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(54) AUTOMATIC VENDING MACHINE

(57) Provided is an automatic vending machine including a product rack 20 having a plurality of product storage columns 21 juxtaposed in a horizontal direction, and a bucket 40 arranged so as to be movable in a front area of the product rack 20, the automatic vending machine further including a controller 60 which, upon selection of a product, moves the bucket 40 positioned at a standby position and arranges the bucket 40 so as to oppose a target product storage column 21 and, after the bucket 40 receives the product, moves the bucket 40 to a relay position I and then causes the bucket 40 to perform a downward delivery movement, wherein when the selected product is stored in a product storage column 21 set in advance, the controller 60 causes the bucket 40 positioned at the standby position to pass through a via position III set to a right-hand side of the relay position I and then arranges the bucket 40 so as to oppose the product storage column 21.

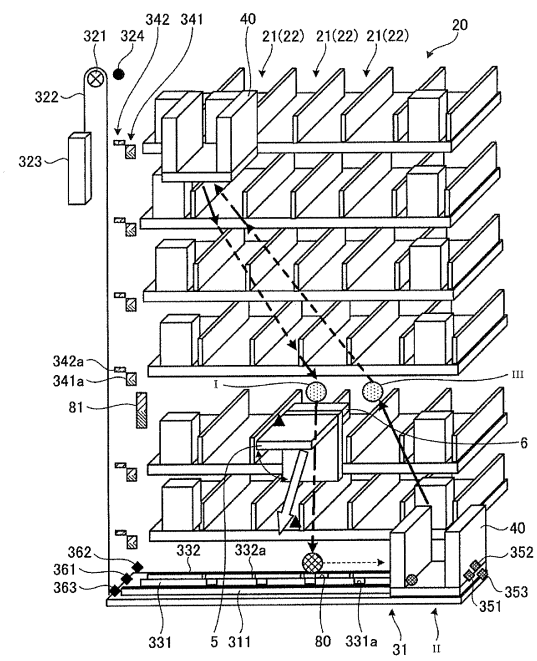

Fig. 3

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Description

TECHNICAL FIELD

[0001] The present invention relates to an automatic vending machine and, more specifically, to an automatic vending machine which is configured such that a product storage chamber having a thermally-insulated structure includes a product storage column that stores products and a bucket that conveys a product, and which sells products stored in the product storage column.

BACKGROUND ART

[0002] There are automatic vending machines configured such that a product storage chamber having a thermally-insulated structure includes a product storage column for storing products and a bucket for conveying products. The product storage column stores a plurality of aligned products and, when a vend mech is driven, the product storage column delivers one product at a time from a front end portion thereof. In a general automatic vending machine, a plurality of product storage columns is juxtaposed in a horizontal direction in a product rack and, further, a plurality of the product racks is provided in a vertical direction between a pair of left and right rack supporting side plates. The bucket picks up/delivers a product from/to a product storage column and is arranged so as to be movable in a front area of a product rack. More specifically, the bucket is arranged so as to be vertically and horizontally movable in a front area of a product rack due to bucket driving means.

[0003] The bucket driving means is configured so as to include an x-axis conveying mechanism capable of moving the bucket in a horizontal direction and a y-axis conveying mechanism capable of moving the bucket including the x-axis conveying mechanism in a vertical direction. In addition, the y-axis conveying mechanism is provided on a side opposite to mutually opposing surfaces of a pair of rack supporting side plates that support the product racks.

[0004] In such an automatic vending machine, a translucent panel is provided on an outer door that constitutes a front surface, and an interior of the product storage chamber can be viewed through the translucent panel from a front surface side (for example, refer to Patent Document 1).

[0005] Patent Document 1: Japanese Patent Application Laid-open No. H11-353546

[0006] As an improvement of the automatic vending machine proposed in Patent Document 1 above in which the interior of the product storage chamber is viewable, an application has been filed by the applicant of the present patent in regards to an automatic vending machine wherein a bucket having received a specified product from a predetermined product storage column is temporarily moved to a relay position determined in advance and a delivery movement of the bucket is then performed downward, and a pin member provided on the bucket abuts a protruding member of a door body constituting a front surface of a product storage chamber to cause the bucket to assume an inclined posture and to deliver the received product (for example, refer to Japanese Patent Application Laid-open No. 2009-93479). In this case, the product that has been delivered reaches a product dispensing chamber through a product discharge port of the door body, and can be taken out by a user through a product dispensing port.

[0007] With such an automatic vending machine, when a product is selected and the bucket positioned at a standby position is moved to a predetermined product storage column, there is a risk that the pin member of the bucket and the protruding member of the door body may come into contact with each other which, in turn, gives rise to a risk of damaging components or the contact preventing the bucket from being arranged so as to oppose the predetermined product storage column.

DISCLOSURE OF THE INVENTION

[0008] In consideration of the above, it is an object of the present invention to provide an automatic vending machine capable of moving a bucket to a desired product storage column while preventing a pin member of the bucket from interfering with a protruding member of a door body.

[0009] In order to achieve the object described above, an automatic vending machine according to claim 1 of the present invention includes, in a product storage chamber having a thermally-insulated structure: a plurality of product racks provided in a vertical direction between a pair of left and right rack supporting side plates, each product rack having a plurality of product storage columns juxtaposed in a horizontal direction; a bucket which is arranged so as to be movable in a front area of the product rack and which is capable of picking up/delivering a product from/to an arbitrary product storage column when arranged so as to oppose the product storage column; and bucket driving means for moving the bucket, the automatic vending machine further including control means for driving the bucket driving means upon selection of a product to move the bucket that is positioned at a standby position and arrange the bucket so as to oppose a product storage column that stores the product, for once again driving the bucket driving means after the bucket receives the product to temporarily move the bucket to a predetermined relay position and then have the bucket perform a downward delivery movement, and for allowing delivery of the received product as a result of a pin member provided on the bucket abutting a protruding member of a door body constituting a front surface of the product storage chamber and causing the bucket to assume an inclined posture, wherein when the selected product is stored in a product storage column set in advance, the control means causes the bucket positioned at the standby position to go through one of vir-

tual via positions set on a left-hand side and a right-hand side of the relay position and then arranges the bucket so as to oppose the product storage column.

[0010] In addition, an automatic vending machine according to claim 2 of the present invention is the automatic vending machine according to claim 1 described above, wherein the pin member is provided protruding into a front area due to biasing by biasing means, and when pressed from above, the pin member swings around its own axis against a biasing force of the biasing means and performs a retreating movement from the front area.

[0011] Furthermore, an automatic vending machine according to claim 3 of the present invention is the automatic vending machine according to claim 1 or 2 described above, wherein the bucket driving means includes stop position detecting means for detecting a stop indicator provided for each of the product storage columns, and the control means varies a stop timing of a drive motor of the bucket driving means from detection by the stop position detecting means of the stop indicator corresponding to a target product storage column, depending on under a temperature environment of the drive motor.

[0012] In addition, an automatic vending machine according to claim 4 of the present invention is the automatic vending machine according to claim 1 described above, wherein the control means stops the delivery movement for a period of time set in advance.

[0013] According to the present invention, when a selected product is stored in a product storage column set in advance, a bucket positioned at a standby position goes through one of virtual via positions set on a left-hand side and a right-hand side of a relay position and is then arranged so as to oppose the product storage column. Therefore, an advantageous effect can be achieved in that the bucket can be moved to a desired product storage column while preventing a pin member of the bucket from interfering with a protruding member of a door body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is a front view showing an automatic vending machine according to an embodiment of the present invention;

FIG. 2 is a perspective view showing an internal structure of an automatic vending machine according to an embodiment of the present invention;

FIG. 3 is a perspective view schematically showing an internal structure of a product storage chamber;

FIG. 4 is a perspective view showing a bucket from front;

FIG. 5 is a perspective view showing a bucket from behind;

FIG. 6 is an explanatory diagram for explaining a retreating movement of a pin member constituting a bucket;

FIG. 7 is a block diagram showing a control system of an automatic vending machine;

FIG. 8 is a sectional side view showing an enlargement of a substantial part of an inner door;

FIG. 9 is an explanatory diagram schematically showing a product storage chamber;

FIG. 10 is an explanatory diagram for explaining a stop operation of a bucket;

FIG. 11 is a side view schematically showing a delivery movement of a bucket;

FIG. 12 is a side view schematically showing a delivery movement of a bucket; and

FIG. 13 is a side view schematically showing a delivery movement of a bucket.

BEST MODE FOR CARRYING OUT THE INVENTION

[0015] Hereinafter, a preferred embodiment of an automatic vending machine according to the present invention will be described in detail with reference to the accompanying drawings.

[0016] FIGS. 1 and 2 respectively show an automatic vending machine according to an embodiment of the present invention, wherein FIG. 1 is a front view and FIG. 2 is a perspective view showing an internal structure. The automatic vending machine exemplified here is for sales of a product that is a canned beverage, a beverage in a plastic bottle, a beverage in a carton, or the like in a refrigerated or heated state, and includes a main body cabinet 10.

[0017] The main body cabinet 10 is shaped as a cuboid with an open front surface. An interior of the main body cabinet 10 is partitioned into halves, with an upper half constituting a product storage chamber 2 and a lower half constituting a machine room 12. The product storage chamber 11 is a chamber having its interior kept at a preset temperature condition, and wall members constituting the product storage chamber 11 are respectively formed of insulating material. In addition, although not shown in the drawings, cooling means for cooling internal atmosphere such as an evaporator that constitutes a refrigeration cycle and heating means for heating the internal atmosphere such as an electrical heater are provided. On the other hand, a refrigerator (a compressor and a condenser) 13 that constitutes the refrigeration cycle together with the evaporator and various control devices are provided in the machine room 12.

[0018] At front end portions of a pair of left and right side plates of the product storage chamber 11 described above, a plurality of light sources 14 is juxtaposed at a predetermined interval in a vertical direction. These light sources 14 have built-in light-emitting elements such as LEDs and are illuminating means for illuminating their surroundings.

[0019] An outer door 1 and an inner door 2 are provided on the front surface of the main body cabinet 10. The inner door 2 is a door body formed by inlaying a transparent plate material 3 such as insulated glass and is

large enough to cover the front surface of the product storage chamber 11. When the inner door 2 performs a closing movement and blocks the front surface of the product storage chamber 11, the inner door 2 becomes an insulating member that constitutes the front surface of the product storage chamber 11.

[0020] A rectangular product discharge port 4 is formed and a discharge flapper 5 for opening and closing the product discharge port 4 is provided in a lower area of a central portion of the transparent plate material 3 of the inner door 2. The discharge flapper 5 is axially supported so as to be swingable in a front-back direction with its lower end being a free end, and normally closes the product discharge port 4 due to its own weight.

[0021] In addition, a protruding member 6 is provided so as to protrude from a portion directly above the product discharge port 4 of the inner door 2. The protruding member 6 is constituted by a metallic member and is provided so as to protrude from a rear surface of the inner door 2. More specifically, the protruding member 6 is provided so as to protrude rearward when the inner door 2 blocks the front surface of the product storage chamber 11.

