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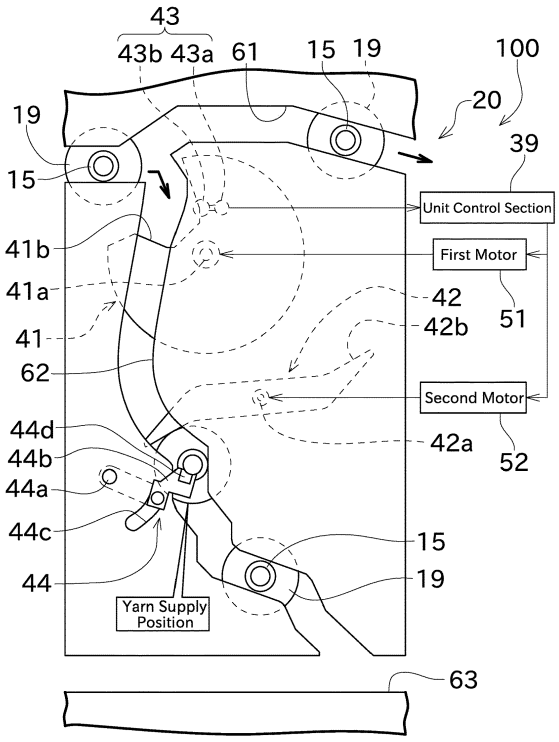
(54) AUTOMATIC WINDER

(57) An automatic winder includes plural winding units. The winding unit includes a yarn supply section 20 and a winding section. The yarn supply section 20 includes a first guide 41, a second guide 42, a first motor 51, and a second motor 52. The first guide 41 takes a tray 19 in. The second guide 42 receives the tray 19 taken in by the first guide 41, settles the tray 19 to a yarn supply position where a yarn is to be unwound, and after the unwinding of the yarn is completed, discharges the tray 19. The first motor 51 drives the first guide 41. The second motor 52, which is operable independently of the first motor 51, drives the second guide 42. The first guide 41 is a disk-shaped member having a single notch for guiding the tray 19.

FIG. 6



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention mainly relates to a winding unit that winds up a yarn from a yarn supply bobbin transported with a tray, to produce a package.

2. Description of the Related Art

[0002]

Patent Literature 1 is Japanese Patent Application Laid-Open No. 2013-197702.
Patent Literature 2 is European Patent Application Publication No. 4015429.

[0003] Patent Literature 1 discloses an automatic winder that transports a tray to a winding unit along a bobbin transport path. The automatic winder according to Patent Literature 1 includes a yarn supply section. The yarn supply section takes the tray into the winding unit, and holds the tray at a predetermined position. The yarn supply section includes a turntable and a transport guide. The turntable is driven by a stepping motor via a cam mechanism. As the turntable turns, the tray is transported toward the predetermined position. The transport guide is, like the turntable, driven by the stepping motor via the cam mechanism. Operations of the transport guide take the tray in, discharge the tray, and hold the tray at the predetermined position. The turntable and the transport guide are driven by the same stepping motor. Patent Literature 2 discloses a bobbin exchange device having an input disk 20 and an output disk 30, which are driven by a motor. The input disk 20 and the output disk 30 each have plural groove portions, and delivery of a bobbin takes place in these groove portions. The output disk 30 has a second sidewall portion where a second curved portion 33 is formed. The second curved portion of the second sidewall portion is configured to prevent entry of a plate 8 of a bobbin holder 7 coming from a first supply path 12.

SUMMARY OF THE INVENTION

[0004] In Patent Literature 1, take-in and discharge of the tray may be impossible in various situations, because the same stepping motor is used to drive the turntable and the transport guide. For example, since the transport guide is used for all of take-in of the tray, discharge of the tray, and holding of the tray, there is a possibility that take-in of the tray and discharge of the tray cannot be performed while the tray is being held, for example. In Patent Literature 2, for achieving delivery of the tray between the groove portions formed in the two disks, it is necessary to strictly control rotation positions and rotation timings of the disks. In addition, the disks having complicated shapes with plural groove portions are exposed, which raises a risk that a yarn end that fell off a yarn supply bobbin during unwinding due to vibrations in transportation may get caught in the disks.

[0005] The present invention has been made in view of the circumstances described above, and aims mainly to provide a winding unit capable of taking a tray in and discharging a tray in various situations.

[0006] The foregoing has described problems to be solved by the present invention. The following will describe solutions to the problems and advantageous effects thereof.

[0007] An aspect of the present invention provides an automatic winder configured as follows. That is, an automatic winder includes plural winding units. The winding unit includes a yarn supply section and a winding section. The yarn supply section performs take-in and discharge of a tray, on which a yarn supply bobbin is supported with an upright posture while being transported. The winding section unwinds a yarn from the yarn supply bobbin set on the tray taken in by the yarn supply section, and winds up the yarn to form a package. The yarn supply section includes a first guide, a second guide, a first drive source, and a second drive source. The first guide takes the tray in. The second guide receives the tray taken in by the first guide, settles the tray to a yarn supply position where the yarn is to be unwound, and after the unwinding of the yarn is completed, discharges the tray. The first drive source drives the first guide. The second drive source, which is operable independently of the first drive source, drives the second guide. The first guide is a disk-shaped member having a single notch for guiding the tray.

[0008] With this configuration, the first guide for performing take-in of the tray and the second guide for performing position settlement and discharge of the tray can be driven independently of each other. Consequently, take-in and discharge of the tray can be performed in various situations. In addition, the shape of the first guide having the single notch can eliminate the possibility that the tray may be transported by an unnecessary notch or that the tray may be jammed by an unnecessary notch. Furthermore, the first guide, due to its disk-like shape, has its trajectory of movement substantially constant even when the rotational phase changes. This can reduce the possibility of the first guide being unexpectedly contacted by the tray. Accordingly, take-in and discharge of the tray can be performed in various situations.

[0009] The automatic winder is preferably configured as follows. The automatic winder includes a supply path, a discharge path, and a unit path. The supply path transports the tray, and supplies the tray to the winding unit. The discharge path transports the tray discharged from the winding unit. The unit path connects the supply path to the yarn supply position. The first guide is driven to turn to and fro within a predetermined angle range by the first drive source. The first guide, by turning in a first direction, connects the supply path to the unit path, and

then by turning in a second direction, pushes the tray so as to bring the tray closer to the yarn supply position.

[0010] With this configuration, as the first guide is driven to turn to and fro, take-in of the tray from the supply path and transport of the tray along the unit path can be performed. It is likely that the yarn of the yarn supply bobbin is entangled in the first guide if the first guide keeps rotating in the same direction. Such entanglement of the yarn can be suppressed by the first guide turning to and fro.

[0011] The automatic winder is preferably configured as follows. The first guide transports the tray toward the discharge path side with the tray sandwiched between the first guide and a wall surface of the unit path. While the tray is sandwiched between the wall surface of the unit path and the first guide, a portion of the unit path toward the supply path side is closed by the first guide, and in this closed portion, an angle formed between a contour of the unit path and a contour of the first guide is an acute angle.

[0012] Since the tray is pushed in a state where the angle formed between the contour of the unit path and the contour of the first guide is an acute angle, a force that pushes the tray is easily converted to a force for transporting the tray to the discharge path side. Accordingly, transport of the tray by the first guide can be performed appropriately.

[0013] The automatic winder is preferably configured as follows. The automatic winder includes a tray sensor, a unit control section, a machine control apparatus, and an adjusting mechanism. The tray sensor, which is provided for each of the winding units, detects the tray. The unit control section controls the winding unit. The machine control apparatus is connected to the plural winding units. The adjusting mechanism adjusts the number of the yarn supply bobbins to be supplied to the winding unit. The adjusting mechanism includes the tray sensor, the unit control section, the machine control apparatus, and the first drive source.

[0014] Use of a result of detection by the tray sensor, which is provided for each winding unit, makes it possible to identify the number of trays supplied to each winding unit. Accordingly, controlling the first drive source, etc. so as to supply an appropriate number of trays is possible.

[0015] The automatic winder is preferably configured as follows. The automatic winder includes a tray sensor, a unit control section, a machine control apparatus, and an adjusting mechanism. The tray sensor, which is disposed in the supply path, detects the tray. The unit control section controls the winding unit. The machine control apparatus is connected to the plural winding units. The adjusting mechanism adjusts the number of the yarn supply bobbins to be supplied to the winding unit. The adjusting mechanism includes the tray sensor, the unit control section, the machine control apparatus, and the first drive source.

[0016] Use of information such as a result of detection by the tray sensor, which is disposed in the supply path, makes it possible to control the first drive source, etc. so as to supply an appropriate number of trays to the winding unit.

[0017] In the automatic winder, it is preferable that the first guide, by turning in the first direction, discharges the tray existing in the unit path toward the supply path.

[0018] Accordingly, not only take-in of the tray but also discharge of the tray can be performed by using the first guide.

[0019] The automatic winder is preferably configured as follows. The second guide is driven in rotation by the second drive source. A direction in which the second guide is rotated when settling the tray to the yarn supply position is the same as a direction in which the second guide is rotated when discharging the tray.

[0020] Accordingly, position settlement of the tray and discharge of the tray can be performed just by rotating the second guide in one direction.

[0021] In the automatic winder, it is preferable that the first guide and the second guide are attached at different levels, so that a trajectory of movement of the first guide overlaps a trajectory of movement of the second guide when viewed in an axial direction of the yarn supply bobbin, and in this overlapping portion, delivery of the tray from the first guide to the second guide takes place.

[0022] This configuration can make delivery of the tray easy.

[0023] The automatic winder is preferably configured as follows. The first guide and the second guide are attached at different levels, so that a trajectory of movement of the first guide overlaps a trajectory of movement of the second guide when viewed in an axial direction of the yarn supply bobbin. The first guide comes into contact with a first portion of the tray, to take the tray in. The second guide comes into contact with a second portion of the tray, to settle the position of the tray, the second portion being different in height from the first portion.

[0024] Since the first guide and the second guide come into contact with different portions of the tray, the first guide and the second guide are less likely to interfere when the first guide and the second guide transport the trays. This can offer a degree of freedom in controlling the position and timing of the first guide and the second guide.

[0025] In the automatic winder, it is preferable that the tray sensor is, in the supply path, disposed at a rate of one for a plurality of winding units.

[0026] This configuration can reduce the number of tray sensors, and thus can lower the costs, as compared to a configuration having the tray sensor provided for each winding unit.

[0027] In the automatic winder, it is preferable that the first guide and the second guide are applicable to both a configuration in which a path extending through the supply path, the unit path, and the discharge path is clockwise in a plan view, and a configuration in which a path extending through the supply path, the unit path, and the

discharge path is counterclockwise in a plan view.

[0028] Accordingly, two kinds of automatic winders that are different from each other in terms of the direction in which trays are transported can adopt identical first guides and identical second guides. The component costs can be lowered, therefore. Use of the identical first guides and the identical second guides results in substantially equal times required to replace the respective yarn supply bobbins. This makes calculation of the working efficiency easy.

[0029] The automatic winder is preferably configured as follows. The winding unit includes an unwinding assist device for assisting unwinding of a yarn from the yarn supply bobbin. The yarn supply position is a position where the tray locates when the unwinding assist device unwinds a yarn from the yarn supply bobbin.

[0030] Accordingly, settling the tray to the yarn supply position allows the unwinding assist device to work appropriately, to assist unwinding of the yarn.

[0031] In the automatic winder, it is preferable that take-in of the tray by the first guide and settlement of the tray to the yarn supply position by the second guide can be performed concurrently.

[0032] This can improve the operating efficiency as compared to when take-in and discharge of the tray are performed sequentially.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033]

FIG. 1 is a front view showing an overall configuration of an automatic winder including winding units according to an embodiment of the present invention.

FIG. 2 is a cross-sectional side view of a tray and a yarn supply bobbin placed on the tray.

FIG. 3 is a side view of the winding unit.

FIG. 4 is a perspective view of an unwinding assist device and its vicinity.

FIG. 5 is a side view illustrating a movable member being descended so as to follow descending of a chase portion.

FIG. 6 is a plan view of a yarn supply section.

FIG. 7 illustrates that rotation of a first guide brings a supply path and a unit path into connection.

FIG. 8 illustrates that rotation of the first guide causes a tray to be taken into the unit path.

FIG. 9 illustrates that rotation of a second guide causes a tray disposed at a yarn supply position to be discharged.

FIG. 10 illustrates that rotation of the second guide causes a next tray to be fixed at the yarn supply position.

FIG. 11 illustrates that rotation of the first guide causes a tray disposed in the unit path to be discharged to the supply path.

FIG. 12 shows a layout of tray sensors according to first variation.

FIG. 13 is a perspective view of a second guide according to second variation.

FIG. 14 is a perspective view of a second guide according to third variation.

FIG. 15 is a plan view of a yarn supply section according to fourth variation.

FIG. 16 is a schematic plan view showing tray transport directions in automatic winders arranged adjacent to each other.

FIG. 17 is a plan view of a yarn supply section according to fifth variation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0034] The following will describe, with reference to the drawings, an automatic winder according to an embodiment of the present invention. FIG. 1 is a front view showing a schematic configuration of an automatic winder 10 according to the embodiment.

[0035] Referring to FIG. 1, the automatic winder 10 includes, as main components, plural winding units 11 arranged side by side, a machine control apparatus 12, a yarn supply bobbin feeder 13, and a doffing device 14.

[0036] The machine control apparatus 12 is configured to be capable of communication with each winding unit 11. An operator of the automatic winder 10 is, by manipulating the machine control apparatus 12 as appropriate, able to collectively manage the plural winding units 11.

[0037] Each winding unit 11 unwinds a yarn 16 from a yarn supply bobbin 15, and winds the unwound yarn 16 onto a winding bobbin while traversing it, to form a package 18.

[0038] Arranged between the yarn supply bobbin feeder 13 and the winding unit 11 is a transport mechanism (not shown) constituted by a belt conveyor or the like. The transport mechanism includes a path for transporting a tray 19 (FIG. 2) on which a yarn supply bobbin 15 is set to the winding unit 11 and also for returning a tray 19 discharged from the winding unit 11.

[0039] As shown in FIG. 2, the tray 19 includes a peg portion 19a, a bobbin set portion (first portion) 19b, and a base portion (second portion) 19c. The peg portion 19a is a member having a substantially cylindrical shape or a substantially conical shape, and protrudes in a substantially perpendicular direction, as shown in FIG. 2. The peg portion 19a can be inserted to the inside of a core tube 15a of the yarn supply bobbin 15. The bobbin set portion 19b is a member having a substantially columnar shape, whose axis is coincident with the axis of the peg portion 19a. The bobbin set portion 19b has an outer diameter larger than the outer diameter of the core tube 15a of the yarn supply bobbin 15. Accordingly, as shown in FIG. 2, if the peg portion 19a is inserted in the core tube 15a of the yarn supply bobbin 15, the yarn supply bobbin 15 can be supported with a substantially upright posture on the tray 19. The base portion 19c is a member having a substantially columnar shape, whose axis is co-

incident with the axis of the bobbin set portion 19b. The base portion 19c has an outer diameter larger than the outer diameter of the bobbin set portion 19b. The bobbin set portion 19b and the base portion 19c are at different positions with respect to the height direction (axial direction).

