

STORAGE SHELF AND BOX LUNCH VENDING MACHINE

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of vending machines, and specifically to a storage shelf and box lunch vending machine.

BACKGROUND

[0002] With the development of economy and people's pursuit of high-quality life, a vending machine as a new commercial retail form quickly became popular. Because the vending machine is not limited to time and place, and has the advantages of labor saving, easy transaction and the like, it is gradually accepted by more and more merchants and consumers. A box lunch vending machine is a main category of the vending machine, and it is not limited to time, place, storefront and chef and breaks through the traditional front-storefront back-kitchen business model, thereby largely saving the human and material resources.

[0003] To increase the capacity of the box lunch vending machine, box lunches are arranged generally in a layering and stacking manner. In the prior art, the shelf for arranging the box lunches is too complex and is very difficult to mount.

SUMMARY

[0004] Based on the above, a storage shelf and a box lunch vending machine containing the same are provided by aiming at a problem that the existing shelf for arranging box lunches has a complex structure.

[0005] A storage shelf, which comprises a central shaft and a plurality of supporting mechanisms, wherein the plurality of supporting mechanisms are axially spaced arranged along the central shaft; and each supporting mechanism comprises a supporting structure and a plurality of storage units that are arranged on the supporting structure, the supporting structure comprises a mounting seat, a plurality of connecting rods and a load bearing frame, the mounting seat is detachably sleeved on the central shaft, one end of each connecting rod is connected with the mounting seat while the other end is connected with the load bearing frame, the plurality of connecting rods are radially distributed by taking the central shaft as the center, and the storage units are detachably connected with the load bearing frame.

[0006] In the storage shelf, the central shaft and the mounting seat of each supporting structure are detachably connected, and the storage units are detachably connected with the load

bearing frame, so that the storage shelf has a simple structure and each element is convenient to detach and assemble. When the storage shelf is applied to a vending machine, all the goods are respectively stored in the mutually independent storage units, thereby facilitating accurate control of a goods delivery process. Additionally, the whole storage shelf is of a frame structure and has a relatively smaller weight so as to be convenient to mount and transport.

[0007] In one embodiment, each storage unit comprises a plurality of mounting strips and a plurality of bearing strips, each bearing strip and each mounting strip are arranged to form an included angle, and the bearing strips and the mounting strips jointly form an accommodating part used for arranging the goods.

[0008] In one embodiment, each bearing strip comprises a main body, the first blocking part and the second blocking part, and the first blocking part and the second blocking part are bent and are arranged at both ends of the main body.

[0009] In one embodiment, the storage unit further comprises limiting strips and a cross rod, both ends of the cross rod are respectively connected with one of the mounting strips, each limiting strip comprises a connecting end and a free end which form an included angle, the connecting end is arranged on the cross rod, the free end is suspended above the main body, and when the goods is put on the accommodating part, the free end is propped against the upper surface of the goods.

[0010] In one embodiment, the storage unit further comprises reinforcing rods, each mounting strip comprises a hooked part and a supporting part that are in bent connection, and one end of each reinforcing rod is connected with the hooked part while the other end is connected with the supporting part.

[0011] In one embodiment, the load bearing frame comprises the first supporting body, the second supporting body and a plurality of vertical rods, the vertical rods are arranged between the first supporting body and the second supporting body, a through hole is formed in each vertical rod, and the hooked part is inserted in the through hole.

[0012] A box lunch vending machine comprises the said storage shelf of the present application.

[0013] In one embodiment, the box lunch vending machine further comprises:

[0014] a box body, which is provided with a plurality of exits, wherein the storage shelf is arranged in the box body;

[0015] a plurality of liquid guiding grooves, which are arranged in the box body, wherein the liquid guiding grooves and the supporting mechanisms are arranged in one-to-one

correspondence, and each of the liquid guiding grooves contains heat conducting medium used for heating the box lunches; and

[0016] a lifting device, which is used for driving the storage shelf to lift up and down, wherein the supporting mechanisms can carry box lunches to move down so that the box lunches are immersed into the corresponding liquid guiding grooves when the lifting device drives the storage shelf to lift down, and when the lifting device drives the storage shelf to lift up, the supporting mechanisms can carry the box lunches to move up so that the box lunches leave the liquid guiding grooves and face to the exit.

[0017] In one embodiment, the lifting device comprises the first fixed plate, a movable plate, the second fixed plate, a plurality of supporting poles, a screw rod and a driving assembly, the first fixed plate is arranged at the box body, the plurality of supporting poles are arranged on the first fixed plate, the movable plate is sleeved on the supporting poles, the second fixed plate is connected with one end of each supporting pole away from the first fixed plate, the screw rod is rotationally connected with both the first fixed plate and the second fixed plate and is in threaded matching with the movable plate, the driving assembly is used for driving the screw rod to rotate so as to drive the movable plate to lift up and down along the supporting poles, the movable plate is connected with a lifting rod, and the lifting rod is connected with the storage shelf.

[0018] In one embodiment, the lifting device further comprises a detecting assembly, the detecting assembly comprises two sensing elements and a detecting strip, the detecting strip is arranged on the movable plate, the two sensing elements are respectively arranged on the first fixed plate and the second fixed plate, and the detecting strip can move along with the movable plate and enter the detection regions of the sensing elements.

25 BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 is a structural schematic diagram of a box lunch vending machine according to one embodiment.

[0020] FIG. 2 is a schematic diagram of a local structure of the box lunch vending machine shown in FIG. 1 without a box door.

