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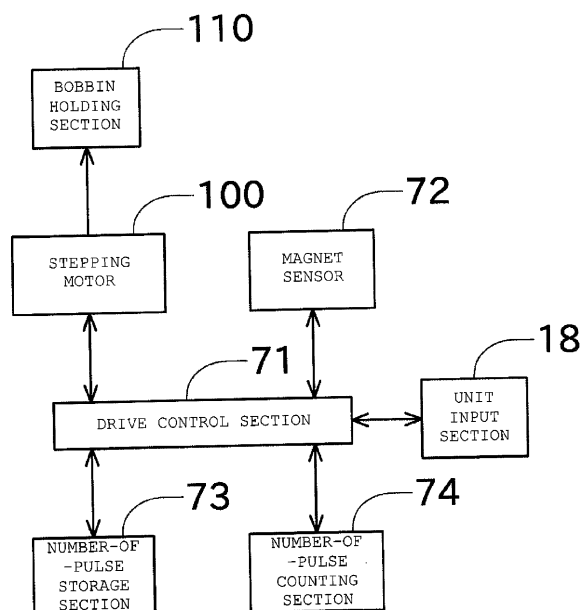
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(54) **Textile machine**

(57) An automatic winder (1) includes a bobbin holding section (54, 110), a stepping motor (100), a drive control section (71), a magnet sensor (72), and a number-of-pulse counting section (74). The bobbin holding section (54, 110) holds a yarn supplying bobbin (21). The drive control section (71) drives the stepping motor (100) by an amount corresponding to a specified command value (number of pulses) to move the bobbin holding sec-

tion (54, 110). The magnet sensor (72) specifies an origin position, which is the reference position of the bobbin holding section (54, 110). The number-of-pulse counting section (74) obtains the command value (number of pulses) necessary for moving the bobbin holding section (54, 110) from the origin position to a target position as an actual measurement command value.

FIG. 7



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a textile machine including a bobbin holding section for holding a yarn supplying bobbin.

2. Description of the Related Art

[0002] A textile machine that winds a yarn unwound from a yarn supplying bobbin around a winding bobbin to form a package is conventionally known. A satisfactory package can be formed by realizing an appropriate position relationship of the yarn supplying bobbin and a yarn guide arranged above the yarn supplying bobbin. Japanese Unexamined Patent Publication No. 2011-241032 discloses a yarn winding machine (textile machine) having a configuration of realizing an appropriate position relationship of the yarn supplying bobbin and the yarn guide (unwinding assisting device) by controlling the position (including posture) of the yarn supplying bobbin.

[0003] Japanese Unexamined Patent Publication No. 2011-241032 discloses a magazine type bobbin supplying device. The bobbin holding section includes a motor for moving the yarn supplying bobbin so as to raise the yarn supplied in an inclined manner. The yarn winding machine includes a sensor for detecting the yarn supplying bobbin to be raised. The yarn winding machine can stop the yarn supplying bobbin at an appropriate position by taking into consideration the detection results of the sensor.

BRIEF SUMMARY OF THE INVENTION

[0004] However, the textile machine that does not include this type of sensor cannot perform the positioning of the yarn supplying bobbin in the above manner. In this case, for example, the bobbin holding section, a supporting member therefor, and the like need to be accurately attached, and the yarn supplying bobbin needs to be accurately stopped using an origin sensor such as a motor for driving the bobbin holding section.

[0005] However, since this configuration requires the bobbin holding section and the like to be accurately attached, the cost required for the attachment increases. Furthermore, since various shapes and inner diameters of the yarn supplying bobbins are supplied to the yarn winding machine, different controls need to be performed according to the type of yarn supplying bobbin supplied. It is thus difficult to align the yarn supplying bobbin at an appropriate position.

[0006] In view of the foregoing, it is a main object of the present invention to provide a textile machine capable of aligning the yarn supplying bobbin at an appropriate position without a sensor for detecting the position of the

yarn supplying bobbin.

[0007] The problem to be solved by the present invention is as described above, and next, the means for solving such a problem and the effect thereof will be described below.

[0008] According to an aspect of the present invention, a textile machine having the following configuration is provided. In other words, the textile machine includes a bobbin holding section, a drive section, a drive control section, an origin sensor, and a command value measuring section. The bobbin holding section is adapted to hold a yarn supplying bobbin. The drive section is adapted to drive the bobbin holding section. The drive control section is adapted to send a command value to the drive section to control drive of the drive section. The origin sensor is adapted to specify an origin position, which is a reference position of the bobbin holding section. The command value measuring section is adapted to obtain the command value necessary for moving the bobbin holding section from the origin position to a target position as an actual measurement command value.

[0009] The difference between the origin position and the target position of the bobbin holding section thus can be obtained as the actual measurement value. With the use of the actual measurement command value, even in a textile machine that does not include a sensor for detecting the position of the yarn supplying bobbin, the position of the yarn supplying bobbin can be accurately aligned.

[0010] In the textile machine described above, preferably, when the yarn supplying bobbin is supplied, the drive control section controls the drive section to move the bobbin holding section to the origin position, and drives the drive section by an amount corresponding to the actual measurement command value from the origin position to move the bobbin holding section to the target position.

[0011] The bobbin holding section is thus moved to the origin position and then moved to the target position, so that the bobbin holding section can be moved to the target position regardless of the position of the bobbin holding section when the yarn supplying bobbin is supplied.

[0012] In the textile machine described above, a command value storage section adapted to store the actual measurement command value is preferably arranged.

[0013] Since a plurality of actual measurement command values are stored in accordance with the inner diameter of the yarn supplying bobbin, for example, even if the yarn supplying bobbin to unwind is changed, the winding of the yarn can be started without re-measuring the actual measurement command value.

[0014] The textile machine described above preferably has the following configuration. In other words, a plurality of winding units, each having the bobbin holding section is arranged. The command value measuring section obtains the actual measurement command value for every winding unit.

[0015] Since the actual measurement command value

differs for every winding unit, the yarn supplying bobbins of all winding units can be moved to an appropriate position by obtaining the actual measurement command value in the above manner.

[0016] The textile machine described above preferably has the following configuration. In other words, the textile machine includes a magazine type bobbin supplying device. The drive control section can adjust an angle at which the supplied yarn supplying bobbin is held by the bobbin holding section.

[0017] The unwinding of the yarn can be carried out with the supplied yarn supplying bobbin fixed at an appropriate angle.

[0018] The textile machine described above preferably has the following configuration. In other words, the textile machine includes a transport tray type bobbin supplying device. The drive control section enables the bobbin holding section to adjust a position of stopping a transport tray on which the yarn supplying bobbin is mounted.

[0019] The unwinding of the yarn can be carried out with the transport tray (yarn supplying bobbin) fixed at an appropriate position.

[0020] In the textile machine described above, the drive section is preferably a stepping motor.

[0021] Since the number of pulses can be used as the command value, the position control can be easily carried out.

[0022] The textile machine described above preferably has the following configuration. In other words, the command value is the number of pulses transmitted to drive the steppingmotor. The command value measuring section is a number-of-pulse counting section adapted to count the number of pulses.

[0023] Thus, the actual measurement command value can be obtained by simply counting the number of pulses, whereby the processing performed by the command value measuring section can be simplified.

[0024] In the textile machine described above, the origin sensor is preferably a magnet sensor.

[0025] Thus, the origin position of the bobbin holding section can be specified with an inexpensive and simple configuration.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a perspective view illustrating an overall configuration of an automatic winder according to one embodiment of the present invention;

FIG. 2 is a schematic side view of a winder unit;

FIG. 3 is a perspective view illustrating a configuration of a yarn supplying section;

FIG. 4 is a side view illustrating a state of a bobbin holding section and a power transmitting section when receiving the yarn supplying bobbin;

FIG. 5 is a side view illustrating a state of the bobbin holding section and the power transmitting section

when unwinding the yarn;

FIG. 6 is a side view illustrating a state of the bobbin holding section and the power transmitting section when discharging the yarn supplying bobbin;

FIG. 7 is a block diagram illustrating a configuration of a position adjustment control of the yarn supplying bobbin;

FIG. 8 is a flowchart illustrating the position adjustment control;

FIG. 9 is a schematic side view of a winder unit according to a variant;

FIG. 10 is a plan view of the yarn supplying section;

FIG. 11 is a plan view of the yarn supplying section at the time of discharging a transport tray; and

FIG. 12 is a plan view illustrating a state of a transport guide.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0027] Next, a description will be made of an embodiment of the present invention with reference to the drawings. First, an outline of an automatic winder 1 of the present embodiment will be described with reference to FIG. 1. FIG. 1 is an outer appearance perspective view of the automatic winder 1 according to one embodiment of the present invention. In the following description, a front side of a winder unit 4 is sometimes simply referred to as a "front side", and a rear side of the winder unit 4 is sometimes simply referred to as a "rear side".

[0028] The automatic winder (textile machine) 1 of the present embodiment includes a plurality of winder units (winding units) 4 arranged in line, and a machine control device 7 arranged at one end in a direction in which the plurality of winder units 4 are arranged in line.

[0029] The machine control device 7 is configured to be communicable with the plurality of winder units 4, so that the operations of the plurality of winder units 4 can be managed in a concentrated manner by the machine control device 7. The machine control device 7 includes a machine input section 8 for carrying out various settings (input of type of yarn supplying bobbin used in the winding operation of each winder unit 4, etc.) on each winder unit 4, and a machine display section 9 capable of displaying status, and the like of the winding operation of each winder unit 4.

[0030] Next, a description will be made on the winder unit 4 with reference to FIG. 2. FIG. 2 is a schematic side view of the winder unit 4. The winder unit 4 is a device that forms a package 29 by winding a yarn from the yarn supplying bobbin 21 around a winding bobbin 22. Hereinafter, each section of the winder unit 4 will be described below.

[0031] As illustrated in FIG. 1 and FIG. 2, a bobbin supplying device 60 for the operator to supply the yarn supplying bobbin 21 is arranged on the front side of the winder unit 4. The bobbin supplying device 60 includes a magazine holder 61 extending in an upward direction

in the front surface from the lower part of the winder unit 4, a magazine can 62 attached to a distal end of the magazine holder 61, and a yarn supplying bobbin guiding section 64 installed below the magazine can 62.

[0032] The magazine can 62 is formed with a plurality of accommodation holes arranged in a circular shape, where a yarn supplying bobbin 21 can be set in an inclined posture in each accommodation hole. The magazine can 62 is configured to be intermittently rotated driven by a motor (not illustrated). A predetermined yarn supplying bobbin 21 can be dropped to the obliquely downward side by the intermittent drive of the magazine can 62 and the opening/closing operation of a control valve (not illustrated) arranged in the magazine can 62.

[0033] The yarn supplying bobbin guiding section 64 is configured to obliquely slide the yarn supplying bobbin 21 dropped from the magazine can 62 to guide the yarn supplying bobbin 21 to a yarn supplying section 10. The details of the yarn supplying section 10 will be described later.

[0034] The yarn of the yarn supplying bobbin 21 set in the yarn supplying section 10 is wound by a winding section 16, and the like. As illustrated in FIG. 2, the winder unit 4 has, as main devices arranged on a yarn travelling path, an unwinding assisting device 12, a tension applying device 13, a yarn joining device 14, and a clearer (yarn quality measuring device) 15 arranged in order from the yarn supplying section 10 toward the package 29.

