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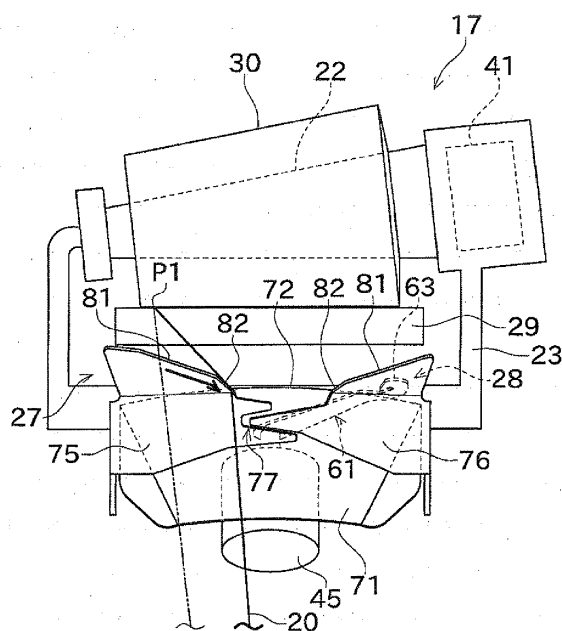
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(54) **Yarn winding machine**

(57) An automatic winder includes a bobbin set section, a cradle (23), a contact roller (29), a traverse guide (28), and a yarn leading plate (75, 76). The bobbin set section supplies a yarn of a yarn supplying bobbin. The cradle (23) rotatably holds a package (30), around which the yarn (20) supplied from the bobbin set section is wound. The contact roller (29) makes contact with and rotates the package (30). The traverse guide (28) is provided independently from the contact roller (29). The traverse guide (28) is engaged with the yarn (20) to be wound into the package (30) to traverse the yarn (20). The yarn leading plate (75, 76) makes contact with the yarn (20) applied with tension to lead the yarn (20) towards a center in a winding width direction of the package (30) before the traverse guide (28) engages with the yarn (20).

FIG. 8



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine adapted to supply a yarn from a yarn supplying section and wind the yarn into a package while traversing.

2. Description of the Related Art

[0002] This type of yarn winding machine is disclosed in Japanese Unexamined Patent Publication No. 2006-298499. The yarn winding machine disclosed in Japanese Unexamined Patent Publication No. 2006-298499 includes a yarn finger that reciprocatingly guides the yarn. The yarn finger includes an arm attached to a rotation shaft of a drive device, and a yarn guide (traverse guide) attached to a tip-end portion of the arm. The yarn guide at the tip end of the yarn finger reciprocates in an arc-like path by the forward/reverse rotation of the rotation shaft of the drive device. The yarn winding machine disclosed in Japanese Unexamined Patent Publication No. 2006-298499 includes a gate-like guiding frame arranged along a path of the tip end of the yarn finger.

[0003] In the yarn winding machine described above, when yarn breakage or the like occurs while winding the yarn, in order to resume winding, the yarn needs to be hooked to the yarn guide so as to again be traversed with the yarn finger. However, it is sometimes difficult to hook the yarn to the yarn guide depending on circumstances. For example, when winding a thin yarn, a tension is often set weak since the yarn breaks if a large tension is applied, which makes the hooking of the yarn to the yarn guide more difficult.

[0004] If the yarn is not successfully hooked to the yarn guide, the yarn cannot be traversed and hence a straight winding is formed on the package, thus causing a great load to remove the straight winding. Furthermore, the yarn is pushed out by the yarn guide, and runs out from the end face of the package thus causing so-called stitching, which may greatly lower the quality of the package. Thus, a configuration in which the yarn is reliably engaged to the yarn guide is desired.

[0005] In this regard, the guiding frame is disclosed in Japanese Unexamined Patent Publication No. 2006-298499, but the purpose of arranging the guiding frame is not described. Furthermore, the yarn cannot be prevented from being pushed out by the yarn guide with the configuration of such a guiding frame.

BRIEF SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide a configuration that reliably hooks a yarn to a traverse guide when resuming winding of the yarn in a yarn wind-

ing machine.

[0007] According to one aspect of the present invention, a yarn winding machine includes a yarn supplying section, a cradle, a contact roller, a traverse guide, and a yarn leading section. The yarn supplying section is adapted to supply a yarn. The cradle is adapted to rotatably hold a package around which the yarn supplied by the yarn supplying section is wound. The contact roller is adapted to make contact with and rotate the package. The traverse guide is provided independently from the contact roller, and is adapted to be engaged with the yarn to be wound into the package held by the cradle to traverse the yarn. The yarn leading section is adapted to make contact with the yarn to lead the yarn towards a center in a winding width direction of the package before the traverse guide hooks the yarn.

[0008] Accordingly, when resuming the winding of the yarn, the traverse guide can be engaged with the yarn led towards the center in the winding width direction of the package. Therefore, the yarn can be reliably hooked to the traverse guide, and the traverse of the yarn can be smoothly started.

[0009] In the above yarn winding machine, a contour of the yarn leading section includes a first guiding section and a second guiding section. The first guiding section is arranged inclining at a first inclination angle so as to be gradually located away from the yarn supplying section as approaching towards an end in the winding width direction of the package. The second guiding section is arranged closer to the center in the winding width direction of the package than the first guiding section and connected to an end of the first guiding section, and arranged inclining at a second inclination angle so as to be gradually located away from the yarn supplying section as approaching towards the end in the winding width direction of the package. The second inclination angle is steeper than the first inclination angle.

[0010] Accordingly, the yarn can be ultimately led until making contact with the second guiding section having a steep inclination angle before the traverse guide engages with the yarn. Therefore, by appropriately defining the position of the second guiding section, the yarn can be hooked at a satisfactory position where the traverse guide can reliably and easily engage with the yarn, and the yarn can be more reliably hooked to the traverse guide.

[0011] In the above yarn winding machine, the first guiding section and the second guiding section are preferably respectively arranged at both sides in the winding width direction of the package.

[0012] Accordingly, the yarn can be led towards the center in the winding width direction of the package even if a pull-out position of the yarn end is positioned at any end in the winding width direction of the package when resuming the winding of the yarn. Therefore, the traverse guide can reliably start to be engaged with the yarn.

[0013] In the above yarn winding machine, the traverse guide includes a hook-shaped yarn hooking section hav-

ing one side in a traverse direction of the yarn opened. The first guiding section and the second guiding section are arranged at least at a same side as the side of the yarn hooking section that is opened in the winding width direction of the package.

[0014] Accordingly, the yarn can be easily hooked to the hook-shaped yarn hooking section of the traverse guide from the opened side.

[0015] In the above yarn winding machine, a yarn path guide adapted to guide a yarn path of the yarn being engaged with and traversed by the traverse guide is preferably arranged.

[0016] Accordingly, after the yarn is hooked to the traverse guide, the yarn is traversed by the traverse guide and wound while the yarn path is being appropriately guided by the yarn path guide without the yarn making contact with the yarn leading section. Therefore, the influence of the yarn leading section on the winding of the package is prevented, and a high quality package can be formed.

[0017] In the above yarn winding machine, the yarn leading section is preferably formed of a plate-like member.

[0018] Thus, a configuration in which the yarn is less likely to get entangled at the yarn leading section is realized, and the winding operation can be smoothly carried out.

[0019] The above yarn winding machine includes a driving section adapted to drive the traverse guide. The traverse guide is formed in an arm-shape including a tip-end portion provided with a portion to be engaged with the yarn and a base-end portion adapted to receive a driving force from the driving section. The tip-end portion of the traverse guide reciprocates in an arc-like path by the base-end portion of the traverse guide being driven by the driving section.

[0020] Generally, it is difficult for the tip-end portion of the traverse arm that moves in the arc-like path to be engaged with the yarn. However, according to the configuration described above, the yarn is led towards the center in the winding width direction of the package in advance by the yarn leading section, and the traverse guide can reliably engage with the yarn.

[0021] The above yarn winding machine includes a yarn joining device, and a catching-and-guiding section. The yarn joining device is adapted to join a yarn end from the yarn supplying section and a yarn end from the package when a continuation of the yarn between the yarn supplying section and the package is disconnected. The catching-and-guiding section is adapted to catch the yarn end from the package and to guide the yarn end to the yarn joining device.

[0022] Accordingly, the traverse guide can reliably engage with the yarn in the yarn winding machine in which the yarn joining operation is carried out as necessary during the winding of the package, and the winding can be smoothly resumed. As a result, the production efficiency of the package can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

- 5 FIG. 1 is a front view illustrating an overall configuration of an automatic winder according to one embodiment of the present invention;
 FIG. 2 is a front view and a block diagram of a winder unit according to a first embodiment;
 10 FIG. 3 is a front enlarged view illustrating a configuration of a periphery of a traverse device;
 FIG. 4 is a schematic side view of the traverse device;
 FIG. 5 is a perspective view illustrating a detailed configuration of a traverse guide;
 15 FIG. 6 is a side view illustrating a state of sucking a yarn end from a package with an upper yarn guiding pipe for yarn joining in a splicer device;
 FIG. 7 is a side view illustrating a state of swinging the upper yarn guiding pipe from the state of FIG. 6 and pulling out the yarn end;
 20 FIG. 8 is a front enlarged view illustrating a state in which the yarn is led towards a center in a winding width direction of the package by yarn leading plates;
 FIG. 9 is a front enlarged view illustrating a state in which the yarn led towards the center in the winding width direction of the package is hooked with the traverse guide;
 25 FIG. 10 is a front enlarged view illustrating a state of hooking a yarn with a traverse guide according to a comparative example;
 FIG. 11 is a front enlarged view illustrating a configuration of a periphery of a traverse device in a winder unit according to a second embodiment;
 30 FIG. 12 is a front view and a block diagram of a winder unit according to a third embodiment;
 FIG. 13 is a front enlarged view illustrating a configuration of a periphery of a traverse device; and
 35 FIG. 14 is a schematic side view of the traverse device.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

- 45 **[0024]** Embodiments of the invention will be hereinafter described. First, an overall configuration of an automatic winder 1 according to an embodiment will be described with reference to FIG. 1. FIG. 1 is a front view of the automatic winder 1 according to one embodiment of the present invention. Herein, "upstream" and "downstream" respectively refer to upstream and downstream in a travelling direction of a yarn at the time of yarn winding. That is, as illustrated in FIG. 2 and the like, since a yarn 20 unwound from a yarn supplying bobbin 21 in a bobbin set section 18 is wound by a winding section 17, the bobbin set section 18 side is the upstream and the winding section 17 side is the downstream in the present embodiment.

[0025] As illustrated in FIG. 1, the automatic winder

(yarn winding machine) 1 includes a plurality of winder units (winding unit) 10 arranged in line, an automatic doffing device 8, and a machine control device 90 as main components.

[0026] Each winder unit 10 is configured to wind the yarn 20 unwound from the yarn supplying bobbin 21 around a winding bobbin 22 while traversing the yarn 20 to form a package 30.

[0027] The automatic doffing device 8 is configured to travel among the plurality of winder units 10. When the package 30 is fully wound in one of the winder units 10, the automatic doffing device 8 travels up to a position of the relevant winder unit 10 to collect the fully wound package 30 and supply a winding bobbin (empty winding bobbin) 22 around which the yarn 20 is not wound. The automatic doffing device 8 may be configured to only collect the fully wound package 30 and not supply the empty winding bobbin 22. The automatic doffing device 8 may also be configured to not collect the fully wound package 30 but only supply the empty winding bobbin 22.

