

VENDING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001]

The present invention relates to a vending machine, and more particular, to a vending machine including a commodity storage housing of heat insulated structure, in which there are provided a commodity storage column with commodities stored therein and a bucket for conveyance of a commodity.

2. Description of the Background Art

[0002]

Some vending machines include a commodity storage housing of heat insulated structure, in which there are provided a commodity storage column with commodities stored therein and a bucket for conveyance of a commodity. While the commodity storage column receives therein a plurality of commodities in an aligned state, it discharges the commodities one by one from a front end thereof in the case where a vend mechanism is driven. With general vending machines, a plurality of commodity storage columns are arranged on a commodity rack in a left and right direction and the commodity racks are provided in plural stages in a vertical direction between a pair of left and right rack support side plates. A bucket serves to deliver a commodity between it and a commodity

storage column and is arranged movably in the region in front of commodity racks. More specifically, the bucket is arranged to be enabled by bucket moving means to move up and down and left and right in the region in front of commodity racks.

[0003]

The bucket moving means includes a X-axis conveyance mechanism capable of moving a bucket in a left and right direction, and Y-axis conveyance mechanisms, which cause the bucket including the X-axis conveyance mechanism to move in a vertical direction. The Y-axis conveyance mechanisms are provided on opposite sides to mutually facing surfaces of a pair of rack support side plates, which support the commodity racks.

[0004]

With such vending machine, a translucent panel is provided on an external door, which defines a front thereof, and an interior of a commodity storage housing can be visually recognized through the translucent panel from the front (see, for example, JP-A-10-302140).

[0006]

By the way, while being not described clearly in JP-A-10-302140, it is known in such vending machine that a fluorescent lamp for illumination of an interior of a commodity storage housing is provided on an external door of the vending machine. Such fluorescent lamp can illuminate the whole

interior of a commodity storage housing. However, energy saving is intensely demanded in recent years and it is unnecessary according to a location, in which a vending machine is mounted, to illuminate the interior of a commodity storage housing more than needed, so that it is demanded to cope flexibly with illumination of a commodity storage housing.

SUMMARY OF THE INVENTION

[0007]

The invention has been thought of in view of the situation and has its object to provide a vending machine capable of achieving energy saving while coping flexibly with illumination of a commodity storage housing.

[0008]

In order to attain the object, a vending machine according to a first aspect of the invention includes a commodity storage housing of heat insulated structure, an interior of which is made visible through a translucent panel of a door body, which defines a front thereof, wherein the commodity storage housing includes a plurality of commodity racks each formed by aligning a plurality of commodity storage columns in a left and right direction and provided in plural stages in a vertical direction between a pair of left and right rack support side plates, a bucket arranged movably in the region in front of the commodity racks to enable delivering

a commodity between it and an optional commodity storage column when being arranged in opposition to the commodity storage column, and a bucket moving unit that drives the bucket, when a commodity storage column is indicated for delivery, and thereby arranges the bucket in opposition to the commodity storage column, and the commodity storage housing includes a plurality of illumination units arranged on front end portions of a pair of left and right side plates to be positioned at predetermined intervals in a vertical direction and to illuminate the interior of the commodity storage housing.

[0009]

According to the invention, since the commodity storage housing includes the plurality of illumination units arranged on the front end portions of the pair of left and right side plates to be positioned at predetermined intervals in a vertical direction and to illuminate the interior of the commodity storage housing, it becomes possible to illuminate only a necessary location, thus producing an effect that it is possible to achieve energy saving while coping flexibly with illumination of the commodity storage housing.

BRIEF DESCRIPTION OF THE DRAWINGS

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

Fig. 2 is a perspective view showing an internal

construction of the vending machine according to the embodiment of the invention;

Fig. 3 is a perspective view schematically showing an internal construction of a commodity storage housing;

Fig. 4 is a perspective view showing the case where a bucket is seen from the front;

Fig. 5 is a perspective view showing the case where the bucket is seen from the rear;

Fig. 6 is a view illustrating the movement of retreat of a pin member, which constitutes the bucket;

Fig. 7 is a block diagram illustrating a control system of a vending machine;

Fig. 8 is a cross sectional side view showing, in enlarged scale, an essential part of an internal door;

Fig. 9 is a view schematically showing the commodity storage housing;

Fig. 10 is a view illustrating the operation of stop of the bucket;

Fig. 11 is a side view illustrating the movement of discharge of the bucket;

Fig. 12 is a side view illustrating the movement of discharge of the bucket; and

Fig. 13 is a side view illustrating the movement of discharge of the bucket.

