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(54) MICROENVIRONMENT FRESH-KEEPING REFRIGERATOR

(57) A microenvironment fresh-keeping refrigerator of the present invention relates to the field of electric appliances. A data acquisition module acquires the temperature, humidity, oxygen concentration, ozone concentration, negative ion concentration, air pressure, air quality data and stored object data of a microenvironment fresh-keeping chamber; a regulation and control device controls an inflation and extracting pump, a water supply and discharge pump, an adsorption type modified atmosphere device, a humidifying device, a refrigerating device, a superoxide generator, negative ion generators and catalyst controlled release devices on the basis of the acquired data in combination with internet big data and set data; various fresh-keeping elements such as air composition, airflow pressure, temperature and humidity, oxygen concentration, ozone concentration, negative ion concentration and air sterility and cleanliness in the refrigerator are regulated and controlled in an omnidirectional and multi-angle digital targeted mode; harmful residues on the surfaces of fruits and vegetables are degraded; harmless and thorough sterilization and disinfection are conducted; rotten elements and freshness loss factors are removed at fixed points; anti-corrosion and fresh-keeping elements are precisely maintained; nutritional components of fruits, vegetables, meat, fish and stored products and original freshness are kept rapidly and permanently; and a fresh-keeping refrigerator microenvironment with precise fresh keeping and comprehensive nutrition keeping is created.

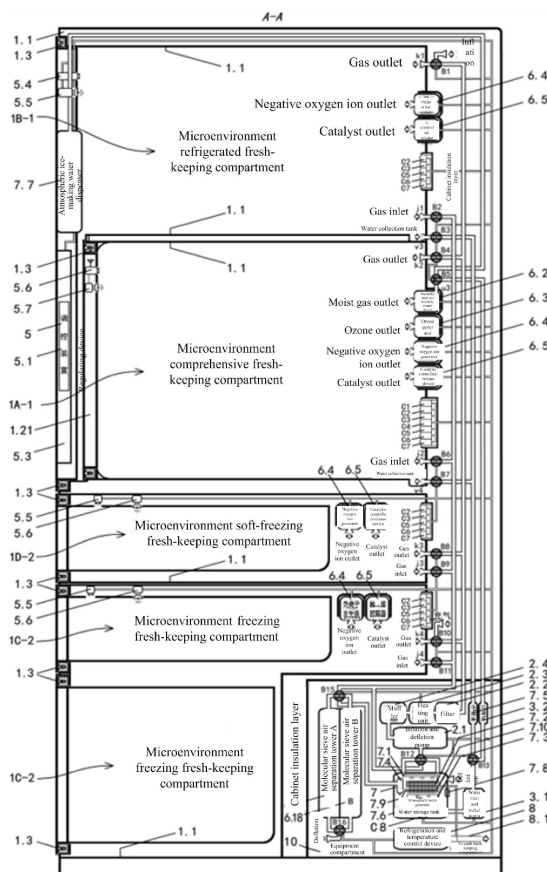


FIG. 2

Description

[0001] The present application claims priority to Chinese Patent Application No. 202410082489.5, filed with the China National Intellectual Property Administration (CNIPA) on January 19, 2024 and entitled "MICROENVIRONMENT FRESH-KEEPING REFRIGERATOR", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of electrical appliances, and in particular, relates to a micro-environment fresh-keeping refrigerator.

BACKGROUND

[0003] Currently, electrical appliances such as refrigerators and washing machines are becoming increasingly popular. However, in recent years, the upgrading of household electrical appliances has been unsatisfactory. For example, refrigerators have relied solely on low-temperature bacteriostasis as a basic storage technique since their inception over a century ago, without any substantial technological breakthroughs. Fresh-keeping technologies such as vacuum, high pressure, ozone, and modified atmosphere have never been practically applied in refrigerators, making it impossible to accurately regulate the air pressure, temperature, humidity, oxygen concentration, and ozone concentration inside refrigerators.

SUMMARY

[0004] An objective of the present disclosure is to provide a microenvironment fresh-keeping refrigerator, enabling accurate regulation of air pressure, temperature, humidity, oxygen concentration, and ozone concentration inside the refrigerator.

[0005] To achieve the above objective, the present disclosure provides the following solutions:

[0006] A microenvironment fresh-keeping refrigerator is provided, including: a cabinet, a door, and a micro-environment fresh-keeping compartment, a data acquisition module, a regulating device, an inflation and deflation pump module, a water inlet and outlet pump module, a gas conditioning module, an atmospheric water generator, a refrigeration and temperature control device, and an equipment compartment that are arranged within the cabinet,

where the microenvironment fresh-keeping compartment includes a microenvironment refrigerated fresh-keeping compartment, a microenvironment comprehensive fresh-keeping compartment, a microenvironment freezing fresh-keeping compartment, and a microenvironment soft-freezing fresh-keeping compartment; each of the microenviron-

ment refrigerated fresh-keeping compartment, the microenvironment comprehensive fresh-keeping compartment, the microenvironment freezing fresh-keeping compartment, and the microenvironment soft-freezing fresh-keeping compartment is provided with a gas inlet, a gas outlet, a water inlet, and a water outlet; and the regulating device includes a control module and a door touch screen; the gas conditioning module includes an adsorption-type modified atmosphere device, a humidification and humidity control device, an ozone generator, a negative oxygen ion generator, and a catalytic controlled-release device; the humidification and humidity control device, the ozone generator, the negative oxygen ion generator, and the catalytic controlled-release device are arranged in the microenvironment fresh-keeping compartment; and the adsorption-type modified atmosphere device, the inflation and deflation pump module, the water inlet and outlet pump module, the atmospheric water generator, and the refrigeration and temperature control device are arranged in the equipment compartment; the gas outlet is connected to the inflation and deflation pump module through a gas outlet pipeline, the inflation and deflation pump module is connected to the atmospheric water generator, the atmospheric water generator is connected to the adsorption-type modified atmosphere device, the adsorption-type modified atmosphere device is connected to the gas inlet through a gas inlet pipeline, so as to form a circulation loop for modified atmosphere preservation; the inflation and deflation pump module is connected to the gas inlet through the gas inlet pipeline, and is also connected to an inflation pipeline through the gas outlet pipeline, so as to generate a high pressure in the microenvironment fresh-keeping compartment for high-pressure preservation; the inflation and deflation pump module is connected to the gas outlet through the gas outlet pipeline, so as to generate a vacuum in the microenvironment fresh-keeping compartment for vacuum preservation; the water inlet and outlet pump module is connected to the atmospheric water generator, and the water inlet and outlet pump module is connected to the humidification and humidity control device and the atmospheric ice-making water dispenser through a water inlet pipeline and the water inlet; and the water inlet and outlet pump module also communicates with a water collection tank of the microenvironment fresh-keeping compartment through a water outlet pipeline and the water outlet;

the data acquisition module is arranged in the microenvironment fresh-keeping compartment; the data acquisition module is connected to the control module; the control module is connected to the adsorption-type modified atmosphere device, the humidification and humidity control device, the ozone generator, the negative oxygen ion generator, the cata-

lytic controlled-release device, the inflation and deflation pump module, the water inlet and outlet pump module, the atmospheric water generator, the refrigeration and temperature control device, and Internet; and the refrigeration and temperature control device is connected to the microenvironment fresh-keeping compartment, the atmospheric water generator, and the atmospheric ice-making water dispenser; the data acquisition module is configured to acquire temperature, humidity, ozone concentration, oxygen concentration, negative oxygen ion concentration, air pressure, and air quality data of the microenvironment fresh-keeping compartment, and data of items stored in the microenvironment fresh-keeping compartment; the control module is configured to: compare the temperature, humidity, ozone concentration, oxygen concentration, negative oxygen ion concentration, air pressure, and air quality data of the microenvironment fresh-keeping compartment with respective set values, and regulate, based on comparison results, the inflation and deflation pump module, the adsorption-type modified atmosphere device, the humidification and humidity control device, the ozone generator, the negative oxygen ion generator, the catalytic controlled-release device, and the refrigeration and temperature control device such that the inflation and deflation pump module drives the adsorption-type modified atmosphere device to generate nitrogen and circulate the nitrogen into the microenvironment fresh-keeping compartment for modified atmosphere preservation; cause the inflation and deflation pump module to generate a vacuum or a high pressure in the microenvironment fresh-keeping compartment through the gas outlet pipeline, the inflation pipeline, and the gas inlet pipeline, enabling vacuum preservation or high-pressure preservation; cause the humidification and humidity control device to perform humidification and humidity control preservation on the microenvironment comprehensive fresh-keeping compartment; cause the ozone generator to generate ozone to enable sterilization and residue degradation for the microenvironment comprehensive fresh-keeping compartment and items stored therein; cause the negative oxygen ion generator to generate negative oxygen ions to perform sterilization and preservation on the microenvironment fresh-keeping compartment and items stored therein; cause the catalytic controlled-release device to perform sterilization and harmful substance decomposition on the microenvironment fresh-keeping compartment and items stored therein; and regulate a temperature of the microenvironment fresh-keeping compartment in real time; and the control module is further configured to: control the inflation and deflation pump module to extract a gas inside or outside the microenvironment fresh-keeping compartment and deliver the gas to the

atmospheric water generator; control the atmospheric water generator to produce water; and control the water inlet and outlet pump module to deliver the produced water to the humidification and humidity control device and the atmospheric ice-making water dispenser.

