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(54) WAX APPLYING DEVICE AND YARN WINDING DEVICE

(57) A wax applying device configured to apply wax to a traveling yarn includes: a casing including an attachment part for attaching the casing to a yarn winding device; a traverse guiding portion configured to guide the yarn to be wound by a winding unit of the yarn winding device so that the yarn is traversed forming a traverse area; and a wax support portion configured to support a wax body while the wax body is positioned in at least part of the traverse area. The traverse guiding portion is provided to the casing in a fixed manner, and the wax support portion is attached to the casing with a moving mechanism that is configured to be movable in a direction separating from the traverse area.

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a wax applying device and a yarn winding device.

BACKGROUND

[0002] Conventionally, a wax applying device attached to a yarn winding device and configured to apply wax to a traveling yarn has been known. For example, German Unexamined Patent Publication No. 102006018838 describes a wax applying device configured to position a wax body in at least part of the traverse area when a yarn wound by a winding unit of a yarn winding device is traversed forming a traverse area.

SUMMARY

[0003] In the above-described wax applying device, when the wax body is replaced (which involves at least one of attachment and detachment of the wax body, the same applies hereinafter), this replacement may affect a yarn path. This may make it difficult, for example, to replace the wax body while the yarn from a package is being connected.

[0004] In view of this, the present disclosure aims to provide a wax applying device and a yarn winding device in which replacement of a wax body is prevented from affecting a yarn path.

[0005] A wax applying device according to one aspect of the present disclosure is a wax applying device conf igured to apply wax to a traveling yarn. The wax applying device includes: a casing including an attachment part for attaching the casing to a yarn winding device; a traverse guiding portion configured to guide the yarn to be wound by a winding unit of the yarn winding device so that the yarn is traversed forming a traverse area; and a wax support portion configured to support a wax body while the wax body is positioned in at least part of the traverse area. The traverse guiding portion is provided to the casing in a fixed manner, and the wax support portion is attached to the casing with a moving mechanism that is configured to be movable in a direction separating from the traverse area.

[0006] In the wax applying device according to the one aspect of the present disclosure, the wax support portion supports the wax body. This wax support portion is attached to the casing with the moving mechanism that is configured to be movable in the direction separating from the traverse area. Thus, after the moving mechanism moves the wax support portion in order to attach and detach the wax body, the wax body can be replaced. At this time, because the traverse guiding portion is provided to the casing in a fixed manner, regardless of whether the wax support portion is beingmovedby the movingmechanism, the traverse guiding portion can guide the yarn to be wound by the winding unit so that the yarn is traversed. Thus, in the wax applying device, replacement of the wax body can be prevented from affecting the yarn path. Consequently, the wax body can be easily replaced while the yarn from the package is being connected.

[0007] In the wax applying device according to one aspect of the present disclosure, themovingmechanismmaymovethewaxsupportportion in such a manner that the wax support portion and the wax body supported by the wax support portion do not pass through the traverse area. With this configuration, the wax body can be replaced in such a manner that the wax support portion and the wax body do not pass through the traverse area.

[0008] The wax applying device according to one aspect of the present disclosure may further include apositioningportion configured to be in contact with the wax body supported by the wax support portion through the traverse area to position the wax body with respect to the yarn. The positioning portion may be provided to the casing in a fixed manner. With this configuration, regardless of whether the wax support portion is being moved by the moving mechanism, the accuracy of positioning the wax body by the positioning portion can be maintained. This can prevent replacement of the wax body from affecting the positioning of the wax body.

[0009] In the wax applying device according to one aspect of the present disclosure, the moving mechanism may include a rotation shaft and rotationally moves the wax support portion with respect to the casing so that the wax support portion rotates about the rotation shaft. This configuration enables the wax body to be easily replaced. Even in a limited workspace, the wax body can be easily replaced.

[0010] In the wax applying device according to one aspect of the present disclosure, the moving mechanism may slidingly move the wax support portion with respect to the casing. This configuration enables the wax body to be easily replaced.

[0011] In the wax applying device according to one aspect of the present disclosure, the moving mechanism may move the wax support portion along an arc-shaped trajectory. With this configuration, the wax support portion can be moved along the arc-shaped trajectory and the wax body can be separated from the traverse area.

[0012] The wax applying device according to one aspect of the present disclosure may further include a locking mechanism configured to restrict the moving mechanism so that the wax support portion is not moved by a force equal to or smaller than a predetermined force. With this configuration, for example, even if an operator releases his/her hold when the operator has caused the moving mechanism to move the wax support portion, the state of the wax support portion can be maintained, facilitating operation of replacing the wax body.

[0013] In the wax applying device according to one aspect of the present disclosure, themovingmechanismmaymovethewaxsupportportion so that the wax body is exposed outside the casing. With this configuration, the

moving mechanism can move the wax body to a state for replacement operation.

[0014] A yarn winding device according to one aspect of the present disclosure includes the above-described wax applying device. In this yarn winding device also, the same effect as the above-described effect, that is, an effect of preventing replacement of the wax body from affecting the yarn path can be obtained. The accuracy of positioning the wax body with respect to the traverse area can be improved.

[0015] In the yarn winding device according to one aspect of the present disclosure, the wax body may be positioned opposite to a front side of the yarn winding device with respect to the traverse area. With this configuration, the yarn path can be prevented being hidden by the wax body when viewed from the front side.

[0016] In the yarn winding device according to one aspect of the present disclosure, the wax applying device may further include an upstream regulating guide provided upstream of the wax body in a traveling direction of the yarn and configured to regulate a yarn path of the yarn. With this configuration, the upstream regulating guide can regulate the yarn path of the yarn to prevent wax damage (what is called "ring-shaped cut").

[0017] In the yarn winding device according to one aspect of the present disclosure, the upstream regulating guide may be provided at a starting point of the traverse area, and when a plane extending along a contact location between the wax body and the traverse area is assumed to be a reference plane, a bending angle ($\theta 1$) at which the yarn brought into the wax applying device bends from the reference plane toward the starting point may be larger than a bending angle ($\theta 2$) at which the yarnbrought out from the wax applying device bends from the reference plane toward a package. With this configuration, the yarn brought into the wax applying device can effectively touch the regulating guide, and thus the tension of this yarn can be stabilized. Consequently, wax can be caused to stably adhere to the yarn. Furthermore, wax damage can be prevented.

[0018] In the yarn winding device according to one aspect of the present disclosure, the wax applying device may further include a downstream regulating guide provided downstream of the wax body in the traveling direction of the yarn and configured to regulate the yarn path of the yarn. The upstream regulating guide and the downstream regulating guide may regulate the yarn path so that the yarn path on a downstream side is more separated from the wax body than the yarn path on an upstream side. This configuration also has the above-described effect of preventing wax damage.

[0019] In the yarn winding device according to one aspect of the present disclosure, the upstream regulating guide, when viewed from a direction along the yarn path, is formed so that a portion on a one side of the yarn path, acting as a center, in a traversing direction protrudes further outward from the wax body than a portion on an other side of the yarn path in the traversing direction. This configuration also has the above-described effect of preventing wax damage.

[0020] The yarn winding device according to one aspect of the present disclosure may further include: a yarn supplying unit configured to support a yarn supplying bobbin; and a yarn storage device configured to unwind the yarn from the yarn supplying bobbin supported by the yarn supplying unit and to wind the yarn unwound. The yarn storage device may be provided in a position upstream of the wax applying device in the traveling direction of the yarn. This configuration can prevent replacement of the wax body from affecting the yarn path between the yarn storage device and the package. When a splicing device is not disposed in the yarnpathbetween the yarn storage device and the package, for example, the above-described effect of facilitating replacement of the wax body while the yarn from the package is being connected is particularly effective.

[0021] According to the present disclosure, in the wax applying device and the yarn winding device, replacement of the wax body can be prevented from affecting the yarn path.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 is a schematic front view illustrating an overall configuration of an automatic winder according to a first embodiment.

FIG. 2 is a schematic side view illustrating a winder unit according to the first embodiment.

FIG. 3 is a perspective view illustrating a wax applying device according to the first embodiment during normal winding.

FIG. 4 is a plan view illustrating the wax applying device according to the first embodiment during normal winding.

FIG. 5 is a diagram for explaining a traverse area of the wax applying device according to the first embodiment.

FIG. 6 is a side view illustrating the wax applying device according to the first embodiment during normal winding.

FIG. 7 is a perspective view illustrating the wax applying device according to the first embodiment during replacement operation.

FIG. 8 is a plan view illustrating the wax applying device according to the first embodiment during replacement operation.

FIG. 9 is a plan view illustrating the wax applying device according to the first embodiment in another state during normal winding.

FIG. 10 is a perspective view illustrating a wax applying device according to a second embodiment during normal winding.

FIG. 11 is a perspective view illustrating the wax applying device according to the second embodiment

during replacement operation.

FIG. 12 is a perspective view illustrating a wax applying device according to a third embodiment during normal winding.

FIG. 13 is a side view illustrating a wax applying device according to a modification.

FIG. 14A is a perspective view illustrating an upstream regulating guide according to the modification.

FIG. 14B is a plan view illustrating the upstream regulating guide according to the modification.

DETAILED DESCRIPTION

[0023] Embodiments of the present disclosure will now be described in detail with reference to the attached drawings. In the description of the drawings, like or equivalent elements are designated by like numerals, and duplicate description is omitted. The terms "upstream" and "downstream" mean upstream and downstream in a traveling direction of a yarn during spinning, respectively.

First Embodiment

[0024] As depicted in FIG. 1, the automatic winder 1 includes a plurality of winder units (yarn winding devices) 2 disposed in parallel, a machine control device 3, a yarn supplying bobbin feeder 4, a doffer 5, and a blower box (not depicted).

[0025] The machine control device 3 is configured to be able to communicate with the respective winder units 2. An operator of the automatic winder 1 can manage the winder units 2 centrally by appropriately operating the machine control device 3. The machine control device 3 controls operation of the yarn supplying bobbin feeder 4 and the doffer 5.

[0026] The yarn supplying bobbin feeder 4 sets a yarn supplying bobbin 21 on a conveying tray 26 on a one-by-one basis. The yarn supplying bobbin feeder 4 feeds the yarn supplying bobbin 21 set on the conveying tray 26 to each of the winder units 2.

[0027] When a package 30 is fully wound in each winder unit 2 (in a state in which a specified amount of yarn 20 is wound), the doffer 5 travels to the position of the corresponding winder unit 2 to remove the fully wound package 30. The doffer 5 sets an empty winding bobbin 22 on this winder unit 2 from which the package 30 is removed.

[0028] The following describes a configuration of each winder unit2. As depicted in FIG. 2, the winder unit 2 includes a yarn supplying unit 6, a yarn storage device 18, a package forming unit 8, and a wax applying device 70. In the winder unit 2, a yarn 20 on the corresponding yarn supplying bobbin 21 of the yarn supplying unit 6 is unwound, and this unwound yarn 20 is temporarily stored in the yarn storage device 18 and is then wound around the winding bobbin 22 to form a package 30.

[0029] The yarn supplying unit 6 is configured to support the yarn supplying bobbin 21 set on the corresponding conveying tray 26 at a predetermined position so as to be able to unwind the yarn 20 from this yarn supplying bobbin 21. When all of the yarn 20 is unwound from the yarn supplying bobbin 21, the yarn supplying unit 6 discharges this empty yarn supplying bobbin 21, and receives a new yarn supplying bobbin 21 supplied from the yarn supplying bobbin feeder 4.

[0030] The yarn storage device 18 is disposed between the yarn supplying unit 6 and the package forming unit 8. The yarn storage device 18 is provided in a position upstream of the wax applying device 70 in the traveling direction of the yarn 20. The yarn storage device 18 temporarily stores therein the yarn 20 unwound at the yarn supplying unit 6. The yarn storage device 18 supplies the stored yarn 20 to the package forming unit 8. The yarn storage device 18 includes a yarn storage roller 32 that can wind the yarn 20 and a roller drive motor 33 configured to rotationally drive the yarn storage roller 32. The roller drive motor 33 rotates the yarn storage roller 32 inadirection of winding the yarn 20 from the yarn supplying unit 6. The roller drive motor 33 can rotate the yarn storage roller 32 also in a direction opposite to this winding direction.

[0031] The package forming unit 8 includes a cradle 23 configured so that the winding bobbin 22 can be mounted thereon and a traverse drum 24 configured to drive the winding bobbin 22 while traversing the yarn 20. The package forming unit 8 constitutes a winding unit. The cradle 23 rotatably supports the winding bobbin 22 (or the package 30). The cradle 23 is configured to be able to bring the outer peripheral surface of the package 30 supported by the cradle 23 into contact with the outer peripheral surface of the traverse drum 24.

[0032] The traverse drum 24 is rotationally driven by a drive source (not depicted) such as an electric motor, and rotates while being in contact with the outer peripheral surface of the winding bobbin 22 or the package 30, thereby causing the winding bobbin 22 to rotate in a driven manner. Accordingly, the yarn 20 stored in the yarn storage device 18 can be unwound and pulled out to be wound around the winding bobbin 22. On the outer peripheral surface of the traverse drum 24, a traverse groove (not depicted) is formed. This traverse groove enables the yarn 20 to be traversed at a predetermined width. With the above-described configuration, the yarn 20 can be wound around the winding bobbin 22 while being traversed to form the package 30 having a predetermined shape.

[0033] The wax applying device 70 is disposed between the yarn storage device 18 and the package forming unit 8. The wax applying device 70 applies wax to the yarn 20 traveling from the yarn storage device 18 toward the package forming unit 8. The specific configuration of the wax applying device 70 will be described later.

[0034] The winder unit 2 includes various devices in a yarn traveling path from the yarn supplying unit 6 to the package forming unit 8 via the yarn storage device 18.

Specifically, on the yarn path (yarn traveling path) of the yarn 20, in the order of from the upstream yarn supplying unit 6 side toward the downstream yarn storage device 18 side, an unwinding assisting device 10, an upstream yarn blow delivering unit 11, a second catcher 12, a splicing device 13, a first catcher 14, a tension applying unit 15, a cutter 16, a yarn monitor 17, and a downstream yarn blow delivering unit 48 are disposed.

[0035] The unwinding assisting device 10 brings a movable member 27 into contact with a balloon that is formed at an upper portion of the yarn supplying bobbin 21 by swinging the yarn 20 unwound from the yarn supplying bobbin 21. The unwinding assisting device 10 assists the unwinding of the yarn 20 by suitably controlling the size of the balloon.