DETAILED DESCRIPTION OF THE INVENTION

[0010]

Referring to the accompanying drawings, a preferred embodiment of a vending machine according to the invention will be described below in detail.

[0011]

Figs. 1 and 2, respectively, show a vending machine according to an embodiment of the invention, Fig. 1 being a front view, and Fig. 2 being a perspective view showing an internal construction. The vending machine illustrated herein sells commodities, such as canned beverage, beverage packed in PET bottles, beverage packed in paper packs, etc. in a cooled or heated state, and includes a body cabinet 10.

[0012]

The body cabinet 10 has a rectangular-parallelepiped shape with a front opening thereof opened and its interior is compartmented into two sections, an upper section of which defines a commodity storage housing 11 and a lower section of which defines a machine room 12. The commodity storage housing 11 includes a chamber, an interior of which is maintained in a state of a preset temperature, and wall members, which define the commodity storage housing 11, respectively, are made of a heat insulating material. Also, while not shown clearly in the figure, there are provided a cooling unit that cools an internal atmosphere, such as an evaporator, which constitutes

a refrigerating cycle, and a heating unit that heats an internal atmosphere, such as electric heater, etc. On the other hand, a refrigerator (compressor, condenser) 13, which constitutes a refrigerating cycle together with the evaporator, and various control equipment, etc. are provided in the machine room 12.

[0013]

A plurality of light sources 14 are provided on front end portions of a pair of left and right side plates of the commodity storage housing 11 to be positioned at predetermined intervals in a vertical direction. The light sources 14 build therein light emitting diodes such as LED, etc. and serves as an illumination unit that illuminate peripheries of the light sources themselves.

[0014]

An external door 1 and an internal door 2 are provided on the front of the body cabinet 10. The internal door 2 includes a door body formed by fitting thereinto a transparent plate member 3 such as insulating glass, etc. and is sufficiently large to cover the front of the commodity storage housing 11. In the case where the internal door 2 is to move in a closing manner to close the front of the commodity storage housing 11, it serves a heat insulating member that constitutes the front of the commodity storage housing 11.

[0015]

Formed in a region below a central portion of the

transparent plate member 3 of the internal door 2 are a rectangular-shaped commodity carrying-out port 4 and a carrying-out flapper 5 that serves to close the commodity carrying-out port 4. The carrying-out flapper 5 is journaled with a lower end thereof made free to be able to swing in a longitudinal direction and closes the commodity carrying-out port 4 in a normal state owing to its weight.

[0016]

Also, a protrusive member 6 is protrusively provided just above the commodity carrying-out port 4 of the internal door 2. The protrusive member 6 is made of a metallic material and provided in a manner to protrude from a rear surface of the internal door 2, and more specifically, provided in a manner to protrude rearward in the case where the internal door 2 is to close the front of the commodity storage housing 11.

[0017]

The external door 1 serves to open and close the front opening of the body cabinet 10 and has a window 7, which is made of a heat insulating material at need and formed by fitting thereinto a transparent plate material such as insulating glass, etc. Accordingly, the vending machine is of a view type, an interior of which can be visually recognized through the window 7 of the external door 1. Also, arranged on the front of the external door 1 are selection switches 8 intended for selection of a sales commodity, a money inlet slot 9 for charging of money,

etc., which elements are necessary at the time of automatic vending of a commodity. In addition, in the specification of the present application, a left direction indicates a leftward direction in the case where the vending machine is seen from the front, and a right direction indicates a rightward direction in the case where the vending machine is seen from the front.

[0018]

Fig. 3 is a perspective view schematically showing an internal construction of the commodity storage housing 11. In the following, the commodity storage housing 11 will be described appropriately with reference to Fig. 3. Commodity racks 20 and a bucket moving unit 30 are provided in the commodity storage housing 11. The commodity racks 20 are formed by aligning a plurality of commodity storage columns 21 in a left and right direction, and can receive a plurality of commodities in a state of being aligned in a longitudinal direction in a commodity storage passage 22 defined in each of the commodity storage columns 21. The commodity racks 20 are provided in plural stages in a vertical direction in a manner to bridge a pair of left and right rack support side plates 23 mounted in the commodity storage housing 11.

