

STORAGE APPARATUS AND STORAGE SYSTEM

CROSS-REFERENCE TO RELATED PATENT APPLICATION

This application claims the benefit of priority to Taiwan Patent Application
5 No. 109132368, filed on September 18, 2020. The entire content of the above
identified application is incorporated herein by reference.

This application claims priority to the U.S. Provisional Patent Application
Ser. No. 63/031,806 filed on May 29, 2020, which application is incorporated
herein by reference in its entirety.

10 Some references, which may include patents, patent applications and
various publications, may be cited and discussed in the description of this
disclosure. The citation and/or discussion of such references is provided merely
to clarify the description of the present disclosure and is not an admission that
any such reference is “prior art” to the disclosure described herein. All
15 references cited and discussed in this specification are incorporated herein by
reference in their entireties and to the same extent as if each reference was
individually incorporated by reference.

FIELD OF THE DISCLOSURE

20 The present disclosure relates to a storage apparatus and a storage system,
and more particularly to a storage apparatus and a storage system configured to
store frozen objects and refrigerated objects at the same time.

BACKGROUND OF THE DISCLOSURE

25 In some semiconductor manufacturing processes, it is necessary to store an

object required to be used in a frozen environment. When the object needs to be used in a related manufacturing process, a technical personnel must take out the object from a freezer and place the object in a room temperature environment, so as to unfreeze the object before the related manufacturing process starts. After the temperature of the object is substantially equal to the room temperature, the object can be used in the related manufacturing process.

According to the above, in a practical application, after the object is taken out by the technical personnel from the freezer, the object is disposed on a table in the room temperature environment, and the object is not used in the related manufacturing process until the temperature of the object is substantially equal to the room temperature. However, this process and manner of operation not only waste human resources, but also tends to cause mistakes.

SUMMARY OF THE DISCLOSURE

In response to the above-referenced technical inadequacies, the present disclosure provides a storage apparatus to improve the inconvenience and the issues associated with a conventional manner of operation, in which an object is manually taken out from a refrigerator and disposed in a room temperature environment, and the object is not used in a related manufacturing process until a temperature of the object is substantially equal to the room temperature.

In one aspect, the present disclosure provides a storage apparatus. The storage apparatus is configured to store a plurality of carrying shelves, and each of the carrying shelves is configured to carry an object. The storage apparatus includes a main body, a processing device, a transferring device, at least one first chamber, at least one second chamber, a temperature barrier, and at least

one environment adjusting device. The main body has an access opening. The transferring device includes a stretchable structure, a rotatable structure, and a holding assembly. The stretchable structure is connected to the rotatable structure, the holding assembly is connected to the stretchable structure, and the
5 holding assembly is configured to hold one of the carrying shelves. The transferring device is electrically connected to the processing device, and the processing device is configured to control the stretchable structure to allow the holding assembly to move forward or backward relative to the rotatable structure. The processing device is configured to control the rotatable structure
10 to allow stretchable structure and the holding assembly to rotate. The at least one first chamber is disposed surrounding the transferring device and configured to accommodate the carrying shelves. The at least one second chamber is disposed surrounding the transferring device. The at least one second chamber is disposed above the at least one first chamber, and the at least
15 one second chamber is configured to accommodate the carrying shelves. The temperature barrier is disposed between the at least one first chamber and the at least one second chamber. The temperature barrier is configured to prevent heat inside the at least one first chamber and heat inside the at least one second chamber from mutual transfer. The at least one environment adjusting device is
20 electrically connected to the processing device. The processing device is configured to control the at least one temperature adjusting device so that a temperature of the at least one first chamber is less than or equal to a first temperature and a temperature of the at least one second chamber is less than or equal to a second temperature. The second temperature is less than 30°C, the
25 first temperature is greater than -10°C, and the first temperature is less than or

equal to the second temperature. The processing device is configured to control the transferring device to allow the holding assembly to transfer and dispose one of the carrying shelves arranged at the access opening into the at least one first chamber or the at least one second chamber, and the control device is
5 configured to control the transferring device to allow the holding assembly to transfer one of the carrying shelves arranged in the at least one first chamber or the at least one second chamber to the access opening.

