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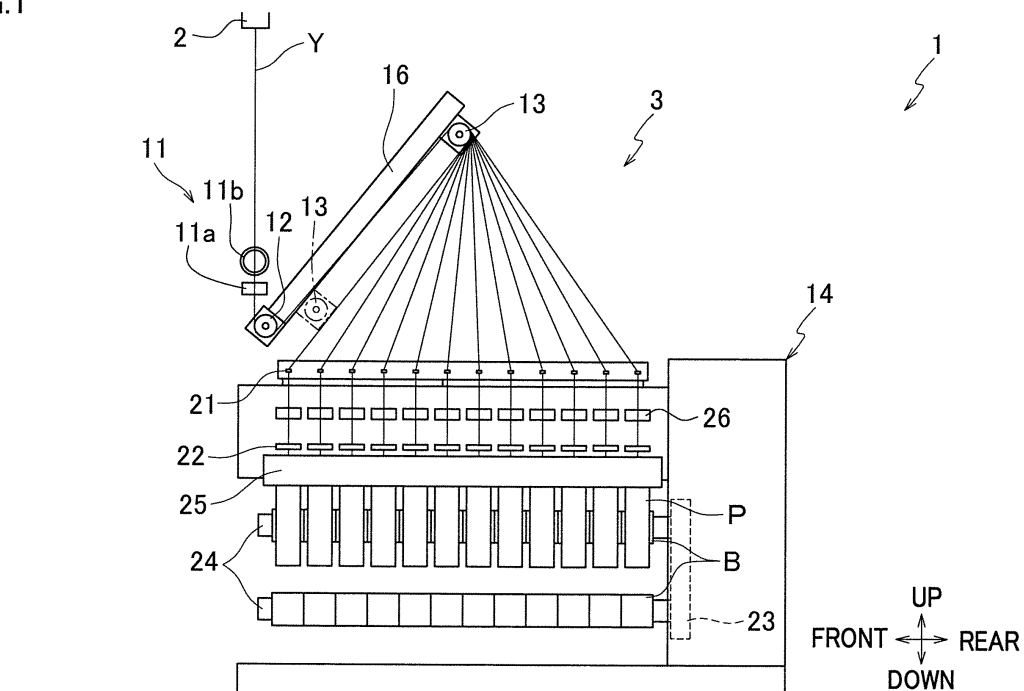
(54) **SPUN YARN WINDING SYSTEM**

(57) An object of the present invention is to reduce production loss due to a failure in yarn threading in a spun yarn take-up winder configured to wind yarns.

A spun yarn take-up winder 3 of a spun yarn winding system 1 includes a bobbin holder 24 supporting bobbins B to be rotatable, a yarn detection unit 26 which is provided between a spinning apparatus 2 and the bobbins

B in a yarn running direction and which detects yarns Y, and a winding controller 15. When the yarn threading is being performed, the winding controller 15 determines whether a failure in the yarn threading occurs in each yarn Y on the basis of a detection result of the yarn detection unit 26 before the yarns Y are threaded onto the respective bobbins B supported by the bobbin holder 24.

FIG.1



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a spun yarn winding system including a spun yarn take-up winder configured to wind yarns.

[0002] Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2015-78455) discloses a spun yarn take-up winder configured to take up yarns spun out from a spinning machine (spinning apparatus) and to wind the yarns onto bobbins being rotated. After the yarns spun out from the spinning apparatus are taken up by godet rollers provided at the spun yarn take-up winder, the yarns are distributed to fulcrum guides and then wound (yarn winding) onto respective bobbins while being traversed by traverse guides.

[0003] Before the yarn winding is started, yarns are required to be threaded to each part of the spun yarn take-up winder as yarn threading. Roughly speaking, the yarns are firstly required to be threaded to the godet rollers and the fulcrum guides while being sucked and held by a suction gun. Secondly, the yarns are required to be threaded onto the bobbins being rotated, and to be caught by the traverse guides in order to cause the traverse guides to start traversing.

[0004] If the yarn winding is started in a state in which the yarn threading is not successfully performed (e.g., yarns are not threaded to predetermined positions), a winding failure occurs. Typically, if the winding failure occurs at one bobbin in the spun yarn take-up winder described above, all yarns wound onto the remaining bobbins are also required to be wasted, leading to significant loss. It is therefore conceivable to use a yarn breakage detection device (yarn detection unit) such as those recited in Patent Literatures 2 and 3 (Japanese Examined Utility Model Publication No. H3-28047 and Japanese Examined Patent Publication No. S59-35816), in order to detect a failure in the yarn threading. The yarn detection unit of Patent Literature 2 can detect whether yarns are successfully being traversed. The yarn detection unit of Patent Literature 3 is attached to a leading end of a suction gun, and can detect whether the yarns are successfully sucked and held.

SUMMARY OF THE INVENTION

[0005] When a yarn detection unit of Patent Literature 2 is used, it is conceivable to detect a failure in yarn threading by, e.g., whether yarns are successfully being traversed after the yarn threading is completed. However, in this method, yarn winding is stopped after a yarn has already been wound onto another bobbin in which the yarn threading is successfully performed, at least to some extent. In this case, significant production loss may occur because operations such as removing the yarns wound onto the bobbins are required. In a yarn detection unit of Patent Literature 3, when yarns are required to be

threaded and any of the yarns is broken although the any of the yarns should be sucked and held by a suction gun, a yarn breakage is undetectable if other yarns are successfully sucked and held.

[0006] An object of the present invention is to reduce production loss due to a failure in yarn threading in a spun yarn take-up winder configured to wind yarns.

[0007] A first aspect of the present invention provides a spun yarn winding system comprising a spun yarn take-up winder configured to perform yarn winding by which yarns spun out from a spinning apparatus are wound onto respective bobbins while being traversed, the spun yarn take-up winder including: a bobbin holder supporting the bobbins to be rotatable; a yarn detection unit which is provided between the spinning apparatus and the bobbins in a yarn running direction and which detects the yarns; and a control unit, and when yarn threading in which the yarns are threaded to the spun yarn take-up winder before the yarn winding starts is being performed, the control unit determining whether a failure in the yarn threading occurs in each yarn based on a detection result provided by the yarn detection unit before the yarns are threaded onto the respective bobbins supported by the bobbin holder.

[0008] In the present invention, the occurrence of a failure in the yarn threading is determined during the yarn threading, before the yarns are threaded onto the respective bobbins. Because of this, the yarn threading can be done again before the yarn winding is started. For this reason, even when the failure in the yarn threading occurred, it is unnecessary to remove the yarns from the bobbins. Therefore, the production loss due to the failure in the threading can be reduced in the spun yarn take-up winder configured to wind the yarns.

[0009] According to a second aspect of the invention, the spun yarn winding system of the first aspect is arranged such that the spun yarn take-up winder further includes: fulcrum guides about which the yarns are respectively traversed; and a yarn feed roller which is provided on an upstream of the fulcrum guides in the yarn running direction and which sends the yarns to the fulcrum guides, and the yarn detection unit is provided on a downstream of the yarn feed roller in the yarn running direction.

[0010] Typically, the bobbins are aligned in a bobbin axial direction in the spun yarn take-up winder. Therefore, in the downstream of the yarn feed roller in the yarn running direction, it may be difficult for an operator to visually find a failure in the yarn threading because, e.g., the yarns are provided at positions which are far from a working space (space in which the yarn threading is performed) by the fulcrum guides. In such a structure, it is effective to provide the yarn detection unit on the downstream of the yarn feed roller in the yarn running direction.

[0011] According to a third aspect of the invention, the spun yarn winding system of the first or second aspect is arranged such that the control unit determines, during the yarn winding, whether the yarn winding is success-

fully being performed, based on the detection result provided by the yarn detection unit.

[0012] In the present invention, both whether a failure in the yarn threading occurs and whether the yarn winding is successfully being performed are determined based on the detection results of the same yarn detection unit. It is therefore possible to achieve cost reduction as compared to a case in which another detection unit is required for the two types of determinations described above.

[0013] According to a fourth aspect of the invention, the spun yarn winding system of any one of the first to third aspects is arranged such that the spun yarn take-up winder further includes traverse guides each of which is provided for traversing each of the yarns, the yarn detection unit is a traversing detection unit for detecting whether the yarns are being traversed by the traverse guides, and the control unit determines the occurrence of a failure in the yarn threading by determining whether each yarn is successfully being traversed by each traverse guide, based on the detection result provided by the traversing detection unit, when the yarn threading is being performed.

[0014] Typically, it is easier and more reliable to detect the existence of a yarn being traversed than to detect the existence of a yarn running straight. In the present invention, it is possible to determine the occurrence of a failure in the yarn threading easily and reliably by using the traversing detection unit.

[0015] According to a fifth aspect of the invention, the spun yarn winding system of any one of the first to fourth aspects is arranged such that the control unit continues the yarn threading only when the control unit determines that the failure in the yarn threading does not occur.

[0016] In the present invention, it is possible to reliably avoid a case in which the yarn winding is started for other yarns even if a failure in the yarn threading occurred for one yarn Y. It is therefore possible to reliably reduce the production loss.

[0017] According to a sixth aspect of the invention, the spun yarn winding system of any one of the first to fifth aspects is arranged such that the spun yarn take-up winder further includes a notification unit for notification of information, and the control unit causes the notification unit to notify an operator when the control unit determines that the failure in the yarn threading occurred.

[0018] In the present invention, the operator is able to swiftly perform the yarn threading again when the failure in the yarn threading occurred.

[0019] According to a seventh aspect of the invention, the spun yarn winding system of any one of the first to sixth aspects is arranged such that the spun yarn take-up winder further includes: a take-up roller taking up the yarns spun out from the spinning apparatus; and a cutting-holding unit which is provided between the spinning apparatus and the take-up roller in the yarn running direction and which cuts, sucks, and holds the yarns, and the control unit controls and causes the cutting-holding unit to cut, suck, and hold the yarns when the control unit

determines that the failure in the yarn threading occurred.

[0020] To begin with, the yarns are typically required to be threaded onto the take-up roller when the yarn threading is done again. In the present invention, the cutting-holding unit can cut and temporally hold the yarns when a failure in the yarn threading occurred. Because of this, the yarn threading can be done again smoothly.

[0021] According to an eighth aspect of the invention, the spun yarn winding system of any one of the first to seventh aspects is arranged such that the spun yarn take-up winder further includes a yarn threading execution part configured to perform at least a part of the yarn threading.

[0022] In the structure in which the at least a part of the yarn threading is performed by the yarn threading execution part, the operator may not always stay in the vicinity of the spun yarn take-up winder in which the yarn threading is being performed, and therefore, e.g., visual check may not be always performed. In such a structure, the following arrangement is especially effective: a failure in the yarn threading is detectable based on a detection result of the yarn detection unit.

[0023] According to a ninth aspect of the invention, the spun yarn winding system of the eighth aspect is arranged such that the control unit controls the yarn threading execution part so that a state of the spun yarn take-up winder is returned to an initial state for performing the yarn threading again when the control unit determines that the failure in the yarn threading occurred.

[0024] In the present invention, it is possible to perform the yarn threading again more smoothly as compared to a case in which the operator is required to intervene in order to return the state of the spun yarn take-up winder to the initial state. It is therefore possible to reduce the production loss further effectively.

[0025] According to a tenth aspect of the invention, the spun yarn winding system of the ninth aspect further includes a yarn threading robot configured to perform a part of the yarn threading for the spun yarn take-up winder, and the control unit outputs a signal for instructing the yarn threading robot to perform again the yarn threading to the spun yarn take-up winder when the control unit determines that the failure in the yarn threading occurred in the spun yarn take-up winder.

[0026] In the present invention, the yarn threading can be performed again further smoothly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

FIG. 1 is a side view showing one spun yarn take-up winder included in a spun yarn winding system related to the present embodiment.

FIG. 2 is a front view of the spun yarn take-up winder.

FIG. 3 is a block diagram showing an electric structure of the spun yarn winding system.

FIG. 4 shows an operation of fulcrum guides.

FIG. 5 shows a yarn threading execution part.

FIGs. 6(a) and 6(b) show a first separator, and FIG. 6(c) shows a second separator.

FIG. 7 shows a yarn shifting guide.

FIG. 8 is a flowchart of processes of the yarn threading.

FIGs. 9(a) to 9(c) are explanatory views of the processes of the yarn threading.

FIG. 10 is an explanatory view of the processes of the yarn threading.

FIG. 11 is a front view of the spun yarn take-up winder in the state shown in FIG. 10.

FIGs. 12(a) and 12(b) are explanatory views of processes in which the first separator holds yarns.

FIGs. 13(a) and 13(b) are explanatory views of processes in which the first separator hands the yarns to the second separator.

FIGs. 14(a) and 14(b) are explanatory views of the processes in which the first separator hands the yarns to the second separator.

FIG. 15 is a front view of the spun yarn take-up winder in a state in which yarns are caught by traverse guides.

FIG. 16 is a front view of the spun yarn take-up winder in yarn threading onto bobbins.

FIGs. 17(a) and 17(b) are explanatory views of an operation of the yarn shifting device.

FIG. 18 is a front view of a spun yarn winding system of a modification.

FIG. 19 shows an operation of a yarn threading robot.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] The following will describe an embodiment of the present invention. Hereinafter, directions shown in FIG. 1 and FIG. 2 will be consistently used as an up-down direction, a left-right direction, and a front-rear direction, for convenience of explanation. The up-down direction is a vertical direction in which the gravity acts. The left-right direction is orthogonal to the up-down direction, and is a direction in which spun yarn take-up winders 3 described later are aligned. The front-rear direction is a direction orthogonal to both the up-down direction and the left-right direction. Moreover, a direction in which a yarn Y runs is referred to as a yarn running direction.

(Spun Yarn Winding System)

[0029] The following will outline a spun yarn winding system 1 related to the present embodiment, with reference to FIG. 1 to FIG. 3. FIG. 1 is a side view showing one of spun yarn take-up winders 3 included in the spun yarn winding system 1 related to the present embodiment. FIG. 2 is a front view of the spun yarn take-up winder 3. FIG. 3 is a block diagram showing an electric structure of the spun yarn winding system 1. The spun yarn winding system 1 includes spinning apparatuses 2, the spun yarn take-up winders 3 provided to correspond

to the respective spinning apparatuses 2, and an integrated controller 4 (as shown in FIG. 3). Each spinning apparatus 2 is configured to spin out yarns Y made of synthetic fibers. The spun yarn take-up winders 3 are aligned in the left-right direction. As yarn winding, each spun yarn take-up winder 3 takes up the yarns Y spun out from the corresponding spinning apparatus 2 provided above the spun yarn take-up winder 3, and then winds the yarns Y onto the bobbins B, with the result that the packages P are formed. The integrated controller 4 controls the spun yarn take-up winders 3 integrally.

