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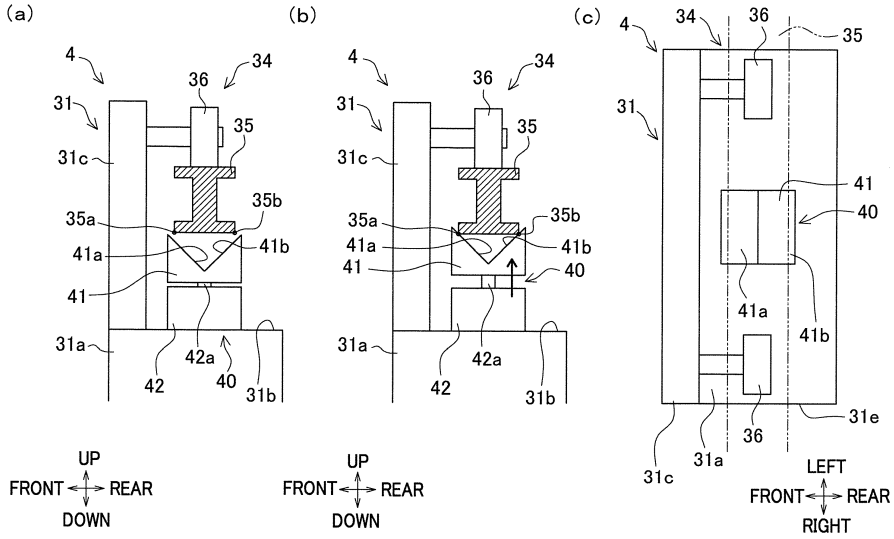
(54) TEXTILE MACHINE

(57) Increase in size in the vertical direction of an operational robot is avoided, and swing of the operational robot while a working unit is in operation is suppressed. A spun yarn take-up machine includes take-up units which are aligned in a predetermined direction orthogonal to the vertical direction, a single rail member 35 which is fixedly provided at a position remote from the floor surface and extends along the predetermined direction, and a yarn threading robot 4 which moves while being suspended from the rail member 35. The yarn threading robot 4 includes a main body 31, a moving unit 34 configured to move the main body 31, a working unit which is configured to perform yarn threading while the moving unit 34 is stopped, and a swing suppressor 40 which is configured to suppress swing of the main body 31 in an orthogonal direction which is orthogonal to both the vertical direction and the predetermined direction. One of the swing suppressor 40 and the rail member 35 includes a V-shaped block 41 which is positioned to sandwich the other one of the rail member 35 and the swing suppressor 40 at least in the orthogonal direction, while the working unit is in operation.

FIG.6



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a textile machine.

[0002] In a spun yarn winding system (textile machine) recited in Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2017-82381), a yarn threading robot (operational robot) performs yarn threading to take-up units (yarn processing apparatuses) each of which takes up a spun yarn and wind it onto a bobbin. The operational robot is suspended from two guide rails extending in a direction in which the take-up units are aligned, with wheels being provided between the robot and the rails, and the operational robot is movable along the guide rails (rail members). The operational robot stops at a yarn processing apparatus and moves a robotic arm (working unit) so as to perform yarn threading (predetermined operation) to that yarn processing apparatus.

[0003] Recently, with the aim of downsizing the operational robot, an operational robot which is able to run along a single rail member is under development. Such an operational robot is arranged so that a wheel is on a single rail member. This operational robot tends to swing in the axial direction of the wheel (orthogonal direction orthogonal to the rail member) as compared to the operational robot suspended from two rail members. For example, the operational robot swings when the working unit is driven and the weight balance in the orthogonal direction is changed. As a result, interference with a surrounding member or a hindrance to the yarn threading may occur.

[0004] To solve the problem above, for example, a positioning mechanism for a doffing device recited in Patent Literature 2 (CN208234289U) may be applied to the operational robot. To be more specific, a pillar extending downward from the operation main body is arranged to extend along a guide formed on the floor surface. With this arrangement, swing of the operational robot is suppressed in the direction vertical to the rail member.

SUMMARY OF THE INVENTION

[0005] In the above-described arrangement with the positioning mechanism, the operational robot which moves along the rail member occupies a space between the rail member and the floor surface in the vertical direction. The working space is therefore disadvantageously narrowed.

[0006] An object of the present invention is to avoid increase in size in the vertical direction of an operational robot which moves in a suspended state, and to suppress swing of the operational robot while a working unit is in operation.

[0007] According to a first aspect of the invention, a textile machine includes: yarn processing apparatuses which are aligned in a predetermined direction intersecting with a vertical direction; a single rail member which extends in the predetermined direction; an operational robot which is configured to move in the predetermined direction while being suspended from the single rail member and to perform a predetermined operation for the yarn processing apparatuses; and a fixed portion which is fixedly provided at a location remote from a floor surface on which the yarn processing apparatuses are provided, the operational robot including: a main body which is suspended from the rail member; a moving unit which is configured to move the main body in the predetermined direction; a working unit which is provided at the main body to perform the predetermined operation while the moving unit is stopped; and a swing suppressor which is provided at the main body to suppress swing of the main body in an orthogonal direction which is orthogonal to both the vertical direction and the predetermined direction, one of the swing suppressor and the fixed portion including a regulatory portion which is positioned to sandwich the other one of the swing suppressor and the fixed portion at least in the orthogonal direction, while the working unit is in operation.

[0008] According to the present invention, when unintentional swing of the operational robot is about to occur in accordance with an operation of the working unit, further swing of the main body in the orthogonal direction is restricted because the regulatory portion of one of the swing suppressor and the fixed portion makes contact with the other one of the swing suppressor and the fixed portion. In this regard, because the fixed portion is fixedly provided at a location remote from the floor surface, it is unnecessary to extend the swing suppressor to reach the floor surface. On this account, it is possible to avoid increase in size in the vertical direction of the operational robot which moves in a suspended state, and to suppress swing of the operational robot while the working unit is in operation.

[0009] According to a second aspect of the invention, the textile machine of the first aspect is arranged such that the swing suppressor includes a state switching unit which switches a state of the swing suppressor between a contact state in which the other one of the swing suppressor and the fixed portion is in contact with the regulatory portion and a non-contact state in which the other one of the swing suppressor and the fixed portion is not in contact with the regulatory portion.

[0010] In the present invention, the state switching unit actively causes the other one of the swing suppressor and the fixed portion to make contact with the regulatory portion. (To put it differently, the state switching unit actively causes the swing suppressor and the fixed portion). With this arrangement, the swing of the operational robot in the orthogonal direction is effectively suppressed. When the operational robot is moved, the contact between the swing suppressor and the fixed portion is canceled (i.e., they are switched to the non-contact state). Damages to the components are therefore prevented.

[0011] According to a third aspect of the invention, the

textile machine of the first or second aspect is arranged such that the fixed portion is the rail member.

[0012] In the present invention, because the rail member which is necessary for moving the operational robot functions as the fixed portion, it is unnecessary to provide another fixed portion in addition to the rail member. It is therefore possible to suppress increase in cost for the components.

[0013] According to a fourth aspect of the invention, the textile machine of the third aspect is arranged such that the swing suppressor includes the regulatory portion.

[0014] Typically, the rail member is not provided with a regulatory portion which is positioned to sandwich another member in the orthogonal direction. Additional labor and cost are therefore required when a regulatory portion is newly provided at the rail member. In the present invention, because the regulatory portion is provided on the swing suppressor side, it is possible to save the labor and cost for manufacturing the rail member.

[0015] According to a fifth aspect of the invention, the textile machine of the fourth aspect is arranged such that the regulatory portion includes a contact member in which a first surface and a second surface are formed, the first surface being inclined relative to the vertical direction and being able to make contact with an end portion on one side in the orthogonal direction of the rail member and the second surface being inclined relative to the vertical direction and being able to make contact with an end portion on the other side in the orthogonal direction of the rail member, and the swing suppressor includes a driving unit which moves the contact member at least in the vertical direction to switch a state of the swing suppressor between a contact state in which the contact member is in contact with the rail member and a non-contact state in which the contact member is not in contact with the rail member.

[0016] In the present invention, as the contact member is moved by the driving unit so that the first surface and the second surface make contact with the fixed portion, it is possible to restrict the swing of the main body in the orthogonal direction. It is therefore possible to effectively suppress the swing of the operational robot while the working unit is in operation, by a simple arrangement.

[0017] According to a sixth aspect of the invention, the textile machine of any one of the first to fifth aspects is arranged such that the swing suppressor is provided above a lower end of the main body.

[0018] In the present invention, the swing suppressor is provided above the lower end of the main body. To put it differently, the swing suppressor does not protrude downward as compared to the main body. It is therefore possible to avoid increase in size of the operational robot in the vertical direction.

[0019] According to a seventh aspect of the invention, the textile machine of any one of the first to sixth aspects is arranged such that, when viewed in the vertical direction, the swing suppressor is provided inside a contour line of the main body.

[0020] In the present invention, when viewed in the vertical direction, the swing suppressor is provided inside the contour line of the main body. To put it differently, the swing suppressor does not protrude from the main body in the horizontal direction. It is therefore possible to avoid increase in size of the operational robot in the horizontal direction.

[0021] According to an eighth aspect of the invention, a textile machine includes: yarn processing apparatuses which are aligned in a predetermined direction intersecting with a vertical direction; a single rail member which extends in the predetermined direction; an operational robot which is configured to move in the predetermined direction while being suspended from the single rail member and to perform a predetermined operation for the yarn processing apparatuses; and a fixed portion which is fixedly provided at a location remote from a floor surface on which the yarn processing apparatuses are provided, the operational robot including: a main body which is suspended from the rail member; a moving unit which is configured to move the main body in the predetermined direction; a working unit which is provided at the main body to perform the predetermined operation while the moving unit is stopped; and a swing suppressor which is provided at the main body to suppress swing of the main body in an orthogonal direction which is orthogonal to both the vertical direction and the predetermined direction, the fixing portion including a pair of contact surfaces which are provided along the orthogonal direction, and the swing suppressor including a sandwiching unit which is in contact with the pair of contact surfaces and sandwiches the fixed portion, while the working unit is in operation.

[0022] In the present invention, because the sandwiching unit of the swing suppressor makes contact with the pair of contact surfaces and sandwiches the fixed portion, friction force is generated between the sandwiching unit and the contact surfaces. When the main body is about to swing in the orthogonal direction, the friction force acts in a direction of suppressing the swing. In this regard, because the fixed portion is fixedly provided at a location remote from the floor surface, it is unnecessary to extend the swing suppressor to reach the floor surface. On this account, it is possible to avoid increase in size in the vertical direction of the operational robot which moves in a suspended state, and to suppress swing of the operational robot while the working unit is in operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

FIG. 1 is a front elevation of a spun yarn take-up machine of an embodiment.