[0022] The outer door 1 is for opening and closing the front opening of the main body cabinet 10 and is constituted using an insulating material as necessary, and includes a window 7 made by inlaying a transparent plate material such as insulated glass. Therefore, the automatic vending machine being described is a so-called glass-front vending machine with its interior viewable through the window 7 of the outer door 1. In addition, arranged on a front surface of the outer door 1 are components necessary for automatic sales of products such as a selection switch 8 for selecting sold products and a coin acceptor 9 into which coins are inserted. Moreover, in the present specification, a left direction indicates a left side direction when the automatic vending machine is viewed from front, and a right direction indicates a right side direction when the automatic vending machine is viewed from front.

[0023] FIG. 3 is a perspective view schematically showing an internal structure of the product storage chamber 11 described above. Hereinafter, the product storage chamber 11 will be described with additional reference to FIG. 3 where appropriate. The product storage chamber 11 is provided with a product rack 20 and bucket driving means 30. The product rack 20 is constituted by juxtaposing a plurality of product storage columns 21 in a horizontal direction, wherein each product storage columns 21 is capable of storing a plurality of products aligned in a front-back direction in a product storage passage 22 that is demarcated in each product storage column 21. A plurality of these product racks 20 is provided in a vertical direction so as to bridge between rack supporting side plates 23 which are provided as a left and right pair in the product storage chamber 11.

[0024] The rack supporting side plates 23 that support the product racks 20 are, for example, elongated plate-like bodies constituted by appropriately fabricating sheet metal or the like, and are provided such that one surface (an inner surface) of each rack supporting side plate faces each other. Specifically, the rack supporting side plates 23 are provided mounted to a top plate, a bottom plate, or the like constituting the product storage chamber 11 via mounting members such as screws.

[0025] Although not explicitly shown, each product storage column 21 of the product racks 20 supported by the rack supporting side plates 23 described above includes a conveying mechanism in which an endless belt is wound around rollers arranged parallel to each other to the front and back, and a product is stored mounted on an upper surface of the conveyor belt. A vend mech that controls delivery of the product is provided at a front end portion of each product storage column 21. The vend mech does not include a drive unit separated from a power source such as a drive motor, a solenoid, or the like, and is driven as power is transmitted from an motorized drive mechanism 411 (refer to FIG. 7) built into a bucket 40 when the bucket 40 is arranged so as to oppose a specified product storage column 21.

[0026] The bucket driving means 30 is configured as an assembly of an x-axis conveying mechanism 31 and a y-axis conveying mechanism 32. The x-axis conveying mechanism 31 includes a rail member 311 that extends in a horizontal direction in a front area of the product rack 20 inside the main body cabinet 10, and moves the mounted bucket 40 in the direction in which the rail member 311 extends (the horizontal direction) due to driving of an x-axis motor 312 (refer to FIG. 7).

[0027] The x-axis motor 312 is driven by, for example, PWM (Pulse Width Modulation). PWM drive involves intermittently turning on and off a motor drive voltage. The higher an On duty, a motor rotates at a higher speed, and the higher an Off duty, the motor rotates at a lower speed. Since a structure itself of the x-axis conveying mechanism 31 is well known, a detailed description will be omitted herein.

[0028] As shown in FIGS. 4 and 5, the bucket 40 is configured so as to include a pair of left and right side portions 41, a supporting member 42, and a mounting member 43. FIGS. 4 to 5 respectively show the bucket 40, wherein FIG. 4 is a perspective view showing the bucket 40 from front and FIG. 5 is a perspective view showing the bucket 40 from behind.

[0029] The side portions 41 are provided so that respective inner surfaces oppose each other. The side portions 41 house various devices in a resin chassis. Examples of such housed devices include the motorized drive mechanism 411. The motorized drive mechanism 411 transmits and provides a drive force to the vend mech in the front end portion of a specified product storage column 21 when the bucket 40 is arranged so as to oppose the product storage column 21. In addition, an area sandwiched by the side portions 41 forms a reception area 44 for receiving a product. Accordingly, the side portions 41 demarcate the reception area 44.

[0030] The supporting member 42 is formed of a me-

tallic material and is arranged between the pair of side portions 41. The supporting member 42 includes a flat plate-like base portion 421 and rearward-extending portions 422 respectively extending rearward from both ends of the base portion 421. As a result of end portions of the rearward-extending portions 422 or, in other words, rear end portions being respectively axially supported by the side portions 41, the supporting member 42 is arranged so as to be swingable with respect to the side portions 41.

[0031] The mounting member 43 is swingably arranged between the pair of side portions 41. The mounting member 43 includes a front surface portion 431, side wall portions 432, and a mounting portion 433. The front surface portion 431 is formed with a rectangular opening. The pin member 424 arranged on the supporting member 42 protrudes forward through this opening.

[0032] The pin member 424 is arranged so as to be swingable around an axis of a shaft portion 425 provided in a horizontal direction on the supporting member 42 and, due to biasing by a spring member (biasing means) 426, the pin member 424 protrudes toward a front area or, in other words, toward the side of the inner door 2 as shown in FIG. 6A. The pin member 424 is configured such that when a tip portion thereof is pressed from above as shown in FIG. 6B, the pin member 424 swings downward against the biasing force of the spring member 426 and performs a retreating movement from the front area as shown in FIG. 6C.

[0033] The side wall portions 432 respectively extend rearward from both ends of the front surface portion 431 with respective inner surfaces opposing each other. Although not clearly shown in the drawings, the side wall portions 432 are respectively swingably and axially supported by the side portions 41 so as to be coaxial to the rearward-extending portions 422 of the supporting member 42. The mounting portion 433 is swingably arranged via an axial portion (not shown) between lower portions of rear ends of the pair of left and right side wall portions 432 with a front end (free end) thereof supported by the chassis of the bucket 40, and is for mounting a product. The mounting portion 433 is configured so as to tilt forward while protruding forward with swinging of the side wall portions 432.

[0034] The y-axis conveying mechanism 32 is provided on a pair of left and right conveyance support frames (not shown). A pulley 321 is rotatably arranged in a vicinity of an upper end portion of the conveyance support frames. A belt 322 that is an elongated cord-like body is wound around the pulley 321. A waiter 323 is connected to one end of the belt 322, and a holding member (not shown) for holding the rail member 311 described earlier is connected to another end of the belt 322. As the pulley 321 rotates due to driving by a y-axis motor 324, the y-axis conveying mechanism 32 moves the rail member 311 held by the holding member and the mounted bucket 40 in a vertical direction. In this case, it is assumed that the y-axis motor 324 is PWM-driven in a similar manner to the x-axis motor 312 described above.

[0035] The bucket driving means 30 described above includes an x-axis stop position detection plate 331, an x-axis position confirmation plate 332, a y-axis stop position detection plate 341, a y-axis position confirmation plate 342, an x-axis stop position sensor 351, an x-axis position confirmation sensor 352, an x-axis position correction sensor 353, a y-axis stop position sensor 361, a y-axis position confirmation sensor 362, and a y-axis position correction sensor 363.

[0036] The x-axis stop position detection plate 331 and the x-axis position confirmation plate 332 are arranged adjacent to the rail member 311. The x-axis stop position detection plate 331 and the x-axis position confirmation plate 332 are respectively elongated plate-like members and are provided such that a horizontal direction thereof is a longitudinal direction. Slit-like notched grooves (hereinafter, also referred to as stop notched grooves) 331a as stop indicators are formed on the x-axis stop position detection plate 331 at a same pitch as horizontal intervals of the product storage column 21. Slit-like notched grooves (hereinafter, also referred to as confirmatory notched grooves) 332a as confirmatory indicators are formed on the x-axis position confirmation plate 332 at a same pitch as the horizontal intervals of the product storage column 21. The stop notched grooves 331a are formed slightly to the front or, in other words, slightly to the right of the confirmatory notched grooves 332a.

[0037] The y-axis stop position detection plate 341 and the y-axis position confirmation plate 342 are arranged adjacent to the conveyance support frames. The y-axis stop position detection plate 341 and the y-axis position confirmation plate 342 are respectively elongated plate-like members and are provided such that a vertical direction thereof is a longitudinal direction. Slit-like notched grooves (hereinafter, also referred to as stop notched grooves) 341a as stop indicators are formed on the y-axis stop position detection plate 341 at a same pitch as vertical intervals of the product storage column 21. Slit-like notched grooves (hereinafter, also referred to as confirmatory notched grooves) 342a as confirmatory indicators are formed on the y-axis position confirmation plate 342 at a same pitch as the vertical intervals of the product storage column 21. The stop notched grooves 341a are formed slightly to the front or, in other words, slightly below the confirmatory notched grooves 342a.

[0038] The x-axis stop position sensor 351, the x-axis position confirmation sensor 352, and the x-axis position correction sensor 353 are respectively provided at a lower portion of the right side portion 41 of the bucket 40. The x-axis stop position sensor 351 is a photo-interrupter or, in other words, a proximity sensor which combines a light-emitting element and a light-receiving element so as to sandwich the x-axis stop position detection plate 331. With the x-axis stop position sensor 351, while light emitted from the light-emitting element is blocked by the x-axis stop position detection plate 331 at positions other than the stop notched groove 331a, light emitted from the light-emitting element is received by the light-receiv-

ing element at the position of the stop notched groove 331a and a signal to that effect is supplied to a controller (to be described later).

[0039] The x-axis position confirmation sensor 352 is a photo-interrupter or, in other words, a proximity sensor which combines a light-emitting element and a light-receiving element so as to sandwich the x-axis position confirmation plate 332. With the x-axis position confirmation sensor 352, while light emitted from the light-emitting element is blocked by the x-axis position confirmation plate 332 at positions other than the confirmatory notched groove 332a, light emitted from the light-emitting element is received by the light-receiving element at the position of the confirmatory notched groove 332a and a signal to that effect is supplied to the controller.

[0040] The x-axis position correction sensor 353 is a photo-interrupter or, in other words, a proximity sensor which combines a light-emitting element and a light-receiving element so as to sandwich the x-axis stop position detection plate 331. With the x-axis position correction sensor 353, while light emitted from the light-emitting element is blocked by the x-axis stop position detection plate 331 at positions other than the stop notched groove 331a, light emitted from the light-emitting element is received by the light-receiving element at the position of the stop notched groove 331a and a signal to that effect is supplied to the controller. The x-axis position correction sensor 353 is arranged on the right-hand side of the x-axis stop position sensor 351 and detects the stop notched groove 331a after a delay from the x-axis stop position sensor 351.

[0041] The y-axis stop position sensor 361, the y-axis position confirmation sensor 362, and the y-axis position correction sensor 363 are respectively provided at a side portion of the rail member 311. The y-axis stop position sensor 361 is a photo-interrupter or, in other words, a proximity sensor which combines a light-emitting element and a light-receiving element so as to sandwich the y-axis stop position detection plate 341. With the y-axis stop position sensor 361, while light emitted from the light-emitting element is blocked by the y-axis stop position detection plate 341 at positions other than the stop notched groove 341a, light emitted from the light-emitting element is received by the light-receiving element at the position of the stop notched groove 341a and a signal to that effect is supplied to the controller.

