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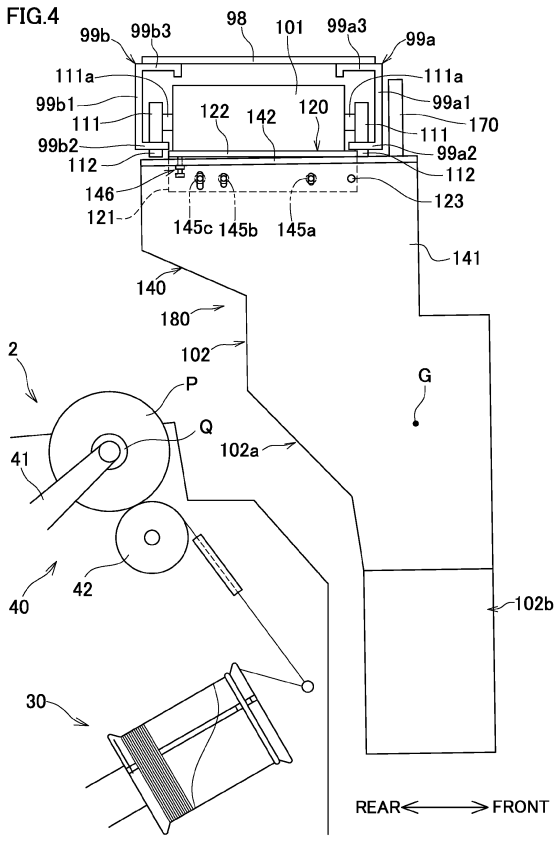
(54) YARN PROCESSING APPARATUS

(57) An object of the present invention is to easily adjust the positional relationship between yarn processing units and a working cart configured to perform an operation selectively for one of the yarn processing units.

A doffing device 3 includes a device main body 100 configured to perform an operation selectively for one of winding units 2, a running unit 101 supported to be movable in a left-right direction by rails 99a and 99b extending along the winding units 2 in the left-right direction, and a swinging unit 102 to which the device main body 100 is attached and which is attached to a lower end portion of the running unit 101. The swinging unit 102 is supported by the running unit 101 to be swingable about a swing shaft 123 extending in the left-right direction. The swinging unit 102 can be fixed to any position within its swing range by bolts 145a to 145c.

FIG.4



EP 4 467 498 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a yarn processing apparatus.

[0002] Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2018-65659) describes a yarn winding apparatus as a yarn processing apparatus. The yarn winding apparatus of Patent Literature 1 includes winding units aligned in an arrangement direction and a doffing device shared between the winding units. The winding units are configured to form packages by winding yarns, which are unwound from yarn supplying bobbins, onto take up tubes. The doffing device is supported by a rail extending in the arrangement direction, and extends downward from the rail. The doffing device is configured to move along the rail in the arrangement direction to a position in front of one winding unit in which the winding of a yarn is completed, to doff a completed package from this winding unit, and to places an empty take up tube.

SUMMARY OF THE INVENTION

[0003] The yarn winding apparatus of Patent Literature 1 needs to be structured so that the positional relationship between the winding units and the doffing device is suitable for performing the above-described operations in the doffing device. Meanwhile, in the yarn winding apparatus of Patent Literature 1, the positional relationship between the winding units and the doffing device may change because of the inclination of the rail supporting the doffing device, the warping of the rail due to the weight of the doffing device, etc. Because the doffing device extends downward from the rail in the yarn winding apparatus of Patent Literature 1, the positional relationship between the winding units and a part of the doffing device tends to significantly change. This part of the doffing device is a lower part thereof, and far from the rail.

[0004] In this regard, the positional relationship between the winding units and the doffing device may be adjusted by adjusting the inclination of the rail, etc. However, in this case, the following operations need to be repeated: an operation of adjusting the inclination of the rail after temporarily detaching the doffing device from the rail; and an operation of checking the positional relationship between the winding units and the doffing device after attaching the doffing device to the rail. This results in a complicated operation.

[0005] An object of the present invention is to provide a yarn processing apparatus which is able to easily adjust the positional relationship between yarn processing units and a working cart configured to perform an operation for the yarn processing units.

[Solution to Problem]

[0006] A yarn processing apparatus of the present invention according to a first aspect includes: yarn processing units aligned in a first direction; a rail extending along the yarn processing units in the first direction; and a working cart which is movable in the first direction along the rail and which is configured to perform an operation selectively for one of the yarn processing units, and the working cart includes: a device main body configured to perform the operation; a running unit supported by the rail so as to be movable in the first direction; a swinging unit to which the device main body is attached, a part of which is farther from the rail in a second direction orthogonal to the first direction than the running unit is, and which is supported by the running unit so as to be swingable about a swing shaft extending in the first direction; and a fixing portion configured to fix the swinging unit to the running unit so that the swinging unit is provided at any position within a swing range of the swinging unit.

[0007] In the present invention, the position of the working cart (the position of the device main body) is easily adjusted by causing the swinging unit of the working cart to swing about the swing shaft.

[0008] The yarn processing apparatus of the present invention is arranged such that the running unit includes a first portion extending in the second direction and a third direction orthogonal to both the first direction and the second direction, the swinging unit includes a second portion which extends in the second direction and the third direction and which overlaps the first portion in the first direction, one of the first portion and the second portion is provided with a first fixing hole which penetrates the one of the first portion and the second portion in the first direction and which extends in the second direction, the other of the first portion and the second portion is provided with a circular second fixing hole which penetrates the other of the first portion and the second portion in the first direction and which overlaps the first fixing hole in the first direction, and the fixing portion is a bolt inserted into the first fixing hole and the second fixing hole.

[0009] In the present invention, the running unit is fixed to the swinging unit by fixing the first portion to the second portion with use of the bolt inserted into the first fixing hole and the second fixing hole.

[0010] The yarn processing apparatus of the present invention is arranged such that the second direction is an up-down direction, the rail is provided above the yarn processing units, a part of the swinging unit is provided below the running unit, and with respect to the swing shaft, the side on which a centroid of a structure formed of the device main body and the swinging unit is provided does not change in a third direction orthogonal to both the first direction and the up-down direction irrespective of a position of the swinging unit within the swing range of the swinging unit.

[0011] In the present invention, with respect to the swing shaft, the side on which the centroid of the structure is provided does not change in the third direction irrespective of the position of the swinging unit within the

swing range of the swinging unit. With this arrangement, by the weight of the structure, a moment which causes the structure to swing about the swing shaft in the same direction is produced in the structure irrespective of the position of the swinging unit within the swing range of the swinging unit. At the time of adjustment of the position of the swinging unit, a force which produces a moment in a direction opposite to the moment due to the weight of the structure is simply applied to the structure irrespective of the position of the swinging unit within the swing range of the swinging unit. This makes it easy to perform an operation of adjusting the position of the swinging unit.

[0012] The yarn processing apparatus of the present invention is arranged such that the running unit includes a first abutment unit extending in the first direction and the third direction, the swinging unit includes a second abutment unit extending in the first direction and the third direction, the second abutment unit is provided below the first abutment unit and overlaps the first abutment unit in the up-down direction, and a part of the first abutment unit and a part of the second abutment unit are provided on the opposite side to the centroid of the structure with respect to the swing shaft in the third direction irrespective of the position of the swinging unit within the swing range of the swinging unit.

[0013] In the present invention, the second abutment unit is provided below the first abutment unit and opposes the first abutment unit. In the third direction, the part of the first abutment unit and the part of the second abutment unit are provided on the opposite side to the centroid of the structure formed of the device main body and the swinging unit with respect to the swing shaft irrespective of the position of the swinging unit within the swing range of the swinging unit. With this arrangement, by the weight of the structure, a moment which causes the structure to swing about the swing shaft so that the second abutment unit approaches the first abutment unit is produced in the structure irrespective of the position of the swinging unit within the swing range of the swinging unit.

[0014] At the time of adjustment of the position of the swinging unit, a force is simply applied to the structure so as to produce the following moment irrespective of the position of the swinging unit within the swing range of the swinging unit: a moment which causes the structure to swing about the swing shaft so that the second abutment unit is moved away from the first abutment unit. The swinging unit includes the second abutment unit and, by the weight of the structure, the moment which causes the structure to swing so that the second abutment unit approaches the first abutment unit is produced in the structure irrespective of the position of the swinging unit within the swing range of the swinging unit. With this arrangement, when the structure is not supported at the time of adjustment of the position of the swinging unit, the swinging unit swings only until the second abutment unit abuts against the first abutment unit. These arrangements make it easy to perform an operation of adjusting the position of the swinging unit.

[0015] The yarn processing apparatus of the present invention further includes a jack member configured to adjustably define the size of a gap provided between the first abutment unit and the second abutment unit, and the jack member is provided on the opposite side to the centroid of the structure with respect to the swing shaft in the third direction irrespective of a position of the swinging unit within the swing range of the swinging unit.

[0016] As described above, by the weight of the structure, the moment which causes the structure to swing about the swing shaft so that the second abutment unit approaches the first abutment unit is produced in the structure irrespective of the position of the swinging unit within the swing range of the swinging unit. As the gap between the first abutment unit and the second abutment unit is increased by the jack member in this state, the structure swings against the moment due to the weight of the structure so that the first abutment unit is moved away from the second abutment unit. Meanwhile, as the gap between the first abutment unit and the second abutment unit is decreased by the jack member in this state, the moment due to the weight of the structure causes the structure to swing so that the first abutment unit approaches the second abutment unit.

[0017] In the present invention, only by adjusting the gap between the first abutment unit and the second abutment unit with use of the jack member, the structure is swingable both in a direction in which the first abutment unit is moved away from the second abutment unit and a direction in which the first abutment unit approaches the second heating unit. This makes it easy to perform an operation of adjusting the position of the structure.

[0018] The yarn processing apparatus of the present invention is arranged such that the swinging unit includes: a first frame which is supported by the running unit so as to be swingable about the swing shaft and which is fixed to the running unit by the fixing portion; and a second frame a part of which is farther from the rail in the second direction than the first frame is, which is fixed to the first frame, and to which at least a part of the device main body is attached.

[0019] When the swinging unit is long in the up-down direction, the swinging unit may include and may be separable in the second direction into the first frame and the second frame which is farther from the rail in the second direction than the first frame is. In this case, when the second frame is fixed to the first frame, the first frame may be deviated from the second frame so that there is some deviation at the device main body attached to the swinging unit along the first frame and second frame. In the present invention, even when there is such deviation, the position of the working cart (the position of the device main body) is adjustable by causing the swinging unit to swing about the swing shaft.

[0020] The yarn processing apparatus of the present invention is arranged such that the second direction is the up-down direction, the rail is provided above the yarn processing units, each of the yarn processing units in-

cludes: a yarn supplying section which can pull out and unwind a yarn from a placed yarn supplying bobbin; a yarn storage section which is provided above the yarn supplying section and which is configured to temporarily store the yarn unwound from the yarn supplying section; and a winding section which is provided above the yarn storage section and which is configured to wind the yarn stored in the yarn storage section, and the working cart is configured to perform an operation for the winding section and the yarn storage section, and a part of the working cart is provided at the same level as the yarn storage section.