(Spun Yarn Take-Up Winder)

[0030] As shown in FIG. 1 and FIG. 2, the spun yarn take-up winder 3 includes a first godet roller 12 (take-up roller of the present invention), a second godet roller 13 (yarn feed roller of the present invention), a winding device 14, and a winding controller 15 (control unit of the present invention; as shown in FIG. 3). The first godet roller 12 is a roller having an axis substantially parallel to the left-right direction, and is provided above a front end portion of the winding device 14. The first godet roller 12 is rotationally driven by an unillustrated motor. The second godet roller 13 is a roller having an axis substantially parallel to the left-right direction, and is provided above and rearward of the first godet roller 12. The second godet roller 13 is rotationally driven by an unillustrated motor.

[0031] The second godet roller 13 is movably supported by a guide rail 16. The guide rail 16 extends obliquely upward and rearward. The second godet roller 13 is configured to be movable along the guide rail 16 by, e.g., a movement motor 111 (as shown in FIG. 3) and an unillustrated pulley pair and belt. Because of this, the second godet roller 13 is movable between a winding position (indicated by solid lines in FIG. 1) in which yarn winding is performed and a yarn threading position (indicated by dashed lines in FIG. 1) in which yarn threading described later is performed. The yarn threading position is closer to the first godet roller 12 than the winding position is to the first godet roller 12.

[0032] Above the first godet roller 12 (i.e., between the spinning apparatus 2 and the first godet roller 12 in a yarn running direction), a cutting-holding unit 11 is provided. The cutting-holding unit 11 is configured to temporarily hold yarns Y before the yarn threading is performed. The cutting-holding unit 11 includes a cutter 11a cutting the yarns Y and an aspirator 11b sucking and holding the yarns Y. The cutter 11a and the aspirator 11b are configured to be movable between a retracted position and a holding position which is to the right of the retracted position and which is provided for cutting and holding the yarns Y, in the left-right direction.

[0033] The winding device 14 is configured to form packages P by winding the yarns Y onto the bobbins B. The winding device 14 is provided below the first godet roller 12 and the second godet roller 13. The winding

device 14 includes fulcrum guides 21, traverse guides 22, a turret 23, two bobbin holders 24, a contact roller 25, and a yarn detection unit 26 (traversing detection unit of the present invention).

[0034] Each of the fulcrum guides 21 is a guide about which a yarn Y is traversed by each traverse guide 22. The fulcrum guides 21 are provided for the respective yarns Y, and are aligned in the front-rear direction. The fulcrum guides 21 are connected to each other by, e.g., an unillustrated belt, and moved by an air cylinder 112 (as shown in FIG. 3). Compressed air is supplied to and discharged from the air cylinder 112 (the same applies to the other air cylinders) in such a way that the winding controller 15 (as shown in FIG. 3) controls an unillustrated electromagnetic valve. Because of this, the fulcrum guides 21 are movable between positions (as shown in FIG. 1) in which the fulcrum guides 21 are separated from each other in the front-rear direction when the yarns Y are wound and positions (as shown in FIG. 4) in which the fulcrum guides 21 are gathered to the front side when the yarn threading is performed.

[0035] The traverse guides 22 are provided for the respective yarns Y, and are aligned in the front-rear direction. Each traverse guide 22 is a traverse guide of, e.g., a known blade type, and includes two blade guides 22a (as shown in FIG. 7) rotating in an opposite direction to each other. The blade guides 22a are driven by, e.g., a traverse motor 113 (as shown in FIG. 3). Because of this, the yarns Y are traversed about the fulcrum guides 21 in the front-rear direction by the blade guides 22a.

[0036] The turret 23 is a disc-shaped member having an axis substantially parallel to the front-rear direction. The turret 23 is rotationally driven by a turret motor 114 (as shown in FIG. 3). The two bobbin holders 24 have axes parallel to the front-rear direction and are rotatably supported at an upper end portion and a lower end portion of the turret 23, respectively. The bobbins B provided for the respective yarns Y are attached to each bobbin holder 24 so as to be aligned in the front-rear direction (bobbin axial direction), and are rotatably supported by each bobbin holder 24. Each of the two bobbin holders 24 is rotationally driven by an individual winding motor 115 (as shown in FIG. 3).

[0037] The contact roller 25 is a roller having an axis substantially parallel to the front-rear direction, and is provided immediately above the upper bobbin holder 24. The contact roller 25 is configured to make contact with the surfaces of the packages P supported by the upper bobbin holder 24. With this, the contact roller 25 applies a contact pressure to the surfaces of the unfinished packages P so as to adjust the shape of each package P. The contact roller 25 is configured to be movable in the up-down direction by, e.g., an unillustrated movement mechanism. Alternatively, the contact roller 25 may be arranged to be swingable about the front-rear direction which is a swing axial direction.

[0038] The yarn detection unit 26 is provided between the fulcrum guides 21 and the traverse guides 22 in the

yarn running direction. In other words, the yarn detection unit 26 is provided on a downstream of the second godet roller 13 in the yarn running direction. The yarn detection unit 26 is constituted by, e.g., reflective optical sensors each of which includes a light emitter 26a and light receiver 26b (as shown in FIG. 2). The light emitter 26a and the light receiver 26b are provided, e.g., to the left of a yarn Y. Each optical sensor is configured to emit light from the light emitter 26a, and to receive the light reflected by the yarn Y by means of the light receiver 26b. The optical sensors send information regarding a quantity of light detected by the light receiver 26b, to the winding controller 15 (as shown in FIG. 3). In this regard, the yarn detection unit 26 may include transmissive optical sensors instead of the reflective optical sensors. In other words, the light emitter 26a may oppose the light receiver 26b over the yarn Y in the left-right direction.

[0039] The winding controller 15 includes members such as a CPU, a ROM, and a RAM, and controls each part of the spun yarn take-up winder 3, such as the movement motor 111 (as shown in FIG. 3). The winding controller 15 further includes an operation unit 121 (as shown in FIG. 3) provided so as to be operated by an operator, and a notification unit 122 (as shown in FIG. 3) for notifying the operator of information. The operation unit 121 includes, e.g., an unillustrated operation button. The notification unit 122 includes, e.g., an unillustrated alarm lamp. The winding controller 15 is electrically connected to the integrated controller 4 (as shown in FIG. 3), and communicates with the integrated controller 4.

[0040] In the winding device 14 structured as described above, when the upper bobbin holder 24 is rotationally driven, the yarns Y traversed by the traverse guides 22 are wound onto the bobbins B, with the result that the packages P are formed (yarn winding). When the formation of the packages P is completed, the turret 23 rotates to switch over the upper and lower positions of the two bobbin holders 24. As a result, the bobbin holder 24 having been at the lower position is moved to the upper position, which allows the yarns Y to be wound onto the bobbins B attached to the bobbin holder 24 having been moved to the upper position so as to form packages P. The bobbin holder 24 to which the fully-formed packages P are attached is moved to the lower position, and the packages P are collected by, e.g., an unillustrated package collector.

[0041] During the yarn winding, the winding controller 15 determines whether each yarn Y is successfully being traversed, on the basis of the information received from the yarn detection unit 26. If the winding controller 15 determines that all yarns Y are successfully being traversed, the winding controller 15 controls the spun yarn take-up winder 3 to cause the yarn winding to be continued. If the winding controller 15 determines that any of the yarns Y is not successfully traversed, for example, the winding controller 15 controls and causes the cutting-holding unit 11 to cut the yarns Y so that the yarn winding of the spun yarn take-up winder 3 is stopped. The yarns

Y which are cut are temporarily held by the cutting-holding unit 11.

(Structure for Performing Yarn Threading)

[0042] The following will describe an example of the structure for performing yarn threading in the spun yarn take-up winder 3, with reference to FIG. 3 to FIG. 7. The yarn threading is a process in which yarns Y are threaded to each part of the spun yarn take-up winder 3 before the spun yarn take-up winder 3 starts the yarn winding. FIG. 4 shows an operation of the fulcrum guides 21. FIG. 5 shows a yarn threading execution part 30 described later. FIGs. 6(a) and 6(b) show a first separator 32 described later. FIG. 6(c) shows a second separator 33 described later, viewed along an arrow VI in FIG. 5. FIG. 7 shows a yarn shifting device 34 described later.

[0043] As described above, the second godet roller 13 and the fulcrum guides 21 are movable between the positions (as shown in FIG. 1) in which the yarn winding is performed and the positions (as shown in FIG. 4) where the yarn threading is being performed. In addition to that, the spun yarn take-up winder 3 includes the yarn threading execution part 30 (as shown in FIG. 5) configured to thread the yarns Y having been threaded to the fulcrum guides 21 to the traverse guides 22 and the bobbins B.

[0044] The yarn threading execution part 30 can perform a part (described later) of the yarn threading. As shown in FIG. 5, the yarn threading execution part 30 includes, e.g., a yarn convergence guide 31, the first separator 32, the second separator 33, and the yarn shifting device 34. The yarn convergence guide 31 is configured to cause the running yarns Y to converge at a front end portion of the spun yarn take-up winder 3 during the yarn threading. The first separator 32 temporarily holds the yarns Y having been threaded to the respective fulcrum guides 21. The second separator 33 performs operations such as receiving the yarns Y from the first separator 32 and moving the yarns Y to positions in which the yarns Y can be captured by the traverse guides 22. The yarn shifting device 34 is configured to guide each yarn Y to a slit S (as shown in FIG. 7) formed at an end portion of each bobbin B in a bobbin axial direction in such a way that each yarn Y being traversed is removed from each traverse guide 22.

[0045] The yarn convergence guide 31 is provided at a front end portion of the spun yarn take-up winder 3. As shown in FIG. 5, the yarn convergence guide 31 is attached to a leading end of an arm-like swing member 36 which is swingable about the front-rear direction which is a swing axial direction. The swing member 36 is swung by, e.g., an air cylinder 116 (as shown in FIG. 3). Because of this, the yarn convergence guide 31 is swingable between an initial position (indicated by solid lines in FIG. 5) positioned at a right end portion of the spun yarn take-up winder 3 and a handover position (indicated by two-dot chain lines in FIG. 5) provided to the left of the initial position. In this regard, the swing member 36 may be

driven by, e.g., a driving unit such as an unillustrated motor, instead of the air cylinder 116.

[0046] As shown in FIGs. 6(a) and 6(b), the first separator 32 includes a guide member 41 extending in the front-rear direction, and holding units 42 movably attached to the guide member 41 so as to be aligned in the front-rear direction. The guide member 41 is configured to be movable or swingable in the left-right direction (indicated by two-dot chain line arrows in FIG. 5) by, e.g., an air cylinder 117 (as shown in FIG. 3). The guide member 41 is movable between an initial position (as shown in FIG. 5) and a handover position provided to the left of the initial position. As shown in FIGs. 6(a) and 6(b), each holding unit 42 includes a main body portion 42a and a protruding portion 42b protruding rearward from an end portion of the main body portion 42a. This end portion of the main body portion 42a is opposite to the guide member 41. The holding units 42 are connected to each other by, e.g., an unillustrated belt, and moved in the front-rear direction by, e.g., an air cylinder 118 (as shown in FIG. 3). To be more specific, the holding units 42 are movable between first positions (as shown in FIG. 6(a)) where intervals of the holding units 42 in the front-rear direction are substantially same as intervals of the bobbins B in the front-rear direction, and second positions (as shown in FIG. 6(b)) where the holding units 42 are gathered on the front side as compared to the first positions. In this regard, the holding units 42 may be driven by, e.g., a driving unit such as an unillustrated motor, instead of the air cylinder 118.

[0047] The second separator 33 is provided to the left of the first separator 32. The second separator 33 includes an arm-like swing member 46 which extends in the front-rear direction and which is swingable about a swing axial center parallel to the front-rear direction, and a holding unit 47 fixed to a leading end of the swing member 46. For example, as shown in FIG. 6(c), roughly C-shaped insertion spaces 47a into which the yarns Y are inserted are formed at the end portion opposite to the swing member 46 of the holding unit 47 so as to be aligned in the front-rear direction. In addition to that, protruding portions 47b and protruding portions 47c are provided so as to oppose each other over a gap in the front-rear direction. Each of the protruding portions 47b protrudes rearward from a front end of an entrance portion of each insertion space 47a. Each of the protruding portions 47c protrudes forward from a rear end of the entrance portion. Intervals of the insertion spaces 47a in the front-rear direction are substantially same as the intervals of the bobbins B in the front-rear direction. The swing member 46 and the holding unit 47 are swung by, e.g., an air cylinder 119 (as shown in FIG. 3). Because of this, the swing member 46 and the holding unit 47 are movable (as shown in FIG. 5) between retracted positions where the swing member 46 and the holding unit 47 do not overlap with the turret 23 when viewed in the front-rear direction, and receiving positions where the swing member 46 and the holding unit 47 partially overlap

with the turret 23 when viewed in the front-rear direction and where the yarns Y are received from the first separator 32. In this regard, the swing member 46 and the holding unit 47 may be driven by, e.g., a driving unit such as an unillustrated motor, instead of the air cylinder 119.

[0048] The yarn shifting device 34 is provided in the vicinity of each traverse guide 22, or integrated with each traverse guide 22. As shown in FIG. 7, the yarn shifting device 34 includes a guide member 51 extending in the front-rear direction and a holding unit 52 including a retaining groove 52a. The holding unit 52 is moved in the front-rear direction by, e.g., an air cylinder 120 (as shown in FIG. 3). Because of this, the holding unit 52 is movable between a retracted position (indicated by a solid line in FIG. 7) provided outside a traversing area T in which a yarn Y is traversed by each traverse guide 22 and a capturing position (indicated by a two-dot chain line in FIG. 7) provided inside the traversing area T.

(Yarn Threading Process, and Detection Method of Failure in Yarn Threading)

[0049] The following will describe an example of processes of the yarn threading in the spun yarn take-up winder 3, and a detection method of a failure in the yarn threading, with reference to a flowchart of FIG. 8 and explanatory views of FIG. 9 to FIG. 16. In the present embodiment, an operator performs a part of the yarn threading, and the yarn threading execution part 30 performs another part of the yarn threading. In the present embodiment, a failure in the yarn threading is detected as described later in order to reduce production loss due to the failure in the yarn threading.

[0050] In a state (initial state) of the spun yarn take-up winder 3 before the yarn threading is performed, yarns Y spun out from the spinning apparatus 2 are sucked and held (as shown in FIG. 4) by the aspirator 11b. The second godet roller 13 and the fulcrum guides 21 are at the positions in the yarn threading (as shown in FIG. 4). The traverse guides 22 and the two bobbin holders 24 are stopped. The yarn detection unit 26 is in an off-state. The yarn convergence guide 31 is at the initial position (indicated by solid lines in FIG. 5). The guide member 41 of the first separator 32 is at the initial position (as shown in FIG. 5). The holding units 42 of the first separator 32 are at the second positions (as shown in FIG. 6(b)). The swing member 46 and holding unit 47 of the second separator 33 are at the retracted positions (indicated by solid lines in FIG. 5). The holding unit 52 of the yarn shifting device 34 is at the retracted position (indicated by a solid line in FIG. 7).

