(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 081 518 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
19.10.2016 Bulletin 2016/42

(51) Int Cl.:
B65H 63/036 *(2006.01)* ***B65H 67/08*** *(2006.01)*

(21) Application number: **16164026.3**

(22) Date of filing: **06.04.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **16.04.2015 JP 2015083893**

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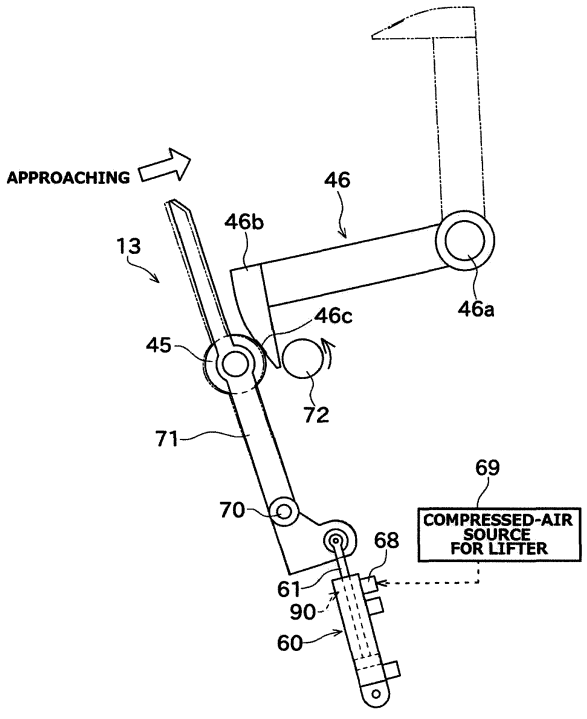
(54) TEXTILE MACHINE

(57) An object is to surely catch a yarn end of a package (45) when performing yarn joining and the like. A suction mouth (46) catches a yarn end of a package (45), a cradle arm (71) rotatably and movably supports the package so as to be movable in a separating direction, and an air cylinder (60) drives the cradle arm to move the package in the separating direction. A unit controller (92) controls, after causing the suction mouth to contact the surface of the package, the air cylinder to move the package in the separating direction. The unit controller provides a control so that the suction mouth catches the yarn end in the state in which the surface of the package and the suction mouth are separated from each other.

FIG.6



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a textile machine that forms a package. Specifically, the present invention relates to a configuration that can surely catch a yarn end of a package when performing yarn joining work and the like.

2. Description of the Related Art

[0002] Conventional textile machines that form a package are known to have a configuration to catch a yarn end of the package when performing yarn joining work and the like. Japanese Patent Laid-Open No. 2010-189083 discloses a spinning frame that is a textile machine of this type.

[0003] The spinning frame disclosed in Japanese Patent Laid-Open No. 2010-189083 includes a suction mouth, a cradle arm, and a package plate. The suction mouth catches the yarn end of the package and guides the yarn end to a yarn joining device and the like. The cradle arm rotatably supports the package, and pivotably supports the package so that the package can be moved by pivoting the cradle arm. The package plate is caused to contact the package when stopping the rotation of the package.

[0004] In the spinning frame having the configuration disclosed in Japanese Patent Laid-Open No. 2010-189083, when performing yarn joining due to occurrence of a yarn defect and the like, the package plate is pressed against the package to move the package away from the suction mouth so that the surface of the package is positioned at the same position every time. After the surface of the package has been positioned in this manner, the suction mouth is brought close to the surface of the package and a catching operation of catching the yarn end is performed.

[0005] However, in the configuration disclosed in Japanese Patent Laid-Open No. 2010-189083, depending on the hardness of the package, there was a possibility that the package is deformed at a portion where the package plate contacts the package. When such deformation of the package occurs, it is not possible to accurately position the package. Moreover, even if positioning of the surface of the package is performed, because a positional relation between the suction mouth and the surface of the package is not adjusted directly in this configuration, the positional relation between the surface of the package and the suction mouth cannot be adjusted to that is suitable for the catching operation, and sometimes it was not possible to surely catch the yarn end in the catching operation.

SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide a configuration that can surely catch a yarn end of a package when performing yarn joining and the like.

[0007] A textile machine according to an aspect of the present invention includes a first catching member that performs a catching operation of catching a yarn end of a package; a cradle arm that rotatably supports the package and also movably supports the package so that the package is movable in a separating direction in which the package moves away from the first catching member; a driving mechanism that drives the cradle arm to move the package in the separating direction; and a controlling section that controls the driving mechanism to move the package in the separating direction after causing a surface of the package and the first catching member to contact each other, and provides a control so that the first catching member performs the catching operation in the state in which the surface of the package and the first catching member are separated from each other.

[0008] The above and other objects, features, advantages and 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

[0009]

FIG. 1 is a front view of a spinning frame according to an embodiment of the present invention showing an overall configuration of the spinning frame.

FIG. 2 is a longitudinal cross-sectional view of the spinning frame in a state in which a yarn is being wound.

FIG. 3 is a block diagram indicating various structural components connected to a unit controller. FIG. 4 is a cross-sectional view of an air cylinder.

FIG. 5 is a longitudinal cross-sectional view of a state in which a package plate is in contact with a package.

FIG. 6 is a schematic diagram of a state in which a surface of the package is caused to contact a suction mouth for positioning.

FIG. 7 is a schematic diagram of a state in which a lifter member is driven from its state shown in FIG. 6 to separate the surface of the package from the suction mouth by only a predetermined distance.

FIG. 8 is a longitudinal cross-sectional view of a state in which a lower yarn is caught by the suction mouth and an upper yarn is caught by a suction pipe.

FIG. 9 is a longitudinal cross-sectional view of a state in which the upper yarn and the lower yarn are guided inside a splicer.

FIG. 10 is a longitudinal cross-sectional view of a state just after restarting rotation of the package after

completion of yarn joining.

FIG. 11 is a timing chart of a yarn joining operation.

DETAILED DESCRIPTION

[0010] Exemplary embodiments of a spinning frame (a spinning machine) according to the present invention are explained in detail below with reference to the accompanying drawings. In the present specification, "upstream" and "downstream" respectively mean upstream and downstream in a traveling direction of a yarn when spinning is performed.

[0011] A spinning frame 1, which is an example of the textile machine, shown in FIG. 1, includes a large number of spinning units (winding units) 2 that are arranged side-by-side. The spinning frame 1 also includes a yarn joining cart (work cart) 3, a blower box 80, and a motor box 5.

[0012] As shown in FIG. 1, each spinning unit 2 mainly includes a drafting device 7, a spinning device (yarn supplying section) 9, a yarn feeding device 11, a yarn-slack removing device 12, and a winding device 13 arranged in this order from the upstream to the downstream.

[0013] The drafting device 7 is arranged near an upper edge of a frame 6 of the spinning frame 1. A fiber bundle 8 that is fed by the drafting device 7 is spun by the spinning device 9. A spun yarn 10 formed in the spinning device 9 is fed by the yarn feeding device 11 and subsequently wound by the winding device 13 on a bobbin 48 thereby forming a package 45.

[0014] The drafting device 7 is a device that draws a fiber bundle called a sliver 15 to form the fiber bundle 8 that is thin. The drafting device 7 includes, as shown in FIG. 2, four roller pairs, namely, a back roller pair 16, a third roller pair 17, a middle roller pair 19 with an apron belt 18 stretched over each roller thereof, and a front roller pair 20.

[0015] Although a detailed configuration of the spinning device 9 is not shown, an air spinning device that uses a swirling air current to apply twists to the fiber bundle 8 to form the spun yarn 10 has been adopted in the present embodiment.

[0016] The yarn feeding device 11 includes a delivery roller 39 supported by the frame 6 of the spinning frame 1, and a nip roller 40 arranged in contact with the delivery roller 39. The spun yarn 10 fed out from the spinning device 9 is pinched between the delivery roller 39 and the nip roller 40. The spun yarn 10 can be fed to the winding device 13 by rotationally driving the delivery roller 39 with a not-shown electric motor.

[0017] The yarn-slack removing device 12 is arranged downstream of the yarn feeding device 11. The yarn-slack removing device 12 includes a slack removing roller 21, a yarn hooking member 22, and an electric motor 25.

[0018] The yarn hooking member 22 is engageable with (hook) the spun yarn 10. When the yarn hooking member 22 is integrally rotated with the slack removing roller 21 while the spun yarn 10 has been engaged therewith, the spun yarn 10 can be guided to an outer peripheral surface of the slack removing roller 21.

[0019] The slack removing roller 21 functions to accumulate the spun yarn 10 wound around the outer peripheral surface thereof. The slack removing roller 21 is rotationally driven by the electric motor 25. Accordingly, the spun yarn 10 can be temporarily accumulated in the yarn-slack removing device 12 that is arranged between the yarn feeding device 11 and the winding device 13.

[0020] A yarn-defect detecting device 52 is arranged in a front portion of the frame 6 of the spinning frame 1 but between the yarn feeding device 11 and the yarn-slack removing device 12. The spun yarn 10 formed in the spinning device 9 passes by / through the yarn-defect detecting device 52 before the spun yarn 10 is wound in the yarn-slack removing device 12. The yarn-defect detecting device 52 monitors a thickness and the like of the traveling spun yarn 10. Upon detecting a defect in the spun yarn 10, the yarn-defect detecting device 52 transmits a yarn-defect detection signal to a unit controller (a controlling section) 92 (see FIG. 3). The unit controller 92 is a computer that controls the spinning unit 2. A cutter 57 is arranged near the yarn-defect detecting device 52 to cut the spun yarn 10 when a yarn defect is detected in the spun yarn 10.

[0021] The winding device 13 mainly includes a cradle arm 71, a winding drum 72, and a traversing device 75.

[0022] The winding drum 72 can be driven while being in contact with an outer peripheral surface of the bobbin 48 or the package 45. The traversing device 75 includes a traversing guide 76 capable of guiding the spun yarn 10. The traversing guide 76 is caused to make a reciprocating movement by a not-shown driving means (this driving means is shared by a large number of the spinning units in the present embodiment) while the winding drum 72 is being driven by a not-shown electric motor. As a result, the package 45 that is in contact with the winding drum 72 is also rotationally driven, and the spun yarn 10 is wound into the package 45 while the spun yarn 10 is being traversed.

[0023] As shown in FIG. 2, the cradle arm 71 rotatably supports the bobbin 48 on which the spun yarn 10 is wound. The cradle arm 71 is pivotably supported by a support shaft 70. Accordingly, the cradle arm 71 can be pivoted in both of a direction in which the package 45 moves toward the winding drum 72 and a direction in which the package 45 moves away from the winding drum 72. With this arrangement, even if a diameter of a yarn layer on the package 45 increases as winding of the spun yarn 10 thereon advances, the increase in the diameter of the yarn layer can be absorbed by pivoting the cradle arm 71, and the surface of the package 45 can be continued to appropriately contact the winding drum 72.

[0024] In a state in which a tip end section of a suction mouth 46, which is installed in the later-explained yarn joining cart 3, is brought close to the package 45, the package 45 can be moved toward the suction mouth 46 (may be called "an approaching direction" below) or can be moved away from the suction mouth 46 (may be called

"a separating direction" below) by pivoting the cradle arm 71.

[0025] An air cylinder (a driving mechanism) 60 is coupled to the cradle arm 71. As shown in FIG. 4, the air cylinder 60 is constructed as a double-acting air cylinder and includes a piston rod 61, a piston 62 fixed to the piston rod 61, a contact-pressure port 63, and a back-pressure port 64. In the air cylinder 60, compressed air (may be simply called "air" below) is supplied from the contact-pressure port 63 and the back-pressure port 64 in a cylinder casing of the air cylinder 60. When there is a difference in air pressures in the air supplied from the contact-pressure port 63 and the air supplied from the back-pressure port 64, the air pushes the piston 62 whereby the piston rod 61 is driven.

