



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.08.2018 Bulletin 2018/33

(51) Int Cl.:
B65H 54/26 (2006.01) B65H 54/70 (2006.01)

(21) Application number: **18151941.4**

(22) Date of filing: **16.01.2018**

(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 TN

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(30) Priority: **10.02.2017 JP 2017022789**

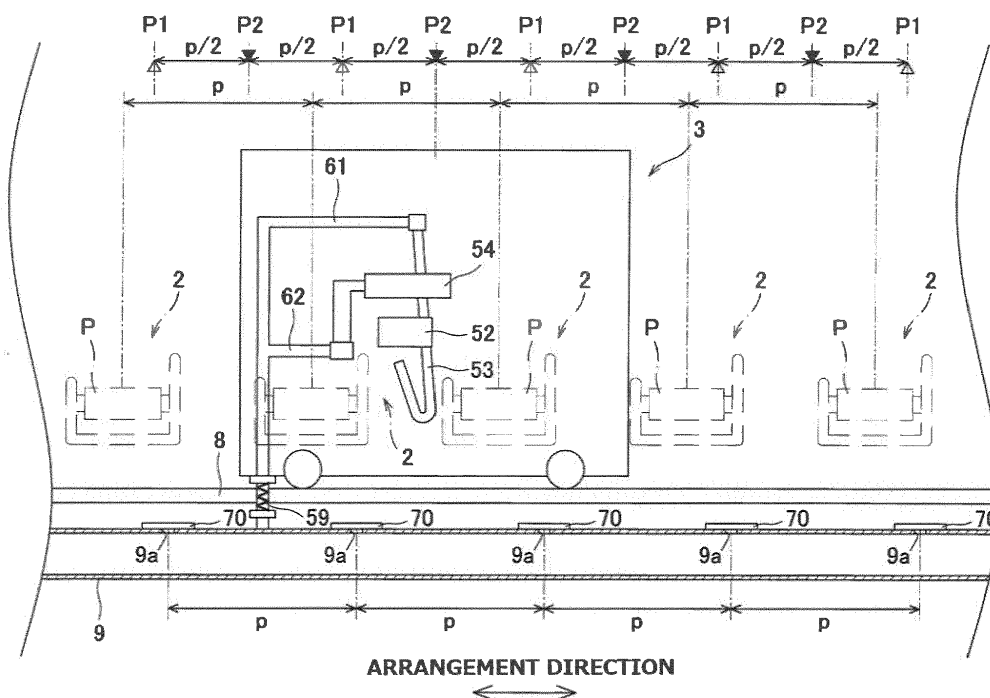
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(54) **YARN WINDING MACHINE**

(57) A service cart (3) is configured such that the service cart (3) can stop at a service position (P1) at which a connection tube (59) can be connected to an opening (9a) formed in a discharge duct (9) and at which a service can be performed in a winding unit (2), and can

stop at a standby position (P2) that is located between two adjacent service positions (P1) and at which the connection tube (59) cannot be connected to the opening (9a).

FIG.8



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine.

2. Description of the Related Art

[0002] For example, Japanese Patent Application Laid-Open No. 2014-9052 discloses a yarn winding machine (spinning frame) in which a plurality of winding units (spinning units) is arranged in an arrangement direction, and a service cart (yarn joining cart) is arranged so as to be movable in the arrangement direction. The yarn winding machine is provided with a discharge duct. Inside of the discharge duct is in a negative pressure state because of an action of a suction device. The discharge duct is provided with a plurality of openings in the arrangement direction. Each of the openings is normally closed by a shutter. When the service cart moves to a certain winding unit to provide a service, the shutter is operated to open the corresponding opening whereby a connection tube provided in the service cart is connected to the opening. As a result, the service cart can provide the service, such as a yarn joining operation, by using the negative pressure (suction force).

[0003] Conventionally, after the service cart has provided the service to a certain winding unit at a position (hereinafter, "service position") at which the connection tube has been connected to the corresponding opening, until a new service request is received from another winding unit, the service cart will remain on standby at the service position. However, for example, because suction members such as a suction mouth and a suction pipe connected to the connection tube are open to the atmosphere, while the service cart is stopping at the service position, air flows in these suction members even if no service is being provided. Thus, the suction device connected to the discharge duct unnecessarily consumes electric power.

SUMMARY OF THE INVENTION

[0004] An object of the present invention is to reduce the electric power consumption of the suction device that supplies a negative pressure to the service cart.

[0005] This object is achieved by a yarn winding machine according to the independent claim.

[0006] A yarn winding machine according to one aspect of the present invention includes a plurality of winding units arranged in an arrangement direction; a discharge duct extending along the arrangement direction and in which a plurality of openings are formed along the arrangement direction; a plurality of shutters adapted to respectively open or close the openings; a service cart

including a connection tube adapted to be connected to the discharge duct via one of the openings, the service cart being movable in the arrangement direction; and a suction device connected to the discharge duct. The service cart is able to stop at a service position and a standby position. The service position is a position at which the connection tube is connected to one of the openings and at which the service cart can perform a service in one of the winding units. The standby position is a position between two adjacent service positions and at which the connection tube is not connected to the opening.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

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

FIG. 2 is a side view of a spinning unit and a yarn joining cart.

FIG. 3 is a side view indicating a state in which a yarn has been held by suction by a suction member of the yarn joining cart.

FIG. 4 is a side view indicating a state in which the yarn is being guided to a yarn joining device by the suction member of the yarn joining cart.

FIG. 5 is a block diagram of an electrical configuration of the spinning frame.

FIG. 6 is a schematic diagram of a service region of the yarn joining cart.

FIG. 7 is a front view of a state in which the yarn joining cart is at a service position.

FIG. 8 is a front view of a state in which the yarn joining cart is at a standby position.

FIGS. 9A, 9B, and 9C are top views of a shutter.

FIGS. 10A and 10B show graphs of a speed pattern of the yarn joining cart.

FIG. 11 is a schematic diagram of a service region when two yarn joining carts are provided.

FIG. 12 is a front view of an example of a position indicating member.

45 DETAILED DESCRIPTION

[0008] Exemplary embodiments of a spinning frame according to the present invention are explained in detail below with reference to the accompanying drawings. A spinning frame 1 (yarn winding machine) shown in FIG. 1 includes a plurality of spinning units 2 (winding units) that is arranged side-by-side along a predetermined arrangement direction (horizontal direction in FIG. 1), a yarn joining cart 3 (service cart) that is movable in the arrangement direction, a blower box 4 arranged on one side in the arrangement direction, and a motor box 5 arranged on the other side in the arrangement direction.

[0009] Each of the spinning units 2 spins, by using a

spinning device 20, a fiber bundle T conveyed from a drafting device 10 and forms a spun yarn Y. A winding device 40 winds the spun yarn Y on a bobbin B thereby forming a package P. When a yarn breakage or a yarn cut occurs in a certain spinning unit 2, the yarn joining cart 3 moves to that spinning unit 2 and performs yarn joining. A suction device 6 that supplies a negative pressure to the spinning unit 2 and the yarn joining cart 3, and the like are arranged in the blower box 4. A not-shown driving source that is shared among all the spinning units 2, and the like are arranged in the motor box 5. However, a separate driving source can be arranged for each of the spinning units 2.

[0010] In the present specification, the side on which a yarn path is present when seen from the yarn joining cart 3 is defined as a front side (left side in FIGS. 2 to 4) while the opposite side of this side is defined as a back side (right side in FIGS. 2 to 4).

[0011] The spinning unit 2 includes the drafting device 10, the spinning device 20, a yarn accumulating device 30, and the winding device 40 as main structural components, and these structural components are arranged in this order from an upstream side to a downstream side in a traveling direction (hereinafter, "yarn traveling direction") of the fiber bundle T or the yarn Y.

[0012] The drafting device 10 is arranged near a top edge of a frame 7 of the spinning frame 1. The drafting device 10 includes four drafting rollers 11 to 14, that is, a back roller 11, a third roller 12, a middle roller 13, and a front roller 14, arranged in this order from the upstream side. An apron belt 15 made of rubber is stretched over the middle roller 13. Each of the drafting rollers 11 to 14 is rotationally driven at a predetermined rotational speed. The drafting device 10 also includes opposed rollers 11a to 14a that are arranged so as to oppose a corresponding roller among the drafting rollers 11 to 14. A sliver S is a raw material of the fiber bundle T. The drafting device 10 transports the sliver S by sandwiching between the rotating drafting rollers 11 to 14 and the opposed rollers 11a to 14a, which oppose the drafting rollers, and pulling (drafting) so that the sliver S has a predetermined width thereby forming the fiber bundle T.

[0013] The spinning device 20 is arranged immediate downstream of the front roller 14. The spinning device 20 spins the fiber bundle T by twisting the fiber bundle T supplied thereto from the drafting device 10 thereby forming the yarn Y. In the present embodiment, an air device that twists the fiber bundle T by using a swirling air current is used as the spinning device 20; however, a device of some other type can be used.

[0014] The yarn accumulating device 30 is arranged between the spinning device 20 and the winding device 40 in the yarn traveling direction. The yarn accumulating device 30 includes an accumulating roller 31, a yarn hooking member 32, and a motor 33. The accumulating roller 31 is configured so that the yarn Y of a predetermined amount can be wound around an outer peripheral surface thereof thereby temporarily accumulating the

yarn Y. The accumulating roller 31 is rotationally driven by the motor 33. The yarn hooking member 32 capable of hooking the yarn Y is attached to a downstream end of the accumulating roller 31. The yarn Y is accumulated on the accumulating roller 31 when the yarn hooking member 32 that has hooked the yarn Y rotates integrally with the accumulating roller 31. The yarn accumulating device 30 has the following functions: to apply a tension to the yarn Y to pull the yarn Y from the spinning device 20, to prevent slackening of the yarn Y by temporarily accumulating the yarn Y fed out from the spinning device 20 when the yarn joining cart 3 performs the yarn joining operation, and to prevent variations in the tension of the yarn Y on the winding device 40 side from being conveyed to the spinning device 20 side. A pair of pulling rollers, such as delivery rollers, can be arranged between the spinning device 20 and the yarn accumulating device 30, and the yarn Y can be pulled from the spinning device 20 by using those pulling rollers. When this configuration is adopted, the yarn accumulating device 30 can be omitted.

[0015] A guide member 34 that guides the yarn Y pulled from the yarn accumulating device 30 to the downstream side is provided downstream of the yarn accumulating device 30. The guide member 34 guides the yarn Y pulled from the accumulating roller 31 such that the yarn Y passes on a line that extends from a rotation axis of the accumulating roller 31.

[0016] A yarn monitoring device 21 that monitors a quality of the yarn Y is arranged between the spinning device 20 and the yarn accumulating device 30 in the yarn traveling direction. The yarn monitoring device 21 monitors a thickness of the traveling yarn Y with a not-shown optical sensor. The yarn monitoring device 21 detects a yarn defect (a portion in which the yarn Y has an abnormal thickness and the like) of the yarn Y. The sensor of the yarn monitoring device 21 is not limited to the optical sensor; it can be, for example, an electrostatic capacitance sensor. Moreover, the yarn monitoring device 21 can also detect a foreign substance included in the yarn Y as the yarn defect.

[0017] When a yarn defect is detected in the yarn Y by the yarn monitoring device 21, the spinning unit 2 stops the supply of the air to the spinning device 20 to stop the formation of the yarn Y thereby cutting the yarn Y. A cutter can be arranged near the yarn monitoring device 21 and the yarn Y can be cut with the cutter.

[0018] The winding device 40 is arranged downstream of the yarn accumulating device 30. The winding device 40 winds the yarn Y on the bobbin B while traversing the yarn Y thereby forming the package P. The winding device 40 includes a cradle arm 41, a winding drum 42, and a traversing device 43.

[0019] The cradle arm 41 is pivotably supported on a support shaft 44. The cradle arm 41 rotatably supports the bobbin B (the package P) on which the yarn Y is wound. The winding drum 42 is rotationally driven in a predetermined direction at a constant rotational speed.

By pivoting about the support shaft 44, the cradle arm 41 can cause the outer peripheral surface of the bobbin B (the package P) to contact with or separate from the winding drum 42. When the outer peripheral surface of the bobbin B (the package P) is made to contact the rotationally driven winding drum 42, the bobbin B (the package P) can be caused to rotate in a winding direction whereby the yarn Y is wound on the outer peripheral surface of the bobbin B (the package P).