[0036] The upstream yarn blow delivering unit 11 is an air sucker device disposed in a position downstream of the unwinding assisting device 10 adjacently to the unwinding assisting device 10. The upstream yarn blow delivering unit 11 ejects compressed air, thereby forming airflow to blow and deliver the yarn 20 to the first catcher 14. Thus, for example, when yarn breakage occurs, the yarn end on the yarn supplying bobbin 21 side can be blown and delivered toward the splicing device 13 by the operation of the upstream yarn blow delivering unit 11.

[0037] In the case immediately after a new yarn supplying bobbin 21 is supplied to the yarn supplying unit 6, the auxiliary blow delivering unit 28 blows and delivers the yarn end to a position where the upstream yarn blow delivering unit 11 can blow and deliver the yarn end toward the splicing device 13.

[0038] The auxiliary blow delivering unit 28 ejects compressed air into the inside of the conveying tray 26 and the yarn supplying bobbin 21 that are formed in hollow shapes, thereby forming, at the distal end of the yarn supplying bobbin 21, an airflow to blow and deliver the yarn 20 on the yarn supplying bobbin 21 toward the upstream yarn blow delivering unit 11. When the newly supplied yarn supplying bobbin 21 is supported in the yarn supplying unit 6, the auxiliary blow delivering unit 28 and the upstream yarn blow delivering unit 11 operate in conjunction with each other, and thus the yarn end on the yarn supplying bobbin 21 side can be reliably delivered toward the splicing device 13.

[0039] The second catcher 12 is disposed upstream of the splicing device 13. The second catcher 12 is connected to a suction-flow generating source (not depicted). During splicing, the second catcher 12 generates a suction airflow to suction and catch the yarn 20 on the yarn storage device 18 side.

[0040] The splicing device 13 splices split yarns 20. Under conditions in which the yarn 20 between the yarn supplying bobbin 21 and the yarn storage device 18 is cut, such as a case of yarn cut when the yarn monitor 17 detects a yarn defect and cuts the yarn 20 with the cutter 16, a case of yarn cut when the yarn 20 being unwound from the yarn supplying bobbin 21 is cut, or a case of changing the yarn supplying bobbins 21, the splicing device 13 splices the yarn 20 on the yarn supplying bobbin 21 side and the yarn 20 on the yarn storage device 18 side. The splicing device 13 is disposed in a position slightly separated from the yarn path in a retracting manner. The splicing device 13 can splice the yarn ends brought in together into a continuous yarn 20. As the splicing device 13, at least one of a device using fluid such as compressed air and a mechanical device can be used.

[0041] The first catcher 14 is disposed in a position downstream of the splicing device 13 adjacently to the splicing device 13. The first catcher 14 is connected to a negative-pressure source (not depicted) and is configured as a tubular member having an opening formed on its distal end. The first catcher 14 includes an advancing/retreating drive unit 47. The advancing/retreating drive unit 47 causes the first catcher 14 to advance to or retreat from the yarn path.

[0042] The first catcher 14, while being approaching the yarn path, generates a suction airflow at the distal end side thereof, thereby suctioning and catching the yarn end from the yarn supplying bobbin 21 blown and delivered by the upstream yarn blow delivering unit 11. When the yarn 20 is cut with the cutter 16, the first catcher 14 suctions and catches the yarn end of the cut yarn 20 on the yarn supplying bobbin 21 side. The first catcher 14 may be configured to generate a suction airflow at the distal end side thereof, thereby suctioning and removing fluff, for example, sticking on the traveling yarn 20. The first catcher 14 retreats from the yarn path while catching the yarn end from the yarn supplying bobbin 21, and thus can bring the yarn end into the splicing device 13.

[0043] The tension applying unit 15 applies a predetermined tension to the traveling yarn 20. The tension applying unit 15 is configured as a gate-type unit in which movable comb teeth are disposed with respect to fixed comb teeth. The tension applying unit 15 applies a predetermined resistance by causing the yarn 20 to travel between the comb teeth. The movable comb teeth are configured to be movable by, for example, a solenoid so that the comb teeth mesh with or disengage from each other. This enables the tension applying unit 15 to adjust the tension to be applied to the yarn 20. The configuration of the tension applying unit 15 is not limited to a particular configuration, and a disk-type tension applying unit may be used.

[0044] The yarn monitor 17 monitors the thickness, for example, of the yarn 20 with an appropriate sensor, thereby detecting a yarn defect such as at least one of slub and mixing of foreign matter. In a position adjacent to the yarn monitor 17 on the upstream side of the yarn monitor 17, the cutter 16 is disposed. When the yarn monitor 17 has detected a yarn defect, the cutter 16 immediately cuts the yarn 20.

[0045] The cutter 16 and the yarn monitor 17 are accommodated together in a housing 19. The housing 19 accommodating the yarn monitor 17 is disposed in a position downstream of the tension applying unit 15 adja-

cently to the tension applying unit 15. This configuration enables the yarn monitor 17 to monitor the vicinity of an area where the traveling yarn 20 is held (guided) by the tension applying unit 15. Thus, the yarn 20 in this monitored area is less likely to shake, whereby the yarn monitor 17 can detect a defect of the yarn 20 with higher accuracy.

[0046] The downstream yarn blow delivering unit 48 is an air sucker device disposed in a position upstream of the yarn storage device 18 adjacently to the yarn storage device 18. The downstream yarn blow delivering unit 48 ejects compressed air, thereby forming an airflow to blow off the yarn end on the yarn storage device 18 side and deliver this yard end to the second catcher 12. Specifically, the downstream yarn blow delivering unit 48 includes a thin tubular guide member through which the yarn 20 can be passed and a yarn guiding member 60 that is a curved tubular member. On one end of the guide member, a blow port for the yarn 20 is formed. The yarn guiding member 60 is provided adjacently to the blow port of the downstream yarn blow delivering unit 48. On both longitudinal ends of the yarn guiding member 60, openings are each formed.

[0047] The yarn guiding member 60 is disposed in such a manner that the opening on one end thereof faces the blow port of the downstream yarn blow delivering unit 48 and the opening on the other end faces the second catcher 12. Inside the yarn guiding member 60, a guiding path is formed. The guiding path connects between the openings on both ends of the yarn guiding member 60 so as to detour around the yarn monitor 17, the tension applying unit 15, and the splicing device 13, for example. The downstream yarn blow delivering unit 48, the yarn guiding member 60, and the second catcher 12 constitute a storage-side yarn end catching device 50.

[0048] When the yarn 20 is split between the yarn supplying bobbin 21 and the yarn storage device 18, the downstream yarn blow delivering unit 48 catches the yarn 20 on the yarn storage device 18 side and blows off this yard 20 to the guiding path of the yarn guiding member 60, pulls out the yarn 20 along the guiding path, and causes the second catcher 12 to catch the yarn 20. The yarn guiding member 60 has a pass-through slit (not depicted) formed along the entire length thereof. This allows the yarn 20 to be pulled out from the inside of the yarn guiding member 60 while the yarn 20 is caught by the second catcher 12. In the above-described manner, the yarn 20 on the yarn storage device 18 side is blown and delivered by the downstream yarn blow delivering unit 48, and the yarn 20 can be guided toward the splicing device 13.

[0049] Each winder unit 2 includes a control unit 25. The control unit 25 includes hardware such as a CPU, a ROM, and a RAM (not depicted) . The RAM stores therein software such as a control program. The control unit 25 controls each component of the winder unit 2 by cooperative operation of the software and the hardware. The control unit 25 is configured to be able to communicate with the machine control device 3. This enables the machine control device 3 to centrically manage operation of the winder unit 2 provided in plurality to the automatic winder 1.

[0050] The following describes the wax applying device 70 according to the first embodiment in detail. In the following description, the terms "front side" and "back side" respectively mean the front side (front) and the back side (rear) of the winder unit 2. The "X-direction" corresponds to the traversing direction of the yarn 20.

[0051] FIG. 3 to FIG. 6 illustrate states of the wax applying device 70 during normal winding. The period during normal winding is a wax application time during which the yarn 20 is continuous between the yarn supplying bobbin 21 and the package 30 and wax is being applied to the traveling yarn 20. FIG. 7 and FIG. 8 illustrate states of the wax applying device 70 during replacement operation. The period during replacement operation is a time during which the yarn 20 is continuous between the yarn supplying bobbin 21 and the package 30 and a wax body W is being replaced (when at least one of attachment and detachment is performed). During replacement operation, the wax body W is exposed outside a casing 72 so that the wax body W can be replaced.

[0052] As depicted in FIG. 3 to FIG. 6, the wax applying device 70 is a wax applying device attached to each winder unit 2. The wax applying device 70 rotates the wax body W having a cylindrical shape about the axis thereof, and presses one end surface of the wax body W against the yarn 20 that is traveling while being traversed. In this manner, the wax applying device 70 applies wax to the yarn 20.

[0053] The wax body W is a wax formed in a cylindrical shape. As the wax, various types of waxes are used depending on, for example, usage or specifications of the yarn 20. Examples of the waxes that can be used include natural waxes, synthetic waxes such as paraffin wax, and a combination of these waxes. The wax applying device 70 includes the casing 72, traverse guiding portion 74, a wax support portion 76, a moving mechanism 82, a locking mechanism 86, a positioning portion 92, an upstream regulating guide 94, a downstream regulating guide 96, and a cushion member 98.

[0054] The casing 72 is attached to a frame (not depicted) of the winder unit 2. The casing 72 is structured with an upstream plate 72a, a downstream plate 72b, and a side plate 72c. The upstream plate 72a and the downstream plate 72b are each formed in a flat shape. The upstream plate 72a and the downstream plate 72b are disposed so that the thickness direction thereof extends along the traveling direction of the yarn 20. The downstream plate 72b is disposed so as to face the upstream plate 72a at a downstream position separated from the upstreamplate 72a at a predetermined distance. In some of the drawings, for convenience of description, the downstream plate 72b is a chain line.

[0055] The side plate 72c fixedly connects one end of the upstream plate 72a and one end of the downstream plate 72b in the X-direction. The side plate 72c extends

orthogonally to the upstream plate 72a and the downstream plate 72b.

[0056] On the side plate 72c, a screw hole 73 is formed. Into the screw hole 73, a screw N is inserted. The side plate 72c is fixed to the frame (not depicted) of the winder unit 2 with the screw N. In this manner, the casing 72 is attached to the winder unit 2. In other words, the casing 72 has the screw hole 73 and the screw N as attachment parts for attaching the casing 72 to the winder unit 2. The screw hole 73 and the screw N are provided to the casing 72 in a fixed manner.

[0057] The traverse guiding portion 74 guides the yarn 20 to be wound by the package 30 (see FIG. 2) so that the yarn 20 is traversed forming a traverse area P. The traverse area P is a plane of motion of the yarn 20 that is formed by the yarn 20 being traversed. The traverse area P is a triangular plane (see FIG. 5) having a vertex (traversing center) at the upstream end, in which the height direction thereof corresponds to the traveling direction of the yarn 20, and the width direction thereof corresponds to the X-direction corresponding to the traversing direction. The traverse area is also called "traverse plane". The traverse guiding portion 74 is structured with a hole portion 74a formed on the upstream plate 72a and a slit portion 74b formed on the downstream plate 72b. In other words, the traverse guiding portion 74 is provided to the casing 72 in a fixed manner.

[0058] Through the hole portion 74a, the yarn 20 traversed on the traverse area P passes. Through the hole portion 74a, the yarn 20 traversed on the traverse area P passes at a position of a first traverse width on the traversing center side. The hole portion 74a communicates with an opening portion 75a that is open to the front side. The opening portion 75a forms a yarn passage through which the yarn 20 enters the hole portion 74a. In the present embodiment, in the hole portion 74a, the starting point of the traverse area P is formed.

[0059] The slit portion 74b extends along the X-direction. The slit portion 74b faces the hole portion 74a in the traveling direction of the yarn 20. Through the slit portion 74b, the yarn 20 traversed on the traverse area P passes. Through the slit portion 74b, the yarn 20 traversed on the traverse area P passes at a position of a second traverse width that is larger than the first traverse width. The slit portion 74b communicates with an opening portion 75b that is open to the front side. The opening portion 75b forms a yarn passage through which the yarn 20 enters the slit portion 74b.

[0060] The wax support portion 76 supports the wax body W while being positioned in at least part of the traverse area P (see FIG. 5). During normal winding, the wax support portion 76 supports the wax body W so as to press one end surface (end surface on the front side) of the wax body W against the traverse area P. The wax support portion 76 is structured with a mounting shaft 77 and a hold-down lever 78.

[0061] The mounting shaft 77 is inserted into a cylindrical hole of the wax body W, and the wax body W is mounted thereon so as to be synchronously rotatable. The mounting shaft 77 is disposed between the upstream plate 72a and the downstream plate 72b. The rear end of the mounting shaft 77 is attached to a motor 79 configured to rotationally drive the mounting shaft 77. The motor 79 is fixed to a swing arm 84 described later. Accordingly, the mounting shaft 77 pivotally supports the wax body W rotatably on the swing arm 84 described later.

[0062] The hold-down lever 78 presses the wax body W mounted on the mounting shaft 77 to the front side. The hold-down lever 78 is disposed between the upstream plate 72a and the downstream plate 72b. The hold-down lever 78 includes a swing shaft 78a provided on the base end side thereof and a pressing portion 78b provided on the distal end side thereof.

[0063] The hold-down lever 78 is configured to be swingable about the swing shaft 78a. The swing shaft 78a is vertically disposed on the swing arm 84 described later. The swing shaft 78a extends along the traveling direction of the yarn 20. To the swing shaft 78a, a torsion coil spring (not depicted) is attached. The hold-down lever 78 is biased by the elastic force of the torsion coil spring, whereby the pressing portion 78b is biased toward the front side. Accordingly, the hold-down lever 78 presses a flange-shaped member Wa attached to the rear end surface of the wax body W with the pressing portion 78b to press the wax body W against the traverse area P toward the front side.

[0064] On an end portion of the hold-down lever 78 on the side opposite to the pressing portion 78b side, a swing restricting pin 78c is vertically disposed. The hold-down lever 78 is biased by the elastic force of the torsion coil spring attached to the swing shaft 78a, whereby the swing restricting pin 78c is biased rearward. During replacement operation, the swing restricting pin 78c engages with an engaging piece 80 provided on the inner surface (surface on the upstream plate72aside) ofthedownstreamplate72b, there by restricting swinging of the hold-down lever 78 (details will be described later).

[0065] The wax body W supported by the wax support portion 76 as described above is positioned on the side (back side) opposite to the front side of the traverse area P. In other words, the traverse area P is positioned on the front side of the wax body W. The wax support portion 76 is attached to the casing 72 with the moving mechanism 82 that is configured to be movable in a direction separating from the traverse area P in order to attach and detach the wax body W.

