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(54) **PRODUCT STOWING DEVICE FOR AUTOMATIC VENDING MACHINE**

(57) A product storage device of an automatic vending machine includes a product rack 20 having a plurality of product storage columns 21 juxtaposed in a horizontal direction, and a bucket 40 capable of picking up/delivering a product W from/to a predetermined product storage column 21, wherein the bucket 40 includes: a storage member 42 which is swingably arranged on a bucket main body 41 that is a frame body, which normally assumes a reception posture where the storage member 42 is housed inside the bucket main body 41 due to the storage member's own weight, and which assumes a delivery posture where the storage member 42 swings to open a bottom surface and allows delivery of the product W when a pin member 433 constituting the bucket 40 abuts a protruding member 10; and a restricting groove 427 which restricts the storage member 42 from assuming the delivery posture due to a weight of the product W upon the product W is received from the product storage column 21.

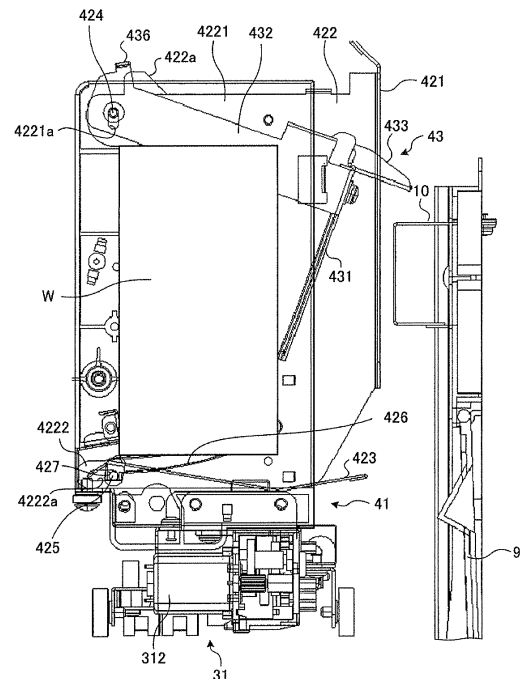


Fig. 6

Description

TECHNICAL FIELD

[0001] The present invention relates to a product storage device of an automatic vending machine and, more particularly, to a product storage device that performs pickup/delivery of a product via a bucket from/to a product rack in which a plurality of product storage columns is juxtaposed in a horizontal direction.

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 product racks is provided in a vertical direction between a pair of left and right rack supporting side plates.

[0003] A 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.

[0004] 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.

[0005] A known example of such an automatic vending machine is configured such that a delivery movement of a bucket having received a specified product from a predetermined product storage column is 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 Patent Document 1).

[0006] Patent Document 1: Japanese Patent Application Laid-open No. H8-202935

[0007] With an automatic vending machine such as that proposed in Patent Document 1 described above, in a case where a bucket arranged so as to oppose a predetermined product storage column receives a product from the product storage column, there is a risk that a weight of the product may cause the bucket to assume an inclined posture that allows delivery of the product if the product has a smooth surface and is relatively heavy such as a bottled beverage. When the bucket assumes

an inclined posture upon receiving a product in this manner, not only is the bucket unable to receive the product in a desired posture but there is also a risk that the bucket may drop the received product.

[0008] In order to solve this problem, the bucket itself can be provided with a locking mechanism that enables the bucket to lock a posture and a releasing mechanism that releases the locking mechanism due to driving of an actuator.

[0009] However, providing the bucket itself with a locking mechanism and a releasing mechanism not only increases the number of components of the bucket but also gives rise to an increase in weight and, by extension, an increase in cost.

DISCLOSURE OF THE INVENTION

[0010] In consideration of the circumstances described above, an object of the present invention is to provide a product storage device of an automatic vending machine which enables a bucket to receive a product from a predetermined product storage column and transfer the received product in a desired posture without dropping the received product and without giving rise to an increase in cost.

[0011] In order to achieve the object described above, a product storage device of an automatic vending machine according to claim 1 of the present invention includes: a plurality of product racks provided in a vertical direction in a product storage chamber having a thermally-insulated structure, 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 racks 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 driving the bucket, the product storage device of an automatic vending machine further includes 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, and the bucket includes: a bucket main body that is a frame body; a storage member which is swingably arranged on the bucket main body, which normally assumes a reception posture where the storage member is housed inside the bucket main body due to the storage member's own weight, and which assumes a delivery posture where the storage member

swings to open a bottom surface and allows delivery of the product when the pin member constituting the bucket abuts the protruding member of the door body constituting the front surface of the product storage chamber; and a restricting member which restricts the storage member from assuming the delivery posture due to a weight of the product when the product is received from the product storage column that is arranged opposing the bucket.

[0012] In addition, a product storage device of an automatic vending machine according to claim 2 of the present invention is the product storage device of an automatic vending machine according to claim 1, wherein the restricting member is a groove portion which allows entry of an axial portion constituting the storage member that assumes the reception posture and which restricts movement of the axial portion in a front-back direction.

[0013] Furthermore, a product storage device of an automatic vending machine according to claim 3 of the present invention is the product storage device of an automatic vending machine according to claim 1, wherein the bucket includes a pusher member which performs an advancing movement with respect to the product storage column that is arranged opposing the bucket in order to open, with respect to the product storage column, a gate member provided on a front end of the product storage column, and the restricting member is a plate-like member which restricts the storage member assuming the reception posture from swinging by moving to a predetermined restriction position in accordance with the advancing movement of the pusher member and abutting a part of the storage member.

[0014] In addition, a product storage device of an automatic vending machine according to claim 4 of the present invention is the product storage device of an automatic vending machine according to claim 1, wherein the bucket includes side portions which are arranged so as to oppose each other and which demarcate a reception area for receiving the product, and the side portions include light sources which illuminate the reception area as well as a front area and a rear area of the reception area.

[0015] Furthermore, a product storage device of an automatic vending machine according to claim 5 of the present invention is the product storage device of an automatic vending machine according to claim 4, wherein the bucket includes a concave portion that enables each of the light sources to be embedded in the side portion, and an inner surface of the concave portion is configured as a reflecting surface of the light source.

[0016] According to the present invention, since the restricting member that constitutes the bucket restricts the storage member from assuming a delivery posture due to the weight of a product when receiving the product from a product storage column which the bucket is arranged so as to oppose, there is no risk of the bucket dropping the received product, and since there is no need to provide a locking mechanism or a releasing mechanism on the bucket itself as a separate member, an in-

crease in cost does not arise. Therefore, an advantageous effect is achieved in that the bucket can receive a product from a predetermined product storage column and can transfer the received product in a desired posture without dropping the received product and without giving rise to an increase in cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a front view showing an automatic vending machine to which a product storage device according to an embodiment of the present invention has been applied;

FIG. 2 is a perspective view showing an internal structure of an automatic vending machine to which a product storage device according to an embodiment of the present invention has been applied;

FIG. 3 is a perspective view schematically showing an internal structure of a product storage chamber shown in FIG. 2;

FIG. 4 is a perspective view showing, from front, a bucket mounted on an x-axis conveying mechanism that constitutes bucket driving means;

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

FIG. 6 is a side view which schematically shows a bucket from the side and which offers a transparent view of an interior of the bucket;

FIG. 7 is an explanatory diagram for explaining a retreating movement of a pin member constituting a bucket;

FIG. 8 is a block diagram showing a control system of the automatic vending machine shown in FIG. 1; FIG. 9 is a sectional side view showing an enlargement of a substantial part of an inner door shown in FIG. 2;

FIG. 10 is an explanatory diagram schematically showing the product storage chamber shown in FIG. 2;

FIG. 11 is an explanatory diagram for explaining a stop operation of a bucket;

FIG. 12 is an explanatory diagram schematically showing a delivery movement of a bucket;

FIG. 13 is a side view which schematically shows a bucket from the side and which offers a transparent view of an interior of the bucket;

FIG. 14 is a side view which schematically shows a bucket from the side and which offers a transparent view of an interior of the bucket;

FIG. 15 is a perspective view showing, from front, a modification of a bucket according to an embodiment of the present invention;

FIG. 16 is a perspective view showing, from behind, a modification of a bucket according to an embodiment of the present invention;

FIG. 17 is a side view which schematically shows

the bucket shown in FIGS. 15 and 16 from the side and which offers a transparent view of an interior of the bucket;

FIG. 18 is a side view which schematically shows the bucket shown in FIGS. 15 and 16 from the side and which offers a transparent view of the interior of the bucket;

FIG. 19 is an explanatory diagram which shows a modification of a bucket according to an embodiment of the present invention and which shows an internal structure of a side portion that constitutes a bucket main body;

FIG. 20 is a perspective view showing, from behind, an internal structure of the side portion shown in FIG. 19;

FIG. 21 is an explanatory diagram which shows a modification of a bucket according to an embodiment of the present invention and which shows an internal structure of a side portion that constitutes a bucket main body;

FIG. 22 is a perspective view showing, from behind, an internal structure of the side portion shown in FIG. 21;

FIG. 23 is a perspective view schematically showing a positional relationship among an abutting piece, a restricting plate, and a pusher of an upper rearward-extending portion shown in FIGS. 21 and 22;

FIG. 24 is a perspective view showing, from front, a modification of a bucket according to an embodiment of the present invention;

FIG. 25 is a perspective view showing, from behind, a modification of a bucket according to an embodiment of the present invention;

FIG. 26 is an explanatory diagram schematically showing, from above, a light source embedded in a side portion of a bucket; and

FIG. 27 is an explanatory diagram showing a modification of a concave portion in a side portion of a bucket.

BEST MODE FOR CARRYING OUT THE INVENTION

[0018] Hereinafter, a preferred embodiment of a product storage device of an automatic vending machine according to the present invention will be described in detail with reference to the accompanying drawings.

[0019] FIGS. 1 and 2 respectively show an automatic vending machine to which a product storage device according to an embodiment of the present invention has been applied, 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 W (refer to FIGS. 11 to 13) 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 1.

[0020] The main body cabinet 1 is shaped as a cuboid with an open front surface. An interior of the main body

cabinet 1 is partitioned into halves, with an upper half constituting a product storage chamber 2 and a lower half constituting a machine room 3. The product storage chamber 2 is a chamber having its interior kept at a preset temperature condition, and wall members constituting the product storage chamber 2 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) 4 that constitutes a refrigeration cycle together with the evaporator and various control devices are provided in the machine room 3. 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.

[0021] An outer door 5 and an inner door 6 are provided on the front surface of the main body cabinet 1. The inner door 6 is a door body formed by inlaying a transparent plate material 7 that is insulated glass or the like, and is large enough to cover the front surface of the product storage chamber 2. When the inner door 6 performs a closing movement and blocks the front surface of the product storage chamber 2, the inner door 6 becomes an insulating member that constitutes the front surface of the product storage chamber 2.

[0022] A rectangular product discharge port 8 is formed and a discharge flapper 9 for opening and closing the product discharge port 8 is provided in a lower area of a central portion of the transparent plate material 7 of the inner door 6. The discharge flapper 9 is 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 8 due to its own weight.

[0023] In addition, a protruding member 10 is provided so as to protrude from a portion directly above the product discharge port 8 of the inner door 6. The protruding member 10 is constituted by a metallic member and is provided so as to protrude from a rear surface of the inner door 6. More specifically, the protruding member 10 is provided so as to protrude rearward when the inner door 6 blocks the front surface of the product storage chamber 2.

[0024] The outer door 5 is for opening and closing the front opening of the main body cabinet 1 and is constituted using an insulating material as necessary, and includes a window 11 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 11 of the outer door 5. In addition, arranged on a front surface of the outer door 5 are components necessary for automatic sales of products such as a selection switch 12 for selecting sold products and a coin

acceptor 13 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.

[0025] FIG. 3 is a perspective view schematically showing an internal structure of the product storage chamber 2 described above. Hereinafter, the product storage chamber 2 will be described with additional reference to FIG. 3 where appropriate. The product storage chamber 2 is provided with a product rack 20 and bucket driving means 30.

[0026] The product rack 20 is constituted by juxtaposing a plurality of product storage columns 21 in a horizontal direction, wherein each product storage column 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 this product rack 20 is provided in a vertical direction so as to bridge between rack supporting side plates (not shown) which are provided as a left and right pair in the product storage chamber 2.

[0027] The rack supporting side plates 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 are provided mounted to a top plate, a bottom plate, or the like constituting the product storage chamber 2 via mounting members such as screws.

[0028] Each product storage column 21 of the product rack 20 supported by the rack supporting side plates described above includes a conveying mechanism in which an endless belt 24 (refer to FIG. 19) is wound around rollers 23 (refer to FIG. 19) arranged parallel to each other to the front and back, and the product W is stored mounted on an upper surface of the conveyor belt 24. A vend mech 25 (refer to FIG. 19) that controls delivery of the product W is provided at a front end portion of each product storage column 21. The vend mech 25 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 a motorized drive mechanism 50 (refer to FIGS. 19 and 21) built into a bucket 40 when the bucket 40 is arranged so as to oppose a specified product storage column 21.

[0029] 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 1, 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. 4).

[0030] FIGS. 4 to 6 respectively show the bucket 40

mounted on the x-axis conveying mechanism 31 that constitutes the bucket driving means 30, wherein FIG. 4 is a perspective view showing the bucket 40 from front, FIG. 5 is a perspective view showing the bucket 40 from behind, and FIG. 6 is a side view which schematically shows the bucket 40 from the side and which offers a transparent view of an interior of the bucket 40. The bucket 40 exemplified here is configured so as to include a bucket main body 41, a storage member 42, and an abutting member 43.

[0031] The bucket main body 41 is a box-like frame body having a front surface, a rear surface, and an upper surface respectively opened. A pair of left and right side portions 411 that constitutes the bucket main body 41 is erected so that respective inner surfaces oppose each other. The side portions 411 house various devices in a resin chassis. Examples of such housed devices include the motorized drive mechanism 50 and a pusher mechanism 60 (refer to FIGS. 19 and 21). The motorized drive mechanism 50 transmits and provides a drive force to the vend mech 25 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. The pusher mechanism 60 includes a pusher 62 (refer to FIG. 19) which performs a rearward advancing movement due to driving by a pusher motor 61 (refer to FIGS. 19 and 21). Due to the advancing movement by the pusher 62, the pusher mechanism 60 opens a gate member 27 provided in the front end portion of the product storage column 21. Moreover, a system in which the motorized drive mechanism 50 transmits a drive force to the vend mech 25 and a system in which the pusher mechanism 60 opens the gate member 27 are known through Japanese Patent Application Laid-open No. H10-302140 and the like.

[0032] The storage member 42 is formed by appropriately combining and performing bend fabrication on metallic plate-like bodies, and is swingably arranged on the bucket main body 41. More specifically, the storage member 42 is configured so as to include a storage front portion 421, storage side portions 422, and a storage bottom portion 423.

[0033] The storage front portion 421 constitutes a front surface of the storage member 42 and includes a rectangular front opening 421a. The storage side portions 422 respectively extend rearward from both end portions of the storage front portion 421 so that respective inner surfaces thereof oppose each other, and include an upper rearward-extending portion 4221 and a lower rearward-extending portion 4222. The upper rearward-extending portion 4221 extends rearward on an upper side of the storage side portions 422 and includes a long hole 4221a with a major axis oriented in a vertical direction. Due to penetration of the long hole 4221a by a shaft member 424, the storage member 42 is provided on the bucket main body 41 so as to be swingable around an axis of the shaft member 424. The lower rearward-extending portion 4222 extends rearward on a lower side of the

storage side portions 422 and includes a long hole 4222a with a major axis oriented in a front-back direction.

[0034] The storage bottom portion 423 is a plate-like body swingably arranged between the lower rearward-extending portions 4222 of the storage side portions 422 via an axial portion 425. More specifically, both ends of the axial portion 425 penetrate the long holes 4222a of the lower rearward-extending portions 4222 and are inserted into a guiding groove 426 formed on both side portions 411 which constitute the bucket main body 41. As a result, the storage bottom portion 423 is configured so as to be swingable around an axis of the axial portion 425.

[0035] The guiding groove 426 is provided for guiding the inserted axial portion 425 and is extended such that the further forward, the guiding groove 426 is gradually oriented upward. A restricting groove 327 that extends downward in a continuous manner from the guiding groove 426 is formed at a rear end of the guiding groove 426. The restricting groove 427 restricts movement of the axial portion 425 in a front-back direction when the axial portion 425 enters the restricting groove 427.

[0036] The abutting member 43 is formed by appropriately combining and performing bend fabrication on metallic plate-like bodies, and is coaxially arranged with the storage member 42 so as to be swingable with respect to the bucket main body 41. The abutting member 43 is configured so as to include an abutting front portion 431 and abutting side portions 432.