[0035] The unwinding assisting device 12 includes a regulating member 27 that makes contact with a portion (balloon) where the yarn 20 unwound from the yarn supplying bobbin 21 is swung by centrifugal force and expanded to the outer side. The unwinding assisting device 12 can lower the regulating member 27 so as to approach the yarn supplying bobbin 21. The yarn 20 is thus suppressed from being swung excessively, and the balloon can be maintained to a prescribed size. Therefore, the winder unit 4 can carry out the unwinding of the yarn 20 from the yarn supplying bobbin 21 at a prescribed tension.

[0036] In order for the unwinding assisting device 12 to appropriately carry out the unwinding assisting operation, the center of the yarn supplying bobbin 21 and the center of the regulating member 27 need to be satisfactorily coincided. With regards to this, a position adjustment control for adjusting the position of the yarn supplying bobbin 21 is carried out to satisfy such a demand in the present embodiment. The details of the position adjustment control will be described later.

[0037] The tension applying device 13 applies a predetermined tension on the travelling yarn 20. The tension applying device 13 of the present embodiment is configured as a gate type in which movable comb teeth are arranged with respect to fixed comb teeth. The comb teeth on the movable side are configured to be swingable by a rotary type solenoid so that the comb teeth can be in a meshed state or a released state.

[0038] A lower yarn detection sensor 31 is arranged

between the unwinding assisting device 12 and the tension applying device 13. The lower yarn detection sensor 31 is configured to detect whether or not the yarn is travelling at the arranged position.

[0039] The clearer 15 is configured to detect the yarn defect (yarn drawback) such as slub by monitoring the yarn thickness of the yarn 20. A cutter 39 for immediately cutting the yarn 20 when the clearer 15 detects the yarn defect is arranged on the upstream side (lower side) of the yarn path regarding the clearer 15.

[0040] The yarn joining device 14 joins the lower yarn from the yarn supplying bobbin 21 and the upper yarn from the package 29, after a yarn cut when the clearer 15 detects a yarn defect and the cutter 39 cuts the yarn, after yarn breakage of the yarn being unwound from the yarn supplying bobbin 21, or at the time of changing the yarn supplying bobbin 21. The yarn joining device 14 may be a type that uses a fluid such as compressed air, or may be a mechanical type.

[0041] A lower yarn guiding pipe 25 for catching and guiding the lower yarn from the yarn supplying bobbin 21 and an upper yarn guiding pipe 26 for catching and guiding the upper yarn from the package 29 are arranged on the lower side and the upper side of the yarn joining device 14. A suction port 32 is formed at the tip of the lower yarn guiding pipe 25, and a suction mouth 34 is arranged at the tip of the upper yarn guiding pipe 26. An appropriate negative pressure source is connected to each of the lower yarn guiding pipe 25 and the upper yarn guiding pipe 26 to cause the suction port 32 and the suction mouth 34 to generate a suction force.

[0042] When changing the yarn supplying bobbin in this configuration, the suction port 32 of the lower yarn guiding pipe 25 is swung to the lower side to suck and catch the lower yarn, and thereafter, swung to the upper side with a shaft 33 as a center to guide the lower yarn to the yarn joining device 14. At substantially the same time, the upper yarn guiding pipe 26 is swung to the upper side with a shaft 35 as the center from the position of FIG. 2 and reversely rotates the package 29 to catch the upper yarn unwound from the package 29 with the suction mouth 34. Then, the upper yarn guiding pipe 26 is swung to the lower side with the shaft 35 as the center to guide the upper yarn to the yarn joining device 14. The lower yarn and the upper yarn are then joined in the yarn joining device 14.

[0043] The winder unit 4 includes a unit input section 18 to which settings, and the like of the yarn supplying section 10, the winding section 16, or the like can be input. The unit input section 18 may be configured, for example, as a key or a button.

[0044] The winder unit 4 further includes a cradle 23 and a traverse drum 24 on a further downstream side of the clearer 15. The cradle 23 is configured such that the winding bobbin 22 can be attached. The traverse drum 24 traverses the yarn 20 and drives the winding bobbin 22 to wind the yarn 20.

[0045] With the above configuration, each winder unit

4 of the automatic winder 1 can wind the yarn 20 unwound from the yarn supplying bobbin 21 around the winding bobbin 22 to form the package 29 having a predetermined length.

[0046] Next, a description will be made on the yarn supplying section 10 with reference to FIG. 3 to FIG. 7. FIG. 3 is a perspective view illustrating a configuration of the yarn supplying section 10. FIG. 4 to FIG. 6 are side views each illustrating configurations of the bobbin holding section 110 and the power transmitting section 120. FIG. 7 is a block diagram illustrating a configuration for performing the control of the bobbin holding section 110.

[0047] As illustrated in FIG. 3, the yarn supplying section 10 includes the bobbin holding section 110 for holding the supplied yarn supplying bobbin 21, a springboard 40 for discharging the yarn supplying bobbin 21 (core tube 21a) in which the unwinding of the yarn 20 is completed, and a stepping motor 100 for operating the bobbin holding section 110 and the springboard 40. As illustrated in FIG. 7, the drive of the stepping motor 100 is controlled by a drive control section 71.

[0048] The bobbin holding section 110 can oscillate as illustrated in FIG. 4 to FIG. 6 to change the position of the unwinding end of the yarn supplying bobbin 21. The bobbin holding section 110 is configured by a main axis member 80 and an auxiliary main axis member 90. The main axis member 80 and the auxiliary main axis member 90 are in a closed state when the yarn supplying bobbin 21 is supplied so as to enter the interior of the core tube 21a, as illustrated in FIG. 4. The auxiliary main axis member 90 oscillates in the direction of moving away from the main axis member 80 in this state to hold the yarn supplying bobbin 21 (see FIG. 5). Moreover, by oscillating the springboard 40 with the holding of the yarn supplying bobbin 21 by the bobbin holding section 110 released, the bottom of the core tube 21a is pushed out and pulled out from the main axis member 80 and the auxiliary main axis member 90, so that the empty core tube 21a of the yarn supplying bobbin 21 can be discharged (see FIG. 6).

[0049] Next, a description will be made on a power transmitting section 120 for transmitting power generated by the stepping motor 100. The power transmitting section 120 includes a main axis member drive cam 81, a bearing 82, an oscillation arm 83, a positioning arm 84a, a contact arm 84b, a transmission shaft 85, and a pushing spring 86, as a configuration for oscillating the main axis member 80. The power transmitting section 120 includes a transmission belt 103, a pulley 104, and a cam shaft 105 as a configuration for transmitting the power of the stepping motor 100 to the main axis member drive cam 81 and the like.

[0050] The pulley 104 is fixed to the cam shaft 105, and the pulley 104 is coupled to the output shaft of the stepping motor 100 through the transmission belt 103. The transmission belt 103 is simply drawn in FIG. 3, but is configured as a timing belt with teeth, and the rotation of the output shaft of the stepping motor 100 can be transmitted to the cam shaft 105 without sliding.

[0051] A magnet sensor 72 (see the block diagram of FIG. 7) is attached to the pulley 104. The magnet sensor 72 is configured to transmit a detection signal when the pulley 104 or the cam shaft 105 is at a predetermined rotation phase. The rotation position of the stepping motor 100 when the magnet sensor 72 transmits the detection signal is assumed as an origin, and the rotation control of the stepping motor 100 is carried out with such an origin as the reference. The position of the bobbin holding section 110 when the stepping motor 100 is at the origin is referred to as an origin position. In the present embodiment, the position where the yarn supplying bobbin 21 is held by the auxiliary main axis member 90 and the main axis member 80 (position of the bobbin holding section 110 of FIG. 5) is set as the origin position. The origin position is specified by the detection signal of the magnet sensor 72, as described above.

[0052] The main axis member drive cam 81 is fixed to the cam shaft 105 and integrally rotates with the cam shaft 105. The oscillation arm 83 is arranged on the rear side of the auxiliary main axis member drive cam 81, and the rotatable bearing 82 is attached to the middle part of the oscillation arm 83. The bearing 82 is configured to appropriately rotate while making contact with the outer peripheral surface of the main axis member drive cam 81.

[0053] The distal end of the oscillation arm 83 is coupled, through a rod shaped link, to the lower end of the positioning arm 84a supported in an oscillating manner at the appropriate position of the power transmitting section 120. A rotatable rotation member 87 is supported at the upper end of the positioning arm 84a.

[0054] The contact arm 84b is arranged on the front side of the positioning arm 84a. The distal end of the contact arm 84b is configured so as to be able to make contact with the rotation member 87 attached to the positioning arm 84a. One end of the transmission shaft 85 is fixed to the base of the contact arm 84b, and the other end of the transmission shaft 85 is fixed to the main axis member 80. That is, the transmission shaft 85 and the main axis member 80 are configured to cooperatively operate. Therefore, the main axis member 80 integrally rotates with the contact arm 84b. The torsion coil spring shaped pushing spring 86 is attached to the contact arm 84b to bias the contact arm 84b in the direction of the arrow in FIG. 3.

[0055] According to the above configuration, the elastic force of the pushing spring 86 acts on the contact arm 84b, so that a projection thereof makes contact with the rotation member 87 thus pushing the positioning arm 84a. Furthermore, since the lower end of the positioning arm 84a pulls the oscillation arm 83 through the link, the bearing 82 of the oscillation arm 83 is pushed against the main axis member drive cam 81. Accordingly, the pushing spring 86 generates a spring force for bringing the main axis member drive cam 81 and the bearing 82 into contact, and for bringing the contact arm 84b into contact with the positioning arm 84a.

[0056] When the main axis member drive cam 81 ro-

tates in such a state and the peripheral edge of the main axis member drive cam 81 (bulged portion to be described later) pushes the bearing 82, the oscillation arm 83 is swung in the direction of moving away from the cam shaft 105, and the distal end of the oscillation arm 83 pulls the lower end of the positioning arm 84a through the link. As a result, the rotation member 87 at the upper end of the positioning arm 84a pushes the contact arm 84b, so that the main axis member 80 can be oscillated toward the front side along with the contact arm 84b.

[0057] The power transmitting section 120 includes an auxiliary main axis member drive cam 91, a bearing 92, an oscillation arm 93, a transmission arm 94, a transmission shaft 95, and a holding spring 96 as a configuration for transmitting the power of the stepping motor 100 to the auxiliary main axis member 90.

[0058] The auxiliary main axis member drive cam 91 is fixed to the cam shaft 105, similarly to the main axis member drive cam 81. The oscillation arm 93 is arranged on the rear side of the auxiliary main axis member drive cam 91, and the rotatable bearing 92 is attached to the middle part of the oscillation arm 93. The bearing 92 is configured to appropriately rotate while making contact with the outer peripheral surface of the auxiliary main axis member drive cam 91.

[0059] The distal end of the oscillation arm 93 is coupled to the lower end of the transmission arm 94 supported in an oscillating manner at the appropriate position of the power transmitting section 120 through a rod shaped link. One end of the transmission shaft 95 is attached to the base of the transmission arm 94, and the other end of the transmission shaft 95 is fixed to the auxiliary main axis member 90. That is, the transmission shaft 95 and the auxiliary main axis member 90 are configured to cooperatively operate. Therefore, the auxiliary main axis member 90 integrally rotates with the transmission arm 94. The torsion coil spring shaped holding spring 96 is attached to the transmission arm 94 to bias the transmission arm 94 in the direction of the dotted line arrow of FIG. 3.