FIG. 2 is a profile of a take-up unit.

Each of FIG. 3(a) to FIG. 3(c) schematically shows the structure of a yarn threading robot.

FIG. 4 is a block diagram showing an electric struc-

ture of the spun yarn take-up machine.

Each of FIG. 5(a) and FIG. 5(b) shows yarn threading to a godet roller.

Each of FIG. 6(a) to FIG. 6(c) shows the structure of a swing suppressor.

Each of FIG. 7(a) to FIG. 7(c) illustrates the structure of a swing suppressor of a modification.

Each of FIG. 8(a) and FIG. 8(b) illustrates the structure of a swing suppressor of another modification.

Each of FIG. 9(a) and FIG. 9(b) illustrates the structure of a swing suppressor of another modification.

Each of FIG. 10(a) and FIG. 10(b) illustrates the structure of a swing suppressor of another modification.

Each of FIG. 11(a) and FIG. 11(b) illustrates the structure of a swing suppressor of another modification.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] 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 (predetermined direction in the present invention) is orthogonal to the up-down direction and is a direction in which later-described take-up units 3 are aligned. The front-rear direction (orthogonal direction in the present invention) is a direction orthogonal to both the up-down direction and the left-right direction. The left-right direction and the front-rear direction are parallel to the horizontal direction.

(Outline of Spun Yarn Take-Up Machine)

[0025] FIG. 1 is a front elevation of a spun yarn take-up machine 1 (textile machine of the present invention) of the present embodiment. The spun yarn take-up machine 1 includes take-up units 3 (yarn processing apparatuses of the present invention) and a yarn threading robot 4 (operational robot of the present invention). The take-up units 3 are aligned in the left-right direction and each of the take-up units 3 takes up yarns Y spun out from a spinning apparatus (not illustrated) provided above the take-up unit 3, and form packages P by winding the yarns Y onto bobbins B. The yarn threading robot 4 is movable in the left-right direction and performs yarn threading to thread the yarns Y to parts constituting each take-up unit 3 before the formation of packages by the take-up unit 3.

(Take-Up Unit)

[0026] The following will describe the structure of each take-up unit 3 with reference to FIG. 2. FIG. 2 is a profile of the take-up unit 3.

[0027] As shown in FIG. 2, the take-up unit 3 includes a first godet roller 12, a second godet roller 13, and a winding unit 14. The first godet roller 12 is a roller having an axis substantially in parallel to the left-right direction and is provided above a front end portion of the winding unit 14. The first godet roller 12 is rotationally driven by a first godet motor 111 (see FIG. 4). The second godet roller 13 is a roller having an axis substantially in 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 a second godet motor 112 (see FIG. 4).

[0028] The second godet roller 13 is movably supported by the guide rail 15. The guide rail 15 extends obliquely upward and rearward. The second godet roller 13 is movable along the guide rail 15 by, for example, a motor 113 (see FIG. 4) and unillustrated members such as a pulley pair and a belt. With this, the second godet roller 13 is movable between a position which is indicated by full lines in FIG. 2, where winding of the yarns Y is carried out and a position which is indicated by dashed lines in FIG. 2, where the second godet roller 13 is close to the first godet roller 12 and yarn threading is carried out.

[0029] The winding unit 14 is arranged to perform winding such that the yarns Y are wound onto bobbins B and package P are formed. The winding unit 14 is provided below the first godet roller 12 and the second godet roller 13. The winding unit 14 includes: fulcrum guides 21; traverse guides 22; a turret 23; two bobbin holders 24; and a contact roller 25.

[0030] 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 yarns Y, respectively, and are aligned in the front-rear direction. The fulcrum guides 21 are movable between positions where the fulcrum guides 21 are separated from one another in the front-rear direction and the yarns Y are wound and positions where the fulcrum guides 21 are gathered to the front side and yarn threading is performed (not illustrated).

[0031] The traverse guides 22 are provided for the respective yarns Y and are aligned in the front-rear direction. Each traverse guide 22 is driven by a traverse motor 114 (see FIG. 4) and reciprocates in the front-rear direction. With this, the yarns Y threaded to the traverse guides 22 are traversed about the fulcrum guides 21.

[0032] The turret 23 is a disc-shaped member having an axis which is in parallel to the front-rear direction. The turret 23 is rotationally driven by a turret motor which is not illustrated. The two bobbin holders 24 have axes in 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. To each bobbin holder 24, bobbins B provided for the respective yarns Y are attached to be aligned in the front-rear direction (bobbin axial direction). Each of the two bobbin holders 24 is rotationally driven by an individual winding motor 115 (see FIG. 4).

[0033] The contact roller 25 is a roller having an axis substantially in 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, to adjust the shape of each package P.

[0034] In the winding unit 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. 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, 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, for example, an unillustrated package collector.

(Yarn Threading Robot)

[0035] The following will describe the yarn threading robot 4 with reference to FIG. 3(a) to FIG. 3(c). FIG. 3(a) is a side view illustrating the entirety of the yarn threading robot 4. FIG. 3(b) is an enlarged view of FIG. 3(a) and illustrates an upper end portion of the yarn threading robot 4. FIG. 3(c) shows the upper end portion of the yarn threading robot 4 viewed from the rear side.

[0036] Before winding is performed by the take-up unit 3, the yarn threading robot 4 threads the yarns Y to the first godet roller 12, the second godet roller 13, the fulcrum guides 21, etc. (i.e., perform a predetermined operation of the present invention). The yarn threading robot 4 includes a main body 31, a robotic arm 32, a yarn threading unit 33, and a moving unit 34. The robotic arm 32 and the yarn threading unit 33 are equivalent to a working unit of the present invention.

[0037] The main body 31 is formed to be substantially rectangular parallelepiped in shape. For example, as shown in FIG. 3(a), the main body 31 includes a substantially rectangular parallelepiped frame 31a and a plate-shaped protrusion 31c which protrudes upward from a front end portion of an upper surface 31b of the frame 31a. Inside the frame 31a, a yarn threading controller 102 (see FIG. 4) is provided to control operations of the robotic arm 32, etc. The protrusion 31c rotatably supports wheels 36 (described later) of the moving unit 34.

[0038] In front of the take-up units 3, a rail member 35 (fixed portion of the present invention) is provided to extend in the left-right direction. The rail member 35 is, for example, H-shaped in cross section (see FIG. 3(b)). The rail member 35 is fixedly provided at a location remote from a floor surface 5 (see FIG. 1 and FIG. 2) on which the take-up units 3 are provided. In the known arrangements, two rail members 35 are aligned in the front-rear direction (e.g., Japanese Laid-Open Patent Publication No. 2017-82381). Meanwhile, in the present embodiment, only one rail member 35 is provided. The main body 31 is suspended from the rail member 35 through the wheels 36.

[0039] The robotic arm 32 is, for example, attached to a lower surface 31d of the main body 31. The robotic arm 32 includes arms 32a and joints 32b connecting the arms 32a with one another. Each joint 32b incorporates therein an arm motor 122 (see FIG. 4). As the arm motor 122 (see FIG. 4) is driven, the arm 32a is swung about the joint 32b.

[0040] The yarn threading unit 33 is attached to a leading end portion of the robotic arm 32. The yarn threading unit 33 includes members such as an unillustrated suction, and is able to temporarily hold the yarns Y.

[0041] The moving unit 34 is configured to move the main body 31 in the left-right direction along the rail member 35. The moving unit 34 includes the wheels 36 which are rotatably attached to the protrusion 31c of the main body 31. The wheels 36 are provided on the upper surface of the one rail member 35 (see FIG. 3(b)). Two wheels 36 are provided in the left-right direction (see FIG. 3(c)). The wheels 36 are driven by a moving motor 121 (see FIG. 4). The moving unit 34 is not arranged to ride on two rail members 35 which are aligned in the front-rear direction as in the known arrangements. The moving unit 34 is therefore small in the front-rear direction as compared to the known arrangements. Accordingly, the main body 31 is small in the front-rear direction as compared to the known arrangements (i.e., is narrow in the up-down direction).

(Electric Structure of Spun Yarn Take-Up Machine)

[0042] Now, an electric structure of the spun yarn take-up machine 1 will be described with reference to a block diagram in FIG. 4. As shown in FIG. 4, in the spun yarn take-up machine 1, a take-up unit controller 101 is provided in each take-up unit 3, and the take-up unit controller 101 controls the first godet motor 111, the second godet motor 112, the motor 113, the traverse motor 114, the winding motor 115, etc. Each take-up unit 3 includes plural traverse motors 114 and two winding motors 115, but FIG. 4 shows only one traverse motor 114 and only one winding motor 115.

[0043] In the spun yarn take-up machine 1, the yarn threading controller 102 is provided in the yarn threading robot 4. The yarn threading controller 102 controls the moving motor 121, the arm motor 122, the yarn threading unit 33, a cylinder 42 (described later), etc. While the robotic arm 32 includes plural joints 32b and plural arm motors 122 corresponding to the respective joints 32b, FIG. 4 shows only one arm motor 122.

[0044] In addition to the above, the spun yarn take-up machine 1 includes a controller 100 which serves to con-

trol the entire machine. The controller 100 is connected with the take-up unit controllers 101 of the take-up units 3 and the yarn threading controller 102. By controlling the take-up unit controllers 101 and the yarn threading controller 102, the controller 100 controls the entire spun yarn take-up machine 1.

(Outline of Yarn Threading)

[0045] The following outlines yarn threading performed by the yarn threading robot 4. Each of FIG. 5(a) and FIG. 5(b) illustrates yarn threading onto the first godet roller 12 and the second godet roller 13. Before the start of the yarn threading, the take-up unit controller 101 of the take-up unit 3 which is the target of the yarn threading controls the motor 113 to position the second godet roller 13 to be close to the first godet roller 12 (see one-dot chain lines in FIG. 2).

[0046] The yarn threading controller 102 then controls the moving motor 121 to drive the wheels 36 so as to move the yarn threading robot 4 to a position overlapping, in the front-rear direction, the take-up unit 3 which is the target of the yarn threading. Subsequently, the yarn threading controller 102 controls the robotic arm 32 and the yarn threading unit 33 to hold the yarns Y spun out from the spinning apparatus. Furthermore, the yarn threading controller 102 drives the robotic arm 32 to cause the yarn threading unit 33 to perform yarn threading. To be more specific, the yarn threading controller 102 causes the yarn threading unit 33 to perform yarn threading to the first godet roller 12 (see FIG. 5(a)), and then causes the yarn threading unit 33 to perform yarn threading to the second godet roller 13 (see 5(b)). Furthermore, the yarn threading controller 102 causes the yarn threading unit 33 to perform yarn threading to the fulcrum guides 21 (not illustrated).

