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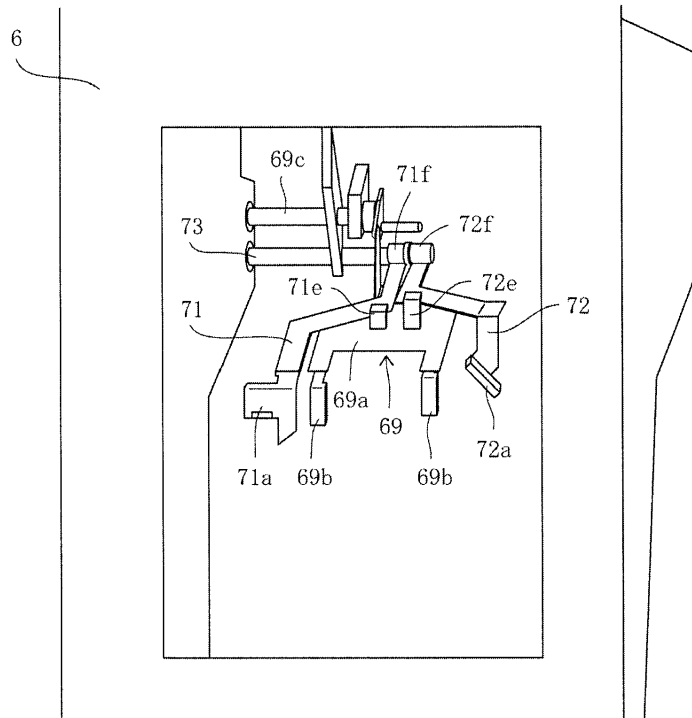
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(54) **Dofting apparatus and textile machine**

(57) A dofting apparatus (6) includes a chuck (66) that supplies a winding tube (9) to a winding-tube support member (21) of a winding unit (2), a restricting lever (71) that comes into contact with a first-side end portion (9a) of the winding tube (9) to restrict a position of the first-side end portion (9a), and a pressing lever (72) that

comes into contact with a second-side end portion (9b) of the winding tube (9) restricted by the restricting lever (71) and presses the second-side end portion (9b) against the restricting lever (71). The winding tube (9) held by the chuck (66) is positioned by the restricting lever (71) and the pressing lever (72).

FIG.5



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a doffing apparatus used in textile machines such as automatic winders. The present invention more particularly relates to a doffing apparatus capable of accurately positioning a winding tube arranged at an unloading opening in a winding-tube tray to a specified position.

2. Description of the Related Art

[0002] A known doffing apparatus is described in JP 2008-162712 A. As shown in Fig. 1 and FIG. 2 of JP 2008-162712 A, multiple winding devices 2 are arranged side-by-side in an automatic winder, and a doffing apparatus 6 is freely movable in the direction of arrangement of the winding devices 2. The doffing apparatus 6 has cradle arms 21 for holding a winding package P. When the cradle arms 21 are opened, a fully-wound winding package P held by the cradle arms 21 rolls down rearward to be loaded onto a transporting device 12. Thereafter, a chuck 66 grips and unloads an empty winding tube 9 from a box-shaped winding-tube tray 65 and puts the winding tube 9 between the cradle arms 21 for the cradle arms 21 to hold the winding tube 9. Subsequently, a yarn Y coming from a yarn supplying bobbin B is set around the winding tube 9 held by the cradle arms 21, and winding on the newly-mounted winding tube 9 is started.

[0003] Meanwhile, winding tubes used in an automatic winder or the like have a variation of approximately 5 millimeters (mm) in their axial length due to variations arising in the manufacturing process. Also, when the type of the winding tube to be used is changed from one to another depending on the type of the yarn to be wound, there can be a circumstance where winding tubes that differ from each other by approximately 5 mm in axial length are used consecutively.

[0004] In this regard, the distance between the opposite sidewalls of the winding-tube tray in the axial direction of the winding tube is set sufficiently large so that all the types of the winding tubes having different axial lengths can be accommodated in the winding-tube tray.

[0005] However, a winding tube that is short in axial length can move freely between the two sidewalls of the winding-tube tray when the distance between the two sidewalls is relatively larger than the axial length of the winding tube. Accordingly, a position in the axial direction of the winding tube where the chuck holds the winding tube may vary. When the holding position varies, there can be a case where the winding tube is not positioned to a normal mounting position in the cradle arms at mounting of the winding tube into the cradle arms, and resulting into mounting failure.

[0006] In this regard, the winding-tube tray of the doff-

ing apparatus of JP 2008-162712 A includes a positioning member. The winding tube is pressed against the positioning member to position the winding tube at a specified position. As shown in FIG. 2 of JP 2008-162712 A, the winding-tube tray 65 is provided corresponding to each of the winding devices 2 in a machine body 61 arranged above the winding devices 2.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide a doffing apparatus capable of accurately positioning a winding tube to a mounting position irrespective of a position of a winding-tube tray.

15 This object is achieved by a doffing apparatus according to claim 1.

It has been found out that the winding-tube tray as used in a conventional doffing apparatus described above may be displaced from the specified position in the winding device due to a manufacturing error, time-related degradation, or the like. In such a case, the winding tube cannot be positioned to the specified position because the position of the positioning member of the winding-tube tray is also displaced. If this happens, the winding tube will not be placed at the normal mounting position in the cradle arms. In addition, the conventional doffing apparatus described above also disadvantageously requires strict position adjustment between the winding device and the winding-tube tray at installation of the machine body.

20 The inventive doffing apparatus avoids the above mentioned disadvantages.

[0008] According to an aspect of the present invention, a doffing apparatus, which travels to a desired one among a plurality of winding units arranged side-by-side, each of the winding units including a winding-tube tray and a winding-tube support member, and supplies a winding tube to the desired winding unit from the winding-tube tray of the desired winding unit, includes a winding-tube holding section that holds the winding tube and supplies the winding tube to the winding-tube supporting member of the winding unit; a restricting lever that comes into contact with a first-side end portion of the winding tube held by the winding-tube holding section thereby restricting a position of the first-side end portion of the winding tube; and a pressing lever that comes into contact with a second-side end portion being on opposite side of the first-side end portion of the winding tube restricted by the restricting lever and presses the second-side end portion of the winding tube against the restricting lever.

25 **[0009]** According to another aspect of the present invention, a textile machine includes the above doffing apparatus and a plurality of winding units.

[0010] The above and other objects, features, advantages and the technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a front view of an automatic winder including a doffing apparatus according to an embodiment of the present invention;

FIG. 2 is a side view of the automatic winder;

FIG. 3 is a front view of the doffing apparatus;

FIG. 4 is a perspective view of a winding-tube tray;

FIG. 5 is a perspective view of the doffing apparatus showing a chuck, a restricting lever, and a pressing lever;

FIG. 6 is a side view for explaining an operation of the doffing apparatus before the chuck holds winding tubes;

FIG. 7 is a side view for explaining an operation of the doffing apparatus after the separator has held the winding tubes;

FIGS. 8A and 8B are front views for explaining a first operation of restricting a position of a winding tube using the restricting lever and the pressing lever; and FIGS. 9A and 9B are front views for explaining a second operation of restricting the position of the winding tube using the restricting lever and the pressing lever.

