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(54) **REFRIGERATOR**

(57) The present disclosure provides a refrigerator including a vacuum sealing device disposed at an outer side of a door. The vacuum sealing device includes a lower support, an upper support and a vacuumization assembly. The upper support moves close to or away from the lower support under the drive of a driving device; after the upper support moves at a first speed until a sealing ring of the upper support is in contact with a sealing ring of the lower support, the upper support moves at a second speed toward the lower support until the sealing ring has a set deformation amount, and a first opening cavity and a second opening cavity are butt-joined to sealingly form a vacuumization region; the first speed is greater than the second speed; the vacuumization assembly is in communication with the vacuumization region through a pipe to perform vacuumization or depressurization for the vacuumization region.

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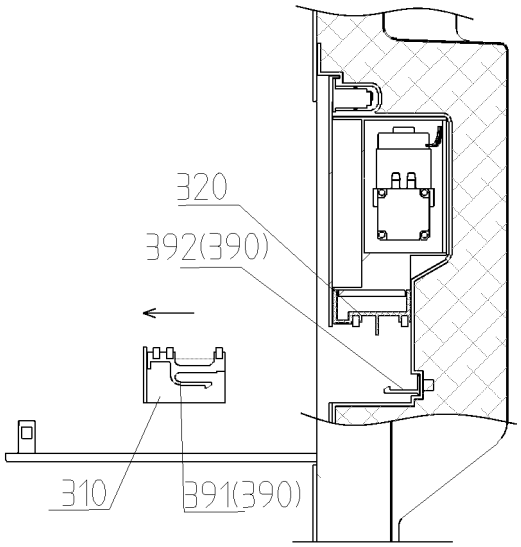


FIG. 33B

Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Chinese Patent ApplicationNo. 201910756799.X, titled as REFRIGERATOR, filed on August16, 2019, and Chinese Patent Application No.201910756811.7 titled as REFRIGERATOR, filed on August 16, 2019, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of household appliances and in particular to a refrigerator.

BACKGROUND

[0003] In recent years, people have an increasing requirement for food material preservation along with increasing awareness of health. Refrigerator is the commonest household appliance for preservation of food materials. Therefore, the food material preservation storage becomes a technical need to be met in the field of refrigerators.

[0004] At present, various manufacturers launch different preservation technologies for food material preservation storage. For example, with vacuum preservation technology, the condition of food spoilage under vacuum takes change. Firstly, in a vacuum environment, it is difficult for microorganisms and various promoting enzymes to survive and the microorganisms will take a long time to grow. Secondly, under vacuum, oxygen in a container will decrease significantly, various chemical reactions cannot be completed, and foods will not be oxidized, so that the foods can be preserved for long.

SUMMARY

[0005] According to a first aspect, the present disclosure provides a refrigerator including a vacuum sealing device disposed at an outer side of a door. The vacuum sealing device includes:

a lower support with its upper side provided with a first opening cavity and a sealing ring surrounding the first opening cavity; an upper support with its lower side provided with a second opening cavity corresponding to the first opening cavity and a sealing ring surrounding the second opening cavity; a driving device including a motor and a transmission mechanism,

wherein the upper support moves close to or away from the lower support under the drive of the driving device, the transmission mechanism is used to convert a rotational movement of the motor into a rectilinear movement, an output end of the transmission mechanism is connected with the upper support, the upper support moves the sealing ring of the upper support at a first speed to contact with the sealing ring of the lower support, and then moves toward the lower support at a second speed until the sealing ring has a set deformation amount, the first opening cavity and the second opening cavity are butt-jointed to sealingly form a vacuumization region,

and the first speed is greater than the second speed;

a vacuumization assembly, wherein the vacuumization assembly is in communication with the vacuumization region through a pipe to perform vacuumization or depressurization for the vacuumization region.

[0006] According to a second aspect, the present disclosure provides a refrigerator including a storage compartment and a door opening or closing the storage compartment. The door is provided with a vacuum sealing device including an upper support, a lower support and a vacuumization assembly. Opening cavities are disposed on mutually-opposed surfaces of the upper support and/or the lower support; sealing rings are disposed around the opening cavities of the upper support and/or the lower support; the upper support may move close to or away from the lower support under the drive of a driving device; when the upper support moves close to the lower support until the upper support and the lower support are butt-joined, the opening cavities sealingly form a vacuumization region through the sealing rings; the vacuumization assembly includes a vacuum pump in communication with the vacuumization region through a pipe; a pressure detection device and a pressure relief device are further disposed on the pipe. The pressure detection device, the pressure relief device and the vacuum pump are in electrical connection with a controller respectively. After the vacuum pump is started, the pressure detection device detects the pressure of the vacuumization region. When determining that abnormal vacuumization is present in the vacuumization region according to a detection signal of the pressure detection device, the controller may control the vacuum pump to stop and start the pressure relief device to perform depressurization for the vacuumization region.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] In order to describe the technical solution of the present disclosure more clearly, the accompanying drawings involved in the examples will be briefly introduced. Apparently, those skilled the art may also obtain other drawings according to these drawings without paying creative work. Further, the accompanying drawings described below can be deemed as illustrative rather than limiting of actual sizes of the products involved in the examples of the present disclosure.

FIG. 1 is a structural schematic diagram of a refrigerator according to some examples of the present

disclosure.

FIG. 2 is a structural schematic diagram of a refrigerating door according to some examples of the present disclosure.

FIG. 3 is an exploded view of a refrigerating door according to some examples of the present disclosure.

FIG. 4 is a side sectional view of a vacuum sealing device according to some examples of the present disclosure.

FIG. 5 is a structural schematic diagram of an upper support of a vacuum sealing device along forward and reverse directions according to some examples of the present disclosure.

FIG. 6 is an assembly schematic diagram of an upper support, a driving device and a vacuumization assembly in a vacuum sealing device according to some examples of the present disclosure.

FIG. 7 is an exploded view of an upper support, a driving device and a vacuumization assembly in a vacuum sealing device according to some examples of the present disclosure.

FIG. 8 is a schematic diagram of connection relationship of an upper support in a vacuum sealing device and a filtering container according to some examples of the present disclosure.

FIG. 9 is a schematic diagram of connection relationship of an upper support in a vacuum sealing device and a filtering net according to some examples of the present disclosure.

FIG. 10 is an exploded view of an upper support, a heating device and a sealing ring according to some examples of the present disclosure.

FIG. 11 is a partial sectional view of connection of an upper support and a heating device according to some examples of the present disclosure.

FIG. 12 is a schematic diagram of connection relationship of an upper support in an initial position and a driving device according to some examples of the present disclosure.

FIG. 13 is a schematic diagram of connection relationship of an upper support in a descending position and a driving device according to some examples of the present disclosure.

FIG. 14A is a structuralschematic diagram of a lower support, a small insulation door and a door in a locked state according to some examples of the present disclosure.

FIG. 14B is a structuralschematic diagram of a lower support, a small insulation door and a door in an unlocked state according to some examples of the present disclosure.

FIG. 14C is a structural schematic diagram of dismounting a lower support and a small insulation door from a door according to some examples of the present disclosure.

FIG. 15 is a structural schematic diagram of a small insulation door and a lower support in an assembled state along forward and reverse directions according to some examples of the present disclosure.

FIG. 16 is an exploded view of a small insulation door, a lower support and a locking hook assembly according to some examples of the present disclosure.

FIG. 17 is a structural schematic diagram of mounting a locking hook assembly to the small insulation door according to some examples of the present disclosure.

FIG. 18 is a partial sectional view of mounting a locking hook assembly to the small insulation door according to some examples of the present disclosure.

FIG. 19 is a perspective diagram of a lower locking hook according to some examples of the present disclosure.

FIG. 20 is a structural schematic diagram of an upper locking hook along forward and reverse directions according to some examples of the present disclosure.

FIG. 21 is a flowchart of a descending process of an upper support of a vacuum sealing device according to some examples of the present disclosure.

FIG. 22 is a flowchart of vacuumization plastic sealing process of a vacuum sealing device according to some examples of the present disclosure.

FIG. 23 is a flowchart of air leakage process of a vacuum sealing device and an ascending process of an upper support according to some examples of the present disclosure.

FIG. 24A is a structural schematic diagram of a lower support, a small insulation door and a door in a locked state according to some examples of the present disclosure.

FIG. 24B is a structural schematic diagram of dismounting a lower support and a small insulation door from a door according to some examples of the present disclosure.

FIG. 25 is an exploded view of a small insulation door, a lower support and a locking hook assembly according to some examples of the present disclosure.

FIG. 26A is a structural schematic diagram of a lower support, a small insulation door and a door in a locked state according to some examples of the present disclosure.

FIG. 26B is a structural schematic diagram of a small insulation door and a door in unlocked state according to some examples of the present disclosure.

FIG. 26C is a structural schematic diagram of dismounting a lower support and a small insulation door from a door according to some examples of the present disclosure.

FIG. 27 is a structural schematic diagram of a refrigerator according to some examples of the present disclosure.

FIG. 28 is an exploded view of a refrigerating door according to some examples of the present disclo-

sure.

FIG. 29 is a structural schematic diagram of a refrigerator according to some examples of the present disclosure.

FIG. 30 is an exploded view of a refrigerating door according to some examples of the present disclosure.

FIG. 31 is an exploded view of a lower support according to some examples of the present disclosure.

FIG. 32A is a structural schematic diagram of a lower support and a door in a locked state according to some examples of the present disclosure.

FIG. 32B is a structural schematic diagram of dismounting a lower support from a door according to some examples of the present disclosure.

FIG. 33A is a structural schematic diagram of a lower support and a door in a locked state according to some examples of the present disclosure.

FIG. 33B is a structural schematic diagram of dismounting a lower support from a door according to some examples of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0008] The technical solution of the present disclosure will be fully and clearly described below in combination with the accompanying drawings of the examples of the present disclosure. Apparently, the described examples are merely some of the present disclosure rather than all examples. All other examples obtained by those skilled in the art based on these examples of the present disclosure without paying creative work shall fall with the scope of protection of the present disclosure.

[0009] In the descriptions of the present disclosure, the terms "one example""some examples", "illustrative examples" "examples""specific examples" or "some embodiments" are all intended to indicate a specific feature, structure, material, or property relating to these examples or embodiments is included in at least one example or embodiment of the present disclosure. The illustrative expressions of the above terms do not necessarily refer to the same example or embodiment. In addition, the specific feature, structure, material or property may be included in any one or more examples or embodiments in a proper manner.

[0010] In the description of the present disclosure, it is to be understood that orientations or positional relationships indicated by terms such as "center", "upper", "lower", "left", "right", "vertical", "horizontal", "inside", "outside", are based on orientations or positional relationships shown in the drawings and are used only for convenience and simplification of descriptions of the present disclosure, rather than indicate or imply that the indicated apparatus or element shall have a specific orientation and be configured or operated in a specific orientation. Thus, the terms shall not be understood as limiting of the present disclosure. In addition, the terms "first", "second" and "third" are used only for descriptions and shall not be understood as indicating or implying relative importance.

[0011] In the descriptions of the present disclosure, it is noted that the terms "mounting""connection" and "coupling" shall be understood in a broad sense, for example, it may be a fixed connection, or a detachable connection, or integrated connection; or direct connection or an indirect connection through an intermediate medium, or may be internal communication between two elements. Those skilled in the art may understand the specific meanings of the above terms in the present disclosure according to the specific situations.

[0012] In addition, the technical features involved in the different examples described below may be combined with each other as long as they do not constitute conflict.

[0013] FIG. 1 is a structural schematic diagram of a refrigerator according to some examples of the present disclosure. As shown in FIG. 1, the refrigerator 1 has an approximate cuboid shape and its external appearance is defined by a storage compartment 100 defining a storage space and a plurality of doors 200 disposed in the storage compartment 100. FIG. 2 is a structural schematic diagram of a refrigerating door according to some examples of the present disclosure. The door 200 includes a door housing 210 at an outer side of the storage compartment 100, an door inner liner 220 at an inner side of the storage compartment 100, an upper end cover 230, a lower end cover 240, and an insulation layer disposed among the door housing 210, the door inner liner 220, the upper end cover 230 and the lower end cover 240. Generally, the insulation layer is formed by filling with foaming material.

[0014] The storage compartment 100 includes a box with opening. The storage compartment 100 is vertically divided into a lower freezing compartment 100A and an upper refrigerating compartment 100B. Each of the partitioned spaces may have an independent storage space. Specifically, the freezing compartment 100A is at the lower part of the storage compartment 100 and may be selectively covered by a drawer-type freezing compartment door A. The space above the freezing compartment 100A is divided into a left side and a right side to form the refrigerating compartment 100B respectively. The refrigerating compartment 100B may be selectively closed or opened by a refrigerating door 200B pivotably mounted on the refrigerating compartment 100B.

[0015] FIG. 3 is an exploded view of a refrigerating door according to some examples of the present disclosure. FIG. 4 is a side sectional view of a vacuum sealing device according to some examples of the present disclosure. As shown in FIGS. 3 and 4, a vacuum sealing device 300 is provided on the door 200 of the refrigerator to perform vacuumization and plastic sealing for storage bags.The vacuum sealing device 300 may be disposed on a freezing door 200A or may be disposed on a refrigerating door 200B. Because the refrigerating door 200B is located above, the vacuum sealing device 300 is gen-

erally preferably disposed on the refrigerating door 200B so as to meet the use habit of users.

[0016] FIG. 4 is a side sectional view of a vacuum sealing device according to some examples of the present disclosure.FIG. 5 is a structural schematic diagram of an upper support of a vacuum sealing device along forward and reverse directions according to some examples of the present disclosure.FIG. 6 is an assembly schematic diagram of an upper support, a driving device and a vacuumization assembly in a vacuum sealing device according to some examples of the present disclosure.FIG. 7 is an exploded view of an upper support, a driving device and a vacuumization assembly in a vacuum sealing device according to some examples of the present disclosure.FIG. 8 is a schematic diagram of connection relationship of an upper support in a vacuum sealing device and a filtering container according to some examples of the present disclosure.FIG. 9 is a schematic diagram of connection relationship of an upper support in a vacuum sealing device and a filtering net according to some examples of the present disclosure.FIG. 10 is an exploded view of an upper support, a heating device and a sealing ring according to some examples of the present disclosure.FIG. 11 is a partial sectional view of connection of an upper support and a heating device according to some examples of the present disclosure.FIG. 12 is a schematic diagram of connection relationship of an upper support in an initial position and a driving device according to some examples of the present disclosure.FIG. 13 is a schematic diagram of connection relationship of an upper support in a descending position and a driving device according to some examples of the present disclosure.FIG. 14A is a structural schematic diagram of a lower support, a small insulation door and a door in a locked state according to some examples of the present disclosure.FIG. 14B is a structural schematic diagram of a lower support, a small insulation door and a door in an unlocked state according to some examples of the present disclosure.FIG. 14C is a structural schematic diagram of dismounting a lower support and a small insulation door from a door according to some examples of the present disclosure.FIG. 15 is a structural schematic diagram of a small insulation door and a lower support in an assembled state along forward and reverse directions according to some examples of the present disclosure.FIG. 16 is an exploded view of a small insulation door, a lower support and a locking hook assembly according to some examples of the present disclosure.FIG. 17 is a structural schematic diagram of mounting a locking hook assembly to the small insulation door according to some examples of the present disclosure.

[0017] FIGS. 4-17 illustrate an example of the vacuum sealing device 300 according to some examples of the present disclosure. As shown in FIG. 4, the vacuum sealing device 300 includes a lower support 310, provided with a first opening cavity 311; and an upper support 320 provided with a second opening cavity 321. The upper support 320 may be moved close to or away from the lower support 310 under the drive of a driving device 340. After the upper support 320 moves close to the lower support 310 to be in place, the first opening cavity 311 and the second opening cavity 321 are butt-joined and sealed up to form a vacuumization region 301. The above vacuum sealing device 300 locks and unlocks the lower support 310 and the upper support 320 by controlling automatic ascent and descent of the driving device 340, thereby realizing automatic vacuum sealing and improving the degree of intelligence of the refrigerator.

[0018] In some examples, as shown in FIG. 4, in order to improve the sealing of the vacuumization region 301, sealing portions for sealing the vacuumization region 301 are disposed on the opposing surfaces of the lower support 310 and the upper support 320. Specifically, a first sealing groove 313 is disposed on the periphery of the first opening cavity 311 of the lower support 310 and a second sealing groove 323 is disposed on the periphery of the second opening cavity 321 of the upper support 320. The first sealing groove 313 and the second sealing groove 323 are opposed in position and internally provided with a sealing ring 350 respectively. The two sealing rings 350 of the first sealing groove 313 and the second sealing groove 323 seal the vacuumization region 301 inside, realizing reliable sealing of the vacuumization region 301.