[0021] FIG. 3 is a structural schematic diagram of a storage shelf in the box lunch vending machine shown in FIG. 2.

[0022] FIG. 4 is a structural schematic diagram of a supporting mechanism in the storage shelf shown in FIG. 3.

[0023] FIG. 5 is a structural schematic diagram of a storage unit in the storage shelf shown in FIG. 3.

[0024] FIG. 6 is a structural schematic diagram of the first embodiment of a supporting structure in the storage shelf shown in FIG. 3.

5 [0025] FIG. 7 is a structural schematic diagram of the second embodiment of a supporting structure in the storage shelf shown in FIG. 3.

[0026] FIG. 8 is a schematic diagram of a local structure of a heating device in the box lunch vending machine shown in FIG. 2.

10 [0027] FIG. 9 is a structural schematic diagram of a liquid guiding groove in the heating device shown in FIG. 8.

[0028] FIG. 10 is a structural schematic diagram of a lifting device in the box lunch vending machine shown in FIG. 2.

[0029] FIG. 11 is a structural schematic diagram of a rotating device and a detecting device in the box lunch vending machine shown in FIG. 2.

15 [0030] FIG. 12 is a structural schematic diagram of the first embodiment of a sensing plate in the detecting device shown in FIG. 11.

[0031] FIG. 13 is a structural schematic diagram of the second embodiment of a sensing plate in the detecting device shown in FIG. 11.

20 [0032] FIG. 14 is a schematic diagram of a local structure of the box lunch vending machine shown in FIG. 1.

[0033] FIG. 15 is another perspective view of a local structure of the box lunch vending machine without the box door shown in FIG. 1.

[0034] FIG. 16 is an enlarged view of an A part in FIG. 14.

25 [0035] FIG. 17 is a structural schematic diagram of a pushing device in the box lunch vending machine shown in FIG. 15.

[0036] FIG. 18 is an explosive view of the pushing device shown in FIG. 17.

DESCRIPTION OF THE EMBODIMENTS

30 [0037] To facilitate understanding the present disclosure, the present disclosure is described more fully hereinafter with reference to the accompanying drawings. Preferable embodiments of the present disclosure are presented in the accompanying drawings. The present disclosure may, however, be embodied in many different forms and should not be limited to the embodiments

set forth herein. Rather, an objective of providing these embodiments is to understand content disclosed in the present disclosure more thoroughly and comprehensively.

[0038] It should be noted that when an element is referred to as being “fixed” to another element, the element can be directly on another element or there may be an intermediate element. When an element is referred to as being “connected” to another element, the element can be directly connected to the other element or there may be an intermediate element. As used herein, the terms “vertical”, “horizontal”, “left”, “right” and other similar expressions are for illustrative purposes only, and should not be construed to be the only implementation.

[0039] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the present disclosure belongs. The terms used in the specification of the present disclosure are merely for describing the specific embodiments, but not intended to limit the present disclosure. The term “and/or” as used herein includes any and all combinations of one or more of the associated listed items.

[0040] A storage shelf provided by the present disclosure may be applied to a vending machine and is used for arranging to-be-sold goods. In one embodiment, the storage shelf is applied to a box lunch vending machine.

[0041] Referring to FIG. 1 and FIG. 2, a box lunch vending machine 1000 comprises a storage shelf 100, a heating device 300, a lifting device 400 and a box body 500. The box body 500 is provided with a plurality of exits 510, the storage shelf 100 is arranged in the box body 500, the storage shelf 100 is provided with multiple layers of supporting mechanisms 20, and the supporting mechanisms 20 are used for arranging box lunches. The heating device 300 is arranged in the box body 500, the heating device 300 comprises a plurality of liquid guiding grooves 310, the liquid guiding grooves 310 and the supporting mechanisms 20 are arranged in one-to-one correspondence, and the liquid guiding grooves 310 each contains heat-conducting medium for heating the box lunches. The lifting device 400 is used for driving the storage shelf 100 to lift up and down, the supporting mechanisms 20 can carry box lunches to move down in order that the box lunches are immersed into the corresponding liquid guiding grooves 310 when the lifting device 400 drives the storage shelf 100 to lift down, and when the lifting device 400 drives the storage shelf 100 to lift up, the supporting mechanisms 20 can carry the box lunches to move up in order that the box lunches leave the liquid guiding grooves 310 and face to the exits 510, so that the box lunches on the supporting mechanisms 20 may be taken out from the exits 510.

[0042] In the embodiment, the box lunch vending machine 1000 comprises the supporting

mechanisms 20 and the liquid guiding grooves 310 that are arranged in one-to-one correspondence, the storage shelf 100 is driven by the lifting device 400 to make the box lunches on the supporting mechanisms 20 to be immersed into the heat-conducting medium in the liquid guiding grooves 310 so that the box lunches are heated. Meanwhile, the lifting device
5 400 can drive the whole storage shelf 100 to move in such a way that the box lunches on the supporting mechanisms 20 move to the corresponding exit 510, thereby effectively improving the efficiency for taking out the box lunches and shortening the waiting time of a user.

[0043] Referring to FIG. 1, the whole box body 500 is of a cuboid structure, and the box body 500 is provided with a box door 520. In the preparation stage, the box door 520 is opened, and
10 the box lunches are put in the supporting mechanisms 20 of the storage shelf 100. It should be understood that a supporting frame is arranged in the box body 500, and the liquid guiding grooves 310 are fixed onto the supporting frame.