[0028] The machine control device 90 includes an operation unit 91 and a display unit 92. An operator may input a predetermined set value or select an appropriate control method by operating the operation unit 91. The setting is thereby made on each winder unit 10. The display unit 92 may display various types of Information such as winding status of the yarn 20 in each winder unit 10.

[0029] Next, a detailed configuration of the winder unit 10 will be described with reference to FIG. 2 to FIG. 5. FIG. 2 is a front view and a block diagram of the winder unit 10 according to a first embodiment. FIG. 3 is a front enlarged view illustrating a configuration of a periphery of a traverse device 27. FIG. 4 is a schematic side view of the traverse device 27. FIG. 5 is a perspective view illustrating a detailed configuration of a traverse guide 28.

[0030] As illustrated in FIG. 2, each winder unit 10 includes a winding unit main body 11, and a unit control section 50.

[0031] The unit control section 50 is configured as a microcomputer type control section, and includes a Central Processing Unit (CPU), and a memory. The memory stores various types of programs. The CPU executes such programs to control each component of the winding unit main body 11. In this case, the memory is also used as a temporary data storage region.

[0032] The winding unit main body 11 is configured with a bobbin set section (yarn supplying section) 18, a yarn-unwinding assisting device 12, a tension applying device 13, a splicer device (yarn joining device) 14, a clearer (yarn quality measuring device) 15, and the winding section 17 arranged in this order from the yarn supplying bobbin 21 along a yarn travelling path between the yarn supplying bobbin 21 and the winding bobbin (winding tube, paper tube, core tube) 22.

[0033] The bobbin set section 18 is arranged at a lower part of the winding unit main body 11. The bobbin set section 18 can hold the yarn supplying bobbin 21 supplied by a bobbin transportation system or a magazine type

bobbin supplying device (not illustrated), and unwind and supply the yarn 20 wound around the yarn supplying bobbin 21. Various configurations of the bobbin set section 18 can be assumed, and for example, a rod-shaped member capable of receiving a tubular core tube of the yarn supplying bobbin 21 and capable of holding an inner wall of the core tube in the inserted state can be assumed.

[0034] The yarn-unwinding assisting device 12 causes a regulation member 40 to make contact with a balloon formed at an upper part of the yarn supplying bobbin 21 when the yarn 20 unwound from the yarn supplying bobbin 21 is swung around, and controls the balloon to an appropriate size to assist the unwinding of the yarn 20. A sensor (not illustrated) for detecting a chase portion of the yarn supplying bobbin 21 is arranged in proximity to the regulation member 40. When this sensor detects lowering of the chase portion, the regulation member 40 is lowered by an air cylinder (not illustrated), for example, following thereto.

[0035] The tension applying device 13 applies a predetermined tension on the travelling yarn 20. The tension applying device 13 may be a gate-type in which a movable comb teeth 37 is arranged with respect to a fixed comb teeth 36. The movable comb teeth 37 is swung by a rotary solenoid 38 or the like, so as to be in a meshed state or a released state with respect to the fixed comb teeth 36. The tension applying device 13 applies a predetermined tension on the yarn 20 to be wound, thus improving the quality of the package 30. A disc type tension applying device 13, for example, may be adopted other than the gate type tension applying device described above.

[0036] The splicer device 14 joins a lower yarn from the yarn supplying bobbin 21 and an upper yarn from the package 30 after a yarn cut when the clearer 15 detects a yarn defect and cuts the yarn 20 with a cutter 39, or after a yarn breakage while unwinding the yarn 20 from the yarn supplying bobbin 21. Such a yarn joining device adapted to join the upper yarn and the lower yarn may be a mechanical type or a type that uses fluid such as compressed air.

[0037] The clearer 15 includes a clearer head 49 provided with a sensor (not illustrated) for detecting a thickness of the yarn 20, and an analyzer 53 for processing a yarn thickness signal from the sensor. The clearer 15 detects a yarn defect such as slub by monitoring the yarn thickness signal from the sensor. The cutter 39 is provided near the clearer head 49, and immediately cuts the yarn 20 when the clearer 15 detects the yarn defect. The clearer 15 may be adapted to detect foreign substances contained in the yarn 20 as the yarn defect. The analyzer 53 may be arranged in the unit control section 50.

[0038] A lower yarn guiding pipe 25 for catching the lower yarn from the yarn supplying bobbin 21 and guiding the lower yarn to the splicer device 14, and an upper yarn guiding pipe (catching-and-guiding section) 26 for catching the upper yarn from the package 30 and guiding the upper yarn to the splicer device 14 are respectively ar-

ranged on the lower side and the upper side of the splicer device 14. The lower yarn guiding pipe 25 and the upper yarn guiding pipe 26 are respectively configured to swing with shafts 33 and 35 as the center. A suction port 32 is formed at a distal end of the lower yarn guiding pipe 25, and a suction mouth 34 is arranged at a distal end of the upper yarn guiding pipe 26. An appropriate negative pressure source (not illustrated) is connected to the lower yarn guiding pipe 25 and the upper yarn guiding pipe 26, so that a suction flow is generated at the suction port 32 and the suction mouth 34 to suck and catch yarn ends of the upper yarn and the lower yarn.

[0039] The winding section 17 includes a cradle 23, a contact roller 29, a traverse device 27, and a pair of yarn leading plates (yarn leading sections) 75 and 76 as main components.

[0040] The cradle 23 removably holds the winding bobbin 22. The cradle 23 can swing towards a front side and a back side of the winder unit 10, and can absorb an increase in a yarn layer diameter of the package 30 accompanying the winding of the yarn 20 around the winding bobbin 22. Thus, even if the yarn layer diameter of the package 30 changes due to the winding of the yarn 20, the surface of the package 30 can be appropriately made in contact with the contact roller 29.

[0041] A package drive motor (winding tube driving section) 41 such as a servo motor is provided on the cradle 23. The winding section 17 rotatably drives the winding bobbin 22 with the package drive motor 41 to wind the yarn 20 around the surface of the winding bobbin 22 (or the surface of package 30). A motor shaft of the package drive motor 41 is coupled with the winding bobbin 22 so as to be relatively non-rotatable when the winding bobbin 22 is supported by the cradle 23 (so-called direct drive type).

[0042] An operation of the package drive motor 41 is controlled by the unit control section 50. A package drive motor control section which is independent from the unit control section 50 may be provided, and the operation of the package drive motor 41 may be controlled by the package drive motor control section.

[0043] The contact roller 29 is arranged to make contact with an outer peripheral surface of the winding bobbin 22 or an outer peripheral surface of the package 30 and is rotatably supported. The contact roller 29 can be rotated accompanying the rotation of the winding bobbin 22 or the package 30. Alternatively, a drive motor that directly drives and rotates the contact roller 29 may be provided, and the package 30 may be rotated accompanying the rotation of the contact roller 29.

[0044] The traverse device 27 is configured as an arm type traverse device, and traverses the yarn 20 with respect to the surface of the package 30. The winding section 17 is configured to wind the yarn 20 into the package 30 while traversing the yarn 20 by the traverse device 27.

[0045] As illustrated in FIG. 3, the traverse device 27 includes a traverse guide 28, a traverse guide drive motor (driving section) 45, and a guide plate (yarn path guide)

71, as main components.

[0046] The traverse guide 28 is configured as an elongate member adapted to swing about a supporting axis. A yarn hooking groove 65 is formed at a first end (side close to the yarn 20, tip-end portion side) of the traverse guide 28 so that the yarn 20 can be hooked. A second end (basal end side) of the traverse guide 28 is fixed to a boss portion 46 arranged on a drive shaft 45a of the traverse guide drive motor 45. Thus, differently from the configuration in which the yarn 20 is traversed with a groove formed on the contact roller 29, the traverse device 27 of the present embodiment drives the traverse guide 28 by the traverse guide drive motor 45 to traverse the yarn 20 irrespective of the rotation of the contact roller 29.

[0047] The traverse guide drive motor 45 is provided to drive the traverse guide 28, and is configured by a servo motor, for example. The traverse guide drive motor 45 may be configured by other appropriate motors such as a brushless DC motor, a stopping motor, a voice coil motor, or the like.

[0048] The traverse device 27 drives the traverse guide drive motor 45 and reciprocates the traverse guide 28 with the yarn 20 hooked to the tip-end portion (the yarn hooking groove 65) of the traverse guide 28. The traverse device 27 thereby reciprocates the tip-end portion in the winding width direction of the package 30 in an arc-like path to traverse the yarn 20 with respect to the surface of the package 30 in the left and right direction. Accordingly, the winder unit 10 winds the yarn 20 around the winding bobbin 22 while traversing the yarn 20 at a predetermined speed and to a predetermined winding width, and forms a yarn layer on the outer peripheral surface of the winding bobbin 22 at a desired density.

[0049] An operation of the traverse guide drive motor 45 is controlled by the unit control section 50. However, instead of being controlled by the unit control section 50, a dedicated traverse control section may be provided, and the traverse guide drive motor 45 may be controlled by this traverse control section.

[0050] The guide plate 71 is arranged immediately upstream of the traverse guide 28. The guide plate 71 is configured as a plate-like member curved in a conical surface shape.

[0051] An edge on a side close to the traverse guide 28 of the edges of the guide plate 71 is formed as an arcuate guide portion 72 formed in an arcuate shape along the path of the tip-end portion of the traverse guide 28. The arcuate guide portion 72 guides the yarn path so that the yarn 20 hooked to the traverse guide 28 smoothly reciprocates when the traverse guide 28 reciprocates.

[0052] As illustrated in FIG. 4, the drive shaft 45a of the traverse guide drive motor 45 is arranged to form an angle close to parallel with respect to the yarn path of the yarn 20 at the downstream of the guide plate 71 when seen in a direction of a line connecting one end side and

the other end side of a traverse stroke (axial direction of contact roller 29). In other words, in the present embodiment, the traverse device 27 reciprocates the traverse guide 28 within a plane substantially parallel to an installation surface of the winder unit 10.

[0053] With such a configuration, the automatic winder 1 of the present embodiment can reduce bending of the yarn path caused by the guide plate 71 as compared with a configuration in which a longitudinal direction of the traverse guide 28 is substantially perpendicular to the installation surface of the winder unit 10 (third embodiment to be described later). In particular, an effect of reducing the bending of the yarn path can be greatly achieved at both ends of the traverse stroke where the bending of the yarn path becomes maximum.

[0054] Next, the shape and the structure of the traverse guide 28 will be described with reference to FIG. 5. The traverse guide 28 includes an arm main body 60, and a yarn guide piece (yarn guide portion) 64 fixed to the arm main body 60.

[0055] The arm main body 60 is an elongate plate-like member, and is made with a light weight metal. The arm main body 60 includes an arm section 61, a bent section 62, and a hooking section (yarn hooking section) 63.

[0056] The arm section 61 occupies a majority (portion other than tip-end portion) of the arm main body 60. A plurality of holes are formed at the central part of the arm section 61 for reducing weight.