[0051] To begin with, as shown in the explanatory views of FIG. 9(a) to FIG. 9(c), the operator threads the yarns Y onto the first godet roller 12, the second godet roller 13, and the fulcrum guides 21. To be more specific, the operator handles a known suction gun 60 which can suck and hold the yarns Y, and receives the yarns Y sucked and held by the aspirator 11b. Subsequently, the

operator threads the yarns Y sucked and held by the suction gun 60 onto the first godet roller 12 and the second godet roller 13 in this order (S101; as shown in FIGs. 9(a) and 9(b)). Furthermore, the operator uses an unillustrated yarn threading tool, and threads the yarns Y to the respective fulcrum guides 21 (S102; as shown in FIG. 9(c)). The operations described above are mainly performed in a space (working space) in front of the spun yarn take-up winder 3.

[0052] Subsequently, the operator operates the operation unit 121 in order to move the second godet roller 13 and the fulcrum guides 21 to the positions in the yarn winding. Accordingly, the winding controller 15 controls and causes the yarn threading execution part 30 to start the yarn threading. To begin with, the winding controller 15 controls and causes the movement motor 111 and the air cylinder 112 (to be precise, an unillustrated electromagnetic valve; hereinafter, the same applies to the other air cylinders) to move the second godet roller 13 and the fulcrum guides 21 to the positions (as shown in FIG. 10) in the yarn winding. Subsequently, the operator handles the suction gun 60, and threads (as shown in FIG. 10) the yarns Y to the yarn convergence guide 31. Because of this, the yarns Y are placed (as shown in FIG. 12(a)) immediately behind the corresponding holding units 42 of the first separator 32, respectively.

[0053] Subsequently, the winding controller 15 controls the air cylinder 119 (as shown in FIG. 3), and causes the swing member 46 and holding unit 47 of the second separator 33 to be swung to the receiving positions (indicated by solid lines in FIG. 11) from the retracted positions (indicated by two-dot chain lines in FIG. 11). Because of this, the holding unit 47 moves (as shown in FIG. 12(b)) to the vicinity of the first separator 32. In this regard, the winding controller 15 controls and causes the turret motor 114 to move the two bobbin holders 24 to positions which do not overlap with the second separator 33, at an appropriate timing during the yarn threading. Substantially, at the same time as the second separator 33 starts such an operation, or after the second separator 33 starts the operation, the winding controller 15 controls and causes the air cylinder 118 (as shown in FIG. 3) to move (as shown in FIG. 12(b)) the holding units 42 of the first separator 32 to the first positions from the second positions. Because of this, each of the yarns Y is temporarily threaded to each holding unit 42 (S103). The protruding portions 42b prevent (as shown in FIG. 12(b)) the yarns Y from dropping off from the holding units 42. In addition to the control of the air cylinder 118, the winding controller 15 also controls the winding motor 115, and causes one of the two bobbin holders 24 to start rotating. At the same time as the one of the two bobbin holders 24 starts rotating, operations of the traverse guides 22 are also caused to start.

[0054] Subsequently, the winding controller 15 causes the yarn threading execution part 30 to deliver the yarns Y to the second separator 33 from the first separator 32 (S104). To be more specific, the winding controller 15

controls and causes the air cylinder 117 to move the guide member 41 of the first separator 32 leftward (as indicated by a two-dot chain line arrow in FIG. 13(a)). Because of this, the yarns Y move to a location immediately to the right of the holding unit 47 of the second separator 33 so that each yarn Y enters (as shown in FIG. 14(a)) each insertion space 47a of the second separator 33. Subsequently, the winding controller 15 controls and causes the air cylinder 116 to move (as shown in FIG. 13(b)) the yarn convergence guide 31 to the handover position. Furthermore, the winding controller 15 controls and causes the air cylinder 117 (as shown in FIG. 3) to again move the holding units 42 of the first separator 32 to the second positions from the first positions. Because of this, the yarns Y are handed (as shown in FIG. 14(b)) to the holding unit 47 of the second separator 33 from the holding units 42 of the first separator 32. The protruding portions 47b and the protruding portions 47c prevent the yarns Y from dropping off from the holding unit 47.

[0055] Subsequently, the winding controller 15 causes the yarn threading execution part 30 to thread the yarns Y to the traverse guides 22 (S105). To be more specific, the winding controller 15 controls the air cylinder 119, and causes the swing member 46 and holding unit 47 of the second separator 33 to be swung leftward from the receiving positions. Because of this, the yarns Y are caught and traversed by the traverse guides 22 in operation.

[0056] In this state, the winding controller 15 turns on the yarn detection unit 26 (S106), and on the basis of the information from the yarn detection unit 26, the winding controller 15 determines whether the yarns Y are being successfully traversed (S107). In this way, winding controller 15 determines an occurrence of the failure in the yarn threading. If the winding controller 15 determines that all yarns Y are successfully detected (YES in S107), i.e., only if the winding controller 15 determines that the failure in the yarn threading does not occur, the yarn threading is continued. In other words, the winding controller 15 temporarily turns off the yarn detection unit 26 (S108), and then causes the yarn shifting device 34 to thread the yarns Y onto the bobbins B (S109). To be more specific, the winding controller 15 controls and causes the turret motor 114 to move (as shown in FIG. 16) the bobbin holder 24 being rotated to the upper position. The winding controller 15 further controls and causes the air cylinder 120 to move (as shown in FIG. 17(a)) the holding unit 52 of the yarn shifting device 34 to the capturing position. Because of this, the yarns Y being traversed are caught by the holding unit 52, and temporarily removed from the traverse guides 22. In this stage, although the yarns Y are not traversed by the traverse guides 22, the winding controller 15 does not mistakenly determine that a failure in the yarn threading occurred because the yarn detection unit 26 is temporarily in the off-state as described above. Subsequently, the yarns Y are threaded to slits S of the bobbins B being

rotated, and bunch winding is formed (not illustrated). A part of each yarn Y is cut on the downstream of the bobbins B in the yarn running direction as tension in each yarn Y increases. Furthermore, the winding controller 15 moves the holding unit 52 back to the capturing position. Because of this, tail winding is formed (not illustrated) between the slit S of each bobbin B and a front end of the traversing area T. After that, the yarns Y are caught by the traverse guides 22, and then the holding unit 52 moves to the retracted position. As such, the yarn threading is completed, and the yarn winding can be started. In this regard, the winding controller 15 turns on the yarn detection unit 26 again when the yarn winding is started.

[0057] Meanwhile, if the winding controller 15 determines that any of the yarns Y is not successfully traversed (NO in S107), the winding controller 15 causes the cutter 11a of the cutting-holding unit 11 to cut all yarns Y (S110) and causes the aspirator 11b to suck and catch the yarns Y. In this regard, yarn waste generated because the yarns Y are cut is sucked by the suction gun 60 and then wasted. Furthermore, the winding controller 15 controls each part of the spun yarn take-up winder 3 so that the state of the spun yarn take-up winder 3 is returned to the initial state described above (S111). In parallel with the return to the initial state, or after the return is completed, the winding controller 15 causes the notification unit 122 to notify the operator (S112). Because of this, the operator can restart the yarn threading smoothly. In this regard, the yarns Y are not wound onto the bobbins B yet, which saves the labor of removing the yarns Y from the bobbins B.

[0058] As described above, the occurrence of a failure in the yarn threading is determined during the yarn threading, before the yarns Y are threaded onto the respective bobbins B. Because of this, the yarn threading can be done again before the yarn winding onto the bobbins B is started. For this reason, even when the failure in the yarn threading occurred, it is unnecessary to remove the yarns Y from the bobbins B. Therefore, the production loss due to the failure in the yarn threading can be reduced in the spun yarn take-up winder 3 configured to wind the yarns Y.

[0059] In the downstream of the second godet roller 13 in the yarn running direction, it may be difficult for the operator to visually find a failure in the yarn threading because, e.g., the yarns Y are provided at positions which are far from the working space by the fulcrum guides 21. In such a structure, it is effective to provide the yarn detection unit 26 on the downstream of the second godet roller 13 in the yarn running direction.

[0060] During the yarn winding, the winding controller 15 determines whether the yarn winding is successfully being performed, on the basis of the detection result of the yarn detection unit 26. In other words, both whether a failure in the yarn threading occurs and whether the yarn winding is successfully being performed are determined based on the detection results of the same yarn detection unit 26. It is therefore possible to achieve cost

reduction as compared to a case in which another detection unit is required for the two types of determinations described above.

[0061] On the basis of the detection result of the yarn detection unit 26, the winding controller 15 determines the occurrence of the failure in the yarn threading by determining whether each yarn Y is being traversed by each traverse guide 22 when the yarn threading is being performed. Typically, it is easier and more reliable to detect the existence of a yarn Y being traversed than to detect the existence of a yarn Y running straight. Therefore, it is possible to determine the occurrence of a failure in the yarn threading easily and reliably by using the yarn detection unit 26 provided for detecting the traversing.

[0062] The winding controller 15 controls and causes the yarn shifting device 34 to thread the yarns Y onto the respective bobbins B only when determining that a failure in the yarn threading does not occur. Because of this, it is possible to reliably avoid a case in which the yarn winding is started for other yarns Y even if a failure in the yarn threading occurred for one yarn Y. It is therefore possible to reliably reduce the production loss.

[0063] The winding controller 15 causes the notification unit 122 to notify the operator when determining that a failure in the yarn threading occurred. Because of this, the operator is able to swiftly perform the yarn threading again when the failure in the yarn threading occurred.

[0064] The cutting-holding unit 11 can cut and temporally hold the yarns Y when a failure in the yarn threading occurred. Because of this, the yarn threading can be done again smoothly.

[0065] In the structure in which a part of the yarn threading is performed by the yarn threading execution part 30, the operator may not always stay in the vicinity of the spun yarn take-up winder 3 in which the yarn threading is being performed, and therefore, e.g., visual check may not be always performed. In such a structure, the following arrangement is especially effective: a failure in the yarn threading is detectable based on a detection result of the yarn detection unit 26.

[0066] The winding controller 15 controls the yarn threading execution part 30 so that the state of the spun yarn take-up winder 3 is returned to the initial state for performing the yarn threading again when determining that a failure in the yarn threading occurred. Because of this, it is possible to perform the yarn threading again more smoothly as compared to a case in which the operator is required to intervene in order to return the state of the spun yarn take-up winder 3 to the initial state. It is therefore possible to reduce the production loss further effectively.

[0067] The following will describe modifications of the above-described embodiment. The members identical with those in the embodiment above will be denoted by the same reference numerals, and the explanations thereof are not repeated.

(1) While in the embodiment above the operator per-

forms the part of the yarn threading, the disclosure is not limited to this. Alternatively, as shown in FIG. 18, a spun yarn winding system 1a may include a yarn threading robot 5 configured to perform the yarn threading instead of the operator. For example, the yarn threading robot 5 hangs down from a rail member 70 extending in the left-right direction, and is movable along the rail member 70 in the left-right direction in a space in front of the spun yarn take-up winders 3. The yarn threading robot 5 is electrically connected to the integrated controller 4 (as shown in FIG. 3), and communicates with the integrated controller 4. The yarn threading robot 5 includes a main body 71, a robotic arm 72, and a yarn threading unit 73. The robotic arm 72 is attached to, e.g., a lower surface of the main body 71. The robotic arm 72 includes arms 72a and joints 72b connecting the arms 72a with each other. Each joint 72b incorporates therein an unillustrated arm motor. As the arm motor is driven, the arm 72a is swung about the joint 72b. The yarn threading unit 73 is attached to a leading end portion of the robotic arm 72. The yarn threading unit 73 includes an unillustrated suction, etc., and is able to temporarily hold the yarns Y. For example, the yarn threading robot 5 may thread the yarns Y onto the first godet roller 12 and the second godet roller 13 as shown in FIGs. 19(a) and 19(b), and may thread the yarns Y further to the fulcrum guides 21, etc., in the yarn threading. As such, all of the yarn threading may be performed not by hand. In this case, the yarn threading robot 5 is also included in the yarn threading execution part of the present invention.

In the spun yarn winding system 1a configured as such, a winding controller 15 of one spun yarn take-up winder 3 may output a signal for instructing the yarn threading robot 5 to perform again the yarn threading to the spun yarn take-up winder 3 when determining that a failure in the yarn threading occurred during the yarn threading. On the basis of the signal supplied from the winding controller 15, the integrated controller 4 may send a signal which instructs the yarn threading robot 5 to perform the yarn threading again, to the yarn threading robot 5. With this arrangement, the yarn threading can be performed again further smoothly. In addition to that, the winding controller 15 may not cause the notification unit 122 to notify the operator when a failure in the yarn threading occurred in this structure.

(2) The structure of the yarn threading execution part 30 is not limited to the above. In other words, the yarn threading execution part 30 may be variously arranged as long as the yarn threading execution part 30 can operate yarns Y so that the yarns Y are arranged to be detectable by the yarn detection unit 26 before being wound onto the bobbins B during the yarn threading.

(3) While in the embodiment above the winding con-

troller 15 determines whether a failure in the yarn threading occurs by utilizing the yarn detection unit 26 for detecting the yarns Y being traversed by the traverse guides 22 not only during the yarn winding but also during the yarn threading, the disclosure is not limited to this. Alternatively, an unillustrated traverse detection sensor for detecting, during the yarn threading, the yarns Y being traversed may be provided to be different from the yarn detection unit 26. The winding controller 15 may determine the occurrence of a failure in the yarn threading on the basis of the detection result by using the traverse detection sensor only during the yarn threading. In this case, the traverse detection sensor is equivalent to the yarn detection unit and traversing detection unit of the present invention. Alternatively, an unillustrated running-yarn detection sensor for detecting the existence of the yarns Y running straight may be provided to be different from the yarn detection unit 26. In this case, the running-yarn detection sensor is equivalent to the yarn detection unit of the present invention. The running-yarn detection sensor may be provided on the downstream or upstream of the second godet roller 13 in the yarn running direction. The running-yarn detection sensor may be used only during the yarn threading, or may be used not only during the yarn threading but also during the yarn winding.

Alternatively, an unillustrated camera may be provided as the yarn detection unit, instead of the above-described sensors. For example, one camera may be provided for one spun yarn take-up winder 3. Alternatively, the camera may be provided as many as the number of the yarns Y. For example, the camera may be provided on an upstream of the winding device 14 (i.e., upstream of the fulcrum guides 21) in the yarn running direction. Alternatively, the camera may be provided at the yarn threading robot 5 described in the modification (1). For example, the camera may be provided at the suction of the yarn threading unit 73 of the yarn threading robot 5.

