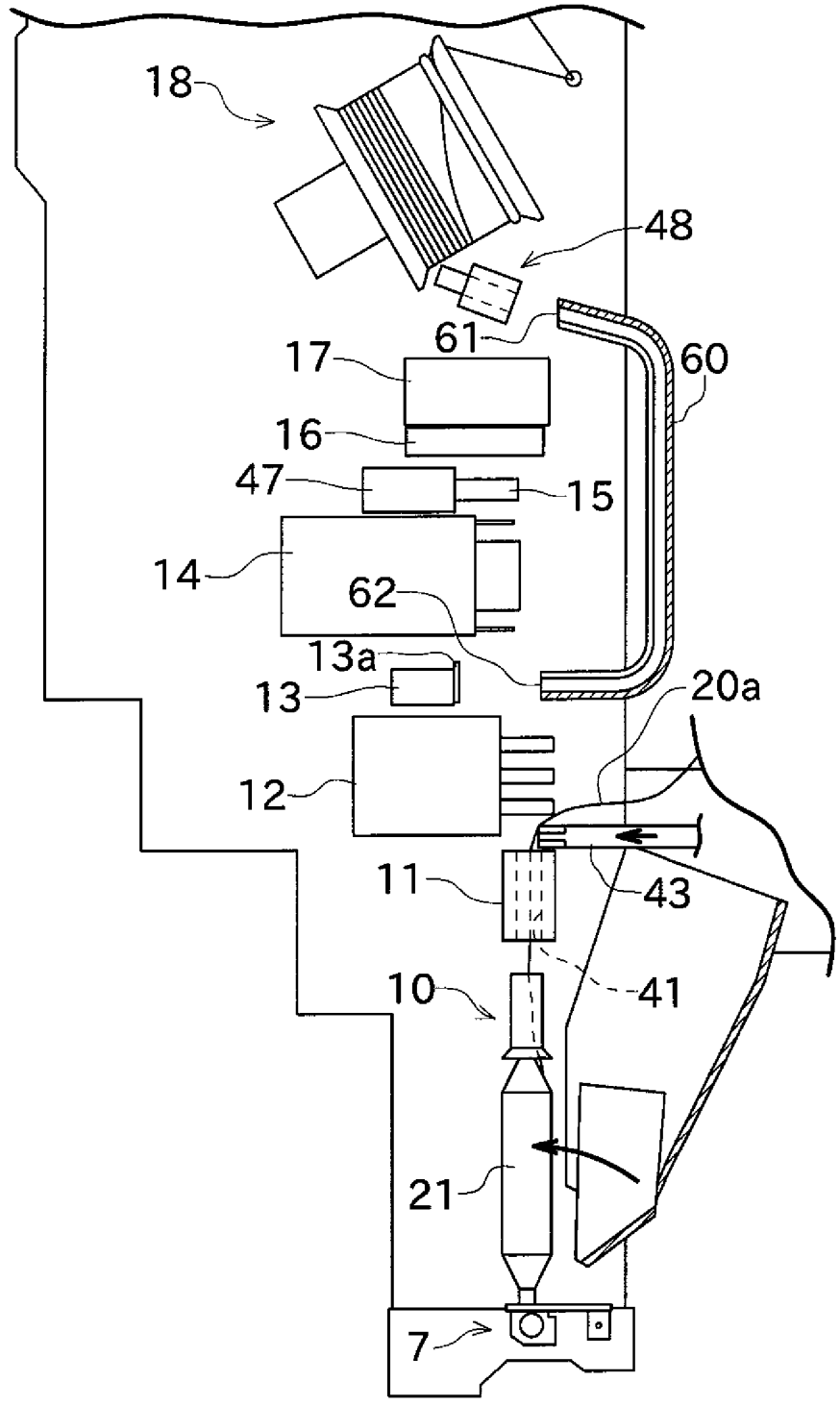

Fig.6

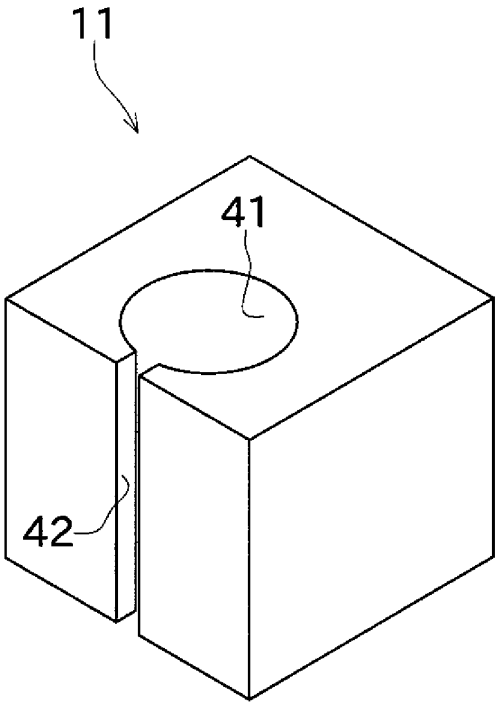
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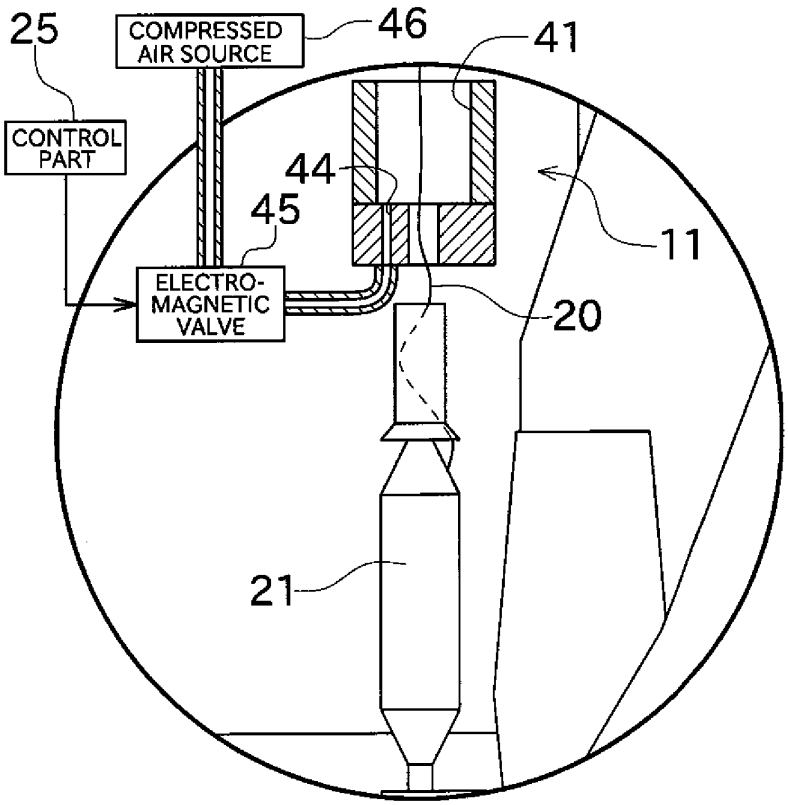
Fig.7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CONTROL PART
COMPRESSED AIR SOURCE
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ELECTRO-MAGNETIC VALVE
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Fig.8

