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

(11) EP 3 006 384 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
13.04.2016 Bulletin 2016/15

(51) Int Cl.:
B65H 54/26 *(2006.01)* ***B65H 67/04*** *(2006.01)*
B65H 67/06 *(2006.01)*

(21) Application number: **15186225.7**

(22) Date of filing: **22.09.2015**

(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

(30) Priority: **08.10.2014 JP 2014207325**

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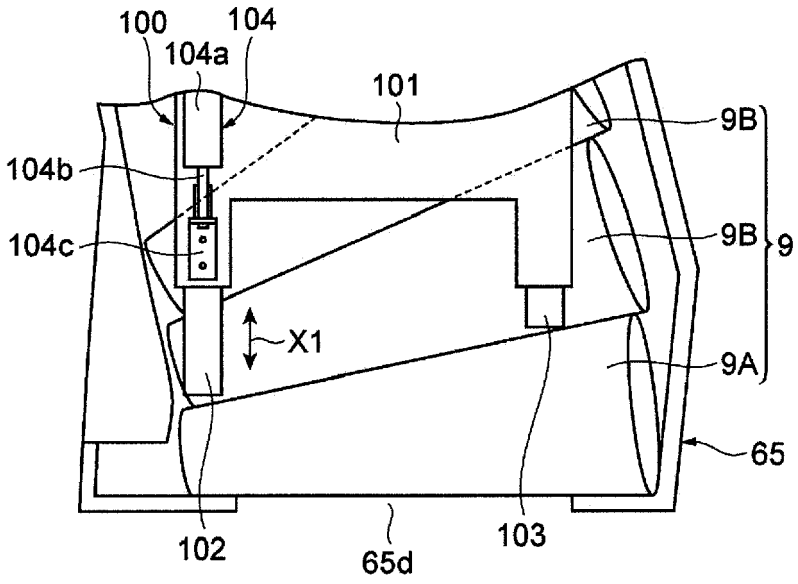
(54) BOBBIN SEPARATING DEVICE, DOFFING CART, AND YARN WINDING MACHINE

(57) A bobbin separating device (100) includes a first member (102) that is contactable with a downstream portion of a stock bobbin (9B) in an arrangement direction, a supporting member (101) that supports the first member (102) and moves between a standby position at which the first member (102) is separated from the stock bobbin (9B) and a separation position at which the first member (102) comes into contact with the downstream portion of the stock bobbin (9B) and separates a target bobbin (9A) and the stock bobbin (9B), and a driving mechanism (104) that moves the first member (102) with respect to the supporting member (101).

FIG.10



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention generally relates to a bobbin separating device, a doffing cart, and a yarn winding machine.

2. Description of the Related Art

[0002] Yarn winding machines that include plural winding units and a doffing cart that is movable with respect to the winding units are known in the art. Each of the winding units forms a package by winding a yarn on a bobbin. When the package is fully wound in a particular winding unit, the doffing cart moves to this winding unit, doffs the fully wound package, and supplies a new bobbin to the winding unit. The yarn winding machine further includes, for each winding unit, a bobbin stocker that stocks plural bobbins. The doffing cart includes a clamping device that can clamp a bobbin. The clamping device clamps, from among plural bobbins stocked in the bobbin stocker, the bobbin positioned at a discharge position, and supplies the clamped bobbin to the winding unit. Such a doffing cart is disclosed in, for example, Japanese Patent Application Laid-open No. 2013-63841 (Patent Document 1).

[0003] The doffing cart disclosed in Patent Document 1 includes a bobbin separating device that separates the bobbins. The bobbin separating device separates the bobbin positioned at the discharge position from the other bobbins in the bobbin stocker so that the clamping device can easily clamp the bobbin positioned at the discharge position.

SUMMARY OF THE INVENTION

[0004] Bobbins of different shapes (for example, diameter) may be used in different winding units of one yarn winding machine. There is a requirement for the bobbin separating device to appropriately separate the bobbin positioned at the discharge position from the other bobbins even if the shapes of the bobbins used in different winding units are different.

[0005] It is an object of the present invention to provide a bobbin separating device, a doffing cart, and a yarn winding machine capable of appropriately separating bobbins in accordance with the shapes of the bobbins to be separated.

[0006] According to an aspect of the present invention, a bobbin separating device that separates, out of two or more bobbins arranged with respect to a target position, a target bobbin positioned at the target position and a stock bobbin arranged with respect to the target position, at a position further upstream of the target bobbin in an arrangement direction includes a contacting member that is contactable with a downstream portion of the stock bobbin in the arrangement direction; a supporting member that supports the contacting member and moves between a standby position that is a position at which the contacting member is located away from the stock bobbin and a separation position that is a position at which the contacting member makes contact with the downstream portion of the stock bobbin and separates the target bobbin and the stock bobbin; and a driving mechanism that moves the contacting member with respect to the supporting member.

[0007] According to another aspect of the present invention, a doffing cart includes the above bobbin separating device and a clamping device that clamps the target bobbin that is separated from the stock bobbin.

[0008] According to still another aspect of the present invention, a yarn winding machine includes the above doffing cart and plural winding units each of which winds a yarn on the bobbin. Each of the winding units includes a traversing device that adjusts a traverse width of the yarn being wound on the bobbin.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a front view illustrating a general structure of an automatic winder according to an embodiment of the present invention.

FIG. 2 is a side view illustrating a general structure of a winding unit and a doffing cart shown in FIG. 1.

FIG. 3 is a top view of a bobbin stocker.

FIG. 4 is a drawing illustrating a general structure of a clamping device, a yarn clamping device, and an opener arranged in the doffing cart.

FIG. 5 is a perspective view illustrating a general structure of a bobbin separating device arranged in the doffing cart.

FIG. 6 is a schematic diagram illustrating a driving mechanism of the bobbin separating device, the clamping device, and the like.

FIG. 7 is a cross-sectional view illustrating a coupled state of the driving mechanism and a first member.

FIG. 8 is a schematic diagram illustrating the driving mechanism of the bobbin separating device, the clamping device, and the like.

FIG. 9A is a drawing illustrating the first member inserted between a target bobbin and a stock bobbin.

FIG. 9B is a drawing illustrating the target bobbin and the stock bobbin separated by the bobbin separating device.

FIG. 10 is a top view illustrating cone-shaped bobbins stocked in a bobbin stocker.

FIG. 11 is a top view illustrating cylindrical bobbins stocked in the bobbin stocker.

DETAILED DESCRIPTION

[0010] Exemplary embodiments of the present invention are explained in detail below with reference to the accompanying drawings. Identical elements are indicated by the same reference symbols in the drawings and redundant explanation thereof is omitted.

[0011] As shown in FIGS. 1 and 2, an automatic winder (yarn winding machine) 1 includes plural winding units 2, a bobbin supplying device 3, a doffing cart 6, a transporting device 12, and a control device 8. The plural winding units 2 are arranged side by side. The bobbin supplying device 3 supplies a yarn supplying bobbin B to each winding unit 2. The doffing cart 6 performs a doffing operation of a package P at each winding unit 2. The transporting device 12 transports the package P doffed by the doffing cart 6. The control device 8 controls various devices, such as the winding units 2 and the doffing cart 6, in the automatic winder 1. Moreover, the control device 8 manages the types of a bobbin 9 used for winding a yarn Y in each winding unit 2.

[0012] As shown in FIG. 2, the winding unit 2 winds on the bobbin 9 the yarn Y that is unwound from the yarn supplying bobbin B to form the package P. The winding unit 2 includes a cradle arm 21, a drum 22, and a traversing device 29. The cradle arm 21 rotatably supports the bobbin 9 at a position above the yarn supplying bobbin B. The drum 22 is rotatable while being in contact with a peripheral surface of the bobbin 9 or a peripheral surface of the package P. The package P is driven to rotate by the rotation of the drum 22. Accordingly, the yarn Y is wound into the package. At the start of winding of the yarn Y, the bobbin 9 is driven to rotate by the rotation of the drum 22. Accordingly, the yarn Y is wound on the bobbin 9. In an alternative configuration, the drum 22 can be driven to rotate by the rotation of the bobbin 9 (package P).

[0013] As shown in FIG. 2, the cradle arm 21 is movable between a winding position (position indicated by a solid line in FIG. 2) and a removal position (position indicated by a chain double-dashed line in FIG. 2). The winding position is a position at which the package P (bobbin 9 at the start of winding) makes contact with the drum 22. The removal position is a position at which the package P can be removed by the doffing cart 6. The cradle arm 21 has a pair of bobbin holders 23 (see FIG. 4) that hold the bobbin 9. Out of the pair of bobbin holders 23, one bobbin holder 23 is arranged so as to be movable in an axial direction of the drum 22. With this configuration, the cradle arm 21 can hold the bobbin 9 between the bobbin holders 23 or release the bobbin 9 held by the bobbin holders 23.