[0066] The moving mechanism 82 includes a rotation shaft 83 extending along the traveling direction of the yarn 20. The moving mechanism 82 moves the wax support portion 76 rotationally about the rotation shaft 83 with respect to the casing 72 to open and close the wax support portion 76. In other words, the moving mechanism 82 is a rotationally opening-and-closing mechanism configured to allow the wax support portion 76 to move between the state of the wax applying device 70 during

normal winding (see FIG. 3 to FIG. 6) and the state of the wax applying device 70 during replacement operation (see FIG. 7 and FIG. 8). The moving mechanism 82 herein enables the wax applying device 70 to be of a rear-opening type, which is opened by swinging the wax support portion 76 to the back side.

[0067] The moving mechanism 82 includes the swing arm 84 configured to be rotatable (swingable) about the rotation shaft 83. The moving mechanism 82 rotates (swings) the swing arm 84 about the rotation shaft 83, thereby rotationally moving (swingingly moving) the wax support portion 76 attached to the swing arm 84 with respect to the casing 72.

[0068] The rotation shaft 83 is disposed between the upstream plate 72a and the downstream plate 72b. The rotation shaft 83 is fixed to the downstream plate 72b with a screw, for example. The swing arm 84 is disposed in the wax applying device 70 on the back side. The swing arm 84 has a shape of a substantially L-shaped plate the thickness direction of which corresponds to the traveling direction of the yarn 20. To the swing arm 84, in a portion (L-shaped bending portion) between one end and the other end thereof, the rotation shaft 83 is attached.

[0069] To one end portion of the swing arm 84, the mounting shaft 77 and the motor 79 are attached. Specifically, the one end portion of the swing arm 84 is provided with a vertical-plate portion 84a that is fixed upright as if the one end portion on the front side is bent to form the vertical-plate portion. The vertical-plate portion 84a extends so as to protrude downstream from the downstream plate 72b. The mounting shaft 77 penetrates the vertical-plate portion 84a. The motor 79 connected to this mounting shaft 77 is fixed to the one end portion of the swing arm 84 while being in contact with the vertical-plate portion 84a. To the other end portion of the swing arm 84 , the hold-down lever 78 is attached. Specifically, to the other end portion of the swing arm 84, the swing shaft 78a of the hold-down lever 78 is fixed. Thus, at the other end portion of the swing arm 84, the hold-down lever 78 is supported swingably about the swing shaft 78a.

[0070] During normal winding and during replacement operation, the locking mechanism 86 restricts the moving mechanism 82 so that the wax support portion 76 is not moved by a force equal to or smaller than a predetermined force. Herein, the locking mechanism 86 locks operation of the swing arm 84 so that the swing arm 84 does not swing even when a force equal to or smaller than the predetermined force is applied to the swing arm 84. The locking mechanism 86 includes a lock pin 87, a cam 88, a locking shaft 89, a locking arm 90, and a torsion coil spring 91.

[0071] The lock pin 87 is formed in a cylindrical shape the axial direction of which corresponds to the traveling direction of the yarn 20. The lock pin 87 is vertically disposed on the other end portion of the swing arm 84. The cam 88 is formed in a cylindrical shape the axial direction of which corresponds to the traveling direction of the yarn 20. The outer peripheral surface of the cam 88 is in slidable contact with the outer peripheral surface of the lock pin 87. The locking shaft 89 is disposed between the upstream plate 72a and the downstream plate 72b. The locking shaft 89 extends in the traveling direction of the yarn 20. The locking shaft 89 is fixed to the upstream plate 72a with a screw, for example.

[0072] The locking arm 90 on the base end side is provided with the locking shaft 89. The locking arm 90 is configured to be swingable about the locking shaft 89. To the locking arm 90 on the distal end side, the cam 88 is attached rotatably about the shaft of the cam 88. The torsion coil spring 91 is attached to the locking shaft 89. The torsion coil spring 91 biases, with its elastic force, the locking arm 90 so that the locking arm 90 is not swung by a force equal to or smaller than the predetermined force.

[0073] In the locking mechanism 86 thus configured, during normal winding, the cam 88 engages with the lock pin 87 on the mounting shaft 77 side as depicted in FIG. 4. Accordingly, to the swing arm 84, the predetermined force (predetermined force acting about the rotation shaft 83 in the rotational direction) is applied in the closing direction. Consequently, the wax body W supported on the swing arm 84 is pressed hard to the front side, whereby backlash of the wax body W can be prevented. In contrast, during replacement operation, the cam 88 engages with the lock pin 87 on the side opposite to the mounting shaft 77 side as depicted in FIG. 8. Accordingly, to the swing arm 84, the predetermined force (predetermined force acting about the rotation shaft 83 in the rotational direction) is applied in the opening direction.

[0074] As depicted in FIG. 3 to FIG. 6, the positioning portion 92 is in contact with the wax body W supported by the wax support portion 76 through the traverse area P. In this manner, the positioning portion 92 positions the wax body W with respect to the yarn 20. The positioning portion 92 is disposed between the upstream plate 72a and the downstream plate 72b. During normal winding, the positioning portion 92 faces the front side of the wax body W. The positioning portion 92 includes a plurality of wax pins 93. During normal winding, the wax pins 93 are caused to abut one end surface of the wax body W supported by the wax support portion 76. The positioning portion 92 is fixed to the upstreamplate 72a and the downstreamplate 72b with screws, for example. In other words, the positioning portion 92 is provided to the casing 72 in a fixed manner.

[0075] The upstream regulating guide 94 and the downstream regulating guide 96 are members configured to regulate the yarn path of the yarn 20. The upstream regulating guide 94 and the downstream regulating guide 96 are each formed in a flat shape. The upstream regulating guide 94 and the downstream regulating guide 96 are disposed so that the thickness direction thereof corresponds to the traveling direction of the yarn 20.

[0076] The upstream regulating guide 94 is provided upstream of and adjacently to the wax body W in the

traveling direction of the yarn 20 during normal winding. The upstream regulating guide 94 is provided at the starting point of the traverse area P. When viewed from the upstream side, the end surface of the upstream regulating guide 94 on the front side lies inside the hole portion 74a of the traverse guiding portion 74. The upstream regulating guide 94 is fixed to the inner surface (surface on the downstream plate 72b side) of the upstream plate 72a with screws, for example.

[0077] The downstream regulating guide 96 is provided downstream of and adjacently to the wax body W in the traveling direction of the yarn 20 during normal winding. The downstream regulating guide 96 is provided on the back side of the traverse area P. When viewed from the downstream side, the end surface of the downstream regulating guide 96 on the front side lies inside the slit portion 74b of the traverse guiding portion 74. The downstream regulating guide 96 is fixed to the inner surface of the downstream plate 72b with screws, for example.

[0078] When the swing arm 84 is swung in changing states from replacement operation to normal winding (when the wax support portion 76 is closed), the cushion member 98 absorbs (cushions) shocks generated by contact between the vertical-plate portion 84a of the swing arm 84 and the downstream plate 72b. As the cushion member 98, for example, a resin part can be used. The cushion member 98 is provided to the downstream plate 72b so as to be sandwiched between the downstream plate 72b and the vertical-plate portion 84a during normal winding. The cushion member 98 can suppress noise and damage generated by contact between the vertical-plate portion 84a and the downstream plate 72b.

[0079] In the wax applying device 70, as depicted in FIG. 6, a bending angle $\theta 1$ at which the yarn 20 brought in bends from the reference plane S toward the starting point of the traverse area P is set larger than a bending angle 82 at which the yarn 20 brought out bends from the reference plane S toward the package 30. The reference plane S is a plane extends along a contact location between the wax body W and the traverse area P. The reference plane S extends along the end surfaces of the upstream regulating guide 94 and the downstream regulating guide 96 on the front side. The bending angles $\theta 1$ and $\theta 2$ are angles between the reference plane S and the yarn 20. The bending angles $\theta 1$ and $\theta 2$ are angles inclined from the reference plane S. The configuration for achieving the bending angles $\theta 1$ and $\theta 2$ is not limited to a particular configuration. For example, the angle at which the wax applying device 70 is attached to the winder unit 2 may be changed to achieve the condition of bending angle $\theta 1$ > bending angle $\theta 2$.

[0080] The following describes one example of operation for replacement of the wax body W in the wax applying device 70.

[0081] In the state during normal winding depicted in FIG. 3 and FIG. 4, when replacing the wax body W, an operator pushes the distal end portion of the hold-down lever 78 toward the back side, and pushes the vertical-plate portion 84a toward the back side to apply a force for swinging the swing arm 84 in the opening direction O thereto.

[0082] In the locking mechanism 86, the cam 88 engages with the lock pin 87. To the swing arm 84, a predetermined restricting force is applied in the direction opposite to the opening direction O. Thus, when the applied force is equal to or smaller than the predetermined force, the swing arm 84 does not swing. In contrast, when a force larger than the predetermined force is applied, the lock pin 87 slides so as to climb over the cam 88, and the swing arm 84 swings in the opening direction O. Consequently, the wax support portion 76 swingingly moves so that the end portion of the wax body W on the front side is exposed outside the casing 72, and thus the state shifts to the state during replacement operation depicted in FIG. 7 and FIG. 8.

[0083] When the swing arm 84 swings in the opening direction O, the swing restricting pin 78c of the hold-down lever 78 passes by the front side of the engaging piece 80. In the state during replacement operation depicted in FIG. 7 and FIG. 8, the swing restricting pin 78c is biased rearward by the elastic force of the torsion coil spring, and the swing restricting pin 78c on the back side engages with the engaging piece 80 on the front side, and thereby disabling the swing restricting pin 78c from moving any farther to the back side. Thus, in the state during replacement operation, swing of the hold-down lever 78 is restricted, and pressing of the wax body W by the hold-down lever 78 is stopped. Consequently, the wax body W can be prevented from being unintendedly pushed and pulled out by the hold-down lever 78.

[0084] In the state during replacement operation, the cam 88 engages with the lock pin 87. To the swing arm 84, a predetermined restricting force is applied in the direction opposite to the closing direction C. Thus, even if the operator releases his/her hold, the swing arm 84 can be prevented from returning (closing in the closing direction C), and the operator can easilyperform replacement operation.

[0085] In the above-described state during replacement operation, after replacing the wax body W with new one, the operator applies a force for swinging the swing arm 84 in the closing direction C thereto in order to change the state back to the state during normal winding. By the restricting force of the above-described locking mechanism 86, when the applied force is equal to or smaller than the predetermined force, the swing arm 84 is caused not to swing. In contrast, when a force larger than the predetermined force is applied, the lock pin 87 slides so as to climb over the cam 88, and the swing arm 84 swings in the closing direction C, so that the state shifts to the state during normal winding depicted in FIG. 3 and FIG. 4.

[0086] In a series of replacement operations described above, the casing 72 is continuously being attached to the winder unit 2. By the traverse guiding portion 74 provided to this casing 72 in a fixed manner, the traveling

yarn 20 continues to be guided so as to be traversed forming the traverse area P. In such a manner that the wax support portion 76 and the wax body W do not pass through (across) the traverse area P, the wax support portion 76 is swingingly moved by the moving mechanism 82.

[0087] As depicted in FIG. 4 and FIG. 9, in the state during normal winding, for example, when the wax body W is consumed and the hold-down lever 78 swings in a direction of pressing the wax body W, the swing restricting pin 78c moves so as to pass by the back side of the engaging piece 80. Thus, in this case, the swing restricting pin 78c that is biased rearward does not engage with the engaging piece 80. Consequently, while the swinging of the hold-down lever 78 is not being restricted, the hold-down lever 78 can press the wax body W to the front side.

[0088] As described in the foregoing, in the present embodiment of the wax applying device 70, and the winder unit 2 and the automatic winder 1 including the wax applying device 70, the wax support portion 76 supports the wax body W. This wax support portion 76 is attached to the casing 72 with the moving mechanism 82 that is configured to be movable in the direction separating from the traverse area P. Thus, after the moving mechanism 82 moves the wax support portion 76 in order to attach and detach the wax body W, the wax body W can be replaced. At this time, because the traverse guiding portion 74 is provided to the casing 72 in a fixed manner, regardless of whether the wax support portion 76 is being moved by the moving mechanism 82, the traverse guiding portion 74 can guide the yarn 20 to be wound by the package forming unit 8 so that the yarn 20 is traversed. Although the traverse guiding portion 74 is provided to the casing 72 in a fixed manner, the traverse guiding portion 74 may be configured so that the position thereof can be slightly adjusted.

[0089] Thus, replacement of the wax body W can be prevented from affecting the yarn path (interfering with the connected state of the yarn 20). Consequently, the wax body W can be easily replaced while the yarn 20 from the package 30 is being connected. The wax body W can be replaced without loosening the traversed yarn 20. During replacement operation of the wax body W, the traversed yarn 20 can be made less likely to be accidentally caught in something. Furthermore, in the present embodiment, the wax body W is positioned in at least part of the traverse area P, which enables height reduction of the winder unit 2 , and consequently downsizing thereof. The accuracy of positioning the wax body W with respect to the traverse area P can be improved.

[0090] In general, the wax body W (wax applying device 70) is disposed on a straight yarn path instead of the traverse area P. By contrast, in the present embodiment, the wax body W is disposed on the traverse area P (is supported by the wax support portion 76 while being positioned in at least part of the traverse area P). This eliminates the need of leaving a space for the case of disposing the wax applying device 70 on a straight yarn path, and consequently, the dimensions of the device in the yarn path direction can be shortened.

[0091] In the wax applying device 70, the moving mechanism 82 moves the wax support portion 76 in such a manner that the wax support portion 76 and the wax body W supported by the wax support portion 76 do not pass through the traverse area P. Thus, the wax body W can be attached and detached, and consequently can be replaced in such a manner that the wax support portion 76 and the wax body W do not pass through the traverse area P.

[0092] The wax applying device 70 has the screw N and the screw hole 73 for attaching the casing 72 to the winder unit 2. Because the screw N and the screw hole 73 are provided to the casing 72 in a fixed manner, regardless of whether the wax support portion 76 is being moved by the moving mechanism 82, the casing 72 can be attached to the winder unit 2. Thus, replacement of the wax body W can be prevented from affecting attachment of the casing 72.

[0093] The wax applying device 70 includes the positioning portion 92 configured to position the wax body W with respect to the yarn 20. Because the positioning portion 92 is provided to the casing 72 in a fixed manner, regardless of whether the wax support portion 76 is being moved by the moving mechanism 82, the accuracy of positioning the wax body W by the positioning portion 92 can be maintained. This can prevent replacement of the wax body W from affecting the positioning of the wax body W.