[0007] According to the specific embodiments provided in the present disclosure, the present disclosure discloses the following technical effects:

[0008] In the microenvironment fresh-keeping refrigerator of the present disclosure, temperature, humidity, oxygen concentration, ozone concentration, negative oxygen ion concentration, air pressure, and air quality data of the microenvironment fresh-keeping compartment and data of items stored in the microenvironment fresh-keeping compartment are acquired by the data acquisition module. Based on the acquired data, in combination with Internet big data and set values, the regulating device controls the inflation and deflation pump, the water inlet and outlet pump, the adsorption-type modified atmosphere device, the humidification device, the refrigeration device, the ozone generator, the negative oxygen ion generator, and the catalytic controlled-release device to enable all-round, multi-angle, and digital targeted regulation of various preservation factors inside the microenvironment fresh-keeping refrigerator, including air composition, airflow pressure, temperature, humidity, oxygen concentration, ozone concentration, negative oxygen ion concentration, and air sterility. As a result, the microenvironment fresh-keeping refrigerator can degrade harmful residues on the surfaces of fruits and vegetables, perform harmless and full-range sterilization, eliminate spoilage factors and freshness-degrading factors in a targeted manner, accurately maintain anti-corrosion and preservation elements, and rapidly and durably protect the nutritional components and original flavor of fruits, vegetables, meats, fish, or other stored items, thereby creating a microenvironment for accurate preservation and comprehensive nutrition retention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] To describe the technical solutions in the embodiments of the present application or in the prior art clearly, the accompanying drawings required for describing the embodiments or the prior art will be briefly described below. Apparently, the accompanying drawings in the following description only show some embodiments of the present application, and a person of ordinary skill in the art may still derive other accompanying drawings from these accompanying drawings without creative efforts.

FIG. 1 is a front view of a structure of a microenvironment fresh-keeping refrigerator provided in a first embodiment of the present disclosure; FIG. 2 is a cross-sectional view taken along a line A-

A of the structure of the microenvironment fresh-keeping refrigerator provided in the first embodiment of the present disclosure;

FIG. 3 is a front view of a structure of a microenvironment fresh-keeping refrigerator provided in a second embodiment of the present disclosure;

FIG. 4 is a cross-sectional view taken along a line B-B of the structure of the microenvironment fresh-keeping refrigerator provided in the second embodiment of the present disclosure;

FIG. 5 is a cross-sectional view taken along a line C-C of the structure of the microenvironment fresh-keeping refrigerator provided in the second embodiment of the present disclosure;

FIG. 6 is a schematic diagram of an internal structure of an equipment compartment; and

FIG. 7 is a schematic diagram of a structure of a humidification and humidity control device.

[0010] Reference numerals: 1.1, cabinet; 1.21, opaque door; 1.22, transparent glass anti-condensation door; 1.23, adjustable-transparency anti-condensation glass door; 1.3, sealing device; 1A, microenvironment comprehensive fresh-keeping compartment; 1B, microenvironment refrigerated fresh-keeping compartment; 1C, microenvironment freezing fresh-keeping compartment; 1D, microenvironment soft-freezing fresh-keeping compartment; 1A-1, side-opening cabinet-type microenvironment comprehensive fresh-keeping compartment; 1B-1, side-opening cabinet-type microenvironment refrigerated fresh-keeping compartment; 1C-2, drawer-type microenvironment freezing fresh-keeping compartment; 1D-2, drawer-type microenvironment soft-freezing fresh-keeping compartment; 2.1, inflation and deflation pump; 2.2, air filter; 2.3, heating unit; 2.4, muffler; 3.1, water inlet and outlet pump; 3.2, water purification filter; 5, regulating device; 5.3, door touch screen; 5.4, high-definition anti-fog camera recognition device; 5.5, wireless anti-fog camera recognition device; 5.6, radar scanning recognition device; 5.7, wireless radar scanning recognition device; 6.17, molecular sieve air separation tower A; 6.18, molecular sieve air separation tower B; 6.2, humidification and humidity control device; 6.21, atomization humidity and water level controller; 6.22, atomizing nozzle; 6.23, nozzle holder; 6.24, water delivery cotton stick; 6.25, spring; 6.26, atomization water tank; 6.27, sealed water plug; 6.28, sealed water socket; 6.3, ozone generator; 6.4, negative oxygen ion generator; 6.5, catalytic controlled-release device; 7, atmospheric water generator; 7.1, water-producing gas outlet pipe; 7.2, condenser assembly; 7.3, fan; 7.4, gas-water separator; 7.5, drainage filter; 7.6, water storage tank; 7.7, atmospheric ice-making water dispenser; 7.8, spare water filling port; 7.9, internal condensing gas pipeline; 7.10, internal and external condensing parallel pipelines; 8, refrigeration and temperature control device; 8.1, refrigeration pipeline; 10, equipment compartment; C1, ozone sensor; C2, negative oxygen ion sensor; C3, catalyst sensor; C4,

humidity sensor; C5, oxygen sensor; C6, temperature sensor; C7, pressure sensor; C8, water level sensor; and B1 to B16, first solenoid valve to sixteenth solenoid valve.

5 DETAILED DESCRIPTION OF THE EMBODIMENTS

[0011] The technical solutions of the embodiments of the present disclosure are clearly and completely described below with reference to the drawings in the embodiments of the present disclosure. Apparently, the described embodiments are merely a part rather than all of the embodiments of the present disclosure. All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of the present disclosure without creative efforts shall fall within the scope of protection of the present disclosure.

[0012] An objective of the present disclosure is to provide a microenvironment fresh-keeping refrigerator, which can achieve all-round, multi-angle, and digital targeted regulation of various preservation factors inside the microenvironment fresh-keeping refrigerator, including air composition, airflow pressure, temperature, humidity, oxygen concentration, ozone concentration, negative oxygen ion concentration, and air sterility.

[0013] In order to make the above objective, features, and advantages of the present disclosure clear and comprehensible, the present disclosure will be further described in detail below in combination with the accompanying drawings and specific implementations.

[0014] Intelligent positive and negative pressure systems are constructed based on positive and negative pressure technology. Positive and negative pressure technology refers to regulating fluids and substances carried thereby with positive and negative pressure, thereby accurately influencing objects in a specific space. The technical principle and basic operation method of intelligent positive and negative pressure systems are as follows: Fluids (such as air and water) or effective loads including ozone, catalysts, negative oxygen ions, modified atmosphere gases, and water carried thereby are intelligently regulated with positive and negative pressure to orderly enter, exit, or stay in a specific space (such as a positive and negative pressure chamber) and exert desired effects on objects in the specific space. Intelligent positive and negative pressure systems exhibit large-capacity carrier performance and cross-domain expandable platform advantages, and can provide targeted influence methods or targeted treatment modes with respective characteristics for various influenced objects. Various positive and negative pressure electrical appliances designed and manufactured based on positive and negative pressure systems, such as positive and negative pressure refrigerators and positive and negative pressure washing machines, can intelligently and accurately regulate and create the optimal environments and the optimal performance for operation of electrical appliances. Thus, the positive and negative pressure technology revolutionizes existing electrical appliances

and traditional technologies, and pioneers a new field of positive and negative pressure electrical appliances. When applied to refrigerators, positive and negative pressure systems can intelligently and accurately regulate various preservation factors of the refrigerators in real time, including air circulation, airflow pressure, gas composition, air sterility and cleanliness, temperature, and humidity, perform harmless and full-range sterilization, and rapidly degrade harmful residues on the surfaces of stored items, thereby achieving all-round, multi-angle, and digital targeted management for comprehensive preservation and nutrition retention. Positive and negative pressure refrigerators integrate various preservation technologies such as vacuum, high pressure, ozone, catalyst, modified atmosphere preservation, negative oxygen ions, sterilization, decomposition, humidification, atmospheric water generation, and low-temperature storage through digital technologies. By applying digital technologies including Internet, big data, cloud computing, machine learning, and artificial intelligence, an adjustable and controllable artificial microclimate can be formed inside a positive and negative pressure refrigerator, creating a high-energy and efficient fresh-keeping microenvironment. Accordingly, fresh foods and other items stored in the positive and negative pressure refrigerator can be kept in the optimal storage environment and preservation ecology with the optimal air pressure range, gas composition, humidity, and temperature. Moreover, for freshness-degrading factors and spoilage factors of different stored items, a digital targeted management-based comprehensive preservation and nutrition retention solution can be established at the cellular and molecular levels. The positive and negative pressure refrigerator can accurately maintain preservation elements, eliminate freshness-degrading factors in a targeted manner, and rapidly and durably protect the nutritional components and original flavor and freshness of fruits, vegetables, meats, fish, and other stored items. Therefore, positive and negative pressure refrigerators are original high-tech products belonging to a new generation of refrigerators.

[0015] As shown in FIG. 1 and FIG. 2, the microenvironment fresh-keeping refrigerator provided by the present disclosure includes a cabinet 1.1, a door, and a microenvironment fresh-keeping compartment, a data acquisition module, a regulating device 5, an inflation and deflation pump module, a water inlet and outlet pump module, a gas conditioning module, a refrigeration and temperature control device 8, an equipment compartment 10, a water collection tank, and an atmospheric water generator 7 that are arranged in the cabinet 1.1. The gas conditioning module includes an adsorption-type modified atmosphere device, a humidification and humidity control device 6.2, an ozone generator 6.3, a negative oxygen ion generator 6.4, and a catalytic controlled-release device 6.5. The humidification and humidity control device 6.2, the ozone generator 6.3, the negative oxygen ion generator 6.4, and the catalytic controlled-release device 6.5 are arranged in the microenvironment fresh-keeping compartment. The adsorption-type modified atmosphere device, the inflation and deflation pump module, the water inlet and outlet pump module, the atmospheric water generator 7, and the refrigeration and temperature control device 8 are arranged in the equipment compartment 10. The regulating device includes a control module and a door touch screen 5.3.

[0016] The data acquisition module is arranged in the microenvironment fresh-keeping compartment. The data acquisition module is connected to the control module. The control module is connected to the adsorption-type modified atmosphere device, the humidification and humidity control device 6.2, the ozone generator 6.3, the negative oxygen ion generator 6.4, the catalytic controlled-release device 6.5, the inflation and deflation pump module, the water inlet and outlet pump module, the atmospheric water generator 7, the refrigeration and temperature control device 8, and Internet. The refrigeration and temperature control device 8 is connected to the microenvironment fresh-keeping compartment 1, the atmospheric water generator 7, and the atmospheric ice-making water dispenser 7.7.