[0026] As shown in FIG. 2, the piston rod 61 is coupled to the cradle arm 71. The contact-pressure port 63 is connected to a compressed-air source for press-contact 65 that is arranged in the blower box 80. When the compressed air is supplied from the compressed-air source for press-contact 65 to the contact-pressure port 63, this air supplied in the cylinder casing from the contact-pressure port 63 pushes the piston 62 whereby the piston rod 61 pulls the cradle arm 71. With this action, a force (torque) that causes the cradle arm 71 to pivot whereby the package 45 is pressed against the winding drum 72 is generated.

[0027] The back-pressure port 64 is connected to a back-pressure-port connection port 81 of a three-port valve 66. The three-port valve 66 is constructed as a solenoid valve and includes the back-pressure-port connection port 81, a pressure-reduction-valve connection port 82, and a drain port 83. A valve element of the three-port valve 66 is switchable between a position (an open position shown in FIG. 2) at which the back-pressure-port connection port 81 is connected to the drain port 83 and the pressure-reduction-valve connection port 82 is closed and a position (a connecting position shown in FIG. 5) in which the back-pressure-port connection port 81 is connected to the pressure-reduction-valve connection port 82. A pressure reduction valve 67 is connected to the pressure-reduction-valve connection port 82, and the drain port 83 is set at the atmospheric pressure.

[0028] During normal winding, the valve element of the three-port valve 66 is arranged in the open position whereby the back-pressure-port connection port 81 is connected to the drain port 83. In the following explanation, this state may be referred to as an open state. Because the back-pressure port 64 is set at the atmospheric pressure in this open state, the air pressure of only the compressed-air source for press-contact 65 acts on the piston 62. As a result, the package 45 can be pressed by a sufficient pressing force against the winding drum 72 whereby the package 45 can be rotationally driven stably by the winding drum 72.

[0029] When the valve element of the three-port valve 66 is switched as shown in FIG. 5, for example, the back-pressure port 64 is connected to the pressure reduction valve 67. In the following explanation, this state may be referred to as a connected state. The pressure reduction valve 67 is connected to the compressed-air source for press-contact 65. The pressure reduction valve 67 reduces the pressure of the air supplied by the compressed-air source for press-contact 65, and the reduced-pressure air is supplied to the pressure-reduction-valve connection port 82. As a result, air at a lower pressure than the pressure of the air supplied to the contact-pressure port 63 can be supplied to the back-pressure port 64. Therefore, because the air supplied to the back-pressure port 64 offsets the air supplied to the contact-pressure port 63 to some extent, the force (torque) applied to the cradle arm 71 is reduced, whereby the package 45 can be caused to contact the winding drum 72 at a reduced force (pressing force).

[0030] The three-port valve 66 is electrically connected to the unit controller 92. The unit controller 92 can switch the three-port valve 66 between the open state and the connected state by transmitting a control signal to the three-port valve 66.

[0031] The air cylinder 60 has a lifter part 90. As shown in FIG. 4, the lifter part 90 mainly includes a lifter port 68, a lifter piston 85, a tapering member 86, balls 87, and a spring 88.

[0032] As shown in FIG. 2, a compressed-air source for lifter 69 that supplies compressed air to the lifter part 90 is connected to the lifter port 68. Although not shown in FIG. 2, a solenoid valve 91 (a valve similar to the three-port valve 66) shown in FIG. 3 is arranged between the lifter port 68 and the compressed-air source for lifter 69. Compressed air can be supplied to the lifter port 68 or compressed air can be released from the lifter port 68 by appropriately operating this solenoid valve 91. For example, a state in which no air is supplied to the lifter port 68 is shown in FIG. 2. That is, a state in which the compressed air is released from the lifter port 68 is shown with a dotted line in FIG. 2. In contrast, for example, a state in which air is supplied to the lifter port 68 is shown with a solid line arrow in FIG. 5.

[0033] The lifter piston 85 is arranged in the lifter part 90 so as to be movable by a predetermined stroke in a longitudinal direction of the piston rod 61. When no air is supplied to the lifter port 68, the lifter piston 85 and the tapering member 86 are biased, as shown in FIG. 4, in a downward direction in the figure by the spring 88. In this state, the piston rod 61 can move freely in the upward-downward direction in the figure. When air is supplied to the lifter port 68, the lifter piston 85 and the tapering member 86 are driven upward in FIG. 4 by the action of the air.

[0034] As shown in FIG. 4, an insertion hole through which the piston rod 61 is passed and can be moved upward-downward is formed in the tapering member 86. The insertion hole is formed in a tapered form such that it becomes narrow going downward in FIG. 4, and an inclined surface 86a is an inner peripheral surface of the insertion hole. A plurality of balls 87 is arranged between the inclined surface 86a and the piston rod 61. The balls

87 are pushed downward as they receive an urging force of a spring 78 via a washer 89. With this arrangement, the balls 87 are pressed on a washer 79, as well as pressed between the inclined surface 86a and the piston rod 61.

[0035] When air is supplied to the lifter port 68 whereby the lifter piston 85 and the tapering member 86 are driven upward in FIG. 4, the balls 87 enter between the inclined surface 86a and the piston rod 61. The piston rod 61 is locked to the tapering member 86 by a wedge action of the inclined surface 86a and the balls 87, and the piston rod 61, the tapering member 86, and the lifter piston 85 integrally move upward in FIG. 4. In this manner, by supplying air to the lifter port 68, the piston rod 61 can be driven upward in FIG. 4 by a distance equal to only the stroke of the lifter piston 85. By driving the piston rod 61 upward, the cradle arm 71 can be pivoted leftward in FIG. 2, whereby the package 45 is separated by a small distance from the winding drum 72.

[0036] When air is supplied to the lifter port 68, because the piston rod 61 is locked by the wedge action, the piston rod 61 can be fixed so that it does not move downward in FIG. 4. However, even when air is supplied to the lifter port 68, the piston rod 61 can be moved upward in FIG. 4. When the piston rod 61 is moved upward in FIG. 4, the balls 87 that have entered between the piston rod 61 and the inclined surface 86a come off, and the lock by the wedge action is released and the piston rod 61 can be moved upward. In this manner, in the lifter part 90, a direction of movement of the piston rod 61 can be regulated to take place in only one direction by supplying air to the lifter port 68.

[0037] The operation of moving the piston rod 61 upward by driving the lifter part 90 by a distance equal to only the stroke of the lifter piston 85 thereby separating the package 45 from the winding drum 72 is performed to prevent a situation in which a yarn tension undesirably increases leading to a yarn discontinuation and the like when the spun yarn 10 accumulated on the slack removing roller 21 is about to run out and the like. By driving the lifter part 90 in this manner, the surface of the package 45 is separated by a small distance from the winding drum 72 whereby a winding speed of the package 45 is reduced leading to an increase in an amount of the spun yarn 10 accumulated on the slack removing roller 21.

[0038] The yarn joining cart 3 is explained below. The yarn joining cart 3 mainly includes, as shown in FIG. 2, a splicer (a yarn joining device) 43, a suction pipe (a second catching member) 44, the suction mouth (a first catching member) 46, a package braking part 30, and a package reverse-rotating part 36. As shown in FIG. 1, the yarn joining cart 3 can travel on a rail 41 that is fixed to the frame 6. When yarn breakage or yarn discontinuation occurs in a certain spinning unit 2, the yarn joining cart 3 moves to that spinning unit 2 by traveling on the rail 41, stops there, and performs yarn joining.

[0039] The suction mouth 46 catches a yarn end of the package 45 and guides it to the splicer 43. The suction mouth 46 is capable of pivoting vertically around a base end part 46a. A tapered suction part 46b (a tip end part) that extends in a pivoting direction of the suction mouth 46 is arranged on an opposite end part of the base end part 46a of the suction mouth 46. A width of the suction part 46b is about the same as a width of the package 45. A suction port 46c (see FIG. 6) for sucking air is arranged in one surface (an outer curved surface) of the suction part 46b that is located away from the base end part 46a. When the suction mouth 46 is pivoted around the base end part 46a and held at a sucking position (explained in detail later), a yarn end (a lower yarn) of the package 45 can be caught by suction with the suction port 46c. In this state, the yarn end can be guided to the splicer 43 by pivoting the suction mouth 46 in a reverse direction.

[0040] The suction pipe 44 catches a yarn end from the spinning device 9 and guides it to the splicer 43. More specifically, the suction pipe 44 is pivotable vertically around an axis and is capable of catching a yarn end (an upper yarn) fed from the spinning device 9 by suction and guiding it to the splicer 43.

[0041] The splicer 43 joins the yarn end (the upper yarn) caught and guided thereto by the suction pipe 44 and the yarn end (the lower yarn) caught and guided thereto by the suction mouth 46. Although an explanation about the detailed configuration of the splicer 43 is omitted herefrom, the splicer 43 performs the operation of joining the upper yarn and the lower yarn by twisting the yarn ends thereof with a swirling air current.

[0042] As shown in FIG. 2, the package braking part 30 includes a plate driving arm 31 and a package plate (a package contacting part) 32. The package plate 32 extends from a tip end part of the plate driving arm 31 in a pivoting direction of the plate driving arm 31. The plate driving arm 31 is pivotable around a support shaft. By pivoting the plate driving arm 31, the package plate 32 can be moved so as to contact the package 45 or separate from the package 45. The package plate 32 is an arcuate plate and can contact a wide area of the package 45. A brake can be applied (stopped) to the rotation of the package 45 by pivoting the plate driving arm 31 around the support shaft and causing the package plate 32 to contact the package 45.

[0043] The package reverse-rotating part 36 includes a reverse rotation arm 37 and a reverse rotation roller 38. The reverse rotation arm 37 is pivotable around a support shaft. By pivoting the reverse rotation arm 37, the reverse rotation roller 38 can be moved so as to contact the package 45 or separate from the package 45. The reverse rotation arm 37 includes a not-shown driving means. The reverse rotation roller 38 can be rotationally driven with this driving means in a direction that is opposite of the direction of rotation of the winding drum 72. By causing the reverse rotation roller 38 to contact the package 45 that has been separated from the winding drum 72, the package 45 can be driven in the reverse direction (that is, can be rotationally driven in a direction that is opposite of the direction in which the package 45

is rotationally driven by the winding drum 72).

[0044] An operation performed when a defect is detected in the spun yarn 10 in the spinning frame 1 according to the present embodiment is explained below with reference to FIGS. 2 to 11.

[0045] In a timing chart shown in FIG. 11, "suction mouth" represents a position of the suction mouth 46, "package plate" represents a position of the package plate 32, "lifter port" represents a supply state of the compressed air to the lifter port 68, "contact-pressure port" represents a supply state of the compressed air to the contact-pressure port 63, and "back-pressure port" represents a supply state of the compressed air to the back-pressure port 64. With respect to the "suction mouth", "sucking position" represents a position of the suction mouth 46 at which a catching operation is performed, and "retracted position" represents a position at which the suction mouth 46 is retracted from the sucking position. With respect to the "package plate", "separated position" represents a position at which the package plate 32 is separated from the package 45, and "contact position" represents a position at which the package plate 32 is in contact with the package 45.

[0046] During normal winding (the state shown in FIG. 2), as shown in FIG. 2, the package plate 32 is positioned at the separated position and no air is supplied to the back-pressure port 64 and the lifter port 68. When air is supplied to the contact-pressure port 63, the winding drum 72 contacts the package 45 at a predetermined contact pressure, whereby the spun yarn 10 is appropriately wound into the package 45.

[0047] When the yarn-defect detecting device 52 detects a defect in the spun yarn 10 during winding of the spun yarn 10, the yarn-defect detecting device 52 transmits a yarn-defect detection signal to the unit controller 92. Upon receiving the yarn-defect detection signal, the unit controller 92 causes the cutter 57 to immediately cut the spun yarn 10, and stops the operation of the drafting device 7, the spinning device 9, and the like.

