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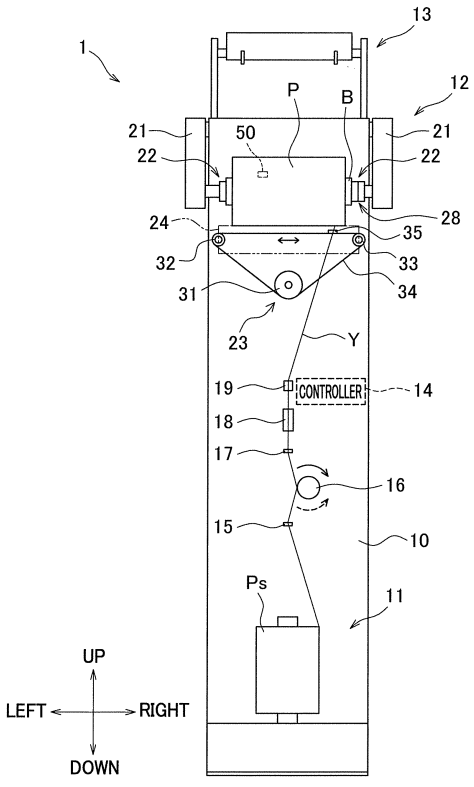
(54) YARN WINDING MACHINE

(57) A yarn is properly guided to a yarn holding portion by a clamp cutter, when a completed package is replaced with a new bobbin. A clamp cutter 50 performs at least first movement and second movement. The clamp cutter 50 performs the first movement after cutting and holding a part of a yarn Y between a yarn supplying unit 11 and a package P. The first movement includes a rearward movement component and is movement in a direction in which the yarn is pulled out from the yarn supplying unit 11. The clamp cutter 50 performs the second movement after the first movement, in order to guide the held yarn Y to a yarn holding portion 28 of a bobbin holder 22. The second movement includes a forward movement component. After the clamp cutter 50 starts the second movement and until the yarn Y is held by the yarn holding portion, a controller 14 causes a feed roller 16 to rotate backward to remove the slack of the yarn Y.

FIG.1



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Description

[Technical Field]

[0001] The present invention relates to a yarn winding machine which is able to automatically replace a completed package with a new bobbin.

[Background Art]

[0002] For example, a yarn winding machine recited in Patent Literature 1 is configured to form a package by winding a yarn supplied from a yarn supplying unit onto a bobbin. In this yarn winding machine, a series of steps until a completed package is replaced with a new bobbin and winding of a yarn onto the new bobbin starts are automated. To be more specific, when the formation of a package is completed, a part of the yarn between the yarn supplying unit and the package is cut by a cutter, and a part of the yarn on the yarn supplying unit side is sucked and captured by a yarn capturing pipe. After the completed package is replaced with a new bobbin, the part of the yarn sucked and captured by the yarn capturing pipe is handed over to a bunch arm, and the bunch arm is moved to the vicinity of a bobbin holder, with the result that the yarn is threaded to the bobbin holder.

[Citation List]

[Patent Literatures]

[0003] [Patent Literature 1] Japanese Laid-Open Patent Publication No. 2008-24438

[Summary of Invention]

[Technical Problem]

[0004] When a yarn is sucked and captured by a yarn capturing pipe as in Patent Literature 1, the yarn is wastefully consumed due to the sucking of the yarn, cost increase is incurred due to the necessity of a sucking unit. In order to avoid the occurrence of such problems, the inventors of the subject application employed an arrangement in which a clamp cutter was used in place of the yarn capturing pipe and a yarn was cut and held by using the clamp cutter.

[0005] The arrangement using the clamp cutter, however, has a different problem described below. After the completion of the formation of the package, the clamp cutter moves toward the bobbin holder when the clamp cutter cuts and holds a part of the yarn between the yarn supplying unit and the package. Subsequently, the clamp cutter having cut the yarn and holding the part of the yarn on the yarn supplying unit side moves away from the bobbin holder in order to avoid an interference with a newly-set bobbin. At this stage, the yarn held by the clamp cutter is pulled out from the yarn supplying unit. Subsequently, in order to guide the yarn to a yarn holding portion of the bobbin holder, the clamp cutter moves toward the bobbin holder again. At this stage, the yarn may not be properly guided to the yarn holding portion because the yarn having been pulled out from the yarn supplying unit is disadvantageously slackened.

[0006] In consideration of the problem above, an object of the present invention is to properly guide a yarn to a yarn holding portion by a clamp cutter, when a completed package is replaced with a new bobbin.

[Solution to Problem]

[0007] A yarn winder of the present invention includes a winding unit configured to form a package by winding a yarn supplied from a yarn supplying unit onto a bobbin, and is capable of automatically replacing the completed package with a new bobbin, the yarn winder comprising: a bobbin holder which supports the bobbin to be rotatable; a clamp cutter which is configured to cut a part of the yarn between the yarn supplying unit and the package and to hold a part of the yarn on the yarn supplying unit side, and then to guide the held yarn to either the bobbin holder or a yarn holding portion of the bobbin, when the package is replaced with the new bobbin; a yarn slack adjustment unit which is configured to perform tensioning that is to remove slack of the yarn held by the clamp cutter and slackening that is to slack the yarn held by the clamp cutter; and a controller which is configured to control at least the yarn slack adjustment unit, wherein, the clamp cutter is arranged to perform at least: after the part of the yarn between the yarn supplying unit and the package is cut and held, first movement of moving in a direction which includes a movement component toward one side in an orthogonal direction orthogonal to an axial direction of the bobbin holder and is a direction of pulling the yarn out from the yarn supplying unit; and after the first movement, second movement of moving in a direction including a movement component toward the other side in the orthogonal direction in order to guide the held yarn to the yarn holding portion, and after the clamp cutter starts to perform the second movement and before the yarn holding portion holds the yarn, the controller causes the yarn slack adjustment unit to perform the tensioning.

[0008] In the present invention, when a completed package is replaced with a new bobbin, after cutting and holding the yarn, the clamp cutter performs at least the first movement and the second movement so as to guide the yarn to the yarn holding portion. In the first movement, the clamp cutter moves in a direction including a movement component toward one side in the orthogonal direction, so that the yarn is pulled out from the yarn supplying unit. On this account, when the clamp cutter performs the second movement and moves in a direction having a movement component toward the other side in the orthogonal direction, the yarn is slackened. For this reason, in the present invention, after the clamp cutter starts to perform the second movement and before the

yarn is held by the yarn holding portion, the yarn slack adjustment unit performs the tensioning in order to remove the slack of the yarn. It is therefore possible to solve the problem of failing the yarn to be properly guided to the yarn holding portion due to the slack of the yarn, and to properly guide the yarn to the yarn holding portion by the clamp cutter.

[0009] Preferably, the present invention is arranged such that the controller causes the yarn slack adjustment unit to perform the tensioning while the clamp cutter is performing the second movement.

[0010] The timing to cause the yarn slack adjustment unit to perform the tensioning may be after the completion of the second movement of the clamp cutter. In such a case, however, the yarn may not be properly guided to the yarn holding portion because the yarn slackened during the second movement of the clamp cutter is caught by another component. In this regard, the slack of the yarn is eliminated during the second movement of the clamp cutter by the arrangement described above. It is therefore possible to reliably guide the yarn to the yarn holding portion by the clamp cutter.

[0011] Preferably, the present invention is arranged such that the clamp cutter is configured to cut and hold the part of the yarn between the yarn supplying unit and the package after the package is moved in the direction in which the yarn is pulled out from the yarn supplying unit, and after the package is moved in the direction in which the yarn is pulled out from the yarn supplying unit and before the yarn is cut by the clamp cutter, the controller causes the yarn slack adjustment unit to perform the slackening.

[0012] When the package is moved in the direction in which the yarn is pulled out from the yarn supplying unit, the tension of the yarn becomes excessively high at a part between the yarn supplying unit and the package, with the result that the yarn may escape from the clamp cutter as soon as the yarn is cut, before the yarn is held by the clamp cutter. In this regard, with the arrangement described above, the tension of the yarn can be reduced before the yarn is cut by the clamp cutter. It is therefore possible to reliably hold the yarn by the clamp cutter.

[0013] Preferably, the present invention is arranged such that the controller causes the yarn slack adjustment unit to perform the slackening while the clamp cutter is performing the first movement.

[0014] In the first movement, when the clamp cutter moves in the direction in which the yarn is pulled out from the yarn supplying unit, the tension of the yarn may become excessively high and the yarn may be detached from the clamp cutter. In this regard, with the arrangement described above, the tension of the yarn can be reduced during the first movement of the clamp cutter. It is therefore possible to prevent the yarn from being detached from the clamp cutter during the first movement.

[0015] Preferably, the present invention is arranged such that the clamp cutter is configured to further perform third movement of moving in the direction in which the yarn is pulled out from the yarn supplying unit along the axial direction, after the part of the yarn between the yarn supplying unit and the package is cut and held and before the second movement is performed, and the controller causes the yarn slack adjustment unit to perform the slackening while the clamp cutter is performing the third movement.

[0016] In the third movement, when the clamp cutter moves in the direction in which the yarn is pulled out from the yarn supplying unit, the tension of the yarn may become excessively high and the yarn may be detached from the clamp cutter. In this regard, with the arrangement described above, the tension of the yarn can be reduced during the third movement of the clamp cutter. It is therefore possible to prevent the yarn from being detached from the clamp cutter during the third movement.

[0017] Preferably, the present invention is arranged such that a tension detection unit configured to detect tension of the yarn is provided between the yarn supplying unit and the winding unit in the yarn running direction, and after the clamp cutter starts to perform the second movement and until the yarn is held by the yarn holding portion, the controller controls the yarn slack adjustment unit so that the tension detected by the tension detection unit is maintained to be equal to or higher than a predetermined first threshold.

[0018] With this arrangement, the state without the slack of the yarn is maintained during the second movement of the clamp cutter, if the first threshold is appropriately set. It is therefore possible to reliably guide the yarn to the yarn holding portion by the clamp cutter.

[0019] Preferably, the present invention is arranged such that, after the clamp cutter starts to perform the second movement and until the yarn is held by the yarn holding portion, the controller controls the yarn slack adjustment unit so that the tension detected by the tension detection unit is maintained to be equal to or lower than a predetermined second threshold that is higher than the first threshold.

[0020] When the yarn slack adjustment unit is only controlled to maintain the tension of the yarn to be equal to or higher than the first threshold during the second movement of the clamp cutter, the tension of the yarn may become excessively high and the yarn may be detached from the clamp cutter. In this regard, by appropriately setting the upper limit of the tension of the yarn during the second movement of the clamp cutter, i.e., the second threshold as described above, it is possible to prevent the yarn from being detached from the clamp cutter during the second movement.

[0021] Preferably, the present invention is arranged such that the clamp cutter is configured to cut and hold the part of the yarn between the yarn supplying unit and the package after the package is moved in the direction in which the yarn is pulled out from the yarn supplying unit, and after the package is moved in the direction in which the yarn is pulled out from the yarn supplying unit

and before the yarn is cut by the clamp cutter, the controller causes the yarn slack adjustment unit to perform the slackening so that the tension detected by the tension detection unit is equal to or lower than a predetermined third threshold.

[0022] When the package is moved in the direction in which the yarn is pulled out from the yarn supplying unit, the tension of the yarn becomes excessively high at a part between the yarn supplying unit and the package, with the result that the yarn may escape from the clamp cutter as soon as the yarn is cut, before the yarn is held by the clamp cutter. In this regard, with the arrangement described above, the tension of the yarn can be reduced before the yarn is cut by the clamp cutter, by appropriately setting the third threshold. It is therefore possible to reliably hold the yarn by the clamp cutter.

[0023] Preferably, the present invention is arranged such that, while the clamp cutter is performing the first movement, the controller controls the yarn slack adjustment unit so that the tension detected by the tension detection unit is equal to or lower than a predetermined fourth threshold.

[0024] In the first movement, when the clamp cutter moves in the direction in which the yarn is pulled out from the yarn supplying unit, the tension of the yarn may become excessively high and the yarn may be detached from the clamp cutter. In this regard, with the arrangement described above, the tension of the yarn can be reduced during the first movement of the clamp cutter, by appropriately setting the fourth threshold. It is therefore possible to prevent the yarn from being detached from the clamp cutter during the first movement.