[0017] The data acquisition module is configured to acquire temperature, humidity, ozone concentration, oxygen concentration, negative oxygen ion concentration, air pressure, and air quality data of the microenvironment fresh-keeping compartment, and data of items stored in the microenvironment fresh-keeping compartment.

[0018] In practical application, a microenvironment fresh-keeping system is provided in the cabinet 1.1. The microenvironment fresh-keeping system includes a microenvironment fresh-keeping compartment, an inflation and deflation pump module, a water inlet and outlet pump module, a regulating device 5, a gas conditioning module, an atmospheric water generator 7, a refrigeration and temperature control device 8, and an equipment compartment 10.

[0019] The microenvironment fresh-keeping compartment includes a microenvironment comprehensive fresh-keeping compartment 1A, a microenvironment refrigerated fresh-keeping compartment 1B, a microenvironment freezing fresh-keeping compartment 1C, and a microenvironment soft-freezing fresh-keeping compartment 1D. Each of the microenvironment comprehensive fresh-keeping compartment 1A, the microenvironment refrigerated fresh-keeping compartment 1B, the microenvironment freezing fresh-keeping compartment 1C, and the microenvironment soft-freezing fresh-keeping compartment 1D is provided with a gas inlet (j1 to j4), a gas outlet (k1 to k4), a water inlet (u3), and a water outlet (v3, v4). Each of the microenvironment comprehensive fresh-keeping compartment 1A, the microenvironment refrigerated fresh-keeping compartment 1B, the microenvironment freezing fresh-keeping compartment 1C, and the microenvironment soft-freezing fresh-keeping compartment 1D is provided in one or more quantities

within the cabinet 1.1. The microenvironment fresh-keeping compartment 1 can be classified into a side-opening microenvironment fresh-keeping compartment and a drawer-type microenvironment fresh-keeping compartment according to shapes and characteristics. As shown in FIG. 2, the side-opening microenvironment fresh-keeping compartment includes a side-opening cabinet-type microenvironment comprehensive fresh-keeping compartment 1A-1, a side-opening cabinet-type microenvironment refrigerated fresh-keeping compartment 1B-1, a side-opening cabinet-type microenvironment freezing fresh-keeping compartment, and a side-opening cabinet-type microenvironment soft-freezing fresh-keeping compartment. As shown in FIG. 3, the drawer-type microenvironment fresh-keeping compartment includes a drawer-type microenvironment comprehensive fresh-keeping compartment, a drawer-type microenvironment refrigerated fresh-keeping compartment, a drawer-type microenvironment freezing fresh-keeping compartment 1C-2, and a drawer-type microenvironment soft-freezing fresh-keeping compartment 1D-2. Each of the side-opening cabinet-type microenvironment comprehensive fresh-keeping compartment 1A-1, the side-opening cabinet-type microenvironment refrigerated fresh-keeping compartment 1B-1, the side-opening cabinet-type microenvironment freezing fresh-keeping compartment, and the side-opening cabinet-type microenvironment soft-freezing fresh-keeping compartment includes a door, a sealing device 1.3, and a sealing joint (not shown in the figures). The door includes an opaque door 1.21 and a transparent glass anti-condensation door 1.22, or an opaque door 1.21 and an adjustable-transparency anti-condensation glass door 1.23. Each of the drawer-type microenvironment comprehensive fresh-keeping compartment, the drawer-type microenvironment refrigerated fresh-keeping compartment, the drawer-type microenvironment freezing fresh-keeping compartment 1C-2, and the drawer-type microenvironment soft-freezing fresh-keeping compartment 1D-2 includes a sealing device 1.3, a sealing joint, and a sealed drawer. The sealing device 1.3 is arranged between the cabinet 1.1 and the door 1.2. All pipelines and wiring leading into and out of the cabinet are connected to a sealing joint (not shown in the figures) to seal the microenvironment fresh-keeping compartment.

[0020] The regulating device 5 and the atmospheric ice-making water dispenser 7.7 are provided on the door of the microenvironment fresh-keeping compartment.

[0021] The gas outlet is connected to the inflation and deflation pump module through a gas outlet pipeline, the inflation and deflation pump module is connected to the atmospheric water generator 7, the atmospheric water generator 7 is connected to the adsorption-type modified atmosphere device, the adsorption-type modified atmosphere device is connected to the gas inlet through a gas inlet pipeline, so as to form a circulation loop for modified atmosphere preservation. The inflation and deflation pump module is further connected to the gas inlet through

a third gas outlet of a twelfth solenoid valve B12 and the gas inlet pipeline, and the inflation and deflation pump module is also connected to an inflation pipeline through the gas outlet pipeline, so as to generate a high pressure in the microenvironment fresh-keeping compartment for high-pressure preservation. The inflation and deflation pump module is further connected to the gas outlet through the gas outlet pipeline, so as to generate a vacuum in the microenvironment fresh-keeping compartment for vacuum preservation. The water inlet and outlet pump module is connected to the atmospheric water generator 7, and the water inlet and outlet pump module is connected to the humidification and humidity control device 6.2 and the atmospheric ice-making water dispenser 7.7 through a water inlet pipeline and the water inlet. The water inlet and outlet pump module also communicates with a water collection tank of the microenvironment fresh-keeping compartment through a water outlet pipeline and the water outlet.

[0022] In practical application, the gas conditioning module includes a modified atmosphere device, a humidification and humidity control device 6.2, an ozone generator 6.3, a negative oxygen ion generator 6.4, and a catalytic controlled-release device 6.5.

[0023] As an optional embodiment, the modified atmosphere device is an adsorption-type air separation modified atmosphere device (adsorption-type modified atmosphere device). The adsorption-type modified atmosphere device includes a molecular sieve air separation tower A 6.17, a molecular sieve air separation tower B 6.18, a fifteenth solenoid valve B15, and a sixteenth solenoid valve B16.

[0024] An end of the molecular sieve air separation tower A 6.17 and an end of the molecular sieve air separation tower B 6.18 are both connected to the fifteenth solenoid valve B15. The fifteenth solenoid valve B15 is provided at a gas inlet of the gas inlet pipeline. Gas outlets of the gas inlet pipeline are connected to gas inlets of the microenvironment refrigerated fresh-keeping compartment 1B, the microenvironment comprehensive fresh-keeping compartment 1A, the microenvironment freezing fresh-keeping compartment 1C, and the microenvironment soft-freezing fresh-keeping compartment 1D, respectively. The fifteenth solenoid valve B15 is further connected to the atmospheric water generator 7. The gas outlets of the gas inlet pipeline are provided with a second solenoid valve B2, a sixth solenoid valve B6, a ninth solenoid valve B9, and an eleventh solenoid valve B11, respectively.

[0025] Another end of the molecular sieve air separation tower A 6.17 and another end of the molecular sieve air separation tower B are both connected to the sixteenth solenoid valve B16. The sixteenth solenoid valve B16 is further connected to an exhaust pipeline.

[0026] Each solenoid valve is connected to the control module. Under control of the control module, the inflation and deflation pump 2.1, the molecular sieve air separation tower A 6.17, the molecular sieve air separation

tower B 6.18, and each solenoid valve operate alternately to produce nitrogen, which is charged into the microenvironment fresh-keeping compartment through the gas inlet pipeline.

[0027] As shown in FIG. 6, the inflation and deflation pump module, the water inlet and outlet pump module, the regulating device 5, the modified atmosphere device, the atmospheric water generator 7, the refrigeration and temperature control device 8, and the plurality of solenoid valves B1 to B16 are arranged outside the microenvironment fresh-keeping compartment and inside the equipment compartment 10.

[0028] As an optional embodiment, the microenvironment fresh-keeping compartment communicates with an end of the inflation and deflation pump module through the gas outlet pipeline. The gas outlet pipeline is provided with a first solenoid valve B1, a fourth solenoid valve B4, an eighth solenoid valve B8, and a tenth solenoid valve B10. A gas outlet of the gas outlet pipeline is connected to an end of the inflation and deflation pump module, and another end of the inflation and deflation pump module is connected to the atmospheric water generator 7.

[0029] The atmospheric water generator 7 is connected to the water inlet and outlet pump module. The water inlet and outlet pump module communicates with the humidification and humidity control device 6.2 through the water inlet pipeline. A water outlet of the water inlet pipeline is provided with a fifth solenoid valve B5.

[0030] As an optional embodiment, the inflation and deflation pump module includes a first filter (air filter 2.2), a heating unit 2.3, a muffler 2.4, and an inflation and deflation pump 2.1 that are connected sequentially.

[0031] The first filter is connected to the microenvironment fresh-keeping compartment through the gas outlet pipeline and a first solenoid valve B1, a fourth solenoid valve B4, an eighth solenoid valve B8, or a tenth solenoid valve B10. The first solenoid valve B1 and the tenth solenoid valve B10 are each further connected to the inflation pipeline. The inflation and deflation pump module extracts air from outside the microenvironment fresh-keeping compartment through the inflation pipeline and charges the air into the atmospheric water generator 7 for water production. A deflation port of the inflation and deflation pump 2.1 is connected to the muffler 2.4. An inflation port of the inflation and deflation pump 2.1 is connected to the atmospheric water generator 7. A twelfth solenoid valve B12 is provided at a connection between the inflation and deflation pump 2.1 and the atmospheric water generator 7.

[0032] When the inflation and deflation pump 2.1 operates, positive and negative pressure generated accordingly drives an airflow such that the adsorption-type modified atmosphere device generates nitrogen and charges the nitrogen into a gas inlet of the microenvironment fresh-keeping compartment, a humid and cold gas is extracted from a gas outlet of the microenvironment fresh-keeping compartment and subjected to dehumidi-

fication and water production by the condenser assembly 7.2 and the gas-water separator 7.4 when flowing through the heating unit 2.3 and the atmospheric water generator 7, and a resulting dry and warm gas is further charged into the adsorption-type modified atmosphere device to produce nitrogen. When such an inflation and deflation cycle continues, a nitrogen concentration increases and an oxygen concentration decreases in the microenvironment fresh-keeping compartment. Once the nitrogen and oxygen concentrations reach the levels required for modified atmosphere preservation, the inflation and deflation cycle stops, and the modified atmosphere preservation is allowed.