[0044] Referring to FIG. 3 and FIG. 4, the storage shelf 100 comprises a central shaft 10 and a plurality of supporting mechanisms 20, and the plurality of supporting mechanisms 20 are
15 axially arranged along the central shaft 10 with intervals; and each supporting mechanism 20 comprises a supporting structure 21 and a plurality of storage units 22 that are arranged on the supporting structure 21, wherein the supporting structure 21 comprises a mounting seat 211, a plurality of connecting rods 212 and a load bearing frame 213, the mounting seat 211 is detachably sleeved on the central shaft 10, one end of each connecting rod 212 is connected
20 with the mounting seat 211 while the other end is connected with the load bearing frame 213, the plurality of connecting rods 212 are radially distributed by taking the central shaft 10 as the center, and the storage units 22 are detachably connected with the load bearing frame 213.

[0045] In the storage shelf 100, the central shaft 10 and the mounting seat 211 of each supporting structure 21 are detachably connected, and the storage units 22 are detachably
25 connected with the load bearing frame 213, so that the storage shelf 100 is convenient to detach and assemble and has a simple structure. When the storage shelf 100 is applied to a vending machine, the goods are respectively stored in the mutually independent storage units 22, thereby facilitating accurate control of a goods delivery process. Additionally, the whole storage shelf 100 is of a frame structure and has a relatively smaller weight so as to be convenient to mount
30 and transport.

[0046] In particular, the supporting mechanisms 20 are axially arranged along the central shaft 10 with intervals. The central shaft 10 is a hollow-structure cylinder body, and the connecting rods 212 and the load bearing frames 213 are made of aluminum profiles, so that the total weight of the storage shelf 100 is reduced. Both ends of each connecting rod 212 are

respectively welded on the mounting seat 211 and the load bearing frame 213, in order to improve the welding strength, both ends of each connecting rod 212 are provided with bent sections, and one bent section is welded on the surface of the mounting seat 211 while the other one is welded on the load bearing frame 213.

5 [0047] Referring to FIG. 6, mounting holes 211a are formed in the mounting seat 211, and a plurality of connecting pieces penetrate through the mounting holes 211a and are in threaded connection with the central shaft 10. When the storage unit 22 is assembled, the mounting seat 211 is sleeved on the central shaft 10 and slides along the central shaft 10 in order that the mounting holes 211a are aligned to threaded holes of the central shaft 10, then the connecting
10 pieces penetrate through the mounting holes 211a and are in threaded connection with the central shaft 10, thereby achieving detachable connection of the supporting mechanism 20 and the central shaft 10.

[0048] The supporting structure 21 further comprises a reinforcing ring 214, and the reinforcing ring 214 is connected with each connecting rod 212 in order to improve the strength
15 of the supporting structure 21.

[0049] Referring to FIG. 5, the storage unit 22 comprises a plurality of mounting strips 221 and a plurality of bearing strips 222, and each bearing strip 222 and each mounting strip 221 are arranged to form an included angle, and the bearing strips 222 and the mounting strips 221 jointly form an accommodating part used for arranging the goods 200. In one embodiment, the
20 storage shelf 100 is applied to the box lunch vending machine 1000, and correspondingly, the goods 200 is the box lunch.

[0050] Furthermore, the included angle formed between each bearing strip 222 and each mounting strip 221 is 90 degrees, and each bearing strip 222 and each mounting strip 221 are crossed in order to form the accommodating part for arranging the goods 200. The storage unit
25 22 is of a frame structure, its structure strength is enough large so that the structure can bear the weight of the single goods 200, and the weight of the storage unit 22 is light, thereby facilitating reduction of the total weight of the storage shelf 100. It should be understood that the number of the bearing strips 222 is two or more, the plurality of the bearing strips 222 are arranged in parallel, the number of the mounting strips 221 is two or more, and the plurality of the mounting
30 strips 221 are arranged in parallel.

[0051] In one embodiment, the accommodating part may be in shape of a platform.

[0052] In other embodiments, the accommodating part is of a semi-open structure, so in one aspect, the relative position of the goods 200 can be fixed; in the other aspect, the goods 200 is convenient to be put in or taken out. Specifically, each bearing strip 222 comprises a main body

2221, the first blocking part 2222 and the second blocking part 2223, and the first blocking part 2222 and the second blocking part 2223 are bent and are arranged at both ends of the main body 2221. The first blocking part 2222 and the second blocking part 2223 can clamp and fix the two opposite side faces of the goods 200, thereby preventing the goods 200 from falling down from the storage unit 22 when the storage shelf 100 rotates.

[0053] The interval between the first blocking part 2222 and the second blocking part 2223 is larger than or equal to the length or the width of the goods 200.

[0054] The storage unit 22 further comprises limiting strips 223 and a cross rod 224, both ends of the cross rod 224 are respectively connected with one of the mounting strips 221, each limiting strip 223 comprises a connecting end 2231 and a free end 2232 that form an included angle, the connecting end 2231 is arranged on the cross rod 224, the free end 2232 is suspended above the main body 2221, and when the goods 200 is put in the accommodating part, the free end 2232 is propped against the upper surface of the goods. When the goods 200 is put in the storage unit 22, the limiting strips 223 limit the thickness direction of the goods 200 so as to prevent the goods 200 from falling down from the storage unit 22 when the whole storage shelf 100 moves in the height direction of the central shaft 10.