[0040] The yarn supply bobbin feeder 13 supplies to the automatic winder 10 the yarn supply bobbin 15 wound with the yarn 16 spun by a spinning machine (not shown). More specifically, the yarn supply bobbin feeder 13 sets the yarn supply bobbin 15 on the tray 19 one by one. Instead of providing the yarn supply bobbin feeder 13, the spinning machine may be linked to the automatic winder. In such a case, a transport mechanism constituted by a belt conveyor or the like is arranged between the spinning machine and the winding unit 11 of the automatic winder. The transport mechanism includes a path for transporting a tray 19 (FIG. 2) on which a yarn supply bobbin 15 is set to the winding unit 11, and also for returning a tray 19 discharged from the winding unit 11 to the spinning machine.

[0041] When a package 18 becomes fully wound (which means a state where a specified amount of yarn is wound) in each winding unit 11, the doffing device 14 travels to the position of this winding unit 11. Then, the doffing device 14 removes the fully wound package 18 from the winding unit 11, and sets an empty winding bobbin on the winding unit 11.

[0042] The winding unit 11 will now be described with reference to FIG. 3. The winding unit 11 includes a yarn supply section 20 and a winding section 21.

[0043] The yarn supply section 20 is configured to hold the yarn supply bobbin 15 placed on the tray 19 at a predetermined position. This enables the yarn 16 to be appropriately unwound from the yarn supply bobbin 15. A detailed configuration of the yarn supply section 20 will be given later.

[0044] The winding section 21 includes a cradle 23 and a winding drum 17.

[0045] The cradle 23 has a pair of bearing centers, and the winding bobbin 22 is sandwiched by the bearing centers so that the winding bobbin 22 is rotatably supported. The cradle 23 is capable of bringing the outer circumference of the package 18 that the cradle 23 is supporting into contact with the outer circumference of the winding drum 17.

[0046] The winding drum 17 rotates the package 18 while traversing the yarn 16 on the surface of the package 18. The winding drum 17 is driven in rotation by a non-illustrated drive source (such as an electric motor). Driving the winding drum 17 in rotation while the outer circumference of the package 18 is in contact with the winding drum 17 allows the package 18 to be driven in rotation accordingly. The winding drum 17 has, on its outer circumferential surface, a helical traversing groove (not shown). The yarn 16 unwound from the yarn supply bobbin 15 is wound up onto the surface of the package 18, while being traversed with a fixed width by the traversing groove. This is how the package 18 having a fixed winding width can be formed.

[0047] In the winding unit 11, an unwinding assist device 24, a tension applying device 25, a yarn splicing device 26, and a yarn quality measuring instrument 27, which are arranged in this order from the yarn supply section 20 side, are disposed along a yarn passage extending from the yarn supply section 20 to the winding section 21. The winding unit 11 also includes a unit control section 39 for controlling respective components of the winding unit 11. The unit control section 39 is capable of communication with the machine control apparatus 12. In the following description, the upstream side and the downstream side in the direction in which the yarn 16 travels may sometimes be referred to just as "upstream side" and "downstream side," respectively.

[0048] The unwinding assist device 24 includes a regulation member 28 capable of hanging over the core tube of the yarn supply bobbin 15. The regulation member 28, which is a substantially tubular member, is disposed so as to be in contact with a balloon formed above a yarn layer of the yarn supply bobbin 15. Here, the balloon refers to where the yarn 16 unwound from the yarn supply bobbin 15 is swung around by the centrifugal force. When the regulation member 28 comes into contact with the balloon, a tension is applied to a portion of the yarn 16 existing in the balloon, so that excessive swinging of the yarn 16 is prevented or reduced. Accordingly, the yarn 16 can be appropriately unwound from the yarn supply bobbin 15.

[0049] The tension applying device 25 applies a predetermined tension to the traveling yarn 16. In this embodiment, the tension applying device 25 is configured as a gate-type one having movable comb teeth disposed in relation to fixed comb teeth. The comb teeth on the movable side are biased such that the two comb teeth are in a meshed state. When passing through between the comb teeth in the meshed state, the yarn 16 is bent, which can apply a moderate tension to the yarn 16, for enhancing the quality of the package 18. The tension applying device 25, however, is not limited to the gate-type one mentioned above, and for example, a disk-type one may be adopted.

[0050] If the yarn 16 is broken between the yarn supply bobbin 15 and the package 18 for some reason, the yarn splicing device 26 splices a lower yarn on the yarn supply bobbin 15 side and an upper yarn on the package 18 side. In this embodiment, the yarn splicing device 26 is configured as a splicer device that twists yarn ends together by using a swirling airflow generated with compressed air. The yarn splicing device 26 is not limited to such a splicer device, and for example, a mechanical-type knotter or the like may be adopted.

[0051] The yarn quality measuring instrument 27 monitors the thickness of the yarn 16 with an appropriate sensor. A cutter (not shown) is additionally disposed near the yarn quality measuring instrument 27. The cutter is for cutting the yarn 16 immediately when the yarn quality

measuring instrument 27 detects an abnormality in the yarn thickness.

[0052] Disposed below and above the yarn splicing device 26 are a lower yarn catching pipe 29 for catching and guiding a yarn (lower yarn) on the yarn supply bobbin 15 side and an upper yarn catching pipe 30 for catching and guiding a yarn (upper yarn) on the package 18 side. The lower yarn catching pipe 29 has, at its distal end, a suction port 31, and the upper yarn catching pipe 30 has, at its distal end, a suction mouth 32. To the two catching pipes 29, 30, appropriate negative pressure sources are respectively connected, which allows suction flows to act on the suction port 31 and the suction mouth 32.

[0053] With this configuration, if the yarn is broken between the yarn supply bobbin 15 and the package 18, the yarn on the yarn supply bobbin 15 side is caught and introduced to the yarn splicing device 26 by the lower yarn catching pipe 29, while the yarn on the package 18 side is caught and introduced to the yarn splicing device 26 by the upper yarn catching pipe 30. As the yarn splicing device 26 is driven in this state, the upper yarn and the lower yarn are spliced to each other, so that the yarn 16 becomes continuous between the yarn supply bobbin 15 and the package 18. Accordingly, winding of the yarn 16 onto the package 18 can be resumed.

[0054] The unwinding assist device 24 will now be described in detail with reference to FIG. 4.

[0055] In the description given below, an extension line of the central axis (the winding center) of the regulation member 28 having a tubular shape is represented by imaginary line 70.

[0056] The unwinding assist device 24 includes a lifting mechanism (not shown) for moving the regulation member 28 substantially in the vertical direction along the axis of the lifting mechanism. The operation of the lifting mechanism is controlled by the unit control section 39.

[0057] The unwinding assist device 24 also includes a sensor holding member 35, which moves integrally with the regulation member 28. Fixed to the sensor holding member 35 is a yarn layer sensor 36 for detecting an upper end surface (hereinafter called a chase portion) of a yarn layer of the yarn supply bobbin 15. The yarn layer sensor 36 is configured as a transmissive-type photo sensor having a light emitter 36a and a light receiver 36b. When the light emitter 36a and the light receiver 36b are obstructed from each other by the chase portion, the chase portion is detected. A result of the detection by the yarn layer sensor 36 is sent to the unit control section 39.

[0058] During yarn winding, the unit control section 39 performs a control to make the regulation member 28 (and the sensor holding member 35) descend to a position where the yarn layer sensor 36 can detect the chase portion. This allows the regulation member 28 (and the sensor holding member 35) to descend so as to follow the descending of the chase portion (a decrease of the yarn on the yarn supply bobbin 15) caused by unwinding of the yarn 16 from the yarn supply bobbin 15, as shown in FIG. 5. The positional relationship between the chase portion and the regulation member 28 can be always kept constant. Thus, a tension applied to the balloon can be kept constant, so that the yarn 16 can be appropriately unwound from the yarn supply bobbin 15.

[0059] A detailed structure of the yarn supply section 20 will now be described with reference to FIG. 6.

[0060] The above-described transport mechanism includes a supply path 61, a unit path 62, and a discharge path 63. The supply path 61, the unit path 62, and the discharge path 63 are formed of cover members made of sheet metals. To be specific, cover members are disposed side by side with gaps between the cover members, so that the supply path 61, the unit path 62, and the discharge path 63 are formed.

[0061] The supply path 61 is a path for supplying a tray 19 to the winding unit 11. The unit path 62 is formed for each winding unit 11. Each unit path 62 is connected to the supply path 61. The unit path 62 is a path extending through a yarn supply position. The yarn supply position refers to a position where the tray 19 locates when the yarn 16 of the yarn supply bobbin 15 is unwound. In this embodiment, the position where the tray 19 locates when the unwinding assist device 24 unwinds the yarn 16 of the yarn supply bobbin 15 corresponds to the yarn supply position.

[0062] After unwinding of the yarn 16 from the yarn supply bobbin 15 at the yarn supply position is finished, the tray 19 is discharged from the yarn supply position to the discharge path 63. The discharge path 63 is a path for transporting a tray 19 discharged from the unit path 62. The yarn supply bobbin 15 is collected from the tray 19 transported by the discharge path 63, and the yarn supply bobbin feeder 13 sets a new yarn supply bobbin 15 on the tray 19.

[0063] As shown in FIG. 6, the yarn supply section 20 includes a first guide 41, a second guide 42, a tray sensor 43, and a tray holding part 44.

[0064] The first guide 41 is disposed in the unit path 62 and near the intersection of the unit path 62 and the supply path 61. The first guide 41 has a disk-like shape, and is attached so as to be capable of turning about a rotation axis 41a, which is the center of the disk. The first guide 41 is disposed below the cover members that form the supply path 61, the unit path 62, and the discharge path 63.

[0065] The first guide 41 is driven to turn by a first motor (first drive source) 51. The first motor 51 is a motor capable of controlling the rotational phase (the number of revolutions), and capable of forward and reverse rotations. The first motor 51 is a stepping motor, for example. The first motor 51 is controlled by the unit control section 39 via a non-illustrated motor driver, for example. With this configuration, the unit control section 39 is able to control the rotational phase of the first guide 41.

[0066] The first guide 41 has a notch 41b. The first guide 41 guides the tray 19 by using the notch 41b. In detail, as the unit control section 39 turns the first guide 41 with the tray 19 residing in the notch 41b, a wall portion

of the notch 41b pushes the tray 19 (and more specifically the bobbin set portion 19b). The tray 19 is consequently guided to a predetermined position. The first guide 41 is configured with a disk in the shape of a perfect circle in this embodiment, but instead the first guide 41 may have an oval shape. Alternatively, a part of the perfect circle may be an arc-shaped portion having unevenness that deviates from the orbit of the perfect circle.

[0067] The second guide 42 is disposed in the unit path 62 and on the downstream side of the first guide 41. The second guide 42 is in the shape of an elongated plate whose opposite end portions serve as guide pieces 42b. The second guide 42 is attached so as to be rotatable about a rotation axis 42a, which is at the center of the second guide 42. The second guide 42 is disposed below the cover members that form the supply path 61, the unit path 62, and the discharge path 63.

[0068] The second guide 42 is driven in rotation by a second motor (second drive source) 52. The second motor 52 is capable of controlling the rotational phase (the number of revolutions). The second motor 52 is a stepping motor, for example. The first motor 51 and the second motor 52 are different motors, and therefore they can operate individually. The second motor 52 is controlled by the unit control section 39 via a non-illustrated motor driver, for example. With this configuration, the unit control section 39 is able to control the rotational phase of the first guide 41 and the rotational phase of the second guide 42 independently of each other.

[0069] The second guide 42 guides the tray 19 by using the guide pieces 42b. In detail, as the second guide 42 rotates, the guide piece 42b of the second guide 42 pushes the tray 19 (and more specifically the base portion 19c). The tray 19 is consequently guided to a predetermined position.

[0070] The first guide 41 and the second guide 42 are at different positions in the height direction (the direction of the rotation axis). Thus, even though a trajectory of movement of the first guide 41 and a trajectory of movement of the second guide 42 overlap when viewed in the height direction (FIG. 6), they do not interfere each other. A control or adjustment for avoiding a collision of the first guide 41 with the second guide 42 is not necessary, therefore. While the first guide 41 pushes the bobbin set portion 19b of the tray 19, the second guide 42 pushes the base portion 19c of the tray 19. The first guide 41 and the second guide 42 push different portions of the tray 19 (contact different portions of the tray 19). Accordingly, it is easy for the first guide 41 and the second guide 42 to simultaneously push the tray 19. Although the second guide 42 is disposed below the first guide 41 in this embodiment, the second guide 42 may be disposed above the first guide 41.

[0071] The tray sensor 43 detects an entry of the tray 19 to the unit path 62. The tray sensor 43 includes a fixed portion 43a and a movable portion 43b. The movable portion 43b is rotatable about the fixed portion 43a. The movable portion 43b includes a magnet for example, and a magnet sensor is fixed below the movable portion 43b. This configuration allows the tray sensor 43 to detect movement of the movable portion 43b. The movable portion 43b is disposed at a position where the movable portion 43b can be in contact with the tray 19 passing through the unit path 62. Entry of the tray 19 to the unit path 62 is detected based on whether or not the tray 19 comes into contact with the movable portion 43b. A result of the detection by the tray sensor 43 is outputted to the unit control section 39.

[0072] This sensor is just an example. For instance, the tray 19 may be detected with an optical sensor. The optical sensor, for example, has a light emitter and a light receiver, and is configured to emit light from the light emitter toward a detection region (e.g., a region above the supply path 61 or the unit path 62). If a tray 19 is present in the detection region, the light receiver detects light reflected from the tray 19. Thus, whether or not any tray 19 is present in the detection region can be detected based on the amount of light received by the light receiver. The optical sensor is not limited to a reflection-type one as mentioned above, but may be a transmissive-type one.

[0073] This embodiment includes an adjusting mechanism 100 for adjusting whether or not to supply a tray 19 to the unit path 62, and/or adjusting the number of trays 19 to be supplied to the unit path 62. The adjusting mechanism 100 is configured to include the tray sensor 43, the unit control section 39, the machine control apparatus 12, and the first guide 41. A specific process performed by the adjusting mechanism 100 will be described later.