[0033] A gas outlet of the inflation and deflation pump 2.1 is further connected to a water-producing gas outlet pipe 7.1 through a twelfth solenoid valve B12. The water-producing gas outlet pipe 7.1 injects a gas from inside or outside the microenvironment fresh-keeping compartment toward the condenser assembly 7.2 for condensation and water production. The fan 7.3 also blows a gas toward the condenser assembly 7.2 for condensation and water production. In this way, the daily needs of the humidification and humidity control device 6.2, an ice maker, and a hot and cold purified water dispenser can be met.

[0034] As shown in FIG. 4, FIG. 5, and FIG. 6, a gas inlet x of the air filter 2.2 is connected: to a gas outlet k1 of the microenvironment refrigerated fresh-keeping compartment 1B through the exhaust pipeline and the first solenoid valve B1, to a gas outlet k2 of the microenvironment comprehensive fresh-keeping compartment 1A through the exhaust pipeline and the fourth solenoid valve B4; to a gas outlet k3 of the microenvironment soft-freezing fresh-keeping compartment 1D through the exhaust pipeline and the eighth solenoid valve B8; and to a gas outlet k4 of the microenvironment freezing fresh-keeping compartment 1C through the exhaust pipeline and the tenth solenoid valve B10.

[0035] As an optional embodiment, the atmospheric water generator 7 includes a water-producing gas outlet pipe 7.1, a condenser assembly 7.2, a fan 7.3, a gas-water separator 7.4, a water storage tank 7.6, a spare water filling port 7.8, a water level sensor C8, a twelfth solenoid valve B12, an internal condensing gas pipeline 7.9, and a refrigeration pipeline 8.1.

[0036] A third gas outlet y of the twelfth solenoid valve B12 is connected to a gas inlet of the microenvironment fresh-keeping compartment through the gas inlet pipeline. A first gas outlet e of the twelfth solenoid valve B12 is connected to the water-producing gas outlet pipe 7.1. A plurality of gas injection holes of the water-producing gas outlet pipe 7.1 face the condenser assembly 7.2. A second gas outlet c of the twelfth solenoid valve B12 is connected to a gas inlet of the condenser assembly 7.2. A gas outlet of the condenser assembly 7.2 is connected to a gas inlet of the gas-water separator 7.4. The internal condensing gas pipeline 7.9 between the gas inlet and the gas outlet of the condenser assembly 7.2 is arranged

side by side with the refrigeration pipeline 8.1 as internal and external condensing parallel pipelines 7.10. A cooling capacity of the refrigeration pipeline 8.1 can be conducted not only to condensing fins of the condenser assembly 7.2 for condensation, but also to the closely adjacent internal condensing gas pipeline 7.9, causing condensation on an inner wall of the internal condensing gas pipeline 7.9. The refrigeration pipeline 8.1 is connected to the refrigeration and temperature control device 8. A gas outlet of the gas-water separator 7.4 is connected to the adsorption-type modified atmosphere device through the fifteenth solenoid valve B15. The fan 7.3 and the condenser assembly 7.2 are adjacent to each other. The fan 7.3 blows air toward the condenser assembly 7.2 for condensation and water production. The water storage tank 7.6 is arranged below the condenser assembly 7.2 and the gas-water separator 7.4. Water condensed on an exterior of the condenser assembly 7.2 and water condensed and separated by the gas-water separator 7.4 from the internal condensing gas pipeline 7.9 both drip into the water storage tank 7.6. Each solenoid valve is connected to the control module. The water storage tank 7.6 is further provided with a spare water filling port 7.8, and the condenser assembly 7.2 is further connected to an exhaust pipeline.

[0037] As an optional embodiment, the water inlet and outlet pump module includes a water inlet and outlet pump 3.1, a second filter (drainage filter 7.5), and a third filter (water purification filter 3.2).

[0038] The control module controls water supply and drainage by regulating forward and reverse rotations of the water inlet and outlet pump 3.1 and adjusting respective solenoid valves. A port u of the water inlet and outlet pump 3.1 is connected to a port u2 of the water storage tank 7.6. A port u1 of the water inlet and outlet pump 3.1 is connected to the drainage filter 7.5 and the third filter through a thirteenth solenoid valve B13. The drainage filter 7.5 is connected to water outlets v3 and v4 of a water collection tank of the microenvironment fresh-keeping compartment through the water outlet pipeline. When the water inlet and outlet pump 3.1 rotates reversely, drainage is conducted. Water from a first water collection tank is discharged into the water storage tank 7.6 through the water outlet v3, a solenoid valve B3, the filter 7.5, the solenoid valve B13, the port u1 of the water inlet and outlet pump, the port u of the water inlet and outlet pump, and the port u2 of the water storage tank. Water from a second water collection tank is discharged into the water storage tank 7.6 through the water outlet v4, a solenoid valve B7, the filter 7.5, the solenoid valve B13, the port u1 of the water inlet and outlet pump, the port u of the water inlet and outlet pump, and the port u2 of the water storage tank 7.6. The third filter is connected to the humidification and humidity control device 6.2 and the atmospheric ice-making water dispenser 7.7 through the water inlet pipeline. A fifth solenoid valve B5 is provided at a connection where the water inlet pipeline is connected to the humidification and humidity control device 6.2 and the atmo-

spheric ice-making water dispenser 7.7.

[0039] When the water inlet and outlet pump 3.1 rotates forward, water supply is conducted. Water from the water storage tank 7.6 flows through the port u2, the port u of the water inlet and outlet pump, the port u1 of the water inlet and outlet pump, the solenoid valve B13, the filter 3.2, and the solenoid valve B5 sequentially and then flows through a sealed water socket 6.28, a sealed water plug 6.27, and the water inlet u3 sequentially, so as to supply water for the atomization water tank 6.26 of the humidification and humidity control device 6.2 or supply water for the atmospheric ice-making water dispenser 7.7 from another water outlet of the solenoid valve B5 through a water supply pipeline.

[0040] The atmospheric ice-making water dispenser 7.7 includes an ice maker and a hot and cold purified water dispenser. The ice maker and the hot and cold purified water dispenser are arranged in the door 1.1, and are connected to the third filter through the water inlet pipeline.

[0041] As shown in FIG. 7, the humidification and humidity control device 6.2 includes an atomization humidity and water level controller 6.21, an atomizing nozzle 6.22, a nozzle holder 6.23, a water delivery cotton stick 6.24, a spring 6.25, an atomization water tank 6.26, a sealed water plug 6.27, a sealed water socket 6.28, and a water level sensor C8. The atomization humidity and water level controller 6.21 is connected to the control module. The atomizing nozzle 6.22, the nozzle holder 6.23, the water delivery cotton stick 6.24, and the spring 6.25 are assembled to form an atomizing nozzle assembly, the atomizing nozzle assembly is fixed to the atomization water tank 6.26, the atomizing nozzle 6.22 is arranged on the nozzle holder 6.23, and the water delivery cotton stick 6.24 is connected to the atomizing nozzle 6.22. The water delivery cotton stick 6.24 is immersed in water within the atomization water tank 6.26 to supply water to the atomizing nozzle 6.22 for atomization, thereby humidifying the microenvironment comprehensive fresh-keeping compartment 1A. The sealed water socket 6.28 is fixed to an upper portion of a groove on an inner wall of the microenvironment comprehensive fresh-keeping compartment 1A and communicates with the water inlet pipeline. The sealed water plug 6.27 is fixed to an upper portion of a rear wall of the atomization water tank 6.26 and inserted into the sealed water socket 6.28 to supply water for the atomization water tank 6.26. The atomizing nozzle assembly and the water level sensor C8 are each connected to the atomization humidity and water level controller 6.21. According to feedback from the humidity sensor C4, the atomization humidity and water level controller 6.21 controls the atomizing nozzle 6.22 to regulate a humidity in the microenvironment comprehensive fresh-keeping compartment 1A.

[0042] The atomization water tank 6.26 is arranged on a wall panel in the microenvironment comprehensive fresh-keeping compartment 1A, with a rear sealed water plug 6.27 inserted into a sealed water socket 6.28 fixed

on the wall panel of the microenvironment comprehensive fresh-keeping compartment 1A. One or more atomizing nozzles 6.22 are provided on an upper portion of a front panel of the atomization water tank 6.26. A humidification water delivery cotton stick 6.24, a holder 6.23, and a spring 6.25 are provided at a rear portion of each atomizing nozzle 6.22. Each atomizing nozzle 6.22 is connected to the atomization humidity and water level controller 6.21 through wiring. The atomization humidity and water level controller 6.21 is connected to the regulating device 5 through wiring. According to feedback from the water level sensor C8, the atomization humidity and water level controller controls the water inlet and outlet pump 3.1 to regulate a water level in the atomization water tank 6.26.

[0043] In practical application, the control module is configured to: compare temperature, humidity, ozone concentration, oxygen concentration, negative oxygen ion concentration, air pressure, and air quality data of the microenvironment fresh-keeping compartment with respective set values, and regulate, based on comparison results, the inflation and deflation pump module, the adsorption-type modified atmosphere device, the humidification and humidity control device 6.2, the ozone generator 6.3, the negative oxygen ion generator 6.4, the catalytic controlled-release device 6.5, and the refrigeration and temperature control device 8 such that the inflation and deflation pump module drives the adsorption-type modified atmosphere device to generate nitrogen and circulate the nitrogen into the microenvironment fresh-keeping compartment for modified atmosphere preservation; cause the inflation and deflation pump module to generate a vacuum or a high pressure in the microenvironment fresh-keeping compartment through the gas outlet pipeline, the inflation pipeline, and the gas inlet pipeline, enabling vacuum preservation or high-pressure preservation; cause the humidification and humidity control device 6.2 to perform humidification and humidity control preservation on the microenvironment comprehensive fresh-keeping compartment 1A; cause the ozone generator 6.3 to generate ozone to enable sterilization and residue degradation for the microenvironment comprehensive fresh-keeping compartment 1A and items stored therein; cause the negative oxygen ion generator 6.4 to generate negative oxygen ions to perform sterilization and preservation on the microenvironment fresh-keeping compartment and items stored therein; cause the catalytic controlled-release device 6.5 to perform sterilization and harmful substance decomposition on the microenvironment fresh-keeping compartment and items stored therein; and regulate a temperature of the microenvironment fresh-keeping compartment in real time.