DETAILED DESCRIPTION OF EMBODIMENTS

[0012] Exemplary embodiments of a doffing apparatus and an automatic winder according to the present invention are explained below.

[0013] A configuration of an automatic winder 1 according to an embodiment of the present invention is explained below. As shown in FIGS. 1 and 2, the automatic winder 1 includes a plurality of winding devices (winding units) 2 arranged side-by-side, a yarn-feeding-bobbin supplying device 3 that supplies yarn supplying bobbins B to each of the winding devices 2, a doffing apparatus 6 that performs a doffing operation for each of the winding devices 2, a transporting device 12 that transports a winding package P undergone the doffing operation performed by the doffing apparatus 6, and a control device 8 that controls each of the winding devices 2, the doffing apparatus 6, and the like.

[0014] As shown in FIG. 2, the winding device 2 unwinds the yarn Y from the yarn supplying bobbin B and winds the yarn Y onto a winding tube 9 to form the winding package P. Cradle arms (winding-tube supporting member) 21 that rotatably hold the winding tube 9, and a drum 22 that causes the winding tube 9 held by the cradle arms 21 to rotate are arranged in an upper portion of the winding device 2.

[0015] As shown in FIG. 2, the cradle arms 21 are movable between a winding position (indicated by solid lines in FIG. 2) where the winding package P (or the winding tube 9 at start of winding) contacts the drum 22 and a dismounting position (indicated by long dashed dou-

ble-short dashed lines in FIG. 2) where the winding package P is dismounted by the doffing apparatus 6. As shown in FIG. 3, the cradle arms 21 include winding-tube holders 23, 23 for holding the winding tube 9 therebetween. One of the winding-tube holders 23 rocks in an axial direction of the drum 22 so that the winding tube 9 can be detachably mounted into the cradle arms 21.

[0016] As shown in FIG. 2, the drum 22 is coupled to a drive motor 25 controlled by a unit controller 24, and rotates at a high speed or low speeds. The unit controller 24 is communicably connected to the control device 8 and receives a value of the number of full-winding rotations from the control device 8.

[0017] The unit controller 24 also controls winding of the yarn Y onto the winding tube 9 that is brought into contact with the drum 22 by controlling the rotation of the drum 22 in the following order. First, the drum 22 is rotated at a low speed for winding a cut yarn Y onto the winding package P; second, the drum 22 is rotated at a low speed for bunch winding the yarn Y onto the winding tube 9; and third, the drum 22 is rotated at a high speed for production winding the yarn Y onto the winding tube 9.

[0018] The winding device 2 includes, on a downstream side along a yarn path, a yarn joining device 26 that performs yarn joining of the yarn Y, a yarn clearer 27 that includes a yarn cutting section 27a and detects a yarn defect, and a suction arm 28 that introduces the yarn Y to the yarn joining device 26 by sucking and catching the yarn Y, which is cut and coming from the yarn supplying bobbin B.

[0019] As shown in FIGS. 2 and 3, the doffing apparatus 6 is capable of travelling above the winding devices 2 along a rail 7 arranged on the machine body 61. When the winding package P of any of the winding devices 2 is fully wound, the doffing apparatus 6 stops at a specified position for that winding device 2 and performs the doffing operation. The doffing apparatus 6 includes a yarn clamping device 62 that is extendable to the suction arm 28, an opener 63 that moves and opens/closes the cradle arms 21, and a yarn handling lever 64 that pulls and guides the yarn Y toward the winding tube 9 held by the cradle arms 21.

[0020] The yarn clamping device 62 includes a yarn-cutting-and-clamping section 62a capable of performing telescopic motion by the action of an air cylinder. The yarn-cutting-and-clamping section 62a cuts and clamps the yarn Y in conjunction with the telescopic motion. The yarn clamping device 62 is arranged in a lower portion of the doffing apparatus 6. The yarn clamping device 62 is swivelable in a radial direction of the drum 22. The yarn clamping device 62 swivels in such a manner as to lift the yarn Y to a position above the drum 22 and interpose the yarn Y between the drum 22 and the cradle arms 21.

[0021] As shown in FIGS. 2 and 3, the opener 63 of the doffing apparatus 6 includes an opening lever 63b that is fixed to a pivot shaft 63a that projects from a side portion of the doffing apparatus 6 in the axial direction of

the drum 22. The opening lever 63b includes at its leading end an opening piece 63c that comes into contact with a cradle lever 21a arranged on one of the cradle arms 21.

[0022] The opening lever 63b is rockable in the axial direction of the drum 22. The opening lever 63b extends toward the cradle arms 21 and includes the opening piece 63c of which swiveling track crosses a swiveling track of the cradle lever 21a that swivels integrally with the cradle arms 21.

[0023] The opener 63, with the opening piece 63c being in contact with the cradle lever 21a, swivels in a direction away from the drum 22, thereby moving the cradle arms 21 that hold the winding package P from the winding position to the dismounting position.

[0024] The opener 63 then swivels toward the drum 22 to cause the cradle arms 21 to swivel from the dismounting position to the winding position, thereby bringing the winding tube 9 into contact with the drum 22. The opener 63 also rocks in the axial direction of the drum 22 to open and close the cradle arms 21 via the cradle lever 21a to allow doffing of the fully-wound package P and mounting of the winding tube 9.

[0025] As shown in FIG. 3, the yarn handling lever 64 of the doffing apparatus 6 includes at its leading end a yarn hook member. The yarn handling lever 64 is arranged on a side from which the yarn Y is introduced to the drum 22 and pivotable toward the winding tube 9. The yarn handling lever 64 hooks the yarn Y lifted by the yarn clamping device 62 by pivoting toward the winding tube 9 and pulls the yarn Y to the winding tube 9 in such a manner as to pinch the yarn Y between a large-diameter end of the winding tube 9 and one of the winding-tube holders 23.

[0026] As shown in FIG. 1, the winding-tube trays 65, each of which is arranged above a corresponding one of the winding devices 2 and stores a plurality of the winding tubes 9, are fixed to the machine body 61. As shown in FIGS. 2 and 3, the doffing apparatus 6 includes the chuck (winding-tube holding section) 66 that holds the winding tube 9 with a chuck claw at a leading end of the chuck 66 and conveys the winding tube 9 from the winding-tube tray 65 fixed onto the machine body 61 to the drum 22, and a separator 69 that causes a remainder of the winding tubes 9 other than the to-be-held winding tube 9 to retreat upward when the chuck 66 holds the to-be-held winding tube 9 so that the chuck 66 can hold and mount the held winding tube 9 into the cradle arms 21.