[0060] With such a configuration, the holding spring 96 acts with the spring force in the direction, in which the auxiliary main axis member 90 oscillates toward the rear side (direction of moving away from the main axis member 80) on the auxiliary main axis member 90 through the transmission arm 94 and the transmission shaft 95. At the same time, since the distal end of the transmission arm 94, on which the elastic force of the holding spring 96 acts, pulls the oscillation arm 93 through the link, the bearing 92 of the oscillation arm 93 is pushed against the auxiliary main axis member drive cam 91. Accordingly, the holding spring 96 generates the spring force for bringing the auxiliary main axis member drive cam 91 and the bearing 92 into contact.

[0061] When the auxiliary main axis member drive cam 91 rotates in this state and the peripheral edge of the auxiliary main axis member drive cam 91 (bulged portion to be described later) pushes the bearing 92, the oscil-

lation arm 93 is oscillated in the direction of moving away from the cam shaft 105 and the distal end of the oscillation arm 93 pulls the lower end of the transmission arm 94 through the link. As a result, the auxiliary main axis member 90 is oscillated toward the front side (direction of moving closer to the main axis member 80).

[0062] When the auxiliary main axis member 90 is oscillated toward the front side exceeding a predetermined angle, the auxiliary main axis member 90 makes contact with the portion (not illustrated) of the main axis member 80, and thereafter, the auxiliary main axis member 90 is integrally oscillated so as to push the main axis member 80 (in this case, the distal end of the contact arm 84b and the rotation member 87 are appropriately spaced apart). In other words, when the auxiliary main axis member 90 is oscillated toward the front side exceeding a predetermined angle, the main axis member 80 is driven by the auxiliary main axis member drive cam 91 rather than by the main axis member drive cam 81.

[0063] Next, a description will be made on the configuration for driving the springboard 40. The power transmitting section 120 includes a springboard drive cam 41, a bearing 42, an oscillation arm 43, a transmission arm 44, a transmission shaft 45, and a return spring 46 as a configuration for transmitting the power of the stepping motor 100 to the springboard 40.

[0064] The springboard drive cam 41 is fixed to the cam shaft 105, similarly to the auxiliary main axis member drive cam 91 and the main axis member drive cam 81. The oscillation arm 43 is arranged on the rear side of the springboard drive cam 41, and the rotatable bearing 42 is attached to the middle part of the oscillation arm 43. The bearing 42 is configured to appropriately rotate while making contact with the outer peripheral surface of the springboard drive cam 41.

[0065] The distal end of the oscillation arm 43 is coupled, through a rod shaped link, to the lower end of the transmission arm 44 supported in an oscillating manner at the appropriate position of the power transmitting section 120. One end of the transmission shaft 45 is attached to the base of the transmission arm 44, and the other end of the transmission shaft 45 is fixed to the springboard 40. That is, the transmission shaft 45 and the springboard 40 are configured to cooperatively operate. Therefore, the springboard 40 integrally rotates with the transmission arm 44. The torsion coil spring shaped return spring 46 is attached to the transmission arm 44 to bias the transmission arm 44 in the direction of the arrow of FIG. 3.

[0066] With such a configuration, since the distal end of the transmission arm 44, on which the elastic force of the return spring 46 acts, pulls the oscillation arm 43 through the link, the bearing 42 of the oscillation arm 43 is pushed against the springboard drive cam 41. Therefore, the return spring 46 generates the spring force for bringing the springboard drive cam 41 and the bearing 42 into contact.

[0067] When the springboard drive cam 41 rotates in this state and the peripheral edge of the springboard drive

cam 41 (bulged portion to be described later) pushes the bearing 42, the oscillation arm 43 is moved in the direction of moving away from the cam shaft 105 and the distal end of the oscillation arm 43 pulls the lower end of the transmission arm 44 through the link. As a result, the springboard 40 is flipped up toward the front side (see FIG. 6).

[0068] Next, a description will be made on the configuration in which the winder unit 4 receives the yarn supplying bobbin 21, holds the yarn supplying bobbin 21 at the predetermined position where the yarn 20 of the yarn supplying bobbin 21 is unwound, and discharges the empty core tube 21a of the yarn supplying bobbin 21. As described above, in the present embodiment, the springboard drive cam 41, the main axis member drive cam 81, and the auxiliary main axis member drive cam 91 are configured as a cam coupling mechanism 130 fixed to the common cam shaft 105, where three cams 41, 81, 91 are integrally driven. Furthermore, the three cams 41, 81, 91 each include a bulged portion, where the position of the springboard 40, the main axis member 80, and the auxiliary main axis member 90 can be changed by such a bulged portion. Thus, in the present embodiment, the yarn supplying bobbin 21 can be received, the yarn supplying bobbin 21 can be held, and the yarn supplying bobbin 21 can be discharged by simply driving the stepping motor 100 with the drive control section 71, as illustrated in FIG. 4 to FIG. 6.

[0069] Next, a description will be made on the position adjustment control of the yarn supplying bobbin 21 with reference to FIG. 7 and FIG. 8. FIG. 8 is a flowchart illustrating processing carried out in the position adjustment control.

[0070] The position adjustment control can be divided into the processing carried out before winding the yarn 20, and the processing carried out during the winding of the yarn 20. Such processing will be hereinafter described along the flowchart, but the processing illustrated in the flowchart is merely an example, and the content and the order of processing may be changed.

[0071] Hereinafter, a description will be made on the processing carried out before the winding of the yarn 20. First, the operator operates the unit input section 18 to give an instruction to shift to the position adjustment mode. The winder unit 4 shifts to the position adjustment mode upon receiving such instruction (S101).

[0072] The operator then sets the yarn supplying bobbin 21 (or the core tube 21a) in the bobbin holding section 110. The operator then operates the unit input section 18 to adjust the position of the bobbin holding section 110. Specifically, when receiving an instruction to swing the bobbin holding section 110 toward the rear side (or the front side), the drive control section 71 transmits a pulse to the stepping motor 100 in accordance with the received instruction. The stepping motor 100 is thereby driven, and the position (angle, posture) of the bobbin holding section 110 (i.e., yarn supplying bobbin 21) can be changed (S102).

[0073] The operator adjusts the position of the yarn supplying bobbin 21 in the manner to coincide the center of the yarn supplying bobbin 21 and the center of the regulating member 27. When the operator determines that the centers are coincided, the operator pushes the decision key (confirm key) of the unit input section 18. The position of the bobbin holding section 110 aligned in the manner is hereinafter referred to as a target position. The drive control section 71 accepts the confirmation of the target position when the decision key is pushed (S103).

[0074] The drive control section 71 then drives the stepping motor 100 to move the bobbin holding section 110 from the target position to the origin position (S104). In this case, a number-of-pulse counting section 74 (FIG. 7) of the winder unit 4 counts the number of pulses necessary for the bobbin holding section 110 to move from the target position to the origin position (S104).

[0075] The drive control section 71 stores the number of pulses (actual measurement command value) counted by the number-of-pulse counting section 74 in a number-of-pulse storage section 73 (command value storage section, see FIG. 7) of the winder unit 4 (S105). In this case, the number-of-pulse counting section 74 stores the number of pulses and the type of yarn supplying bobbin 21 held by the bobbin holding section 110 in correspondence with each other. This is because the target position changes according to the inner diameter of the yarn supplying bobbin 21, and the like. Therefore, when using a plurality of yarn supplying bobbins 21 having different inner diameters, for example, the processing indicated in S102 to S105 is preferably carried out for every yarn supplying bobbin 21.

[0076] After carrying out the processing indicated in S102 to S105 for the necessary yarn supplying bobbin 21, the operator operates the unit input section 18 to instruct the termination of the position adjustment mode. The drive control section 71 terminates the position adjustment mode upon receiving the instruction of the operator (S106).

[0077] The origin position of the bobbin holding section 110 is defined by the magnet sensor 72, but since a shift sometimes occurs in the attachment position of the power transmitting section 120, the magnet sensor 72 and the like, the origin position may differ slightly for every winder unit 4. Therefore, the processing described above is preferably carried out for every winder unit 4.

[0078] Next, a description will be made on the processing carried out by the drive control section 71 during the winding of the yarn 20 based on the number of pulses stored in the number-of-pulse storage section 73.

[0079] When the yarn supplying bobbin 21 is supplied to the yarn supplying section 10 during the winding of the yarn 20, the drive control section 71 detects the supply of the yarn supplying bobbin 21 with signals from a sensor (not illustrated), the unit control section of the winder unit 4, and the like (S201).

[0080] When detecting the supply of the yarn supplying

bobbin 21, the drive control section 71 rotates the stepping motor 100 to the origin based on a detection signal from the magnet sensor 72. The bobbin holding section 110 is thereby moved to the origin position specified by the magnet sensor 72 (S202).

[0081] The drive control section 71 can also grasp the type of yarn supplying bobbin 21 currently being used based on the signals transmitted from the machine control device 7, and the like. The drive control section 71 reads out the number of pulses (actual measurement command value) corresponding to the yarn supplying bobbin 21 currently being used based on the type of yarn supplying bobbin 21 currently being used, and the storage content of the number-of-pulse storage section 73. The drive control section 71 then transmits the pulse to the stepping motor 100 by the read number of pulses to rotate the stepping motor 100. The bobbin holding section 110 then can be moved to the target position obtained above (S203).

[0082] According to the processing described above, even in the winder unit 4 that does not include a sensor for detecting the position of the yarn supplying bobbin 21, the yarn supplying bobbin 21 can be moved to an appropriate position. Furthermore, the drive control section 71 of the present embodiment has a configuration of automatically switching the number of pulses according to the type of yarn supplying bobbin 21 currently being used, so that the trouble of the user to select the number of pulses can be omitted.

[0083] As described above, the automatic winder 1 of the present embodiment includes the bobbin holding section 110, the stepping motor 100, the drive control section 71, the magnet sensor 72, and the number-of-pulse counting section 74. The bobbin holding section 110 holds the yarn supplying bobbin 21. The stepping motor 100 drives the bobbin holding section 110. The drive control section 71 sends the command value (number of pulses) to the stepping motor 100 to control the drive of the stepping motor 100. The magnet sensor 72 specifies the origin position, which is the reference position of the bobbin holding section 110. The number-of-pulse counting section 74 obtains the command value (number of pulses) necessary for moving the bobbin holding section 110 from the origin position to the target position as the actual measurement command value.

[0084] The difference between the origin position and the target position of the bobbin holding section 110 thus can be obtained as the actual measurement command value. With the use of the actual measurement command value, the position of the yarn supplying bobbin 21 can be accurately aligned even in a textile machine that does not include a sensor for detecting the position or the posture of the yarn supplying bobbin 21.

[0085] Furthermore, in the automatic winder 1 of the present embodiment, when the yarn supplying bobbin 21 is supplied, the drive control section 71 drives the stepping motor 100 to move the bobbin holding section 110 to the origin position, and drives the stepping motor 100

by an amount corresponding to the actual measurement command value from the origin position to move the bobbin holding section 110 to the target position.

[0086] The bobbin holding section 110 is thus moved to the origin position and then moved to the target position, so that the bobbin holding section can be moved to the target position regardless of the position of the bobbin holding section 110 when the yarn supplying bobbin 21 is supplied.