[0057] The bent section 62 is formed between the arm section 61 and the hooking section 63. As illustrated in FIG. 4, the bent section 62 has a shape bent in a direction in which the hooking section 63 on the tip end side approaches the contact roller 29. With such a configuration, since a free length (length of the yarn 20 from the traverse guide 28 until making contact with the contact roller 29) can be reduced, a behavior of the yarn 20 can be stabilized and a high quality package 30 can be formed.

[0058] The hooking section 63 is a portion constituting the tip-end portion of the arm main body 60, and is configured in a hook shape in which a side close to the base of the traverse guide 28 is opened and one side in the traverse direction is opened. The yarn guide piece 64 made of ceramic is arranged inside the hooking section 63. The slit-like yarn hooking groove 65, to which the yarn 20 can be inserted, is formed in the yarn guide piece 64.

[0059] The yarn hooking groove 65 is formed in a linear shape, and is arranged such that the longitudinal direction of the yarn hooking groove 65 is substantially parallel to the longitudinal direction of the traverse guide 28. One end in the longitudinal direction of the yarn hooking groove 65 (an end portion located closer to the base end of the traverse guide 28) is connected to the opened portion of the hooking section 63.

[0060] Next, the yarn leading plates 75 and 76 will be described in detail with reference to FIG. 3 and the like. Before the yarn 20 is hooked to the yarn hooking groove 65 of the traverse guide 28, when the yarn 20 is positioned

closer to the end in the winding width direction of the package 30, the yarn leading plates 75 and 76 lead and guide the yarn 20 towards the center in the winding width direction.

[0061] Each of the yarn leading plates 75 and 76 is configured by appropriately bending a plate-like member. The yarn leading plates 75 and 76 are arranged as a pair, where one is arranged on one side in the winding width direction of the package 30 (a small diameter side of a cone winding package) and the other one is arranged on the other side (a large diameter side of the cone winding package).

[0062] The hooking section 63 of the traverse guide 28 is configured such that the one side in the traverse direction (specifically, the small diameter side of the cone winding package) is opened. Therefore, describing in relation to the shape of the hooking section 63, the yarn leading plate 75 is arranged at the same side as the opened side of the hooking section 63 in the winding width of the package 30 (i.e., traverse stroke of the traverse guide 28), and the yarn leading plate 76 is arranged opposite to the opened side of the hooking section 63.

[0063] As illustrated in FIG. 4 and the like, the two yarn leading plates 75 and 76 are arranged immediately upstream of the guide plate 71 in the yarn travelling direction. The respective yarn leading plates 75 and 76 are arranged on the outer side of the guide plate 71 so as to partially cover the conical surface of the guide plate 71.

[0064] As illustrated in FIG. 3, when the winder unit 10 is seen from the front side, the arcuate guide portion 72, which is the edge of the guide plate 71, has only a portion corresponding to the center in the winding width direction of the package 30 exposed and the other portions are covered by the yarn leading plates 75 and 76.

[0065] As illustrated in FIG. 4, a gap 78, through which the yarn 20 can be passed, is formed between the yarn leading plates 75 and 76, and the guide plate 71 (inner side of the yarn leading plates 75 and 76). An opened portion 77 having a zigzag shape, through which the yarn 20 can be passed, is formed between the two yarn leading plates 75 and 76 (see FIG. 3). The opened portion 77 is connected with the gap 78.

[0066] As illustrated in FIG. 3, among the edges of the yarn leading plate 75, an edge located closer to the traverse guide 28 is formed in a broken-line, and includes a first guiding section 81 and a second guiding section 82.

[0067] The first guiding section 81 has a substantially linear contour, and is arranged to incline so as to be gradually located away from the bobbin set section 18 as approaching towards the end in the winding width direction of the package 30. The first guiding section 81 is arranged to include a position corresponding to the end of the winding width of the package 30.

[0068] The second guiding section 82 also has a substantially linear contour, and is arranged to incline so as to be gradually located away from the bobbin set section 18 as approaching towards the end in the winding width

direction of the package 30. An inclination angle of the second guiding section 82 is steeper than an inclination angle of the first guiding section 81. The second guiding section 82 is arranged closer to the center in the winding width direction of the package 30 than the first guiding section 81, and the second guiding section 82 and the first guiding section 81 are connected to each other while forming a gradual bent portion.

[0069] Among the edges of the yarn leading plate 76 located opposite to the yarn leading plate 75 in the winding width direction of the package 30, an edge located closer to the traverse guide 28 includes the first guiding section 81 and the second guiding section 82. The structure of the first guiding section 81 and the second guiding section 82 are similar to those of the yarn leading plate 75, and hence the description thereof will be omitted.

[0070] As illustrated in FIG. 3, by configuring the yarn leading plates 75 and 76 in the above manner, a pair of the first guiding sections 81 and a pair of the second guiding sections 82 are respectively arranged substantially symmetrically with a central part in the winding width direction of the package 30 therebetween. When the winder unit 10 is seen from the front side, the contours of the yarn leading plates 75 and 76 intersect the arcuate guide portion 72 of the guide plate 71 at the portion of the second guiding section 82.

[0071] Next, a description will be made on the control carried out in the winder unit 10 having the above configuration when the yarn 20 unwound from the yarn supplying bobbin 21 is broken or when the clearer 15 detects the yarn defect and cuts the yarn 20 with the cutter 39. FIG. 6 to FIG. 9 sequentially illustrate the operations of catching the yarn end from the package 30 with the upper yarn guiding pipe 26, joining the yarn end from the package 30 with the yarn end from the yarn supplying bobbin 21 by the splicer device 14, and hooking the yarn 20 to the traverse guide 28 to resume the traversing. FIG. 10 is a front enlarged view illustrating a state in which the yarn 20 is hooked with the traverse guide 28 according to a comparative example.

[0072] When the yarn 20 is broken or the yarn 20 is cut with the cutter 39, the unit control section 50 carries out a control to immediately stop the rotation of the package 30 and stop the traversing of the traverse guide 28 based on the signal from the clearer 15.

[0073] The yarn 20 is naturally removed from the yarn hooking groove 65 of the traverse guide 28 immediately after being disconnected and becoming free. As the package 30 rotates to a certain extent by inertia until coming to a complete stop, the yarn end from the package 30 that became free is wound around the outer peripheral surface of the package 30 with the inertial rotation.

[0074] The unit control section 50 then swings the upper yarn guiding pipe 26 to the upper side (towards package 30) from the position of FIG. 2. Thereafter, the unit control section 50 controls the package drive motor 41 to rotate (reversely rotate) the package 30 in the direction opposite to the winding direction. Accordingly, the yarn

end wound around the outer peripheral surface of the package 30 is unwound as illustrated in FIG. 6, and the yarn 20 is sucked into the upper yarn guiding pipe 26 from the suction mouth 34. In this case, the unit control section 50 controls the traverse guide drive motor 45 to evacuate the traverse guide 28 to a predetermined position in advance such that the traverse guide 28 does not obstruct the unwinding of the yarn end.

[0075] Subsequently, the unit control section 50 immediately swings the upper yarn guiding pipe 26 to the lower side, and guides the yarn end caught by the upper yarn guiding pipe 26 to the splicer device 14. Accordingly, the yarn 20 is pulled out from the package 30 so as to pass the outer side of the yarn leading plates 75 and 76 (front side of the winder unit 10 than the yarn leading plates 75 and 76) (FIG. 7).

[0076] The above-mentioned reverse rotation of the package 30 is controlled to stop at least about the time the upper yarn guiding pipe 26 finishes guiding the yarn end to the splicer device 14. At the time of stopping the reverse rotation, the position where the yarn end is pulled from the contact area of the package 30 and the contact roller 29 (hereinafter sometimes referred to as a pull-out point) is indefinite, and may take various positions in the winding width direction of the package 30. In the following description, assume that the pull-out point is located in proximity to an end in the winding width direction of the package 30 (proximity to the small diameter end of the cone winding package), as indicated by a reference symbol P1 in FIG. 8.

[0077] A prescribed tension is applied by the sucking operation or the like of the suction mouth 34 on the yarn end (the yarn 20) pulled out from the package 30. In this example, since the pull-out point P1 is located in proximity to the end in the winding width direction of the package 30, when the yarn 20 is pulled, the yarn 20 located upstream of the pull-out point P1 is made to contact with the second guiding section 82 of the yarn leading plate 75. By the yarn 20 being pulled towards the upstream, the yarn path is led towards the center in the winding width direction of the package 30 so as to slide the slope of the second guiding section 82 and the first guiding section 81.

[0078] Although not illustrated in the drawings, in parallel to the catching and the guiding of the upper yarn by the upper yarn guiding pipe 26, the lower yarn guiding pipe 25 illustrated in FIG. 2 sucks and catches the yarn end from the yarn supplying bobbin 21, and is then swung to the upper side to guide the yarn end to the splicer device 14. Thereafter, the yarn end from the package 30 and the yarn end from the yarn supplying bobbin 21 are joined by the splicer device 14.

[0079] The unit control section 50 then resumes the rotation of the package 30 and also resumes the reciprocating movement of the traverse guide 28. FIG. 9 illustrates a state immediately after the rotation of the package 30 is started. When the traverse guide 28 is rotated from such a state in the direction of the thick line arrow (direction towards the small diameter side of the package

30), the yarn 20 can be hooked to the tip-end portion of the traverse guide 28.

[0080] As described above, the pull-out point P1 of the yarn 20 from the package 30 is in proximity to the end in the winding width direction of the package 30, but the yarn 20 located upstream than the pull-out point P1 is led towards the center in the winding width direction of the package 30 by the yarn leading plate 75. Therefore, since the traverse guide 28 can start to hook the yarn 20 from the position near the center of the traverse stroke, the failure of the yarn hooking can be effectively reduced.

[0081] In the conventional configuration in which the yarn leading plates 75 and 76 are not arranged, if the pull-out point P1 of the yarn end from the package 30 is located in proximity to the end in the winding width direction of the package 30 as illustrated in a comparative example of FIG. 10, the yarn hooking is difficult because the traverse guide 28 is required to hook the yarn 20 within a short stroke S1. In particular, if the tension applied on the yarn 20 is weak, it is difficult to securely hook the yarn 20 with the traverse guide 28, and a failure of yarn hooking has frequently occurred. Furthermore, in addition to the failure of yarn hooking, the traverse guide 28 tends to easily push out the yarn 20 beyond the traverse range, whereby the yarn 20 is wound while running out from the end face of the package 30 (stitching) and the quality of the package 30 is greatly lowered. In this regard, since the winder unit 10 of the present embodiment includes the yarn leading plates 75 and 76 described above, the traverse guide 28 can reliably hook the yarn 20, and a high quality package 30 can be produced.

[0082] However, the position of the pull-out point P7 of the yarn end from the package 30 is indefinite as described above, and thus is not limited to the example illustrated in FIG. 8, and may take various positions within the range of the winding width of the package 30. If the pull-out point P1 is located in proximity to the end that is opposite to the example of FIG. 8 (i.e., the large diameter side of the cone winding package), the yarn 20 is led towards the center in the winding width direction of the package 30 by the first guiding section 81 and the second guiding section 82 of the yarn leading plate 76. If the pull-out point P1 is located in proximity to the center in the winding width direction of the package 30, the yarn 20 is pulled out without making contact with the first guiding section 81 and the second guiding section 82. Since the yarn 20 is originally located at the center in the winding width direction of the package 30, the yarn 20 can be hooked to the traverse guide 28 without any problems.