[0020] The traversing device 43 includes a traversing guide 45 that can guide the yarn Y. The traversing guide 45 is configured so as to perform, by a not-shown driving source, a reciprocating movement in a direction parallel to an axial direction of the winding drum 42. By reciprocally driving the traversing guide 45 while rotating the winding drum 42, it is possible to wind the yarn Y on the package P while traversing the yarn Y. A traversing groove can be formed on the winding drum 42 so that the spinning unit 2 can traverse the yarn Y by using only the winding drum 42 without the traversing device 43.

[0021] The yarn joining cart 3 is explained below. As shown in FIG. 1, a rail 8 that extends in the arrangement direction is arranged in the spinning frame 1. The yarn joining cart 3 has wheels 50 that move on the rail 8 and a motor 51 (see FIG. 5) that drives the wheels 50. Accordingly, the yarn joining cart 3 can travel freely in the arrangement direction of the spinning units 2. When a yarn breakage or a yarn cut occurs in a certain spinning unit 2, the yarn joining cart 3 moves to that spinning unit 2, and performs the yarn joining of the yarn Y that has become discontinuous between the spinning device 20 and the winding device 40.

[0022] As shown in FIGS. 2 to 4, the yarn joining cart 3 includes a yarn joining device 52, a suction pipe 53 (suction member), a suction mouth 54 (suction member), and the like. When the yarn Y has become discontinuous between the spinning device 20 and the winding device 40, as shown in FIG. 4, the yarn joining device 52 performs the yarn joining of the yarn (upper yarn) Y from the spinning device 20 guided by the suction pipe 53 and the yarn (lower yarn) Y from the winding device 40 guided by the suction mouth 54. In the present embodiment, a splicer that applies a twist to yarn ends of the upper yarn Y and the lower yarn Y by a swirling air current thereby forming a joint is used as the yarn joining device 52. However, the yarn joining device 52 is not limited to the splicer and, for example, can be a knoter that joins the upper yarn Y and the lower yarn Y. The yarn joining cart 3 can be a piecer that guides the lower yarn Y to the spinning device 20 and connects the yarns Y by restarting the spinning in the spinning device 20.

[0023] The suction pipe 53 is configured so as to be pivotable vertically about an axis 53a. As shown in FIG. 3, when the suction pipe 53 is pivoted upward such that a tip of the suction pipe 53 is positioned near the downstream of the spinning device 20, the suction pipe 53 can suck and hold the upper yarn Y spun by the spinning device 20. Furthermore, as shown in FIG. 4, when the

suction pipe 53 is pivoted downward with the upper yarn Y spun by the spinning device 20 sucked and held thereby, the suction pipe 53 can guide the upper yarn Y to the yarn joining device 52.

[0024] The suction mouth 54 is configured so as to be pivotable vertically around an axis 54a. As shown in FIG. 3, when the suction mouth 54 is pivoted downward such that a tip of the suction mouth 54 is positioned near the outer peripheral surface of the package P, the suction mouth 54 can suck and hold the lower yarn Y pulled from the package P. Furthermore, as shown in FIG. 4, when the suction mouth 54 is pivoted upward with the lower yarn Y pulled from the package P sucked and held thereby, the suction mouth 54 can guide the lower yarn Y to the yarn joining device 52.

[0025] The yarn joining cart 3 includes a reverse rotation roller 55 that rotates the package P in a pulling direction that is a reverse direction of the winding direction. The reverse rotation roller 55 is attached to a linking mechanism 56. The reverse rotation roller 55 is rotationally driven by a reverse rotation motor 57 (see FIG. 5) in a reverse direction of the rotation direction of the winding drum 42. The linking mechanism 56 is expanded and contracted by an air cylinder 58. When the linking mechanism 56 is expanded by the air cylinder 58, as shown in FIG. 3, the reverse rotation roller 55 contacts the package P that has been separated from the winding drum 42 thereby rotating the package P in the pulling direction. While rotating the package P in the pulling direction, the yarn end of the lower yarn Y that has been wound on the package P can be sucked with the suction mouth 54, and the yarn end can be guided to the yarn joining device 52.

[0026] An electrical configuration of the spinning frame 1 is explained below by referring to FIG. 5. The spinning frame 1 according to the present embodiment includes a central control section 1a. The central control section 1a is configured so as to exchange electric signals between the spinning units 2 and the yarn joining cart 3. The central control section 1a is capable of centrally managing and controlling the spinning units 2 and the yarn joining cart 3. Each of the spinning units 2 includes a unit control section 2a that controls operations of the components of the spinning unit 2 and that can communicate with the central control section 1a. However, one unit control section 2a can be arranged for a predetermined number of the spinning units 2. The yarn joining cart 3 includes a cart control section 3a that controls operations of the components of the yarn joining cart 3 and that can communicate with the central control section 1a.

[0027] In the present embodiment, as shown in FIG. 6, one yarn joining cart 3 can perform the yarn joining operation with respect to 40 spinning units 2 arranged in a service region R, by moving in the service region R. A unit number among the numbers Y1 to Y40 is assigned to each of the spinning units 2. The number of the spinning units 2 arranged in the service region R can be equal to or more than 1 and equal to or less than 39, or equal to or more than 41 and equal to or less than 100. The

unit control section 2a of each of the spinning units 2 can transmit a yarn joining request signal containing information about its own unit number to the central control section 1a. The central control section 1a transmits to the cart control section 3a the yarn joining request signal received from the spinning unit 2. Accordingly, the yarn joining cart 3 starts the yarn joining operation. The yarn joining request signal can be transmitted directly from the unit control section 2a to the cart control section 3a.

[0028] Although the detailed explanation will be given later, each hollow triangle P1 shown in FIG. 6 represents a service position at which the yarn joining cart 3 performs the yarn joining operation in the corresponding spinning unit 2. A plurality of service positions P1 are arranged in the spinning frame 1. Each solid triangle P2 represents a standby position at which the yarn joining cart 3 stands by in a stop state without traveling and does not perform the yarn joining operation in any of the spinning units 2. Each of the standby positions P2 is set at the center of two adjacent service positions P1 in the arrangement direction. In each of the drawings, a position of the yarn joining cart 3 will be shown at a center of the yarn joining cart 3 in the arrangement direction (for example, FIG. 6 shows a state in which the yarn joining cart 3 has stopped at the service position P1 of the spinning unit 2 having the unit number Y16).

[0029] As shown in FIG. 1, the spinning frame 1 includes a discharge duct 9 extending along the arrangement direction. One end of the discharge duct 9 is connected to the suction device 6. As shown in FIGS. 2 to 4, a pipe-shaped connection tube 59 that projects downward from a lower side of a frame of the yarn joining cart 3 is provided in the yarn joining cart 3. In the present embodiment, a bottom end of the connection tube 59 is separated from a top surface of the discharge duct 9 by a small distance. However, the bottom end of the connection tube 59 may be touching the top surface of the discharge duct 9. The connection tube 59 can be connected to an opening 9a formed on the top surface of the discharge duct 9.

[0030] The connection tube 59 of the yarn joining cart 3 is connected to the suction pipe 53 via a suction tube 61, and the connection tube 59 is connected to the suction mouth 54 via a suction tube 62. A plurality of openings 9a is formed on the top surface of the discharge duct 9 in the arrangement direction at a pitch p that is the same as an arrangement pitch p of the spinning units 2. When the yarn joining cart 3 is positioned at the service position P1, the connection tube 59 is connected to the discharge duct 9 via one of the openings 9a. As a result, as shown by arrows in FIG. 7, an airflow that flows from the suction pipe 53 and the suction mouth 54 to the suction device 6 via the suction tubes 61 and 62, the connection tube 59, and the discharge duct 9 is generated. Accordingly, a negative pressure (suction force) can be generated at the tips of the suction pipe 53 and the suction mouth 54.

[0031] When performing the yarn joining operation with the yarn joining cart 3 in a certain spinning unit 2, as

shown in FIG. 7, the yarn joining cart 3 moves to the service position P1 corresponding to the spinning unit 2 and stops (an example in which the yarn joining operation is performed in the central spinning unit 2 is shown in FIG. 7). When the yarn joining cart 3 is positioned at the service position P1, the yarn joining device 52 is positioned at a position at which the yarn joining device 52 overlaps, when seen from the front, with a yarn path in the spinning unit 2 in which the yarn joining operation is to be performed, and the connection tube 59 is connected to the opening 9a provided corresponding to this spinning unit 2. Accordingly, the yarn joining operation by the yarn joining cart 3 can be performed. The service positions P1 are arranged in the arrangement direction at the pitch p that is the same as the arrangement pitch p of the spinning units 2 so that the yarn joining cart 3 can perform the yarn joining operation in each of the spinning units 2.

[0032] When not performing the yarn joining operation, as shown in FIG. 8, the yarn joining cart 3 moves to the standby position P2 and stops. The standby position P2 is located at the center of two adjacent service positions P1 in the arrangement direction. In the same manner as the service position P1, the standby positions P2 are arranged in the arrangement direction at the pitch p that is the same as the arrangement pitch p of the spinning units 2. When the yarn joining cart 3 is positioned at the standby position P2, the connection tube 59 is positioned at a position (a central location between the two adjacent openings 9a) that does not match with the opening 9a. Therefore, when the yarn joining cart 3 is positioned at the standby position P2, the yarn joining operation cannot be performed in the spinning unit 2 as the connection tube 59 is not connected to the discharge duct 9.

[0033] A plurality of shutters 70 is arranged on the top surface of the discharge duct 9 such that each of the shutters 70 opens / closes a corresponding one of the openings 9a. As shown in FIGS. 9A to 9C, each of the shutters 70 according to the present embodiment is a thin, cross-shaped member having a contour obtained by combining a plurality of circular members. The shutter 70 includes a central part 70a and four plates 70b that project outward in a radial direction from the central part 70a. The four plates 70b are arranged at an equal interval of 90 degrees in a circumferential direction. The opening 9a is closed when any of the plates 70b covers the opening 9a. Between two adjacent plates 70b in the circumferential direction is formed an open part 70c that is concave. The opening 9a is opened when the open part 70c overlaps with the opening 9a. The central part 70a is attached to the top surface of discharge duct 9 via a support shaft 71. The shutter 70 is rotatable about the support shaft 71.

[0034] As shown in FIG. 9A, when the plate 70b covers the opening 9a, as the plate 70b firmly contacts the top surface of the discharge duct 9 around the opening 9a because of the negative pressure in the discharge duct 9, the opening 9a is closed by the shutter 70. When the yarn joining cart 3 is being moved to the service position

P1 (moving the connection tube 59 to a position of the opening 9a), as shown in FIG. 9B, the lower end of the connection tube 59 contacts a border of the plate 70b, rotates the shutter 70, and enters into the open part 70c. When the yarn joining cart 3 arrives at the service position P1, as shown in FIG. 9C, the connection tube 59 is exactly above the opening 9a and positioned in the open part 70c. Accordingly, the connection tube 59 can be connected to the discharge duct 9 via the opening 9a.

[0035] When the yarn joining cart 3 leaves the service position P1, the lower end of the connection tube 59 contacts the border of the plate 70b thereby rotating the shutter 70. As a result, as shown in FIG. 9A, the opening 9a is closed by the shutter 70 again. That is, the shutter 70 according to the present embodiment is configured such that, when the yarn joining cart 3 moves to the service position P1, the connection tube 59 contacts the shutter 70 and the shutter 70 is rotated to an open position at which the opening 9a is opened, and when the yarn joining cart 3 leaves the service position P1, the connection tube 59 contacts the shutter 70 and the shutter 70 is rotated to a closed position at which the shutter 70 closes the opening 9a.

[0036] Conventionally, the yarn joining cart 3 that has finished the yarn joining operation at the service position P1 is controlled to wait at the same service position P1 until the next yarn joining request signal is received. However, as shown in FIG. 7, when the yarn joining cart 3 is positioned at the service position P1, the airflow is generated from the suction pipe 53 and the suction mouth 54 that are opened to the atmosphere to the discharge duct 9. Therefore, the suction device 6 unnecessarily consumes electric power. In contrast, in the present embodiment, when not performing the yarn joining operation, the yarn joining cart 3 is stopped at the standby position P2, and the openings 9a are closed by the shutters 70. As a result, the power consumption can be reduced.