[0087] Furthermore, the automatic winder 1 of the present embodiment includes the number-of-pulse storage section 73 for storing a plurality of actual measurement command values (in correspondence with the type of yarn supplying bobbin 21). The stepping motor 100 switches the actual measurement command value for moving the bobbin holding section 110 from the origin position to the target position in accordance with the received instruction.

[0088] Since the plurality of actual measurement command values are stored in accordance with the inner diameter of the yarn supplying bobbin 21, for example, even if the yarn supplying bobbin 21 to wind is changed, the winding of the yarn 20 can be started without re-measuring the actual measurement command value.

[0089] Next, a description will be made on a variant of the embodiment described above with reference to FIG. 9 to FIG. 12. FIG. 9 is a schematic side view of a winder unit according to a variant. FIG. 10 to FIG. 12 are plan views each illustrating states of the yarn supplying section, the transport guide, and the like. In the description of the present variant, the same reference numerals are denoted in the drawings on the members same as or similar to those in the embodiment described above, and the description thereof may be omitted.

[0090] The automatic winder 1 of the embodiment described above has a configuration including a magazine type bobbin supplying device. The automatic winder of the present variant, on the other hand, includes a transport tray type bobbin supplying device 200. The automatic winder of the variant includes a bobbin transporting path configured by a belt conveyor, and the like, where the yarn supplying bobbin 21 can be supplied to the winder unit 4 by moving a transport tray 19 mounted with the yarn supplying bobbin 21 along the bobbin transporting path.

[0091] As illustrated in FIG. 10, the bobbin transporting path is configured by a supplying conveyor 50 for transporting the transport tray 19 mounted with the yarn supplying bobbin 21 to each winder unit 4, and a collecting conveyor 51 for collecting the transport tray 19 discharged from each winder unit 4. The supplying conveyor 50 is arranged on the rear side of the winder unit 4, and the collecting conveyor 51 is arranged on the front side of the winder unit 4.

[0092] The yarn supplying section 10 of the present variant mainly includes a passage panel 52, a turn table 53, and a transport guide (bobbin holding section) 54.

[0093] The passage panel 52 is disposed substantially

horizontally, and arranged above the transportation surfaces of the supplying conveyor 50 and the collecting conveyor 51. The passage panel 52 is formed with a tray passage 55 for connecting the supplying conveyor 50 and the collecting conveyor 51.

[0094] The transport tray 19 transported on the supplying conveyor 50 is sequentially retrieved to the tray passage 55. The transport tray 19 retrieved to the tray passage 55 is guided along the tray passage 55 (see FIG. 10). In the following description, the direction in which the transport tray 19 is transported from the supplying conveyor 50 to the collecting conveyor 51 in the tray passage 55 is referred to as a transporting direction. In the present embodiment, the transporting direction is a substantially front and back direction (substantially up and down direction in FIG. 10) of the apparatus.

[0095] The turn table 53 is arranged below the passage panel 52 at an entrance portion of the tray passage 55. As illustrated in FIG. 12, the turn table 53 has a circular plate shape, and has a substantially horizontal upper surface. The turn table 53 is configured to be rotatably driven in one direction (counterclockwise direction) by a drive force of the stepping motor 100 through the cam mechanism 58 and the one-way clutch 59. The transport tray 19 retrieved into the tray passage 55 is placed on the turn table 53, and transported towards a downstream in the tray passage 55 by the rotation of the turn table 53.

[0096] The transport guide 54 for stopping the transport tray 19 transported by the turn table 53 is arranged in a middle of the tray passage 55. The transport guide 54 includes a lock portion 54a that makes contact with the transport tray 19 transported through the tray passage 55. As illustrated in FIG. 11, a configuration of stopping the transport tray 19 by bringing the lock portion 54a into contact with the transport tray 19 transported by the turn table 53 from the downstream in the transporting direction is provided. The transport guide 54 is configured to be rotatably driven in the clockwise direction or the counterclockwise direction by the drive force of the stepping motor 100 through the cam mechanism 58.

[0097] The winder unit 4 includes the magnet sensor 72 for defining the origin of the stepping motor 100. Hereinafter, similar to the embodiment described above, the rotation position of the stepping motor 100 of when the magnet sensor 72 transmits the detection signal is referred to as the origin, and the position of the transport guide 54 of when the stepping motor 100 is at the origin is referred to as the origin position. The magnet sensor 72 may be attached to the transport guide 54, or may be attached to the cam mechanism 58, for example.

[0098] The yarn supplying section 10 includes a swing member 57 configured to swing with the supporting shaft 56 as the center. The swing member 57 is such that a biasing member (not illustrated) is arranged in the swing member 57 to bias the swing member 57 in the clockwise direction in FIG. 11. In order to prevent the swing member 57 from swinging endlessly by the biasing force of the biasing member, a stopper that makes contact with the

swing member 57 is arranged on the passage panel 52.

[0099] As illustrated in FIG. 11, a contacting portion 54c of the transport guide 54 pushes the transport tray 19 so as to push against the swing member 57 to hold the yarn supplying bobbin 21. In the winder unit 4 of the variant, the unwinding of the yarn 20 is carried out with the position of the yarn supplying bobbin 21 fixed in this manner. In the present embodiment, the origin position is set to a position where the contacting portion 54c pushes the transport tray 19 against the swing member 57.

[0100] As described above, since the drive control section 71 controls the stepping motor 100, the transport guide 54 can be swung in the clockwise direction or the counterclockwise direction. A case in which the transport guide 54 is slightly swung in the clockwise direction from the state of FIG. 11 will now be considered. In this case, the contacting portion 54c of the transport guide 54 slightly moves toward the upstream in the transporting direction. The swing member 57 pushes the transport tray 19 by the biasing force of the biasing member. As a result, the transport tray 19 held by the transport guide 54 is pushed by the swing member 57 and moved toward the upstream in the transporting direction.

[0101] A case in which the transport guide 54 is slightly swung in the counterclockwise direction from the state of FIG. 11 will now be considered. In this case, the contacting portion 54c of the transport guide 54 slightly moves toward the downstream in the transporting direction of the transport tray 19. In this case, the transport tray 19 is pushed toward the downstream in the transporting direction to overcome the biasing force of the swing member 57 (push away the swing member 57) with the force received from the contacting portion 54c. As a result, the transport tray 19 held by the transport guide 54 is pushed by the contacting portion 54c and moved toward the downstream in the transporting direction.

[0102] Thus, the position of the transport tray 19 (position of the yarn supplying bobbin 21) can be adjusted by driving the stepping motor 100 according to the control of the drive control section 71 to rotate the transport guide 54. The position adjustment control similar to the embodiment described above thus can be carried out.

[0103] Specifically, the operator shifts the winder unit 4 to the position adjustment mode. The operator then operates the unit input section 18 to rotate the transport guide 54, and aligns the center of the yarn supplying bobbin 21 and the center of the regulating member 27. The operator confirms the position where the centers are coincided as the target position of the transport guide 54. The drive control section 71 returns the transport guide 54 from the target position to the origin position specified by the magnet sensor 72. In this case, the number-of-pulse counting section 74 counts the number of pulses necessary to return the transport guide 54 to the origin position. The drive control section 71 then stores the counted number of pulses in the number-of-pulse storage section 73.

[0104] When the yarn supplying bobbin 21 is newly supplied during the winding of the yarn 20, the drive control section 71 drives the stepping motor 100 and moves (rotates) the transport guide 54 to the origin position specified by the magnet sensor 72. Thereafter, the drive control section 71 reads out the number of pulses corresponding to the yarn supplying bobbin 21 currently being used based on the storage content of the number-of-pulse storage section 73. The drive control section 71 then transmits the pulses to the stepping motor 100 by the read number of pulses to rotate the transport guide 54. The transport guide 54 then can be moved to the target position obtained above.

[0105] According to the processing described above, even in the winder unit 4 that does not include a sensor for detecting the position of the yarn supplying bobbin 21, the yarn supplying bobbin 21 can be moved to an appropriate position.

[0106] When the yarn 20 is unwound from the yarn supplying bobbin 21 and the yarn supplying bobbin 21 becomes empty (state in which the yarn is not wound around the yarn supplying bobbin 21), the yarn supplying section 10 discharges the transport tray 19 mounted with the empty yarn supplying bobbin 21 and supplies the transport tray 19 mounted with a new yarn supplying bobbin 21.

[0107] Specifically, when detection is made that the yarn supplying bobbin 21 is empty, a bobbin change signal is transmitted to the drive control section 71. The drive control section 71 that has received the bobbin change signal appropriately controls the stepping motor 100 to swing the transport guide 54 in the clockwise direction from the state of FIG. 10 through the cam mechanism 58.

[0108] Thus, as illustrated in FIG. 11, the transport tray 19 held by the swing member 57 up to this point is released, and the relevant transport tray 19 is pushed out toward the collecting conveyor 51 by a pushing portion 54b formed in the transport guide 54. The transport tray 19 pushed out to the collecting conveyor 51 is transported and collected by the collecting conveyor 51. At the same time, one of the transport trays 19 stopped by the lock portion 54a of the transport guide 54 is retrieved toward the downstream in the transporting direction.

[0109] Thereafter, the drive control section 71 appropriately controls the stepping motor 100 to swing the transport guide 54 in the counterclockwise direction from the state of FIG. 11 through the cam mechanism 58. Since the position of the transport guide 54 is thereby returned to the state of FIG. 10, the retrieved new transport tray 19 is held by the transport guide 54, and the transport tray 19 more on the upstream in the transporting direction is again stopped by the lock portion 54a.

[0110] With the above configuration, each winder unit 4 of the transport tray type automatic winder can wind the yarn 20 unwound from the yarn supplying bobbin 21 around the winding bobbin 22 to form the package 29 having a predetermined length. Furthermore, since the position adjustment control is carried out, even in the

winder unit 4 that does not include a sensor for detecting the position of the yarn supplying bobbin 21, the yarn supplying bobbin 21 can be moved to an appropriate position.

[0111] The suitable embodiment and variant of the present invention have been described above, but the above-described configuration may be modified as below.

[0112] In the embodiment described above, the drive control section 71 automatically selects the number of pulses corresponding to the yarn supplying bobbin 21 currently being used among the plurality of numbers of pulses stored in the number-of-pulse storage section 73. The drive control section 71 may have a configuration of using the number of pulses selected by the operator among the plurality of number of pulses stored in the number-of-pulse storage section 73. In place of the configuration of storing the number of pulses in correspondence with the yarn supplying bobbin 21, a configuration of storing the number of pulses in correspondence with the type of transport tray 19 may be adopted.

[0113] The drive section is not limited to the stepping motor 100, and other devices (servo motor, etc.) that can adjust the drive amount may be used.

[0114] The origin sensor is not limited to the magnet sensor 72, and other devices (limit switch, etc.) that can specify the origin position may be used.

[0115] The magazine type bobbin supplying device 60 is not limited to the configuration of the embodiment described above as long as it can supply the yarn supplying bobbin 21 to a predetermined position where the yarn 20 is unwound. For example, a column-shaped accommodation member capable of loading and accommodating a plurality of yarn supplying bobbins 21 may be arranged, and the yarn supplying bobbin 21 may be supplied from the accommodation member.

