

PRODUCT DROPPING AND SUPPORTING MECHANISM FOR VENDING MACHINES

Technical Field of the Invention

[0001] The invention relates to a product drop and support mechanism used in vending machines.

Background of the Invention

[0002] Currently, most vending machines use a product drop mechanism that is a motor that rotates a metal spring placed on a horizontal tray (please refer to Patent Publication No. US 9,262,377 B2 which discloses a vending machine with a similar function). The product is inclined between the rings of the spring, spaced at a distance such that when the motor rotates the spring, all the products are pushed out onto the tray surface, moving forward the same distance. Then, the outer product closest to the edge of the tray is pushed out of the tray and falls straight into the product store compartment, the next product also moves near the edge of the tray, and the products behind also move forward similarly according to the rotation of the spring.

[0003] The disadvantages of this mechanism in current vending machines are as follows:

- + Non-aligned display: The product must be placed inclined in the space between the spring rings.

- + To get less products: Products are placed in the space between the spring rings, so there must be space between the products (horizontally and vertically), resulting in taking up a lot of space.

- + Complicated inventory intake process: When loading goods, it is a must to pull the product tray out of the cabinet, move the product from top to bottom, place it inclined in the space between the spring rings, rely on the plastic stoppers on both sides and push the tray back into the cabinet.

- + Different size products must use different springs.

- + When products are dropped directly from the upper tray to the product store compartment below, they can easily be dented, broken or shaken violently, leading to gas leakage if it is bottled carbonated water.

Brief Summary of the Invention

[0004] To solve the existing problems, the present invention refers to a product drop and support mechanism used for products such as milk cartons, water cans, and water bottles in vending machines.

[0005] In one embodiment, the invention relates to a product drop and support

mechanism, with the product drop mechanism utilizing a product tray having a roller plate and a product pushing/stopping/retaining device, wherein:

[0006] The product tray is a popular type of tray used in freezers/refrigerators, with side and front bars to guide and stop the bottom of the product.

[0007] The roller plate is a readily available accessory for product display, allowing products to slide easily, consisting of two parallel vertical metal bars retaining horizontal rollers.

[0008] The pushing/stopping/retaining device is a mechanical device that is controlled on/off via an electrical circuit, using a push solenoid to move two pushing/stopping bars and a retaining bar back and forth, performing the pushing, stopping and retaining of the product head, coordinating with the roller plate and product tray to perform the process of dropping each product placed in a row on the tray.

[0009] The complete installation mechanism will have a product tray installed with a forward inclination at about 8 to 10 degrees, roller plates placed on the product tray, the end of the roller plate is the front bar of the product tray. The pushing/stopping/retaining device is mounted high on the bottom of the upper product tray at the end of the roller plate, above the top of the outer product of the product row. In a static state, due to the inclination with rollers and gravity, the product row always slides forward, but the outer product will be held at the end of the roller plate by the front bar of the product tray (stopping the product's base) and the retaining bar of the pushing/stopping/retaining device (stopping the product's head). When there is a command to drop the product from the control circuit, the pushing/stopping/retaining device operates the push solenoid to move the pushing/stopping bar and the retaining bar to perform two steps of operation on the top of the outer product as follows:

- + Step one: Switch to operating state to simultaneously push the outer product out and stop the products behind from standing still.

- + Step two: Switch to static state to simultaneously drop the products behind to continue sliding and retain the outer product head of the product row (combined with the front bar stopping the product base), bringing the product row back to its original state waiting for the next drop command.

[00010] When the product is dropped, there is a lifting pin for product base on the edge of the product tray, which will lift one side of the product's base being dropped, causing the product to fall to one side and always fall horizontally onto the product support mechanism. The product support mechanism is a metal mechanical device consisting of a support bar, a guide point, a rotating axis, a coil spring box, placed on each level, the support bar can be lifted and lowered by the rotating axis and coil spring, helping the

product slide smoothly down each level to the product store compartment below.

[00011] The advantages that the above mechanisms bring are as follows:

- + Products are displayed in a straight line, standing upright on the product tray.
- + To get more products: Products are placed close together both horizontally and vertically.

- + Simple inventory intake process: Load goods from the front, put products into the product tray, push products in turn inside on the roller plate until the product line is full.

- + Products with different shapes and sizes still use the same product pushing/stopping/retaining device, just need to adjust the device position and the distance between the retaining bar and the pushing/stopping bar.