[0094] In the wax applying device 70, the moving mechanism 82 rotationally moves the wax support portion 76 with respect to the casing 72 so that the wax support portion 76 rotates about the rotation shaft 83. This configuration enables the wax body W to be easily replaced. Even in a limited workspace, the operator can easily replace the wax body W. A mechanism having reduced backlash can be constructed with a small number of components. The operator can easily replace the wax body W with one hand. During replacement operation of the wax body W, a cable of the motor 79 can be prevented from being heavily dragged.

[0095] The wax applying device 70 includes the locking mechanism 86 configured to restrict the moving mechanism 82 so that the wax support portion 76 is not moved by a force equal to or smaller than the predetermined force. With this configuration, for example, even if the operator releases his/her hold when the operator has caused the moving mechanism 82 to move the wax support portion 76, the state of the wax support portion 76 (state during replacement operation) can be maintained. The wax body W can be easily replaced with one hand facilitating the replacement operation.

[0096] In the wax applying device 70, the wax body W is positioned in the side opposite to the front side of the traverse area P. With this configuration, the yarn path can be prevented from being hidden by the wax body W when viewed from the front side. Consequently, the wear-

ing surface of the wax body W can be visually checked from the front side, improving accessibility to the wax body W.

[0097] The wax applying device 70 includes the upstream regulating guide 94. The upstream regulating guide 94 is provided upstream of the wax body W in the traveling direction of the yarn 20 and on the back side of the traverse area P. The bending angle $\theta 1$ of the yarn 20 brought into the wax applying device 70 is set larger than the bending angle $\theta 2$ of the yarn 20 brought out from the wax applying device 70. By this setting, the yarn 20 brought into the wax applying device 70 can effectively touch the upstream regulating guide 94, and thus the tension of the yarn 20 can be stabilized. Consequently, wax can be caused to stably adhere to the yarn 20. Furthermore, for example, wax damage (what is called "ring-shaped cut") caused by, for example, positioning the wax body W on the traverse area P can be prevented.

[0098] The winder unit 2 includes the yarn storage device 18 in a position upstream of the wax applying device 70 in the traveling direction of the yarn 20. This configuration can prevent replacement of the wax body W from affecting the yarn path between the yarn storage device 18 and the package 30. Because a splicing device such as the splicing device 13 is not disposed on the yarn path between the yarn storage device 18 and the package 30, the above-described effect of facilitating replacement of the wax body W while the yarn from the package 30 is being connected is particularly effective.

Second Embodiment

[0099] The following describes a wax applying device according to a second embodiment. In the description of the present embodiment, duplicate description already provided in the first embodiment is omitted, and different points will be described.

[0100] As depicted in FIG. 10 and FIG. 11, this wax applying device 170 according to the second embodiment is different from the wax applying device 70 of the first embodiment in including a moving mechanism 182 instead of the moving mechanism 82 (see FIG. 3). In FIG. 10 and FIG. 11, for convenience of description, illustration of the positioning portion 92 is omitted.

[0101] The moving mechanism 182 slidingly moves the wax support portion 76 with respect to the casing 72 to open and close the wax support portion 76. In other words, the moving mechanism 182 is a slidingly opening-and-closing mechanism configured to cause the wax support portion 76 to move between the state of the wax applying device 170 during normal winding (see FIG. 10) and the state of the wax applying device 170 during replacement operation (see FIG. 11). The moving mechanism 182 causes the wax support portion 76 to move along an arc-shaped trajectory that is close in shape to a straight line extending in the X-direction so that the wax body W moves apart from and moves closer to the traverse area P. This arc shape is an arc shape that is convex toward the side opposite to the wax body W side. By causing the wax support portion 76 to move along the arc-shaped trajectory that is close in shape to a straight line, the wax body W can be reliably separated apart from the traverse area P when the wax support portion 76 is moved. The wax body W can be prevented from unstably coming into contact with the yarn 20.

[0102] The moving mechanism 182 includes a slide plate 184 configured to slidingly move in the X-direction and cam grooves 185 and 186 formed on the downstream plate 72b. To the slide plate 184, the mounting shaft 77, the motor 79, and the hold-down lever 78 are attached. The slide plate 184 is provided with an engaging pin 184a protruding downstream. The cam grooves 185 and 186 extend in an arc shape along the X-direction that is the traversing direction. In the cam groove 185, the engaging pin 184a of the slide plate 184 is disposed. In the cam groove 186, the swing restricting pin 78c of the hold-down lever 78 is disposed.

[0103] With the moving mechanism 182 thus configured, movement of the engaging pin 184a and the swing restricting pin 78c along the X-direction is guided by the cam grooves 185 and 186, respectively, and the engaging pin 184a and the swing restricting pin 78c are caused to move along the cam grooves 185 and 186, respectively. Thus, the slide plate 184 slidingly moves along the X-direction.

[0104] Herein, one end of the cam groove 186 communicates with a fore-and-aft groove 187 extending toward the back side. During normal winding depicted in FIG. 10, when the pressing portion 78b of the hold-down lever 78 is positioned farthest on the back side, the swing restricting pin 78c is positioned farthest on the front side in the cam groove 186 (fore-and-aft groove 187). In this state, the swing restricting pin 78c can move in the X-direction along the cam groove 186. Consequently, also the slide plate 184 can slidingly move along the X-direction. By contrast, during normal winding, when the pressing portion 78b of the hold-down lever 78 moves toward the front side, the swing restricting pin 78c accordingly moves toward the back side in the fore-and-aft groove 187. In this state, the swing restricting pin 78c cannot move in the X-direction. Consequently, also the slide plate 184 cannot slidingly move along the X-direction, and thus sliding movement of the moving mechanism 182 is locked.

[0105] During replacement operation depicted in FIG. 11, the swing restricting pin 78c is positioned in the other end of the cam groove 186. In this state, the swing restricting pin 78c cannot move toward the back side, which restricts swing of the hold-down lever 78, and pressing of the wax body W by the hold-down lever 78 is stopped. Consequently, the wax body W can be prevented from being unintendedly pushed and pulled out by the hold-down lever 78.

[0106] As described above, according to the present embodiment, in the wax applying device 170, replacement of the wax body W can be prevented from affecting

the yarn path. The moving mechanism 182 of the wax applying device 170 slidingly moves the wax support portion 76 with respect to the casing 72. This configuration enables the wax body W to be easily replaced.

Third Embodiment

[0107] The following describes a wax applying device according to a third embodiment. In the description of the present embodiment, duplicate description already provided in the first embodiment is omitted, and different points will be described.

[0108] As depicted in FIG. 12, this wax applying device 270 according to the third embodiment is different from the wax applying device 70 of the first embodiment in being a back-type device in which the traverse area P is positioned on the back side of the wax body W. The wax body W supported by the wax support portion 76 is positioned on the front side of the traverse area P.

[0109] The wax applying device 270 is different from the wax applying device 70 of the first embodiment in including a moving mechanism 282 instead of the moving mechanism 82 (see FIG. 3). The moving mechanism 282 includes a rotation plate 284 configured to be rotatable about a hinge 283. The rotation plate 284 is disposed in the wax applying device 270 on the front side. The moving mechanism 282 rotates the rotation plate 284 about the hinge 283, thereby rotationally moving the wax support portion 76 attached to the rotation plate 284 with respect to the casing 72. The moving mechanism 282 enables the wax applying device 270 to be of a front-opening type in which the wax support portion 76 is opened toward the front side.

[0110] As described above, according to the present embodiment, in the wax applying device 170, replacement of the wax body W can be prevented from affecting the yarn path.

[0111] Although embodiments of the present disclosure have been described in the foregoing, the present disclosure is not limited to the above-described embodiments.

[0112] FIG. 13 is a side view illustrating a wax applying device according to a modification. As depicted in FIG. 13, the upstream regulating guide 94 and the downstream regulating guide 96 according to this modification regulate the yarn path so that the yarn path on the downstream side (upper side in FIG. 13) is more separate from the wax body W than the yarn path on the upstream side (lower side in FIG. 13) is. In this illustrated example, the distal end of the downstream regulating guide 96 on the front side is positioned farther on the front side than the distal end of the upstream regulating guide 94 on the front side. In other words, the downstream regulating guide 96 protrudes toward the front side (the side separating from the wax body W) more than the upstream regulating guide 94 does. When viewed from the side, the straight line connecting the distal end of the downstream regulating guide 96 with the distal end of the upstream regulating guide 94 is set so as not to be orthogonal to (cross at an angle of 90°) the axis of the wax body W.

[0113] By this setting, the wax body W on the upstream side can effectively touch the yarn 20, and thus wax can be caused to stably adhere to the yarn 20. Furthermore, wax damage caused by positioning the wax body W on the traverse area P can be prevented.

[0114] FIG. 14A is a perspective view illustrating an upstream regulating guide according to a modification. FIG. 14B is a plan view illustrating the upstream regulating guide according to the modification. FIG. 14B illustrates a state when viewed from a direction along the yarn path of the yarn 20. As depicted in FIG. 14A and FIG. 14B, when viewed from the direction along the yarn path of the yarn 20, the upstream regulating guide 94 may be formed so that a portion on a one side (left side in FIG. 14B) of the yarn path, acting as a center, in the X-direction corresponding to the traversing direction protrudes further outward from the wax body W than a portion on an other side (right side in FIG. 14B) of the yarn path in the X-direction.

[0115] Specifically, in the upstream regulating guide 94, the portion on the other side from the yarn path (traversing center) has a front surface 94x extending planarly along the X-direction. In the upstream regulating guide 94, the portion on the one side in the X-direction from the yarn path protrudes to the front side with respect to the front surface 94x, and has a front surface 94y. The front surface 94y of the upstream regulating guide 94 is inclined in a curved shape so as to tilt toward the front side in a position farther to the one side in the X-direction from the position of the yarn path, and then extends planarly along the traversing direction in a position farther to the front side than the front surface 94x.

[0116] Herein, the rotational direction CW of the wax body W is clockwise when viewed from the front. In this case, the one side in X-direction protruding in the upstream regulating guide 94 corresponds to the left side when viewed from the front. When the rotational direction CW of the wax body W is counterclockwise when viewed from the front, the one side in the X-direction protruding in the upstream regulating guide 94 corresponds to the right side when viewed from the front.

[0117] With this configuration, the wax body W can be effectively touch the yarn 20, and thus wax can be caused to more stably adhere to the yarn 20. Furthermore, wax damage caused by positioning the wax body W on the traverse area P can be more reliably prevented.

[0118] In the above-described embodiments, a configuration may be used in which the yarn storage device 18 is omitted, the yarn 20 from the yarn supplying unit 6 is directly wound by the package forming unit 8, and when the yarn 20 is split, the yarn 20 is caught from the package forming unit 8 to be brought into the splicing device 13. In the above description, the expression "provided in a fixed manner" includes, in addition to the case of being providing so as to be completely (integrally) fixed, a case

of being provided in a position adjustable manner by a position adjusting mechanism, for example.

[0119] In the above-described embodiments, the configuration of the yarn supplying unit 6 is not limited to a tray conveying type, and a configuration may be used in which a new yarn supplying bobbin 21 is supplied from a magazine-type bobbin feeder. In this configuration, when the bobbin feeder supplies a new yarn supplying bobbin 21 to the yarn supplying unit 6, the bobbin feeder can pull out a yarn end from the yarn supplying bobbin 21 to deliver the yarn end to the upstream yarn blow delivering unit 11. In this case, the auxiliary blow delivering unit 28 can be omitted.

[0120] In the above-described embodiments, one example of the package forming unit 8 has been described inwhich the yarn 20 is traversed by the traverse drum 24, but the traversing method is not limited to this. As a method of traversing the yarn 20, an arm-type or belt-type traverse mechanism may be used. In the above-described embodiments, torsion coil springs are used, but various types of elastic members may be used. In the above-described embodiments, the package 30 may be wound in a cheese shape, or the package 30 may be wound in a cone shape. The materials and shapes of the respective components are not limited to those described above, and various types of materials and shapes may be used.

[0121] At least some of the above-described embodiments may be used in combination.

[0122] In the wax applying device, the attachment parts may be provided to the casing in a fixed manner. In this configuration, regardless of whether the wax support portion is being moved by the moving mechanism, the casing can be attached to the yarn winding device. Thus, replacement of the wax body can be prevented from affecting the attachment of the casing.

[0123] The wax applying device may be a wax applying device configured to apply wax to a traveling yarn and including: a casing including an attachment part for attaching the casing to the yarn winding device; a traverse guiding portion configured to guide the yarn to be wound by a winding unit of the yarn winding device so that the yarn is traversed forming a traverse area; a wax support portion configured to support the wax body; and a motor configured to rotate the wax body about an axis of the wax body. The traverse guiding portion is provided to the casing in a fixed manner, and the motor and the wax support portion are attached to the casing with a moving mechanism that is configured to be movable in a direction separating from the traverse area.

[0124] The wax applying device may be a device configured to apply wax to a traveling yarn and including: a casing including an attachment part for attaching the casing to a yarn winding device; a traverse guiding portion configured to guide the yarn to be wound by a winding unit of the yarn winding device so that the yarn is traversed forming a traverse area; and a wax support portion including a hold-down lever configured to press the wax body against the traverse area and configured to support the wax body. The traverse guiding portion is provided to the casing in a fixed manner, and the wax support portion is attached to the casing with a moving mechanism that is configured to be movable in a direction separating from the traverse area.

[0125] The wax applying device may be a wax applying device configured to apply wax to a traveling yarn and including: a casing including an attachment part for attaching the casing to a yarn winding device; a traverse guiding portion configured to guide the yarn to be wound by a winding unit of the yarn winding device so that the yarn is traversed forming a traverse area; and a wax support portion configured to support a wax body so that the wax body is positioned in at least part of the traverse area. The traverse guiding portion is provided to the casing in a fixed manner, and the wax support portion is attached to the casing with a moving mechanism that is configured to be movable in a direction separating from the traverse area in order to attach and detach the wax body.

[0126] The wax applying device may be a wax applying device configured to apply wax to a traveling yarn and including: a casing including an attachment part for attaching the casing to a yarn winding device; a traverse guiding portion configured to guide the yarn to be wound by a winding unit of the yarn winding device so that the yarn is traversed forming a traverse area; a wax support portion configured to support the wax body; and an upstream regulating guide provided upstream of the wax body in a traveling direction of the yarn and configured to regulate a yarn path of the yarn. The upstream regulating guide is provided to at a starting point of the traverse area, and when a plane extending along a contact location between the wax body and the traverse area is assumed to be a reference plane, a bending angle ($\theta 1$) at which the yarn brought into the wax applying device bends from the reference plane toward the starting point is larger than a bending angle ($\theta 2$) at which the yarn brought out from the wax applying device bends from the reference plane toward a package. With this wax applying device, the yarn brought into the wax applying device can efficiently touch the regulating guide, and thus the tension of this yarn can be stabilized. Consequently, wax can be caused to stably adhere to the yarn. Furthermore, wax damage can be prevented.