(4) While in the embodiment above the winding controller 15 controls the yarn threading execution part 30 so that the state of the spun yarn take-up winder 3 is returned to the initial state when determining that the failure in the yarn threading occurred, the disclosure is not limited to this. Alternatively, the winding controller 15 may simply cause the notification unit 122 to notify the operator after the winding controller 15 controls and causes the cutting-holding unit 11 to cut, suck, and hold the yarns Y. In this case, the winding controller 15 may control the yarn threading execution part 30 so that the state of the spun yarn take-up winder 3 is returned to the initial state when the operator operates the operation unit 121.

(5) While in the embodiment above the winding controller 15 controls and causes the cutting-holding unit 11 to cut, suck, and hold the yarns Y when determin-

ing that the failure in the yarn threading occurred, the disclosure is not limited to this. Alternatively, the winding controller 15 may cause the notification unit 122 to notify the operator after the winding controller 15 simply stops the yarn threading. In this case, the winding controller 15 may cause the cutting-holding unit 11 to work when the operator operates the operation unit 121.

(6) While in the embodiment above the winding controller 15 continues the yarn threading only when determining that the failure in the yarn threading does not occur, the disclosure is not limited to this. Alternatively, the winding controller 15 may urge the operator to act promptly by, e.g., causing the notification unit 122 to notify the operator while continuing the yarn threading even when the winding controller 15 determines that a failure in the yarn threading occurred. In this case, the winding controller 15 may stop the yarn threading as the operator operates the operation unit 121.

(7) While in the embodiment above the winding controller 15 is provided for controlling the spun yarn take-up winder 3, the disclosure is not limited to this. Alternatively, the integrated controller 4 may control the spun yarn take-up winders 3.

(8) While in the embodiment above the spun yarn winding system 1 includes the spun yarn take-up winders 3, the disclosure is not limited to this. Only one spun yarn take-up winder 3 may be provided.

Claims

1. A spun yarn winding system (1) comprising a spun yarn take-up winder (3) configured to perform yarn winding by which yarns (Y) spun out from a spinning apparatus (2) are wound onto respective bobbins (B) while being traversed, the spun yarn take-up winder (3) including:

a bobbin holder (24) supporting the bobbins (B) to be rotatable;

a yarn detection unit (26) which is provided between the spinning apparatus (2) and the bobbins (B) in a yarn running direction and which detects the yarns (Y); and

a control unit (15), and

when yarn threading in which the yarns (Y) are threaded to the spun yarn take-up winder (3) before the yarn winding starts is being performed, the control unit (15) determining whether a failure in the yarn threading occurs in each yarn (Y) based on a detection result provided by the yarn detection unit (26) before the yarns (Y) are threaded onto the respective bobbins (B) supported by the bobbin holder (24).

2. The spun yarn winding system (1) according to claim

1, wherein, the spun yarn take-up winder (3) further includes:

- fulcrum guides (21) about which the yarns (Y) are respectively traversed; and
 a yarn feed roller (13) which is provided on an upstream of the fulcrum guides (21) in the yarn running direction and which sends the yarns (Y) to the fulcrum guides (21), and
 the yarn detection unit (26) is provided on a downstream of the yarn feed roller (13) in the yarn running direction.
3. The spun yarn winding system (1) according to claim 1 or 2, wherein, the control unit (15) determines, during the yarn winding, whether the yarn winding is successfully being performed, based on the detection result provided by the yarn detection unit (26).
4. The spun yarn winding system (1) according to any one of claims 1 to 3, wherein, the spun yarn take-up winder (3) further includes traverse guides (22) each of which is provided for traversing each of the yarns (Y),
 the yarn detection unit (26) is a traversing detection unit (26) for detecting whether the yarns (Y) are being traversed by the traverse guides (22), and
 the control unit (15) determines the occurrence of a failure in the yarn threading by determining whether each yarn (Y) is successfully being traversed by each traverse guide (22), based on the detection result provided by the traversing detection unit (26), when the yarn threading is being performed.
5. The spun yarn winding system (1) according to any one of claims 1 to 4, wherein, the control unit (15) continues the yarn threading only when the control unit (15) determines that the failure in the yarn threading does not occur.
6. The spun yarn winding system (1) according to any one of claims 1 to 5, wherein, the spun yarn take-up winder (3) further includes
 a notification unit (122) for notification of information, and
 the control unit (15) causes the notification unit (122) to notify an operator when the control unit (15) determines that the failure in the yarn threading occurred.
7. The spun yarn winding system (1) according to any one of claims 1 to 6, wherein, the spun yarn take-up winder (3) further includes:
- a take-up roller (12) taking up the yarns (Y) spun out from the spinning apparatus (2); and
 a cutting-holding unit (11) which is provided between the spinning apparatus (2) and the take-

up roller (12) in the yarn running direction and which cuts, sucks, and holds the yarns (Y), and
 the control unit (15) controls and causes the cutting-holding unit (11) to cut, suck, and hold the yarns (Y) when the control unit (15) determines that the failure in the yarn threading occurred.

8. The spun yarn winding system (1) according to any one of claims 1 to 7, wherein, the spun yarn take-up winder (3) further includes a yarn threading execution part (30) configured to perform at least a part of the yarn threading.
9. The spun yarn winding system (1) according to claim 8, wherein, the control unit (15) controls the yarn threading execution part (30) so that a state of the spun yarn take-up winder (3) is returned to an initial state for performing the yarn threading again when the control unit (15) determines that the failure in the yarn threading occurred.
10. The spun yarn winding system (1) according to claim 9, further comprising a yarn threading robot (5) configured to perform a part of the yarn threading for the spun yarn take-up winder (3), and
 the control unit (15) outputs a signal for instructing the yarn threading robot (5) to perform again the yarn threading to the spun yarn take-up winder (3) when the control unit (15) determines that the failure in the yarn threading occurred in the spun yarn take-up winder (3).