[0019]

The rack support side plates 23, which support the commodity racks 20, include a lengthy plate-shaped body formed

by appropriately working, for example, a sheet metal or the like and are provided in a manner to have mutual surfaces (inner surfaces) thereof facing each other. Specifically, the rack support side plates are provided and mounted to a roof plate, a bottom plate, etc., which constitute the commodity storage housing 11, by means of mounting members such as screws or the like.

[0020]

While not shown clearly in the figure, the respective commodity storage columns 21 on the commodity rack 20 supported by the rack support side plates 23 include a conveyance mechanism with an endless belt stretched around rollers (not shown) arranged in parallel fore and aft and commodities are put and received on an upper surface of the conveyance belt. A vend mechanism is provided at a front end of each of the commodity storage columns 21 to control discharge of a commodity. The vend mechanism does not include a drive unit separated from a power source such as drive motor, solenoid, or the like and is driven upon transmission of power from an electrically-driven drive mechanism 411 (see Fig. 7) built in a bucket 40 described later in the case where the bucket 40 is arranged in opposition to a commodity storage column 21 as indicated.

[0021]

The bucket moving unit 30 is constructed as an assembly

of a X-axis conveyance mechanism 31 and a Y-axis conveyance mechanisms 32. The X-axis conveyance mechanism 31 includes a rail member 311 disposed in the body cabinet 10 and extending in a region forwardly of the commodity racks 20 in a left and right direction and is driven by a X-axis motor 312 (see Fig. 7) to move the bucket 40 put thereon in a direction (a left and right direction), in which the rail member 311 extends.

[0022]

The X-axis motor 312 is, for example, PWM (Pulse Width Modulation) driven. Here, in PWM driving, the drive voltage of a motor is made intermittently ON and OFF, the larger an ON duty, the higher in speed the motor rotates, and the larger an OFF duty, the lower in speed the motor rotates. The construction itself of the X-axis conveyance mechanism 31 is well known and so a detailed explanation therefor is omitted herein.

[0023]

As shown in Figs. 4 and 5, the bucket 40 includes a pair of left and right sides 41, a support member 42, and a mounting member 43. Here, Figs. 4 and 5, respectively, show the bucket 40, Fig. 4 being a perspective view as viewed from the front, and Fig. 5 being a perspective view as viewed from the rear.

[0024]

The sides 41 are provided in a manner to have mutual inner surfaces thereof facing each other. The sides 41 receive

various equipment in a housing made of a resin, and an electrically-driven drive mechanism 411 as an example is received therein. In the case where the bucket 40 is arranged in opposition to a commodity storage column 21 as indicated, the electrically-driven drive mechanism 411 transmits and gives a driving force to the vend mechanism at a front end of the commodity storage column 21. Also, a region interposed by the sides 41 makes a receiving region 44, which receives a commodity, whereby the sides 41 define the receiving region 44.

[0025]

The support member 42 is formed from a metallic material and arranged between the pair of sides 41. The support member 42 includes a flat plate like base 421 and rear extensions 422, respectively, extending rearward from both ends of the base 421. Ends, that is, rear ends of the rear extensions 422 are journaled by the sides 41 with the result that the support member 42 is arranged to be able to swing relative to the sides 41.

[0026]

The mounting member 43 is arranged between the pair of sides 41 to be able to swing. The mounting member 43 includes a front portion 431, side wall portions 432, and a mounting portion 433. The front portion 431 has a rectangular-shaped opening. A pin member 424 arranged on the support member 42

protrudes forward through the opening.

[0027]

Here, the pin member 424 is arranged to be able to swing about an axis of a shaft portion 425 provided on the support member 42 in a left and right direction and biased by a spring member (bias means) 426 to protrude toward a front region, that is, the internal door 2 as shown in Fig. 6(a). The pin member 424 swings downward against the bias of the spring member 426 when a tip end thereof is pushed from above as shown in Fig. 6(b), and retreats and moves from the front region as shown in Fig. 6(c).

[0028]

The side wall portions 432 extend rearward from both ends of the front portion 431 in a manner to have mutual inner surfaces thereof facing each other. While not shown clearly in the figure, the side wall portions 432 are journaled coaxially with the rear extensions 422 of the support member 42 to be supported on the sides 41 to be able to swing relative thereto. The mounting portion 433 is arranged between lower portions of rear ends of the pair of left and right side wall portions 432 through shaft-like portions (not shown) to be able to swing relative thereto, and has its front end (free end) supported by a housing of the bucket 40 to mount thereon a commodity. The mounting portion 433 is inclined forward while protruding forward interlocking with the swinging movement of

the side wall portions 432.