- + Can use a pushing/stopping/retaining device combined with a conveyor belt to drop multiple rows of the same product, optimizing equipment costs.

- + Dropped products are guided and supported by product support mechanisms, limiting product distortion, breakage or strong shaking.

Brief description of the drawings

[00012] Detailed description of one or more embodiments of the present invention is described in the document by reference to the following figures. The same reference numbers are used throughout the drawings to denote the same or similar technical features and parts:

Figure 1.1 – Figure 1.3 describe the overall product drop and support mechanism.

Figure 2.1 – Figure 2.4 describe the parts that drop products, and detailed components, assembly and operation of a pushing/stopping/retaining device.

Figure 3.1 – Figure 3.5 describe each step of product drop operation.

Figure 4.1 – Figure 4.4 describe the operation of the pushing/stopping/retaining device on the head of different products bottles, cans, boxes.

Figure 5.1 – Figure 5.2 illustrate the assembly of the pushing/stopping/retaining device into the product tray and position adjustment.

Figure 6.1 – Figure 6.4 illustrate how to combine a pushing/stopping/retaining device with a conveyor belt device to move back and forth and drop multiple rows of the same product.

Figure 7.1 – Figure 7.2 describe the parts that support the product, and detailed components, installation and operation of a product support mechanism.

Figure 8.1 – Figure 8.4 describe the entire operation process of the product drop and support mechanism.

Detailed Description of the Invention

[00013] The above-mentioned and other features of the various embodiments according to the present invention will become apparent from the detailed description of the invention of the subject-matter described above and will be discussed in more detail below that can be implemented in any number of ways since the claimed subject matter is not limited to any particular embodiment. Examples on embodiments and applications are primarily provided for a purpose of illustration.

[00014] Herein terms are explained below aiming substantially describe the present invention and its embodiments, which do not aim for limiting the scope of the invention.

[00015] Although terms "first", "second", "third", etc. used herein describe various elements, these elements are not limited to these terms. They intend to distinguish an element from another element. Therefore, elements described below may relates to second elements without departing the instructions of illustrated embodiments.

[00016] The terms "comprise", "include", "contain" and "consist of" as used herein refer to the existence of cited elements or steps, but do not exclude the presence or addition of one or more elements or steps.

[00017] As used herein, the terms "upper", "lower", "right", "left", "front", "behind", "above", "below", "outside", "inside" and the terms related to locations such as "vertical", "horizontal" and so on are based on directions or their relative locations illustrated in the figures and do not limit the scope of the invention in case of actual view are changed.

[00018] With reference to Figure 1.1 to Figure 1.3, this is a general view of the product drop and support mechanism.

[00019] Referring to Figure 1.1, this is a view showing an overview from the front of a vending machine using a product drop and support mechanism, with inclined product tray 220 so that the product row always slides forward and stops at the top of the tray because the outer product 291 is stoped at both the product base and the product head, at which the pushing/stopping/retaining device 241 placed on the top of the product will drop (push the product head to fall forward) each product in turn. When dropped, the product will be caused to fall horizontally by the lifting pin for product base 226 placed at the top of the tray and slide horizontally on the product support mechanism 280. Due to the weight of the product, the product support mechanism 280 will lower one end to drop the product down through each level and then lift it back up by the pulling force of the coil spring 285 at the other end, preventing the product from falling freely.

[00020] Referring to Figure 1.2, this is a side view of a vending machine using a product

drop and support mechanism. With the inclined product tray 220, the product support mechanism 280 is placed on the narrow groove between the glass door of the vending machine 288 and the product tray 220, the product when dropped and slid will be limited and directed, always towards a horizontal position on the product support mechanism 280 and slide down in each level.

[00021] Referring to Figure 1.3, this is a view that shows an overview of the arrangement of the entire product drop and support mechanism with the product tray 220 having a lifting pin for product base 226, the pushing/stopping/retaining device 241, the product support mechanism 280 and the glass door of the vending machine 288, forming a continuous operating process for the product to be dropped and supported.

[00022] Figure 2.1 – Figure 2.4 describe the parts that drop products, and detailed components, assembly and operation of a pushing/stopping/retaining device.

[00023] With reference to Figure 2.1, this is a view showing the components that perform product dropping.