[0116] In the embodiment and the variants described above, the tubular regulating member 27 is used in the unwinding assisting device 12, but instead, the regulating member 27 having various shapes such as a plate member with a guide hole, a linear guide member molded with a wire or the like, a polygonal column shaped member, and the like can be used.

[0117] The present invention can also be applied to other textile machines as long as it has a configuration of unwinding the yarn wound around the yarn supplying bobbin and winding the same.

Claims

1. A textile machine (1) **characterized by** comprising:
 - a bobbin holding section (54; 110) adapted to hold a yarn supplying bobbin (21);
 - a drive section (100) adapted to drive the bobbin holding section (54; 110);
 - a drive control section (71) adapted to send a

- command value to the drive section (100) to control drive of the drive section (100);
 an origin sensor (72) adapted to specify an origin position, which is a reference position of the bobbin holding section (54; 110); and
 a command value measuring section (74) adapted to obtain the command value necessary for moving the bobbin holding section (54; 110) from the origin position to a target position as an actual measurement command value.
2. The textile machine (1) according to claim 1, **characterized in that**
 when the yarn supplying bobbin (21) is supplied, the drive control section (71) controls the drive section (100) to move the bobbin holding section (54; 110) to the origin position, and drives the drive section (100) by an amount corresponding to the actual measurement command value from the origin position to move the bobbin holding section (54; 110) to the target position.
3. The textile machine (1) according to claim 2, **characterized by** further comprising a command value storage section (73) adapted to store the actual measurement command value.
4. The textile machine (1) according to any one of claims 1 to 3, **characterized by** further comprising a plurality of winding units (4), each having the bobbin holding section (54; 110), wherein the command value measuring section (74) obtains the actual measurement command value for each of the winding units (4).
5. The textile machine (1) according to any one of claims 1 to 4, **characterized by** further comprising a magazine type bobbin supplying device (60), wherein the drive control section (71) adjusts an angle at which the supplied yarn supplying bobbin (21) is held by the bobbin holding section (110).
6. The textile machine according to any one of claims 1 to 4, **characterized by** further comprising a transport tray type bobbin supplying device (200), wherein the drive control section (71) enables the bobbin holding section (54) to adjust a position of stopping a transport tray, on which the yarn supplying bobbin (21) is mounted.
7. The textile machine (1) according to any one of claims 1 to 6, **characterized in that** the drive section (100) is a stepping motor (100).
8. The textile machine (1) according to any one of claims 1 to 7, **characterized in that**
- the command value is the number of pulses transmitted to drive the stepping motor (100), and the command value measuring section (74) is a number-of-pulse counting section (74) adapted to count the number of pulses.
9. The textile machine (1) according to any one of claims 1 to 8, **characterized in that** the origin sensor (72) is a magnet sensor (72).
10. Method for operating a textile machine (1) comprising:
 a bobbin holding section (54; 110) adapted to hold a yarn supplying bobbin (21);
 a drive section (100) adapted to drive the bobbin holding section (54; 110); **characterized by** the following steps:
 specifying an origin position, which is a reference position of the bobbin holding section (54; 110); and
 measuring the command value necessary for moving the bobbin holding section (54; 110) from the origin position to a target position and using it as an actual measurement command value;
 controlling the drive section (100) by sending the command value to the drive section (100).
11. The method according to claim 10, **characterized by** the step of controlling the drive section (100) to move the bobbin holding section (54; 110) to the origin position, and driving the drive section (100) by an amount corresponding to the actual measurement command value from the origin position to move the bobbin holding section (54; 110) to the target position when the yarn supplying bobbin (21) is supplied.
12. The method according to claim 11, **characterized by** storing the actual measurement command value in a command value storage section (73).
13. The method according to any one of claims 10 to 12, for a textile machine (1) with a plurality of winding units (4), each having a bobbin holding section (54; 110), **characterized by** obtaining the actual measurement command value for each of the winding units (4).
14. The method according to any one of claims 10 to 13, for a textile machine (1) with a magazine type bobbin supplying device (60), **characterized by** adjusting an angle at which the supplied yarn supplying bobbin (21) is held by the bobbin

holding section (110).

15. The method according to any one of claims 10 to 13,
for a textile machine with a transport tray type bobbin
supplying device (200),
characterized by adjusting a position of stopping a
transport tray, on which the yarn supplying bobbin
(21) is mounted. 5
16. The method according to any one of claims 10 to 15, 10
characterized in that
the command value is the number of pulses trans-
mitted to drive the stepping motor (100), and
as a command value measuring section (74) a
number-of-pulse counting section (74) is used to 15
count the number of pulses.

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FIG. 1

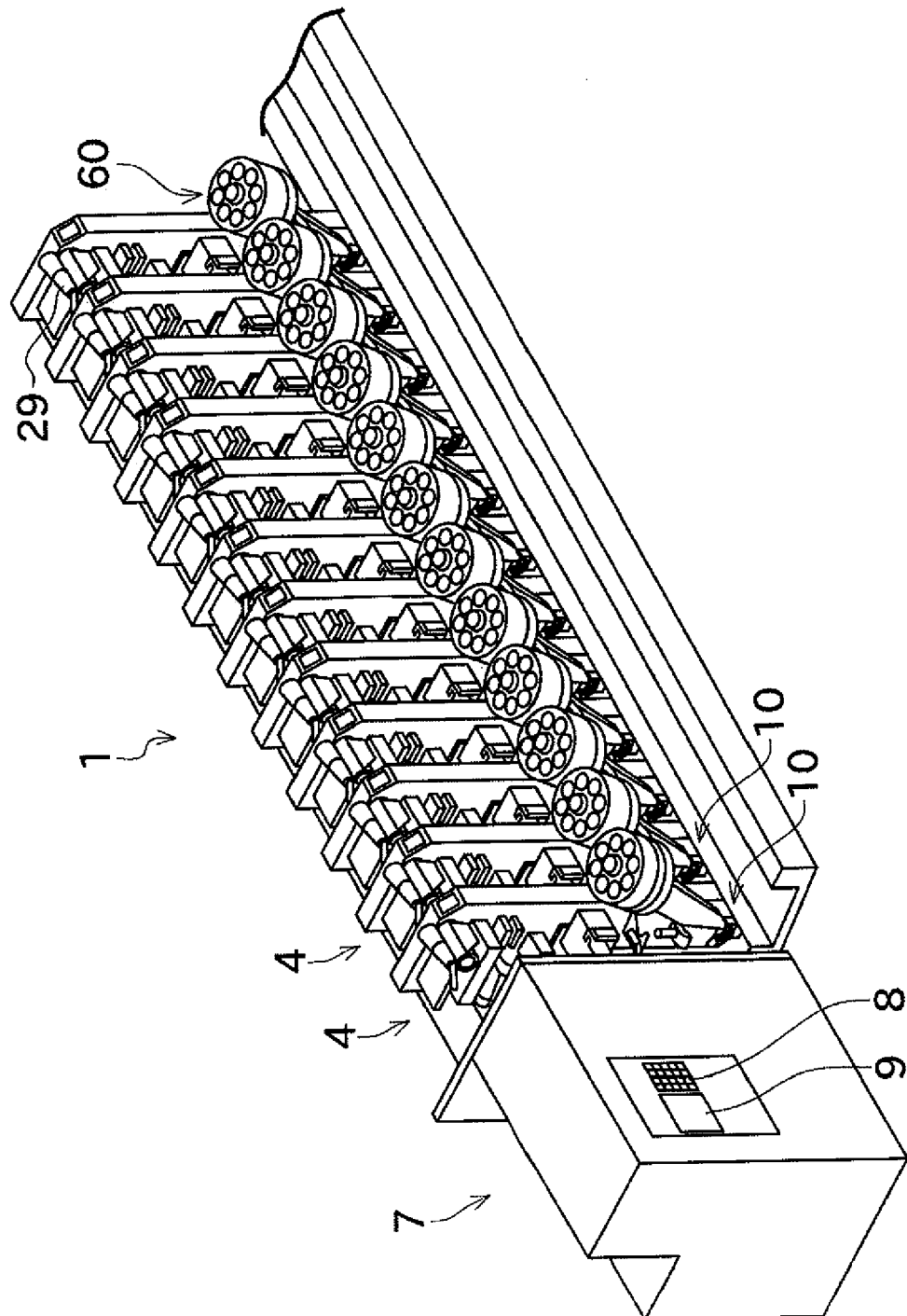


FIG. 2

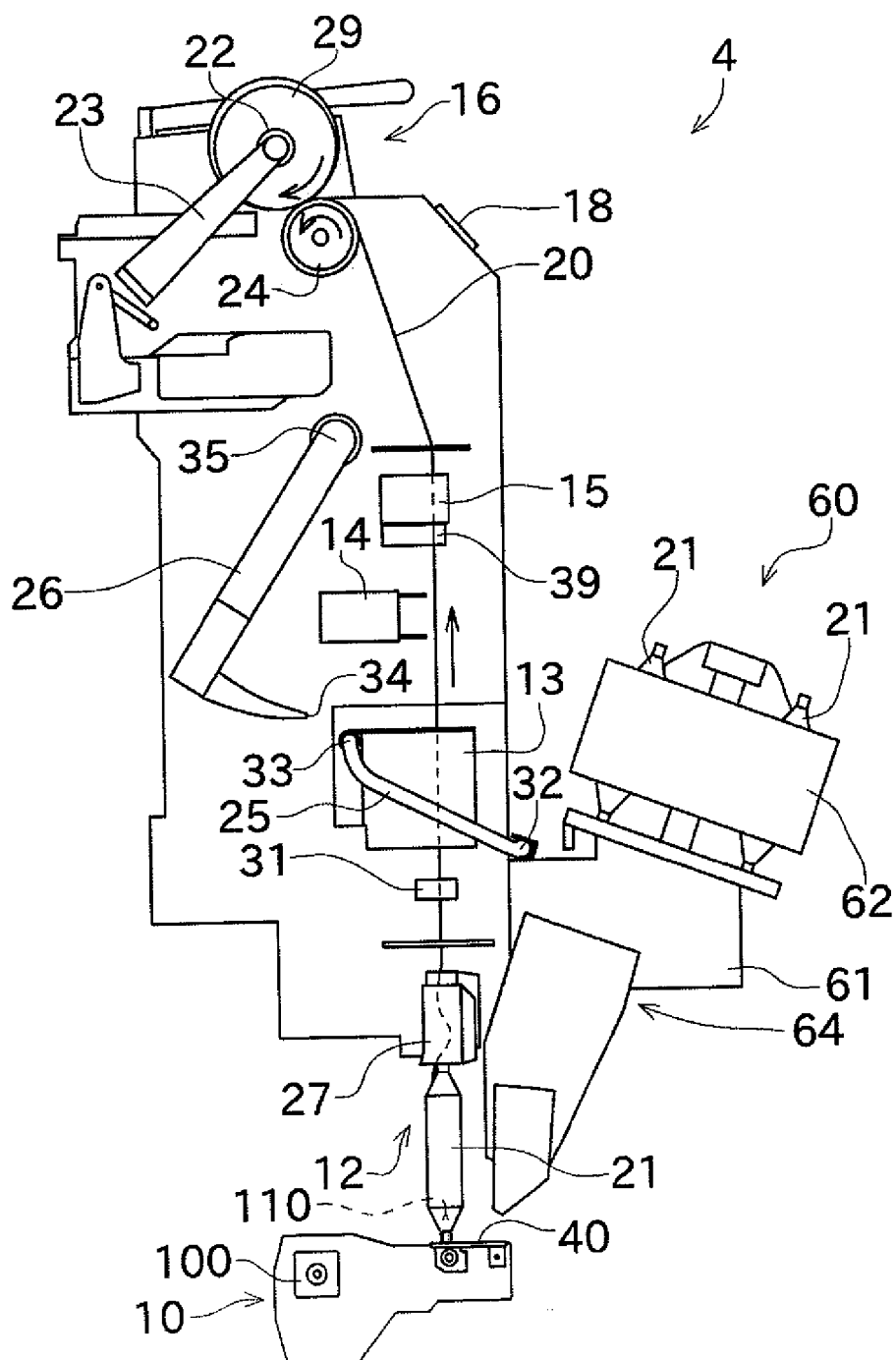


FIG. 3.