[0083] Next, the arrangement of the second guiding section 82 in the yarn leading plates 75 and 76 will be described. Since the second guiding section 82 is arranged at a steeper inclination angle than the first guiding section 81, the yarn 20 is led to the portion of the second guiding section 82 when the yarn 20 is led by the yarn leading plates 75 and 76 as described above. Using such an aspect, in the present embodiment, the position of the second guiding section 82 is set such that the yarn path

can be guided to a point where the success rate of the yarn hooking by the traverse guide 28 is high. In other words, since the tip-end portion of the traverse guide 28 reciprocates in the arc-like path, the direction of the hooking section 63 of the traverse guide 28 (an angle of the yarn hooking groove 65) changes according to the traverse position. Such an aspect is taken into consideration in the present embodiment, and the position of the second guiding section 82 is appropriately adjusted such that the engagement of the traverse guide 28 and the yarn 20 starts at a position where the relationship of the direction of the hooking section 63 and the angle of the yarn path become satisfactory. Accordingly, the reliability of the yarn hooking is further improved.

[0084] When the yarn 20 is hooked to the tip-end portion of the traverse guide 28, the yarn 20 is wound around the package 30 while being traversed by the traverse guide 28. Accompanying the traversing of the yarn 20, the yarn 20 enters the gap 78 (the inner side of the yarn leading plates 75 and 76) from the opened portion 77 formed between the pair of the yarn leading plates 75 and 76. The yarn 20 is thereafter guided by the arcuate guide portion 72 of the guide plate 71, and no longer makes contact with the yarn leading plates 75 and 76. Therefore, the yarn leading plates 75 and 76 do not influence the traversing of the yarn 20. Accordingly, the state returns from that illustrated in FIG. 2 to FIG. 4, and the winding of the yarn 20 is continued.

[0085] As described above, the automatic winder 1 of the present embodiment includes the bobbin set section 18, the cradle 23, the contact roller 29, the traverse guide 28, and the yarn leading plates 75 and 76. The bobbin set section 18 supplies the yarn 20 wound around the yarn supplying bobbin 21. The cradle 23 rotatably holds the package 30, around which the yarn 20 supplied from the bobbin set section 18 is wound. The contact roller 29 makes contact with and rotates the package 30. The traverse guide 28 is provided independently from the contact roller 29. The traverse guide 28 engages with the yarn 20 to be wound into the package 30 held by the cradle 23 to traverse the yarn 20. The yarn leading plates 75 and 76 make contact with the yarn 20 applied with tension to lead the yarn 20 towards the center in the winding width direction of the package 30 before the traverse guide 28 engages with the yarn 20.

[0086] Accordingly, when joining the yarn ends with the splicer device 14 and resuming the winding of the yarn 20, the traverse guide 28 can be engaged with the yarn 20 led towards the center in the winding width direction of the package 30. Therefore, the yarn 20 can be reliably hooked on the traverse guide 28, and the traversing of the yarn 20 can be smoothly started.

[0087] In the automatic winder 1 of the present embodiment, the contour of the yarn leading plates 75 and 76 includes the first guiding section 81 and the second guiding section 82. The first guiding section 81 is arranged inclining at first inclination angle so as to be gradually located away from the bobbin set section 18 as ap-

proaching towards the end in the winding width direction of the package 30. The second guiding section 82 is arranged closer to the center in the winding width direction of the package 30 than the first guiding section 81 and connected to the end of the first guiding section 81. The second guiding section 82 is arranged inclining at a second inclination angle so as to be gradually located away from the bobbin set section 18 as approaching towards the end in the winding width direction of the package 30. The second inclination angle is steeper than the first inclination angle.

[0088] Accordingly, before the traverse guide 28 engages with the yarn 20, the yarn 20 is led until eventually making contact with the second guiding section 82 having a steep inclination angle. Therefore, by appropriately defining the position of the second guiding section 82, the traverse guide 28 can hook the yarn 20 at a satisfactory position where the traverse guide 28 can easily engage with the yarn 20, and the yarn 20 can be more reliably hooked to the traverse guide 28.

[0089] In the automatic winder 1 of the present embodiment, the first guiding section 81 and the second guiding section 82 are respectively arranged at both sides in the winding width direction of the package 30.

[0090] Accordingly, even if the pull-out point P1. of the yarn end is located at any end in the winding width direction of the package 30 when resuming the winding of the yarn 20, the yarn 20 can be led towards the center in the winding width direction of the package 30. Therefore, the traverse guide 28 can reliably start to be engaged with the yarn 20.

[0091] In the automatic winder 1 of the present embodiment, the traverse guide 28 includes the hooking section 63 having one side in the traverse direction (the small diameter side of the cone winding package) of the yarn 20 opened. The first guiding section 81 and the second guiding section 82 of the yarn leading plate 75 are arranged on the same side (the small diameter side of the cone winding package) as the hooking section 63 that is opened in the winding width direction of the package 30.

[0092] Accordingly, the yarn 20 can be easily hooked to the hooking section 63 of the traverse guide 28 from the opened side.

[0093] The automatic winder 1 of the present embodiment includes the guide plate 71 for guiding the yarn path of the yarn 20 being engaged with and traversed by the traverse guide 28.

[0094] Accordingly, after the yarn 20 is hooked to the traverse guide 28, the yarn 20 is traversed by the traverse guide 28 and wound while the yarn path being appropriately guided by the guide plate 71 without making contact with the yarn leading plates 75 and 76. Therefore, the influence of the yarn leading plates 75 and 76 on the winding of the package 30 can be prevented, and a high quality package 30 can be formed.

[0095] In the automatic winder 1 of the present embodiment, the yarn leading plates 75 and 76 are formed

of a plate-like member.

[0096] A configuration is realized in which the yarn 20 is less likely to get entangled at the portion of the yarn leading plates 75 and 76, and the winding operation can be smoothly carried out.

[0097] The automatic winder 1 of the present embodiment includes the traverse guide drive motor 45 for driving the traverse guide 28. The traverse guide 28 is formed in an arm shape including the tip-end portion provided with the portion to be engaged with the yarn 20 (yarn hooking groove 65), and the base-end portion adapted to receive the driving force from the traverse guide drive motor 45. When the traverse guide 28 is driven the traverse guide drive motor 45, the tip-end portion of the traverse guide 28 reciprocates in an arc-like path.

[0098] Generally, it is difficult to engage the yarn 20 with the tip-end portion of traversed guide 28 moving in the arc-like path. However, according to configurations described above, since the yarn 20 is led towards the center in the winding width direction of the package 30 in advance by the yarn leading plates 75 and 76, the yarn 20 can be reliably engaged by the traverse guide 28.

[0099] The automatic winder 1 of the present embodiment includes the splicer device 14 and the upper yarn guiding pipe 26. The splicer device 14 is adapted to join a yarn end from the bobbin set section 18 and a yarn end from the package 30 when a continuation of the yarn 20 between the bobbin set section 18 and the package 30 is disconnected. The upper yarn guiding pipe 26 is adapted to catch the yarn end from the package 30 and to guide the yarn end to the splicer device 14.

[0100] Accordingly, in the automatic winder 1 in which the yarn joining operation is carried out as necessary during the winding of the package 30, since the traverse guide 28 can reliably engage with the yarn 20, the winding can be smoothly resumed. As a result, the production efficiency of the package 30 can be improved.

[0101] Next, a second embodiment will be described. FIG. 11 is a front enlarged view illustrating a configuration of a periphery of the traverse device 27 in a winder unit 10 of the second embodiment. In the description of the present embodiment and onwards, the same reference numerals are denoted in the figures for the members same as or similar to those of the first embodiment, and the description thereof may be omitted.

[0102] In a winding section 17x of the second embodiment illustrated in FIG. 11, yarn leading plates 75x and 76x arranged in a pair have a portion that overlaps in the thickness direction. The overlapping portion 77x is arranged to correspond to the center in the winding width direction of the package 30. At the overlapping portion 77x, a gap in the thickness direction of the plates is formed between the yarn leading plates 75x and 76x, and the yarn 20 can enter the inner side of the yarn leading plates 75x and 76x from this gap.

[0103] Next, a third embodiment will be described. FIG. 12 is a front view and a block diagram of a winder unit 10 according to a third embodiment. FIG. 13 is a front

enlarged view illustrating a configuration of a periphery of the traverse device 27. FIG. 14 is a schematic side view of the traverse device 27.

[0104] In a winding section 17y of the third embodiment, the direction of the traverse device 27 is different from the first and second embodiments. That is, in the third embodiment, as illustrated in FIG. 14, when seen in a direction of a straight line connecting one end side and the other end side of the traverse stroke (axial direction of contact roller 29), the longitudinal direction of the traverse guide 28 is arranged, substantially perpendicular to the installation surface of the winder unit 10. In other words, in the present embodiment, the traverse guide 28 reciprocates within a plane substantially perpendicular to the installation surface of the winder unit 10. The arm main body 60 of the traverse guide 28 is not formed with a bent section, which is arranged in the first and second embodiments, and the arm main body 60 is straight.

[0105] The guide plate 71y is configured as a flat member that does not have a curved portion having a conical surface. An arcuate guide portion 72y formed in an arcuate shape that is convex upward is formed at the upper end of the guide plate 71y (an end located closer to the package 30). Guiding plate sections 75y and 76y are arranged on a surface of the guide plate 71y facing opposite to the traverse guide 28 (the side facing to the front side of winder unit 10).

[0106] The two guiding plate sections 75y and 76y are formed by bending one plate-like member (i.e., the guiding plate sections 75y and 76y on both sides are integrally formed). The broken-line shaped edge, that is the first guiding section 81 and the second guiding section 82, as illustrated in FIG. 3 in the first embodiment is formed only in the guiding plate section 75y arranged on one side in the winding width direction of the package 30 (the opened side of the hooking section 63 of the traverse guide 28) in the third embodiment. Therefore, in the present embodiment, only the guiding plate section 75y on one side corresponds to the yarn leading section.

[0107] Similarly to the second embodiment described above, the guiding plate sections 75y and 76y have a portion that overlaps in the thickness direction (see FIG. 13). A gap in the thickness direction of the plates is formed between the two guiding plate sections 75y and 76y at the overlapping area 77y, and the yarn 20 can pass through this gap.

[0108] The preferred embodiments of the present invention have been described above, but the above configurations may be modified as below.

[0109] The structure of the yarn leading section (e.g., the yarn leading plates 75 and 76 of the first embodiment) is not limited to the above-described examples, and may be appropriately changed. For example, at least one of the first guiding section 81 and the second guiding section 82 may be formed in a curved line instead of a straight line.

[0110] The yarn leading plates 75 and 76 of the first embodiment and the yarn leading plates 75x and 76x of

the second embodiment may be respectively changed to be configured with one member.

[0111] Among the first guiding section 81 and the second guiding section 82 arranged on both sides in the winding width direction of the package 30 while being substantially symmetric in the first embodiment and the second embodiment, the first guiding section 81 and the second guiding section 82 may be omitted from one side in the winding width direction. In this case, the first guiding section 81 and the second guiding section 82 located opposite to the opened side of the hooking section 63 of the traverse guide 28 are preferably omitted.