[0014] As shown in FIG. 2, the drum 22 is rotated by a driving motor 25. The driving motor 25 is controlled by a unit controller 24. The unit controller 24 can be arranged for a predetermined number of winding units 2 or a separate unit controller 24 can be arranged for each winding unit 2. The unit controller 24 is communicably connected to the control device 8. The unit controller 24 can obtain from the control device 8 conditions (information such as a length of the yarn Y wound on the package P or a diameter of the package P) which when satisfied mean that the package P is fully wound. Moreover, the unit controller 24 obtains from the control device 8 the type of the bobbin 9 that is to be used by the winding unit 2 during winding of the yarn Y.

[0015] The traversing device 29 is arranged at a position further upstream than the drum 22 in a movement direction of the yarn Y. The traversing device 29 can adjust a traversing width of the yarn Y when the yarn is wound on the bobbin 9 or the package P. In the present embodiment, the traversing device 29 is an arm-type traversing device. The traversing device 29 includes a traversing arm 29a and a driving motor 29b. The base end of the traversing arm 29a is coupled to the driving motor 29b. The driving motor 29b causes the distal end of the traversing arm 29a to swing while the yarn Y has been guided to the distal end of the traversing arm 29a. With this action, the traversing device 29 traverses the yarn Y being wound on the bobbin 9 or the package P. In the traversing device 29, the traversing width can be adjusted by adjusting a width by which the distal end of the traversing arm 29a is swung by the driving motor 29b. The width by which the driving motor 29b causes the distal end of the traversing arm 29a to swing is controlled by the unit controller 24. The unit controller 24 controls the width by which the distal end of the traversing arm 29a is to be swung in accordance with, for example, the type (for example, the length) of the bobbin 9. The control of the traversing device 29 can be performed by a device other than the unit controller 24. For example, a traverse controller dedicated to controlling the traversing device 29 can be used for controlling the traversing device 29.

[0016] The winding unit 2 includes a yarn joining device 26, a yarn monitoring device 27, a not shown lower yarn catching section, and a not shown upper yarn catching section. The yarn joining device 26 and the yarn monitoring device 27 are arranged at positions further upstream than the traversing device 29 in the movement direction of the yarn Y. The yarn monitoring device 27 monitors information pertaining to the running yarn Y, and detects presence/absence of a yarn defect based on the monitored information. Upon detecting a yarn defect, the yarn monitoring device 27 cuts the yarn Y with a yarn cutting section 27a. When performing yarn joining of the yarn Y from the yarn supplying bobbin B and the yarn Y from the package P, the lower yarn catching section sucks and catches the end of the cut yarn Y from the yarn supplying bobbin B and guides it to the yarn joining device 26. The upper yarn catching section sucks and catches the end of the cut yarn Y from the package P and guides it to the yarn joining device 26. The yarn joining device 26 joins together the yarns Y guided by the upper yarn catching section and the lower yarn catching section.

[0017] As shown in FIGS. 1 and 2, each winding unit

2 includes a bobbin stocker 65 that can stock plural bobbins 9. The bobbin stocker 65 is fixed to a machine frame 61 at a position above the winding unit 2.

[0018] As shown in FIG. 3, the bobbin stocker 65 includes a loading member 65a and a pair of supporting pieces 65c. Plural bobbins 9 can be loaded on the loading member 65a. FIG. 3 shows a situation where only one bobbin 9 is loaded on the bobbin stocker 65. As shown in FIG. 2, the loading member 65a is tilted with respect to the horizontal direction such that the end thereof toward the doffing cart 6 side is situated at a lower level than the other end thereof. The doffing cart 6 side is the side where the doffing cart 6 travels. When indicating directions in the following explanation, the doffing cart 6 side with respect to the bobbin stocker 65 shall be called the "front side" and the bobbin stocker 65 side with respect to the doffing cart 6 shall be called the "back side".

[0019] As shown in FIGS. 2 and 3, a removal opening 65d is arranged on the front side of the loading member 65a. The removal opening 65d is arranged such that a bobbin 9 that is arranged closest to the doffing cart 6 side (front side) can be taken out in a downward direction. The pair of supporting pieces 65c is attached to the loading member 65a. The supporting pieces 65c extend inside the removal opening 65d. The supporting pieces 65c are pressed in an upward direction by not shown coil springs. The supporting pieces 65c support the bobbin 9 from the bottom so that the bobbin 9 loaded on the loading member 65a will not fall down through the removal opening 65d.

[0020] Among the bobbins 9 loaded on the loading member 65a, the bobbin 9 that is closest to the doffing cart 6 side shall be called a target bobbin 9A. The target bobbin 9A is a bobbin that is supported by the supporting pieces 65c. The position of the target bobbin 9A in the loading member 65a shall be called a target position. The bobbins 9 loaded on the loading member 65a are arranged with respect to the target position. All the bobbins 9 loaded on the loading member 65a except the target bobbin 9A shall be called stock bobbins 9B. The stock bobbins 9B are the bobbins 9 that are arranged with respect to the target position at positions further upstream than the target bobbin 9A in an arrangement direction. The arrangement direction of the bobbins 9 is a direction in which the bobbins 9 loaded on the loading member 65a move toward the target position (direction indicated by an arrow W in FIG. 2).

[0021] As shown in FIGS. 2 and 4, the doffing cart 6 runs above the winding unit 2 along a rail 7 arranged on the machine frame 61 of the automatic winder 1. When the package P of the winding unit 2 is fully wound, the doffing cart 6 stops at a predetermined position that is predetermined with respect to the winding unit 2 in which the package P has been fully wound and performs the doffing operation. Once the doffing operation is over, the doffing cart 6 supplies a new bobbin 9 to the winding unit 2. The doffing cart 6 includes a yarn clamping device 62, an opener 63, a clamping device 66, and a bobbin separating device 100.

[0022] The opener 63 opens/closes the cradle arm 21 during the doffing operation. The opener 63 includes an open lever 63b and an open hand 63c. The open lever 63b swings about a shaft 63a. The open hand 63c is attached to the distal end of the open lever 63b and makes contact with a cradle lever 21a when the open lever 63b is swung. The cradle arm 21 moves between the winding position and the removal position by the swinging of the open lever 63b with the open hand 63c making contact with the cradle arm 21.

[0023] The clamping device 66 clamps the target bobbin 9A stocked in the bobbin stocker 65 and transports the clamped target bobbin 9A to the cradle arm 21. In further detail, the clamping device 66 clamps the target bobbin 9A stocked in the bobbin stocker 65 and moves the target bobbin 9A downward. The clamping device 66 includes a clamping member 66a at the tip thereof and clamps the target bobbin 9A with the clamping member 66a. During this action, the clamping device 66 pushes the target bobbin 9A downward with a force that is stronger than the pressing force of the coil springs that press the supporting pieces 65c. With this action, the positions of the supporting pieces 65c change, allowing the target bobbin 9A to pass through the removal opening 65d. The clamping device 66 places the bobbin 9A, which is taken out from the bobbin stocker 65 through the removal opening 65d, between the bobbin holders 23 of the cradle arm 21.

[0024] The yarn clamping device 62, by extending, contracting, swinging, and the like, guides the yarn Y that is unwound from the yarn supplying bobbin B to the bobbin 9 that is newly set between the bobbin holders 23.

[0025] The bobbin separating device 100 is arranged above the bobbin stocker 65 (see FIG. 2). When the clamping device 66 is about to clamp the target bobbin 9A, the bobbin separating device 100 separates the target bobbin 9A and the stock bobbins 9B. That is, the clamping device 66 clamps the target bobbin 9A that has been separated from the stock bobbins 9B.

[0026] In further detail, the bobbin separating device 100 includes, as shown in FIGS. 5 and 6, a supporting member 101, a first member (contacting member, first contacting member) 102, a second member (contacting member, second contacting member) 103, and a driving mechanism 104. The supporting member 101 is swingably supported by a first shaft 105. The first shaft 105 is fixed to a housing 69 of the doffing cart 6. The first member 102 and the second member 103 are attached to a front end 101a of the supporting member 101. The distal end of the first member 102 and the distal end of the second member 103 extend downward. The first member 102 and the second member 103 are contactable with the stock bobbin 9B at mutually different positions in an axial direction of the stock bobbin 9B. As shown in FIG. 6, one end of a spring 106 is attached to a back end 101b of the supporting member 101. The other end of the spring 106 is fixed to the housing 69. The back end 101b

is pulled upward by the spring 106.

[0027] The driving mechanism 104 causes the first member 102 to move with respect to the supporting member 101. In the present embodiment, the driving mechanism 104 includes an air cylinder that functions as an actuator. As shown in FIG. 7, the driving mechanism 104 includes a main member 104a and a rod member 104b. The driving mechanism 104 causes the rod member 104b to move with respect to the main member 104a by using pressure of air supplied into the main member 104a from an air supply source 20. That is, the main member 104a and the rod member 104b constitute the air cylinder. The rod member 104b moves in a direction so as to protrude from the main member 104a by, for example, the pressure of air that is supplied into the main member 104a. The rod member 104b moves in the direction opposite to the direction in which the rod member 104b protrudes by the action of air pressure when, for example, the supply of air into the main member 104a is stopped.

[0028] The rod member 104b of the driving mechanism 104 moves linearly between two predetermined positions in the protruding direction of the rod member 104b. The driving mechanism 104 can maintain the rod member 104b at the two predetermined positions. The driving mechanism 104 causes the first member 102 to move so as to change the length by which the first member 102 protrudes with respect to the supporting member 101.