[0021] When (i) the working cart is configured to perform an operation for the yarn storage section provided below the winding section and (ii) a part of the working cart is provided at the same level as the yarn storage section, this part of the working cart is very far from the rail. Because of this, the deviation of the position of this part of the working cart due to the inclination, warping, etc. of the rail is large. In the present invention, a part of the working cart is very far from the rail and is provided on the same level as the yarn storage section, and the position of this part of the working cart is adjustable by causing the swinging unit to swing about the swing shaft.

[0022] A yarn processing apparatus of the present invention according to a second aspect includes: yarn processing units aligned in a first direction; a rail extending along the yarn processing units in the first direction; and a working cart which is movable in the first direction along the rail and which is configured to perform an operation selectively for one of the yarn processing units, and the working cart including: a device main body configured to perform the operation; a running unit supported by the rail so as to be movable in the first direction; wherein a positional relationship between the device main body and the running unit is adjustable for adjusting a positional relationship between the device main body and the yarn processing units. To this end, the working cart may comprise a coupling and adjustment arrangement that couples the device main body with the running unit and enables to adjust the position of the device main body with respect to the running unit.

[0023] The yarn processing apparatus of the present invention preferably is arranged such that the positional relationship between the device main body and the running unit is adjustable such that a distance between a predetermined part of the device main body and a respective predetermined part of the yarn processing units in a direction being orthogonal to the first direction and to a vertical direction is adjustable.

[0024] The yarn processing apparatus of the present invention preferably is arranged such that the distance between the predetermined part of the device main body and the respective pre-determined part of the yarn processing units is adjustable by adjusting a relative swiveling position between the device main body and the running unit. To this end, the mentioned coupling and adjustment arrangement may comprise a swinging or swiveling unit. The swinging unit may be realized as is proposed in the foregoing for the swinging unit of the yarn processing apparatus according to the first aspect of the invention. The yarn processing apparatus according to the second aspect of the invention may be characterized by further features of the yarn processing apparatus according to the first aspect of the invention as proposed and discussed in the foregoing.

[0025] In the present invention, the position of a working cart is easily adjusted, preferably by causing a swinging unit to which the working cart is attached to swing about a swing shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a front elevation of an automatic winder of an embodiment.

FIG. 2 shows a doffing device viewed from the winding unit side.

FIG. 3 is an enlarged view of a part of FIG. 2.

FIG. 4 shows the doffing device viewed from the left side.

FIG. 5A is an enlarged view of a part of FIG. 4, and FIG. 5B shows a part of the doffing device viewed from the right side. This part of the doffing device corresponds to FIG. 5A.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0027] The following will describe the details of a preferred embodiment of the present invention with reference to figures.

[Automatic Winder]

[0028] FIG. 1 is a front elevation of an automatic winder of the present embodiment. As shown in FIG. 1, an automatic winder 1 (a "yarn processing apparatus" of the present invention) includes winding units 2 ("yarn processing units" of the present invention) aligned in a predetermined arrangement direction (a left-right direction of FIG. 1; a "first direction" of the present invention), a doffing device 3 (a "working cart" of the present invention), a bobbin supplier 4 configured to supply a yarn supplying bobbin B, and a machine controller 5. Hereinafter, the left-right direction of FIG. 1, the up-down direction thereof, and a direction perpendicular to the sheet of FIG. 1 will be respectively used as the left-right, up-down (a "second direction" of the present invention), and front-rear (a "third direction" of the present invention) directions of the automatic winder 1 of the present embodiment. In this regard, the near side in the direction perpendicular to the sheet of FIG. 1 will be used as the front side in the front-rear direction, and the far side in the direction perpendicular to the sheet thereof will be used as the rear side in the front-rear direction.

[0029] The winding units 2 are configured to form packages P by winding yarns Y, which are unwound from yarn supplying bobbins B, onto take up tubes Q. The doffing device 3 is movable in the left-right direction along two rails 99a and 99b extending over the winding units 2 in the left-right direction. The doffing device 3 is configured to move along the rails 99a and 99b in the left-right direction to a position where to oppose each winding unit 2, and to perform an operation for the winding unit 2. The bobbin supplier 4 is configured to place a yarn supplying bobbin B on a conveyance tray T, and to supply the yarn supplying bobbin B supported by the conveyance tray T for a lower part of each yarn winding unit 2. The machine controller 5 is configured to control each winding unit 2, the doffing device 3, and the bobbin supplier 4. An operator is able to manage the winding units 2 in a concentrated manner by suitably operating the machine controller 5.

[Winding Unit]

[0030] As shown in FIG. 1, each winding unit 2 includes a yarn supplying section 10, a yarn processing section 20, a yarn storage section 30, and a winding section 40. The yarn supplying section 10, the yarn processing section 20, the yarn storage section 30, and the winding section 40 are aligned in this order. In this regard, the yarn supplying section 10 is the lowest in position while the winding section 40 is the highest in position. The yarn supplying section 10 is configured to pull out, unwind, and supply a yarn Y wound onto a yarn supplying bobbin B maintained by a conveyance tray T (a yarn supplying bobbin B placed on the conveyance tray T) to stand up. The yarn processing section 20 is configured to perform processes such as (i) applying of tension to the yarn Y supplied from the yarn supplying section 10 and (ii) yarn joining at the time of disconnection of the yarn Y. The yarn storage section 30 is configured to temporarily store the yarn Y which is unwound from the yarn supplying bobbin B by the yarn supplying section 10 and which passes through the yarn processing section 20. The winding section 40 is configured to form a package P by winding the yarn Y, which is supplied from the yarn storage section 30, onto a take up tube Q while traversing this yarn Y by means of a traversing drum 42. The structure and operation of each of the yarn supplying section 10, the yarn processing section 20, the yarn storage section 30, and the winding section 40 are the same as those in, e.g., Japanese Laid-Open Patent Publication No. 2018-65659. For this reason, a further detailed description of those is not given here.

[Doffing Device]

[0031] The following will describe the doffing device 3. FIG. 2 shows the doffing device 3 viewed from the winding unit 2 side (the rear side). The left-right direction of FIG. 2 is reverse to that of FIG. 1. FIG. 3 is an enlarged view of a part of FIG. 2. FIG. 4 shows the doffing device 3 viewed from the left side. FIG. 5A is an enlarged view of a part of FIG. 4. FIG. 5B shows a part of the doffing device 3 viewed from the right side. This part of the doffing device 3 corresponds to FIG. 5A.

(Rail)

[0032] In advance of the description of the doffing device 3, the following will describe the rails 99a and 99b supporting the doffing device 3. As described above, the rails 99a and 99b extend over the winding units 2 in the left-right direction. The rail 99a is spaced apart from the rail 99b in the front-rear direction, and the rail 99b is provided behind the rail 99a.

[0033] The rail 99a is formed by bending a plate-shaped member, and includes a vertical portion 99a1, a lower part 99a2, and an upper part 99a3. The vertical portion 99a1 extends in the left-right and up-down directions. The lower part 99a2 extends rearward from a lower end portion of the vertical portion 99a1. The upper part 99a3 extends rearward from an upper end portion of the vertical portion 99a1.

[0034] The rail 99b is formed by bending a plate-shaped member, and includes a vertical portion 99b1, a lower part 99b2, and an upper part 99b3. The vertical portion 99b1 extends in the left-right and up-down directions, and opposes the vertical portion 99a1 of the rail 99a in the front-rear direction. The lower part 99b2 extends forward from a lower end portion of the vertical portion 99b1. The upper part 99b3 extends forward from an upper end portion of the vertical portion 99b1.

[0035] The rail 99a is connected to the rail 99b by connection members 98. The connection members 98 extend in the front-rear direction, and are spaced apart from one another in the left-right direction. A front end portion of each connection member 98 is fixed to an upper surface of the upper part 99a3 of the rail 99a. A rear end portion of each connection member 98 is fixed to an upper surface of the upper part 99b3 of the rail 99b.

[0036] The doffing device 3 includes a device main body 100, a running unit 101, and the swinging unit 102.

(Device Main Body)

[0037] The device main body 100 is provided for performing an operation for each winding unit 2. In the present embodiment, examples of an operation for the winding unit 2 include (i) a doffing operation of doffing a completed package P from the winding unit 2 in which the winding of a yarn Y is completed, (ii) a yarn-type changing operation of changing the type of the yarn Y wound by the winding section 40 in cooperation with the winding unit 2, and (iii) an upper-yarn breakage operation of performing the yarn joining when yarn breakage occurs between the package P and the yarn storage section 30.

[0038] The device main body 100 includes a clamp cutter 51, a pull-out arm 52, a chucker 53, a cradle opener

54, a suction mouth 55, a standard thread supplier 70, etc.

[0039] The clamp cutter 51 includes an unillustrated cutter configured to cut the yarn Y and an unillustrated clamp configured to hold the yarn Y. The clamp cutter 51 is attached to a leading end portion of the pull-out arm 52. The pull-out arm 52 is extendable and contractable, and is swingable in the front-rear direction. The clamp cutter 51 attached to the leading end portion of the pull-out arm 52 which is extendable, contractable, and swingable is able to hold the yarn Y provided immediately below the winding section 40 and to move the held yarn Y to a position adjacent to a take up tube Q.

[0040] The chucker 53 is rotatably attached to a shaft 57 extending in the left-right direction, and configured to rotate about the shaft 57 in the up-down direction. A leading end portion of the chucker 53 is provided with a chuck portion 53a configured to grip the take up tube Q. The chucker 53 is configured to rotate downward after taking out one empty take up tube Q from an unillustrated stocker provided above the automatic winder 1 and gripping the take up tube Q by means of the chuck portion 53a, so as to place the take up tube Q on a cradle 41 (see FIG. 4) configured to hold the take up tube Q in the winding section 40.

[0041] The cradle opener 54 is configured to operate an unillustrated cradle lever provided at the cradle 41. As the cradle lever is operated, the detachment of the completed package P from the cradle 41 and the attachment of the empty take up tube Q to the cradle 41 are enabled.

[0042] The suction mouth 55 includes a suction port 55a which is provided on a front surface of the suction mouth 55, which is provided substantially at the same level as the package P, and which extends in the left-right direction. The suction mouth 55 is movable in the front-rear direction. The yarn Y is sucked and held by the suction port 55a, by generating negative pressure at the suction port 55a with use of an unillustrated negative pressure source on the premise that the suction mouth 55 is at a near position where the suction port 55a is close to the package P. A mouth cutter 61 configured to cut the yarn Y is provided immediately below a right end portion of the suction mouth 55.