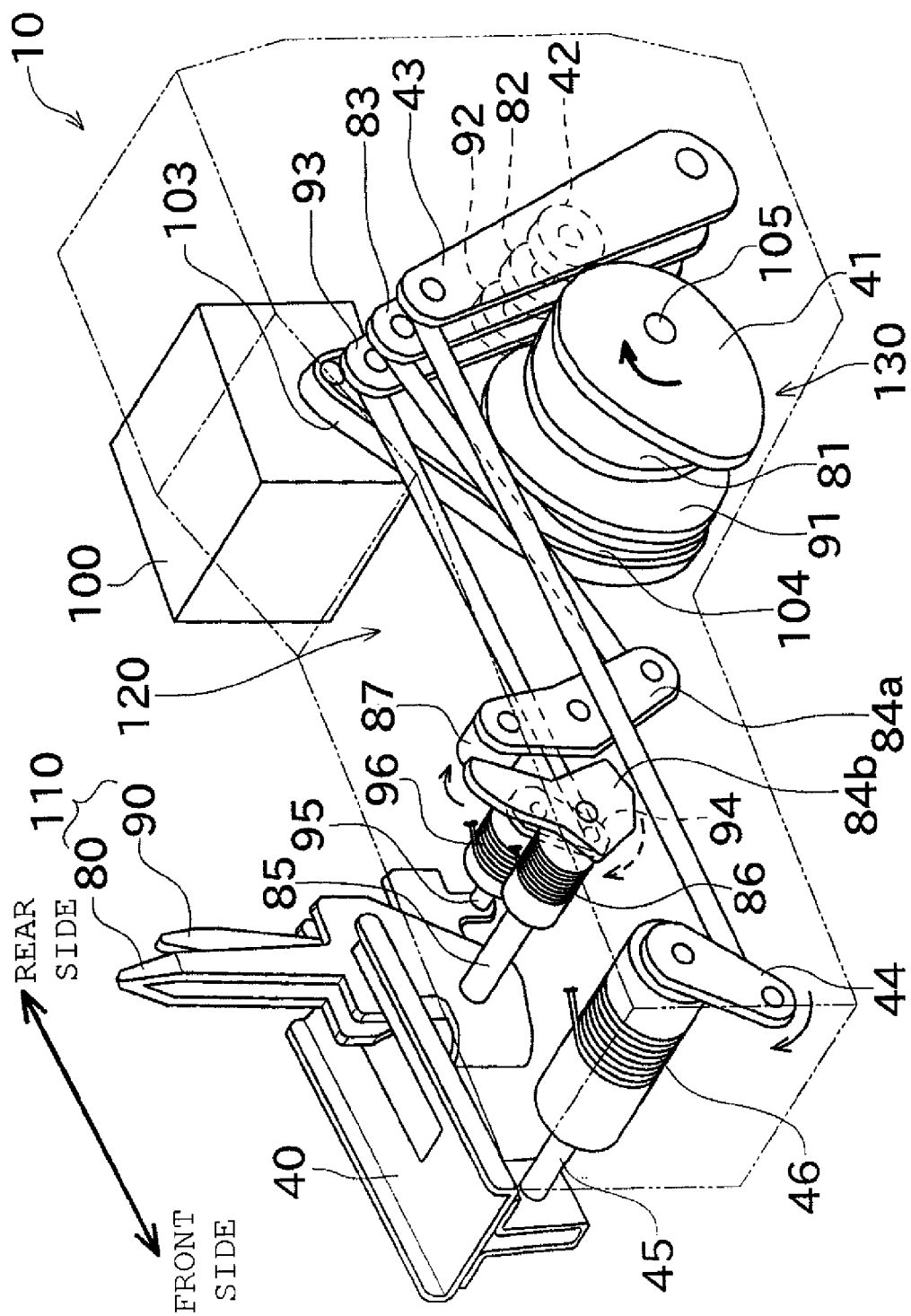


FIG. 5

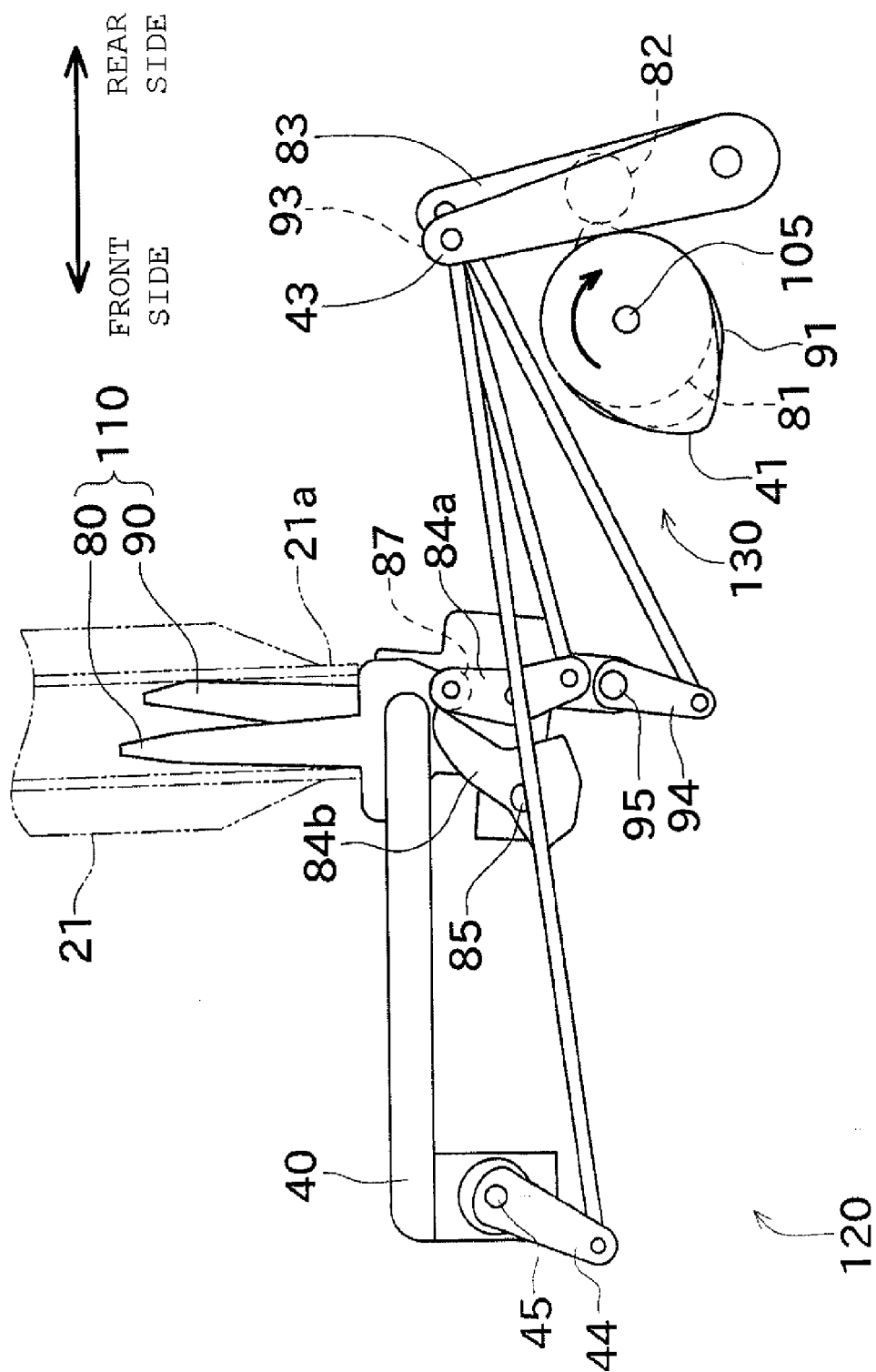


FIG. 6

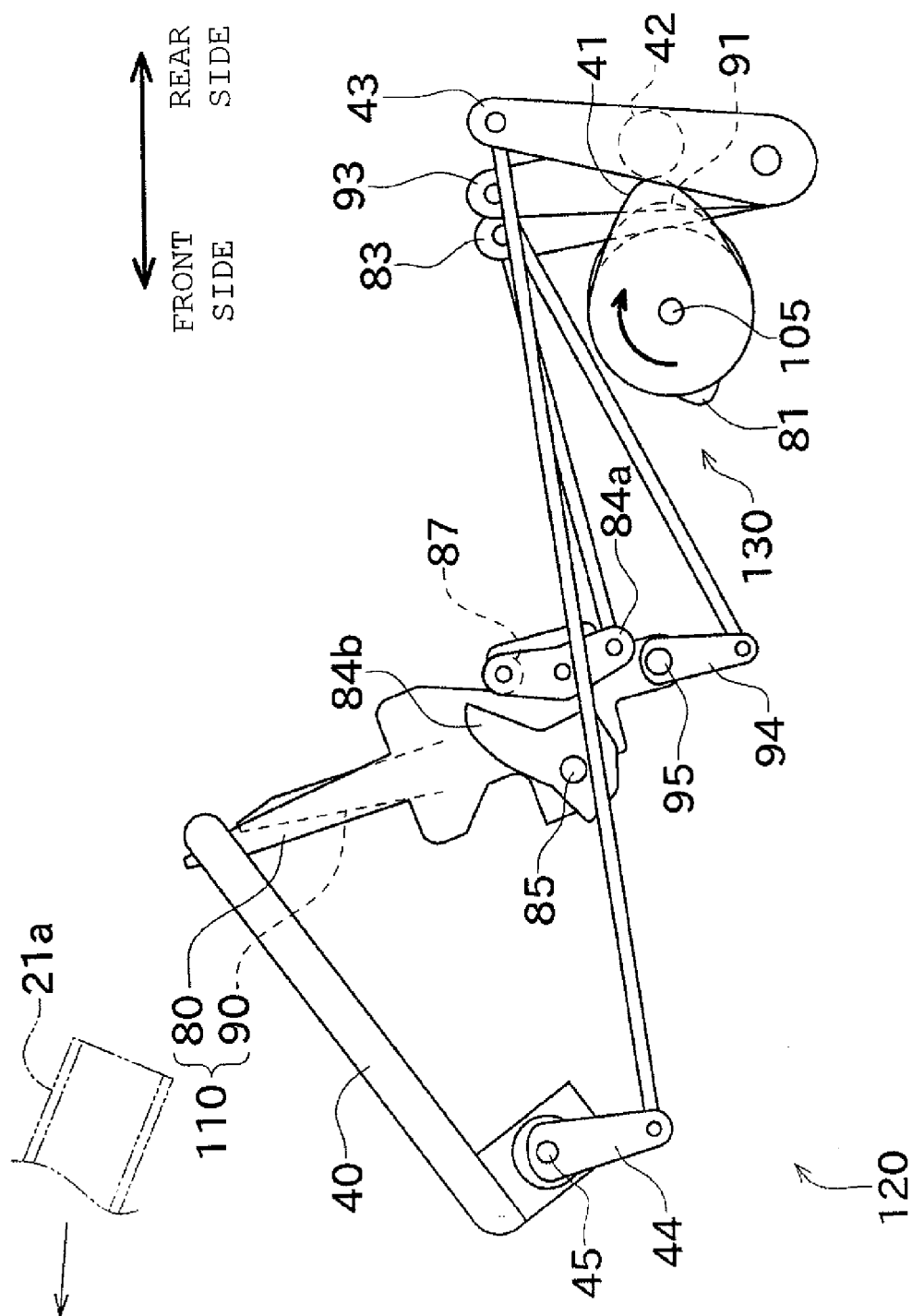


FIG. 7

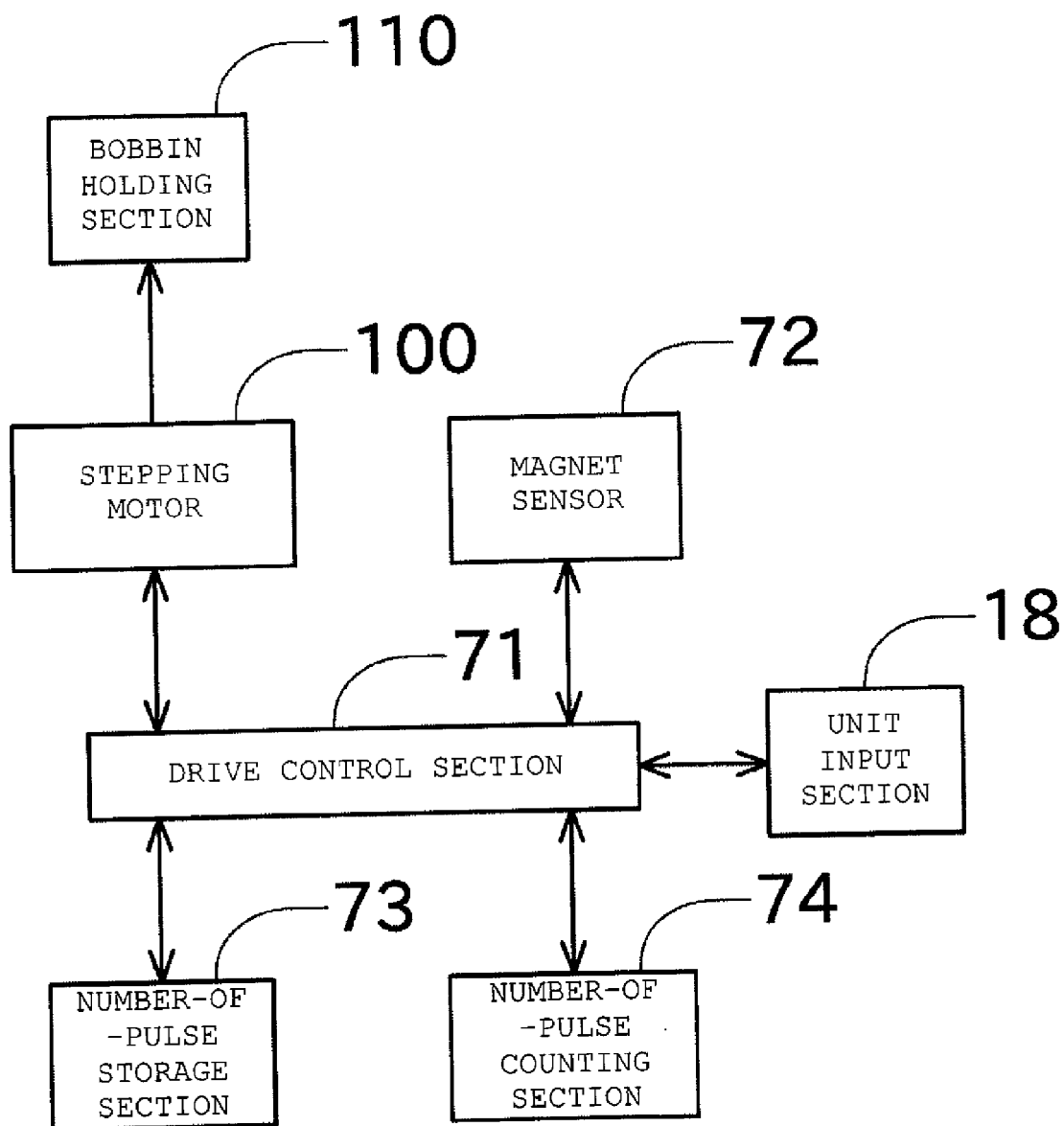