[00024] From bottom to top, the product tray 220 is inclined forward of about 8 degrees to 10 degrees, with a front bar 221 and side bar 222 to stop the product base. The roller plate 230 is a commercially available product for displaying goods, comprising two parallel vertical metal bars retaining horizontal rollers, placed on the tray surface between the side bar 222 and the front bar 221. The product is bottled water, comprising the outer product 291, the adjacent product 290 and a rear product, which when placed on the roller plate 230 slides forward and stops when the outer product 291 touches, respectively, the base of the front bar 221 and the head of the pushing/stopping/retaining device 241. The pushing/stopping/retaining device 241 is a mechanical device that drives the two pushing/stopping bars 260 and the retaining bar 255 to move back and forth, placed high in a position such that the head of the outer product 291 is between the pushing/stopping bar 260 and the retaining bar 255. When the mechanism operates, the pushing/stopping/retaining device 241 will move the pushing/stopping bar 260 and the retaining bar 255 to perform push, stop, and retain movements on the outer product 291 and the adjacent product 290 to drop each product in turn.

[00025] With reference to Figure 2.2, which is a detailed drawing of the components of a pushing/stopping/retaining device 241.

+ Push solenoid 242 uses electric current to operate the electromagnet to attract the push solenoid axis 243 to move forward, creating a pushing force. When the current is turned off, the suction force is gone and the spring will return the push solenoid axis 243 to its original position. There are screw holes on the push solenoid 242 to attach other components.

+ Metal force transmission bar 244 has support plates for force transmission bar 246, mounting holes for pushing/stopping bar 247, mounting holes for retaining bar 248 and mounting plates for push solenoid axis 245.

+ Metal pushing/stopping bar 260, with mounting pin for pushing/stopping bar 261 and support plate for pushing/stopping bar 262, with L-shaped pushing/stopping hook 263 in front.

+ Metal retaining bar 255, with mounting pin for retaining bar 256, pulling support plate for retaining bar 257 and retaining hook 258.

+ Two symmetrical metal support/guide plates 250 having L-shaped hanging positioning pins 259 at the ends, screw holes and guide grooves, including a groove for support/guide force transmission bar 251 having a horizontal narrow groove, a groove for support/guide retaining bar 252 having an upward inclined narrow groove with a fixed retaining angle 252a and a support/guide groove for pushing/stopping bar 253 having a rectangular shape with a fixed stopping angle 253a.

[00026] References to Figures 2.3.a to 2.3.c, the details of the assembly of a pushing/stopping/retaining device 241 consist of the following:

+ Reference to Figure 2.3.a: The force transmission bar 244 is attached to the push solenoid axis 243 of the push solenoid 242 at the position where the mounting plate for push solenoid axis 245 is attached.

+ With reference to Figure 2.3.b: The retaining bar 255 is attached to the force transmission bar 244 by means of the mounting pin for retaining bar 256 through the mounting hole for retaining bar 248. The pushing/stopping bar 260 is attached to the force transmission bar 244 by means of the mounting pin for pushing/stopping bar 261 through the mounting hole for pushing/stopping bar 247.

+ Reference to Figure 2.3.c: Two support/guide plates 250 are attached to the two sides of the push solenoid 242, forming support and guide frames comprising:

- The two groove for support/guide force transmission bar 251 will support the two sides of the support plate for force transmission bar 246 of the force transmission bar 244, allowing the the force transmission bar 244 to move back and forth in line.

- The two support/guide grooves of the retaining bar 252 with fixed retaining angle 252a, will support the two sides of the support plate for retaining bar 257 of the retaining bar 255, help to guide the retaining bar 255 to move forward/up, backward/down and fix in the lowered state when the support plate for retaining bar 257 touches the fixed retaining angle 252a.

- The two support/guide groove for pushing/stopping bar 253 with fixed stopping angle 253a, will support the two sides of the support plate for pushing/stopping bar 262 of the pushing/stopping bar 260, help to guide the pushing/stopping bar 260 to move back and forth in a state of being able to freely lift and lower and fix in a lowered state when the support plate for pushing/stopping bar 262 touches the fixed stopping angle 253a.

[00027] With reference to Figure 2.4.a to Figure 2.4.b, these are detailed description of the operating principle through two static and dynamic states of the pushing/stopping/retaining device 241, which includes the following:

[00028] Referring to Figure 2.4.a, this figure depicts a pushing/stopping/retaining device 241 in a stationary state with the push solenoid 242 inoperative, the force transmission bar 244, pushing/stopping bars 260 and retaining bar 255 stationary. The pushing/stopping bar 260 is relaxed with the support plate for pushing/stopping bar 262 resting on the top of the support/guide groove for pushing/stopping bar 253. The retaining bar 255 and the retaining hook 258 are lowered with the support plate for retaining bar 257 resting on the top of the groove for support/guide retaining bar 252..