[0112] Instead of arranging the first guiding section 81 and the second guiding section 82 at the edge of the plate-like member (the yarn leading plates 75 and 76), for example, the functions similar to the embodiments described above can be realized by appropriately bending the rod shaped member, as used in the guiding frame of Japanese Unexamined Patent Publication No. 2006-298499, to the shapes of the first guiding section 81 and the second guiding section 82. However, the plate-like member is preferable as compared with the rod shaped member in that the yarn 20 is less likely to get entangled.

[0113] The shape of the traverse guide 28 can be appropriately changed, and for example, the hooking section 63 may be formed to have the opening facing towards the large diameter side of the cone winding package. In this case, in the configuration of FIG. 13, for example, the positional relationship of the guiding plate sections 75y and 76y is preferably inverted so that the first guiding section 81 and the second guiding section 82 are located on the same side as the opened side of the hooking section 63.

[0114] A case of forming the cone winding package has been described in the above embodiments by way of example, but the present invention can be applied to an automatic winder having a configuration of forming a cheese-shaped package.

[0115] The present invention is not limited to the automatic winder, and can be applied to other yarn winding machines such as a rewinding machine, a fine spinning machine (e.g., a pneumatic spinning machine, an open-end spinning machine), and the like.

Claims

1. A yarn winding machine comprising:

- a yarn supplying section (18) adapted to supply a yarn (20);
- a cradle (23) adapted to rotatably hold a package (30) around which the yarn (20) supplied by the yarn supplying section (18) is wound;
- a contact roller (29) adapted to make contact with and rotate the package (30);
- a traverse guide (28) provided independently

- from the contact roller (29), and adapted to be engaged with the yarn (20) to be wound into the package (30) held by the cradle (23) to traverse the yarn (20); and
 a yarn leading section (75, 76) adapted to make contact with the yarn (20) applied with tension to lead the yarn (20) towards a center in a winding width direction of the package (30) before the traverse guide (28) engages with the yarn (20).
2. The yarn winding machine according to claim 1, wherein a contour of the yarn leading section (75, 76) includes:
- a first guiding section (81) arranged inclining at a first inclination angle so as to be gradually located away from the yarn supplying section (18) as approaching towards an end in the winding width direction of the package (30), and
 a second guiding section (82) arranged closer to the center in the winding width direction of the package (30) than the first guiding section (81) and connected to the first guiding section (81), and arranged inclining at a second inclination angle so as to be gradually located away from the yarn supplying section (18) as approaching towards the end in the winding width direction of the package (30), and
- wherein the second inclination angle is steeper than the first inclination angle.
3. The yarn winding machine according to claim 2, wherein the first guiding section (81) and the second guiding section (82) are respectively arranged at both sides in the winding width direction of the package (30).
4. The yarn winding machine according to claim 2 or claim 3, wherein the traverse guide (28) includes a hook-shaped yarn hooking section (63) having one side in a traverse direction of the yarn (20) opened, and the first guiding section (81) and the second guiding section (82) are arranged at least at a same side as the side of the yarn hooking section (63) that is opened in the winding width direction of the package (30).
5. The yarn winding machine according to any one of claim 1 through claim 4, further comprising a yarn path guide (71) adapted to guide a yarn path of the yarn (20) being engaged with and traversed by the traverse guide (28).
6. The yarn winding machine according to any one of claim 1 through claim 5, wherein the yarn leading section (75, 76) is formed of a plate-like member.
7. The yarn winding machine according to any one of claim 1 through claim 6, further comprising a driving section (45) adapted to drive the traverse guide (28), wherein the traverse guide (28) is formed in an arm-shape including a tip-end portion provided with a portion to be engaged with the yarn (20) and a base-end portion adapted to receive a driving force from the driving section (45), and the tip-end portion of the traverse guide (38) reciprocates in an arc-like path by the base-end portion of the traverse guide (28) being driven by the driving section (45).
8. The yarn winding machine according to any one of claim 1 through claim 7, further comprising:
- a yarn joining device (14) adapted to join a yarn end from the yarn supplying section (18) and a yarn end from the package (30) when a continuation of the yarn (20) between the yarn supplying section (18) and the package (3) is disconnected; and
 a catching-and-guiding section (26) adapted to catch the yarn end from the package (30) and to guide the yarn end to the yarn joining device (14).