[0055] It should be noted that in other embodiments, the cross rod 224 and the bearing strips 222 have the same structure.

[0056] The storage unit 22 further comprises reinforcing rods 225, each mounting strip 221 comprises a hooked part 2211 and a supporting part 2212 that are in bent connection, and one end of each reinforcing rod 225 is connected with the hooked part 2211 while the other end is connected with the supporting part 2212. The reinforcing rod 225 and the corresponding mounting strip 221 form a triangular structure so as to exert fixing and support-reinforcing functions and prevent the storage unit 22 from deforming due to long-term weight or pressure after the storage unit 22 is arranged on the load bearing frame 213.

[0057] Referring to FIG. 6, in the first embodiment, the load bearing frame 213 comprises the first supporting body 2131, the second supporting body 2132 and a plurality of vertical rods 2133, wherein the vertical rods 2133 are arranged between the first supporting body 2131 and the second supporting body 2132. The first supporting body 2131 and the second supporting body 2132 are both ring-shaped, and both ends of each vertical rod 2133 are respectively welded on the first supporting body 2131 and the second supporting body 2132. The load bearing frame 213 has a small weight on the premise of meeting the strength requirement.

[0058] A through hole is formed in each vertical rod 2133, and the hooked part 2211 is inserted in the through hole. The vertical rods 2133 and the hooked parts 2211 match with each

other, thereby fixing the position of the storage unit 22 and preventing a situation that the storage unit 22 generates displacement on the load bearing frame 213 to influence the normal operation of the vending machine adopting the storage shelf 100. Furthermore, each hooked part 2211 has such a length that the hooked part 2211 is unlikely to separate from the corresponding vertical rod 2133.

[0059] It should be noted that the whole load bearing frame 213 may be in shape of square, circle or polygon, and the plurality of storage units 22 are centrally symmetrically distributed on the load bearing frame 213.

[0060] Referring to FIG. 7, in the second embodiment, the load bearing frame 213 is of a plate structure, and the hooked parts 2211 are overlapped at the edge of the load bearing frame 213.

[0061] Furthermore, a plurality of stop blocks (not shown in the drawings) may be arranged on the circumference of the load bearing frame 213, the hooked parts 2211 of each storage unit 22 are suspended on the load bearing frame 213, and the two adjacent stop blocks stop each storage unit 22 in order to prevent each storage unit 22 from generating displacement on the load bearing frame 213.

[0062] Referring to FIG. 8 and FIG. 9, the heating device 300 further comprises a valve assembly 320, the valve assembly 320 comprises a plurality of plugs 321, a pull rod 322 and a power element 323, a connecting pipe 330 is arranged between every two adjacent liquid guiding grooves 310, a liquid outlet 316 is formed in a position, corresponding to the upper end of the corresponding connecting pipe 330 of each liquid guiding groove 310, a plug 321 is arranged in the liquid outlet 316 of each liquid guiding groove 310, each liquid guiding groove 310 is provided with a support plate 311, the power element 323 is arranged on the support plate 311 and is connected with the pull rod 322, each plug 321 is connected with the pull rod 322, and the power element 323 can drive each plug 321 to be plugged in or pulled out of the liquid outlet 316.

[0063] The connecting pipe 330 is arranged between the two adjacent liquid guiding grooves 310, so the liquid guiding grooves 310 may be communicated mutually when the plug 321 is pulled out of the liquid outlet 316. When the heat conducting medium needs to be filled into or discharged from the liquid guiding groove 310, the power element 323 drives the plug 321 to move upwards so that the liquid outlet 316 opens, the liquid conducting medium can flow from an upper liquid guiding groove 310 to a lower liquid guiding groove 310, so the liquid conducting medium is convenient to be filled or discharged, it is unnecessary to arrange an individual pipe for each liquid guiding groove 310, the structure is simple, and the installation is quick. Additionally, due to the valve assembly 320, synchronous control of the liquid

conducting medium discharging/filling processes of the plurality of liquid guiding grooves 310 may be realized, so the high efficiency is achieved.

[0064] The power element 323 may be an air cylinder, a stepping motor and the like.

5 **[0065]** It should be noted that, the heating device 300 further comprises a liquid storage tank (not shown in the drawings), the liquid storage tank is arranged below the storage shelf 100 and is used for containing the heat conducting medium, and the liquid guiding groove 310 at the bottom is communicated with the liquid storage tank. In other words, the heat conducting medium may be recycled to the liquid storage tank through the liquid guiding grooves 310, thereby achieving cyclic utilization of the heat conducting medium.

10 **[0066]** The liquid outlet 316 is formed in the bottom wall of the liquid guiding groove 310 in order to ensure that the heat conducting medium in the liquid guiding groove 310 can be completely discharged.

[0067] Referring to FIG. 9, the support plate 311 is provided with a sleeve 312, and the plug 321 penetrates through the sleeve 312. The plug 321 is of a pipe structure, and the tail end of the
15 plug 321 forms a flange 321a; in one aspect, when the plug 321 plugs in the liquid outlet 316, the flange 321a is propped against the inner wall of the liquid guiding groove 310 so as to prevent the heat conducting medium from leaking; in the other aspect, when the plug 321 moves upwards, the flange 321a is propped against the end part of the sleeve 312 so as to limit the plug 321. Furthermore, the arrangement of the sleeve 312 limits the moving process of the plug 321
20 and also ensures the stability of the plug 321 in the moving process.