[0029]

The Y-axis conveyance mechanisms 32 are provided on a pair of left and right conveyance and support frames (not shown). Pulleys 321 are arranged rotatably in the vicinity of upper ends of the conveyance support frames. A belt 322 in the form of a lengthy cable is stretched around the pulley 321, the belt 322 being connected at one end thereof to a weight 323 and connected at the other end thereof to a holding member (not shown), which holds the rail member 311. With the Y-axis conveyance mechanisms 32, a Y-axis motor 324 is driven to rotate the pulleys 321 whereby the rail member 311 held on the holding member and the bucket 40 as mounted are moved in a vertical direction. The Y-axis motor 324 is PWM driven in the same manner as the X-axis motor 312.

[0030]

The bucket moving unit 30 includes a X-axis stop position detection plate 331, a X-axis position identification plate 332, a Y-axis stop position detection plate 341, a Y-axis position identification plate 342, a X-axis stop position sensor 351, a X-axis position identification sensor 352, a X-axis position correction sensor 353, a Y-axis stop position sensor 361, a Y-axis position identification sensor 362, and a Y-axis position correction sensor 363.

[0031]

The X-axis stop position detection plate 331 and the X-axis position identification plate 332 are arranged adjacent to the rail member 311. The X-axis stop position detection plate 331 and the X-axis position identification plate 332, respectively, include a lengthy plate-shaped member and are arranged such that a left and right direction corresponds to a length direction. Slit-shaped notched grooves (referred below to as stop notched grooves) 331a as stop marks are formed at the same pitch as a spacing of the commodity storage columns 21 in a left and right direction on the X-axis stop position detection plate 331. Slit-shaped notched grooves (referred below to as identification notched grooves) 332a as identification marks are formed at the same pitch as a spacing of the commodity storage columns 21 in a left and right direction on the X-axis position identification plate 332. Here, the stop notched grooves 331a are formed a little this side of, that is, a little on the right side of the identification notched grooves 332a.

[0032]

The Y-axis stop position detection plate 341 and the Y-axis position identification plate 342 are arranged adjacent to the conveyance and support frames. The Y-axis stop position detection plate 341 and the Y-axis position identification plate 342, respectively, include a lengthy plate-shaped member and are arranged such that a vertical direction corresponds

to a length direction. Slit-shaped notched grooves (referred below to as stop notched grooves) 341a as stop marks are formed at the same pitch as a spacing of the commodity storage columns 21 in a vertical direction on the Y-axis stop position detection plate 341. Slit-shaped notched grooves (referred below to as identification notched grooves) 342a as identification marks are formed at the same pitch as a spacing of the commodity storage columns 21 in a vertical direction on the Y-axis position identification plate 342. Here, the stop notched grooves 341a are formed a little this side of, that is, a little below the identification notched grooves 342a.

[0033]

The X-axis stop position sensor 351, the X-axis position identification sensor 352, and the X-axis position correction sensor 353, respectively, are arranged on a lower portion of the right side 41 of the bucket 40. The X-axis stop position sensor 351 includes a photo-interrupter, that is, a proximity switch, in which a light emitting diode and a light receiving diode are combined in a manner to interpose therebetween the X-axis stop position detection plate 331. With the X-axis stop position sensor 351, light outgoing from the light emitting diode is interrupted by the X-axis stop position detection plate 331 in positions except for the stop notched grooves 331a and light outgoing from the light emitting diode is received by the light receiving diode in positions on the stop notched

grooves 331a to give a signal to that effect to a control unit.

[0034]

The X-axis position identification sensor 352 includes a photo-interrupter, that is, a proximity switch, in which a light emitting diode and a light receiving diode are combined in a manner to interpose therebetween the X-axis position identification plate 332. With the X-axis position identification sensor 352, light outgoing from the light emitting diode is interrupted by the X-axis position identification plate 332 in positions except for the identification notched grooves 332a and light outgoing from the light emitting diode is received by the light receiving diode in positions on the identification notched grooves 332a to give a signal to that effect to the control unit.

[0035]

The X-axis position correction sensor 353 includes a photo-interrupter, that is, a proximity switch, in which a light emitting diode and a light receiving diode are combined in a manner to interpose therebetween the X-axis stop position detection plate 331. With the X-axis position correction sensor 353, light outgoing from the light emitting diode is interrupted by the X-axis stop position detection plate 331 in positions except for the stop notched grooves 331a and light outgoing from the light emitting diode is received by the light receiving diode in positions on the stop notched grooves 331a

to give a signal to that effect to the control unit. The X-axis position correction sensor 353 is arranged on the right of the X-axis stop position sensor 351 to detect the stop notched groove 331a later than the X-axis stop position sensor 351.