[0019] In some examples, as shown in FIG. 5, the first opening cavity 311 or the second opening cavity 321 is internally provided with a limiting portion to limit an inserting position of a storage bag inserted into the vacuumization region 301, thereby preventing an opening position of the storage bag protruding out of the vacuumization region 301. Specifically, the limiting portion is a limiting rib 322 disposed in the first opening cavity 311 or the second opening cavity 321, a height of the limiting rib 322 is greater than a depth of the first opening cavity 311 or the second opening cavity 321, and a length of the limiting rib 322 is slightly lower than that of the first openingcavity 311 or the second opening cavity 321. When the user inserts the storage bag into the vacuumization region 301, the limiting rib 322 may block the storage bag from being further inserted inwardly. In other examples, an in-place detection device may also be disposed on the vacuumization region 301. Specifically, a microwave sensor or an infrared sensor may be adopted to detect the presence and absence of the storage bag inserted into the vacuumization region 301, further send a signal indicating whether the storage bag is in place to a controller. The controller may control the vacuum pump to start according to the in-place signal. By disposing the in-place detection device, whether the storage bag is in place is detected automatically and the controller further automatically controls the vacuum pump to be switched on and off.

[0020] In some examples, the vacuum sealing device 300 further includes a vacuumization assembly 330. As shown in FIGS. 6 and 7, the vacuumization assembly 330 includes a vacuum pump 331 communicating with

the vacuumization region 301 through a pipe 335. Further, a pressure detection device 332 and a pressure relief device 333 are disposed on the pipe 335. The pressure detection device 332 is specifically a pressure sensor for detecting a pressure of the vacuumization region 301, and the pressure relief device 333 is specifically an electric pressure relief valve for releasing the pressure of the vacuumization region 301 when the valve is opened. When a user performs vacuumization sealing, the vacuum pump 331 is started to perform vacuumization treatment for the vacuumization region 301. When the pressure detection device 332 detects that the pressure of the vacuumization region 301 reaches a set negative pressure value, the controller controls the vacuum pump 331 to stop. The vacuum degree of the vacuumization region 301 can be controlled by disposing the pressure sensor, and the vacuum pump 331 can be switched on and off based on the detection value of the pressure sensor, thereby guaranteeing the vacuumization effect. After the vacuumization and sealing operations are completed, the above electric pressure relief valve may be started to automatically control the pressure relief of the vacuumization region 301, thereby facilitating taking out the storage bag by users. In order to prevent foreign matters in the vacuumization region 301 entering the vacuum pump 331 through the pipe 335, a filtering protection device is also disposed on the pipe 335. In an example, as shown in FIG. 8, the filtering protection device is specifically a filtering container 334 series-connected with the pipe 335. An inlet and an outlet are disposed on an upper end of the filtering container 334, the inlet is in communication with the vacuumization region 301 through the pipe and the outlet is in communication with the vacuum pump 331 through the pipe. The foreign matters in the vacuumization region 301 enter the filtering container 334 through the pipe 335 and are trapped at the bottom of the filtering container 334, avoiding entry of the foreign matters into the vacuum pump 331. In order to clean the filtering container 334 easily, the filtering container 334 specifically includes a tank body with an opening and an upper cover detachably connected to the tank body. The inlet and the outlet are disposed on the upper cover. During cleaning, the tank body may be dismounted, thereby avoiding the problem of poor sealing of the pipe 335 caused by frequent mounting and dismounting of the pipe 335.

[0021] In another example, as shown in FIG. 9, the filtering protection device is a filtering net 336 disposed on the pipe 335. Specifically, for ease of mounting and dismounting, the filtering net 336 is disposed at a vent 324 at the connection position of the upper support 320 and the pipe 335. The user may perform mounting/dismounting or cleaning for the filtering net 336 from the lower side by moving the upper support 320 to a highest position.

[0022] One connection hole of the vacuumization region 301 connecting with the pipe 335 may be disposed. Of course, in order to prevent vacuumization failure caused by plugging of the connection hole by the foreign matters in the vacuumization region 301 in a case of single connection hole, two or more connection holes may be disposed to connect with the pipe 335 respectively. The pipes 335 are parallel-disposed to connect with a main pipe through a three-way or multi-way connector. The pressure sensor and the electronic pressure relief valve are disposed on the main pipe.

[0023] As shown in FIG. 4, the vacuum sealing device 300 further includes a sealing zone 302 at an outer side of the vacuumization region 301. The sealing zone 302 is used to perform plastic sealing treatment for the storage bag after vacuumization. The sealing zone 302 is internally provided with an insulation cushion 360 and a heating device 370 mutually opposed. Specifically, the heating device 370 is mounted in a groove of a lower surface of the upper support 320. The insulation cushions 360 are mounted in grooves of upper surfaces of the upper support 320 and the lower support 310. When the upper support 320 moves to form the sealed vacuumization region 301 with the lower support 310, the insulation cushion 360 in the sealing zone 302 abuts against the heating device 370. After vacuumization is completed, the storage bag may be quickly sealed by the heating device 370 in the sealing zone 302. After the heating device 370 works for a set time length, the driving device 340 is controlled to drive the upper support 320 to move upward so that the user may pull out the storage bag to complete the plastic sealing.

[0024] More specifically, as shown in FIGS. 10 and 11, the heating device 370 includes a heating wire 371. A heat conducting plate 373 is disposed at a lower side of the heating wire 371 to expand the heating area of the heating wire 371 so that the plastic sealing area of the storage bag is expanded to realize tight sealing. The heating wire 371 extends along a length direction of the upper support 320 and bends upward at both sides of the upper support 320. The free end of the heating wire 371 extending to an upper side of the upper support 320 is fixed at the upper support 320 through an insulation plate 372. Specifically, the insulation plate 372 is made of insulation material and shaped into a bending plate wrapped around the heating wire 371, thereby avoiding external exposure of the heating wire 371. Further, the two free ends of the heating wire 371 are connected, through a spring 375, to two conducting wires leading from a connection terminal 374. With the spring 375, the heating wire 371 can be always maintained in tensioned state so that the heating wire 371 has a higher flatness. The heat conducting plate 373 at the lower side of the heating wire 371 is in close contact with the storage bag. Thus, the problem of loose contact and incomplete sealing at a particular position due to non-flatness of the heating wire 371 is avoided.

[0025] In the above vacuum sealing device, the driving device 340 may be an electric driving device or an air pressure driving device. Because of large occupation space of the air pressure driving device, the electric driv-

ing device is adopted as the driving device 340 in this example. Specifically, as shown in FIGS. 7, 12 and 13, the driving device 340 includes a motor 341 and a transmission mechanism. The transmission mechanism is used to convert a rotational movement of the motor into a rectilinear movement, and an output end of the transmission mechanism is connected with the upper support. The transmission mechanism includes a first gear 342 fixedly connected to an output shaft of the motor and a second gear 343 meshed with the first gear 342, a third gear 344 fixedly connected with the second gear 343 and an output rack 345 meshed with the third gear 344. A pin hole is disposed at a lower side of the output rack 345, and the upper support 320 and the output rack 345 are connected through a pin shaft 346 inserted into the pin hole. Through the transmission mechanism, the rotation of the motor 341 is converted into up and down movement of the upper support 320.

[0026] In some examples, as shown in FIG. 7, a connection plate 347 is disposed between the upper support 320 and the driving device 340. The connection plate 347 is thread-connected with the upper support 320, and a guide groove 3471 is formed on the connection plate 347. A lower end of the output rack 345 is plugged into the guide groove 3471, and an elongated pin hole is disposed at the guide groove 3471 and the lower end of the output rack 345 respectively. The pin shaft 346 is inserted through the pin holes of the guide groove 3471 and the output rack 345. When the pin shaft 346 is at the lowest end of the pin hole, there is a clearance between a lower end surface of the output rack 345 and a groove bottom of the guide groove 3471 and an elastomer 348 is disposed in the clearance.

[0027] As shown in FIG. 12, at an initial position, the upper support 320 is at the highest position. During a pressing stage, as shown in FIG. 13, the driving device 340 brings the upper support 320 to move down. In order to ensure tight mating of the lower support 310 and the upper support 320, a set rotation stroke of the motor is generally taken as an in-place determination signal. Thus, by disposing the elastomer 348 between the output rack 345 and the guide groove 3471, the upper support 320 is enabled to move downward to be in contact with the lower support 310 and then the output rack 345 can continue moving a distance downwardly. Thus, the elastomer 348 is compressed to prevent stalling of the motor, thereby providing protection for the motor 341 and maintaining the pressing force stable.

[0028] During a vacuumization stage, a sealed vacuumization region 301 is formed between the lower support 310 and the upper support 320, and the upper support 320 moves downward under the action of atmospheric pressure due to decrease of air pressure. At this time, due to existence of the elongated pin hole, the output rack 345 keeps stationary when the upper support 320 moves downward, thereby providing protection for the entire driving device 340.

[0029] In order to accurately control the movement of the upper support 320 and further determine whether the upper support 320 moves to be in place, the vacuumization region 301 is enabled to form a sealed space. In an example, the motor 341 is a stepping motor 341 and whether the upper support 320 moves to be in place can be determined by detecting the rotational stroke of the stepping motor 341. In another example, a microswitch is disposed at the lower support 310 or the upper support 320. After the upper support 320 moves to be in place and then triggers the microswitch, the controller controls the driving device 340 to be stopped and locked at a current position according to a feedback signal of the microswitch. One driving device 340 may be disposed. The output gear is located in a middle region of the upper support 320. In this case, it causes an edge area of the upper support 320 and the lower support 310 to be loosely attached, resulting in air leakage of the vacuumization region 301. Thus, in order to provide sealing of the vacuumization region 301, the driving devices 340 are symmetrically disposed at both sides of the upper support 320. Correspondingly, one connection plate 347 is disposed, two guide grooves 3471 are disposed on the connection plate 347, and two output racks 345 protrude into the guide grooves 3471 respectively.

[0030] Specifically, as shown in FIGS. 6 and 7, the driving device 340 and the vacuumization assembly 330 are both mounted on a mounting base 305 at the upper side of the upper support 320. A vent 324 is disposed at the upper support 320 to communicate with the vacuumization assembly 330. Three cavities are disposed at a side of the mounting base 305, and the cavities include a vacuum pump mounting cavity 3051 at the middle position, and driving device mounting cavities 3052 at right and left sides. In order to guarantee entire aesthetics of external surface of the door 200 of the refrigerator and ease of application of the vacuum sealing device 300, as shown in FIG. 3, a mounting cavity 211 recessed inwardly is disposed on the door housing 210. The driving device 340 is connected with the upper support 320 and then connected to the mounting base 305 through a screw. The vacuumization assembly 330 is connected with the vent 324 on the upper support 320 and then mounted to the mounting base 305. In this way, one assemblyis formed and then entirely mounted into the mounting cavity 211 by inserting a screw through two support lugs at both sides of the mounting base 305. Thus, modularized assembly is realized for various parts with no part exposed out of the external surface, realizing good entirety of the device.

[0031] When the user performs plastic sealing for a storage bag, especially powder-like foods such as flour or liquid or the like by use of the vacuum sealing device 300, the powder or liquid may enter the vacuumization region 301 during vacuumization and finally accumulate in the first opening cavity 311 of the lower support 310. Therefore, in order to help the user to clean the food residues in the lower support 310, the lower support 310 is detachably mounted relative to the door 200.

[0032] The lower support 310 may be mounted on the door 200 in several manners. In this example, as shown in FIGS. 14A-14C, the lower support 310 may be detachably mounted on the door 200 from an inner side of the door 200 (i.e. a side with an inner liner). Because the heat insulation of the door 200 of the refrigerator must be ensured, a small insulation door 250 is disposed at an inner side portion of the lower support 310 facing the storage compartment 100. As shown in FIG. 14C, a mounting hole 201 communicating inside with outside is disposed on the door 200, and the lower support 310 and the small insulation door 250 are inserted into the mounting hole 201 from the inner side of the door 200, thereby realizing dismounting cleaning of the lower support 310 and insulation performance of the door 200 at the same time.

[0033] In an example, as shown in FIG. 15, the lower support 310 and the small insulation door are integrally formed. As shown in FIGS. 16 and 17, the lower support 310 and the small insulation door 250 are formed by a first housing 251 and a second housing 252 with opening cavity structures and an insulation piece disposed between the first housing 251 and the second housing 252. The first housing 251 and the second housing 252 are snap-fitted. The first housing 251 is provided with an extension arm 2511 along a direction away from the second housing 252, and the lower support 310 is formed on the extension arm 2511. The first opening cavity 311 is an open groove formed on an upper side of the extension arm 2511, and a first sealing groove 313 is formed on the periphery of the open groove.

[0034] In order to further ensure the insulation performance of the door 200 and avoid cold leakage occurring from a clearance between the mounting hole 201 and the small insulation door 250, as shown in FIGS. 16 and 17, a small door gasket 253 is disposed between the small insulation door 250 and the door inner liner 220. Specifically, a support arm 2512 is disposed at the position of the first housing 251 mated with the door inner liner 220 where the size of the support arm 2512 is greater than that of the mounting hole 201. A mounting groove surrounding the mounting hole 201 is disposed on thesupport arm 2512, and the small door gasket 253 is mounted in the mounting groove.

[0035] Specifically, in order to guarantee the small insulation door 250 is reliably fixed on the door 200, a locking device 400 disposed between the small insulation door 250 and the door inner liner 220. The locking device 400 is used to lock or unlock the small insulation door 250 on or from the door 200.

[0036] As shown in FIGS. 14A-14C, 16 and 17, the locking device 400 includes a locking hook assembly disposed on the small insulation door 250 and a locking groove 221 disposed on the door inner liner 220. The locking hook assembly includes a locking hook inserted through the small insulation door 250. The locking hook may switch between a first position and a second position. When switching to the first position, the locking hook may be mated with the locking groove 221 to realize the locking of the small insulation door 250 and when switching to the second position, may be separated from the locking groove 221 to realize unlocking of the small insulation door 250.

[0037] Specifically, in order to improve the reliability of the locking device 400, two locking grooves 221 and two locking hooks are disposed respectively. The locking grooves 221 are located at upper and lower sides of the mounting hole 201. As shown in FIGS. 15-20, the locking hook assembly includes an upper locking hook 420 and a lower locking hook 410 and a reset spring 430. As shown in FIG. 19, the lower locking hook 410 includes a hooking portion 414 mated with the locking groove 221 at the lower side, a hinging portion 412 rotatably connected with the small insulation door 250 and a handle portion 411 at the lower side of the small insulation door 250. The handle portion 411 and the hooking portion 414 are located at both sides of the hinging portion 412 respectively. The lower locking hook 410 further includes a lower connection portion 413 connecting with the upper locking hook 420, where the lower connection portion 413 extends above the handle portion 411. Specifically, an end of the lower connection portion 413 is formed into a T-shaped protrusion 4131. As shown in FIG. 20, the upper locking hook 420 includes a hooking portion 421 mated with the locking groove 221 at the upper side and an upper connection portion 423 connecting with the lower locking hook 410. Specifically, a lower end of the upper connection portion 423 is formed into an open groove structure 4231. The T-shaped protrusion 4131 is inserted into the open groove 4231 to realize connection of the upper locking hook 420 and the lower locking hook 410. The reset spring 430 is disposed between the upper locking hook 420 and an upper end surface of the small insulation door 250. More specifically, a connection shaft 422 is formed on the upper locking hook 420 and the reset spring 430 is sleeved on the connection shaft 422.

[0038] As shown in FIG. 17, a guide positioning portion is formed on an inner surface of the second housing 252, and the upper connection portion 423 is fitted on the guide positioning portion. The upper locking hook 420 may slide along the guide positioning portion. Specifically, the guide positioning portion is a snapping hook 2521 formed on the inner surface of the second housing 252. The snapping hooks 2521 are located at left and right sides of the upper connection portion 423 and extend a distance up and down, and the upper connection portion 423 is fitted between the two snapping hooks 2521.

[0039] In an initial state, the upper locking hook 420 and the lower locking hook 410 are in the first position under the elastic force of the reset spring 430 to realize the locking of the small insulation door 250 and the door inner liner 220. When the user moves the lower locking hook 410 by hand, the lower locking hook 410 rotates around the hinging portion 412, the hooking portion 414 moves downward to separate from the locking groove 221 at the lower side, and at the same time, the connec-

tion portion push up the upper locking hook 420 to move upward so that the upper locking hook 420 separates from the locking groove 221 at the upper side. In this way, the upper locking hook 420 and the lower locking hook 410 are in the second position to realize the unlocking of the small insulation door 250 and the door inner liner 220.

[0040] In order to ensure the external aesthetics of the door 200 of refrigerator, as shown in FIGS. 1 and 2, a bar table door 260 is disposed in the region of the refrigerator door 200 where the vacuum sealing device 300 is located. A lower end of the bar table door 260 is hinged with the door 200 and the bar table door 260 can be flipped to the position where it is perpendicular to the surface of the door housing 210. An upper end of the bar table door 260 is connected with the door housing 210 through a first push ejection switch 212. With the disposal of the bar table door 260 structure, in the state of the bar table door 260 being opened, the storage bag holding foods can be put on the bar table door 260 and then is subjected to vacuum sealing treatment, thereby facilitation operation of users. When the bar table door 260 is closed, the external aesthetics of door 200 can be ensured.