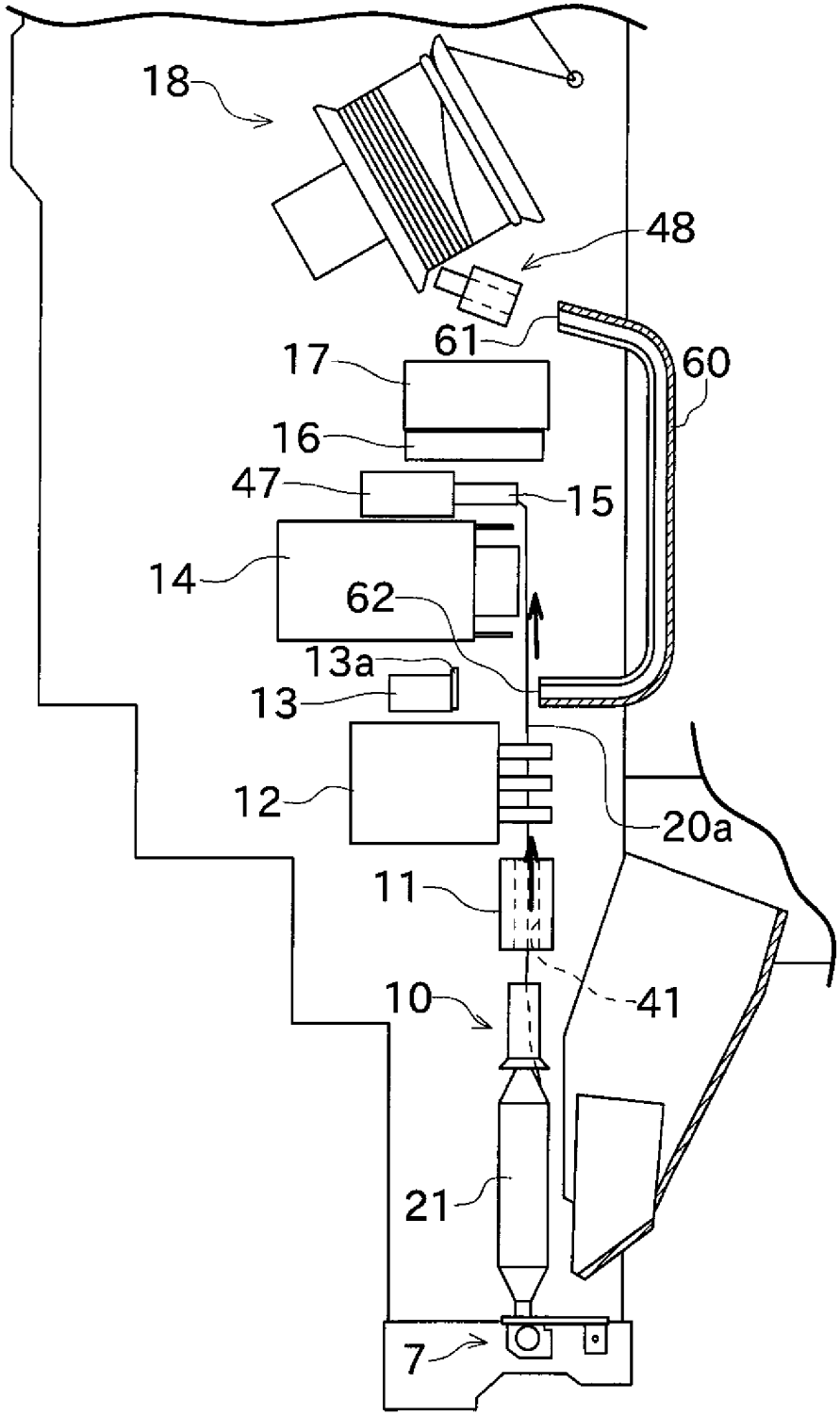

Fig.9

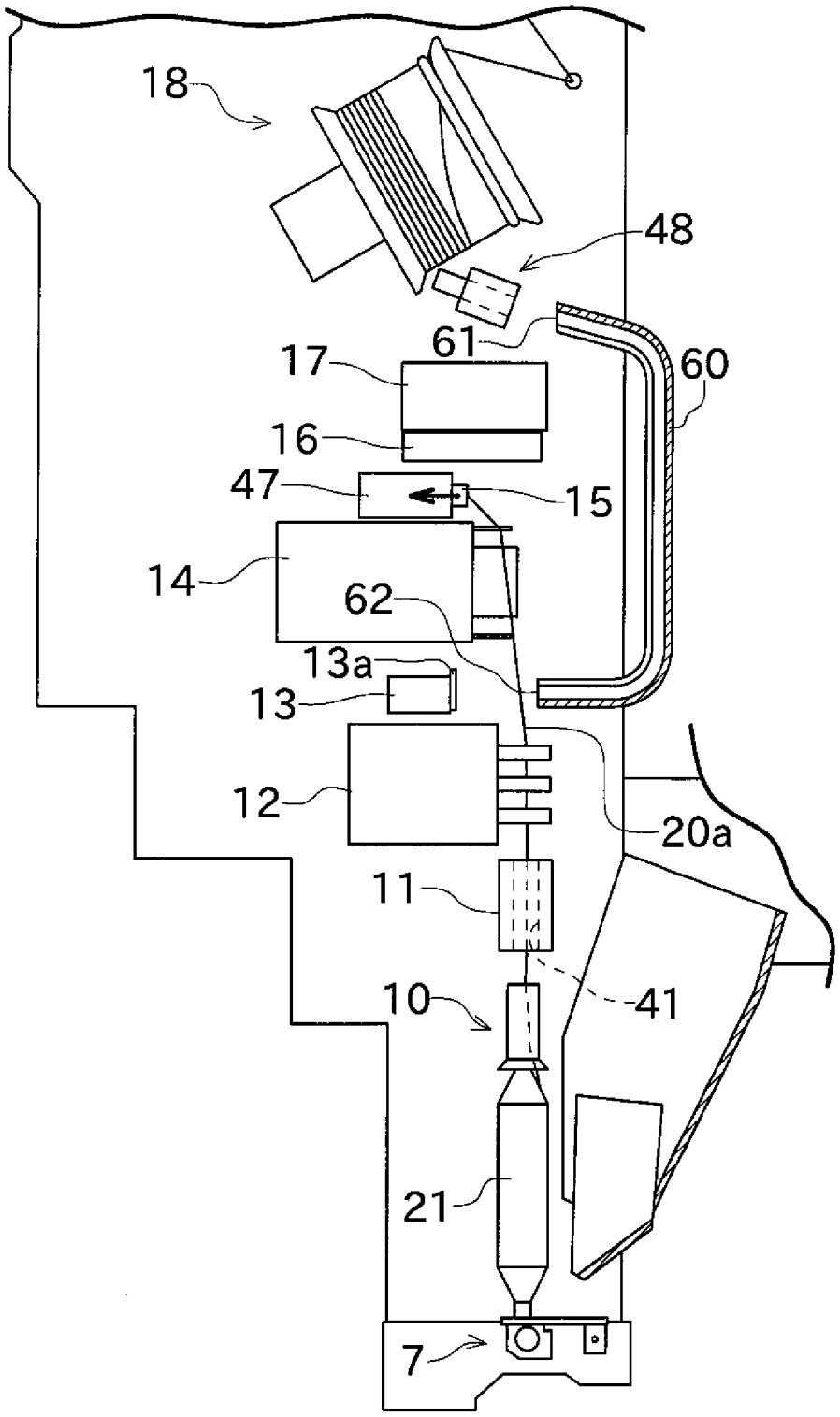

Fig.10

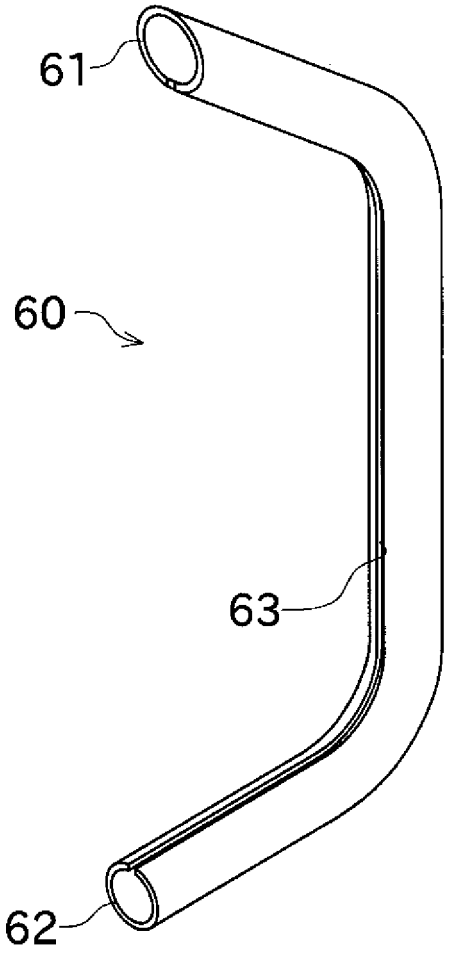