[0043] The standard thread supplier 70 includes a standard thread bobbin 71, a standard thread handover lever 72, a standard thread clamp cutter 73, a yarn trap 74, etc. The standard thread bobbin 71 is a bobbin onto which a standard thread Y is wound, and is rotatably supported by a support shaft 75. The standard thread handover lever 72 is horizontally rotatable about a supporting shaft 72a by means of an unillustrated standard thread handover motor. An unillustrated slit into which the yarn Y is inserted is formed at a leading end portion of the standard thread handover lever 72 in order to hook and pull out the yarn Y. Furthermore, a standard thread guide 77 is fixed to the leading end portion of the standard thread handover lever 72. The standard thread guide 77 is provided above and spaced apart from the standard thread handover lever 72. The standard thread guide 77 is configured to horizontally rotate together with the standard thread handover lever 72. The standard thread guide 77 includes an unillustrated notch slit configured to hook and pull out the yarn Y. The standard thread handover lever 72 is movable between the following positions: a standby position where the standard thread handover lever 72 is retracted in the swinging unit 102; and a pull-out position where the standard thread handover lever 72 protrudes from the swinging unit 102 toward the winding unit 2 side and pulls out the standard thread Y so that the standard thread Y can be held by the clamp cutter 51.

[0044] The standard thread clamp cutter 73 is provided slightly above the standard thread guide 77 at the standby position. The standard thread clamp cutter 73 includes an unillustrated cutter configured to cut the standard thread Y and an unillustrated clamp configured to hold the standard thread Y. The cutter and clamp of the standard thread clamp cutter 73 are driven by suitable driving sources such as air cylinders. The standard thread Y pulled out from the standard thread bobbin 71 passes through the slit of the standard thread handover lever 72 and the notch slit of the standard thread guide 77 which are described above, and is guided toward the standard thread clamp cutter 73. The yarn trap 74 is provided close to the standard thread clamp cutter 73, and configured to suck the yarn Y.

[0045] The doffing device 3 further includes a yarn moving lever 62, a fixed guide 64, a yarn handover lever 65, and a yarn blowing lever 67 in order to guide the yarn Y from the package P side toward a sucking unit of an unillustrated yarn threading nozzle of the yarn storage section 30 in a case where the yarn Y is disconnected between the package P and the yarn storage section 30.

[0046] The yarn moving lever 62 is provided slightly above the suction mouth 55, and horizontally rotatable about a supporting shaft 62a. The yarn moving lever 62 is configured to move the yarn Y by rotating while the yarn Y is hooked at a leading end portion of the yarn moving lever 62. The yarn moving lever 62 is used mainly at the time of the fixation of the yarn Y to the take up tube Q and the formation of bunch winding.

[0047] The fixed guide 64 is provided below the suction mouth 55. A recessed engaging portion 64a is formed at a lower left end portion of the fixed guide 64 so that the yarn Y can be engaged with this engaging portion 64a. The fixed guide 64 is provided with an unillustrated protruding portion extending forward. As the yarn Y is engaged with the engaging portion 64a and the protruding portion, a yarn path of the yarn Y is defined.

[0048] The yarn handover lever 65 is provide immediately in front of the fixed guide 64, and rotatable about a supporting shaft 65a in the up-down direction. A leading end portion of the yarn handover lever 65 is provided with a hook portion 65b configured to hook and move the yarn Y. As the yarn handover lever 65 viewed from the rear

side in the front-rear direction rotates counterclockwise, the yarn Y is hooked by the hook portion 65b. When viewed from the rear side in the front-rear direction, a curved recess 65c is formed on the right side in the left-right direction and between the leading end portion and base end portion of the yarn handover lever 65 while a curved protrusion 65d is formed on the left side in the left-right direction and between the leading end portion and base end portion of the yarn handover lever 65.

[0049] The yarn blowing lever 67 is rotatable about a supporting shaft 67a in the up-down direction. The yarn blowing lever 67 is provided at the lowermost end portion of the doffing device 3, and a yarn pick-up unit 67b configured to pick up the yarn Y is provided at a leading end portion of the yarn blowing lever 67. The yarn blowing lever 67 is configured to pick up the yarn Y, which is moved downward by the yarn handover lever 65, by means of the yarn pick-up unit 67b and to guide this yarn Y to the sucking unit of the unillustrated yarn threading nozzle of the yarn storage section 30.

[0050] The operation of the device main body 100 at the time of the doffing operation, the yarn-type changing operation, and the upper-yarn breakage operation performed in the device main body 100 is the same as that in, e.g., Japanese Laid-Open Patent Publication No. 2018-65659. For this reason, a further detailed description of that is not given here. The device main body 100 may be differently arranged as long as it is able to perform the doffing operation, the yarn-type changing operation, and the upper-yarn breakage operation. The device main body 100 may be configured to perform only one or two of the doffing operation, the yarn-type changing operation, and the upper-yarn breakage operation. The device main body 100 may be configured to perform an operation which is not any of the doffing operation, the yarn-type changing operation, or the upper-yarn breakage operation.

(Running Unit)

[0051] The running unit 101 is substantially rectangular parallelepiped in shape. The running unit 101 is supported to be movable along the two rails 99a and 99b in the left-right direction. To be more specific, a front end portion of the running unit 101 is provided with two axes 111a which extend in the front-rear direction and which are spaced apart from each other in the left-right direction. Each axis 111a rotatably supports a wheel 111. A rear end portion of the running unit 101 is also provided with two axes 111a which extend in the front-rear direction and which are spaced apart from each other in the left-right direction. Furthermore, each axis 111a rotatably supports a wheel 111. The two wheels 111 provided at the front end portion of the running unit 101 are placed on the upper surface of the lower part 99a2 of the front rail 99a. The two wheels 111 provided at the rear end portion of the running unit 101 are placed on the upper surface of the lower part 99b2 of the rear rail 99b. These four wheels 111 are connected to an unillustrated motor. As this motor is driven, the four wheels 111 rotate and move on the upper surfaces of the lower parts 99a2 and 99b2 in the left-right direction. As a result, the running unit 101 moves along the rails 99a and 99b in the left-right direction.

[0052] The front end portion of the running unit 101 is also provided with two axes 112a which extend in the front-rear direction and which are spaced apart from each other in the left-right direction. Furthermore, each axis 112a rotatably supports a roller 112. The rear end portion of the running unit 101 is also provided with two axes 112a which extend in the front-rear direction and which are spaced apart from each other in the left-right direction. Furthermore, each axis 112a rotatably supports a roller 112. The two rollers 112 provided at the front end portion of the running unit 101 are in contact with a lower surface of the lower part 99a2 of the front rail 99a. The two rollers 112 provided at the rear end portion of the running unit 101 are in contact with a lower surface of the lower part 99b2 of the rear rail 99b. As the running unit 101 moves along the rails 99a and 99b in the left-right direction as described above, these four rollers 112 passively rotate. In the present embodiment, as described above, the wheels 111 are placed on the upper surfaces of the lower parts 99a2 and 99b2, the rollers 112 are in contact with the lower surfaces of the lower parts 99a2 and 99b2, and thus the lower parts 99a2 and 99b2 are sandwiched between the wheels 111 and the rollers 112 in the up-down direction. This suppresses the running unit 101 from being lifted up. Therefore, the running unit 101 is less likely to be detached from the rails 99a and 99b.

[0053] A left end portion and right end portion of a lower end portion of the running unit 101 are respectively provided with an attaching member 120 and an attaching member 130.

[0054] The attaching member 120 is substantially L-shaped when viewed in the front-rear direction, and includes: a vertical portion 121 (a "first portion" of the present invention) extending in the up-down and front-rear directions; and a horizontal portion 122 (a "first abutment unit" of the present invention) extending leftward from an upper end portion of the vertical portion 121.

[0055] As shown in FIG. 5A, a swing shaft 123 extending in the left-right direction is provided at a front end portion of a left end surface of the vertical portion 121. The vertical portion 121 is provided with three fixing holes 124a to 124c (a "second fixing hole" of the present invention). Each of the fixing holes 124a to 124c is a circular through hole penetrating the vertical portion 121 in the left-right direction. The three fixing holes 124a to 124c are spaced apart from one another in the front-rear direction so that the fixing hole 124a is provided behind the swing shaft 123, the fixing hole 124b is provided behind the fixing hole 124a, and the fixing hole 124c is provided behind the fixing hole 124b.

[0056] The attaching member 130 is substantially L-

shaped when viewed in the front-rear direction, and includes: a vertical portion 131 (the "first portion" of the present invention) extending in the up-down and front-rear directions; and a horizontal portion 132 (the "first abutment unit" of the present invention) extending rightward from an upper end portion of the vertical portion 131.

[0057] As shown in FIG. 5B, a swing shaft 133 extending in the left-right direction is provided at a front end portion of a right end surface of the vertical portion 131. The swing shaft 133 overlaps the swing shaft 123 in the left-right direction. The vertical portion 131 is provided with three fixing holes 134a to 134c (the "second fixing hole" of the present invention). Each of the fixing holes 134a to 134c is a circular through hole penetrating the vertical portion 131 in the left-right direction. The three fixing holes 134a to 134c are spaced apart from one another in the front-rear direction so that the fixing hole 134a is provided behind the swing shaft 133, the fixing hole 134b is provided behind the fixing hole 134a, and the fixing hole 134c is provided behind the fixing hole 134b.

[0058] The swinging unit 102 is a part to which the device main body 100 is attached, and extends in the up-down direction. The swinging unit 102 includes a first frame 102a and a second frame 102b. In FIG. 2, except the yarn blowing lever 67, the device main body 100 is attached to the first frame 102a directly or via an unillustrated attaching member. The yarn blowing lever 67 is attached to the second frame 102b. Furthermore, each part of the device main body 100 is attached to the first frame 102a or the second frame 102b, but the disclosure is not limited to this. This does not necessarily mean that the yarn blowing lever 67 is attached to the second frame 102b while each part of the device main body 100 except the yarn blowing lever 67 is attached to the first frame 102a.

[0059] The first frame 102a includes two plates 140 and 150. The plates 140 and 150 are spaced apart from each other in the left-right direction so that the plate 150 is provided to the right of the plate 140.

[0060] The plate 140 is substantially L-shaped when viewed in the front-rear direction, and includes: a vertical portion 141 extending in the up-down and front-rear directions; and a horizontal portion 142 (a "second abutment unit" of the present invention) extending leftward from an upper end portion of the vertical portion 141.

[0061] A part of the vertical portion 141 (a "second portion" of the present invention) near the upper end portion thereof is provided to the left of the vertical portion 121 of the attaching member 120, and overlaps the vertical portion 121 in the left-right direction. Furthermore, this part of the vertical portion 141 is provided with a supporting hole 143. The supporting hole 143 is a circular through hole penetrating the vertical portion 141 in the left-right direction. The swing shaft 123 is inserted into the supporting hole 143. With this arrangement, the plate 140 is supported to be swingable about the swing shaft 123.