[0036]

The Y-axis stop position sensor 361, the Y-axis position identification sensor 362, and the Y-axis position correction sensor 363, respectively, are arranged on a side portion of the rail member 311. The Y-axis stop position sensor 361 includes a photo-interrupter, that is, a proximity switch, in which a light emitting diode and a light receiving diode are combined in a manner to interpose therebetween the Y-axis stop position detection plate 341. With the Y-axis stop position sensor 361, light outgoing from the light emitting diode is interrupted by the Y-axis stop position detection plate 341 in positions except for the stop notched grooves 341a and light outgoing from the light emitting diode is received by the light receiving diode in positions on the stop notched grooves 341a to give a signal to that effect to the control unit.

[0037]

The Y-axis position identification sensor 362 includes a photo-interrupter, that is, a proximity switch, in which a light emitting diode and a light receiving diode are combined in a manner to interpose therebetween the Y-axis position identification plate 342. With the Y-axis position

identification sensor 362, light outgoing from the light emitting diode is interrupted by the Y-axis position identification plate 342 in positions except for the identification notched grooves 342a and light outgoing from the light emitting diode is received by the light receiving diode in positions on the identification notched grooves 342a to give a signal to that effect to the control unit.

[0038]

The Y-axis position correction sensor 363 includes a photo-interrupter, that is, a proximity switch, in which a light emitting diode and a light receiving diode are combined in a manner to interpose therebetween the Y-axis stop position detection plate 341. With the Y-axis position correction sensor 363, light outgoing from the light emitting diode is interrupted by the Y-axis stop position detection plate 341 in positions except for the stop notched grooves 341a and light outgoing from the light emitting diode is received by the light receiving diode in positions on the stop notched grooves 341a to give a signal to that effect to the control unit. The Y-axis position correction sensor 363 is arranged below the Y-axis stop position sensor 361 to detect the stop notched grooves 341a later than the Y-axis stop position sensor 361.

[0039]

Fig. 7 is a block diagram illustrating a control system of a vending machine according to an embodiment of the invention.

Here, only elements characteristic of the invention are shown. As shown in Fig. 7, the vending machine includes, as described above, an input unit 50, a micro-switch 51, and a control unit 60 in addition to the X-axis motor 312, the Y-axis motor 324, the electrically-driven drive mechanism 411, the X-axis stop position sensor 351, the X-axis position identification sensor 352, the X-axis position correction sensor 353, the Y-axis stop position sensor 361, the Y-axis position identification sensor 362, and the Y-axis position correction sensor 363.

[0040]

The input unit 50 includes, for example, a remote control to enable giving various commands to the control unit 60. Also, a display unit is provided on the input unit 50 to enable displaying information given from the control unit 60.

[0041]

As shown in Fig. 8, the micro-switch 51 is provided in front of the internal door 2. The micro-switch 51 includes an opening degree detection unit for detection of the opening degree of the carrying-out flapper 5 and gives a detection signal to the control unit 60. Here, while details are described later, when the bucket 40 is moved downward for discharge, the pin member 424 of the bucket 40 abuts against the protrusive member 6 with the result that the mounting member 43, which constitutes the bucket 40, is put in an inclined posture and the carrying-out flapper 5 abuts against the

mounting member 43 in such inclined posture to swing forward.

[0042]

The control unit 60 exercises integrated control on the basis of a program and data, which are stored in a memory unit 70 in relation to movements of the bucket 40 and lighting of the light sources 14. In addition, the control unit 60 herein is separate from a control unit that controls a sales operation of the vending machine, that is, operations of commodity selection, disposition of money, etc.

[0043]

The memory unit 70 stores therein various programs and data. More specifically, the memory unit stores therein positional information of the respective commodity storage columns 21 and information regarding numerals as shown in Fig. 9 according to a well-known cleaning operation performed when the operation of the vending machine begins (when an electric source is put on), and stores therein an interexchange position a, a standby position b, and routine positions c, which are predetermined.

[0044]

The interexchange position a is determined beforehand in a region just above the protrusive member 6. A position of the interexchange position a is detected by detecting exclusive notched grooves 80, 81, which make a mark indicative of the interexchange position a shown in Fig. 3. Thereby, the

protrusive member 6 protrusively provided on the internal door 2 is positioned in a region just below the interexchange position a (a position of the protrusive member 6 is denoted by the character d in Fig. 9).