[0037] The abutting front portion 431 constitutes a front surface of the abutting member 43 and is formed in a size capable of passing through the front opening 421a of the storage front portion 421 of the storage member 42. A pin member 433 is provided so as to protrude forward on the abutting front portion 431. The pin member 433 is arranged so as to be swingable around an axis of a shaft portion 434 provided in a horizontal direction on the abutting front portion 431 and, due to biasing by a spring member 435, the pin member 433 protrudes toward a front area or, in other words, toward a side of the inner door 6 through the front opening 421a of the storage front portion 421.

[0038] The pin member 433 is arranged so as to be swingable around an axis of the shaft portion 434 provided in a horizontal direction on the abutting front portion 431 and, due to biasing by the spring member 435, the pin member 433 protrudes toward a front area or, in other words, toward the side of the inner door 6 as shown in FIG. 7A. The pin member 433 is configured such that when a tip portion thereof is pressed from above as shown in FIG. 7B, the pin member 433 swings downward against a biasing force of the spring member 435 and performs a retreating movement from the front area as shown in FIG. 7C.

[0039] A pair of left and right abutting side portions 432 extend rearward from upper parts of both ends of the abutting front portion 431, and the shaft member 424 that penetrates the long hole 4221a of the upper rearward-ex-

tending portion 4221 of the storage side portions 422 is coupled to rear end portions of the abutting side portions 432 by swaging. Accordingly, the abutting member 43 is supported so as to be swingable around the axis of the shaft member 424 or, in other words, supported coaxially with the storage member 42, and is arranged so as to be swingable with respect to the bucket main body 41. In addition, a bent restricting piece 436 is formed in an upper part of a rear end of the left abutting side portion 432 of the pair of left and right abutting side portions 432.

[0040] The bucket 40 described above will now be summarized. The storage member 42 and the abutting member 43 are both arranged on the bucket main body 41 so as to be swingable around the axis of the same shaft member 424. One end of the shaft member 424 is rotatably supported around its own axis by the side portions 411 of the bucket main body 41, and the other end of the shaft member 424 penetrates the long hole 4221a of the storage member 42 and is coupled by swaging to a rear end portion of the storage side portions 432 of the abutting member 43. Normally, the storage member 42 assumes a reception posture in which the storage member 42 is housed inside the bucket main body 41 due to its own weight. In the reception posture, as shown in FIG. 6, the axial portion 425 penetrating the long hole 4222a of the lower rearward-extending portion 4222 of the storage member 42 has entered the restricting groove 427 of the side portions 411 of the bucket main body 41 and movement of the axial portion 425 in the front-back direction is being restricted.

[0041] In addition, in the reception posture, the storage bottom portion 423 of the storage member 42 is supported by a bottom portion of the bucket main body 41 and blocks the bottom surface of the storage member 42 to create a state in which the product W is mountable.

[0042] Meanwhile, the abutting member 43 assumes a standby posture in which the abutting member 43 is similarly housed inside the bucket main body 41 due to its own weight. Even in this standby posture, the pin member 433 provided on the abutting front portion 431 protrudes forward through the front opening 421a of the storage front portion 421. When the abutting member 43 is assuming the standby posture, the restricting piece 436 formed in an upper part of a rear end of the left abutting side portion 432 is positioned in an upper area of a protruding portion 422a that protrudes upward from an upper end portion of the storage side portion 422, thereby restricting the storage member 42 that is assuming the reception posture from moving upward.

[0043] 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.

[0044] Since a structure itself of the y-axis conveying

mechanism 32 is well known, a detailed description will be omitted herein and a simple description will be given instead. The y-axis conveying mechanism 32 is provided on a pair of left and right conveyance support frames. 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 x-axis conveying mechanism 31 mounted with the 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.

[0045] 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.

[0046] 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.

[0047] 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 indica-

tors 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.

[0048] The x-axis stop position sensor 351, the x-axis position confirmation sensor 352, and the x-axis position correction sensor 353 are respectively arranged at a lower portion of the right side portion 411 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-receiving 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).

[0049] 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.

[0050] 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.

[0051] The y-axis stop position sensor 361, the y-axis position confirmation sensor 362, and the y-axis position correction sensor 363 are respectively arranged 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.

[0052] 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.

[0053] 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.

[0054] FIG. 8 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. 8, in addition to the x-axis motor 312, the y-axis motor 324, the motorized drive mechanism 50, 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 70, a microswitch 71, and a controller 80.

[0055] The input means 70 is a remote controller or the like and is capable of providing various commands and the like to the controller 80. In addition, the input means 70 is provided with a display unit and is capable of displaying information supplied from the controller 80.

[0056] As shown in FIG. 9, the microswitch 71 is provided to the front of the inner door 6. The microswitch 71 is aperture sensing means for sensing an aperture of the discharge flapper 9 and supplies a sensing signal to the controller 80. Although details will be described later, as the bucket 40 performs a downward delivery movement and the pin member 433 of the bucket 40 abuts the pro-

truding member 10, the storage bottom portion 423 constituting the bucket 40 assumes an inclined posture and the discharge flapper 9 is abutted by the bottom portion 423 assuming the inclined posture and swings forward.

[0057] The controller 80 integrally controls movement of the bucket 40 and lighting of the light source 14 based on programs and data stored in a storage unit 80M. Note that the controller 80 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.

[0058] The storage unit 80M 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 80M stores position information and information related to a number of each product storage column 21 as shown in FIG. 10 in addition to a predetermined relay position I, a predetermined standby position II, and a predetermined via position III stored in advance.

[0059] The relay position I is determined in advance in an area directly above the protruding member 10. 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 10 provided on the inner door 6 so as to protrude therefrom is positioned in an area directly below the relay position I (in FIG. 10, the position of the protruding member 10 is denoted by reference symbol IV).

[0060] 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. 10. 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. 10 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.

[0061] Reference numeral 15 in FIG. 10 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 80M 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 80M also stores the fact that the y-axis motor 324 is positioned in a high-temperature environment. Further-

more, the storage unit 80M 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.

[0062] 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 12 and money-received information regarding coins fed from the coin acceptor 13 respectively satisfy predetermined sales conditions, a sales command is issued to the controller 80. For this description, it is assumed that a product stored in the product storage column 21 with the column number 1 has been selected.

[0063] The controller 80 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. 10, the controller 80 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 80 may light only the light sources 14 that are in close proximity to the product storage column 21 with the column number 1.

[0064] 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 80 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.

[0065] 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 80M.

[0066] As shown in FIG. 11, 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 80 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 bucket 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 80 can recognize that the bucket 40 has been arranged so as to oppose the target product storage column 21.

[0067] 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 80 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 80 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 80 can recognize that the bucket 40 has been arranged so as to oppose the target product storage column 21. At this point, the controller 80 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 80M.

[0068] 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 80 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 80 can

recognize that the bucket 40 has been arranged so as to oppose the target product storage column 21. At this point, the controller 80 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 80M.

[0069] 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 a temperature environment of the x-axis motor 312 and the controller 80 issuing a drive stop command after lapse of the set time.

[0070] When the bucket 40 is arranged so as to oppose the target product storage column 21, the controller 80 issues a drive command to the motorized drive mechanism 50. Accordingly, the motorized drive mechanism 50 drives the vend mech 25 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 while being mounted on the storage bottom portion 423. Once the bucket 40 receives the product, the controller 80 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 80 performs PWM control in which the motors are driven at a predetermined power.

[0071] When it is detected that the bucket 40 is at the relay position I, the controller 80 drives only the y-axis motor 324 and causes the bucket 40 to perform a delivery movement. During the delivery movement, the controller 80 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 80 drives the y-axis motor 324 to cause the bucket 40 to perform a downward delivery movement. Even during the delivery movement, the controller 80 performs PWM control in which the motor is driven at a predetermined power.

[0072] 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. 12, the pin member 433 of the bucket 40 abuts the protruding member 10 as shown in FIG. 13. When the pin member 433 abuts the protruding member 10 in this manner, the abutting front portion 431 swings upward and the storage bottom portion 423 abutted by the pin member 433 also swings upward. In addition to the swinging, the storage bottom portion 423 assumes a forward-tilted posture while protruding forward as shown in FIG. 14. Accordingly, since a bottom surface of the storage bottom portion 423 opens wide and the product mounted on the storage bottom portion 423 inclines, the product is delivered from the bucket 40. The product delivered from the bucket 40 abuts the discharge flapper 9, pushes open the discharge flapper 9, passes through the opened product discharge port 8, 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 433 abuts a top surface (a top surface in a vertical direction (a horizontal surface)) of the protruding member 10 and holds inclined postures of the storage front portion 421 and the storage side portions 422 of the storage bottom portion 423 together with the abutting front portion 431, thereby guaranteeing that the product is reliably delivered from the bucket 40.

[0073] With the product storage device according to the present embodiment described above, when the storage member 42 is assuming a reception posture, both ends of the axial portion 425 constituting the storage member 42 enters the restricting groove 427 formed on the side portions 411 of the bucket main body 41 and movement in a front-back direction is restricted. Accordingly, the storage member 42 is restricted from swinging around the axis of the shaft member 424. In other words, the restricting groove 427 constitutes a restricting member that restricts the storage member 42 assuming a reception posture from swinging and assuming a delivery posture.

[0074] In addition, since the restricting groove 427 restricts the storage member 42 assuming a reception posture from swinging and assuming a delivery posture, when receiving the product W from the product storage column 21 which the bucket 40 is arranged so as to oppose, the storage member 42 assuming a reception posture is restricted from assuming a delivery posture due to the weight of the product W. Accordingly, since there is no risk of the bucket 40 dropping the received product W and there is no need to provide a locking mechanism or a releasing mechanism on the bucket 40 itself as a separate member, there is no increase in cost. Therefore, the bucket 40 can receive the product W from the predetermined product storage column 21 and transfer the received product W in a desired posture without dropping the received product W and without giving rise to an increase in cost.

[0075] With such an automatic vending machine, alternatively, an aperture of the discharge flapper 9 may be detected via the microswitch 71 during the cleaning operation described above, and when the aperture detected via the microswitch 71 is under a reference value (threshold) set in advance, the controller 80 may judge that the aperture is insufficient and notify the input means 70 as such, and have a predetermined display unit of the input means 70 display the fact that the aperture is insufficient. Accordingly, an operator can recognize insufficient abutment between the pin member 433 and the protruding member 10 and can correct positions of the pin member 433 and the protruding member 10 so that a favorable positional relationship is maintained.

[0076] 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 80 arrang-

es 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 433 of the bucket 40 abutting the protruding member 10 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 433 of the bucket 40 interfering with the protruding member 10 of the inner door 6.

[0077] In addition, since the pin member 433 swings around its own axis against a biasing force of the spring member 435 when pressed from above and performs a retreating movement from a front area into which the pin member 433 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 433 coming into contact with and damaging the protruding member 10 at this point.

[0078] 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.

[0079] In addition, with the automatic vending machine described above, since the controller 80 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.

[0080] 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 2, 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 2.

[0081] 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.

[0082] While the present invention has been described in its preferred embodiment, it is to be understood that the present invention is not limited thereto and various modifications can be made.

[0083] For example, while the storage member 42 assuming a reception posture is restricted from assuming a delivery posture by the restricting groove 427 formed on the side portions 411 of the bucket main body 41 in the embodiment described above, the present invention may adopt a configuration such as that shown in FIGS. 15 to 18.

[0084] FIGS. 15 to 18 respectively show a modification of the bucket 40 according to an embodiment of the present invention, wherein FIG. 15 is a perspective view showing the modification from front and FIG. 16 is a perspective view showing the modification from behind. Components similar to those of the embodiment described above are denoted by the same reference characters and a description thereof will be omitted.

[0085] A bucket 40' exemplified here is configured so as to include a bucket main body 41, a storage member 42, and an abutting member 44. The abutting member 44 is formed by appropriately combining and performing bend fabrication on metallic plate-like bodies, and is coaxially arranged with the storage member 42 so as to be swingable with respect to the bucket main body 41. The abutting member 44 is configured so as to include an abutting front portion 441 and abutting side portions 442. A pair of left and right abutting side portions 442 extend rearward from upper parts at both ends of the abutting front portion 441, and the shaft member 424 that penetrates the long hole 4221a of the upper rearward-extending portion 4221 of the storage side portions 422 is coupled to rear end portions of the abutting side portions 432 by swaging. Accordingly, the abutting member 44 is supported so as to be swingable around the axis of the shaft member 424 or, in other words, swingably supported so as to be coaxial with the storage member 42, and is arranged so as to be swingable with respect to the bucket main body 41. In addition, a supporting piece 4421 is formed in an upper part of a rear end of the left abutting side portion 442 among the pair of left and right abutting side portions 442. The supporting piece 4421 is for supporting an elongated restricting rod 4422. As also shown in FIG. 17, the restricting rod 4422 is provided so as to penetrate the left side portion 411 of the bucket main body 41, and when the abutting member 44 is in a standby posture, a tip of the restricting rod 4422 is positioned in an area above a protruding piece 422a which protrudes leftward from the storage side portions 422 of the storage member 42. Accordingly, swinging of the storage member 42 assuming the reception posture is restricted.

[0086] In addition, when a downward movement of the bucket 40' from a relay position causes the pin member 433 to abut the protruding member 10, the abutting member 44 swings forward from the standby posture and the tip of the restricting rod 4422 performs a rearward retreating movement from the area above the protruding piece 422a as shown in FIG. 18. Accordingly, the storage member 42 assuming the reception posture becomes swingable, and swings due to being pressed by the swinging abutting member 44 and assumes a delivery

posture. In other words, the restricting rod 4422 supported by the supporting piece 4421 constitutes a restricting member that restricts the storage member 42 assuming a reception posture from swinging and assuming a delivery posture.

[0087] Even according to such a configuration, when the bucket 40' receives a product W from the product storage column 21 which the bucket 40' is arranged so as to oppose, the storage member 42 assuming the reception posture is restricted from assuming a delivery posture due to the weight of the product W. Accordingly, since there is no risk of the bucket 40' dropping the received product W and there is no need to provide a locking mechanism or a releasing mechanism on the bucket 40' itself, there is no increase in cost. Therefore, the bucket 40' can receive the product W from the predetermined product storage column 21 and can transfer the received product W in a desired posture without dropping the received product W and without giving rise to an increase in cost.

[0088] FIG. 19 is an explanatory diagram which shows a modification of a bucket according to an embodiment of the present invention and which shows an internal structure of a side portion that constitutes a bucket main body. Same components as those of the embodiment described above are denoted by the same reference characters and a description thereof will be omitted. A bucket 40" exemplified here is configured so as to include a bucket main body 41, a storage member 42, and an abutting member 44. A restricting plate 45 is provided so as to be vertically movable on a side portion 411' constituting the bucket main body 41. When a pusher 62 is stored in the side portion 411' as shown in FIG. 19, the restricting plate 45 is positioned at a lower limit position as also shown in FIG. 20. When the restricting plate 45 is positioned at the lower limit position, the restricting plate 45 does not abut an abutting piece 4221b formed on a rear end of an upper rearward-extending portion 4221 constituting the storage member 42 and allows swinging of the storage member 42.

[0089] On the other hand, when a pusher mechanism 60 is driven and the pusher 62 performs a rearward advancing movement as shown in FIG. 21, the restricting plate 45 moves upward and is positioned at an upper limit position (restricting position) as shown in FIG. 22. When the restricting plate 45 is positioned at the upper limit position, the restricting plate 45 abuts the abutting piece 4221b of the storage member 42 and restricts swinging of the storage member 42 assuming a reception posture as schematically shown in FIG. 23.

[0090] In other words, the restricting plate 45 constitutes a restricting member that restricts the storage member 42 assuming a reception posture from swinging and assuming a delivery posture when the pusher 62 performs an advancing movement due to driving of the pusher mechanism 60. Even according to such a configuration, when the bucket 40" receives a product W from the product storage column 21 which the bucket 40" is ar-

ranged so as to oppose, the storage member 42 assuming the reception posture is restricted from assuming a delivery posture due to the weight of the product W. Accordingly, since there is no risk of the bucket 40" dropping the received product W and since only the restricting plate 45 need be added and a locking mechanism or a releasing mechanism need no longer be provided on the bucket 40" itself as a separate member, there is no increase in cost. Therefore, the bucket 40" can receive the product W from the predetermined product storage column 21 and can transfer the received product W in a desired posture without dropping the received product W and without giving rise to an increase in cost.

[0091] FIGS. 24 to 25 respectively show a modification of the bucket according to an embodiment of the present invention, wherein FIG. 24 is a perspective view showing the modification from front and FIG. 25 is a perspective view showing the modification from behind. Same components as those of the embodiment described above are denoted by the same reference characters and a description thereof will be omitted. In a bucket 400 exemplified here, a plurality of light sources 450 is embedded in a side portion 411 of a bucket main body 41 so as to face a reception area.