[00029] In this static state, when the product head slides underneath, it will be affected by the pushing/stopping bars 260 and the retaining bar 255 as follows:

- + Pushing/stopping bar 260: lift up to let the product head slide through then lower down.

- + Retaining bar 255: the product head touches the retaining hook 258 with a pulling force and the force point is low, causing the retaining bar 255 to simultaneously be lifted and moved forward, pulling support plate for retaining bar 257 to slide along the upper edge of the support plate for retaining bar 257 and touching the fixed retaining angle 252a, fixing the retaining bar 255 to prevent the product head from sliding through.

[00030] With reference to Figure 2.4.b, this figure depicts a pushing/stopping/retaining device 241 in a moving state with the push solenoid 242 operating, pushing the solenoid push axis 243 together with the force transmission bar 244, the pushing/stopping bar 260 and the retaining bar 255 forward. The support plate for pushing/stopping bar 262 also moves to touch the fixed stopping angle 253a of the support/guide groove for pushing/stopping bar 253 to stop, thereby fixing the pushing/stopping bar 260 in a lowered state. As for the retaining bar 255, due to the force in the rearward direction pushing out and the force application point being at a high position, support plate for retaining bar 257 slides along the lower edge of the groove for support/guide retaining bar 252, moves to a high position, fully lifting the retaining bar 255 and the retaining hook 258.

[00031] In this dynamic state, when the product head slides underneath, it will be affected

by the pushing/stopping bars 260 and the retaining bar 255 as follows:

- + Pushing/stopping bar 260: keeps the lowered position fixed to prevent the product head from sliding over.

- + Retaining bar 255: lifts up completely and does not affect the product head.

[00032] Referring to Figure 3.1 to Figure 3.5, these are drawings detailing each step of the product drop operation.

[00033] Referring to Figure 3.1, the product line comprising 3 products placed on the roller plate 230 in a state of always sliding forward due to the inclination, is stopped by the outer product 291 touching the base of the front bar 221 at the first stopping point 223. The pushing/stopping/retaining device 241 is mounted in an elevated position so that the head of the outer product 291, after sliding down and stopping, will lie between the pushing/stopping hook 263 of the pushing/stopping bar 260 and the retaining hook 258 of the retaining bar 255.

[00034] Referring to Figure 3.2, when the pushing/stopping/retaining device 241 operates, the pushing/stopping bar 260 and the pushing/stopping hook 263 are pushed forward to impact the head of the outer product 291, causing the outer product 291 to lose balance and fall forward. At the same time, the support plate for retaining bar 257 slides along the lower edge of the groove for support/guide retaining bar 252, causing the retaining bar 255 and the retaining hook 258 to slide forward and lift up so that the outer product 291 falls out.

[00035] Referring to Figure 3.3, the outer product 291 has fallen out, at the same time the support plate for pushing/stopping bar 262 slides to the fixed stopping angle 253a of the support/guide groove for pushing/stopping bar 253 causing the pushing/stopping bar 260 to be fixed in a lowered position, the pushing/stopping bar 260 and the pushing/stopping hook 263 stop the head of the adjacent product 290 that is sliding out, causing the product line to stop.

[00036] Referring to Figure 3.4, after 1 second of retaining in the operating state, the pushing/stopping/retaining device 241 turns off, returns to the static state, causing the pushing/stopping bar 260 and the retaining bar 255 to retract. The support plate for pushing/stopping bar 262 retracts from the fixed stopping angle 253a of the support/guide groove for pushing/stopping bar 253, causing the pushing/stopping bar 260 to escape from the fixed lowering position, relaxes to lift up for the adjacent product head 290 to slide through. At the same time, the retaining bar 255 also retracts and lowers down.

[00037] Referring to Figure 3.5, the adjacent product 290 continues to slide forward, touching the product base on the front stopper 221 at the first stopping point 223, due to

inertia, the product head inclines slightly forward and touches the retaining hook 258 at the second stopping point 224, causing the retaining bar 255 to simultaneously be lifted and moved forward. At this time, the support plate for retaining bar 257 is also pulled and slide along the upper edge of the groove for support/guide retaining bar 252, touching the fixed retaining angle 252a, causing the retaining bar 255 and the product head to stop together. The adjacent product 290 til back to a balanced position with the product head lying between the two pushing/stopping bars 260 and the retaining bar 255, the mechanism returns to a static state waiting for the next product drop.