[0025] Preferably, the present invention is arranged such that the clamp cutter is configured to further perform third movement of moving in the direction in which the yarn is pulled out from the yarn supplying unit along the axial direction, after the part of the yarn between the yarn supplying unit and the package is cut and held and before the second movement is performed, and while the clamp cutter is performing the third movement, the controller controls the yarn slack adjustment unit so that the tension detected by the tension detection unit is equal to or lower than the fourth threshold.

[0026] In the third movement, when the clamp cutter moves in the direction in which the yarn is pulled out from the yarn supplying unit, the tension of the yarn may become excessively high and the yarn may be detached from the clamp cutter. In this regard, with the arrangement described above, the tension of the yarn can be reduced during the third movement of the clamp cutter, by appropriately setting the fourth threshold. It is therefore possible to prevent the yarn from being detached from the clamp cutter during the first movement.

[0027] Preferably, the present invention is arranged such that a feed roller which is rotatable forward and backward is provided between the yarn supplying unit and the winding unit in the yarn running direction, and the feed roller functions as the yarn slack adjustment unit.

[0028] Such a feed roller is typically provided in a yarn winder. When the feed roller is utilized as the yarn slack adjustment unit, it is unnecessary to provide an additional apparatus, and hence cost reduction is achieved.

[0029] Preferably, the present invention is arranged such that the yarn holding portion includes: a supporting portion supporting an end portion in the axial direction of the bobbin; and a movable portion movable between a contact position where the movable portion is in contact with the supporting portion and a separated position where the movable portion is separated from the supporting portion in the axial direction, after the yarn is provided in a gap between the movable portion at the separated position and the supporting portion, the movable portion is moved to the contact position so that the yarn is held.

[0030] When the yarn held by the clamp cutter is guided to the narrow gap in this way, the present invention that is capable of removing the slack of the yarn is particularly effective.

[Brief Description of Drawings]

[0031]

FIG. 1 is a schematic front view of a re-winder of an embodiment.

FIG. 2 shows an electric structure of the re-winder of the embodiment.

FIG. 3(a) is a front view and FIG. 3(b) is a side view, both of which show a supporting structure of supporting a package.

FIG. 4 is a top view of a front end portion of a yarn threading arm having a clamp cutter.

FIG. 5 is a cross section of the clamp cutter.

FIG. 6 is a flow chart illustrating a bobbin replacement operation.

FIG. 7 is a flow chart illustrating the bobbin replacement operation.

FIG. 8 is a schematic diagram illustrating the bobbin replacement operation.

FIG. 9 is a schematic diagram illustrating the bobbin replacement operation.

FIG. 10 is a schematic diagram illustrating the bobbin replacement operation.

FIG. 11 is a schematic diagram illustrating the bobbin replacement operation.

FIG. 12 is a schematic diagram illustrating the bobbin replacement operation.

FIG. 13 is a schematic diagram illustrating a modification of a yarn slack adjustment unit.

[Description of Embodiments]

(Structure of Re-Winder)

[0032] The structure of a re-winder 1 (yarn winder of the present invention) of the present embodiment will be

described with reference to figures. FIG. 1 is a schematic front view of the re-winder 1 of the present embodiment. FIG. 2 shows an electric structure of the re-winder 1 of the present embodiment. An up-down direction and a left-right direction shown in FIG. 1 will be used as an up-down direction and a left-right direction of a re-winder 1. A direction orthogonal to both the up-down direction and the left-right direction (i.e., a direction perpendicular to the plane of FIG. 1) is set as a front-rear direction. A direction in which a yarn Y runs will be referred to as a yarn running direction.

[0033] As shown in FIG. 1, the re-winder 1 includes members such as a frame 10, a yarn supplying unit 11, a winding unit 12, a bobbin supplier 13, and a control unit 14. The re-winder 1 unwinds a yarn Y from a yarn supply package Ps at the yarn supplying unit 11 and winds the unwound yarn Y onto a bobbin B at the winding unit 12, so as to form a package P. The re-winder 1 is used for, for example, re-winding a yarn Y wound on a yarn supply package Ps in a beautiful manner, and for forming a package P with desired density.

[0034] The yarn supplying unit 11 is provided at a lower part of the frame 10 that is vertically long, and supplies the yarn Y to the winding unit 12. The yarn supplying unit 11 supports the yarn supply package Ps so that the yarn Y can be unwound from the yarn supply package Ps.

[0035] Between the yarn supplying unit 11 and the winding unit 12, a yarn guide 15, a feed roller 16, a yarn guide 17, a tension application device 18, and a tension detection sensor 19 are provided in this order from the upstream to the downstream in the yarn running direction. The yarn Y unwound from the yarn supply package Ps passes through the yarn guide 15, the feed roller 16, the yarn guide 17, the tension application device 18, and the tension detection sensor 19 and is then supplied to the winding unit 12.

[0036] The yarn guides 15 and 17 are guides defining a yarn path, and are provided on an extension of the central axis of the yarn supply package Ps, for example. The feed roller 16 (a yarn slack adjustment unit of the present invention) is, for example, arranged to be rotatable forward and backward by a roller drive motor 41 (see FIG. 2) composed of a stepping motor that is rotatable forward and backward. The roller drive motor 41 is controlled by the control unit 14. As the feed roller 16 is rotated forward in a direction indicated by a solid arrow in FIG. 1 (slackening in the present invention), the yarn Y is sent to the downstream side in the yarn running direction. Meanwhile, as the feed roller 16 is rotated backward in a direction indicated by a dotted arrow in FIG. 1 (tensioning in the present invention), the yarn Y is pulled toward the upstream side in the yarn running direction.

[0037] The tension application device 18 is configured to apply a tension to the yarn Y. The tension application device 18 is able to apply a tension to the yarn Y by nipping the running yarn Y. The tension detection sensor 19 is configured to detect the tension of the yarn Y between the yarn supplying unit 11 and the winding unit 12 in the yarn running direction. The information of the tension of the yarn Y detected by the tension detection sensor 19 is sent to the control unit 14. When the yarn Y is traversed by a later-described traverse unit 23, the tension detection sensor 19 functions as a fulcrum of traversal.

[0038] The winding unit 12 is provided at an upper part of the frame 10 to wind the yarn Y supplied from the yarn supplying unit 11 onto the bobbin B and form the package P. The winding unit 12 includes members such as paired left and right cradle arms 21, a paired left and right bobbin holders 22, the traverse unit 23, and a contact roller 24.

[0039] FIG. 3(a) is a front view and FIG. 3(b) is a side view, both of which show a supporting structure of supporting the package P. To begin with, the structures of the cradle arms 21 and the bobbin holders 22 will be described with reference to FIG. 3. The cradle arms 21 are two arm-shaped members aligned in the left-right direction. The paired left and right cradle arms 21 rotatably support the package P (bobbin B). To be more specific, the bobbin holder 22 is provided at a leading end portion of each cradle arm 21. The paired left and right bobbin holders 22 rotatably support the package P (bobbin B).

[0040] Each cradle arm 21 is swingable about a swing shaft 21a extending in the left-right direction, by a cradle drive motor 42 (see FIG. 2) . The cradle drive motor 42 is controlled by the control unit 14. As the cradle arms 21 swing, the package P (bobbin B) supported by the cradle arms 21 are movable between a winding position (see solid lines in FIG. 3(b)) substantially below the swing shaft 21a and a doffing position (see dashed lines in FIG. 3(b)) substantially rearward of the swing shaft 21a. The yarn Y is wound onto the package P (bobbin B) when the package P (bobbin B) is at the winding position. When the package P is at the doffing position, the package P is detached from the cradle arms 21 and doffed to a storage unit 29 provided behind the frame 10.

[0041] The bobbin holder 22 includes a shaft portion 25 extending in the axial direction (left-right direction) and a disc-shaped supporting portion 26 attached to a leading end portion of the shaft portion 25 (i.e., an end portion on the inner side in the axial direction). A base end portion (outer end portion in the axial direction) of the shaft portion 25 is attached the cradle arm 21 by an unillustrated bearing, and the shaft portion 25 is rotatable about its axis by a winding motor 43 (see FIG. 2) . The winding motor 43 is controlled by the control unit 14. As the supporting portion 26 rotates together with the shaft portion 25, the package P (bobbin B) supported by the paired left and right supporting portions 26 is rotated about the axis.

[0042] The shaft portion 25 of the bobbin holder 22 is arranged to be extendable and contractable in the axial direction by an extension drive unit 44 (see FIG. 2) composed of, for example, a cylinder. The extension drive unit 44 is controlled by the control unit 14. As the left and right shaft portions 25 are extended, the left and right supporting portions 26 become close to each other, with

the result that the end portions in the axial direction of the bobbin B are supported by the bobbin holders 22. Meanwhile, as the left and right shaft portions 25 are contracted, the left and right supporting portions 26 move away from each other, with the result that the package P can be detached from the bobbin holders 22.

[0043] The right bobbin holder 22 further includes a ring-shaped movable portion 27 that is externally fitted to the shaft portion 25 at a position to the right of (on the outer side in the axial direction of) the supporting portion 26. The supporting portion 26 and the movable portion 27 constitute a yarn holding portion 28. The movable portion 27 is arranged to be movable in the axial direction by a yarn holding driving unit 45 (see FIG. 2) composed of, for example, a cylinder. The movable portion 27 is movable between a contact position (see FIG. 1) where the movable portion 27 is in contact with the supporting portion 26 and a separated position (see FIG. 3 (a)) where the movable portion 27 is separated from the supporting portion 26. The yarn holding driving unit 45 is controlled by the control unit 14. To start winding of the yarn Y onto a new bobbin B, to begin with, the yarn Y is disposed in a gap between the supporting portion 26 and the movable portion 27 while the movable portion 27 is set at the separated position, and then the movable portion 27 is moved to the contact position so that the yarns Y is pinched by the supporting portion 26 and the movable portion 27. In this way, the yarn Y is held by the yarn holding portion 28.

[0044] The traverse unit 23 is configured to traverse the yarn Y in the left-right direction. The traverse unit 23 is arranged such that a traverse guide 35 is attached to an endless belt 34 wound onto pulleys 31 to 33. The pulley 31 is a driving pulley and is controlled by the control unit 14. The traverse guide 35 is attached to a part of the endless belt 34, which extends in the left-right direction. As the endless belt 34 is reciprocated by the driving pulley 31, the traverse guide 35 reciprocates in the left-right direction. As a result of this, the yarn Y engaged with the traverse guide 35 is traversed in the left-right direction about the tension detection sensor 19 functioning as a fulcrum of traversal.

[0045] The contact roller 24 is provided to make contact with the package P on which the yarn Y is being wound, and is rotated in accordance with the rotation of the package P. The contact roller 24 adjusts the shape of the package P by applying contact pressure to the package P.

[0046] In addition to the above, the re-winder 1 includes the bobbin supplier 13. The bobbin supplier 13 is attached to the upper most part of the frame 10. The bobbin supplier 13 supplies a new bobbin B when a completed package P is replaced with a new bobbin B. The bobbin supplier 13 is controlled by the control unit 14. The bobbin supplier 13 is not shown in figures other than FIG. 1.

[0047] The re-winder 1 is arranged to be able to automatically replace a completed package P with a new bobbin B. It is therefore necessary to cut the yarn Y at a part between the package P and the yarn supplying unit 11 (yarn supply package Ps) and to cause the yarn holding portion 28 of the bobbin holder 22 to hold a part of the yarn Y on the yarn supplying unit 11 side. The re-winder 1 is provided with a clamp cutter 50 which is configured to cut and hold the yarn Y in order to guide the yarn Y to the yarn holding portion 28.

[0048] FIG. 4 is a top view of a front end portion of the yarn threading arm 51 having the clamp cutter 50. FIG. 5 is a cross-section of the clamp cutter 50. As shown in FIG. 4, the clamp cutter 50 is attached to a front end portion of the yarn threading arm 51 that extends in the front-rear direction. The yarn threading arm 51 is movable in the front-rear direction and in the left-right direction by an arm driving unit 52 (see FIG. 2) composed of, for example, a cylinder. The arm driving unit 52 is controlled by the control unit 14. At the front end portion of the yarn threading arm 51, a guide groove 51a is formed to guide the yarn Y to the clamp cutter 50. A front end portion of the guide groove 51a is open to the right. The yarn Y can be introduced into the guide groove 51a from this opening and guided to the clamp cutter 50.