[0041] The inner side of the bar table door 260 further includes an operation panel 270 covered on the outer side of the mounting cavity. An inserting hole 271 is formed on the operation panel 270, and a lower surface of the inserting hole 271 is flushed with an upper surface of the first opening cavity 311. In this case, the vacuum sealing device 300 can be entirely hidden at the rear side of the operation panel 270. When performing vacuum plastic sealing, the user may directly insert the opening of the storage bag from the inserting hole 271 of the operation panel 270, and directly extend it to the upper surface of the first opening cavity 311. When the upper support 320 moves downward, the opening of the storage bag can be placed in the vacuumization region 301. Specifically, the operation panel 270 is detachably connected to the door housing 210. A display control device 272 is further disposed on the operation panel 270. The display control device 272 includes an indicating device for displaying a working state of the vacuum sealing device 300 and a control button for controlling the vacuum sealing device 300 to stop or start. The user may determine whether to pull out the storage bag according to the working state of the vacuum sealing device 300 indicated by the display control device 272. The display control device 272 includes "vacuumization plastic sealing" button, "opening sealing" button, "manual vacuumization" button, and "stop" button. Vacuumization and plastic sealing process can be realized by depressing the button "vacuumization plastic sealing", sealing operation can be realized for individual storage bag by depressing the button "opening sealing", and manual vacuumization treatment can be realized by depressing the button "manual vacuumization". For example, the "manual vaccumization" button may be set to perform automatic vacuumization for several seconds for one depress and then continue vacuumization for a second depress and repeat like this until the user thinks the vacuumization is completed. Alternatively, the user keeps depressing the "manual vacuumization" button to perform continuous vacuumization until the user stops depressing the "manual vacuumization" button. In this way, the user realizes the manual vacuumization. By depressing the "stop" button, the flow of air release and upper support ascent is performed. When the user determines that the vacuum sealing device works abnormally during the vacuumization process, the user may terminate the flow of the vacuumization in advance by depressing "stop" button.

[0042] The above vacuum sealing device performs vacuumization sealing in the following procedure including upper support descent, vacuumization plastic sealing, air release, and upper support ascent.

[0043] As shown in FIG. 21, the specific flow of the descent of the upper support 320 includes following steps:

[0044] At step 101, the upper support 320 performs first-stage descent at a first speed.

[0045] At step 102, whether the upper support 320 descends a first preset distance is determined. If yes, step 103 is performed, otherwise, step 101 is performed.

[0046] The upper support 320 descends the first preset distance at the first speed until the sealing ring of the upper support 320 is in contact with the sealing ring of the lower support 310; the upper support 320 quickly descends toward the lower support 310 at the higher first speed so that the vacuumization sealing process will take a shorter time.

[0047] At step 103, the upper support 320 performs second-stage descent at a second speed.

[0048] At step 104, whether the upper support 320 descends a second preset distance is determined. If yes, step 105 is performed, and otherwise, the step 103 is performed. The second speed is lower than the first speed.

[0049] When the upper support 320 descends the second preset distance, the sealing rings of the upper support 320 and the lower support 310 deform to a preset value, and the preset value is big enough to seal the vacuumization region; the upper support 320 moves toward the lower support 310 at the second speed under the drive of the driving device, which is a slow descending stage where the driving device increases its acting force with its speed decreased to ensure the sealing of the upper support 320 and the lower support 310.

[0050] When it is determined that the upper support 320 descends the first preset distance, the flow of vacuumization plastic sealing shown in FIG. 22 is started. The flow of vacuumization plastic sealing includes the following steps.

[0051] At step 201, the vacuum pump is started.

[0052] At step 202, whether the pressure value of the vacuumization region 301 reaches a first pressure value is determined. If yes, step 207 is performed, and other-

wise, step 203 is performed.

[0053] The pressure detection device may determine whether the pressure value of the vacuumization region 301 reaches the first pressure value. When it is determined the first pressure value is reached, the vacuumization of the vacuum pump 331 is stopped.

[0054] At step 203, whether a vacuumization time reaches a preset vacuumization time is determined. If yes, step 207 is performed, and otherwise step 204 is performed.

[0055] Whether the vacuumization time reaches the preset vacuumization time is determined. When the preset vacuumization time is reached, the vacuumization of the vacuum pump 331 may also be stopped.

[0056] At step 204, whether the pressure value of the vacuumization region 301 reaches a second pressure value is determined, where the second pressure value is smaller than the first pressure value; if yes, step 205 is performed and otherwise step 202 is performed.

[0057] At step 205, whether the change of the pressure value of the vacuumization region 301 is smaller than a third pressure value after a preset time is determined, where the third pressure value is smaller than the second pressure value; if yes, step 206 is performed and otherwise step 202 is performed.

[0058] When the pressure detection device detects that the pressure value of the vacuumization region 301 reaches the second pressure value and the change of the pressure value is smaller than the third pressure value after a preset time, it is determined the vacuumization process is abnormal, for example, the problems such as poor sealing of pressing strip, entry of foreign matters, creased sealing opening, broken bag occur. In this case, it is necessary to end the vacuumization in advance.

[0059] At step 206, vacuumization is stopped, and the vaccumization region 301 is depressurized and opened.

[0060] After it is determined that the vacuumization is abnormal, the vacuumization of the vacuum pump 331 may be stopped, and the vacuumization region 301 is depressurized by the pressure relief device.

[0061] At step 207, the vacuumization is stopped to heat the sealing opening.

[0062] After the vacuumization step is completed, the vacuum pump is stopped and the heating wire is started to perform hot melting plastic sealing for the storage bag.

[0063] At step 208, after the time for heating the sealing opening reaches a heating time, air release stage is started after a delay of a first time.

[0064] After the sealing opening heating device performs heating plastic sealing for the storage bag for the heating time, the air release stage may be started after a delay of the first time. The heating time and the first time may be set according to experiences.

[0065] As shown in FIG. 23, the specific flow of the above air release and upper support ascent includes the following steps.

[0066] At step 301, an air release device performs air release. Pipe air release is performed by opening an air release valve.

[0067] At step 302, the air release device determines whether the air release exceeds an air release time. If yes, step 303 is performed and otherwise step 301 is performed. The air release time may be set according to experiences.

[0068] At step 303, the driving device controls the upper support 302 to ascend.

[0069] The driving device may drive the upper support 320 to move up at a third speed to separate from the lower support 310 so as to open the vacuumization region 301.

[0070] At step 304, whether the upper support 301 ascends a set step number is determined. If yes, the ascending is ended and otherwise step 301 is performed.

[0071] After the upper support 320 ascends the preset step number, the next vacuumization sealing operation may be prepared. The preset step number may be a step number for the upper support 320 to arrive at the vacuumization region 301.

[0072] It is noted that the first speed is greater than the second speed, the third speed is greater than the second speed, the first preset distance, the second preset distance, the first speed, the second speed and the third speed all may be set according to experiences, and the first preset distance and the second preset distance can be realized by controlling a preset advancing step number of the electric motor.

[0073] FIG. 24A is a structural schematic diagram of a lower support, a small insulation door and a door in a locked state according to some examples of the present-disclosure. FIG. 24B is a structural schematic diagram of dismounting a lower support and a small insulation door from a door according to some examples of the present disclosure. In some examples of the present disclosure, as shown in FIGS 24A and 24B, the lower support 310 is detachably connected to the small insulation door 250. As shown in FIG. 25, the small insulation door 250 is formed of the first housing 251 and the second housing 252 with opening cavity structures and the insulation piece disposed between the first housing 251 and the second housing 252. The first housing 251 is snap-fitted with the second housing 252, the extension arm 2511 is disposed on the first housing 251 along a direction away from the second housing 252, and the lower support 310 is detachably connected to the extension arm 2511.

[0074] In some examples, a first limiting portion extending upward is formed on an end of the extension arm 2511, a second limiting portion mated with the first limiting portion is formed on a lower side of the lower support 310, and the first limiting portion and the second limiting portion are mated to position the lower support 310 on the extension arm 2511. More specifically, the first limiting portion is a limiting plate and the limiting portion is a baffle plate formed on the bottom of the lower support 310 and extending downwardly. The baffle plate is inserted into the inner side of the limiting plate to mount the lower support 310 to the extension arm 2511, thus

avoiding the problem of poor sealing of the vacuumization region caused by horizontal movement of the lower support 310.

[0075] In order to further guarantee the heat insulation of the door 200 and avoid cold leakage occurring from the clearance between the mounting hole 201 and the small insulation door 250, the small door gasket 253 is disposed between the small insulation door 250 and the door inner liner 220. Specifically, the support arm 2512 is disposed at the position of the first housing 251 mated with the door inner liner 220, and the size of the support arm 2512 is greater than that of the mounting hole 201. Amounting groove surrounding the mounting hole 201 is disposed on the support arm 2512 and the small door gasket 253 is mounted in the mounting groove.

[0076] Specifically, in order to guarantee the small insulation door 250 can be reliably fixed on the door 200, the locking device 400 is disposed between the small insulation door 250 and the door inner liner 220.

[0077] FIG. 25 is an exploded view of a small insulation door, a lower support and a locking hook assembly according to some examples of the present disclosure. As shown in FIG. 25, the locking device 400 includes a locking hook 440 hinged at the bottom of the small insulation door 250. The middle of the locking hook 440 is provided with a hinging shaft for connecting with the small insulation door 250 to connect with the small insulation door 250. The locking device further includes a locking groove formed on the door inner liner 220 to mate with the locking hook and a reset torsion spring 450 sleeved on the hinging shaft. One support leg of the reset torsion spring is abutted against the small insulation door 250 and the other support leg is abutted against the locking hook 440. In an initial state, the torsional force of the reset torsion spring 450 enables the locking hook 450 to be in the first position so that the small insulation door 250 can be mounted on the door.

[0078] Specifically, in order to improve the aesthetics of the small door, a mounting recess is formed on the bottom of the small door and the locking hook is mounted into the mounting recess. FIGS. 24A and 24B show a process of dismounting the small insulation door 250 and the lower support 310. When the small insulation door 250 and the lower support 310 are mounted on the door 200, the locking hook is mated with the locking groove to realize the locked state of the small insulation door 250. When the small insulation door 250 and the lower support 310 are to be dismounted, the locking hook is moved away from the locking groove, the locking device 400 is in an unlocked state, and the small insulation door 250 and the lower support 310 can be pulled out. After the lower support 310 is removed from thesmall insulation door 250, cleaning can be performed for the lower support 310. In this example, the lower support 310 is detachably connected to the small insulation door 250, facilitating cleaning the lower support 310.

[0079] FIG. 26A is a structural schematic diagram of a lower support, a small insulation door and a door in a locked state according to some examples of the present disclosure. FIG. 26B is a structural schematic diagram of a small insulation door and a door in an unlocked state according to some examples of the present disclosure. FIG. 26C is a structural schematic diagram of dismounting a lower support and a small insulation door from a door according to some examples of the present disclosure.

[0080] In some examples of the present disclosure, as shown in FIGS. 26A-26C, the lower support 310 and the small insulation door 250 are disposed independent from each other. The lower side of the mounting hole 201 is provided with a limiting portion limiting the lower support 310 to be in place, one end of the lower support 310 is abutted against the limiting portion and the other end is abutted against the small insulation door 250. In this case, the small insulation door 250 can be mounted to the door 200 by use of the locking device 400 of example 1 or 2.

[0081] FIG. 27 is a structural schematic diagram of a refrigerator according to some examples of the present disclosure. FIG. 28 is an exploded view of a refrigerating door according to some examples of the present disclosure. In some examples of the present disclosure, as shown in FIGS. 27 and 28, in order to ensure the external aesthetics of the door 200 of the refrigerator and avoid exposure of the vacuum sealing device 300 at the outer side of the door 200, an auxiliary door plate 280 is disposed at the area of the door 200 where the vacuum sealing device 300 is located. The auxiliary door plate 280 has a width identical with that of other area of the door 200. The auxiliary door plate 280 is connected to the area by snap fitting or bonding. A surface of the auxiliary door plate 280 is flushed with the surface of other area of the door 200. An inserting hole 281 is formed on the auxiliary door plate 280 and a lower surface of the inserting hole 281 is flushed with the upper surface of the first opening cavity 311. When performing vacuum plastic sealing, the user may directly insert the opening of the storage bag from the inserting hole 281 of the auxiliary door plate 280 and directly extend it to the upper surface of the first opening cavity 311. When the upper support 320 moves downward, the opening of the storage bag can be placed in the vacuumization region 301. A display control device 282 is further disposed on the auxiliary door plate 280. The display control device 282 includes an indicating device for displaying a working state of the vacuum sealing device 300 and a control button for controlling the vacuum sealing device 300 to stop or start. The user may determine whether to pull out the storage bag according to the working state of the vacuum sealing device 300 indicated by the indicating device.

[0082] FIG. 29 is a structural schematic diagram of a refrigerator according to some examples of the present disclosure. FIG. 30 is an exploded view of a refrigerating door according to some examples of the present disclosure. FIG. 31 is an exploded view of a lower support according to some examples of the present disclosure.

In some examples of the present disclosure, as shown in FIGS. 29-31, the lower support 310 is detachably mounted to the door 200 from the outer side of the door 200.

[0083] In some examples, the lower support 310 is detachably connected to the door 200 by push ejection. As shown in FIGS. 29 and 30, a connection surface of the lower support 310 connecting with the door 200 is provided with a second push ejection switch 380. The second push ejection switch 380 includes a push ejection lock 381, and a lock catch 382. A groove for receiving the lock catch 382 is disposed on an inner side surface of the lower support 310 and the push ejection lock 381 is fixed on the outer side surface of the door 200.

[0084] FIG. 32A is a structural schematic diagram of a lower support and a door in a locked state according to some examples of the present disclosure. FIG. 32B is a structural schematic diagram of dismounting a lower support from a door according to some examples of the present disclosure. As shown in FIG. 32A, when the lower support 310 is pressed along a direction perpendicular to the door 200, the push ejection lock 381 is fitted with the lock catch 382, and the lower support 310 is mounted on the door 200. As shown in FIG. 32B, when the lower support 310 is pressed again, the push ejection lock 381 releases the lock catch 382 so that the lower support 310 is dismounted from the door 200. In this way, the user may perform cleaning for the lower support 310 separately, facilitating user operation.

[0085] In some examples of the present disclosure, as shown in FIGS. 33A and 33B, the lower support 310 is detachably mounted to the door 200 from the outer side of the door 200.

[0086] In some examples, the lower support 310 is detachably connected to the door 200 by snap fitting. A first fitting portion 391 and a second fitting portion 392 mutually mated are formed respectively on the lower support 310 and the door 200. The first fitting portion 391 is formed on the lower surface of the lower support 310 and specifically is a bending hook. The second fitting portion 392 is fixedly connected to a front side surface of the door 200. The lower support 310 moves close to the door 200 until the first fitting portion 391 and the second fitting portion 392 are mated, realizing the mounting of the lower support 310. During dismounting, the lower support 310 is pulled outwardly, and the first fitting portion 391 and the second fitting portion 392 are separated due to elastic deformation. Thus, the user can perform separate cleaning for the lower support 310, facilitating user operation.

[0087] Obviously, the above examples are only used to clearly describe the present disclosure rather than limit the present disclosure. Those skilled in the prior art may make different types of other changes or modifications based on the above descriptions. All examples are not necessarily or cannot be exhausted herein. All apparent changes or modifications derived herein still fall within the scope of protection of the present disclosure.

Claims

1. A refrigerator, comprising a vacuum sealing device disposed at an outer side of a door, wherein the vacuum sealing device comprises:

   a lower support, wherein an upper side of the lower support are provided with a first opening cavity and a sealing ring surrounding the first opening cavity;
   an upper support, wherein a lower side of the upper support is provided with a second opening cavity and a sealing ring surrounding the second opening cavity;
   a driving device including a motor and a transmission mechanism, wherein the upper support moves close to or away from the lower support under the drive of the driving device, the upper support moves at a second speed until the sealing ring has a preset deformation amount after the upper support moves at a first speed until the sealing ring of the upper support is in contact with the sealing ring of the lower support, the first opening cavity and the second opening cavity are butt-joined to sealingly form a vacuumization region, and the first speed is greater than the second speed;
   a vacuumization assembly, wherein the vacuumization assembly is in communication with the vacuumization region through a pipe to perform vacuumization or depressurization for the vacuumization region.

2. The refrigerator according to claim 1, wherein,
   the vacuum sealing device further comprises a sealing zone comprising a heating wire at a lower side of the upper support and an insulation cushion at an upper side of the lower support; when the pressure of the vacuumization region satisfies a preset condition, the heating wire performs hot melting plastic sealing for a storage bag inserted into the sealing zone.

3. The refrigerator according to claim 1, wherein the vacuumization assembly comprises a vacuum pump and a pressure detection device for detecting a pressure of the vacuumization region; after the upper support and the lower support are butt-j oined, the vacuum pump is started; when a pressure value detected by the pressure detection device is smaller than a first preset value, the vacuum pump is shut down.

4. The refrigerator according to claim 2, wherein the vacuumization assembly further comprises a pressure relief device in communication with the vacuumization region through a pipe; after the heating wire works for a first preset time, the pressure relief device

is used to perform depressurization for the vacuumization region, and after the pressure relief device completes depressurizing for a second preset time, the upper support moves upward at a third speed under the drive of the driving device until the upper support restores to an initial position; wherein the third speed is greater than the second speed.