[0062] This part of the vertical portion 141 near the upper end portion thereof is provided with three fixing holes 144a to 144c (a "first fixing hole" of the present invention). The three fixing holes 144a to 144c are provided to correspond to the three fixing holes 124a 124c. The fixing holes 144a to 144c penetrate the vertical portion 141 in the left-right direction, and respectively overlap the fixing holes 124a to 124c in the left-right direction. The fixing holes 144a to 144c are long holes extending in the up-down direction. In the up-down direction, the length of the fixing hole 144b is larger than that of the fixing hole 144a, and the length of the fixing hole 144c is larger than that of the fixing hole 144b. The fixing holes 144a to 144c are arranged so that, the farther a fixing hole is from the swing shaft 123, the larger the length of the fixing hole in the up-down direction is.

[0063] The attaching member 120 is fixed to the plate 140 by a bolt 145a inserted into the fixing hole 124a of the attaching member 120 and the fixing hole 144a of the plate 140, a bolt 145b inserted into the fixing hole 124b of the attaching member 120 and the fixing hole 144b of the plate 140, and a bolt 145c inserted into the fixing hole 124c of the attaching member 120 and the fixing hole 144c of the plate 140.

[0064] When the bolts 145a to 145c are loosened, the plate 140 is swingable about the swing shaft 123. The fixing holes 144a to 144c overlap the fixing holes 124a to 124c in the left-right direction, and an overlapping part of each of the fixing holes 144a to 144c varies as the plate 140 is swung about the swing shaft 123. As a result, while being provided at any position within its swing range, the plate 140 is fixed to the attaching member 120 by the bolts 145a to 145c. This swing range of the plate 140 is a swing range of the plate 140 in which the loosened bolts 145a to 145c are inserted into the fixing holes 124a to 124c and the fixing holes 144a to 144c.

[0065] The horizontal portion 142 is provided below the horizontal portion 122 of the attaching member 120, and overlaps the horizontal portion 122 in the up-down direction. As shown in FIG. 4 and FIG. 5A, a part of the horizontal portion 142 is provided behind the swing shaft 123 and provided with a jack member 146. The jack member 146 is movable in the up-down direction, and can be fixed to the horizontal portion 142 at any position in the up-down direction. For example, the jack member 146 is formed of a bolt inserted into a screw hole penetrating the horizontal portion 142 in the up-down direction. While being at least partially provided in a traveling range of the jack member 146 in the up-down direction, the jack member 146 protrudes upward from the horizontal portion 142. That is, an upper end portion of the jack member 146 protrudes upward from the horizontal portion 142 so as to make contact with a lower surface of the horizontal portion 122 of the attaching member 120. At this time, the jack member 146 widens a gap between the horizontal portion 142 of the plate 140 and the horizontal portion 122 of the attaching member 120. In this regard, the larger the degree of protrusion of the jack member 146 from the horizontal portion 142 is because the position of the jack member 146 is high, the wider this gap is.

[0066] The plate 150 is substantially L-shaped when viewed in the front-rear direction, and includes: a vertical portion 151 extending in the up-down and front-rear directions; and a horizontal portion 152 (the "second abutment unit" of the present invention) extending rightward from an upper end portion of the vertical portion 151.

[0067] A part of the vertical portion 151 (the "second portion" of the present invention) near the upper end portion thereof is provided to the right of the vertical portion 131 of the attaching member 130, and overlaps the vertical portion 131 in the left-right direction. Furthermore, this part of the vertical portion 151 is provided with a supporting hole 153. The supporting hole 153 is a circular through hole penetrating the vertical portion 151 in the left-right direction. The swing shaft 133 is inserted into the supporting hole 153. With this arrangement, the plate 150 is supported to be swingable about the swing shaft 133.

[0068] This part of the vertical portion 151 near the upper end portion thereof is provided with three fixing holes 154a to 154c (the "first fixing hole" of the present invention). The three fixing holes 154a to 154c are provided to correspond to the three fixing holes 134a 134c. The fixing holes 154a to 154c penetrate the vertical portion 151 in the left-right direction, and respectively overlap the fixing holes 134a to 134c in the left-right direction. The fixing holes 154a to 154c are long holes extending in the up-down direction. In the up-down direction, the length of the fixing hole 154b is larger than that of the fixing hole 154a, and the length of the fixing hole 154c is larger than that of the fixing hole 154b. The fixing holes 154a to 154c are arranged so that, the farther a fixing hole is from the swing shaft 133, the larger the length of the fixing hole in the up-down direction is.

[0069] The attaching member 130 is fixed to the plate 150 by a bolt 155a inserted into the fixing hole 134a of the attaching member 130 and the fixing hole 154a of the plate 150, a bolt 155b inserted into the fixing hole 134b of the attaching member 130 and the fixing hole 154b of the plate 150, and a bolt 155c inserted into the fixing hole 134c of the attaching member 130 and the fixing hole 154c of the plate 150.

[0070] When the bolts 155a to 155c are loosened, the plate 150 is swingable about the swing shaft 133. The fixing holes 154a to 154c overlap the fixing holes 134a to 134c in the left-right direction, and an overlapping part of each of the fixing holes 154a to 154c varies as the plate 150 is swung about the swing shaft 133. As a result, while being provided at any position within its swing range, the plate 150 is fixed to the attaching member 130 by the bolts 155a to 155c. This swing range of the plate 150 is a swing range of the plate 150 in which the loosened bolts 155a to 155c are inserted into the fixing holes 134a to 134c and the fixing holes 154a to 154c.

[0071] The horizontal portion 152 is provided below the horizontal portion 132 of the attaching member 130, and overlaps the horizontal portion 132 in the up-down direction. As shown in FIG. 5B, a part of the horizontal portion 152 is provided behind the swing shaft 133 and provided with a jack member 156. The jack member 156 is similar to the jack member 146. When the jack member 156 protrudes upward from the horizontal direction 152, an upper end portion of the jack member 156 is in contact with a lower surface of the horizontal portion 132 of the attaching member 130 so as to widen a gap between the horizontal portion 152 of the plate 150 and the horizontal portion 132 of the attaching member 130. In this regard, the larger the degree of protrusion of the jack member 156 from the horizontal portion 152 is because the position of the jack member 156 is high, the wider this gap is.

[0072] A left end surface of the plate 140 is covered by a cover 160a. A right end surface of the plate 150 is covered by a cover 160b. An upper front end portion of the plate member 140 is connected to an upper front end portion of the plate 150 by a connection member 161 extending in the left-right direction. An upper rear end portion of the plate member 140 is connected to an upper rear end portion of the plate 150 by a connection member 162 extending in the left-right direction. FIG. 2 and FIG. 3 show the outer shape of each of the covers 160a and 160b and that of the connection member 162 by two-dot chain lines, and FIG. 4 and FIGs. 5A and 5B do not show the covers 160a and 160b. The swinging unit 102 may include a member connecting the plates 140 and 150, in addition to the connection members 161 and 162.

[0073] The second frame 102b is attached to a lower end portion of the first frame 102a. To be more specific, the second frame 102b is fixed to lower end portions of the plates 140 and 150 by unillustrated bolts. The device main body 100 is provided between the plates 140 and 150 in the left-right direction, and provided along the first frame 102a and the second frame 102b in the up-down direction as described above.

[0074] In the present embodiment, as described above, the plate 140 is swung about the swing shaft 123, and the plate 150 is swung about the swing shaft 133. With this arrangement, the swinging unit 102 is swung about the swing shafts 123 and 133. In the present embodiment, the jack members 146 and 156 are respectively provided behind the swing shafts 123 and 133 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit 102. Meanwhile, in the present embodiment, as shown in FIG. 4, a centroid G of a structure 180 formed of the swinging unit 102 and the device main body 100 attached to the swinging unit 102 is provided below and in front of (provided on the same side in the front-rear direction as) the swing shafts 123 and 133 irrespective of a position of the swinging unit 102 within the swing range of the swinging unit 102. Furthermore, the jack members 146 and 156 are attached to parts of the horizontal portions 142 and 152, and the upper end portions of the jack members 146 and 156 make contact with parts of the horizontal portions 122 and 132. With these arrangements, the jack members 146 and 156, the parts of the horizontal portions 142 and 152, and the parts of the horizontal portions 122 and

132 are provided, irrespective of the position of the swinging unit 102 within the swing range of the swinging unit, on the side opposite to the centroid G with respect to the swing shafts 123 and 133 in the front-rear direction.

[0075] As shown in FIG. 1, FIG. 4, and FIGs. 5A and 5B, the swinging unit 102 extends forward as compared to the front rail 99a. A part of an upper surface of the swinging unit 102 is provided in front of the front rail 99a, and provided with a position detection sensor 170 configured to detect the position of the doffing device 3. Meanwhile, the vertical portion 99a1 of the front rail 99a is provided with positioning holes 171. Each positioning hole 171 is formed in the vertical portion 99a1 of the rail 99a at a position where to oppose the position detection sensor 170. In this regard, the doffing device 3 is provided at a position in order to perform an operation for each winding unit 2. As the position detection sensor 170 detects the positioning holes 171, the running unit 101 is stopped. As a result, the doffing device 3 is stopped at a position where to perform an operation for the winding unit 2.

[0076] In this regard, an operation of stopping the running unit 101 as the position detection sensor 170 detects the positioning holes 171 is the same as that in, e.g., Japanese Laid-Open Patent Publication No. 2022-177371. For this reason, a further detailed description of this is not given here.

(How to Adjust Position of Doffing Device)

[0077] The following will describe how to adjust the position of the doffing device 3.

[0078] In the present embodiment, the plates 140 and 150 are swung about the respective swing shafts 123 and 133. With this arrangement, the above-described structure 180 is swung about the swing shafts 123 and 133. The position of the doffing device 3 (the device main body 100) in the front-rear direction is adjustable by causing the structure 180 to swing.

[0079] In the present embodiment, as described above, the jack members 146 and 156 are respectively provided behind the swing shafts 123 and 133 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit, and the centroid G of the structure 180 is provided in front of the swing shafts 123 and 133 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit. With this arrangement, the following moment is produced in the structure 180 because of its own weight: a moment which causes the structure 180 to swing about the swing shafts 123 and 133 so that the horizontal portions 142 and 152 of the plates 140 and 150 approach the horizontal portions 122 and 132 of the attaching members 120 and 130.

[0080] Therefore, when the bolts 145a to 145c and the bolts 155a to 155c are loosened and no external force is applied, the above-described moment causes the structure 180 to swing until (i) the horizontal portion 142 of the plate 140 or the jack member 146 abuts against the horizontal portion 122 of the attaching member 120 and (ii) the horizontal portion 152 of the plate 150 or the jack member 156 abuts against the horizontal portion 132 of the attaching member 130.