[0068] Furthermore, a screw penetrates through the plug 321 and is fixed to the pull rod 322 so that the plug 321 and the pull rod 322 are connected.

[0069] Each liquid guiding groove 310 comprises a liquid inlet 313 and an overflow pipe 314, the liquid inlet 313 is formed in the support plate 311, and the overflow pipe 314 is arranged at
25 the bottom wall of the liquid guiding groove 310, so the liquid guiding medium can flow from the overflow pipe 314 of the upper liquid guiding groove 310 to the lower liquid guiding groove 310 through the liquid inlet 313. It should be understood that, referring to FIG. 8, a pipeline 340 is connected between the overflow pipe 314 of the upper liquid guiding groove 310 and the liquid inlet 313 of the lower liquid guiding groove 310.

30 **[0070]** The liquid guiding groove 310 at the top is communicated with the liquid storage tank, and the heat conducting medium in the liquid storage tank is pumped to the liquid guiding groove 310 at the top by a pump body, so the heat conducting medium gradually flows from the liquid guiding groove 310 at the top to other liquid guiding grooves 310.

[0071] The overflow pipe 314 of the liquid guiding groove 310 at the bottom is communicated with the liquid storage tank.

[0072] Each liquid guiding groove 310 comprises a bottom wall 310a, the first annular side wall 310b and the second annular side wall 310c, the first annular side wall 310b and the second annular side wall 310c are arranged on the bottom wall 310a, a diaphragm 315 is arranged in the liquid guiding groove 310, the diaphragm 315 is sequentially connected with the first annular side wall 310b, the bottom wall 310a and the second annular side wall 310c, and the liquid inlet 313 and the overflow pipe 314 are respectively located on both sides of the diaphragm 315. Due to such arrangement, after the upper liquid guiding groove 310 is full of the liquid conducting medium, the liquid conducting medium may flow into the lower liquid guiding groove 310 so as to ensure that each liquid guiding groove 310 may be filled with the sufficient heat conducting medium to heat the box lunch.

[0073] In some embodiments, an overflow hole is formed in the side wall of the overflow pipe 314, the liquid guiding groove 310 further comprises an overflow plate 317, the overflow plate 317 is sequentially connected with the second annular side wall 310c, the bottom wall 310a and the diaphragm 315, and the height of the overflow plate 317 is larger than the height of the diaphragm 315, so the heat conducting medium can flow into the lower liquid guiding groove 310 when the liquid level of the liquid guiding groove 310 is over the height of the overflow plate 317, and due to the arrangement of the overflow plate 317, the liquid guiding groove 310 can contain sufficient heat conducting medium to heat the box lunch. In the other embodiments, the height of the overflow pipe 314 is designed to be smaller than the height of the diaphragm 315, so no overflow hole needs to be formed in the overflow pipe 314, wherein when the liquid level of the liquid guiding groove 310 is over the height of the overflow pipe 314, the heat conducting medium can flow into the lower liquid guiding groove 310.

[0074] Referring to FIG. 10, the lifting device 400 comprises the first fixed plate 410, a movable plate 420, the second fixed plate 430, a plurality of supporting poles 440, a screw rod 450 and a driving assembly 460, the first fixed plate 410 is arranged at the box body, the plurality of supporting poles 440 are arranged on the first fixed plate 410, the movable plate 420 is sleeved on the supporting pole 440, the second fixed plate 430 is connected with one end of each supporting pole 440 away from the first fixed plate, the screw rod 450 is rotationally connected with both the first fixed plate 410 and the second fixed plate 430 and is in threaded matching with the movable plate 420, the driving assembly 460 is used for driving the screw rod 450 to rotate so as to drive the movable plate 420 to lift up and down along the supporting poles 440, the movable plate 420 is connected with a lifting rod 470, and the lifting rod 470 is

connected with the storage shelf 100. The lifting device 400 is arranged at the top of the box body, as shown in FIG. 3 and FIG. 10, the central shaft 10 is arranged at the center of the storage shelf 100, and the lifting rod 470 is fixedly connected with the central shaft 10.

[0075] In particular, the driving assembly 460 drives the screw rod 450 to rotate, the screw rod 450 is in threaded matching with the movable plate 420 so that the screw rod 450 can drive the movable plate 420 to lift up and down, and the storage shelf 100 is connected with the movable plate 420 by the lifting rod 470 so that the storage shelf 100 lifts up or down when the movable plate 420 lifts up and down. The supporting poles 440 are used for fixing the relative positions of the first fixed plate 410 and the second fixed plate 430 and guiding the movable plate 420. It should be understood that the number of the supporting poles 440 is four and the four supporting poles 440 are symmetrically arranged on the first fixed plate 410 or the second fixed plate 430.

[0076] The driving assembly 460 comprises the first gear 461, the second gear 462 and a rotating motor 463, the first gear 461 and the second gear 462 are mutually meshed, the output end of the rotating motor 463 is connected with the first gear 461, and the second gear 462 and the screw rod 450 are coaxially arranged. The rotating motor 463 is a speed reduction motor and can reduce the speed when the movable plate 420 is close to the right position in the lifting up or down process, thereby preventing sharp shake caused by sudden stop.