In another aspect, the present disclosure provides a storage system including a storage apparatus, a transferring apparatus, and a processing
10 apparatus. The storage apparatus is configured to store a plurality of carrying shelves. Each of the carrying shelves is configured to carry an object, and the storage apparatus includes a main body, a processing device, a transferring device, at least one first chamber, at least one second chamber, a temperature barrier, and at least one environment adjusting device. The main body includes
15 a carrying platform and an access opening, and the carrying platform is provided so that one of the carrying shelves is configured to be disposed thereon. The transferring device includes a stretchable structure, a rotatable structure, and a holding assembly. The stretchable structure is connected to the rotatable structure, the holding assembly is connected to the stretchable
20 structure, and the holding assembly is configured to hold one of the carrying shelves. The transferring device is electrically connected to the processing device, and the processing device is configured to control the stretchable structure to allow the holding assembly to move forward or backward relative to the rotatable structure. The processing device is configured to control the
25 rotatable structure to allow the stretchable structure and the holding assembly to

rotate. The at least one first chamber is disposed surrounding the transferring device and configured to accommodate the carrying shelves. The at least one second chamber is disposed surrounding the transferring device. The at least one second chamber is disposed above the at least one first chamber, and the at least one second chamber is configured to accommodate the carrying shelves.

The temperature barrier is disposed between the at least one first chamber and the at least one second chamber. The temperature barrier is configured to prevent heat inside the at least one first chamber and heat inside the at least one second chamber from mutual transfer. The at least one environment adjusting device is electrically connected to the processing device. The processing device is configured to control the at least one temperature adjusting device so that a temperature of the at least one first chamber is less than or equal to a first temperature and a temperature of the at least one second chamber is less than or equal to a second temperature. The second temperature is less than 30°C, the first temperature is greater than -10°C, and the first temperature is less than or equal to the second temperature. The processing device is configured to control the transferring device so that the holding assembly allows one of the carrying shelves arranged at the carrying platform to pass through the access open and be moved and disposed into the at least one first chamber or the at least one second chamber.

The processing device is configured to control the transferring device so that the holding assembly allows one of the carrying shelves arranged in the at least one first chamber or the at least one second chamber to pass through the access opening and be disposed on the carrying platform. The transferring apparatus is configured to transfer one of the carrying shelves and the object carried by the one of the carrying shelves from a freezer to the carrying

platform of the storage apparatus. The processing apparatus is configured to receive a requirement data. The processing apparatus is configured to control the transferring apparatus to take out and transfer at least one of the carrying shelves and the object carried by the at least one of the carrying shelves from the freezer to the carrying platform according to the requirement data. The processing device is configured to control the transferring device to transfer the at least one of the carrying shelves and the object carried by the at least one of the carrying shelves that are arranged at the carrying platform into the at least one first chamber according to the requirement data. After the at least one of the carrying shelves and the object carried by the at least one of the carrying shelves are disposed in the at least one first chamber for a predetermined time period, the processing device is configured to control the transferring device to transfer the at least one of the carrying shelves and the object carried by the at least one of the carrying shelves into the at least one second chamber according to the requirement data.

Therefore, through the design of the processing device and the transferring device, the storage apparatus and the storage system provided by the present disclosure allows a technical personnel to conveniently take out and store the carrying shelf and the object carried by the carrying shelf.

These and other aspects of the present disclosure will become apparent from the following description of the embodiment taken in conjunction with the following drawings and their captions, although variations and modifications therein may be affected without departing from the spirit and scope of the novel concepts of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure will become more fully understood from the following description and accompanying drawings, in which:

FIG. 1 is a schematic view of a storage apparatus of the present disclosure;

5 FIG. 2 is a block diagram of the storage apparatus of the present disclosure;

FIG. 3 is a partial sectional view of the storage apparatus of the present disclosure;

FIG. 4 is a schematic view of a first chamber and a plurality of second chambers of the storage apparatus of the present disclosure;

10 FIG. 5 a schematic view of the storage apparatus having a plurality of carrying shelves disposed thereon according to the present disclosure;

FIG. 6 is a schematic view of the first chamber and an annular movable wall of the storage apparatus of the present disclosure;

15 FIG. 7 is a schematic view showing a holding assembly of the storage apparatus holding the carrying shelf arranged in the first chamber according to the present disclosure;

FIG. 8 is a partial sectional view of a first base seat of the storage apparatus of the present disclosure;

20 FIG. 9 and FIG. 10 are schematic views of the carrying shelf of the storage apparatus from different angles according to the present disclosure;

FIG. 11 is a schematic view of a stretchable structure and the holding assembly of the storage apparatus of the present disclosure;

FIG. 12 is a schematic view showing the holding assembly of the storage apparatus holding the carrying shelf according to the present disclosure; and

25 FIG. 13 is a block diagram of a storage system of the present disclosure.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

The present disclosure is more particularly described in the following examples that are intended as illustrative only since numerous modifications
5 and variations therein will be apparent to those skilled in the art. Like numbers in the drawings indicate like components throughout the views. As used in the description herein and throughout the claims that follow, unless the context clearly dictates otherwise, the meaning of “a”, “an”, and “the” includes plural reference, and the meaning of “in” includes “in” and “on”. Titles or subtitles
10 can be used herein for the convenience of a reader, which shall have no influence on the scope of the present disclosure.