[0042] The y-axis position confirmation sensor 362 is a photo-interrupter or, in other words, a proximity sensor which combines a light-emitting element and a light-receiving element so as to sandwich the y-axis position confirmation plate 342. With the y-axis position confirmation sensor 362, while light emitted from the light-emitting element is blocked by the y-axis position confirmation plate 342 at positions other than the confirmatory notched groove 342a, light emitted from the light-emitting element is received by the light-receiving element at the position of the confirmatory notched groove 342a and a signal to that effect is supplied to the controller.

[0043] The y-axis position correction sensor 363 is a photo-interrupter or, in other words, a proximity sensor which combines a light-emitting element and a light-receiving element so as to sandwich the y-axis stop position detection plate 341. With the y-axis position correction sensor 363, while light emitted from the light-emitting element is blocked by the y-axis stop position detection plate 341 at positions other than the stop notched groove 341a, light emitted from the light-emitting element is received by the light-receiving element at the position of the stop notched groove 341a and a signal to that effect is supplied to the controller. The y-axis position correction sensor 363 is arranged below the y-axis stop position sensor 361 and detects the stop notched groove 341a after a delay from the y-axis stop position sensor 361.

[0044] FIG. 7 is a block diagram showing a control system of an automatic vending machine according to an embodiment of the present invention. Only features of the present invention are shown. As shown in FIG. 7, in addition to the x-axis motor 312, the y-axis motor 324, the motorized drive mechanism 411, the x-axis stop position sensor 351, the x-axis position confirmation sensor 352, the x-axis position correction sensor 353, the y-axis stop position sensor 361, the y-axis position confirmation sensor 362, and the y-axis position correction sensor 363 described above, the automatic vending machine includes input means 50, a microswitch 51, and a controller 60.

[0045] The input means 50 is a remote controller or the like and is capable of providing various commands and the like to the controller 60. In addition, the input means 50 is provided with a display unit and is capable of displaying information supplied from the controller 60.

[0046] As shown in FIG. 8, the microswitch 51 is provided to the front of the inner door 2. The microswitch 51 is aperture sensing means for sensing an aperture of the discharge flapper 5 and supplies a sensing signal to the controller 60. While details will be described later, as the bucket 40 performs a downward delivery movement and the pin member 424 of the bucket 40 abuts the protruding member 6, the mounting member 43 constituting the bucket 40 assumes an inclined posture and the discharge flapper 5 is abutted by the mounting member 43 assuming the inclined posture and swings forward.

[0047] The controller 60 integrally controls movement of the bucket 40 and lighting of the light source 14 based on programs and data stored in a storage unit 70. Note that the controller 60 described herein is separate to control means for controlling a sales operation of the automatic vending machine or, in other words, operations including product selection and money transaction.

[0048] The storage unit 70 is for storing various programs and data. More specifically, due to a known cleaning operation that is performed upon start of operation (power activation) of the automatic vending machine, the storage unit 70 stores position information and information related to a number of each product storage column 21 as shown in FIG. 9 in addition to a predetermined

relay position I, a predetermined standby position II, and a predetermined via position III stored in advance.

[0049] The relay position I is determined in advance in an area directly above the protruding member 6. Position detection of the relay position I is performed by detecting dedicated notched grooves 80 and 81 which act as indicators that indicate the relay position I shown in FIG. 3. Accordingly, the protruding member 6 provided on the inner door 2 so as to protrude therefrom is positioned in an area directly below the relay position I (in FIG. 9, the position of the protruding member 6 is denoted by reference symbol IV).

[0050] The standby position II is determined in advance at a lower right position or, in other words, a position opposing the product storage column 21 with a column number of 49 in the example shown in FIG. 9. For example, two via positions III are determined in advance: one on the right hand side of the relay position I; and the other on the left hand side of the relay position I. The right-hand side via position III is a via position of the bucket 40 when the bucket 40 is positioned inside zone D and moves to zone A in FIG. 9 that has been divided in quarters with reference to the standby position II. In addition, the left-hand side via position III is a via position of the bucket 40 when the bucket 40 is positioned inside zone C and moves to zone B.

[0051] Reference numeral 15 in FIG. 9 denotes an insulating partition plate. For example, an area above the insulating partition plate 15 constitutes a heated area and an area below the insulating partition plate 15 constitutes a cooled area. In this case, the storage unit 70 stores the fact that product storage columns 21 with the column numbers 1 to 14 are positioned in the heated area and the product storage columns 21 with the column numbers 15 to 49 are positioned in the cooled area. In addition, due to configuring the area above the insulating partition plate 15 as a heated area and the area below the insulating partition plate 15 as a cooled area, the storage unit 70 also stores the fact that the y-axis motor 324 is positioned in a high-temperature environment. Furthermore, the storage unit 70 stores set times which lapse after the stop position sensors 351 and 361 detect the stop notched grooves 331a and 341a in accordance with temperatures in the installation environments of the y-axis motor 324 and the x-axis motor 312 and before a drive stop command is issued to the respective motors 312 and 324. Specifically, if the installation environment of each motor is in a high-temperature atmosphere, the set time is set to, for example, 0.01 seconds, and if the installation environment of each motor is in a low-temperature atmosphere, the set time is set to, for example, 0.1 seconds.

[0052] Operations of the automatic vending machine configured as shown above will now be described. In a sales stand-by state, when information regarding selection of a product through the selection switch 8 and money-received information regarding coins fed from the coin acceptor 9 respectively satisfy predetermined sales conditions, a sales command is issued to the controller 60. For this description, it is assumed that a product stored in the product storage column 21 with the column number 1 has been selected.

[0053] The controller 60 issues a drive command to the x-axis motor 312 and the y-axis motor 324 and drives these motors. In this case, since the bucket 40 positioned in the zone D is to be moved to the zone A as shown in FIG. 9, the controller 60 moves the bucket 40 via the right-hand side via position III and arranges the bucket 40 so as to oppose the product storage column 21 with the column number 1. In doing so, the controller 60 may light only the light sources 14 that are in close proximity to the product storage column 21 with the column number 1.

[0054] A more detailed description will now be given. When moving the bucket 40 positioned at the standby position II to the product storage column 21 with the column number 1, the controller 60 drives the motors at a predetermined power. For example, a duty for driving the y-axis motor 324 is set to 70% until a signal indicating detection of a position that is one level above the standby position II is supplied by the y-axis stop position sensor 361, and a duty for driving the motor is set to 100% to rotate the motor at full speed when a signal indicating detection of a position that is two levels above the standby position II is further supplied. PWM control is performed in which when a signal indicating detection of a position that is one level below the product storage column 21 with the column number 1 is supplied, the duty for driving the motor is set to, for example, 30%. While driving of the y-axis motor 324 has been described, PWM control is similarly applied to driving of the x-axis motor 312.

[0055] The bucket 40 is stopped at a target product storage column 21 (the product storage column 21 with the column number 1) in the following manner. For the sake of description, driving of the y-axis motor 324 will be described below. It is assumed that the fact the y-axis motor 324 is installed in a high-temperature atmosphere has been stored in the storage unit 70.

[0056] As shown in FIG. 10, when the y-axis motor 324 is driven to move the bucket 40 upward, the y-axis stop position sensor 361 detects the stop notched groove 341a and the y-axis position confirmation sensor 362 detects the confirmatory notched groove 342a. In addition, the y-axis position correction sensor 363 detects the same stop notched groove 341a after the detection by the y-axis stop position sensor 361. In addition, the controller 60 having been supplied a signal indicating detection of a stop notched groove y3 (341a) corresponding to the target product storage column 21 (the product storage column 21 with the column number 1) from the y-axis stop position sensor 361 stands by for a set time ΔT determined in advance (since the y-axis motor 324 is installed in a high-temperature atmosphere, the set time is set to, for example, 0.01 seconds), and after lapse of the set time ΔT, issues a drive stop command to the y-axis motor 324 to stop the upward movement of the buck-

et 40. In doing so, when a signal indicating detection by the y-axis position confirmation sensor 362 of a confirmatory notched groove Y3 (342a) corresponding to the product storage column 21 with the column number 1 is supplied, the controller 60 can recognize that the bucket 40 has been arranged so as to oppose the target product storage column 21.

[0057] At this point, when a signal indicating detection by the y-axis position confirmation sensor 362 of the confirmatory notched groove Y3 (342a) is not supplied, the controller 60 checks whether a signal indicating detection of the stop notched groove y3 (341a) has been supplied by the y-axis position correction sensor 363, and if the signal indicating detection of the stop notched groove y3 (341a) has been supplied, the controller 60 is able to recognize that the stop position of the bucket 40 has moved excessively upward beyond the target product storage column 21. In this case, the y-axis motor 324 is reversed for a predetermined amount of time in order to move the bucket 40 downward. Subsequently, when a signal indicating detection of the confirmatory notched groove Y3 (342a) is supplied from the y-axis position confirmation sensor 362, the controller 60 can recognize that the bucket 40 has been arranged so as to oppose the target product storage column 21. At this point, the controller 60 subtracts the time during which the motor was reversed from the set time ΔT and stores the calculated time as a new set time in the storage unit 70.

[0058] On the other hand, when a signal indicating detection of the stop notched groove y3 (341a) has not been supplied by the y-axis position correction sensor 363, the controller 60 can recognize that the stop position of the bucket 40 is lower than the target product storage column 21 and that the movement had been insufficient. In this case, the y-axis motor 324 is additionally rotated in a same direction for a predetermined amount of time in order to move the bucket 40 upward. Subsequently, when a signal indicating detection of the confirmatory notched groove Y3 (342a) is supplied from the y-axis position confirmation sensor 362, the controller 60 can recognize that the bucket 40 has been arranged so as to oppose the target product storage column 21. At this point, the controller 60 adds the time during which the motor was additionally rotated to the set time ΔT and stores the calculated time as a new set time in the storage unit 70.

[0059] While the driving of the y-axis motor 324 has been described above, driving of the x-axis motor 312 similarly involves determining a set time in accordance with under a temperature environment of the x-axis motor 312 and the controller 60 issuing a drive stop command after lapse of the set time.

[0060] When the bucket 40 is arranged so as to oppose the target product storage column 21, the controller 60 issues a drive command to the motorized drive mechanism 411. Accordingly, the motorized drive mechanism 411 drives the vend mech of the relevant product storage column 21. As a result, a single product is moved to the bucket 40 and is received in the reception area 44 while being mounted on the mounting portion 433. Once the bucket 40 receives the product, the controller 60 issues a drive command to the x-axis motor 312 and the y-axis motor 324 in order to move the bucket 40 to the relay position I. Even in this case, the controller 60 performs PWM control in which the motors are driven at a predetermined power.

[0061] When it is detected that the bucket 40 is at the relay position I, the controller 60 drives only the y-axis motor 324 and causes the bucket 40 to perform a delivery movement. During the delivery movement, the controller 60 stops driving of the y-axis motor 324 for a period of time set in advance (for example, one second). Accordingly, the bucket 40 performs a downward delivery movement due to inertia. After lapse of the period of time, the controller 60 drives the y-axis motor 324 to cause the bucket 40 to perform a downward delivery movement. Even during the delivery movement, the controller 60 performs PWM control in which the motor is driven at a predetermined power.