[0027] As shown in FIG. 2, the winding-tube tray 65 is inclined relative to a horizontal direction corresponding to an apparatus installation surface in such a manner that the front side of the winding-tube tray 65 is at a level lower than that of the rear side. Accordingly, the winding tubes 9 in the winding-tube tray 65 roll down toward the front side (toward an unloading opening 65d) to be accumulated.

[0028] As shown in FIG. 4, the winding-tube tray 65 has the unloading opening 65d through which the winding tubes 9 pass. The winding-tube tray 65 includes a pair

of support lugs 65c, 65c. The support lugs 65c, 65c support the winding tube 9 when the winding tube 9 is placed at the unloading opening 65d. The support lugs 65c, 65c are upwardly urged by a not shown coil spring to contact with the winding-tube tray 65. The chuck 66 moves further downward against the urging force applied from the support lugs 65c, 65c while holding the winding tube 9 at the forward end in the winding-tube tray 65. As a result, the winding tube 9 is placed between the cradle arms 21 of the winding device 2 through the unloading opening 65d in the winding-tube tray 65.

[0029] The winding tube 9 held by the chuck 66 includes a first-side end portion 9a which is on the left side in FIG. 4 and a second-side end portion 9b which is on the right side in FIG. 4. The winding-tube tray 65 includes an L-shaped side wall portion 65a outside the first-side end portion 9a of the winding tube 9 and has an opening 65b that allows insertion of a portion of a restricting plate 71a of a restricting lever 71, which will be described later, therethrough. In the present embodiment, the opening 65b and the unloading opening 65d are in communication with each other.

[0030] As shown in FIGS. 5 and 6, the separator 69 includes lugs 69b, 69b that project downward from a front end of a base portion 69a, and a spring 69e at a rear end 69d of the base portion 69a. The separator 69 is rotated about a first support shaft 69c by an urging force of the spring 69e. The first support shaft 69c and the spring 69e are fixed to inside of the doffing apparatus 6.

[0031] The restricting lever 71 includes the restricting plate 71a that projects downward from a front end of the restricting lever 71. The restricting lever 71 is rotatably supported on a second support shaft 73 at a rear end 71f of the restricting lever 71. The restricting lever 71 includes a leg 71e at its central portion and rests on the base portion 69a of the separator 69 via the leg 71e.

[0032] A pressing lever 72 has a pressing plate (pressing member) 72a at its front end. The pressing lever 72 is rotatably supported on the second support shaft 73 at a rear end 72f of the pressing lever 72. The pressing lever 72 has a leg 72e at its central portion and rests on the base portion 69a of the separator 69 via the leg 72e. The second support shaft 73 is fixed to the inside of the doffing apparatus 6.

[0033] As shown in FIG. 6, a first link arm 68 has a projection 68g. A spring 68f is connected to the projection 68g at one end of the spring 68f and fixed to the inside of the doffing apparatus 6 at the other end. The first link arm 68 is urged in a direction in which a rear end 68b of the first link arm 68 rocks upward about a rocking shaft 68c.

[0034] The rear end 68b of the first link arm 68 is pressed downward by a cam 67 so as to rock about the rocking shaft 68c before the chuck 66 performs a holding operation. As a result, the rear end 69d of the separator 69 is stopped by being pressed downward by the rear end 68b. The restricting lever 71 and the pressing lever 72 stop integrally with the separator 69 because they rest

on the separator 69 under their own weights.

[0035] The cam 67 is rotated by a driving section 67a. The cam 67 includes a cam follower 68e at a point where the first link arm 68 and the cam 67 contact each other. As shown in FIG. 6, a front end 68a of the first link arm 68 is coupled to the chuck 66 via a second link arm 68d, thereby pulling up the chuck 66 into a standing position.

[0036] As shown in FIG. 7, the cam 67 rotates during the holding operation performed by the chuck 66, causing the rear end 68b of the first link arm 68 to be rocked upward by the spring 68f. As a result, the rear end 69d of the separator 69 is pulled up by the spring 69e to pivot upward about the first support shaft 69c. This pivoting causes the separator 69 to insert leading ends of the lugs 69b between the to-be-held winding tube 9 and the remainder of the winding tubes 9 and causes the remainder of the winding tubes 9 to retreat upward away from the to-be-held winding tube 9.

[0037] As the separator 69 rotates downward about the first support shaft 69c, the restricting lever 71 and the pressing lever 72 rotate downward about the second support shaft 73 under their own weights. As a result, the restricting lever 71 and the pressing lever 72 position the to-be-held winding tube 9 to a specified position.

[0038] The restricting lever 71 restricts a position of the first-side end portion 9a of the winding tube 9 first. Thereafter, the pressing lever 72 restricts a position of the second-side end portion 9b of the winding tube 9. In the present embodiment, the height of the leg 71e of the restricting lever 71 is smaller than the height of the leg 72e of the pressing lever 72. Accordingly, the restricting lever 71 restricts the position of the first-side end portion 9a first, and thereafter the pressing lever 72 restricts the position of the second-side end portion 9b. Operations of the restricting lever 71 and the pressing lever 72 are described in detail later.

[0039] Downward rocking of the front end 68a of the first link arm 68 causes the chuck 66 to pivot downward and hold the to-be-held winding tube 9. Thereafter, the chuck 66 rotates further downward while holding the winding tube 9, causing the winding tube 9 to pass through the unloading opening 65d in the winding-tube tray 65 and be positioned to a specified position in the cradle arms 21 of the winding device 2.

[0040] In other words, the separator 69 is coupled to the chuck 66 via the first link arm 68 and the second link arm 68d (linkage) so as to cause the remainder of the winding tubes 9 other than the to-be-held winding tube 9 to retreat in conjunction with the holding operation performed by the chuck 66. The separator 69 is thus pivotable in conjunction with the operation of the chuck 66 without involving an independent driving source for the separator 69.

[0041] The operations of the restricting lever 71 and the pressing lever 72 are explained with reference to FIGS. 8A to 9B. As described above, the restricting lever 71 and the pressing lever 72 move downward under their own weights in a manner to follow rotation of the separator 69.

rator 69.

[0042] Referring to FIGS. 8A and 8B, the first-side end portion 9a of the winding tube 9 is placed toward an inner side of the winding-tube tray 65 relative to a position 71g where the first-side end portion 9a is restricted by the restricting lever 71.

[0043] As shown in FIG. 8A, the restricting plate 71a of the restricting lever 71 is inserted into the opening 65b in the winding-tube tray 65 from above to be positioned by resting on the side wall portion 65a first. The restricting plate 71a has a shape of an inverted L. The restricting plate 71a includes a vertical portion 71b that extends in a direction perpendicular to a winding-tube carrying surface 65e of the winding-tube tray 65. The vertical portion 71b is arranged on the restriction position 71g of the first-side end portion 9a of the winding tube 9. The restricting plate 71a also includes a parallel portion 71d that extends in a horizontal direction corresponding to the winding-tube carrying surface 65e of the winding-tube tray 65. The parallel portion 71d rests on the side wall portion 65a of the winding-tube tray 65.