[0037] Upon receiving the yarn joining request signal from a certain spinning unit 2, the cart control section 3a moves the yarn joining cart 3 to the service position P1 provided corresponding to the certain spinning unit 2 in which the yarn joining operation is to be performed. Then, as shown in FIG. 4, the yarn joining device 52 performs the yarn joining of the upper yarn Y guided to the yarn joining device 52 by the suction pipe 53 and the lower yarn Y guided to the yarn joining device 52 by the suction mouth 54.

[0038] In the spinning unit 2 in which the yarn joining operation has been just performed, a yarn breakage is easy to occur within about one minute after the completion of the yarn joining operation until traveling of the yarn Y becomes stable. When not receiving a yarn joining request signal from some other spinning unit 2 after the completion of the yarn joining operation, the cart control section 3a does not move the yarn joining cart 3 to the standby position P2 immediately after the completion of the yarn joining operation, instead, the cart control sec-

tion 3a causes the yarn joining cart 3 to wait at the service position P1 for a predetermined standby time (for example, between 30 seconds and 60 seconds).

[0039] When the standby time has elapsed, the cart control section 3a moves the yarn joining cart 3 from the current service position P1 to the standby position P2 that is adjacent to the current service position P1. For example, as shown in FIG. 6, when the standby position P2 adjacent to the current service position P1 exists on either side in the arrangement direction, the yarn joining cart 3 can be moved to the standby position P2 that is adjacent but that is toward the center (right side in FIG. 6) of the service region R of the yarn joining cart 3. The cart control section 3a causes the yarn joining cart 3 to wait at the standby position P2 until a yarn joining request signal is received next. When a yarn joining request signal is received newly, the cart control section 3a moves the yarn joining cart 3 to the service position P1 provided corresponding to the spinning unit 2 to perform the yarn joining operation, and causes the yarn joining cart 3 to perform the yarn joining operation.

[0040] When a yarn joining request signal has already been received from some other spinning unit 2 before completion of the yarn joining operation, the cart control section 3a does not stop the yarn joining cart 3 at any of the standby positions P2 after the completion of the yarn joining operation but directly moves the yarn joining cart 3 to the service position P1 provided corresponding to the spinning unit 2 that sent the yarn joining request signal.

[0041] In the present embodiment, two speed patterns are prepared for moving the yarn joining cart 3. In a first speed pattern shown in FIG. 10A, after increasing a moving speed of the yarn joining cart 3 by a certain acceleration to a maximum speed V1 (first maximum speed), the speed V1 is maintained. Moreover, when the yarn joining cart 3 approaches a stop position, the moving speed of the yarn joining cart 3 is reduced by a certain deceleration to stop the yarn joining cart 3. In a second speed pattern shown in FIG. 10B, after increasing the moving speed of the yarn joining cart 3 by a certain acceleration to a maximum speed V2 (second maximum speed) that is higher than the speed V1, the speed V2 is maintained. Moreover, when the yarn joining cart 3 approaches the stop position, the moving speed of the yarn joining cart 3 is first reduced by a certain deceleration so that the speed reaches the speed V1, the speed V1 is maintained for a certain time, thereafter, the speed is reduced by a certain deceleration to stop the yarn joining cart 3. In the second speed pattern, the speed of the yarn joining cart 3 may be reduced from the speed V2 directly to zero.

[0042] Upon moving the yarn joining cart 3, the cart control section 3a determines which speed pattern is to be used. The time for which the maximum speed V1 is to be maintained in the first speed pattern, or the time for which the maximum speed V2 is to be maintained in the second speed pattern is calculated depending on an ac-

tual moving distance. In the present embodiment, the same acceleration and the same deceleration are used in both the first speed pattern and the second speed pattern. However, the acceleration and the deceleration can be set different in the first speed pattern and the second speed pattern.

[0043] The low-speed first speed pattern is used when moving the yarn joining cart 3 from a certain service position P1 to the service position P1 that is adjacent to the certain service position P1 (when the moving distance is p). The high-speed second speed pattern is used when moving the yarn joining cart 3 from a certain service position P1 to the service position P1 that is two or more service positions away from the certain service position P1 (when the moving distance is px2 or more). Moreover, the low-speed first speed pattern is used when moving the yarn joining cart 3 from a certain service position P1 to the standby position P2 adjacent to the certain service position P1 (when the moving distance is p/2).

[0044] When moving the yarn joining cart 3, the cart control section 3a can calculate a required time for the movement based on a moving distance and a rotation number (rpm) of the motor 51, and the like. Specifically, first, the cart control section 3a calculates the moving distance of the yarn joining cart 3. Then, the cart control section 3a selects the first speed pattern when the moving distance is shorter than or equal to p, and selects the second speed pattern when the moving distances is longer than p. After selecting the appropriate speed pattern, the cart control section 3a calculates, based on the moving distance, the time for which the maximum speed V1 or V2 is to be maintained, and calculates the required time for the movement by adding thus calculated time to a fixed acceleration time and a fixed deceleration time. Instead of calculating the required time each time, the cart control section 3a can store a table that contains a correspondence of required times and moving distances beforehand, and acquire the required time from this table as needed. The cart control section 3a determines whether the required time has elapsed after the start of the movement of the yarn joining cart 3, and stops the yarn joining cart 3 when the required time has elapsed thereby positioning the yarn joining cart 3 at a desired position.

[0045] In the present embodiment, the yarn joining cart 3 (service cart) is configured such that the yarn joining cart 3 can stop at the service position P1 at which the connection tube 59 can be connected to the opening 9a formed in the discharge duct 9 and at which a service can be provided to the spinning unit 2 (winding unit), and can stop at the standby position P2 that is located between the two adjacent service positions P1 and at which the connection tube 59 cannot be connected to the opening 9a. Therefore, by stopping the yarn joining cart 3 at the standby position P2 when not performing the yarn joining operation in the spinning unit 2, the opening 9a to which the connection tube 59 is not connected can be closed with the shutter 70. Accordingly, the power consumption of the suction device 6 can be reduced. To re-

duce the power consumption of the suction device 6, one approach could be to provide some kind of opening and shutting valve to the connection tube 59. However, the number of parts will increase leading to increased costs and increased man-hours in the maintenance. However, the present embodiment has no such drawback.

[0046] In the present embodiment, after completion of the yarn joining operation in the spinning unit 2 at the service position P1, the yarn joining cart 3 moves to and stops at the standby position P2. As a result, the power consumption of the suction device 6 after the completion of the yarn joining operation can be reduced.

[0047] In the present embodiment, after completion of the yarn joining operation in the spinning unit 2 at the service position P1, the yarn joining cart 3 moves to the standby position P2 that is adjacent to the service position P1. As a result, the yarn joining cart 3 can quickly move to the standby position P2.

[0048] In the present embodiment, the yarn joining cart 3 can perform the yarn joining operation in a plurality of the spinning units 2 arranged in the predetermined service region R. After completion of the yarn joining operation in the spinning unit 2 at the service position P1, the yarn joining cart 3 moves to the standby position P2 that is nearer to the center of the service region R than the service position P1. As a result, the distance between the yarn joining cart 3 and most of the spinning units 2 can be reduced. Accordingly, when there is a service request from one of those spinning units 2 next, the time taken by the yarn joining cart 3 for the movement can be shortened.

[0049] In the present embodiment, there is provided the cart control section 3a (control section) that can control the operation of the yarn joining cart 3. A work efficiency and the like of the yarn joining cart 3 can be improved by causing the cart control section 3a to make various kinds of decisions and determinations.

[0050] In the present embodiment, when moving the yarn joining cart 3 from the service position P1 to the standby position P2, the cart control section 3a determines whether the required time for the movement has elapsed, and stops the yarn joining cart 3 if the required time has elapsed. Accordingly, the yarn joining cart 3 can be stopped at the standby position P2 without providing a sensor and the like in the yarn joining cart 3 to recognize the standby position P2.

[0051] In the present embodiment, the cart control section 3a can control the movement of the yarn joining cart 3 in accordance with the first speed pattern in which the yarn joining cart 3 can be moved from a certain service position P1 to another service position P1 adjacent to the certain service position P1 and the second speed pattern in which the maximum speed is faster than the maximum speed in the first speed pattern and in which the yarn joining cart 3 can be moved from the certain service position P1 to another service position P1 that is positioned two or more service positions P1 away from the certain service position P1. When moving the yarn joining cart

3 from the certain service position P1 to the standby position P2 adjacent to the certain service position P1, the cart control section 3a moves the yarn joining cart 3 by using the first speed pattern. By using the low-speed first speed pattern when moving the yarn joining cart 3 to the adjacent standby position P2, the yarn joining cart 3 can be accurately stopped at the standby position P2.

[0052] In the present embodiment, when the cart control section 3a receives a yarn joining request signal (service request signal) from a certain spinning unit 2 while the yarn joining cart 3 is stopping at the standby position P2, the yarn joining cart 3 is moved from the standby position P2 to the service position P1 at which the yarn joining cart 3 can perform the yarn joining operation in the spinning unit 2 that sent the yarn joining request signal. With this arrangement, the yarn joining operation can be quickly started in the spinning unit 2 that sent the yarn joining request signal.

[0053] In the present embodiment, when a yarn joining request signal has been received from some other spinning unit 2 before completion of the yarn joining operation in a certain spinning unit 2 at the service position P1, the cart control section 3a does not stop the yarn joining cart 3 at any of the standby positions P2 after completion of the yarn joining operation but directly moves the yarn joining cart 3 to the service position P1 for performing the yarn joining operation provided corresponding to the spinning unit 2 that sent the yarn joining request signal. Thus, when the service request signal has been received before completion of the yarn joining operation, by directly moving the yarn joining cart 3 from the current service position P1 to the next service position P1 without stopping at the standby position P2, the yarn joining operation can be started quickly.

[0054] In the present embodiment, the yarn joining cart 3 includes the yarn joining device 52 that performs the yarn joining operation. Moreover, the cart control section 3a moves the yarn joining cart 3 to the standby position P2 after completion of the yarn joining operation in the spinning unit 2 at the service position P1. As a result, the power consumption of the suction device 6 after completion of the yarn joining operation can be reduced.

[0055] In the present embodiment, the cart control section 3a moves the yarn joining cart 3 to the standby position P2 after a predetermined standby time has elapsed after the completion of the yarn joining operation in the spinning unit 2 at the service position P1. Generally, in the spinning unit 2 in which the yarn joining operation has been just performed, a yarn breakage is easy to occur immediately after the completion of the yarn joining operation. Therefore, by stopping the yarn joining cart 3 at the same service position P1 just for the predetermined standby time after the completion of the yarn joining operation, the yarn joining operation can be performed immediately in case a yarn breakage occurs.

[0056] In the present embodiment, when the yarn joining cart 3 moves to the service position P1, by contact with the connection tube 59, the shutter 70 is switched

to the open position at which the opening 9a is open, and when the yarn joining cart 3 leaves the service position P1, by contact with the connection tube 59, the shutter 70 is switched to the closed position at which the shutter closes the opening 9a. As a result, no special mechanism and electric parts are required to operate the shutter 70.

[0057] The embodiments of the present invention are explained above; however, the present invention is not necessarily limited to these embodiments. As explained below, the present invention can be implemented by making various changes in a range that does not deviate from the gist of the present invention.

[0058] For example, in the above embodiment, it is assumed that one yarn joining cart 3 performs the yarn joining operation in all the spinning units 2; however, a plurality of the yarn joining carts 3 can be arranged to perform the yarn joining operation. An example in which the yarn joining operation is performed in 40 spinning units 2 (unit numbers Y1 to Y40) with two yarn joining carts 3 (3A, 3B) is explained below by referring to FIG. 11. In FIG. 11, for simplicity, it is shown that the yarn joining carts 3A and 3B travel on different rails; however, in a real situation, both the yarn joining carts 3A and 3B travel on a common rail.