[0029] In the present embodiment, the air supply source 20 is arranged in the doffing cart 6 to supply air to the driving mechanism 104. A cart controller 50 arranged in the doffing cart 6 controls the air supply source 20 to supply or to stop the supply of air to the driving mechanism 104. In an alternative configuration, an air supply source that is, for example, arranged alongside the winding units 2 and that supplies air to plural winding units 2 can be used as the air supply source 20. When such an air supply source is used, the cart controller 50 can control the supply of air or stoppage of supply of air from the air supply source 20 to the driving mechanism 104 by controlling a valve or the like. In this manner, the cart controller 50 controls the movement of the first member 102 by controlling the driving mechanism 104. Apart from the control of the movement of the first member 102, the cart controller 50 can perform control of running of the doffing cart 6 based on instructions from the control device 8 and/or control of operations of each structural component of the doffing cart 6. The cart controller 50 physically includes, for example, a Central Processing Unit (CPU), a Read-only Memory (ROM), and a Random Access Memory (RAM).

[0030] The main member 104a of the driving mechanism 104 is fixed to the upper surface of the supporting member 101. A slit-shaped guide hole 101c is formed in the supporting member 101. The first member 102 makes contact with the lower surface of the supporting member 101. That is, the supporting member 101 is arranged between the first member 102 and the driving mechanism 104. The first member 102 and a coupling metal 104c are mutually coupled by a bolt 104d. The bolt 104d passes through the guide hole 101c of the supporting member 101. The guide hole 101c extends linearly along a movement direction of the rod member 104b of the driving mechanism 104. With this configuration, the first member 102 moves linearly accompanying the movement of the rod member 104b of the driving mechanism 104.

[0031] A movement direction of the first member 102 is indicated by an arrow X1 in FIGS. 5 and 7. The driving mechanism 104 causes the first member 102 to move in a separating direction from an axial line X2 of the first shaft 105 or an approaching direction toward the axial line X2. That is, the movement direction of the first member 102 (direction of the arrow X1) and the axial line X2 of the first shaft 105 are mutually orthogonal when viewed from a direction orthogonal to the movement direction of the first member 102 and the axial line X2.

[0032] As explained above, the tip of the rod member 104b moves linearly between the two predetermined positions. The first member 102 is coupled to the rod member 104b. That is, the driving mechanism 104 can cause the first member 102 to move linearly between two predetermined positions with respect to the supporting member 101. Moreover, the driving mechanism 104 can maintain the first member 102 at the two predetermined positions with respect to the supporting member 101. Out of the two predetermined positions with respect to the supporting member 101, the position at which the first member 102 protrudes more to the front side than at the other position shall be called a first position and the other position shall be called a second position. That is, the driving mechanism 104 causes the first member 102 to move linearly between the first position and the second position.

[0033] As shown in FIGS. 5 and 6, the doffing cart 6 includes a regulating lever 71, a pressing lever 72, and a first link 68. A base end 71b of the regulating lever 71 is swingably supported by a second shaft 73. The second shaft 73 is fixed to the housing 69 of the doffing cart 6. The regulating lever 71 is mounted on the supporting member 101 of the bobbin separating device 100. The regulating lever 71 swings accompanying the swinging of the supporting member 101. A base end 72b of the pressing lever 72 is swingably supported by the second shaft 73. The pressing lever 72 is placed on the supporting member 101 of the bobbin separating device 100. The pressing lever 72 swings accompanying the swinging of the supporting member 101. When the clamping device 66 clamps the target bobbin 9A, a distal end 71a of the regulating lever 71 and a distal end 72a of the pressing lever 72 make contact with the lateral ends of the target bobbin 9A, and thereby perform positioning of the target bobbin 9A.

[0034] As shown in FIG. 6, the first link 68 is swingably supported by a swinging shaft 68c. A protrusion 68g is arranged in the first link 68 behind the swinging shaft 68c. One end of a spring 68f is attached to the protrusion 68g. The other end of the spring 68f is fixed to the housing 69

of the doffing cart 6. A back end 68b of the first link 68 is pulled upward by the spring 68f.

[0035] Before the clamping device 66 clamps the target bobbin 9A, the back end 68b of the first link 68 is pressed downward by a cam 67. The back end 101b of the bobbin separating device 100 is pressed downward by the back end 68b. The swinging of the supporting member 101 is stopped while the back end 68b is pressing down the back end 101b. In this state, the first member 102 and the second member 103 are located away the stock bobbin 9B. The position of the supporting member 101 in a stopped state by the pressing of the first link 68 shall be called a standby position.

[0036] The cam 67 is caused to rotate by a driving member 67a. A cam follower 68e is arranged at the position at which the first link 68 and the cam 67 make contact. A front end 68a of the first link 68 is coupled to the clamping device 66 via a second link 68d. The first link 68 pulls the clamping member 66a of the clamping device 66 upward with the second link 68d while the back end 68b of the first link 68 is pressed down by the cam 67.

[0037] A separation operation of the bobbins 9 performed by the bobbin separating device 100 and the clamping operation of the bobbin 9 performed by the clamping device 66 are explained next with reference to FIGS. 6 and 8. FIG. 6 shows a state before the separation operation and the clamping operation are performed. During the clamping operation performed by the clamping device 66, the back end 68b is released from being urged by the cam 67 by the rotation of the cam 67. With this action, the back end 68b moves upward by a pulling force of the spring 68f and the back end 101b moves upward by a pulling force of the spring 106. That is, the supporting member 101 swings so as to move the back end 101b upward. With this action, the first member 102 and the second member 103 are inserted between the target bobbin 9A and the stock bobbin 9B. Thereafter, by further swinging of the supporting member 101 by the action of the pulling force of the spring 106, the bobbin separating device 100 causes the stock bobbin 9B to move back, as shown in FIG. 8. The position of the supporting member 101 when the target bobbin 9A and the stock bobbin 9B are in a separated state by the action of the bobbin separating device 100 shall be called a separation position.

[0038] Accompanying the swinging of the supporting member 101, the regulating lever 71 and the pressing lever 72 swing about the second shaft 73 by their own weights. This causes the distal end 71a and the distal end 72a, respectively, to move downward. With this action, the regulating lever 71 and the pressing lever 72 make contact with the lateral ends of the target bobbin 9A, and thereby perform positioning of the target bobbin 9A.

[0039] The clamping member 66a swings so as to move downward by the downward swinging of the front end 68a of the first link 68, and thereby the clamping device 66 clamps the target bobbin 9A. Thereafter, the clamping device 66 swings further, with the target bobbin 9A clamped, and takes out the target bobbin 9A from the bobbin stocker 65 downward via the removal opening 65d and places the target bobbin 9A in the cradle arm 21 of the winding unit 2.

[0040] In this manner, the spring 106 attached to the back end 101b functions as a moving mechanism that causes the supporting member 101 to move from the standby position to the separation position. By being pressed downward by the back end 68b, the back end 101b swings so as to move downward. That is, the first link 68 functions as a moving mechanism that causes the supporting member 101 to move from the separation position to the standby position.

[0041] Movements of the first member 102 caused by the driving mechanism 104 are explained below. When the bobbin separating device 100 separates the target bobbin 9A and the stock bobbin 9B, it is preferable that, as shown in FIG. 9A, the first member 102 and the second member 103 are inserted between the target bobbin 9A and the stock bobbin 9B. With this action, the first member 102 and the second member 103 make contact with a downstream portion of the stock bobbin 9B in the arrangement direction (in the direction of the arrow W). By further swinging of the supporting member 101, as shown in FIGS. 8 and 9B, the bobbin separating device 100 separates the target bobbin 9A and the stock bobbin 9B with the first member 102 and the second member 103 making contact with the downstream portion of the stock bobbin 9B in the arrangement direction. That is, the bobbin separating device 100 causes the stock bobbin 9B to move in a separating direction from the target bobbin 9A. The downstream portion of the stock bobbin 9B in the arrangement direction is the part of an outer peripheral surface of the stock bobbin 9B that is adjacent to the target bobbin 9A, the part being arranged next to the side of the target bobbin 9A.

[0042] The bobbins 9 having different shapes may be in use in plural winding units 2 arranged in the automatic winder 1. Even when bobbins of different shapes are used, it is preferable that the first member 102 and the second member 103 are properly inserted between the target bobbin 9A and the stock bobbin 9B.

[0043] In the present embodiment, an example is presented in FIG. 10 in which there is a mixed presence of the winding units 2 that use cone-shaped bobbins 9 and the winding units 2 that use cylindrical bobbins. In the cone-shaped bobbin 9, diameters at the lateral ends mutually differ. In the cylindrical bobbin, the diameters at both ends are mutually identical. The diameter of the large-diameter portion of the cone-shaped bobbin 9 and the diameter of the cylindrical bobbin 9 are substantially similar. The cone-shaped bobbin 9 is oriented such that, when the first member 102 and the second member 103 make contact with the bobbin 9, the small-diameter portion makes contact with the first member 102 and the large-diameter portion makes contact with the second member 103 (see FIG. 10).