[0047] In this connection, the moving unit 34 and the main body 31 are small in the front-rear direction as compared to the known arrangements, as described above. In other words, these members are long and narrow as compared to the known arrangements. For this reason, during the yarn threading, the weight balance in the front-rear direction (i.e., the axial direction of the wheels 36) tends to be significantly changed in accordance with the operations of the robotic arm 32 and the yarn threading unit 33, with the result that unintentional swing of the yarn threading robot 4 in the front-rear direction tends to occur (see arrows in FIG. 5(a) and FIG. 5(b)). As a result, interference with a surrounding member or a hindrance to the yarn threading may occur.

[0048] However, if a guide such as a groove is formed in the floor surface 5 (see FIG. 1 and FIG. 2) to extend in the left-right direction and a pillar extending downward is attached to the main body 31 of the yarn threading robot 4 to be along the guide, the following problem occurs. The yarn threading robot 4 occupies the space between the rail member 35 and the floor surface 5 in the vertical direction and hence the working space is disadvantageously narrowed. In the present embodiment, in order to suppress the swing of the yarn threading robot 4 while the robotic arm 32, etc. is in operation and to avoid the upsizing of the yarn threading robot 4 in the vertical direction, the spun yarn take-up machine 1 includes a swing suppressor 40 which is arranged as described below.

(Swing Suppressor)

[0049] The following will describe the swing suppressor 40 with reference to FIG. 6(a) to FIG. 6(c). Each of FIG. 6(a) and FIG. 6(b) is a side view of an upper part of the yarn threading robot 4. FIG. 6(c) is a plan view of the yarn threading robot 4. In FIG. 6(c), the rail member 35 is depicted by two-dot chain lines for easy understanding.

[0050] The swing suppressor 40 is provided in the main body 31 of the yarn threading robot 4 and is configured to suppress swing of the main body 31 by restricting the movement of the main body 31 in the front-rear direction. As shown in FIG. 6(a) to FIG. 6(c), the swing suppressor 40 is, for example, provided on the upper surface 31b of the main body 31 and directly below the rail member 35. To put it differently, the swing suppressor 40 is provided above the lower surface 31d of the main body 31 (the lower end of the main body 31). As shown in FIG. 6(c), the swing suppressor 40 is provided inside a contour line 31e of the main body 31 when viewed in the up-down direction. The swing suppressor 40 includes, for example, a V-shaped block 41 (a regulatory portion and a contact member of the present invention) and a cylinder 42 (a state switching unit and a driving unit of the present invention).

[0051] The V-shaped block 41 is a member in which a cutout which is triangular prism in shape is formed in a substantially rectangular parallelepiped block. The V-shaped block 41 includes a flat first surface 41a which is oriented upward and rearward (obliquely upward and rearward) and a flat second surface 41b which is oriented upward and forward (obliquely upward and forward). When the V-shaped block 41 is viewed in the left-right direction, a V shape is formed by the first surface 41a and the second surface 41b (see FIG. 6(a) and FIG. 6(b)). The first surface 41a is inclined to form a negative slope relative to the front-rear direction (i.e., is inclined upward and forward in a direction toward one side in the orthogonal direction of the present invention). The first surface 41a is provided below a front end portion 35a of a lower part of the rail member 35. The second surface 41b is provided behind the first surface 41a and is inclined to form a positive slope relative to the front-rear direction (i.e., is inclined upward and rearward in a direction toward the other side in the orthogonal direction of the present invention). In other words, the first surface 41a and the second surface 41b are inclined relative to the vertical direction. The second surface 41b is provided below a rear end portion 35b of the lower part of the rail member 35. The lower surface of the V-shaped block 41 is con-

nected to the cylinder 42.

[0052] The cylinder 42 is provided to move the V-shaped block 41 in the up-down direction by, for example, pressure of compressed air. The cylinder 42 is connected to an unillustrated compressed air source. The cylinder 42 includes a piston rod 42a which is able to extend and contract in the up-down direction. The V-shaped block 41 is connected to a leading end (upper end) of the piston rod 42a.

[0053] When no compressed air is supplied to the cylinder 42, the first surface 41a and the second surface 41b of the V-shaped block 41 are not in contact with the rail member 35 (non-contact state; see FIG. 6(a)). At this stage, swing of the main body 31 in the front-rear direction is not restricted. In other words, because the V-shaped block 41 does not interfere with the rail member 35, the main body 31 is movable by the moving unit 34. Meanwhile, when compressed air is supplied to the cylinder 42, the V-shaped block 41 is moved up together with the piston rod 42a (see an arrow in FIG. 6(b)). As a result, the first surface 41a of the V-shaped block 41 makes contact with the front end portion 35a of the rail member 35 and the second surface 41b of the V-shaped block 41 makes contact with the rear end portion 35b of the rail member 35 (contact state; see FIG. 6(b)). In this way, the swing suppressor 40 is switchable between the contact state and the non-contact state by the cylinder 42.

[0054] When the swing suppressor 40 is in the contact state, the rail member 35 is sandwiched (gripped) by the V-shaped block 41 in the front-rear direction, with the result that the swing of the main body 31 to which the V-shaped block 41 and the cylinder 42 are attached is suppressed in the front-rear direction. In other words, because the V-shaped block 41 is in contact with the both end portions in the front-rear direction of the rail member 35, unintentional swing of the main body 31 in the front-rear direction is effectively suppressed during the above-described yarn threading. As a result, the swing of the yarn threading robot 4 in the front-rear direction is suppressed.

[0055] As described above, when unintentional swing of the yarn threading robot 4 is about to occur in accordance with an operation of the robotic arm 32, etc., the swing of the main body 31 in the orthogonal direction is restricted because the V-shaped block 41 of the swing suppressor 40 makes contact with the rail member 35. In this regard, because the rail member 35 is fixedly provided at a location remote from the floor surface 5, it is unnecessary to extend the swing suppressor 40 to reach the floor surface. On this account, it is possible to avoid increase in size in the vertical direction of the yarn threading robot 4 which moves in a suspended state, and to suppress swing of the yarn threading robot 4 while the robotic arm 32, etc. is in operation.

[0056] In addition to the above, because the cylinder 42 actively causes the rail member 35 and the V-shaped block 41 to make contact with each other, the swing of the yarn threading robot 4 is effectively suppressed in the front-rear direction. When the yarn threading robot 4 is moved, the contact between the swing suppressor 40 and the rail member 35 is canceled (i.e., they are switched to the non-contact state). Damages to the components are therefore prevented.

[0057] In addition to the above, because the fixedly-provided rail member 35 is used as a fixed portion, it is unnecessary to provide a fixed portion in addition to the rail member 35. It is therefore possible to suppress increase in cost for the components.

[0058] In addition to the above, the swing suppressor 40 includes the V-shaped block 41 (regulatory portion) which sandwiches the rail member 35. Because the regulatory portion is provided on the swing suppressor 40 side, it is possible to save the labor and cost for manufacturing the rail member 35 as compared to a case where a regulatory portion is additionally provided in the rail member 35.

[0059] In addition to the above, as the V-shaped block 41 is moved by the cylinder 42 so that the first surface 41a and the second surface 41b make contact with the rail member 35, it is possible to restrict the swing of the main body 31 in the front-rear direction (orthogonal direction). It is therefore possible to effectively suppress the swing of the yarn threading robot 4 while the robotic arm 32, etc. is in operation, by a simple arrangement.

[0060] In addition to the above, the swing suppressor 40 is provided above the lower end (lower surface 31d) of the main body 31. To put it differently, the swing suppressor 40 does not protrude downward as compared to the main body 31. It is therefore possible to avoid increase in size of the yarn threading robot 4 in the vertical direction.

[0061] In addition to the above, when viewed in the vertical direction, the swing suppressor 40 is provided inside the contour line 31e of the main body 31. To put it differently, the swing suppressor 40 does not protrude from the main body 31 in the horizontal direction. It is therefore possible to avoid increase in size of the yarn threading robot 4 in the horizontal direction.

[0062] 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 one swing suppressor 40 is provided in the yarn threading robot 4, the disclosure is not limited to this arrangement. Plural swing suppressors 40 may be provided.

(2) While in the embodiment above the cylinder 42 moves the V-shaped block 41 in the up-down direction, the moving direction of the V-shaped block 41 may be inclined relative to the vertical direction. For example, the moving direction of the V-shaped block 41 may be slightly inclined in the left-right direction. Furthermore, while each of the first surface 41a and the second surface 41b of the V-shaped block 41 is

flat in the embodiment above, the disclosure is not limited to this arrangement. Each of these surfaces may be curved, for example.

(3) While in the embodiment above the swing of the main body 31 in the front-rear direction is restricted by moving the V-shaped block 41 by the cylinder 42 and causing the first surface 41a and the second surface 41b to make contact with the rail member 35, the disclosure is not limited to this arrangement. An alternative arrangement will be described below with reference to FIG. 7(a) to FIG. 7(c). FIG. 7(a) is a side view illustrating an upper part of a yarn threading robot 4a. Each of FIG. 7(b) and FIG. 7(c) is a plan view of the yarn threading robot 4a. As shown in FIG. 7(a) to FIG. 7(c), the yarn threading robot 4a includes a swing suppressor 50. The swing suppressor 50 includes, for example, a motor 51 provided on the upper surface 31b of the main body 31, a rotational table 52 connected to a rotation shaft 51a of the motor 51, and a pair of cam followers 53 which stand on an end portion which is on the radially outside of the rotational table 52. The rotational shaft 51a of the motor 51 extends upward from the main body of the motor 51. The rotation center of the rotational table 52 is identical with the rotation center of the rotational shaft 51a. A pair of cam followers 53 are provided to sandwich the lower end portion of the rail member 35 at least in the front-rear direction. The pair of cam followers 53 oppose each other over the rotation center of the rotational table 52 and extend substantially vertically.

As the rotational shaft 51a of the motor 51 rotates, the rotational table 52 and the pair of cam followers 53 rotate together with the rotational shaft 51a. By this rotation, the distance between the pair of cam followers 53 and the rail member 35 is changed in the front-rear direction. In other words, the state of the swing suppressor 50 is switchable between a non-contact state (see FIG. 7(b)) in which the cam followers 53 are not in contact with a front end surface 35c and a rear end surface 35d of the rail member 35 and a contact state (see FIG. 7(c)) in which the cam followers 53 are in contact with the front end surface 35c and the rear end surface 35d. When the swing suppressor 50 is in the contact state, the cam followers 53 may be positionally deviated from each other in the left-right direction. In other words, the cam followers 53 may be variously arranged as long as the rail member 35 is sandwiched at least in the front-rear direction. With this arrangement, swing of the main body 31 in the front-rear direction is suppressed. The motor 51 is equivalent to the state switching unit of the present invention. The pair of cam followers 53 are equivalent to the regulatory portion of the present invention.