[00038] Figures 4.1 to 4.4 detail the operation of the pushing/stopping/retaining device on the head of various products such as bottles, cans, boxes.

[00039] Referring to Figure 4.1 for the bottle product, the product heads of two adjacent bottles have a large gap, so the pushing/stopping bar 260 and the pushing/stopping hook 263 are completely lowered, making it easy to push and stop each product in turn.

[00040] Referring to Figure 4.2 for the product being a can, the product heads of two adjacent cans are close together and there is only space on both sides, at this time the pushing/stopping hook 263 is partially dropped down and placed on the side edge of the can lid No. 2. When the pushing/stopping bar 260 moves forward, the pushing/stopping hook 263 also moves away from the can lid No. 2 and falls into the space next to the two can lids, pushing can No. 1 is performed, then stopping can No. 2 is performed, finally letting can No. 2 slide over, resetting the pushing/stopping hook 263 on the side edge of the can lid No. 3 that has just slid over, returning to the static state.

[00041] Referring to Figure 4.3 for the product being a box, the product heads of two adjacent boxes are close together and there is only a small groove between the two boxes, at this time the pushing/stopping hook 263 is partially dropped down and placed on the cover of box 2. When the pushing/stopping bar 260 moves forward, the pushing/stopping hook 263 also moves away from the cover of box 2 and falls into the groove between the two box covers, performing the pushing of box 1, immediately following the stopping of box 2, finally releasing box 2 to slide over, resetting the pushing/stopping hook 263 on the cover of box 3 that has just slid to, returning to the static state.

[00042] Referring to Figure 4.4, due to the different sizes of the head of the bottle, can, box, the distance between the pushing/stopping hook 263 and the retaining hook 258 is also adjusted to fit the size of all the product heads. The retaining hook 258 will be mounted to the retaining bar body 255 by a screw-in groove, which can be adjusted to retract according to the size of the product head.

[00043] Figure 5.1 – Figure 5.2 are views showing the assembly of the pushing/stopping/retaining device into the product tray and position adjustment.

[00044] Referring to Figure 5.1 which illustrates how to assemble the

pushing/stopping/retaining device 241 into the product tray 220, the pushing/stopping/retaining device 241 is additionally equipped with two accessories, namely the sliding hanging bar 240a and the positioning bar 240c. The sliding hanging bar 240a is a long piece of metal with grooves and holes, one end of which is mounted to the push solenoid 242, the other end is placed on the shaft retaining the retaining axis for sliding hanging bar 240b, allowing the pushing/stopping/retaining device 241 to be balanced and able to slide back and forth. The positioning bar 240c is a U-shaped metal plate with multiple rectangular holes punched on both sides for hooking and retaining the L-shaped hanging positioning pin 259 of the support/guide plate 250, through which the head of the pushing/stopping/retaining device 241 can be adjusted back and forth up and down when hooked to different rectangular hole positions on the positioning bar 240c. The positioning bar 240c is mounted to the underside of the product tray 220 by the retaining plate for positioning bar 240d.

[00045] With reference to Figure 5.2, this is an illustration of how to position the pushing/stopping/retaining device 241 properly onto the outer product 291.

[00046] Referring to Figure 5.2.a, the hanging positioning pin 259 hooks into the highest inner rectangular hole of the positioning bar 240c, so the pushing/stopping/retaining device 241 is also located at the highest inner position, resulting in the outer product head 291 not being properly positioned between the pushing/stopping hook 263 and the retaining hook 258.

[00047] Referring to Figure 5.2.b, in order to adjust the position of the pushing/stopping/retaining device 241, simply remove the two hanging positioning pins 259 on both sides from the innermost highest rectangular hole, bring them to the outermost highest rectangular hole position of the positioning bar 240c, the corresponding pushing/stopping/retaining device 241 also slides forward along with the two sliding hanging bars 240a supporting behind.

[00048] Referring to Figure 5.2.c, two hanging positioning pins 259 are continuously brought to the lowest outer rectangular hole of the positioning hanging bar 240c, hook the two hanging positioning pins 259 into the new rectangular hole position on the positioning bar 240c. At this time, the adjustment is complete, the pushing/stopping/retaining device 241 is in the correct position where the outer product head 291 is between the pushing/stopping hook 263 and the retaining hook 258.