[0062] The delivery movement will now be described. When causing a delivery movement of the bucket 40 positioned at the relay position I as shown in FIG. 11, the pin member 424 of the bucket 40 abuts the protruding member 6 as shown in FIG. 12. When the pin member 424 abuts the protruding member 6 in this manner, the supporting member 42 swings upward and the mounting member 43 abutted by the pin member 424 also swings upward. In addition to the swinging of the mounting member 43, the mounting portion 433 assumes a forward-tilted posture while protruding forward as shown in FIG. 13. Accordingly, since a bottom surface of the mounting member 43 opens wide and the product mounted on the mounting portion 433 inclines, the product is delivered from the bucket 40. The product delivered from the bucket 40 abuts the discharge flapper 5, pushes open the discharge flapper 5, passes through the opened product discharge port 4, and reaches a predetermined product dispensing chamber. Subsequently, as the driving of the y-axis motor is temporarily stopped, the bucket 40 moves downward due to inertia. As a result, a tip of the pin member 424 abuts a top surface (a top surface in a vertical direction (a horizontal surface)) of the protruding member 6 and holds inclined postures of the front surface portion 431 and the side wall portions 432 of the mounting member 43 together with the supporting member 42, thereby guaranteeing that the product is reliably delivered from the bucket 40.

[0063] With such an automatic vending machine, alternatively, an aperture of the discharge flapper 5 may be detected via the microswitch 51 during the cleaning operation described above, and when the aperture detected via the microswitch 51 is under a reference value (threshold) set in advance, the controller 60 may judge that the aperture is insufficient and notify the input means 50 as such, and have a predetermined display unit of the input means 50 display the fact that the aperture is in-

sufficient. Accordingly, an operator can recognize insufficient abutment between the pin member 424 and the protruding member 6 and can correct positions of the pin member 424 and the protruding member 6 so that a favorable positional relationship is maintained.

[0064] With such an automatic vending machine, when a selected product is stored in a product storage column 21 set in advance or, in other words, when the product storage column 21 storing the selected product is positioned in a predetermined zone, the controller 60 arranges the bucket 40 positioned at the standby position II so as to oppose the target product storage column 21 via the virtual via position III set on a right-hand side of the relay position I. Therefore, there is no risk of the pin member 424 of the bucket 40 abutting the protruding member 6 during the movement of the bucket 40. As a result, the bucket 40 can be moved to the desired product storage column 21 without the pin member 424 of the bucket 40 interfering with the protruding member 6 of the inner door 2.

[0065] In addition, since the pin member 424 swings around its own axis against a biasing force of the spring member 426 when pressed from above and performs a retreating movement from a front area into which the pin member 424 protrudes, the bucket 40 can be moved from below to above even when positional information of the bucket 40 has not yet been obtained such as during power activation. Accordingly, there is no risk of the pin member 424 coming into contact with and damaging the protruding member 6 at this point.

[0066] With the automatic vending machine described above, a set time from detection of the stop notched grooves 331a and 341a by the stop position sensors 351 and 361 is given a certain amount of latitude depending on the installation environment of the drive motors (the x-axis motor 312 and the y-axis motor 324) to vary a stop timing of the motors 312 and 324, the bucket 40 can be reliably stopped at a desired position even with a simple combination of a proximity sensor and a detecting plate as described above. As a result, cost reduction and sharing of components can be achieved.

[0067] In addition, with the automatic vending machine described above, since the controller 60 performs PWM control in which the x-axis motor 312 and the y-axis motor 324 are driven at a power set in advance, loads acting on the belt 322 and the like can be reduced and service lives of the motors 312 and 324 can be extended.

[0068] Furthermore, with the automatic vending machine described above, since the plurality of light sources 14 is juxtaposed at a predetermined interval in a vertical direction at front end portions of the pair of left and right side plates of the product storage chamber 11, when the bucket 40 is moved to a target product storage column 21, only the light sources 14 in close proximity of the product storage column 21 can be lighted. Therefore, energy saving can be achieved while offering flexibility to the lighting in the product storage chamber 11.

[0069] In addition, with the automatic vending machine described above, since a delivery movement of the bucket 40 is stopped for a period of time set in advance, the bucket 40 is able to move downward due to inertia. As a result, a period of an inclined posture of the bucket 40 can be extended and products can be delivered in a reliable manner.

EXPLANATION OF REFERENCE NUMERALS

[0070]

4	product discharge port
5	discharge flapper
6	protruding member
10	main body cabinet
11	product storage chamber
14	light source
20	product rack
21	product storage column
22	product storage passage
30	bucket driving means
31	x-axis conveying mechanism
311	rail member
312	x-axis motor
32	y-axis conveying mechanism
324	y-axis motor
331	x-axis stop position detection plate
332	x-axis position confirmation plate
341	y-axis stop position detection plate
342	y-axis position confirmation plate
351	x-axis stop position sensor
352	x-axis position confirmation sensor
353	x-axis position correction sensor
361	y-axis stop position sensor
362	y-axis position confirmation sensor
363	y-axis position correction sensor
40	bucket
424	pin member
51	microswitch
60	controller
70	storage unit

Claims

1. An automatic vending machine comprising, in a product storage chamber having a thermally-insulated structure:

   a plurality of product racks provided in a vertical direction between a pair of left and right rack supporting side plates, each product rack having a plurality of product storage columns juxtaposed in a horizontal direction;

   a bucket which is arranged so as to be movable in a front area of the product rack and which is capable of picking up/delivering a product from/to an arbitrary product storage column

when arranged so as to oppose the product storage column; and
bucket driving means for moving the bucket,
the automatic vending machine further comprising control means for driving the bucket driving means upon selection of a product to move the bucket that is positioned at a standby position and arrange the bucket so as to oppose a product storage column that stores the product, for once again driving the bucket driving means after the bucket receives the product to temporarily move the bucket to a predetermined relay position and then have the bucket perform a downward delivery movement, and for allowing delivery of the received product as a result of a pin member provided on the bucket abutting a protruding member of a door body constituting a front surface of the product storage chamber and causing the bucket to assume an inclined posture, wherein
when the selected product is stored in a product storage column set in advance, the control means causes the bucket positioned at the standby position to go through one of virtual via positions set on a left-hand side and a right-hand side of the relay position and then arranges the bucket so as to oppose the product storage column.

2. The automatic vending machine according to claim 1, wherein the pin member is provided protruding into a front area due to biasing by biasing means, and when pressed from above, the pin member swings around its own axis against a biasing force of the biasing means and performs a retreating movement from the front area.

3. The automatic vending machine according to claim 1 or 2, wherein
the bucket driving means includes stop position detecting means for detecting a stop indicator provided for each of the product storage columns, and
the control means varies a stop timing of a drive motor of the bucket driving means from detection by the stop position detecting means of the stop indicator corresponding to a target product storage column, depending on under a temperature environment of the drive motor.

4. The automatic vending machine according to claim 1, wherein the control means stops the delivery movement for a period of time set in advance.