Fig.11

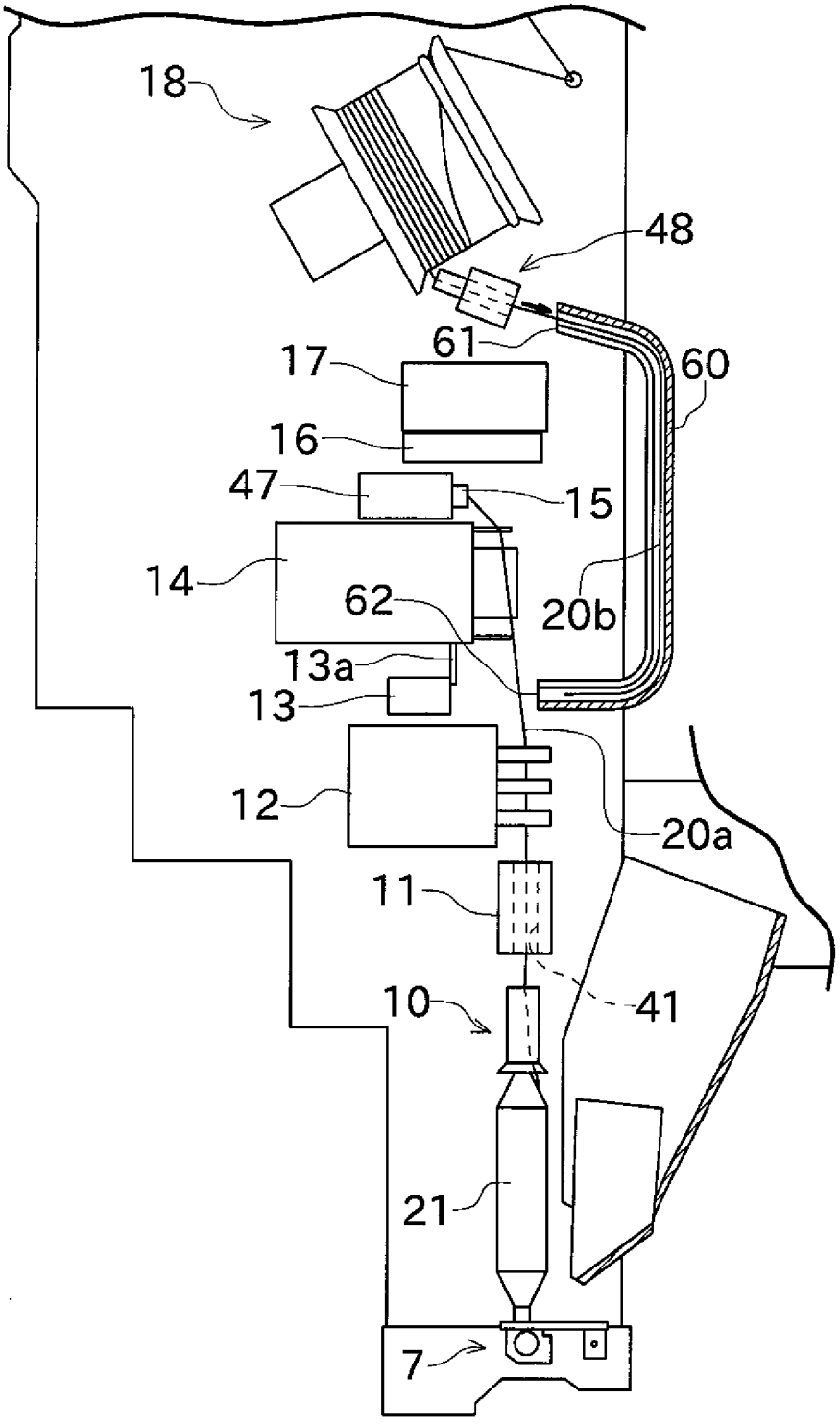

Fig.12

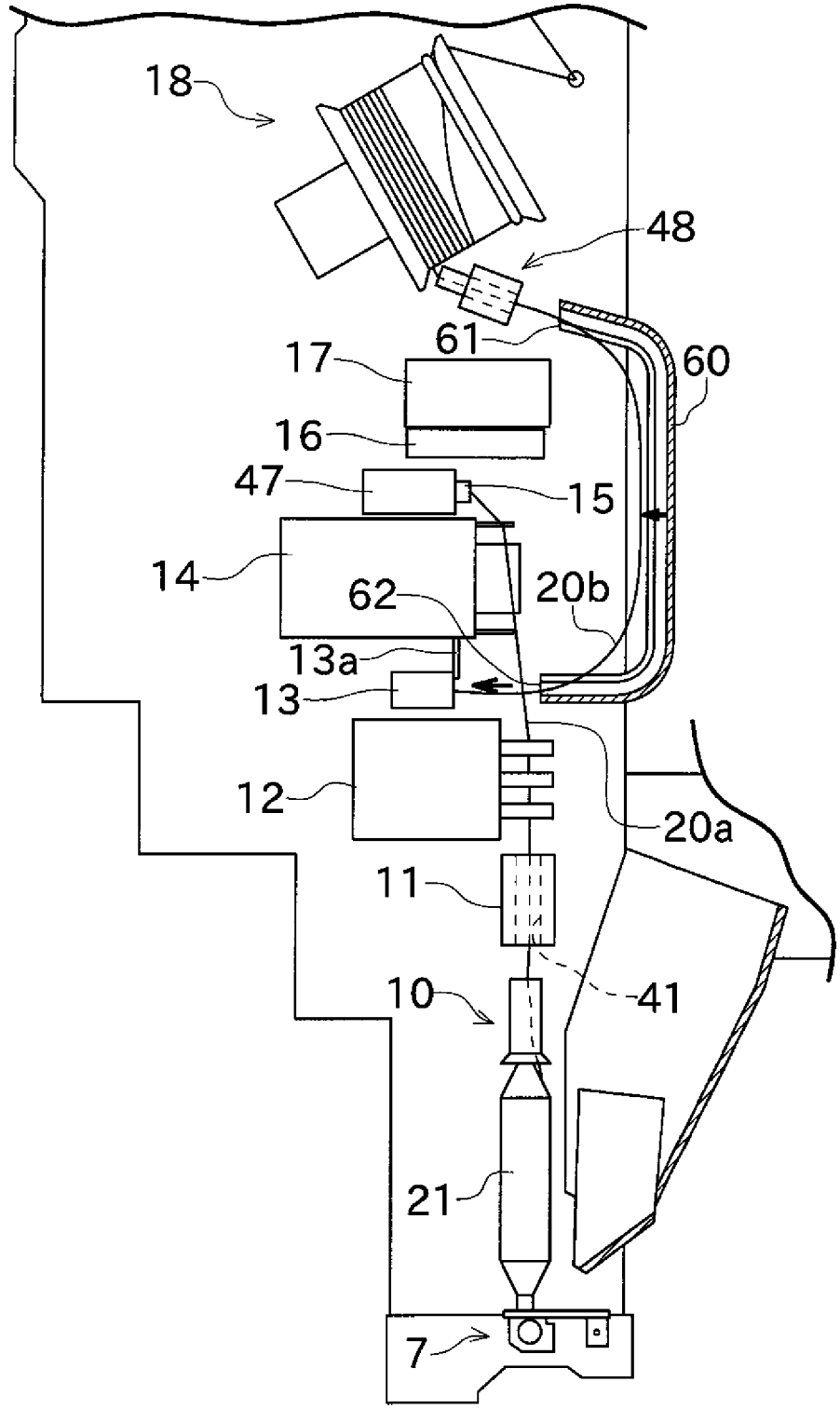

Fig.13