[0081] As the bolts 145a to 145c and the bolts 155a to 155c are loosened, a gap between the horizontal portion 122 of the attaching member 120 and the horizontal portion 142 of the plate 140 may be increased by correspondingly adjusting the jack member 146, and a gap between the horizontal portion 132 of the attaching member 130 and the horizontal portion 152 of the plate 150 may be increased by correspondingly adjusting the jack member 156. Therewith, the structure 180 swings against the above-described moment so that (i) the horizontal portion 142 is moved away from the horizontal portion 122 and (ii) the horizontal portion 152 is moved away from the horizontal portion 132. Because of this, the position of the device main body 100 is moved forward and away from the winding unit 2.

[0082] As the bolts 145a to 145c and the bolts 155a to 155c are loosened, the gap between the horizontal portion 122 of the attaching member 120 and the horizontal portion 142 of the plate 140 may be decreased by correspondingly adjusting the jack member 146, and the gap between the horizontal portion 132 of the attaching member 130 and the horizontal portion 152 of the plate 150 may be decreased by correspondingly adjusting the jack member 156. Therewith, the above-described moment causes the structure 180 to swing so that (i) the horizontal portion 142 approaches the horizontal portion 122 and (ii) the horizontal portion 152 approaches the horizontal portion 132. Because of this, the position of the device main body 100 is moved rearward so that the device main body 100 approaches the winding unit 2.

[0083] The distance between a predetermined part of the device main body 100 or the swinging unit 102 and a predetermined part of the winding unit 2 is measured at the time of adjustment of the position of the doffing device 3.

[0084] When the above-described distance is below a desired range, this distance is increased by causing the structure 180 to swing after loosening the bolts 145a to 145c and the bolts 155a to 155c, increasing the gap between the horizontal portions 122 and 142 with use of the jack member 146, and increasing the gap between the horizontal portions 132 and 152 with use of the jack member 156.

[0085] Meanwhile, when this distance is above the desired range, this distance is decreased by causing the structure 180 to swing after loosening the bolts 145a to 145c and the bolts 155a to 155c, decreasing the gap between the horizontal portions 122 and 142 with use of the jack member 146, and decreasing the gap between the horizontal portions 132 and 152 with use of the jack member 156.

[0086] The measurement of the above-described distance and the adjustment of these gaps with use of the

jack members 146 and 156 are repeated until this distance falls within the desired range. Because of this, the position of the doffing device 3 (the device main body 100) is adjusted to a desired position. After the position of the doffing device 3 (the device main body 100) is adjusted to the desired position, the bolts 145a to 145c and the bolts 155a to 155c are fastened so as to fix the swinging unit 102 (the structure 180) to the running unit 101.

[0087] In this regard, the inclination of the doffing device 3 in the left-right direction is also adjustable by individually performing the adjustment of the gap between the horizontal portions 122 and 142 with use of the jack member 146 and that of the gap between the horizontal portions 132 and 152 with use of the jack member 156.

(Effects)

[0088] In the present embodiment, the swinging unit 102 to which the device main body 100 of the doffing device 3 is attached is swung about the swing shafts 123 and 133 so as to easily adjust the position of the device main body 100 of the doffing device 3.

[0089] In the present embodiment, the attaching member 120 is fixed to the plate 140 by the bolts 145a to 145c inserted into the fixing holes 124a to 124c provided at the vertical portion 121 and the fixing holes 144a to 144c provided at the vertical portion 141. The attaching member 130 is fixed to the plate 150 by the bolts 155a to 155c inserted into the fixing holes 134a to 134c provided at the vertical portion 131 and the fixing holes 154a to 154c provided at the vertical portion 151. With these arrangements, the running unit 101 is fixed to the swinging unit 102. In the present embodiment, the fixing holes 144a to 144c are long holes extending in the up-down direction. With this arrangement, even when the plate 140 is swung about the swing shaft 123, the fixing holes 124a to 124c overlap the fixing holes 144a to 144c in the left-right direction so that the bolts 145a to 145c can be inserted into the fixing holes 124a to 124c and the fixing holes 144a to 144c. In the present embodiment, the fixing holes 154a to 154c are long holes extending in the up-down direction. With this arrangement, even when the plate 150 is swung about the swing shaft 133, the fixing holes 134a to 134c overlap the fixing holes 154a to 154c in the left-right direction so that the bolts 155a to 155c can be inserted into the fixing holes 134a to 134c and the fixing holes 154a to 154c.

[0090] In the present embodiment, the centroid G of the structure 180 is provided in front of the swing shafts 123 and 133 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit. With this arrangement, by the weight of the structure 180, a moment which causes the structure 180 to swing about the swing shafts 123 and 133 in the same direction as the moment is produced in the structure 180 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit.

[0091] At the time of adjustment of the position of the swinging unit 102, a force which produces a moment in a direction opposite to the moment due to the weight of the structure 180 is simply applied to the structure 180 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit. This makes it easy to perform an operation of adjusting the position of the swinging unit 102.

[0092] In the present embodiment, the jack members 146 and 156 are provided at parts of the horizontal portions 142 and 152, and the upper end portions of the jack members 146 and 156 respectively make contact with parts of the horizontal portions 122 and 132. In this case, while these parts of the horizontal portions 142 and 152 and these parts of the horizontal portions 122 and 132 are provided behind the swing shafts 123 and 133 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit, the centroid G of the structure 180 is provided in front of the swing shafts 123 and 133 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit. With this arrangement, the following moment is produced in the structure 180 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit: a moment which causes the horizontal portions 142 and 152 of the plates 140 and 150 to swing so as to approach the horizontal portions 122 and 132 of the attaching members 120 and 130.

[0093] At the time of adjustment of the position of the swinging unit 102, a force is simply applied to the structure 180 so as to produce the following moment irrespective of the position of the swinging unit 102 within the swing range of the swinging unit: a moment which causes the structure 180 to swing about the swing shafts 123 and 133 so that the horizontal portions 142 and 152 are moved away from the horizontal portions 122 and 132. The moment which causes the horizontal portions 142 and 152 to swing so as to approach the horizontal portions 122 and 132 is produced in the structure 180 irrespective of the position of the swinging unit 102 within the swing range of the swinging unit. With this arrangement, when the structure 180 is not supported at the time of adjustment of the position of the swinging unit 102, the swinging unit 102 swings only until the horizontal portions 142 and 152 or the jack members 146 and 156 abuts against the horizontal portions 122 and 132. These arrangements make it easy to perform an operation of adjusting the position of the swinging unit 102.

[0094] In the present embodiment, each of the following forces is a force which produces the moment causing the horizontal portions 142 and 152 to swing so as to move away from the horizontal portions 122 and 132, i.e., a force which produces the moment in the direction opposite to the moment due to the weight of the structure 180: a force of the jack member 146 increasing the gap between the horizontal portions 122 and 142; and a force of the jack member 156 increasing the gap between the horizontal portions 132 and 152.

[0095] In the present embodiment, irrespective of the position of the swinging unit 102 within the swing range of the swinging unit, the jack members 146 and 156 are provided on the side opposite to the centroid G with respect to the swing shafts 123 and 133 in the front-rear direction. With this arrangement, as the jack members 146 and 156 are moved downward so as to decrease (i) the gap between the horizontal portion 142 of the plate 140 and the horizontal portion 122 of the attaching member 120 and (ii) the gap between the horizontal portion 152 of the plate 150 and the horizontal portion 132 of the attaching member 130, the moment due to the weight of the structure 180 causes the structure 180 to swing about the swing shafts 123 and 133 so that (I) the horizontal portions 142 and 152 of the plates 140 and 150 respectively approach the horizontal portions 122 and 132 of the attaching members 120 and 130 and (II) the above-described gaps are decreased.

[0096] With this arrangement, as the jack members 146 and 156 are moved upward so as to increase (i) the gap between the horizontal portion 142 of the plate 140 and the horizontal portion 122 of the attaching member 120 and (ii) the gap between the horizontal portion 152 of the plate 150 and the horizontal portion 132 of the attaching member 130, the structure 180 swings about the swing shafts 123 and 133 against the moment due to the weight of the structure 180 so that (I) the horizontal portions 142 and 152 of the plates 140 and 150 are respectively moved away from the horizontal portions 122 and 132 of the attaching members 120 and 130 and (II) the above-described gaps are increased.

[0097] Because of this, at the time of adjustment of the position of the structure 180, the structure 180 is swingable only by moving the jack members 146 and 156 in the up-down direction irrespective of a direction in which the structure 180 swings. It is therefore possible to easily adjust the position of the structure 180.

[0098] In the present embodiment, while the swinging unit 102 is long in the up-down direction, the swinging unit 102 includes the first frame 102a and the second frame 102b which is provided below the first frame 102a (which is far from the rails 99a and 99b) and is separable into the first frame 102a and the second frame 102b in the up-down direction. With this arrangement, at the time of placement of the doffing device 3, the second frame 102b can be attached to the first frame 102a after the first frame 102a is attached to the running unit 101. This makes it easy to place the doffing device 3.

[0099] In this case, however, when the second frame 102b is attached to the first frame 102a, the first frame 102a may be deviated from the second frame 102b so that there is some deviation at the device main body 100 attached to the swinging unit 102 along the first frame 102a and second frame 102b. In the present embodiment, even when the first frame 102a is deviated from the second frame 102b, the position of the device main body 100 of the doffing device 3 is adjustable by causing the swinging unit 102 to swing about the swing shafts 123 and 133.

[0100] When (i) the doffing device 3 is configured to perform an operation for the yarn storage section 30 provided below the winding section 40 and (ii) a part of the doffing device 3 is provided at the same level as the yarn storage section 30, this part of the doffing device 3 is very far from the rails 99a and 99b to some degree. Because of this, the deviation of the position of this part of the doffing device 3 due to the inclination, warping, etc. of the rails 99a and 99b may be large to some degree. In the present embodiment, a part of the doffing device 3 is very far from the rails 99a and 99b to some degree and is provided on the same level as the yarn storage section 30, and the position of this part of the doffing device 3 is adjustable by causing the swinging unit 102 to swing about the swing shafts 123 and 133.

(Modifications)

[0101] A preferred embodiment of the present invention has been described. It should be noted that the present invention is not limited to the above-described embodiment, and various changes, substitutions, and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims.

[0102] In the embodiment above, the jack member 146 is able to change the gap between the horizontal portion 122 of the attaching member 120 and the horizontal portion 142 of the plate 140, and the jack member 156 is able to change the gap between the horizontal portion 132 of the attaching member 130 and the horizontal portion 152 of the plate 150. In the embodiment above, the jack members 146 and 156 are provided at parts of the horizontal portions 142 and 152 and make contact with parts of the horizontal portions 122 and 132. With these arrangements, the jack members 146 and 156, the parts of the horizontal portions 142 and 152, and the parts of the horizontal portions 122 and 132 are provided, irrespective of the position of the swinging unit 102 within the swing range of the swinging unit, on the side opposite to the centroid G of the structure 180 with respect to the swing shafts 123 and 133 in the front-rear direction. However, the disclosure is not limited to this.