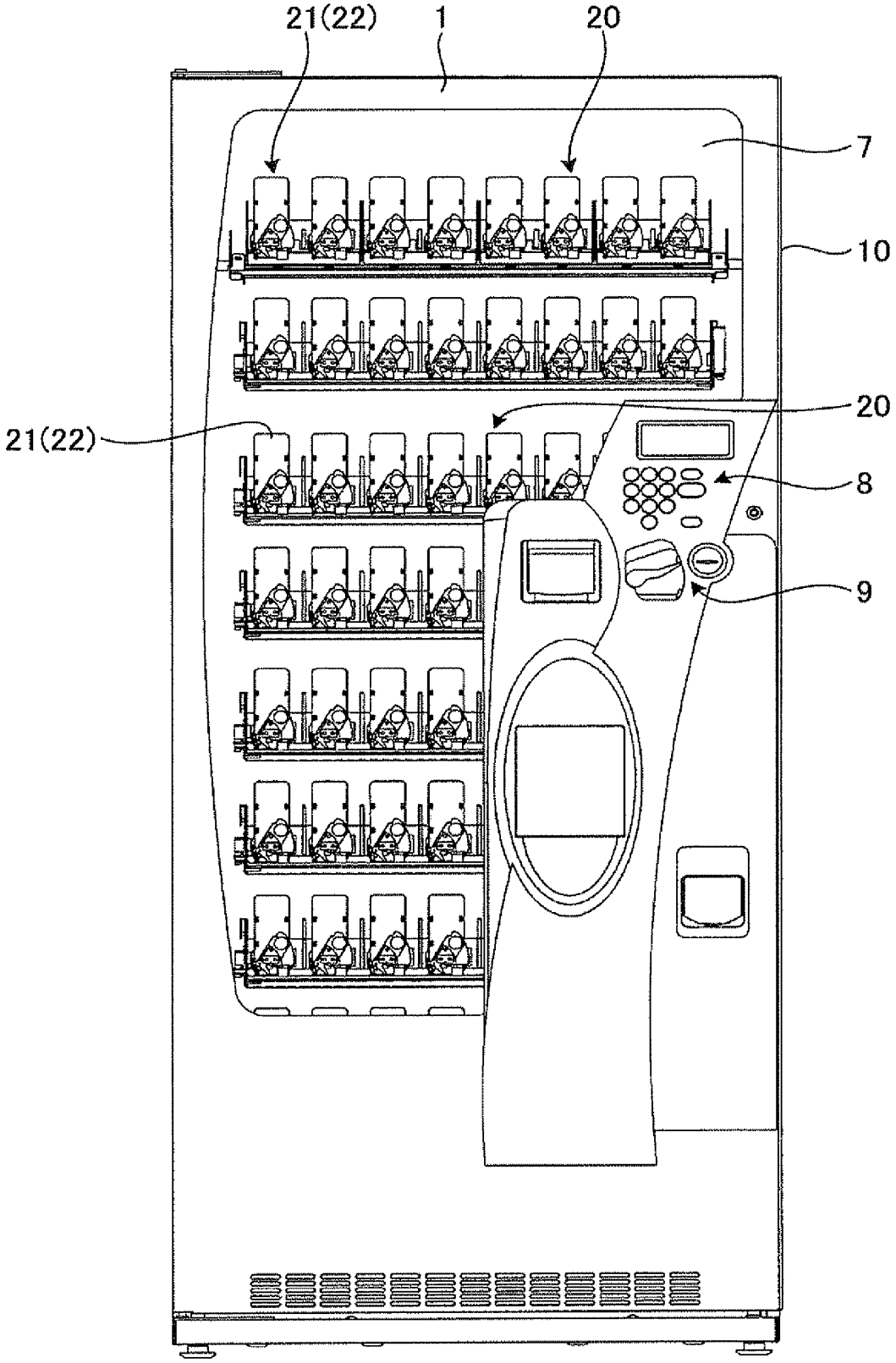


Fig. 1

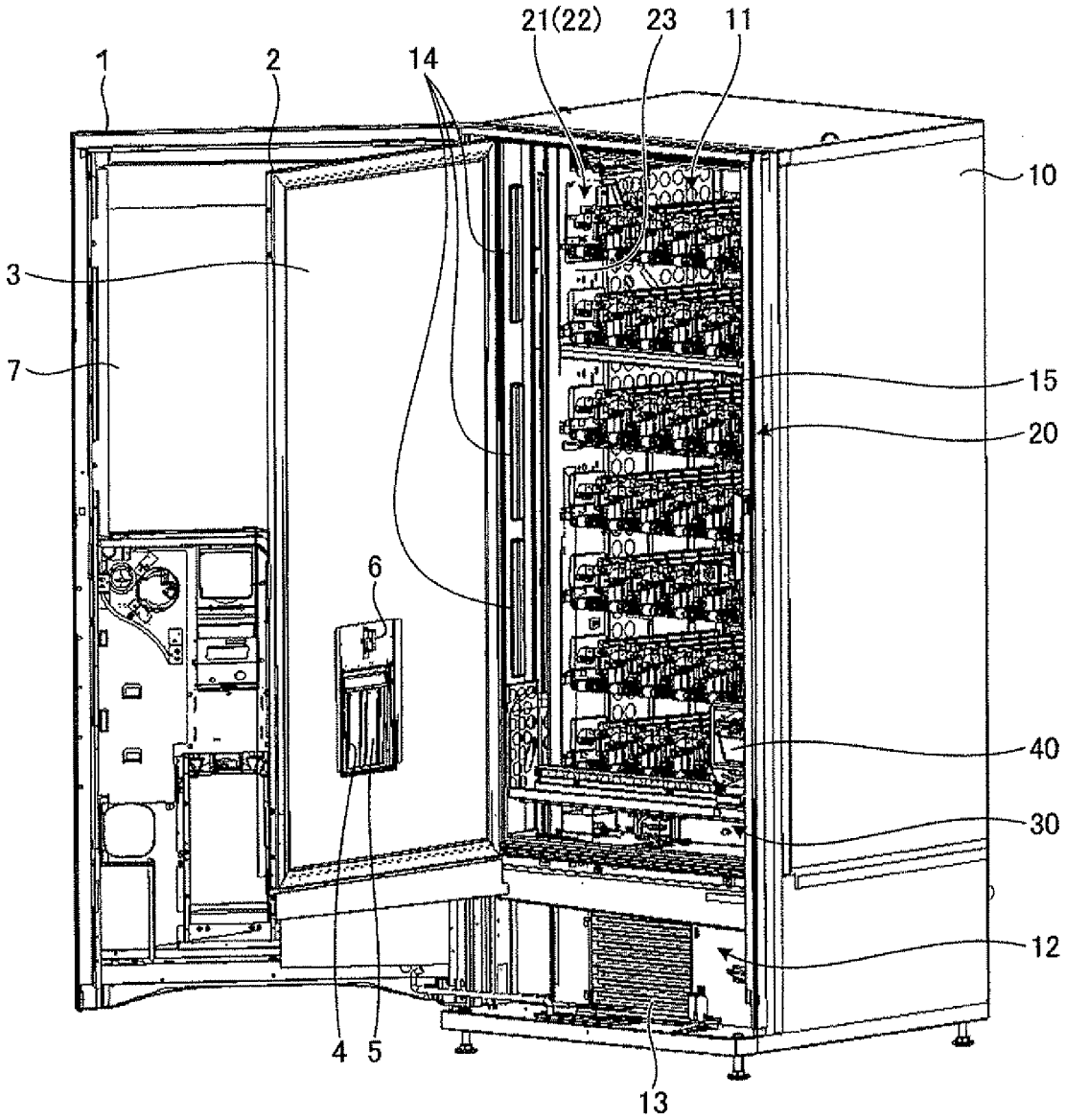
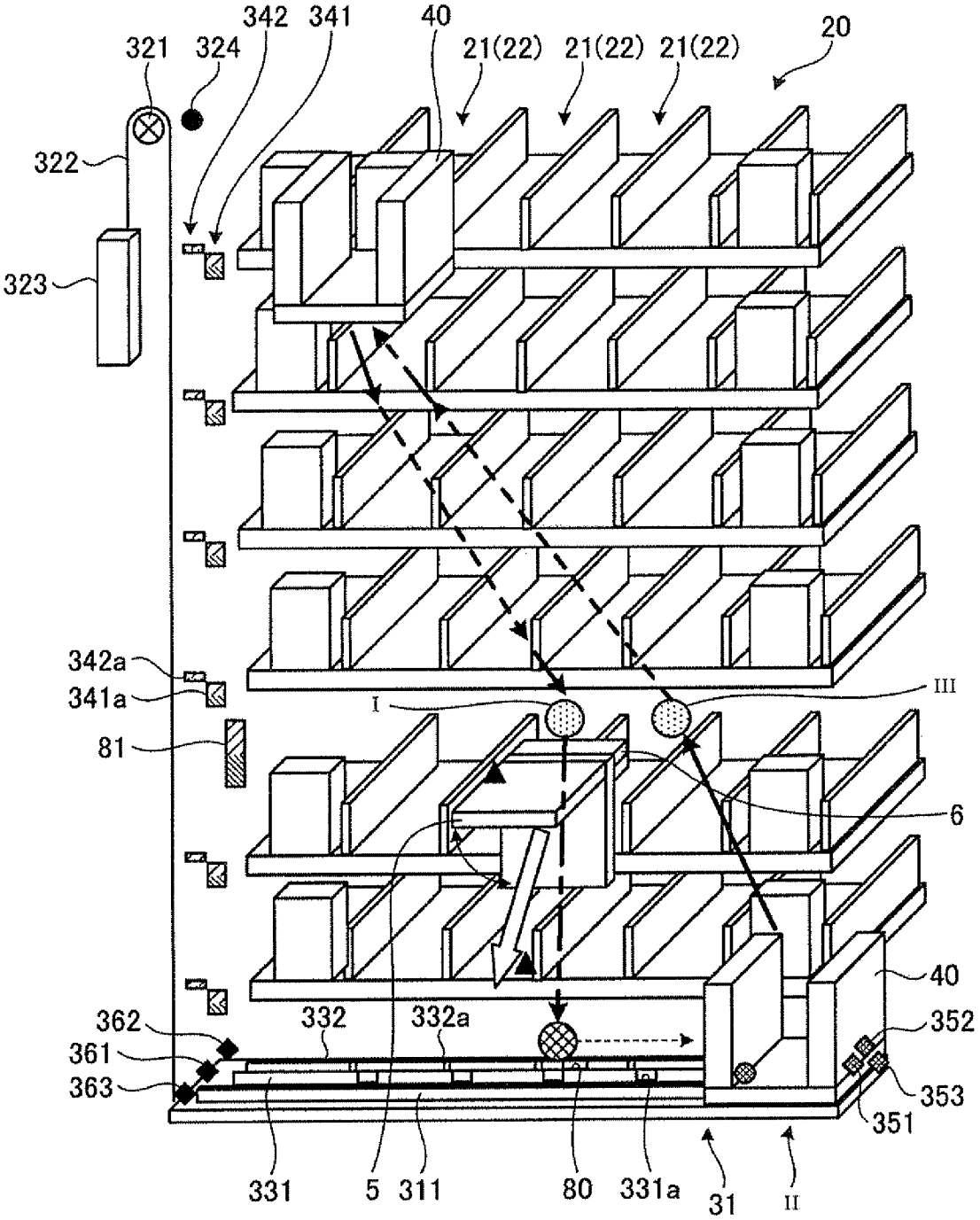


Fig. 2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341a
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331a
31
II