[0092] FIG. 26 is an explanatory diagram schematically showing, from above, the light source 450 embedded in the side portion 411. The light source 450 is, for example, a cuboid chassis with a built-in LED, and at least a front surface 451, a rear surface 452, and a side surface (hereinafter also referred to as a receiving surface) 453 facing a reception area among the chassis are made of a translucent material. The light source 450 is provided in a state where the light source 450 is fitted into a concave portion 411b formed on the side portion 411. In other words, an inner surface 411a of the side portion 411 protrudes to a same level as or to a reception area-side of the receiving surface 453 of the light source 450. An inner surface 411c of the concave portion 411b forms a reflecting surface that reflects light emitted from the light source 450. In this case, the inner surface 411c of the concave portion 411b has a planar shape.

[0093] In a product storage device configured as described above, due to driving of cooling means or heating means in a sales stand-by state, products stored in the product storage chamber 2 are kept in a desired temperature condition.

[0094] In the sales stand-by state described above, when information regarding selection of a product through the selection switch 12 and money-received information regarding coins fed from the coin acceptor 13 respectively satisfy predetermined sales conditions, the bucket 400 is arranged so as to oppose the product storage column 21 storing the selected product due to driving of the bucket driving means 30. When the bucket 400 is arranged so as to oppose the product storage column 21, a motorized drive mechanism 50 housed in the side portion 411 of the bucket 400 drives a vend mech 25 of the relevant product storage column 21. As a result, a

single product is moved to the bucket 400 and is received in the reception area while being mounted on the storage bottom portion 423. The bucket 400 having received the product is moved to a predetermined product dispensing chamber due to driving of the bucket driving means 30. As a result, a user can take out the product having been moved to the product dispensing chamber (not shown).

[0095] In addition, in the product storage device described above, for example, as a result of the light source 450 being lighted during a movement of the bucket 400 due to driving of the bucket driving means 30, light from the LED passes through the front surface 451, the rear surface 452, and the receiving surface 453 and is emitted to the reception area and areas in front and behind the reception area either directly or as a result of being reflected by the inner surface 411c of the concave portion 411b. Accordingly, the reception area and areas in front and behind the reception area of the bucket 400 are illuminated.

[0096] Therefore, when the bucket 400 is arranged so as to oppose the product storage column 21 storing the selected product, the product of the product storage column 21 can be illuminated, and when the product is received from the product storage column 21, the product, or in other words, the product present in the reception area can be illuminated. In addition, since the front area of the bucket 400 is also illuminated, a user in the front of the automatic vending machine can view the light from the light source 450 and a superior "stage" effect can be produced. Therefore, while producing a favorable "stage" effect during product sales, a product received in the bucket 400 can be illuminated to improve visibility.

[0097] Furthermore, according to the product storage device described above, since the reception area and areas in front and behind the reception area of the bucket 400 can be illuminated by lighting the light source 450 embedded in the side portion 411 of the bucket 400, a user can visually confirm the products even after light sources 14 arranged inside the main body cabinet 1 are turned off due to the time of day (for example, during daytime). Therefore, a favorable "stage" effect can be produced and product visibility can be improved during product sales while achieving energy saving.

[0098] In particular, the "stage" effect during product sales can be further enhanced by lighting the light source 450 so as to blink when the bucket 400 at a standby position is moved to the product storage column 21 storing the selected product due to driving by the bucket driving means 30 and then switching the light source 450 to normal lighting when the product is received from the product storage column 21 and moved to the product dispensing chamber.

[0099] While a case where the inner surface 411c of the concave portion 411b of the side portion 411 of the bucket 400 has a planar shape has been shown in the example described above, the shape of an inner surface 411e of a concave portion 411d is not particularly limited and may have a curved surface as shown in FIG. 27.

EXPLANATION OF REFERENCE NUMERALS

[0100]

5	2	product storage chamber
	6	inner door
	8	product discharge port
	9	discharge flapper
	10	protruding member
10	20	product rack
	21	product storage column
	22	product storage passage
	27	gate member
	30	bucket driving means
15	31	x-axis conveying mechanism
	311	rail member
	312	x-axis motor
	32	y-axis conveying mechanism
	324	y-axis motor
20	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
25	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
30	40	bucket
	41	bucket main body
	411	side portion
	42	storage member
	421	storage front portion
35	422	storage side portion
	423	storage bottom portion
	425	axial portion
	426	guiding groove
	427	restricting groove
40	43	abutting member
	431	abutting front portion
	432	abutting side portion
	433	pin member
	45	restricting plate
45	450	light source
	50	motorized drive mechanism
	60	pusher mechanism
	62	pusher
	71	microswitch
50	80	controller
	80M	storage unit

Claims

1. A product storage device of an automatic vending machine comprising:

a plurality of product racks provided in a vertical direction in a product storage chamber having a thermally-insulated structure, 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 racks 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 driving the bucket, the product storage device of an 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 the bucket includes:

a bucket main body that is a frame body; a storage member which is swingably arranged on the bucket main body, which normally assumes a reception posture where the storage member is housed inside the bucket main body due to the storage member's own weight, and which assumes a delivery posture where the storage member swings to open a bottom surface and allows delivery of the product when the pin member constituting the bucket abuts the protruding member of the door body constituting the front surface of the product storage chamber; and a restricting member which restricts the storage member from assuming the delivery posture due to a weight of the product when the product is received from the product storage column that is arranged opposing the bucket.

2. The product storage device of an automatic vending machine according to claim 1, wherein the restricting member is a groove portion which allows entry of an axial portion constituting the storage member that assumes the reception posture and which restricts

movement of the axial portion in a front-back direction.

3. The product storage device of an automatic vending machine according to claim 1, wherein the bucket includes a pusher member which performs an advancing movement with respect to the product storage column that is arranged opposing the bucket in order to open, with respect to the product storage column, a gate member provided on a front end of the product storage column, and the restricting member is a plate-like member which restricts the storage member assuming the reception posture from swinging by moving to a predetermined restriction position in accordance with the advancing movement of the pusher member and abutting a part of the storage member.
4. The product storage device of an automatic vending machine according to claim 1, wherein the bucket includes side portions which are arranged so as to oppose each other and which demarcate a reception area for receiving the product, and the side portions include light sources which illuminate the reception area as well as a front area and a rear area of the reception area.
5. The product storage device of an automatic vending machine according to claim 4, wherein the bucket includes a concave portion that enables each of the light sources to be embedded in the side portion, and an inner surface of the concave portion is configured as a reflecting surface of the light source.