[0048] The cut yarn end (the lower yarn) is wound into the rotating package 45 by the winding device 13. Because the defect detected by the yarn-defect detecting device 52 in the spun yarn 10 is present downstream of the cutter 57, a portion of the spun yarn 10 containing the defect is also once wound into the package 45.

[0049] The unit controller 92 controls, after stopping the operation of the drafting device 7, the spinning device 9, and the like, the solenoid valve 91 to connect the lifter port 68 to the compressed-air source for lifter 69, thereby starting supply of compressed air to the lifter port 68 (see a time point A in FIG. 11). The piston rod 61 moves upward by a distance equal to only the stroke of the lifter piston 85, whereby the cradle arm 71 is driven leftward in FIG. 2. In other words, the cradle arm 71 is driven so as to separate from the winding drum 72 by the lifter part 90 that is the driving mechanism. As a result, the package 45 is moved to a position that is separated by a small distance from the winding drum 72, whereby a rotational speed of the package 45 is reduced.

[0050] Subsequently, the unit controller 92 transmits a control signal to the yarn joining cart 3 to cause the yarn joining cart 3 to travel to the position of the spinning unit 2 to perform the yarn joining.

[0051] Subsequently, the unit controller 92 applies brake to the rotation of the package 45 by using the package plate 32 of the package braking part 30. Specifically, as shown in FIG. 5, the plate driving arm 31 is pivoted around the support shaft thereby causing the package plate 32 to be pressed against and contact the package 45. As a result, the rotation of the package 45 is stopped and the package 45 is held by the lifter part 90 at a position that is further away from the winding drum 72 than the position that is separated by the small distance from the winding drum 72. When the package 45 stops rotating, the package braking part 30 is returned to its original position (a position separated from the package 45). The package 45 is held at this position by the action of the lifter part 90 even if the package braking part 30 is returned to the position that is separated from the package 45.

[0052] Subsequently, the unit controller 92 precisely controls, to ensure the catching operation of catching the yarn end (the lower yarn) of the package 45 with the suction mouth 46, a positional relation between the surface of the package 45 and the suction mouth 46.

[0053] The yarn end cannot be caught surely if the surface of the package 45 and the suction mouth 46 are not positioned in an appropriate positional relation when catching the lower yarn with the suction mouth 46 by suction. It is preferable that the suction port 46c of the suction mouth 46 that sucks the yarn end is positioned exactly at a position that is separated by a predetermined distance from the surface of the package 45. If this distance is not accurate, the suction action with respect to the surface of the package 45 becomes unstable. However, there may be a dimension error in the winding device 13 and the like, moreover, the diameter of the yarn layer on the package 45 increases as the winding advances. Therefore, the surface of the package 45 cannot be positioned precisely only by separating the package 45 from the winding drum 72 with the package plate 32.

[0054] That is, when a hardness, a surface shape, and/or the like of the package 45 is uneven, the surface of the package 45 cannot be positioned accurately with the method of positioning the surface of the package 45 by pushing the package plate 32 between the package 45 and the winding drum 72.

[0055] In the present embodiment, a success rate of catching the yarn end is improved by precisely positioning the surface of the package 45 to the predetermined position with respect to the suction mouth 46.

[0056] A detailed explanation is given below. At first, the unit controller 92 causes the suction mouth 46 to pivot around the base end part 46a (in a counterclockwise direction in FIG. 5) from the retracted position and holds the suction mouth 46 in the sucking position (see a time

point B in FIG. 11). The "sucking position" represents a position of the suction mouth 46 that is suitable for performing the catching operation of catching the yarn end of the package 45 with the suction mouth 46.

[0057] Subsequently, the unit controller 92 controls the air cylinder 60 so as to drive the cradle arm 71 so that the package 45 moves in the approaching direction. Specifically, supply of the compressed air to the lifter port 68 is stopped (see a time point C in FIG. 11) while maintaining the state in which the compressed air is supplied to the contact-pressure port 63 and the back-pressure port 64. By setting the lifter port 68 in the open state in this manner, because the lock by the wedge action is released in the lifter part 90, the piston rod 61 moves downward, whereby the cradle arm 71 pivots rightward from its pivoting position shown in FIG. 5. When the cradle arm 71 pivots in this manner, as shown in FIG. 6, the surface of the package 45 contacts the suction mouth 46 that is in the sucking position. Because the compressed air is being supplied to the back-pressure port 64, the momentum of the cradle arm 71 achieved by the pivoting is weakened, and an impact generated when the package 45 contacts the suction mouth 46 can be softened.

[0058] As explained above, the suction part 46b of the suction mouth 46 is tapered and extends in the pivoting direction. The package 45 contacts the surface of the suction part 46b that is away from the base end part 46a. The suction port 46c is formed in this surface of the suction part 46b that is away from the base end part 46a. When the package 45 contacts the suction mouth 46, the suction port 46c contacts a surface of the package 45 (in other words, at least a part of the suction port 46c is closed by the surface of the package 45).

[0059] Subsequently, the unit controller 92 controls the air cylinder 60 so as to drive the cradle arm 71 so that the package 45 moves in the separating direction. Specifically, the air cylinder 60 is controlled to again supply the compressed air to the lifter port 68 (see a time point D in FIG. 11). With this action, the piston rod 61 is locked to the tapering member 86 by the above-mentioned wedge action, and the piston rod 61, the tapering member 86, and the lifter piston 85 integrally move upward in FIG. 4.

[0060] The position of the piston rod 61 in the air cylinder 60 in the state shown in FIG. 6 may vary depending on the diameter of the package 45, the hardness of the package 45, a dimension error in the winding device 13 of each spinning unit 2, and the like. In contrast, because a movement amount of the piston rod 61 when the compressed air is supplied to the lifter port 68 is equal to the stroke of the lifter piston 85, the movement amount is always constant. Accordingly, the cradle arm 71 pivots by only a predetermined pivoting amount leftward from its pivoting position shown in FIG. 6. When the cradle arm 71 is pivoted in this manner, the package 45 that is supported by the cradle arm 71 moves by only a predetermined distance in the separating direction from its state shown in FIG. 6 in which the surface of the package 45 is in contact with the suction part 46b (i.e., the suction port 46c) of the suction mouth 46, and the state of the package 45 changes to a separated state shown in FIG. 7 in which the package 45 is separated from the suction mouth 46. As a result, even if the catching operation is performed repeatedly, each time the surface of the package 45 is positioned precisely at the same position based on a state in which the surface of the package 45 and the suction mouth 46 are actually in contact with each other. Therefore, the control of keeping the distance between the suction port 46c and the surface of the package 45 constant can be reproduced with high precision.

[0061] Next, the unit controller 92 provides a control to start the yarn joining. At first, the unit controller 92 operates the drafting device 7, the spinning device 9, and the like again and restarts formation of the spun yarn 10. In parallel with the restarting of the spinning, the unit controller 92 causes the suction pipe 44 to pivot to a position near the downstream of the spinning device 9 as shown in FIG. 8, causes the suction pipe 44 to generate a suction air current, and provides a control to catch the yarn end (the upper yarn) fed from the spinning device 9. Next, the suction pipe 44 is pivoted downward while continuing the suction thereby pulling the spun yarn 10 from the spinning device 9 therewith and guiding it to the splicer 43.

[0062] Almost simultaneously with (or, before or after) the pivoting operation of the suction pipe 44, the unit controller 92 causes the suction port 46c of the suction mouth 46, which is at the sucking position, to generate a suction air current. Almost simultaneously with the starting of the suction by the suction port 46c of the suction mouth 46, the reverse rotation arm 37 is pivoted to cause the reverse rotation roller 38 to contact the package 45 whereby the package 45 starts rotating in the reverse direction. When the suction mouth 46 is at the sucking position, a distance from the surface of the package 45 to the base end part 46a is longer than a distance from the suction port 46c to the base end part 46a. Therefore, the yarn end on the surface of the package 45 can be sucked favorably through the suction port 46c that is formed in the surface (the surface where the surface of the package 45 was in contact) of the suction part 46b that is away from the base end part 46a. With this operation, the yarn end (the lower yarn) is pulled from the outer peripheral surface of the reverse-rotating package 45, and the pulled yarn end is sucked and caught by the suction port 46c of the suction mouth 46. The spun yarn 10 including the defect can be removed from the package 45 when the spun yarn 10 including the defect is pulled from the package 45 and sucked with the suction mouth 46.

[0063] The catching operation including sucking and catching the yarn end of the package 45 with the suction mouth 46 is performed after a positional relation (distance) between the surface of the package 45 and the suction mouth 46 is adjusted based on the state in which the surface of the package 45 and the suction mouth 46 were in contact with each other. As a result, even if the

catching operation is performed repeatedly, each time the surface of the package 45 is positioned at the same position with respect to the suction mouth 46 (the suction port 46c) and the yarn end can be caught stably.

[0064] While continuing the reverse rotation of the package 45 by the reverse rotation roller 38, the suction mouth 46 that has sucked the lower yarn is pivoted upward so as to move to a yarn-joining guiding position, and then, the lower yarn is guided to the splicer 43. The reverse rotation of the package 45 is stopped after the lower yarn is guided to the splicer 43.

[0065] The splicer 43 joins the upper yarn and the lower yarn that are guided thereto. The spinning by the spinning device 9 is continued even while the yarn joining is being performed. Although the winding operation by the winding device 13 is stopped while the yarn joining is being performed, because the spun yarn 10 is continually fed from the spinning device 9 during this period, a slack of the spun yarn 10 occurs if no measure is taken. In this regard, the slack of the spun yarn 10 is prevented by winding the spun yarn 10 on the slack removing roller 21.

[0066] When the yarn joining by the splicer 43 is finished, the supply of the air to the lifter port 68 is stopped, whereby the lock of the piston rod 61 is released (see a time point E in FIG. 11). With this operation, the piston rod 61 is driven by the action of the compressed air supplied to the contact-pressure port 63, whereby the cradle arm 71 pivots in the direction in which the package 45 can contact the winding drum 72. With this operation, the package 45 and the winding drum 72 contact each other and winding of the spun yarn 10 is restarted. When the package 45 is caused to contact the winding drum 72, because the compressed air is being supplied to the back-pressure port 64, the momentum of the cradle arm 71 by the pivoting is weakened, and the impact generated when the package 45 contacts the winding drum 72 can be softened.

[0067] As explained the above, the spinning frame 1 according to the present embodiment includes the suction mouth 46, the cradle arm 71, the air cylinder 60, and the unit controller 92. The suction mouth 46 performs a catching operation of catching the yarn end of the package 45. The cradle arm 71 rotatably supports the package 45. Moreover, the cradle arm 71 movably supports the package 45 so that the package 45 is movable in both of the approaching direction in which the package 45 moves toward the suction mouth 46 and the separating direction in which the package 45 moves away from the suction mouth 46. The air cylinder 60 drives the cradle arm 71 to move the package 45 in both of the approaching direction and the separating direction. The unit controller 92 controls, after causing the suction mouth 46 to contact the surface of the package 45, the air cylinder 60 (the lifter part 90) to move the package 45 in the separating direction. The unit controller 92 provides a control so that the suction mouth 46 performs the catching operation in the state in which the surface of the package 45 and the suction mouth 46 are separated from each other.

[0068] With this operation, as shown in FIG. 6, because the surface of the package 45 and the suction mouth 46 are once caused to contact each other, and thereafter, the package 45 is moved in the separating direction as shown in FIG. 7, a precise control can be performed so that the positional relation between the surface of the package 45 and the suction mouth 46 becomes suitable for performing the catching operation.

[0069] In the spinning frame 1 according to the present embodiment, the unit controller 92 controls the air cylinder 60 (the lifter part 90) so that the package 45 is moved in the separating direction by only a predetermined distance from the state in which the surface of the package 45 is in contact with the suction mouth 46.