[0103] For example, the jack members may be provided at the horizontal portions 122 and 132 and be able to change the degree of protrusion of the jack members protruding downward from the horizontal portions 122 and 132 so as to change (i) the gap between the horizontal portions 122 and 142 and (ii) the gap between the horizontal portions 132 and 152. Alternatively, the jack members may be able to change the gap between the horizontal portions 122 and 142 and the gap between the horizontal portions 132 and 152 by means of an arrangement different from an arrangement in which the degree of protrusion of the jack members protruding from the horizontal portions 142 and 152 or the horizontal portions 122 and 132 is changed.

[0104] Alternatively, the jack members 146 and 156 may not be provided. In this case, as the bolts 145a to 145c and the bolts 155a to 155c are loosened, the moment due to the weight of the structure 180 causes the structure 180 to swing until the horizontal portions 142 and 152 respectively abuts against the horizontal portions 122 and 132. For example, at the time of adjustment of the position of the structure 180 in this case, a force which produces a moment in a direction in which the horizontal portions 142 and 152 are moved away from the horizontal portions 122 and 132 is applied by an operator to the structure 180 so that the structure 180 swings to a desired position. In this state, the vertical portions 141 and 151 are fixed to the vertical portions 121 and 131 by the bolts 145a to 145c and the bolts 155a to 155c.

[0105] The horizontal portions 122 and 132 of the attaching members 120 and 130 and the horizontal portions 142 and 152 of the plates 140 and 150 may not be provided. In this case, while supporting the structure 180 at a desired position after causing the structure 180 to swing to this position, the operator fixes the plate 140 to the attaching member 120 by means of the bolts 145a to 145c and fixes the plate 150 to the attaching member 130 by means of the bolts 155a to 155c.

[0106] For example, irrespective of the position of the swinging unit 102 within the swing range of the swinging unit, the swing shafts 123 and 133 may be provided behind the jack members 146 and 156 and the centroid G of the structure 180. In this case, a moment in a direction in which the horizontal portion 142 is moved away from the horizontal portion 122 and the horizontal portion 152 is moved away from the horizontal portion 132 is produced in the structure 180 because of the weight of the structure 180. Because of this, for example, the operator moves the structure 180 upward after adjusting the positions of the jack members 146 and 156 and causes the structure 180 to swing until upper ends of the jack members 146 and 156 abut against the horizontal portions 122 and 132. In this state, the operator fixes the plate 140 to the attaching member 120 by means of the bolts 145a to 145c and fixes the plate 150 to the attaching member 130 by means of the bolts 155a to 155c.

[0107] The positional relationship between the swing shafts 123 and 133, the jack members 146 and 156, and the centroid of the structure 180 in the front-rear direction may be different from that in the embodiment above. For example, this positional relationship in the front-rear direction may vary depending on the position of the structure 180 within the swing range of the swinging unit 102.

[0108] In the embodiment above, the fixing holes 124a to 124c provided at the attaching member 120 are circular holes, and the fixing holes 144a to 144c provided at the plate 140 are long holes extending in the up-down direction. In the embodiment above, the fixing holes 134a to 134c provided at the attaching member 130 are circular holes, and the fixing holes 154a to 154c provided at the plate 150 are long holes extending in the up-down direction. However, the disclosure is not limited to this.

[0109] For example, the fixing holes 124a to 124c may be long holes extending in the up-down direction and the fixing holes 144a to 144c may be circular holes. Furthermore, the fixing holes 134a to 134c may be long holes extending in the up-down direction and the fixing holes 154a to 154c may be circular holes. In this case, the fixing holes 124a to 124c and the fixing holes 134a to 134c are equivalent to the "first fixing hole" of the present invention, and the fixing holes 144a to 144c and the fixing holes 154a to 154c are equivalent to the "second fixing hole" of the present invention.

[0110] In the embodiment above, the attaching members 120 and 130 forming the running unit 101 respectively include the vertical portions 121 and 131, and the plates 140 and 150 forming the swinging unit 102 respectively includes the vertical portions 141 and 151. The attaching member 120 is fixed to the plate 140 by the bolts 145a to 145c inserted into the fixing holes 124a to 124c provided at the vertical portion 121 and the fixing holes 144a to 144c provided at the vertical portion 141. The attaching member 130 is fixed to the plate 150 by the bolts 155a to 155c inserted into the fixing holes 134a to 134c provided at the vertical portion 131 and the fixing holes 154a to 154c provided at the vertical portion 151. However, the disclosure is not limited to this. The swinging unit 102 may be fixed to the running unit 101 by a fixing portion arranged differently from the arrangements above.

[0111] In the embodiment above, the swinging unit 102 includes the first frame 102a and the second frame 102b fixed to the first frame 102a and is separable into the first frame 102a and the second frame 102b in the up-down direction. However, the disclosure is not limited to this. The swinging unit 102 may not be separable in the up-down direction.

[0112] In the embodiment above, the doffing device 3 is configured to perform an operation for the winding section 40 and the yarn storage section 30 provided below the winding section 40, and a part of the doffing device 3 is provided at the same level as the yarn storage section 30. However, the disclosure is not limited to this. For example, the doffing device 3 may be configured to perform an operation for the winding section 40 and not for the yarn storage section 30 and the entire doffing device 3 may be provided above the yarn storage section 30.

[0113] In the embodiment above, the rails 99a and 99b are provided above the plural winding units 2, and a part of the doffing device 3 is provided below the rails 99a and 99b. However, the disclosure is not limited to this. For example, the rails may be provided on the same plane as the winding units 2 and a part of the doffing device may be provided above the rails.

[0114] The embodiment above is an example where the present invention is applied to an automatic winder including the winding units 2 and the doffing device 3. However, the disclosure is not limited to this. The yarn processing units forming the yarn processing apparatus may be different from the winding units. The working cart

forming the yarn processing apparatus may be different from the doffing device.

[0115] An object of the present invention is to easily adjust the positional relationship between yarn processing units and a working cart configured to perform an operation selectively for one of the yarn processing units. According to a preferred embodiment, a doffing device 3 includes a device main body 100 configured to perform an operation selectively for one of winding units 2, a running unit 101 supported to be movable in a left-right direction by rails 99a and 99b extending along the winding units 2 in the left-right direction, and a swinging unit 102 to which the device main body 100 is attached and which is attached to a lower end portion of the running unit 101. The swinging unit 102 is supported by the running unit 101 to be swingable about a swing shaft 123; 153 extending in the left-right direction. The swinging unit 102 can be fixed to any position within its swing range by bolts 145a to 145c; 155a to 155c.

Claims

1. A yarn processing apparatus comprising: yarn processing units aligned in a first direction;

a rail extending along the yarn processing units in the first direction; and
a working cart which is movable in the first direction along the rail and which is configured to perform an operation selectively for one of the yarn processing units, and
the working cart including:

a device main body configured to perform the operation;
a running unit supported by the rail so as to be movable in the first direction;
a swinging unit to which the device main body is attached, a part of which is farther from the rail in a second direction orthogonal to the first direction than the running unit is, and which is supported by the running unit so as to be swingable about a swing shaft extending in the first direction; and
a fixing portion configured to fix the swinging unit to the running unit so that the swinging unit is provided at any position within a swing range of the swinging unit.

2. The yarn processing apparatus according to claim 1, wherein, the running unit includes a first portion extending in the second direction and a third direction orthogonal to both the first direction and the second direction,

the swinging unit includes a second portion which extends in the second direction and the third direction and which overlaps the first portion in the first direction,
one of the first portion and the second portion is provided with a first fixing hole which penetrates the one of the first portion and the second portion in the first direction and which extends in the second direction,
the other of the first portion and the second portion is provided with a circular second fixing hole which penetrates the other of the first portion and the second portion in the first direction and which overlaps the first fixing hole in the first direction, and
the fixing portion is a bolt inserted into the first fixing hole and the second fixing hole.

3. The yarn processing apparatus according to claim 1 or 2, wherein, the second direction is an up-down direction,

the rail is provided above the yarn processing units,
a part of the swinging unit is provided below the running unit, and
with respect to the swing shaft, the side on which a centroid of a structure formed of the device main body and the swinging unit is provided does not change in a third direction orthogonal to both the first direction and the up-down direction irrespective of a position of the swinging unit within the swing range of the swinging unit.

4. The yarn processing apparatus according to claim 3, wherein, the running unit includes a first abutment unit extending in the first direction and the third direction,

the swinging unit includes a second abutment unit extending in the first direction and the third direction,
the second abutment unit is provided below the first abutment unit and overlaps the first abutment unit in the up-down direction, and
a part of the first abutment unit and a part of the second abutment unit are provided on the opposite side to the centroid of the structure with respect to the swing shaft in the third direction irrespective of the position of the swinging unit within the swing range of the swinging unit.

5. The yarn processing apparatus according to claim 4, further comprising a jack member configured to adjustably define the size of a gap provided between the first abutment unit and the second abutment unit, wherein,
the jack member is provided on the opposite side to the centroid of the structure with respect to the swing shaft in the third direction irrespective of the position

of the swinging unit within the swing range of the swinging unit.

6. The yarn processing apparatus according to any one of claims 1 to 5, wherein, the swinging unit includes:
a first frame which is supported by the running unit so as to be swingable about the swing shaft and which is fixed to the running unit by the fixing portion; and
a second frame a part of which is farther from the rail in the second direction than the first frame is, which is fixed to the first frame, and to which at least a part of the device main body is attached.

7. The yarn processing apparatus according to any one of claims 1 to 6, wherein, the second direction is the up-down direction,

the rail is provided above the yarn processing units,
each of the yarn processing units includes:

a yarn supplying section which can pull out and unwind a yarn from a placed yarn supplying bobbin;
a yarn storage section which is provided above the yarn supplying section and which is configured to temporarily store the yarn unwound from the yarn supplying section; and
a winding section which is provided above the yarn storage section and which is configured to wind the yarn stored in the yarn storage section,
the working cart is configured to perform an operation for the winding section and the yarn storage section, and a part of the working cart is provided at the same level as the yarn storage section.

8. A yarn processing apparatus comprising:

yarn processing units aligned in a first direction;
a rail extending along the yarn processing units in the first direction; and
a working cart which is movable in the first direction along the rail and which is configured to perform an operation selectively for one of the yarn processing units, and
the working cart including:

a device main body configured to perform the operation;
a running unit supported by the rail so as to be movable in the first direction;
wherein a positional relationship between the device main body and the running unit is adjustable for adjusting a positional relationship between the device main body and the yarn processing units.

9. The yarn processing apparatus according to claim 8, wherein the positional relationship between the device main body and the running unit is adjustable such that a distance between a predetermined part of the device main body and a respective predetermined part of the yarn processing units in a direction being orthogonal to the first direction and to a vertical direction is adjustable.