The terms used herein generally have their ordinary meanings in the art. In the case of conflict, the present document, including any definitions given herein, will prevail. The same thing can be expressed in more than one way.
15 Alternative language and synonyms can be used for any term(s) discussed herein, and no special significance is to be placed upon whether a term is elaborated or discussed herein. A recital of one or more synonyms does not exclude the use of other synonyms. The use of examples anywhere in this specification including examples of any terms is illustrative only, and in no way
20 limits the scope and meaning of the present disclosure or of any exemplified term. Likewise, the present disclosure is not limited to various embodiments given herein. Numbering terms such as “first”, “second” or “third” can be used to describe various components, signals or the like, which are for distinguishing one component/signal from another one only, and are not intended to, nor
25 should be construed to impose any substantive limitations on the components,

signals or the like.

Referring to FIG. 1 to FIG. 3, FIG. 1 is a schematic view of a storage apparatus of the present disclosure, FIG. 2 is a block diagram of the storage apparatus of the present disclosure, and FIG. 3 is a partial sectional view of the storage apparatus of the present disclosure. A storage apparatus 100 is configured to store a plurality of carrying shelves 200 (as shown in FIG. 5), and each of the carrying shelves 200 is configured to carry an object 2 (as shown in FIG. 5). The storage apparatus 100 includes a main body A, a processing device B, a transferring device C, a first chamber D, three second chambers E, a temperature barrier F, and at least one environment adjusting device G.

The main body A can include a frame A1 and a plurality of covering boards A2. The frame A1 can be an overall supporting structure of the storage apparatus 100, the covering boards A2 are fixedly disposed on the frame A1, and the frame A1 and the covering boards A2 jointly define the first chamber D and the three second chambers E. In a practical application, the covering boards A2 defining the first chamber D can selectively be a member having a good thermal insulation effect, so that the covering boards A2 can prevent a temperature in the first chamber D from being affected by an external environment.

The processing device B is electrically connected to the transferring device C and the environment adjusting device G, the processing device B can control the transferring device C to be operated, and the processing device B can also control the environment adjusting device G to be operated. In a practical application, the processing device B can be, for example, various types of computers, servers, or processors, but the present disclosure is not limited

thereto. The processing device B can be disposed in the main body A of the storage apparatus 100, or, the processing device B can be disposed independent from the main body A. The processing device B can be connected to at least one input device (e.g., various types of keyboards, mouses, touch screens, or touchpads) and at least one display device. A technical personnel can control the processing device B to implement a related process through the input device, and the technical personnel can watch the display device to know a current storage state of the storage apparatus 100.

The transferring device C includes a stretchable structure C1, a rotatable structure C2, a holding assembly C3, and a lift structure C4. The stretchable structure C1 is connected to the rotatable structure C2, the holding assembly C3 is disposed at an end of the stretchable structure C1, and the holding assembly C3 is configured to hold one of the carrying shelves 200 (as shown in FIG. 5). The stretchable structure C1, the rotatable structure C2, and the holding assembly C3 are connected to the lift structure C4, and the lift structure C4 can vertically move the stretchable structure C1 and the holding assembly C3 upward or downward. The stretchable structure C1 is electrically connected to the processing device B, and the processing device B can control the stretchable structure C1 to be operated, so that the holding assembly C3 moves forward (i.e., in a direction toward the first chamber D) or backward (i.e., in a direction away from the first chamber D) relative to the rotatable structure C2.

The rotatable structure C2 is electrically connected to the processing device B, and the processing device B can control the rotatable structure C2 to be operated, so that the stretchable structure C1 and the holding assembly C3 connected thereto rotate by a predetermined angle relative to the first chamber

D. The predetermined angle can be any angle according to practical requirements. The holding assembly C3 is configured to hold one of the carrying shelves 200, a structure of the holding assembly C3 can be changed according to a practical structure of the carrying shelves 200, and any assembly
5 configured to hold the carrying shelf 200 falls within the applicable scope of the holding assembly C3 mentioned herein.