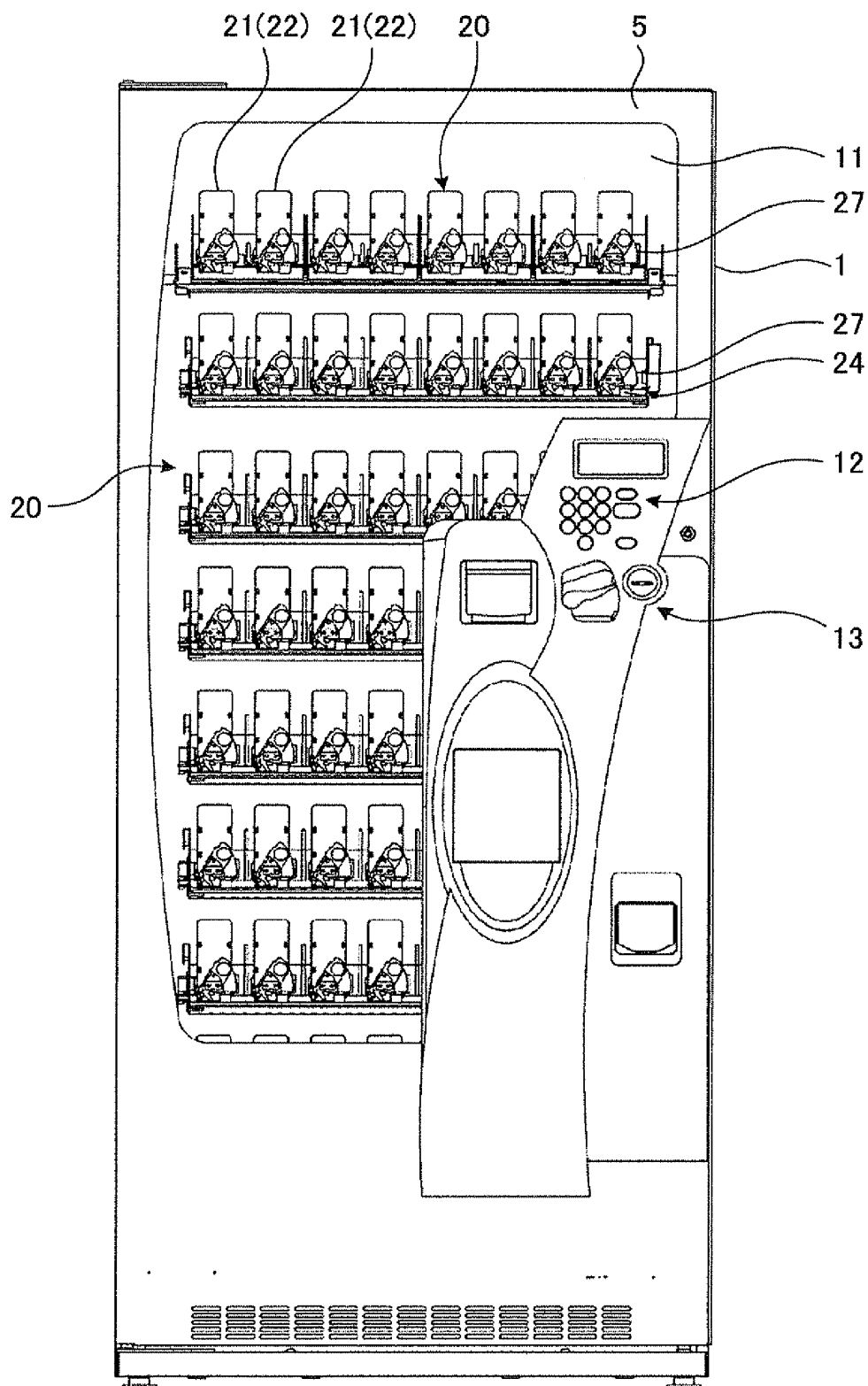


Fig. 1

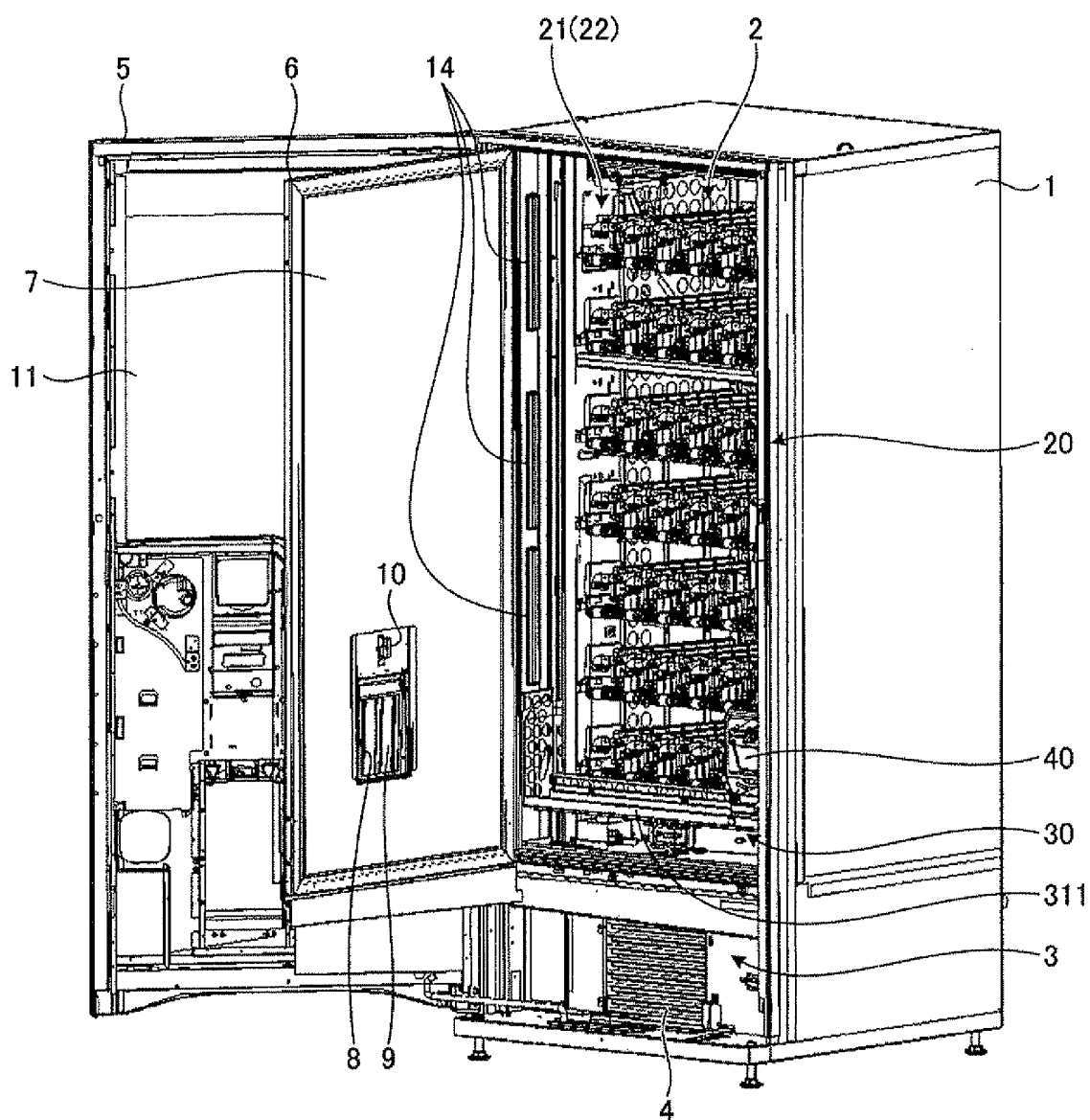


Fig. 2

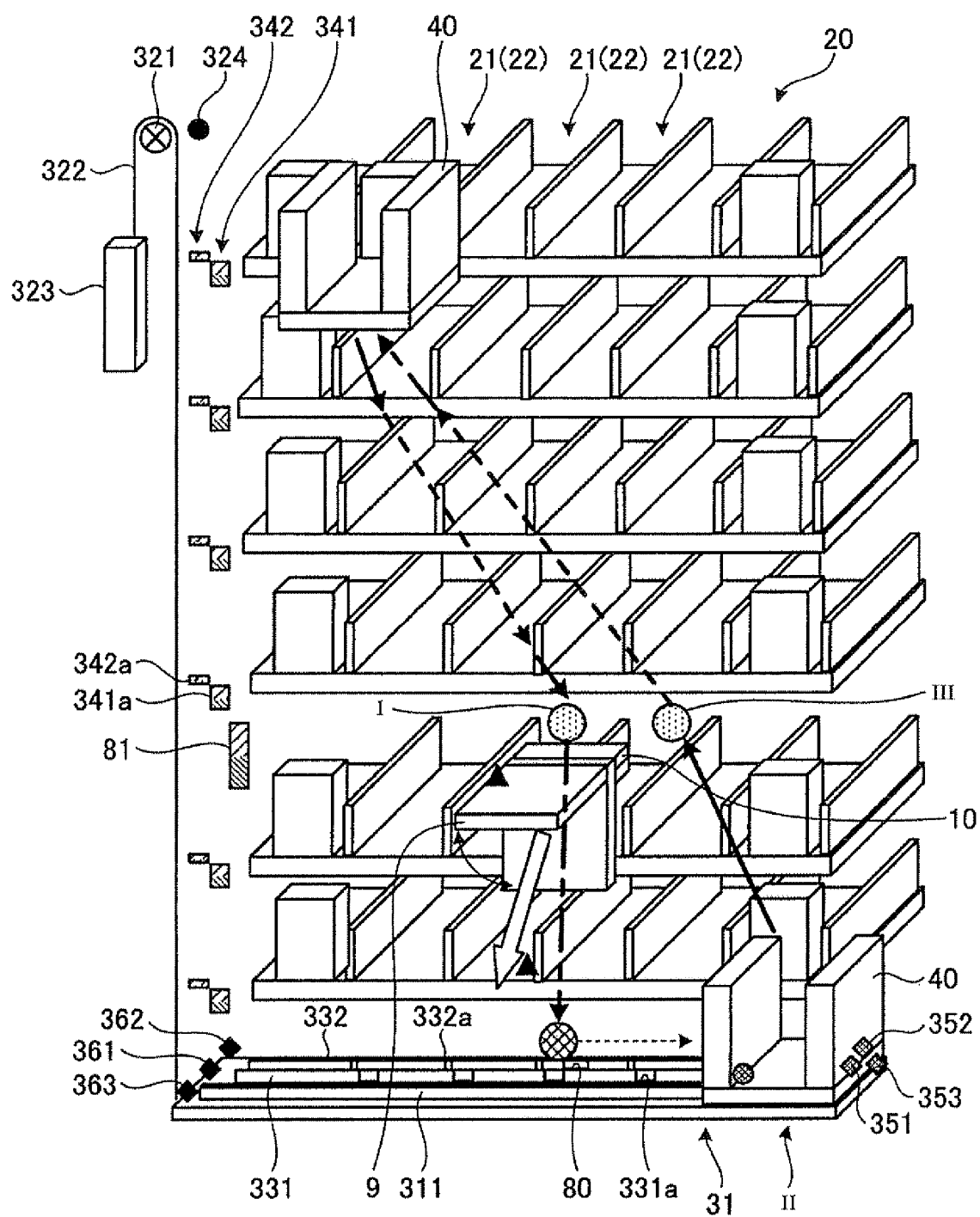


Fig. 3

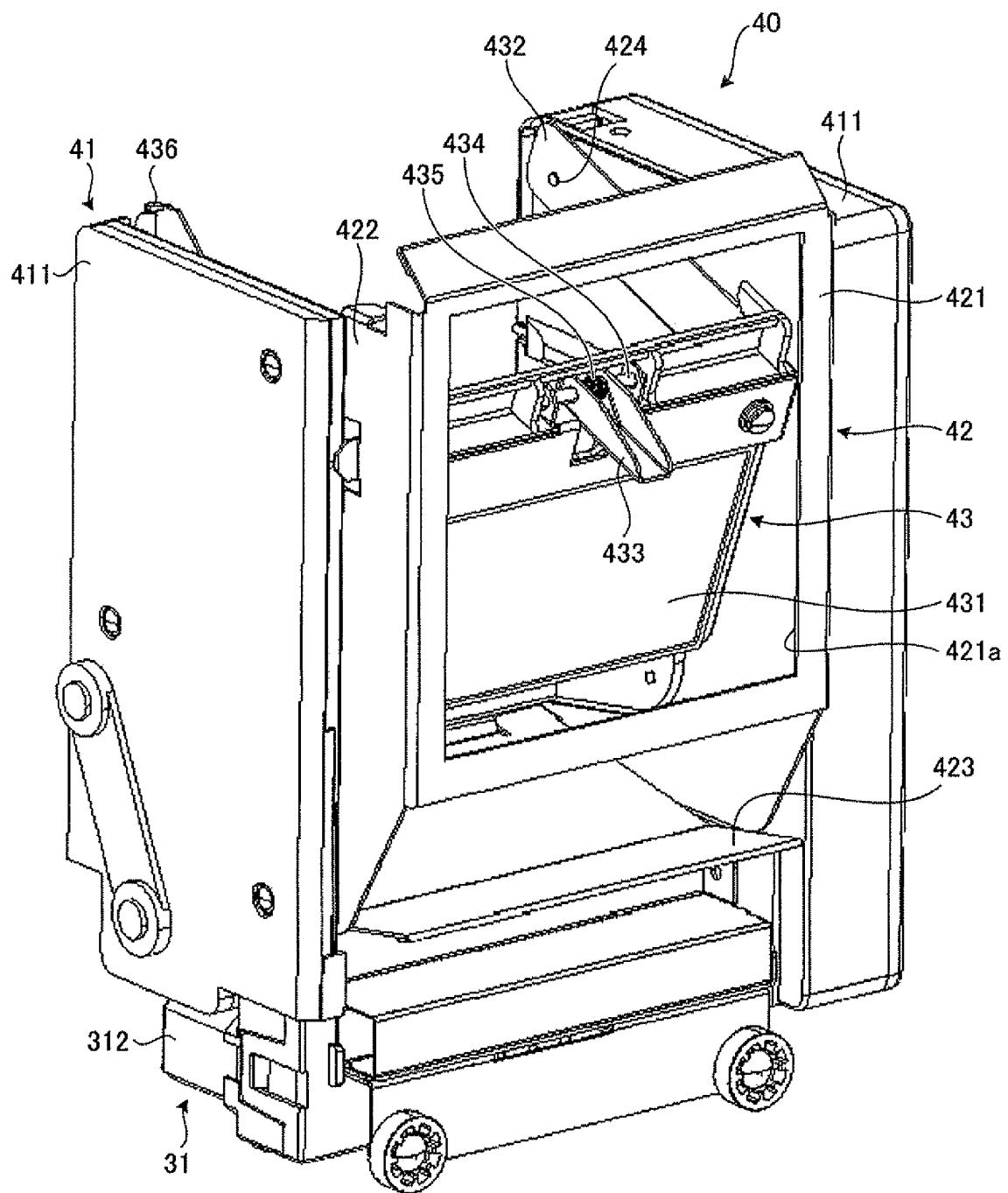


Fig. 4

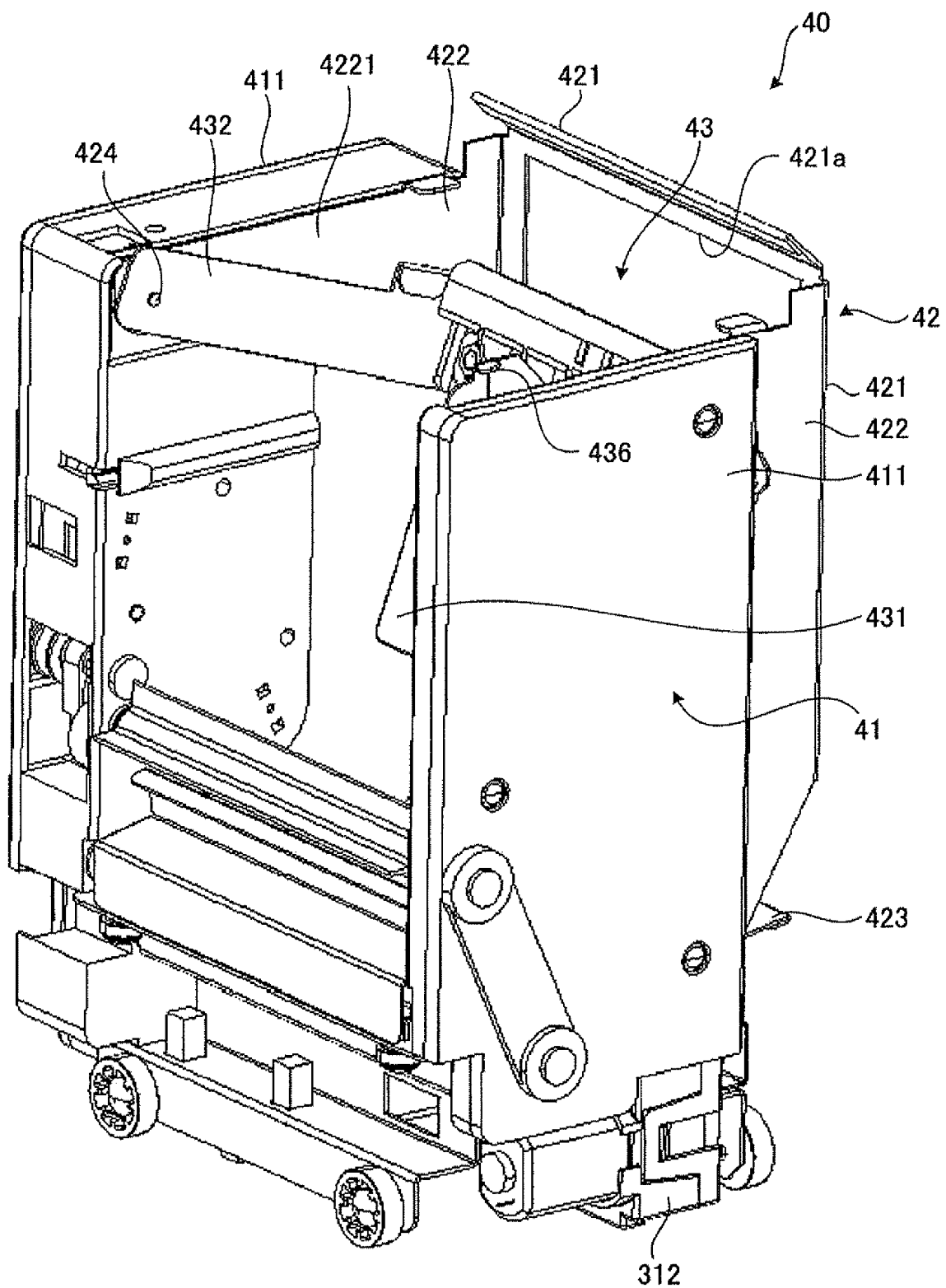


Fig. 5

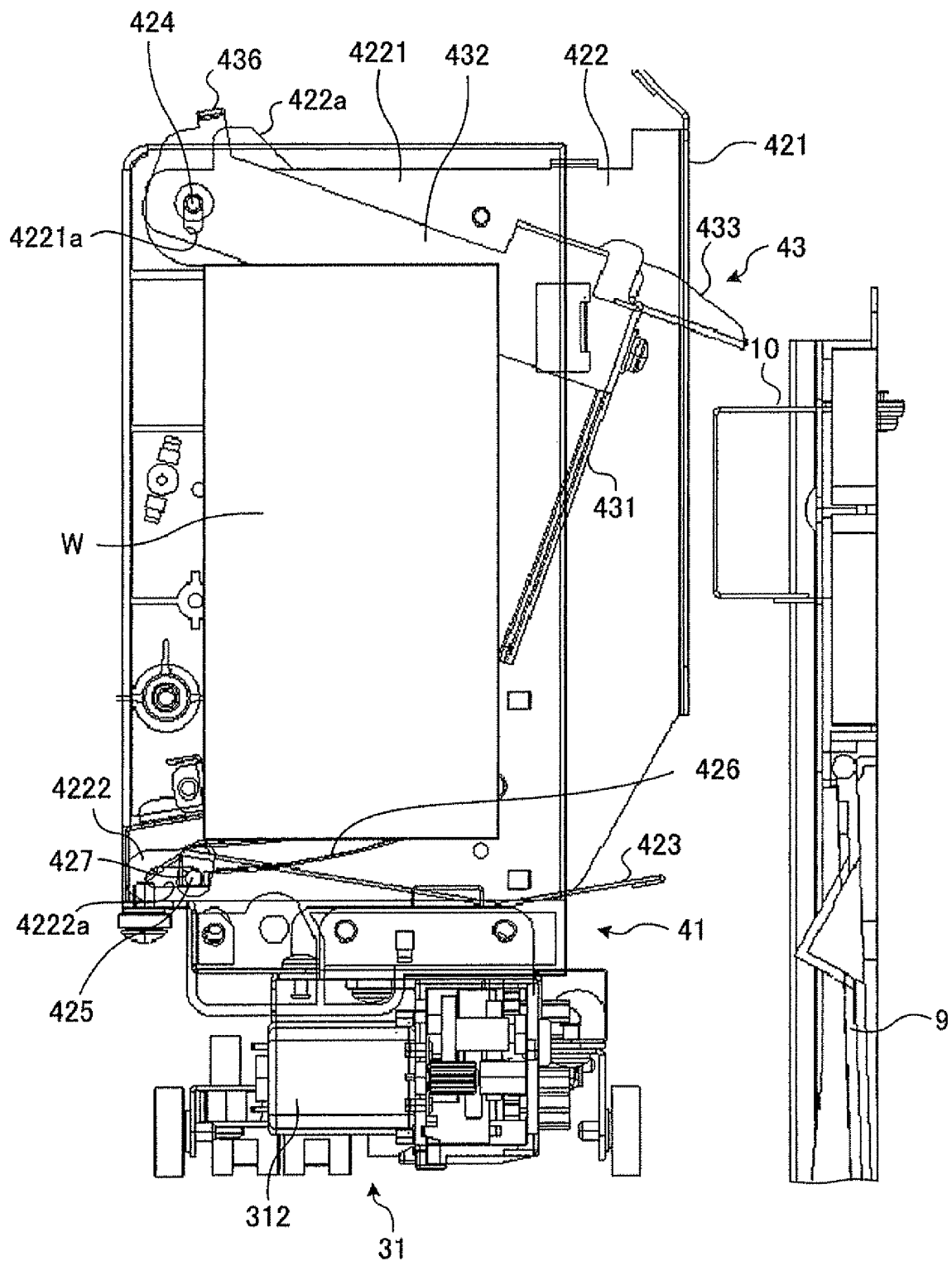


Fig. 6

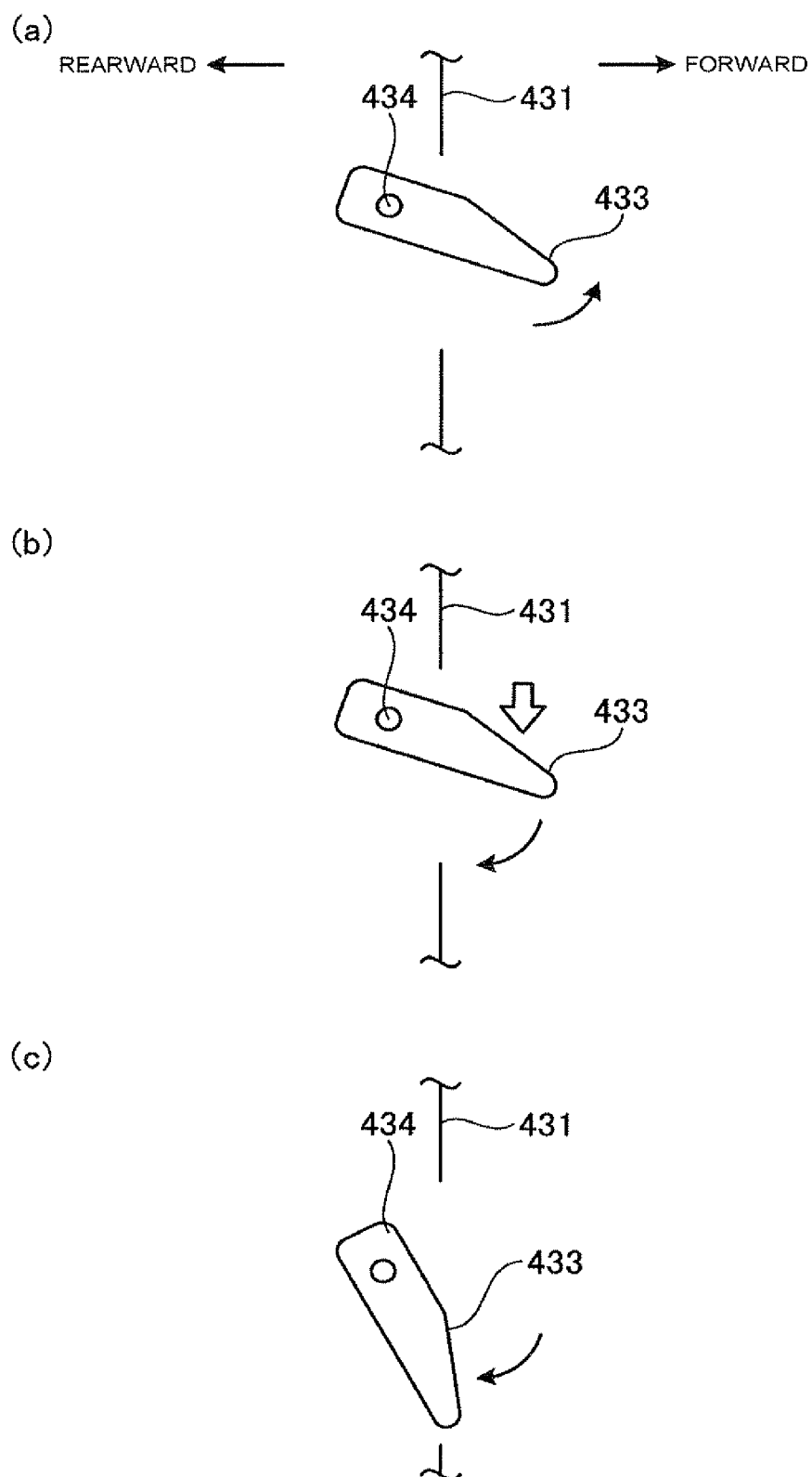


Fig. 7

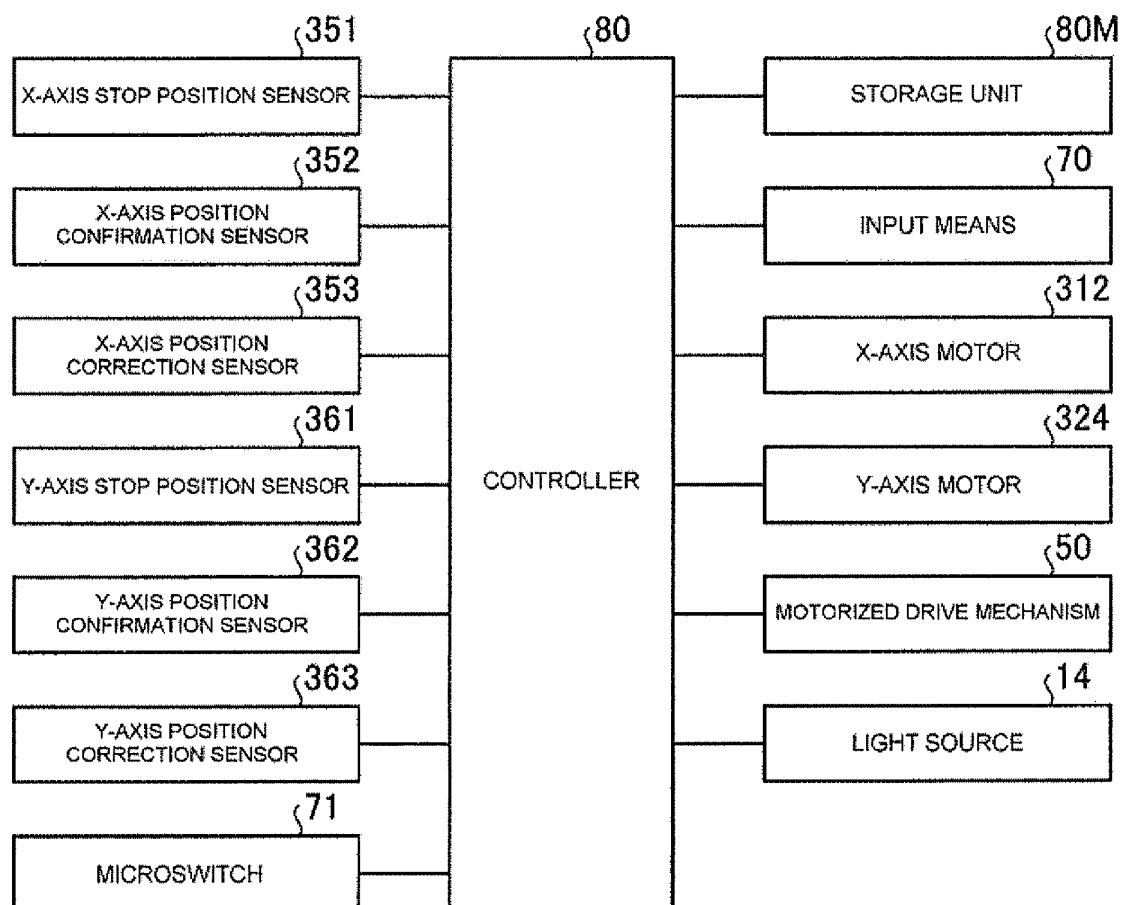


Fig. 8

REARWARD ← → FORWARD

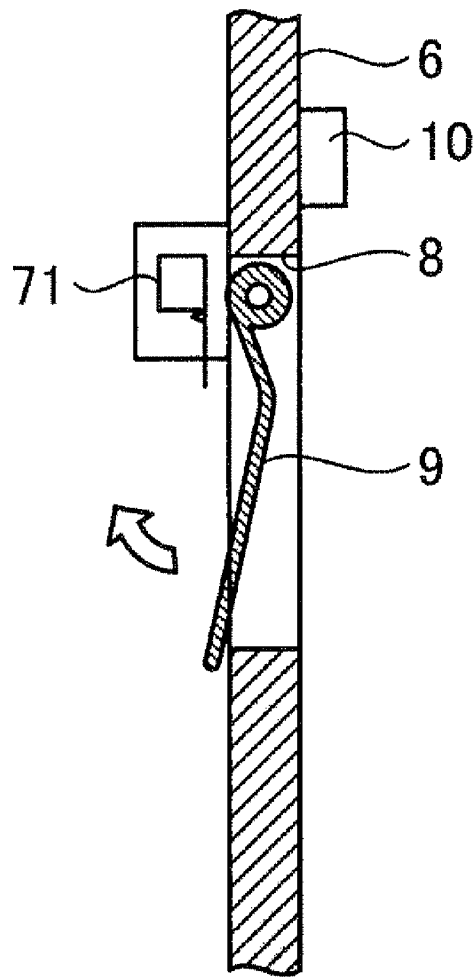