[0059] A service region RA is a region in which the yarn joining cart 3A can travel. The spinning units 2 having the unit numbers Y1 to Y24 are arranged in the service region RA. A service region RB is a region in which the yarn joining cart 3B can travel. The spinning units 2 having the unit numbers Y17 to Y40 are arranged in the service region RB. A service region RC is a region of overlap of the service region RA and the service region RB. That is, the service region RC is the region in which both the yarn joining carts 3A and 3B can travel, and the spinning units 2 having the unit numbers Y17 to Y24 are arranged in the service region RC.

[0060] When a yarn joining request signal is received from a certain spinning unit 2, the central control section 1a transmits the yarn joining request signal to the yarn joining cart 3 that can perform the yarn joining operation in that spinning unit 2. Specifically, when the yarn joining request signal is sent from one of the spinning units 2 having the unit numbers Y1 to Y16, the yarn joining request signal is transmitted to the yarn joining cart 3A. In contrast, when the yarn joining request signal is sent from one of the spinning units 2 having the unit numbers Y25 to Y40, the yarn joining request signal is transmitted to the yarn joining cart 3B. If the yarn joining request signal is sent from one of the spinning units 2 having the unit numbers Y17 to Y24, for example, the yarn joining request signal is transmitted to the yarn joining cart 3A (or 3B) positioned nearer the spinning unit 2 that sent the yarn joining request signal.

[0061] The cart control section 3a of the yarn joining cart 3A (or 3B) that received the yarn joining request signal moves the yarn joining cart 3A (or 3B) to the service position P1 provided corresponding to the spinning unit 2 for the yarn joining operation. After completion of the

yarn joining operation, the cart control section 3a moves the yarn joining cart 3 from the service position P1 to the standby position P2 that is adjacent to the service position P1. At this time, in the same manner as in the above embodiment, the yarn joining cart 3 is not immediately moved to the standby position P2 after the completion of the yarn joining operation, instead, the yarn joining cart 3 can be caused to wait at the service position P1 for the predetermined standby time.

[0062] However, even if there is a plurality of the yarn joining carts 3A and 3B, it is not necessary that the service region RA of the yarn joining cart 3A and the service region RB of the yarn joining cart 3B partially overlap in the manner explained above.

[0063] In the above embodiment, after finishing the yarn joining operation at the service position P1, the yarn joining cart 3 is moved to the standby position P2 that is adjacent to the current service position P1. However, the yarn joining cart 3 may be moved to some other standby position P2 that is not adjacent to the current service position P1. For example, the yarn joining cart 3 can be moved to the standby position P2 that is nearest to the center of the service region R.

[0064] In the above embodiment, when the standby position P2 adjacent to the current service position P1 exists on either side in the arrangement direction, the yarn joining cart 3 is moved after the completion of the yarn joining operation at the service position P1 to the standby position P2 that is adjacent but toward the center of the service region R of the yarn joining cart 3. However, the yarn joining cart 3 can be moved to the standby position P2 that is adjacent but located in the opposite direction of the center of the service region R.

[0065] Alternatively, the cart control section 3a can determine the standby position P2 at which the yarn joining cart 3 is to be stopped based on a service occurrence frequency in each of the spinning units 2. With this arrangement, the yarn joining cart 3 can be caused to wait at the standby position P2 near the spinning unit 2 having a high service occurrence frequency, whereby the work efficiency can be improved. For example, after completion of the yarn joining operation in the spinning unit 2 at the service position P1, the cart control section 3a can move the yarn joining cart 3 to the standby position P2 that is adjacent to the service position P1 for providing the service to the spinning unit 2 having the highest service occurrence frequency. With this arrangement, the yarn joining cart 3 can be caused to wait at the standby position P2 near the spinning unit 2 having the highest service occurrence frequency, whereby the work efficiency can be further improved.

[0066] In the above embodiment, the yarn joining cart 3 is moved based on the required time acquired beforehand by the cart control section 3a. However, a position indicator that indicates the service position P1 and / or the standby position P2 can be provided in the spinning frame 1, and a detecting section that detects the position indicator can be provided in the yarn joining cart 3. In the

example shown in FIG. 12, a position indicating member 80 is arranged above the yarn joining cart 3 along the arrangement direction. The position indicating member 80 includes a plurality of service position indicators 81 that indicates the positions of the service positions P1 and a plurality of standby position indicators 82 that indicates the positions of the standby positions P2. A detecting section 63 including a proximity sensor and the like adapted to detect the service position indicators 81 and the standby position indicators 82 is arranged at an upper end of the yarn joining cart 3. The cart control section 3a can control the movement of the yarn joining cart 3 based on a detection signal output from the detecting section 63. Accordingly, the yarn joining cart 3 can be accurately stopped at the desired service position P1 and / or the standby position P2.

[0067] In the above embodiment, the standby position P2 is set at the center of the two adjacent service positions P1. However, as long as the connection tube 59 of the yarn joining cart 3 does not hinder the shutter 70 from closing the opening 9a, the standby position P2 can be anywhere and not limited to the center of the two adjacent service positions P1.

[0068] The specific structure of the shutter 70 is not limited to the one explained in the above embodiment. For example, an electric opening and shutting valve may be adopted as the shutter 70.

[0069] In the above embodiment, the movement of the yarn joining cart 3 is controlled based on the two speed patterns; however, the speed pattern to be used can be only one or can be three or more.

[0070] In the above embodiment, a case of causing the yarn joining cart 3 of the spinning frame 1 to wait at the standby position P2 is explained; however, the device to which the present invention can be applied is not limited to the spinning frame 1. For example, if a suction mouth and the like of a doffing cart of an automatic winder is connected to a discharge duct in the same manner as in the above embodiment, the doffing cart can be caused to wait at a standby position between a service position and another service position.

[0071] A yarn winding machine according to one aspect of the present invention includes a plurality of winding units arranged in an arrangement direction; a discharge duct extending along the arrangement direction and in which a plurality of openings are formed along the arrangement direction; a plurality of shutters adapted to respectively open or close the openings; a service cart including a connection tube adapted to be connected to the discharge duct via one of the openings, the service cart being movable in the arrangement direction; and a suction device connected to the discharge duct. The service cart is able to stop at a service position and a standby position. The service position is a position at which the connection tube is connected to one of the openings and at which the service cart can perform a service in one of the winding units. The standby position is a position between two adjacent service positions and

at which the connection tube is not connected to the opening.

[0072] According to the above yarn winding machine, when the service is not performed in the winding unit, because the service cart can stop at the standby position and the opening to which the connection tube is not connected can be closed with the shutter, the power consumption of the suction device can be reduced.

[0073] In the above yarn winding machine, the service cart can move from a certain service position at which the service cart performs the service in a certain winding unit to the standby position after completion of the service in the certain winding unit.

[0074] As a result, the power consumption of the suction device after the completion of the service can be reduced.

[0075] In the above yarn winding machine, the service cart can move from a certain service position at which the service cart performs the service in a certain winding unit to the standby position adjacent to the certain service position after completion of the service in the certain winding unit.

[0076] As a result, the service cart can quickly move to the standby position.

[0077] In the above yarn winding machine, the service cart can perform the service in a plurality of the winding units within a predetermined service region, and after completion of the service in a certain winding unit at a certain service position, the service cart can move to the standby position positioned nearer to a center of the service region than the certain service position.

[0078] As a result, the distance between the service cart and most of the winding units can be reduced. Accordingly, when there is a service request from one of those winding units next, the time taken by the service cart for the movement can be shortened.

[0079] The above yarn winding machine can further include a control section adapted to control operation of the service cart.

[0080] A work efficiency and the like of the service cart can be improved by causing the control section to make various kinds of decisions and determinations.

[0081] In the above yarn winding machine, the control section can determine the standby position for stopping the service cart in accordance with a service occurrence frequency of each of the winding units.

[0082] As a result, the service cart can be caused to wait, for example, at the standby position near the winding unit having the highest service occurrence frequency, whereby the work efficiency can be improved.

[0083] In the above yarn winding machine, after completion of the service in a certain winding unit at a certain service position, the control section can control the service cart to move to the standby position adjacent to a different service position for performing service in a different winding unit having the highest service occurrence frequency.

[0084] As a result, the work efficiency can be further

improved.

[0085] In the above winding machine, when moving the service cart from a certain service position to the standby position, the control section can determine whether a required time for such movement has elapsed, and when the required time has elapsed, the control section can control the service cart to stop.

[0086] Accordingly, the service cart can be stopped at the standby position without providing a sensor and the like in the service cart to recognize the standby position.

[0087] In the above yarn winding machine, the control section can control movement of the service cart in accordance with a first speed pattern and a second speed pattern. The first speed pattern can be a speed pattern in which the service cart moves from a certain service position to a different service position adjacent to the certain service position at a speed that is equal to or lower than a first maximum speed, and the second speed pattern can be a speed pattern in which the service cart moves from a certain service position to a different service position positioned at least two service positions away from the certain service position at a speed that is equal to or lower than a second maximum speed that is higher than the first maximum speed. When moving the service cart from a certain service position to the standby position adjacent to the certain service position, the control section can control the service cart to move by using the first speed pattern.

[0088] As a result, the service cart can be accurately stopped at the standby position.

[0089] In the above yarn winding machine, upon receiving a service request signal from a certain winding unit while the service cart is stopping at the standby position, the control section can control the service cart to move from the standby position to a certain service position at which the service can be performed in the certain winding unit that has issued the service request signal.

[0090] As a result, the service can be quickly started in the winding unit that issued the service request signal.

[0091] In the above yarn winding machine, upon completion of the service in a certain winding unit at a certain service position, when the control section has already received a new service request signal from a different winding unit different from the certain winding unit, the control section can control the service cart to move to a different service position at which the service can be performed in the different winding unit without stopping at the standby position after completion of the service in the certain winding unit.

[0092] Thus, when the service request signal has already been received from the different winding unit before completion of the service in the certain winding unit, by directly moving the service cart from the certain service position to the different service position without stopping at the standby position, the service can be started quickly in the different winding unit.

[0093] In the above yarn winding machine, the service cart can include a yarn joining device adapted to perform

a yarn joining operation. After completion of the yarn joining operation in a certain winding unit at a certain service position, the control section can move the service cart to the standby position.

[0094] As a result, the power consumption of the suction device after completion of the yarn joining operation can be reduced.

[0095] In the above yarn winding machine, upon elapse of a predetermined standby time after completion of the yarn joining operation in a certain winding unit at a certain service position, the control section can move the service cart to the standby position.

[0096] Generally, in the winding unit in which the yarn joining operation has been just performed, a yarn breakage is easy to occur immediately after the completion of the yarn joining operation. Therefore, by stopping the service cart at the same service position just for the predetermined standby time after the completion of the yarn joining operation, the yarn joining operation can be performed immediately in case a yarn breakage occurs.

[0097] In the above yarn winding machine, when the service cart moves to a certain service position, the connection tube can contact a corresponding shutter and the shutter can be switched to an open position to open the opening, and when the service cart moves away from the certain service position, the connection tube can contact the shutter and the shutter can be switched to a closed position to close the opening.

[0098] As a result, no special mechanism and electric parts can be required to operate the shutter.

[0099] The above yarn winding machine can further include a standby position indicator adapted to indicate the standby position. The service cart can include a detecting section adapted to detect the standby position indicator.

[0100] In this arrangement, by controlling the movement of the service cart based on a detection signal output from the detecting section, the service cart can be accurately stopped at the standby position.

[0101] In the above yarn winding machine, the winding units are arranged at a predetermined arrangement pitch in the arrangement direction, and a distance between the service position and the standby position adjacent to the service position is shorter than the arrangement pitch.

[0102] In the above explanation, the meaning of "a plurality of" also includes "a predetermined number of".

Claims

1. A yarn winding machine (1) comprising:

a plurality of winding units (2) arranged in an arrangement direction;
 a discharge duct (9) extending along the arrangement direction and in which a plurality of openings (9a) are formed along the arrangement direction;

a plurality of shutters (70) adapted to respectively open or close the openings (9a);

a service cart (3; 3A, 3B) including a connection tube (59) adapted to be connected to the discharge duct (9) via one of the openings (9a), the service cart (3; 3A, 3B) being movable in the arrangement direction; and

a suction device (6) connected to the discharge duct (9), **characterized in that**

the service cart (3; 3A, 3B) is able to stop at a service position (P1) and a standby position (P2), the service position (P1) being a position at which the connection tube (59) is connected to one of the openings (9a) and at which the service cart (3; 3A, 3B) performs a service in one of the winding units (2), and the standby position (P2) being a position between two adjacent service positions (P1) and at which the connection tube (59) is not connected to the opening (9a) .