[0077] In one embodiment, the lifting device 400 further comprises a detecting assembly 480, the detecting assembly 480 comprises two sensing elements 481 and detecting strips 482, the detecting strips 482 are arranged on the movable plate 420, and the detecting strips 482 can move along with the movable plate 420 and enter detection regions of the sensing elements 481 to judge whether the movable plate 420 moves to the right position. The two sensing elements 481 are respectively arranged on the first fixed plate 410 and the second fixed plate 430. The sensing elements 481 are communicated with a controller. When the sensing elements 481 detect a signal that the movable plate 420 lifts up or down to the right position, the signal is transmitted to the controller, and the controller transmits an operation stopping signal to the driving assembly 460, thereby achieving real-time monitoring of a motion state of the movable plate 420, and preventing a situation that the movable plate 420 moves out of a maximum motion range to cause that the storage shelf 100 impacts other components in the box body 500.

[0078] It should be noted that only one detecting strip 482 may be provided, the projections of the two sensing elements 481 at the top of the box body 500 are superposed, and the detecting strip 482 enters a detection region of a corresponding sensing element 481 when the detecting strip 482 moves up or down along with the movable plate 420. Alternatively, a detecting strip

482 is respectively arranged corresponding to each sensing element 481.

[0079] The lifting device 400 further comprises limit blocks 490, the limit blocks 490 are respectively sleeved on the supporting poles 440, and the limit blocks 490 are connected with the first fixed plate 410, the second fixed plate 430 or the movable plate 420. When the movable plate 420 lifts up or down, the limit blocks 490 are clamped between the first fixed plate 410 (or the second fixed plate 430) and the movable plate 420 so as to limit the movable plate 420 and prevent the movable plate 420 from moving out of a maximum lifting stroke when the detecting assembly 480 breaks down.

[0080] The sensing element 481 comprises an optical signal sender and an optical signal receiver that are oppositely arranged, and the detecting strip 482 can block optical signals sent by the optical signal sender. A region between the optical signal sender and the optical signal receiver is the detection region, and when the detecting strip 482 enters the detection region, an optical signal sent by the optical signal sender is blocked, the optical light receiver cannot receive the optical signal, and then the sensing element 481 obtains a signal that the movable plate 420 moves to the right position.

[0081] It should be noted that the sensing element 481 further may be a contact sensor or a potentiometer.

[0082] In one embodiment, the first fixed plate 410 and the box body are integrated. In other words, the first fixed plate 410 is a part of the box body so that one end of each supporting pole 440 may be directly arranged on the box body.

[0083] Referring to FIG. 11, the box lunch vending machine 1000 further comprises a rotating device 600 and a detecting device 700, the rotating device 600 comprises a motor and a drive group 620, and the motor can drive the storage shelf 100 to rotate by the drive group 620. The detecting device 700 comprises a detecting element 710 and a sensing plate 720, the detecting element 710 comprises the first sensor 711 and the second sensor 712 that are arranged at an interval, the sensing plate 720 can rotate synchronously along with the storage shelf 100, a plurality of locating teeth are circumferentially arranged on the sensing plate 720, and each locating tooth correspond to one storage unit 22. Each locating tooth comprises the first locating tooth 721 and the second locating tooth 722, the first locating tooth 721 can be detected by one of the first sensor 711 and the second sensor 712, and the second locating tooth 722 can be detected by the first sensor 711 and the second sensor 712 at the same time.

[0084] The rotating device 600 drives the storage shelf 100 to rotate so that one storage unit 22 is aligned to an exit and the box lunch arranged on the storage unit 22 is taken out through the exit.

[0085] In the first embodiment, referring to FIG. 12, the number of the first locating tooth 721 is one, the number of the second locating teeth 722 is two or more, in the initial state, the first locating tooth 721 is located in the detection region of the first sensor 711 or the second sensor 712, and one storage unit 22 is aligned to the exit. The sensing plate 720 synchronously rotates
5 along with the storage shelf 100, wherein when the second locating teeth 722 are detected by the detecting element 710, it represents that a next storage unit 22 reaches a position aligned to the exit, and the motor stops running in order to push the box lunch on the storage unit 22 out of the exit 510; and when the first locating tooth 721 is detected by the detecting element 710 again, it represents that the storage shelf 100 rotates for one cycle, that is, the box lunches on
10 the all storage units 22 are taken away completely.

[0086] In the second embodiment, referring to FIG. 13, the number of the first locating teeth 721 is two or more, the number of the second locating tooth 722 is one, in the initial state, the second locating tooth 722 is located in the detection region of the first sensor 711 and the detection region of the second sensor 712 at the same time, and one storage unit 22 is aligned to the exit. The sensing plate 720 synchronously rotates along with the storage shelf 100, wherein
15 when the first locating teeth 721 are detected by the detecting element 710, it represents that a next storage unit 22 reaches a position aligned to the exit, and the motor stops running in order to push the box lunch on the storage unit 22 out of the exit 510; and when the second locating tooth 722 is detected by the detecting element 710 again, it represents that the storage shelf 100
20 rotates for one cycle, that is, the box lunches on the all storage units 22 are taken away completely.

[0087] The drive group 620 comprises the first drive component 621 and the second drive component 622 that are meshed with each other, the output end of the motor is connected with the first drive component 621, the second drive component 622 and the storage shelf 100 are
25 coaxially arranged, a plurality of arc slots 723 are formed in the sensing plate 720, and a plurality of connecting pieces penetrate through the arc slots 723 in order to fix the sensing plate 720 to the second drive component. The arrangement of the arc slots 723 helps to regulate the relative positions of the sensing plate 720 and the storage shelf 100 in order that the position of the first locating tooth 721/the second locating tooth 722 on the sensing plate 720 corresponds
30 to the position of the storage unit 22 on the storage shelf 100.