[0127] The wax applying device may be a wax applying device configured to apply wax to a traveling yarn and including: a casing including an attachment part for attaching the casing to a yarn winding device; a traverse guiding portion configured to guide the yarn to be wound by a winding unit of the yarn winding device so that the yarn is traversed forming a traverse area; a wax support portion configured to support the wax body; an upstream regulating guide provided upstream of the wax body in a traveling direction of the yarn and configured to regulate a yarn path of the yarn; and a downstream regulating guide provided downstream of the wax body in the

traveling direction of the yarn and is configured to regulate the yarn path of the yarn. The upstream regulating guide and the downstream regulating guide regulate the yarn path so that the yarn path on a downstream side is more separated from the wax body than the yarn path on an upstream side. With this wax applying device, the above-described effect of preventing wax damage can be obtained.

[0128] The wax applying device may be a wax applying device configured to apply wax to a traveling yarn and including: a casing including an attachment part for attaching the casing to a yarn winding device; a traverse guiding portion configured to guide the yarn to be wound by a winding unit of the yarn winding device so that the yarn is traversed forming a traverse area; a wax support portion configured to support the wax body; and an upstream regulating guide provided upstream of the wax body in a traveling direction of the yarn and configured to regulate a yarn path of the yarn. The upstream regulating guide, when viewed from a direction along the yarn path, is formed so that a portion on a one side of the yarn path, acting as a center, in a traversing direction protrudes further outward from the wax body than a portion on an other side of the yarn path in the traversing direction. With this wax applying device, the above-described effect of preventing wax damage can be obtained.

Claims

1. A wax applying device (70, 170, 270) configured to apply wax to a traveling yarn (20), the wax applying device comprising:

a casing (72) including an attachment part (73, N) for attaching the casing to a yarn winding device (2);
a traverse guiding portion (74) configured to guide the yarn to be wound by a winding unit (8) of the yarn winding device so that the yarn is traversed forming a traverse area (P); and
a wax support portion (76) configured to support a wax body (W) while the wax body is positioned in at least part of the traverse area, wherein
the traverse guiding portion is provided to the casing in a fixed manner, and
the wax support portion is attached to the casing with a moving mechanism (82, 182, 282) that is configured to be movable in a direction separating from the traverse area.

2. The wax applying device according to claim 1, wherein the moving mechanism moves the wax support portion in such a manner that the wax support portion and the wax body supported by the wax support portion do not pass through the traverse area.

3. The wax applying device according to claim 1 or 2, further comprising a positioning portion (92) configured to be in contact with the wax body supported by the wax support portion through the traverse area to position the wax body with respect to the yarn, wherein
the positioning portion is provided to the casing in a fixed manner.

4. The wax applying device according to any one of claims 1 to 3, wherein the moving mechanism includes a rotation shaft (83) and rotationally moves the wax support portion with respect to the casing so that the wax support portion rotates about the rotation shaft.

5. The wax applying device according to any one of claims 1 to 3, wherein the moving mechanism slidinglymoves the wax support portion with respect to the casing.

6. The wax applying device according to claim 5, wherein the moving mechanism moves the wax support portion along an arc-shaped trajectory.

7. The wax applying device according to any one of claims 1 to 6, further comprising a locking mechanism (86) configured to restrict the moving mechanism so that the wax support portion is not moved by a force equal to or smaller than a predetermined force.

8. The wax applying device according to any one of claims 1 to 7, wherein the moving mechanism moves the wax support portion so that the wax body is exposed outside the casing.

9. A yarn winding device comprising the wax applying device as claimed in any one of claims 1 to 8.

10. The yarn winding device according to claim 9, wherein the wax body is positioned opposite to a front side of the yarn winding device with respect to the traverse area.

11. The yarn winding device according to claim 9 or 10, wherein

the wax applying device further comprises

an upstream regulating guide (94) provided upstream of the wax body in a traveling direction of the yarn and configured to regulate a yarn path of the yarn.

12. The yarn winding device according to claim 11, wherein
the upstream regulating guide is provided at a starting point of the traverse area, and

when a plane extending along a contact location between the wax body and the traverse area is assumed to be a reference plane (S), a bending angle (θ1) at which the yarn brought into the wax applying device bends from the reference plane toward the starting point is larger than a bending angle (θ2) at which the yarn brought out from the wax applying device bends from the reference plane toward a package (30).

13. The yarn winding device according to claim 11 or 12, wherein

the wax applying device further comprises

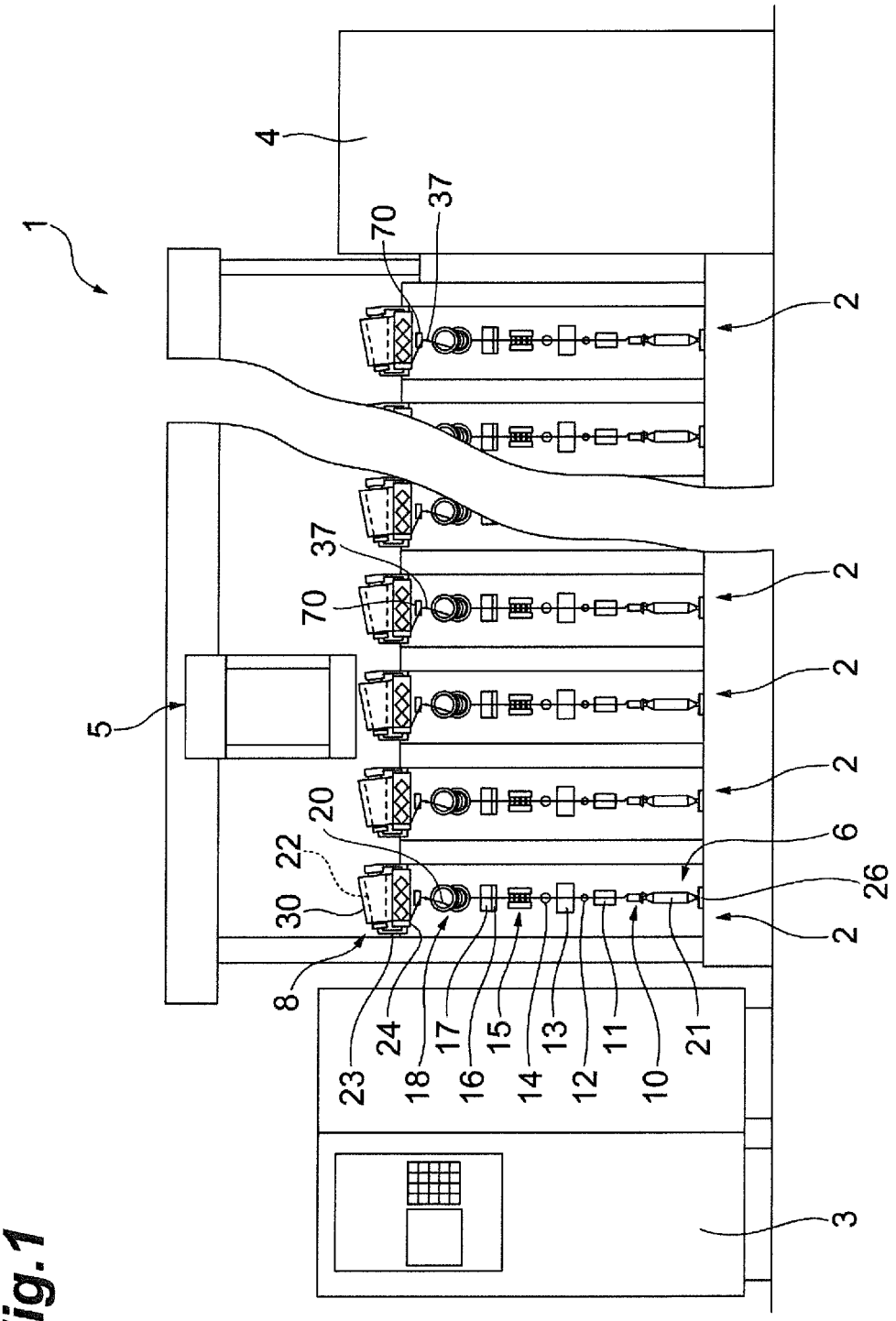
a downstream regulating guide provided downstream of the wax body in a traveling direction of the yarn and configured to regulate the yarn path of the yarn, and

the upstream regulating guide and the downstream regulating guide regulate the yarn path so that the yarn path on a downstream side is more separated from the wax body than the yarn path on an upstream side.

14. The yarn winding device according to any one of claims 11 to 13, the upstream regulating guide, when viewed from a direction along the yarn path, is formed so that a portion on a one side of the yarn path, acting as a center, in a traversing direction protrudes further outward from the wax body than a portion on an other side of the yarn path in the traversing direction.

15. The yarn winding device according to any one of claims 9 to 14, further comprising:

a yarn supplying unit (6) configured to support a yarn supplying bobbin (21); and
a yarn storage device (18) configured to unwind the yarn from the yarn supplying bobbin supported by the yarn supplying unit and to wind the yarn unwound, wherein
the yarn storage device is positioned in a position upstream of the wax applying device in the traveling direction of the yarn.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6
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14
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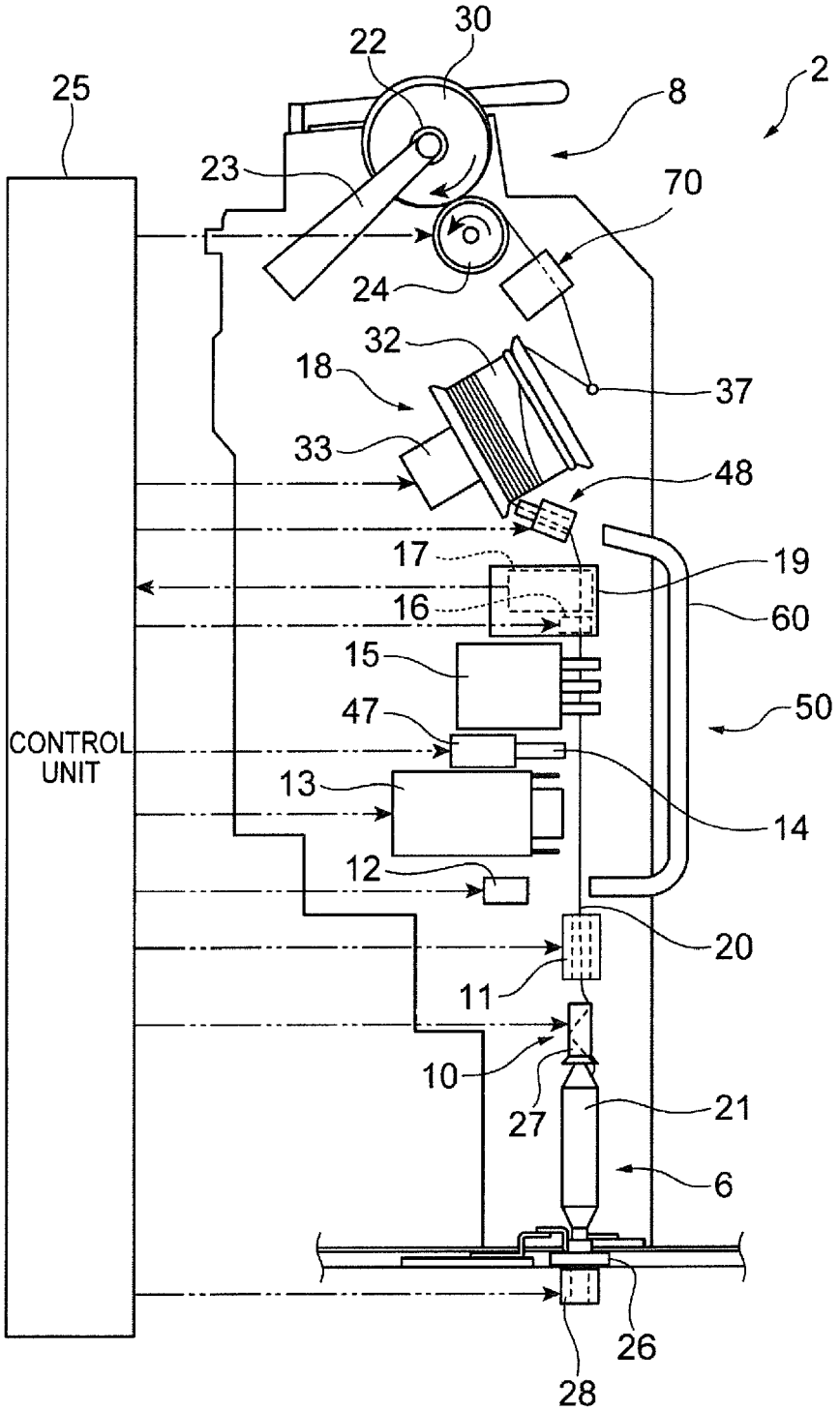
12
11
10
21
3