[0044] As shown in FIG. 8B, thereafter, the pressing plate (pressing member) 72a of the pressing lever 72 presses the second-side end portion 9b of the winding tube 9 against the restricting plate 71a from above. The pressing plate 72a is inclined to the horizontal direction corresponding the winding-tube carrying surface 65e. The pressing plate 72a moves downward to come in contact with the second-side end portion 9b of the winding tube 9 and presses the winding tube 9 against the restricting plate 71a of the restricting lever 71 by a component Gh of a force of gravity acting on the pressing lever 72. The first-side end portion 9a of the winding tube 9 is restricted by the vertical portion 71b of the restricting plate 71a, while the second-side end portion 9b of the winding tube 9 is pressed by the pressing plate 72a. As a result, the winding tube 9 is positioned to the specified position.

[0045] Referring to FIGS. 9A and 9B, the first-side end portion 9a of the winding tube 9 is placed toward an outer side of the winding-tube tray 65 relative to the position 71g where the first-side end portion 9a is restricted by the restricting lever 71.

[0046] As shown in FIG. 9A, the restricting plate 71a of the restricting lever 71 includes an inclined portion 71c that is inclined to the horizontal direction corresponding the winding-tube carrying surface 65e. Moving down the restricting plate 71a brings the inclined portion 71c into contact with the first-side end portion 9a of the winding tube 9 first. Thereafter, as shown in FIG. 9B, the restricting plate 71a presses the winding tube 9 under the weight of the restricting lever 71, causing the first-side end portion 9a of the winding tube 9 to slide along the inclined portion 71c to come into contact with the vertical portion 71b. Meanwhile, the vertical portion 71b of the restricting plate 71a is placed at a position where the vertical portion 71b reliably abuts on the first-side end portion 9a of the winding tube 9 because the inclined portion 71c of the restricting plate 71a passes through the opening 65b in

the winding-tube tray 65.

[0047] Thereafter, the pressing plate 72a of the pressing lever 72 presses the second-side end portion 9b of the winding tube 9 against the restricting plate 71a. The first-side end portion 9a of the winding tube 9 is restricted by the vertical portion 71b of the restricting plate 71a, and the second-side end portion 9b of the winding tube 9 is pressed by the pressing plate 72a, causing the winding tube 9 to be positioned to the specified position.

[0048] As described above, the restricting lever 71 and the pressing lever 72 are provided in the doffing apparatus 6. Accordingly, the positions of the restricting plate 71a of the restricting lever 71 and the pressing plate 72a of the pressing lever 72 can be adjusted according to a stop position of the doffing apparatus 6. Therefore, the winding tube 9 can be positioned to the specified position according to the stop position of the doffing apparatus 6. Put another way, the winding tube 9 can be positioned to a proper mounting position in the cradle arms 21, independent of a position where the winding-tube tray 65 is installed, by controlling the stop position of the doffing apparatus 6. Hence, improper mounting is prevented. Furthermore, the pressing plate 72a of the pressing lever 72 presses the second-side end portion 9b of the winding tube 9 against the restricting plate 71a of the restricting lever 71. Accordingly, the winding tube 9 is accurately positioned to the specified position even when the winding tubes 9 to be used have various lengths.

[0049] The pressing lever 72 rotates about the second support shaft 73 under its own weight. Accordingly, a force acting on the winding tube 9 does not exceed a force due to the weight of the pressing lever 72, and application of an excessively large force on the second-side end portion 9b of the winding tube 9 does not occur. Furthermore, the restricting lever 71 and the pressing lever 72 move in a manner to follow the separator 69 and therefore have a simple structure that does not require a driving mechanism. Note that the restricting lever 71 and the pressing lever 72 can alternatively be driven by a driving mechanism (an air cylinder, a motor, or the like).

[0050] A sequence of operations to be performed by the automatic winder 1 according to the present embodiment for doffing of the fully-wound winding package P is explained below with reference to FIGS. 1 to 9B.

[0051] When the winding package P rotated at a high speed by the drum 22 of the winding device 2 is fully wound, the yarn cutting section 27a of the yarn clearer 27 is actuated to cut the yarn Y, and simultaneously the suction arm 28 sucks and catches a leading end of the cut yarn Y coming from the yarn supplying bobbin B. Simultaneously with this operation of the winding device 2, the doffing apparatus 6 travels and stops at a position immediately above the fully-wound winding package P of the winding device 2.

[0052] When the doffing apparatus 6 stops at the position immediately above the fully-wound winding package P, the unit controller 24 drives the drive motor 25 to thereby rotate the drum 22 at a low speed, causing the

cut yarn Y coming from the winding package P to be wound onto the winding package P. When the cut yarn Y has been wound onto the winding package P, the unit controller 24 stops driving of the drive motor 25 to stop rotation of the drum 22.

[0053] After the cut yarn Y has been wound onto the winding package P, the doffing apparatus 6 causes the opener 63 to swivel to thereby move the cradle arms 21 that hold the fully-wound package P from the winding position to the dismounting position. Furthermore, the doffing apparatus 6 opens the cradle arms 21 by causing the opener 63 to rock in the axial direction of the drum 22, thereby removing the fully-wound package P (perform doffing). The fully-wound package P is placed on the transporting device 12 via a package guide 29 and conveyed to a predetermined location.

[0054] After the doffing apparatus 6 has removed the fully-wound package P from the cradle arms 21 (i.e., performed doffing), the opener 63 stops rocking and swivels toward the drum 22 to move the cradle arms 21 to the winding position. The opener 63 is then caused to rock again to open the cradle arms 21. At this time, the yarn clamping device 62 of the doffing apparatus 6 extends to the suction arm 28 to cut and grip the leading end of the yarn Y, which is coming from the yarn supplying bobbin B and sucked and caught by the suction arm 28, and then ascends to pull up the yarn Y to a position above the drum 22 across in front of the drum 22.

[0055] The yarn clamping device 62 that has pulled up the yarn Y to the position above the drum 22 swivels toward the cradle arms 21, thereby interposing the yarn Y between the cradle arms 21 and also inserts the yarn Y into the yarn clearer 27 to detect presence/absence of the yarn Y.

[0056] The yarn handling lever 64 of the doffing apparatus 6 pivots toward the drum 22 to hook the yarn Y, which is on the side from which the yarn Y is introduced to the drum 22, on a leading end of the yarn handling lever 64 and guides the yarn Y to a bunch winding position. When the yarn handling lever 64 has pulled the yarn Y to the bunch winding position, the chuck 66 pivots toward the drum 22 to hold the winding tube 9 at an unloading opening end (front end) of the winding-tube tray 65.

[0057] At this time, the separator 69 pivots downward about the first support shaft 69c in conjunction with the chuck 66, and causes the remainder of the winding tubes 9 to retreat upward before the chuck 66 holds the to-be-held winding tube 9. Meanwhile, this retreat is maintained until the chuck 66 mounts the winding tube 9 held by the chuck 66 into the cradle arms 21 and returns to its default position.