[0045]

The standby position b is determined beforehand in a rightwardly lower position, that is, in a position opposed to the commodity storage column 21 of the column number 49 in an example of Fig. 9. For example, two routine positions c are determined, one being determined beforehand on the right of the interexchange position a and the other being determined beforehand on the left of the interexchange position a. Here, the routine position c on the right is one, via which the bucket 40 positioned in D zone in Fig. 9, out of four zones divided on the basis of the standby position b, is moved to A zone, and the routine position c on the left is one, via which the bucket 40 positioned in C zone is moved to B zone.

[0046]

The reference numeral 15 in Fig. 9 denotes a heat insulating partition, a region above the heat insulating partition 15 is made, for example, a heating region, and a region below the heat insulating partition 15 is made, for example, a cooling region. In this case, the memory unit 70 stores therein the matter that the commodity storage columns 21, to which the column numbers 1 to 14 are assigned, are

positioned in the heating region while the commodity storage columns 21, to which the column numbers 15 to 49 are assigned, are positioned in the cooling region. Also, the region above the heat insulating partition 15 is defined as a heating region and the region therebelow is defined as a cooling region whereby the memory unit 70 stores therein the matter that the Y-axis motor 324 is positioned in a high-temperature atmosphere. The memory unit 70 stores therein a set period of time lapsed until a driving stop command is given to the respective motors 312, 324 after the stop position sensors 351, 361 detect the stop notched grooves 331a, 341a according to temperatures in those atmospheres, in which the Y-axis motor 324 and the X-axis motor 312 are mounted. Specifically, when those atmospheres, in which the respective motors are mounted, are high-temperature ones, a set period of time is made, for example, 0.01 second, and when those atmospheres, in which the respective motors are mounted, are low-temperature ones, a set period of time is made, for example, 0.1 second.

[0047]

The operation of the vending machine constructed in the above manner will be described. In the sales standby state, when information of selection of a commodity through the selection switches 8 and receipt information of money charged through the money inlet slot 9, respectively, meet a predetermined sales condition, a sales command is given to the

control unit 60. Here, an explanation will be given assuming that a commodity stored in the commodity storage column 21 of the column number 1 is selected.

[0048]

The control unit 60 gives a driving command to the X-axis motor 312 and the Y-axis motor 324 to drive the same. In this case, since the bucket 40 positioned in D zone is moved to A zone as shown in Fig. 9, the control unit 60 causes the bucket 40 to move via the routine position c on the right to be arranged in opposition to the commodity storage column 21 of the column number 1. At this time, the control unit 60 may light up only the light source 14 close to the commodity storage column 21 of the column number 1.

[0049]

This will be described in further details. The control unit 60 drives the motors with a predetermined output when the bucket 40 positioned in the standby position b is to be moved to the commodity storage column 21 of the column number 1. Until a signal to the effect that a higher position by one stage than the standby position b is detected is given by, for example, the Y-axis stop position sensor 361, the duty for driving of the Y-axis motor 324 is made, for example, 70 %, and when a signal to the effect that a position higher by two stages than the standby position is detected is given by the Y-axis stop position sensor, the duty for driving of the motor is made 100 %

to rotate the motor at full speed. When a signal to the effect that a lower position by one stage than the commodity storage column 21 of the column number 1 is given, PWM control is exercised to make the duty for driving of the motor, for example, 30 %. In addition, while driving of the Y-axis motor 324 has been described, PWM control is likewise exercised for driving of the X-axis motor 312.

[0050]

In the case where the bucket 40 is to be stopped at a target commodity storage column 21 (the commodity storage column 21 of the column number 1), the operation is performed in the following manner. Here, for the sake of explanation, driving of the Y-axis motor 324 will be described. The memory unit 70 stores therein the matter that the Y-axis motor 324 is assumed to be mounted in a high-temperature atmosphere.