Fig.1

Fig.2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47
CONTROL UNIT
13
14
12
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11
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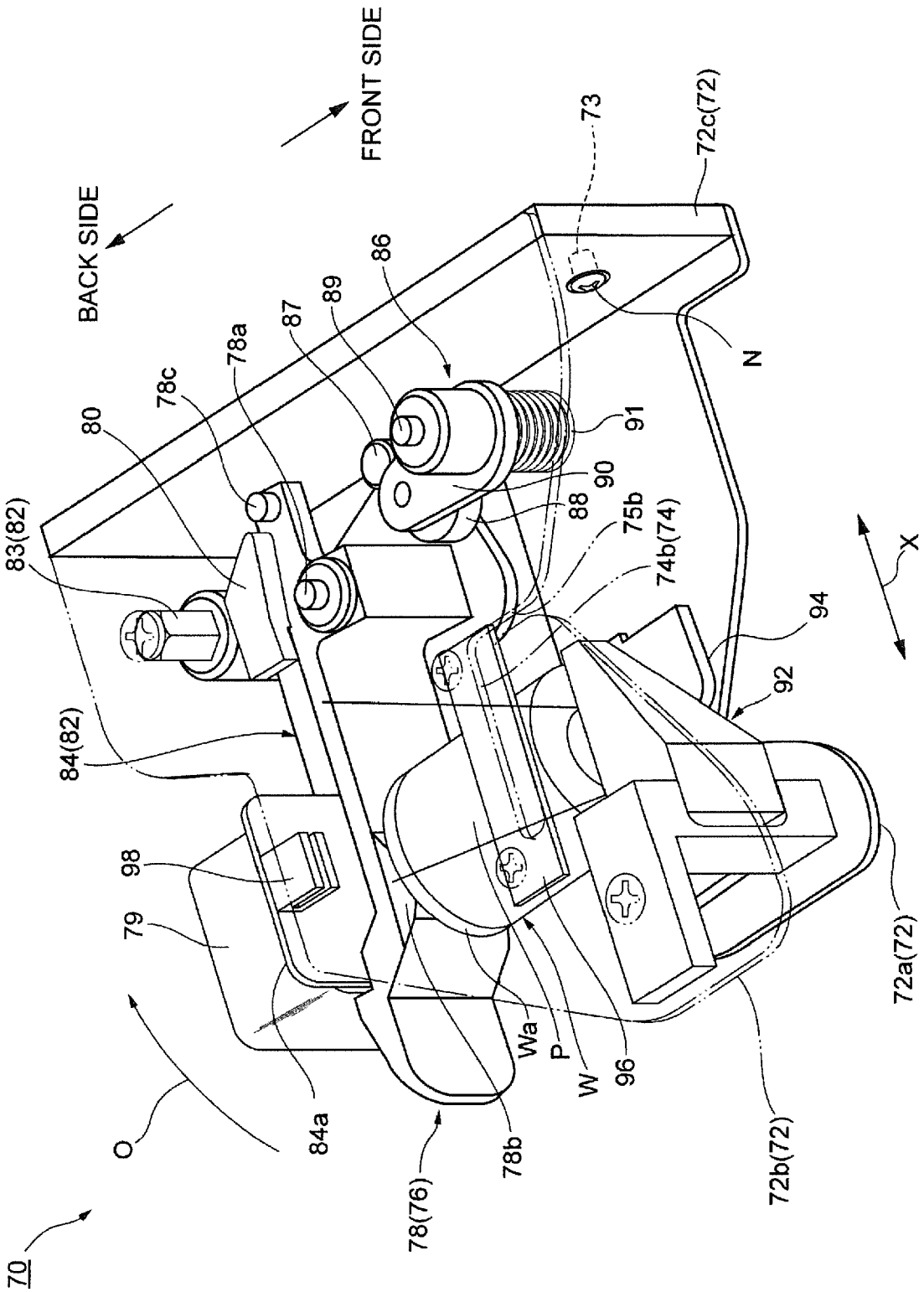
27
21
6
26
28

Fig.3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78b
72b(72)
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P
W
96
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98
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83(82)
80
78c
78a
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75b
74b(74)
94
92
X
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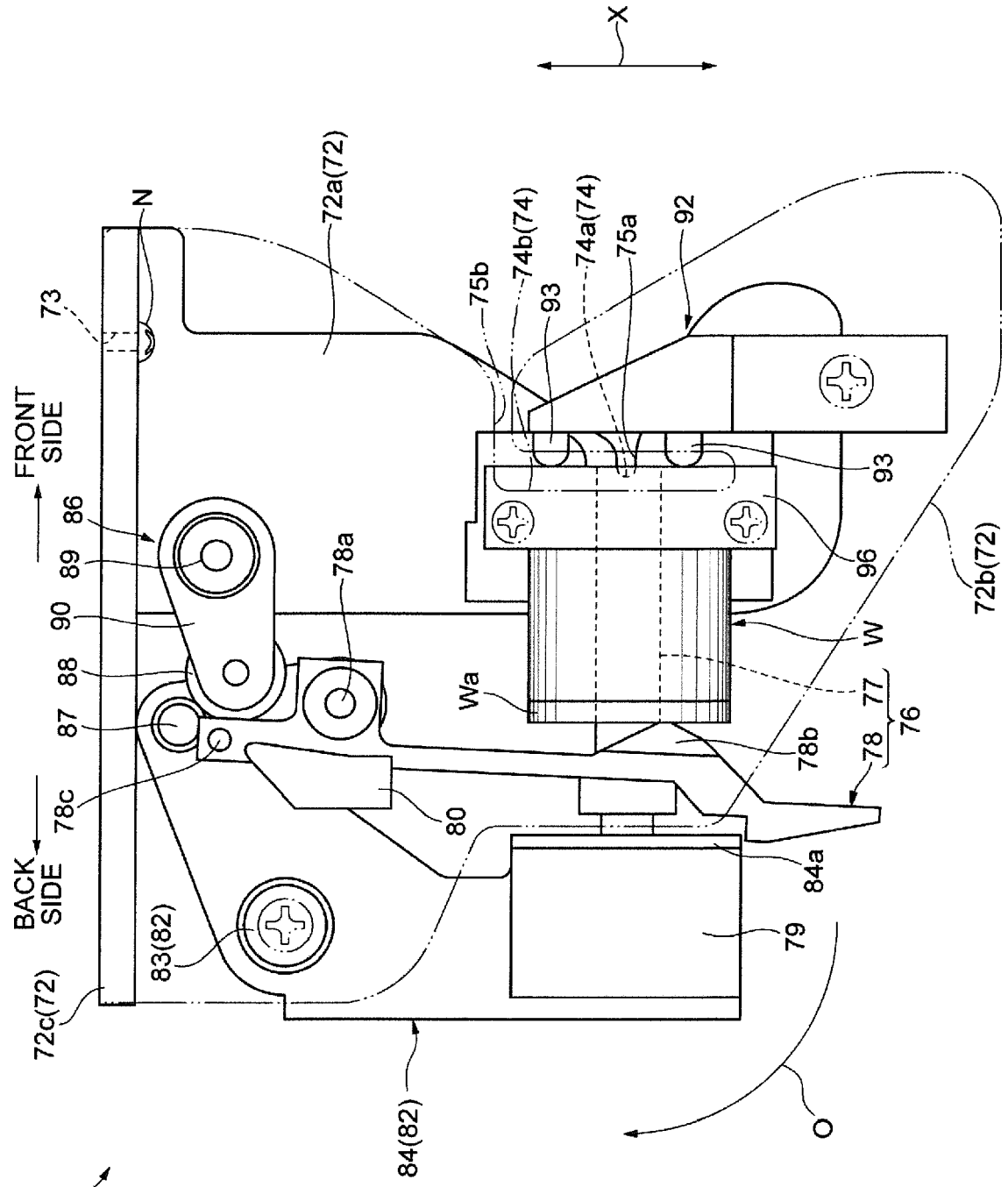
BACK SIDE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74a(74)
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90
88
87
78c
BACK SIDE
78a
96
72b(72)
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78b
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84a
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83(82)
72c(72)
84(82)
O
70

Fig.4

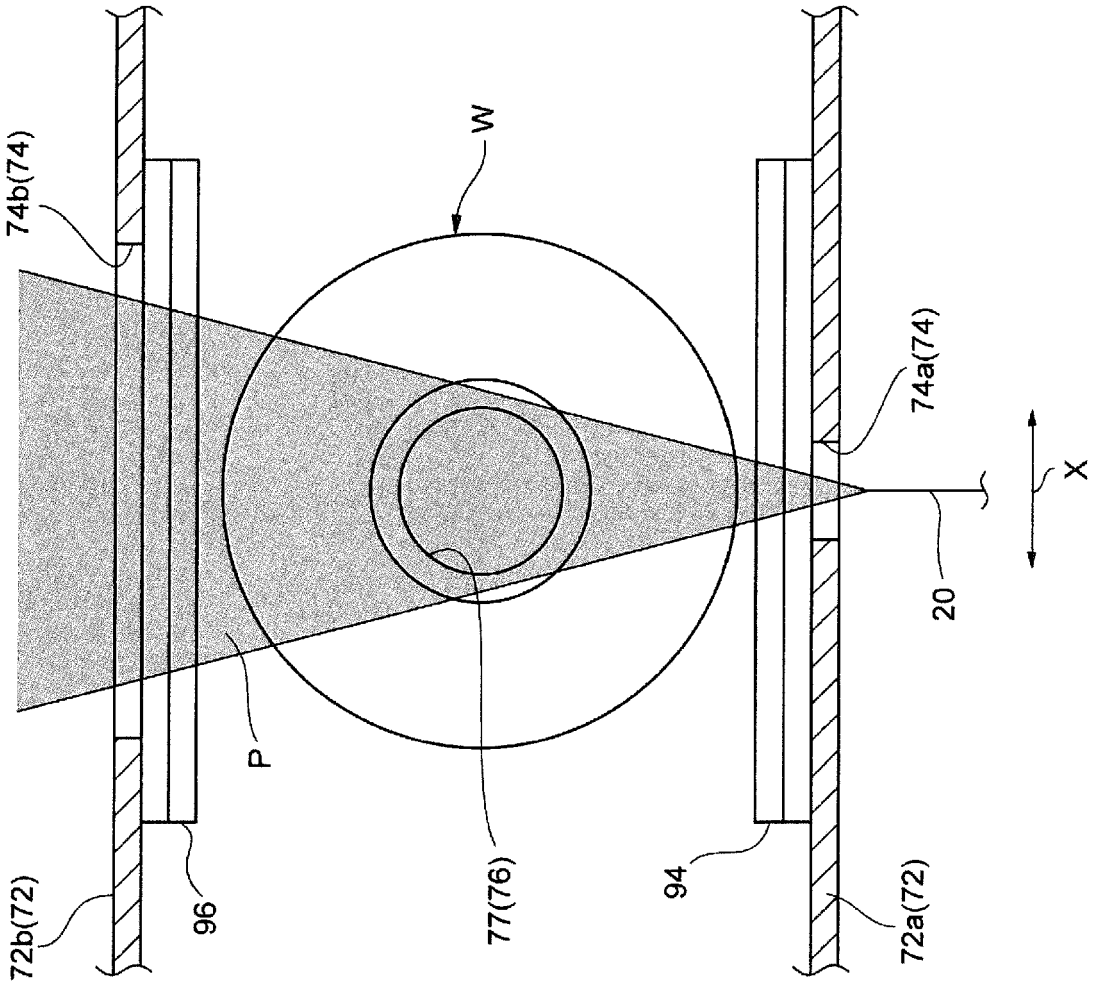
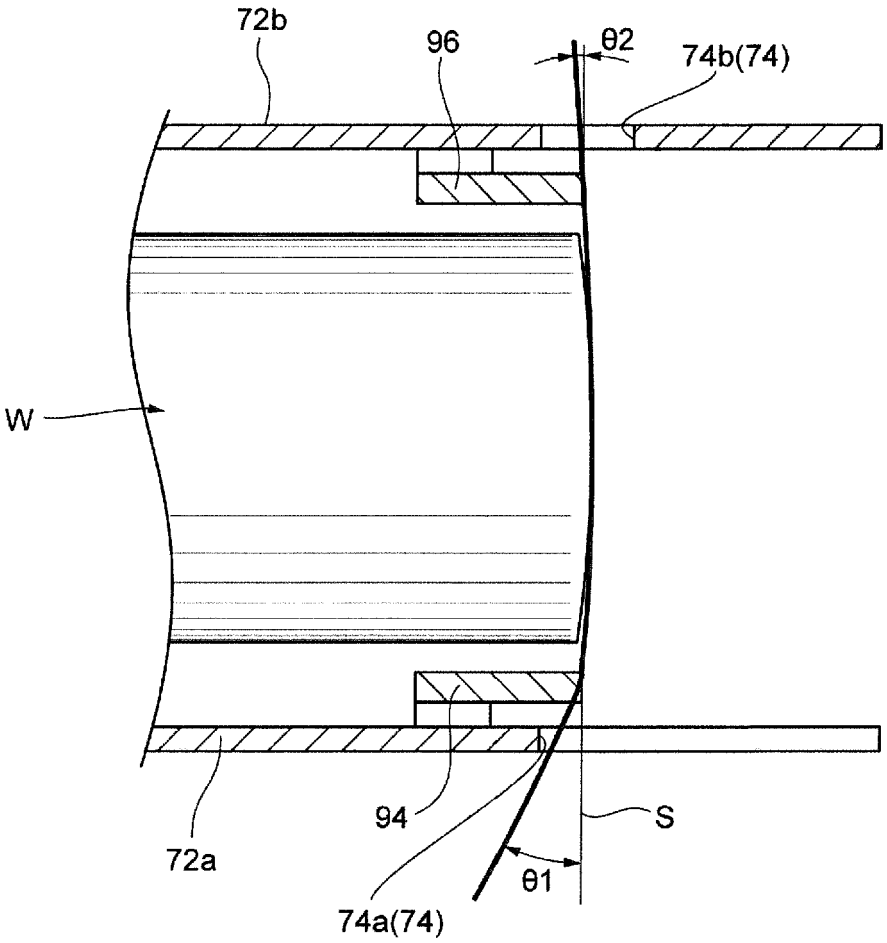