FIG.1

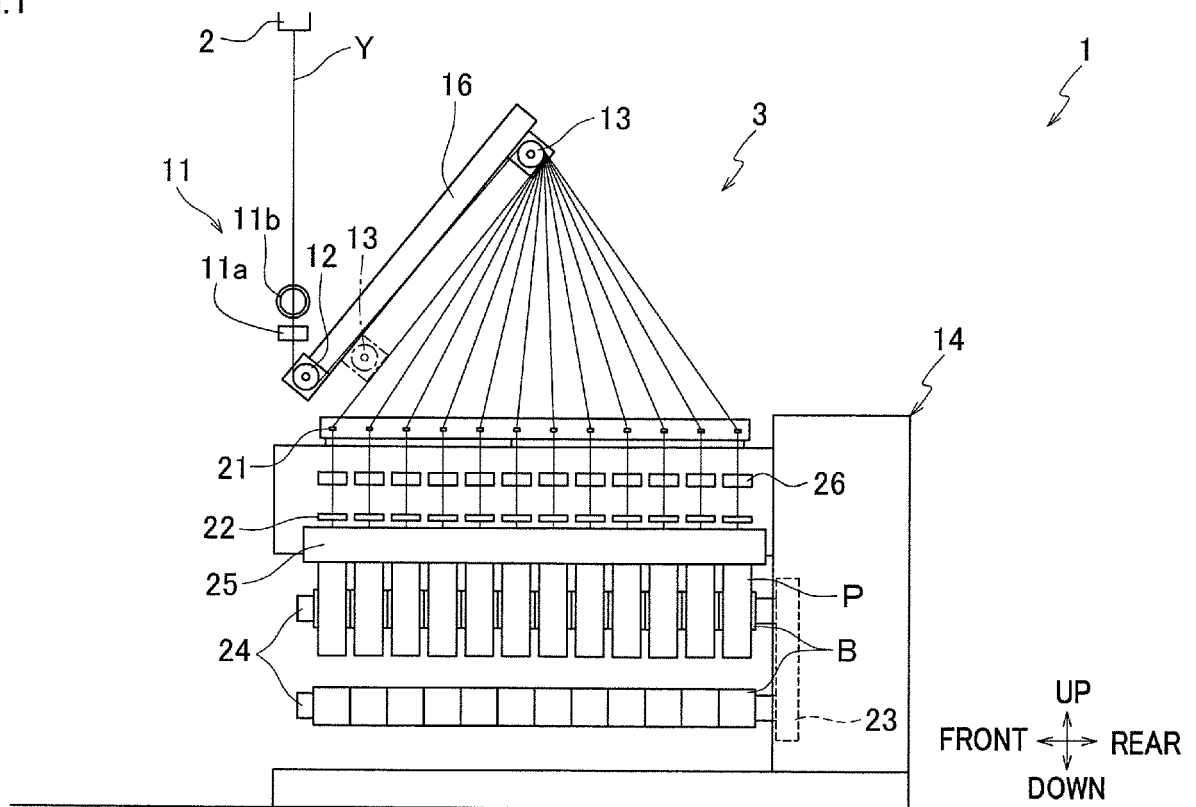


FIG.2

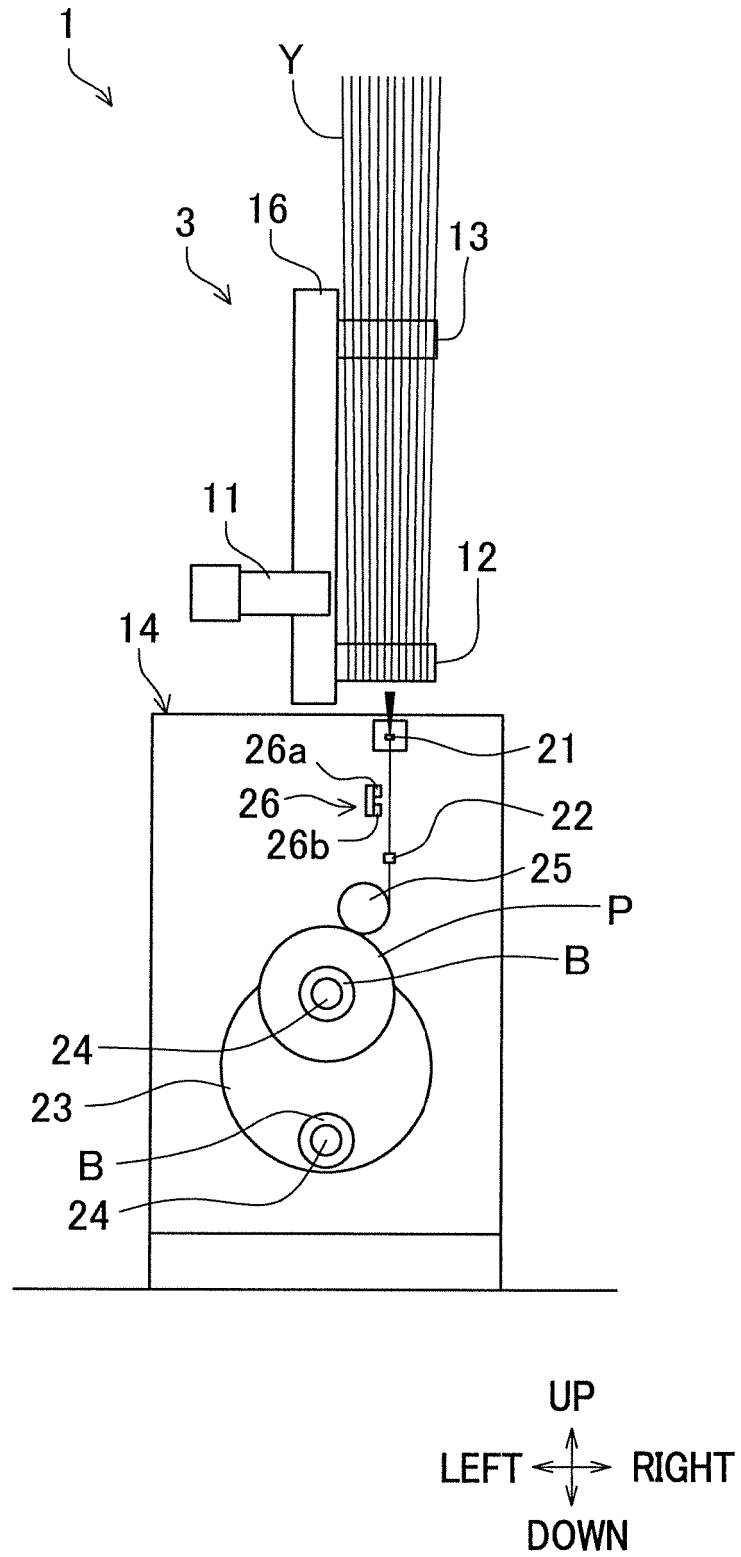


FIG.3

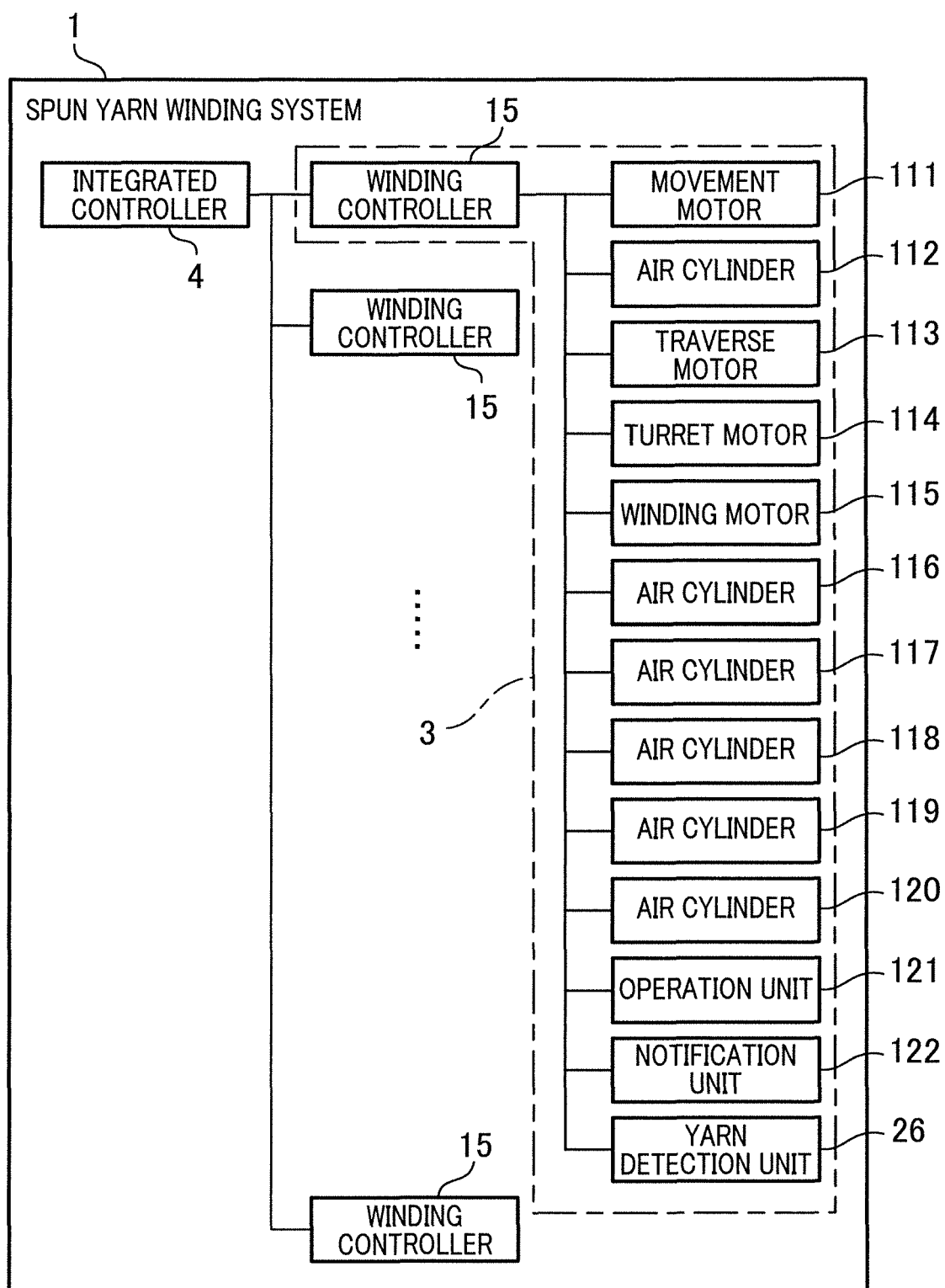


FIG.4

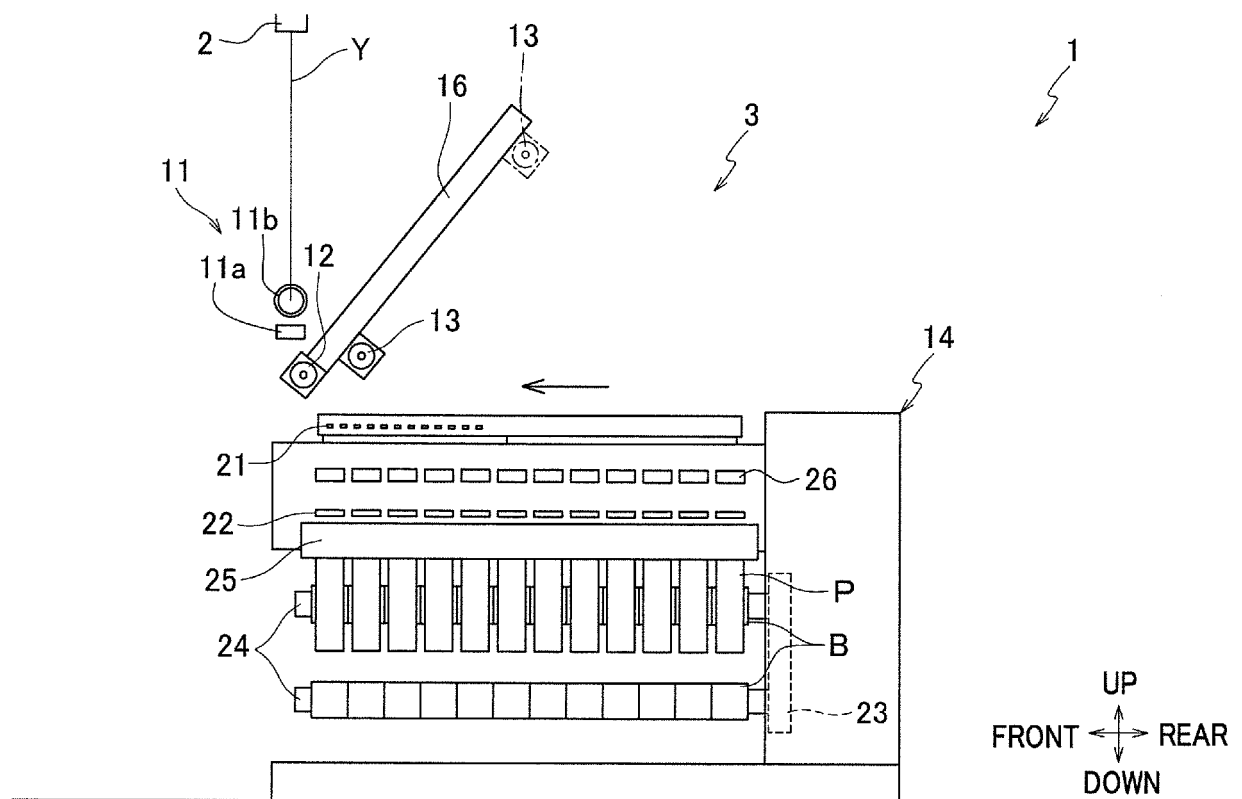


FIG.5

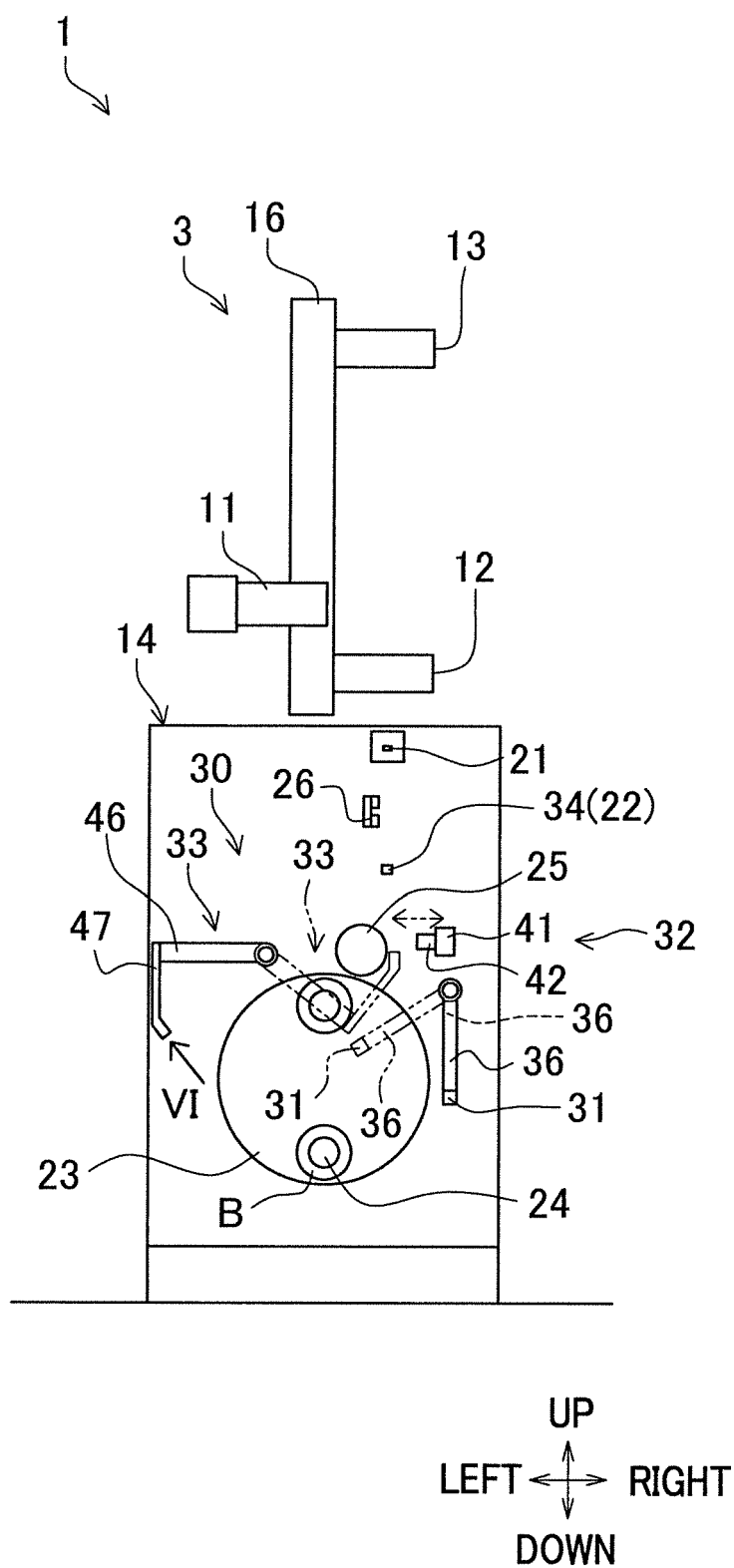


FIG.6