FIG. 8A

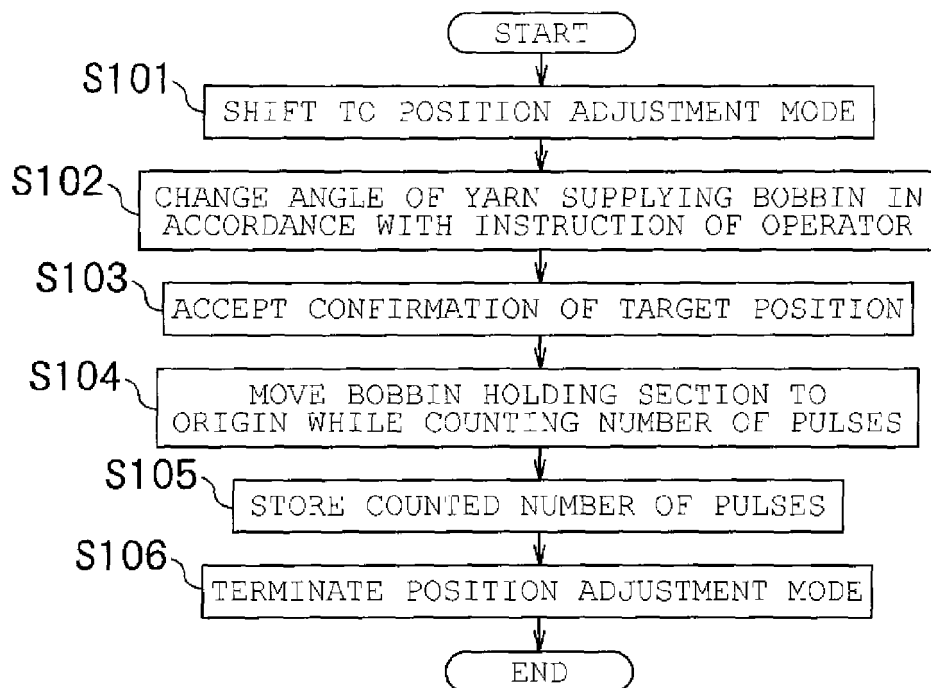


FIG. 8B

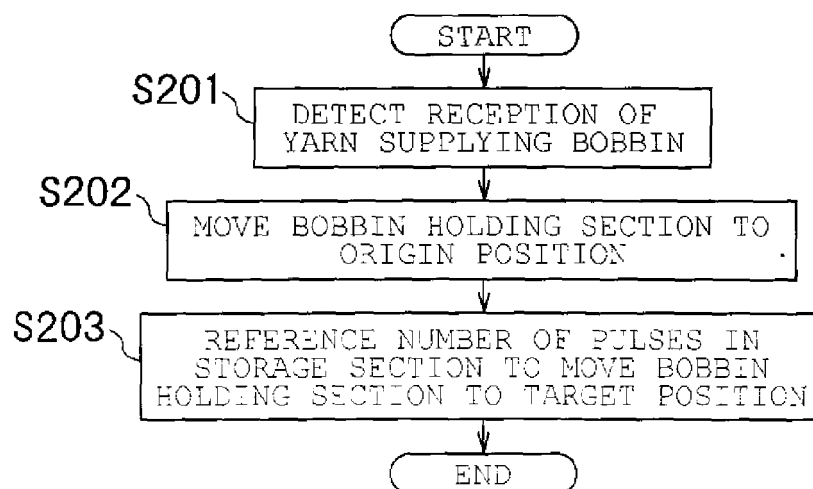


FIG. 9

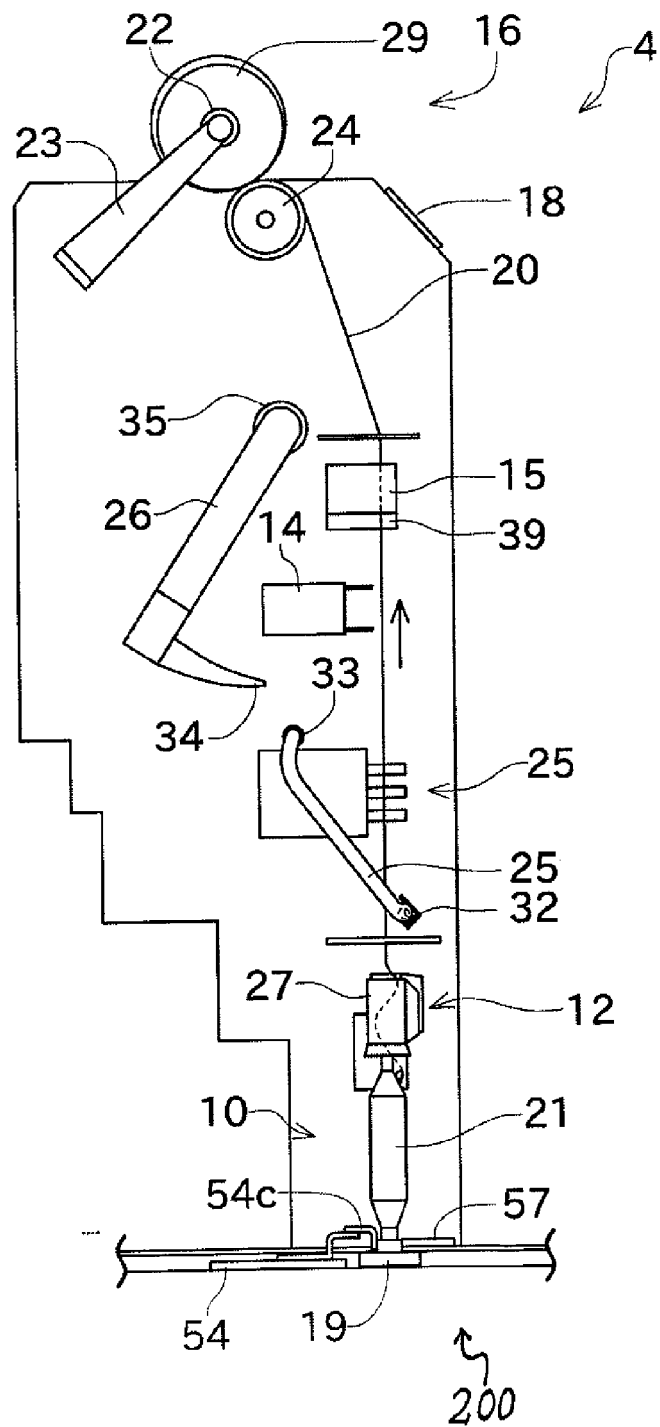


FIG. 10

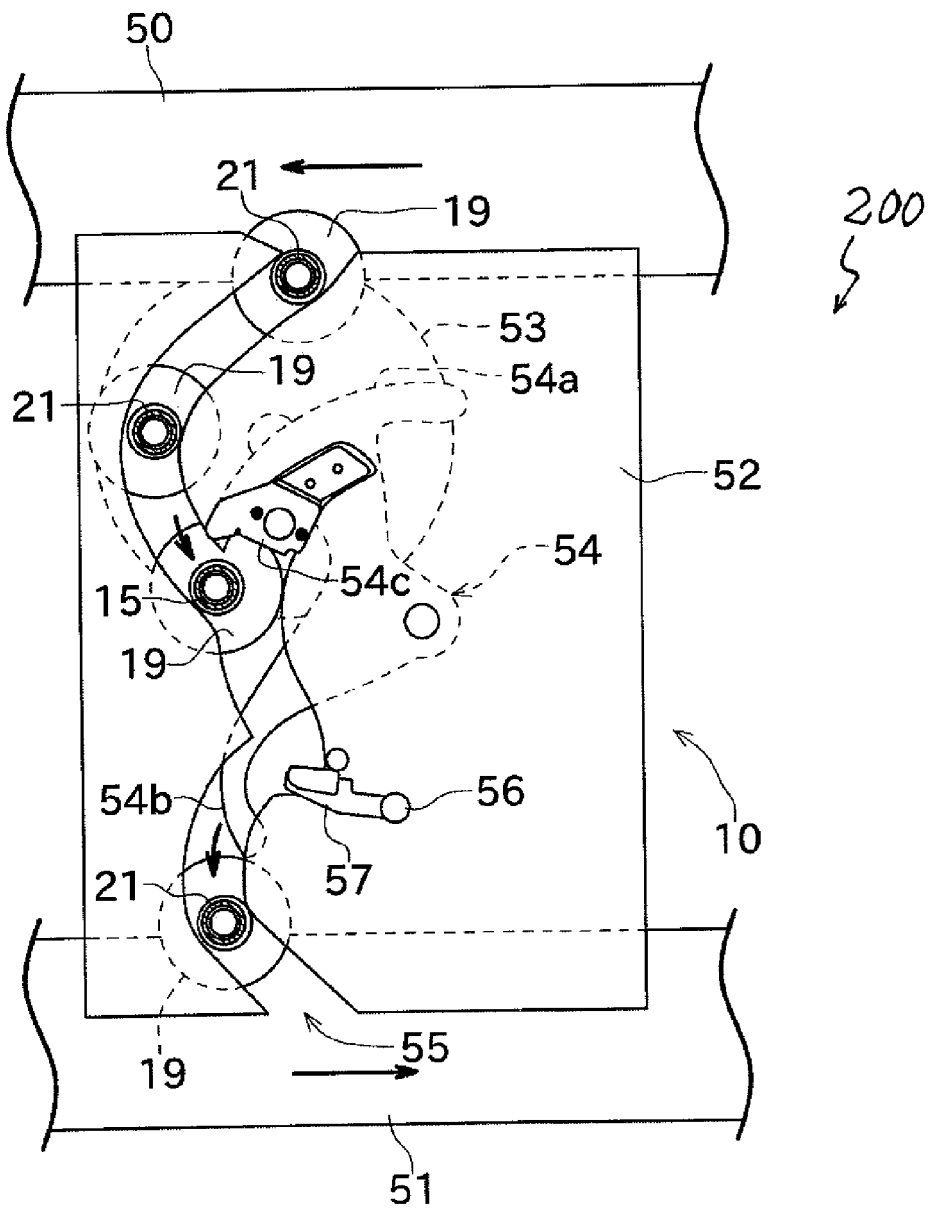