Fig.5

Fig.6



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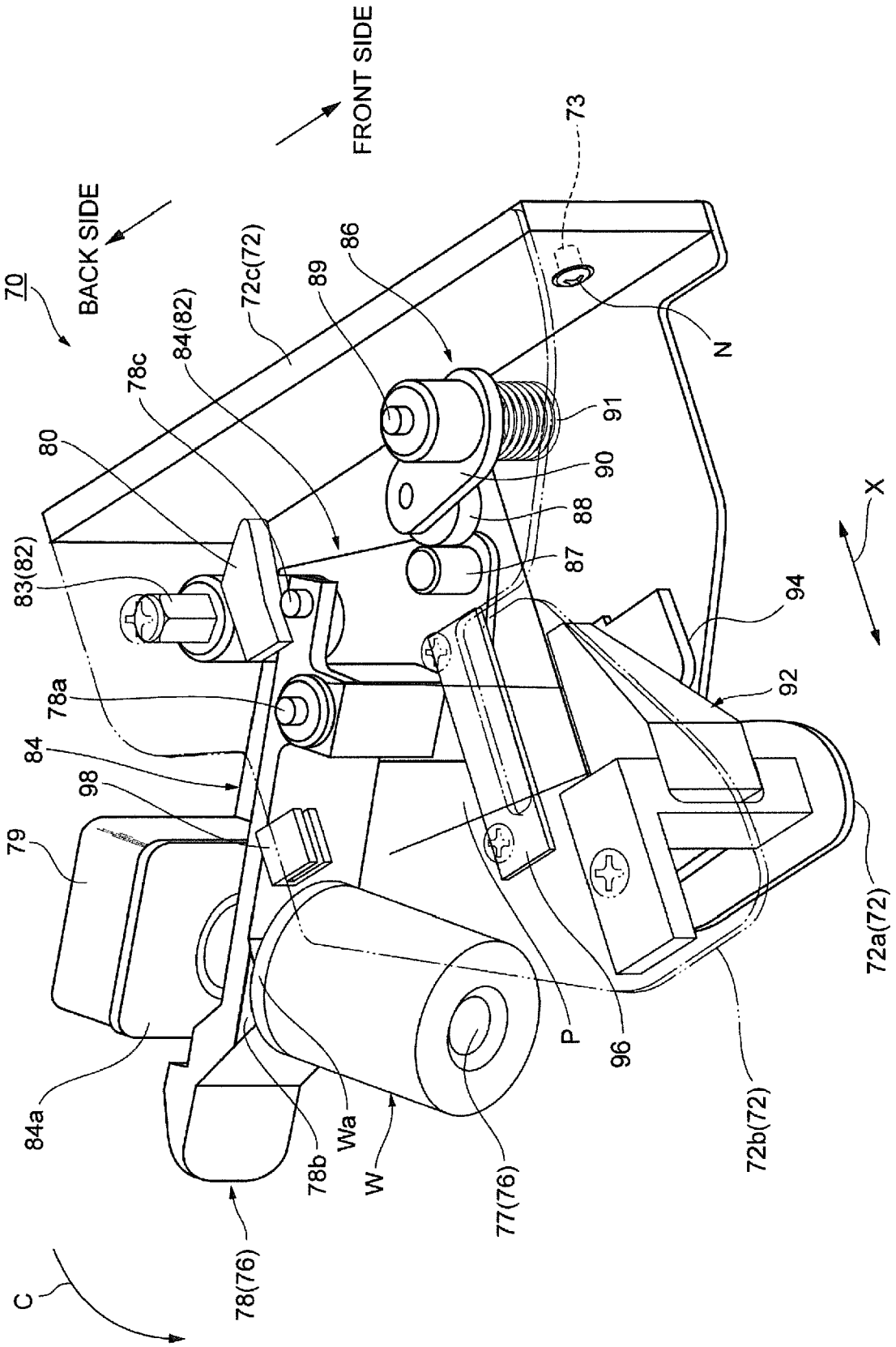
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C
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94
X
N
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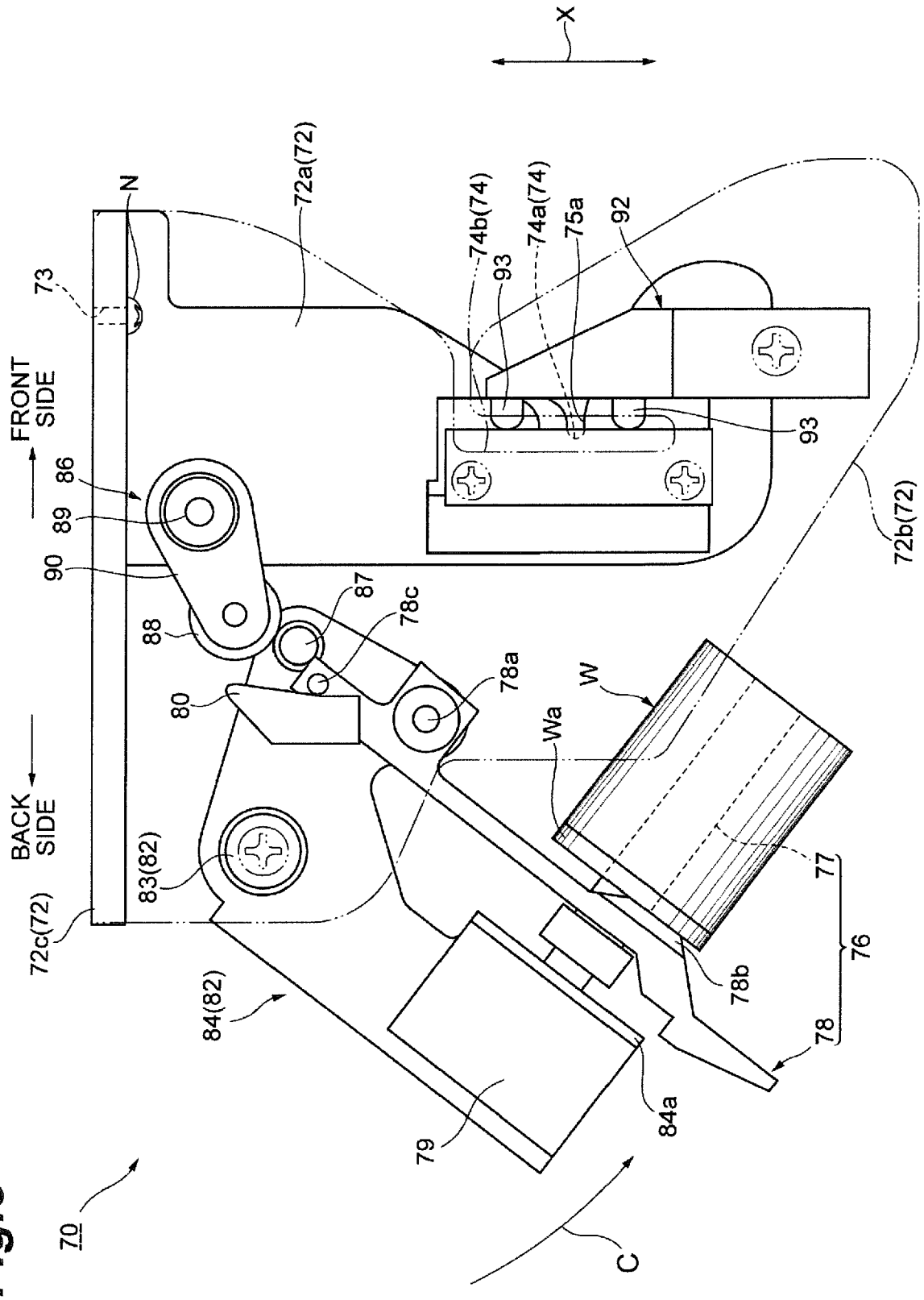
90
88
87

Fig.7

Fig.8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78b
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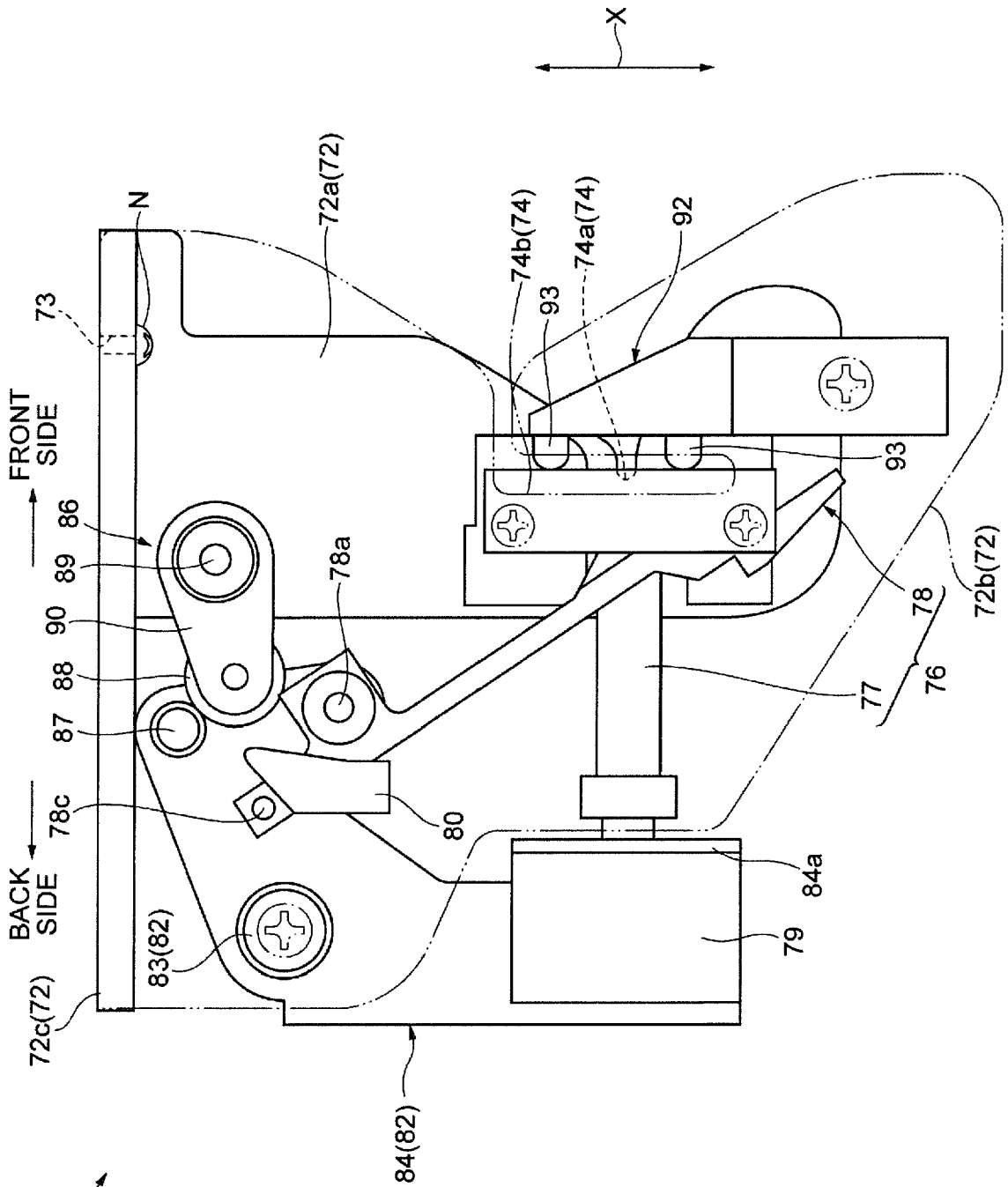
70
C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72b(72)
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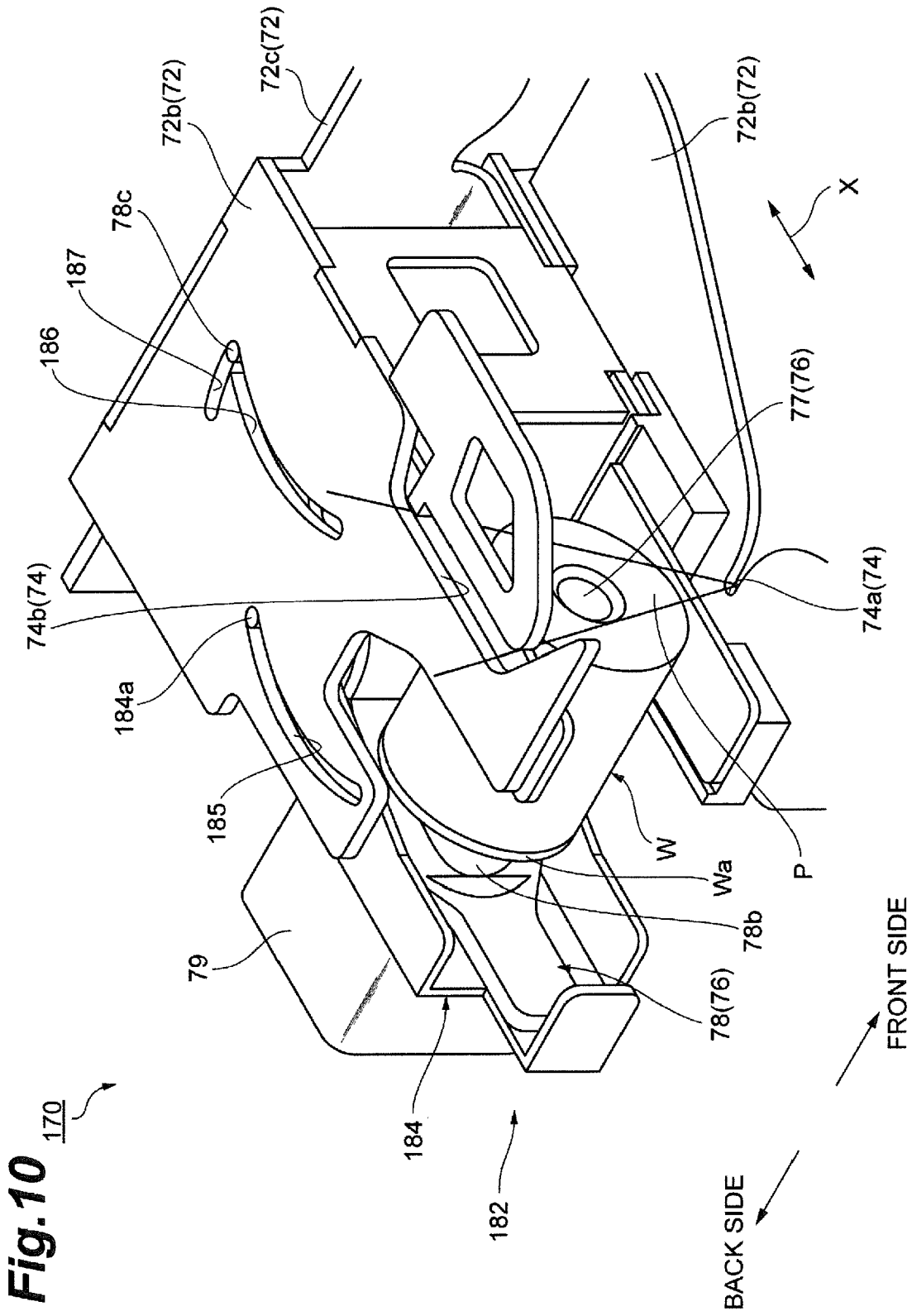
84a
79
70