[0049] As shown in FIG. 5, the clamp cutter 50 includes a fixed blade 53, a movable blade 54, and a grip member 55. The fixed blade 53 is fixed to the yarn threading arm 51. The movable blade 54 is provided below the fixed blade 53 and is rotated in a horizontal plane by a cutter driving unit 56 (see FIG. 2) . The cutter driving unit 56 is controlled by the control unit 14. The grip member 55 is a plate-shaped member that is provided below the movable blade 54 and fixed to the yarn threading arm 51.

[0050] As shown in FIG. 4 and FIG. 5 (a), the movable blade 54 is rotated to the fixed blade 53 side while the yarn Y is provided between the fixed blade 53 and the movable blade 54, with the result that the yarn Y is cut. In so doing, as shown in FIG. 5(b), the movable blade 54 enters between the fixed blade 53 and the grip member 55. Therefore a part of the yarn Y on the yarn supplying unit 11 side is nipped between the lower surface of the movable blade 54 and the upper surface of the grip member 55. In this way, the part of the yarn Y on the yarn supplying unit 11 side is held by the clamp cutter 50 at the same time as the cutting of the yarn Y.

(Bobbin Replacement Operation)

[0051] The re-winder 1 of the present embodiment is arranged to be able to automatically replace a completed package P with a new bobbin B. The following will describe a series of steps of a bobbin replacement operation until the start of winding of the yarn Y onto the new bobbin B after the completion of the package P. Each of FIG. 6 and FIG. 7 is a flow chart illustrating the bobbin replacement operation. FIG. 8 to FIG. 11 are schematic diagrams illustrating the bobbin replacement operation. In each figure, the left drawing is a front view whereas the right drawing is a side view.

[0052] When the formation of the package P is completed, the control unit 14 stops the winding motor 43 to stop the winding of the yarn Y, and stops the rotation of the feed roller 16 (step S10; FIG. 8(a)). In the present embodiment, when the winding is stopped, the traverse guide 35 is stopped at a location slightly to the right of the center of the package P in the left-right direction. At this stage, the clamp cutter 50 (yarn threading arm 51) is on standby at a standby position that is behind the package P and to the left of the center of the package P in the left-right direction. In this connection, the stop position of the traverse guide 35 and the standby position of the clamp cutter 50 are not limited to those described above.

[0053] Subsequently, the control unit 14 swings the cradle arms 21 forward to move the package P up (step S11; FIG. 8(b)). The package P is moved up in order to allow the clamp cutter 50 to move to a location below the package P, because the clamp cutter 50 is attached to the yarn threading arm 51 that is able to move only in the front-rear direction and the left-right direction. In this way, the clamp cutter 50 is able to cut and hold the yarn Y between the package P and the yarn supplying unit 11.

[0054] In connection with the above, after the package P is moved up, the yarn path between the tension detection sensor 19 functioning as the fulcrum of traversal and the package P becomes long. For this reason, when the package P is moved up, the yarn Y is pulled out from the yarn supply package Ps, with the result that the tension of the yarn Y may become excessively high. When such an excessively tensioned yarn Y is cut by the clamp cutter 50, the yarn Y tends to escape from the clamp cutter 50 as soon as the yarn Y is cut, and hence the clamp cutter 50 is likely to fail to hold the yarn Y.

[0055] In order to avoid this problem, after the package P is moved up, it is determined whether or not the following condition is satisfied: the tension of the yarn Y detected by the tension detection sensor 19 is equal to or lower than a predetermined threshold T1 (third threshold in the present invention) (step S12). If the tension of the yarn Y exceeds T1 (NO in the step S12), the feed roller 16 is rotated forward (step S13) to send the yarn Y to the package P side. As a result, the tension of the yarn Y is decreased. As the steps S12 and S13 are repeated according to need, the tension of the yarn Y is decreased to be equal to or lower than T1, before the clamp cutter 50 cuts the yarn Y. T1 is appropriately set in accordance with the type of the yarn Y. For example, when the yarn Y is a false-twisted processed yarn, T1 is about 2 grams.

[0056] When the tension of the yarn Y becomes equal to or lower than T1 (YES in the step S12), the control unit 14 moves the yarn threading arm 51 forward and rightward so as to move the clamp cutter 50 to a cutting position that is below the package P and on the yarn path (step S14) . The clamp cutter 50 then cuts a part of the yarn Y between the package P and the yarn supplying unit 11 and causes the clamp cutter 50 to hold a part of the yarn Y on the yarn supplying unit 11 side (step S15; FIG. 9 (a)). The steps S12 and S13 are executed at suitable timings after the execution of the step S11 and before the execution of the step S15. In other words, the steps S12 and S13 may be executed during the execution of the step S14 or after the execution of the step S14.

[0057] When the yarn Y is cut and held by the clamp cutter 50, the package P is doffed and then a new bobbin B is attached (step S16). To be more specific, to begin with, the control unit 14 swings the cradle arms 21 rearward so as to position the package P at a location above the storage unit 29 (FIG. 9(b)). In this state, the bobbin holders 22 are driven and the package P is detached from the cradle arms 21. As a result, the package P is doffed to the storage unit 29 (FIG. 10(a)). After the completion of the doffing, the control unit 14 returns the cradle arms 21 slightly forward and attach a new bobbin B supplied from the bobbin supplier 13 to the cradle arms 21 (bobbin holders 22) (FIG. 10(b)). When the new bobbin B is attached, the control unit 14 arranges the yarn holding portion 28 of the right bobbin holder 22 to be open (i.e., causes the movable portion 27 to be detached from the supporting portion 26) .

[0058] While the package P is doffed and the new bobbin B is attached, the control unit 14 moves the clamp cutter 50 rearward from the cutting position (first movement of the present invention; shift from FIG. 9(b) to FIG. 10(a)) and then moves the clamp cutter 50 rightward along the axial direction (third movement of the present invention; shift from FIG. 10(a) to FIG. 10(b)) (step S17) . While the flowchart in FIG. 6 and FIG. 7 indicates that the steps S17 to S20 are executed after the step S16, in reality, the steps S17 to S20 are executed during the execution of the step S16. The steps S17 to S20 are executed at suitable timings after the execution of the step S15 and before the execution of the step S22.

[0059] The clamp cutter 50 is moved rearward in the step S17 in order to prevent the clamp cutter 50 from interfering with the bobbin B when the bobbin B is moved to the winding position in the later-described step S22. The position in the left-right direction of the clamp cutter 50 after its movement rightward is substantially identical with the position of the gap between the supporting portion 26 and the movable portion 27 of the bobbin holder 22. When the clamp cutter 50 is moved rightward, the traverse guide 35 is moved rightward together. The clamp cutter 50 may be moved rightward and then rearward, or may be moved obliquely rightward and rearward.

[0060] After the clamp cutter 50 is moved rearward and rightward from the cutting position, the yarn path between the tension detection sensor 19 and the clamp cutter 50 becomes long. For this reason, when the clamp cutter 50 is moved, the yarn Y is pulled out from the yarn supply package Ps, with the result that the tension of the yarn Y may become excessively high. On this account, the yarn Y may be detached from the clamp cutter 50.

[0061] In order to avoid this problem, while the clamp cutter 50 is moving rearward and rightward, it is determined whether the following condition is satisfied: the

tension of the yarn Y detected by the tension detection sensor 19 is equal to or lower than a predetermined threshold T2 (fourth threshold in the present invention) (step S18). If the tension of the yarn Y exceeds T2 (NO in the step S18), the feed roller 16 is rotated forward (step S19) to send the yarn Y to the clamp cutter 50 side. As a result, the tension of the yarn Y is decreased. By continuously monitoring the tension of the yarn Y during the movement of the clamp cutter 50 (the step S18 is executed again when a result of the step S20 is NO), it is possible to maintain the tension of the yarn Y to be equal to or lower than T2 while the clamp cutter 50 is moving. T2 is appropriately set in accordance with the type of the yarn Y. For example, when the yarn Y is a false-twisted processed yarn, T2 is about 2 grams.

[0062] After the completion of the movement of the clamp cutter 50 rearward and rightward (YES in the step S20), the control unit 14 swings the cradle arms 21 forward and downward so as to move the new bobbin B to the winding position (step S21; FIG. 11(a)). Subsequently, the control unit 14 moves the clamp cutter 50 forward (second movement of the present invention; shift from FIG. 11(a) to FIG. 11(a)) (step S22). In this way, the yarn Y held by the clamp cutter 50 is guided to the yarn holding portion 28, to be more specific, to the gap between the supporting portion 26 and the movable portion 27.

[0063] After the clamp cutter 50 is moved forward, the yarn path between tension detection sensor 19 and the clamp cutter 50 become short. On this account, the yarn Y having been pulled out from the yarn supply package Ps when the clamp cutter 50 was moved rearward and rightward is slackened when the clamp cutter 50 is moved forward. If the yarn Y held by the clamp cutter 50 is slackened, the clamp cutter 50 may not be able to guide the yarn Y to the narrow gap between the supporting portion 26 and the movable portion 27, and hence the yarn threading to the bobbin holders 22 tends to be failed.

[0064] In order to avoid this problem, while the clamp cutter 50 is moving forward, it is determined whether the following condition is satisfied: the tension of the yarn Y detected by the tension detection sensor 19 is equal to or higher than a predetermined threshold T3 (first threshold in the present invention) (step S23). If the tension of the yarn Y is lower than T3 (NO in the step S23), the feed roller 16 is rotated backward (step S24) to send the yarn Y to the yarn supplying unit 11 side. As a result, the slack of the yarn Y is eliminated. In this way, the yarn Y is appropriately guided to the yarn holding portion 28 (i.e., the gap between the supporting portion 26 and the movable portion 27).

[0065] Subsequently, it is determined whether the following condition is satisfied: the tension of the yarn Y detected by the tension detection sensor 19 is equal to or lower than a predetermined threshold T4 (second threshold in the present invention) (step S25). If the tension of the yarn Y exceeds T4 (NO in the step S25), the feed roller 16 is rotated forward (step S26) to send the yarn Y to the clamp cutter 50 side. As a result, the tension of the yarn Y is decreased. In this way, it is possible to prevent the yarn Y held by the clamp cutter 50 from being detached from the clamp cutter 50 on account of excessively high tension.

[0066] By continuously monitoring the tension of the yarn Y during the forward movement of the clamp cutter 50 (the step S23 is executed again when a result of the step S27 is NO), it is possible to maintain the tension of the yarn Y to be equal to or higher than T3 and equal to or lower than T4 while the clamp cutter 50 is moving. T3 and T4 are appropriately set in accordance with the type of the yarn Y. For example, when the yarn Y is a false-twisted processed yarn, T3 is about 2 grams and T4 is about 5 grams.

[0067] After the completion of the forward movement of the clamp cutter 50 (YES in the step S27), the yarn Y held by the clamp cutter 50 is provided in the gap between the supporting portion 26 and the movable portion 27. In this state, the control unit 14 causes the movable portion 27 to make contact with the supporting portion 26, with the result that the yarn holding portion 28 holds the yarn Y whereas the holding of the yarn Y by the clamp cutter 50 is canceled (step S28; FIG. 12(a)).

[0068] When the holding of the yarn Y by the clamp cutter 50 is canceled, the control unit 14 moves the clamp cutter 50 to the standby position (FIG. 12(b)). Furthermore, the control unit 14 re-starts the winding of the yarn Y onto the new bobbin B by rotating the bobbin holders 22, rotating the feed roller 16 forward, and reciprocating the traverse guide 35 (step S29) .

[0069] In the present embodiment, the rearward movement of the clamp cutter 50 from the cutting position is equivalent to the first movement of the present invention, the rightward movement subsequent to the first movement is equivalent to the third movement of the present invention, and the forward movement subsequent to the third movement is equivalent to the second movement of the present invention. The operation of eliminating the slack of the yarn Y by rotating the feed roller 16 backward is equivalent to tensioning of the present invention, whereas the operation of slackening the yarn Y by rotating the feed roller 16 forward is equivalent to slackening of the present invention.

(Effects)

[0070] In the present embodiment, after the clamp cutter 50 starts the second movement and until the yarn Y is held by the yarn holding portion 28, the control unit 14 controls the feed roller 16 (yarn slack adjustment unit) so that the tension detected by the tension detection sensor 19 (tension detection unit) is maintained to be equal to or higher than T3 (first threshold) . With this arrangement, the state without the slack of the yarn Y is maintained during the second movement of the clamp cutter 50, if T3 is appropriately set. It is therefore possible to reliably guide the yarn Y to the yarn holding portion 28 by the clamp cutter 50.