[0070] With this operation, based on the state in which the surface of the package 45 and the suction mouth 46 are in contact with each other, because the package 45 is separated from the suction mouth 46 by only the predetermined distance, even if the catching operation is performed repeatedly, each time the surface of the package 45 and the suction mouth 46 can be arranged with the positional relation therebetween suitable for performing the catching operation, and the yarn end can be caught stably.

[0071] The spinning frame 1 according to the present embodiment further includes the winding drum 72 that rotationally drives the package 45 while being in contact with the package 45. The unit controller 92 controls the air cylinder 60, after separating the package 45 from the winding drum 72, so that the surface of the package 45 contacts the suction mouth 46.

[0072] With this operation, because the surface of the package 45 and the suction mouth 46 are caused to contact each other after vibrations of the package 45 have been reduced by separating the package 45 from the winding drum 72, variation does not occur easily in the position at which the surface of the package 45 and the suction mouth 46 contact each other and based on which the positioning is performed.

[0073] The spinning frame 1 according to the present embodiment further includes the package reverse-rotating part 36 that rotationally drives the package 45 in the direction opposite to the direction in which the package 45 is rotationally driven by the winding drum 72 by contacting the package 45 that has been separated from the winding drum 72. Accordingly, the catching operation performed by the suction mouth 46 in the state in which the package 45 is separated from the winding drum 72 can be performed suitably.

[0074] The spinning frame 1 according to the present embodiment further includes the package plate 32 that brakes the rotation of the package 45 by being in contact with the package 45. The package plate 32 contacts the package 45 in a period from a time point at which the package 45 is separated from the winding drum 72 to a time point at which the package 45 contacts the suction mouth 46.

[0075] With this arrangement, because the surface of

the package 45 and the suction mouth 46 are caused to contact each other after the package 45 has stopped rotating, a rotational force of the package 45 is not conveyed to the suction mouth 46 even if the surface of the package 45 and the suction mouth 46 are in contact, whereby further variations do not occur easily in the position based on which the positioning is performed.

[0076] In the spinning frame 1 according to the present embodiment, the cradle arm 71 is driven by the air cylinder 60 (the lifter part 90) in both of the approaching direction and the separating direction.

[0077] With this arrangement, the motion of the cradle arm 71 that is driven by the air cylinder 60 including the lifter part 90 is softened by a spring action of the air, the impact generated when the package 45 contacts the suction mouth 46 is softened, and the possibility of occurrence of variations in the position based on which the positioning is performed is reduced. Moreover, the suction mouth 46 can be prevented from being broken due to the impact at the time of contact with the package 45.

[0078] In the spinning frame 1 according to the present embodiment, the unit controller 92 controls the air cylinder 60 (the lifter part 90) to reduce the winding speed of the package 45 by causing the package 45 to move away from the winding drum 72.

[0079] With this arrangement, the configuration of the spinning frame 1 can be made simple as no special mechanism is required to adjust the position of the package 45.

[0080] The spinning frame 1 according to the present embodiment is configured as explained below. The suction mouth 46 includes the base end part 46a as the pivoting center and the suction part 46b having a shape that extends in the pivoting direction. The suction port 46c for catching the yarn end by suction is arranged on one surface of the suction part 46b that is away from the base end part 46a. When catching the yarn end with the suction port 46c, the distance from the base end part 46a to the package 45 is longer than the distance from the base end part 46a to the suction port 46c.

[0081] With this arrangement, the surface of the package 45 and the suction port 46c of the suction mouth 46 are arranged facing each other whereby the catching of the yarn end by the suction action can be surely performed.

[0082] In the spinning frame 1 according to the present embodiment, the unit controller 92 controls the air cylinder 60 (the lifter part 90) so that the surface of the package 45 contacts the surface of the suction part 46b of the suction mouth 46 in which the suction port 46c has been formed.

[0083] With this operation, by separating the package 45 in the separating direction by a small distance from the state in which the surface of the package 45 and the suction mouth 46 are in contact, un-wasted operation can be realized as the suction to catch the yarn end in the state shown in FIGS. 7 and 8 can be started immediately.

[0084] The spinning frame 1 according to the present embodiment further includes a plurality of spinning units 2 and the yarn joining cart 3. Each spinning unit 2 includes the cradle arm 71 and the air cylinder 60. The yarn joining cart 3 is capable of traveling (moving) with respect to each of the plurality of spinning units 2 and performing the catching operation in each spinning unit 2. The suction mouth 46 is arranged in the yarn joining cart 3.

[0085] With this arrangement, even if a variation occurs in the position of the surface of the package 45 in each spinning unit 2, the surface of the package 45 and the suction mouth 46 are once caused to contact each other, and the positional relation between the surface of the package 45 and the suction mouth 46 can be precisely controlled by using this state as a reference. Therefore, even if one suction mouth 46 is shared by the plurality of spinning units 2, the yarn end can be surely caught in each of the plurality of spinning units 2.

[0086] The spinning frame 1 according to the present embodiment includes the spinning device 9, the suction pipe 44, and the splicer 43. The suction pipe 44 catches and guides the yarn end from the spinning device 9. The splicer 43 joins the yarn end caught by the suction mouth 46 and the yarn end caught by the suction pipe 44.

[0087] With this arrangement, a precise control can be performed so that the positional relation between the surface of the package 45 and the suction mouth 46 when performing the catching operation becomes suitable for performing the catching operation whereby the yarn end of the package 45 can be surely caught by the suction mouth 46. As a result, the yarn joining by the splicer 43 can be performed smoothly.

[0088] Exemplary embodiments of the present invention are explained above. The configuration explained above can, however, be modified as explained below.

[0089] In the above embodiment, the package 45 and the suction mouth 46 are caused to contact each other by pivoting both the package 45 and the suction mouth 46. However, the present invention is not limited to this configuration. For example, in an alternative configuration, the suction mouth 46 and the package 45 can be caused to contact each other by pivoting only the suction mouth 46, and then the lifter part 90 can be driven to move the package 45.

[0090] Moreover, in the above embodiment, by using the fact that the stroke of the lifter piston 85 is constant, the movement of the cradle arm 71 is controlled so that the suction port 46c and the surface of the package 45 are separated from each other by the predetermined distance. However, in an alternative configuration, a sensor (e.g., a potentiometer) that detects an inclination of the cradle arm 71 can be provided. This sensor can be used to control the movement of the cradle arm 71 so that the suction port 46c and the surface of the package 45 are separated from each other by the predetermined distance based on an inclination detected by this sensor in the state in which the surface of the package 45 and the suction mouth 46 were in contact with each other.

[0091] The cradle arm 71 can be driven by a fluid-pres-

sure cylinder (e.g., an oil-pressure cylinder) instead of the air cylinder 60. In an alternative configuration, the cradle arm 71 can be driven by any other actuator (e.g., an electric motor).

[0092] The package braking part 30 (the package plate 32) can be omitted.

[0093] In the above embodiment, the spinning device 9 is arranged above the cradle arm 71 (the winding device 13), and the spun yarn 10 travels downward in the spinning unit 2. However, a configuration of a textile machine to which the present invention is applied is not limited to this configuration. The present invention can similarly be applied to a textile machine in which the yarn supplying section that supplies the yarn is arranged below the cradle arm (the winding device) and the yarn travels upward. The yarn supplying section is a structural component that supplies the yarn to the package and can include a yarn supplying bobbin on which the yarn has been wound, and the like.

[0094] In the above embodiment, the suction mouth 46 is arranged in the yarn joining cart 3. However, a configuration of a textile machine to which the present invention is applied is not limited to this configuration. That is, the suction mouth 46 can be arranged in each spinning unit 2.

[0095] In the above embodiment, the present invention is applied to the spinning frame (an air spinning frame) 1. However, the present invention can similarly be applied to other textile machines such as an open-end spinning frame and an automatic winder.

[0096] In the above embodiment, the splicer is used as the yarn joining device; however, the present invention is not limited to this configuration. That is, in an alternative configuration, for example, a knotter and the like can be used as the yarn joining device.

[0097] In the above embodiment, the spun yarn 10 is fed from the spinning device 9 to the yarn feeding device 11. However, a configuration of a textile machine according to the present invention is not limited to this configuration. For example, the yarn feeding device 11 can be omitted (that is, the yarn feeding device 11 is not provided), and the spun yarn 10 can be pulled from the spinning device 9 by using the slack removing roller 21.

[0098] In the above embodiment, the spun yarn 10 is cut by the cutter 57 upon detection of the yarn defect. However, a configuration of a textile machine according to the present invention is not limited to this configuration. For example, the cutter 57 can be omitted (that is, the cutter 57 is not provided), and the spun yarn 10 can be cut by stopping the spinning operation by the spinning device 9.

[0099] In the above embodiment, a work cart is used as the yarn joining cart 3; however, it is sufficient that the work cart includes the first catching member. Moreover, the work cart can be caused to move with respect to a limited number of the winding units, e.g., two winding units.

[0100] In the above embodiment, as shown in FIG. 11, the supply of the compressed air to the back-pressure port 64 is started at a timing at which the package plate 32 is caused to contact the package 45; however, the supply of the compressed air to the back-pressure port 64 can be started at a timing that is little before the time point at which the package 45 is caused to contact the winding drum 72 (a timing little before the time point E in FIG. 11).

[0101] In the above embodiment, the winding drum 72 of each spinning unit is connected to a not-shown electric motor via a driving shaft that is shared by a large number of the spinning units. In an alternative configuration, a separate driving means dedicated to one spinning unit can be arranged in each spinning unit and the winding drum 72 of each spinning unit can be driven with this driving means.

[0102] In the above embodiment, the surface of the package 45 and the suction mouth 46 are caused to contact after separating the package 45 from the winding drum 72. In an alternative configuration, the surface of the package 45 and the suction mouth 46 can be caused to contact without separating the package 45 from the winding drum 72. When this configuration is adopted, the winding drum 72 in each spinning unit is configured so as to rotate freely and separately, or a separate driving means is arranged in each spinning unit. Even in this configuration, as in the above embodiment, the unit controller (the controlling section) 92 controls the air cylinder (the driving mechanism) 60 so that the suction mouth (the first catching member) 46 performs the catching operation in the state in which the surface of the package 45 and the winding drum 72 are separated.

[0103] According to one aspect of the present invention, a textile machine includes a first catching member, a cradle arm, a driving mechanism, and a controlling section. The first catching member performs a catching operation of catching a yarn end of a package. The cradle arm rotatably supports the package and also movably supports the package so that the package is movable in a separating direction in which the package moves away from the first catching member. The driving mechanism drives the cradle arm to move the package in the separating direction. The controlling section controls the driving mechanism to move the package in the separating direction after causing a surface of the package and the first catching member to contact each other, and provides a control so that the first catching member performs the catching operation in the state in which the surface of the package and the first catching member are separated from each other.

[0104] With this operation, because the surface of the package and the first catching member are once caused to contact each other, and thereafter, the package is moved in the separating direction, a precise control can be performed so that the positional relation between the surface of the package and the first catching member becomes suitable for performing the catching operation.

[0105] In the above textile machine, it is preferable that the controlling section controls the driving mechanism so

that the package is moved in the separating direction by only a predetermined distance from the state in which the surface of the package is in contact with the first catching member.

[0106] With this arrangement, based on the state in which the surface of the package and the first catching member are in contact with each other, because the package is separated from the first catching member by only the predetermined distance, even if the catching operation is performed repeatedly, each time the surface of the package and the first catching member can be arranged with the positional relation therebetween suitable for performing the catching operation, and the catching operation can be performed stably.

[0107] It is preferable that the above textile machine further includes a winding drum that contacts the package and rotates while being in contact with the package and the package is movable by driving the cradle arm with the driving mechanism to a position at which the package is separated from the winding drum, and the controlling section controls the driving mechanism so that the first catching member performs the catching operation in the state in which the surface of the package and the winding drum are separated from each other.

[0108] In the above textile machine, it is preferable that the winding drum rotationally drives the package, and the controlling section controls the driving mechanism so that the surface of the package and the first catching member are caused to contact each other after the package is separated from the winding drum.