[00049] Figures 6.1 to 6.4 illustrate how to combine a pushing/stopping/retaining device with a conveyor device to move back and forth and drop multiple rows of the same product.

[00050] Referring to Figure 6.1, for a product tray 220 containing the same type of product arranged in multiple rows, the pushing/stopping/retaining device 241 can be mounted to a conveyor belt 270 (which electronically controls the back-and-forth

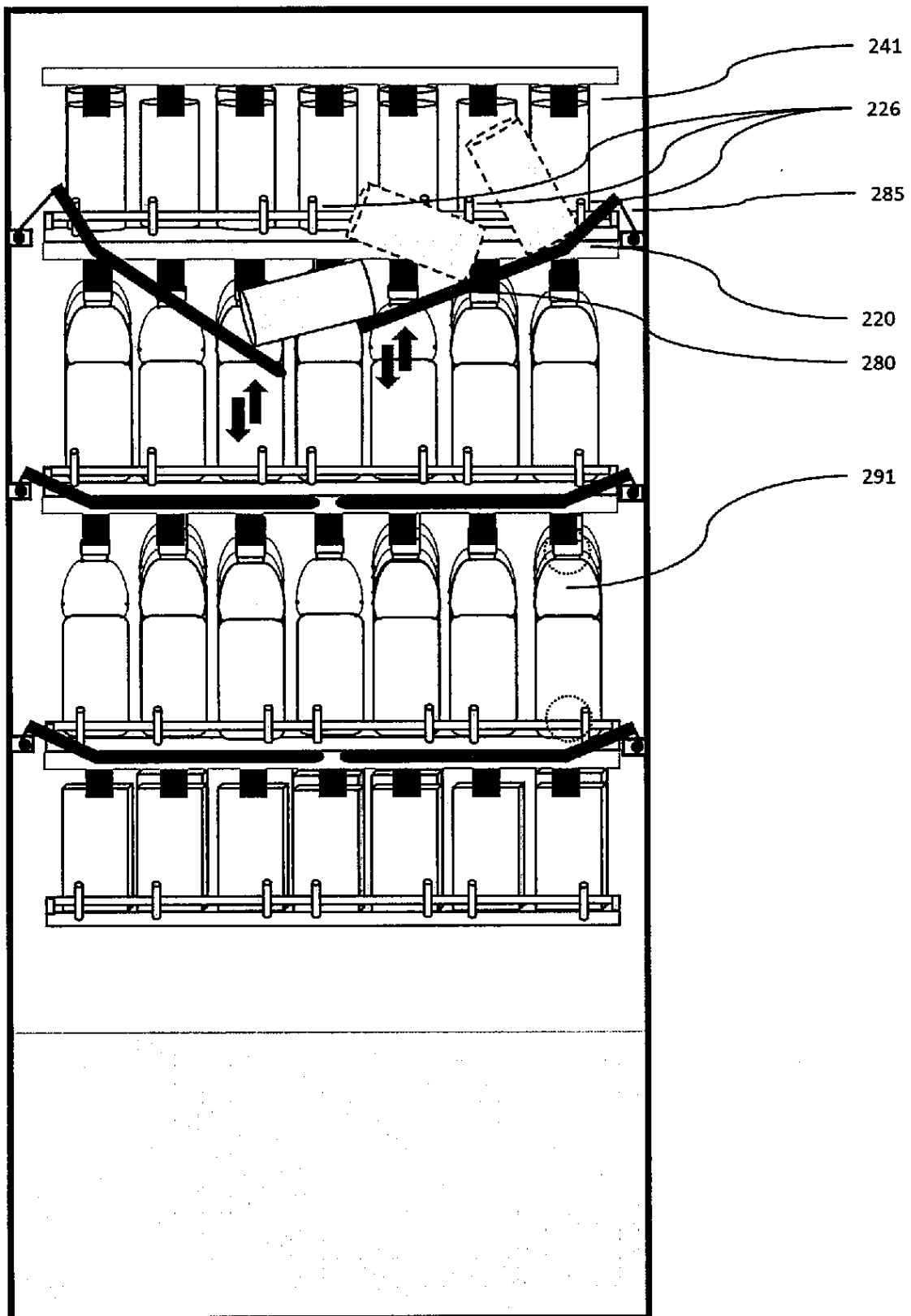


FIG 1.1

pushing/stopping/retaining device 241 drops a product on the far right of the 4th floor, which is guided to slide down and press on the support bar 281, stretching the coil spring 285, causing the support bar 281 to lower. Referring to Figures 8.2, 8.3 and 8.4, the product continues to fall through the product support mechanism 280 on the 3rd and 2nd floors with the same principle and down to the product storage compartment.