The stretchable structure C1, the rotatable structure C2, the holding assembly C3, and the lift structure C4 can be in cooperation with each other, so that the carrying shelf 200 held by the holding assembly C3 moves in a
10 horizontal direction (i.e., an X-axis direction or a Y-axis direction of the coordinates shown in FIG. 3) to enter or exit the first chamber D or one of the second chambers E.

The stretchable structure C1, the rotatable structure C2, the holding assembly C3, and the lift structure C4 can be in cooperation with each other, so
15 that the carrying shelf 200 held by the holding assembly C3 moves in a vertical direction (i.e., a Z-axis direction of the coordinates shown in FIG. 3) from a position near one of the second chambers E to a position near the first chamber D, or vice versa.

The stretchable structure C1, the rotatable structure C2, the holding
20 assembly C3, and the lift structure C4 can be in cooperation with each other, so that the carrying shelf 200 held by the holding assembly C3 rotates relative to the first chamber D and the second chambers E.

The structure, the component, and the electronic assembly included by the stretchable structure C1, the rotatable structure C2, the holding assembly C3,
25 and the lift structure C4 can be designed according to the structure and the

dimension of the actual carrying shelf 200, the object 2 that are going to be carried by the carrying shelf 200, and the main body A, but the present disclosure is not limited thereto. In other words, any structure that can hold and move the carrying shelf 200 and the object 2 carried by the carrying shelf 200 along the Z-axis direction, the X-axis direction, and the Y-direction, and rotate them relative to the Z-axis (i.e., taking the Z-axis as a central axis) falls within the applicable scope of the transferring device C mentioned herein.

Referring to FIG. 4 to FIG. 8, FIG. 4 is a schematic view of a first chamber and a plurality of second chambers of the storage apparatus of the present disclosure, FIG. 5 a schematic view of the storage apparatus having a plurality of carrying shelves disposed thereon according to the present disclosure, FIG. 6 is a schematic view of the first chamber and an annular movable wall of the storage apparatus of the present disclosure, FIG. 7 is a schematic view showing a holding assembly of the storage apparatus holding the carrying shelf arranged in the first chamber according to the present disclosure, and FIG. 8 is a partial sectional view of a first base seat of the storage apparatus of the present disclosure. The first chamber D is disposed surrounding the transferring device C, the first chamber D can accommodate the carrying shelves 200, and the carrying shelves 200 can be arranged annularly and disposed in the first chamber D. More specifically, the storage apparatus 100 can include a first base seat H, the first base seat H is in an annular shape, and the first base seat H is disposed surrounding the transferring device C. The first base seat H, the covering boards A2 of the main body A, and the temperature barrier F jointly define the first chamber D.

The first base seat H is provided so that the carrying shelves 200 can be

disposed thereon. When the carrying shelves 200 are disposed on the first base seat H, the carrying shelves 200 are disposed around the transferring device C in a corresponding manner, and the processing device B can control operation of the transferring device C, so as to allow the holding assembly C3 to take out
5 one of the carrying shelves 200 disposed on the first base seat H. The processing device B can also control the transferring device C, so that one of the carrying shelves 200 is disposed on the first base seat H by the holding assembly C3. The structure and the dimension of the first base seat H can be changed according to practical requirements and are not limited to those shown
10 in FIG. 4 to FIG. 8. The quantity of the carrying shelves 200 that can be accommodated by the first base seat H can also be changed according to practical requirements.

In a practical application, the first base seat H can include a plurality of positioning structures H1 (as shown in FIG. 8), and the positioning structures
15 H1 are configured to limit a movement range of the carrying shelves 200 in the first chamber D relative to the first base seat H. In a preferable embodiment, four of the positioning structures H1 can jointly limit one of the carrying shelves 200 disposed on the first base seat H, and can correspondingly abut against four bottom corners of the carrying shelf 200. Naturally, the quantity of
20 the positioning structures H1 configured to limit one of the carrying shelves 200 is not limited to four, and the arrangement positions thereof relative to the first base seat H are not limited to those shown in FIG. 8.

It is worth mentioning that the main body A can further include a plurality of sensors A3 (as shown in FIG. 2), each of the sensors A3 is electrically
25 connected to the processing device B, and each of the sensors A3 is configured

to sense whether each of the carrying shelves 200 in the first chamber D is correctly disposed on the first base seat H. In this way, the processing device B can determine whether each of the carrying shelves 200 is disposed on the corresponding position of the first base seat H according to each of the sensors
5 A3 disposed on the first base seat H. The processing device B can determine whether or not each of the carrying shelves 200 is correctly disposed on the first base seat H according to the corresponding one of the sensors A3.