[0109] With this arrangement, because the surface of the package and the first catching member are caused to contact each other after vibrations of the package have been reduced by separating the package from the winding drum, variation does not occur easily in the position at which the surface of the package and the first catching member contact each other and based on which the positioning is performed.

[0110] It is preferable that the above textile machine further includes a package reverse-rotating part that rotationally drives the package in a direction opposite to the direction in which the package is rotationally driven by the winding drum by contacting the package that has been separated from the winding drum.

[0111] It is preferable that the above textile machine further includes a package contacting part capable of applying brake to rotation of the package by contacting the package, and the package contacting part contacts the package in a period from a time point at which the package is separated from the winding drum to a time point at which the package contacts the first catching member.

[0112] With this arrangement, because the surface of the package and the first catching member are caused to contact each other after the package has stopped rotating, a rotational force of the package is not conveyed to the first catching member even if the surface of the package and the first catching member are in contact, whereby further variations do not occur easily in the position based on which the positioning is performed.

[0113] In the above textile machine, it is preferable that the driving mechanism is an air cylinder.

[0114] With this arrangement, the motion of the cradle arm that is driven by the driving mechanism is softened by a spring action of the air, the impact generated when the package contacts the first catching member is softened, and the possibility of occurrence of variations in the position based on which the positioning is performed is reduced.

[0115] In the above textile machine, it is preferable that the first catching member includes a base end part as a pivoting center and a tip end part formed in a shape that extends in a pivoting direction. A suction port is formed in a surface of the tip end part that is away from the base end part. When catching the yarn end with the suction port, a distance from the base end part to the package is longer than a distance from the base end part to the suction port.

[0116] With this arrangement, the suction port of the first catching member and the surface of the package are arranged facing each other whereby the catching of the yarn end by the suction action can be surely performed.

[0117] In the above textile machine, it is preferable that the controlling section controls the driving mechanism, to reduce a winding speed of the package, so as to move the package away from the winding drum.

[0118] With this arrangement, because the same mechanism can be used to separate the package from the first catching member and separate the package from the winding drum, the configuration of the textile machine can be made simple.

[0119] In the above textile machine, it is preferable that the controlling section controls the driving mechanism so that the surface of the package contacts the surface in which the suction port is formed.

[0120] With this arrangement, by separating the package in the separating direction by a small distance from the state in which the surface of the package and the first catching member are in contact, un-wasted operation can be realized as the suction to catch the yarn end can be started immediately.

[0121] It is preferable that the above textile machine further includes a plurality of winding units and a work cart. The plurality of winding units each includes the cradle arm and the driving mechanism. The work cart is capable of moving with respect to each winding unit and performing the catching operation in each winding unit. Moreover, the first catching member is arranged in the work cart.

[0122] With this arrangement, even if a variation occurs in the position of the surface of the package in each winding unit, the surface of the package and the first catching member are once caused to contact each other, and the positional relation between the surface of the package and the first catching member can be precisely controlled by using this state as a reference. Therefore, even if one first catching member is shared by the plurality of winding

units, the yarn end can be surely caught in each of the plurality of winding units.

[0123] It is preferable that the above textile machine further includes a yarn supplying section, a second catching member, and a yarn joining device. The yarn supplying section supplies a yarn to the package. The second catching member catches and guides a yarn end from the yarn supplying section. The yarn joining device joins the yarn end caught by the first catching member to the yarn end caught by the second catching member.

[0124] With this arrangement, a precise control can be performed so that the positional relation between the surface of the package and the first catching member when performing the catching operation becomes suitable for performing the catching operation whereby the yarn end of the package can be surely caught by the first catching member. As a result, the yarn joining by the yarn joining device can be performed smoothly.

[0125] In the above explanation, the meaning of "a plurality of" also includes "a predetermined number of".

[0126] Although the invention has been explained 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 of the claims.

Claims

1. A textile machine (1) comprising:

a first catching member (46) that performs a catching operation of catching a yarn end of a package (45);
a cradle arm (71) that rotatably supports the package (45) and also movably supports the package so that the package is movable in a separating direction in which the package moves away from the first catching member (46);
a driving mechanism (60) that drives the cradle arm (71) to move the package in the separating direction; and
a controlling section (92) that controls the driving mechanism (60) to move the package (45) in the separating direction after causing a surface of the package (45) and the first catching member (46) to contact each other, and provides a control so that the first catching member (46) performs the catching operation in the state in which the surface of the package (45) and the first catching member (46) are separated from each other.

2. The textile machine (1) as claimed in Claim 1, wherein the controlling section (92) controls the driving mechanism (60) so that the package (45) is moved in the separating direction by only a predetermined distance from the state in which the surface of the package (45) is in contact with the first catching member (46).

3. The textile machine (1) as claimed in Claim 1 or 2, further comprising a winding drum (72) that contacts the package (45) and rotates while being in contact with the package and the package (45) is movable by driving the cradle arm (71) with the driving mechanism (60) to a position at which the package (45) is separated from the winding drum (72), wherein
the controlling section (92) controls the driving mechanism (60) so that the first catching member (46) performs the catching operation in the state in which the surface of the package (45) and the winding drum (72) are separated from each other.

4. The textile machine (1) as claimed in Claim 3, wherein
the winding drum (72) rotationally drives the package (45), and
the controlling section (92) controls the driving mechanism (60) so that the surface of the package (45) and the first catching member (46) are caused to contact each other after the package (45) is separated from the winding drum (72).

5. The textile machine (1) as claimed in Claim 4, further comprising a package reverse-rotating part (36) that rotationally drives the package (45) in a direction opposite to the direction in which the package (45) is rotationally driven by the winding drum (72) by contacting the package that has been separated from the winding drum.

6. The textile machine (1) as claimed in Claim 4 or 5, further comprising a package contacting part (32) capable of applying brake to rotation of the package (45) by contacting the package, wherein
the package contacting part (32) contacts the package (45) in a period from a time point at which the package is separated from the winding drum (72) to a time point at which the package contacts the first catching member (46).

7. The textile machine (1) as claimed in any one of Claims 4 to 6, wherein the controlling section (92) controls the driving mechanism (60), to reduce a winding speed of the package (45), so as to move the package away from the winding drum (72).

8. The textile machine (1) as claimed in any one of Claims 1 to 7, wherein the driving mechanism (60) is an air cylinder.

9. The textile machine (1) as claimed in any one of

Claims 1 to 8, wherein
the first catching member (46) includes a base end part (46a) as a pivoting center and a tip end part (46b) formed in a shape that extends in a pivoting direction,
a suction port (46c) is formed in a surface of the tip end part (46a) that is away from the base end part (46b), and
when catching the yarn end with the suction port (46c), a distance from the base end part (46b) to the package (45) is longer than a distance from the base end part (46b) to the suction port (46c).

10. The textile machine (1) as claimed in Claim 9, wherein the controlling section (92) controls the driving mechanism (60) so that the surface of the package (45) contacts the surface in which the suction port (46c) is formed.

11. The textile machine (1) as claimed in any one of Claims 1 to 10, further comprising:

a plurality of winding units (2) each including the cradle arm (71) and the driving mechanism (60), and
a work cart (3) capable of moving with respect to each winding unit (2) and performing the catching operation in each winding unit, wherein the first catching member (46) is arranged in the work cart (3).

12. The textile machine (1) as claimed in any one of Claims 1 to 11, further comprising:

a yarn supplying section (9) that supplies a yarn to the package (45),
a second catching member (44) that catches and guides a yarn end from the yarn supplying section (9), and
a yarn joining device (43) that joins the yarn end caught by the first catching member (46) to the yarn end caught by the second catching member (44).

FIG.1

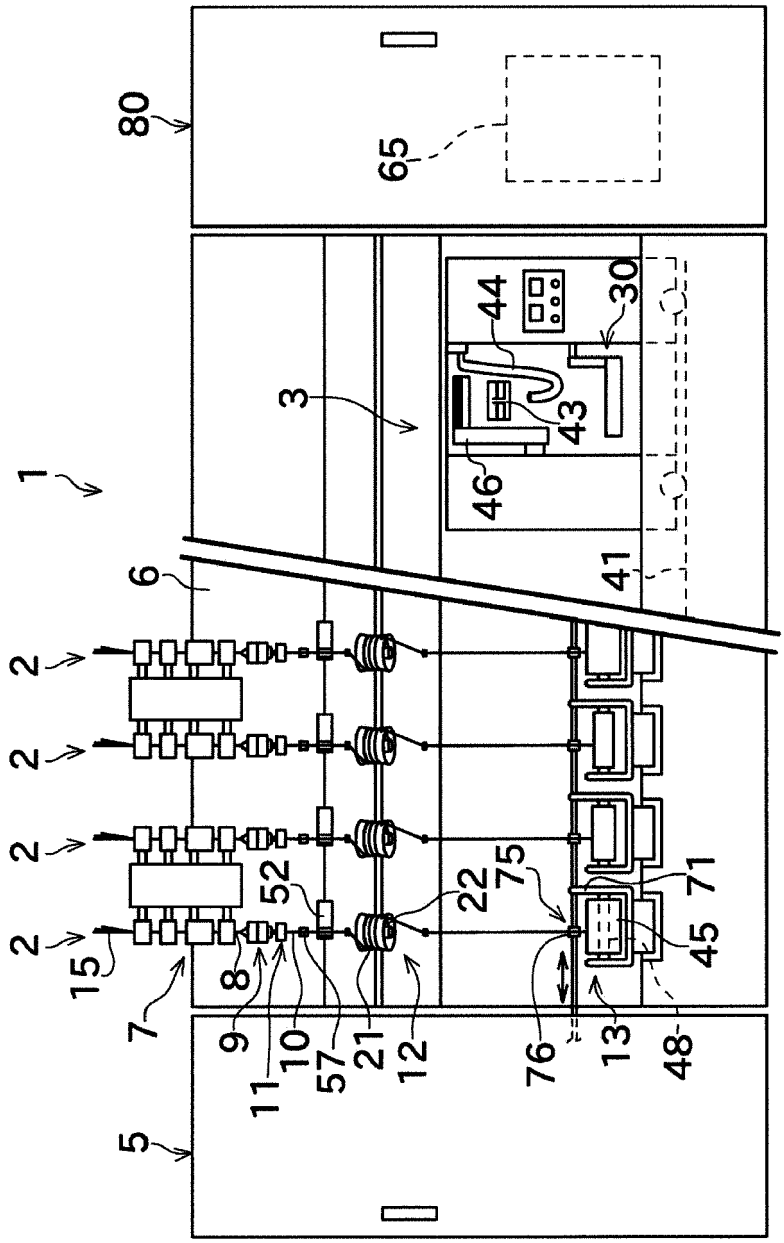
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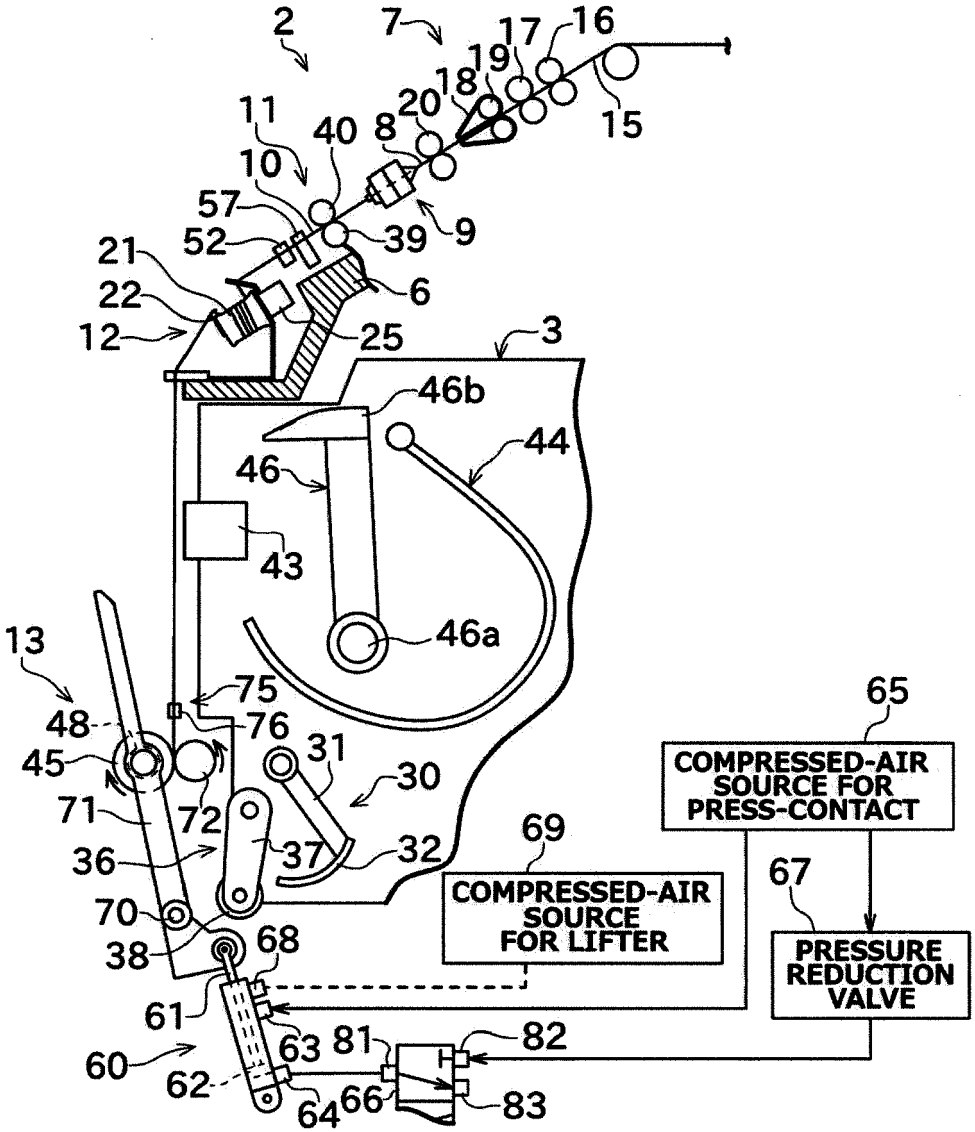
FIG.2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46b
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46
43
46a
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75
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48
76
31
45
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71
72
37
32
69
36
COMPRESSED-AIR SOURCE FOR PRESS-CONTACT
67
70
COMPRESSED-AIR SOURCE FOR LIFTER
38
68
PRESSURE REDUCTION VALVE
61
63
81
82
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66
83