[0044] In this configuration, the cart controller 50 obtains from the unit controller 24 the information pertaining to the type of the bobbin 9 used in the winding unit 2 in which the doffing operation is to be performed. The cart controller 50 causes the first member 102 to move in accordance with the obtained type of the bobbin 9 (shape of the bobbin 9) in such a way that the first member 102 is inserted between the target bobbin 9A and the stock bobbin 9B when the supporting member 101 is moved to the separation position.

[0045] Specifically, when separating the cone-shaped bobbin 9, as shown in FIG. 10, the cart controller 50 causes the first member 102 to move to the first position in advance. The mounting position of the driving mechanism 104, the movement amount of the rod member 104b, and the like are set in advance such that the distal end of the first member 102 that is positioned at the first position is inserted between the target bobbin 9A and the stock bobbin 9B. The attached position of the second member 103 is adjusted (set) such that the second member 103 is inserted between the target bobbin 9A and the stock bobbin 9B.

[0046] When separating the cylindrical bobbins 9, as shown in FIG. 11, the cart controller 50 causes the first member 102 to move to the second position in advance. The mounting position of the driving mechanism 104, the movement amount of the rod member 104b, and the like are set in advance such that the distal end of the first member 102 that is positioned at the second position is inserted between the target bobbin 9A and the stock bobbin 9B. In the present embodiment, the diameter of the large-diameter portion of the cone-shaped bobbin 9 and the diameter of the cylindrical bobbin 9 are substantially similar. Hence, even if the cylindrical bobbin 9 is used, the second member 103 is inserted between the target bobbin 9A and the stock bobbin 9B.

[0047] After the doffing cart 6 reaches the predetermined position with respect to the winding unit 2 in which the doffing operation is to be performed, before the clamping device 66 clamps the target bobbin 9A, the cart controller 50 causes the first member 102 to move in accordance with the shape of the bobbin 9. Alternatively, the cart controller 50 can cause the first member 102 to move in accordance with the shape of the bobbin 9 while the doffing cart 6 is running to the winding unit 2 in which the doffing operation is to be performed.

[0048] By being configured as explained above and including the driving mechanism 104, the bobbin separating device 100 according to the present embodiment can cause the first member 102 to move in accordance with the shape of the bobbin 9. Hence, by moving the supporting member 101 to the separation position, the bobbin separating device 100 can properly insert the first member 102 and the second member 103 between the target bobbin 9A and the stock bobbin 9B. Accordingly, the bobbin separating device 100 can appropriately separate the bobbins 9 in accordance with the shape of the bobbins 9 to be separated.

[0049] The driving mechanism 104 includes the air cylinder (the main member 104a and the rod member 104b) that functions as an actuator. The driving mechanism 104 can easily move the first member 102 by using the air cylinder.

[0050] The driving mechanism 104 causes the first member 102 to move between the first position and the second position. The driving mechanism 104 maintains the first member 102 at the first position or the second position. With this action, the bobbin separating device 100 can cause the first member 102 to move in accordance with two different types of bobbins 9 in terms of the shape thereof. Hence, even if the shape of the bobbins 9 differs among bobbin groups in which the bobbin separating device 100 performs the separation operation, the bobbin separating device 100 can appropriately separate the bobbins 9 in each bobbin group.

[0051] The driving mechanism 104 causes the first member 102 to move linearly between the first position and the second position. Because the first member 102 does not meander while moving between the first position and the second position, the driving mechanism 104 can cause the first member 102 to move within a small space.

[0052] The spring 106 functions as a moving mechanism that causes the supporting member 101 to swing and move from the standby position to the separation position. The first link 68 functions as a moving mechanism that causes the supporting member 101 to swing and move from the separation position to the standby position. Accordingly, the bobbin separating device 100 can properly separate the bobbins 9 by swinging the supporting member 101.

[0053] The proper separation of the bobbins 9 by the bobbin separating device 100 enables the clamping device 66 to properly clamp the target bobbin 9A separated by the bobbin separating device 100.

[0054] The winding unit 2 includes the traversing device 29 that can adjust the traverse width of the yarn Y. Consequently, the winding units 2 can wind the yarns Y by mutually different winding methods. In the automatic winder 1, in accordance with the winding method of the yarn Y adopted by each winding unit 2, different shapes of the bobbin 9 are used in different winding units 2. Even when the bobbins 9 having different shapes are used in different winding units 2, the bobbin separating device 100, by causing the first member 102 to move in accordance with the shape of the bobbin 9, can appropriately separate the bobbins 9 in accordance with the shape of the bobbins 9 to be separated.

[0055] The embodiments of the present invention are explained above. The present invention, however, is not limited to the above embodiments. For example, in the above embodiment, the first member 102 is caused to move by the driving mechanism 104 that includes the actuator. In an alternative configuration, the first member 102 can be caused to move by a driving mechanism that does not include an actuator. In place of an actuator, the driving mechanism can cause movement of the first

member 102 with, for example, a cam mechanism or the like that operates accompanying the swinging of the supporting member 101. Moreover, the driving mechanism 104 can include an actuator other than the air cylinder. For example, the driving mechanism 104 can use a motor, a solenoid, a hydraulic cylinder or the like, as the actuator. It is preferable that the actuator is light. A light actuator allows the bobbin separating device 100 to cause the supporting member 101 to move swiftly. Consequently, the bobbin separating device 100 can separate the bobbins 9 swiftly.

[0056] The driving mechanism 104 causes the first member 102 to move to the first position or the second position and holds the first member 102 at the first position or the second position. However, the movement of the first member 102 by the driving mechanism 104 is not limited to the above two positions. For example, the first member 102 can be caused to move to three or more positions and held at any of those positions. When this configuration is adopted, the bobbin separating device 100 can cause the first member 102 to move in accordance with three or more types of bobbins 9 of different shapes. In this manner, even if three or more types of bobbins 9 of different shapes are present in plural bobbin groups for which the bobbin separating device 100 performs separation, the bobbin separating device 100 can appropriately separate the bobbins 9 in each bobbin group.

[0057] The bobbin separating device 100 includes the second member 103. However, the second member 103 can be omitted if the first member 102 is movable. The bobbin separating device 100 can cause the second member 103 also to move by using the driving mechanism 104, similar to the first member 102. The bobbins 9 can be appropriately separated in accordance with the shape of the bobbins 9 if both the first member 102 and the second member 103 are movable. Moreover, the bobbin separating device 100 can include three or more movable members similar to the first member 102.

[0058] The movement direction of the first member 102 is not limited to the direction indicated by the arrow X1. The first member 102 can be caused to move with respect to the supporting member 101 in a direction other than that of the arrow X1. That is, the movement direction of the first member 102 and the axial line X2 of the first shaft 105 can intersect at an angle other than orthogonally when viewed from the direction orthogonal to the movement direction of the first member 102 and the axial line X2. The driving mechanism 104 needs not to cause the first member 102 to move linearly. The driving mechanism 104 can, for example, cause the first member 102 to move such that a movement track thereof is arc-shaped.

[0059] The supporting member 101 is caused to move between the standby position and the separation position by the spring 106 and the first link 68 that function as moving mechanisms. The present embodiment, however, is not limited to the above, and the supporting member 101 can be caused to move by a driving source, such as a motor. The supporting member 101 is not limited to moving between the standby position and the separation position by swinging about the first shaft 105. The supporting member 101 can, for example, move linearly between the standby position and the separation position.

[0060] The cart controller 50 can obtain the type of the bobbin 9 used in the winding unit 2, in which the doffing operation is to be performed, from a device other than the unit controller 24. The cart controller 50 can, for example, obtain the type of the bobbin 9 used in the winding unit 2, in which the doffing operation is to be performed, from the control device 8.

[0061] It is not necessary for the cart controller 50 to control the movement of the first member 102 based on the type of the bobbin 9 obtained from the unit controller 24 or the control device 8. The automatic winder 1, for example, can group the winding units 2 in accordance with the type of the bobbins 9 used in the winding units 2. The cart controller 50 can control the position of the first member 102 based on the group to which the winding unit 2 in which the doffing operation is to be performed belongs. Information pertaining to the group to which the winding unit 2 belongs can be obtained from, for example, the unit controller 24 or the control device 8.

[0062] The traversing device 29 is not limited to the arm-type traversing device. For example, a belt-type traversing device, a rotary traversing device, or a rod traversing device can be used as the traversing device 29. In an alternative configuration, the winding unit 2 can use, instead of the arm-type traversing device or the like, a drum having a traverse groove for traversing the yarn Y being wound on the bobbin 9.

[0063] The automatic winder 1 can include plural doffing carts 6 in accordance with the number of the winding units 2 present in the automatic winder 1. In the above embodiment, the automatic winder 1 includes the doffing cart 6 that performs both the doffing operation and the setting of the bobbin 9; however, the present invention is not limited to the example cited in the above embodiment. The automatic winder 1 can include a cart that performs the setting operation of the bobbin 9 that includes the separation operation of the bobbins 9 and a cart that performs the doffing operation.