[0071] In the present embodiment, after the clamp cutter 50 starts the second movement and until the yarn Y is held by the yarn holding portion 28, the control unit 14 controls the feed roller 16 so that the tension detected by the tension detection sensor 19 is maintained to be equal to or lower than T4 (second threshold) which is higher than T3. When the feed roller 16 is only controlled to maintain the tension of the yarn Y to be equal to or higher than T1 during the second movement of the clamp cutter 50, the tension of the yarn Y may become excessively high and the yarn Y may be detached from the clamp cutter 50. In this regard, by appropriately setting the upper limit of the tension of the yarn Y during the second movement of the clamp cutter 50, i.e., T4 as described above, it is possible to prevent the yarn Y from being detached from the clamp cutter 50 during the second movement.

[0072] In the present embodiment, after the package P is moved in the direction in which the yarn Y is pulled out from the yarn supplying unit 11 (i.e., moved upward) and before the yarn Y is cut by the clamp cutter 50, the control unit 14 causes the feed roller 16 to perform the slackening so that the tension detected by the tension detection sensor 19 is equal to or lower than T1 (third threshold) . When the package P is moved in the direction in which the yarn Y is pulled out from the yarn supplying unit 11, the tension of the yarn Y becomes excessively high at a part between the yarn supplying unit 11 and the package P, with the result that the yarn Y may escape from the clamp cutter 50 as soon as the yarn Y is cut, before the yarn Y is held by the clamp cutter 50. In this regard, with the arrangement described above, the tension of the yarn Y can be reduced before the yarn Y is cut by the clamp cutter 50, by appropriately setting T1. It is therefore possible to reliably hold the yarn Y by the clamp cutter 50.

[0073] In the present embodiment, while the clamp cutter 50 is performing the first movement, the control unit 14 controls the feed roller 16 so that the tension detected by the tension detection sensor 19 is maintained to be equal to or lower than T2 (fourth threshold). In the first movement, when the clamp cutter 50 moves in the direction in which the yarn Y is pulled out from the yarn supplying unit 11, the tension of the yarn Y may become excessively high and the yarn Y may be detached from the clamp cutter 50. In this regard, with the arrangement described above, the tension of the yarn Y can be reduced during the first movement of the clamp cutter 50, by appropriately setting T2. It is therefore possible to prevent the yarn Y from being detached from the clamp cutter 50 during the first movement.

[0074] In the present embodiment, while the clamp cutter 50 is performing the third movement, the control unit 14 controls the feed roller 16 so that the tension detected by the tension detection sensor 19 is equal to or lower than T2 (fourth threshold). In the third movement, when the clamp cutter 50 moves in the direction in which the yarn Y is pulled out from the yarn supplying unit 11, the tension of the yarn Y may become excessively high and the yarn Y may be detached from the clamp cutter 50. In this regard, with the arrangement described above, the tension of the yarn Y can be reduced during the third movement of the clamp cutter 50, by appropriately setting T2. It is therefore possible to prevent the yarn Y from being detached from the clamp cutter 50 during the first movement.

[0075] In the present embodiment, the feed roller 16 which is provided between the yarn supplying unit 11 and the winding unit 12 in the yarn running direction and is rotatable forward and backward is utilized as the yarn slack adjustment unit of the present invention. Such a feed roller 16 is typically provided in the re-winder 1. When the feed roller 16 is utilized as the yarn slack adjustment unit, it is unnecessary to provide an additional apparatus, and hence cost reduction is achieved.

[0076] In the present embodiment, the yarn holding portion 28 includes the supporting portion 26 supporting the end portion in the axial direction of the bobbin B and the movable portion 27 movable between the contact position where the movable portion 27 is in contact with the supporting portion 26 and the separated position where the movable portion 27 is separated from the supporting portion 26 in the axial direction. After the yarn Y is provided in the gap between the movable portion 27 and the supporting portion 26 in the state in which the movable portion 27 is at the separated position, the movable portion 27 is moved to the contact position so that the yarn Y is held. When the yarn Y held by the clamp cutter 50 is guided to the narrow gap in this way, the present invention that is capable of removing the slack of the yarn Y is particularly effective.

(Other Embodiments)

[0077] The following will describe modifications of the above-described embodiment.

[0078] While in the embodiment above the feed roller 16 is controlled based on the tension of the yarn Y detected by the tension detection sensor 19, the feed roller 16 may not be controlled based on the tension of the yarn Y. For example, the amount of forward or backward rotation of the feed roller 16 may be determined in advance based on a predicted amount of slack and a predicted tension of the yarn Y. In this case, the feed roller 16 can be easily controlled in the bobbin replacement operation only by rotating the feed roller 16 forward or backward for a predetermined amount of rotation at a suitable timing.

[0079] In the embodiment above, the rearward movement of the clamp cutter 50 from the cutting position is equivalent to the first movement of the present invention. In this regard, in the first movement, the moving direction of the clamp cutter 50 may be an obliquely rearward direction which is formed by synthesizing a rearward movement component with a movement component in the left-right direction.

[0080] In the embodiment above, the forward movement of the clamp cutter 50 toward the yarn holding portion 28 is equivalent to the second movement of the present invention. In this regard, in the second movement, the moving direction of the clamp cutter 50 may be an obliquely forward direction which is formed by synthesizing a forward movement component with a movement component in the left-right direction.

[0081] In the embodiment above, the yarn threading arm 51 having the clamp cutter 50 is movable in the front-rear direction and in the left-right direction. In this regard, the yarn threading arm 51 may be differently arranged on condition that the clamp cutter 50 is properly moved. For example, the yarn threading arm 51 may be movable in the up-down direction, or may be swingable.

[0082] In the embodiment above, the feed roller 16 is equivalent to the yarn slack adjustment unit of the present invention. In this regard, the yarn slack adjustment unit may be differently arranged. For example, a yarn pressing mechanism 60 shown in FIG. 13 may be used as the yarn slack adjustment unit. This yarn pressing mechanism 60 is provided between suitable yarn guides 68 and 69. The yarn pressing mechanism 60 includes an arm 61, a swing shaft 62 provided at a base end portion of the arm 61, and a roller 63 provided at a leading end portion of the arm 61. By swinging the arm 61 about the swing shaft 62, the degree of pressing of the yarn Y by the roller 63 is adjustable. The slack of the yarn Y can be removed by swinging the arm 61 toward the left side of the figure. The yarn Y can be slackened by swinging the arm 61 toward the right side in the figure. Alternatively, when the tension application device 18 (see FIG. 1) pinching the yarn Y is arranged to be movable in the up-down direction, it is possible to utilize the tension application device 18 as the yarn slack adjustment unit.

[0083] In the embodiment above, the yarn holding portion 28 is composed of the supporting portion 26 and the movable portion 27 provided at the bobbin holder 22. The yarn holding portion may be differently arranged. For example, a slit may be formed in the circumferential surface of the bobbin B, and yarn threading may be performed such that the clamp cutter 50 guides the yarn Y to the slit. In this case, the slit formed in the bobbin B is equivalent to the yarn holding portion of the present invention.

[0084] While in the embodiment above the yarn winder of the present invention is applied to the re-winder 1, the present invention may be applied to a yarn winder of another type.

[Reference Signs List]

[0085]

1 re-winder (yarn winding machine)
11 yarn supplying unit
12 winding unit
14 controller
16 feed roller (yarn slack adjustment unit)
19 tension detection sensor (tension detection unit)
22 bobbin holder
26 supporting portion
27 movable portion
28 yarn holding portion
50 clamp cutter
B bobbin
P package
Y yarn

Claims

1. A yarn winder which includes a winding unit configured to form a package by winding a yarn supplied from a yarn supplying unit onto a bobbin, and is capable of automatically replacing the completed package with a new bobbin, the yarn winder comprising:

   a bobbin holder which supports the bobbin to be rotatable;
   a clamp cutter which is configured to cut a part of the yarn between the yarn supplying unit and the package and to hold a part of the yarn on the yarn supplying unit side, and then to guide the held yarn to either the bobbin holder or a yarn holding portion of the bobbin, when the package is replaced with the new bobbin;
   a yarn slack adjustment unit which is configured to perform tensioning that is to remove slack of the yarn held by the clamp cutter and slackening that is to slack the yarn held by the clamp cutter; and
   a controller which is configured to control at least the yarn slack adjustment unit, wherein,
   the clamp cutter is arranged to perform at least:

      after the part of the yarn between the yarn supplying unit and
      the package is cut and held, first movement of moving in a direction which includes a movement component toward one side in an orthogonal direction orthogonal to an axial direction of the bobbin holder and is a direction of pulling the yarn out from the yarn supplying unit; and
      after the first movement, second movement of moving in a direction including a movement component toward the other side in the orthogonal direction in order to guide the held yarn to the yarn holding portion, and
      after the clamp cutter starts to perform the second movement and before the yarn holding portion holds the yarn, the controller causes the yarn slack adjustment unit to perform the tensioning.

2. The yarn winder according to claim 1, wherein,

the controller causes the yarn slack adjustment unit to perform the tensioning while the clamp cutter is performing the second movement.

3. The yarn winder according to claim 1 or 2, wherein, the clamp cutter is configured to cut and hold the part of the yarn between the yarn supplying unit and the package after the package is moved in the direction in which the yarn is pulled out from the yarn supplying unit, and
after the package is moved in the direction in which the yarn is pulled out from the yarn supplying unit and before the yarn is cut by the clamp cutter, the controller causes the yarn slack adjustment unit to perform the slackening.

4. The yarn winder according to any one of claims 1 to 3, wherein, the controller causes the yarn slack adjustment unit to perform the slackening while the clamp cutter is performing the first movement.

5. The yarn winder according to any one of claims 1 to 4, wherein,
the clamp cutter is configured to further perform third movement of moving in the direction in which the yarn is pulled out from the yarn supplying unit along the axial direction, after the part of the yarn between the yarn supplying unit and the package is cut and held and before the second movement is performed, and
the controller causes the yarn slack adjustment unit to perform the slackening while the clamp cutter is performing the third movement.

6. The yarn winder according to claim 1, wherein,
a tension detection unit configured to detect tension of the yarn is provided between the yarn supplying unit and the winding unit in the yarn running direction, and
after the clamp cutter starts to perform the second movement and until the yarn is held by the yarn holding portion, the controller controls the yarn slack adjustment unit so that the tension detected by the tension detection unit is maintained to be equal to or higher than a predetermined first threshold.

7. The yarn winder according to claim 6, wherein,
after the clamp cutter starts to perform the second movement and until the yarn is held by the yarn holding portion, the controller controls the yarn slack adjustment unit so that the tension detected by the tension detection unit is maintained to be equal to or lower than a predetermined second threshold that is higher than the first threshold.

8. The yarn winder according to claim 6 or 7, wherein, the clamp cutter is configured to cut and hold the part of the yarn between the yarn supplying unit and the package after the package is moved in the direction in which the yarn is pulled out from the yarn supplying unit, and
after the package is moved in the direction in which the yarn is pulled out from the yarn supplying before and until the yarn is cut by the clamp cutter, the controller causes the yarn slack adjustment unit to perform the slackening so that the tension detected by the tension detection unit is equal to or lower than a predetermined third threshold.

9. The yarn winder according to any one of claims 6 to 8, wherein, while the clamp cutter is performing the first movement, the controller controls the yarn slack adjustment unit so that the tension detected by the tension detection unit is equal to or lower than a predetermined fourth threshold.

10. The yarn winder according to claim 9, wherein,
the clamp cutter is configured to further perform third movement of moving in the direction in which the yarn is pulled out from the yarn supplying unit along the axial direction, after the part of the yarn between the yarn supplying unit and
the package is cut and held and before the second movement is performed, and
while the clamp cutter is performing the third movement, the controller controls the yarn slack adjustment unit so that the tension detected by the tension detection unit is equal to or lower than the fourth threshold.

11. The yarn winder according to any one of claims 1 to 10, wherein, a feed roller which is rotatable forward and backward is provided between the yarn supplying unit and the winding unit in the yarn running direction, and
the feed roller functions as the yarn slack adjustment unit.

12. The yarn winder according to any one of claims 1 to 11, wherein,
the yarn holding portion includes:

a supporting portion supporting an end portion in the axial direction of the bobbin; and
a movable portion movable between a contact position where the movable portion is in contact with the supporting portion and
a separated position where the movable portion is separated from the supporting portion in the axial direction,
after the yarn is provided in a gap between the movable portion at the separated position and the supporting portion, the movable portion is moved to the contact position so that the yarn is held.