FIG.3

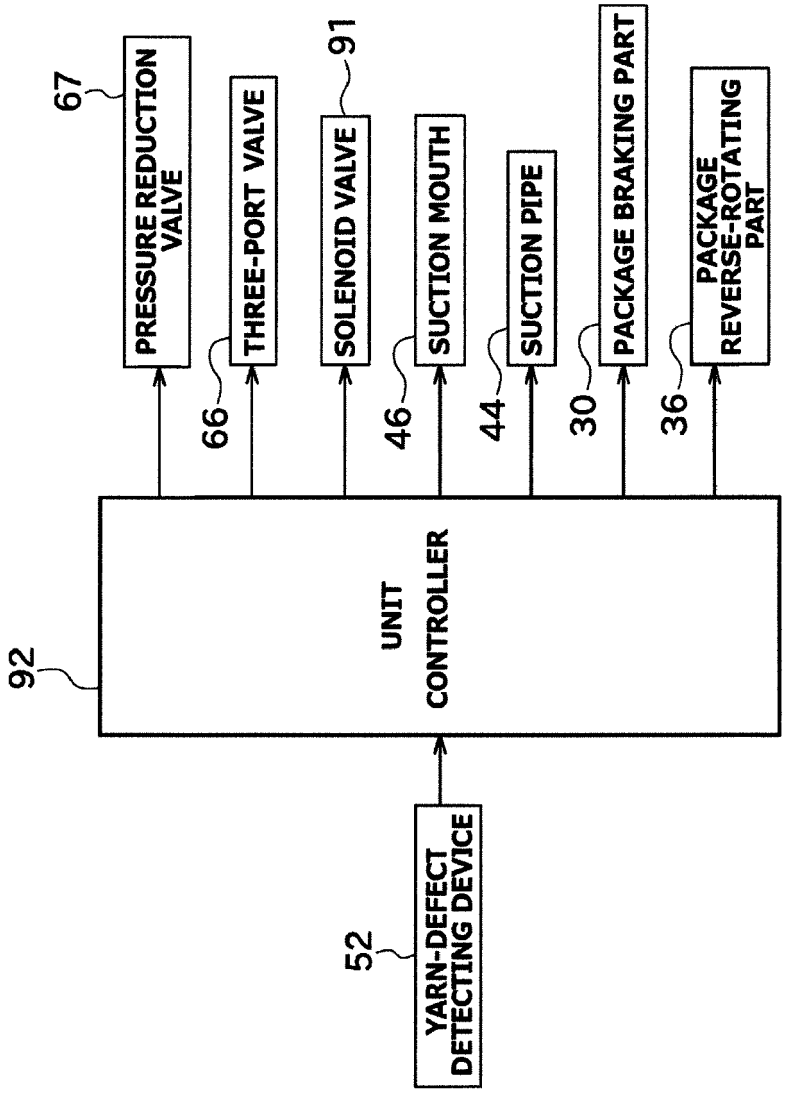

92
UNIT CONTROLLER
52
YARN-DEFECT DETECTING DEVICE
67
PRESSURE REDUCTION VALVE
66
THREE-PORT VALVE
91
SOLENOID VALVE
46
SUCTION MOUTH
44
SUCTION PIPE
30
PACKAGE BRAKING PART
36
PACKAGE REVERSE-ROTATING PART

FIG.4

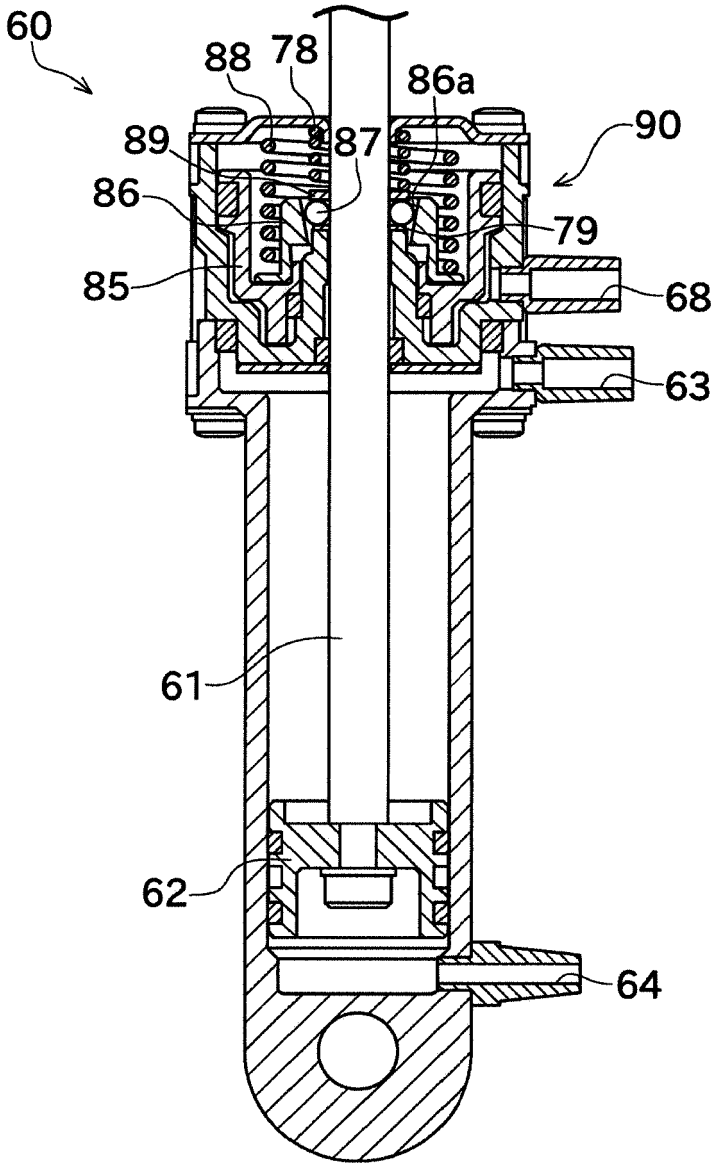
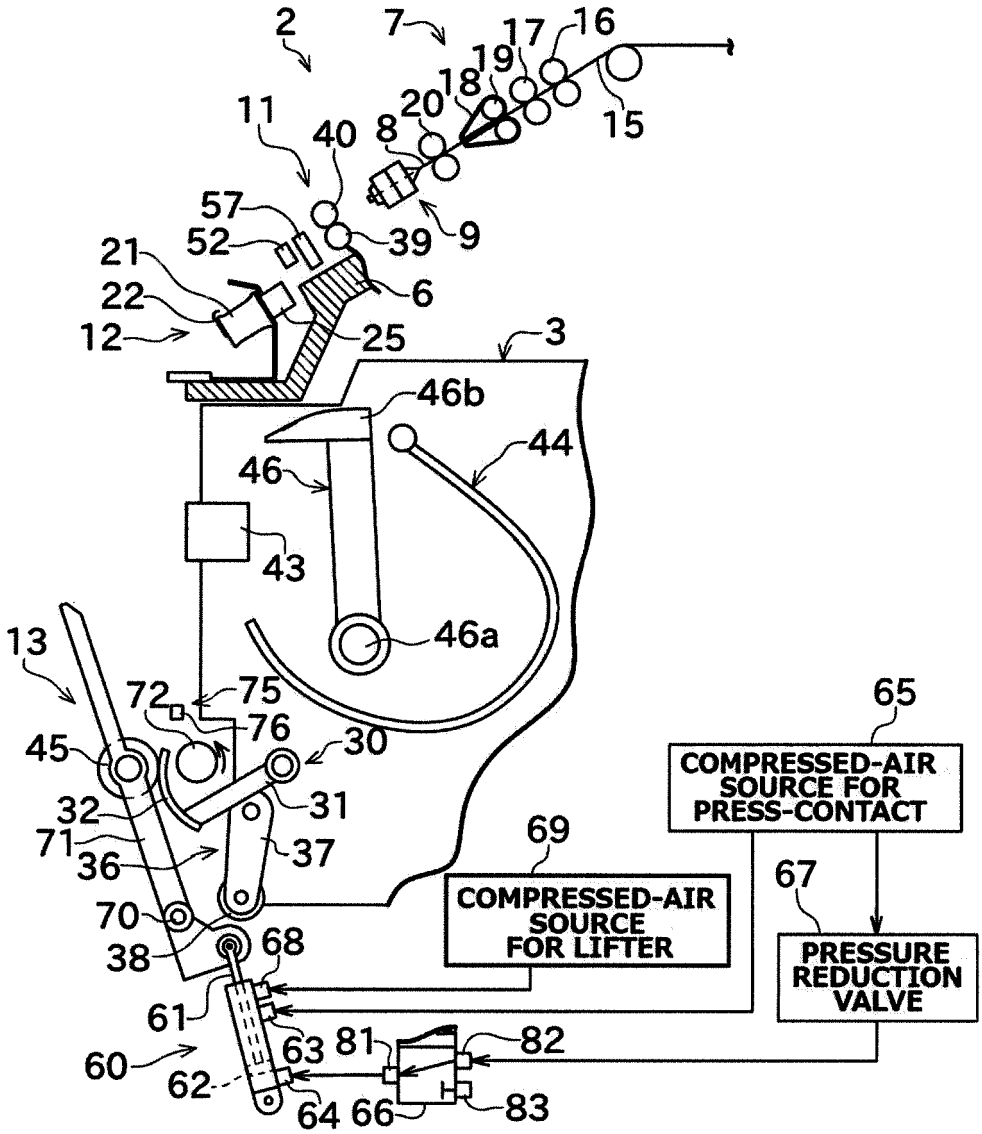