(4) While in the embodiment above the rail member 35 is sandwiched by the swing suppressor 40 or the swing suppressor 50, a target to be sandwiched is not limited to the rail member 35. The following will describe a specific example with reference to FIG. 8(a) and FIG. 8(b). Each of FIG. 8(a) and FIG. 8(b) is a side view of an upper part of a yarn threading robot 4b. The yarn threading robot 4b includes a swing suppressor 60. In the vicinity of the yarn threading robot 4b, for example, a pin member 38 is attached to a beam member 37 which is fixedly provided. The pin member 38 extends downward and is remote from the floor surface 5 (see, e.g., FIG. 1). The swing suppressor 60 includes a cylinder 61 and a block 62. The cylinder 61 is attached to the front surface of the frame 31a of the main body 31. To put it differently, the swing suppressor 60 may protrude as compared to the main body 31 in the horizontal direction. A piston rod 61a of the cylinder 61 extends upward from the main body of the cylinder 61 and is able to extend and contract in the up-down direction. The block 62 is, for example, provided directly below the pin member 38. A groove 62a extending downward is formed in an upper surface of the block 62. The pin member 38 is able to relatively enter the groove 62a. The block 62 is attached to an upper end of the piston rod 61a.

When no compressed air is supplied to the cylinder 61, as shown in FIG. 8(a), the block 62 and the pin member 38 are separated from each other in the up-down direction. When compressed air is supplied to the cylinder 61 and the piston rod 61a extends upward, as shown in FIG. 8(b), the block 62 is moved up and the pin member 38 enters the groove 62a. In other words, the block 62 is arranged to sandwich the pin member 38 in the front-rear direction. In this regard, "arranged to sandwich" indicates that the swing suppressor 60 and the pin member 38 may be in contact with each other or may be provided so that a narrow gap is provided therebetween. The same applies to the embodiment above. With this arrangement, when the main body 31 is about to swing in the front-rear direction, further swing of the main body 31 is restricted as the block 62 makes contact with the pin member 38. The block 62 is equivalent to the regulatory portion of the present invention. The pin member 38 is equivalent to the fixed portion of the present invention.

(5) While in the modification (4) above the block 62 is attached to the cylinder 61 and the pin member 38 is attached to the beam member 37, the disclosure is not limited to this arrangement. For example, as shown in FIG. 9(a) and FIG. 9(b), the block 62 may be attached to the beam member 37 to extend downward. Furthermore, in a swing suppressor 70 of a yarn threading robot 4c, the pin member 38 may be attached to the piston rod 61a of the cylinder 61. The pin member 38 may be inserted into the groove 62a of the block 62 by supplying compressed air to the cylinder 61 and extending the piston rod 61a upward. In this case, the block 62 is equivalent to the

fixed portion and the regulatory portion of the present invention.

(6) In addition to the embodiment above, various modifications are conceivable. For example, a hole may be formed in the lower surface of the rail member 35 and the yarn threading robot includes a pin member (not illustrated) which can be inserted into the hole. Furthermore, the pin member may be movable in the vertical direction, and the pin member may move to be sandwiched by the rail member 35 in the front-rear direction.

(7) While in the embodiment above, for example, the swing suppressor 40 is provided on the upper surface 31b of the main body 31 of the yarn threading robot 4 (i.e., above the lower end of the main body 31), the disclosure is not limited to this arrangement. The swing suppressor 40 may be provided to be in the frame 31a. Alternatively, the swing suppressor 40 may be provided below the lower surface 31d (see FIG. 3(a)) of the main body 31.

(8) While in the embodiment above the swing suppressor 40, etc. includes a driving unit such as the cylinder 42, the disclosure is not limited to this arrangement. An alternative arrangement will be described below with reference to FIG. 10(a) and FIG. 10(b). FIG. 10(a) is a side view illustrating an upper part of a yarn threading robot 4d. FIG. 10(b) is a plan view of the yarn threading robot 4d. As shown in FIG. 10(a) and FIG. 10(b), for example, pin members 38 each of which is identical with the above-described pin member may be provided on the lower surface of the rail member 35 at predetermined intervals in the left-right direction. Furthermore, in a swing suppressor 80 of the yarn threading robot 4b, the above-described block 62 may be provided, for example, on the upper surface 31b of the main body 31. In this case, when the yarn threading robot 4d is stopped at a predetermined position (position for yarn threading) in the left-right direction, the block 62 is positioned to sandwich the pin member 38 in the front-rear direction (see FIG. 10(b)). In this arrangement, when the main body 31 is about to swing in the front-rear direction while the yarn threading robot 4d is stopped at the predetermined position and yarn threading is being performed by the robotic arm 32, etc., the block 62 makes contact with the pin member 38 and the swing of the main body 31 is restricted. In this way, the swing suppressor 80 may not include a driving unit.

(9) While in the embodiment above the swing of the main body 31 in the front-rear direction is restricted in such a way that one of the swing suppressor and the fixing portion is positioned to sandwich the other one in the front-rear direction, the swing of the main body 31 in the front-rear direction may be restricted by another means. The following will describe a specific example with reference to FIG. 11(a) and FIG. 11(b). A swing suppressor 90 of a yarn threading robot 4e includes a rectangular parallelepiped block 91 attached to the leading end of the piston rod 42a of the cylinder 42 and the above-described wheel 36. The rail member 35 includes an upper surface 35e and a lower surface 35f which are parallel to each other along the front-rear direction and the left-right direction. The upper surface 35e and the lower surface 35f are equivalent to a pair of contact surfaces of the present invention. The outer circumferential surface 36a of the wheel 36 is in contact with the upper surface 35e. The block 91 is provided directly below the rail member 35. When no compressed air is supplied to the cylinder 42, an upper surface 91a of the block 91 is separated from the lower surface 35f of the rail member 35 (see FIG. 11(a)). When compressed air is supplied to the cylinder 42, the piston rod 42a extends and the block 91 is moved upward, with the result that the upper surface 91a of the block 91 makes contact with the lower surface 35f of the rail member 35 (see FIG. 11(b)). In this way, the rail member 35 is sandwiched between the wheel 36 and the block 91. The wheel 36 and the block 91 are equivalent to a sandwiching unit of the present invention. With this arrangement, friction force is generated between the outer circumferential surface 36a and the upper surface 35e and between the upper surface 91a and the lower surface 35f. When the main body 31 is about to swing in the front-rear direction, the friction force acts in a direction of suppressing the swing. Because the rail member 35 is tightly sandwiched, swing of the yarn threading robot 4e while the robotic arm 32, etc. is in operation is suppressed. The arrangement for suppressing swing by means of friction force is not limited to the above. For example, the rail member 35 may be sandwiched without using the wheel 36. In place of the rail member 35, a sandwiching unit which sandwiches a fixed portion which is fixedly provided at a position remote from the floor surface may be provided. The fixed portion is required only to have a pair of contact surfaces formed along the front-rear direction.

(10) While in the embodiment above the rail member 35 extends in the left-right direction (i.e., in the direction orthogonal to the vertical direction), the disclosure is not limited to this arrangement. The rail member 35 may extend in a direction intersecting with the vertical direction (i.e., may be inclined relative to the horizontal direction).

(11) The present invention can be applied not only to the spun yarn take-up machine 1 described above but also to various textile machines including an operational robot such as the yarn threading robot 4. For example, the present invention may be applied to an automatic winder disclosed in Japanese Laid-Open Patent Publication No. 2017-190210, which includes a doffing wagon which is suspended from a rail and moves and is configured to doff fully-wound

packages formed by winder units. In this case, the automatic winder is equivalent to the textile machine of the present invention and the doffing wagon is equivalent to the operational robot of the present invention. Alternatively, for example, the present invention may be applied to a texturing machine recited in Japanese Laid-Open Patent Publication No. H9-104565, which includes an apparatus (distributing apparatus) which is suspended from a rail and moves and is configured to distribute bobbins to yarn pull-out stations. In this case, the texturing machine is equivalent to the textile machine of the present invention and the distributing apparatus is equivalent to the operational robot of the present invention.

Claims

1. A textile machine (1) comprising:

yarn processing apparatuses (3) which are aligned in a predetermined direction intersecting with a vertical direction;
a single rail member (35) which extends in the predetermined direction;
an operational robot (4) which is configured to move in the predetermined direction while being suspended from the single rail member (35) and to perform a predetermined operation for the yarn processing apparatuses (3); and
a fixed portion (35, 38, 62) which is fixedly provided at a location remote from a floor surface (5) on which the yarn processing apparatuses (3) are provided,
the operational robot (4) including:

a main body (31) which is suspended from the rail member (35);
a moving unit (34) which is configured to move the main body (31) in the predetermined direction;
a working unit (32, 33) which is provided at the main body (31) to perform the predetermined operation while the moving unit (34) is stopped; and
a swing suppressor (40) which is provided at the main body (31) to suppress swing of the main body (31) in an orthogonal direction which is orthogonal to both the vertical direction and the predetermined direction,
one of the swing suppressor (40) and the fixed portion (35, 38, 62) including a regulatory portion (41, 53, 62) which is positioned to sandwich the other one of the swing suppressor (40) and the fixed portion (35, 38, 62) at least in the orthogonal direction, while the working unit (32, 33) is in operation.

2. The textile machine (1) according to claim 1, wherein, the swing suppressor (40) includes a state switching unit (42, 51) which switches a state of the swing suppressor (40) between a contact state in which the other one of the swing suppressor (40) and the fixed portion (35, 38, 62) is in contact with the regulatory portion (41, 53, 62) and a non-contact state in which the other one of the swing suppressor (40) and the fixed portion (35, 38, 62) is not in contact with the regulatory portion (41, 53, 62).

3. The textile machine (1) according to claim 1 or 2, wherein, the fixed portion (35) is the rail member (35).

4. The textile machine (1) according to claim 3, wherein, the swing suppressor (40) includes the regulatory portion (41, 53, 62).

5. The textile machine (1) according to claim 4, wherein,
the regulatory portion (41) includes
a contact member (41) in which a first surface (41a) and a second surface (41b) are formed, the first surface (41a) being inclined relative to the vertical direction and being able to make contact with an end portion (35a) on one side in the orthogonal direction of the rail member (35) and the second surface (41b) being inclined relative to the vertical direction and being able to make contact with an end portion (35b) on the other side in the orthogonal direction of the rail member (35), and
the swing suppressor (40) includes
a driving unit (42) which moves the contact member (41) at least in the vertical direction to switch a state of the swing supporter (40) between a contact state in which the contact member (41) is in contact with the rail member (35) and a non-contact state in which the contact member (41) is not in contact with the rail member (35).