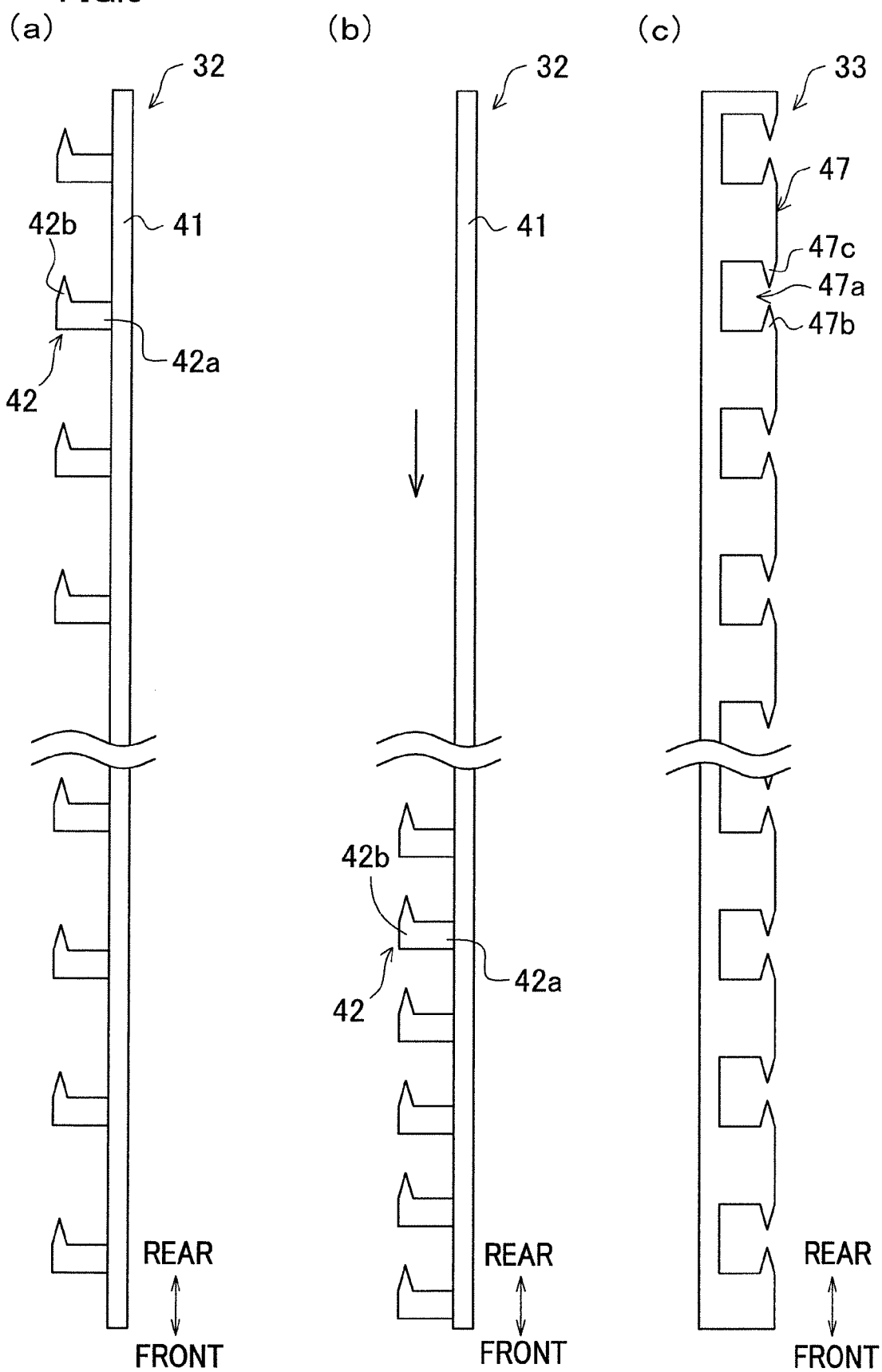


FIG.7

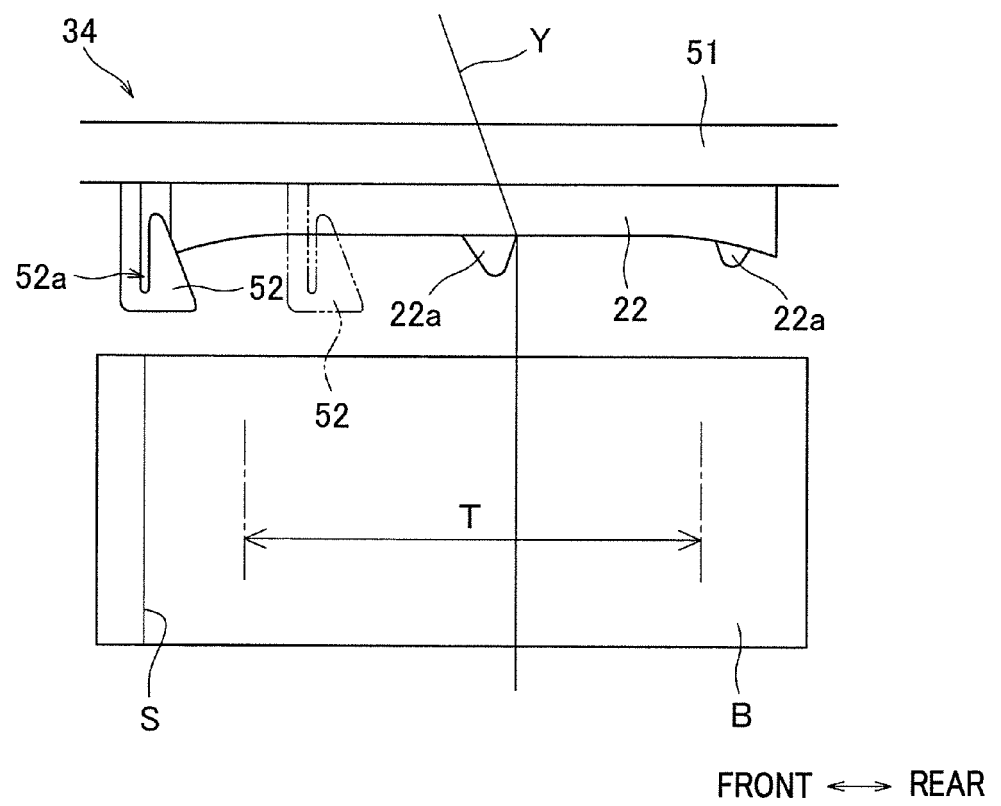


FIG.8

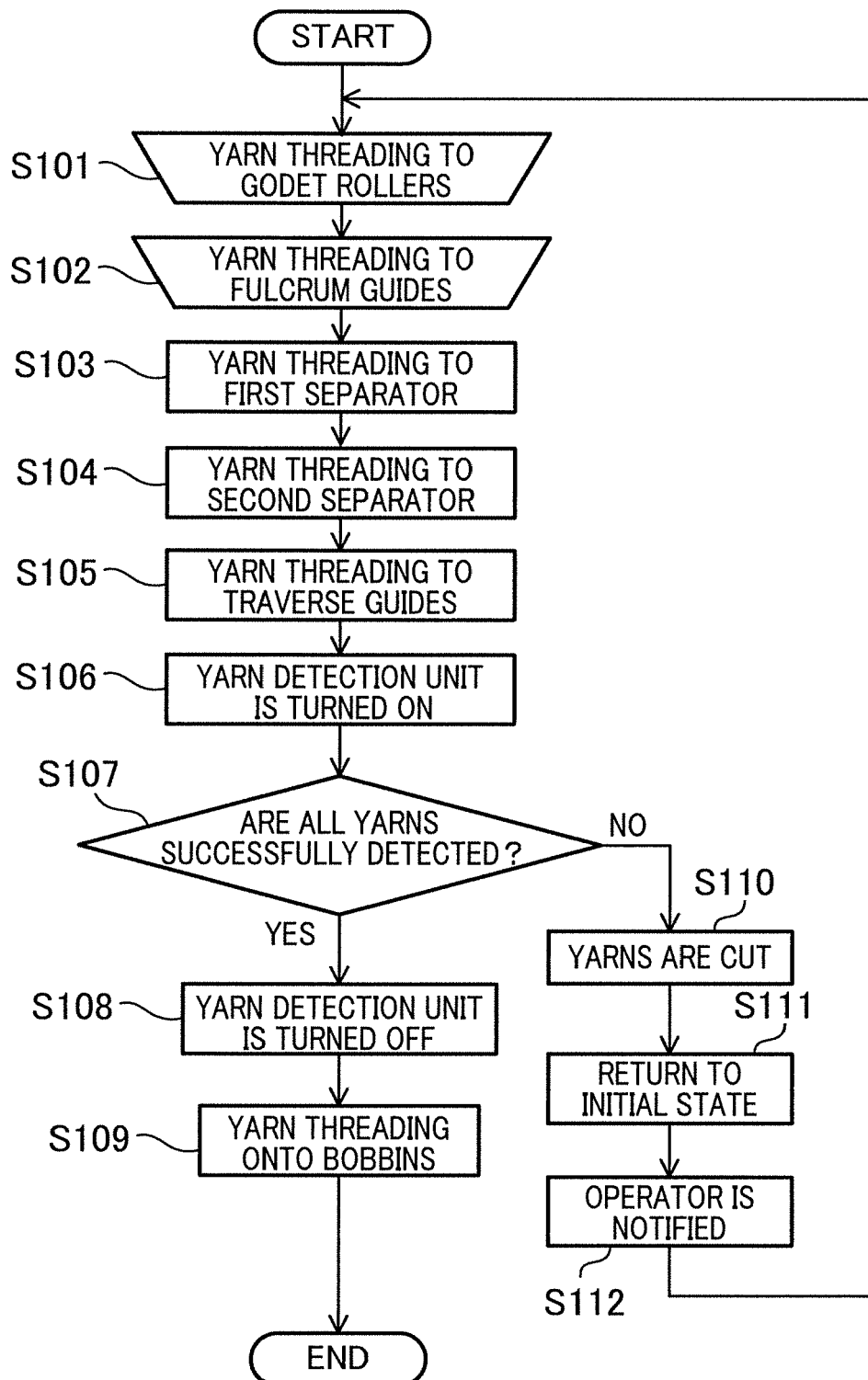
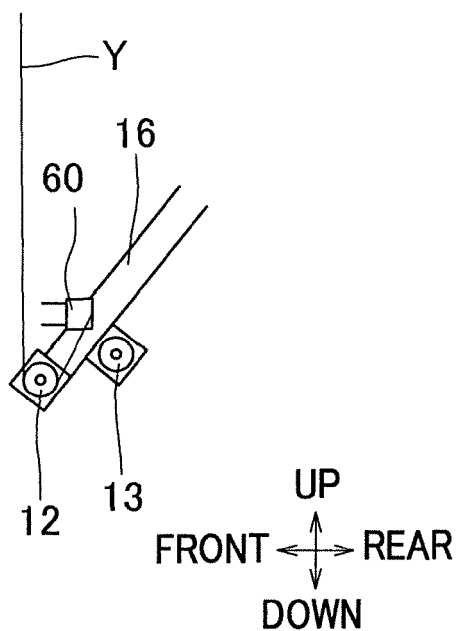
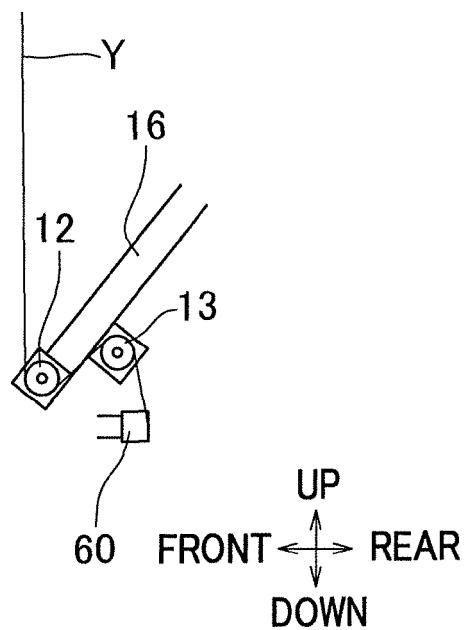


FIG.9

(a)



(b)



(c)