[0088] The first sensor 711 and the second sensor 712 both comprise an optical signal sender and an optical signal receiver that are arranged relatively, and when the sensing plate 720 rotates, the first locating tooth 721 and the second locating tooth 722 can selectively block an optical signal sent by the optical signal sender.

[0089] Referring to FIG. 14 and FIG. 15, the box lunch vending machine 1000 further comprises pushing devices 800, the pushing devices 800 are arranged in the box body 500, a cabinet door 511 is articulated to the top of each exit 510, the box body is further provided with supporting plates 530, each supporting plate 530 is located below the corresponding exit 510, an interval between the supporting plate 530 and the corresponding exit 510 is larger than or equal to the thickness of the box lunch, each pushing device 800 is used for opening the corresponding cabinet door 511 and pushing out the box lunch 200 on the storage shelf 100 through the exit 510, and when the box lunch 200 falls on the supporting plate 530 through the exit 510, the corresponding pushing device 800 is retracted so that the cabinet door 511 is closed.

[0090] The supporting plate 530 is arranged below the exit 510, and the distance between the supporting plate 530 and the edge of the exit 510 is larger than or equal to the thickness of the box lunch 200, so, when the box lunch 200 is pushed out by the pushing device 800 and falls on the supporting plate 530 through the exit 510, the cabinet door 511 can be immediately closed no matter that the box lunch 200 is taken away, thereby reducing heat exchange of the box lunch vending machine 1000 and the external environment.

[0091] The supporting plate 530 is provided with an in-place sensor 531, and the in-place sensor 531 is used for detecting whether the box lunch 200 is on the supporting plate 530. The in-place sensor 531 is communicated with the controller of the box lunch vending machine 1000, the in-place sensor 531 can transmit a signal that the box lunch 200 falls on the supporting plate 530 to the controller, and the controller transmits a retraction signal to the pushing device 800 so that the cabinet door 511 is closed.

[0092] Referring to FIG. 16, the box lunch vending machine 1000 further comprises a plurality of electromagnetic locks 540, each electromagnetic lock 540 comprises a plunger latch 541 and a lock hole 542, the plunger latch 541 is arranged on one side of the exit 510, the cabinet door 511 is provided with the lock hole 542 matching the plunger latch 541, and when the cabinet door 511 closes the exit 510, the plunger latch 541 can selectively insert into the lock hole 542 or retract from the lock hole 542.

[0093] When the cabinet door 511 rotates to close the exit 510, the lock hole 542 on the cabinet door 511 is aligned to the plunger latch 541, and at this time, an electromagnet in the electromagnetic lock 540 is in a power-off state so that the plunger latch 541 can insert into the lock hole 542 to achieve the locking of the cabinet door 511. Correspondingly, when the cabinet door 511 needs to be opened, the electromagnet in the electromagnetic lock 540 is powered on and drives the plunger latch 541 to retract from the lock hole 542 so as to release the locking of

the cabinet door 511, and then the cabinet door 511 can rotate to open the exit 510.

[0094] The box lunch vending machine 1000 further comprises a plurality of door state sensors 550, each door state sensor 550 is arranged on one side of one exit 510, a sensing sheet 551 is arranged on the cabinet door 511, and when the sensing sheet 551 is located in the detection region of the door state sensor 550, the door state sensor 550 detects a cabinet door closing signal and transmits the cabinet door closing signal to the corresponding electromagnetic lock 540.

[0095] The end part of the plunger latch 541 is an oblique section so as to facilitate alignment of the plunger latch 541 and the lock hole 542.

[0096] Referring to FIG. 17, the pushing device 800 comprises a mounting base 810, a guide component 820, a power component 830 and a pushing assembly 840, the mounting base 810 is arranged on the side wall of the box body 500, the guide component 820 and the mounting base 810 are fixedly connected, the power component 830 is arranged on the guide component 820, the output end of the power component 830 is connected with the pushing assembly 840, the pushing assembly 840 is slidingly arranged on the guide component 820, and when the power component 830 drives the pushing assembly 840 to move in a direction close to the exit 510, the pushing assembly 840 opens the cabinet door 511 and pushes out the box lunch 200 on the storage shelf 100 through the exit 510.

[0097] The pushing device 800 is mounted on the side wall of the box body 500 and faces to the exit 510. When a user completes payment operations, the power component 830 starts to drive the pushing assembly 840 to move in a direction close to the exit 510 along the guide component 820 in order to open the cabinet door 511 and push out the box lunch 200. The pushing device 800 can ensure the stable operation of the pushing assembly 840 and prevent the box lunch 200 from being overturned.

[0098] Referring to FIG. 18, the pushing assembly 840 comprises a base 841, a plurality of rollers 842, the first pushing component 843 and the second pushing component 844, the rollers 842 are symmetrically arranged on both sides of the base 841, guide slots are formed in the guide component 820, the rollers 842 are arranged in the guide slots in a rolling manner, the first pushing component 843 and the second pushing component 844 are arranged on the base 841, and when the pushing assembly 840 moves in a direction close to the exit 510, the first pushing component 843 is propped against the cabinet door 511 in order to open the cabinet door 511, and the second pushing component 844 pushes out the box lunch. Due to the arrangement of the first pushing component 843 and the second pushing component 844, the pushing device 840 can achieve operations of opening the cabinet door 511 and pushing out the

box lunch 200.