6. The textile machine (1) according to any one of claims 1 to 5, wherein, the swing suppressor (40) is provided above a lower end (31d) of the main body (31).

7. The textile machine (1) according to any one of claims 1 to 6, wherein, when viewed in the vertical direction, the swing suppressor (40) is provided inside a contour line (31e) of the main body (31).

8. A textile machine (1) comprising:

yarn processing apparatuses (3) which are aligned in a predetermined direction intersecting with a vertical direction;
a single rail member (35) which extends in the predetermined direction;
an operational robot (4) which is configured to

move in the predetermined direction while being suspended from the single rail member (35) and to perform a predetermined operation for the yarn processing apparatuses (3); and

a fixed portion (35, 38, 62) which is fixedly provided at a location remote from a floor surface (5) on which the yarn processing apparatuses (3) are provided,

the operational robot (4) including:

a main body (31) which is suspended from the rail member (35);

a moving unit (34) which is configured to move the main body (31) in the predetermined direction;

a working unit (32, 33) which is provided at the main body (31) to perform the predetermined operation while the moving unit (34) is stopped; and

a swing suppressor (90) which is provided at the main body (31) to suppress swing of the main body (31) in an orthogonal direction which is orthogonal to both the vertical direction and the predetermined direction,

the fixed portion (35, 38, 62) including a pair of contact surfaces (35e, 35f) which are provided along the orthogonal direction, and

the swing suppressor (90) including a sandwiching unit (91) which is in contact with the pair of contact surfaces (35e, 35f) and sandwiches the fixed portion (35, 38, 62), while the working unit (32, 33) is in operation.

FIG.1

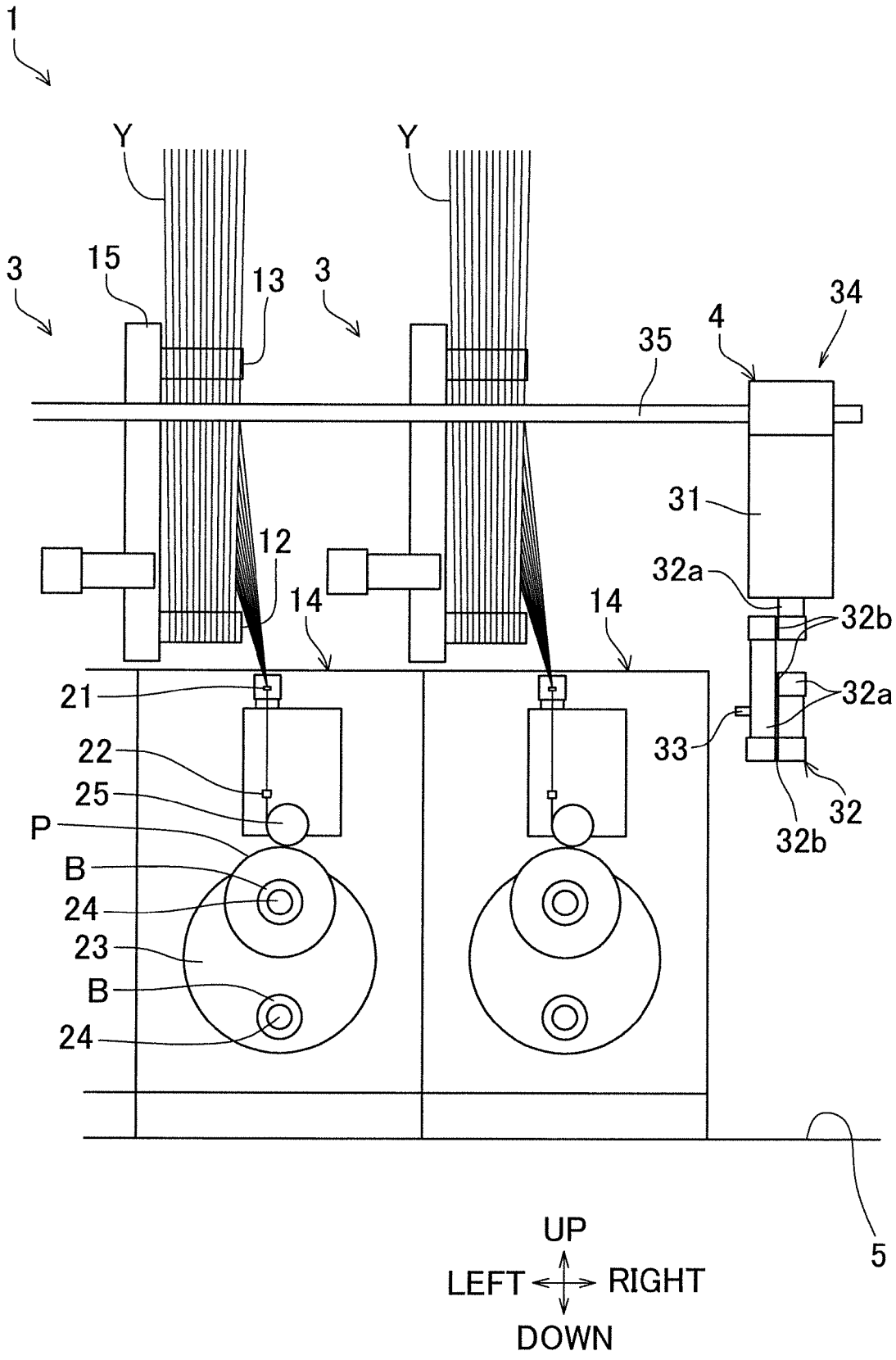

1
Y
Y
3
15
13
3
34
4
35
31
12
32a
14
14
32b
21
32a
22
33
25
32
P
32b
B
24
23
B
24
5
UP
LEFT
RIGHT
DOWN

FIG.2

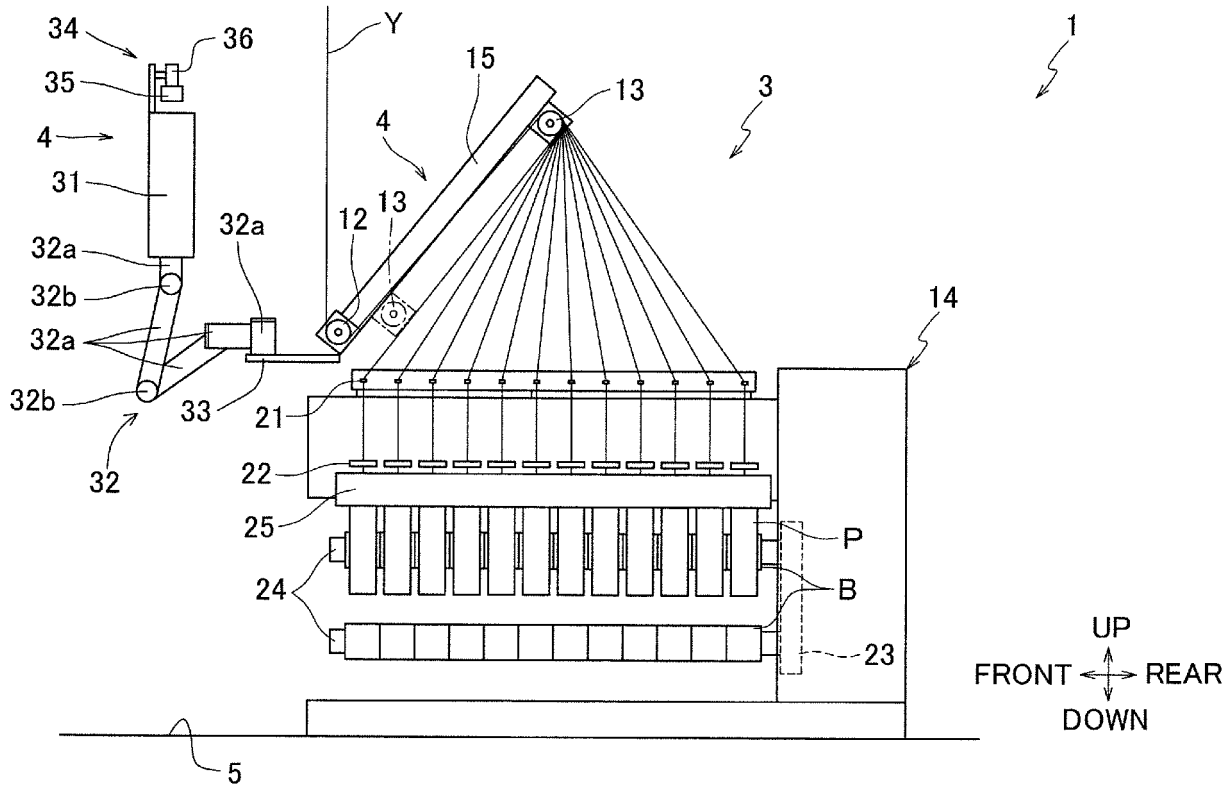

34
36
35
4
31
32a
32b
32a
32b
32
33
32a
Y
15
13
4
12
13
3
1
14
21
22
25
24
P
B
23
5
UP
FRONT
REAR
DOWN