[0058] Furthermore, while the separator 69 performs the winding-tube retreating operation, the restricting plate 71a of the restricting lever 71 restricts the position of the first-side end portion 9a of the to-be-held winding tube 9, and the pressing plate 72a of the pressing lever 72 presses the second-side end portion 9b of the to-be-

held winding tube 9 against the restricting plate 71a. As a result, the to-be-held winding tube 9 is positioned to the specified position.

[0059] The chuck 66 holds the winding tube 9, and thereafter further pivots toward the drum 22, thereby bringing the winding tube 9 held by the chuck 66 into contact with the drum 22 and placing the winding tube 9 between the winding-tube holders 23 of the cradle arms 21. Rocking motion of the opener 63 is stopped while maintaining contact between the winding tube 9 and the drum 22 so that the winding tube 9 is rotatably held at its large-diameter end and small-diameter end between the winding-tube holders 23 of the cradle arms 21. As a result, the yarn Y is clamped between the large-diameter end of the winding tube 9 and one of the winding-tube holders 23; hence, a state where bunch winding can be performed onto the winding tube 9 is achieved. When the winding tube 9 has been held between the winding-tube holders 23, the chuck 66 pivots and retreats toward the doffing apparatus 6, and simultaneously, the yarn Y clamped by the yarn clamping device 62 is released.

[0060] When the sequence of operations from doffing of the fully-wound package P to mounting of the winding tube 9 is completed as described above, the unit controller 24 causes the drive motor 25 to drive to rotate the drum 22 at a low speed, thereby performing bunch winding of the yarn Y coming from the yarn supplying bobbin B onto the large-diameter end of the winding tube.

[0061] The unit controller 24 then controls the drive motor 25 to cause the drum 22 to rotate continuously while transferring from low-speed rotation to high-speed rotation to automatically start production winding of the yarn Y. Hence, production winding, during which the drum 22 rotates the winding tube 9 at a high speed while causing the yarn Y to be traversed in the axial direction of the winding tube 9, of the yarn Y is automatically started. The production winding of the yarn Y ends at completion of winding of a predetermined length, or when the number of rotations of the drum 22 counted by the unit controller 24 reaches the number of full-winding rotations. The doffing apparatus 6 performs doffing of the fully-wound package P on the winding device 2 that has fully wound the yarn Y.

[0062] Exemplary embodiments of the present invention have been explained above; however, the present invention is not limited to these embodiments. In the above embodiment, the doffing apparatus is applied to the automatic winder including a plurality of winding devices arranged side-by-side; however, application of the doffing apparatus is not limited thereto. For example, the doffing apparatus can be applied to a spinning machine including a plurality of spinning devices arranged side-by-side.

[0063] As explained above, according to an aspect of the present invention, a doffing apparatus that travels to a desired one among a plurality of winding units arranged side-by-side, each of the winding units including a winding-tube tray and a winding-tube supporting member, and

supplies a winding tube to the winding unit from the winding-tube tray includes a chuck that holds the winding tube and supplies the winding tube to the winding-tube supporting member of the winding unit; a restricting lever that comes into contact with a first-side end portion of the winding tube held by the chuck thereby restricting a position of the first-side end portion of the winding tube; and a pressing lever that comes into contact with a second-side end portion, which is on an opposite side of the winding tube from the first-side end portion, of the winding tube restricted by the restricting lever and presses the second-side end portion of the winding tube against the restricting lever. The doffing apparatus positions the winding tube held by the chuck using the restricting lever and the pressing lever.

[0064] It is preferable that the restricting lever includes a vertical portion for restricting the position of the first-side end portion of the winding tube and an inclined portion for causing the first-side end portion of the winding tube to slide, and the pressing lever includes a pressing member that comes into contact with the second-side end portion of the winding tube and presses the winding tube against the restricting lever. The vertical portion extends in a direction perpendicular to a winding-tube carrying surface of the winding-tube tray. The inclined portion being inclined to a horizontal direction corresponding the winding-tube carrying surface of the winding-tube tray. The pressing member being inclined to the horizontal direction corresponding the winding-tube carrying surface.

[0065] It is preferable that the doffing apparatus further includes a separator that, when the chuck holds the winding tube, causes a remainder of the winding tubes to retreat. The remainder is the winding tubes other than the winding tube to be held by the chuck.

[0066] It is preferable that the doffing apparatus further includes a first support shaft and a second support shaft, the separator is rotatably supported on the first support shaft, the restricting lever and the pressing lever are rotatably supported on the second support shaft and rest on the separator, and when the separator rotates about the first support shaft downward, the restricting lever and the pressing lever rotate downward under a weight of the restricting lever and a weight of the pressing lever, respectively, about the second support shaft in a manner to follow the separator.

[0067] As described above, the doffing apparatus includes the restricting lever that restricts the position of the first-side end portion of the winding tube and the pressing lever that presses the second-side end portion of the winding tube restricted by the restricting lever against the restricting lever. Accordingly, the winding tube held by the chuck is positioned by the restricting lever and the pressing lever.

[0068] The positions of the restricting lever and the pressing lever can be adjusted according to a stop position of the doffing apparatus because the restricting lever and the pressing lever are installed on the doffing appa-

ratus. Therefore, it is possible to restrict the winding tube to a specified position according to the stop position of the doffing apparatus. Put another way, by controlling the stop position of the doffing apparatus, the winding tube can be positioned to a proper mounting position in the cradle arms independent of a position where the winding-tube tray is installed. It is possible to accurately position the winding tube even when the winding tube to be used varies in length because the pressing lever presses the winding to against the restricting lever.

[0069] A textile machine according to another aspect of the present invention includes the above doffing apparatus and a plurality of winding units.

[0070] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

Claims

1. A doffing apparatus (6) adapted to travel to a desired one among a plurality of winding units (2) arranged side-by-side, each of the winding units (2) including a winding-tube tray (65) and a winding-tube support member (21), and adapted to supply a winding tube (9) to the desired winding unit (2) from the winding-tube tray (65) of the desired winding unit (2), the doffing apparatus (6) comprising:

a winding-tube holding section (66) adapted to hold the winding tube (9) and to supply the winding tube (9) to the winding-tube supporting member (21) of the winding unit (2);

a restricting lever (71) adapted to come into contact with a first-side end portion (9a) of the winding tube (9) held by the winding-tube holding section (66) thereby restricting a position of the first-side end portion (9a) of the winding tube (9); and

a pressing lever (72) adapted to come into contact with a second-side end portion (9b) being on opposite side of the first-side end portion (9a) of the winding tube (9) restricted by the restricting lever (71) and adapted to press the second-side end portion (9b) of the winding tube (9) against the restricting lever (71).

2. The doffing apparatus (6) according to Claim 1, wherein the restricting lever (71) includes a vertical portion (71b) adapted to restrict the position of the first-side end portion (9a) of the winding tube (9), the vertical portion (71b) extending in a direction perpendicular to a winding-tube carrying surface

(65e) of the winding-tube tray (65), and an inclined portion (71c) adapted to cause the first-side end portion (9a) of the winding tube (9) to slide, the inclined portion (71c) being inclined to a horizontal direction corresponding the winding-tube carrying surface (65e) of the winding-tube tray (65), and the pressing lever (72) includes a pressing member (72a) adapted to come into contact with the second-side end portion (9b) of the winding tube (9) and to press the winding tube (9) against the restricting lever (71), the pressing member (72a) being inclined to the horizontal direction corresponding the winding-tube carrying surface (65e).