[0074] The tray holding part 44 is a member for settling the tray 19 to a yarn supply position. The tray holding part 44 includes a swing shaft 44a, a body 44b, a rail 44c, and a contact portion 44d. The body 44b is capable of swinging about the swing shaft 44a and along the rail 44c. The body 44b is biased to the upstream side by a biasing member (not shown). The contact portion 44d, which is attached to the body 44b, is a portion that can be in contact with the tray 19. The contact portion 44d is made of a resin for example. The biasing member exerts a biasing force, which makes the contact portion 44d push the tray 19 to the upstream side and hold the tray 19. Details of an operation of the tray holding part 44 settling the tray 19 to the yarn supply position will be given later. The configuration of the tray holding part 44 is just an example. The same function may be implemented by another configuration, as long as the other configuration is capable of holding the tray 19 at a certain position.

[0075] Next, a flow of taking the tray 19 from the supply path 61 into the unit path 62, unwinding the yarn 16, and discharging the tray 19 to the discharge path 63 will be described with reference to FIG. 7 to FIG. 10.

[0076] FIG. 7 and FIG. 8 show an operation of the first guide 41 when taking the tray 19 into the unit path 62. Referring to the upper diagram of FIG. 7, the first guide

41 closes the unit path 62, and therefore the tray 19 is not taken into the unit path 62. An edge portion of the first guide 41 constitutes a part of the supply path 61.

[0077] The machine control apparatus 12 and the unit control section 39, which constitute the adjusting mechanism 100, determine whether or not a tray 19 needs to be taken into the unit path 62. For example, the unit control section 39 determines that the necessity to take a new tray 19 in is high, if the amount of yarn remaining on the yarn supply bobbin 15 from which the yarn 16 is currently being unwound or the number of trays 19 stocked up in the unit path 62 is small. Alternatively, the machine control apparatus 12 may calculate the number of trays 19 that should be stocked up in the unit path 62, based on how many trays 19 are flowing in the supply path 61. Especially when a lot is nearly finishing, the machine control apparatus 12 may calculate the number of trays 19 that should be stocked up in the unit path 62 such that not too many trays 19 are stocked up in a particular winding unit 11.

[0078] If the machine control apparatus 12 and the unit control section 39 determine that a new tray 19 needs to be taken in, the unit control section 39 controls the first motor 51 to make the first guide 41 turn clockwise (in the first direction) (the lower diagram of FIG. 7). The unit control section 39 stops the turning of the first guide 41 at a point of time when the notch 41b of the first guide 41 is positioned at the intersection of the supply path 61 and the unit path 62. As a result, the supply path 61 and the unit path 62 are connected. In other words, a tray 19 transported in the supply path 61 can be taken into the notch 41b (the upper diagram of FIG. 8).

[0079] As the tray 19 is taken into the notch 41b of the first guide 41, the tray sensor 43 detects the tray 19. In response to the tray sensor 43 detecting the tray 19, the unit control section 39 makes the first guide 41 turn counterclockwise (in the second direction) (the lower diagram of FIG. 8). This allows the tray 19 to be transported to the downstream side in the unit path 62.

[0080] In the lower diagram of FIG. 8, an enlarged view of the first guide 41 transporting the tray 19 to the downstream side is additionally shown. As illustrated in this enlarged view, the first guide 41 transports the tray 19 to the downstream side with the tray 19 sandwiched between the first guide 41 and a wall surface of the unit path 62. At this time, the unit path 62 is, on the side upstream of its portion where the tray 19 is sandwiched, closed by the first guide 41. In this closed portion, the angle formed between the contour of the unit path 62 and the contour of the first guide 41 is defined as angle θ (see FIG. 8). In this embodiment, the angle θ is an acute angle, and therefore a force that the tray 19 receives from the first guide 41 is converted into a force that transports the tray 19 to the downstream side. Accordingly, in this embodiment, the first guide 41 can easily transport the tray 19. When the contour of the unit path 62 or the contour of the first guide 41 includes a curve, it is acceptable to calculate the angle θ by approximating the curve to a straight line. When, in the closed portion, the contour of the unit path 62 or the contour of the first guide 41 includes a polygonal line and it is impossible to calculate the angle θ appropriately, it is acceptable to calculate the angle θ by extending the contour of a portion that is in contact with the tray 19.

[0081] Thereafter, if a necessity arises to take a tray 19 in again, the unit control section 39 makes the first guide 41 turn in the first direction (clockwise). Thus, in this embodiment, the first guide 41 turns alternately in the first and second directions. That is, the first motor 51 drives the first guide 41 such that the first guide 41 is driven to turn to and fro within a predetermined angle range. Therefore, even if yarn wastes are adhered, the yarn wastes do not easily get entangled in the first guide 41. Here, the first guide 41 may be rotated only in one direction.

[0082] An operation of the second guide 42 will now be described. The upper diagram of FIG. 9 shows a state after the tray 19 is transported by the first guide 41. The second guide 42 cooperates with the tray holding part 44 to fix the tray 19 in the yarn supply position. More specifically, the tray holding part 44 pushes the tray 19 (bobbin set portion 19b) toward the upstream side with the biasing force of the biasing member, as described above. On the other hand, the guide piece 42b of the second guide 42 pushes the tray 19 (base portion 19c) toward the downstream side. This is how the tray 19 can be fixed in a sandwiched manner. Since the guide piece 42b of the second guide 42 pushes the base portion 19c, which has the largest area in the tray 19, a pushing force applied by the guide piece 42b can be stably transmitted to the tray 19. Adoption of this configuration suppresses the tray 19 being tilted by the pushing force of the guide piece 42b. Furthermore, the tray holding part 44 and the guide piece 42b of the second guide 42 are disposed at different levels such that they can push the tray 19 at different heights. Accordingly, even if the tray holding part 44 and the guide piece 42b of the second guide 42 are disposed so as to overlap each other when viewed in the vertical direction, they are not in contact with each other, and thus the degree of freedom in layout is improved.

[0083] Then, after unwinding of the yarn 16 on the tray 19 placed at the yarn supply position is completed, the unit control section 39 rotates the second guide 42 counterclockwise. Since the second guide 42 is rotated with a force exceeding the biasing force of the biasing member, the tray 19 can be discharged to the downstream side in such a manner that the guide piece 42b pushes away the tray holding part 44 (the lower diagram of FIG. 9).

[0084] Simultaneously with the discharge of the tray 19, the other guide piece 42b transports an upstream tray 19 to the downstream side. As described above, transport of this tray 19 by the first guide 41 has been completed, and therefore the second guide 42 comes into contact with the tray 19 in a region where the first guide 41 overlaps the second guide 42, to transport the

tray 19. The tray 19 is consequently transported to the yarn supply position, and settled to the yarn supply position while being sandwiched between the second guide 42 and the tray holding part 44 (FIG. 10). Then, unwind of the yarn 16 from the yarn supply bobbin 15 is started again.

[0085] In this manner, the second guide 42 according to this embodiment is capable of, by using the plural guide pieces 42b, simultaneously performing discharge of a tray 19 placed at the yarn supply position and transport of an upstream tray 19 to the yarn supply position. Thus, the yarn supply section 20 according to this embodiment exhibits a high operating efficiency. The second guide 42 is, unlike the first guide 41, driven in rotation only in one direction. In this embodiment, as described above, the first guide 41 and the second guide 42 do not interfere each other, and their drive sources are independent of each other. It therefore is possible to start transporting a tray 19 by the second guide 42 without waiting for completion of an operation of the first guide 41. Accordingly, settling the position of a tray 19 by the second guide 42, etc. may be performed concurrently with take-in of a tray 19 by the first guide 41.

[0086] Another function implemented with use of the first guide 41 will now be described with reference to FIG. 11. As described above, the first guide 41 has a function of taking a tray 19 transported in the supply path 61 into the unit path 62. The first guide 41 may additionally have a function of discharging (returning) a tray 19 existing in the unit path 62 to the supply path 61.

[0087] For example, assume a case where: a tray 19 is present in the unit path 62; the tray 19 is within the notch 41b (the upper diagram of FIG. 11); and the unit control section 39 determines that the tray 19 needs to be discharged to the supply path 61. In this case, the unit control section 39 makes the first guide 41 turn clockwise, to discharge the tray 19 to the supply path 61 (the lower diagram of FIG. 11). Furthermore, even after the tray 19 is transported by the first guide 41 as shown in the upper diagram of FIG. 9, the unit control section 39 can discharge the tray 19 to the supply path 61 by a cooperation between the first guide 41 and the second guide 42. To be specific, the unit control section 39 makes the second guide 42 rotate in the clockwise direction so that the tray 19 can be inserted into the notch 41b of the first guide 41, and moreover the unit control section 39 makes the first guide 41 turn clockwise so that the tray 19 can be discharged to the supply path 61.

[0088] In a case where, for example, trays 19 concentrate in the unit path 62 of a particular winding unit 11, such a phenomenon can be eliminated by the foregoing configuration. The first guide 41 according to this embodiment has a single notch 41b. If the first guide 41 has plural notches 41b, the above-described function of discharging (returning) the tray 19 existing in the unit path 62 to the supply path 61 cannot be implemented. Only a single notch 41b is preferable, therefore.

[0089] First variation of the above-described embodiment will now be described. FIG. 12 shows a layout of tray sensors 43 according to the variation. In the following descriptions of variations, members identical or similar to those of the above-described embodiment will be given the same reference signs on the drawings, and their descriptions may sometimes be omitted.

[0090] In the above-described embodiment, the tray sensor 43 is provided for each winding unit 11. Instead, the first variation has one tray sensor 43 provided for every predetermined number of winding units 11 (hereinafter, one group of winding units 11). The number of winding units 11 included in one group is an integer equal to or greater than two, but preferably is five or more and twenty or less, for example.

[0091] In the above-described embodiment, the tray sensor 43 is used to determine whether or not the first guide 41 of a relevant winding unit 11 has taken a tray 19 in. In the first variation, on the other hand, the tray sensor 43 is used to determine whether or not a winding unit 11 included in a group has taken a tray 19 in. For example, assume a case where a necessity to take a tray 19 into one winding unit 11 included in a group arises. In such a case, only the relevant winding unit 11 makes its first guide 41 rotate to connect the supply path 61 and the unit path 62 to each other, whereas the other winding units 11 included in the same group close the unit paths 62 by their first guides 41. If a predetermined time has elapsed since the tray sensor 43 detected a tray 19, a unit control section 39 determines that the tray 19 has been taken into the relevant winding unit 11. The predetermined time is a time that is set because there is a time lag from when the tray sensor 43 detects a tray 19 to when the tray 19 reaches the relevant winding unit 11.

[0092] In this variation, as compared to in the above-described embodiment, the number of tray sensors 43 can be reduced, and the costs can be lowered accordingly.

[0093] Second variation and third variation will now be described with reference to FIG. 13 and FIG. 14. FIG. 13 is a perspective view of a second guide 42 according to the second variation. FIG. 14 is a perspective view of a second guide 42 according to the third variation.

[0094] While the second guide 42 of the above-described embodiment is shaped like a flat plate, the second guides 42 of the second and third variations are shaped such that bent portions 42c are provided in parts of them. The bent portions 42c are end portions of the second guide 42 being bent substantially at a right angle. The bent portions 42c are formed at a position kept from the guide pieces 42b, that is, at a position closer to the rotation center than the guide piece 42b. Thanks to the presence of the bent portions 42c, the second guide 42 has an increased strength. The direction in which the bent portions 42c are bent may be either upward or downward. It may be possible that recesses 42d are formed on opposite longitudinal sides of the bent portion 42c, as shown in FIG. 14.

[0095] Fourth variation will now be described with ref-

erence to FIG. 15. FIG. 15 is a plan view of a yarn supply section 20 including a second guide 42 according to the fourth variation.

[0096] The second guide 42 of the above-described embodiment has two guide pieces 42b. The second guide 42 of the fourth variation has four guide pieces 42b. In other words, the second guide 42 of the fourth variation is a disk-shaped member having four notches. The number of guide pieces 42b formed is not limited to the ones illustrated in the above-described embodiment and in the fourth variation, and for example, may be one, three, or five or more.

[0097] Fifth variation will now be described with reference to FIG. 16 and FIG. 17. FIG. 16 is a schematic plan view showing transport directions in which trays 19 are transported in automatic winders 10 arranged adjacent to each other. FIG. 17 is a plan view of a yarn supply section 20 according to the fifth variation.

[0098] In a textile factory, plural automatic winders 10 are arranged side by side. A configuration including plural automatic winders 10 is called fiber processing equipment. As shown in FIG. 16, the plural automatic winders 10 are arranged such that apparatus front surfaces face each other, in other words, such that apparatus rear surfaces face each other. The apparatus front surface refers to a surface of the machine control apparatus 12 on which input keys or a display is disposed. With this arrangement, a gap between the apparatus front surfaces of the automatic winders 10 can be used as a passageway for an operator, which allows the operator to perform operations efficiently. The machine control apparatuses 12 of the automatic winders 10 arranged facing each other are disposed in end portions of the automatic winders 10 on the same side with respect to the direction in which the winding units 11 are arranged side by side.

[0099] Two automatic winders 10 arranged facing each other are different from each other in terms of the direction in which trays 19 are transported. One of them will be referred to as first automatic winder 10a, while the other as second automatic winder 10b, as shown in FIG. 16. The first automatic winder 10a, in a plan view, has a counterclockwise path formed by extending through the supply path 61, the unit path 62, and the discharge path 63 (in other words, the supply path 61 is on the apparatus rear surface side). The second automatic winder 10b, in a plan view, has a clockwise path formed by extending through the supply path 61, the unit path 62, and the discharge path 63 (in other words, the supply path 61 is on the apparatus front surface side).

[0100] Referring to FIG. 17, the yarn supply section 20 of the fifth variation is different from that of the above-described embodiment in terms of the direction in which a tray 19 is transported. This is why the fifth variation and the above-described embodiment are different from each other in terms of the shape of a unit path 62. A first guide 41 and a second guide 42 of the fifth variation are identical to the first guide 41 and the second guide 42 of the above-described embodiment. Here, being identical encompasses being substantially identical. Just required is that a function and an approximate shape be identical. Being strictly identical is not required. That is, the first guide 41 and the second guide 42 are applicable to both the first automatic winder 10a and the second automatic winder 10b.

[0101] The first guide 41 turns with a tray 19 positioned within a notch 41b, and can thereby transport the tray 19 to the downstream side along the unit path 62. Thus, the first guide 41 is applicable to unit paths 62 with various shapes, as long as a trajectory of movement of the first guide 41 (specifically, the notch 41b) overlaps a part of the unit path 62 in a plan view. A portion of the second guide 42 capable of pushing a tray 19 is large, and therefore the second guide 42 is applicable to unit paths 62 with various shapes, as long as a trajectory of movement of the second guide 42 overlaps a part of the unit path 62. Accordingly, the first guide 41 and the second guide 42 according to this embodiment are applicable to both the first automatic winder 10a and the second automatic winder 10b.