[0044] When an excessively high oxygen concentration in the microenvironment fresh-keeping compartment is detected by the data acquisition module, based on set data, the fifteenth solenoid valve B15, the sixteenth solenoid valve B16, the twelfth solenoid valve B12, and the

adsorption-type modified atmosphere module are controlled to produce nitrogen, and the first solenoid valve B1, the second solenoid valve B2, the fourth solenoid valve B4, the sixth solenoid valve B6, the eighth solenoid valve B8, the ninth solenoid valve B9, the tenth solenoid valve B10, and the eleventh solenoid valve B11 are turned on such that nitrogen is circulated into the microenvironment fresh-keeping compartment through the gas inlet pipeline for modified atmosphere preservation.

[0045] When high-pressure preservation is required, according to set data and feedback from a pressure sensor C7, the control module turns on the second solenoid valve B2, the sixth solenoid valve B6, the ninth solenoid valve B9, or the eleventh solenoid valve B11, turns off the first solenoid valve B1, the fourth solenoid valve B4, the eighth solenoid valve B8, the tenth solenoid valve B10, and the fifteenth solenoid valve B15, opens an inflation port of the first solenoid valve B1 or the tenth solenoid valve B10 to communicate with the inflation pipeline, and starts the inflation and deflation pump 2.1. Accordingly, air from outside the microenvironment fresh-keeping compartment is charged into the microenvironment fresh-keeping compartment through the inflation pipeline, the gas outlet pipeline, the inflation and deflation pump module, the third gas outlet y of the twelfth solenoid valve B12, and the gas inlet pipeline, thereby generating a high pressure in the microenvironment fresh-keeping compartment for high-pressure preservation.

[0046] When vacuum preservation is required, according to set data and feedback from the pressure sensor C7, the control module turns on the second solenoid valve B2, the sixth solenoid valve B6, the ninth solenoid valve B9, or the eleventh solenoid valve B11, turns off the first solenoid valve B1, the fourth solenoid valve B4, the eighth solenoid valve B8, the tenth solenoid valve B10, and the fifteenth solenoid valve B15, and starts the inflation and deflation pump 2.1. Accordingly, air is extracted from the microenvironment fresh-keeping compartment, injected toward the condenser assembly 7.2 through the gas outlet, the gas outlet pipeline, the inflation and deflation pump module, a first gas outlet e of the twelfth solenoid valve B12, and the water-producing gas outlet pipe 7.1, and then discharged through the exhaust pipeline, thereby generating a vacuum in the microenvironment fresh-keeping compartment for vacuum preservation.

[0047] The control module is further configured to: control the inflation and deflation pump module to extract a gas inside or outside the microenvironment fresh-keeping compartment and deliver the gas to the atmospheric water generator 7; control the atmospheric water generator 7 to produce water; and control the water inlet and outlet pump module to deliver the produced water to the humidification and humidity control device 6.2 and the atmospheric ice-making water dispenser 7.7.

[0048] The regulating device 5 includes an integrated circuit/chip (namely, a control module, not shown in the

figures), a preservation regulation system, a touch screen and mobile phone monitoring and recognition system, a door touch screen 5.3, a camera module (a high-definition anti-fog camera recognition device 5.4 or a wireless anti-fog camera recognition device 5.5), a scanning module (a radar scanning recognition device 5.6 or a wireless radar scanning recognition device 5.7), a power supply, and sensors C1 to C8. The power supply is configured to supply power to the integrated circuit/chip, the preservation regulation system, the touch screen and mobile phone monitoring and recognition system, the door touch screen 5.3, the camera module, and the scanning module. The regulating device 5 is connected to Internet in a wired or wireless manner.

[0049] The adjustable-transparency anti-condensation glass door 1.23, the inflation and deflation pump module, the water inlet and outlet pump module, a preservation system, the atmospheric water generator 7, the refrigeration and temperature control device 8, the sensors C1 to C8, and the solenoid valves B1 to B16 are all connected to the control module in the regulating device 5 through wiring. The control module is configured to control a transparency of the adjustable-transparency anti-condensation glass door 1.23.

[0050] In practical application, the equipment compartment 10 may be arranged at a lower rear portion of the cabinet 1.1, and may also be arranged at a middle portion or a top of the cabinet 1.1.

[0051] As an optional embodiment, the microenvironment fresh-keeping refrigerator further includes the water collection tank.

[0052] The water collection tank is arranged at a bottom of the microenvironment fresh-keeping compartment. The water collection tank is configured to collect water resulting from gas condensation and defrosting in the microenvironment fresh-keeping compartment. The water collection tank communicates with the water inlet and outlet pump 3.1 through the water outlet pipeline and the second filter 7.5. The water outlet pipeline is provided with a solenoid valve.

[0053] A water inlet v of the drainage filter 7.5 is connected to a water outlet v3 of a water collection tank of the microenvironment refrigerated fresh-keeping compartment 1B, a water outlet v4 of a water collection tank of the microenvironment comprehensive fresh-keeping compartment 1A, a water outlet of a water collection tank (not shown in the figures) of the microenvironment soft-freezing fresh-keeping compartment 1D, and a water outlet of a water collection tank (not shown in the figures) of the microenvironment freezing fresh-keeping compartment 1C through the water outlet pipeline, a third solenoid valve B3, and a seventh solenoid valve B7.

[0054] As shown in FIG. 4 and FIG. 5, in another embodiment, a water collection tank is provided at a bottom of the microenvironment fresh-keeping compartment, the water collection tank communicates with the drainage filter 7.5 through the water outlet pipeline, and a

third solenoid valve B3 and a seventh solenoid valve B7 are provided at a water inlet of the water outlet pipeline.

[0055] In practical application, the camera module and the scanning module are both connected to the control module. The camera module captures images of fruits or vegetables stored in the microenvironment fresh-keeping refrigerator in real time and transmits the captured images to the control module. The control module determines a type of the stored fruits or vegetables based on the captured images, and retrieves the pre-stored optimal preservation oxygen concentration, optimal preservation ozone concentration, optimal preservation temperature, and optimal preservation humidity for the type of the stored fruits or vegetables. The control module calculates an average oxygen concentration, an average ozone concentration, an average temperature, an average humidity, and an average nitrogen concentration, and performs real-time accurate regulation of the gas conditioning module in the microenvironment fresh-keeping refrigerator based on the calculated average values, such that the vegetables or fruits stored in the microenvironment fresh-keeping refrigerator can be preserved for a long period of time.

[0056] The various embodiments in this specification are described in a progressive manner, with each embodiment focusing on the differences from other embodiments, and references can be made to each other for the same and similar parts among the various embodiments.

[0057] Specific examples are used herein to explain the principles and implementations of the present disclosure. The description of the embodiments is merely intended to help understand the method of the present disclosure and a core idea thereof. In addition, those of ordinary skill in the art can make various modifications to the specific implementations and application scope in accordance with the teachings of the present disclosure. In conclusion, the content of the specification shall not be construed as a limitation to the present disclosure.

Claims

1. A microenvironment fresh-keeping refrigerator, comprising: a cabinet, a door, and a microenvironment fresh-keeping compartment, a data acquisition module, a regulating device, an inflation and deflation pump module, a water inlet and outlet pump module, a gas conditioning module, an atmospheric water generator, a refrigeration and temperature control device, and an equipment compartment that are arranged within the cabinet,

wherein the microenvironment fresh-keeping compartment comprises a microenvironment refrigerated fresh-keeping compartment, a microenvironment comprehensive fresh-keeping compartment, a microenvironment freezing fresh-keeping compartment, and a microenvir-

onment soft-freezing fresh-keeping compartment; each of the microenvironment refrigerated fresh-keeping compartment, the microenvironment comprehensive fresh-keeping compartment, the microenvironment freezing fresh-keeping compartment, and the microenvironment soft-freezing fresh-keeping compartment is provided with a gas inlet, a gas outlet, a water inlet, and a water outlet; and the regulating device comprises a control module and a door touch screen;

the gas conditioning module comprises an adsorption-type modified atmosphere device, a humidification and humidity control device, an ozone generator, a negative oxygen ion generator, and a catalytic controlled-release device; the humidification and humidity control device, the ozone generator, the negative oxygen ion generator, and the catalytic controlled-release device are arranged in the microenvironment fresh-keeping compartment; and the adsorption-type modified atmosphere device, the inflation and deflation pump module, the water inlet and outlet pump module, the atmospheric water generator, and the refrigeration and temperature control device are arranged in the equipment compartment;

the gas outlet is connected to the inflation and deflation pump module through a gas outlet pipeline, the inflation and deflation pump module is connected to the atmospheric water generator, the atmospheric water generator is connected to the adsorption-type modified atmosphere device, the adsorption-type modified atmosphere device is connected to the gas inlet through a gas inlet pipeline, so as to form a circulation loop for modified atmosphere preservation; the inflation and deflation pump module is connected to the gas inlet through the gas inlet pipeline, and is also connected to an inflation pipeline through the gas outlet pipeline, so as to generate a high pressure in the microenvironment fresh-keeping compartment for high-pressure preservation; the inflation and deflation pump module is connected to the gas outlet through the gas outlet pipeline, so as to generate a vacuum in the microenvironment fresh-keeping compartment for vacuum preservation; the water inlet and outlet pump module is connected to the atmospheric water generator, and the water inlet and outlet pump module is connected to the humidification and humidity control device and the atmospheric ice-making water dispenser through a water inlet pipeline and the water inlet; and the water inlet and outlet pump module also communicates with a water collection tank of the microenvironment fresh-keeping compartment through a water outlet pipeline and