5. The refrigerator according to claim 1, wherein the driving device comprises a motor and a transmission mechanism, the transmission mechanism is used to convert a rotational movement of the motor into a rectilinear movement, and an output end of the transmission mechanism is connected with the upper support; the transmission mechanism comprises a gear and rack transmission mechanism, a pin hole is disposed at a lower side of an output rack of the gear and rack transmission mechanism, the upper support and the output rack are connected by a pin shaft inserted through the pin hole, and the pin hole is an elongated hole extending longitudinally.

6. The refrigerator according to claim 5, wherein the gear and rack transmission mechanism comprises a first gear fixedly connected to an output shaft of the motor, a second gear meshed with the first gear, a third gear fixedly connected to the second gear, and the output rack meshed with the third gear.

7. The refrigerator according to claim 6, wherein a connection plate is disposed between the upper support and the driving device, the connection plate is thread-connected with the upper support, a guide groove is formed on the connection plate, a lower end of the output rack is inserted into the guide groove, and the pin shaft is inserted through the pin holes of the guide groove and theoutput rack.

8. The refrigerator according to claim 7, wherein when the pin shaft is at the lowest end of the pin hole, there is a clearance between a lower end surface of the output rack and a groove bottom of the guide groove, and an elastomer is disposed in the clearance.

9. The refrigerator according to claim 8, wherein two driving devices are symmetrically disposed at both sides of the upper support, one connection plate is disposed, and two guide grooves are disposed on the connection plate; and two output racks are inserted into the guide grooves respectively.

10. The refrigerator according to claim 1, wherein the driving device and the vacuumization assembly are mounted on one mounting base, a mounting cavity recessed inwardly is disposed on a door housing, and the mounting base and the upper support are mounted into the mounting cavity.

11. A refrigerator, comprising a storage compartment and a door opening or closing the storage compartment, wherein a vacuum sealing device is disposed on the door and comprises:

an upper support and a lower support; wherein opening cavities are disposed on mutually-opposed surfaces of the upper support and/or the lower support; sealing rings surrounding the opening cavities of the upper support and/or the lower support are disposed; the upper support moves close to or away from the lower support under the drive of a driving device; when the upper support moves close to the lower support until the upper support and the lower support are butt-joined, the opening cavities sealingly form a vacuumization region by sealing rings;
a vacuumization assembly, wherein the vacuumization assembly comprises a vacuum pump in communication with the vacuumization region through a pipe; a pressure detection device and a pressure relief device are further disposed on the pipe, the pressure detection device, the pressure relief device and the vacuum pump are in electrical connection with a controller respectively, the pressure detection device detects a pressure of the vacuumization region after the vacuum pump is started, and when the controller determines the vacuumization region is abnormal according to a detection signal of the pressure detection device, the controller controls the vacuum pump to stop and starts the pressure relief device to perform depressurization for the vacuumization region.

12. The refrigerator according to claim 11, wherein the controller is configured to determine that the vacuumization is abnormal when a pressure value of the vacuumization region reaches a first pressure value and the change of the pressure value is smaller than a second pressure value within a preset time, wherein the first pressure value is greater than the second pressure value.

13. The refrigerator according to claim 12, wherein the controller is configured to control the vacuum pump to stop when it is determined that the pressure value of the vacuumization region reaches a third pressure value or a vacuumization time reaches a preset vacuumization time, wherein the third pressure value is greater than the first pressure value.

14. The refrigerator according to claim 11, wherein the lower support is detachably connected to the door and the vacuumization region is in communication with the uppersupportthrough a pipe.

15. The refrigerator according to claim 11, wherein the

vacuum sealing device further comprises a sealing zone comprising a heating wire at a lower side of the upper support and an insulation cushion at an upper side of the lower support; when vacuumization is completed in the vacuumization region, the heating wire is used to perform hot melting plastic sealing for a storage bag inserted into the sealing zone.

16. The refrigerator according to claim 11, wherein the driving device comprises a motor and a transmission mechanism used to convert a rotational movement of the motor into a rectilinear movement, and an output end of the transmission mechanism is connected with the upper support.

17. The refrigerator according to claim 14, wherein after the upper support moves at a first speed under the drive of the driving device until the sealing ring of the upper support is in contact with the sealing ring of the lower support, the upper support moves toward the lower support at a second speed until the sealing ring has a preset deformation amount, wherein the first speed is greater than the second speed.

18. The refrigerator according to claim 17, wherein after the pressure relief device works for a set time, the upper support moves upward at a third speed under the drive of the driving device until the upper support restores to an initial position, wherein the third speed is greater than the second speed.

19. The refrigerator according to claim11, wherein the driving device and the vacuumization assembly are mounted in one mounting base, a mounting cavity recessed inwardly is formed on a door housing, and the mounting base and the upper support are mounted into the mounting cavity.

20. The refrigerator according to claim 19, wherein three cavities are disposed at a side of the mounting base, comprising a vacuum pump mounting cavity at a middle position, and driving device mounting cavities at left and right sides; the side of the mounting base having the cavities faces the door housing and fixed on the door housing through a screw.

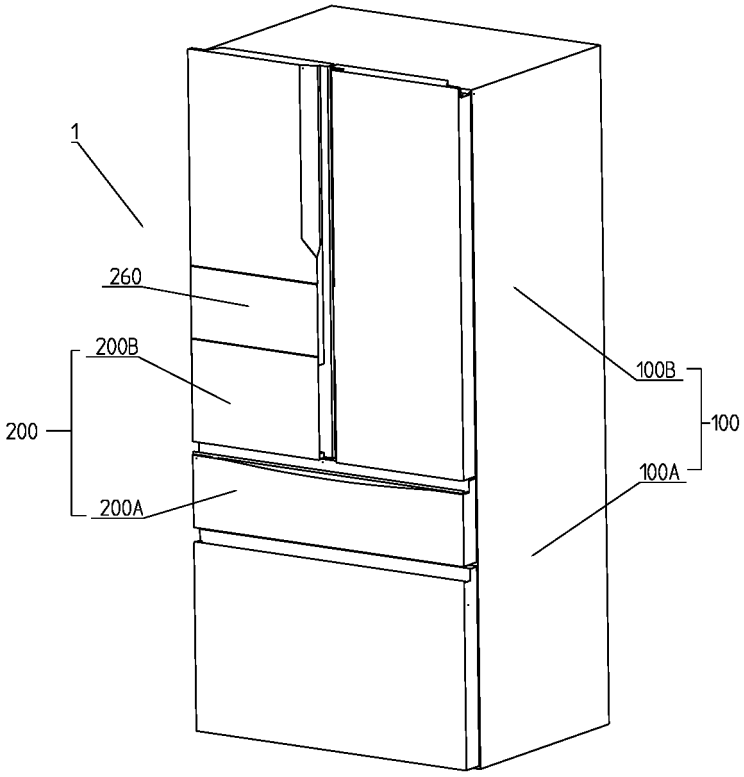
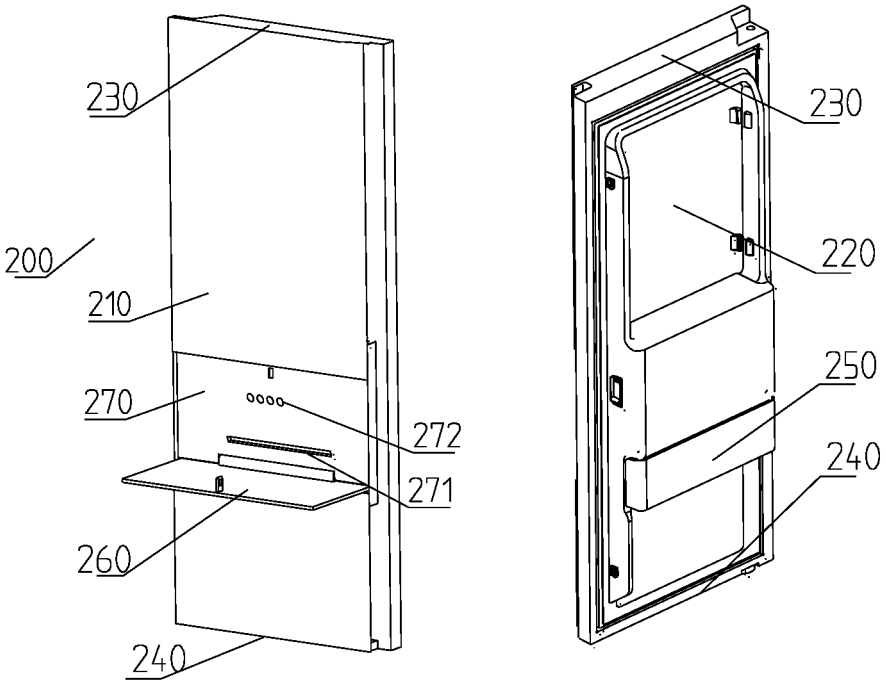

1
260
200B
200
200A
100B
100
100A

FIG. 1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272
271
260
240
230
220
250
240

FIG. 2

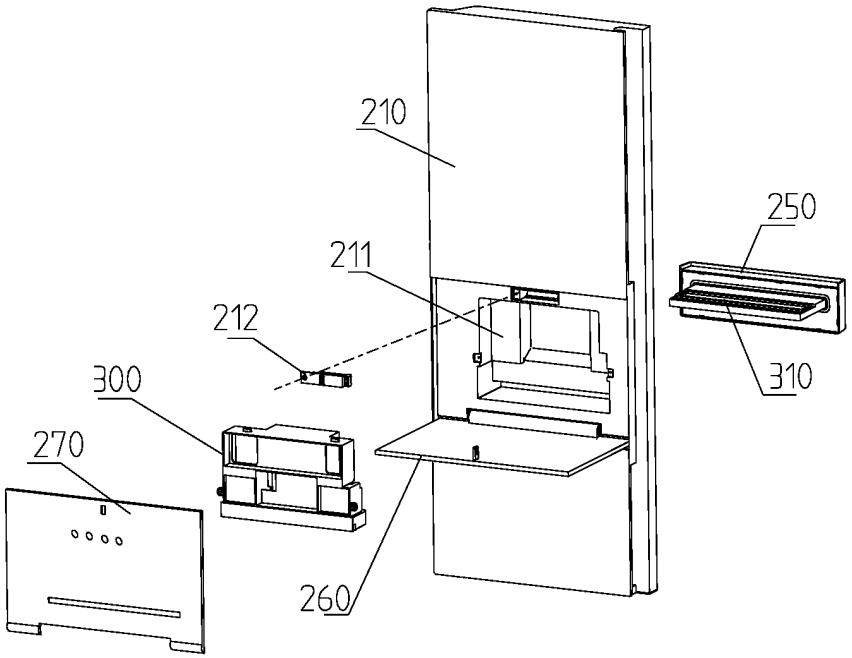

210
250
211
212
310
300
270
260

FIG. 3

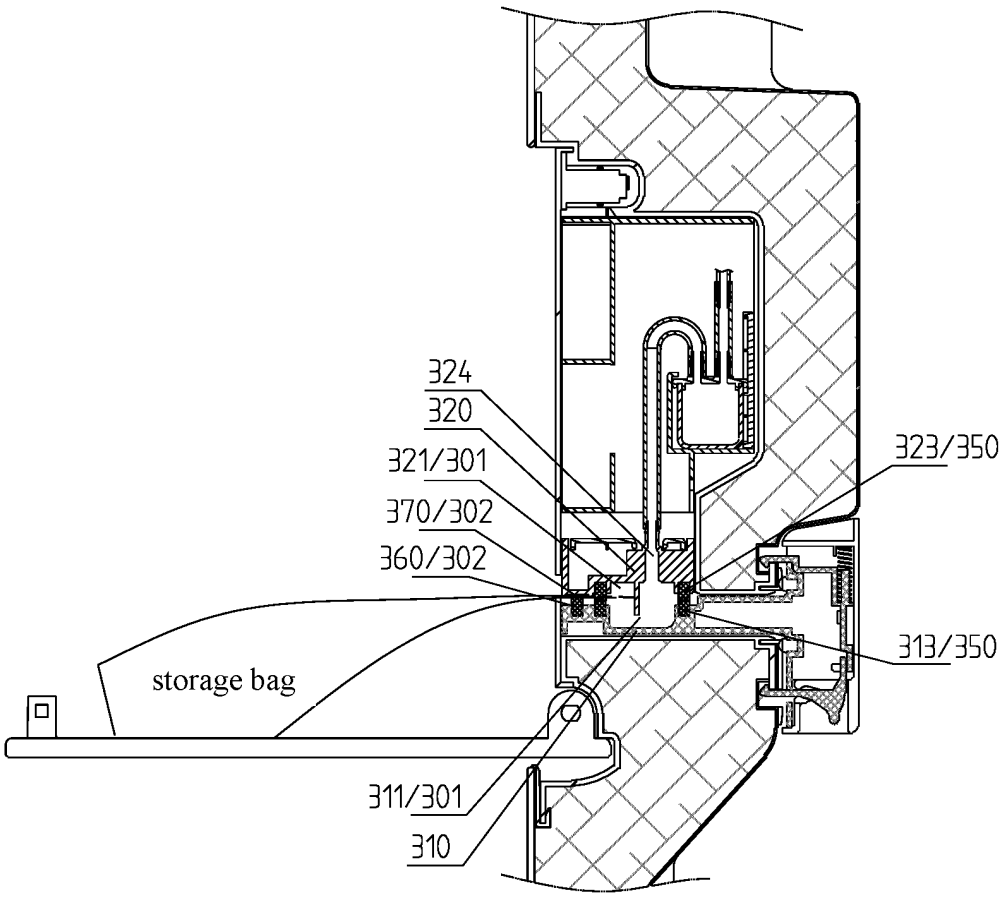
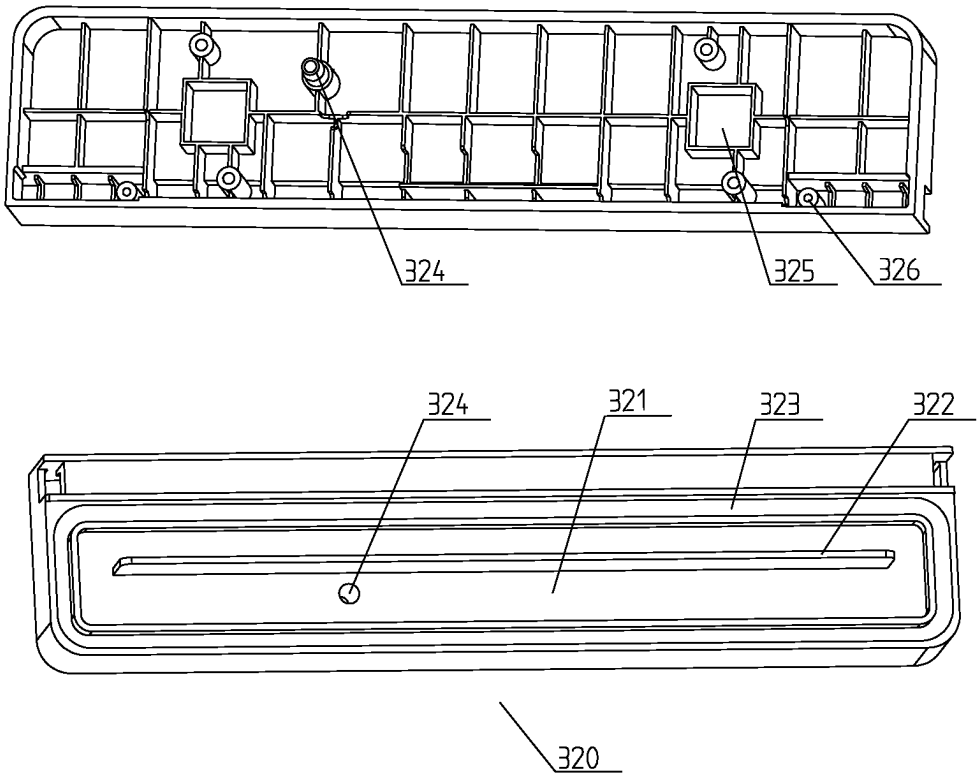