[0051]

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 grooves 341a and the Y-axis position identification sensor 362 detects the identification notched grooves 342a. Also, after a stop notched groove 341a is detected by the Y-axis stop position sensor 361, the same stop notched groove is detected by the Y-axis position correction sensor 363. The control unit 60, to which a signal to the effect that a stop notched groove y3 (341a) corresponding

to a target commodity storage column 21 (the commodity storage column 21 of the column number 1) is detected is given from the Y-axis stop position sensor 361, stands by for a preset period of time ΔT (a set period of time is, for example, 0.01 second since the Y-axis motor 324 is set in a high-temperature atmosphere) and gives a driving stop command to the Y-axis motor 324 after the lapse of the set period of time ΔT to stop upward movement of the bucket 40. At this time, when a signal to the effect that the Y-axis position identification sensor 362 detects a identification notched grooves Y3 (342a) corresponding to the commodity storage column 21 of the column number 1 is given, the control unit 60 can recognize that the bucket 40 has been arranged in opposition to the target commodity storage column 21.

[0052]

Here, in the case where a signal to the effect that the Y-axis position identification sensor 362 detects the identification notched grooves Y3 (342a) is not given, the control unit 60 confirms whether a signal to the effect that the stop notched groove y3 (341a) is detected is given from the Y-axis position correction sensor 363, and in the case where the signal is given, it is possible to recognize that a stop position of the bucket 40 is past above the target commodity storage column 21. In this case, the Y-axis motor 324 is caused to reversely rotate for a predetermined period of time to move

the bucket 40 downward. When a signal to the effect that the identification notched grooves Y3 (342a) is detected is given from the Y-axis position identification sensor 362, it is possible to recognize that the bucket 40 has been arranged in opposition to the target commodity storage column 21. At this time, the control unit 60 subtracts a period of time, during which reverse rotation is made, from the set period of time ΔT and stores the thus calculated period of time as a new set period of time in the memory unit 70.

[0053]

On the other hand, in the case where a signal to the effect that the stop notched groove y3 (341a) is detected is not given from the Y-axis position correction sensor 363, a stop position of the bucket 40 is below the target commodity storage column 21, and so it is possible to recognize that movement is insufficient. In this case, the Y-axis motor 324 is caused to additionally rotate for a predetermined period of time in the same direction to move the bucket 40 upward. When a signal to the effect that the identification notched grooves Y3 (342a) is detected is given from the Y-axis position identification sensor 362, it is possible to recognize that the bucket 40 has been arranged in opposition to the target commodity storage column 21. At this time, the control unit 60 adds a period of time, during which additional rotation is made, to the set period of time ΔT and stores the thus calculated period of time

as a new set period of time in the memory unit 70.

[0054]

While driving of the Y-axis motor 324 has been described, a set period of time according to a temperature atmosphere of the X-axis motor 312 is likewise determined with respect to driving of the X-axis motor 312 and the control unit 60 gives a driving stop command after the lapse of the set period of time.

[0055]

When the bucket 40 has been arranged in opposition to the target commodity storage column 21, the control unit 60 gives a driving command to the electrically-driven drive mechanism 411. Thereby, the electrically-driven drive mechanism 411 drives a vend mechanism of an associated commodity storage column 21. Thereby, only one commodity is moved onto the bucket 40 to be received in the receiving region 44 in a manner to be put on the mounting portion 433. When the bucket 40 receives the commodity, the control unit 60 gives driving commands to the X-axis motor 312 and the Y-axis motor 324 to move the bucket toward the interexchange position a. At this time, the control unit 60 exercises PWM control with a predetermined output for driving of the motors.

[0056]

When it is detected that the bucket 40 is positioned in the interexchange position a, the control unit 60 drives only

the Y-axis motor 324 for movement of discharge. The control unit 60 stops driving of the Y-axis motor 324 in the course of movement of discharge for a preset period of time (for example, 1 second). Thereby, the bucket 40 moves downward with inertia for discharge. After the lapse of such period of time, the control unit 60 drives the Y-axis motor 324 to move the bucket 40 downward for discharge. At the time of movement of discharge, the control unit 60 exercises PWM control with a predetermined output for driving of the motor.

[0057]

An explanation will be given to movement of discharge. As shown in Fig. 11, when the bucket 40 positioned in the interexchange position a is caused to make a movement of discharge, the pin member 424 of the bucket 40 abuts against the protrusive member 6 as shown in Fig. 12. When the pin member 424 abuts against the protrusive member 6 in this manner, the support member 42 swings upward and the mounting member 43, which abuts against the pin member 424, also swings upward. As the mounting member 43 swings, the mounting portion 433 is also put in a forwardly inclined posture as shown in Fig. 13 while protruding forward. Thereby, a bottom surface of the mounting member 43 is opened much to cause a commodity put on the mounting portion 433 to fall inclinedly, so that the commodity is discharged. The commodity discharged from the bucket 40 abuts against the carrying-out flapper 5 to push the

carrying-out flapper 5 open and reaches a predetermined take-out chamber through the commodity carrying-out port 4. Thereafter, when driving of the Y-axis motor 324 is once stopped, the bucket 40 moves downward with inertia. Then, the tip end of the pin member 424 abuts against a roof surface (a flat surface (horizontal surface) in a vertical direction) of the protrusive member 6 to hold the front portion 431 and the side wall portions 432 of the mounting member 43 in an inclined posture to guarantee sure discharge of the commodity from the bucket 40.