Fig. 3

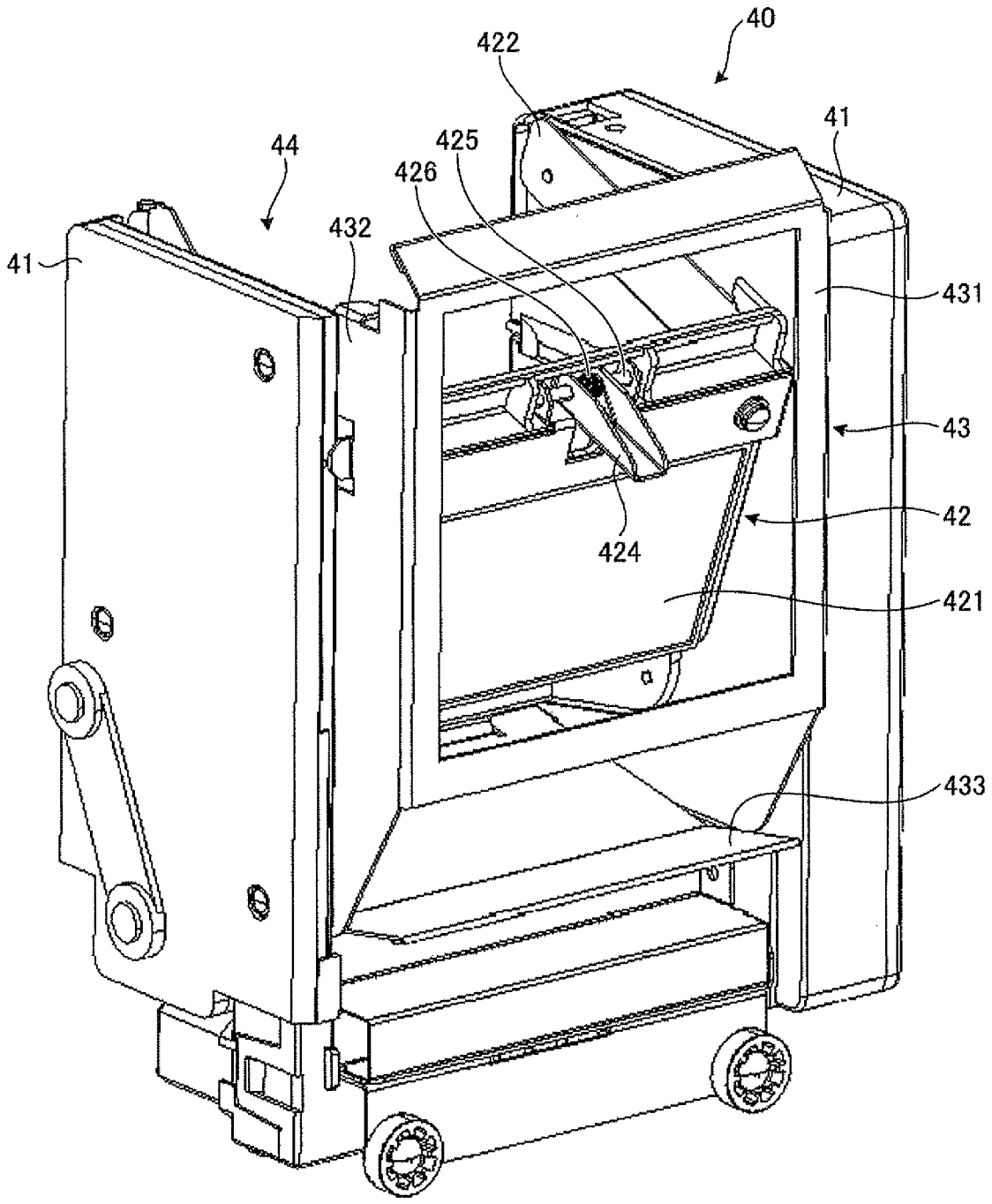


Fig. 4

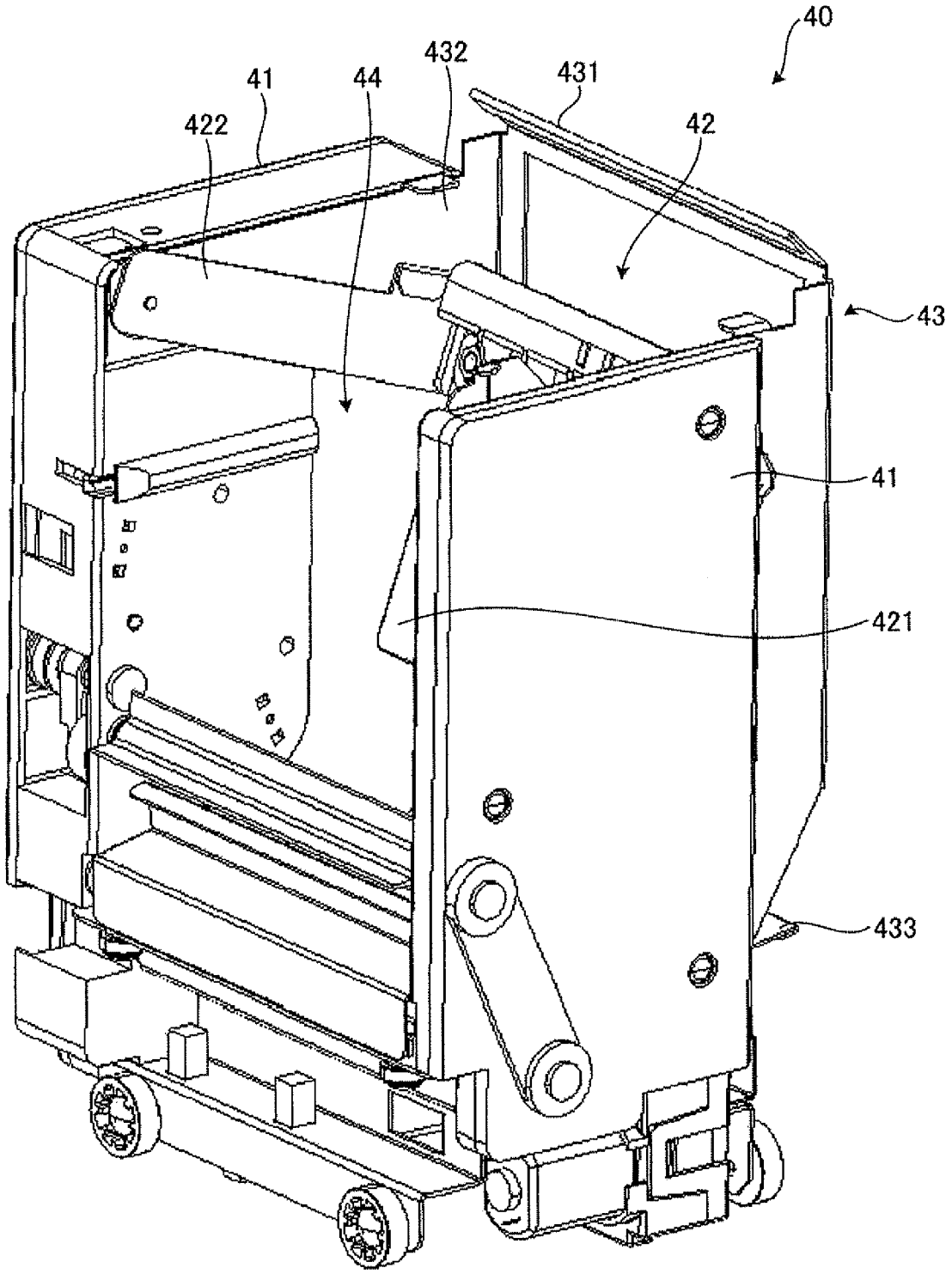


Fig. 5

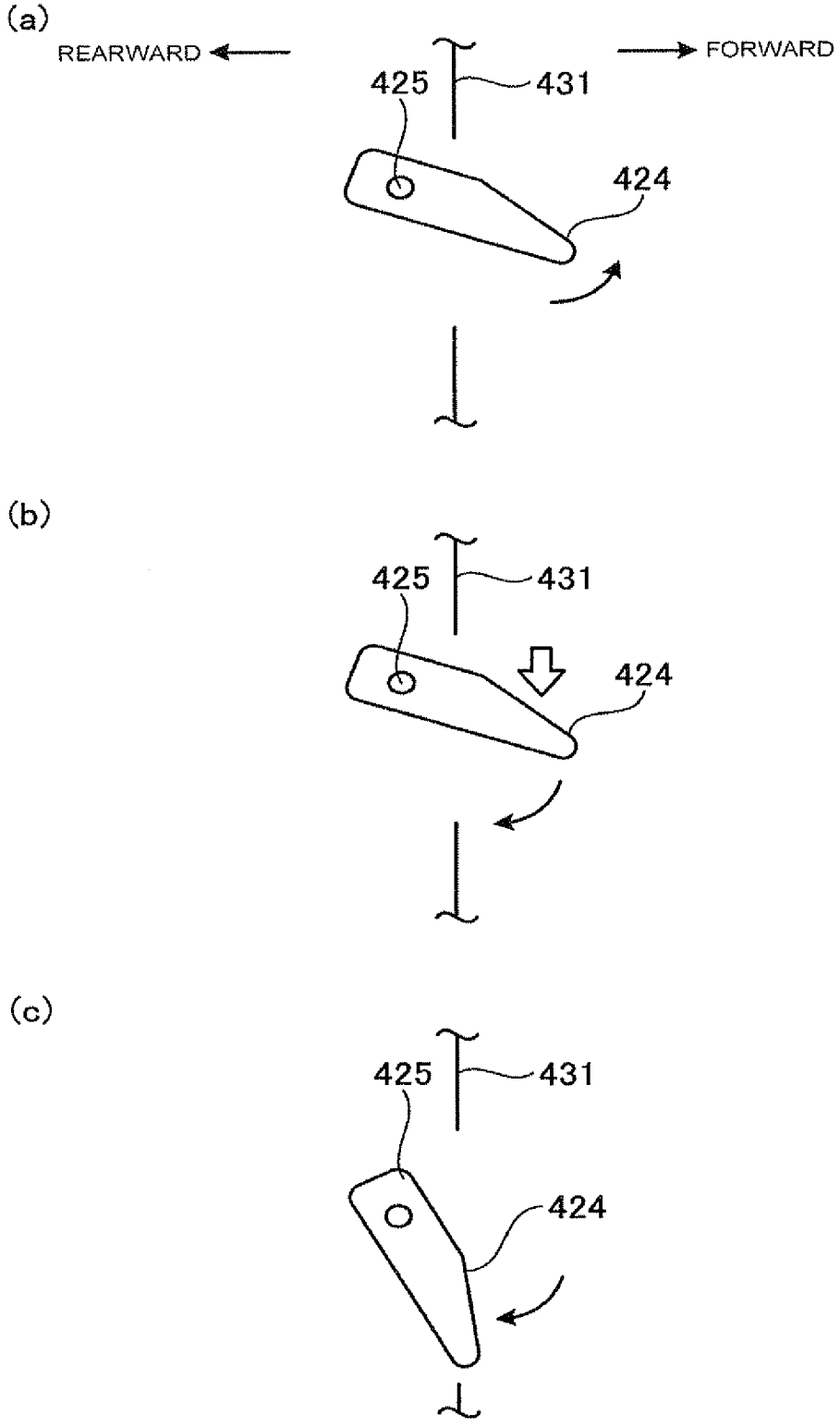
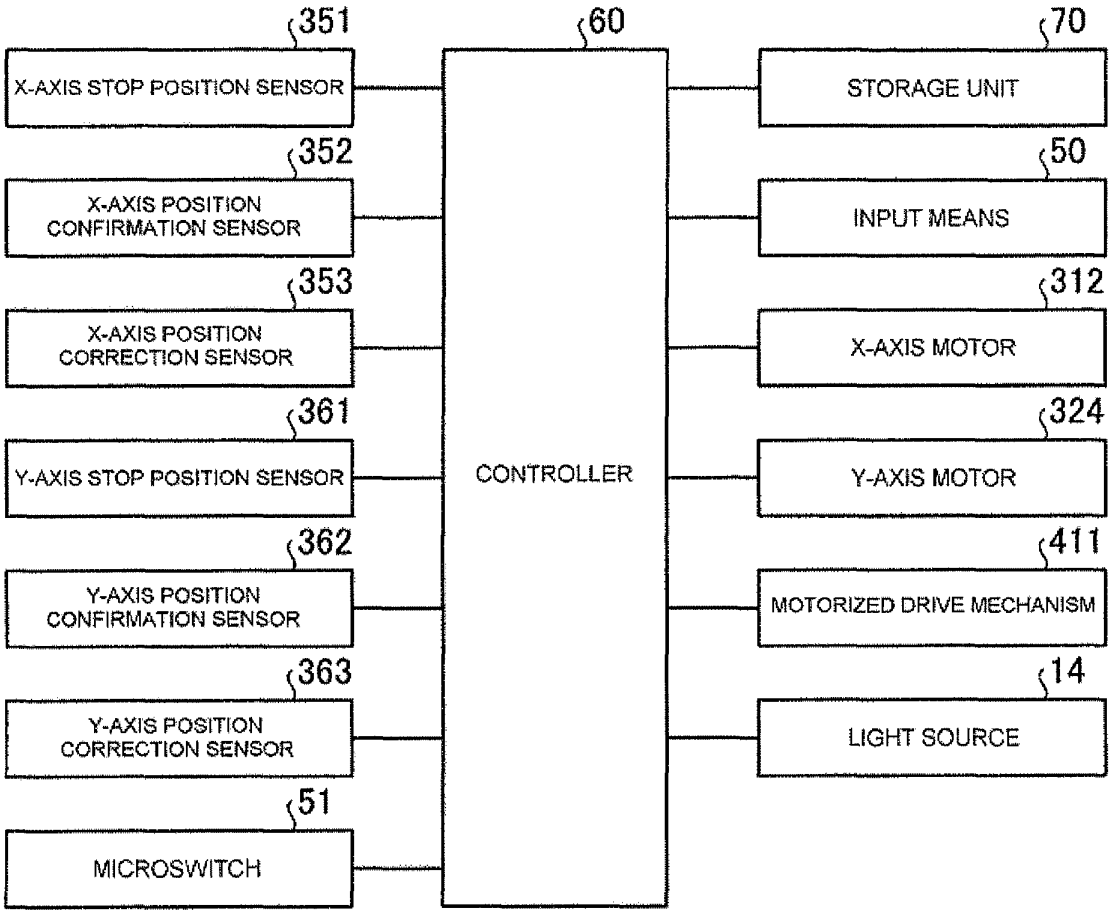


Fig. 6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X-AXIS POSITION CONFIRMATION SENSOR
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X-AXIS POSITION CORRECTION SENSOR
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Y-AXIS POSITION CONFIRMATION SENSOR
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Y-AXIS POSITION CORRECTION SENSOR
51
MICROSWITCH
60
CONTROLLER
70
STORAGE UNIT
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INPUT MEANS
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X-AXIS MOTOR
324
Y-AXIS MOTOR
411
MOTORIZED DRIVE MECHANISM
14
LIGHT SOURCE