324
320
321/301
370/302
360/302
323/350
313/350
storage bag
311/301
310

FIG. 4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325
326
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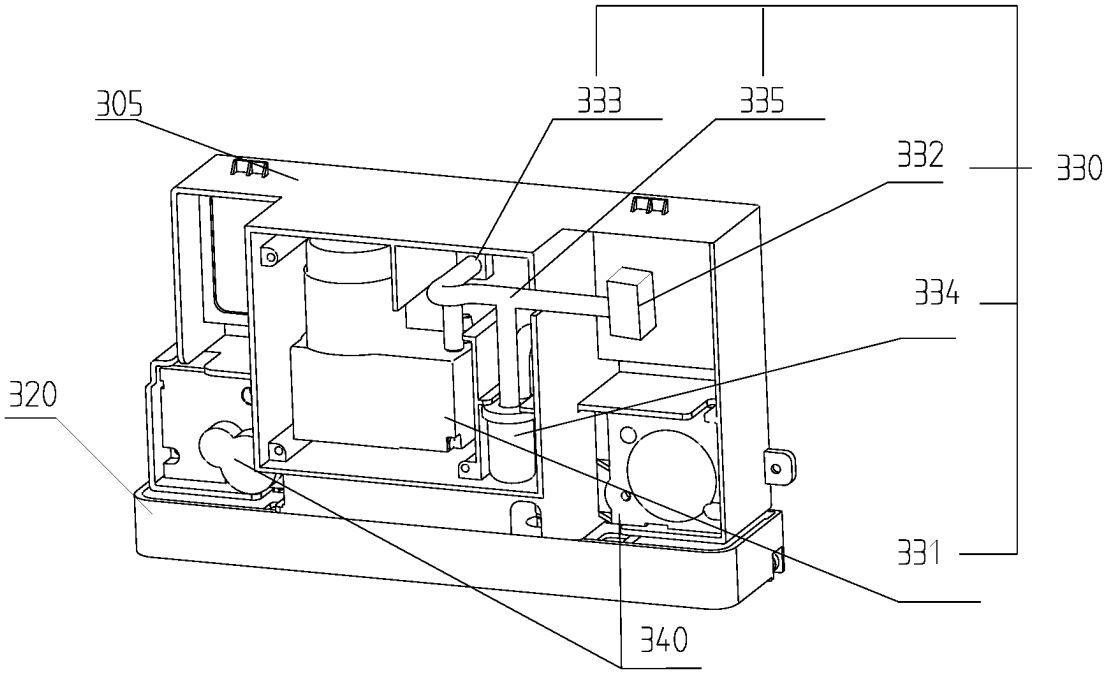
321
323
322
320

FIG. 5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333
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330
334
320
331
340

FIG. 6

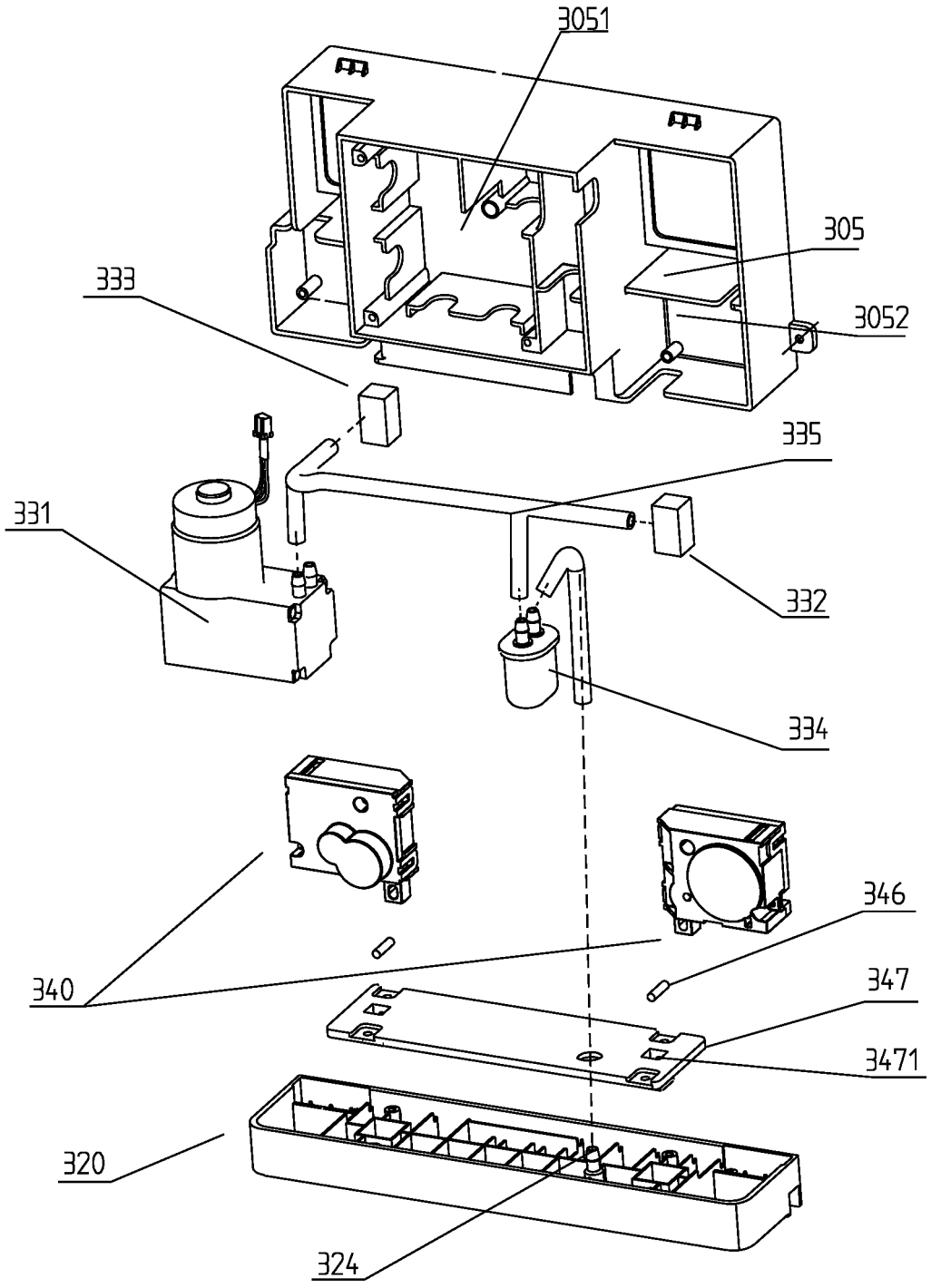


FIG. 7

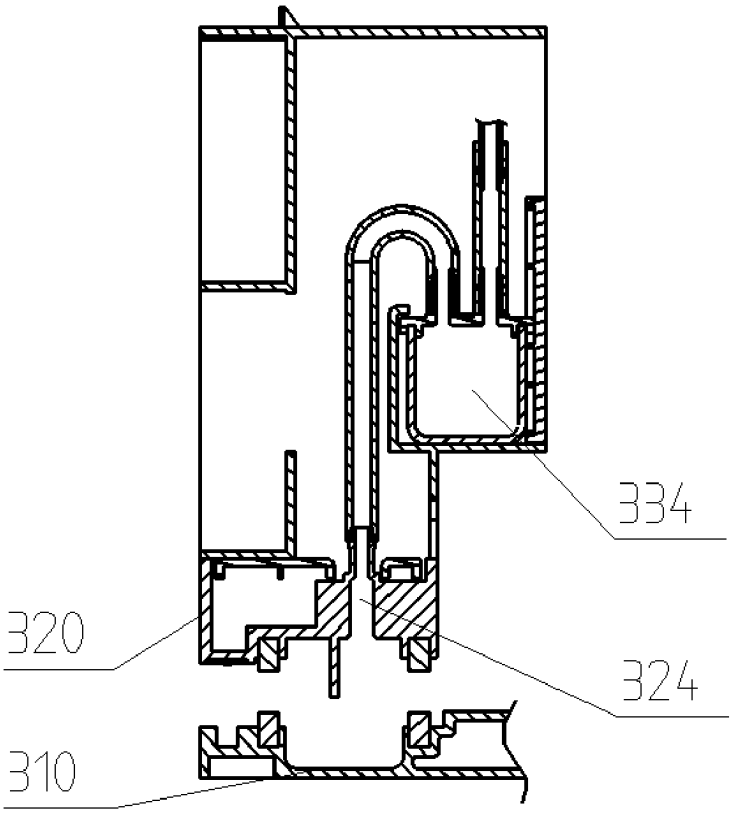


FIG. 8

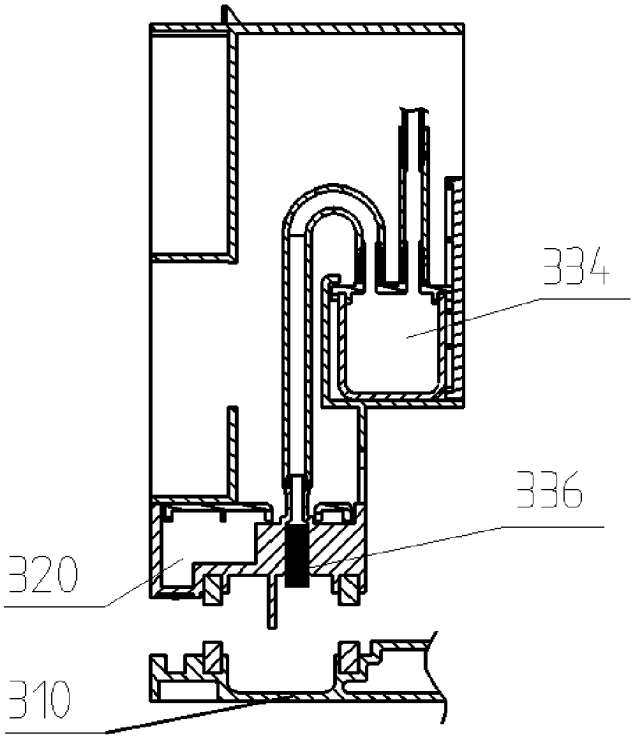


FIG. 9

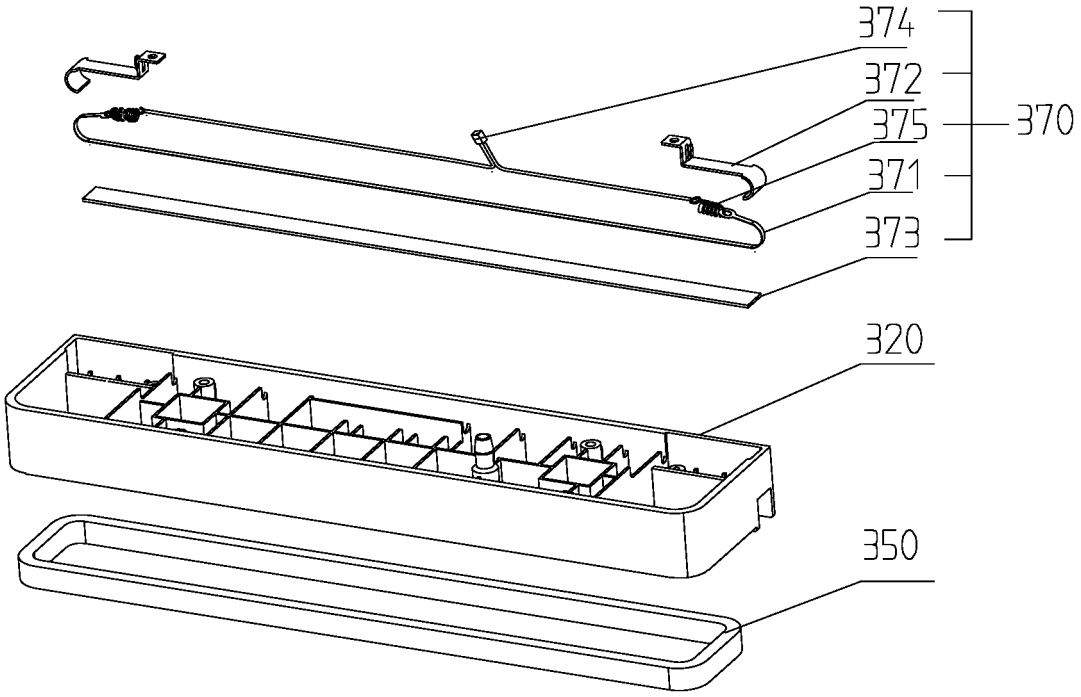


FIG. 10

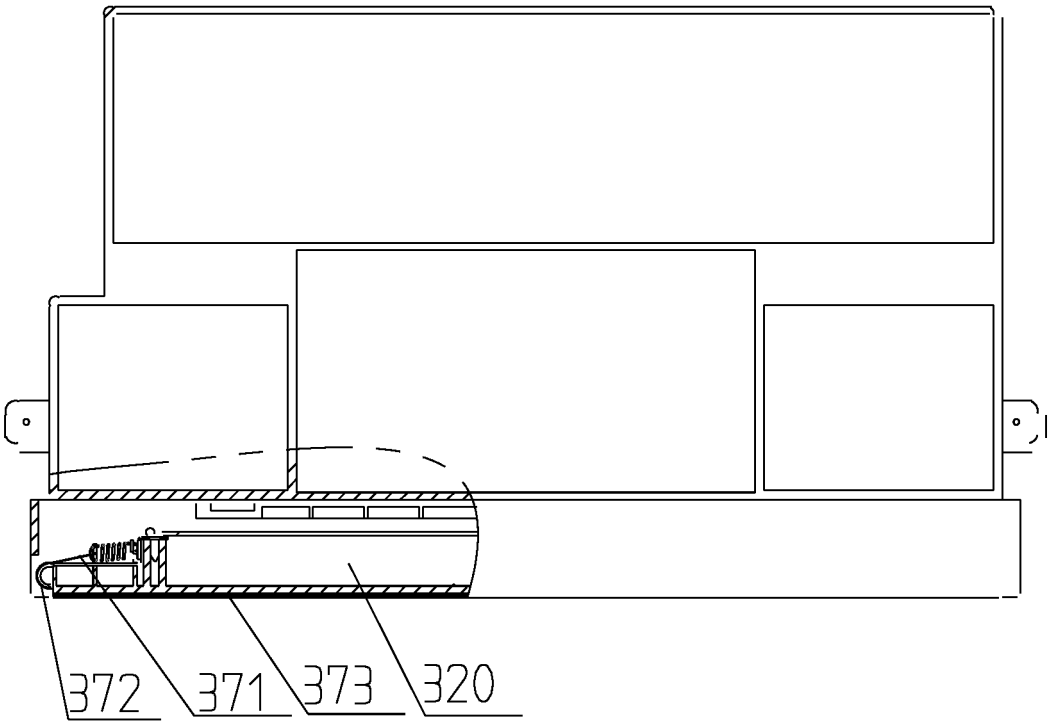


FIG. 11

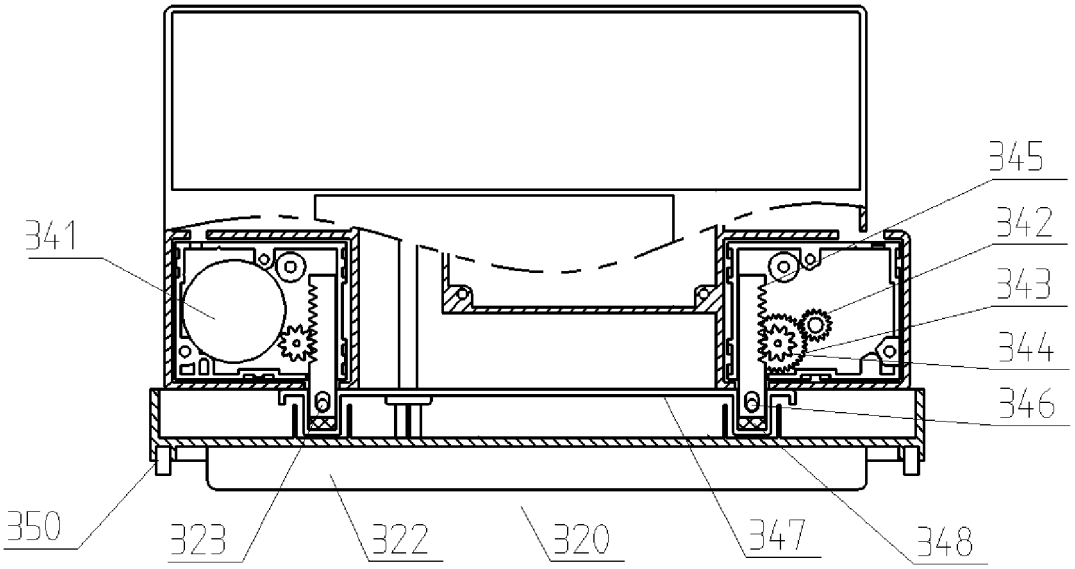
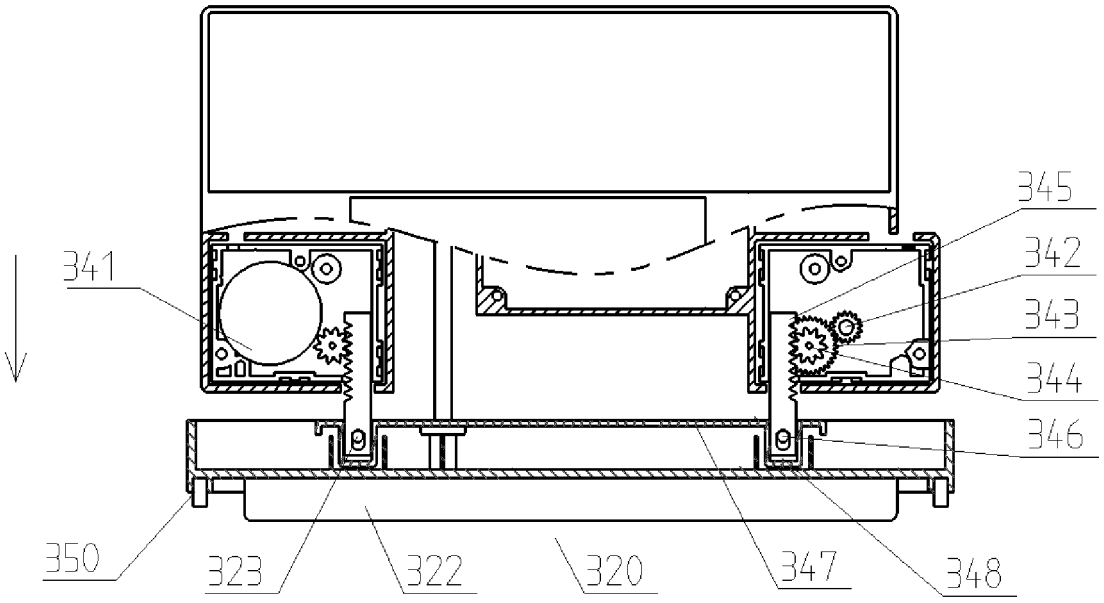