10. The yarn processing apparatus according to claim 9, wherein the distance between the predetermined part of the device main body and the respective predetermined part of the yarn processing units is adjustable by adjusting a relative swiveling position between the device main body and the running unit.

FIG.1

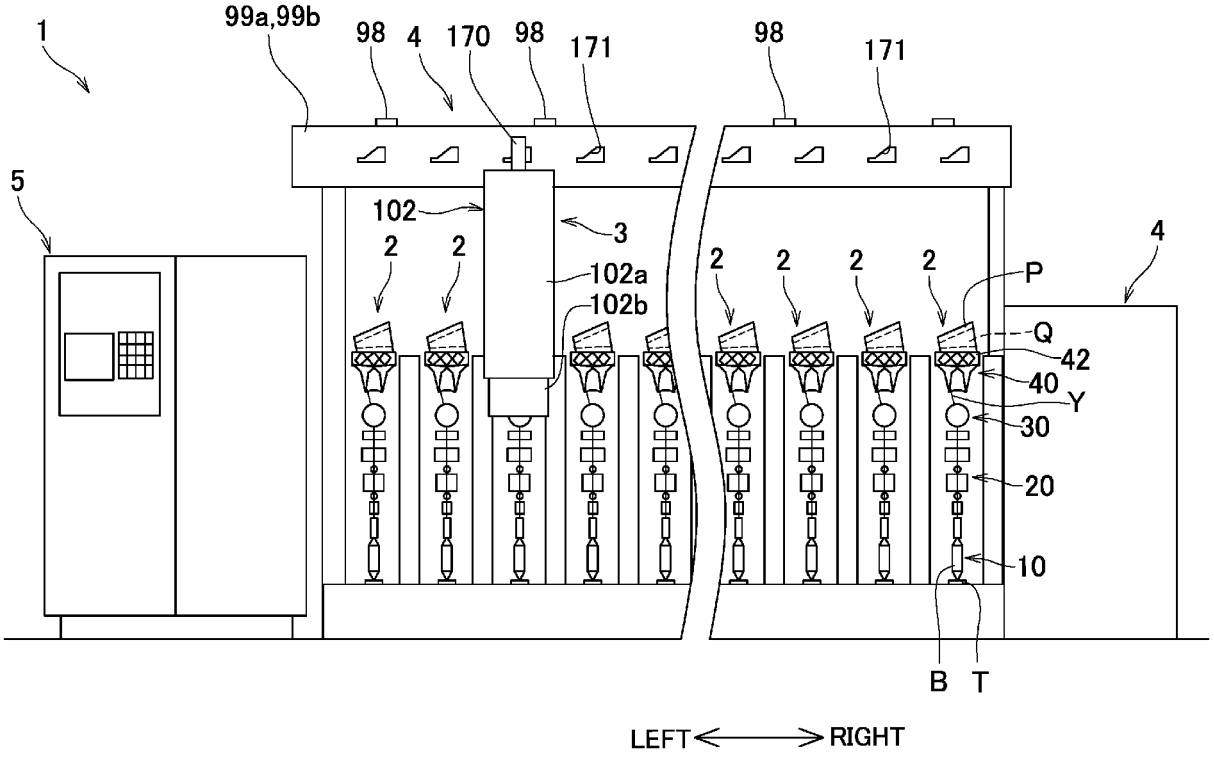

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FIG.2

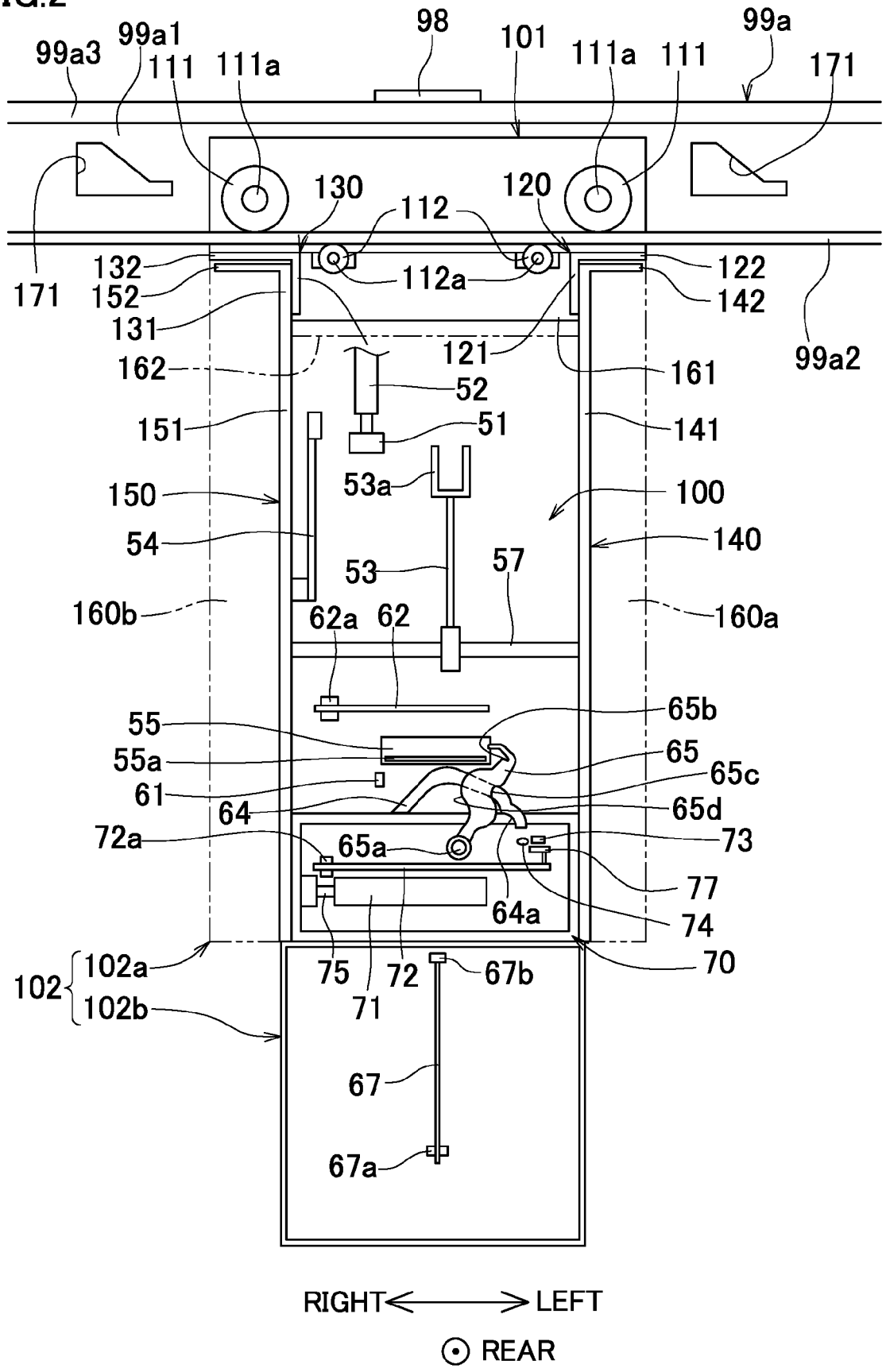
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FIG.3

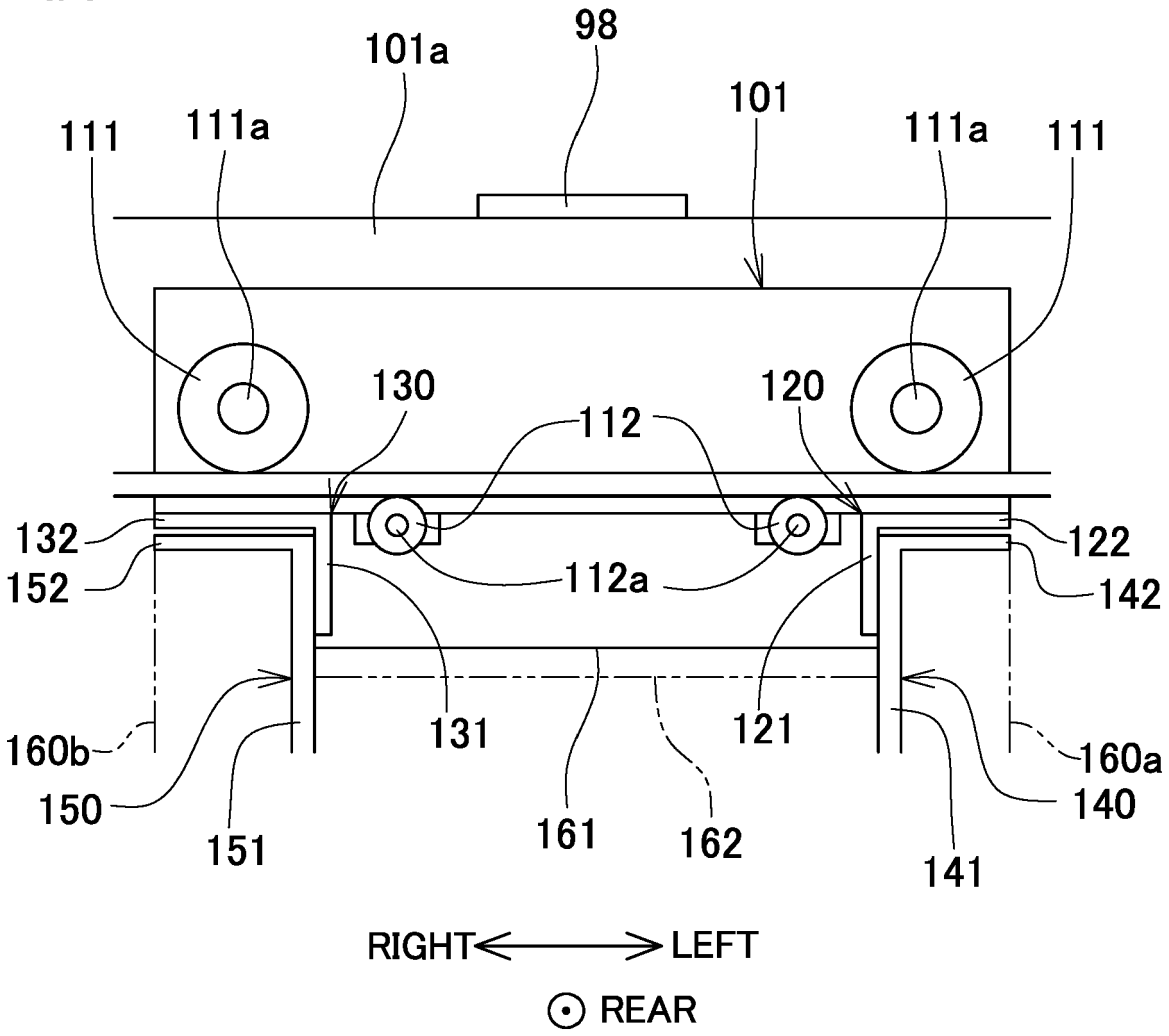
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FIG.4