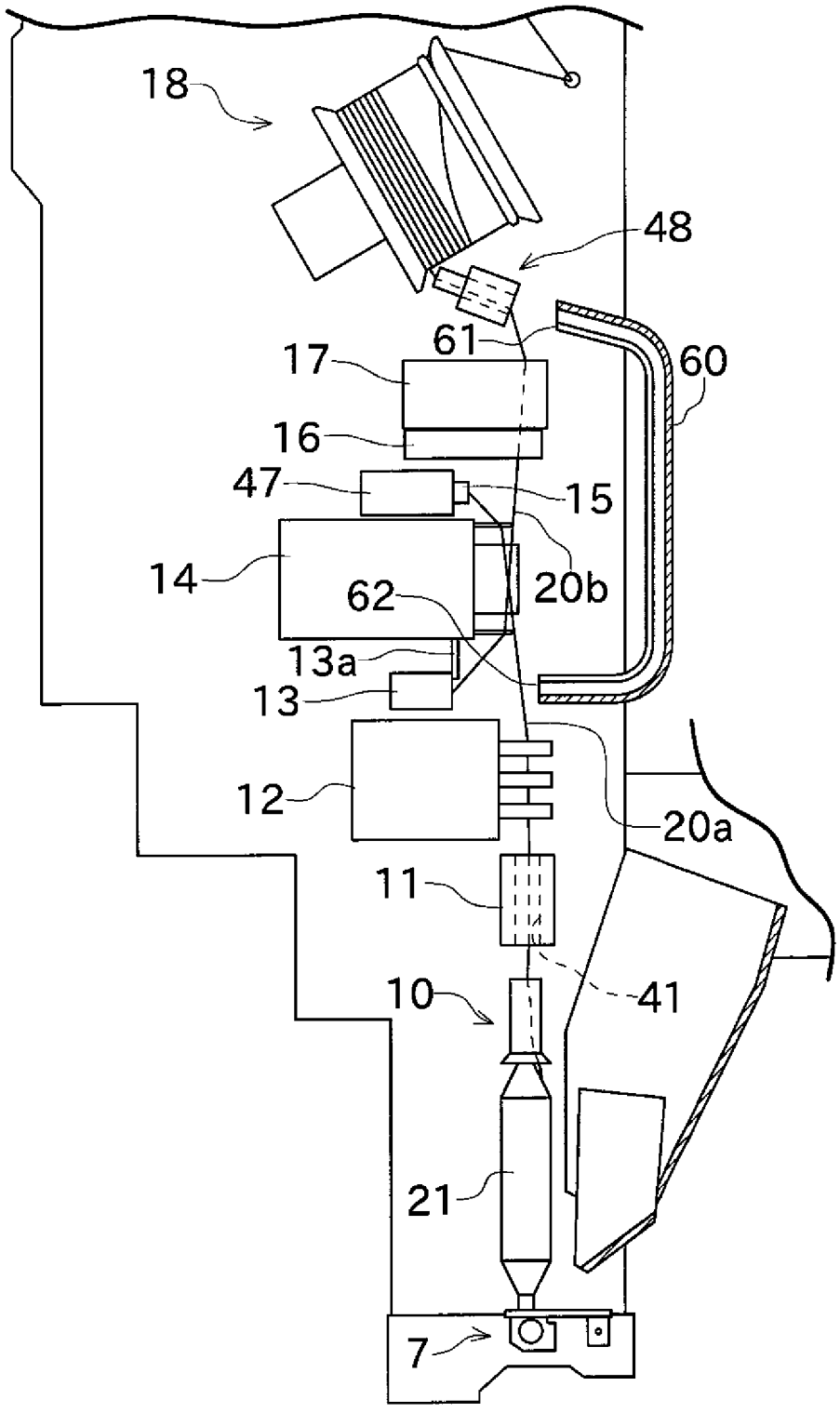

Fig.14

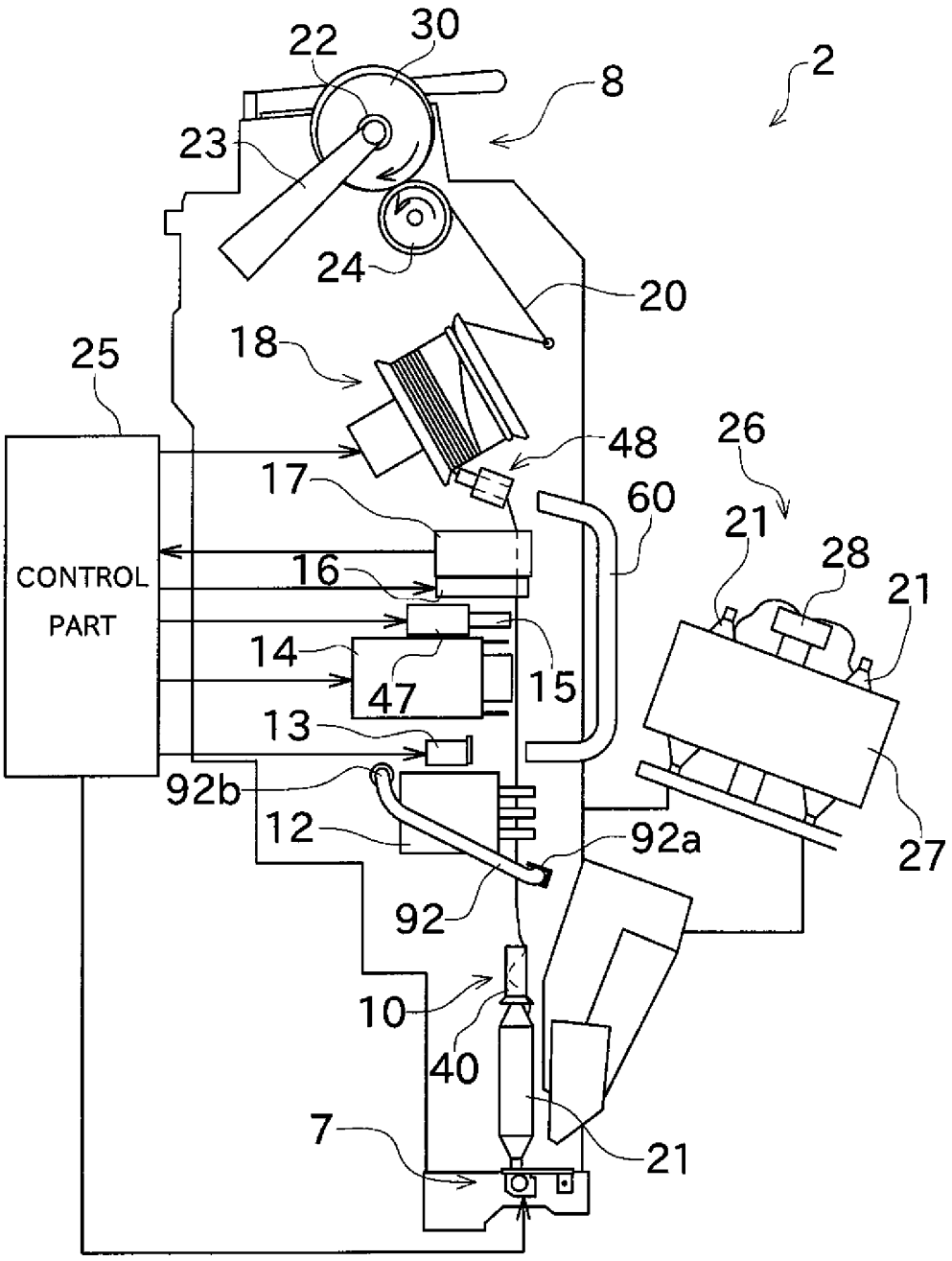
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Fig.15