FIG.3

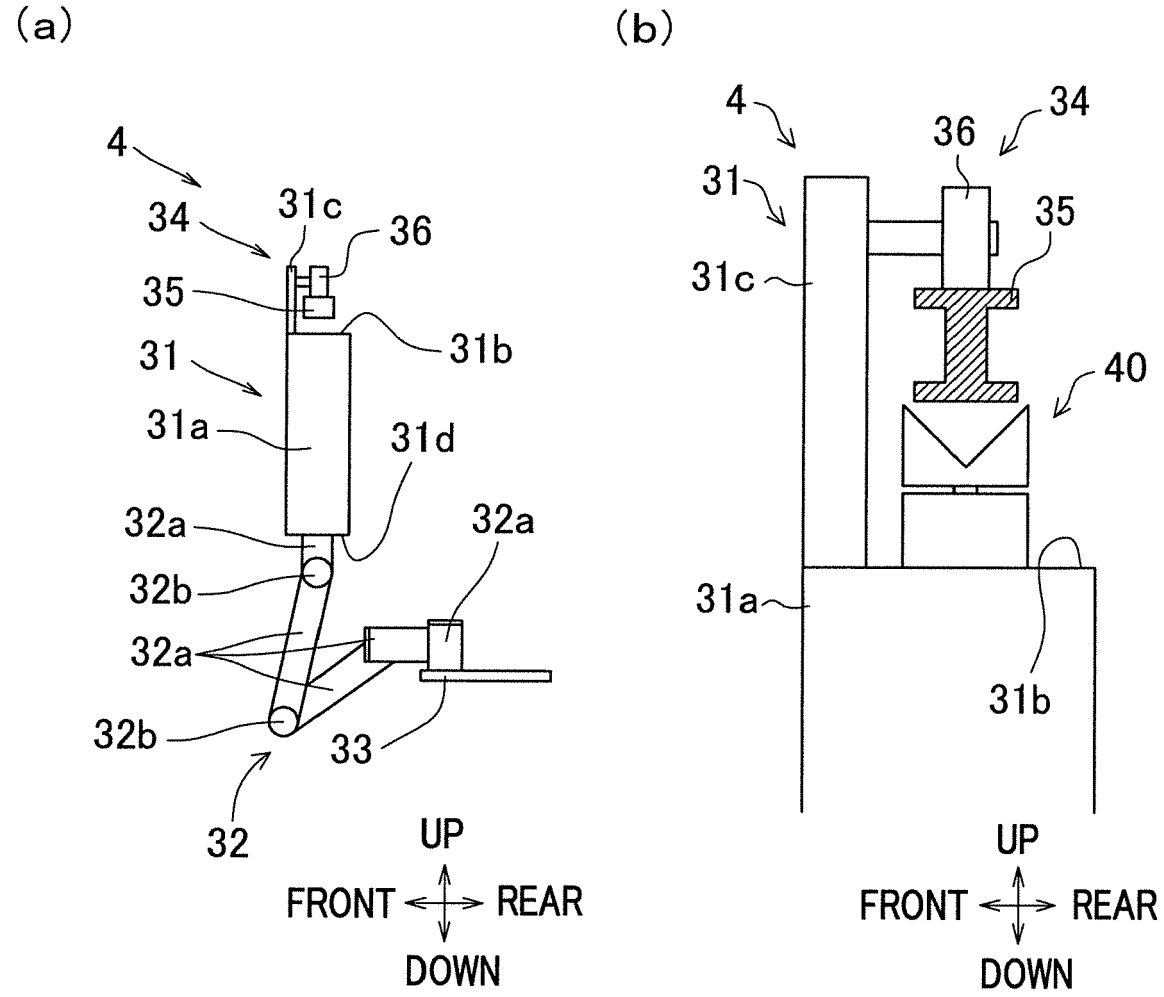

(a)
4
34
31c
36
35
31b
31
31a
31d
32a
32b
32a
32a
32b
33
32
UP
FRONT
REAR
DOWN
(b)
4
34
36
31
35
31c
40
31a
31b
UP
FRONT
REAR
DOWN
(c)
34
31c(31)
36
36
35
UP
RIGHT
LEFT
DOWN

FIG.4

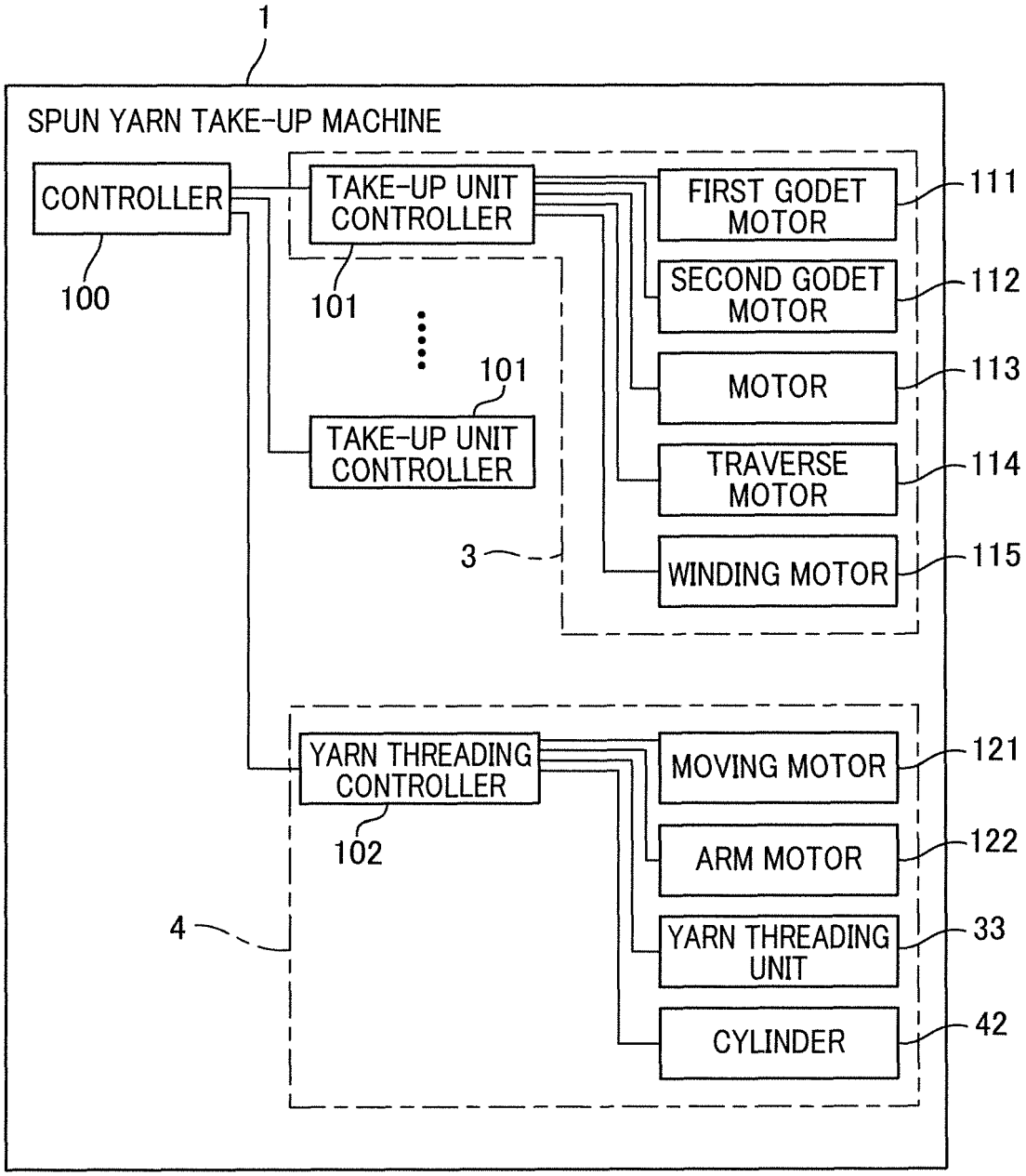
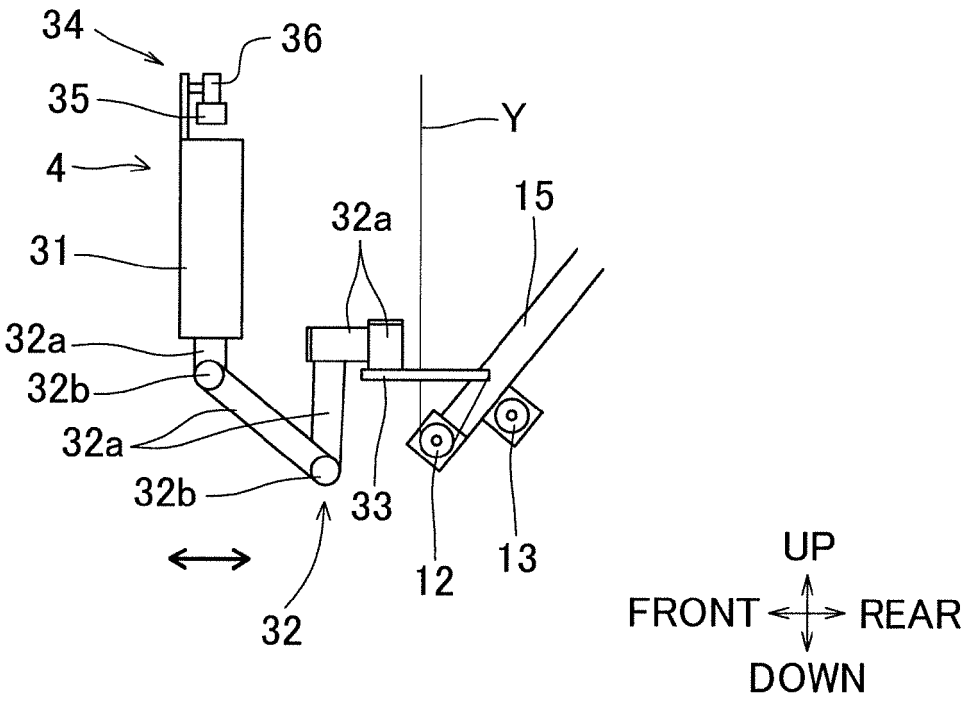

1
SPUN YARN TAKE-UP MACHINE
CONTROLLER
100
TAKE-UP UNIT CONTROLLER
101
101
TAKE-UP UNIT CONTROLLER
3
FIRST GODET MOTOR
111
SECOND GODET MOTOR
112
MOTOR
113
TRAVERSE MOTOR
114
WINDING MOTOR
115
YARN THREADING CONTROLLER
102
4
MOVING MOTOR
121
ARM MOTOR
122
YARN THREADING UNIT
33
CYLINDER
42

FIG.5

(a)


34
36
35
Y
4
15
32a
31
32a
32b
32a
32b
33
12
13
32
UP
FRONT
REAR
DOWN

(b)