In other embodiments, the base seat H can include a plurality of rails, and each of the carrying shelves 200 can be slidably disposed on the first base seat
10 H through the corresponding one of the rails. A plurality of related sensors and a plurality of blocking structures can be correspondingly disposed at an outer periphery of each of the rails. The sensors are configured to sense whether the carrying shelves 200 are connected to the rails or not, and if the sensors sense that the rails are already connected to the carrying shelves 200, a related
15 processor controls the blocking structures to limit a movement range of the carrying shelves 200 on the rails.

The second chambers E are arranged above the first chamber D, and the second chambers E are in spatial communication with each other and are arranged in a vertical direction. In other embodiments, the second chambers E
20 can be not in spatial communication with each other. Each of the second chambers E is disposed surrounding the transferring device C, each of the second chambers E is configured to accommodate the carrying shelves 200, and the carrying shelves 200 can be arranged annularly and disposed in the second chambers E. More specifically, the storage apparatus 100 includes three second
25 base seats L, the three second base seats L are vertically arranged through a

plurality of supporting structures M, and one of the second base seats L that is nearest to the temperature barrier F is connected to the temperature barrier F through the supporting structures M. Each of the second base seats L is in an annular shape, each of the second base seats L is disposed surrounding the transferring device C, and part of the second base seats L and the covering boards A2 jointly define some of the second chambers E. One of the second base seats L, the temperature barrier F, and the covering boards A2 jointly define one of the second chambers E.

In the present embodiment, the number of the first chamber D and the number of the second chambers E included by the storage apparatus 100 are respectively one and three, but the number of the first chamber D and the number of the second chambers E are not limited thereto. In other embodiments, the number of the first chamber D can be two or greater than two, and the number of the second chamber E can be one, two, or greater than four. Preferably, the number of the second chambers E is greater than the number of the first chamber D.

The temperature barrier F is disposed between the first chamber D and one of the second chambers E that is nearest to the first chamber D. The temperature barrier F is configured to block the first chamber D and the second chamber E, so that the first chamber D is not in spatial communication with the second chamber E, thereby preventing heat inside of the first chamber D and heat inside of the second chamber E from mutually transferring. The structure and dimension of the temperature barrier F can be designed according to practical requirements, but the present disclosure is not limited thereto.

The environment adjusting device G is electrically connected to the

processing device B, and the processing device B is configured to control the environment adjusting device G, so that a temperature of the first chamber D is less than or equal to a first temperature and a temperature of each of the second chambers E is less than or equal to a second temperature. The first temperature is greater than -10°C , the second temperature is lower than 30°C , and the first temperature is less than or equal to the second temperature. Preferably, a difference between the first temperature and the second temperature is greater than 5°C . In a preferable embodiment, the second temperature is within a range from 20°C to 25°C , and the first temperature is within a range from 5°C to 15°C . In other words, the processing device B controls the environment adjusting device G, so that the temperature of each of the second chambers E is close to the room temperature, and the temperature of the first chamber D is close to a refrigeration temperature.

For better control of an environment state of the first chamber D and an environment state of each of the second chambers E, the storage apparatus 100 can include two temperature adjusting devices G respectively defined as a first temperature adjusting device and a second temperature adjusting device. The first temperature adjusting device is independently used to control the temperature and a humidity of the first temperature, and the second temperature adjusting device is independently used to control the temperature and a humidity of the second chambers E.

Referring to FIG. 2, FIG. 6, and FIG. 7, in a practical application, the storage apparatus 100 can further include an annular movable wall N, a movable wall rotating structure P, and a movable door Q. The annular movable wall N is connected to the movable wall rotating structure P, and the movable

5 wall rotating structure P is configured to rotate the annular movable wall N relative to the first chamber D. The annular movable wall N has an opening N1, and the movable door Q is movably disposed at a side of the annular movable wall N. The movable door Q can be operated to cover the opening N1, or be operated to not cover the opening N1. When the opening N1 is not covered by the movable door Q, the carrying shelf 200 held by the holding assembly C3 can enter or exit the first chamber D through the opening N1. In FIG. 6 and FIG. 7 of the present embodiment, the annular movable wall N is disposed surrounding the transferring device C and is substantially in a ring shape, but the structure of the annular movable wall N is not limited thereto. In other embodiments, the annular movable wall N can be disposed surrounding the transferring device C, and can be substantially in a rectangular-ringed shape.