the water outlet;

the data acquisition module is arranged in the microenvironment fresh-keeping compartment; the data acquisition module is connected to the control module; the control module is connected to the adsorption-type modified atmosphere device, the humidification and humidity control device, the ozone generator, the negative oxygen ion generator, the catalytic controlled-release device, the inflation and deflation pump module, the water inlet and outlet pump module, the atmospheric water generator, the refrigeration and temperature control device, and Internet; and the refrigeration and temperature control device is connected to the microenvironment fresh-keeping compartment, the atmospheric water generator, and the atmospheric ice-making water dispenser;

the data acquisition module is configured to acquire temperature, humidity, ozone concentration, oxygen concentration, negative oxygen ion concentration, air pressure, and air quality data of the microenvironment fresh-keeping compartment, and data of items stored in the microenvironment fresh-keeping compartment; the control module is configured to: compare the temperature, humidity, ozone concentration, oxygen concentration, negative oxygen ion concentration, air pressure, and air quality data of the microenvironment fresh-keeping compartment with respective set values, and regulate, based on comparison results, the inflation and deflation pump module, the adsorption-type modified atmosphere device, the humidification and humidity control device, the ozone generator, the negative oxygen ion generator, the catalytic controlled-release device, and the refrigeration and temperature control device such that the inflation and deflation pump module drives the adsorption-type modified atmosphere device to generate nitrogen and circulate the nitrogen into the microenvironment fresh-keeping compartment for modified atmosphere preservation; cause the inflation and deflation pump module to generate a vacuum or a high pressure in the microenvironment fresh-keeping compartment through the gas outlet pipeline, the inflation pipeline, and the gas inlet pipeline, enabling vacuum preservation or high-pressure preservation; cause the humidification and humidity control device to perform humidification and humidity control preservation on the microenvironment comprehensive fresh-keeping compartment; cause the ozone generator to generate ozone to enable sterilization and residue degradation for the microenvironment comprehensive fresh-keeping compartment and items stored therein; cause the negative oxygen

- ion generator to generate negative oxygen ions to perform sterilization and preservation on the microenvironment fresh-keeping compartment and items stored therein; cause the catalytic controlled-release device to perform sterilization and harmful substance decomposition on the microenvironment fresh-keeping compartment and items stored therein; and regulate a temperature of the microenvironment fresh-keeping compartment in real time; and the control module is further configured to: control the inflation and deflation pump module to extract a gas inside or outside the microenvironment fresh-keeping compartment and deliver the gas to the atmospheric water generator; control the atmospheric water generator to produce water; and control the water inlet and outlet pump module to deliver the produced water to the humidification and humidity control device and the atmospheric ice-making water dispenser.
2. The microenvironment fresh-keeping refrigerator according to claim 1, wherein the inflation and deflation pump module comprises a first filter, a heating unit, a muffler, and an inflation and deflation pump that are connected sequentially; and the first filter is connected to the microenvironment fresh-keeping compartment through the gas outlet pipeline and a first solenoid valve, a fourth solenoid valve, an eighth solenoid valve, or a tenth solenoid valve, and the first solenoid valve and the tenth solenoid valve are each further connected to the inflation pipeline; and a deflation port of the inflation and deflation pump is connected to the muffler; an inflation port of the inflation and deflation pump is connected to the atmospheric water generator; and a twelfth solenoid valve is provided at a connection between the inflation and deflation pump and the atmospheric water generator.
 3. The microenvironment fresh-keeping refrigerator according to claim 1, wherein the adsorption-type modified atmosphere device comprises a molecular sieve air separation tower A, a molecular sieve air separation tower B, a fifteenth solenoid valve, and a sixteenth solenoid valve;

an end of the molecular sieve air separation tower A and an end of the molecular sieve air separation tower B are both connected to the fifteenth solenoid valve; the fifteenth solenoid valve is provided at a gas inlet of the gas inlet pipeline; gas outlets of the gas inlet pipeline are connected to gas inlets of the microenvironment refrigerated fresh-keeping compartment, the microenvironment comprehensive fresh-keeping compartment, the microenvironment freezing fresh-keeping compartment, and the microenvironment soft-freezing fresh-keeping compartment, respectively; and the fifteenth solenoid valve is further connected to the atmospheric water generator;

another end of the molecular sieve air separation tower A and another end of the molecular sieve air separation tower B are both connected to the sixteenth solenoid valve; and the sixteenth solenoid valve is further connected to an exhaust pipeline; and each solenoid valve is connected to the control module.
 4. The microenvironment fresh-keeping refrigerator according to claim 1, wherein the humidification and humidity control device comprises an atomization humidity and water level controller, an atomizing nozzle, a nozzle holder, a water delivery cotton stick, a spring, an atomization water tank, a sealed water plug, a sealed water socket, and a water level sensor; the atomization humidity and water level controller is connected to the control module; the atomizing nozzle, the nozzle holder, the water delivery cotton stick, and the spring are assembled to form an atomizing nozzle assembly, the atomizing nozzle assembly is fixed to the atomization water tank, the atomizing nozzle is arranged on the nozzle holder, and the water delivery cotton stick is connected to the atomizing nozzle; the water delivery cotton stick is immersed in water within the atomization water tank; the sealed water socket is fixed to an upper portion of a groove on an inner wall of the microenvironment comprehensive fresh-keeping compartment and communicates with the water inlet pipeline; the sealed water plug is fixed to an upper portion of a rear wall of the atomization water tank and inserted into the sealed water socket to supply water for the atomization water tank; and the atomizing nozzle assembly and the water level sensor are each connected to the atomization humidity and water level controller.
 5. The microenvironment fresh-keeping refrigerator according to claim 1, wherein the gas outlet pipeline is provided with a first solenoid valve, a fourth solenoid valve, an eighth solenoid valve, and a tenth solenoid valve; the gas inlet pipeline is provided with a second solenoid valve, a sixth solenoid valve, a ninth solenoid valve, and an eleventh solenoid valve; and each solenoid valve is connected to the control module.
 6. The microenvironment fresh-keeping refrigerator according to claim 2, wherein the atmospheric water generator comprises a water-producing gas outlet pipe, a condenser assembly, a fan, a gas-water separator, a water storage tank, an internal conden-

sing gas pipeline, and a refrigeration pipeline; and a first gas outlet of the twelfth solenoid valve is connected to the water-producing gas outlet pipe; a plurality of gas injection holes of the water-producing gas outlet pipe face the condenser assembly; a second gas outlet of the twelfth solenoid valve is connected to a gas inlet of the condenser assembly; a gas outlet of the condenser assembly is connected to a gas inlet of the gas-water separator; the internal condensing gas pipeline between the gas inlet and the gas outlet of the condenser assembly is arranged side by side with the refrigeration pipeline as internal and external condensing parallel pipelines; the refrigeration pipeline is connected to the refrigeration and temperature control device; a gas outlet of the gas-water separator is connected to the adsorption-type modified atmosphere device through a fifteenth solenoid valve; the fan and the condenser assembly are adjacent to each other; the water storage tank is arranged below the condenser assembly and the gas-water separator; water condensed on an exterior of the condenser assembly and water condensed and separated by the gas-water separator from the internal condensing gas pipeline both drip into the water storage tank; the atmospheric water generator is further connected to an exhaust pipeline; and each solenoid valve is connected to the control module.

7. The microenvironment fresh-keeping refrigerator according to claim 6, wherein the water inlet and outlet pump module comprises a water inlet and outlet pump, a second filter, and a third filter; and an end of the water inlet and outlet pump is connected to the water storage tank, and another end of the water inlet and outlet pump is connected to the second filter and the third filter through a thirteenth solenoid valve; the second filter is connected to the microenvironment fresh-keeping compartment through the water outlet pipeline; the third filter is connected to the humidification and humidity control device and the atmospheric ice-making water dispenser through the water inlet pipeline; and a fifth solenoid valve is provided at a connection where the water inlet pipeline is connected to the humidification and humidity control device and the atmospheric ice-making water dispenser; and the control module is configured to control water supply and drainage by regulating forward and reverse rotations of the water inlet and outlet pump and adjusting respective solenoid valves.
8. The microenvironment fresh-keeping refrigerator according to claim 7, wherein the atmospheric ice-making water dispenser comprises an ice maker and a hot and cold purified water dispenser; the ice maker and the hot and cold purified water dispenser are connected to the third filter through the water inlet pipeline; and the ice maker and the hot and cold

purified water dispenser are arranged in the door and both connected to the control module.

9. The microenvironment fresh-keeping refrigerator according to claim 7, further comprising the water collection tank, wherein the water collection tank is arranged at a bottom of the microenvironment fresh-keeping compartment; the water collection tank is configured to collect water resulting from gas condensation and defrosting in the microenvironment fresh-keeping compartment; the water collection tank communicates with the water inlet and outlet pump through the water outlet pipeline and the second filter; and the water outlet pipeline is provided with a solenoid valve.
10. The microenvironment fresh-keeping refrigerator according to claim 1, wherein the data acquisition module further comprises a camera module and a scanning module; and the camera module and the scanning module are both connected to the control module.
11. The microenvironment fresh-keeping refrigerator according to claim 1, wherein the door comprises an opaque door, a transparent glass anti-condensation door, and an adjustable-transparency anti-condensation glass door; and the adjustable-transparency anti-condensation glass door is connected to the control module, and the control module is configured to control a transparency of the adjustable-transparency anti-condensation glass door.