[0102] Since the first automatic winder 10a and the second automatic winder 10b adopt identical first guides 41 and identical second guides 42, the number of kinds of components to be manufactured and managed is reduced, so that the component costs can be lowered. In addition, a time required to transport a tray 19 to the yarn supply position along the unit path 62 and to discharge the tray 19 from the unit path 62 in the first automatic winder 10a can be equal to that in the second automatic winder 10b. Accordingly, it is possible that the first automatic winder 10a and the second automatic winder 10b need substantially the same time for transporting a tray 19. Consequently, a method for calculating the operating efficiency of the first automatic winder 10a can be used to calculate the operating efficiency of the second automatic winder 10b.

[0103] As thus far described above, the automatic winder 10 according to this embodiment includes the plural winding units 11. The winding unit 11 includes the yarn supply section 20 and the winding section 21. The yarn supply section 20 performs take-in and discharge of the tray 19, on which the yarn supply bobbin 15 is supported with an upright posture while being transported. The winding section 21 unwinds the yarn 16 from the yarn supply bobbin 15 set on the tray 19 taken in by the yarn supply section 20, and winds up the yarn 16 to form the package 18. The yarn supply section 20 includes the first guide 41, the second guide 42, the first motor 51, and the second motor 52. The first guide 41 takes the tray 19 in. The second guide 42 receives the tray 19 taken in by the first guide 41, settles the tray 19 to the yarn supply position where the yarn 16 is to be unwound, and after the unwinding of the yarn 16 is completed, discharges the tray 19. The first motor 51 drives the first guide 41. The second motor 52, which is operable independently of the first motor 51, drives the second guide 42. The first guide 41 is a disk-shaped member having the

single notch for guiding the tray 19.

[0104] With this configuration, the first guide 41 for performing take-in of the tray 19 and the second guide 42 for performing position settlement and discharge of the tray 19 can be driven independently of each other. Consequently, take-in and discharge of the tray 19 can be performed in various situations. In addition, the shape of the first guide 41 having the single notch can eliminate the possibility that the tray 19 may be transported by an unnecessary notch or that the tray 19 may be jammed by an unnecessary notch. Furthermore, the first guide 41, due to its disk-like shape, has its trajectory of movement substantially constant even when the rotational phase changes. This can reduce the possibility of the first guide 41 being unexpectedly contacted by the tray 19. Accordingly, take-in and discharge of the tray 19 can be performed in various situations.

[0105] The automatic winder 10 according to this embodiment includes the supply path 61, the discharge path 63, and the unit path 62. The supply path transports the tray 19, and supplies the tray 19 to the winding unit 11. The discharge path 63 transports the tray 19 discharged from the winding unit 11. The unit path 62 connects the supply path 61 to the yarn supply position. The first guide 41 is driven to turn to and fro within a predetermined angle range by the first motor 51. The first guide 41, by turning in the first direction, connects the supply path 61 to the unit path 62, and then by turning in the second direction, pushes the tray 19 so as to bring the tray 19 closer to the yarn supply position.

[0106] With this configuration, as the first guide 41 is driven to turn to and fro, take-in of the tray 19 from the supply path 61 and transport of the tray 19 along the unit path 62 can be performed. It is likely that the yarn 16 of the yarn supply bobbin 15 is entangled in the first guide 41 if the first guide 41 keeps rotating in the same direction. Such entanglement of the yarn 16 can be suppressed by the first guide 41 turning to and fro.

[0107] In the automatic winder 10 according to this embodiment, the first guide 41 transports the tray 19 toward the discharge path 63 side with the tray 19 sandwiched between the first guide 41 and the wall surface of the unit path 62. While the tray 19 is sandwiched between the wall surface of the unit path 62 and the first guide 41, a portion of the unit path 62 toward the supply path 61 side is closed by the first guide 41, and in this closed portion, the angle θ formed between the contour of the unit path 62 and the contour of the first guide 41 is an acute angle.

[0108] Since the tray is pushed in a state where the angle formed between the contour of the unit path 62 and the contour of the first guide 41 is an acute angle, a force that pushes the tray is easily converted to a force for transporting the tray 19 to the discharge path 63 side. Accordingly, transport of the tray 19 by the first guide 41 can be performed appropriately.

[0109] The automatic winder 10 according to this embodiment includes the tray sensor 43, the unit control section 39, the machine control apparatus 12, and the adjusting mechanism 100. The tray sensor 43, which is provided for each of the winding units 11, detects the tray 19. The unit control section 39 controls the winding unit 11. The machine control apparatus 12 is connected to the plural winding units 11. The adjusting mechanism 100 adjusts the number of yarn supply bobbins 15 to be supplied to the winding unit 11. The adjusting mechanism 100 includes the tray sensor 43, the unit control section 39, the machine control apparatus 12, and the first motor 51.

[0110] Use of a result of detection by the tray sensor 43, which is provided for each winding unit 11, makes it possible to identify the number of trays 19 supplied to each winding unit 11. Accordingly, controlling the first motor 51, etc. so as to supply an appropriate number of trays 19 is possible.

[0111] The automatic winder 10 according to the variation includes the tray sensor 43, the unit control section 39, the machine control apparatus 12, and the adjusting mechanism 100. The tray sensor 43, which is disposed in the supply path 61, detects the tray 19. The unit control section 39 controls the winding unit 11. The machine control apparatus 12 is connected to the plural winding units 11. The adjusting mechanism 100 adjusts the number of yarn supply bobbins 15 to be supplied to the winding unit 11. The adjusting mechanism 100 includes the tray sensor 43, the unit control section 39, the machine control apparatus 12, and the first motor 51.

[0112] Use of information such as a result of detection by the tray sensor 43, which is disposed in the supply path 61, makes it possible to control the first motor 51, etc. so as to supply an appropriate number of trays 19.

[0113] In the automatic winder 10 according to this embodiment, the first guide 41, by rotating in the first direction, discharges the tray 19 existing in the unit path 62 toward the supply path 61.

[0114] Accordingly, not only take-in of the tray 19 but also discharge of the tray 19 can be performed by using the first guide 41.

[0115] In the automatic winder 10 according to this embodiment, the second guide 42 is driven in rotation by the second motor 52. The direction in which the second guide 42 is rotated when settling the tray 19 to the yarn supply position is the same as the direction in which the second guide 42 is rotated when discharging the tray 19.

[0116] Accordingly, position settlement of the tray 19 and discharge of the tray 19 can be performed just by rotating the second guide 42 in one direction.

[0117] In the automatic winder 10 according to this embodiment, the trajectory of movement of the first guide 41 overlaps the trajectory of movement of the second guide 42 when viewed in the axial direction of the yarn supply bobbin 15, and in this overlapping portion, delivery of the tray 19 from the first guide 41 to the second guide 42 takes place.

[0118] This configuration can make delivery of the tray 19 easy.

[0119] In the automatic winder 10 according to this em-

bodiment, the trajectory of movement of the first guide 41 overlaps the trajectory of movement of the second guide 42 when viewed in the axial direction of the yarn supply bobbin 15. The first guide 41 comes into contact with the bobbin set portion 19b of the tray 19, to thereby take the tray 19 in. The second guide 42 comes into contact with the base portion 19c of the tray 19, to thereby settle the position of the tray 19, the base portion 19c being different in height from the bobbin set portion 19b.

[0120] Since the first guide 41 and the second guide 42 come into contact with different portions of the tray 19, the first guide 41 and the second guide 42 are less likely to interfere when the first guide 41 and the second guide 42 transport the trays 19. This can offer a degree of freedom in controlling the position and timing of the first guide 41 and the second guide 42.

[0121] In the automatic winder 10 according to the variation, the tray sensor 43 is, in the supply path 61, disposed at a rate of one for a plurality of winding units 11.

[0122] This configuration can reduce the number of tray sensors 43, and thus can lower the costs, as compared to a configuration having the tray sensor 43 provided for each winding unit 11.

[0123] In the automatic winder 10 according to this embodiment, the winding unit 11 includes the unwinding assist device 24 for assisting unwinding of the yarn 16 from the yarn supply bobbin 15. The yarn supply position is a position where the tray 19 locates when the unwinding assist device 24 unwinds the yarn 16 from the yarn supply bobbin 15.

[0124] In the automatic winder 10 according to this embodiment, the first guide 41 and the second guide 42 are applicable to both the configuration (second automatic winder 10b) in which the path extending through the supply path 61, the unit path 62, and the discharge path 63 is clockwise in a plan view and the configuration (first automatic winder 10a) in which the path extending through the supply path 61, the unit path 62, and the discharge path 63 is counterclockwise in a plan view.

[0125] Accordingly, two kinds of automatic winders 10 that are different from each other in terms of the direction in which trays 19 are transported can adopt identical first guides 41 and identical second guides 42. The component costs can be lowered, therefore. Use of the identical first guides 41 and the identical second guides 42 results in substantially equal times required to replace the respective yarn supply bobbins. This makes calculation of the working efficiency easy.

[0126] Accordingly, settling the tray 19 to the yarn supply position allows the unwinding assist device 24 to work appropriately, to assist unwinding of the yarn 16.

[0127] In the automatic winder 10 according to this embodiment, take-in of the tray 19 by the first guide 41 and settlement of the tray 19 to the yarn supply position by the second guide 42 can be performed concurrently.

[0128] This can improve the operating efficiency as compared to when take-in and discharge of the tray 19 are performed sequentially.

[0129] While a preferred embodiment of the present invention and its variations have been described, the foregoing configurations may be modified, for example, as follows.

[0130] Although the first guide 41 and the second guide 42 are driven in rotation in the above-described embodiment, they may be driven linearly. In such a configuration, a cylinder or the like, instead of the motor, can be used as the first drive source or the second drive source.

[0131] In the above-described embodiment, the second guide 42 performs transport of the tray 19 to the yarn supply position, position settlement of the tray 19, and discharge of the tray 19. Instead, transport of the tray 19 to the yarn supply position may be performed by another guide.

[0132] For example, the unwinding assist device 24 is not an essential component, and may be omitted. In such a case, the yarn supply position may be a predetermined position that is preset based on a frame of the winding unit 11 or another member as a reference.

[0133] Although the above-described embodiment illustrates the automatic winder 10 including the plural winding units 11, it may be acceptable that the automatic winder 10 includes one winding unit 11.

Claims

1. An automatic winder (10) comprising plural winding units (11),

the winding unit (11) including:

a yarn supply section (20) for performing take-in and discharge of a tray (19), on which a yarn supply bobbin (15) is supported with an upright posture while being transported; and
a winding section for unwinding a yarn from the yarn supply bobbin (15) set on the tray (19) taken in by the yarn supply section (20), and winding up the yarn to form a package (18),

the yarn supply section (20) including:

a first guide (41) for taking the tray (19) in;
a second guide (42) for receiving the tray (19) taken in by the first guide (41), settling the tray (19) to a yarn supply position where the yarn is to be unwound, and after the unwinding of the yarn is completed, discharging the tray (19);
a first drive source (51) for driving the first guide (41); and
a second drive source (52) for driving the second guide (42), the second drive source (52) being operable independently of the

first drive source (51),

the first guide (41) being a disk-shaped member having a single notch (41b) for guiding the tray (19).

2. The automatic winder (10) according to claim 1, comprising:

a supply path (61) for transporting the tray (19), and supplying the tray (19) to the winding unit (11);
a discharge path (63) for transporting the tray (19) discharged from the winding unit (11); and
a unit path (62) connecting the supply path (61) to the yarn supply position,
the first guide (41) being driven to turn to and fro within a predetermined angle range by the first drive source (51),
the first guide (41) being configured to, by turning in a first direction, connect the supply path (61) to the unit path (62), and then by turning in a second direction, push the tray (19) so as to bring the tray (19) closer to the yarn supply position.

3. The automatic winder (10) according to claim 2, wherein

the first guide (41) transports the tray (19) toward the discharge path (63) side with the tray (19) sandwiched between the first guide (41) and a wall surface of the unit path (62), and
while the tray (19) is sandwiched between the wall surface of the unit path (62) and the first guide (41), a portion of the unit path (62) toward the supply path (61) side is closed by the first guide (41), and in this closed portion, an angle formed between a contour of the unit path (62) and a contour of the first guide (41) is an acute angle.

4. The automatic winder (10) according to claim 2 or 3, comprising:

a tray sensor (43) for detecting the tray (19), the tray sensor (43) being provided for each of the winding units (11);
a unit control section (39) for controlling the winding unit (11);
a machine control apparatus (12) connected to the plural winding units (11); and
an adjusting mechanism (100) for adjusting the number of the yarn supply bobbins (15) to be supplied to the winding unit (11),
the adjusting mechanism (100) including the tray sensor (43), the unit control section (39), the machine control apparatus (12), and the first drive source (51).

5. The automatic winder (10) according to claim 2 or 3, comprising:

a tray sensor (43) for detecting the tray (19), the tray sensor (43) being disposed in the supply path (61);
a unit control section (39) for controlling the winding unit (11);
a machine control apparatus (12) connected to the plural winding units (11); and
an adjusting mechanism (100) for adjusting the number of the yarn supply bobbins (15) to be supplied to the winding unit (11),
the adjusting mechanism (100) including the tray sensor (43), the unit control section (39), the machine control apparatus (12), and the first drive source (51).

6. The automatic winder (10) according to any one of claims 2 to 5, wherein
the first guide (41), by turning in the first direction, discharges the tray (19) existing in the unit path (62) toward the supply path (61).

7. The automatic winder (10) according to any one of claims 2 to 6, wherein

the second guide (42) is driven in rotation by the second drive source (52), and
a direction in which the second guide (42) is rotated when settling the tray (19) to the yarn supply position is the same as a direction in which the second guide (42) is rotated when discharging the tray (19).

8. The automatic winder (10) according to any one of claims 2 to 7, wherein
the first guide (41) and the second guide (42) are attached at different levels, so that a trajectory of movement of the first guide (41) overlaps a trajectory of movement of the second guide (42) when viewed in an axial direction of the yarn supply bobbin (15), and in this overlapping portion, delivery of the tray (19) from the first guide (41) to the second guide (42) takes place.

9. The automatic winder (10) according to any one of claims 2 to 8, wherein

the first guide (41) and the second guide (42) are attached at different levels, so that a trajectory of movement of the first guide (41) overlaps a trajectory of movement of the second guide (42) when viewed in an axial direction of the yarn supply bobbin (15),
the first guide (41) comes into contact with a first

portion of the tray (19), to take the tray (19) in, and
the second guide (42) comes into contact with a second portion of the tray (19), to settle the position of the tray (19), the second portion being different in height from the first portion.

10. The automatic winder (10) according to claim 4 or 5, wherein
the tray sensor (43) is, in the supply path (61), disposed at a rate of one for a plurality of winding units (11).

11. The automatic winder (10) according to any one of claims 2 to 10, wherein
the first guide (41) and the second guide (42) are applicable to both a configuration in which a path extending through the supply path (61), the unit path (62), and the discharge path (63) is clockwise in a plan view, and a configuration in which a path extending through the supply path (61), the unit path (62), and the discharge path (63) is counterclockwise in a plan view.