FIG.1

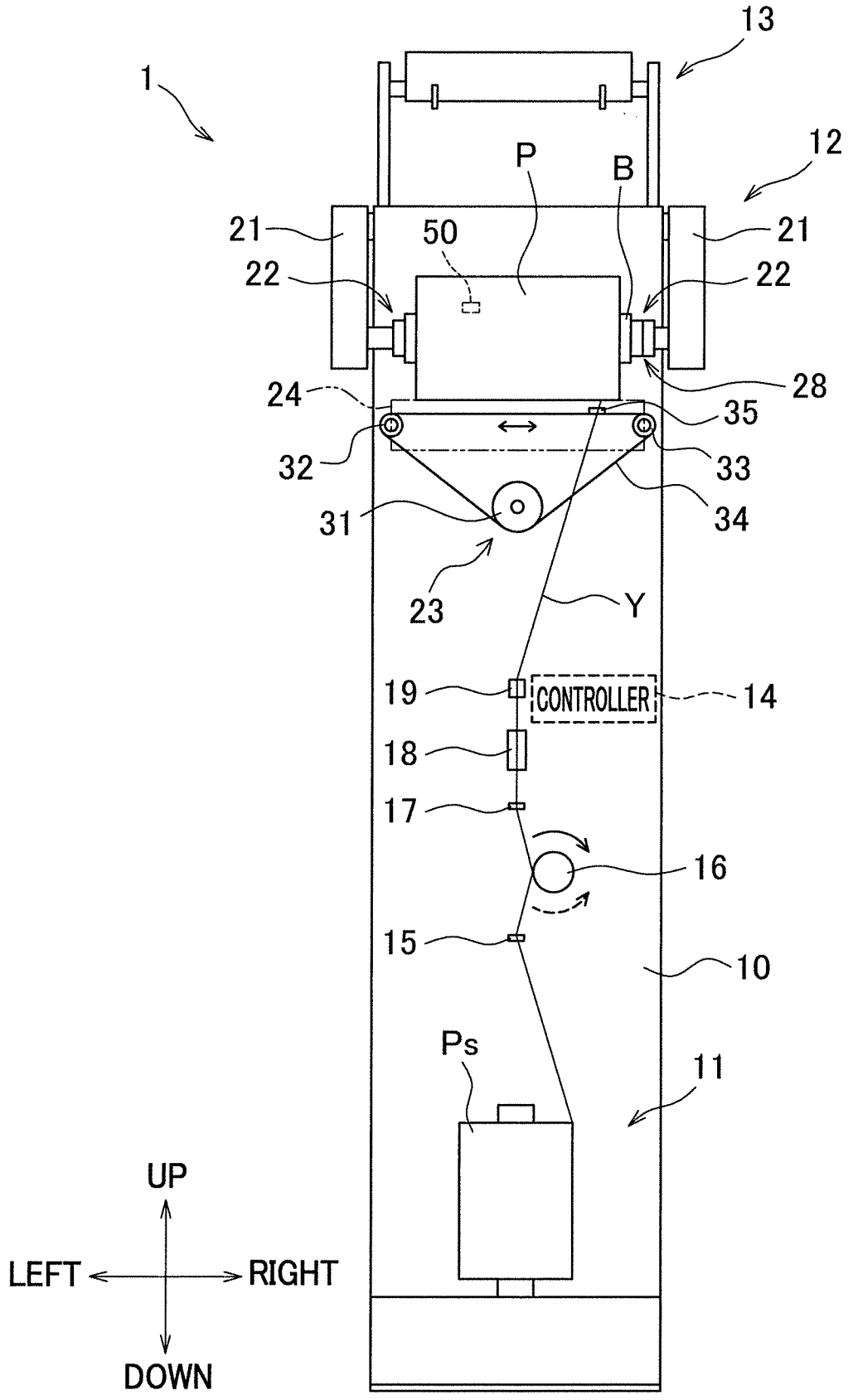

13
1
12
P
B
21
50
21
22
22
28
24
35
32
33
31
34
23
Y
19
CONTROLLER
14
18
17
16
15
10
Ps
11
UP
LEFT
RIGHT
DOWN

FIG.2

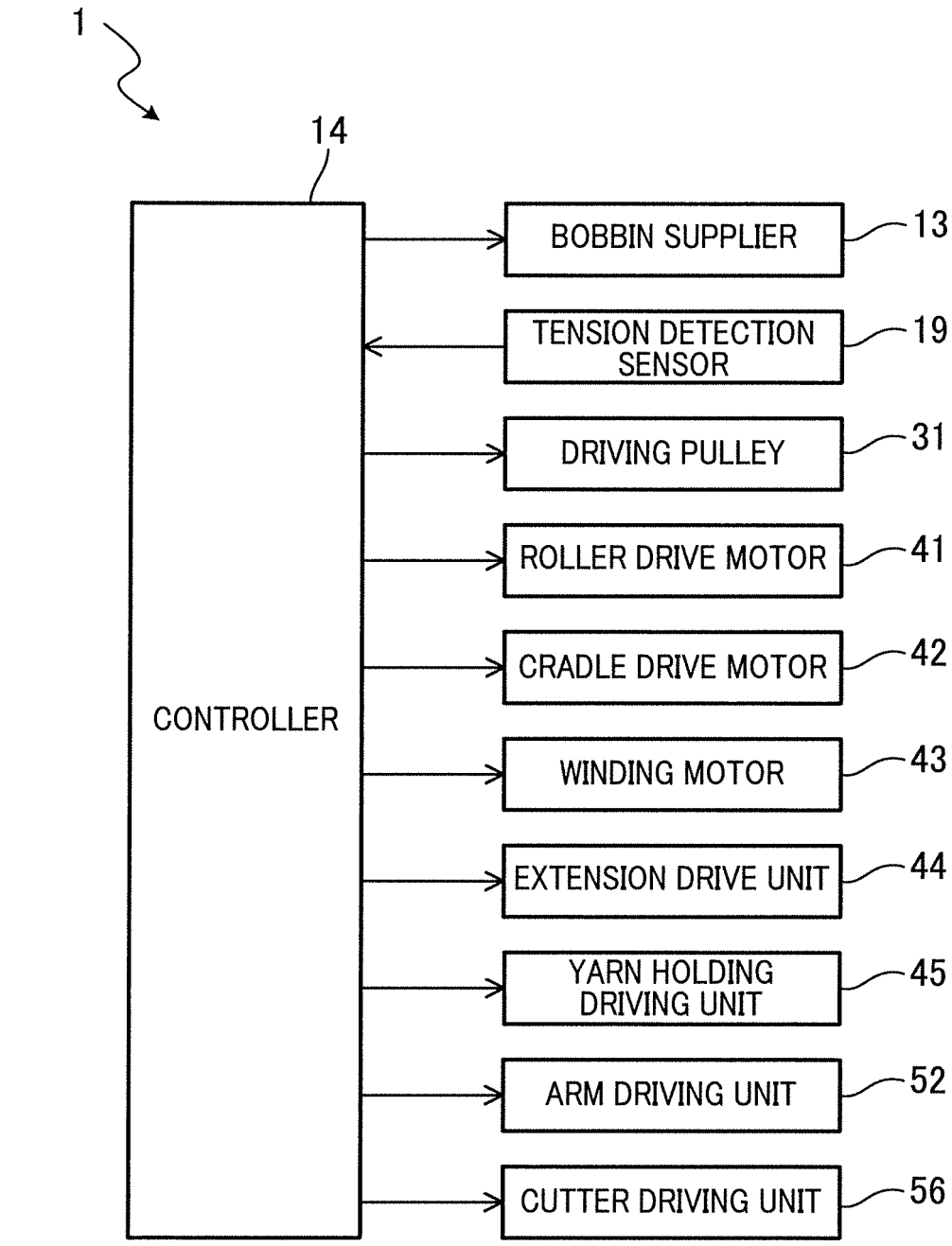
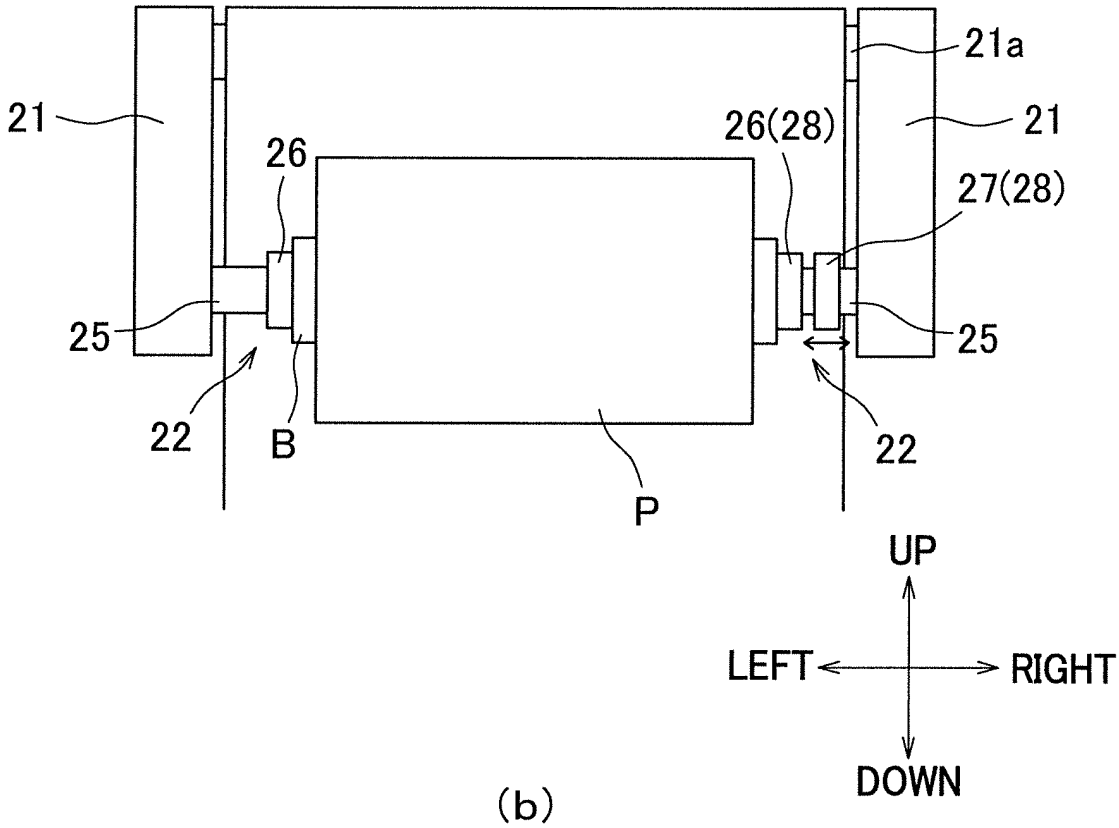

1
14
CONTROLLER
BOBBIN SUPPLIER
13
TENSION DETECTION SENSOR
19
DRIVING PULLEY
31
ROLLER DRIVE MOTOR
41
CRADLE DRIVE MOTOR
42
WINDING MOTOR
43
EXTENSION DRIVE UNIT
44
YARN HOLDING DRIVING UNIT
45
ARM DRIVING UNIT
52
CUTTER DRIVING UNIT
56

FIG.3

(a)


21
21a
26(28)
21
26
27(28)
25
25
22
B
22
P
UP
LEFT
RIGHT
DOWN

(b)