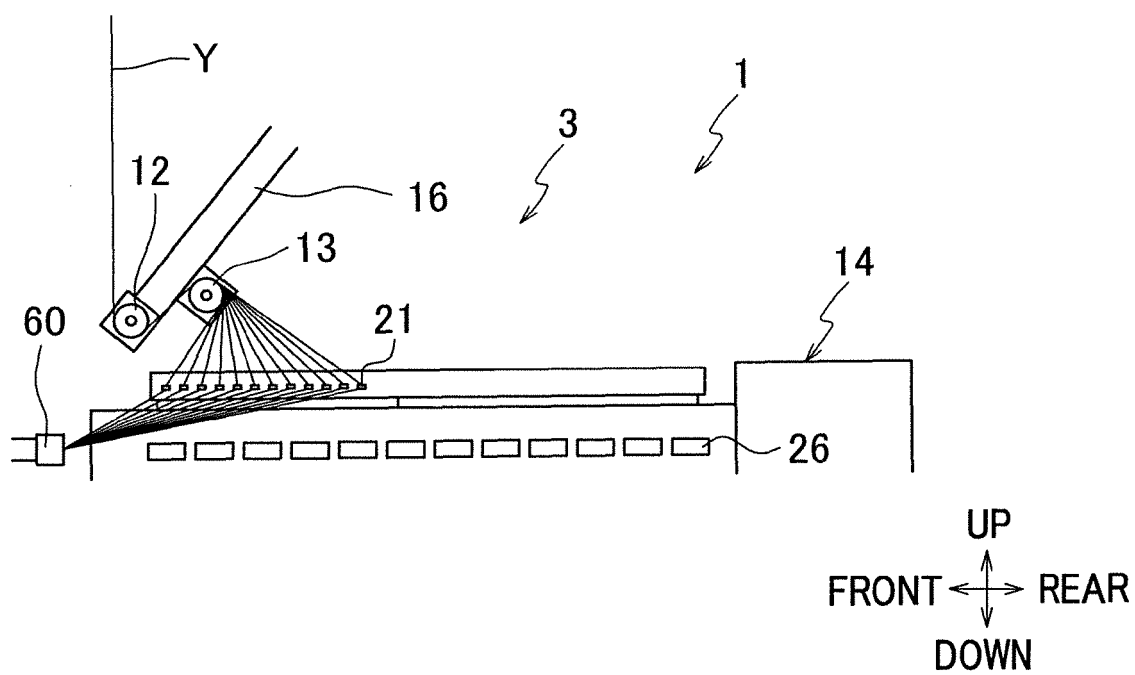


FIG.10

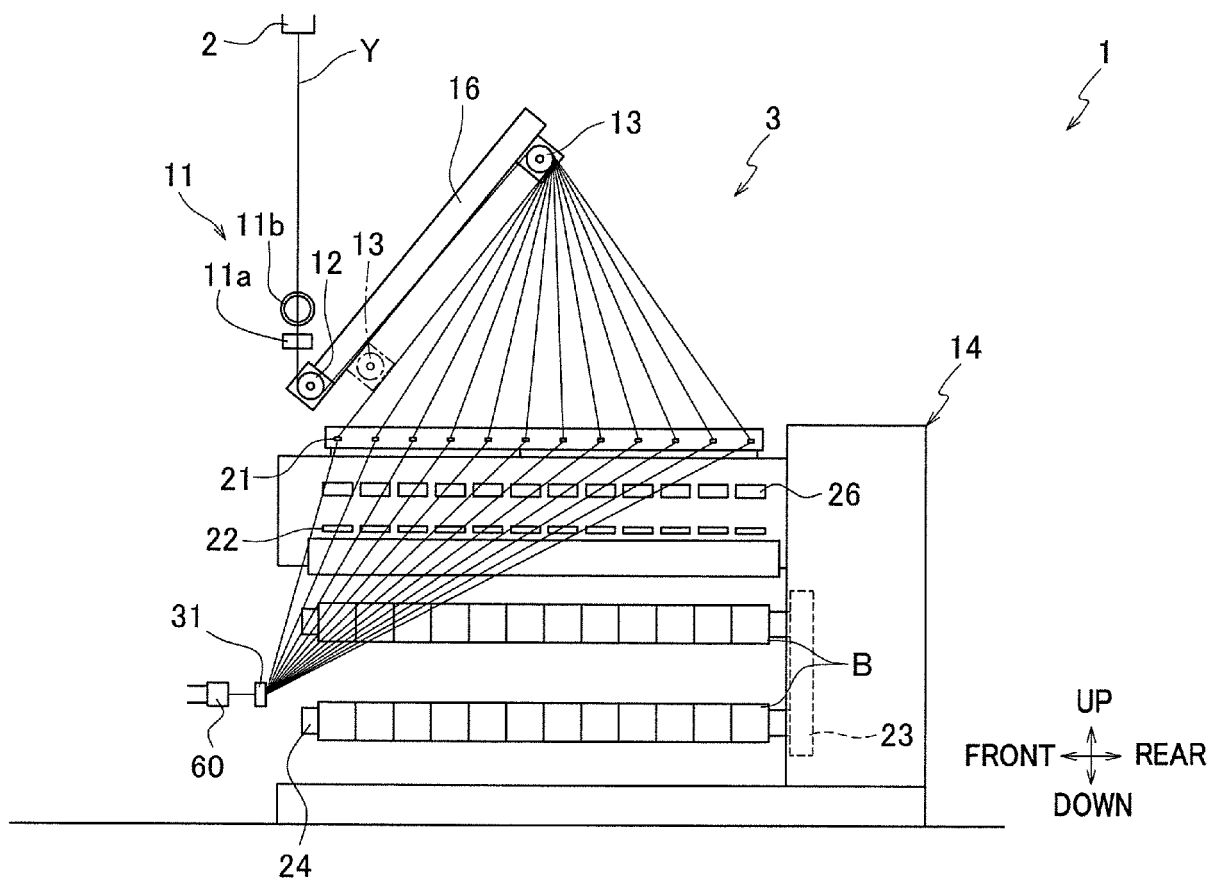


FIG.11

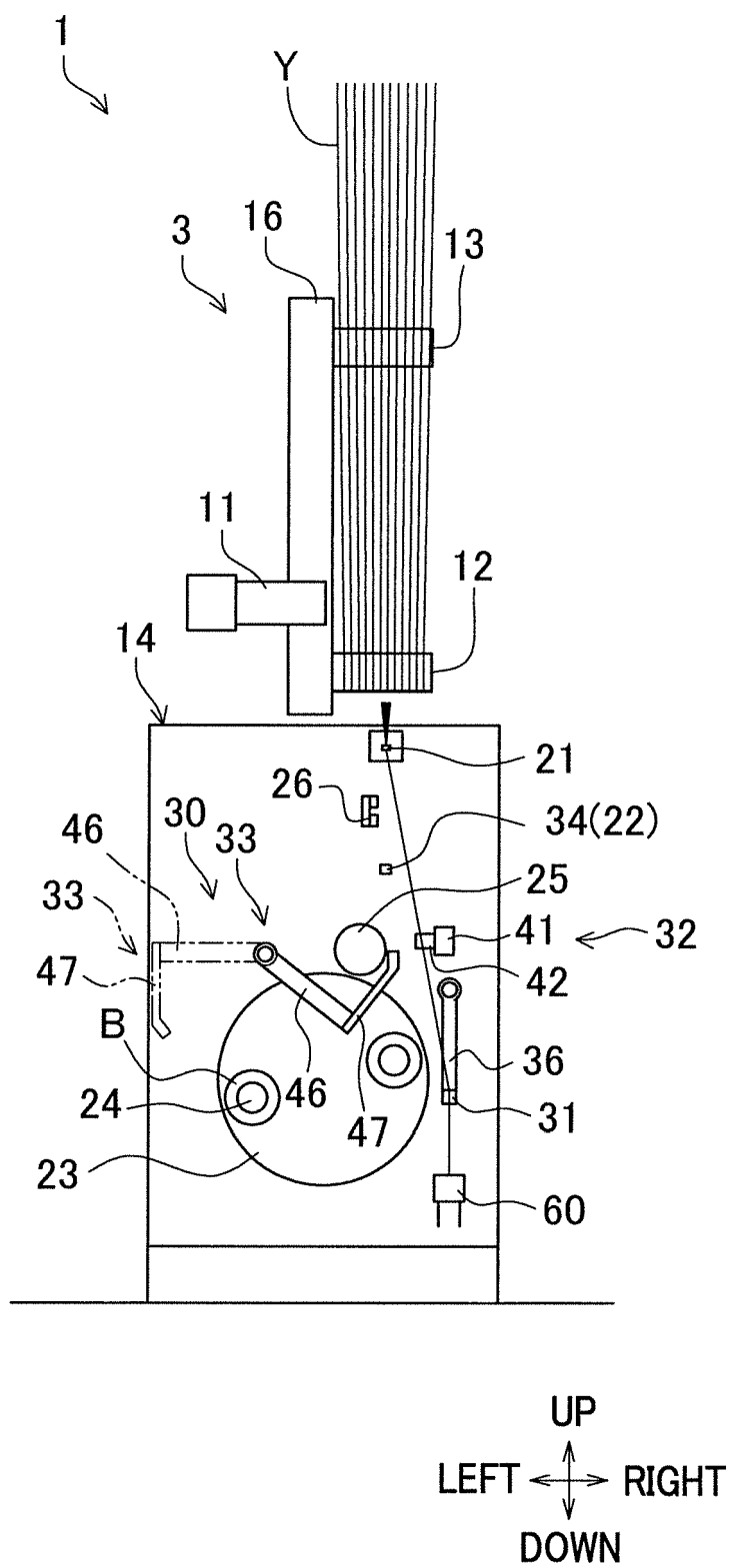


FIG.12

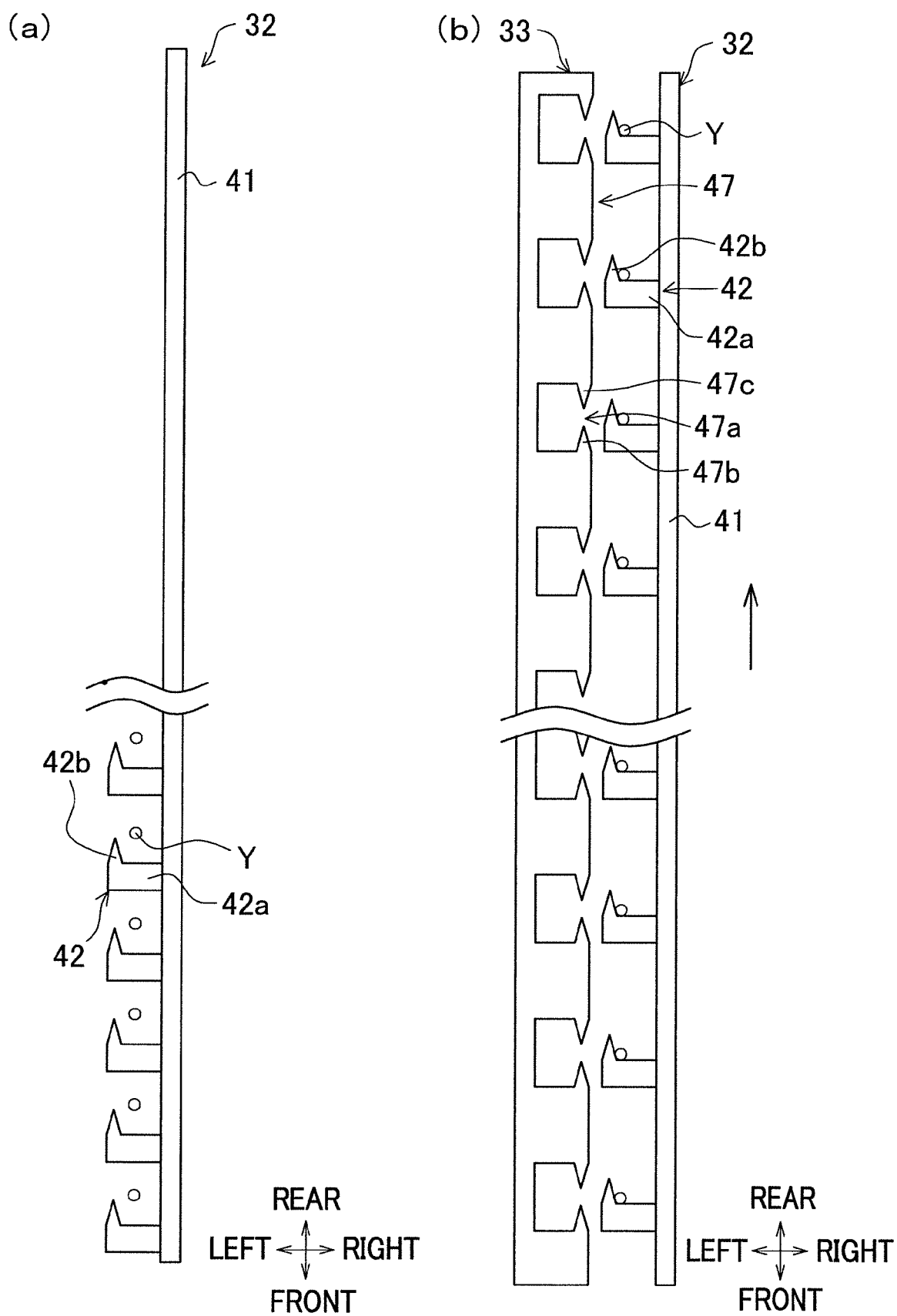
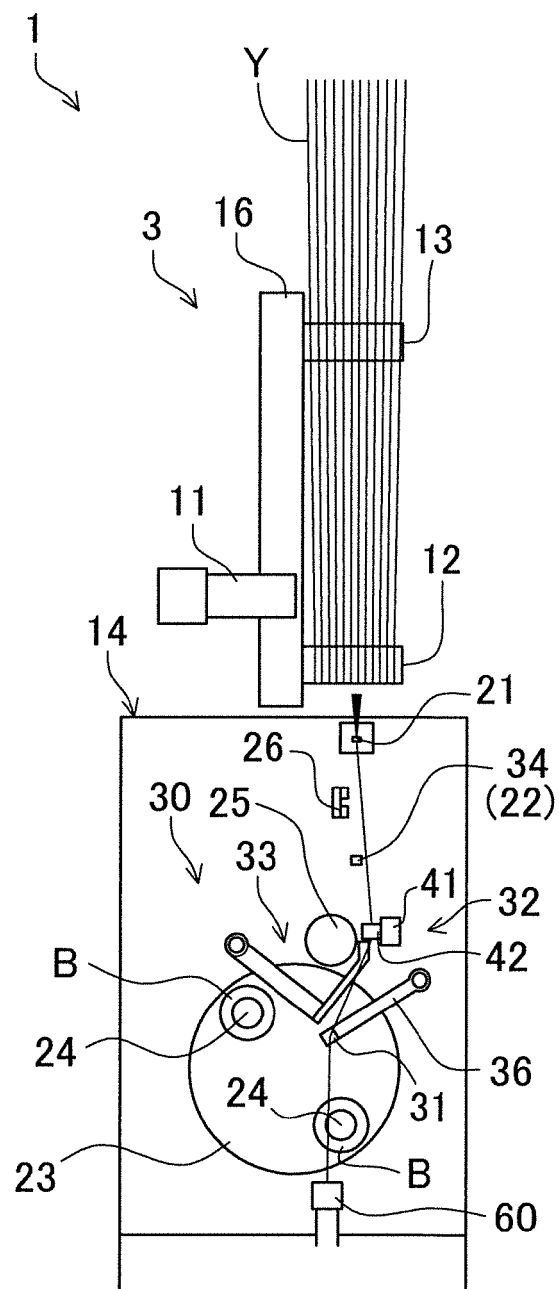
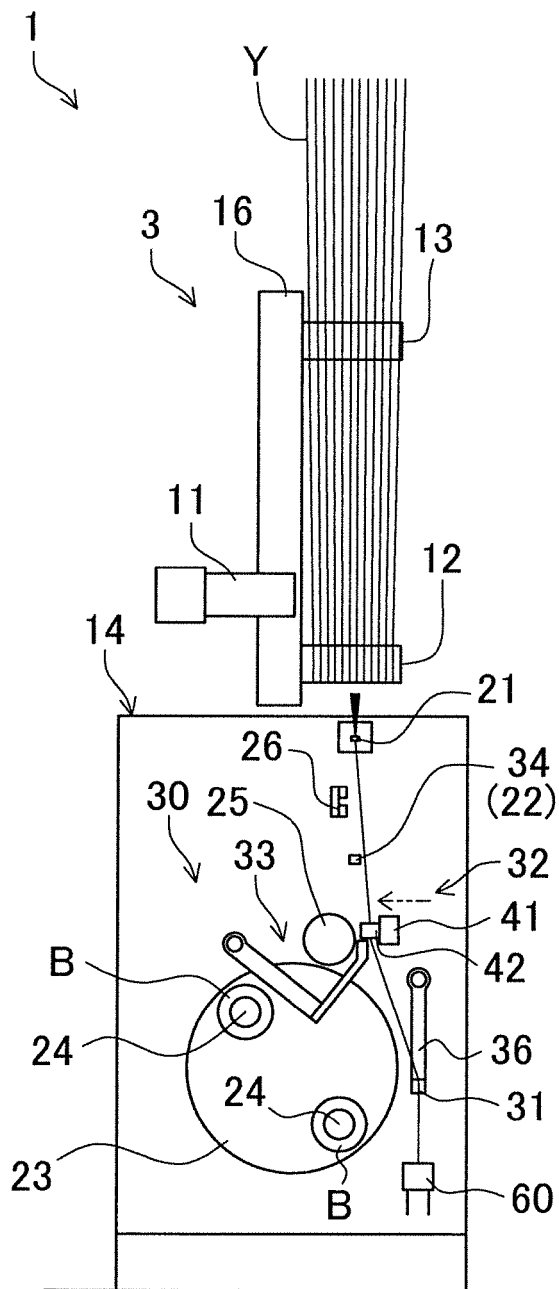


FIG.13

(a)

(b)



UP
LEFT ↔ RIGHT
DOWN

UP
LEFT ↔ RIGHT
DOWN

FIG.14

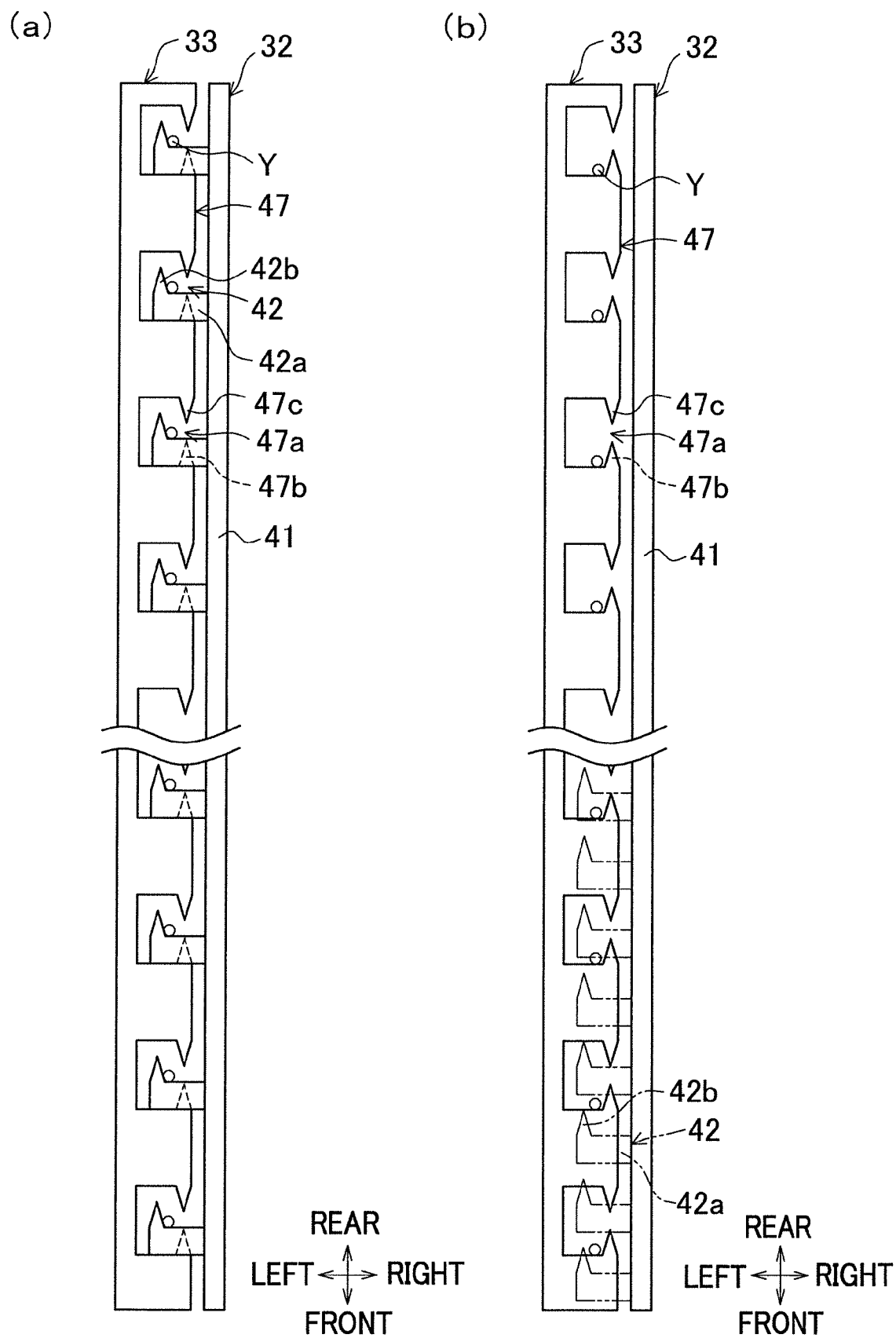


FIG.15

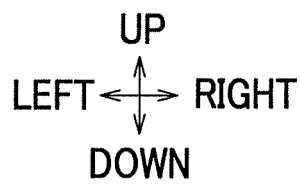
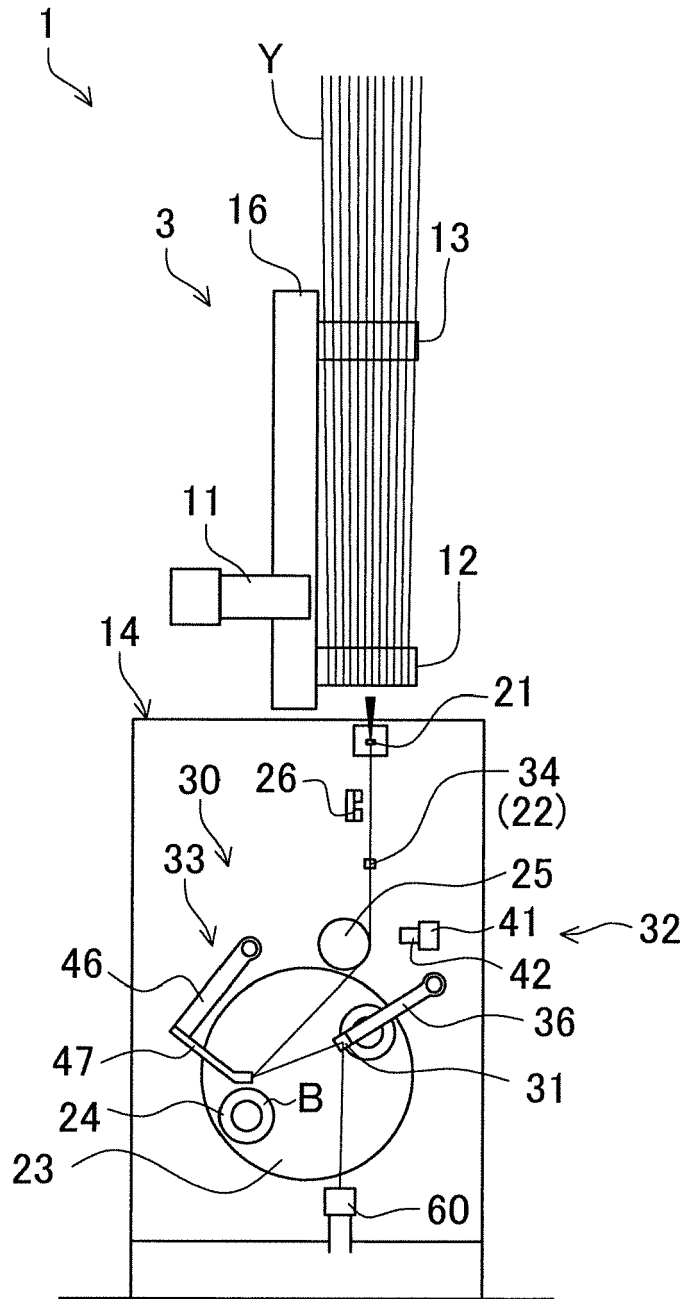