2. The yarn winding machine (1) as claimed in Claim 1, wherein the service cart (3; 3A, 3B) is adapted to move from a certain service position (P1) at which the service cart (3; 3A, 3B) performs the service in a certain winding unit (2) to the standby position (P2) after completion of the service in the certain winding unit (2).

3. The yarn winding machine (1) as claimed in Claim 2, wherein the standby position (P2) is adjacent to the certain service position (P1).

4. The yarn winding machine (1) as claimed in Claim 2 or 3, wherein
 the service cart (3; 3A, 3B) is adapted to perform the service in a plurality of the winding units (2) within a predetermined service region (R; RA, RB, RC), and after completion of the service in a certain winding unit (2) at a certain service position (P1), the service cart (3; 3A, 3B) moves to the standby position (P2) positioned nearer to a center of the service region (R; RA, RB, RC) than the certain service position (P1).

5. The yarn winding machine (1) as claimed in any one of Claims 1 to 4, comprising a control section (3a) adapted to control operation of the service cart (3; 3A, 3B).

6. The yarn winding machine (1) as claimed in Claim 5, wherein the control section (3a) is adapted to determine the standby position (P2) for stopping the service cart (3; 3A, 3B) in accordance with a service occurrence frequency of each of the winding units (2).

7. The yarn winding machine (1) as claimed in Claim 6,

wherein after completion of the service in a certain winding unit (2) at a certain service position (P1), the control section (3a) is adapted to control the service cart (3; 3A, 3B) to move to the standby position (P2) adjacent to a different service position (P1) for performing service in a different winding unit (2) having the highest service occurrence frequency.

8. The yarn winding machine (1) as claimed in any one of Claims 5 to 7, wherein when moving the service cart (3; 3A, 3B) from a certain service position (P1) to the standby position (P2), the control section (3a) is adapted to determine whether a required time for such movement has elapsed, and when the required time has elapsed, the control section (3a) is adapted to control the service cart (3; 3A, 3B) to stop.

9. The yarn winding machine (1) as claimed in any one of Claims 5 to 8, wherein the control section (3a) is adapted to control movement of the service cart (3; 3A, 3B) in accordance with a first speed pattern and a second speed pattern,

the first speed pattern being a speed pattern in which the service cart (3; 3A, 3B) moves from a certain service position (P1) to a different service position (P1) adjacent to the certain service position (P1) at a speed that is equal to or lower than a first maximum speed, and the second speed pattern being a speed pattern in which the service cart (3; 3A, 3B) moves from a certain service position (P1) to a different service position (P1) positioned at least two service positions (P1) away from the certain service position (P1) at a speed that is equal to or lower than a second maximum speed that is higher than the first maximum speed, and

when moving the service cart (3; 3A, 3B) from a certain service position (P1) to the standby position (P2) adjacent to the certain service position (P1), the control section (3a) is adapted to control the service cart (3; 3A, 3B) to move by using the first speed pattern.

10. The yarn winding machine (1) as claimed in any one of Claims 5 to 9, wherein upon receiving a service request signal from a certain winding unit (2) while the service cart (3; 3A, 3B) is stopping at the standby position (P2), the control section (3a) is adapted to control the service cart (3; 3A, 3B) to move from the standby position (P2) to a certain service position (P1) at which the service is to be performed in the certain winding unit (2) that has issued the service request signal.

11. The yarn winding machine (1) as claimed in any one of Claims 5 to 10, wherein upon completion of the

service in a certain winding unit (2) at a certain service position (P1), when the control section (3a) has already received a new service request signal from a different winding unit (2) different from the certain winding unit (2), the control section (3a) is adapted to control the service cart (3; 3A, 3B) to move to a different service position (P1) at which the service is to be performed in the different winding unit (2) without stopping at the standby position (P2) after completion of the service in the certain winding unit (2).

12. The yarn winding machine (1) as claimed in any one of Claims 5 to 11, wherein the service cart (3; 3A, 3B) includes a yarn joining device (52) adapted to perform a yarn joining operation, wherein after completion of the yarn joining operation in a certain winding unit (2) at a certain service position (P1), the control section (3a) is adapted to move the service cart (3; 3A, 3B) to the standby position (P2).

13. The yarn winding machine (1) as claimed in Claim 12, wherein upon elapse of a standby time after completion of the yarn joining operation in a certain winding unit (2) at a certain service position (P1), the control section (3a) is adapted to move the service cart (3; 3A, 3B) to the standby position (P2).

14. The yarn winding machine (1) as claimed in any one of Claims 1 to 13, wherein when the service cart (3; 3A, 3B) moves to a certain service position (P1), the connection tube (59) contacts a corresponding shutter (70) and the shutter (70) is switched to an open position to open the opening (9a), and when the service cart (3; 3A, 3B) moves away from the certain service position (P1), the connection tube (59) contacts the shutter (70) and the shutter (70) is switched to a closed position to close the opening (9a).

15. The yarn winding machine (1) as claimed in any one of Claims 1 to 14, further comprising a standby position indicator (82) adapted to indicate the standby position (P2), wherein the service cart (3; 3A, 3B) includes a detecting section (63) adapted to detect the standby position indicator (82).

16. The yarn winding machine (1) as claimed in any one of Claims 1 to 15, wherein the winding units (2) are arranged at a predetermined arrangement pitch in the arrangement direction, and a distance between the service position (P1) and the standby position (P2) adjacent to the service position (P1) is shorter than the arrangement pitch.