FIG. 1

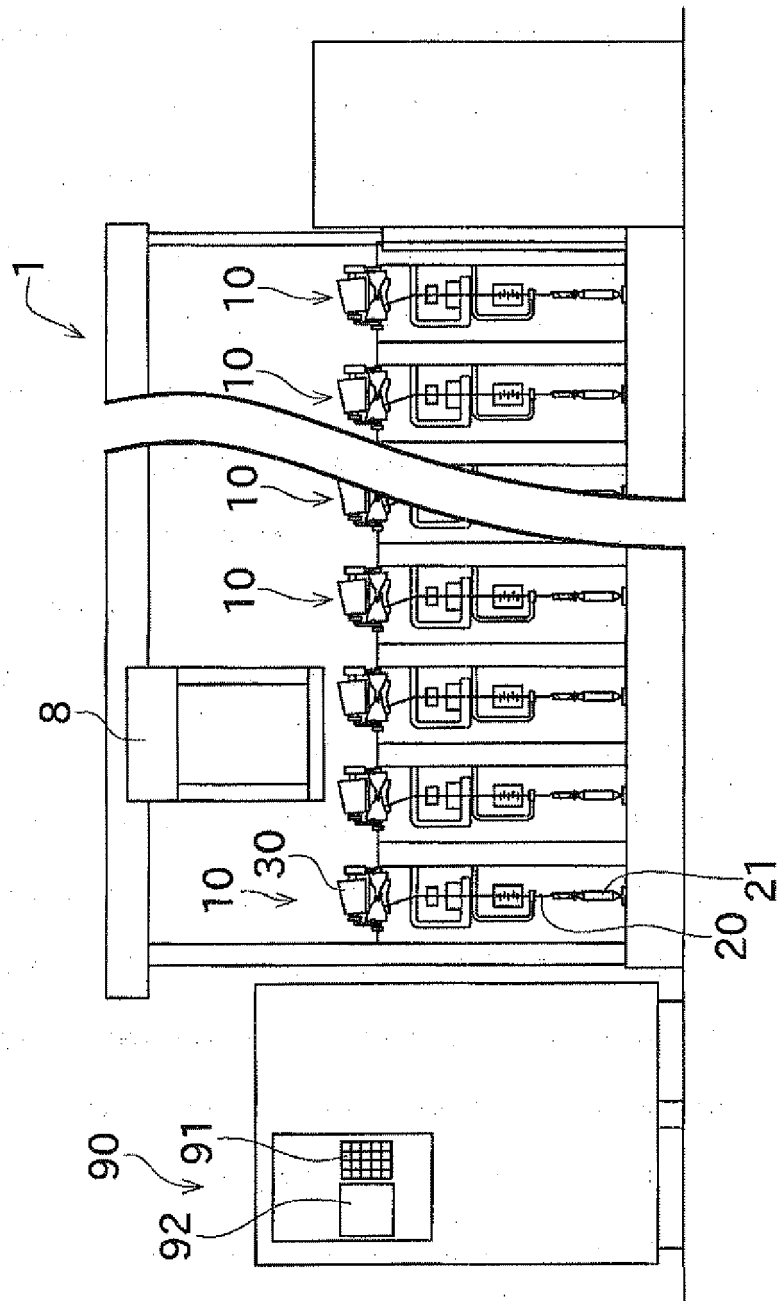


FIG. 2

FIRST EMBODIMENT

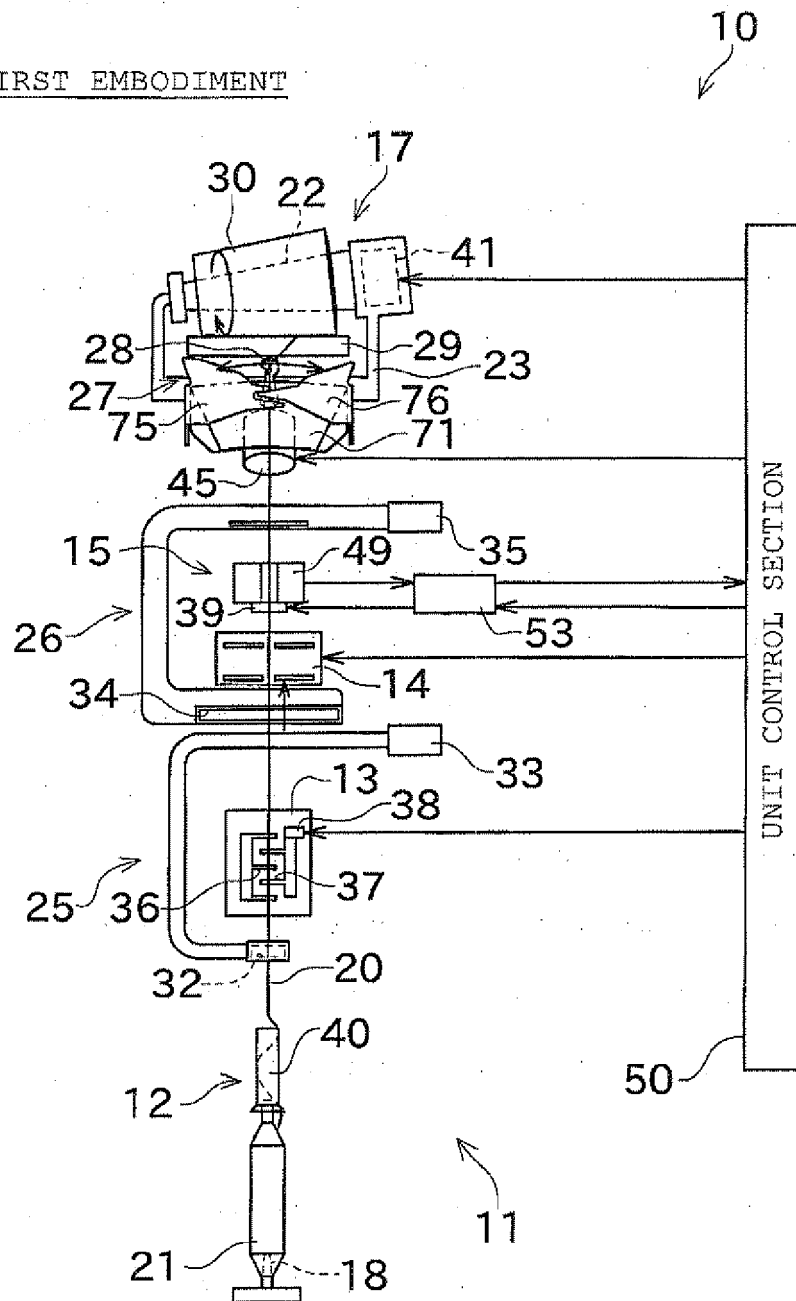


FIG. 3

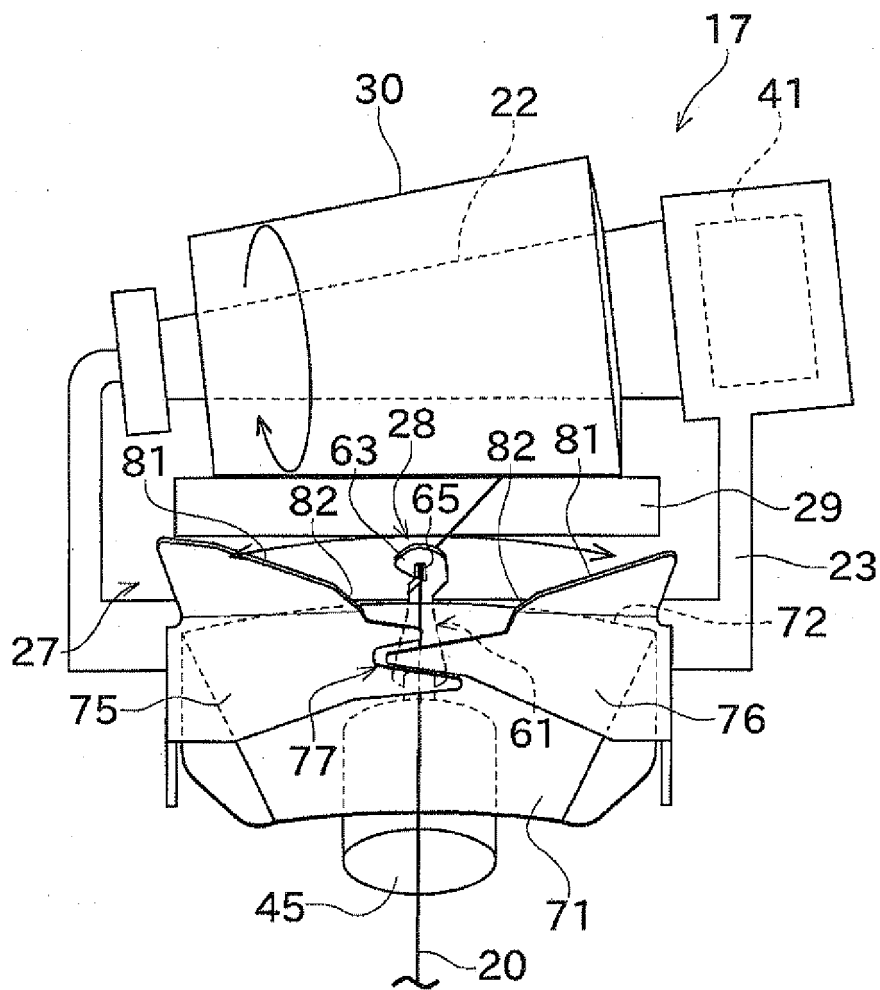


FIG. 4

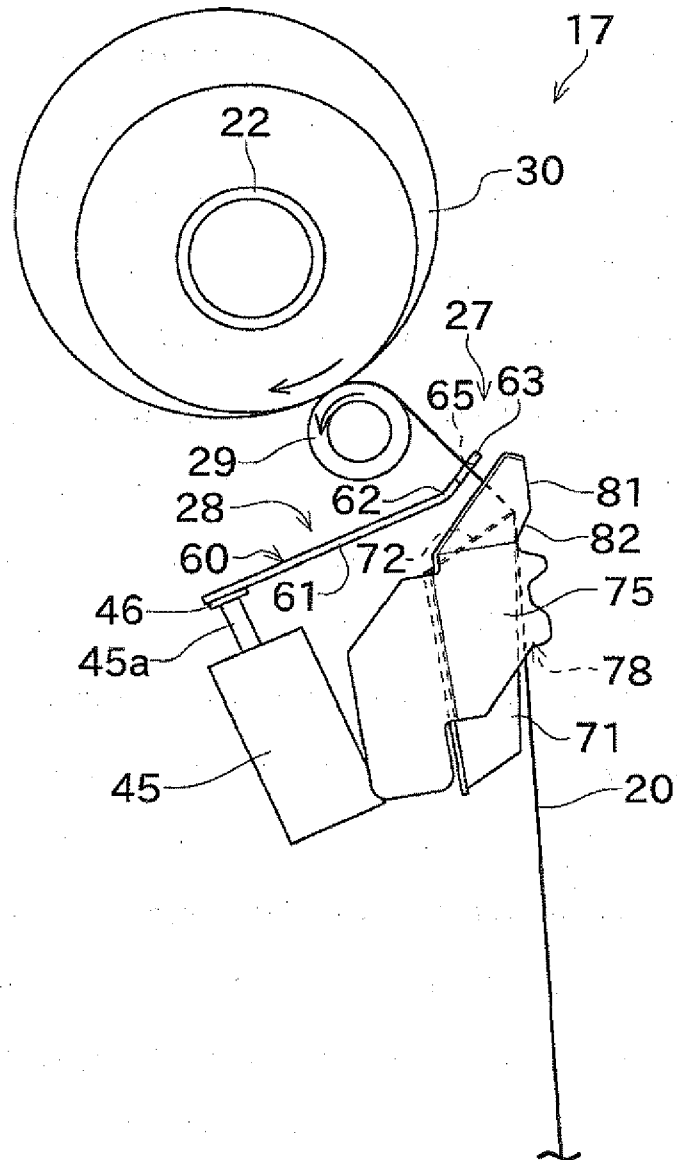


FIG. 5

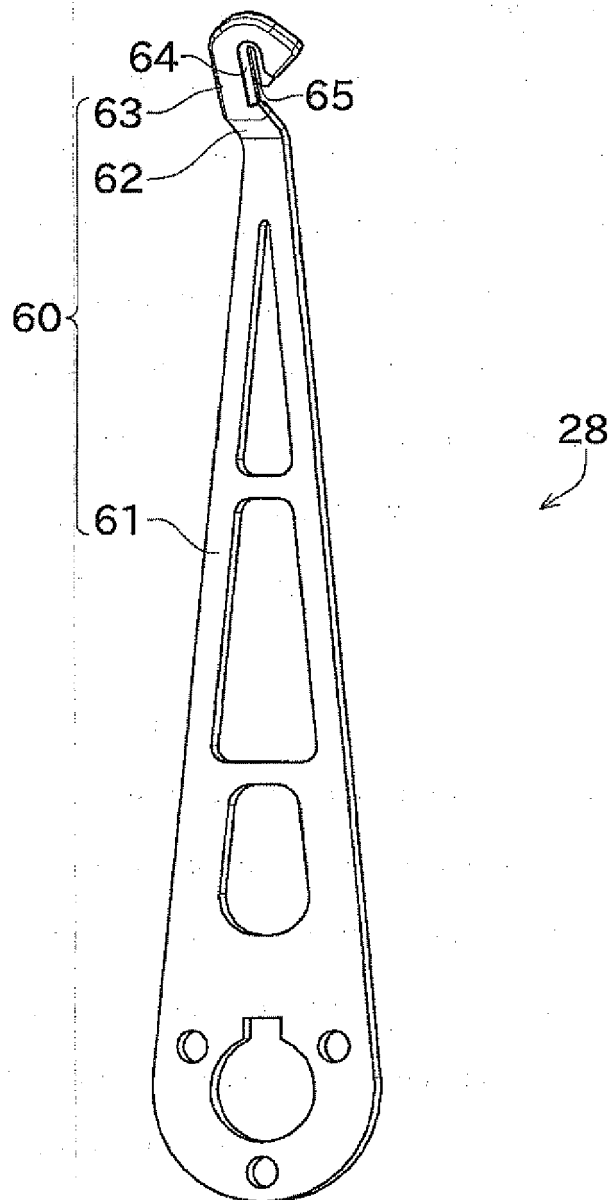


FIG. 6