[0064] In the embodiment of the present invention, the bobbin separating device 100 and the doffing cart 6 are not limited to be used in the automatic winder 1. For example, the bobbin separating device 100 and the doffing cart 6 can be used in any other yarn winding machine (for example, air-jet spinning machine, open-ended spinning machine, and the like) in which a yarn path is arranged such that a yarn moves from bottom to top.

[0065] According to an aspect of the present invention, a bobbin separating device that separates, out of two or more bobbins arranged with respect to a target position, a target bobbin positioned at the target position and a stock bobbin arranged with respect to the target position, at a position further upstream of the target bobbin in an

arrangement direction includes a contacting member that is contactable with a downstream portion of the stock bobbin in the arrangement direction; a supporting member that supports the contacting member and moves between a standby position that is a position at which the contacting member is located away from the stock bobbin and a separation position that is a position at which the contacting member makes contact with the downstream portion of the stock bobbin and separates the target bobbin and the stock bobbin; and a driving mechanism that moves the contacting member with respect to the supporting member.

[0066] Because the bobbin separating device includes a driving mechanism, the contacting member can be moved with respect to the supporting member in accordance with the shape of the bobbin. Hence, by causing the supporting member to move to the separation position, the bobbin separating device can properly insert the contacting member between the target bobbin and the stock bobbin. Thus, the bobbin separating device can appropriately separate the bobbins in accordance with the shape of the bobbins to be separated.

[0067] The driving mechanism can include an actuator. With this configuration, the driving mechanism can easily move the contacting member by using the actuator.

[0068] The actuator can be an air cylinder. With this configuration, the driving mechanism can easily move the contacting member by using the air cylinder.

[0069] The driving mechanism can move the contacting member to at least two positions predetermined with respect to the supporting member, and maintain the contacting member at the position to which the contacting member is moved. With this configuration, the bobbin separating device can move the contacting member in accordance with at least two or more different types of bobbins in terms of the shape thereof. In this manner, even if the shape of the bobbins differs among bobbin groups for which the bobbin separating device performs the separation operation, the bobbin separating device can appropriately separate the bobbins in each bobbin group.

[0070] The driving mechanism can move the contacting member to change a protrusion length of the contacting member with respect to the supporting member. In this manner, the bobbin separating device can appropriately separate the bobbins of two or more different types in terms of the shape thereof.

[0071] The contacting member includes a first contacting member and a second contacting member. The first contacting member and the second contacting member are arranged so as to be contactable at mutually different positions with the stock bobbin in an axial direction of the stock bobbin, and the driving mechanism can move at least one of the first contacting member and the second contacting member. With this configuration, at least one of the first contacting member and the second contacting member can be moved in accordance with the shape of the bobbin. In this manner, the bobbins can be appropriately separated by the first contacting member and the second contacting member.

[0072] The driving mechanism can move the first contacting member linearly. Because the first contacting member does not meander while moving, the driving mechanism can move the first contacting member within a small space.

[0073] The bobbin separating device can include a moving mechanism that swings the supporting member to move the supporting member between the standby position and the separation position. With this configuration, the bobbin separating device can appropriately separate the bobbins by swinging the supporting member.

[0074] According to another aspect of the present invention, a doffing cart includes the above bobbin separating device and a clamping device that clamps the target bobbin that is separated from the stock bobbin.

[0075] Because the doffing cart includes the above bobbin separating device, the bobbins can be appropriately separated in accordance with the shape of the bobbins to be separated. The clamping device can appropriately clamp the target bobbin separated from the stock bobbin by the bobbin separating device.

[0076] According to still another aspect of the present invention, a yarn winding machine includes the above doffing cart and plural winding units each of which winds a yarn on the bobbin. Each of the winding units includes a traversing device that can adjust a traverse width of the yarn being wound on the bobbin.

[0077] Because the traversing device can adjust a traverse width of the yarn, each winding unit can wind the yarn by using mutually different winding methods. In the yarn winding machine, in accordance with the winding method of the yarn adopted by each winding unit, different shapes of the bobbin are used in different winding units. Even when the bobbins of different shapes are used in different winding units, the bobbin separating device, by causing the contacting member to move in accordance with the shape of the bobbin, can appropriately separate the bobbins in accordance with the shape of the bobbins to be separated.

Claims

1. A bobbin separating device (100) adapted to separate, out of two or more bobbins (9) arranged with respect to a target position, a target bobbin (9A) positioned at the target position and a stock bobbin (9B) arranged with respect to the target position, at a position further upstream of the target bobbin in an arrangement direction, comprising:

   a contacting member (102, 103) adapted to be contactable with a downstream portion of the stock bobbin (9B) in the arrangement direction;
   a supporting member (101) adapted to support the contacting member (102, 103) and to move

between a standby position that is a position at which the contacting member (102, 103) is located away from the stock bobbin (9B) and a separation position that is a position at which the contacting member (102, 103) makes contact with the downstream portion of the stock bobbin (9B) and separates the target bobbin (9A) and the stock bobbin (9B); and
a driving mechanism (104) adapted to move the contacting member (102; 103) with respect to the supporting member (101).

2. The bobbin separating device (100) as claimed in Claim 1, wherein the driving mechanism (104) includes an actuator.

3. The bobbin separating device (100) as claimed in Claim 2, wherein the actuator (104) is an air cylinder.

4. The bobbin separating device (100) as claimed in any one of Claims 1 to 3, wherein the driving mechanism (104) is adapted to move the contacting member (102; 103) to at least two positions predetermined with respect to the supporting member (101), and to maintain the contacting member (102; 103) at the position to which the contacting member (102; 103) is moved.

5. The bobbin separating device (100) as claimed in any one of Claims 1 to 4, wherein the driving mechanism (104) is adapted to move the contacting member (102; 103) to change a protrusion length of the contacting member (102) with respect to the supporting member (101).

6. The bobbin separating device (100) as claimed in any one of Claims 1 to 5, wherein
the contacting member includes (102, 103) a first contacting member (102) and a second contacting member (103),
the first contacting member (102) and the second contacting member (103) are arranged so as to be contactable at mutually different positions with the stock bobbin (9B) in an axial direction of the stock bobbin (9B), and
the driving mechanism (104) is adapted to move at least one of the first contacting member (102) and the second contacting member (103).

7. The bobbin separating device (100) as claimed in Claim 6, wherein the driving mechanism (104) is adapted to move the first contacting member (102) linearly.

8. The bobbin separating device (100) as claimed in any one of Claims 1 to 7, further comprising a moving mechanism (68, 106) adapted to swing the supporting member (101) to move the supporting member (101) between the standby position and the separation position.

9. A doffing cart (6) comprising:

the bobbin separating device (100) as claimed in any one of Claims 1 to 8; and
a clamping device (66) adapted to clamp the target bobbin (9A) that is separated from the stock bobbin (9B).

10. A yarn winding machine (1) comprising:

the doffing cart (6) as claimed in Claim 9; and
plural winding units (2) each of which is adapted to wind a yarn (Y) on the bobbin (9),
wherein each of the winding units (2) includes a traversing device (29) adapted to adjust a traverse width of the yarn (Y) being wound on the bobbin (9).