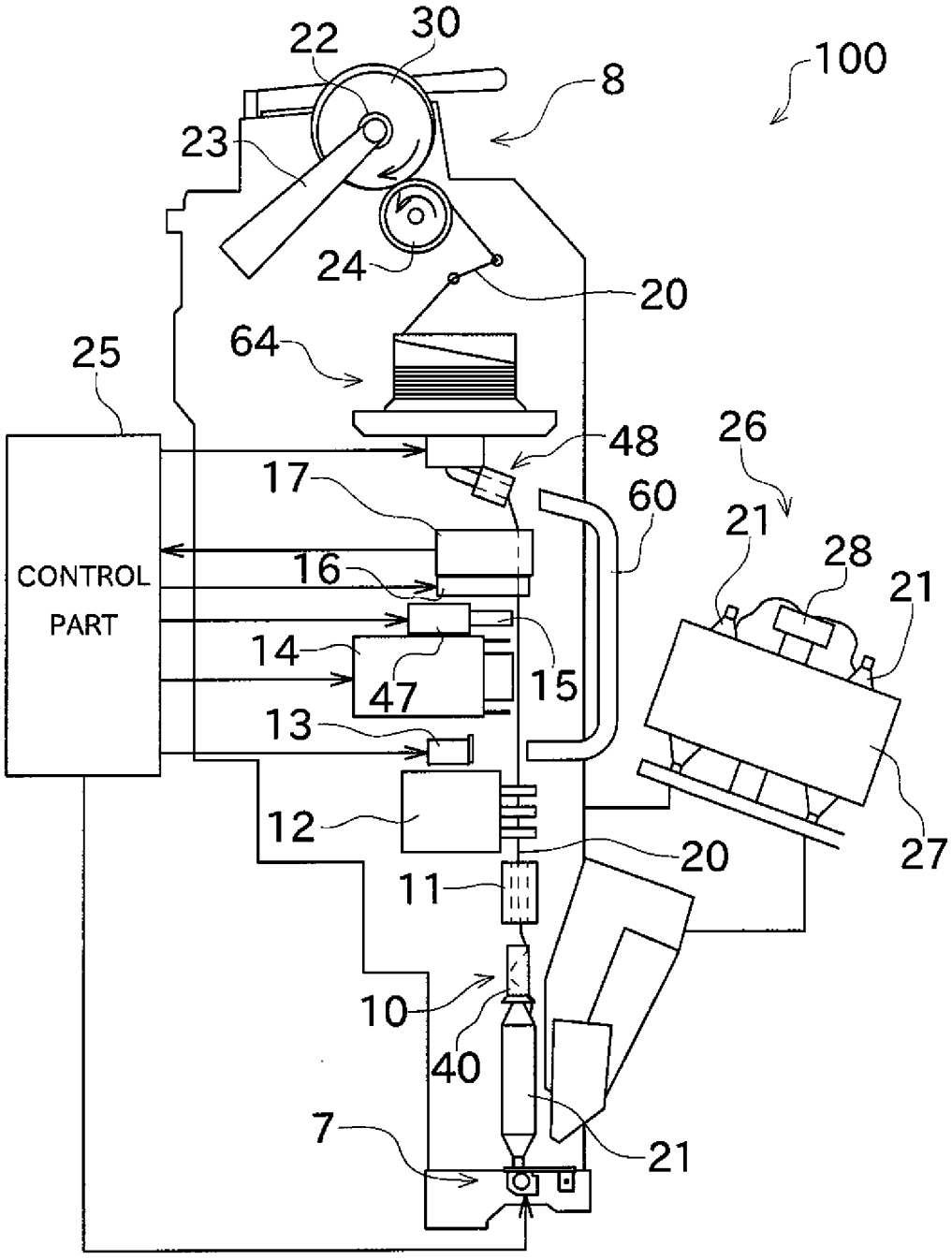
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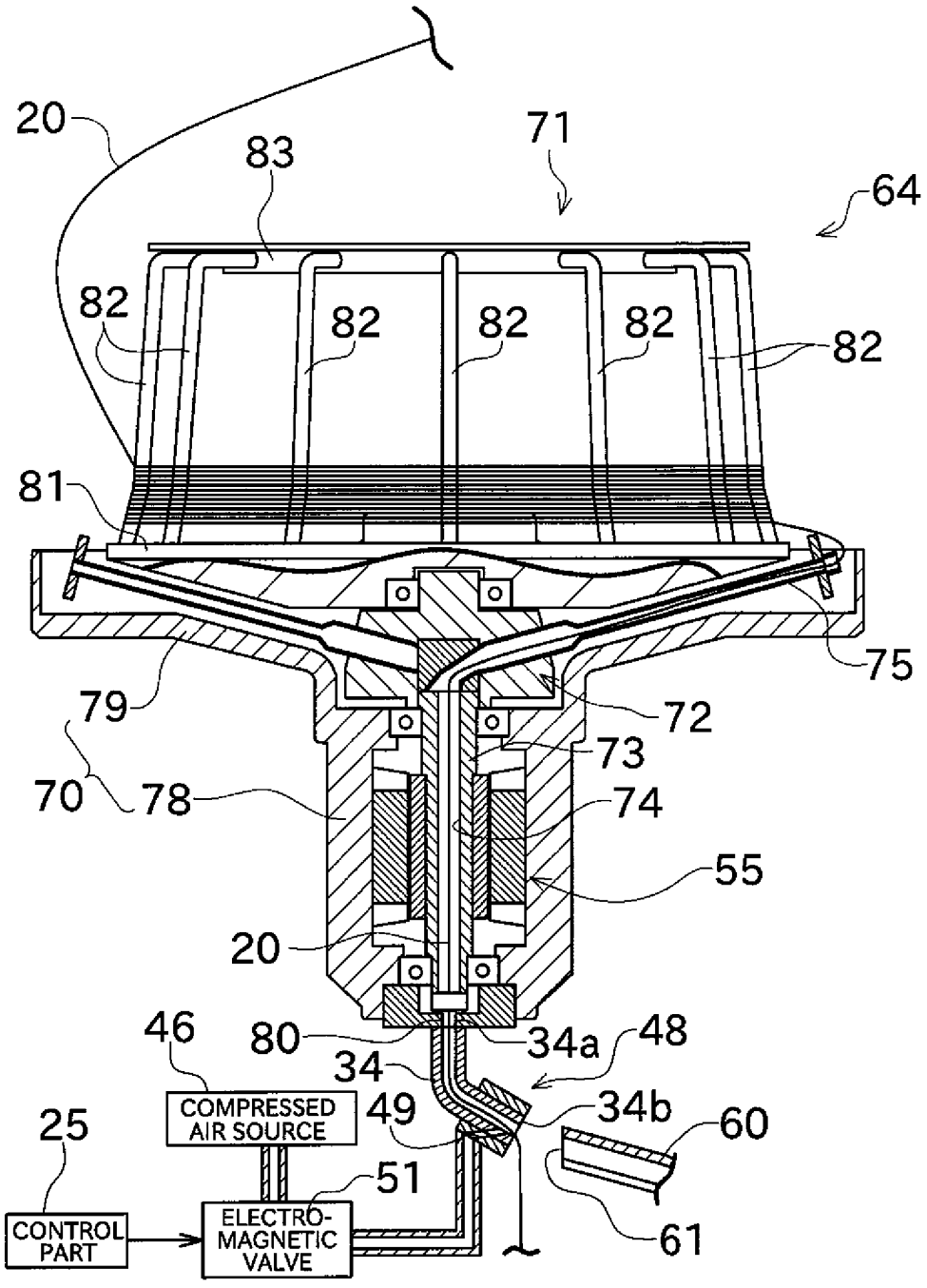
Fig.16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34b
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COMPRESSED AIR SOURCE
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CONTROL PART
ELECTRO-MAGNETIC VALVE
61