Fig. 7

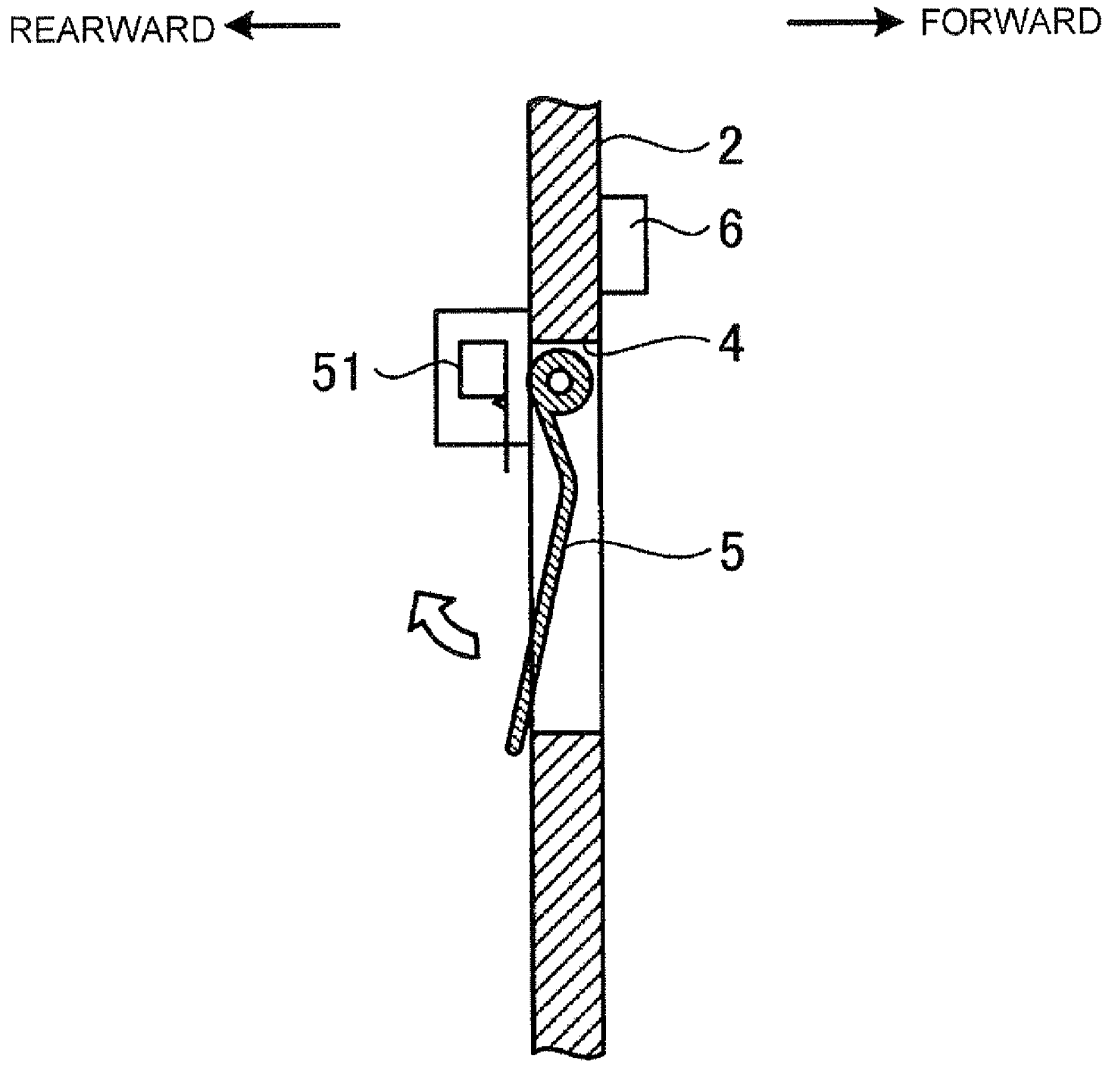

Fig. 8

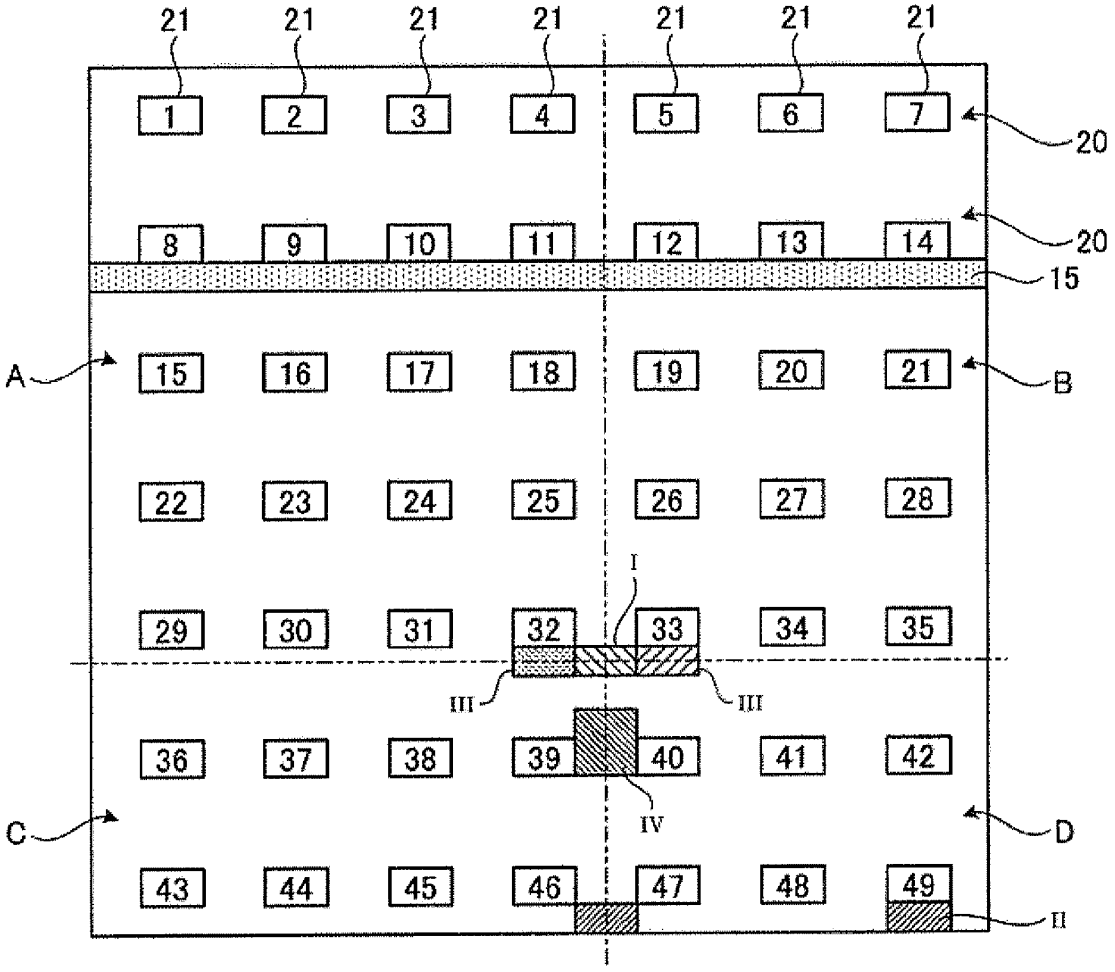
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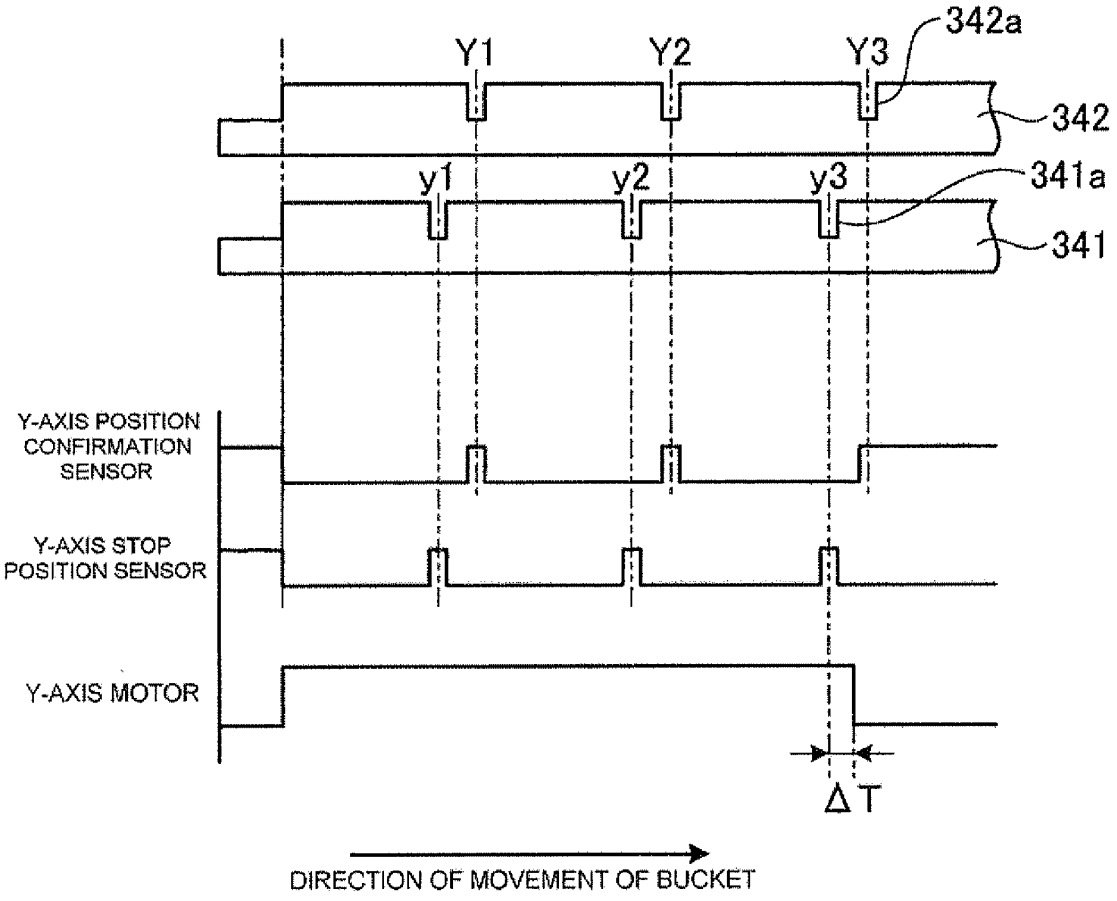
Fig. 9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Y-AXIS STOP POSITION SENSOR
Y-AXIS MOTOR
ΔT
DIRECTION OF MOVEMENT OF BUCKET