3. The doffing apparatus according to Claim 1 or 2, further comprising a separator (69) adapted to cause a remainder of the winding tubes to retreat, when the winding-tube holding section holds the winding tube, the remainder being the winding tubes other than the winding tube to be held by the winding-tube holding section.

4. The doffing apparatus according to Claim 3, wherein the separator (69) is rotatably supported on a first support shaft (69c), the restricting lever (71) and the pressing lever (72) are rotatably supported on a second support shaft (73) and rest on the separator (69), and when the separator (69) rotates about the first support shaft downward, the restricting lever (71) and the pressing lever (72) are adapted to rotate downward under their own weights, about the second support shaft in a manner to follow the separator (69).

5. A textile machine comprising:

the doffing apparatus (6) according to any one of Claims 1 to 4; and a plurality of winding units (2).

FIG.1

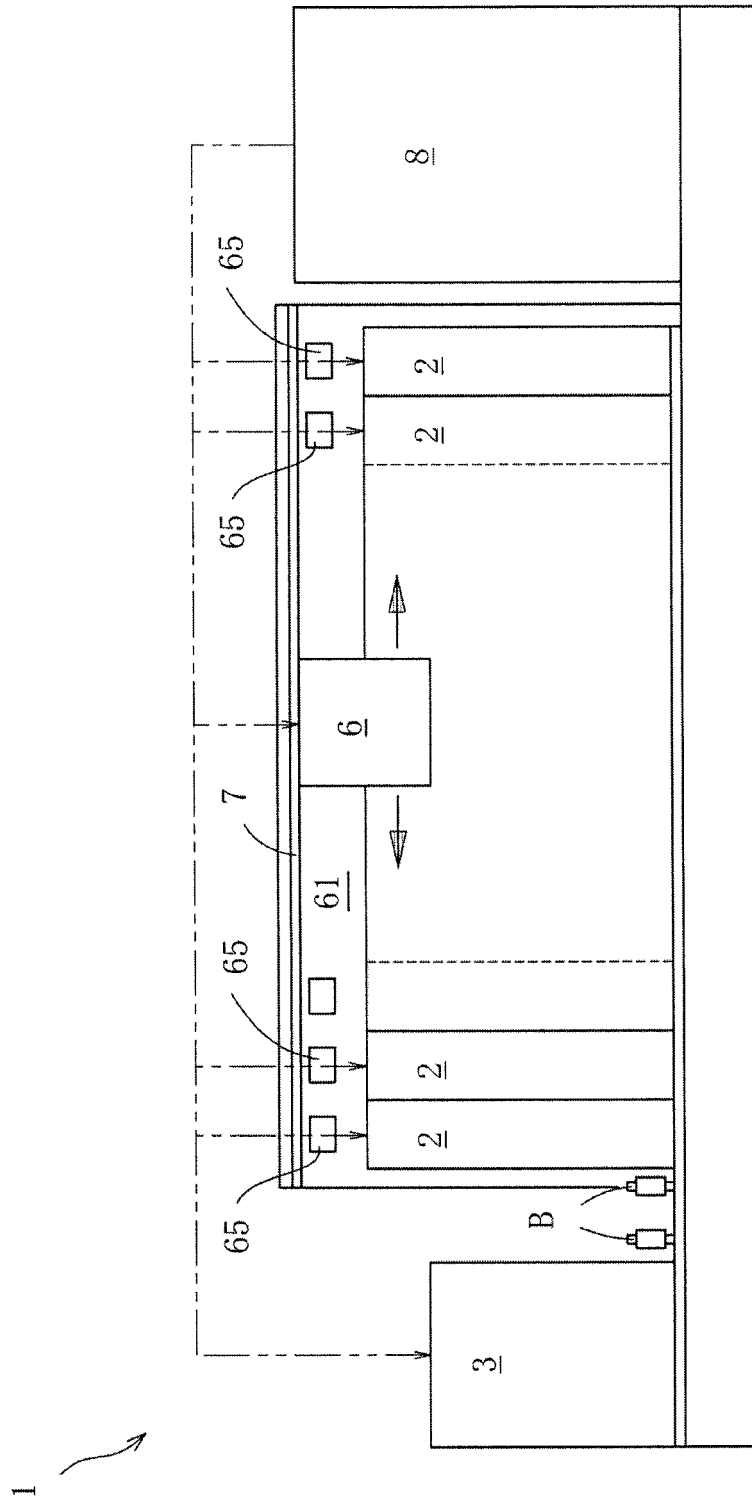