12. The automatic winder (10) according to any one of claims 1 to 11, wherein

the winding unit (11) includes an unwinding assist device (24) for assisting unwinding of a yarn from the yarn supply bobbin (15), and
the yarn supply position is a position where the tray (19) locates when the unwinding assist device (24) unwinds a yarn from the yarn supply bobbin (15).

13. The automatic winder (10) according to any one of claims 1 to 12, wherein
take-in of the tray (19) by the first guide (41) and settlement of the tray (19) to the yarn supply position by the second guide (42) can be performed concurrently.

FIG. 1

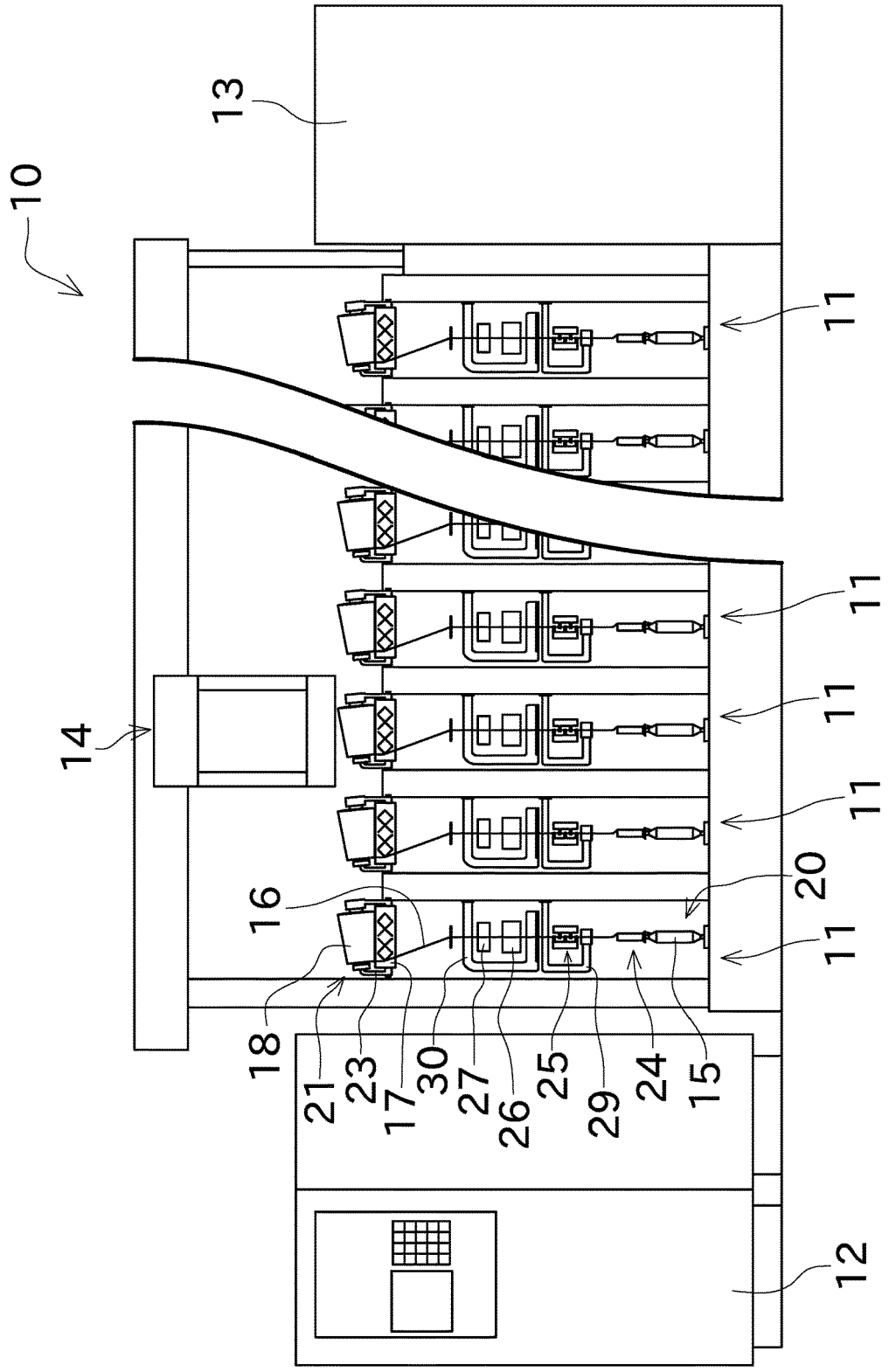


FIG. 2

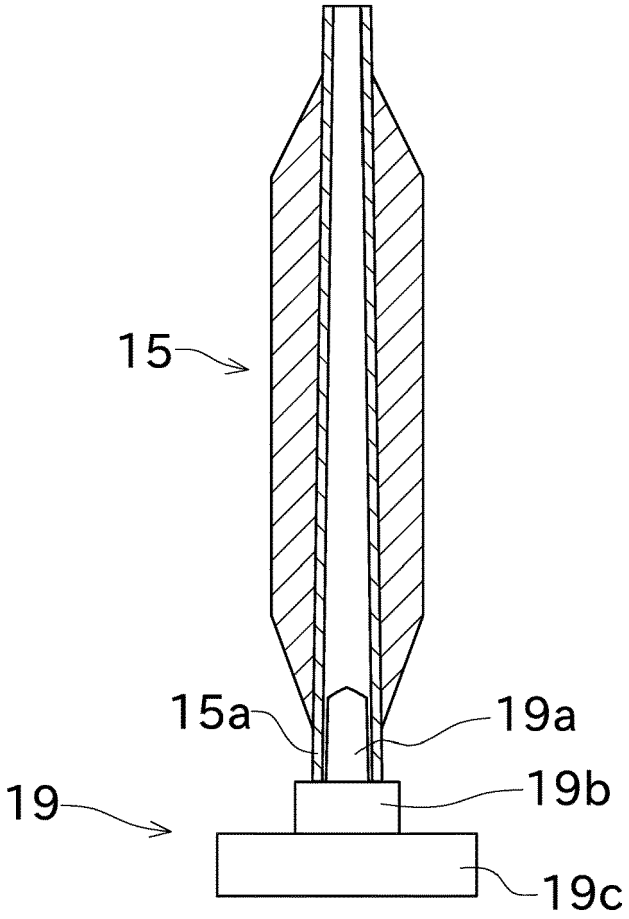


FIG. 3

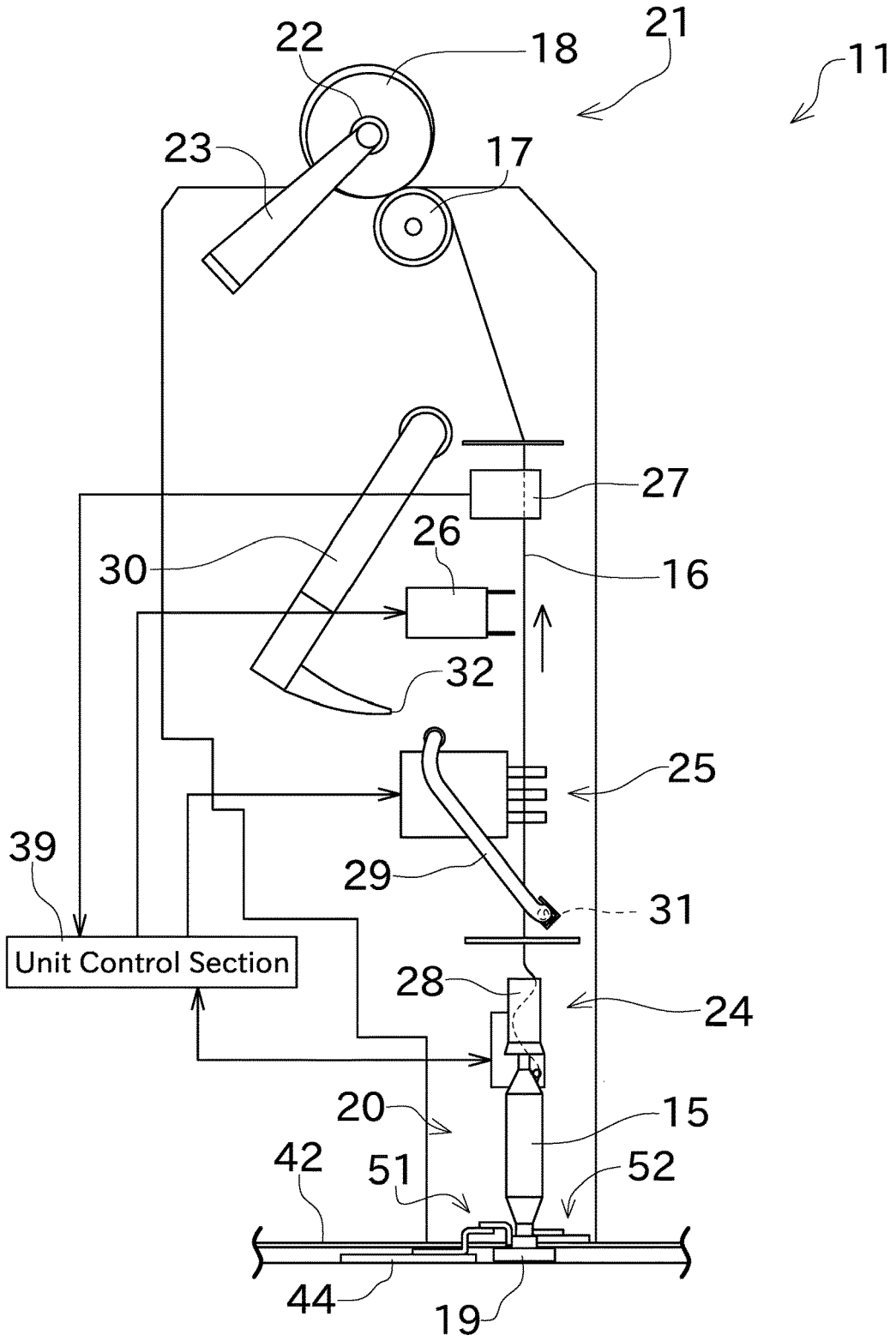

22
18
21
11
23
17
27
26
30
16
32
25
39
29
31
Unit Control Section
28
24
20
15
42
51
52
44
19