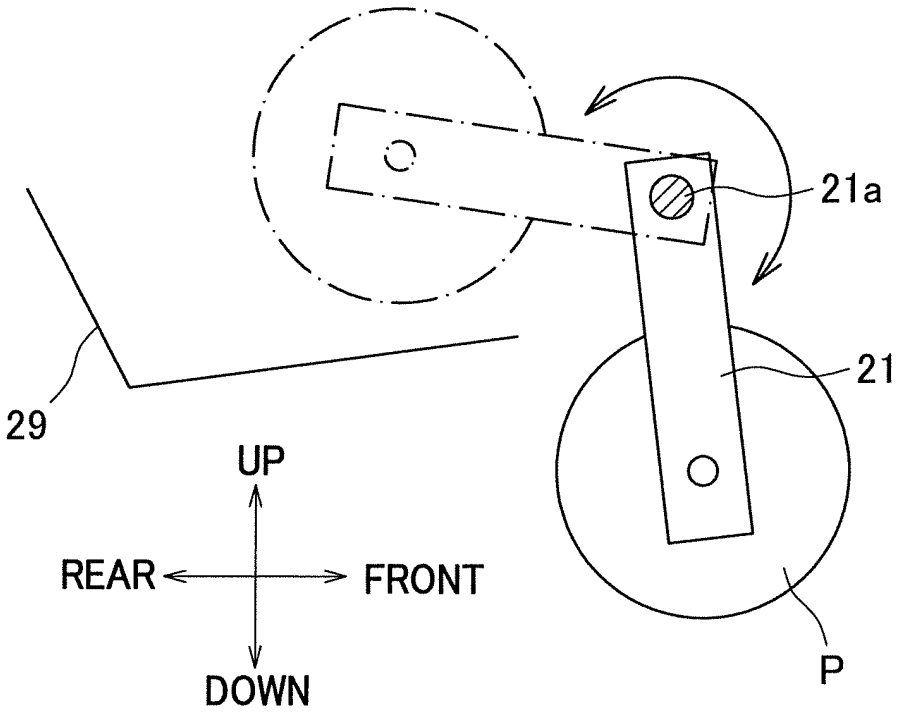

21a
21
29
UP
REAR
FRONT
DOWN
P

FIG.4

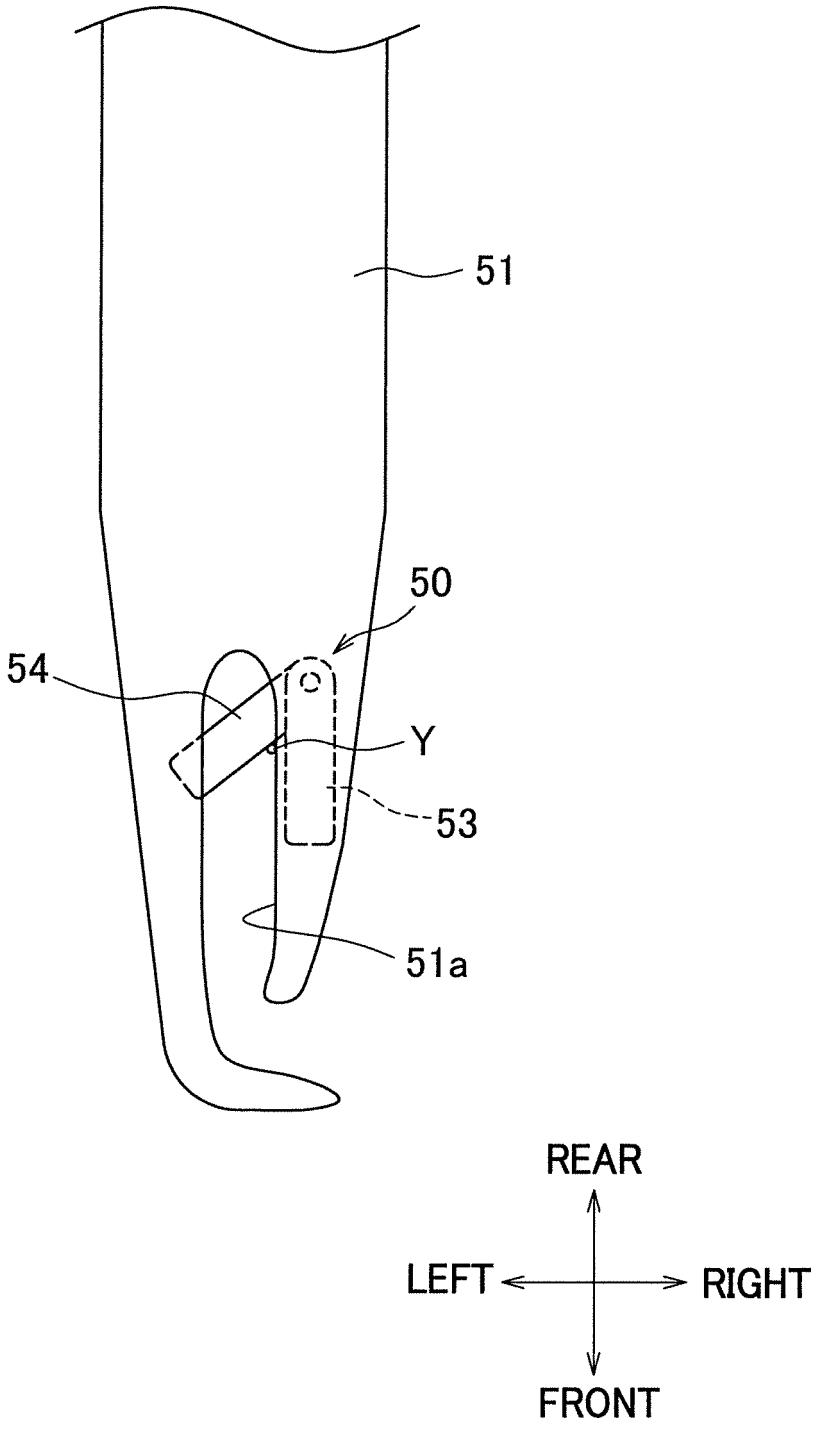


FIG.5

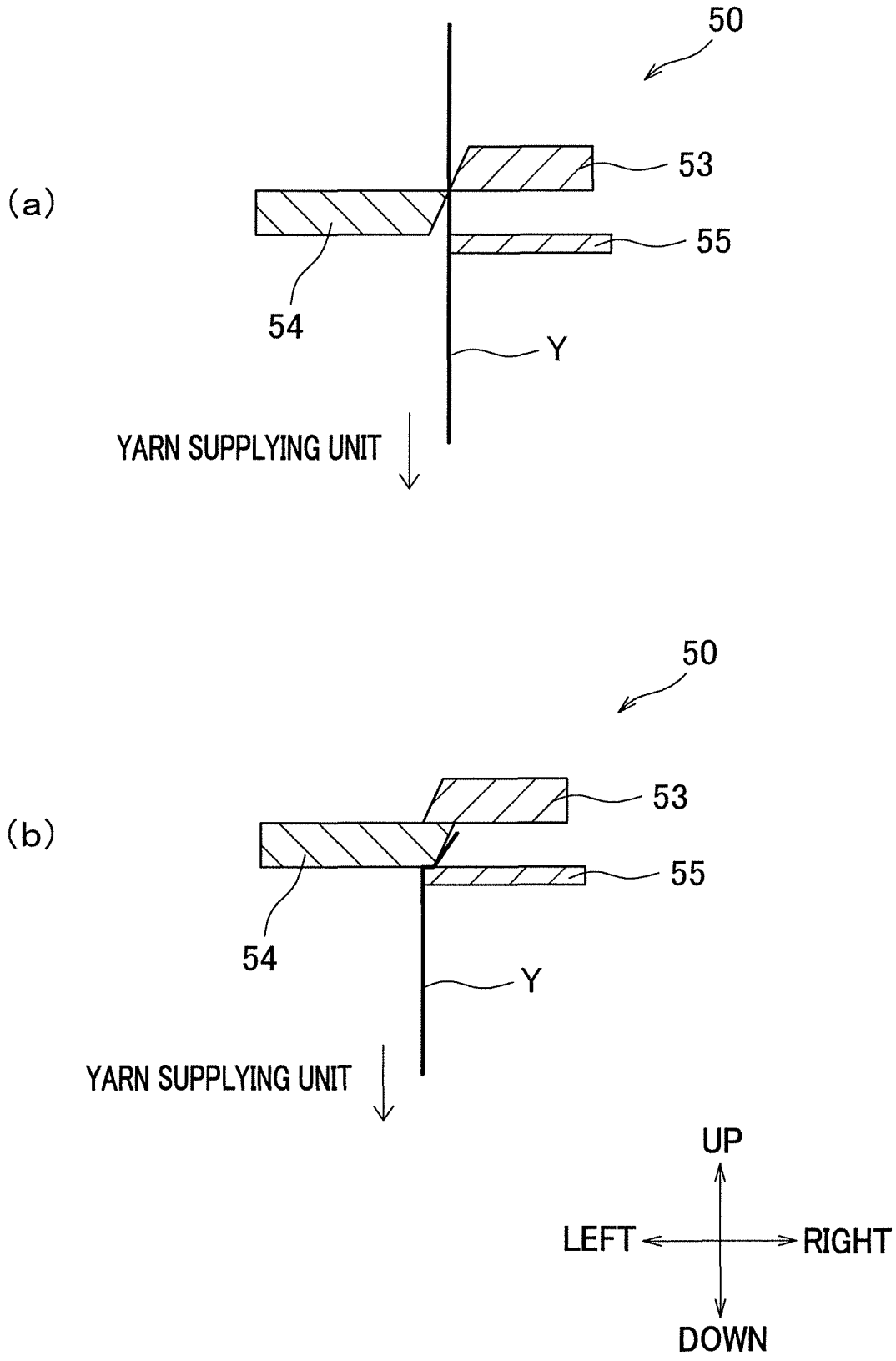

(a)
50
53
55
54
Y
YARN SUPPLYING UNIT
(b)
50
53
55
54
Y
YARN SUPPLYING UNIT
UP
LEFT
RIGHT
DOWN

FIG.6

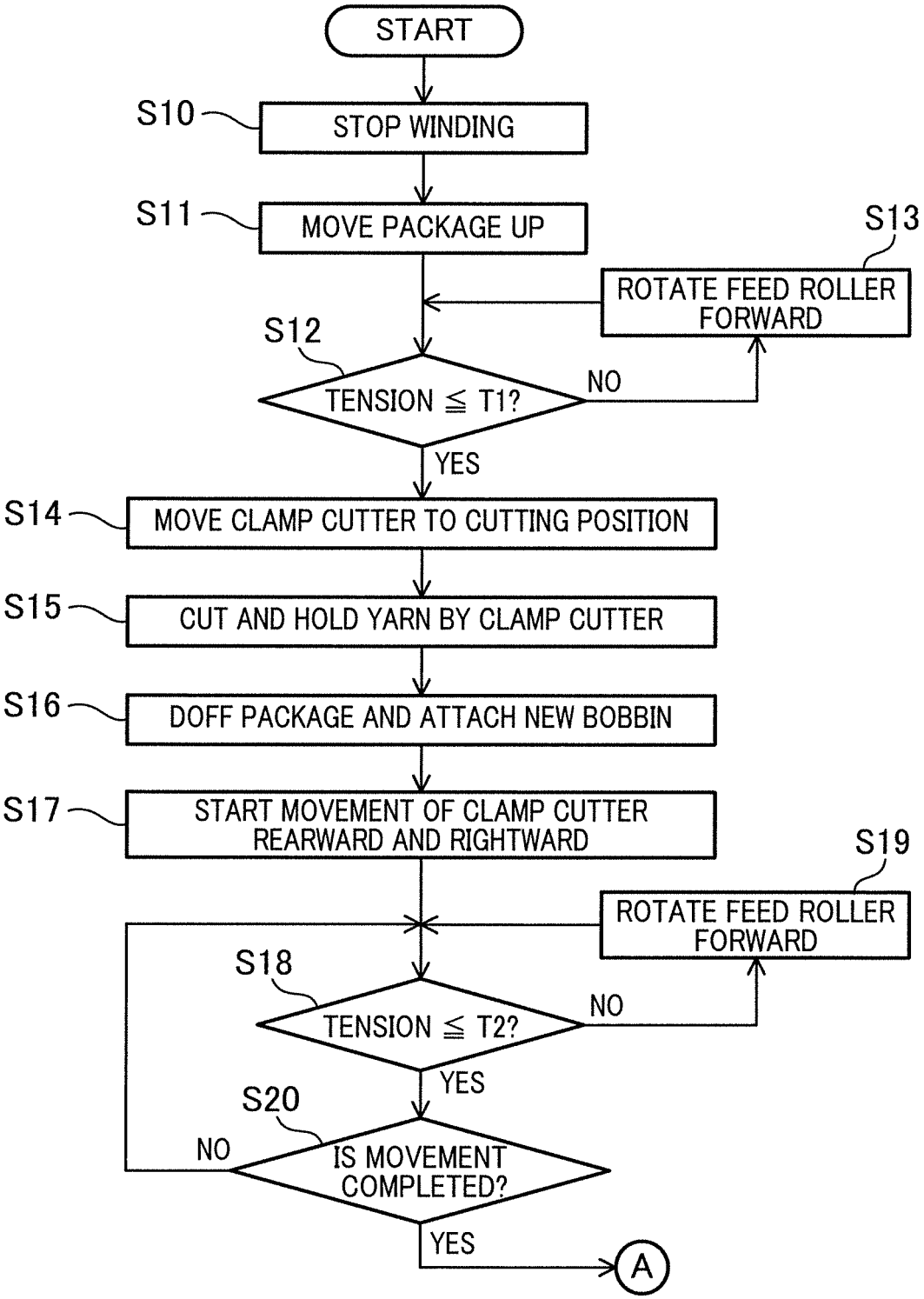

START
S10
STOP WINDING
S11
MOVE PACKAGE UP
S13
ROTATE FEED ROLLER FORWARD
S12
TENSION ≦ T1?
NO
YES
S14
MOVE CLAMP CUTTER TO CUTTING POSITION
S15
CUT AND HOLD YARN BY CLAMP CUTTER
S16
DOFF PACKAGE AND ATTACH NEW BOBBIN
S17
START MOVEMENT OF CLAMP CUTTER REARWARD AND RIGHTWARD
S19
ROTATE FEED ROLLER FORWARD
S18
TENSION ≦ T2?
NO
YES
S20
IS MOVEMENT COMPLETED?
NO
YES
A