FIG.16

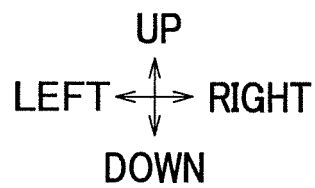
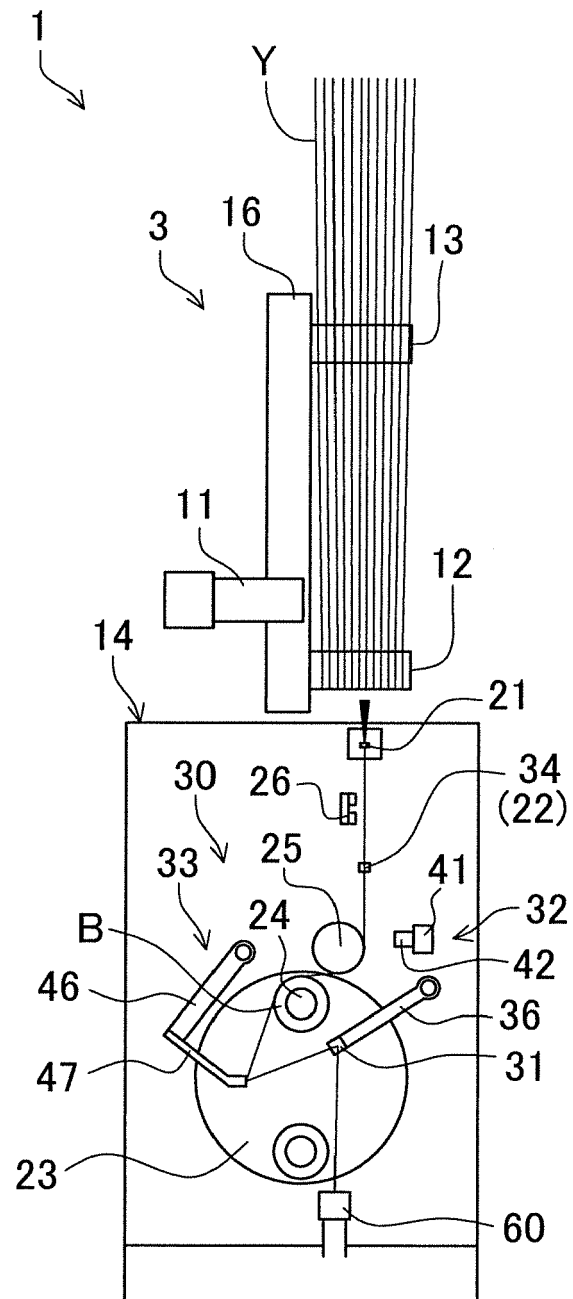


FIG.17

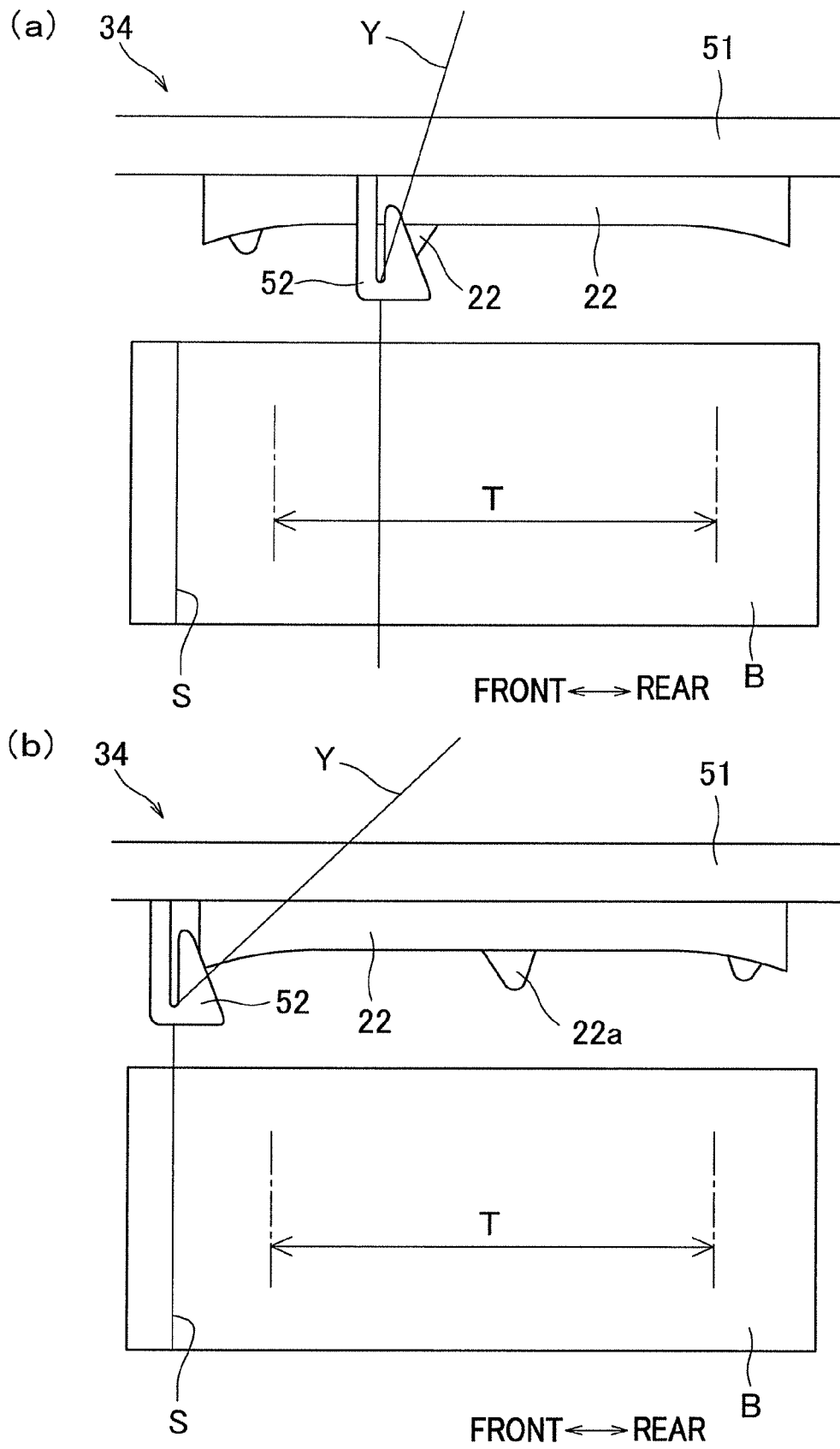


FIG.18

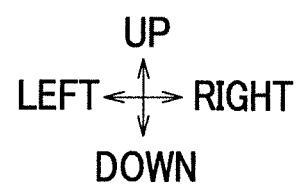
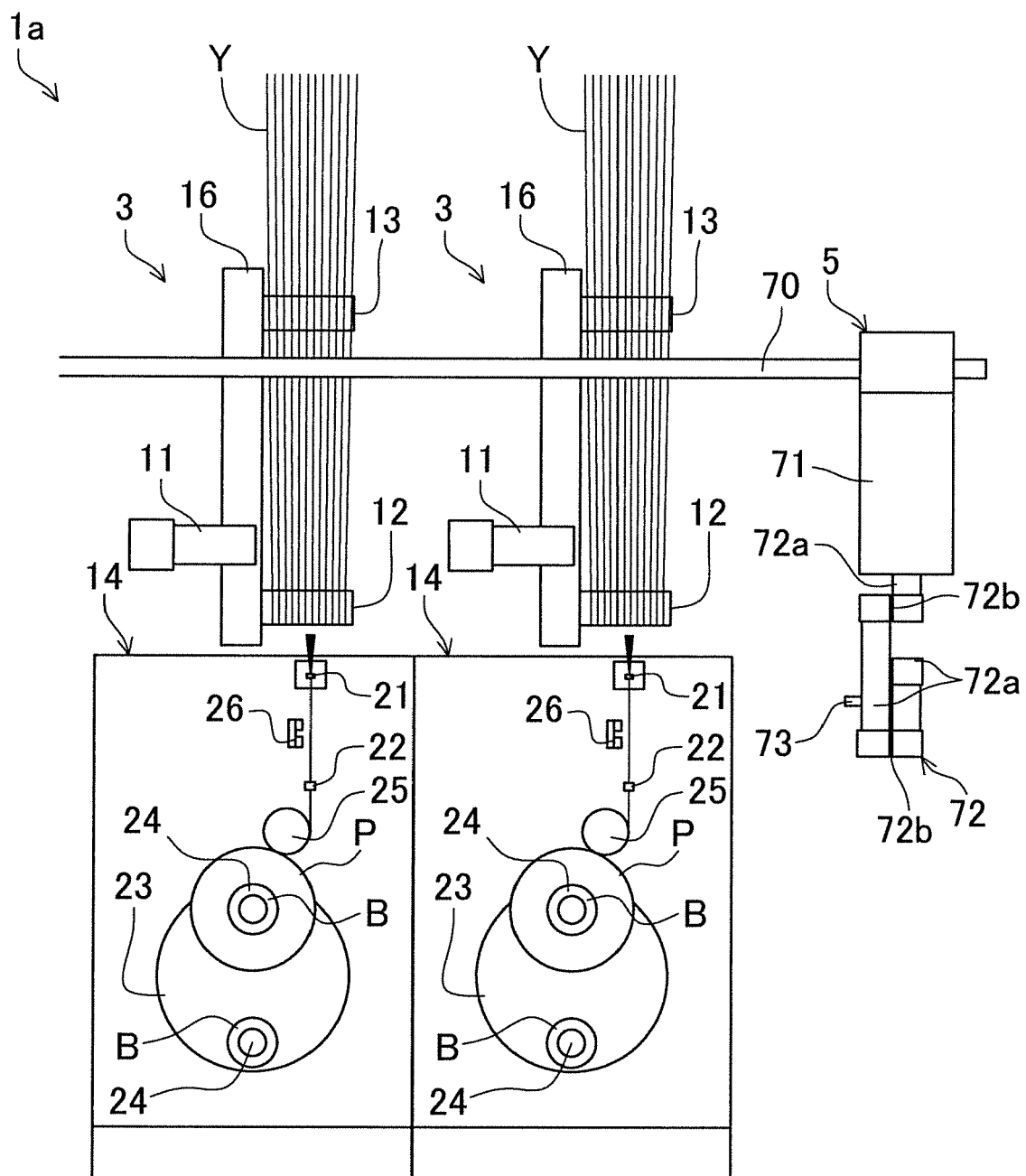
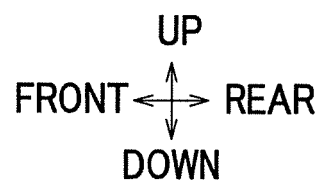
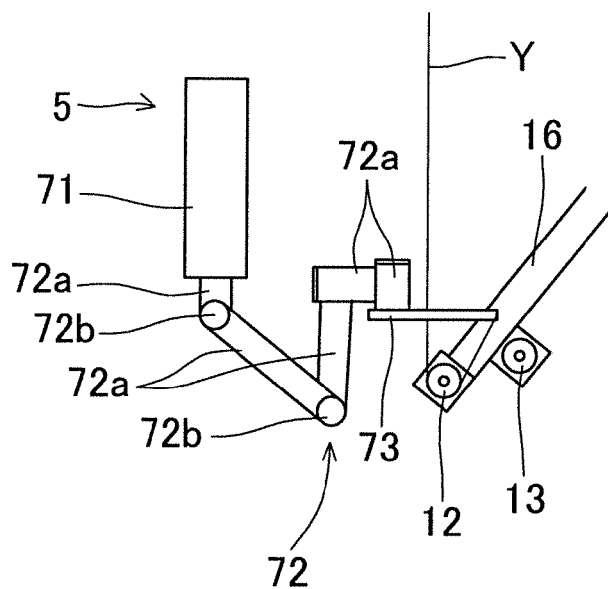
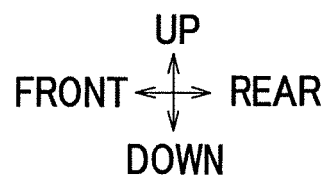
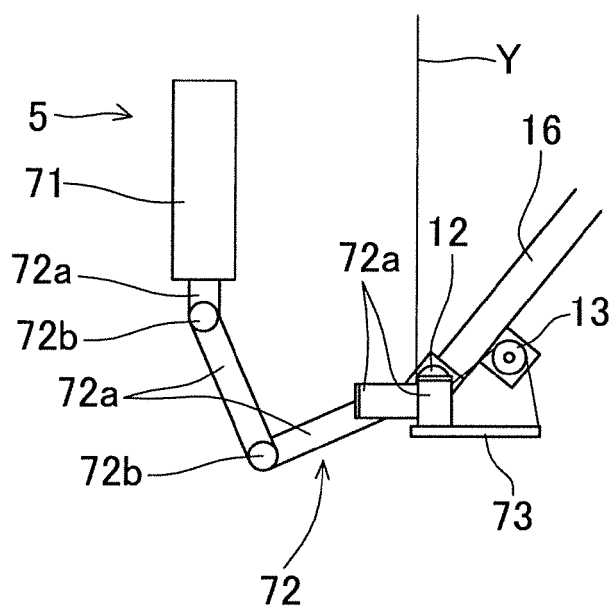


FIG.19

(a)



(b)





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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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