FIG.4

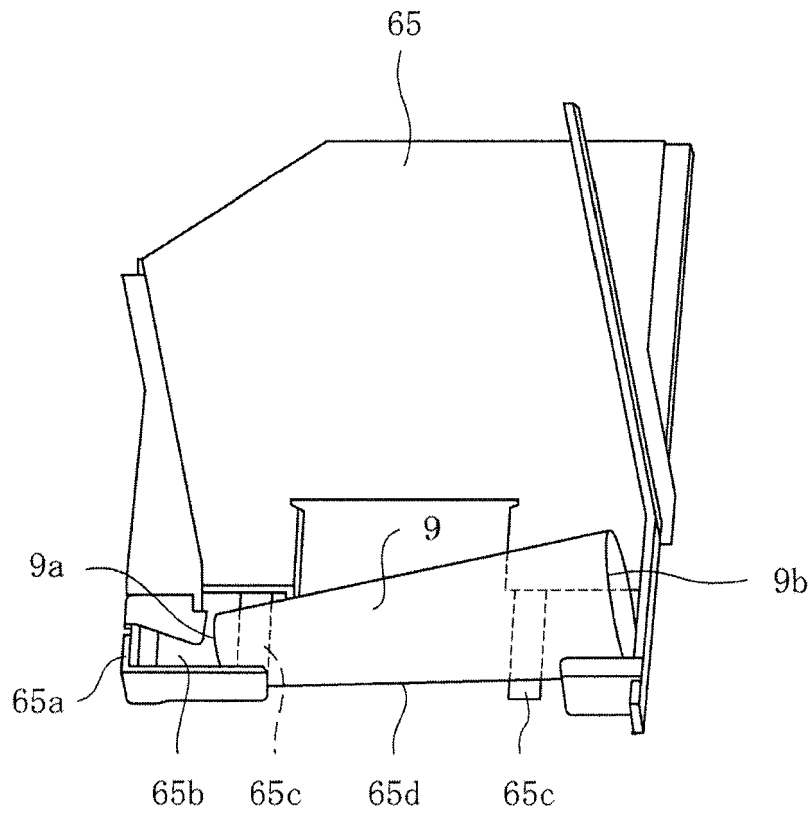


FIG.5

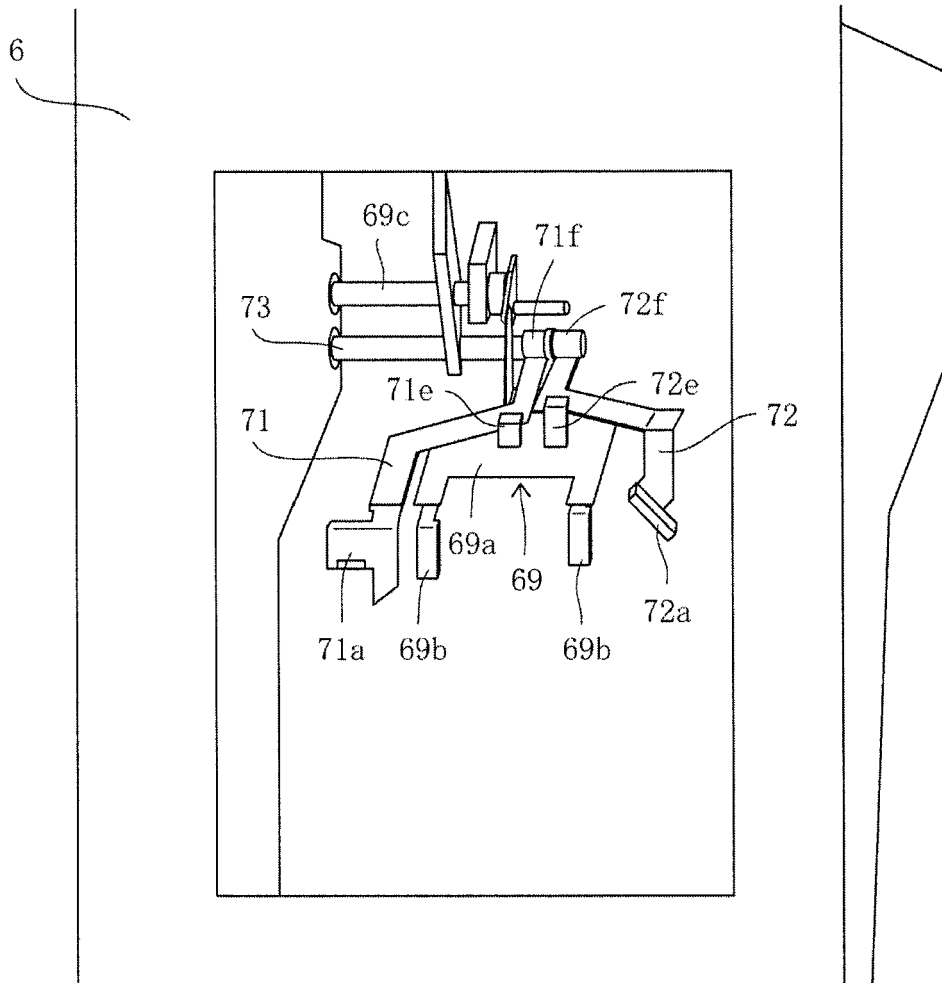


FIG.6

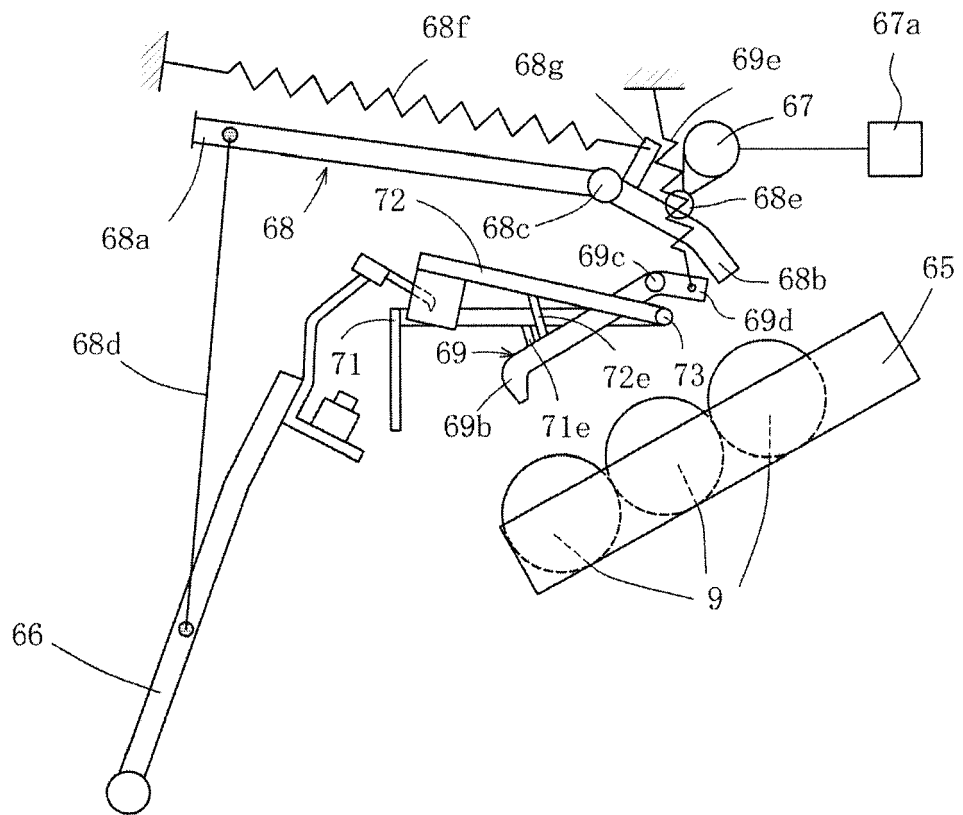


FIG.7

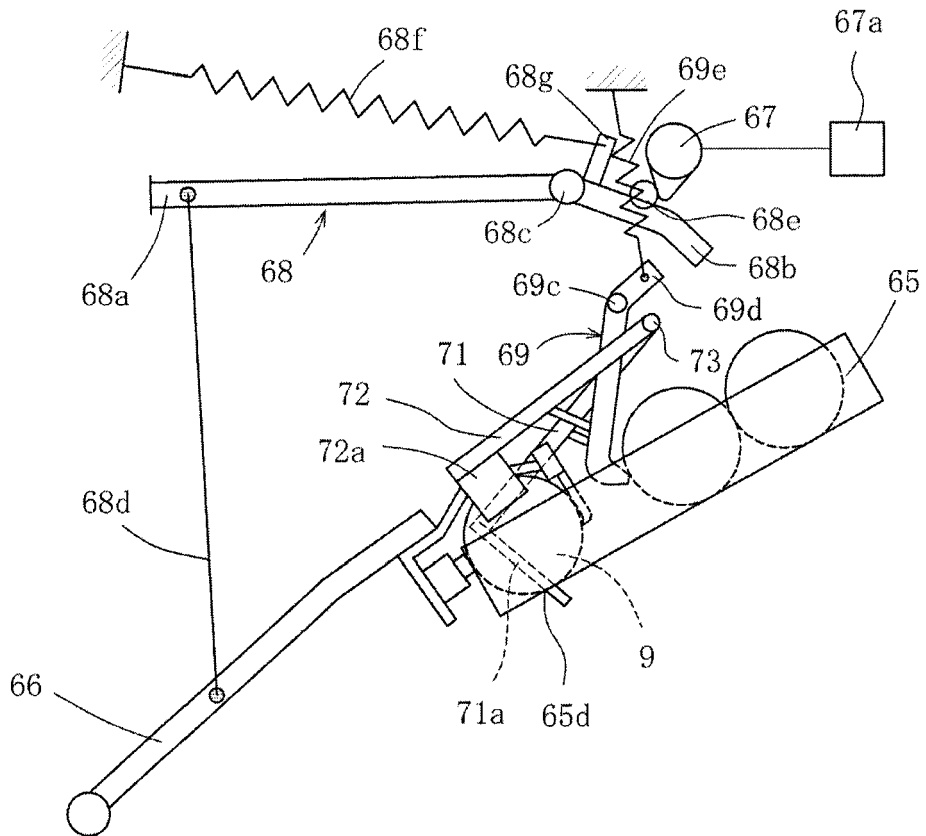


FIG.8A

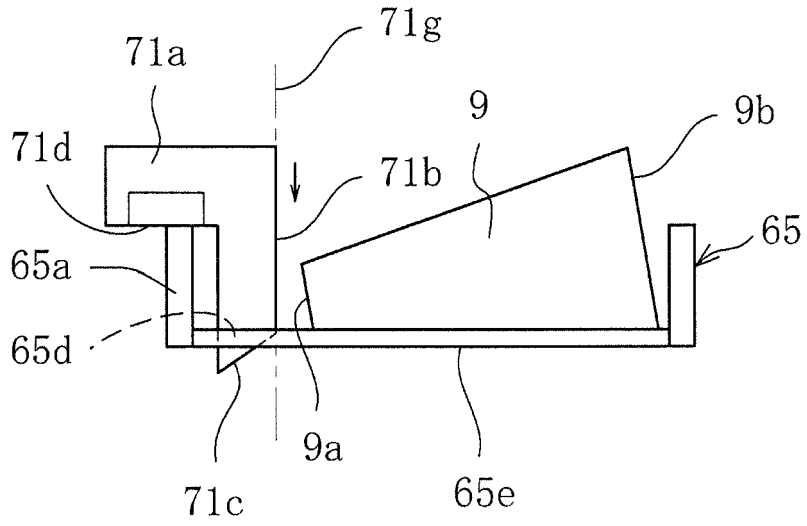


FIG.8B

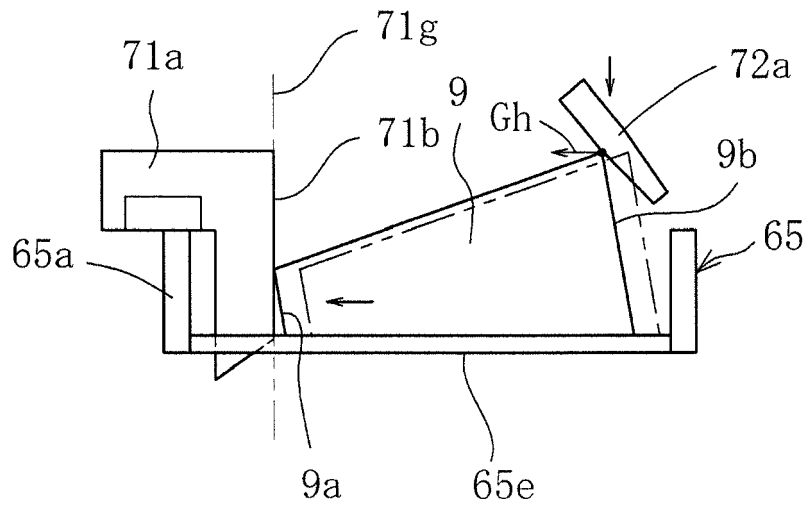


FIG.9A

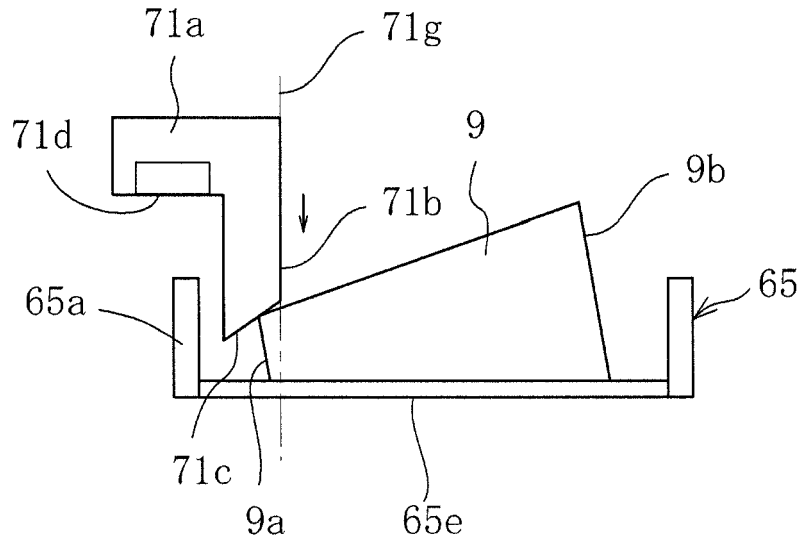
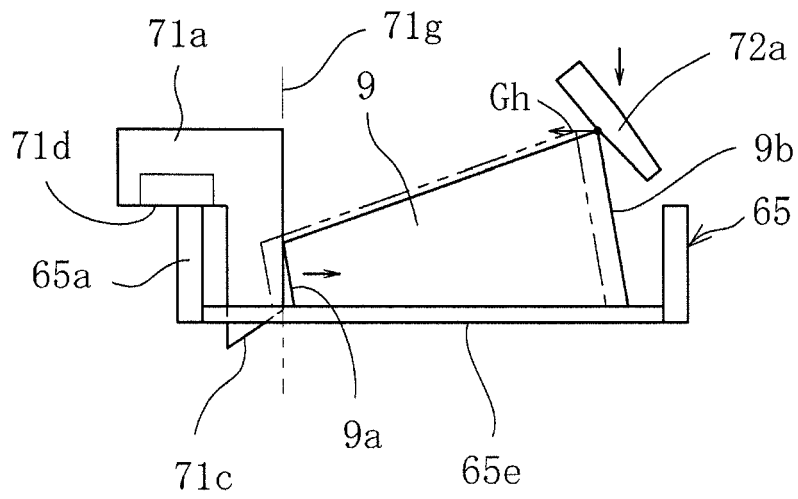


FIG.9B



REFERENCES CITED IN THE DESCRIPTION

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