FIG.7

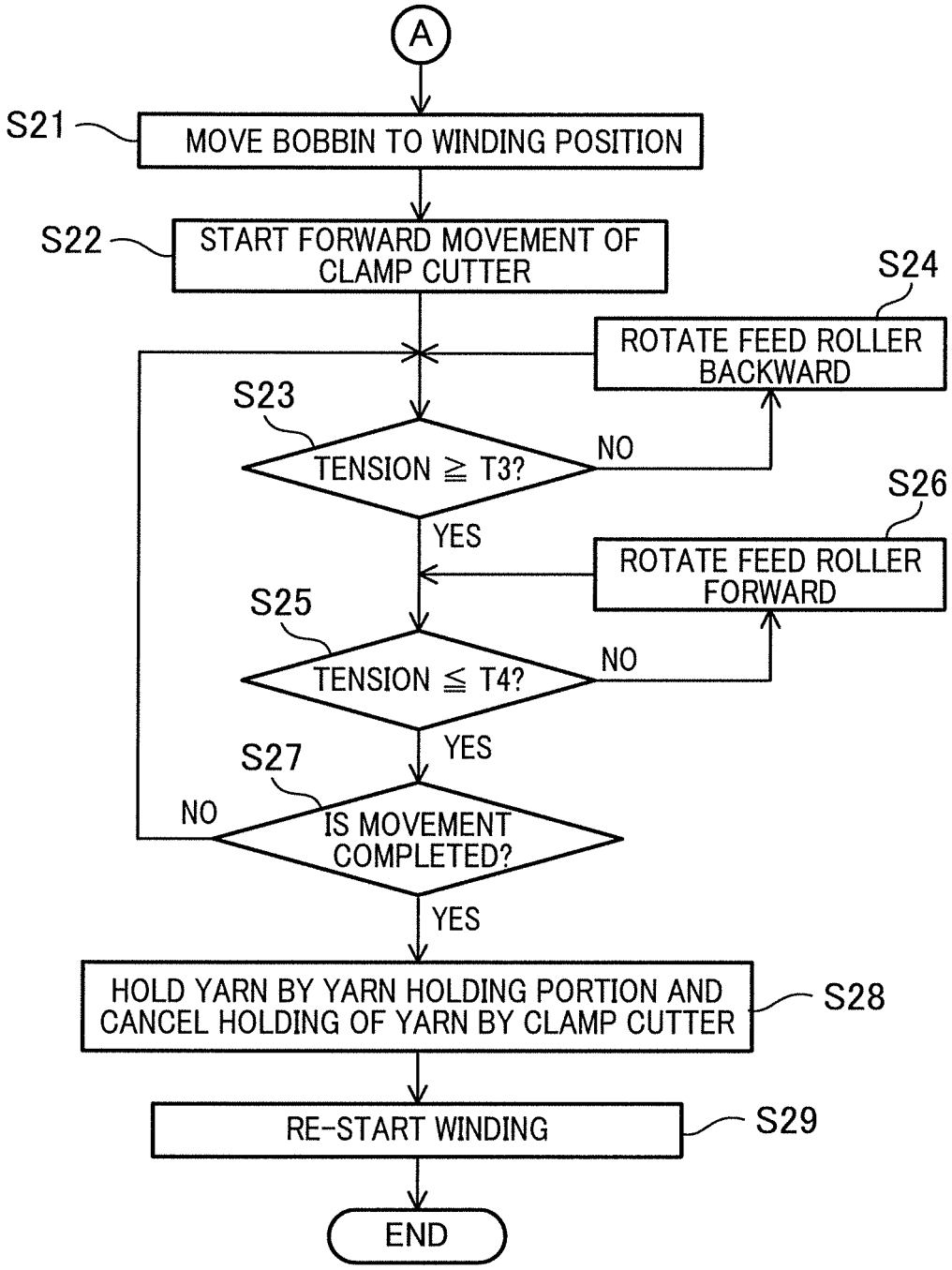

A
S21
MOVE BOBBIN TO WINDING POSITION
S22
START FORWARD MOVEMENT OF CLAMP CUTTER
S24
ROTATE FEED ROLLER BACKWARD
S23
TENSION ≧ T3?
NO
YES
S26
ROTATE FEED ROLLER FORWARD
S25
TENSION ≦ T4?
NO
YES
S27
NO
IS MOVEMENT COMPLETED?
YES
HOLD YARN BY YARN HOLDING PORTION AND CANCEL HOLDING OF YARN BY CLAMP CUTTER
S28
RE-START WINDING
S29
END