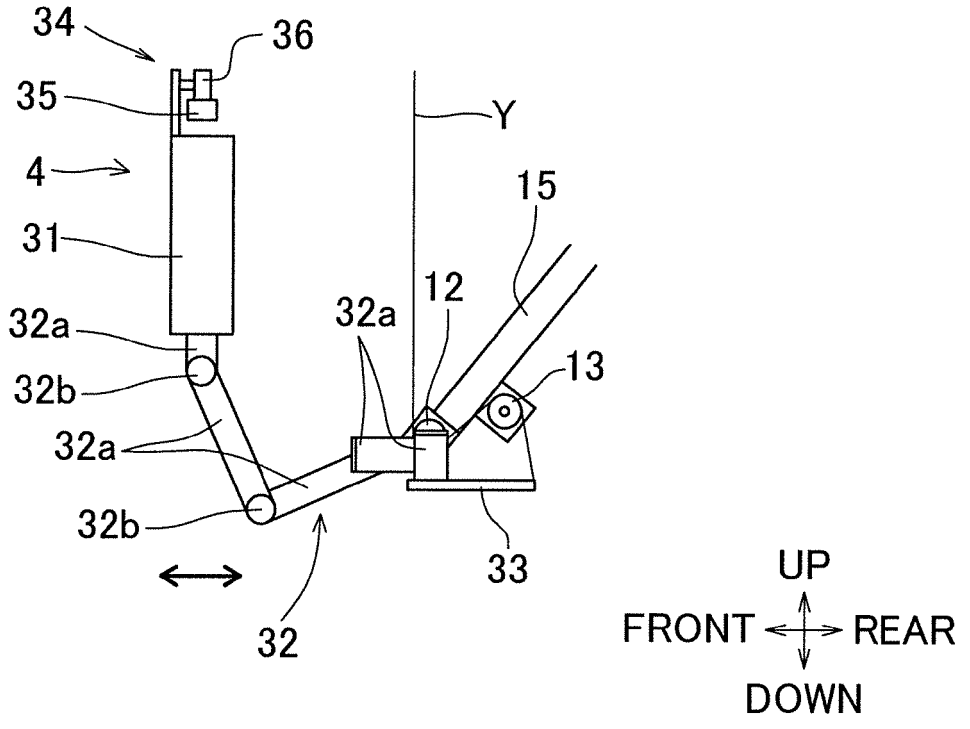

34
36
35
Y
4
15
31
12
32a
32a
13
32b
32a
32b
33
32
UP
FRONT
REAR
DOWN

FIG.6

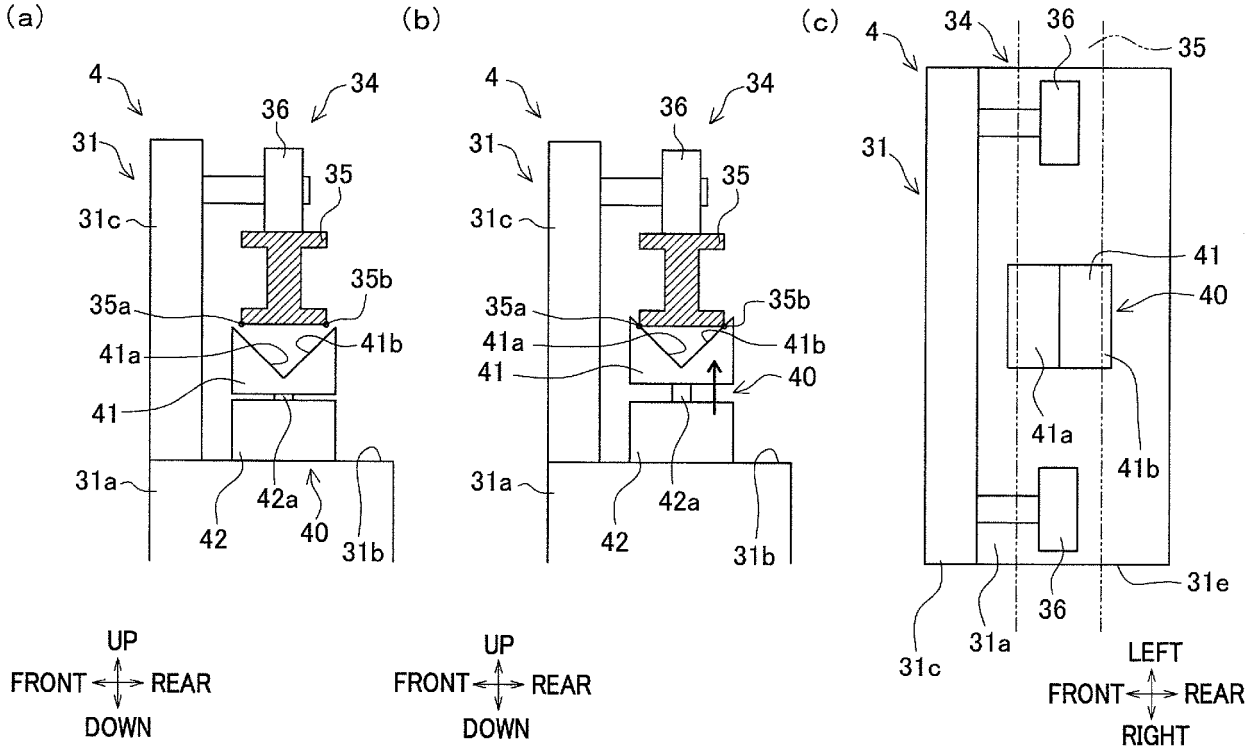

(a)
4
34
36
31
35
31c
35b
35a
41a
41b
41
31a
42a
42
40
31b
UP
FRONT
REAR
DOWN
(b)
4
34
36
31
35
31c
35b
35a
41a
41b
41
40
31a
42a
42
31b
UP
FRONT
REAR
DOWN
(c)
4
34
36
35
31
41
40
41a
41b
31e
36
31a
31c
LEFT
FRONT
REAR
RIGHT

FIG.7

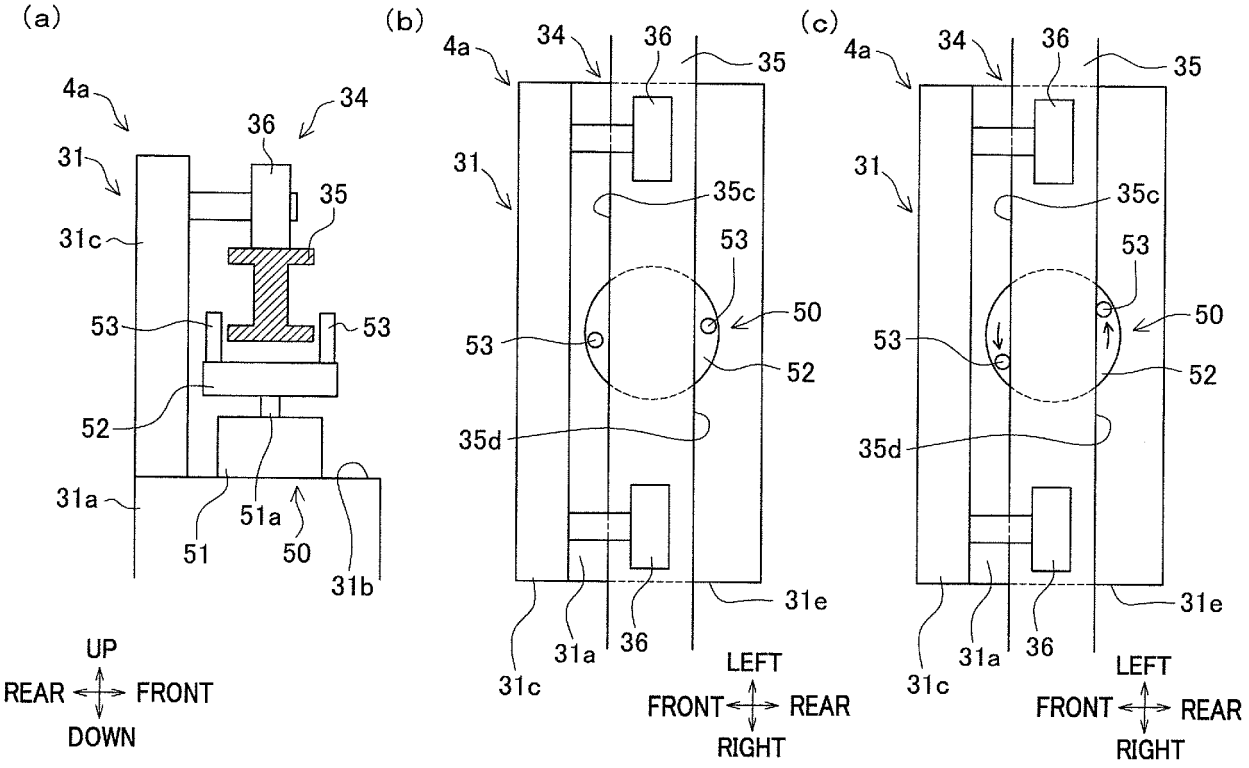

(a)
4a
34
36
31
35
31c
53
53
52
31a
51
51a
50
31b
UP
REAR
FRONT
DOWN
(b)
4a
34
36
35
31
35c
53
50
53
52
35d
31e
31c
31a
36
LEFT
FRONT
REAR
RIGHT
(c)
4a
34
36
35
31
35c
53
50
53
52
35d
31e
31c
31a
36
LEFT
FRONT
REAR
RIGHT

FIG.8

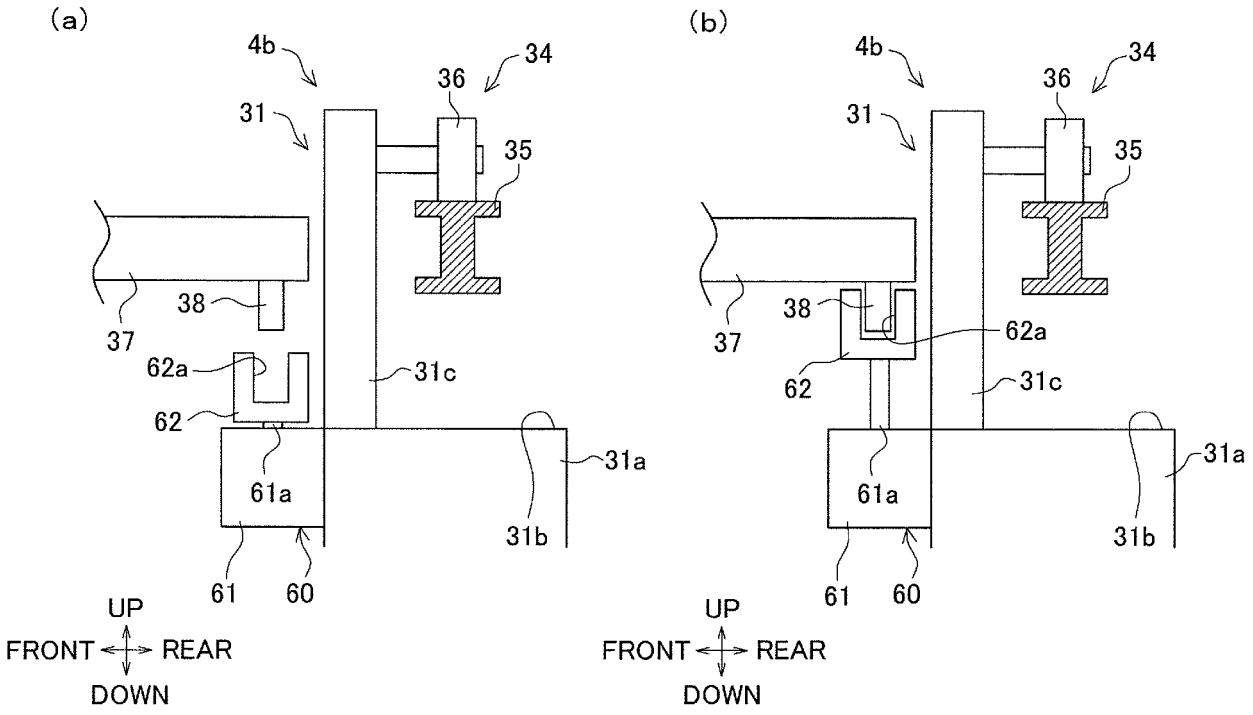

(a)
4b
34
36
31
35
38
37
62a
31c
62
31a
61a
31b
61
60
UP
FRONT
REAR
DOWN
(b)
4b
34
36
31
35
38
37
62a
62
31c
31a
61a
31b
61
60
UP
FRONT
REAR
DOWN