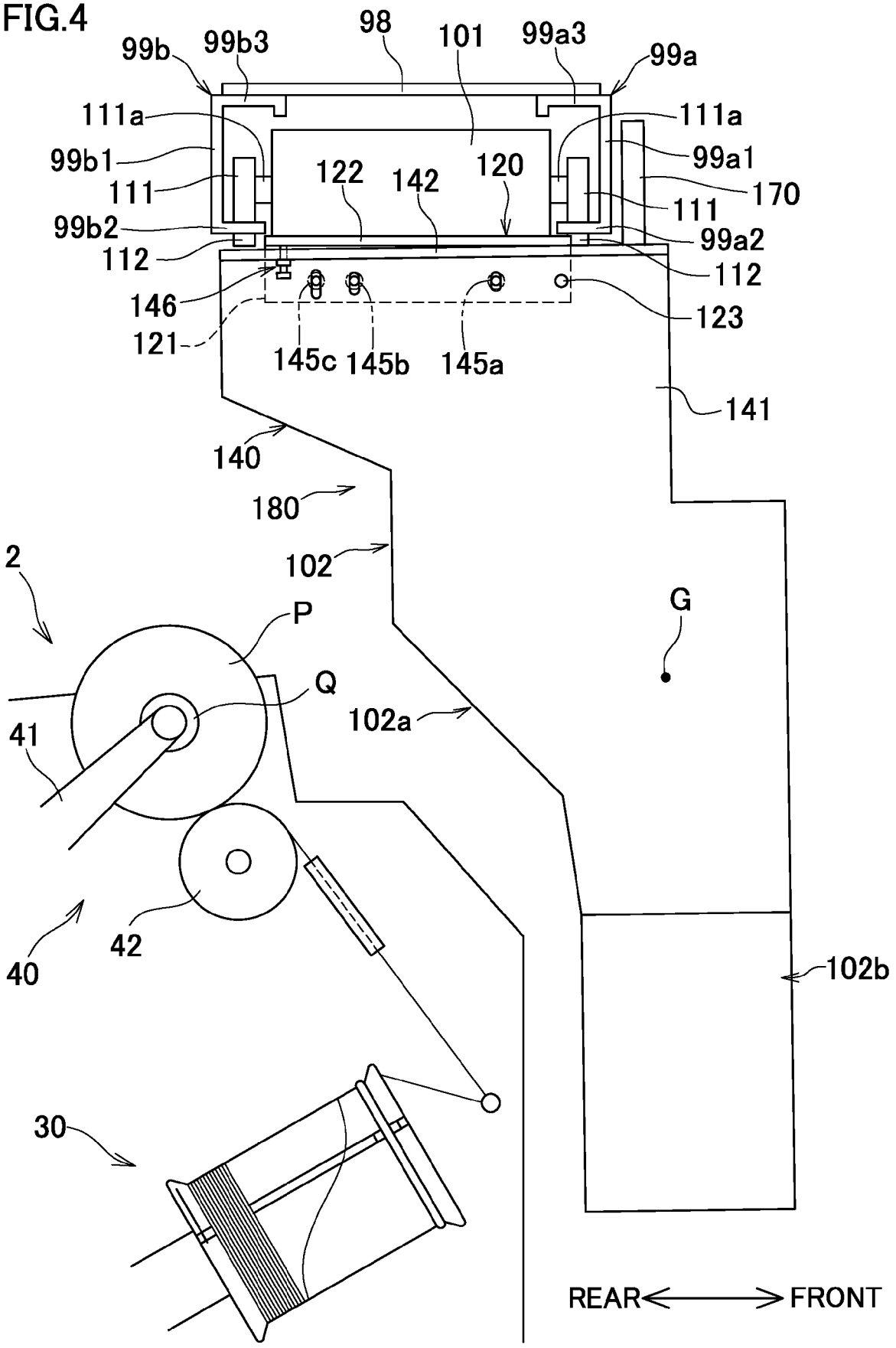
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FIG.5A

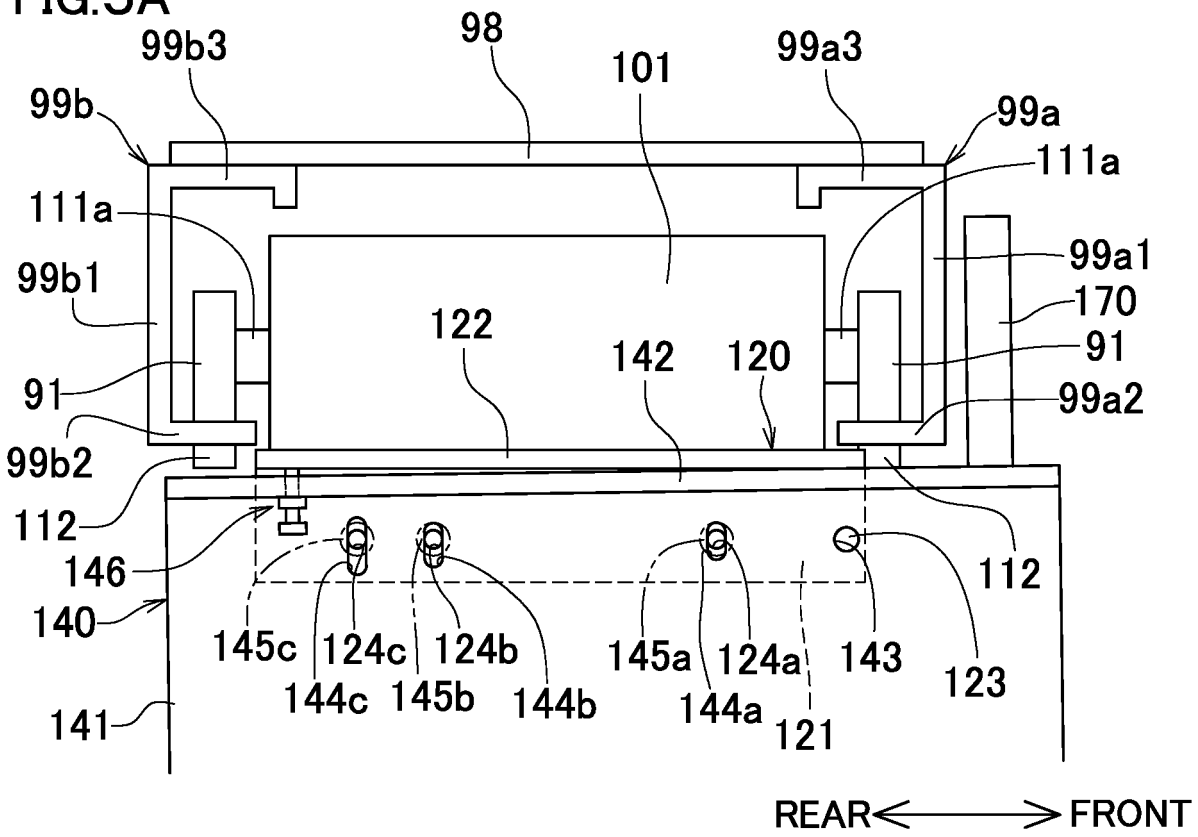
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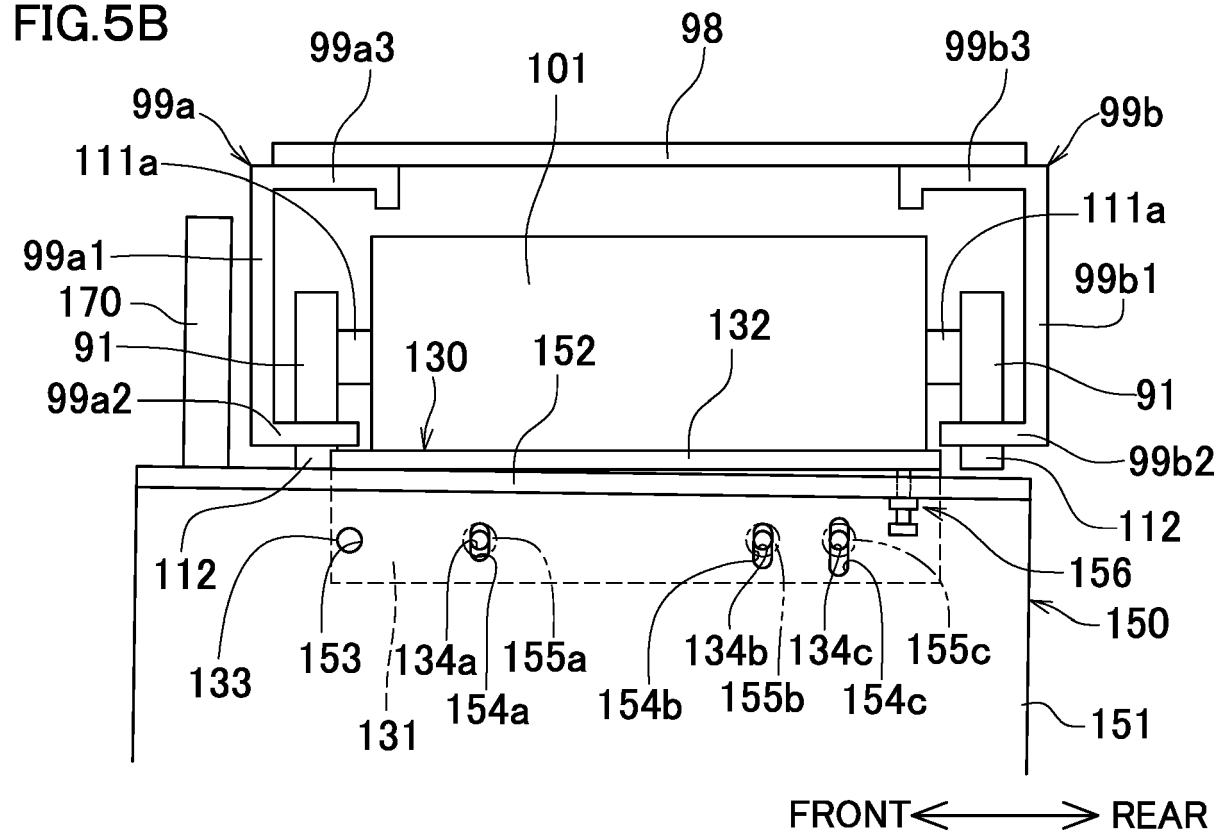
FIG.5B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134c
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154a
154b
155b
154c
131
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FRONT
REAR

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EUROPEAN SEARCH REPORT

Application Number
EP 24 17 5730

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A	* page 11, line 14 - page 11, line 5; figures 2-4 *	1-7	B65H54/26 B65H54/72 D01H13/00
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B65H
D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 October 2024	Pussemier, Bart

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04-10-2024

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