[0058]

With the vending machine, when the cleaning operation described above is performed, the opening degree of the carrying-out flapper 5 is detected through the micro-switch 51 and in the case where the opening degree detected through the micro-switch 51 is less than a preset reference value (threshold value), the control unit 60 may determine that the opening degree is insufficient and give the matter to the input unit 50 to have a predetermined display unit of the input unit 50 displaying the insufficient opening degree to inform the same. Thereby, a worker can recognize that the pin member 424 and the protrusive member 6 abut badly against each other and correct positions of the both members to enable holding a favorable, positional relationship.

[0059]

With the vending machine described above, in the case where a selected commodity is stored in a preset commodity storage column 21, that is, in the case where a commodity storage column 21 with a selected commodity stored therein is positioned in a predetermined zone, the control unit 60 causes the bucket 40 positioned in the standby position b to go through a virtual routine position c set on the right of the interexchange position a to be arranged in opposition to a target commodity storage column 21, so that there is no fear that the pin member 424 of the bucket 40 abuts against the protrusive member 6 at the time of such movement. Accordingly, the pin member 424 of the bucket 40 does not interfere with the protrusive member 6 and it is possible to move the bucket 40 to a desired commodity storage column 21.

[0060]

Also, when being pushed from above, the protrusive member 6 is caused to swing about its axis against the bias of the spring member 426 to retreat and move from the protruding front region, so that the bucket 40 can be moved upward from under in a stage, in which positional information of the bucket 40 is not obtained as when an electric source is put on, or the like, and so at this time there is no fear that the pin member 424 comes into contact with the protrusive member 6 to be broken.

[0061]

With the vending machine, a set period of time since detection of the stop notched grooves 331a, 341a by the stop position sensors 351, 361 is broadened according to those atmospheres, in which the drive motors (the X-axis motor 312 and the Y-axis motor 324) are mounted, to make the motors 312, 324 variable in stop timing, so that even a simple combination of the proximity switches and the detection plates enables surely stopping the bucket 40 in a desired position, thus enabling achieving reduction in cost and making the parts common.

[0062]

Also, with the vending machine, the control unit 60 exercises PWM control to drive the X-axis motor 312 and the Y-axis motor 324 with a predetermined output, so that it is possible to reduce a load on the belt 322, etc. and to lengthen the motors 312, 324 in service life.

[0063]

Further, with the vending machine, the plurality of light sources 14 are provided on the front end portions of the pair of left and right side plates of the commodity storage housing 11 to be positioned at predetermined intervals in a vertical direction, so that it is possible to light up only the light source 14 close to a target commodity storage column 21 when the bucket 40 is to be moved to the commodity storage column 21. Accordingly, it is possible to achieve energy saving while

coping flexibly with illumination of the commodity storage housing 11.

[0064]

Also, with the vending machine, since movement of discharge of the bucket 40 is stopped for a preset period of time, the bucket 40 can move downward with inertia, so that it is possible to lengthen a period of time, during which the bucket 40 is inclined, thus enabling surely discharging a commodity.

What is claimed is:

1. A vending machine comprising

a commodity storage housing of heat insulated structure, an interior of which is made visible through a translucent panel of a door body, which defines a front thereof, wherein

the commodity storage housing includes:

a plurality of commodity racks each formed by aligning a plurality of commodity storage columns in a left and right direction and provided in plural stages in a vertical direction between a pair of left and right rack support side plates,

a bucket arranged movably in the region in front of the commodity racks to enable delivering a commodity between it and an optional commodity storage column when being arranged in opposition to the commodity storage column, and

a bucket moving unit that drives the bucket, when a commodity storage column is indicated for delivery, and thereby arranges the bucket in opposition to the commodity storage column, and

the commodity storage housing includes a plurality of illumination units arranged on front end portions of a pair of left and right side plates to be positioned at predetermined intervals in a vertical direction and to illuminate the interior of the commodity storage housing.