Fig.17

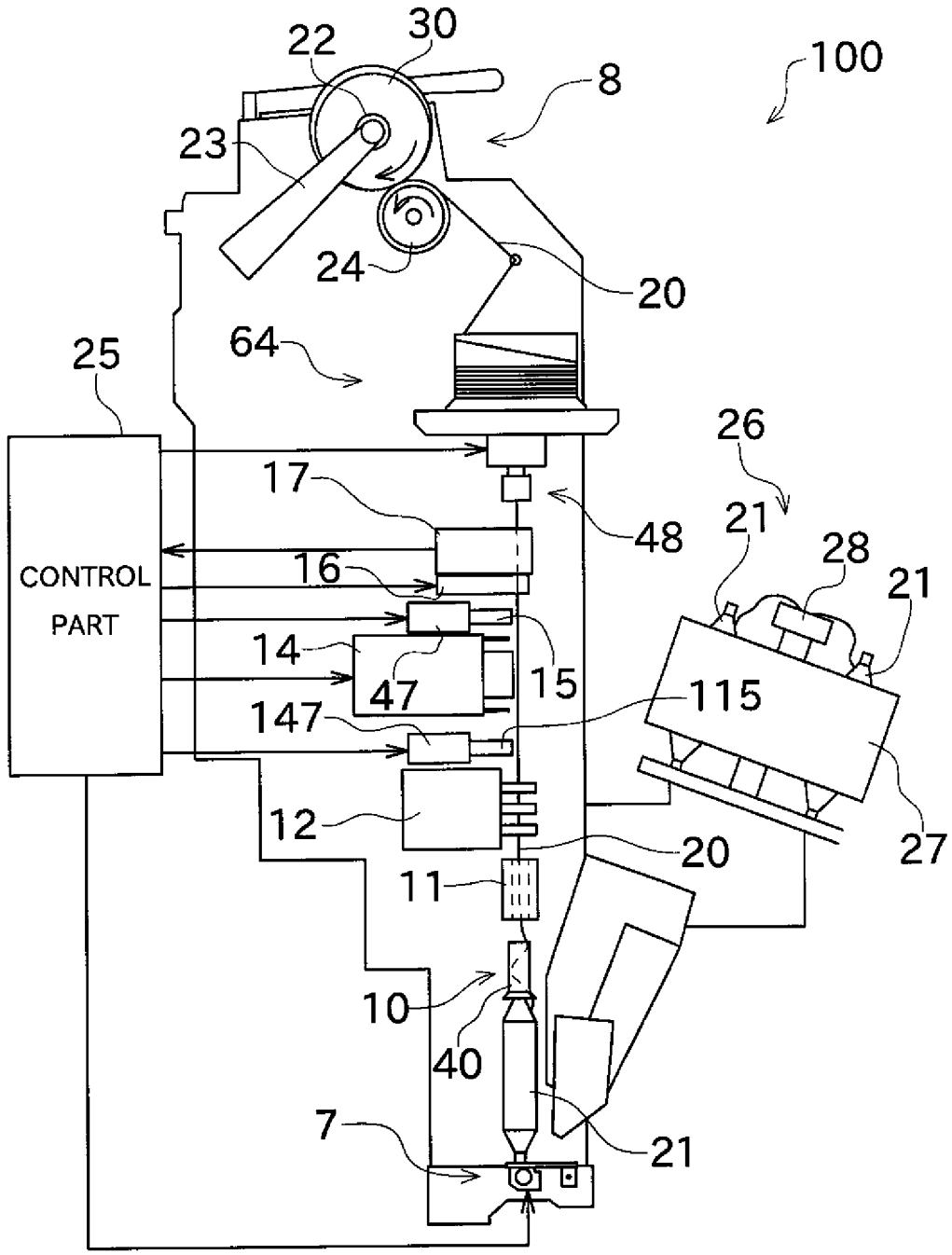
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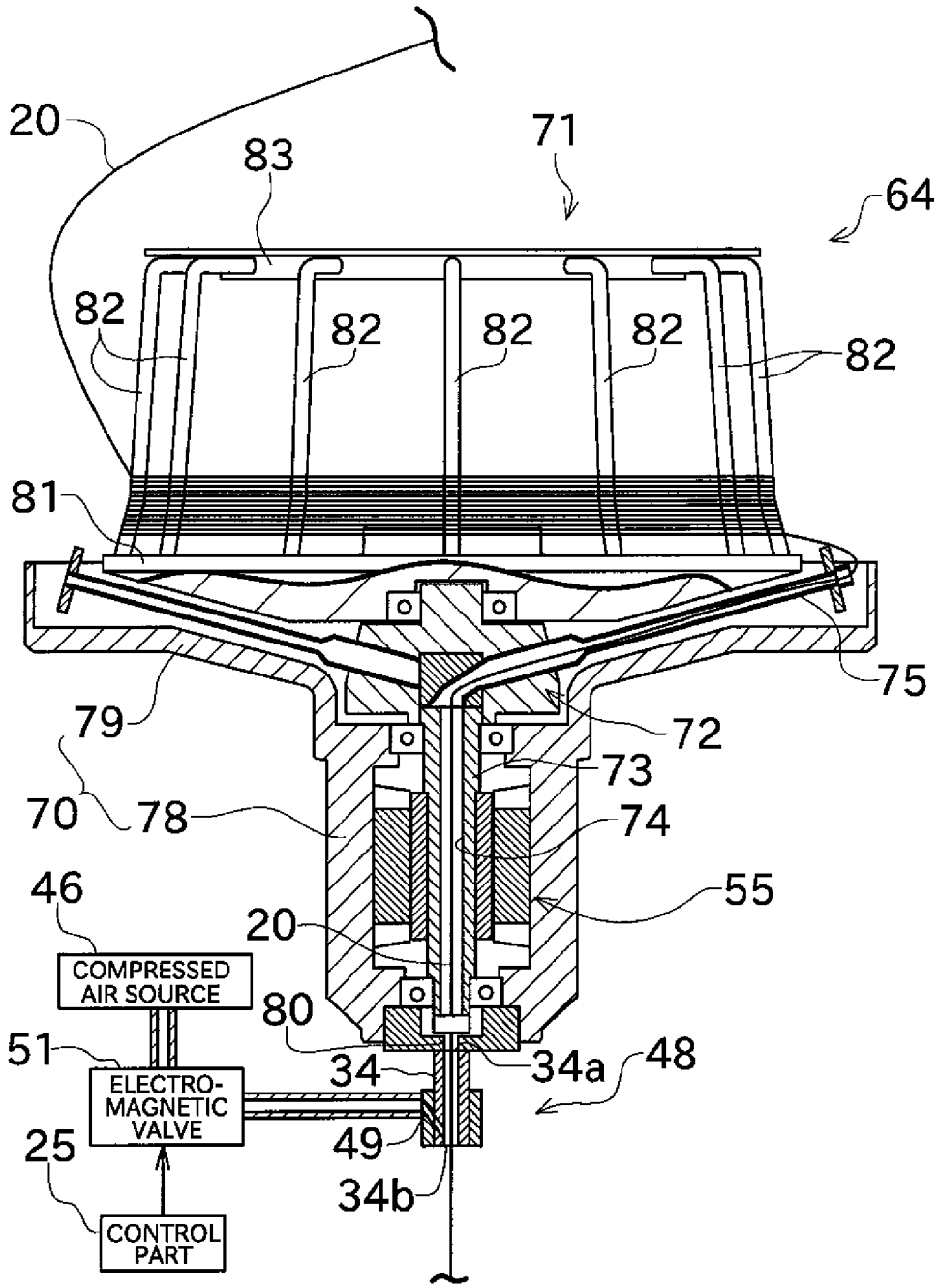
Fig.18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COMPRESSED AIR SOURCE
80
51
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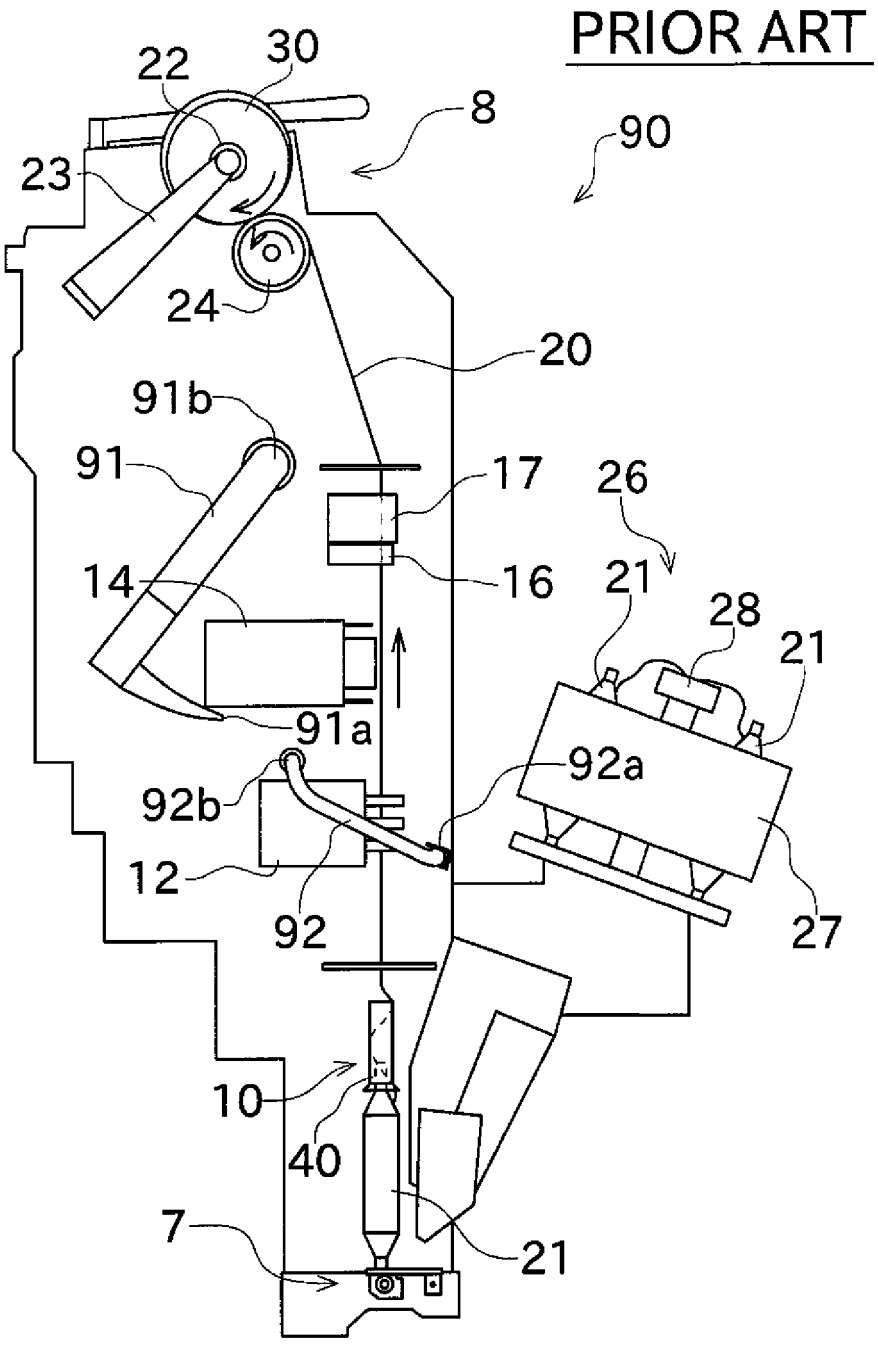
34a
48
ELECTRO-MAGNETIC VALVE
49
25
34b
CONTROL PART