345
342
343
344
346
341
350
323
322
320
347
348

FIG. 12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342
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341
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323
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320
347
348

FIG. 13

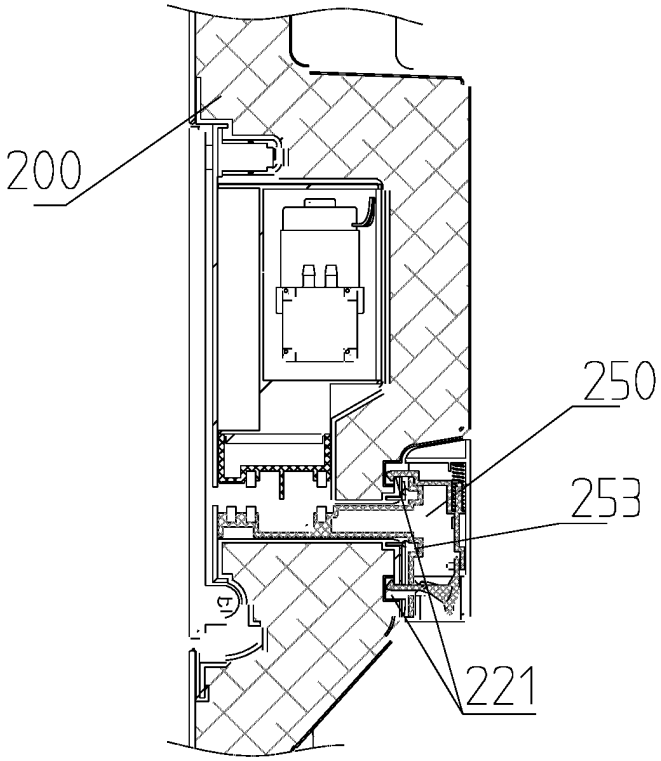


FIG. 14A

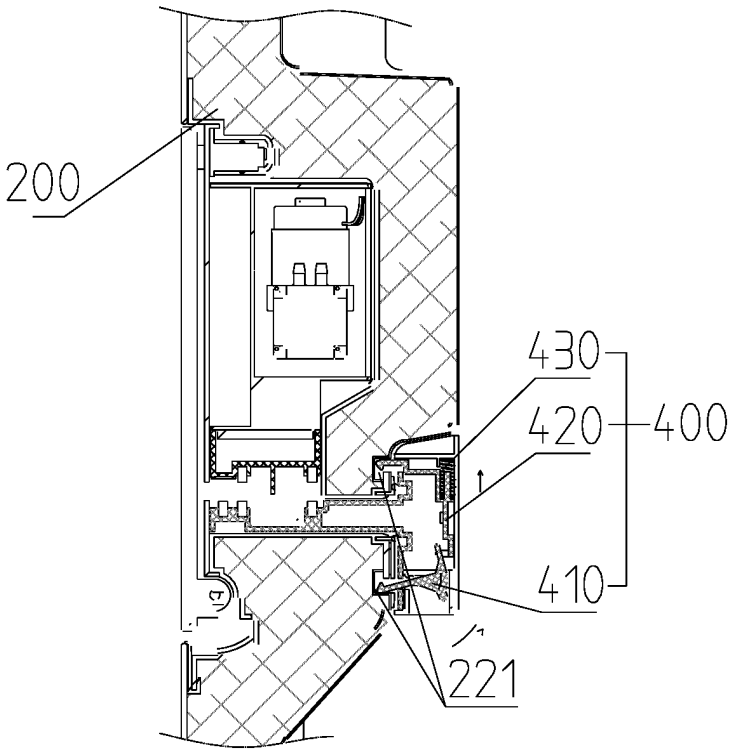


FIG. 14B

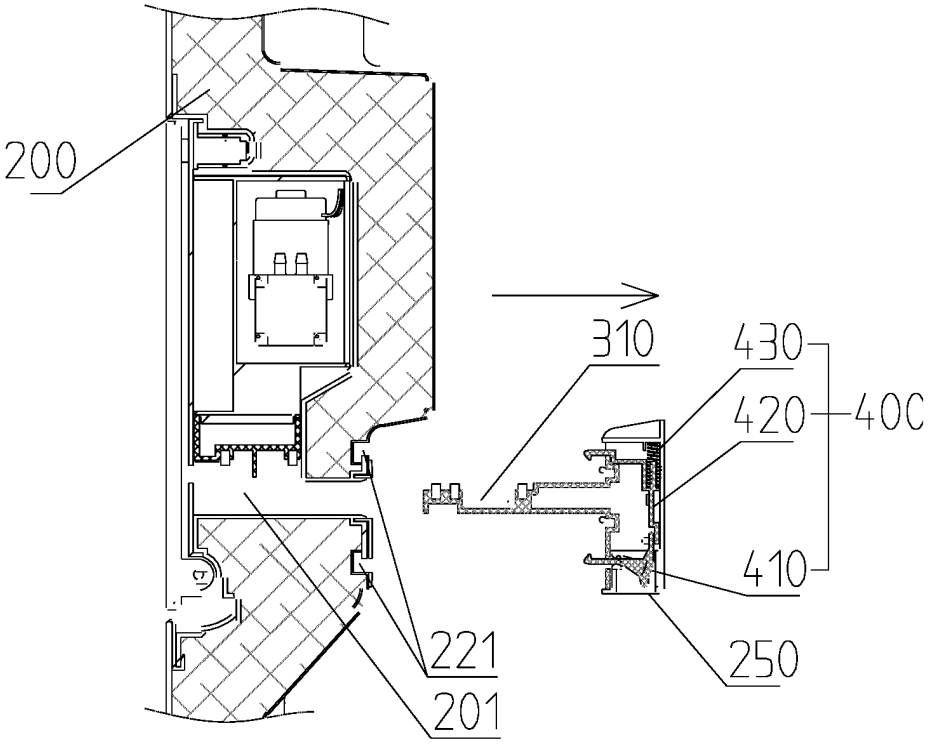


FIG. 14C

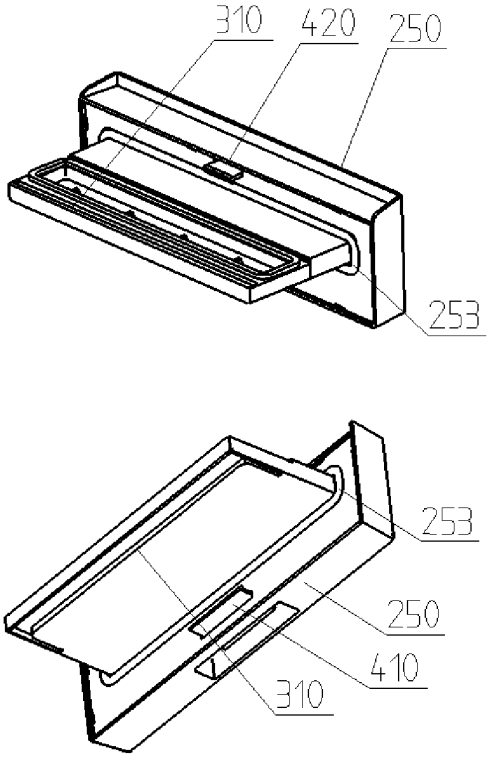
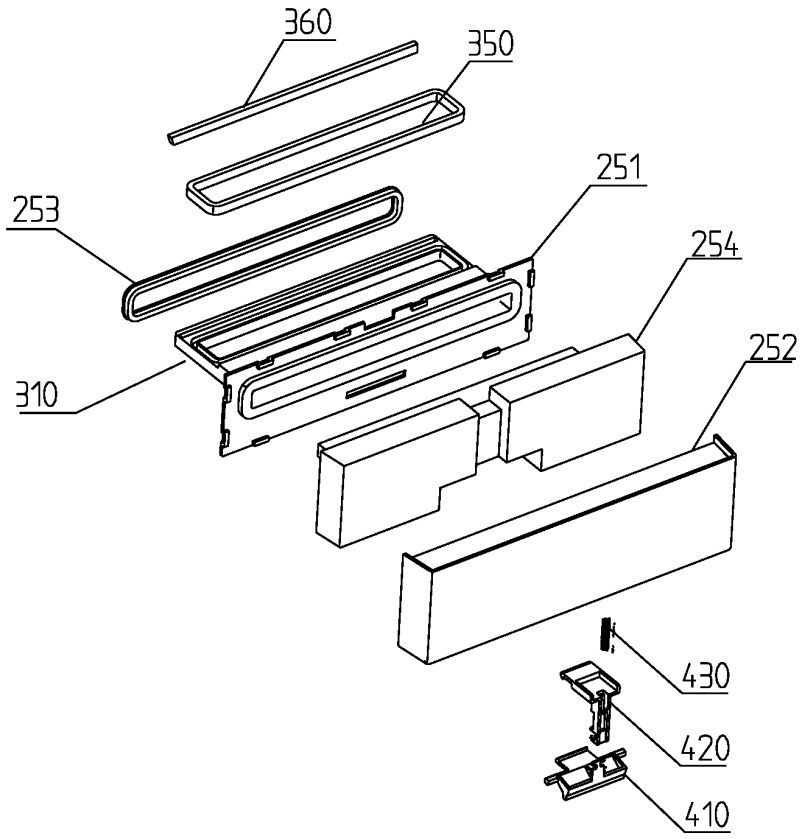


FIG. 15


360
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251
253
254
252
310
430
420
410

FIG. 16

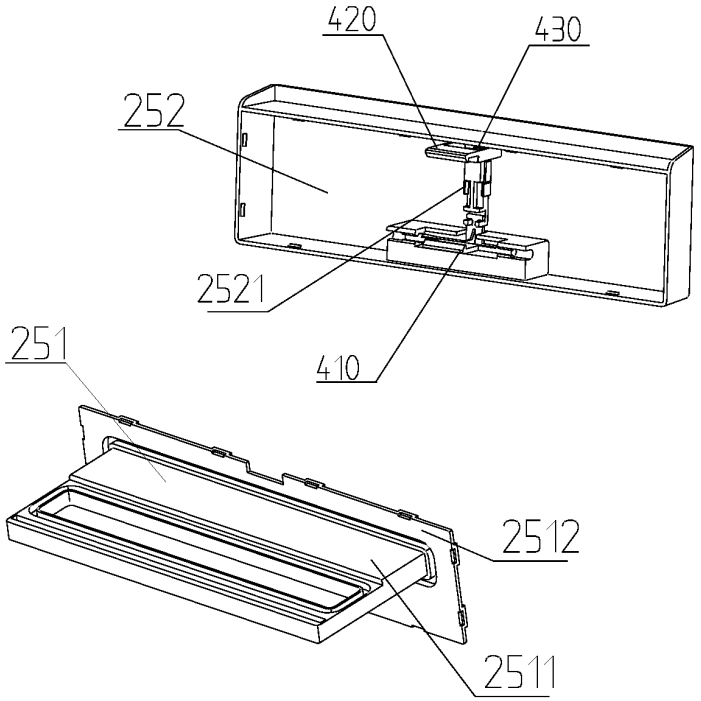
420
430
252
2521
410
251
2512
2511

FIG. 17

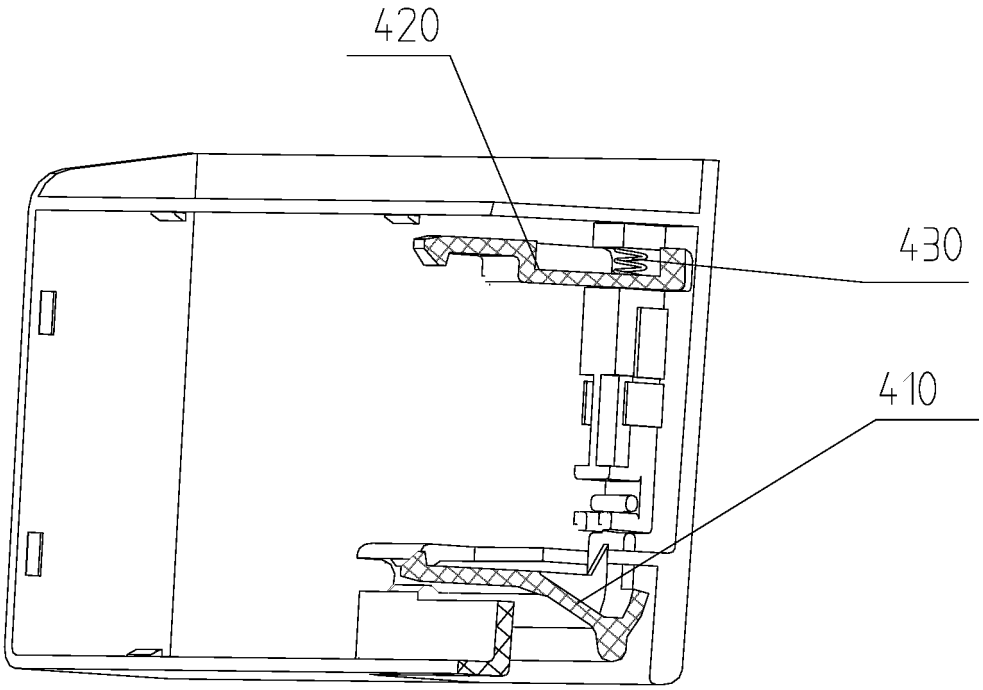

FIG. 18

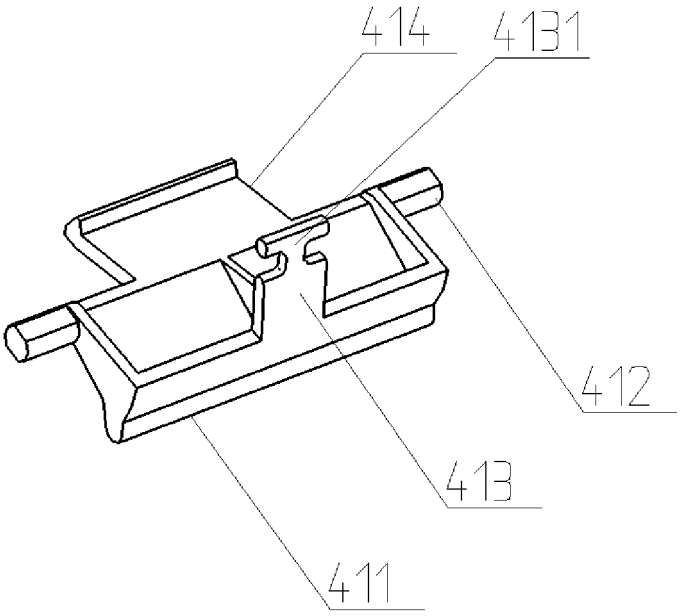

FIG. 19

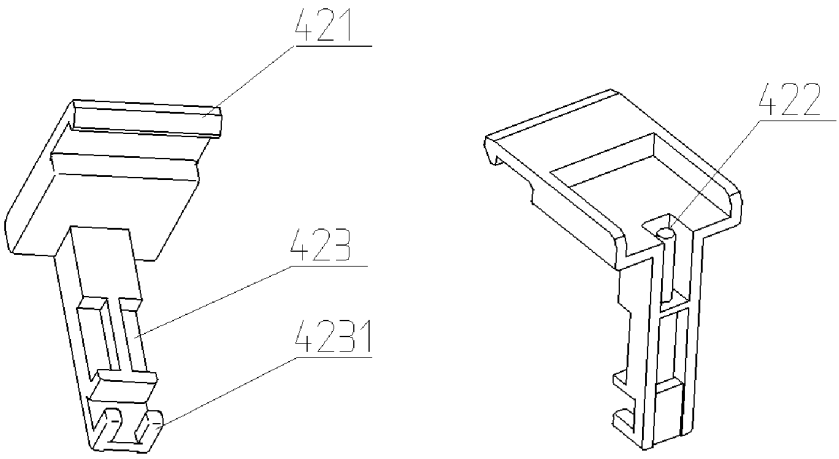
421
422
423
4231

FIG. 20

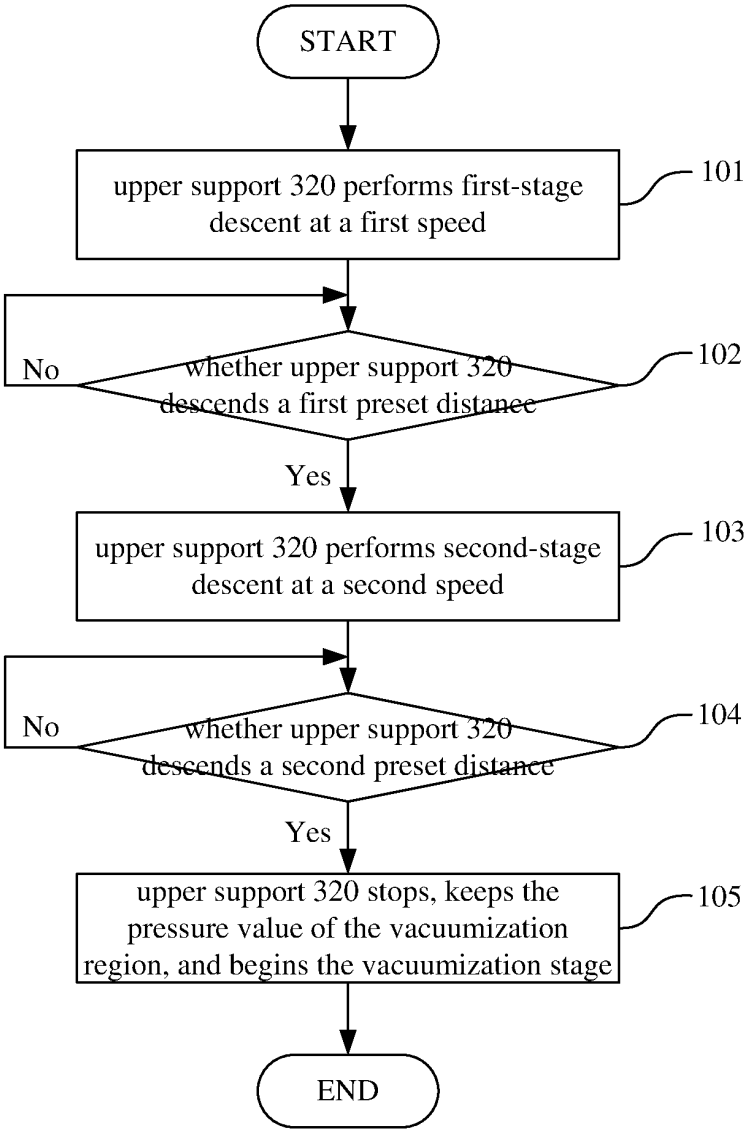
START
upper support 320 performs first-stage descent at a first speed
101
No
whether upper support 320 descends a first preset distance
102
Yes
upper support 320 performs second-stage descent at a second speed
103
No
whether upper support 320 descends a second preset distance
104
Yes
upper support 320 stops, keeps the pressure value of the vacuumization region, and begins the vacuumization stage
105
END