FIG.1

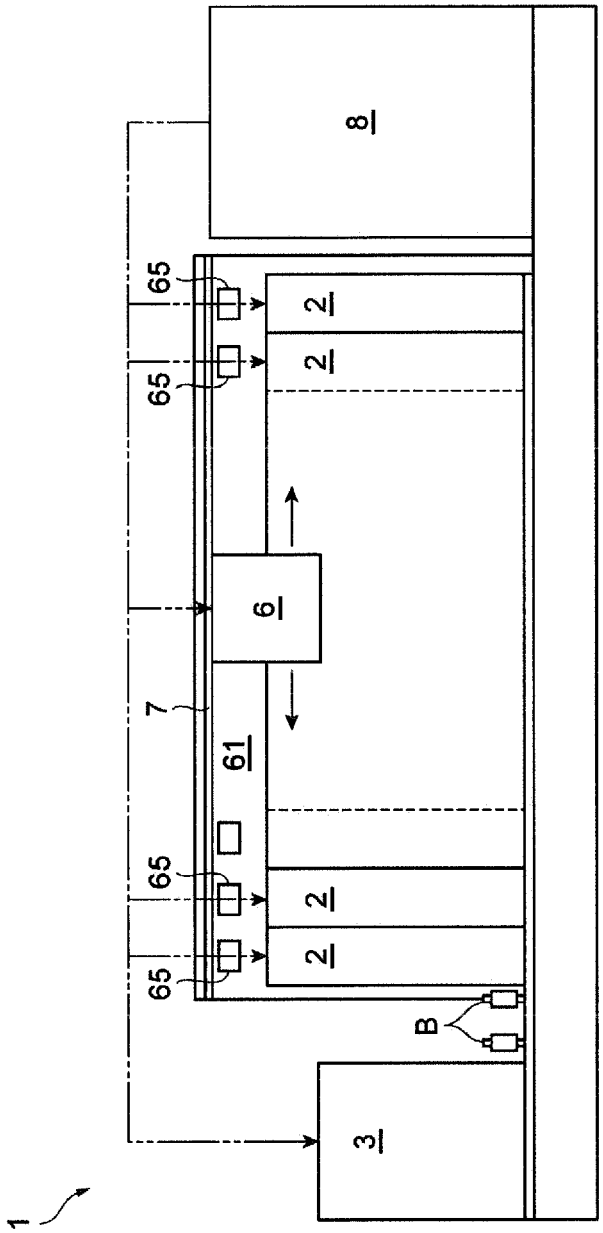
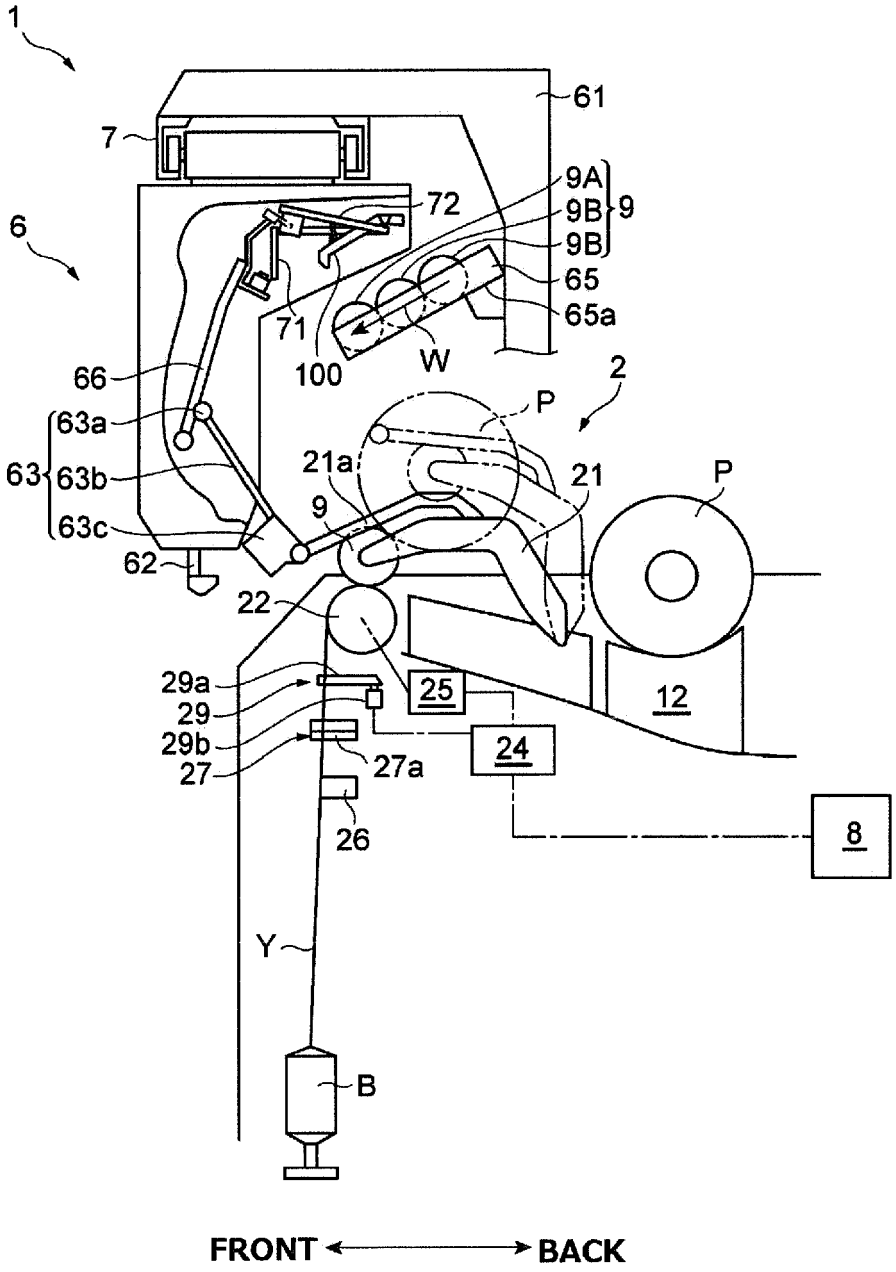


FIG.2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9A
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9B
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72
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63c
21a
21
P
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25
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Y
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BACK

FIG.3

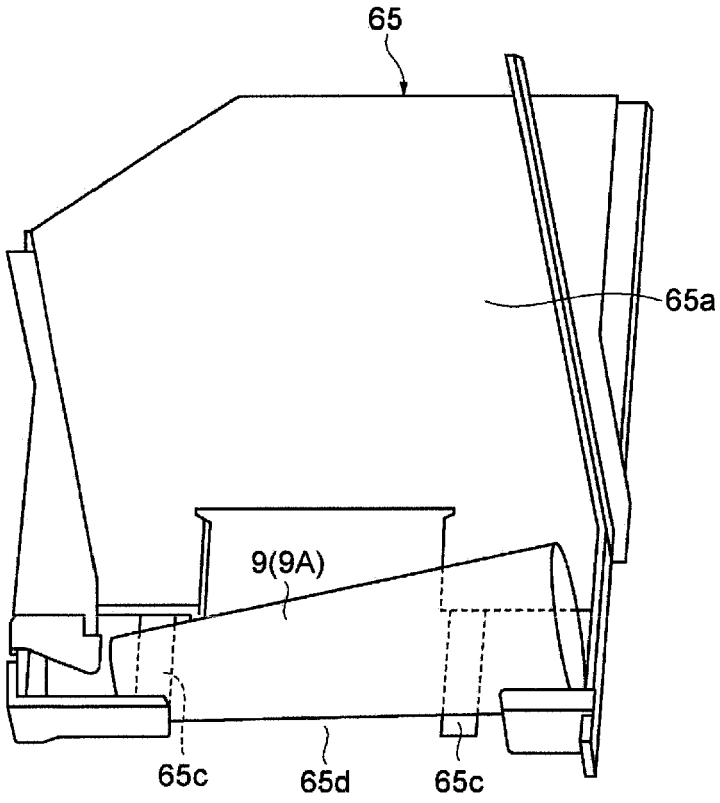


FIG.4

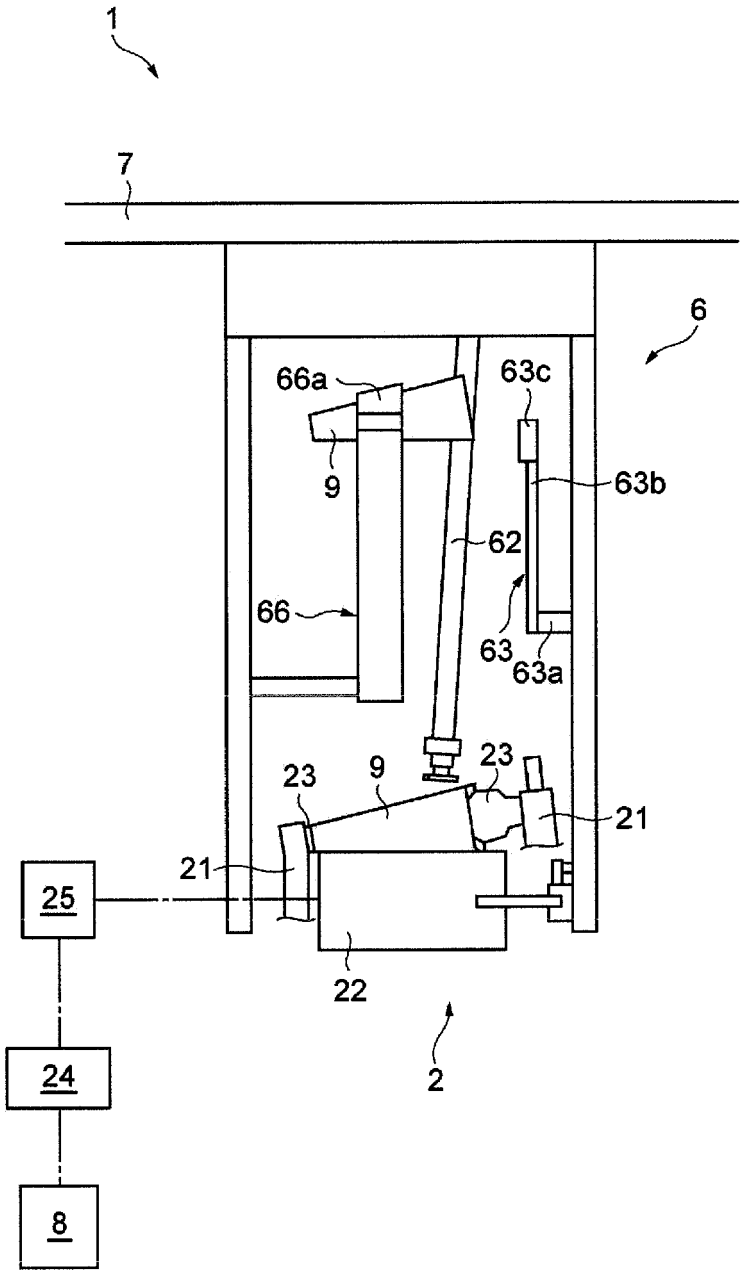
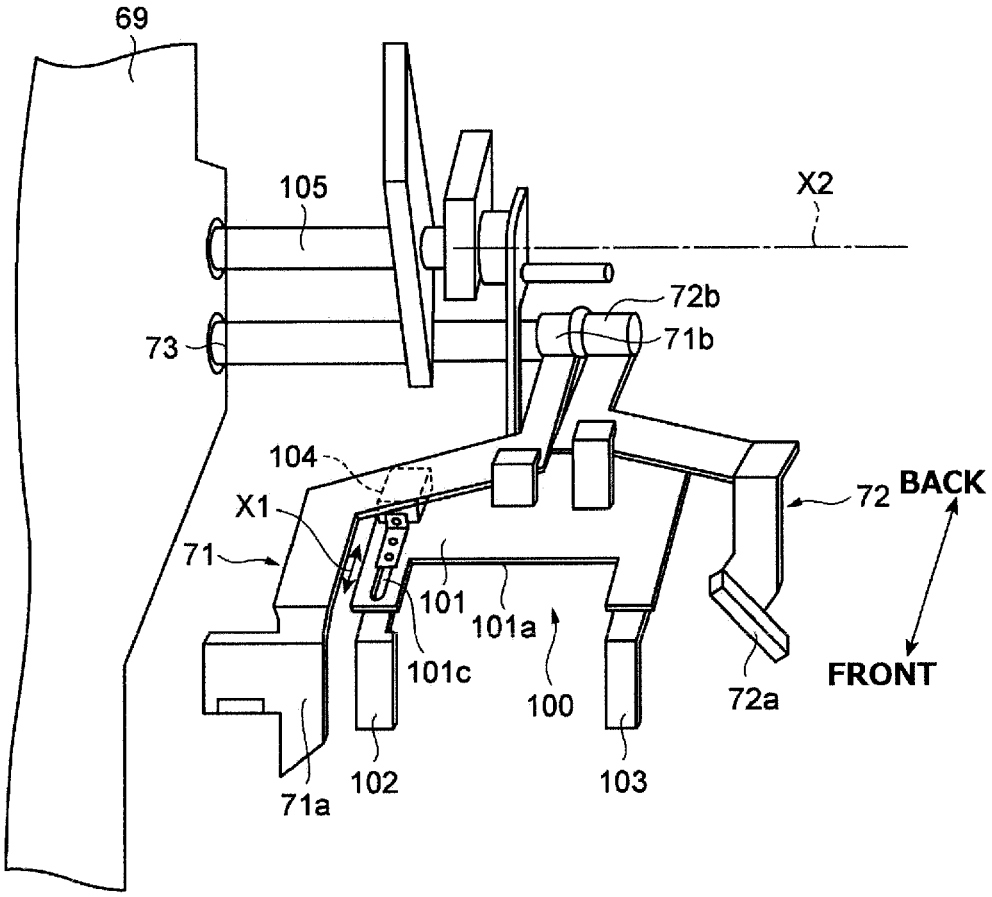