FIG.8

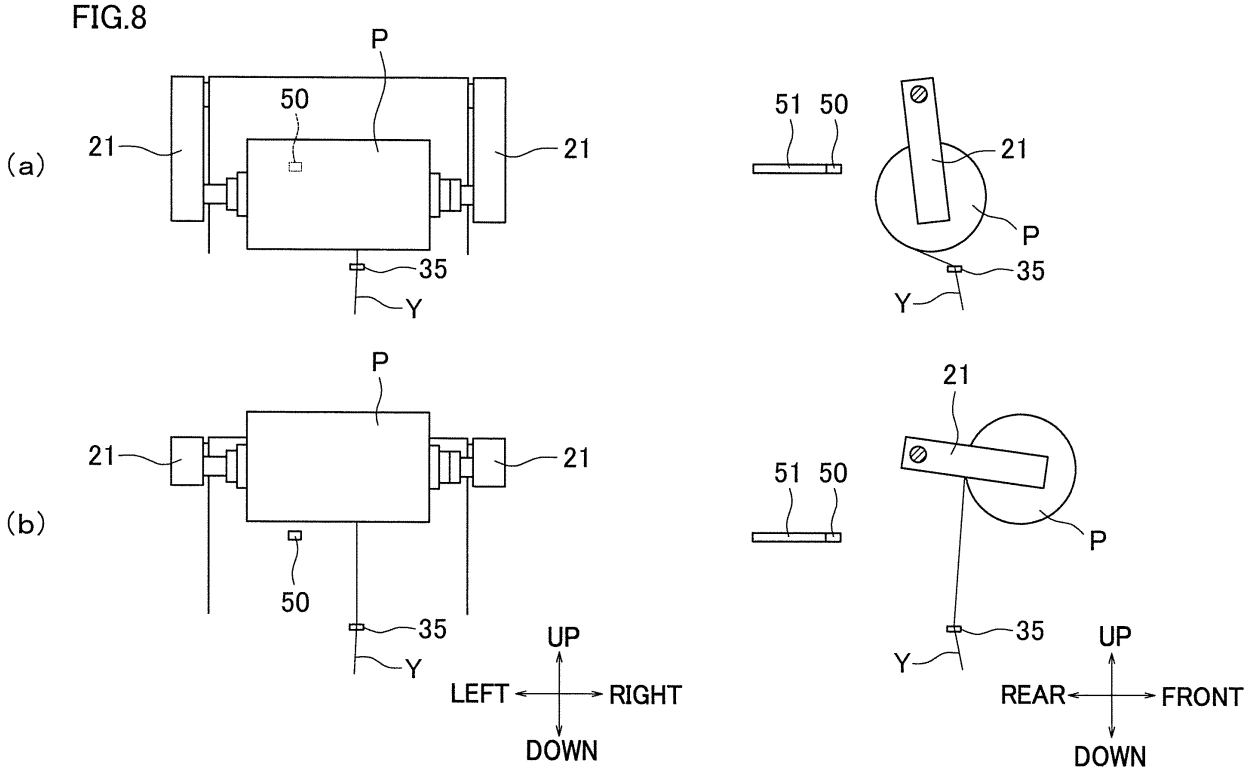

(a)
P
50
21
21
35
Y
51 50
21
P
35
Y
(b)
P
21
21
50
35
Y
UP
LEFT
RIGHT
DOWN
21
51 50
P
35
Y
UP
REAR
FRONT
DOWN

FIG.9

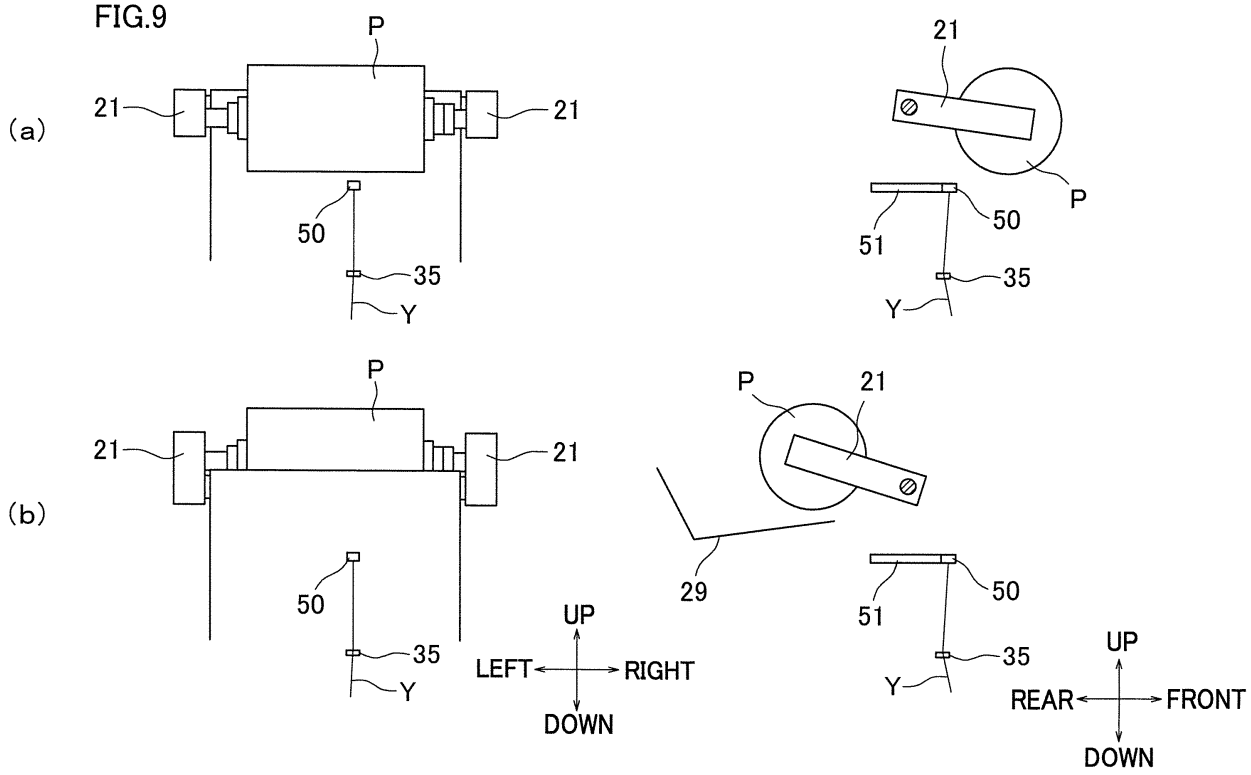

(a)
P
21
21
50
35
Y
21
P
50
51
35
Y
(b)
P
21
21
50
35
Y
UP
LEFT
RIGHT
DOWN
P
21
29
50
51
35
Y
UP
REAR
FRONT
DOWN

FIG.10

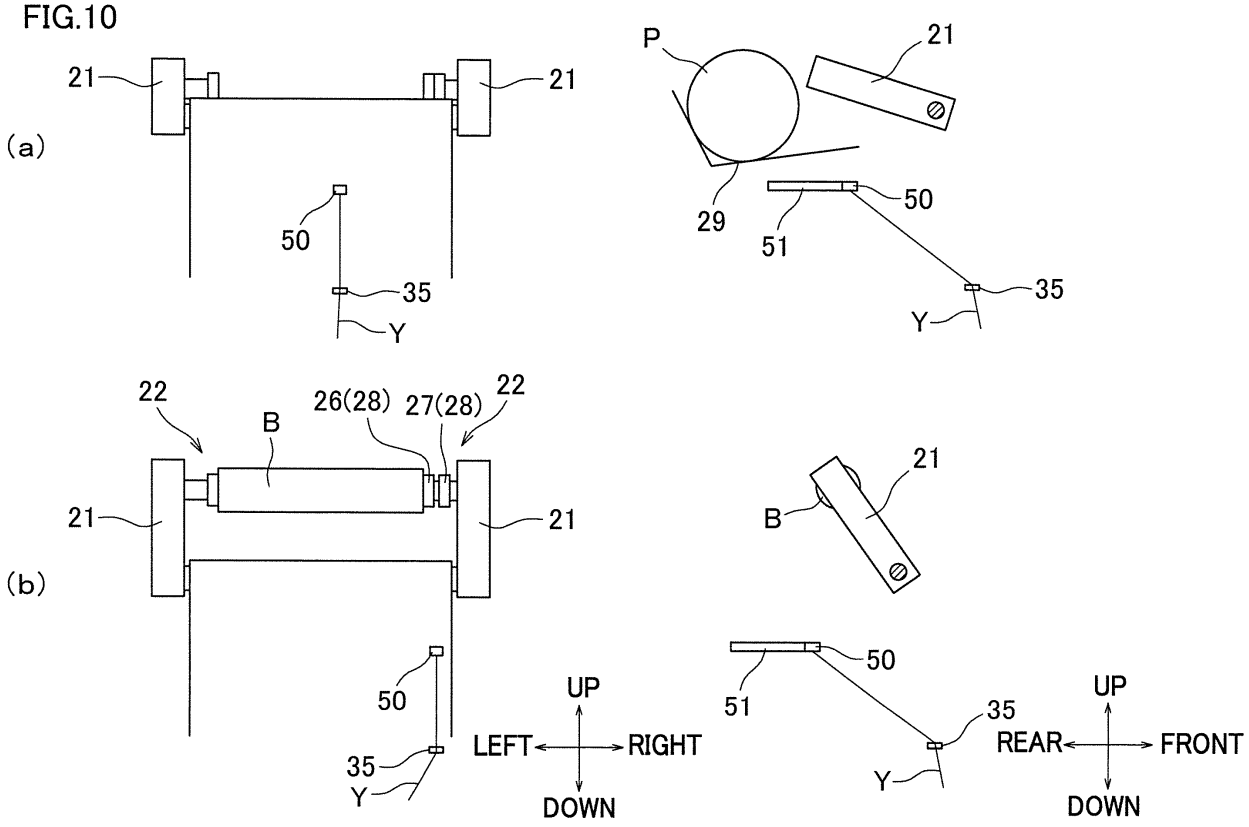

(a)
21
21
50
35
Y
P
21
29
50
51
35
Y
(b)
22
B
26(28)
27(28)
22
21
21
50
35
Y
UP
LEFT
RIGHT
DOWN
21
B
50
51
35
Y
UP
REAR
FRONT
DOWN

FIG.11

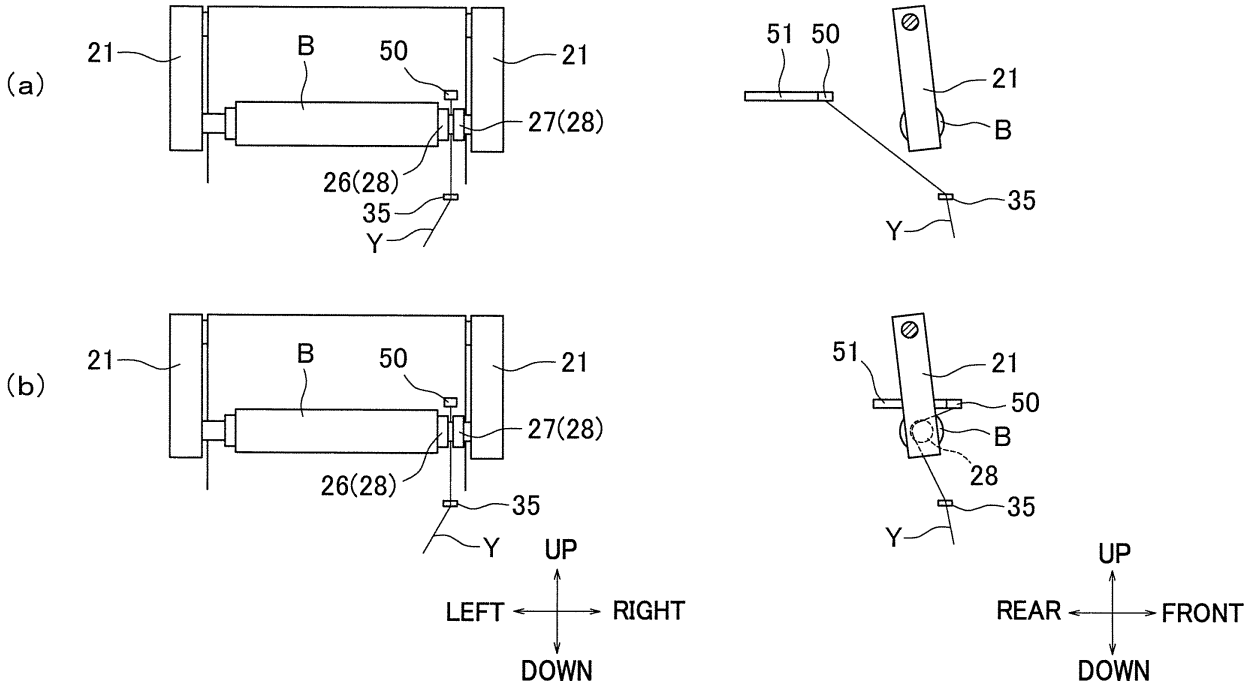

(a)
21
B
50
21
27(28)
26(28)
35
Y
51
50
21
B
35
Y
(b)
21
B
50
21
27(28)
26(28)
35
Y
UP
LEFT
RIGHT
DOWN
51
21
50
B
28
35
Y
UP
REAR
FRONT
DOWN

FIG.12

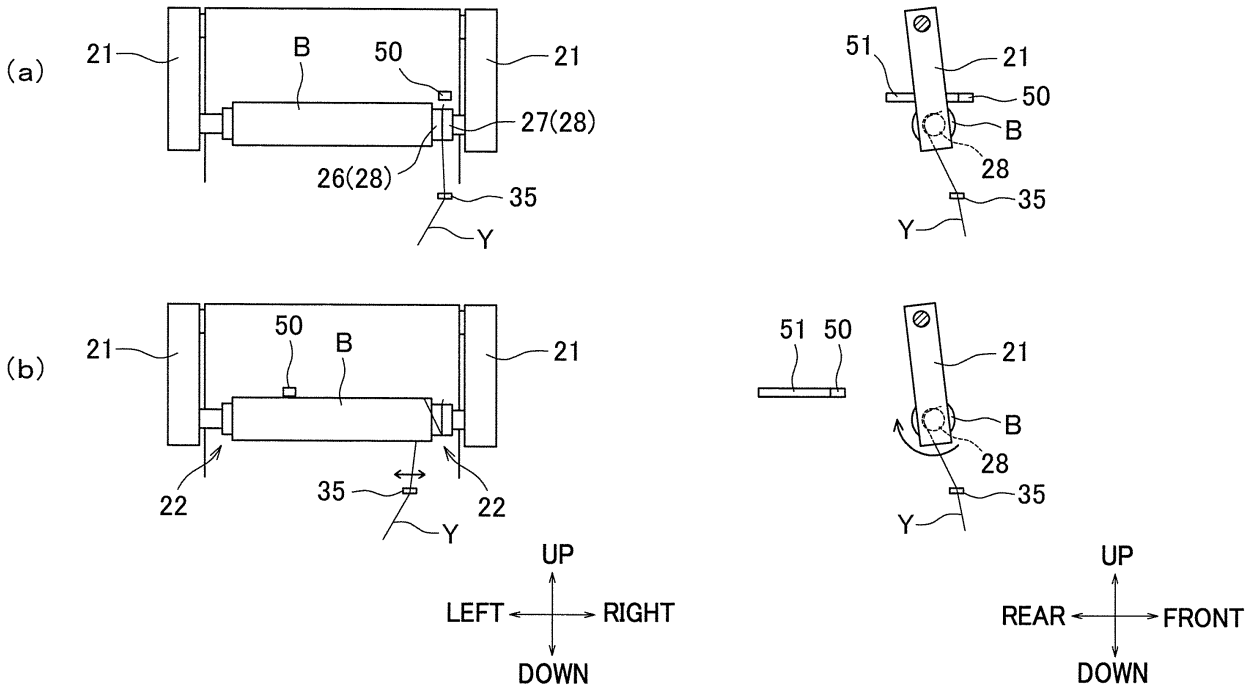
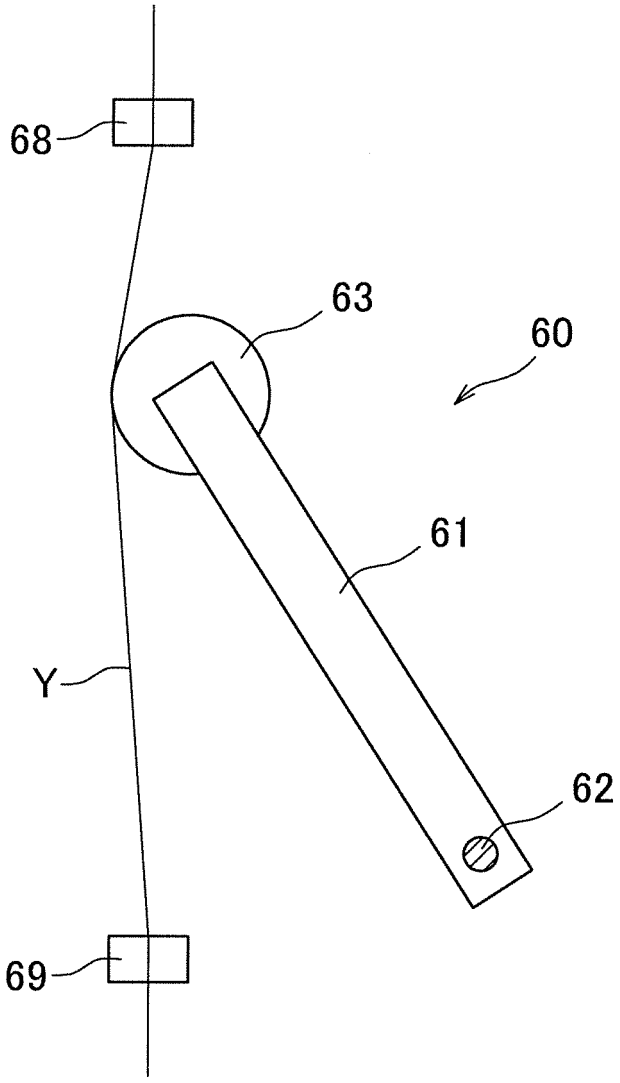

(a)
21
B
50
21
27(28)
26(28)
35
Y
51
21
50
B
28
35
Y
(b)
21
50
B
21
22
35
22
Y
UP
LEFT
RIGHT
DOWN
51
50
21
B
28
35
Y
UP
REAR
FRONT
DOWN

FIG.13



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/031766

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. B65H54/34(2006.01)i, B65H51/32(2006.01)i, B65H67/04(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. B65H54/34, B65H51/28, B65H51/32, B65H67/00-67/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2019
Registered utility model specifications of Japan 1996-2019
Published registered utility model applications of Japan 1994-2019

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2018-65658 A (MURATA MACHINERY LTD.) 26 April 2018 & EP 3312116 A1 & CN 107963512 A	1-12
A	JP 2009-286608 A (MURATA MACHINERY LTD.) 10 December 2009 (Family: none)	1-12

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27.08.2019	10.09.2019
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2008024438 A **[0003]**