Fig. 10

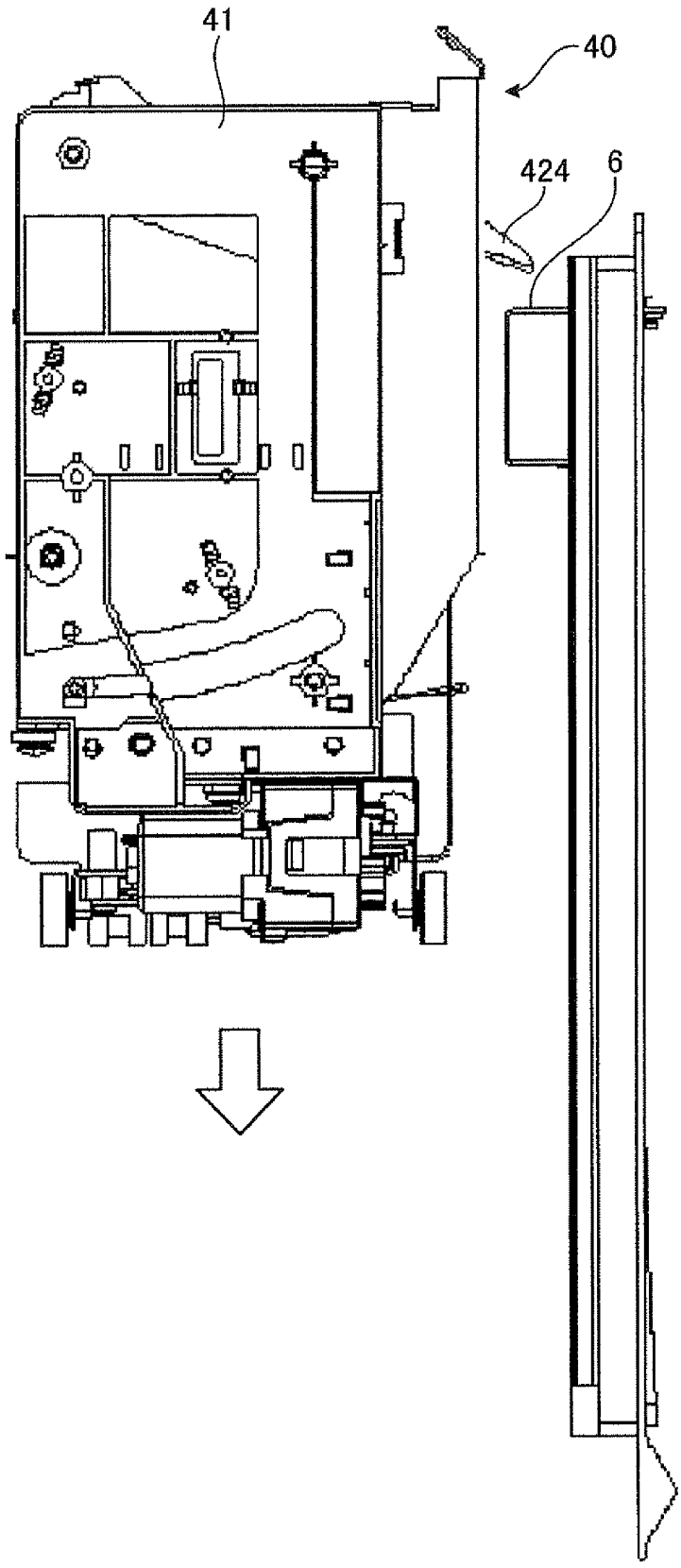

Fig. 11

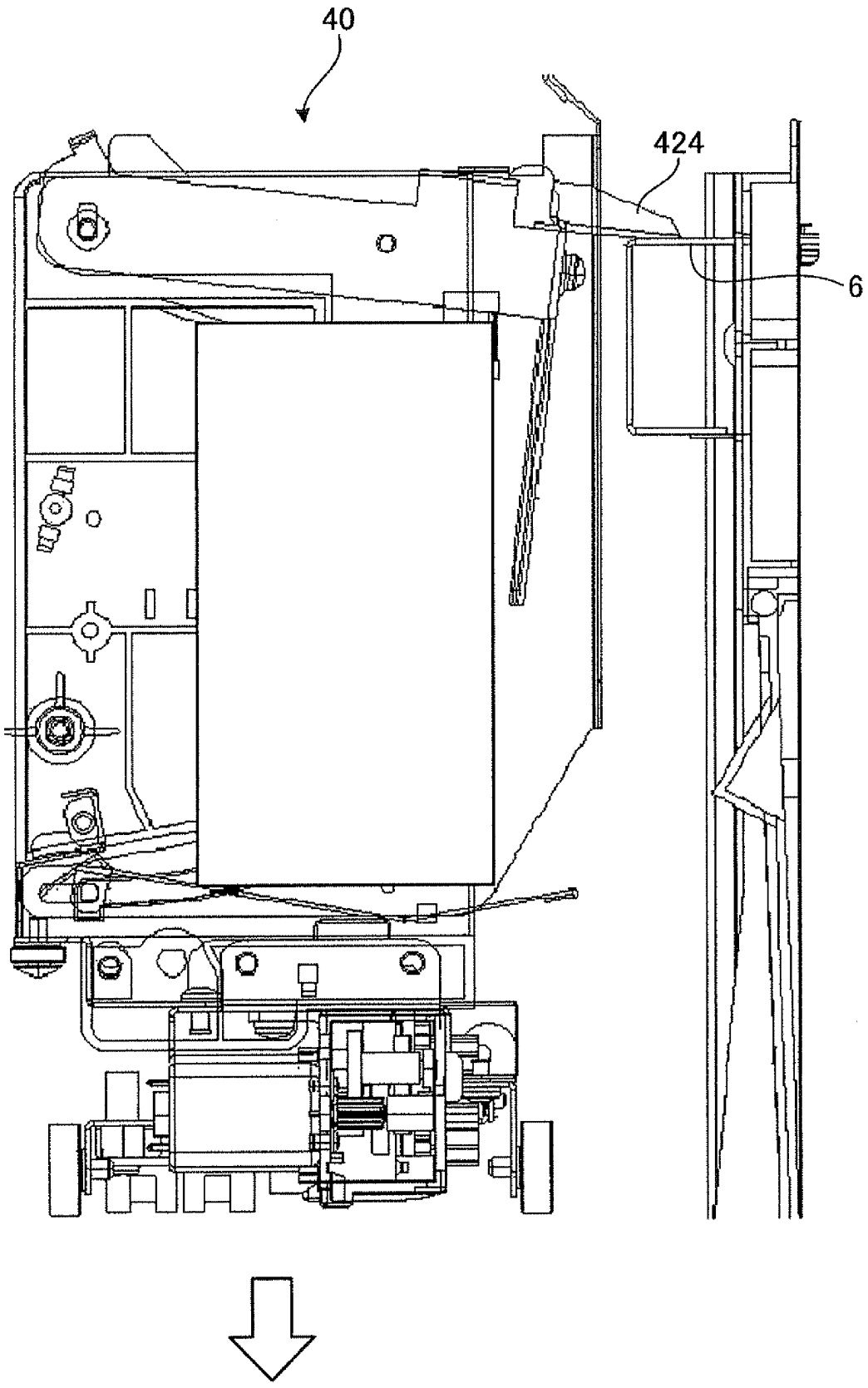

Fig. 12

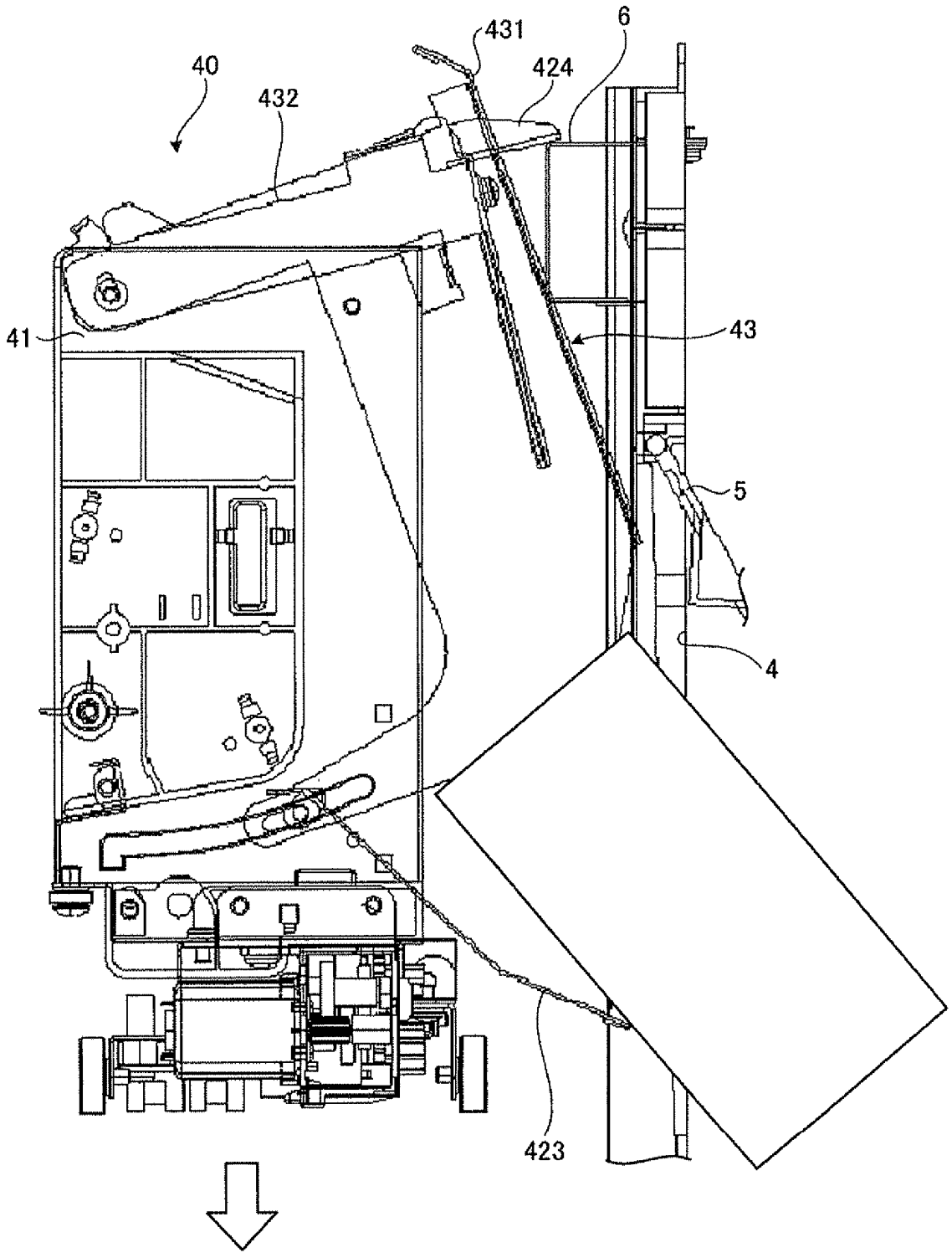

Fig. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/060837

A. CLASSIFICATION OF SUBJECT MATTER
G07F11/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G07F11/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2010
Kokai Jitsuyo Shinan Koho	1971-2010	Toroku Jitsuyo Shinan Koho	1994-2010

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-093479 A (Fuji Electric Retail Systems Co., Ltd.), 30 April 2009 (30.04.2009), (Family: none)	1-4
A	JP 11-353546 A (Fuji Electric Co., Ltd.), 24 December 1999 (24.12.1999), (Family: none)	3,4

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 July, 2010 (23.07.10)	03 August, 2010 (03.08.10)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

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Patent documents cited in the description

- JP H11353546 B **[0005]**
- JP 2009093479 A **[0006]**