FIG. 11

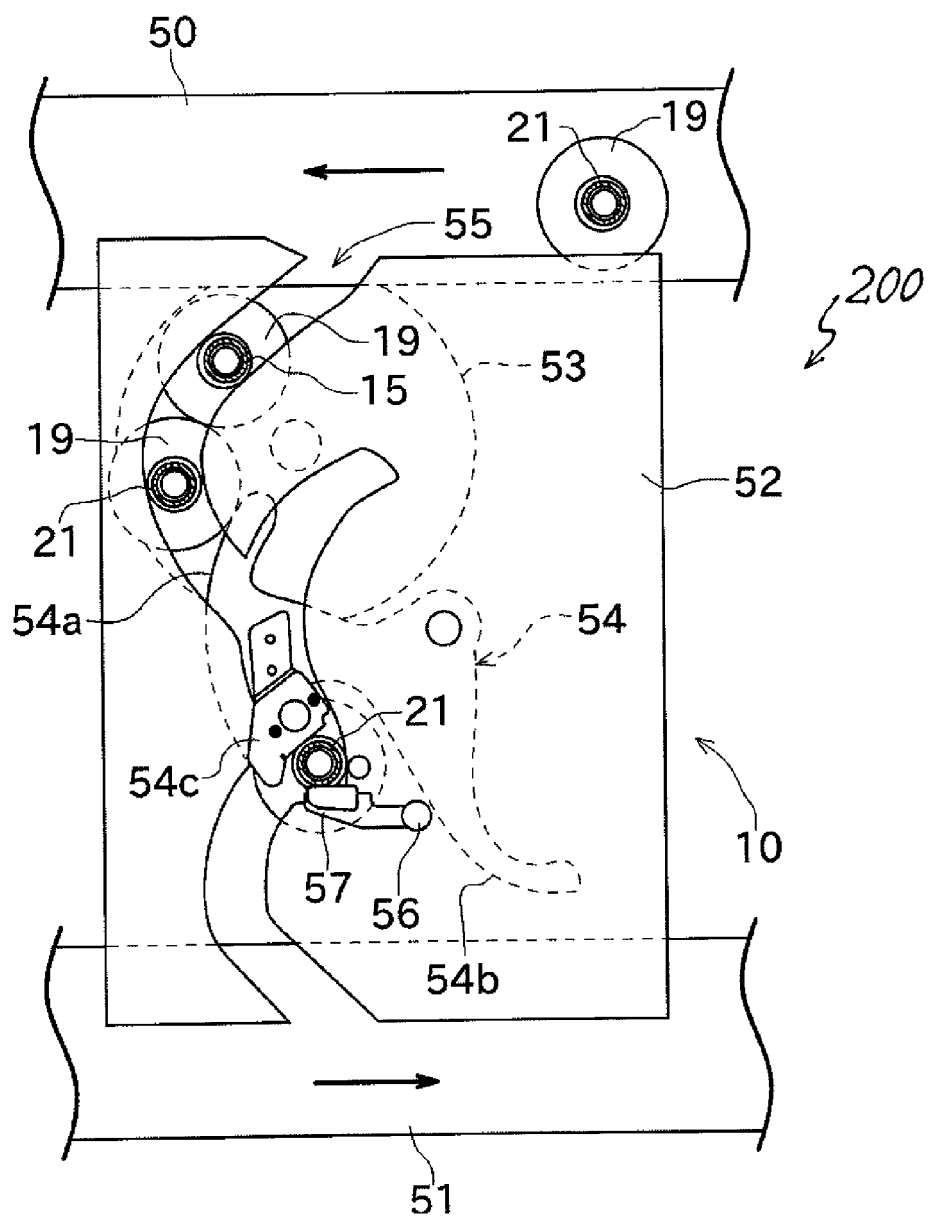
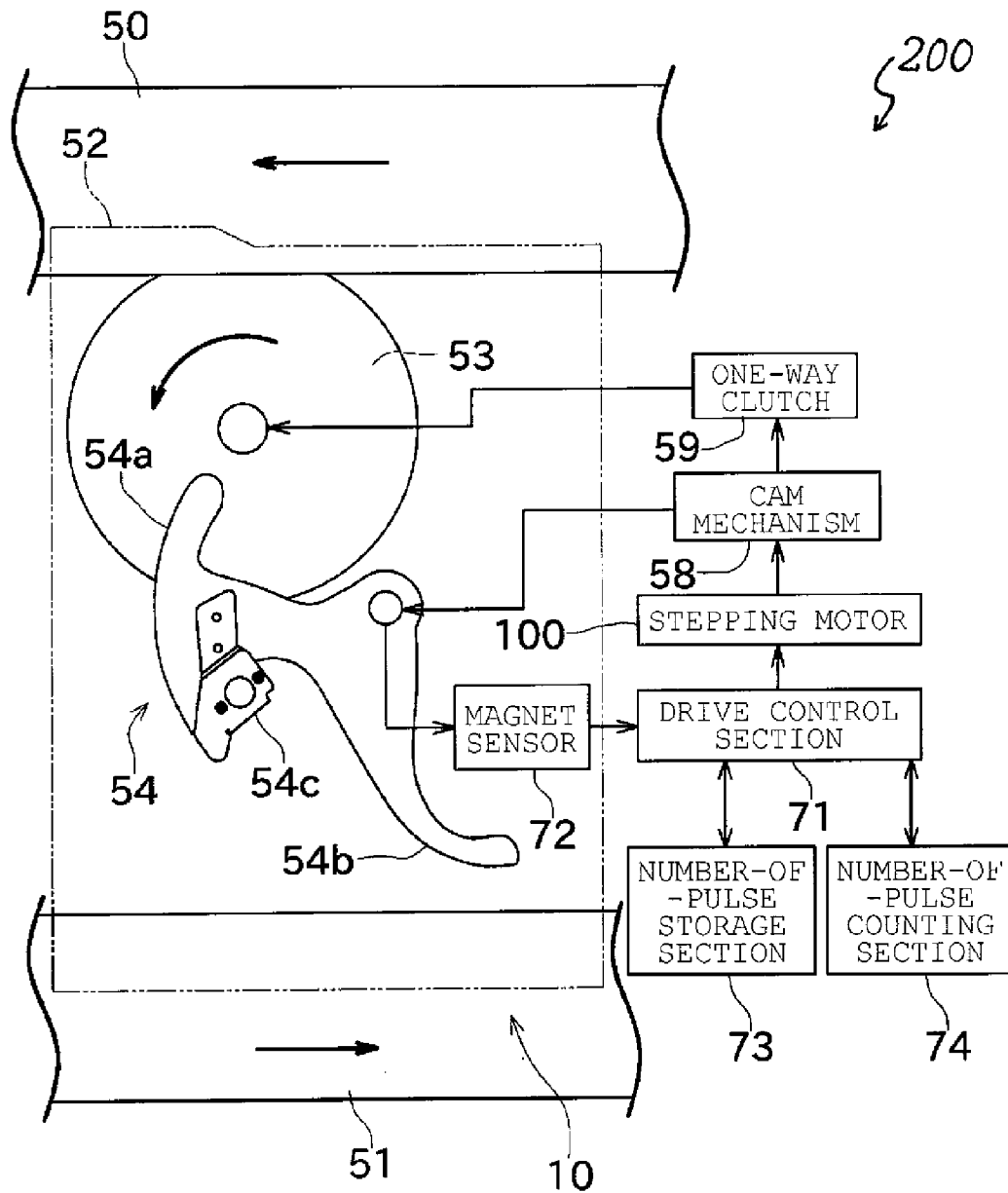


FIG. 12



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2011241032 A [0002] [0003]