[00061] List of reference numbers:

220: Product tray	252a: Fixed retaining angle
221: Front bar	253: Support/guide groove for pushing/stopping bar
222: Side bar	253a: Fixed stopping angle
223: First stopping point	255: Retaining bar
224: Second stopping point	256: Mounting pin for retaining bar
226: Lifting pin for product base	257: Support plate for retaining bar
230: Roller plate	258: Retaining hook
240a: Sliding hanging bar	259: Hanging positioning pin
240b: Retaining axis for sliding hanging bar	260: Pushing/stopping bar
240c: Positioning bar	261: Mounting pin for pushing/stopping pin
240d: Retaining plate for positioning bar	262: Support plate for pushing/stopping bar
241: Pushing/stopping/retaining device	263: Pushing/stopping hook
242: Push solenoid	270: Conveyor belt
243: Push solenoid axis	280: Product support mechanism
244: Force transmission bar	281: Support bar
245: Mounting plate for push solenoid axis	282: Guide point
246: Support plate for force transmission bar	283: Rotating axis
247: Mounting hole for pushing/stopping bar	284: Coil spring box
248: Mounting hole for retaining bar	285: Coil spring
250: Support/guide plate	288: Glass door of the vending machine
251: Groove for support/guide force	290: Adjacent product

transmission bar

291: Outer product

252: Groove for support/guide retaining
bar

The effectiveness of the invention

[00062] The advantages of the above product drop and support mechanism are as follows:

- + Display in a straight line, products stand upright on product trays.
- + To get more products: Products are placed close together both horizontally and vertically.
- + Simple loading operation: Load goods from the front, put products into the product tray, push products in turn inside on the roller plate until the product line is full.
- + Products with different shapes and sizes still use the same product pushing/stopping/retaining device, just need to adjust the device position and the distance between the retaining bar and the push/stop bar.
- + Can use a pushing/stopping/retaining device combined with a conveyor to drop multiple rows of the same product, optimizing equipment costs.
- + Falling products are guided and supported by product support structures, limiting product distortion, breakage or strong shaking.

Claims

1. Product drop and support mechanisms used in the vending machine, including:
the product drop mechanism uses a product tray (220) with a roller plate (230), wherein
the product tray (220) is mounted with an forward inclination at approximately
from 8 to 10 degrees, with side bars (222) and a front bar (221) to guide and stop
the product base;
the roller plate (230) is placed on the product tray (220), comprising two parallel
vertical metal bars retaining the rollers horizontally;
the pushing/stopping/retaining device (241) is hung on the underside of the product tray
(220) by flexible hanging bars, located high above the end of the roller plate (230),
pushing/stopping/retaining the head of the product; and
the product support structure includes a lifting pin for product base (226), a support bar
(281), a guide point (282), a rotating axis (283), a coil spring box (284), located on each
floor, in which the support bar (281) can be lifted and lowered by the rotating axis (283) and
the coil spring (285), helping the product to fall horizontally and slide smoothly down each
floor to the product store compartment below.
2. The product drop and support mechanism according to claim 1, is characterized in that
the product sliding on the product tray (220) due to gravity and stopping in a state of
equilibrium due to the outer product (291) touching two stopping points in turn, wherein
the product tray (220) has a roller plate (230) placed at an inclined angle to create an
inclination and the front bar (221) creates a first stopping point (223) at a low position at
the base of the outer product (291), wherein the pushing/stopping/retaining device (241)
hanging from above has a retaining bar 255 creating a second stopping point (224) at a
high position at the head of the outer product (291).
3. The product drop and support mechanism according to claim 1 is characterized in that
the products dropping one by one by pushing/stopping/retaining operations performed on
the outer product head (291), by a pushing/stopping/retaining device (241) that is adjusted
to flexibly move back and forth, up and down to the correct product head of different
shapes, different sizes, at different high and low positions depending on each type of
product.
4. The product pushing/stopping/retaining device according to claim 1, comprising:
the push solenoid (242) has a push solenoid axis (243) that moves forward to create a push
force through the use of an electric current to activate a suction electromagnet;
a force transmission bar (244) having a support plate for force transmission bar (246), a