Fig.9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184a
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79
184
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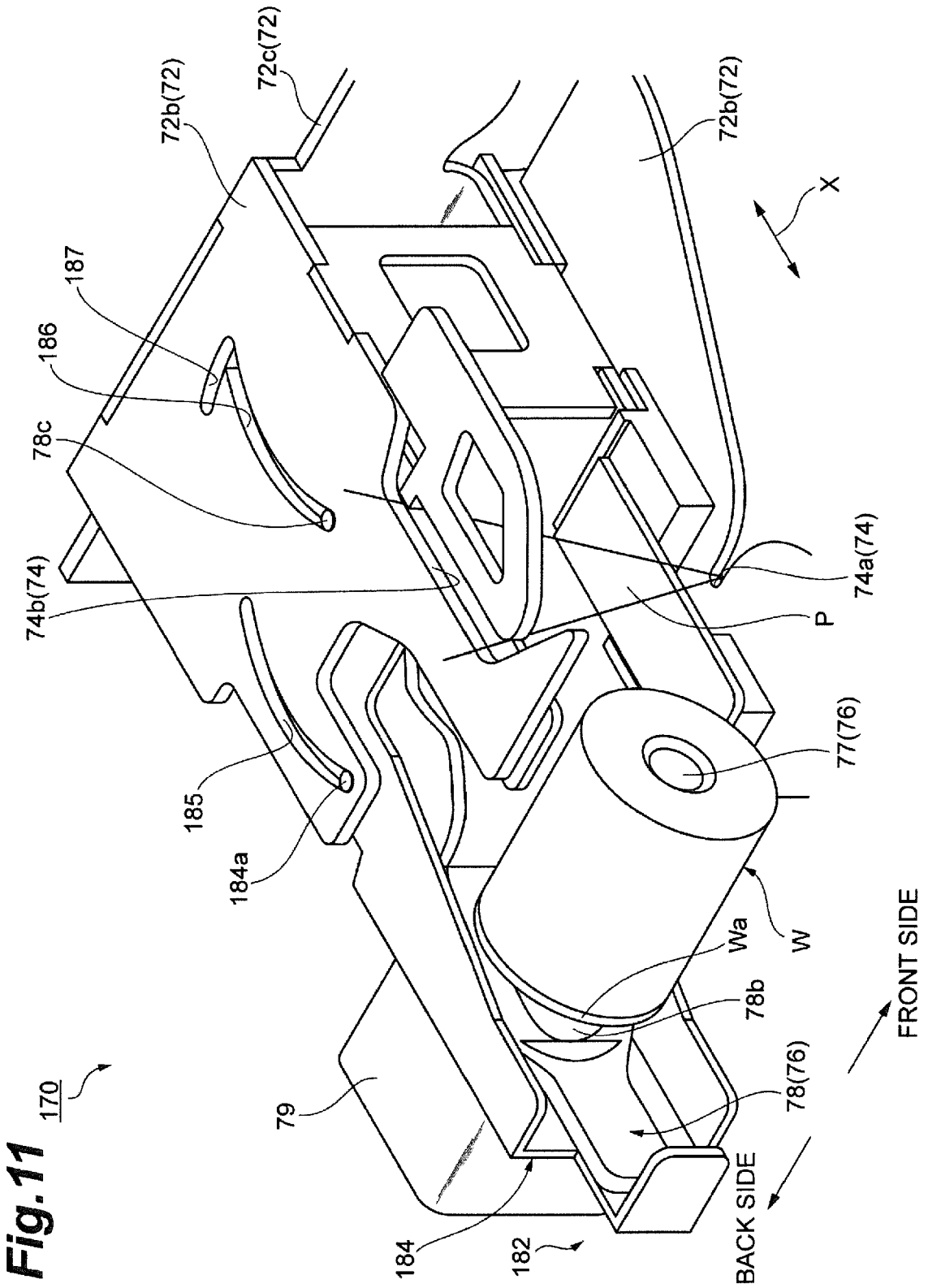
78b
Wa
W
P
74a(74)
77(76)
72b(72)
X
FRONT SIDE
BACK SIDE

Fig.10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P
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W
Wa
78b
78(76)
79
184
182
X
FRONT SIDE
BACK SIDE

Fig.11

Fig.12

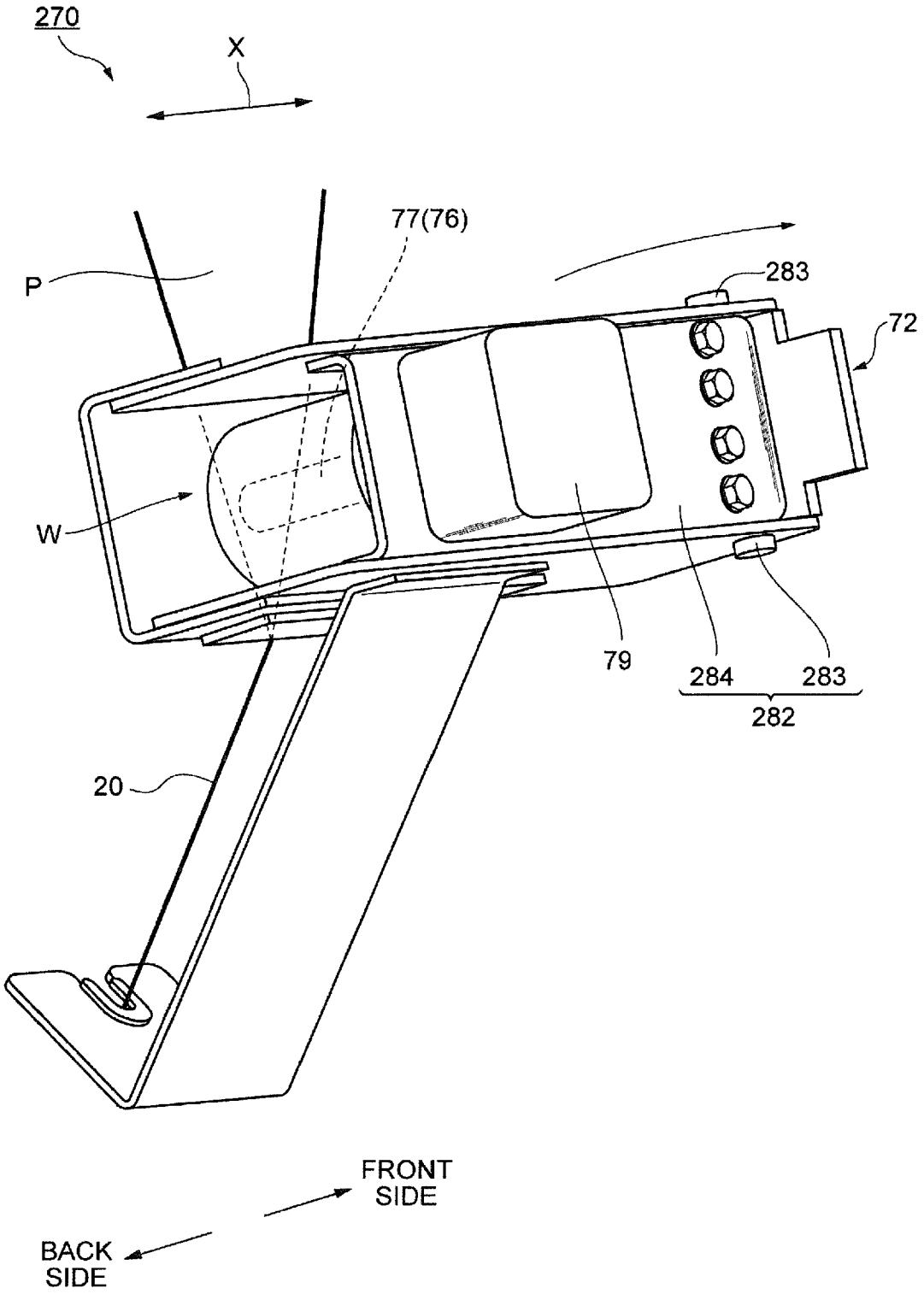


Fig.13

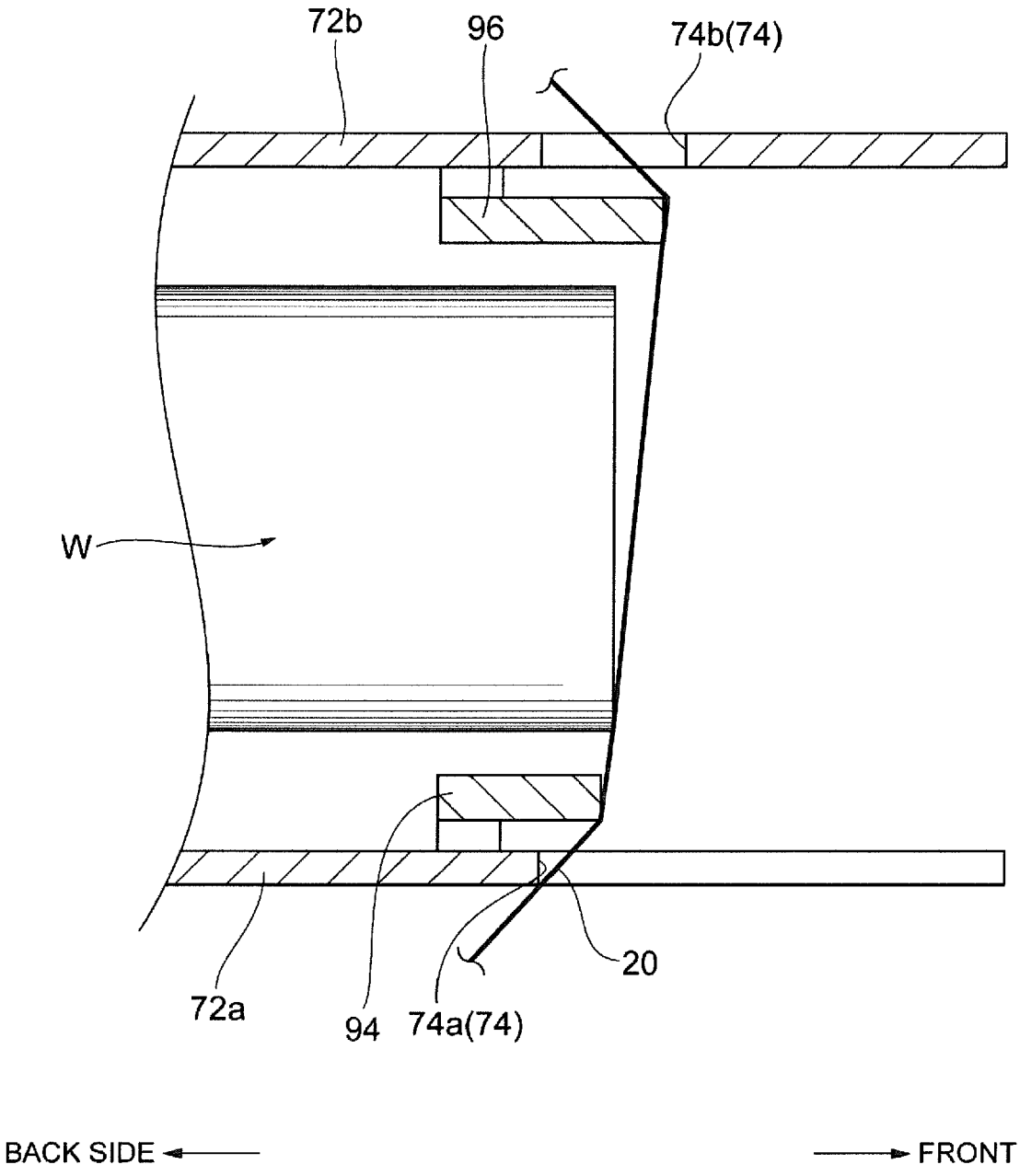


Fig.14B

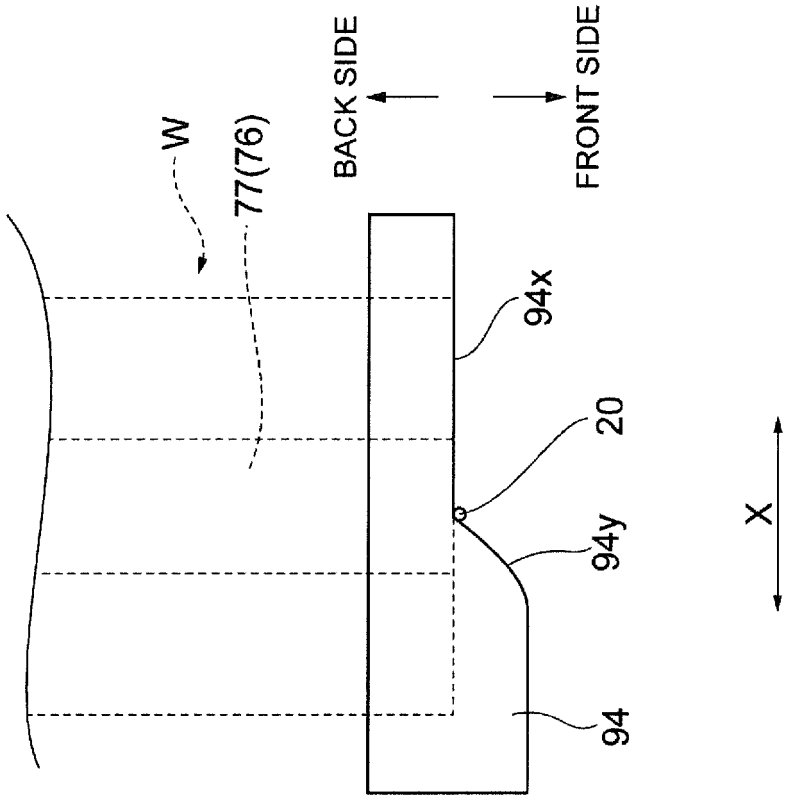
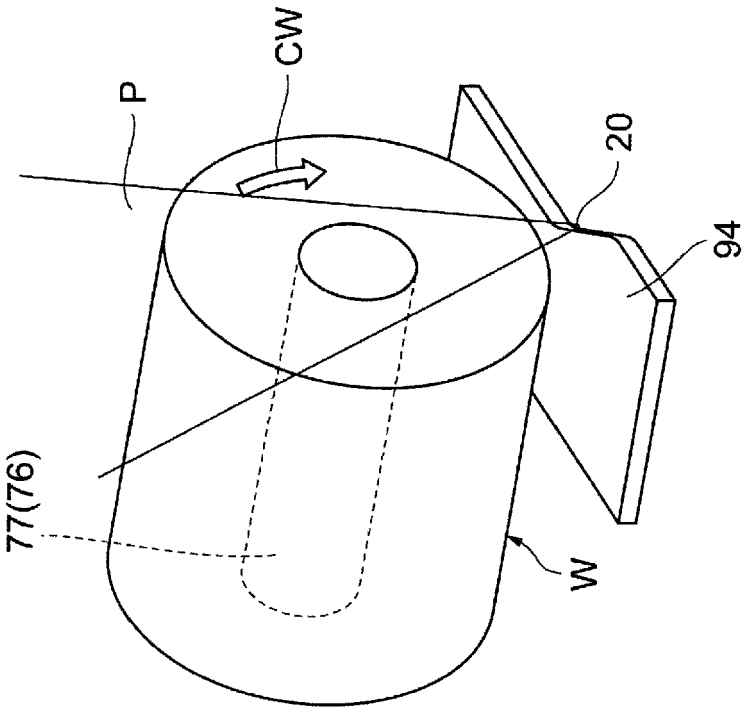


Fig.14A



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EUROPEAN SEARCH REPORT

Application Number
EP 16 18 8501

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	DE 10 2006 018838 A1 (SAURER GMBH & CO KG [DE]) 4 January 2007 (2007-01-04) * the whole document *	1-15	INV. B65H71/00
A	JP S58 31128 A (TOYODA AUTOMATIC LOOM WORKS) 23 February 1983 (1983-02-23) * the whole document *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

B65H
D01H
D02J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 February 2017	Guisan, Thierry

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06-02-2017

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