FIG. 4

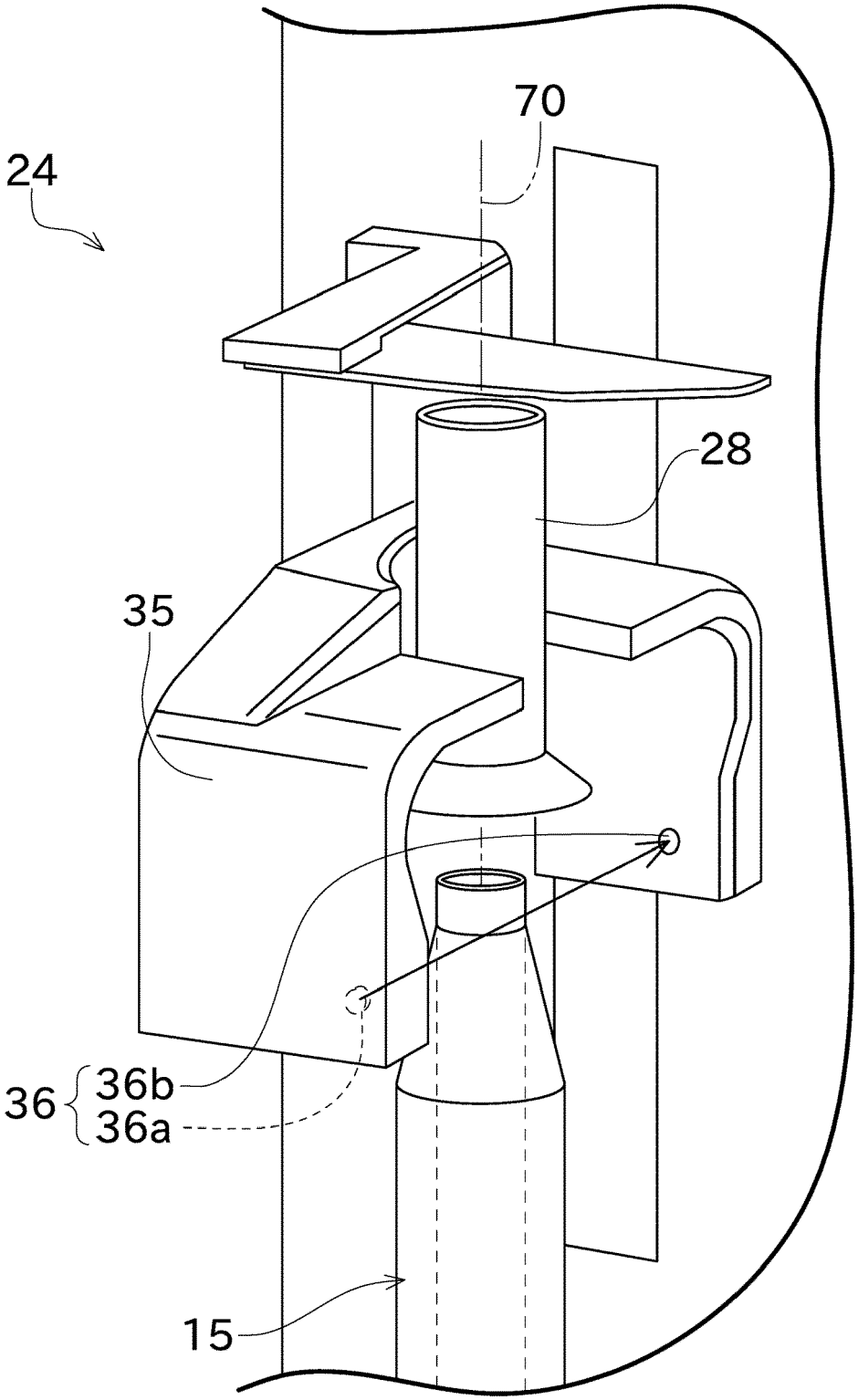


FIG. 5

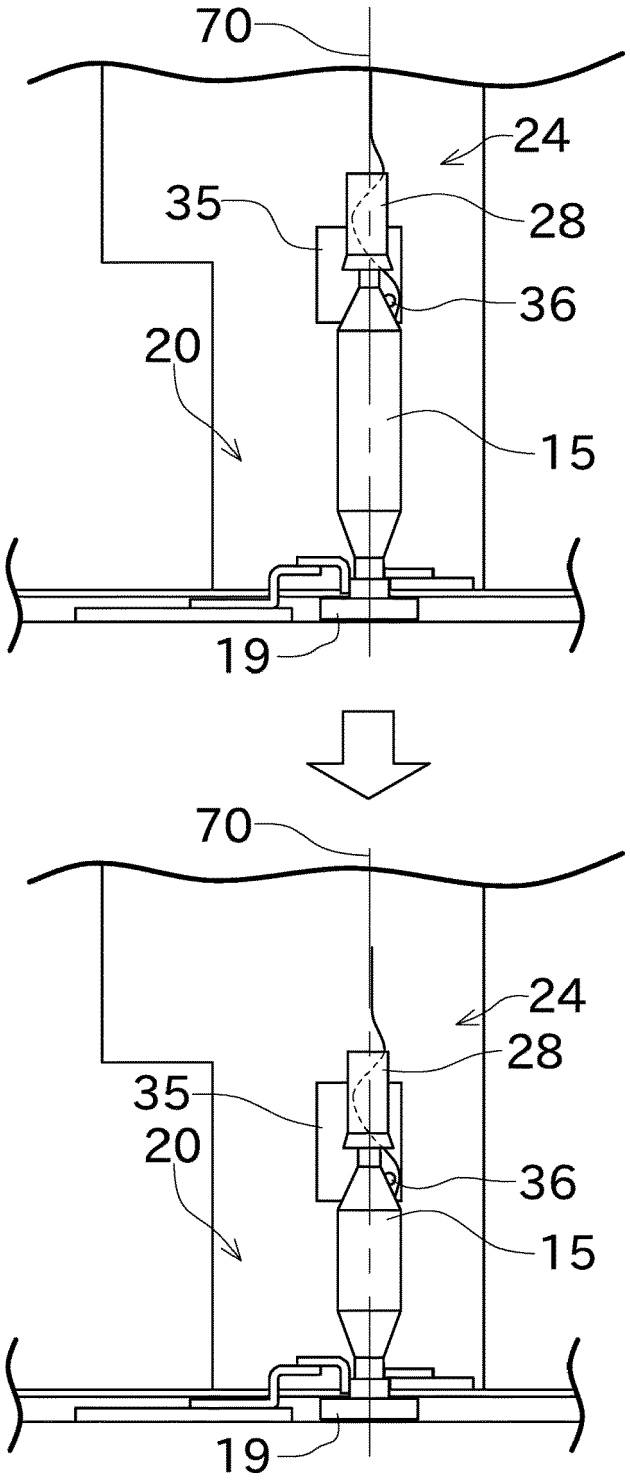


FIG. 6

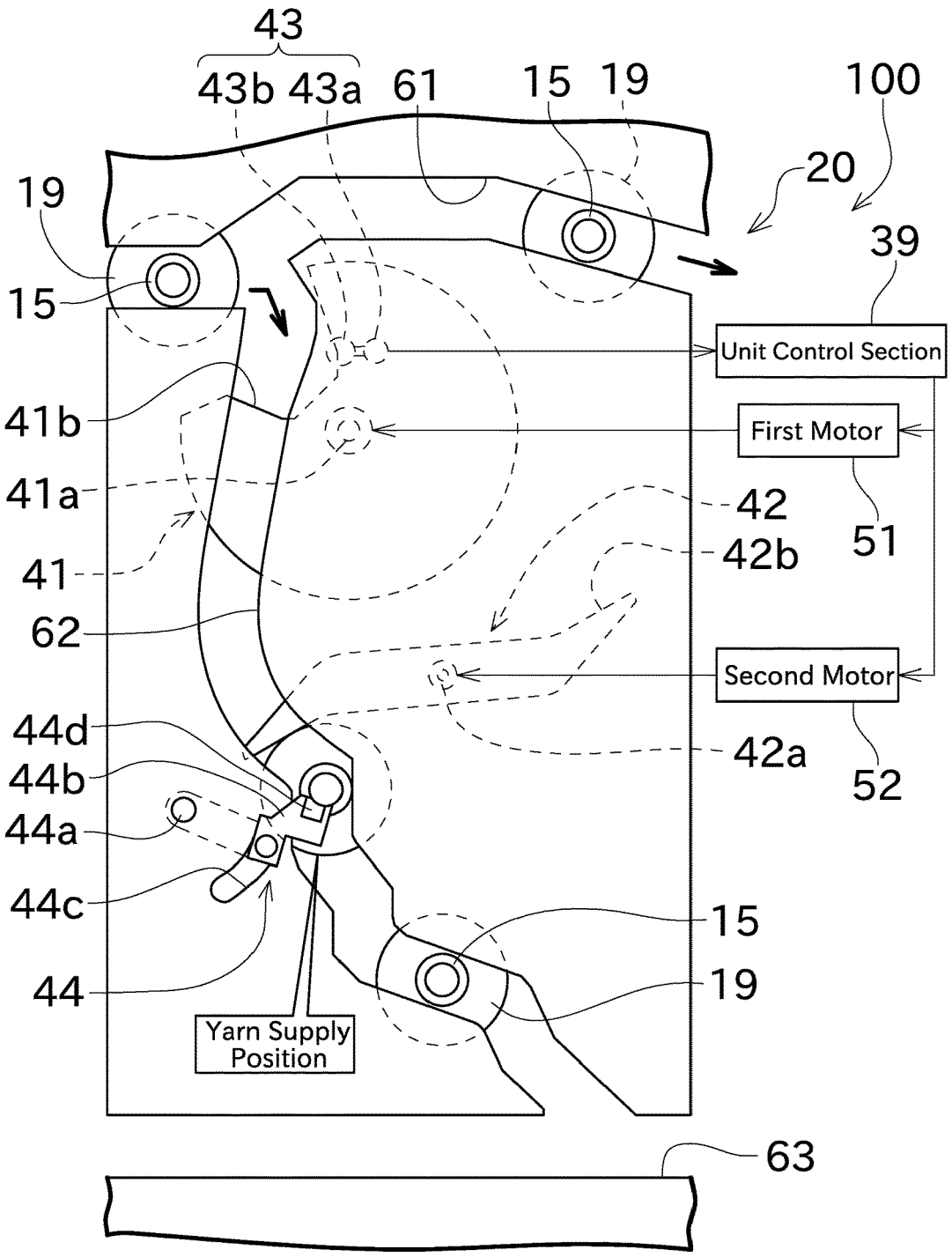
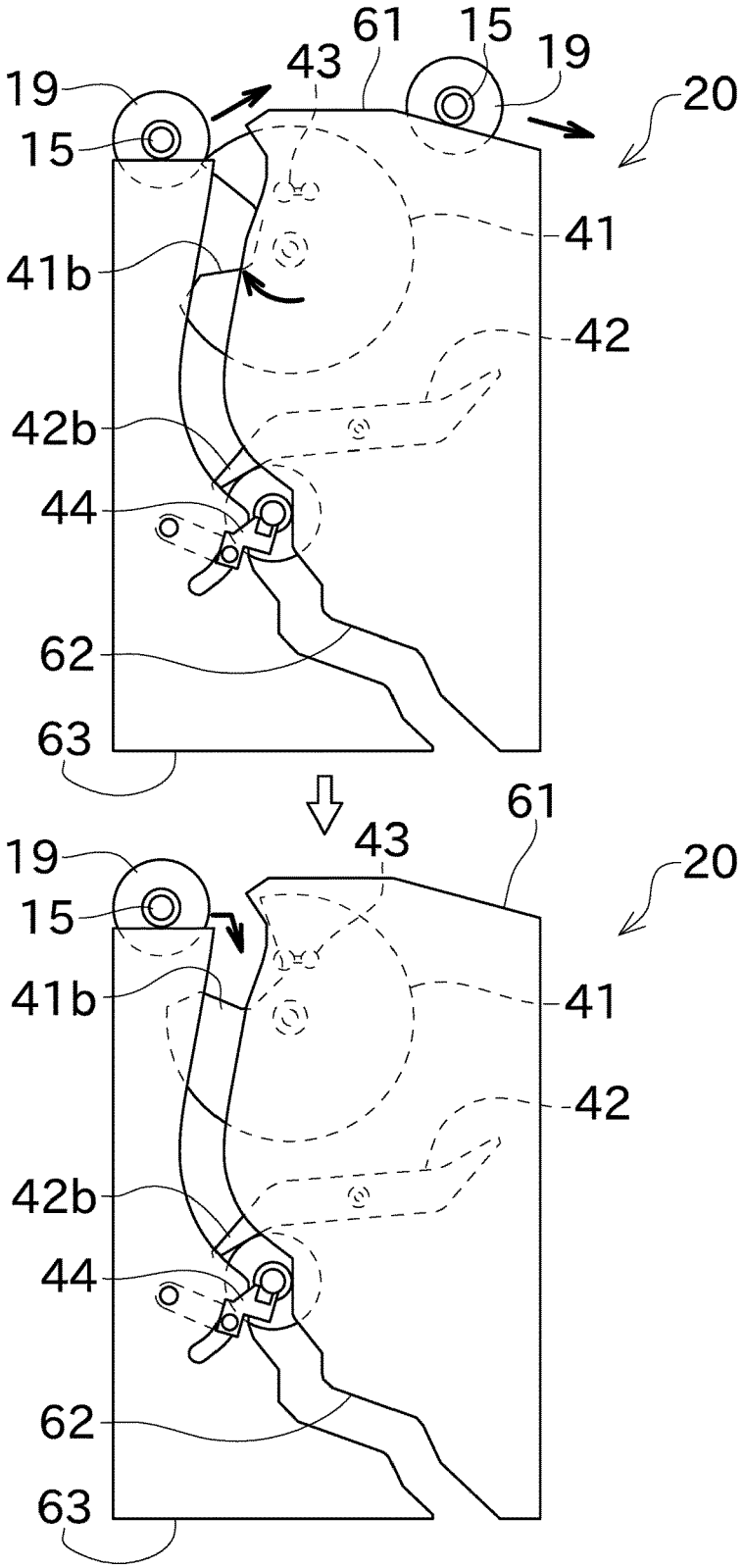

43
43b
43a
61
15
19
100
20
39
19
15
Unit Control Section
41b
First Motor
41a
42
42b
51
41
62
Second Motor
44d
42a
44b
52
44a
44c
15
44
19
Yarn Supply Position
63

FIG. 7


61
15
19
43
19
20
15
41
41b
42
42b
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62
63
61
43
19
20
15
41b
41
42
42b
44
62
63

FIG. 8

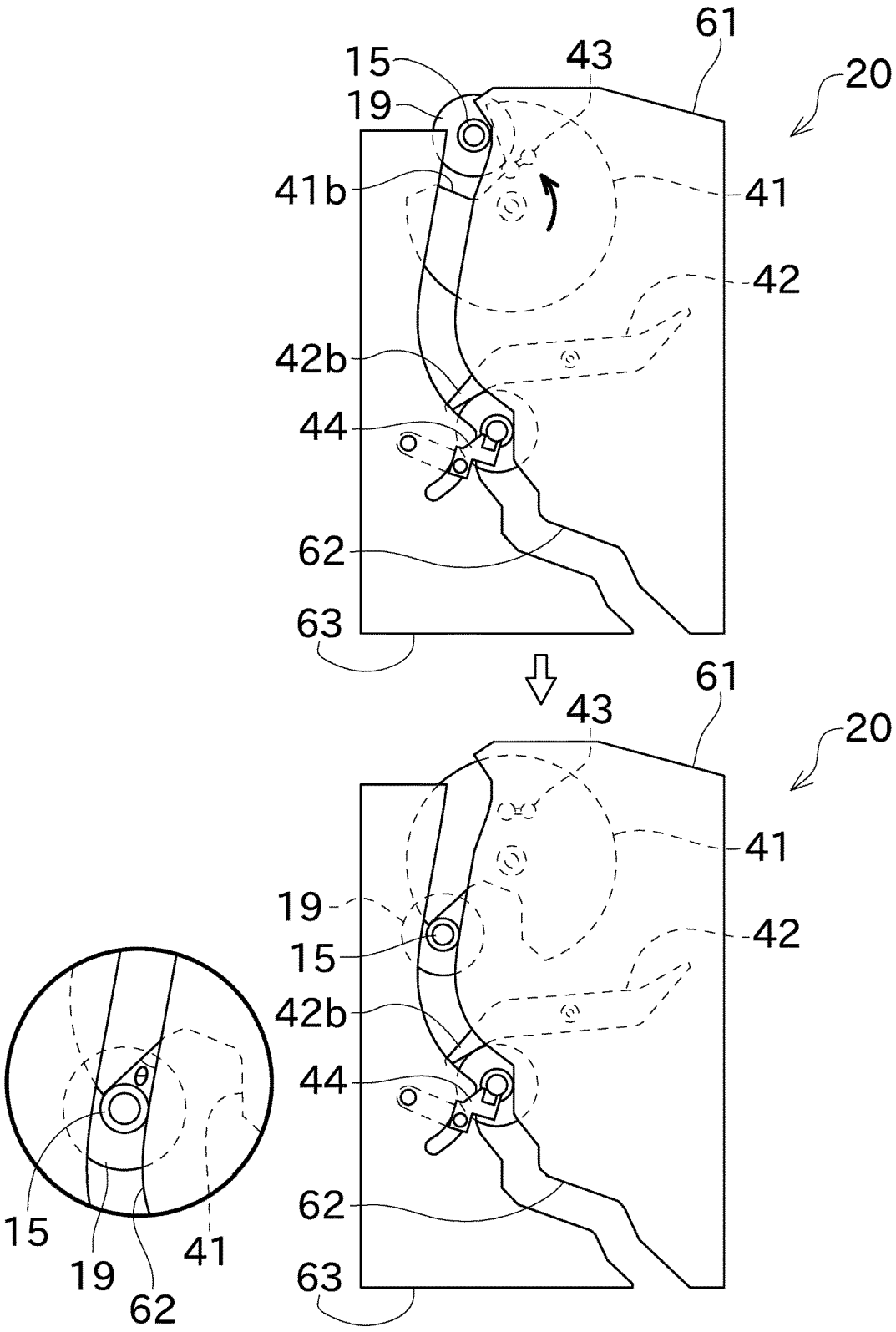

61
43
15
19
20
41b
41
42
42b
44
62
63
61
43
20
41
19
42
15
42b
44
62
63
θ
15
19
62
41