FIG. 21

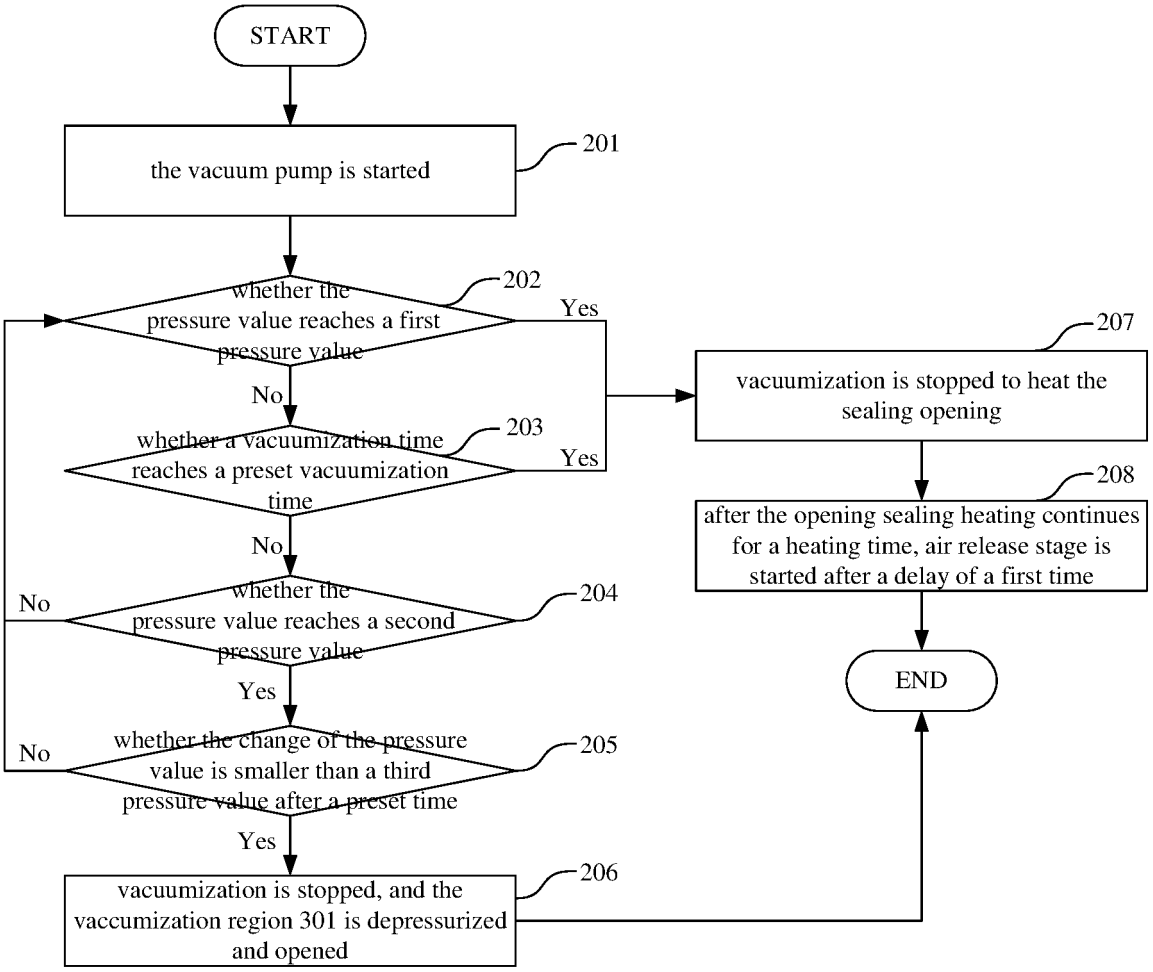
START
the vacuum pump is started
201
whether the pressure value reaches a first pressure value
202
Yes
No
whether a vacuumization time reaches a preset vacuumization time
203
Yes
No
whether the pressure value reaches a second pressure value
204
No
Yes
whether the change of the pressure value is smaller than a third pressure value after a preset time
205
No
Yes
vacuumization is stopped, and the vaccumization region 301 is depressurized and opened
206
vacuumization is stopped to heat the sealing opening
207
after the opening sealing heating continues for a heating time, air release stage is started after a delay of a first time
208
END