Fig. 9

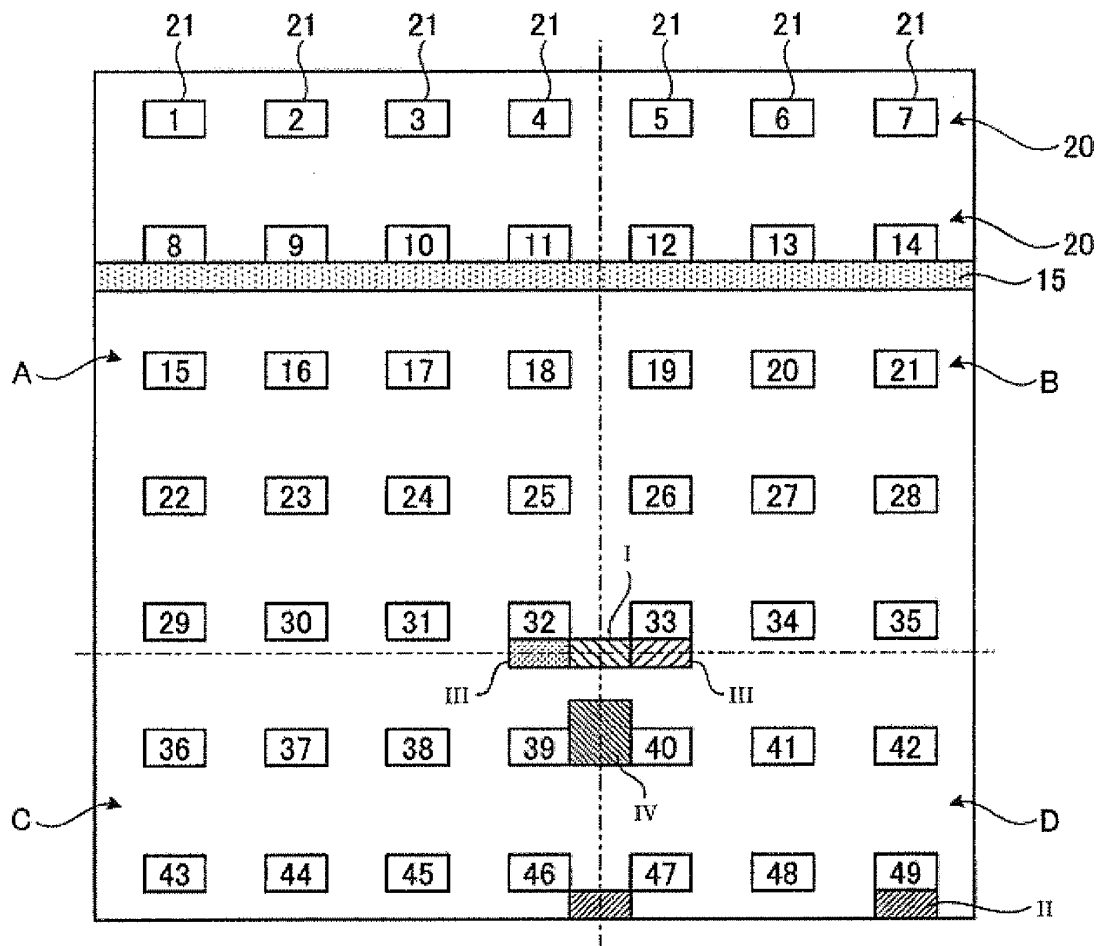


Fig. 10

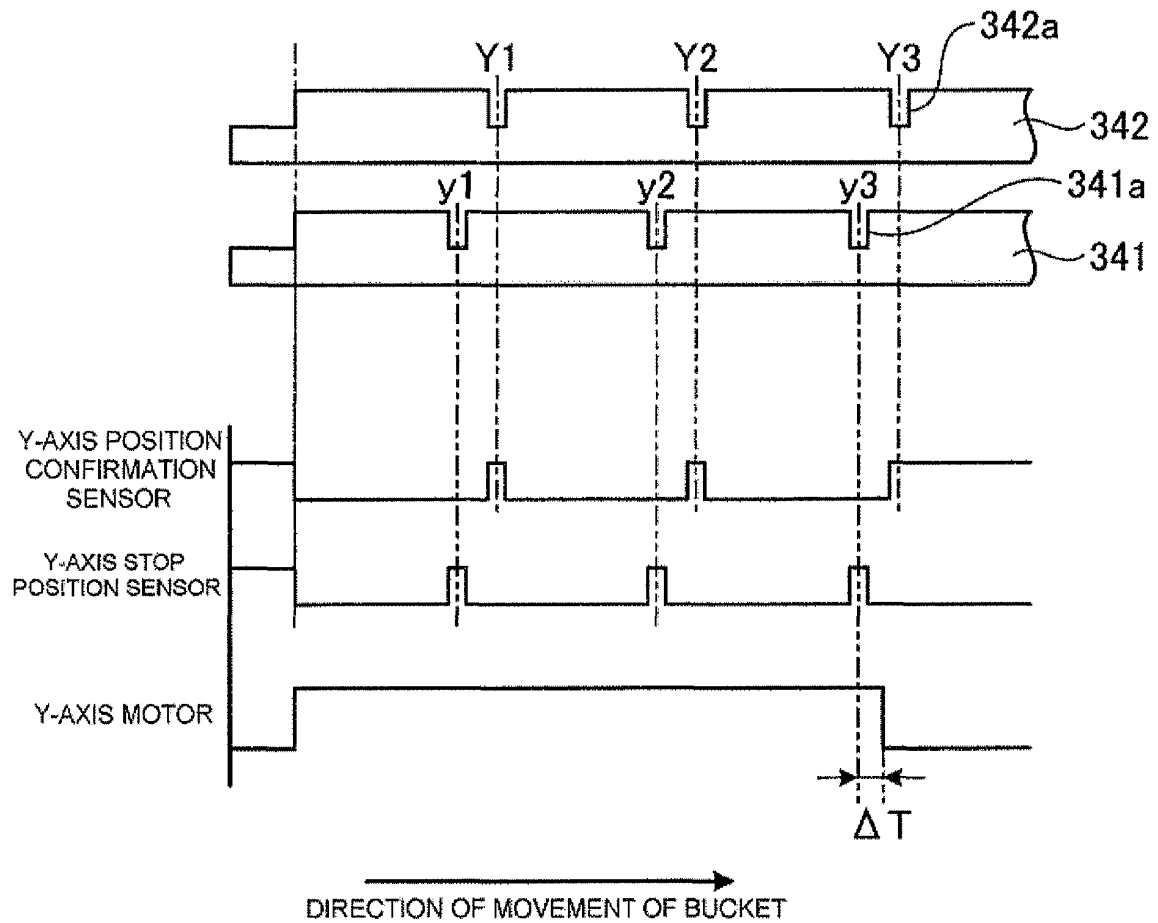


Fig. 11

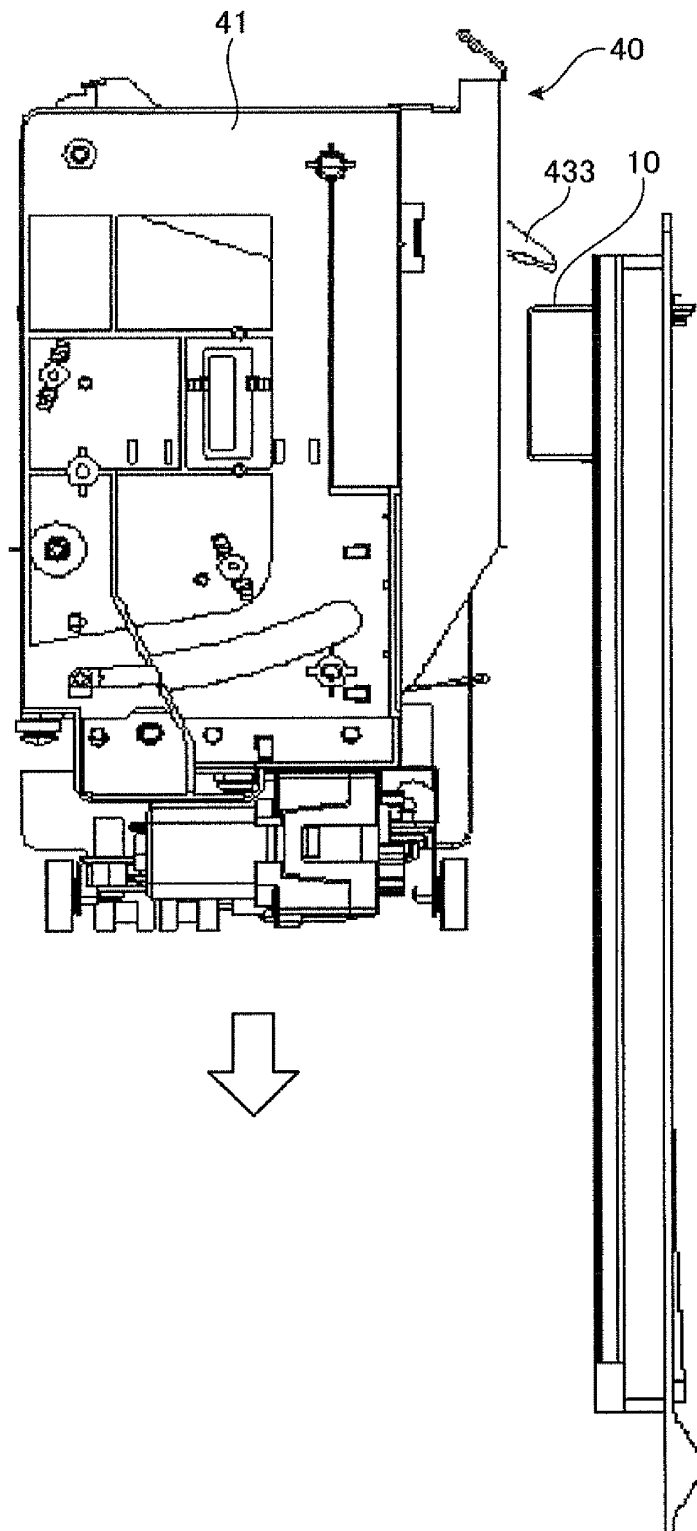


Fig. 12

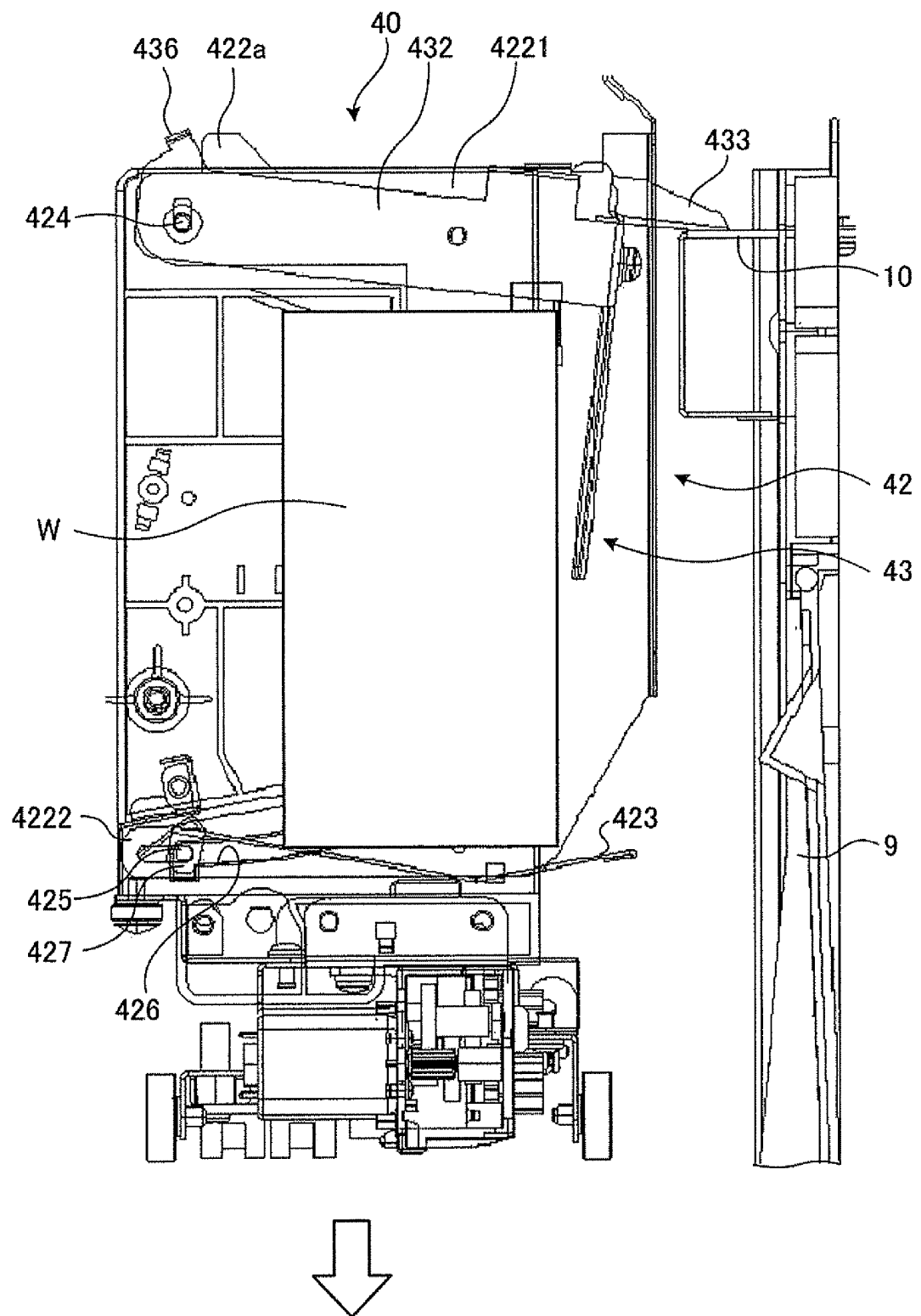


Fig. 13

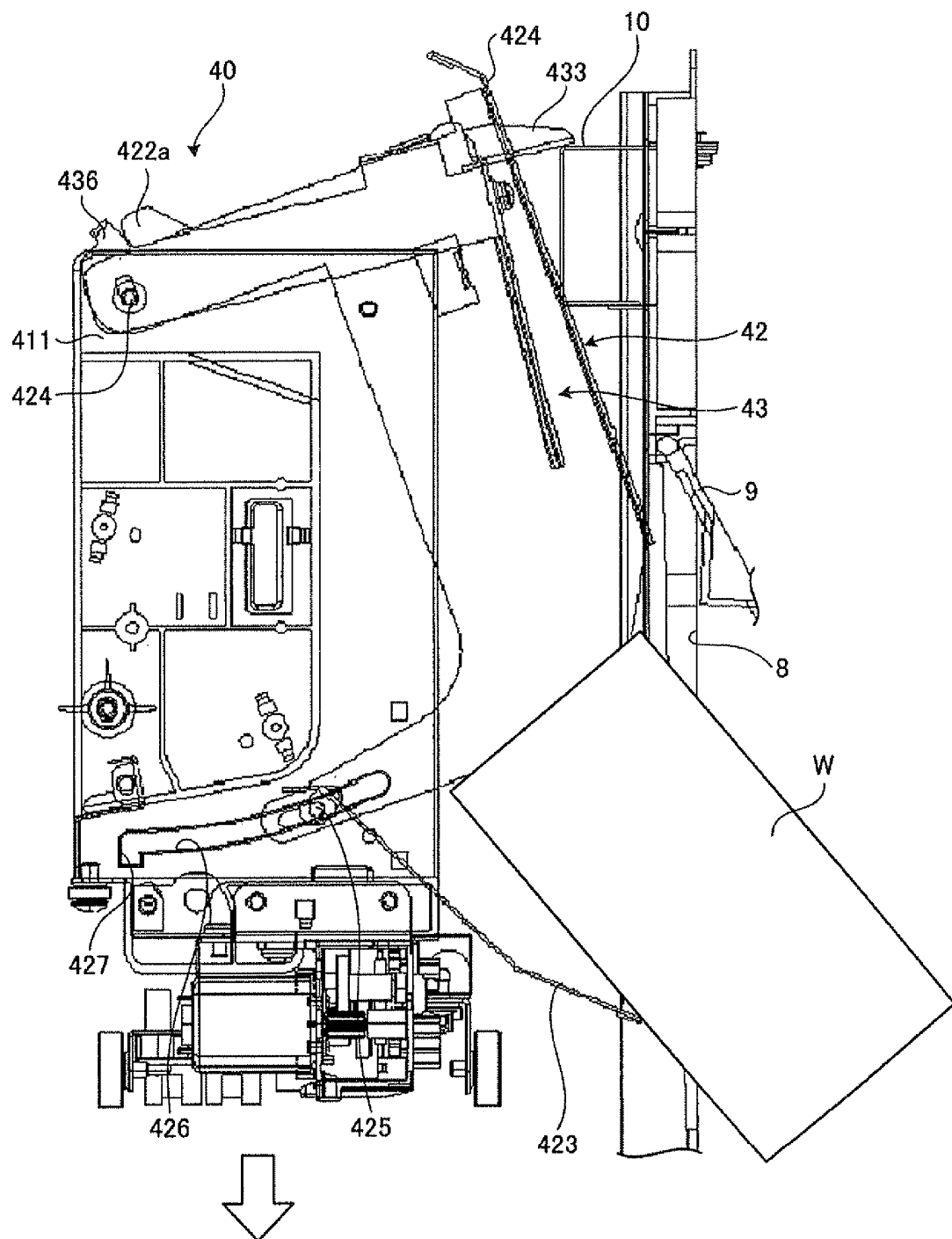


Fig. 14

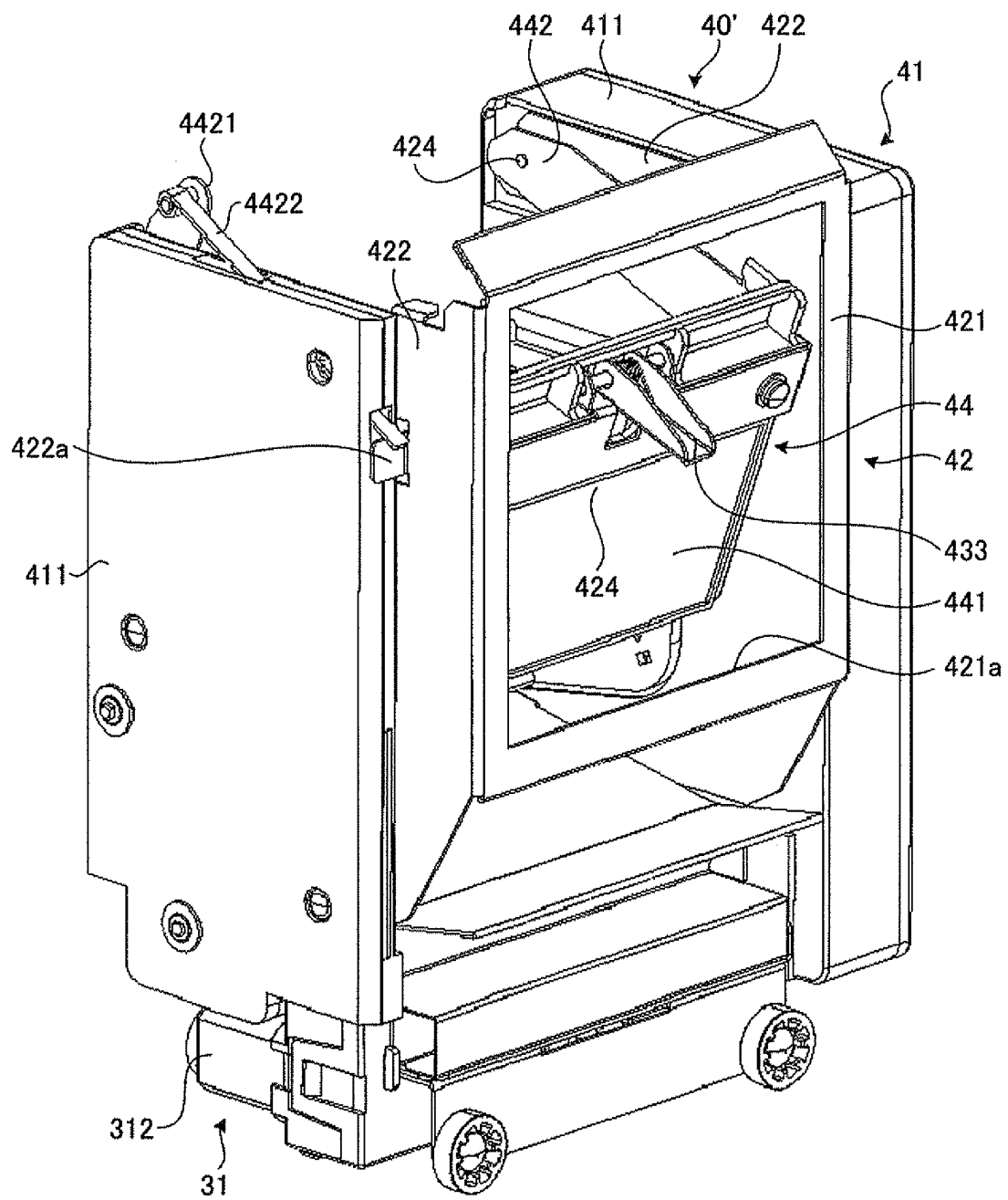


Fig. 15

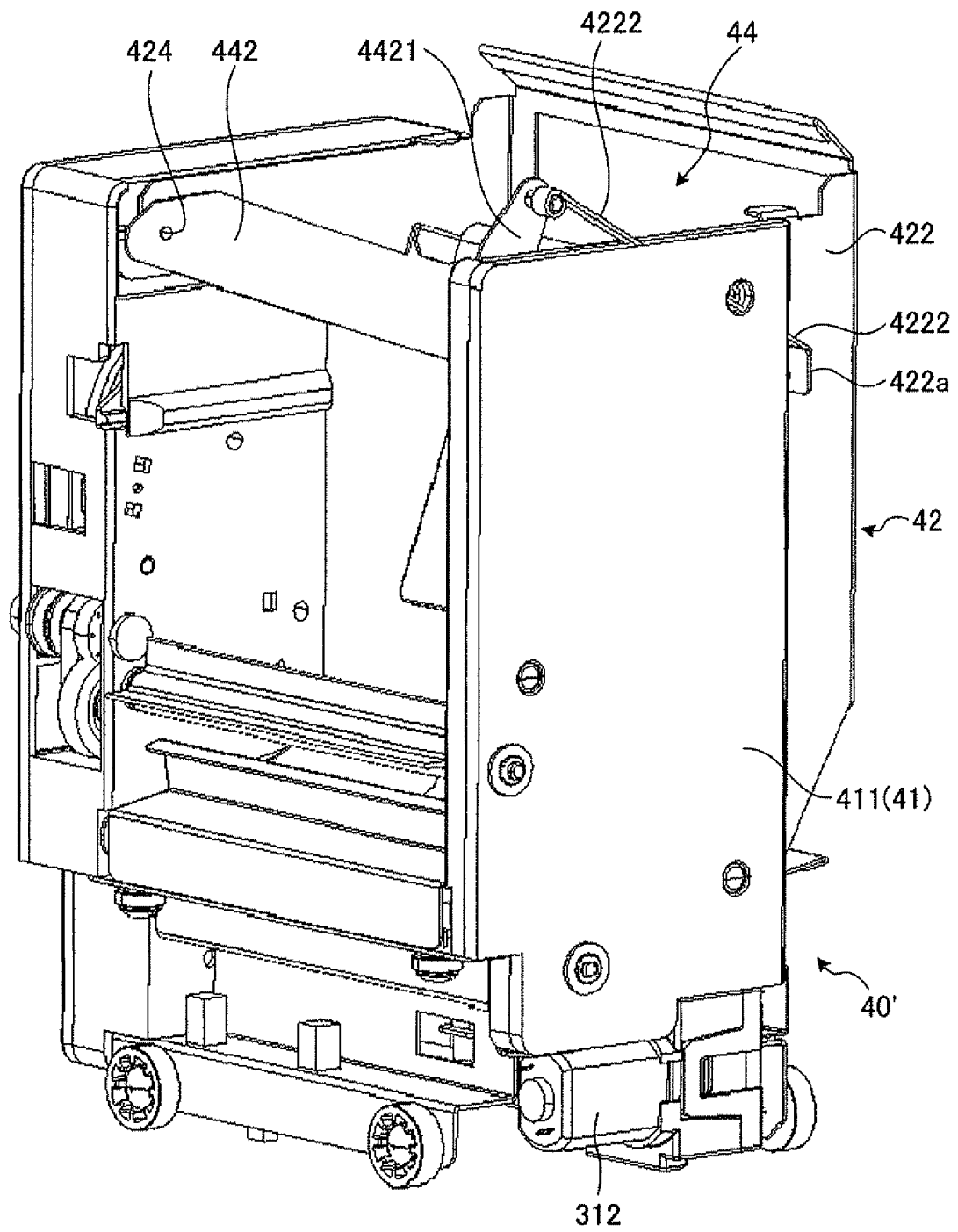


Fig. 16

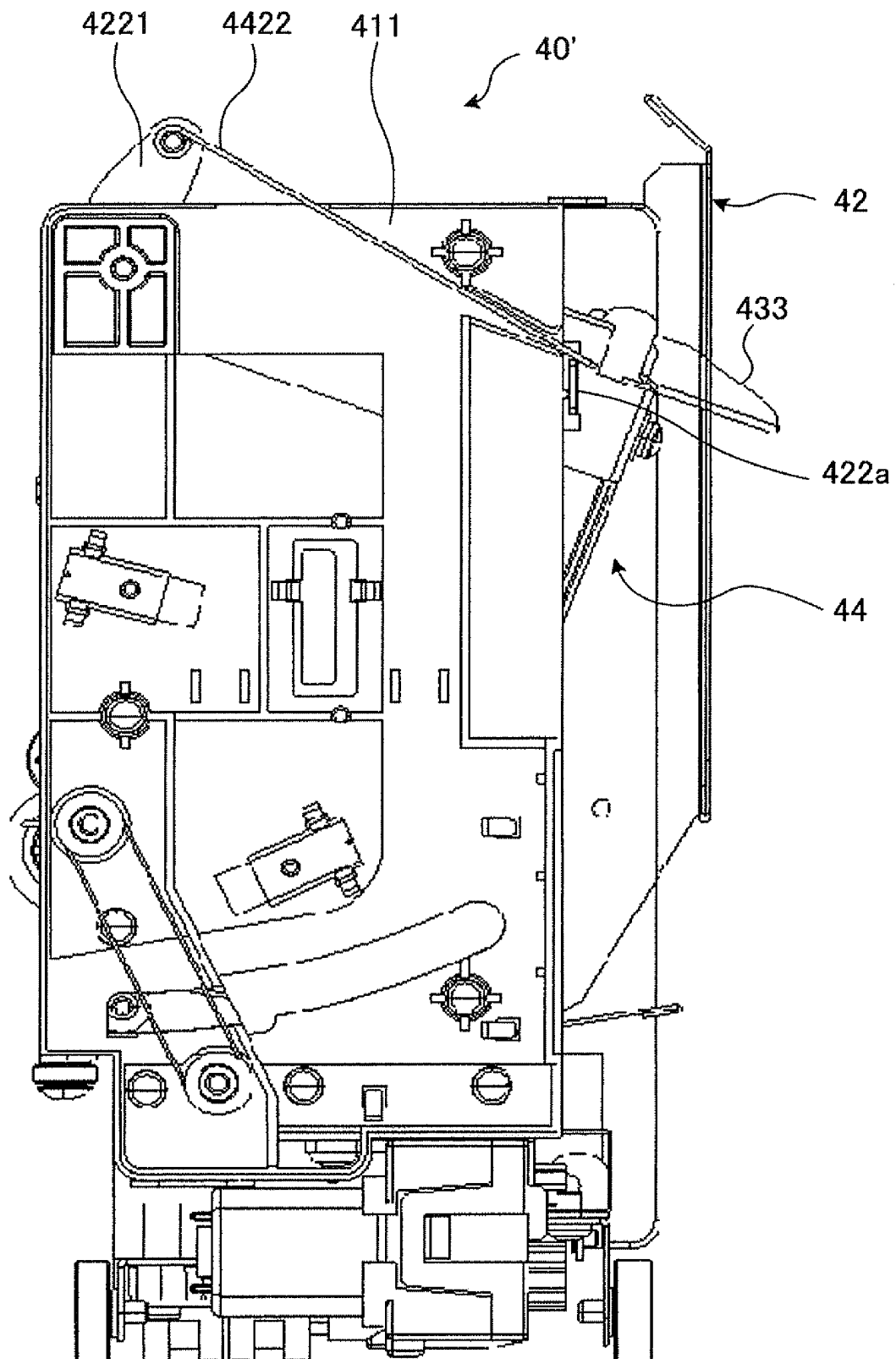


Fig. 17

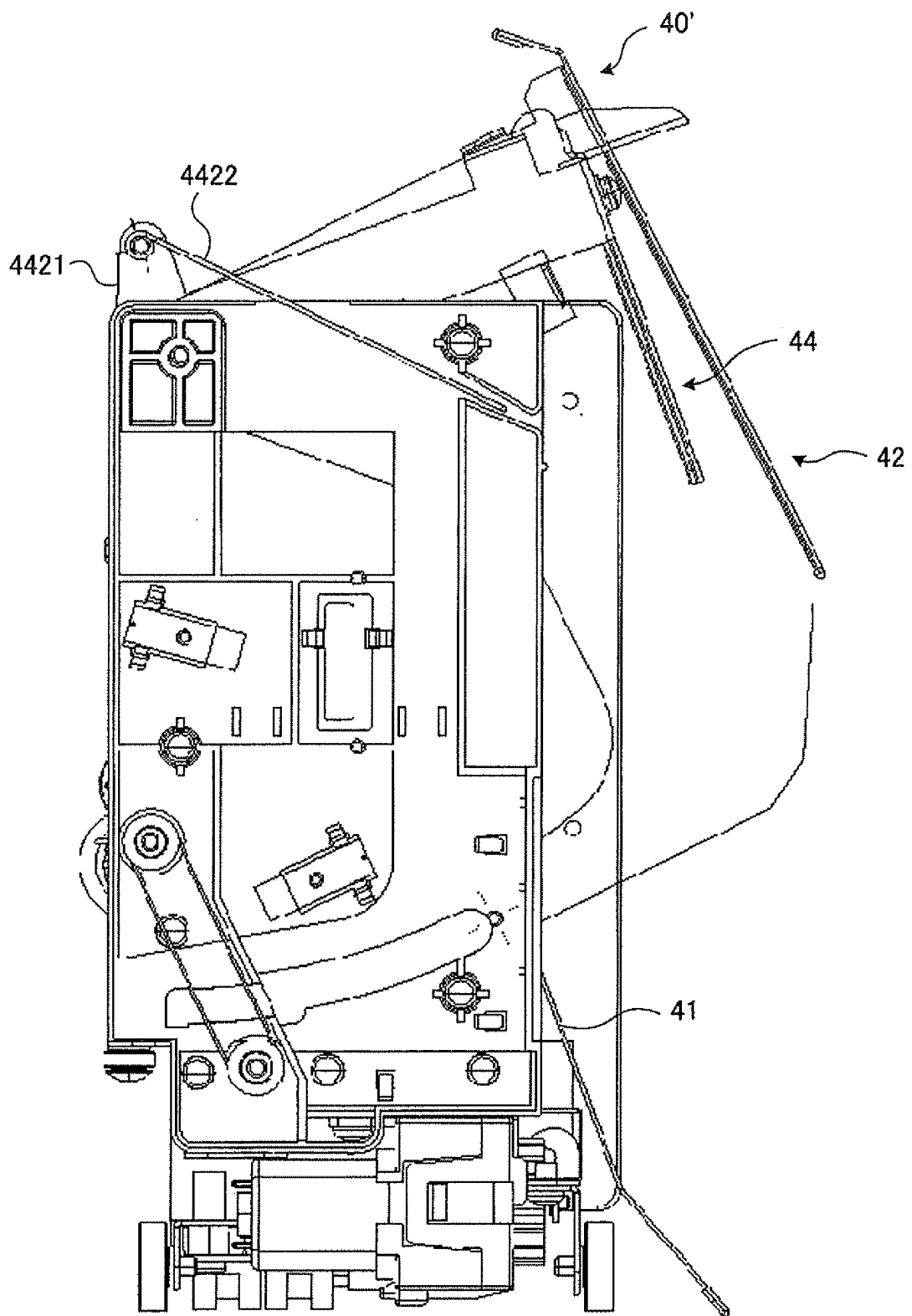