FIG.9

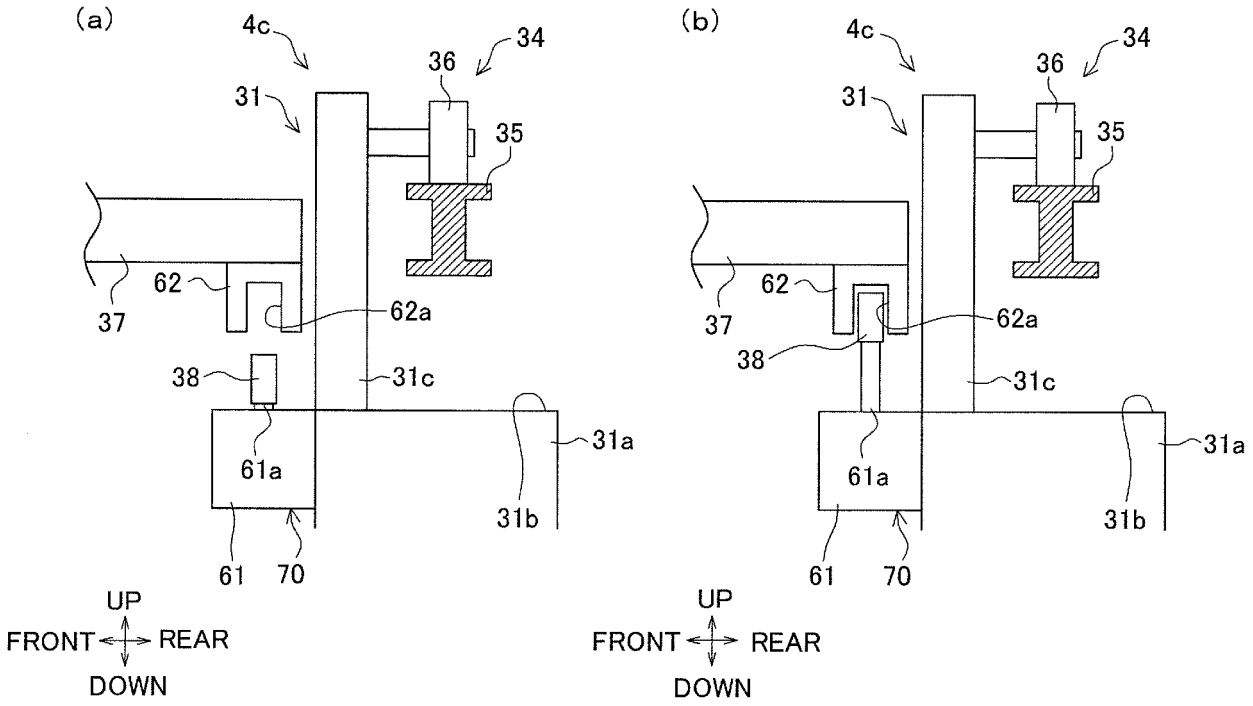

(a)
4c
34
36
31
35
37
62
62a
38
31c
31a
61a
31b
61
70
UP
FRONT
REAR
DOWN
(b)
4c
34
36
31
35
37
62
62a
38
31c
31a
61a
31b
61
70
UP
FRONT
REAR
DOWN

FIG.10

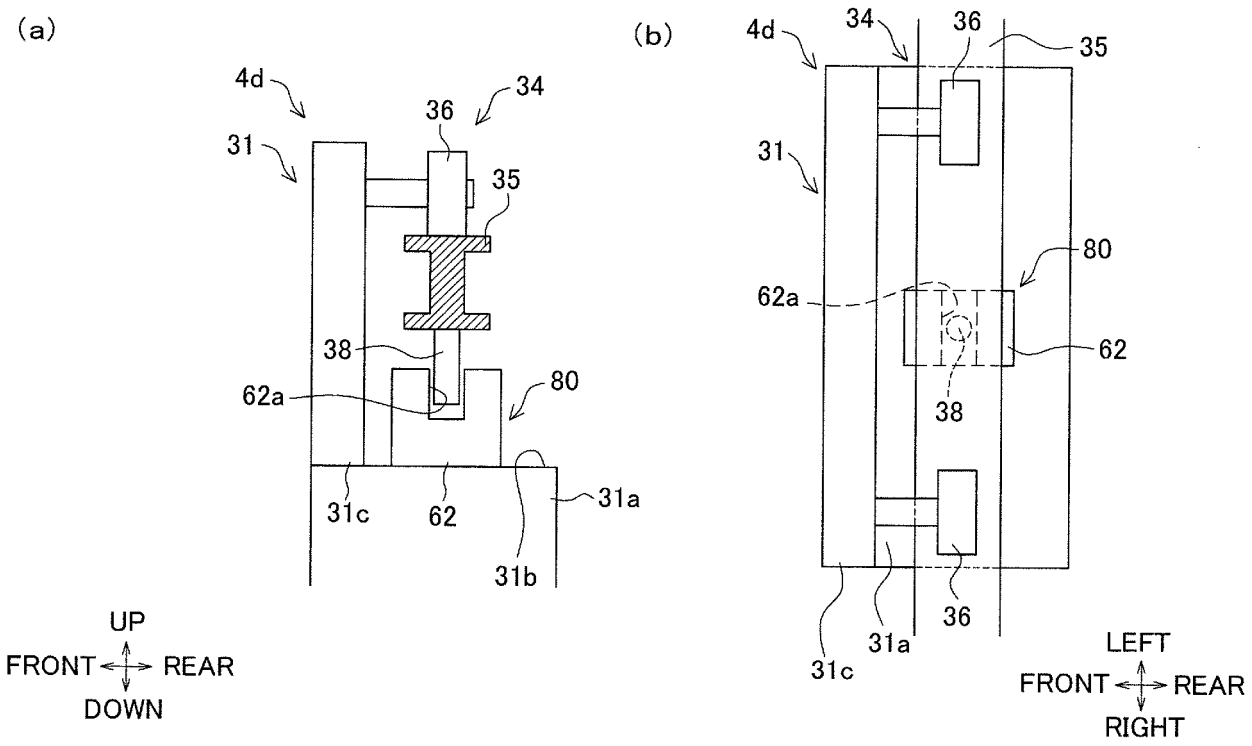
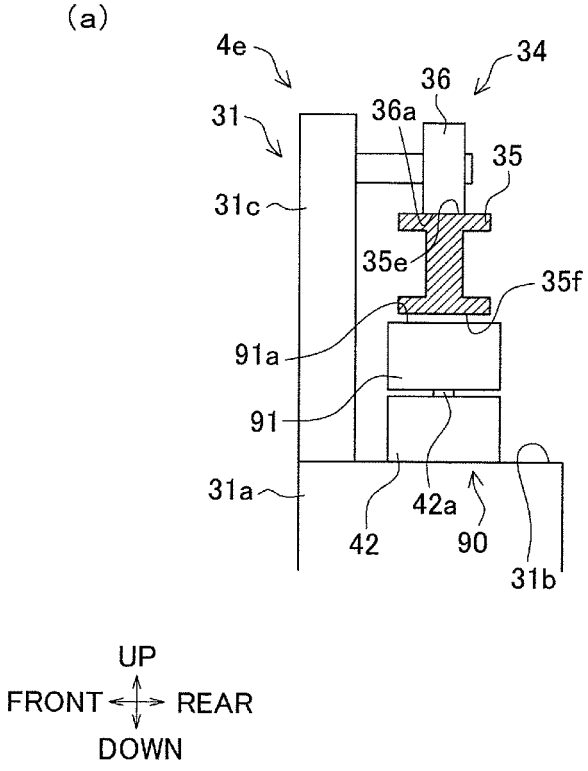
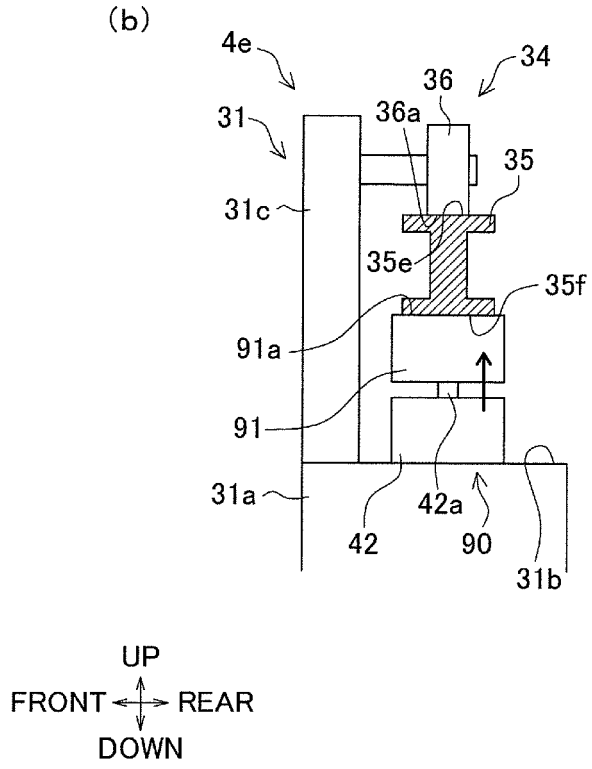

(a)
4d
34
36
31
35
38
62a
80
31c
62
31a
31b
UP
FRONT
REAR
DOWN
(b)
4d
34
36
35
31
80
62a
62
38
36
31a
31c
LEFT
FRONT
REAR
RIGHT

FIG.11

(a)


4e
34
36
36a
31
35
31c
35e
35f
91a
91
31a
42a
42
90
31b
UP
FRONT
REAR
DOWN

(b)


4e
34
36
36a
31
35
31c
35e
35f
91a
91
31a
42a
42
90
31b
UP
FRONT
REAR
DOWN

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 16 3272

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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