FIG.5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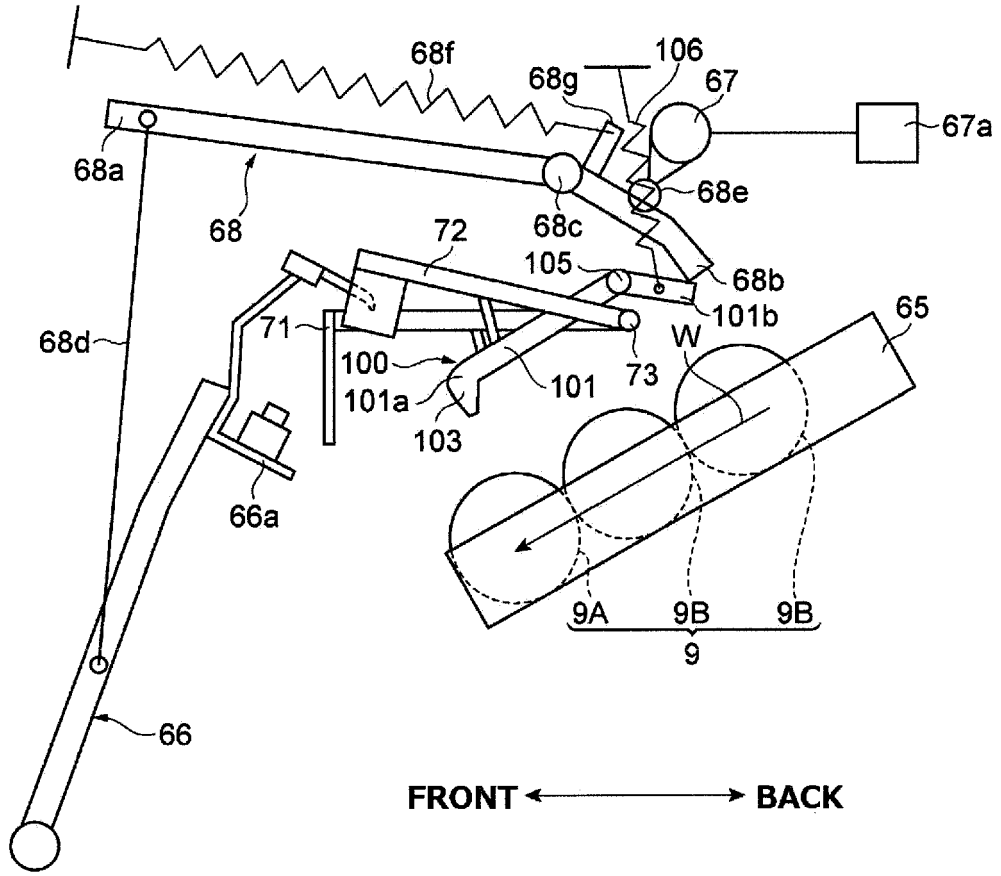
103