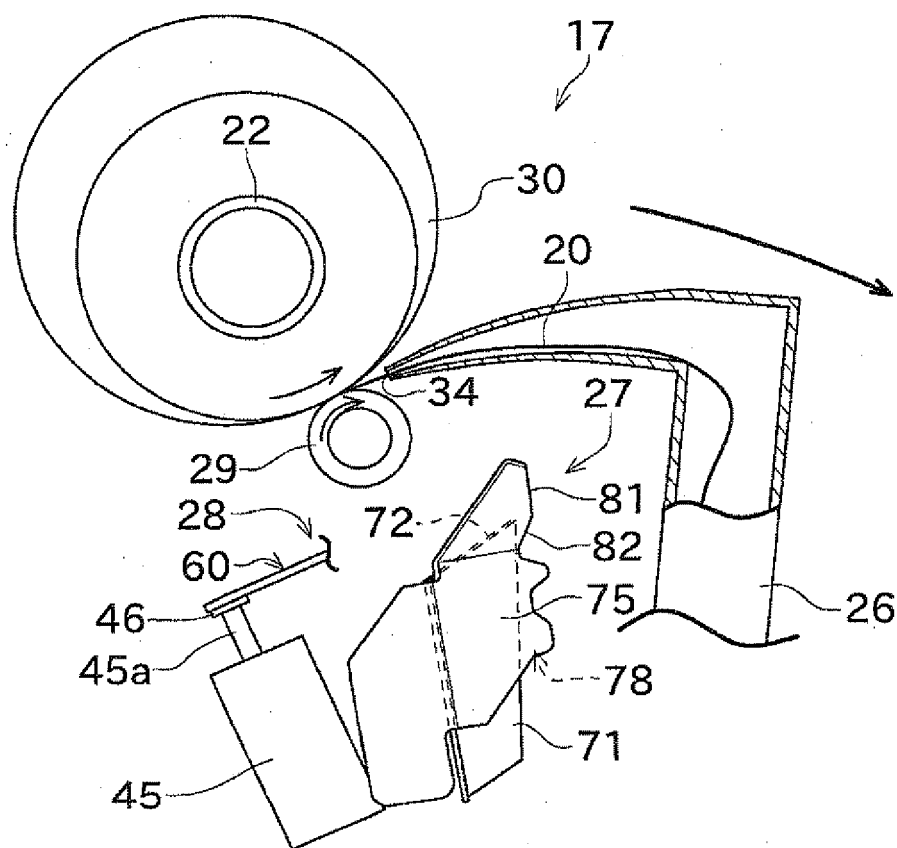


FIG. 7

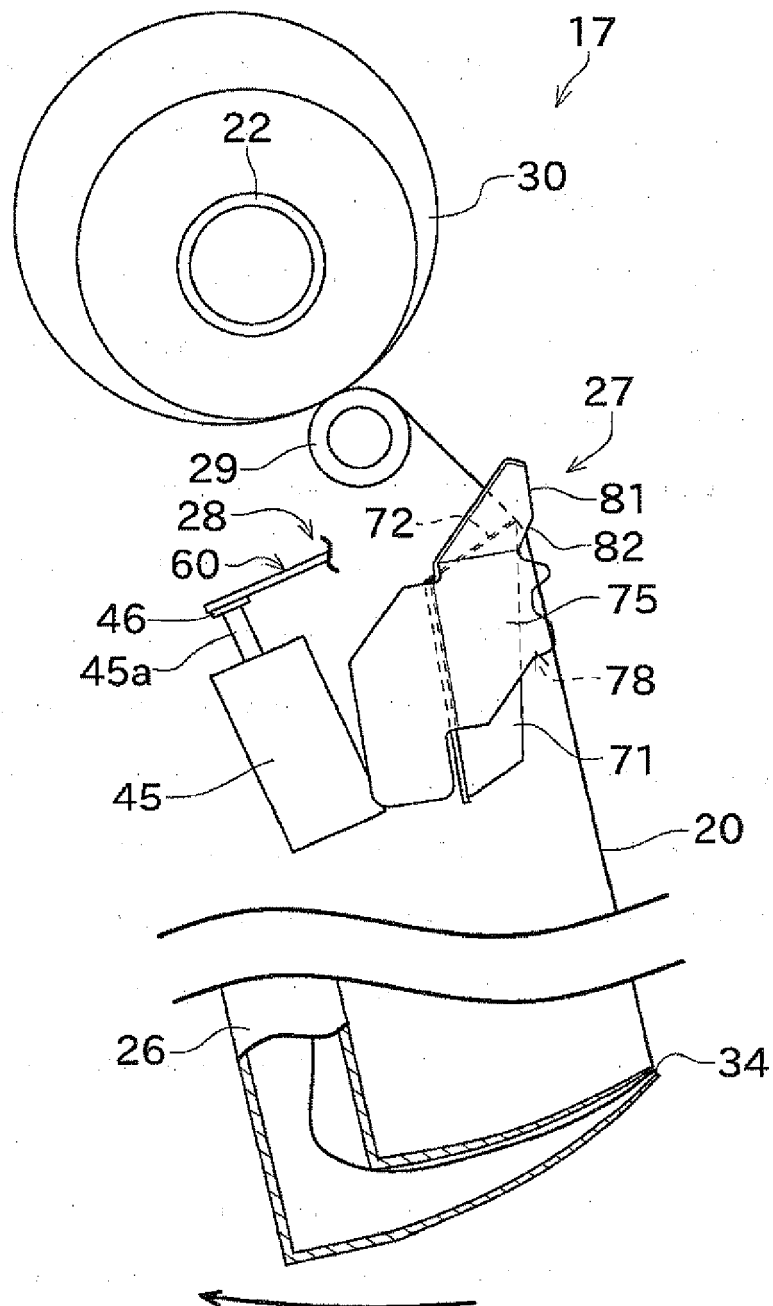


FIG. 8

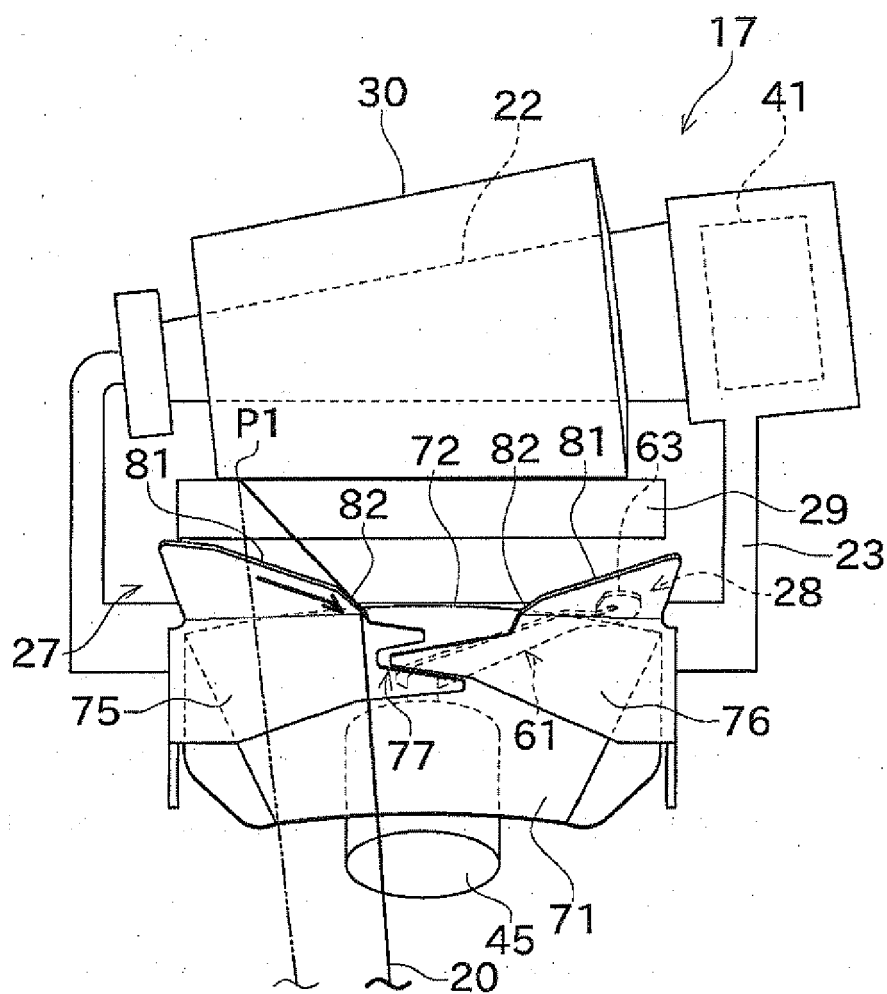


FIG. 9

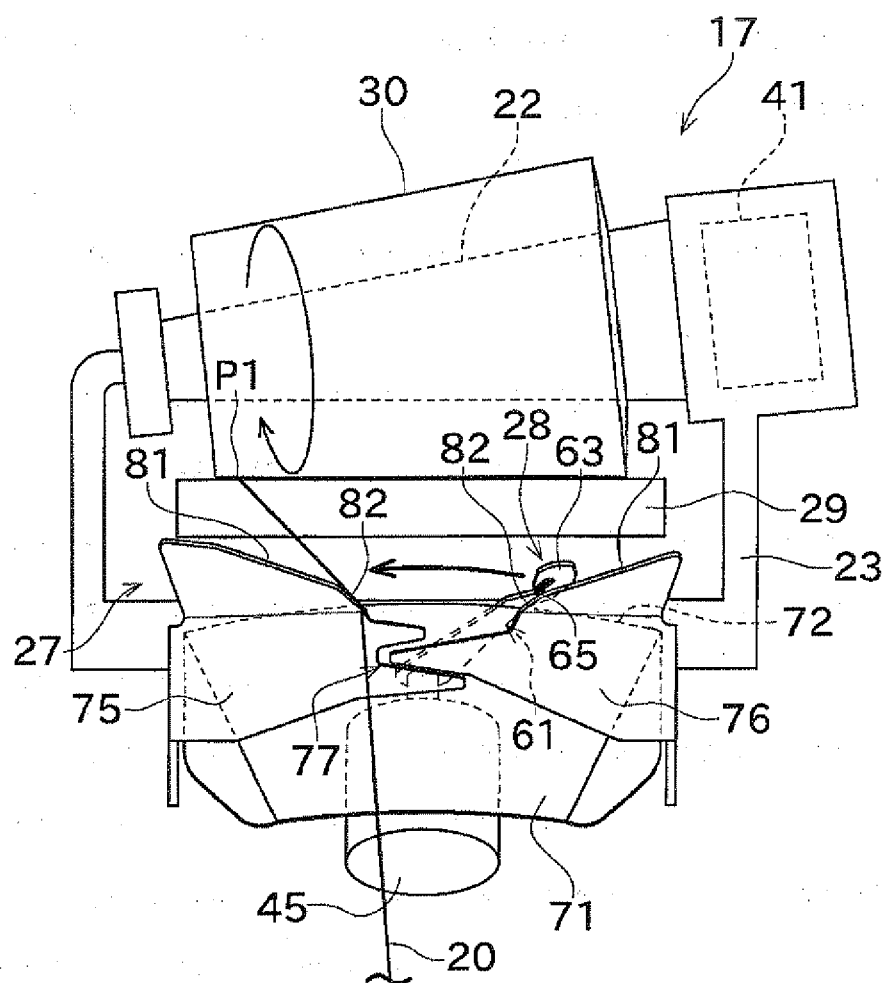


FIG. 10

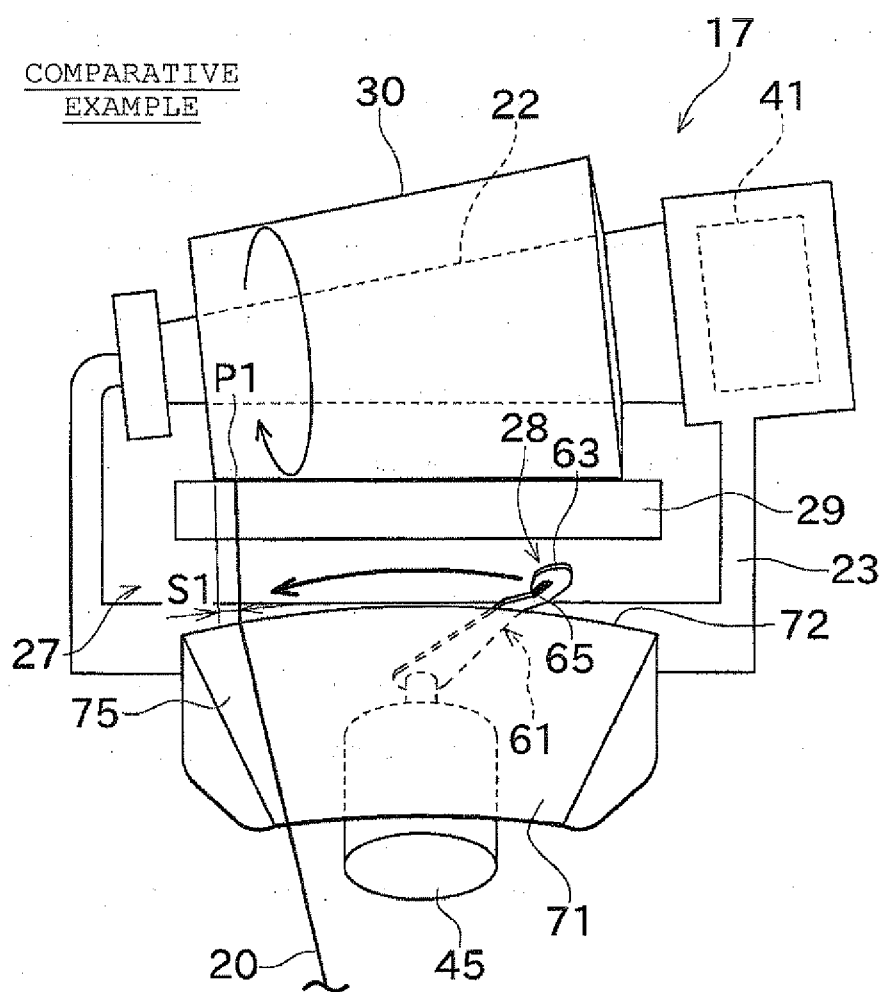


FIG. 11

SECOND EMBODIMENT