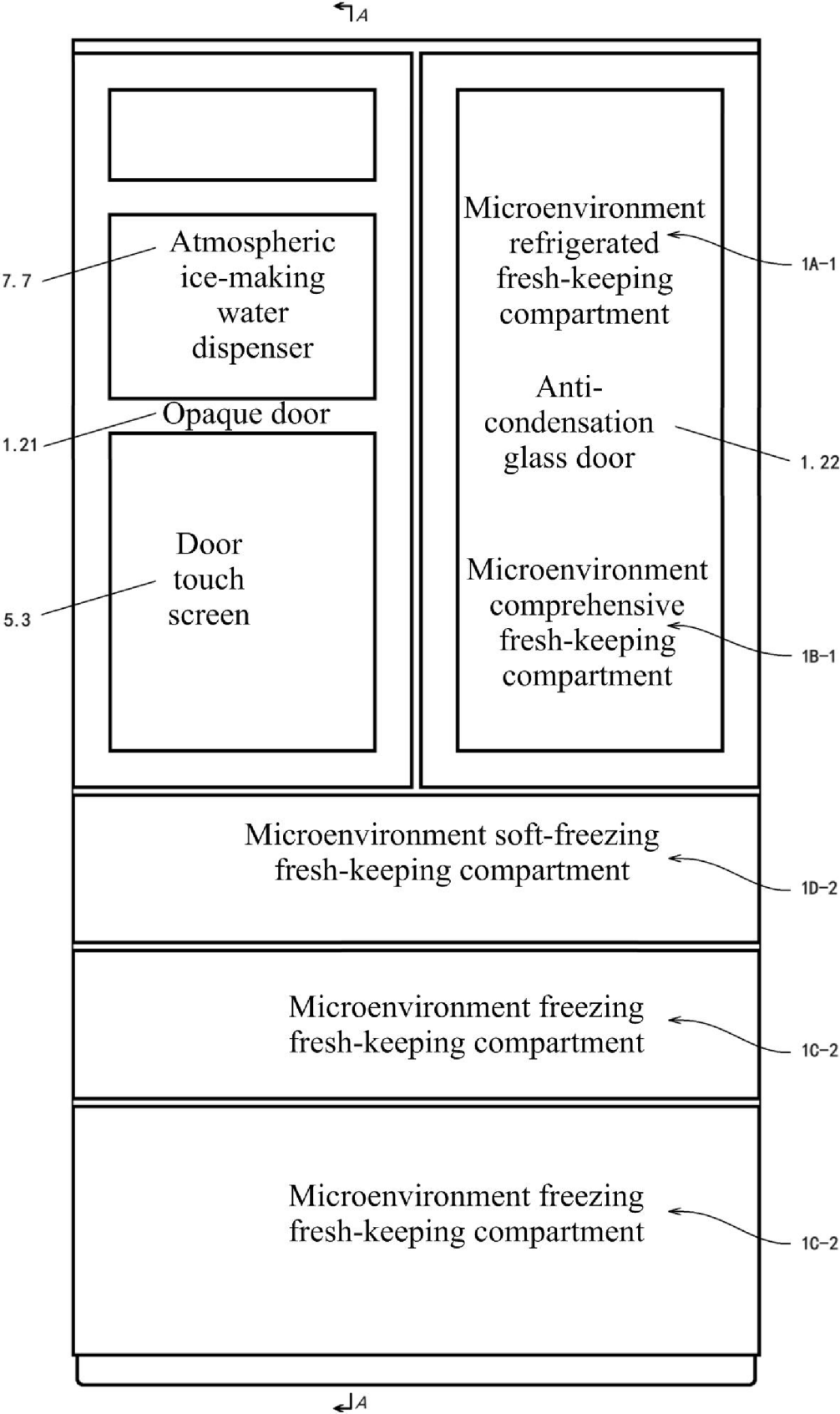


FIG. 1



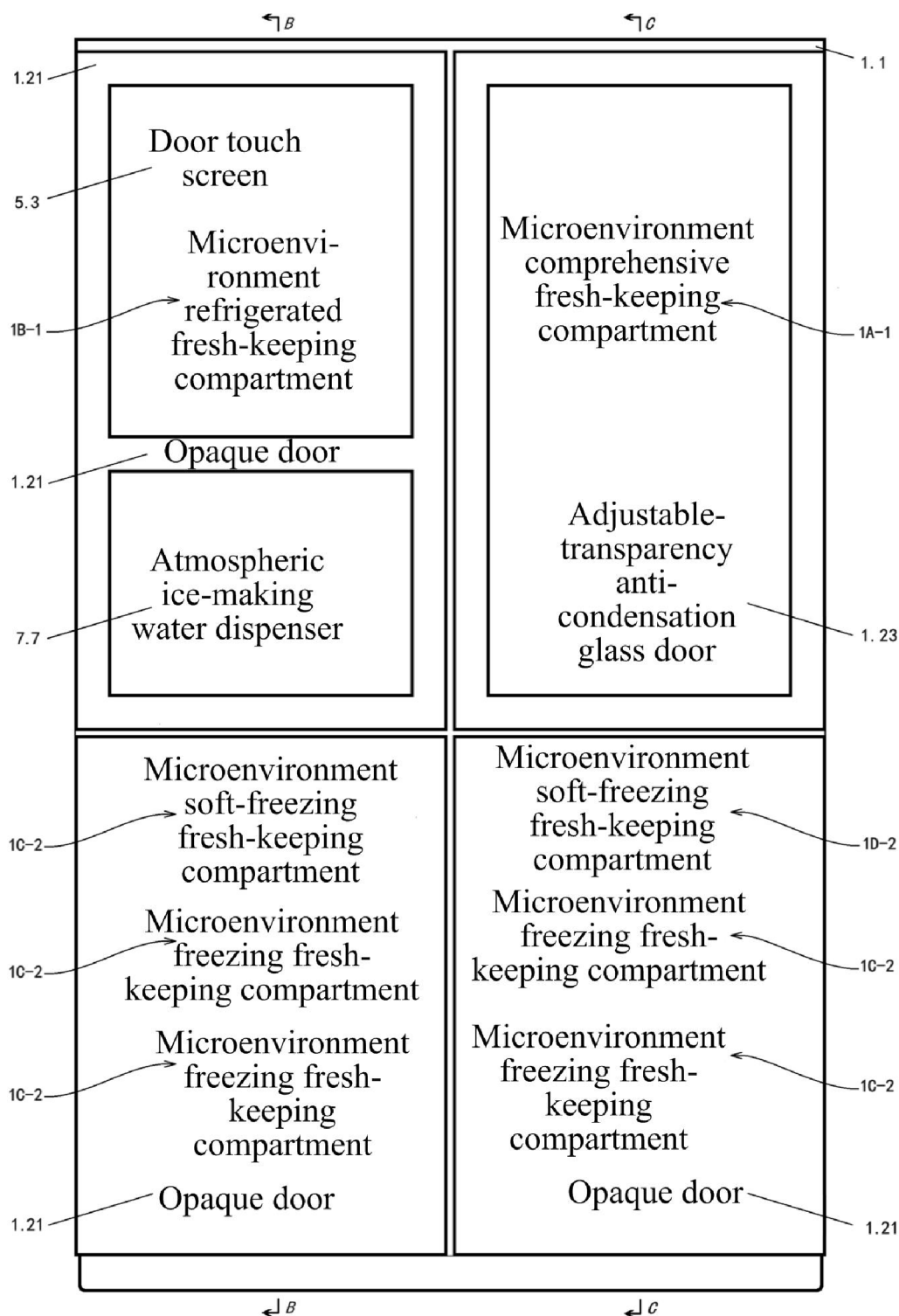


FIG. 3



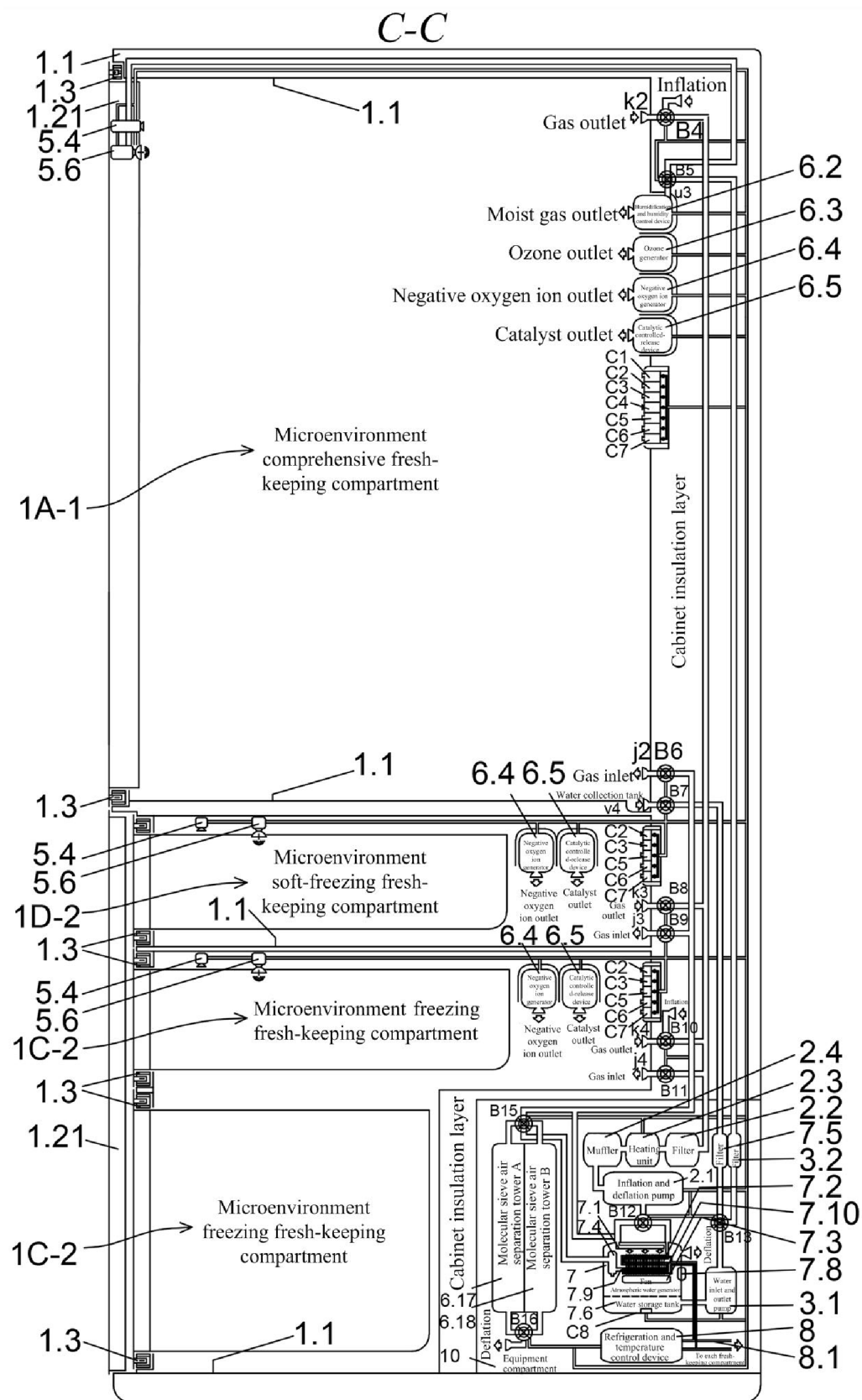


FIG. 5

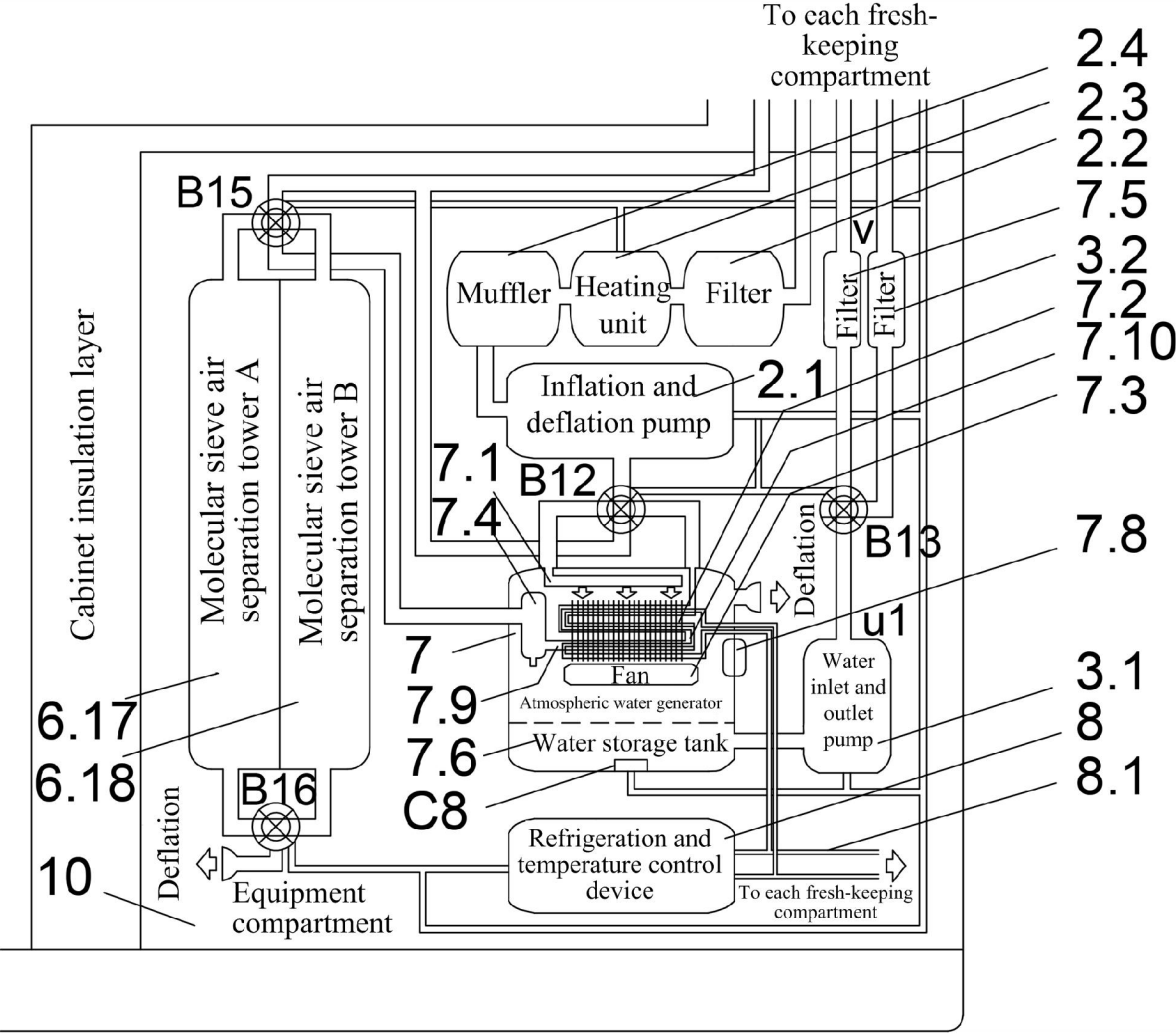


FIG. 6

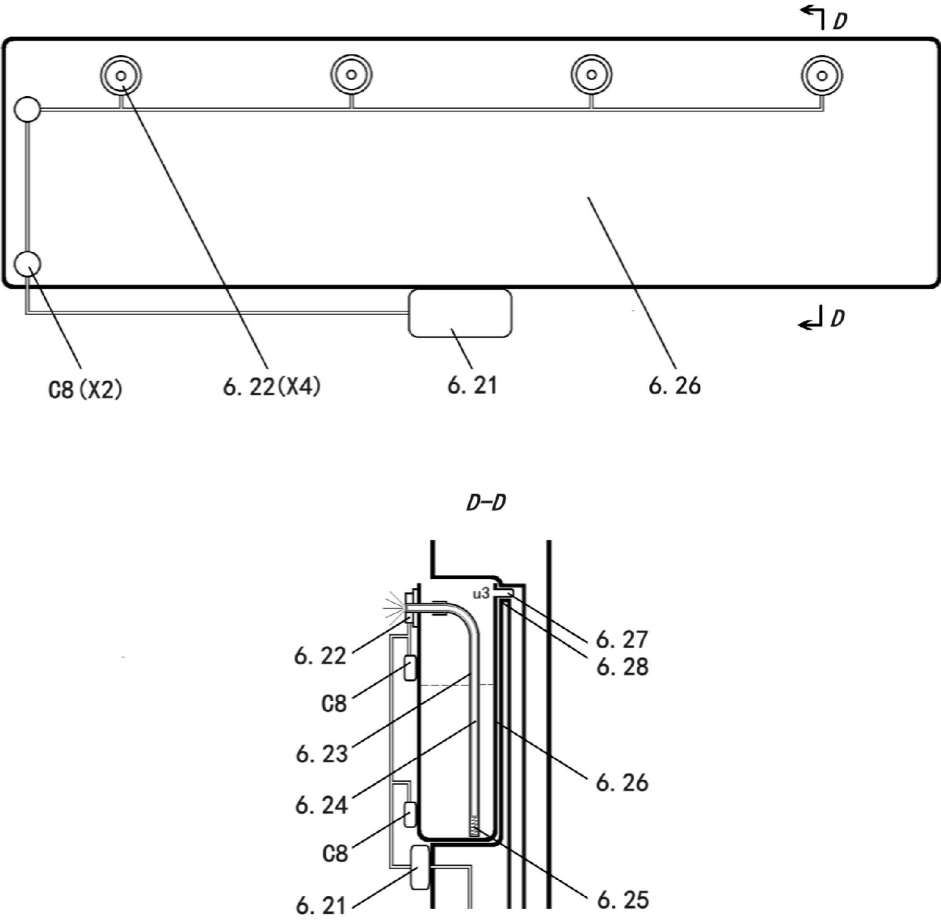


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/124840

A. CLASSIFICATION OF SUBJECT MATTER

F25D11/02(2006.01)i; F25D29/00(2006.01)i; F25D17/04(2006.01)i; F25D23/12(2006.01)i; F25D23/02(2006.01)i;
E03B3/28(2006.01)i; G05D16/20(2006.01)i; G05D27/02(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)

IPC: F25D E03B G05D

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)

CNABS, CNTXT, VEN, ENTXTC, CNKI, USTXT, EPTXT, WOTXT, ISI Web of Knowledge, 万方, WANFANG, 超星读秀, DUXIU: 北京正负压科技发展有限公司, 郑伯昂, 冰箱, 保鲜, 杀菌, 灭菌, 气, 水, 湿, 氧, 臭氧, 负离子, 触媒, 温度, 压力, 气压, refrigerat+, fresh, steriliz+, air, water, humidity, wet, moisture, oxygen, O2, ozone, O3, ion, accelerant, temperature, pressure

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	CN 113433981 A (ZHENG BOANG) 24 September 2021 (2021-09-24) description, paragraphs [0007]-[0008], and figures 1-8	1-11
X	CN 111562804 A (ZHENG BOANG) 21 August 2020 (2020-08-21) description, paragraphs [0007]-[0008], and figures 1-5	1-11
A	CN 108759243 A (QINGDAO HAIER CO., LTD.) 06 November 2018 (2018-11-06) description, paragraphs [0017]-[0033], and figures 1-6	1-11
A	CN 211695558 U (HU QINHENG) 16 October 2020 (2020-10-16) description, paragraphs [0038]-[0076], and figures 1-6	1-11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"D" document cited by the applicant in the international application	"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
"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"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	

Date of the actual completion of the international search

30 November 2024

Date of mailing of the international search report

12 December 2024

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
CN)
China No. 6, Xitucheng Road, Jimenqiao, Haidian District,
Beijing 100088

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2024/124840

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CN 211695558 U	16 October 2020	None	

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202410082489 [0001]