FIG. 9

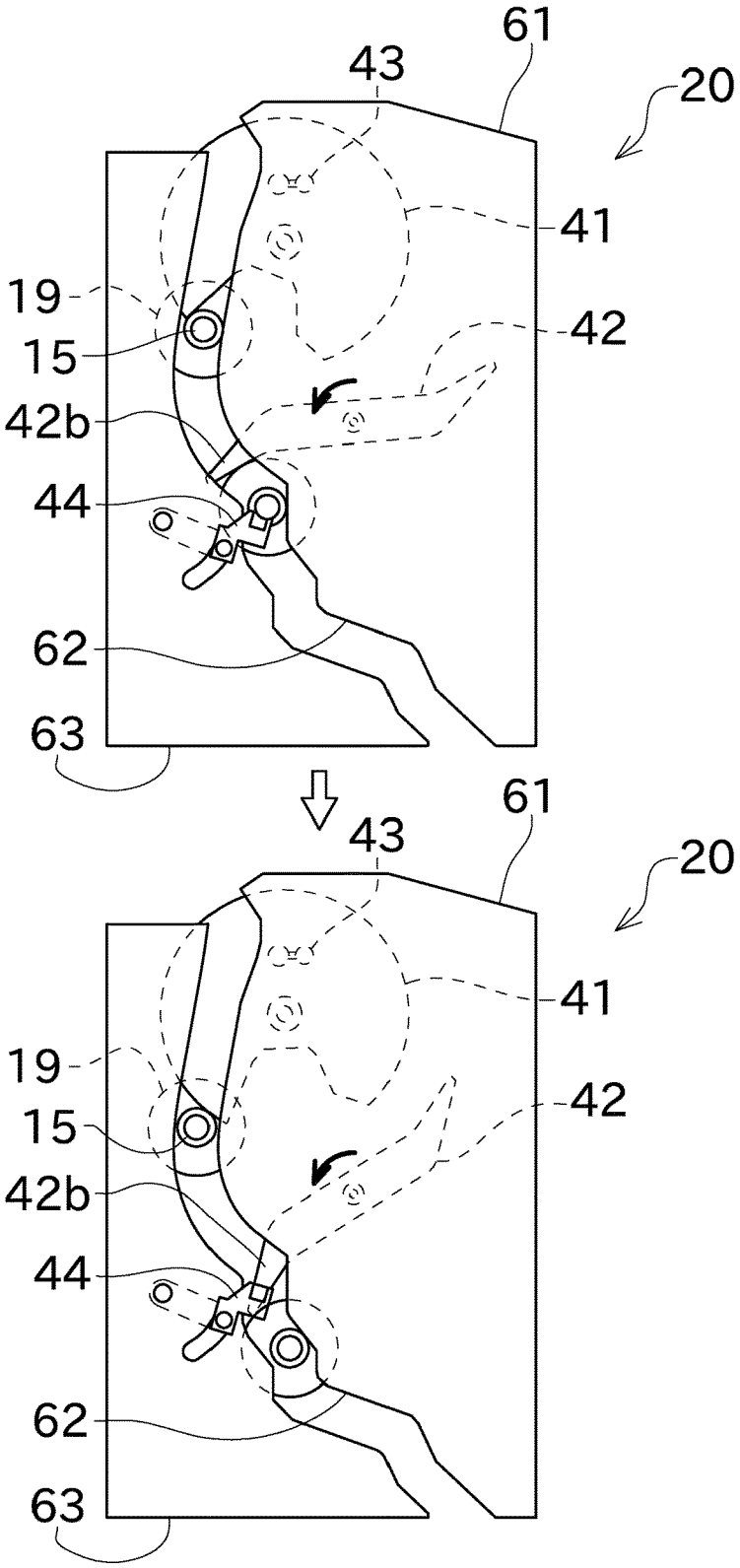


FIG. 10

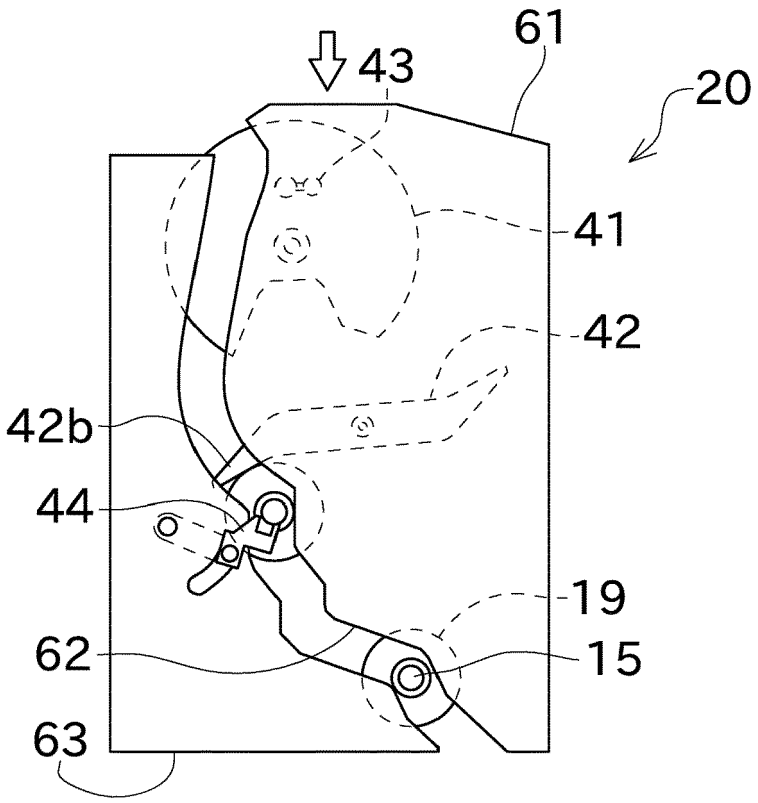


FIG. 11

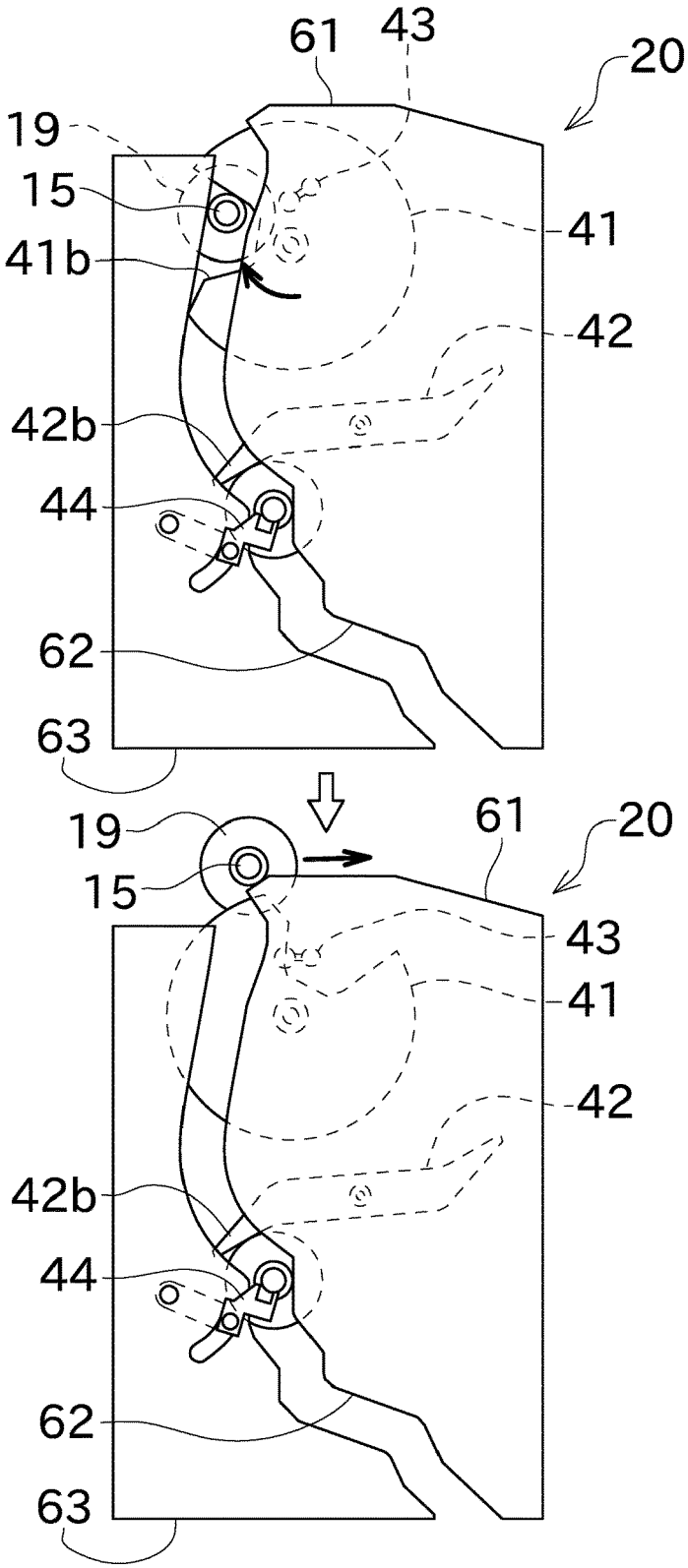


FIG. 12

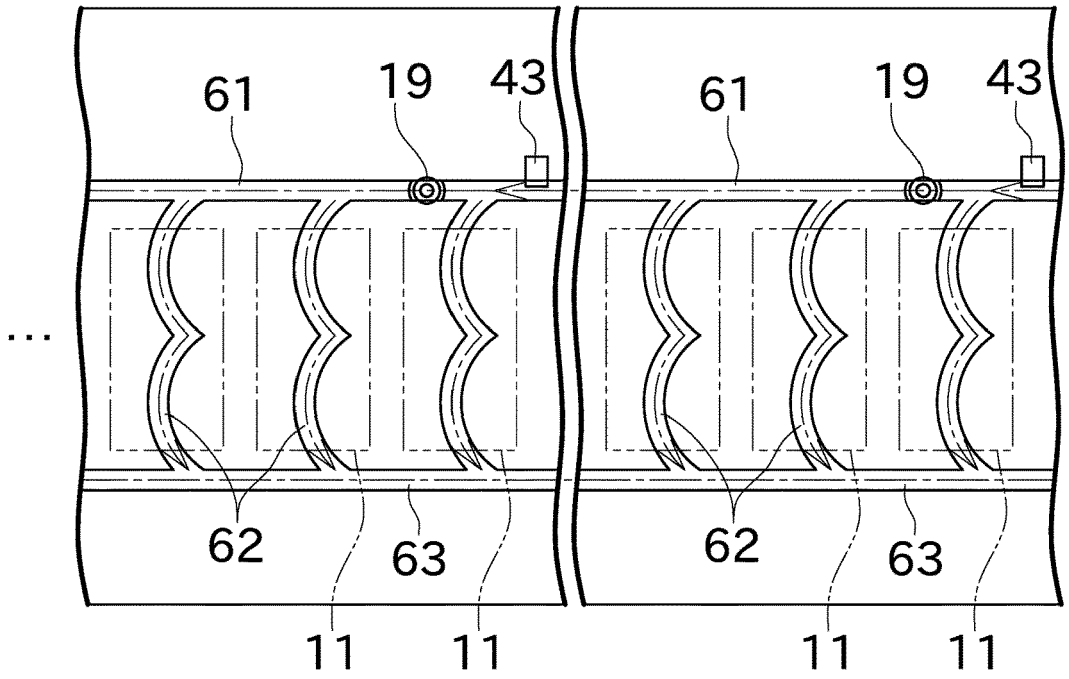


FIG. 13

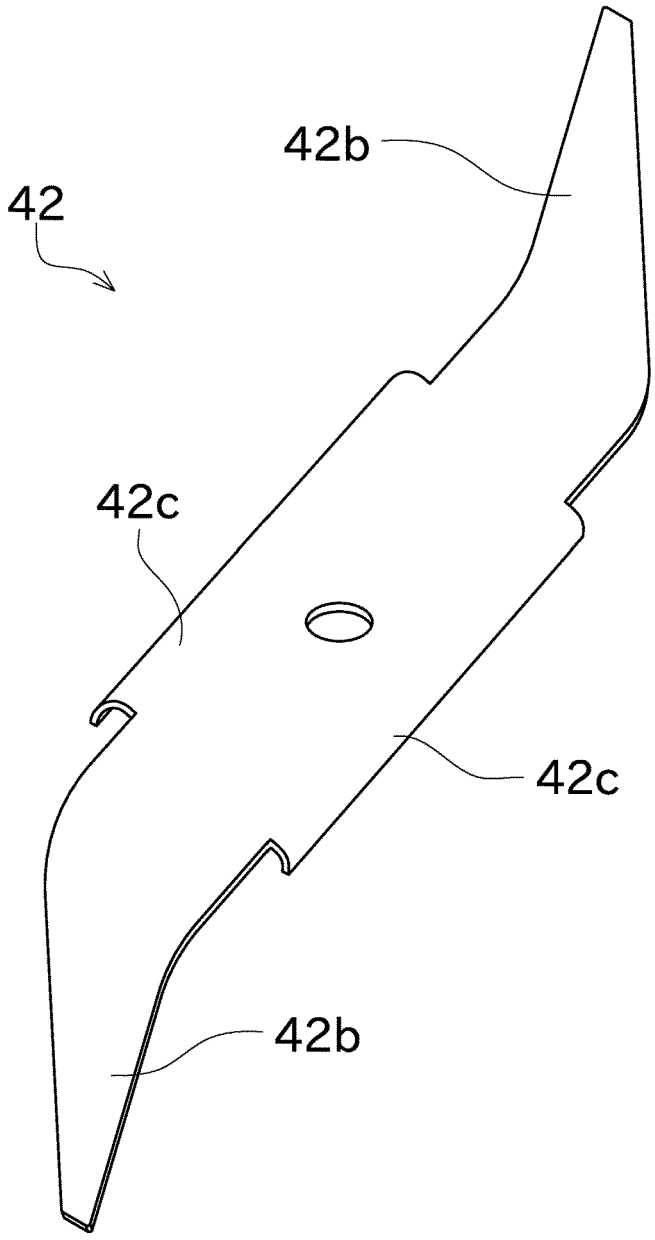


FIG. 14

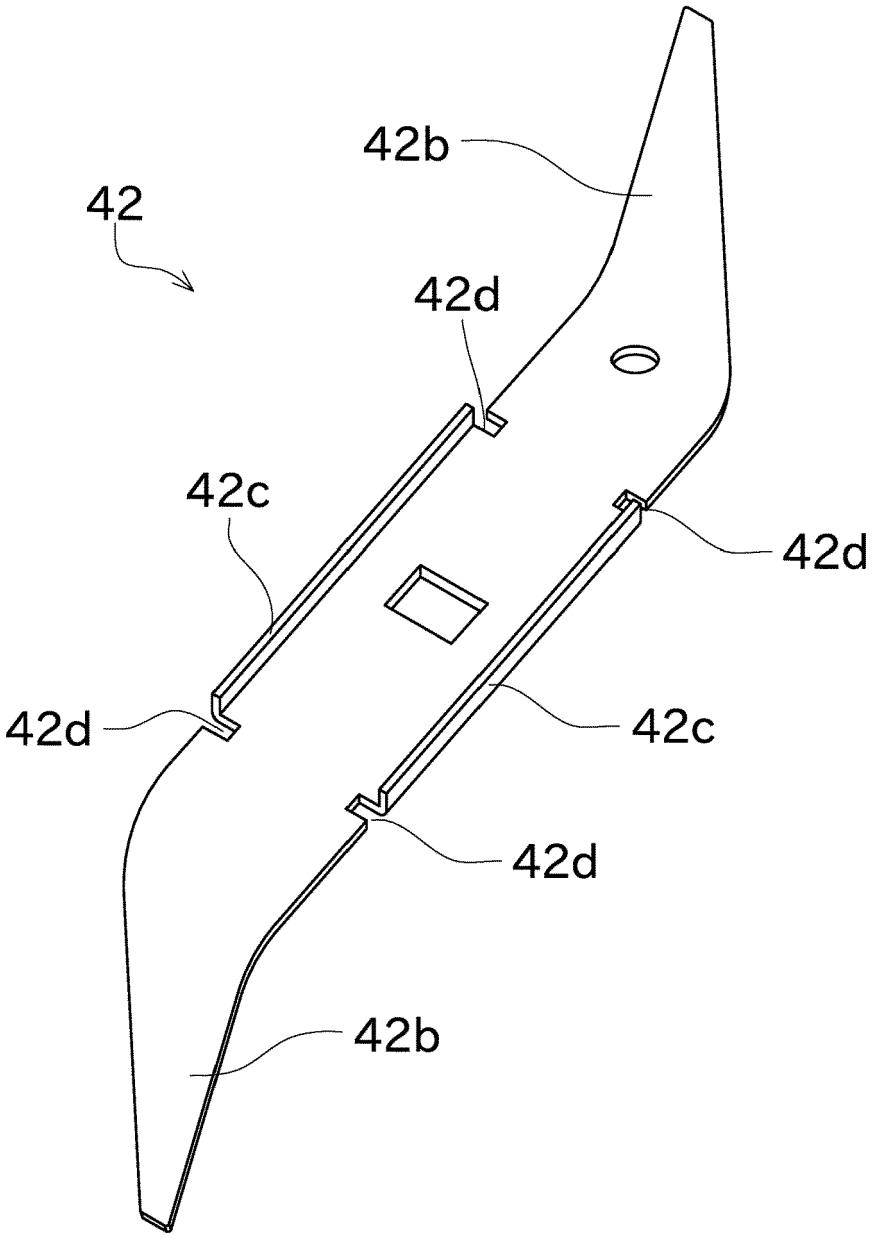
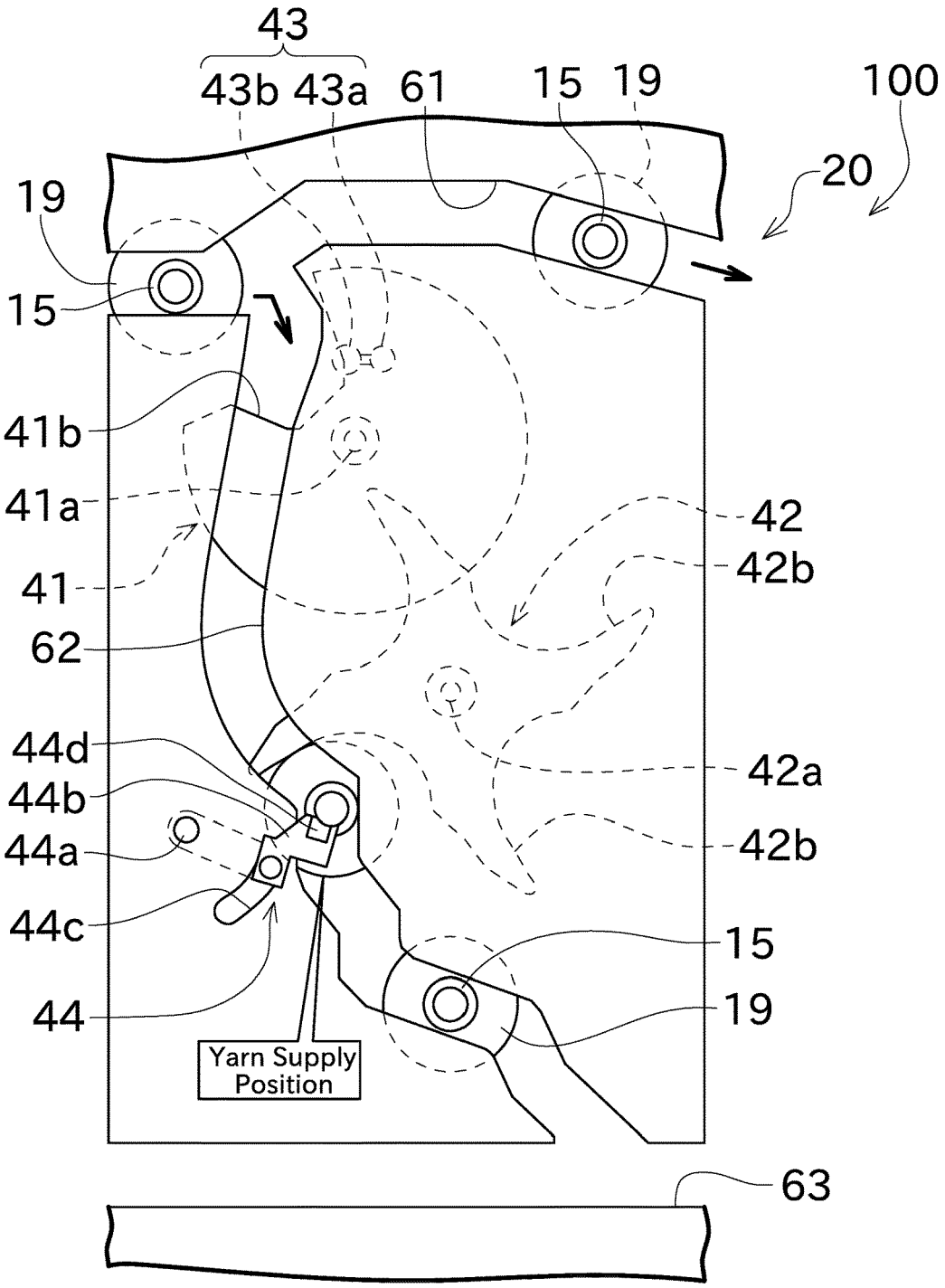


FIG. 15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43b
43a
61
15
19
100
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19
15
41b
41a
41
62
44d
44b
44a
44c
44
Yarn Supply Position
42
42b
42a
42b
15
19
63

FIG. 16

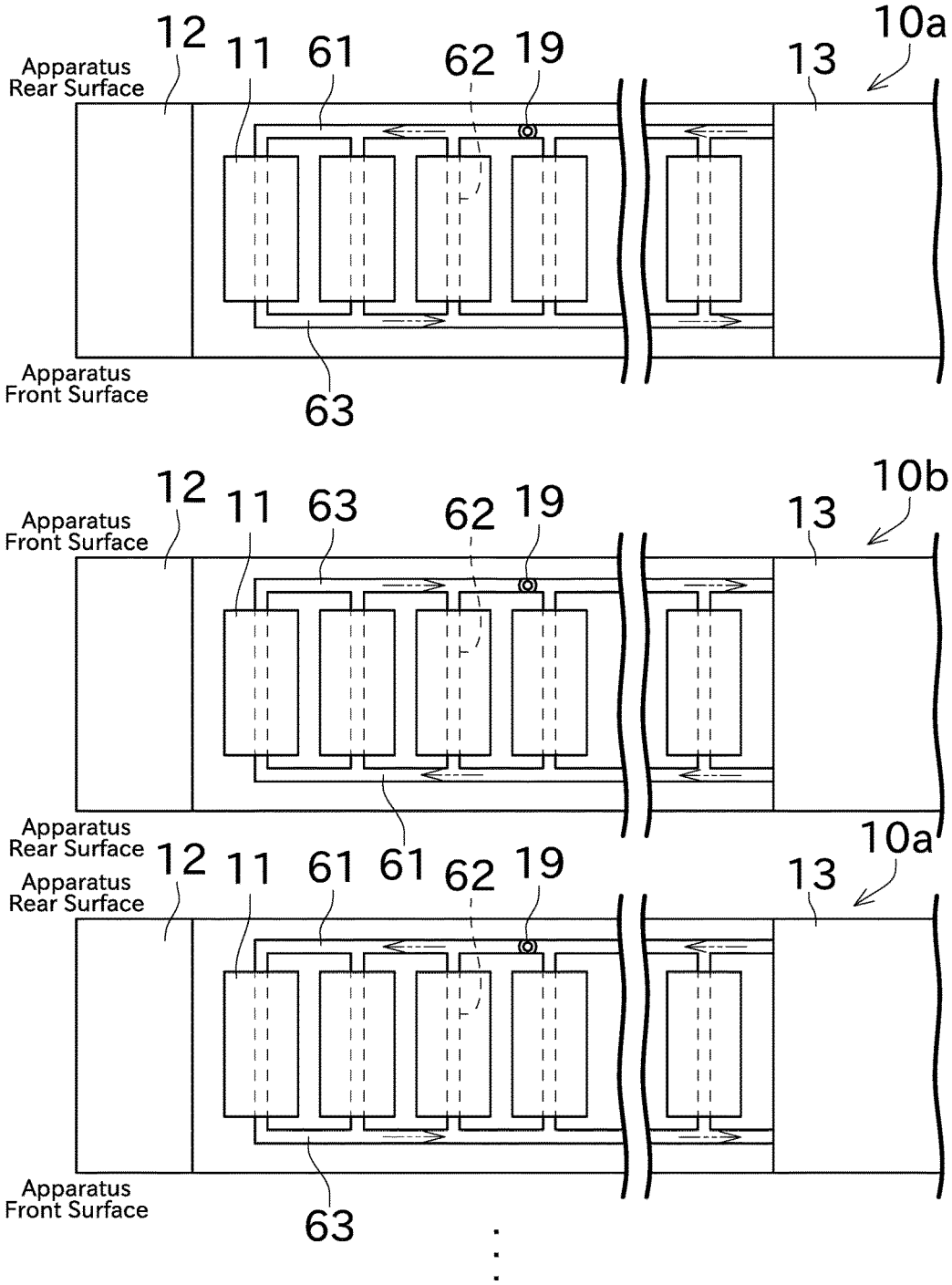
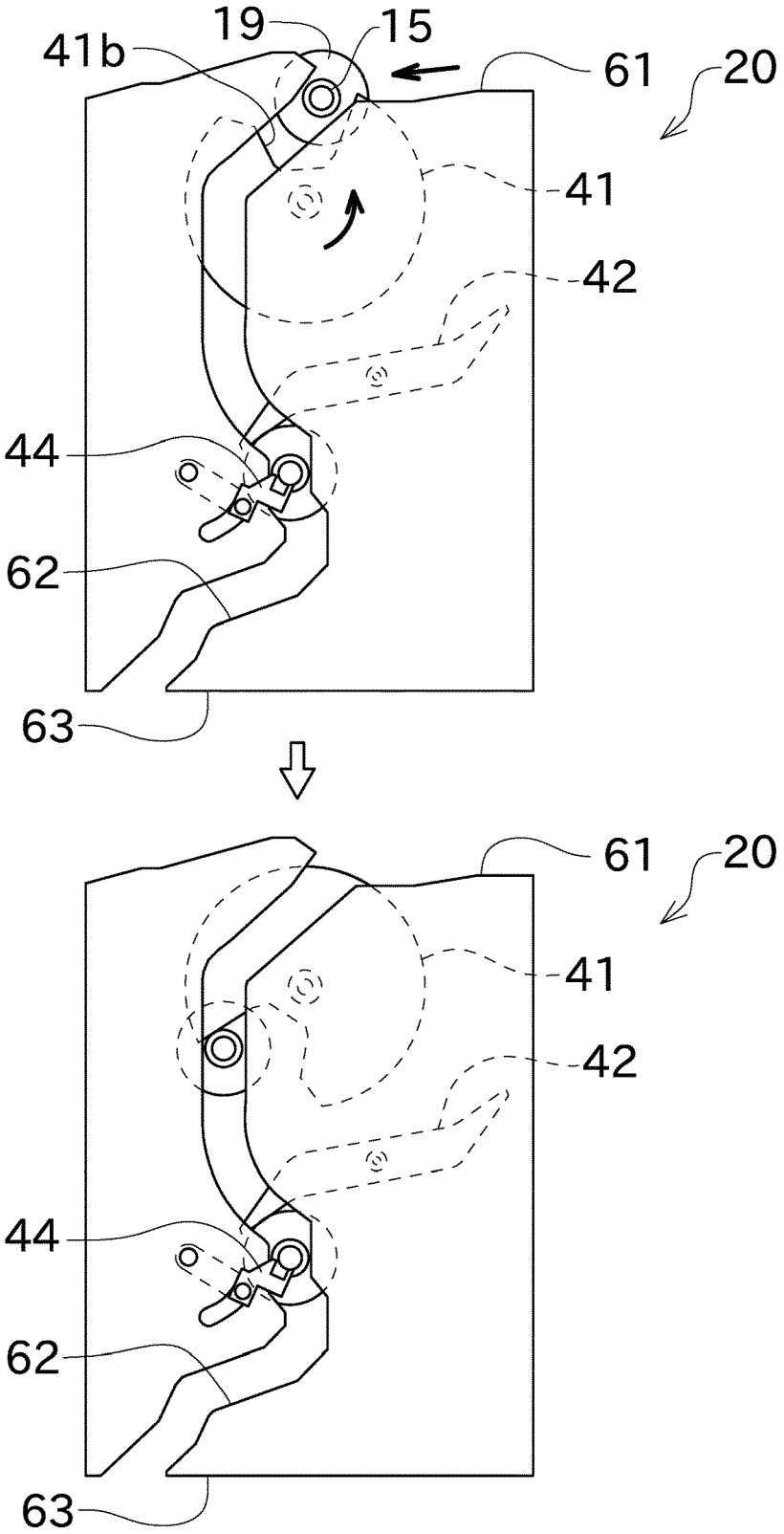

12
11
61
62
19
13
10a
Apparatus
Rear Surface
Apparatus
Front Surface
63
12
11
63
62
19
13
10b
Apparatus
Front Surface
Apparatus
Rear Surface
12
11
61
61
62
19
13
10a
Apparatus
Rear Surface
Apparatus
Front Surface
63

FIG. 17



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EUROPEAN SEARCH REPORT

Application Number
EP 23 21 5256

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	EP 4 015 429 A1 (SAVIO MACCH TESSILI SPA [IT]) 22 June 2022 (2022-06-22) * the whole document *	1-13	INV. B65H67/02 B65H67/06
A	EP 2 567 921 A2 (MURATA MACHINERY LTD [JP]) 13 March 2013 (2013-03-13) * paragraphs [0040] - [0052]; figures 6-8 *	1-13	
A	JP H01 313269 A (MURATA MACHINERY LTD) 18 December 1989 (1989-12-18) * the whole document *	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 April 2024	Pussemier, Bart

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19-04-2024

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- EP 4015429 A **[0002]**