Fig. 18

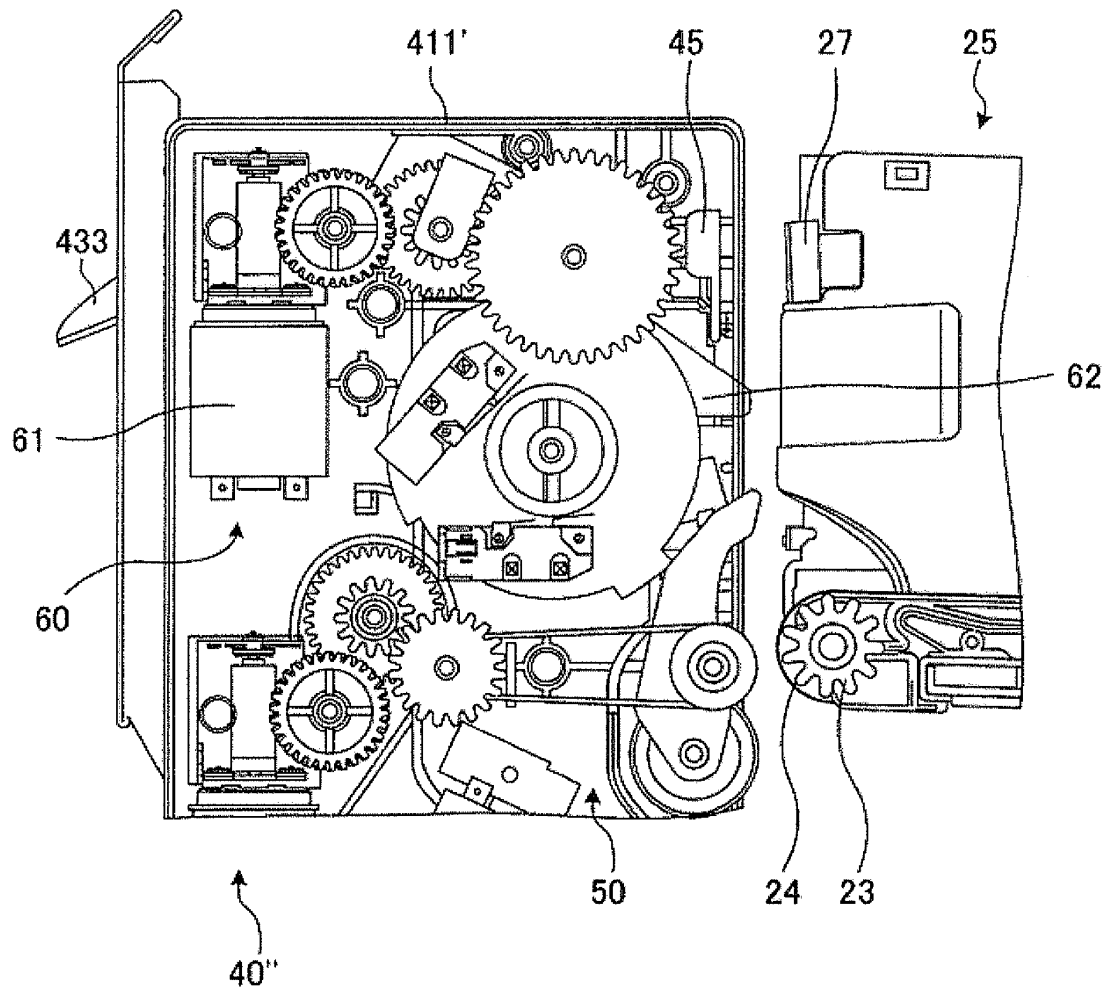


Fig. 19

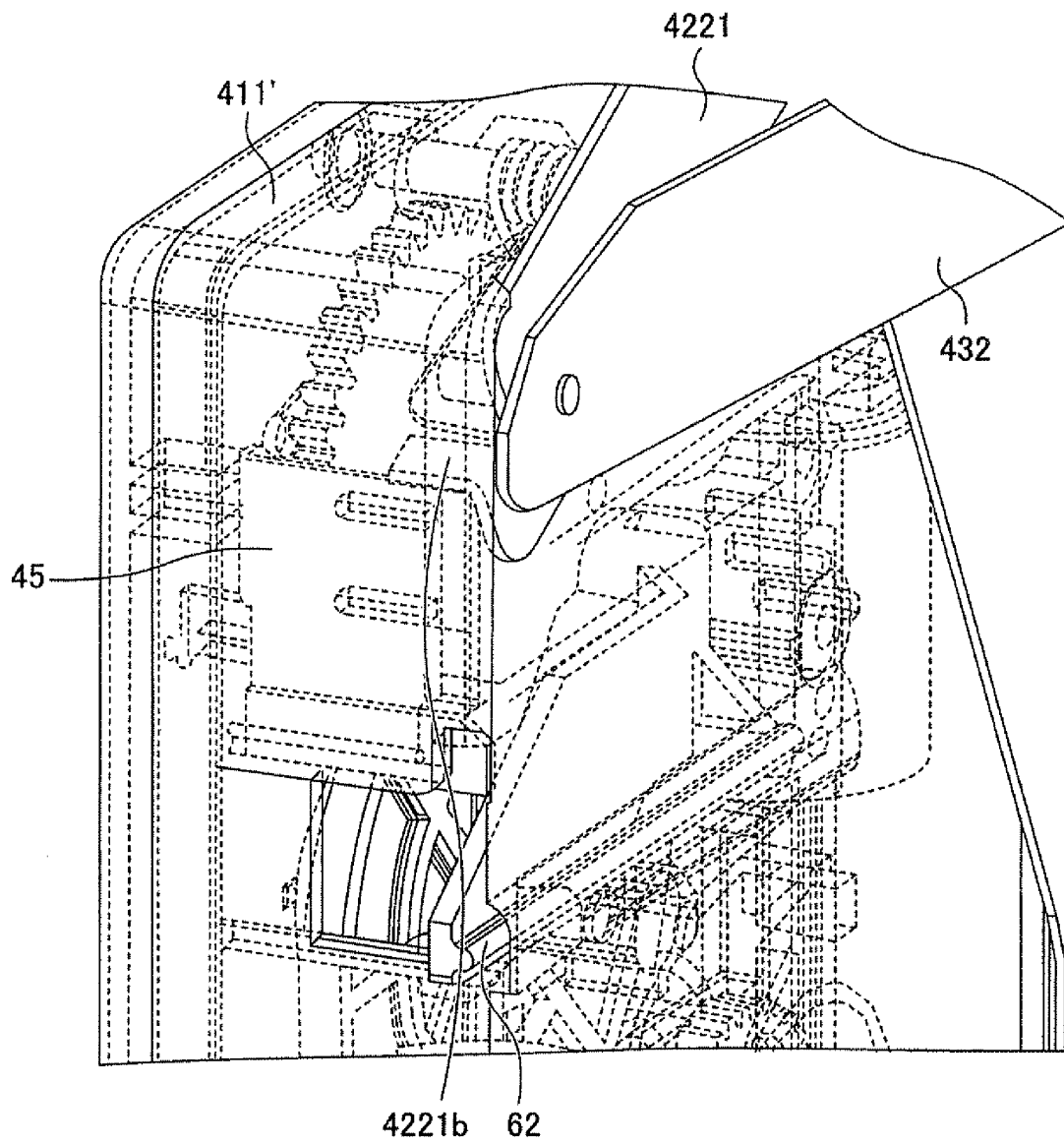


Fig. 20

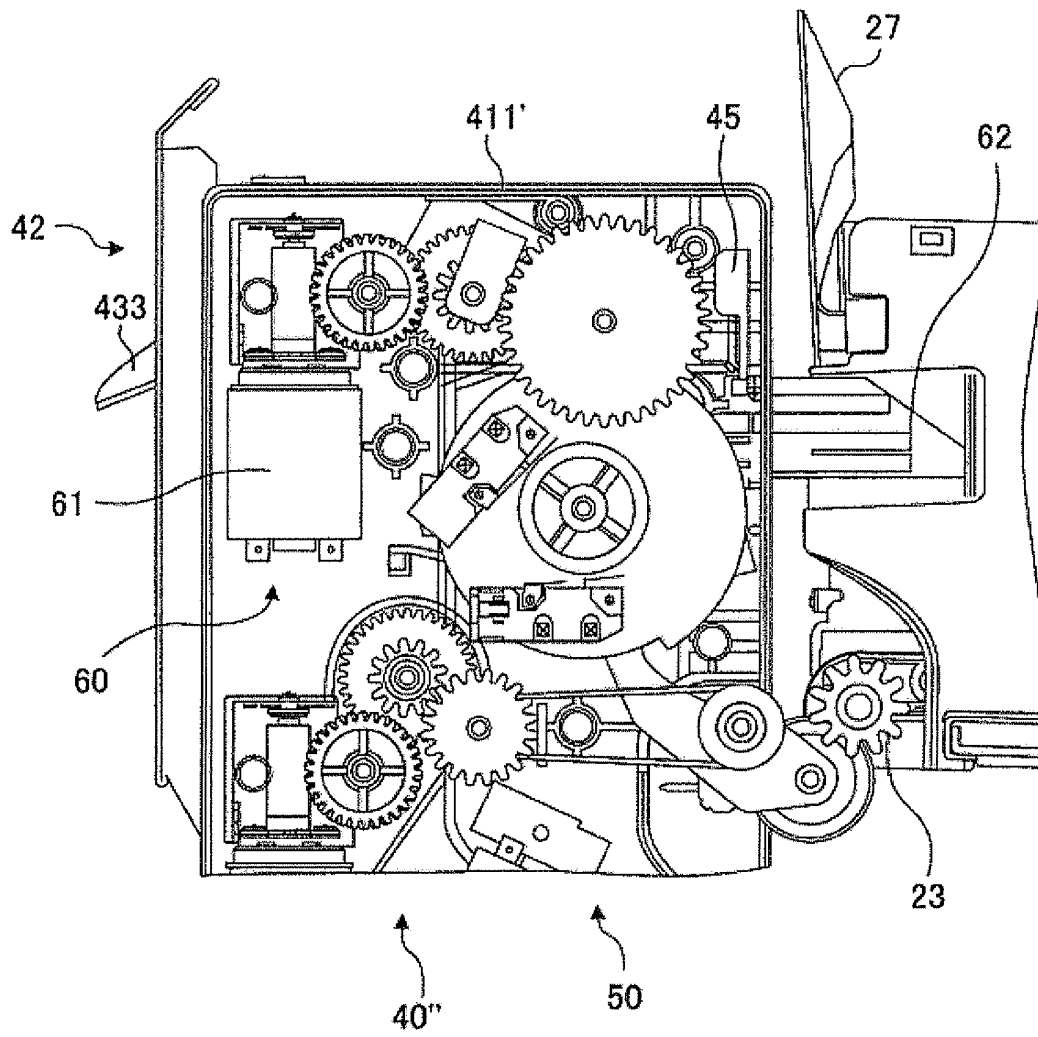


Fig. 21

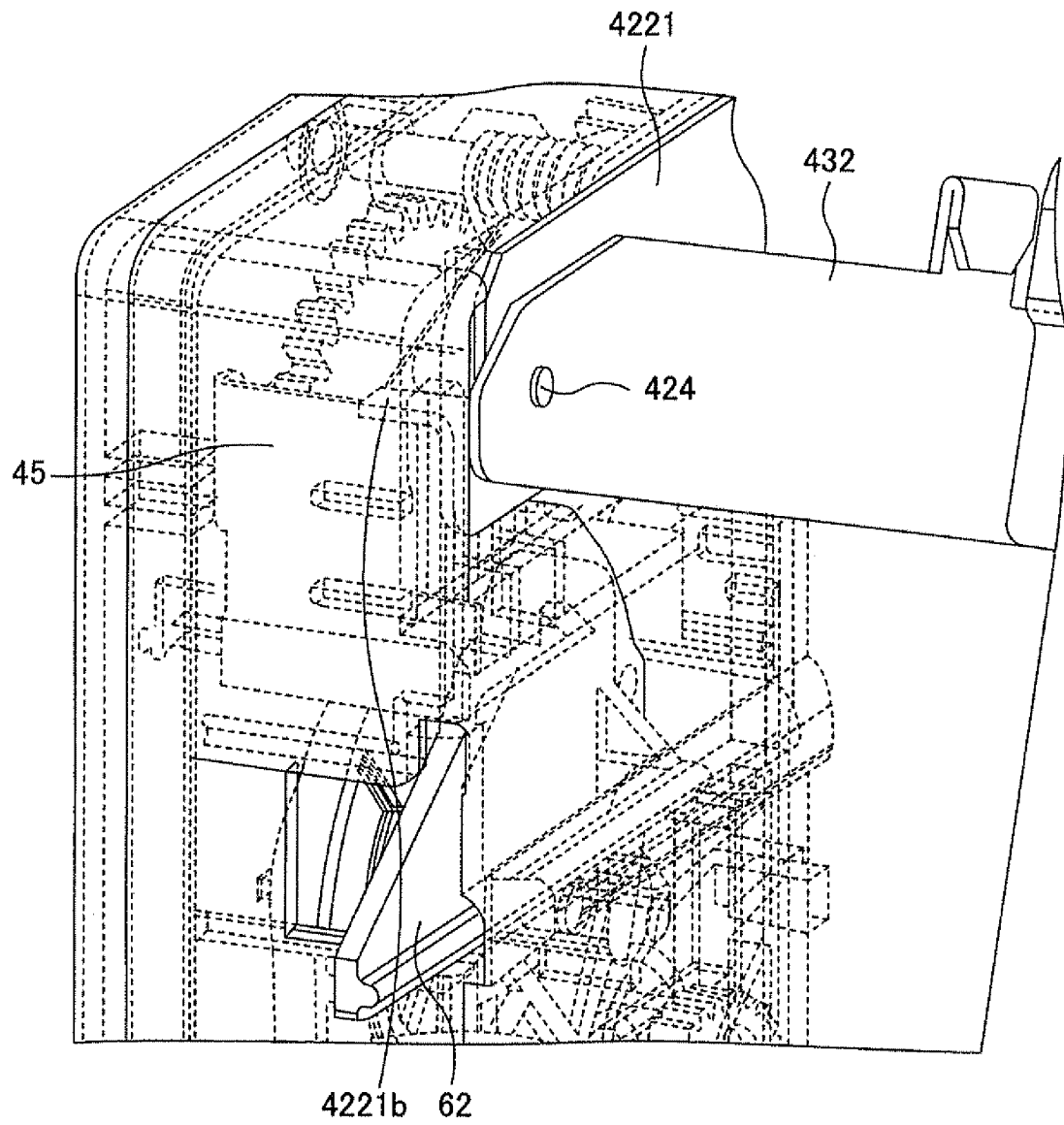


Fig. 22

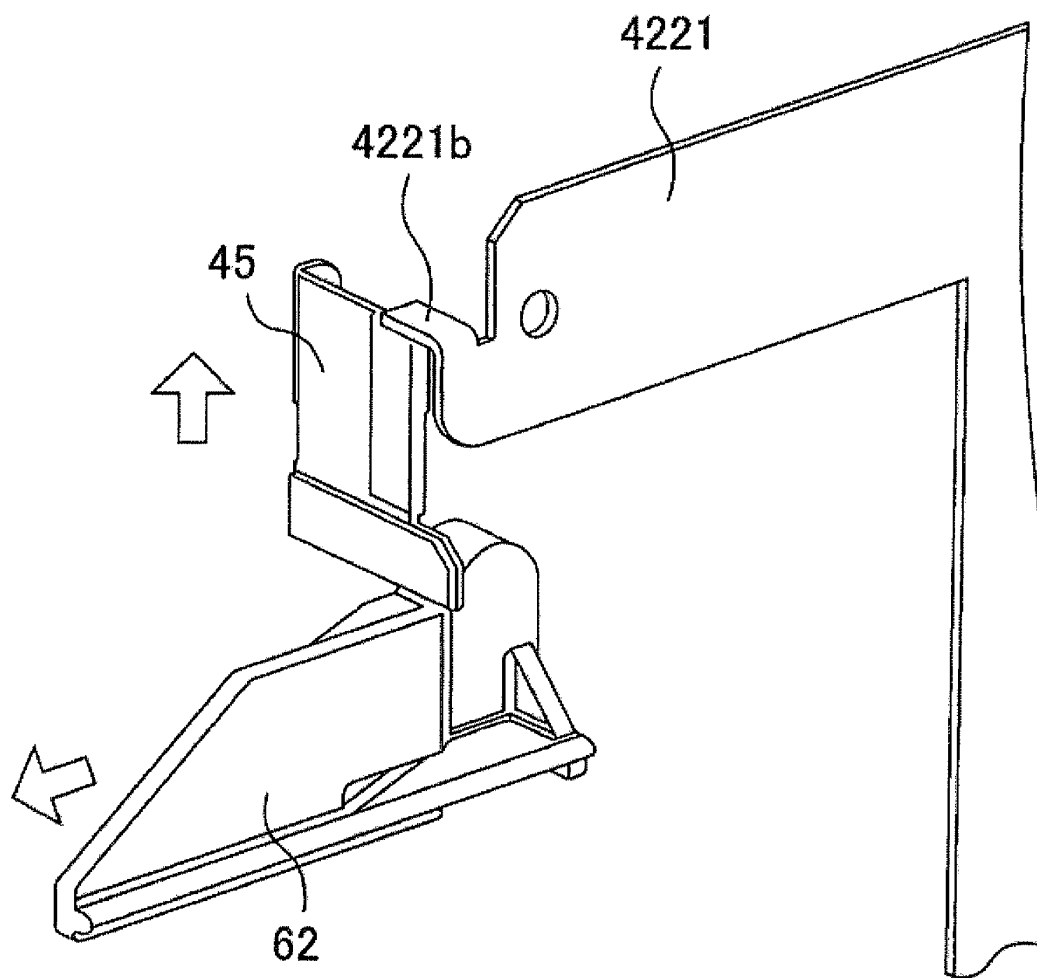


Fig. 23

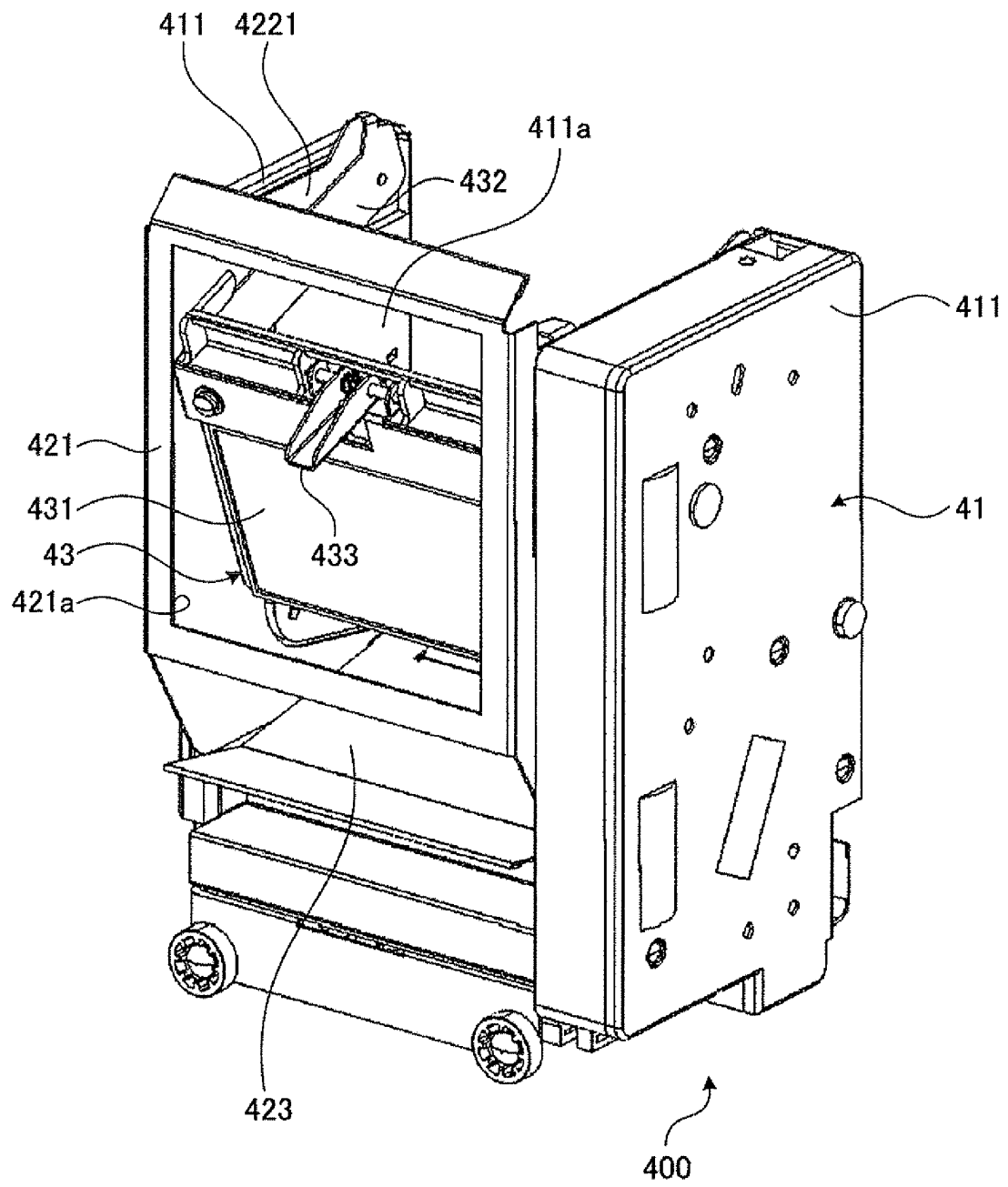


Fig. 24

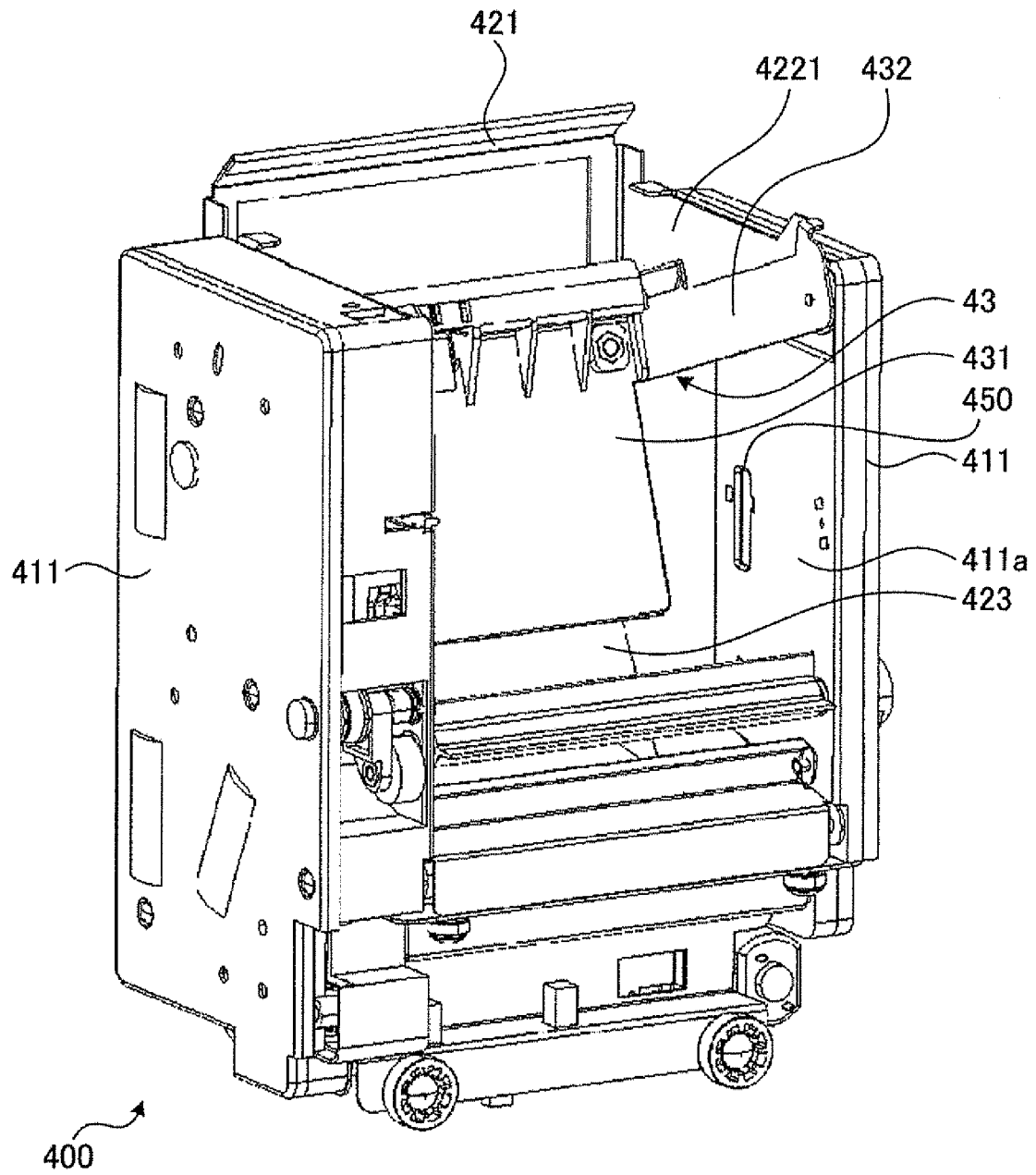


Fig. 25

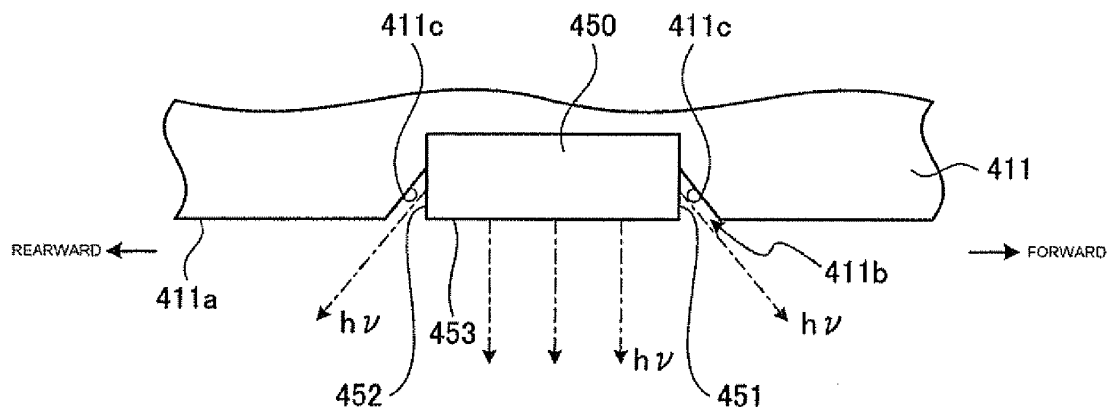


Fig. 26

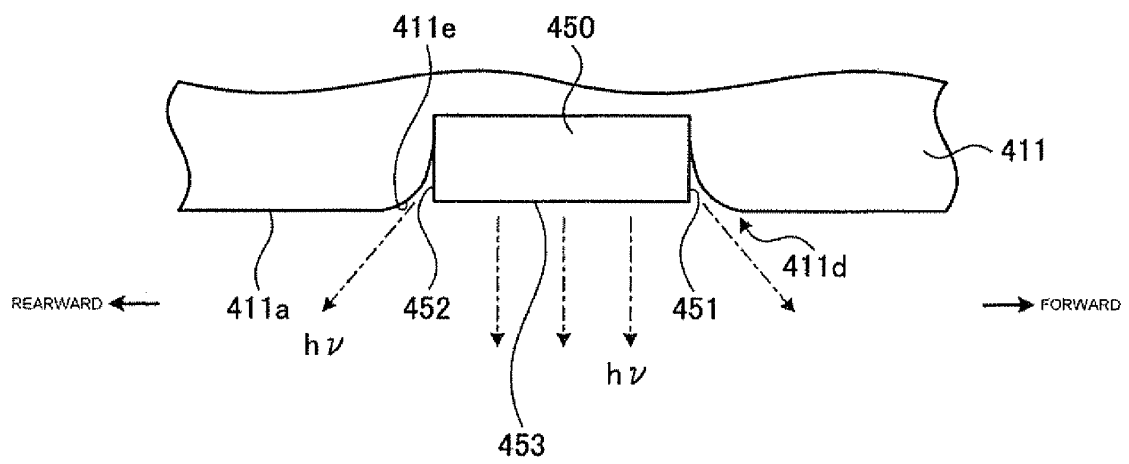


Fig. 27

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/060836

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.
Y A	JP 2009-93480 A (Fuji Electric Retail Systems Co., Ltd.), 30 April 2009 (30.04.2009), (Family: none)	1 2-5
Y A	JP 2008-310810 A (Sanden Corp.), 25 December 2008 (25.12.2008), & US 2008/0283545 A1 & EP 1993078 A2 & CN 101308591 A	1 2-5



Further documents are listed in the continuation of Box C.



See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"I" 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
08 September, 2010 (08.09.10)Date of mailing of the international search report
21 September, 2010 (21.09.10)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

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

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Patent documents cited in the description

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- JP H10302140 B [0031]