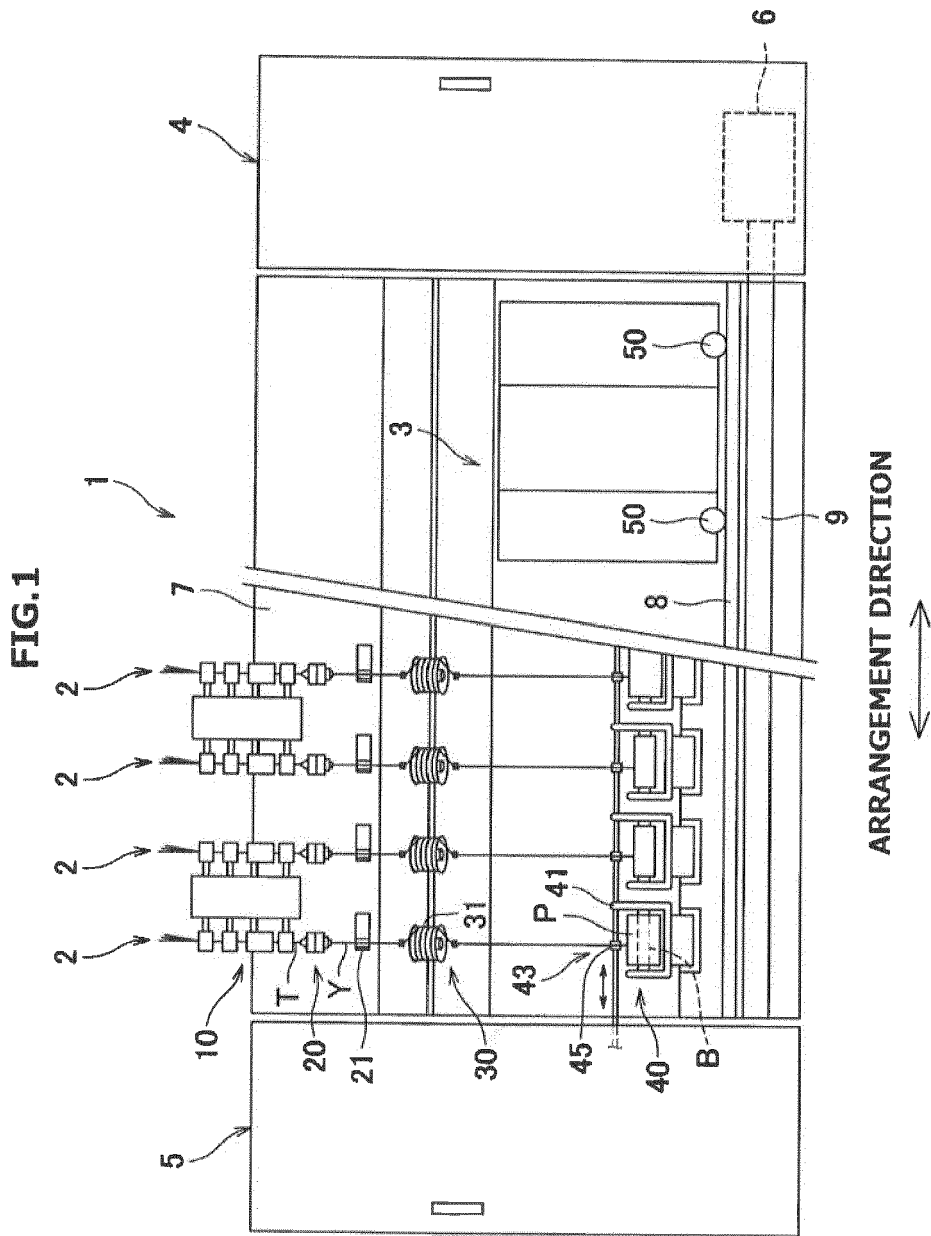


FIG. 2

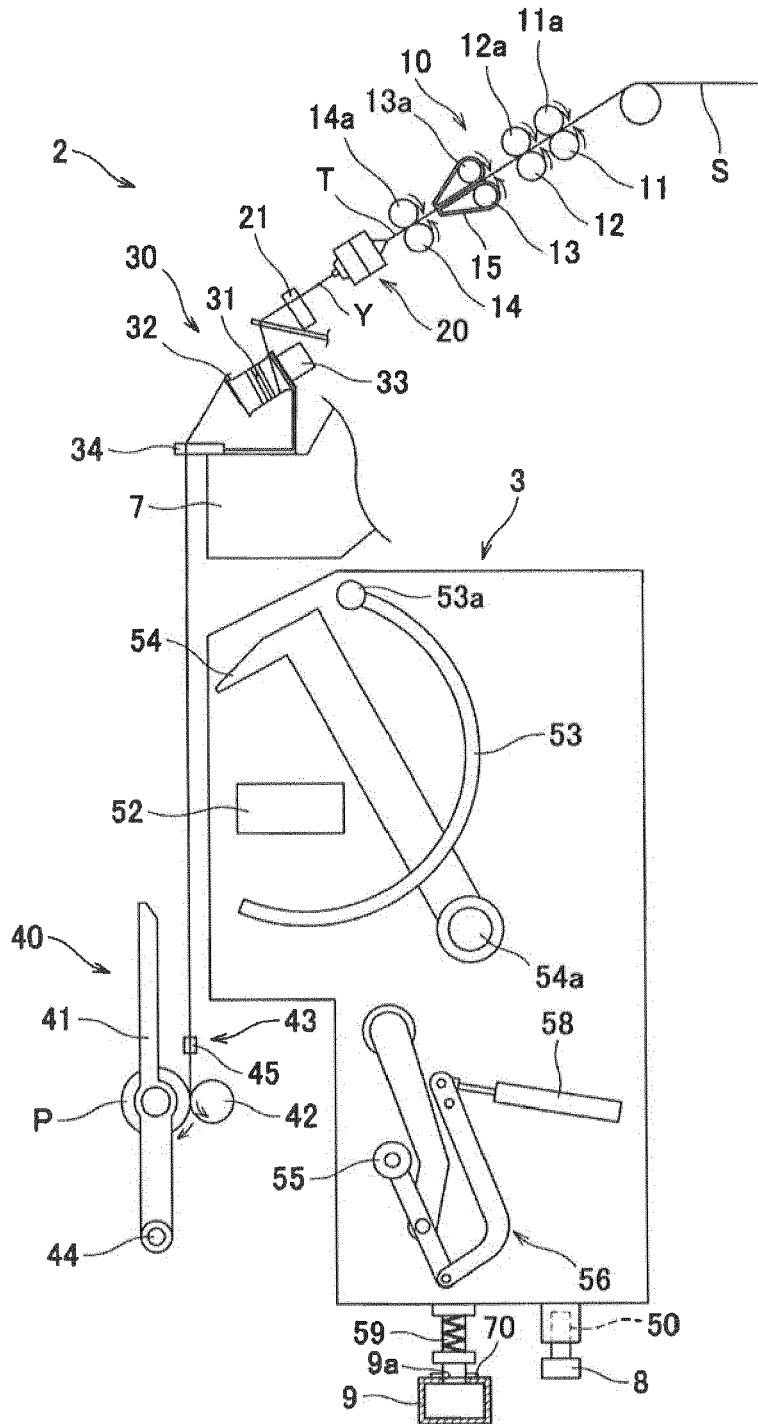


FIG.3

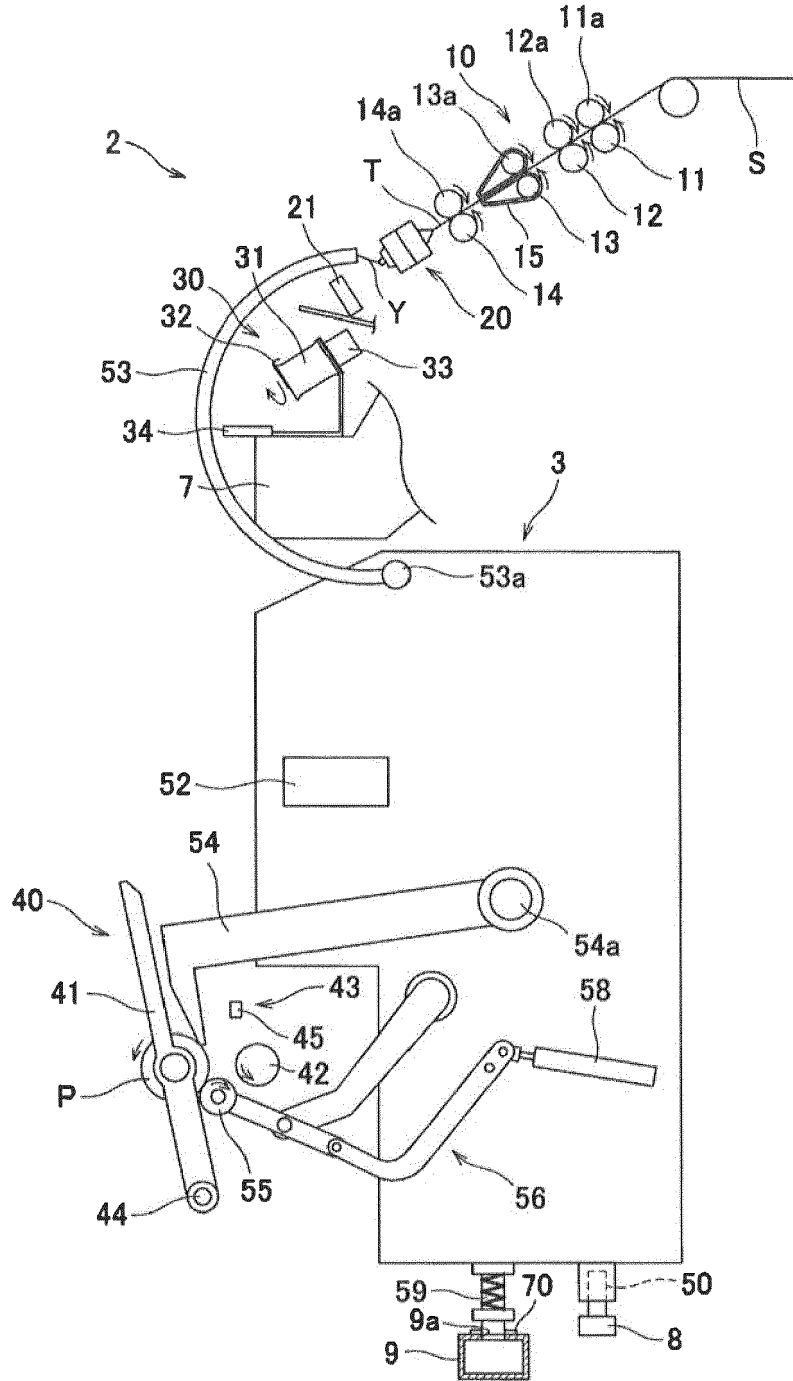


FIG. 4

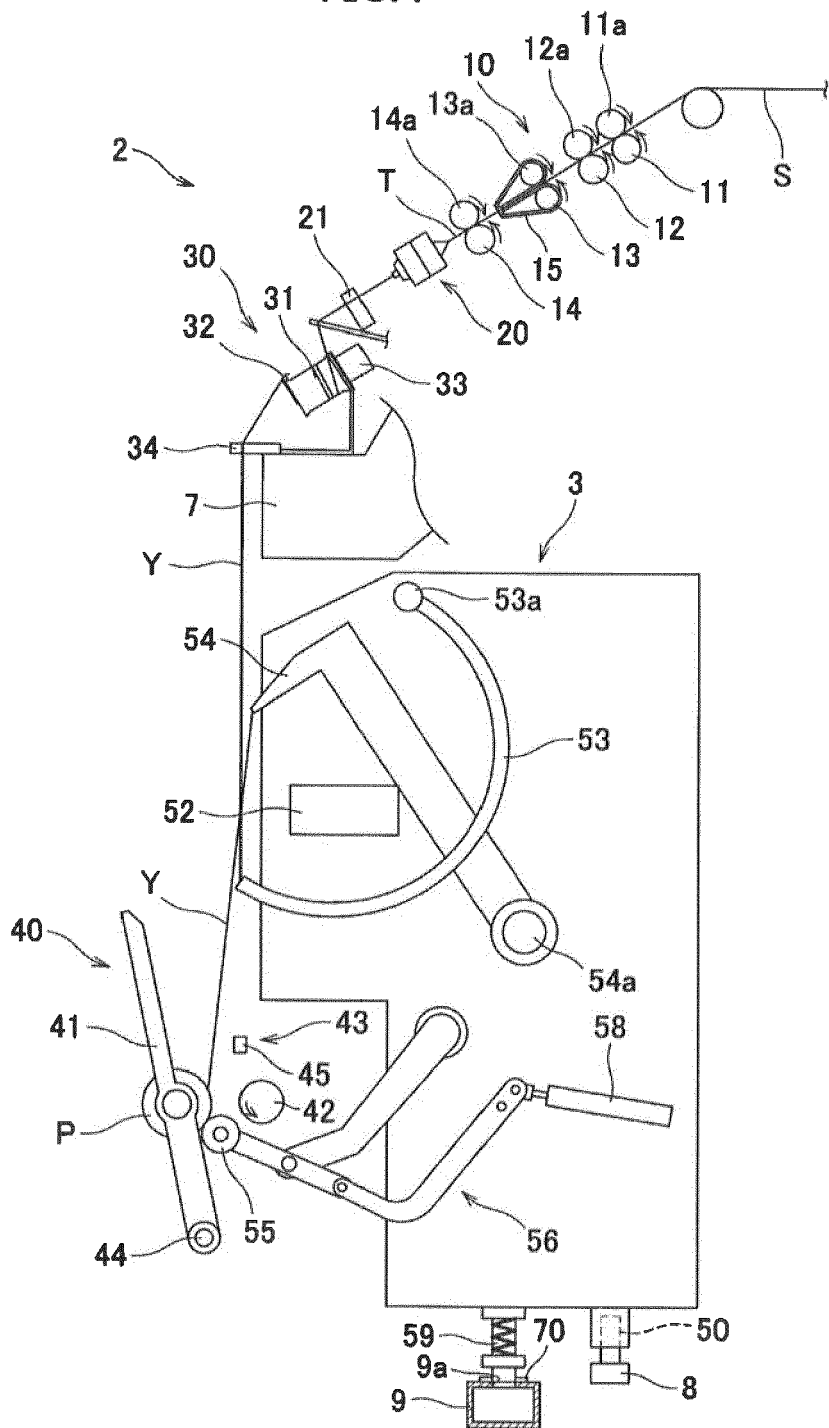


FIG.5

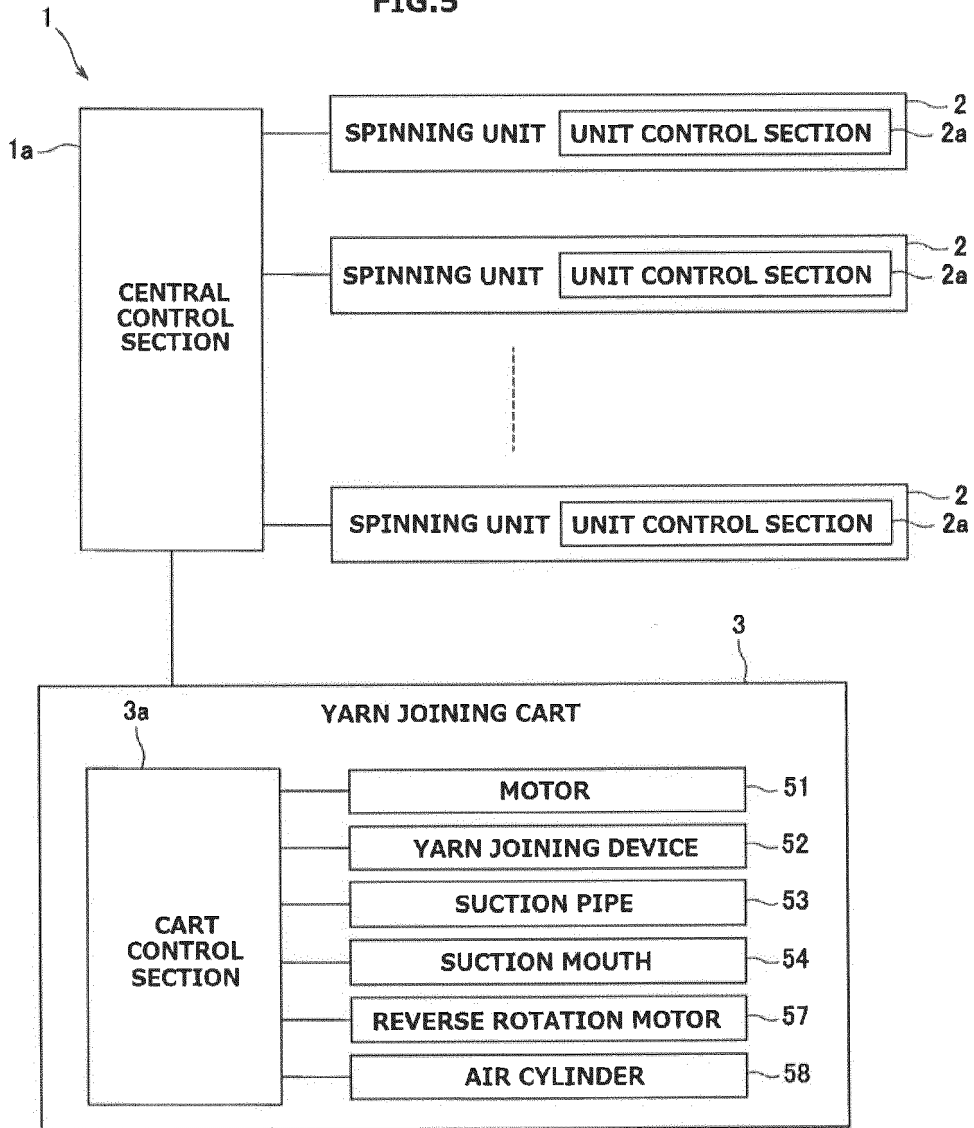


FIG. 6

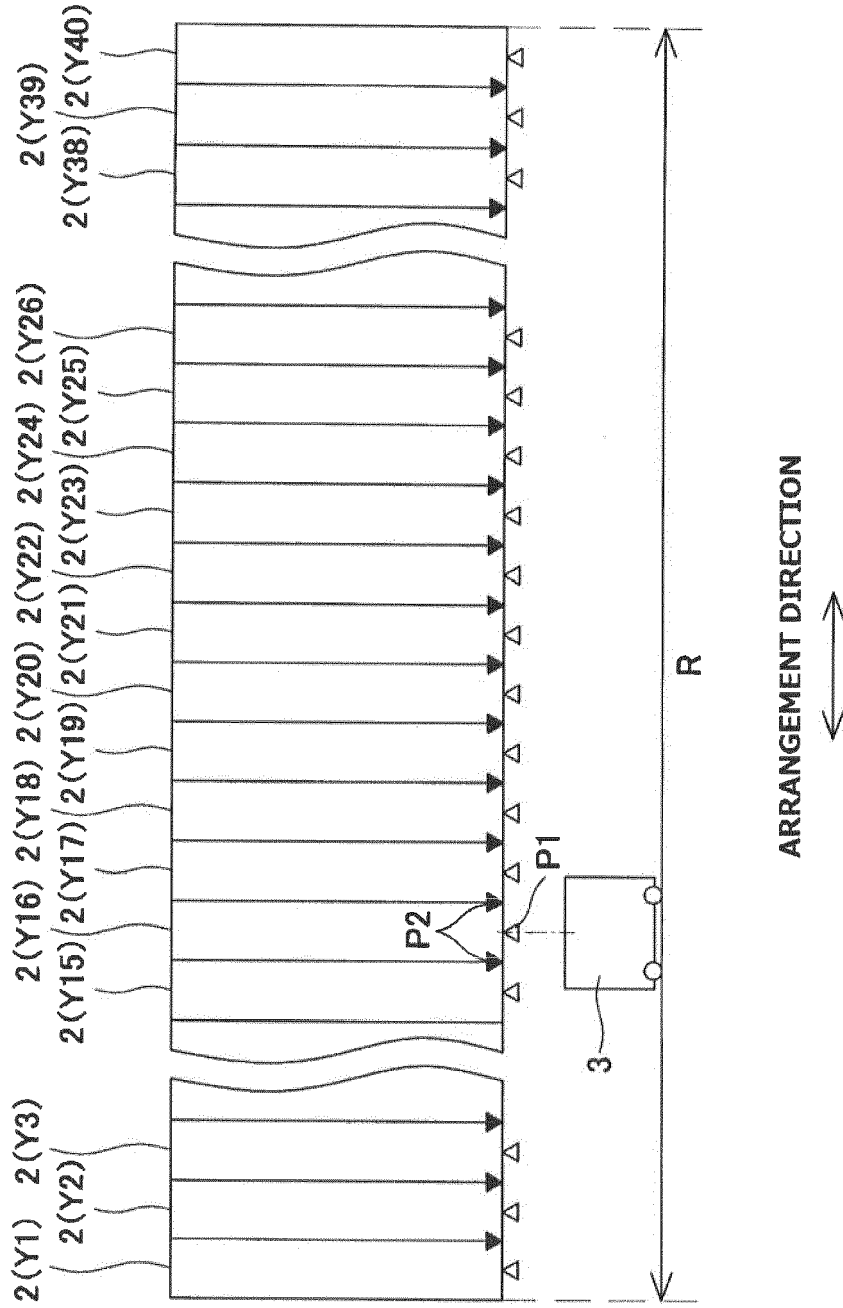


FIG.7

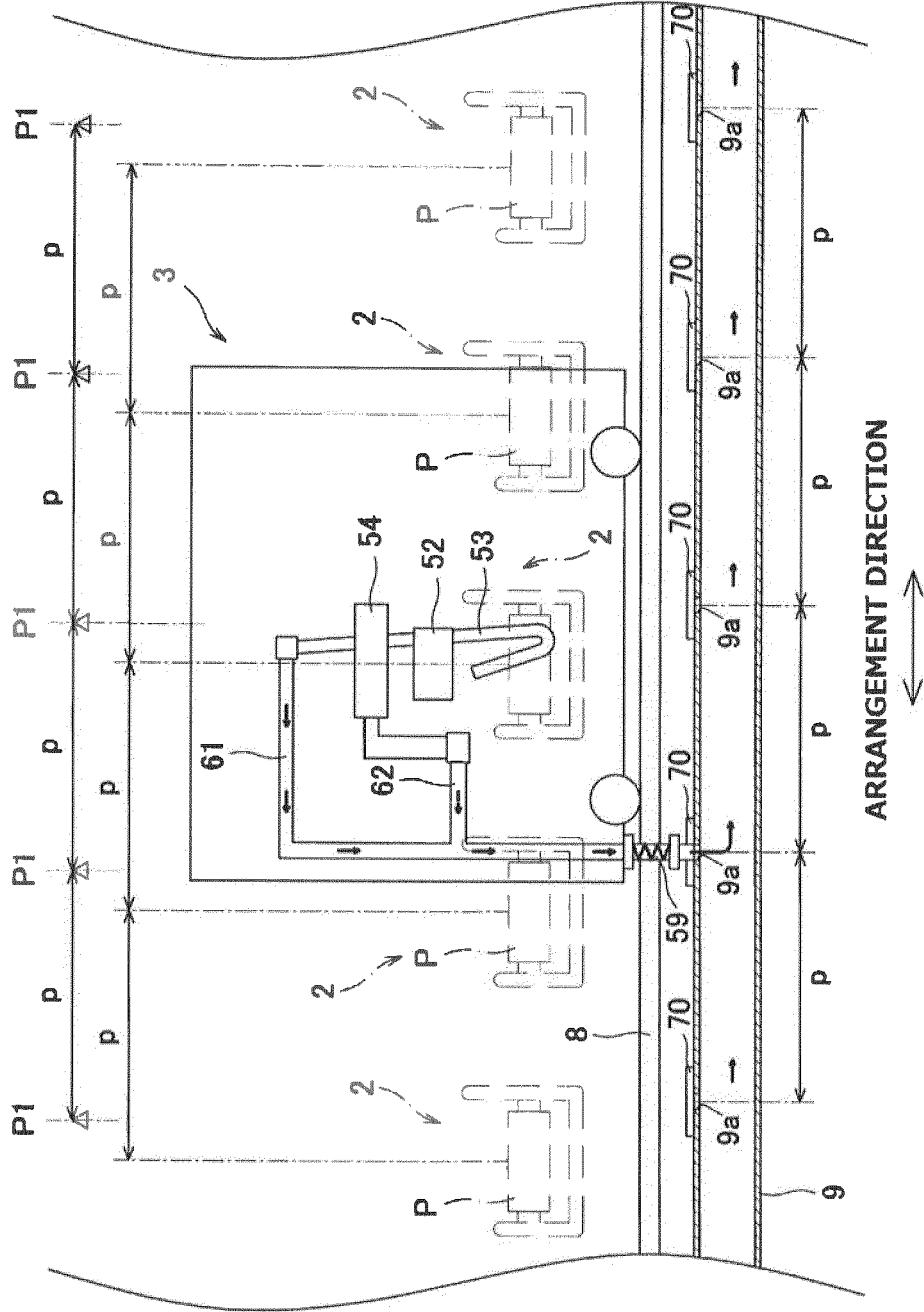


FIG.8