FIG. 22

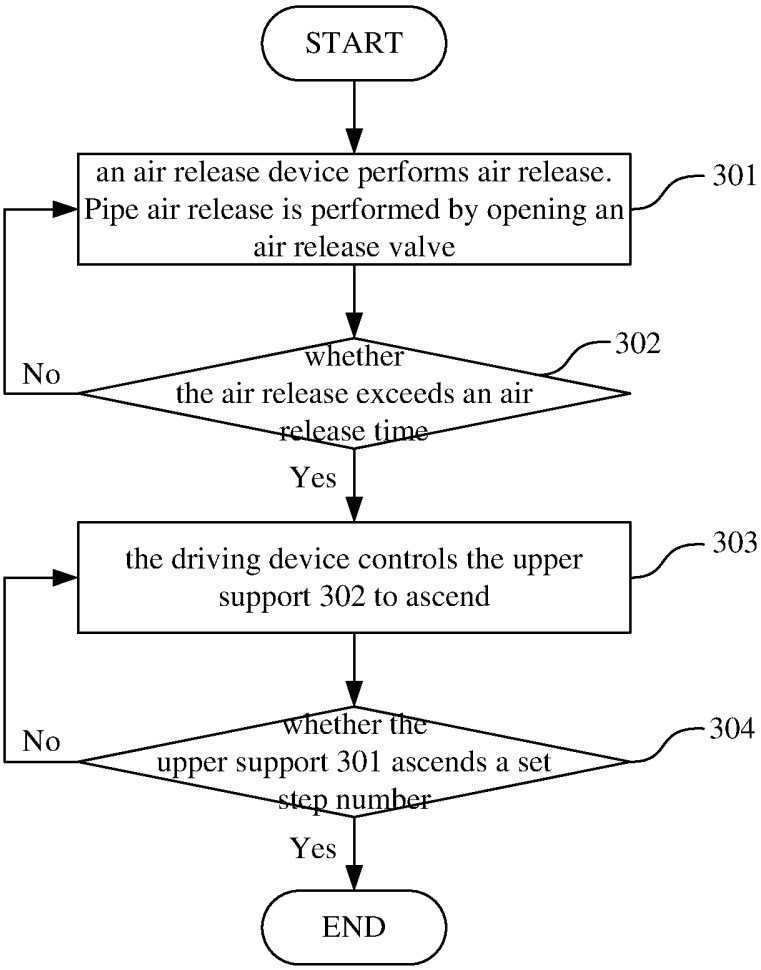

FIG. 23

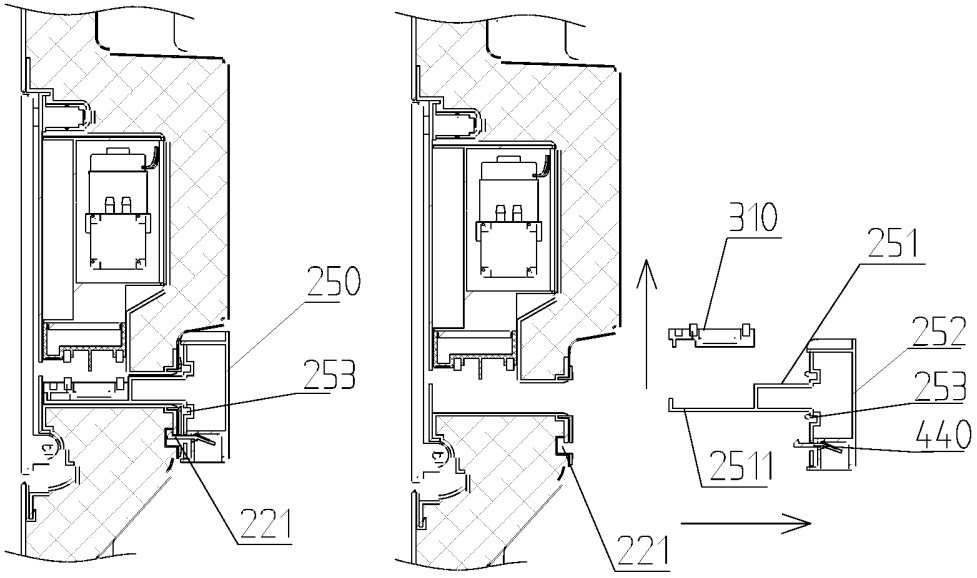

FIG. 24AFIG. 24B

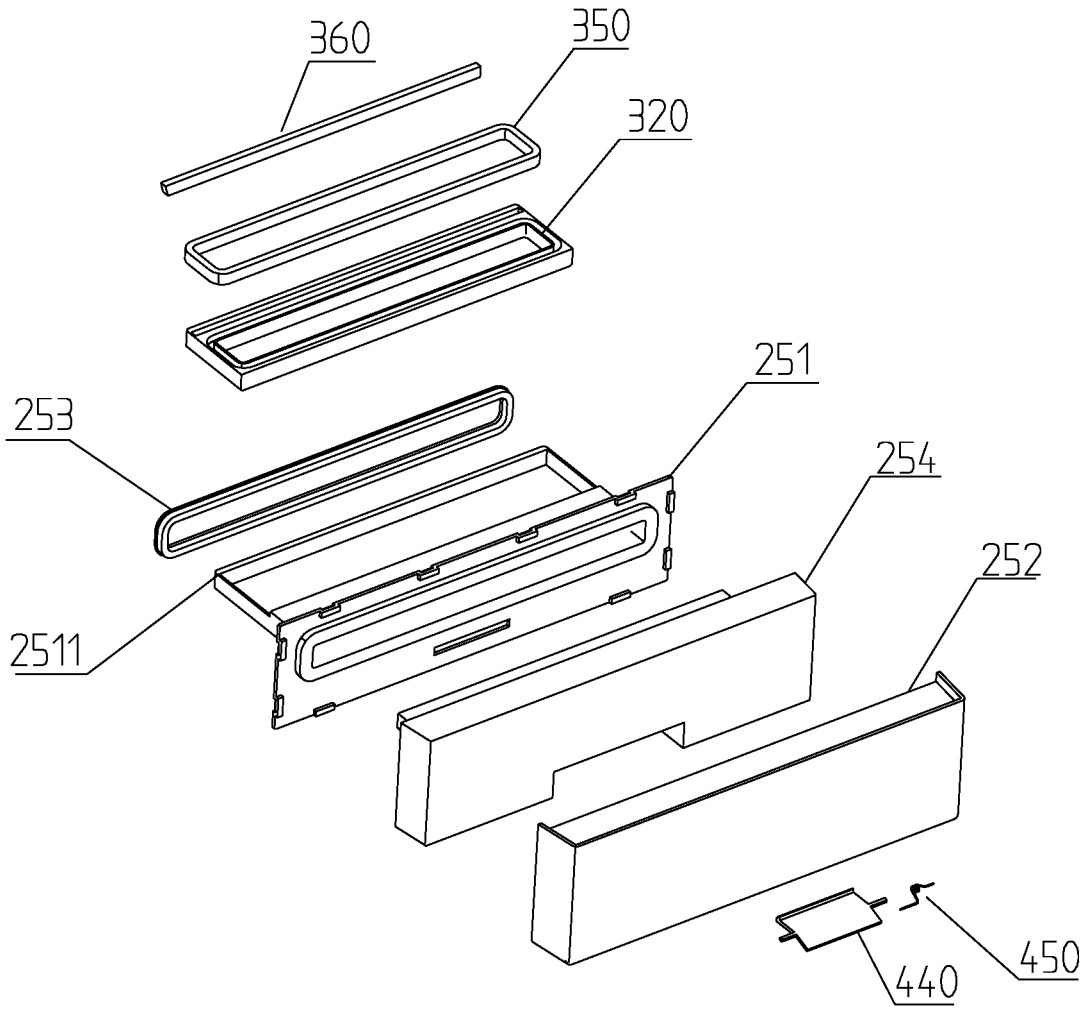

FIG. 25

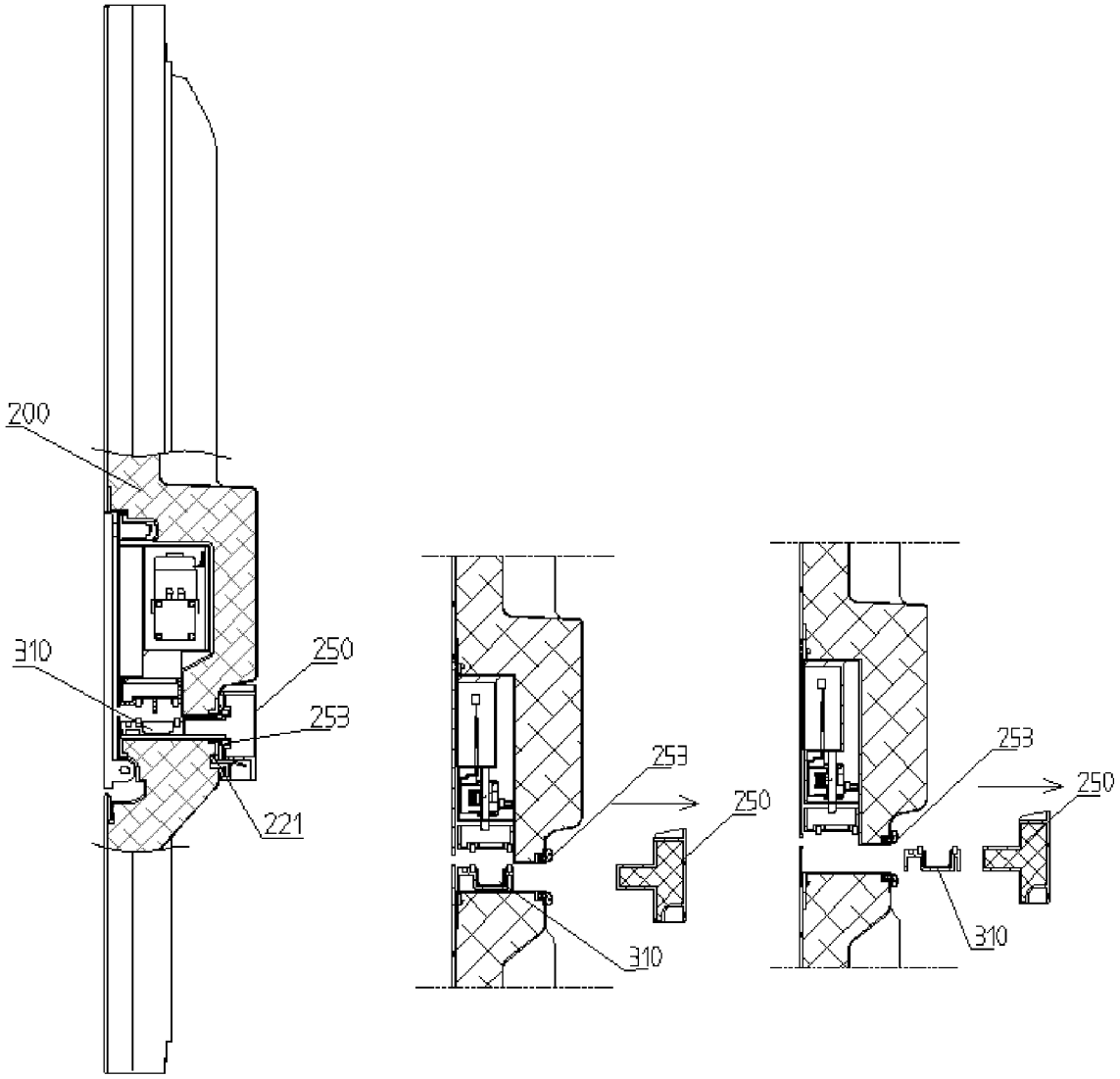

FIG. 26A FIG. 26BFIG. 26C

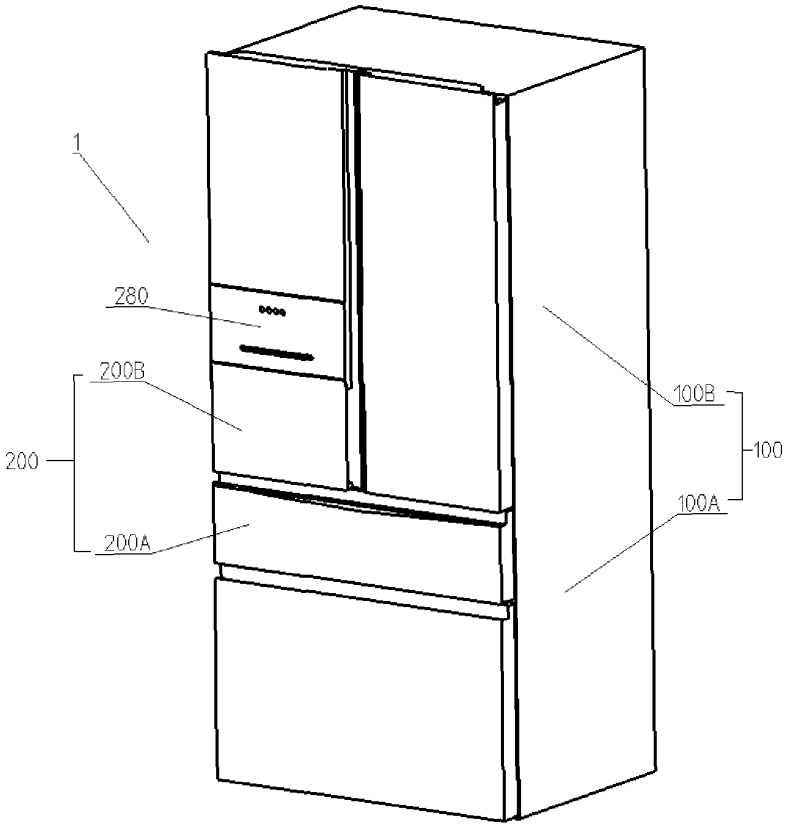
1
280
200B
200
200A
100B
100
100A

FIG. 27

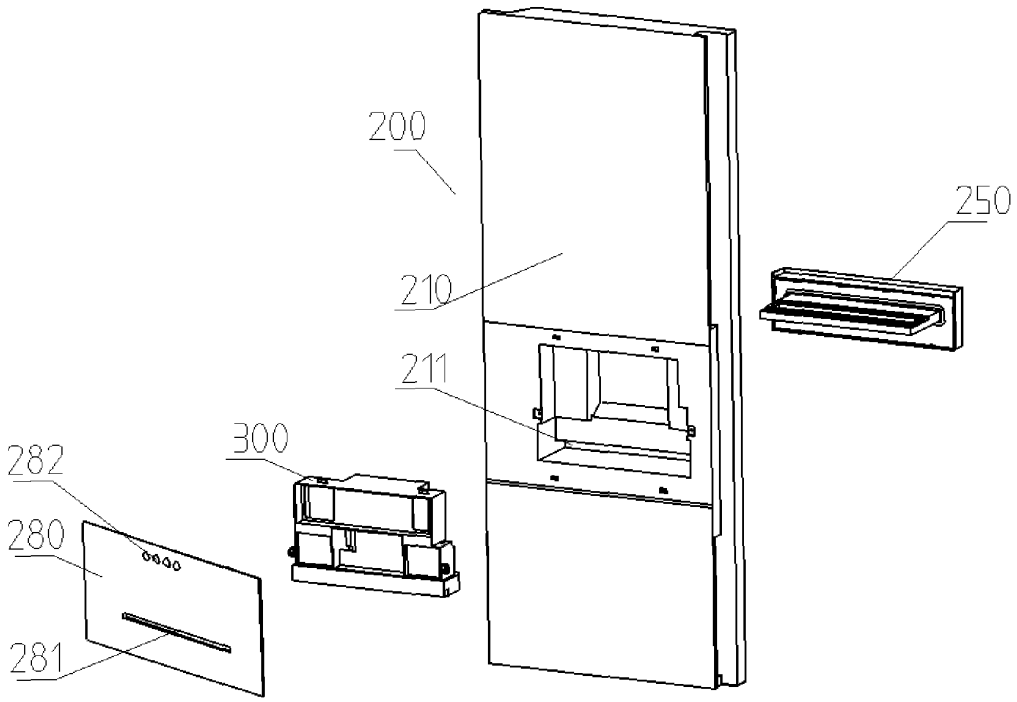
200
250
210
211
300
282
280
281

FIG. 28

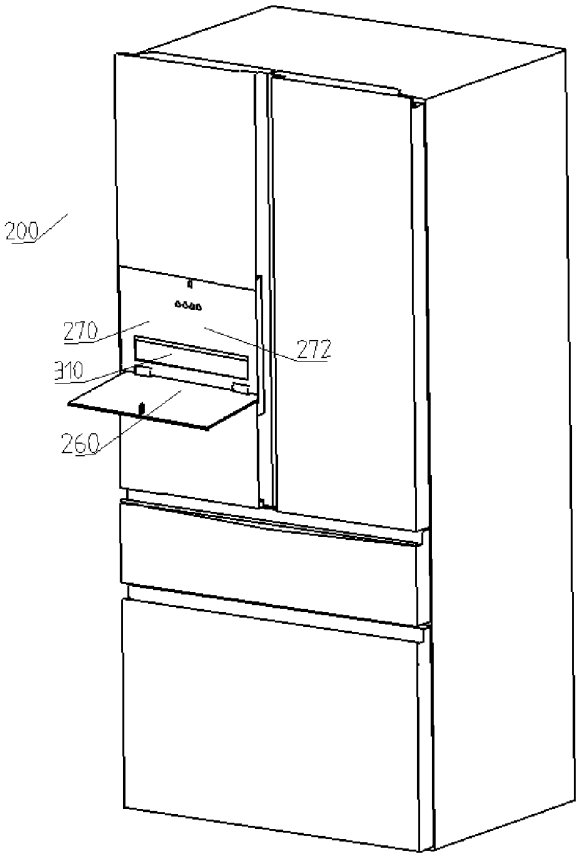

FIG. 29

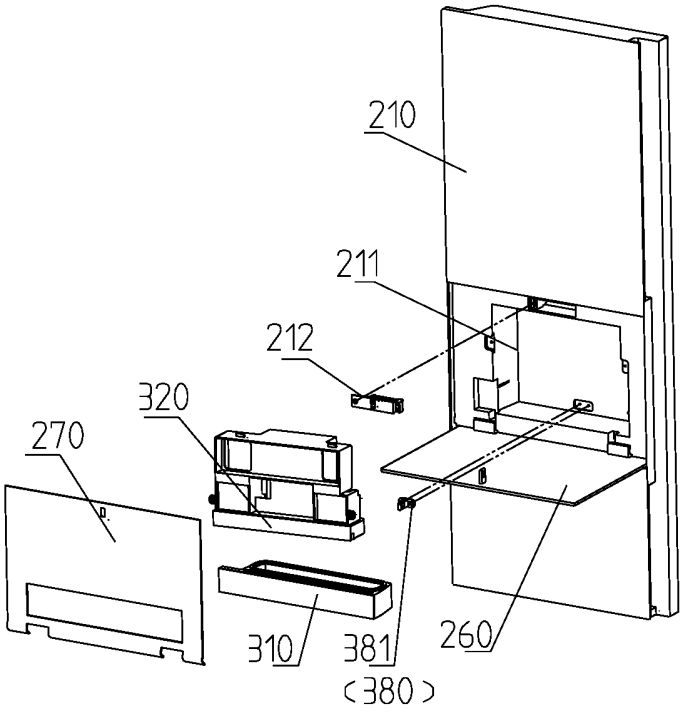

FIG. 30

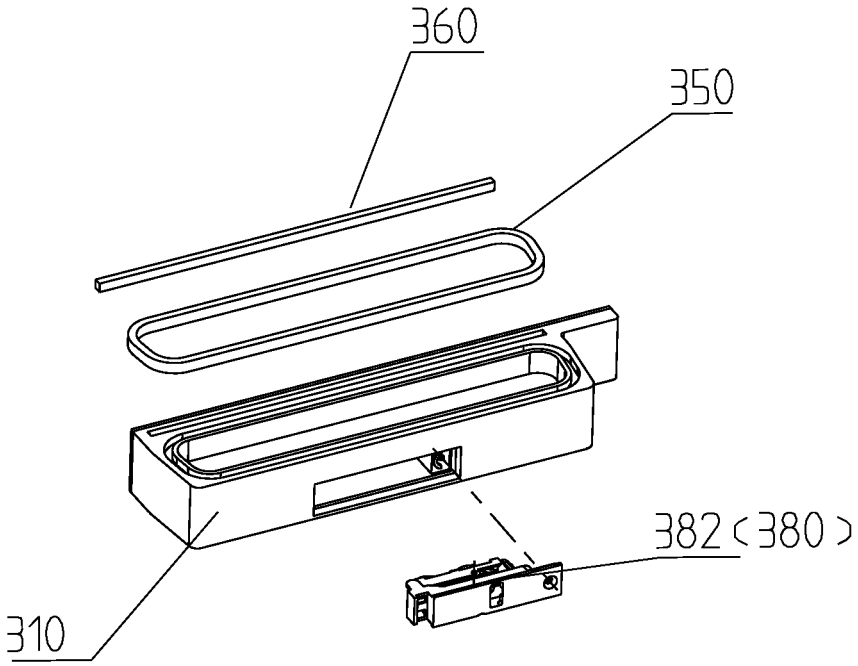

FIG. 31

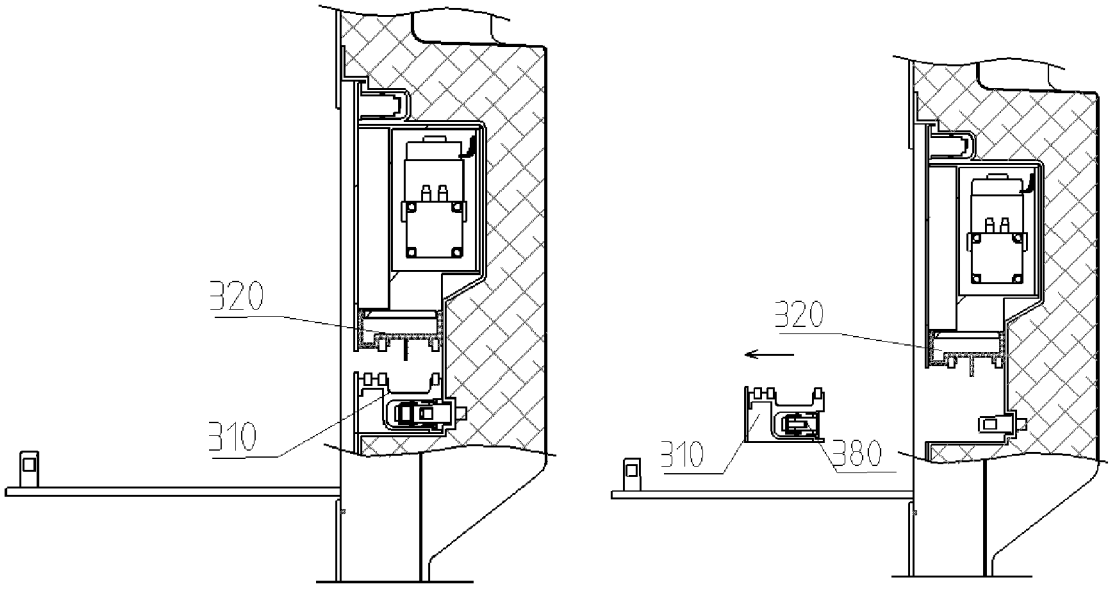

FIG. 32AFIG. 32B

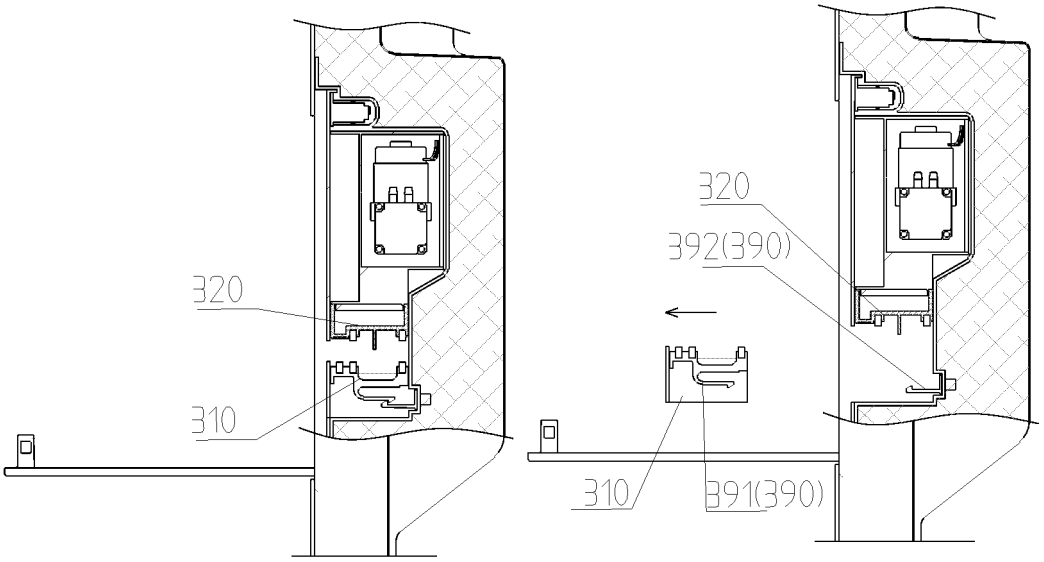

FIG. 33AFIG. 33B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/096532

A. CLASSIFICATION OF SUBJECT MATTER

F25D 23/12(2006.01)i; B65B 31/04(2006.01)i; B65B 51/10(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25D; B65B

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

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

CNTXT, CNABS, CNKI, SIPOABS, DWPI, 冰箱, 门, 真空, 泵, 封装, 速度, 驱动, 支座, 压力, 传感器, 泄压, 齿轮, 异常, 故障, refrigerator, door, vacuum, seal, pump, speed, drive, support, pressure, sensor, relief, gear, abnormal, malfunction

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 106895631 A (QINGDAO HAIGAO DESIGN MANUFACTURE CO., LTD.) 27 June 2017 (2017-06-27) description, paragraphs [0044]-[0062], and figures 1-4	1-4, 10
X	CN 106895630 A (QINGDAO HAIGAO DESIGN MANUFACTURE CO., LTD.) 27 June 2017 (2017-06-27) description, paragraphs [0040]-[0071], and figures 1-4	1-4, 10
X	CN 106895650 A (QINGDAO HAIGAO DESIGN MANUFACTURE CO., LTD.) 27 June 2017 (2017-06-27) description, paragraphs [0049]-[0079], and figures 1-4	1-4, 10
A	CN 205525152 U (JIANGSU JIBAILI FOOD CO., LTD.) 31 August 2016 (2016-08-31) entire document	1-20
A	CN 207450356 U (DONGGUAN BONSEN ELECTRONICS CO., LTD.) 05 June 2018 (2018-06-05) entire document	1-20
A	US 2009193760 A1 (WHIRLPOOL CO.) 06 August 2009 (2009-08-06) entire document	1-20

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

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"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 September 2020	**23 September 2020**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China**	Authorized officer
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2020/096532

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 106895631 A	27 June 2017	CN 106895631 B	26 November 2019
CN 106895630 A	27 June 2017	CN 106895630 B	26 November 2019
CN 106895650 A	27 June 2017	CN 106895650 B	26 November 2019
CN 205525152 U	31 August 2016	None	
CN 207450356 U	05 June 2018	None	
US 2009193760 A1	06 August 2009	IT MI20090136 A1	07 August 2009
		IT 1392701 B1	16 March 2012
		US 2010126117 A1	27 May 2010
		US 8438870 B2	14 May 2013
		US 7669434 B2	02 March 2010

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201910756799X **[0001]**
- CN 201910756811 **[0001]**