FIG.5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46b
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46a
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76
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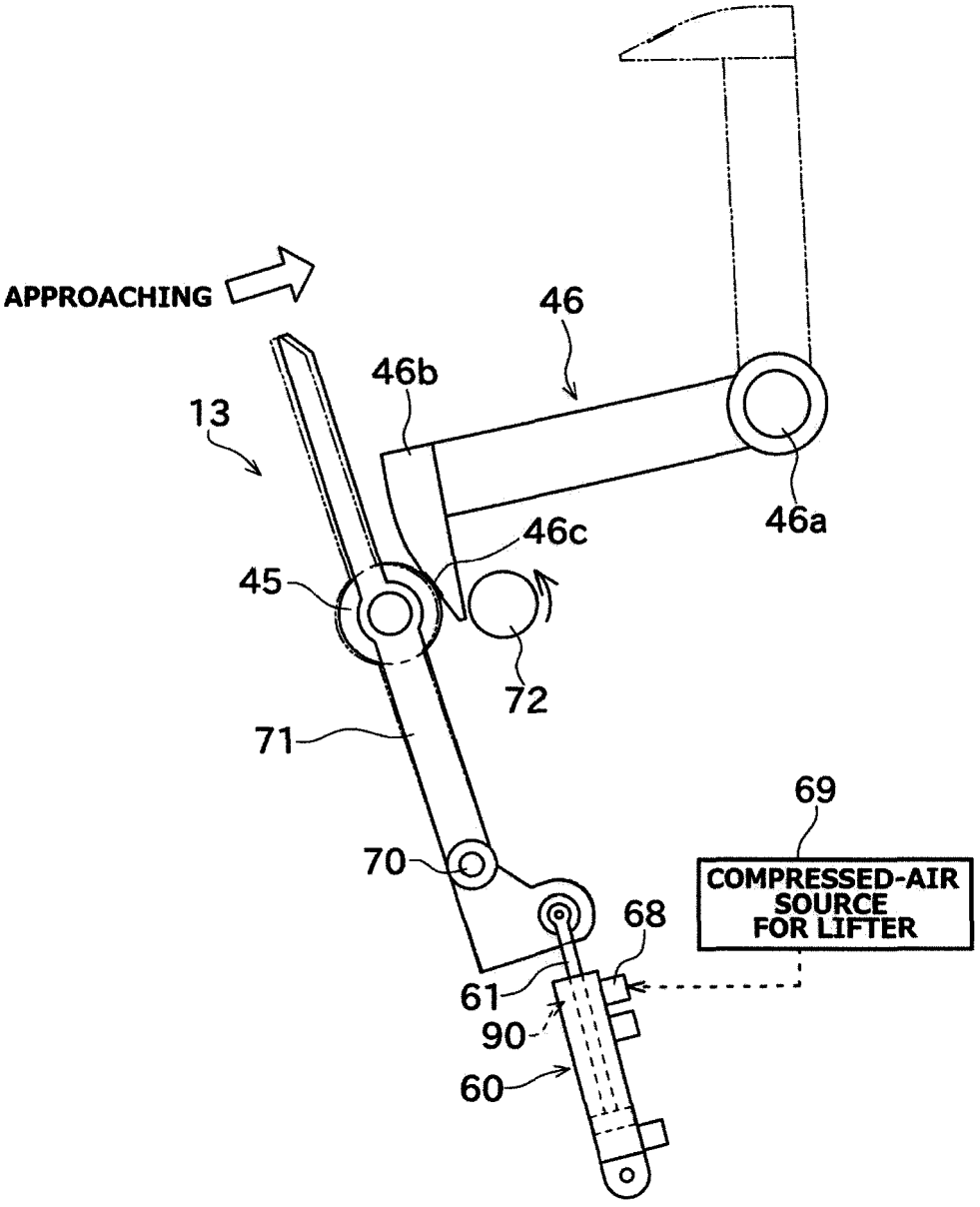
45
COMPRESSED-AIR SOURCE FOR PRESS-CONTACT
32
31
71
37
69
36
67
70
COMPRESSED-AIR SOURCE FOR LIFTER
68
38
PRESSURE REDUCTION VALVE
61
63
81
82
60
62
64
66
83

FIG.6


APPROACHING
46
46b
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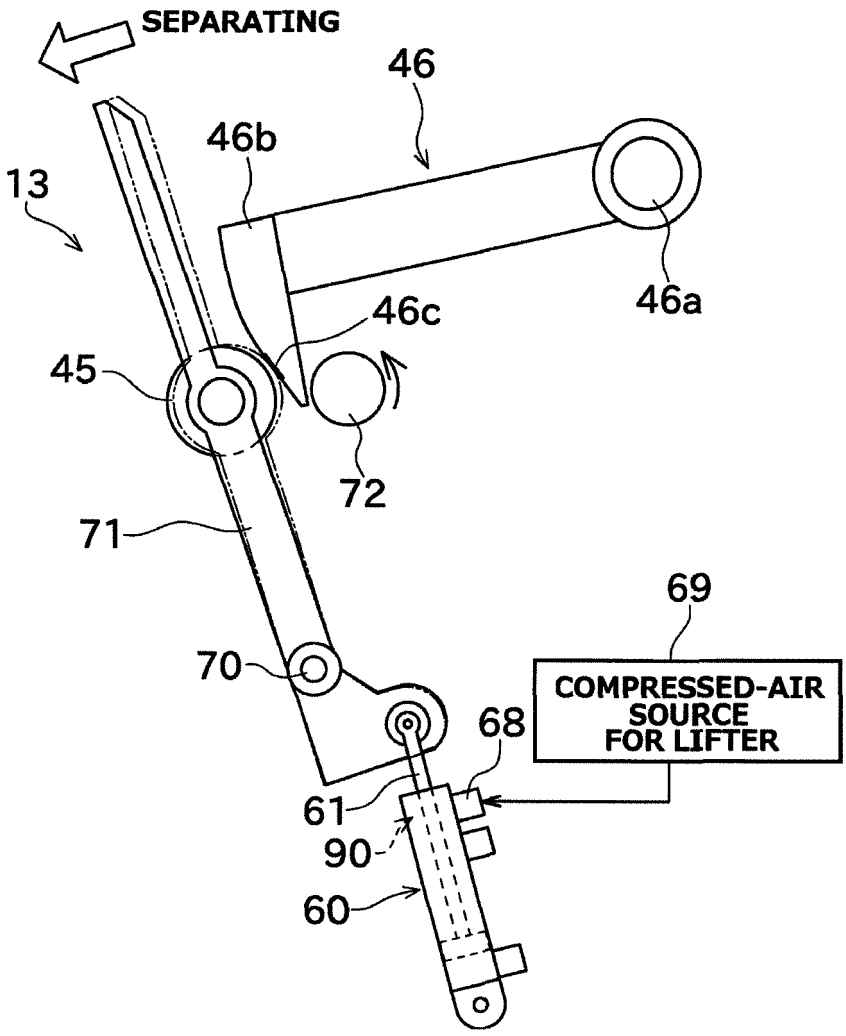
46a
46c
45
72
71
69
70
COMPRESSED-AIR SOURCE FOR LIFTER
68
61
90
60