Fig.19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92b
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Fig.20

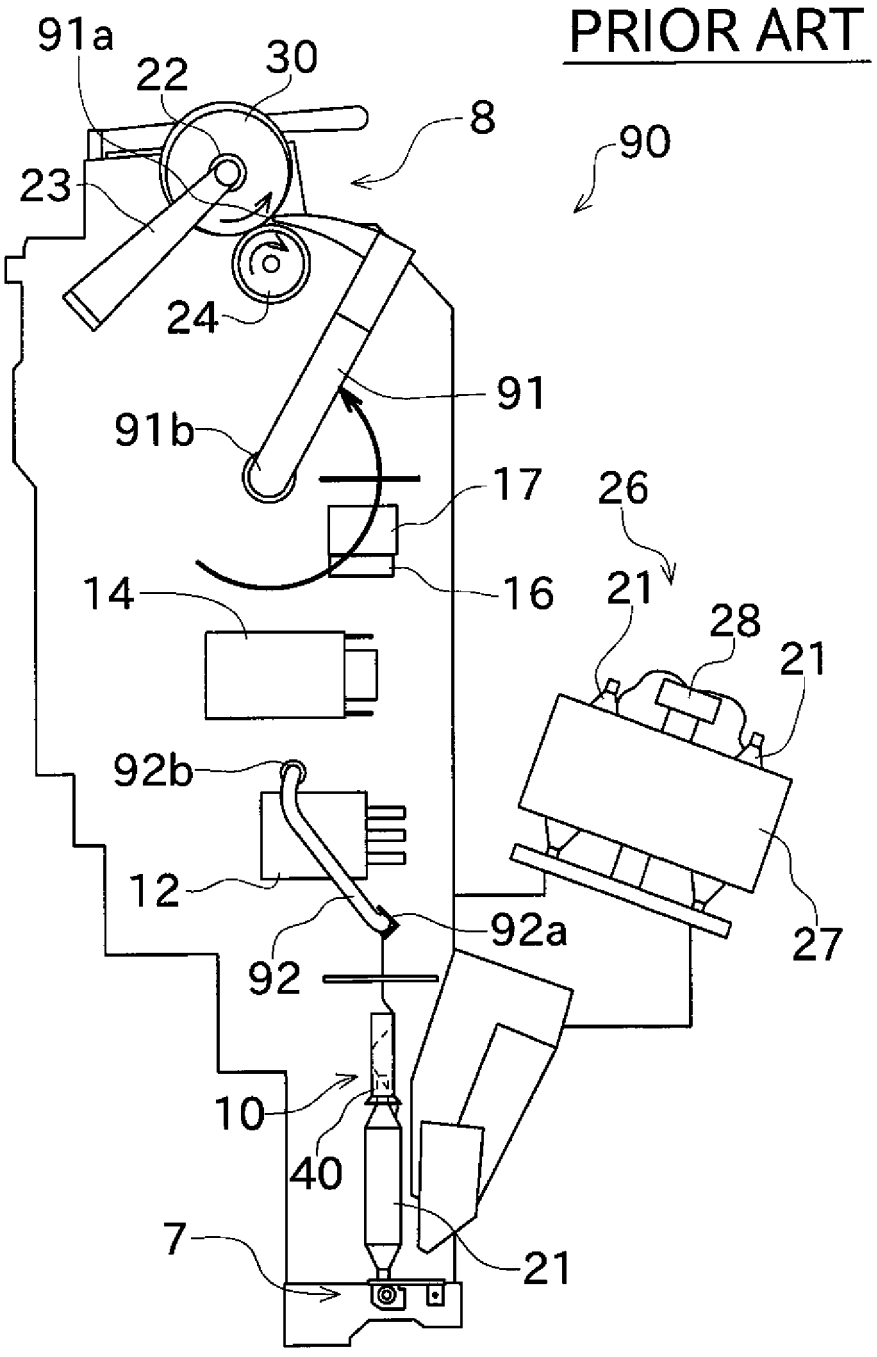
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Fig.21