[0099] Referring to FIG. 17, the pushing device 800 further comprises a restoring assembly 850, the restoring assembly 850 is arranged between the guide component 820 and the cabinet door 511, and the restoring assembly 850 can store energy in a cabinet door 511 opening process and is used for driving the cabinet door to be closed when the pushing assembly 840 moves away from the exit 510.

[00100] The restoring assembly 850 comprises an elastic component 851 and a transmission component 852 that are connected, the transmission component 852 is provided with the first limit block 853 and the second limit block 854 at an interval, the pushing device 800 further comprises a stop block 860, and the stop block 860 is located between the first limit block 853 and the second limit block 854 and is used for limiting the motion range of the transmission component 852. Specifically, when the stop block 860 is clamped by the second limit block 854, the cabinet door 511 is opened; and when the stop block 860 is clamped by the first limit block 853, the cabinet door 511 is closed.

[00101] The technical features of the above-described embodiments can be arbitrarily combined. For simplicity, not all possible combinations of the technical features in the above embodiments are described. However, the combinations shall fall in the scope of the present disclosure as long as there is no contradiction among the combinations of these technical features.

[00102] The above embodiments are merely several embodiments of the present disclosure, and are relatively specific and detailed. However, the above embodiments should not be deemed as limitations to the scope of the present disclosure. It should be noted that, various changes and modifications made by a person of ordinary skill in the art without departing from the concepts of the present disclosure shall fall within the protection scope of the present disclosure. Therefore, the protection scope of the present disclosure should be defined by the appended claims.

Claims

What is claimed is:

1. A storage shelf comprising a central shaft and a plurality of supporting mechanisms, wherein the plurality of supporting mechanisms are axially spaced arranged along the central shaft; and
5 each supporting mechanism comprises a supporting structure and a plurality of storage units that are arranged on the supporting structure, the supporting structure comprises a mounting seat, a plurality of connecting rods and a load bearing frame, the mounting seat is detachably sleeved on the central shaft, one end of each connecting rod is connected with the mounting seat while the other end is connected with the load bearing frame, the plurality of connecting rods
10 are radially distributed by taking the central shaft as the center, and the storage units are detachably connected with the load bearing frame.
2. The storage shelf of claim 1, wherein the storage unit comprises a plurality of mounting strips and a plurality of bearing strips, each bearing strip and each mounting strip are arranged to form
15 an included angle, and the bearing strips and the mounting strips jointly form an accommodating part used for arranging the goods.
3. The storage shelf of claim 2, wherein the bearing strip comprises a main body, a first blocking part and a second blocking part, and the first blocking part and the second blocking
20 part are bent and arranged at both ends of the main body.
4. The storage shelf of claim 3, wherein the storage unit further comprises a limiting strip and a cross rod, both ends of the cross rod are respectively connected with one of the mounting strips, the limiting strip comprises a connecting end and a free end which form an included angle, the
25 connecting end is arranged on the cross rod, the free end is suspended above the main body, and when the goods is put on the accommodating part, the free end is propped against the upper surface of the goods.
5. The storage shelf of claim 2, wherein the storage unit further comprises a reinforcing rod, the
30 mounting strip comprises a hooked part and a supporting part that are in bent connection, and one end of the reinforcing rod is connected with the hooked part while the other end is connected with the supporting part.
6. The storage shelf of claim 5, wherein the load bearing frame comprises a first supporting

body, a second supporting body and a plurality of vertical rods, the vertical rods are arranged between the first supporting body and the second supporting body, a through hole is formed in each vertical rod, and the hooked part is inserted in the through hole.

5 7. A box lunch vending machine comprising the storage shelf of any one of claims 1 to 6.

8. The box lunch vending machine of claim 7, wherein the box lunch vending machine further comprises:

10 a box body provided with a plurality of exits, wherein the storage shelf is arranged in the box body;

15 a plurality of liquid guiding grooves arranged in the box body, wherein the liquid guiding grooves and the supporting mechanisms are arranged in one-to-one correspondence, and each of the liquid guiding grooves contains heat conducting medium used for heating the box lunches; a lifting device, which is used for driving the storage shelf to lift up and down, wherein the supporting mechanism carries box lunches to move down so that the box lunches are immersed into the corresponding liquid guiding groove when the lifting device drives the storage shelf to lift down, and when the lifting device drives the storage shelf to lift up, the supporting mechanism carries the box lunches to move up so that the box lunches leave the liquid guiding groove and face to the exit.

20 9. The box lunch vending machine of claim 8, wherein the lifting device comprises a first fixed plate, a movable plate, a second fixed plate, a plurality of supporting poles, a screw rod and a driving assembly, the first fixed plate is arranged at the box body, the plurality of supporting poles are arranged on the first fixed plate, the movable plate is sleeved on the supporting pole, 25 the second fixed plate is connected with one end of each supporting pole away from the first fixed plate, the screw rod is rotationally connected with both the first fixed plate and the second fixed plate and is in threaded matching with the movable plate, the driving assembly is used for driving the screw rod to rotate so as to drive the movable plate to lift up and down along the supporting poles, the movable plate is connected with a lifting rod, and the lifting rod is 30 connected with the storage shelf.

35 10. The box lunch vending machine of claim 9, wherein the lifting device further comprises a detecting assembly, the detecting assembly comprises two sensing elements and a detecting strip, the detecting strip is arranged on the movable plate, the two sensing elements are respectively arranged on the first fixed plate and the second fixed plate, and the detecting strip

can move along with the movable plate and enter the detection regions of the sensing elements.