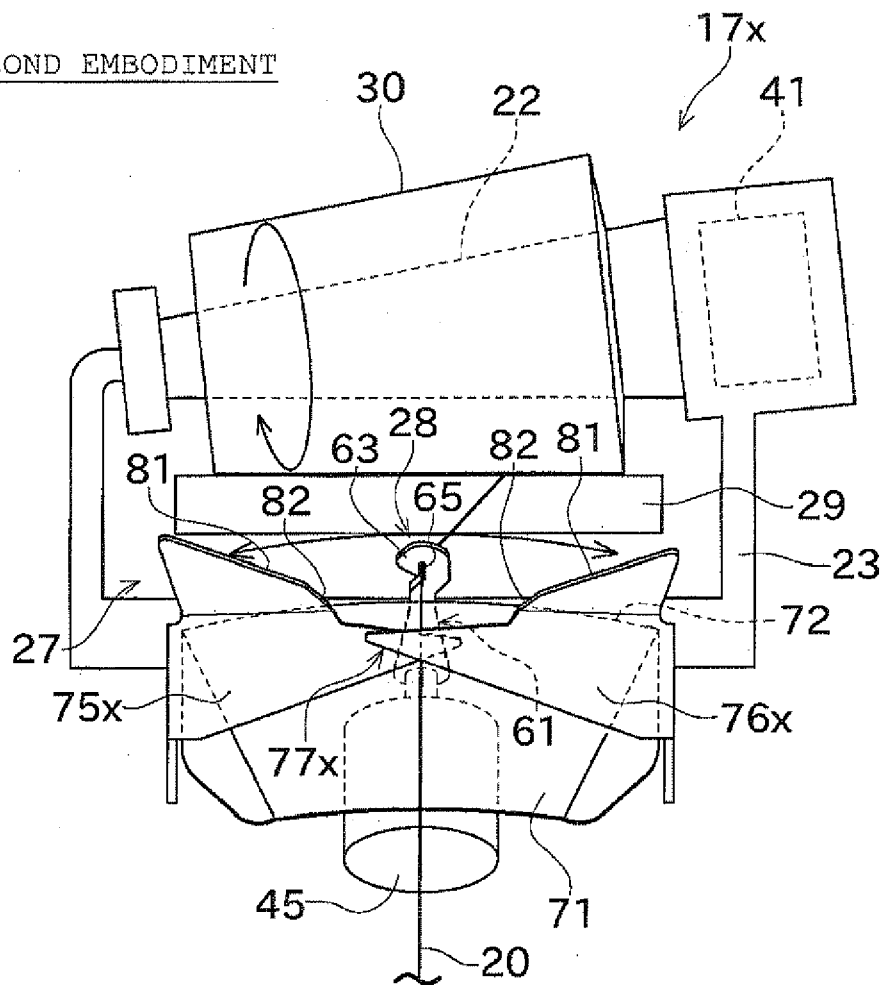


FIG. 12

THIRD EMBODIMENT

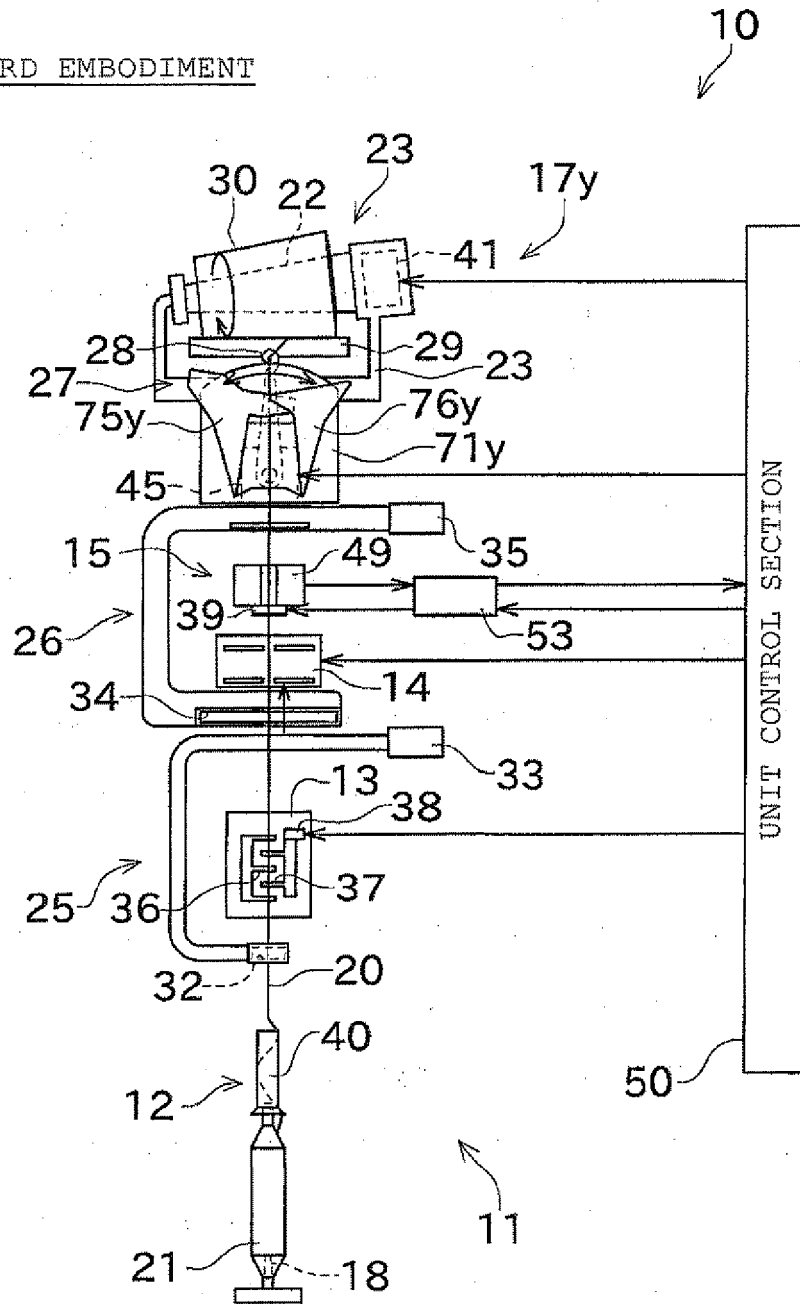


FIG. 13

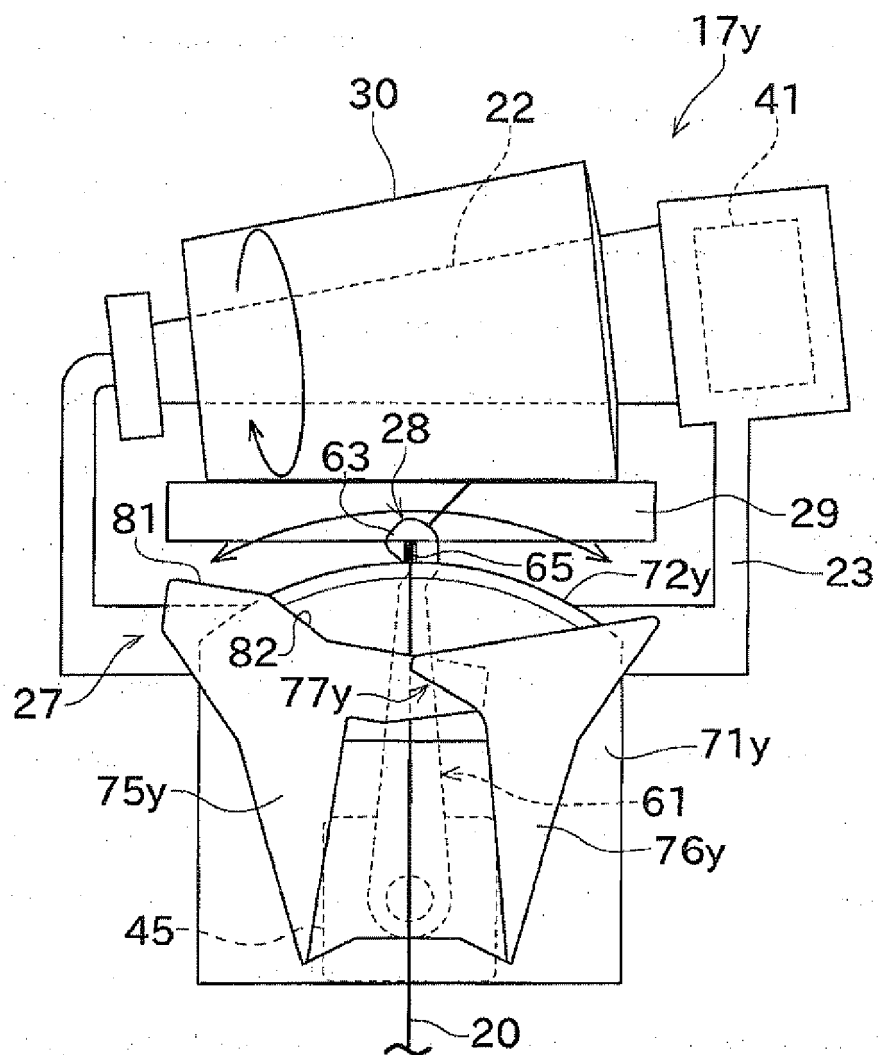
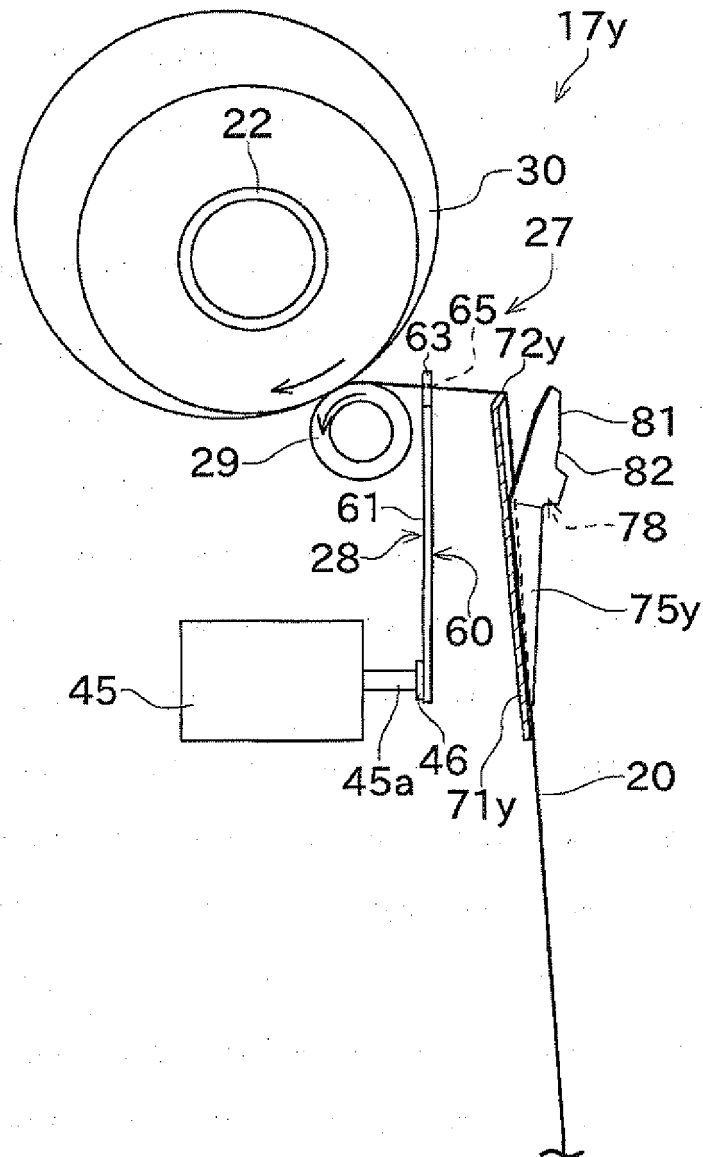


FIG. 14



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006298499 A [0002] [0005] [0112]