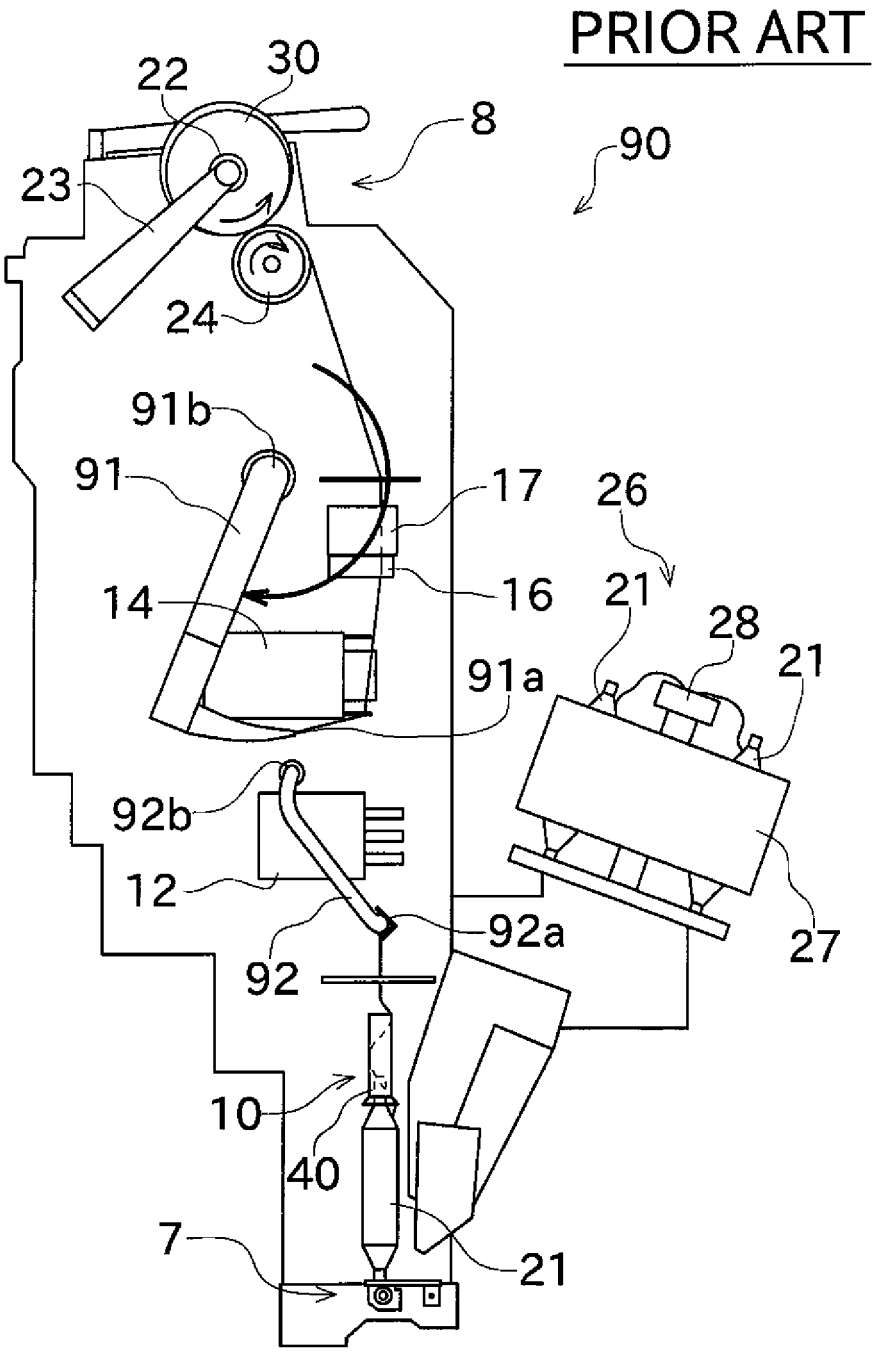
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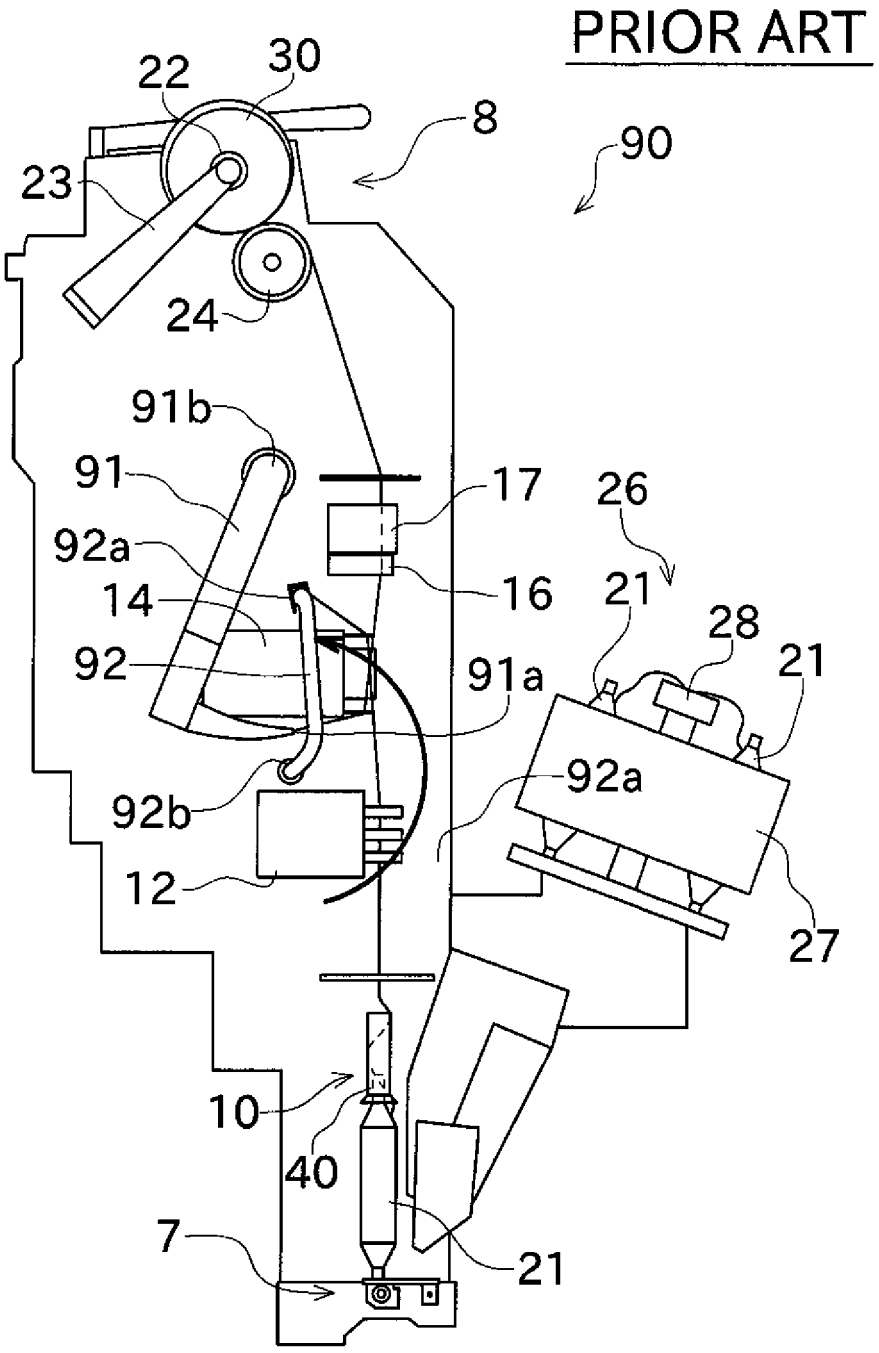
Fig.22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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/003621

A. CLASSIFICATION OF SUBJECT MATTER
B65H67/08(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65H67/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 4-246072 A (Murata Machinery Ltd.), 02 September 1992 (02.09.1992), paragraphs [0012] to [0016]; fig. 1 to 6 (Family: none)	1-10
A	JP 2001-310872 A (Murata Machinery Ltd.), 06 November 2001 (06.11.2001), paragraphs [0031] to [0038]; fig. 1 to 3 (Family: none)	1-10
A	JP 11-49433 A (Murata Machinery Ltd.), 23 February 1999 (23.02.1999), paragraph [0025] (Family: none)	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 September, 2011 (13.09.11)	27 September, 2011 (27.09.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

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Patent documents cited in the description

- JP 4213563 A **[0014]**
- JP 4241136 A **[0014]**