FIG.7


SEPARATING
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46b
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46c
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72
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COMPRESSED-AIR SOURCE FOR LIFTER
68
61
90
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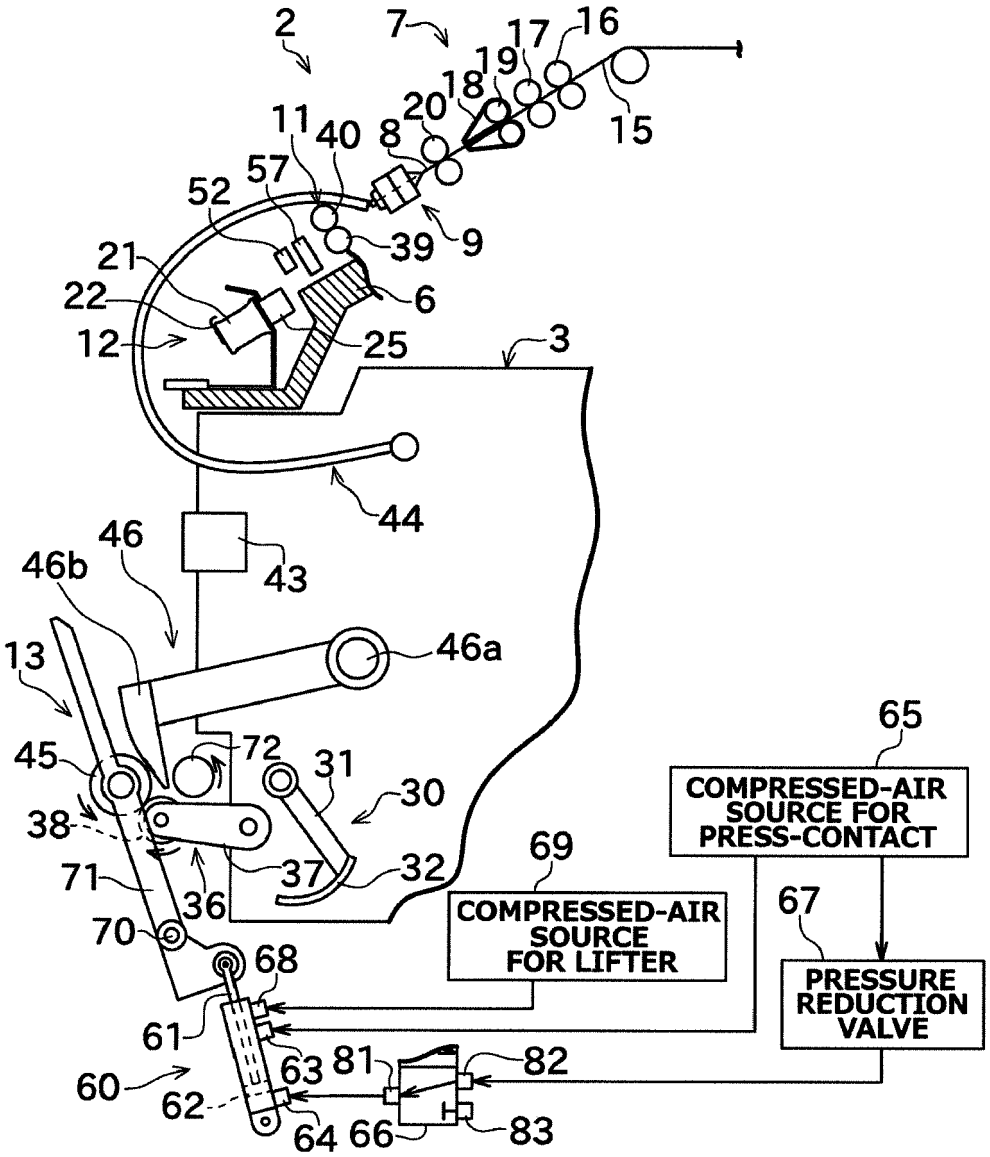
FIG.8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COMPRESSED-AIR SOURCE FOR PRESS-CONTACT
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COMPRESSED-AIR SOURCE FOR LIFTER
PRESSURE REDUCTION VALVE
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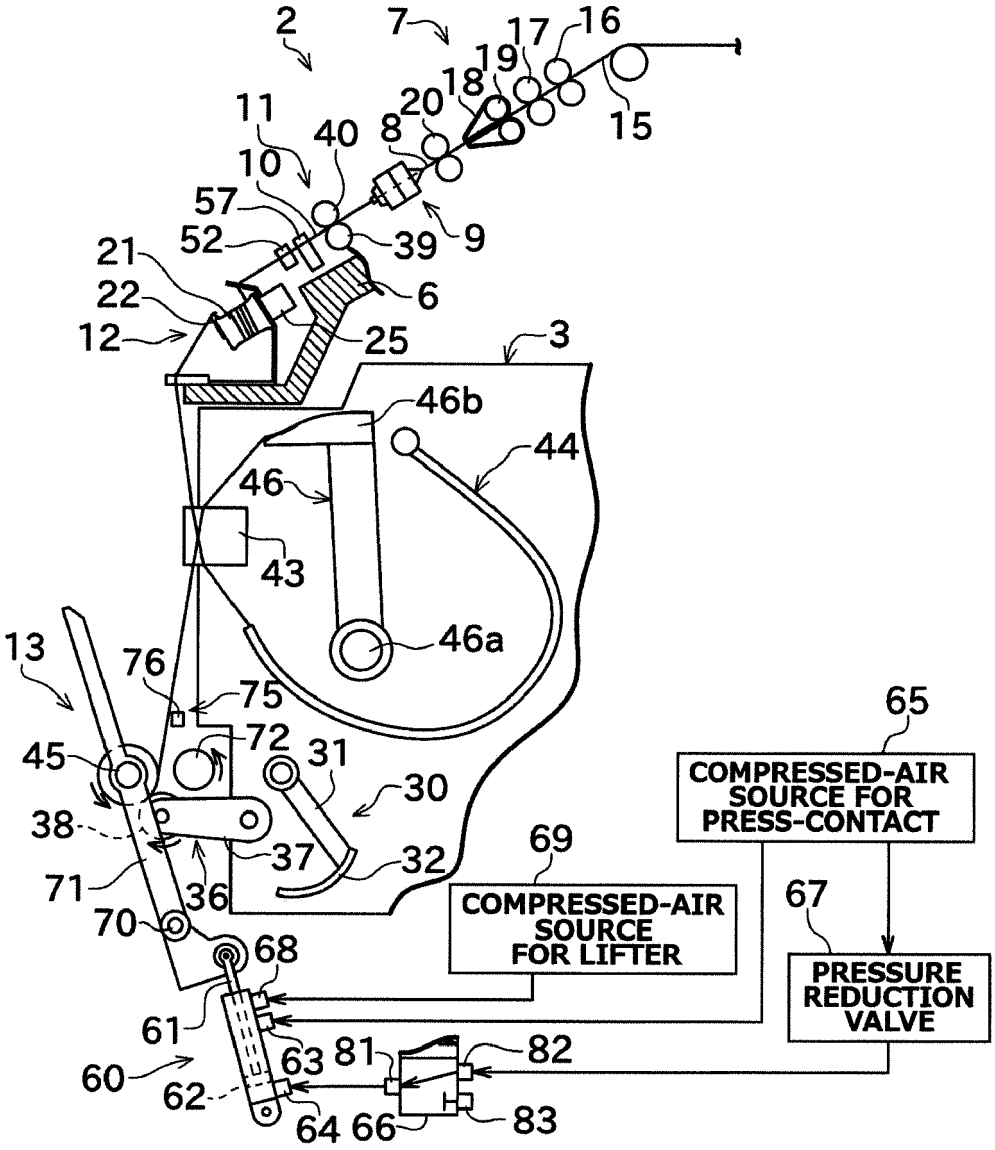
FIG.9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COMPRESSED-AIR SOURCE FOR PRESS-CONTACT
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COMPRESSED-AIR SOURCE FOR LIFTER
PRESSURE REDUCTION VALVE
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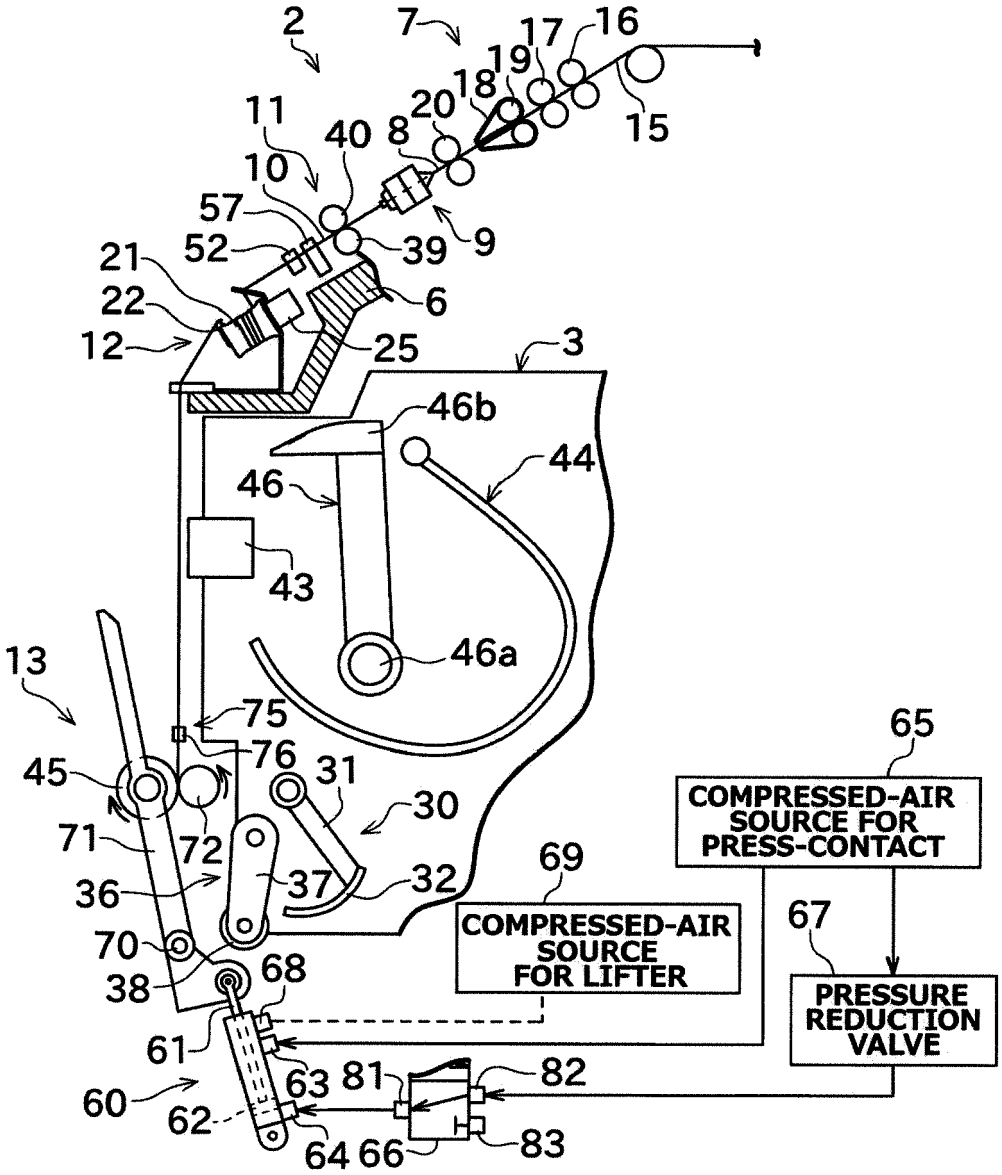
FIG.10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COMPRESSED-AIR SOURCE FOR PRESS-CONTACT
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COMPRESSED-AIR SOURCE FOR LIFTER
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PRESSURE REDUCTION VALVE
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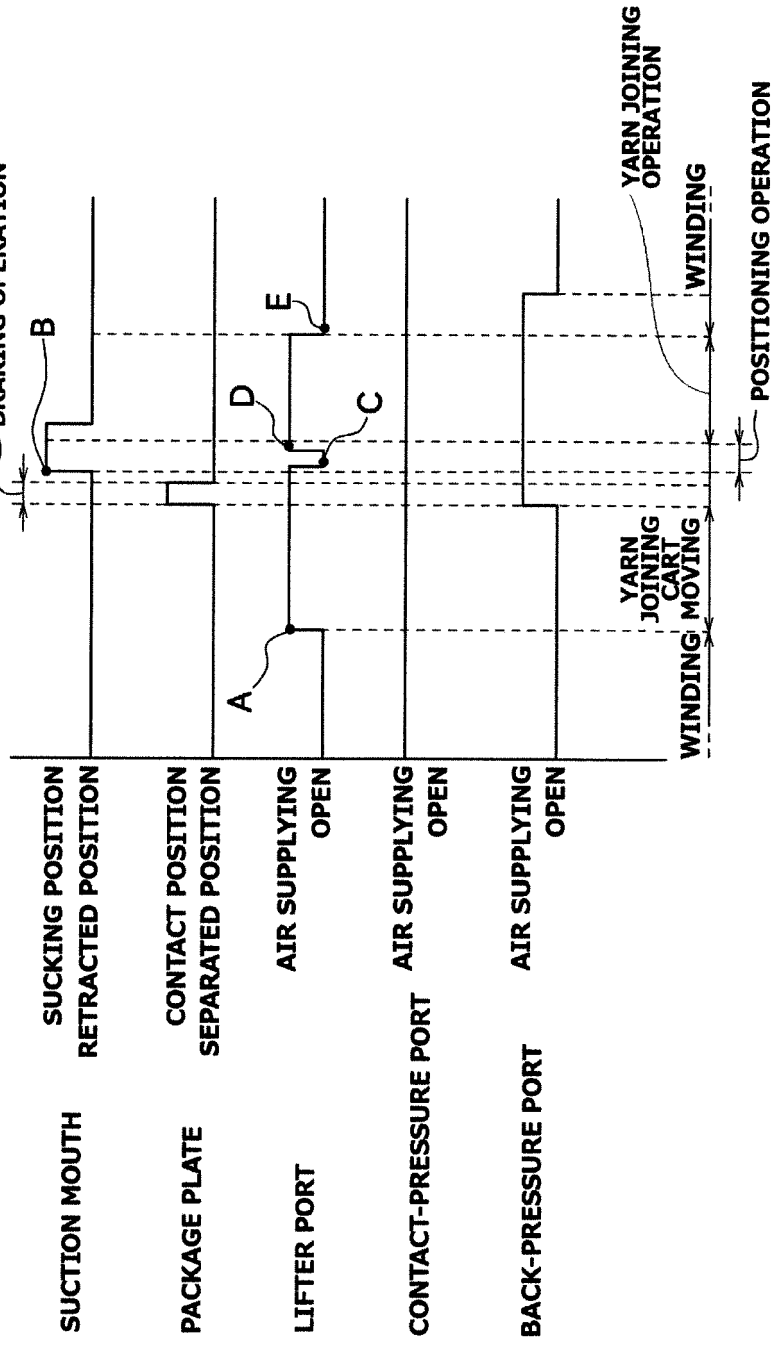
FIG.11


SUCTION MOUTH
SUCKING POSITION
RETRACTED POSITION
PACKAGE PLATE
CONTACT POSITION
SEPARATED POSITION
LIFTER PORT
AIR SUPPLYING
OPEN
CONTACT-PRESSURE PORT
AIR SUPPLYING
OPEN
BACK-PRESSURE PORT
AIR SUPPLYING
OPEN
A
B
C
D
E
BRAKING OPERATION
WINDING
YARN JOINING
CART
MOVING
YARN JOINING
OPERATION
WINDING
POSITIONING OPERATION

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EUROPEAN SEARCH REPORT

Application Number
EP 16 16 4026

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	JP 2010 189083 A (MURATA MACHINERY LTD) 2 September 2010 (2010-09-02) * abstract; figures 3-8 *	1-12	INV. B65H63/036 B65H67/08
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TECHNICAL FIELDS SEARCHED (IPC)

B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 August 2016	Pussemier, Bart

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25-08-2016

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- JP 2010189083 A **[0002] [0003] [0004] [0005]**