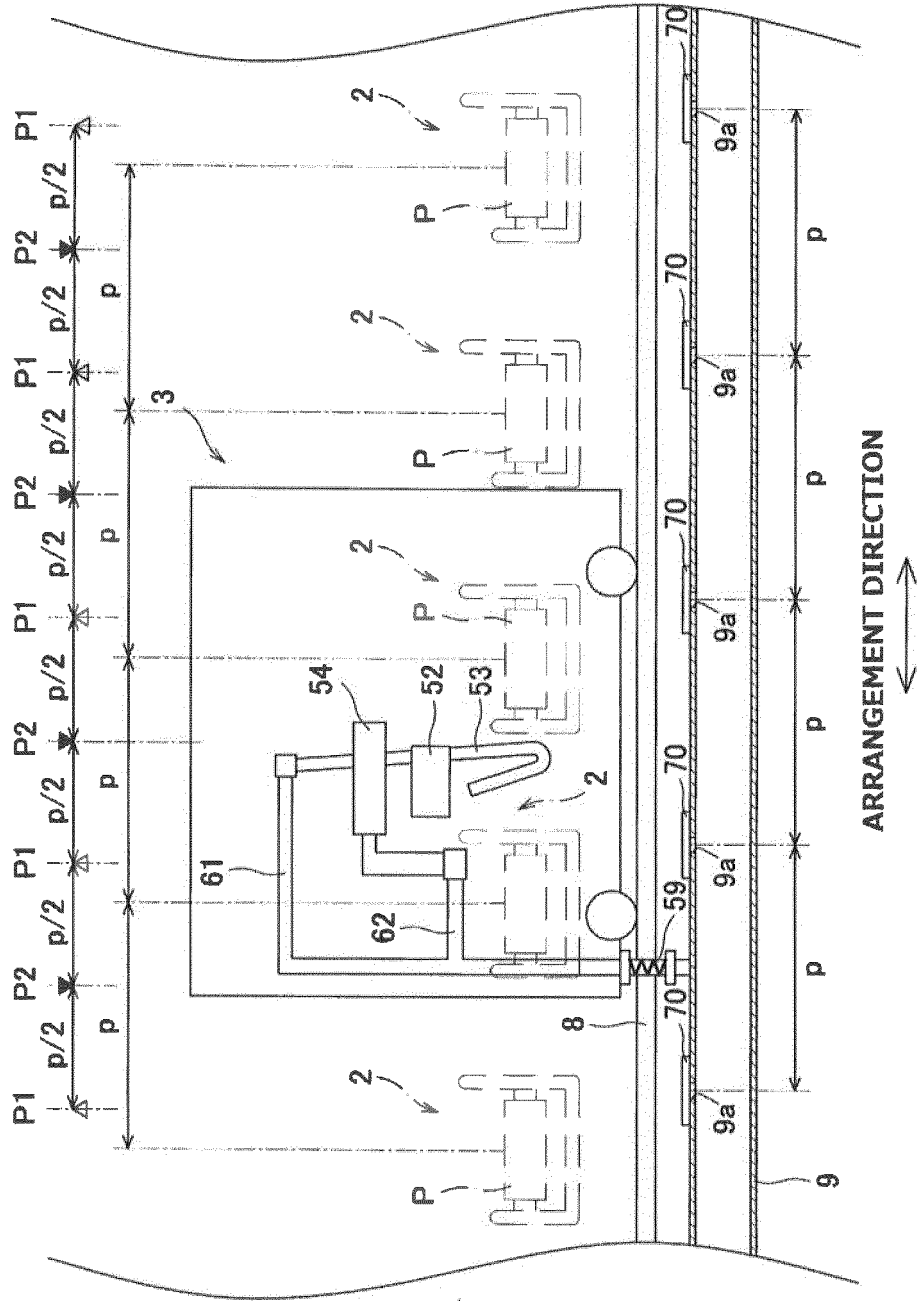


FIG.9A

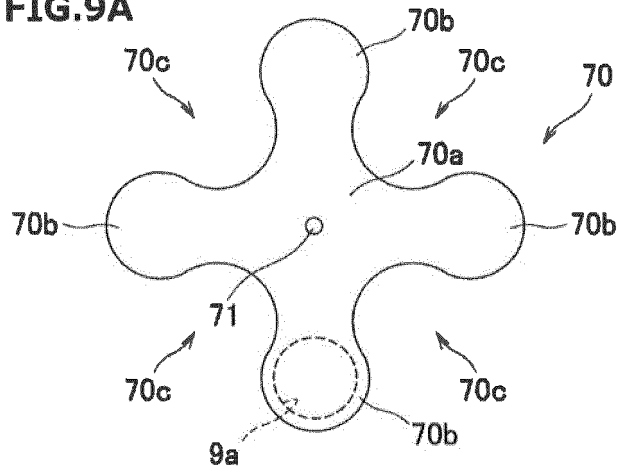


FIG.9B

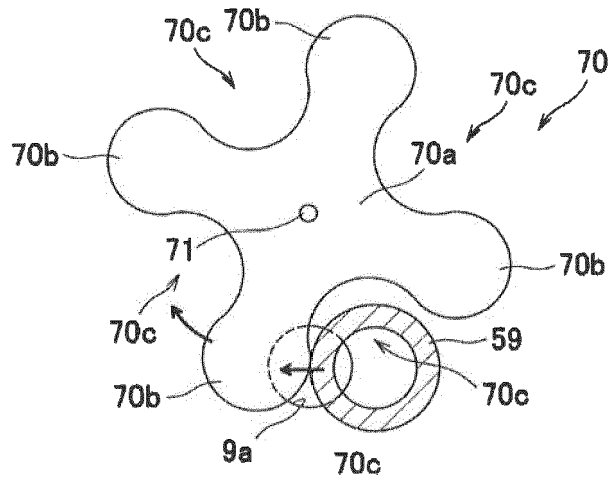


FIG.9C

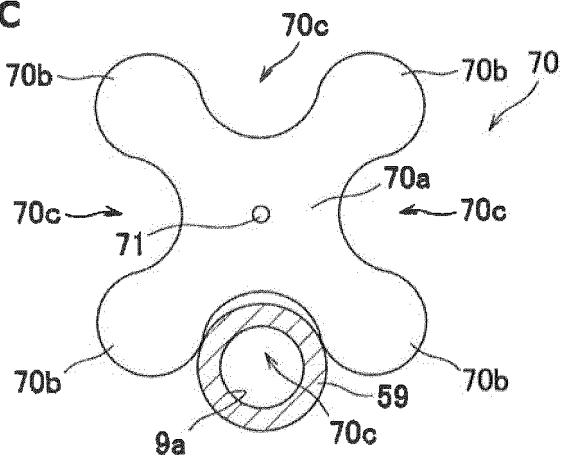


FIG.10A

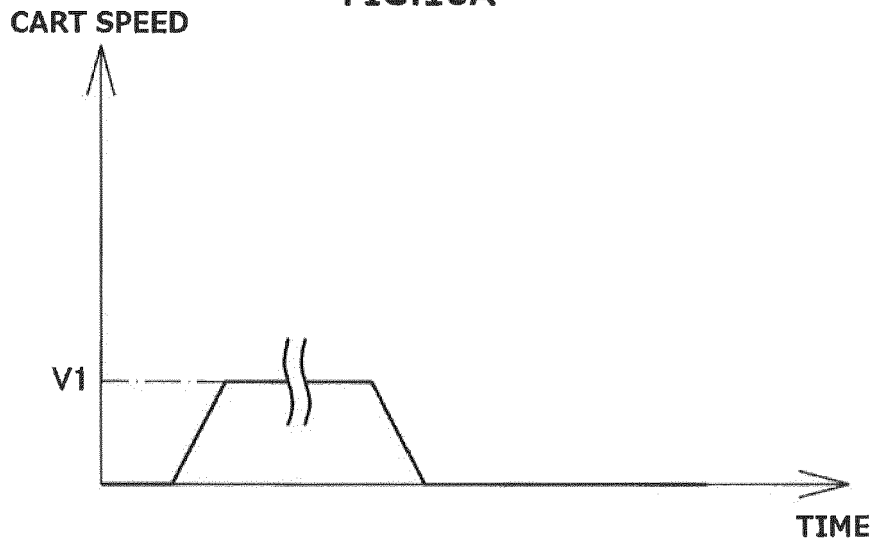
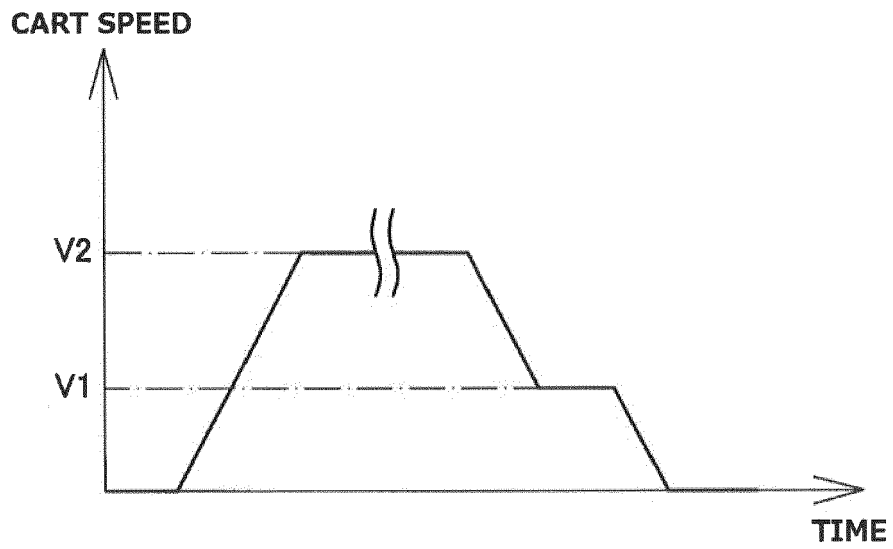


FIG.10B



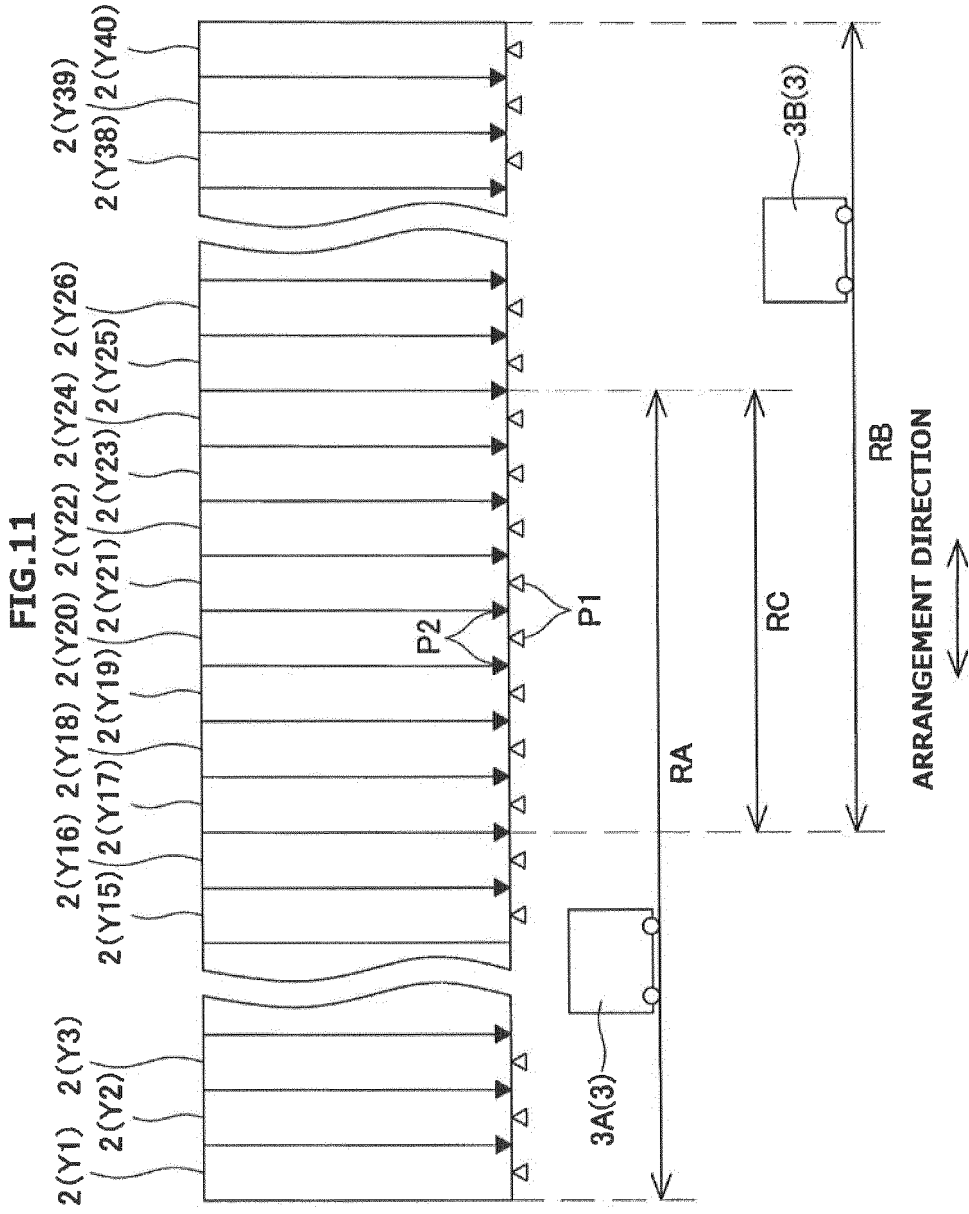
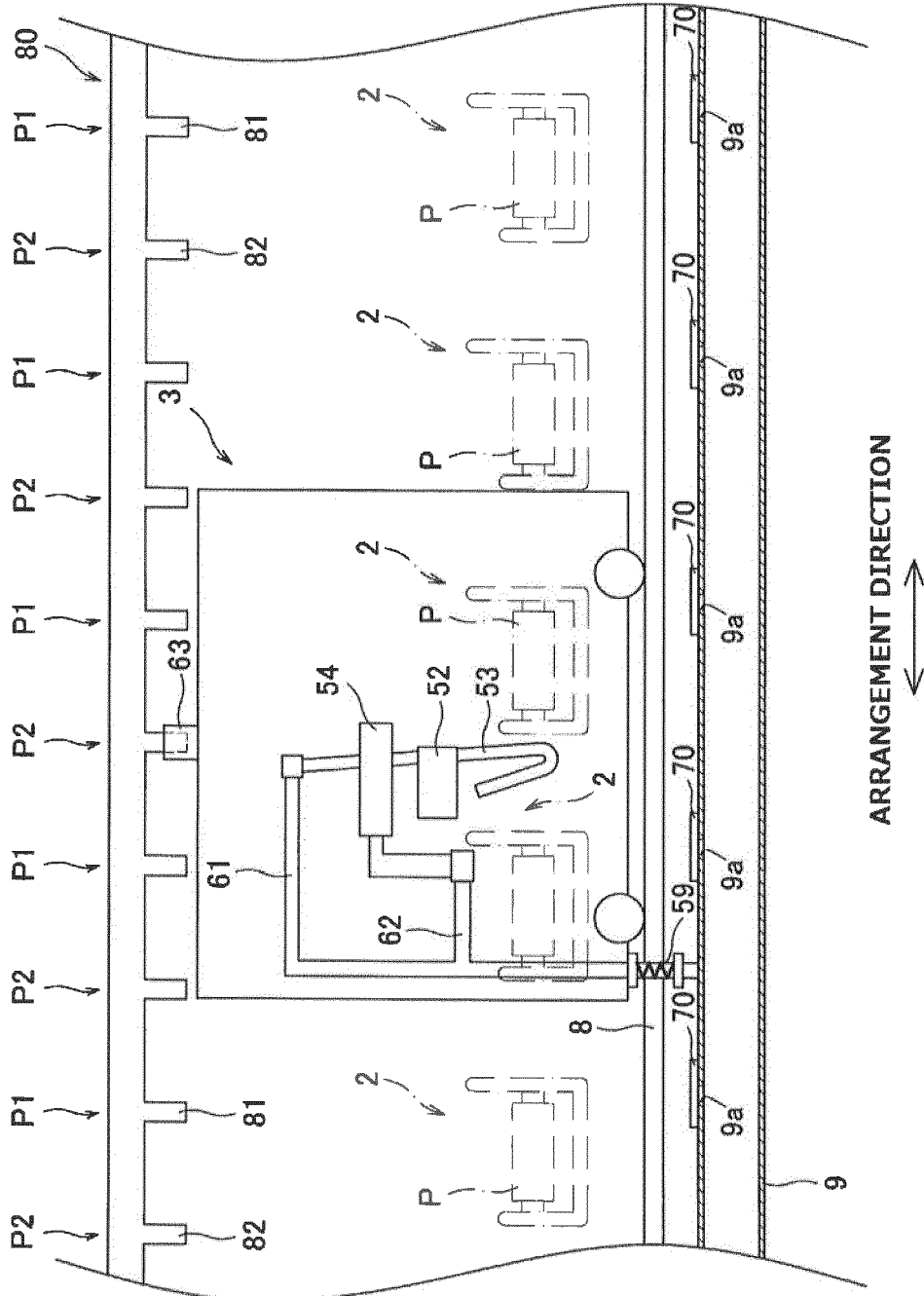


FIG.12





EUROPEAN SEARCH REPORT

Application Number
EP 18 15 1941

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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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Place of search The Hague		Date of completion of the search 15 June 2018	Examiner Pussemier, Bart
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