mounting hole for pushing/stopping bar (247), a mounting hole for retaining bar (248) and a mounting plate for push solenoid axis (245);

pushing/stopping bar (260) of metal, with mounting pin for pushing/stopping bar (261) and support plate for pushing/stopping bar (262), front with pushing/stopping hook (263);

a metal retaining bar (255), with mounting pin for retaining bar (256), support plate for retaining bar (257) and retaining hook (258); and

two symmetrical metal support/guide plates (250) having L-shaped hanging positioning pins (259) at the ends, screw holes and support/guide grooves, including a horizontal groove for support/guide force transmission bar (251), a groove for support/guide retaining bar (252) having an upward-sloping narrow groove with a fixed retaining angle (252a), and a rectangular support/guide groove for pushing/stopping bar (253) having a fixed stopping angle (253a).

5. The product pushing/stopping/retaining device according to claim 4, is characterized in that,

in the static state, the relaxed pushing/stopping bar (260) can be lifted and lowered to allow the product head to slide through,

in the operating state, the pushing/stopping bar (260) moves along the lower edge of the support/guide groove for pushing/stopping bar (253) to a fixed stopping angle (253a) to simultaneously push the front outer product (291) outward and stop the adjacent product (290) behind to stop;

characterized in that,

in the static state, the retaining bar (255) lowers and moves along the upper edge of the groove for support/guide retaining bar (252) to a fixed retaining angle (252a) when impacted by the product head and holds the product head stationary,

in the operating state, the retaining bar (255) moves along the lower edge of the groove for support/guide retaining bar (252) when acted upon by the solenoid (242) and the force transmission bar (244), to the highest point and is fully lifted for the product head to slide through.

6. The product pushing/stopping/retaining device according to claim 4, wherein the pushing/stopping/retaining device (241) is hung from the underside of the product tray (220) by a sliding hanging bar (240a) and a positioning bar (240c) forming flexible structures for adjusting back and forth, up and down to the correct position on the head of the outer product (291), wherein

the sliding hanging bar (240a) is a long piece of metal with grooves and holes, one head of

which is mounted to the push solenoid (242), the other end of which rests on the retaining axis for sliding hanging bar (240b), allowing the pushing/stopping/retaining device (241) to be balanced and to slide back and forth; and

the positioning bar (240c) is a U-shaped metal plate with multiple rectangular holes punched on both sides to hook and hold the L-shaped hanging positioning pin (259) of the support/guide plate (250), through which the head of the pushing/stopping/retaining device (241) can be adjusted back and forth, up and down when hooked into different rectangular hole positions on the positioning bar (240c), wherein the positioning bar (240c) is mounted to the underside of the product tray (220) by the retaining plate for positioning bar (240d).

7. The product pushing/stopping/retaining device of claim 4, wherein such a product pushing/stopping/retaining device may be mounted to a conveyor belt (270) that moves back and forth and sequentially drops multiple rows of products of the same type of height and size onto the same product level.

8. The product pushing/stopping/retaining device according to claim 4, wherein pushing/stopping hook (263) is L-shaped to perform push/stop corresponding to different types of bottles, cans, box products; and
the retaining hook (258) is adjusted in distance from the pushing/stopping hook (263) depending on the different product head sizes, ensuring that the product head is always between the two hooks.

9. The product support mechanism (280) according to claim 1, comprising:

lifting pin for product base (226);

support bar (281);

guide point (282);

the rotating axis (283) is mounted in front of the product tray (220) so that the entire device is located in the space between the product tray (220) and the glass door of the vending machine (288);

the coil spring box (284) internally contains a coil spring (285) with the spring head extending outward through a narrow groove;

characterized in that the coil spring box (284) being mounted to the sales cabinet wall in such a position that when the guide point (282) is placed on the coil spring box (284) and connected to the coil spring (285), the support bar (281) is horizontally in front parallel to the product tray (220); and

characterized in that the lifting pin for product base (226) is located in front of the product

tray (220) so that when the product falls out, one base will be lifted, falling sideways and sliding down the narrow gap between the edge of the product tray (220) and the glass door of the vending machine (288) lying on the support bar (281) to slide down through each level.