FIG.6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BACK

FIG.7

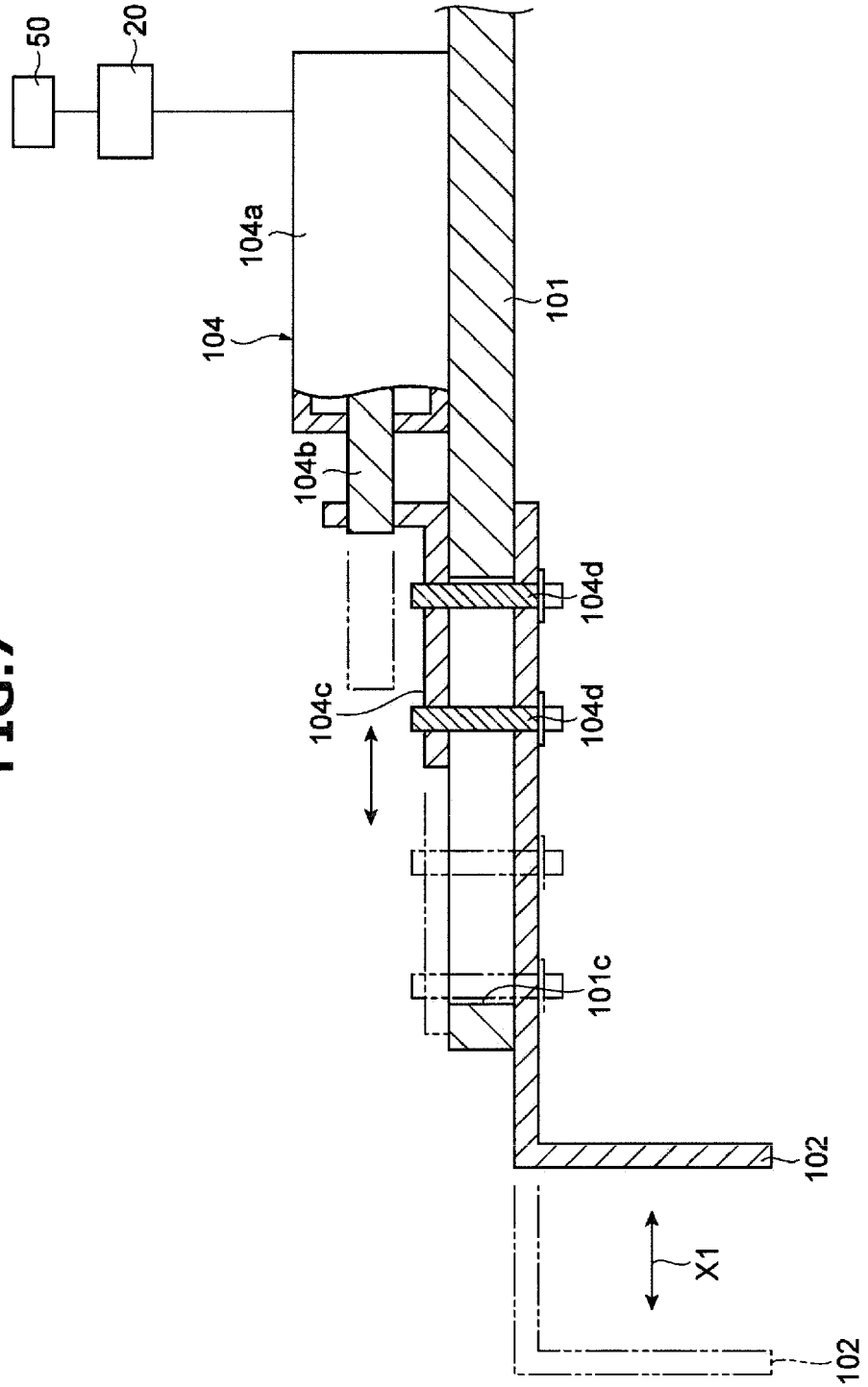
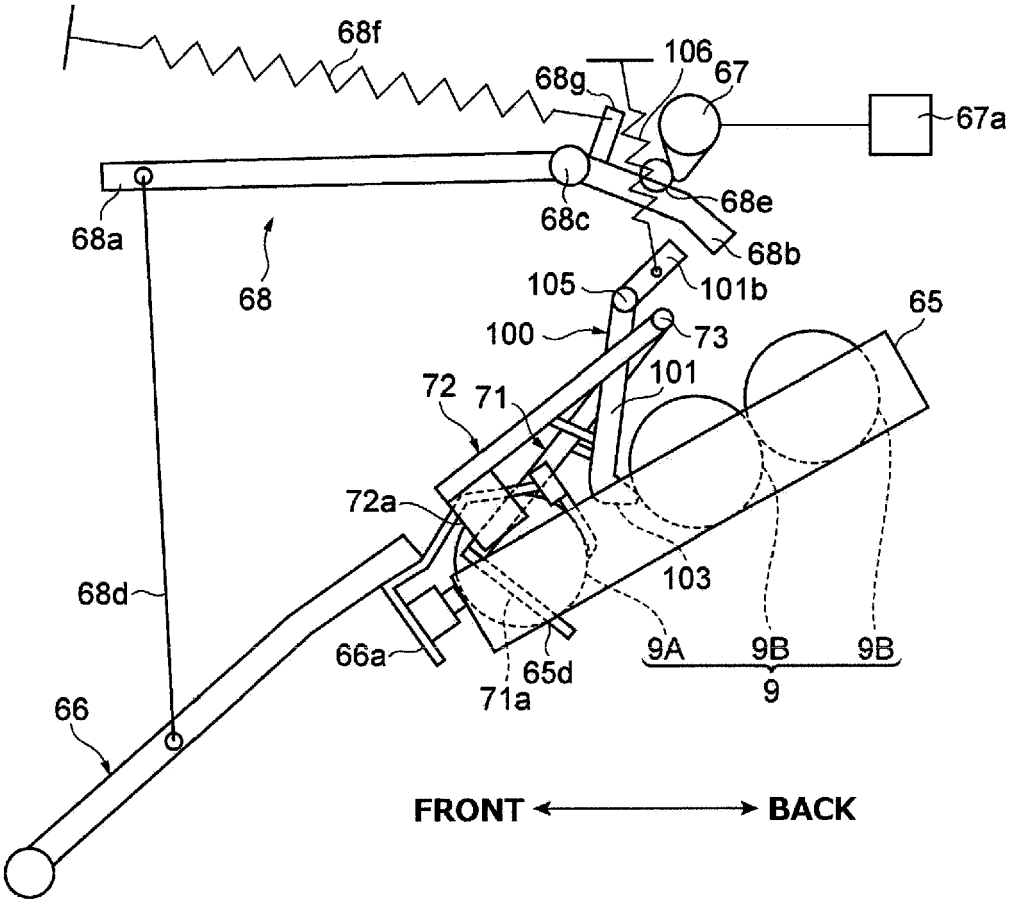


FIG.8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71a
66
FRONT
BACK

FIG.9A

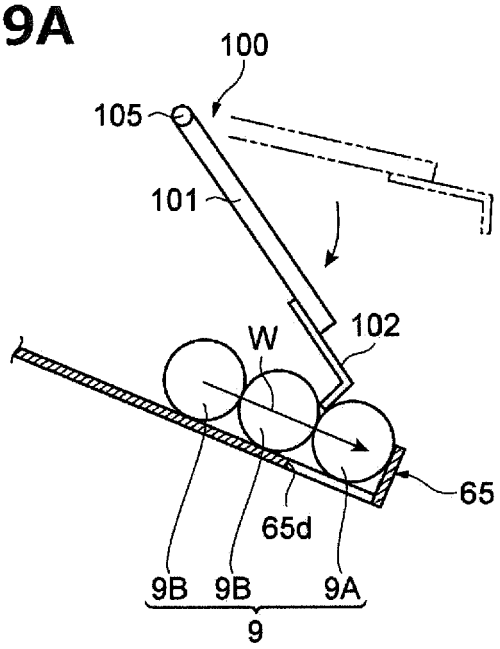


FIG.9B

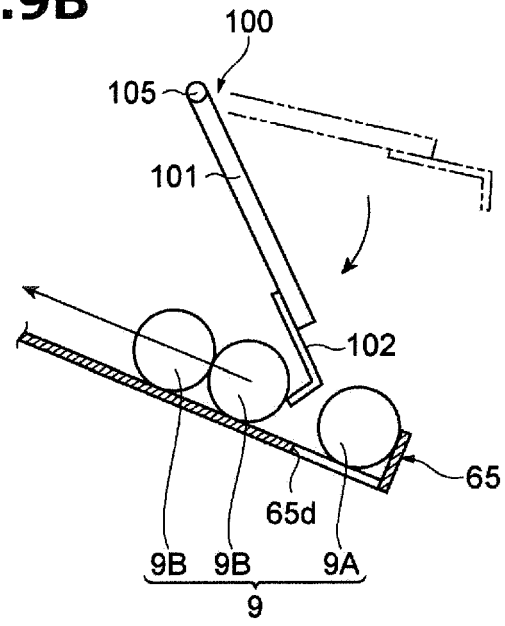
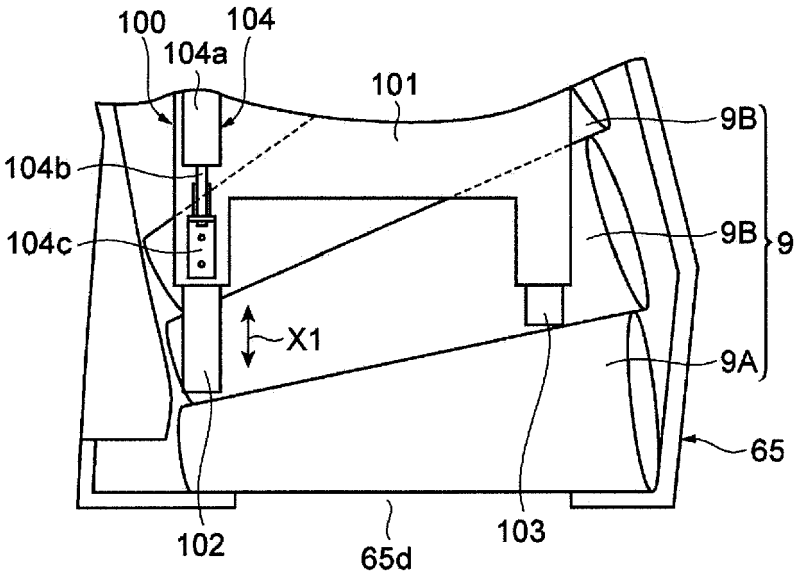


FIG.10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104
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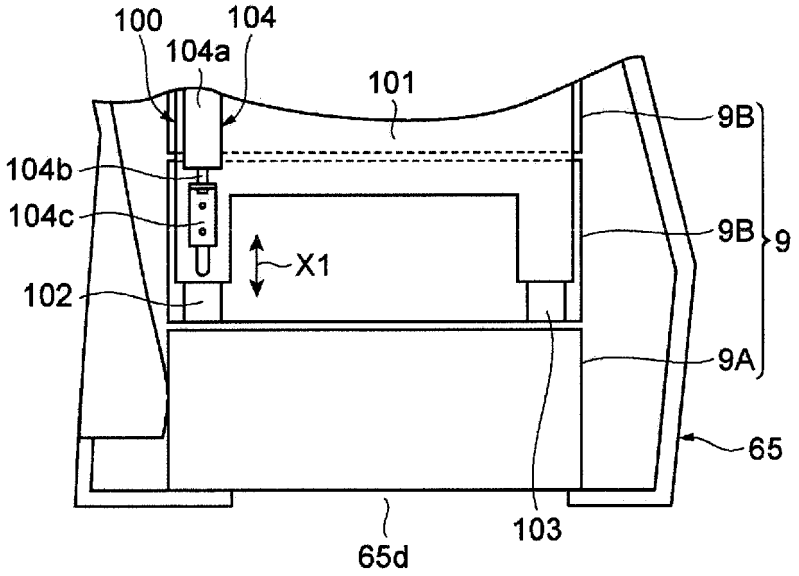
9B
104b
9B
9
104c
X1
9A
65
102
65d
103

FIG.11


100
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9B
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X1
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9A
65
65d
103

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 6225

DOCUMENTS CONSIDERED TO BE RELEVANT

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

B65H
D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 February 2016	Pussemier, Bart

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