15 According to the above, a process where the processing device B controls the holding assembly C3 to dispose the carrying shelf 200 and the object 2 carried by the carrying shelf 200 into the first chamber D can be as follows. The processing device B controls the transferring device C to transfer the holding assembly C3 and the carrying shelf 200 held by the holding assembly C3 to a position outside of the first chamber D. Afterwards, the processing device B controls the movable wall rotating structure P to rotate, so that the movable door Q and the opening N1 rotate to a position corresponding to a current position of the holding assembly C3. Finally, the processing device B controls the movable door Q to be open and controls the transferring device C to be operated, so that the holding assembly C3 allows the carrying shelf 200 held by the hold assembly C3 to pass through the opening N1 and move into the first chamber D. Naturally, in other embodiments, the processing device B can

also control the transferring device C and the movable wall rotating structure P to be operated at the same time. In a process where the transferring device C transfers the carrying shelf 200 held by the transferring device C to the position outside of the first chamber D, the movable wall rotating structure P can rotate the annular movable wall N at the same time, so that the opening N1 correspondingly moves to a predetermined position.

The movable door Q can be connected to the annular movable wall N through an electronically-controlled rail assembly, and through controlling the electronically-controlled rail assembly, the processing device B can control the movable door Q to move relative to the annular movable wall N, so that the opening N1 is open or closed. Or, the movable door Q can only be mechanically connected to the annular movable wall N, and the processing device B cannot electronically control the movable door Q to move relative to the annular movable wall N. In other words, the movable door Q can be an electric door or a non-electric door.

In an embodiment of the present disclosure, the annular movable wall N is in an arc shape, the movable door Q can be the non-electric door, and the storage apparatus 100 can further include a door opening assembly R. The door opening assembly R is connected to the rotatable structure C2 mentioned above, the door opening assembly R can follow the rotatable structure C2 mentioned above to rotate relative to the first chamber D, and the door opening assembly R is configured to move the movable door Q relative to the annular movable wall N, so that the opening N1 is exposed or not exposed. In a practical application, the movable door Q can include a doorknob, the door opening assembly R can include a structure for holding the doorknob, and the processing device B is

configured to control the door opening assembly R to hold the doorknob of the movable door Q and move the movable door Q relative to the annular movable wall N.

Referring to FIG. 2 and FIG. 8, in an embodiment of the present disclosure, the processing device B maintains the temperature of the first chamber D within a range from -5°C to 15°C through the environment adjusting device G, and the first base seat H can further have a plurality of draining grooves H2. An end of the draining grooves H2 is in spatial communication with a draining channel H3, a fluid in each of the draining grooves H2 is guided into the draining channel H3, and the fluid in the draining channel H3 is guided and expelled. The quantity, structure, and arrangement of the draining grooves H2 are not limited to those shown in FIG. 8, and any structure configured to guide the fluid to the draining channel H3 falls within the applicable scope of the draining grooves H2 of the present disclosure. The quantity of the draining channel H3 and the manner by which the draining channel H3 is connected to the draining grooves H2 are not limited to those shown in FIG. 8.

For example, the first chamber D is configured to store the carrying shelves 200 and the objects 2 carried by the carrying shelves 200 that are just taken out from a refrigerator. When the carrying shelves 200 and the objects 2 carried by the carrying shelves 200 are taken out from the refrigerator (a temperature of the refrigerator is less than 5°C) and are disposed on the first base seat H, condensed water may form on a surface of each of the carrying shelves 200 and a surface of each of the objects 2 carried by the corresponding one of the carrying shelves 200 since the temperature of the first chamber D is greater than the temperature of the refrigerator. The condensed water can be expelled

through the draining grooves H2 and the draining channel H3. In a preferable embodiment, a surface H4 of the first base seat H can be inclined toward the draining channel H3. In this way, the condensed water falls on the surface H4 of the first base seat H can be guided to flow into the draining channel H3 or the
5 draining grooves H2.

In other embodiments, the storage apparatus 100 can further include an air blowing device W electrically connected to the processing device B. The air blowing device W is controllable by the processing device B to blow a gas to the first chamber D, so that a temperature of the carrying shelves 200 that are
10 just taken out from the refrigerator and disposed into the first chamber D can be swiftly increased and substantially equal to the temperature of the first chamber D. The air blowing device W can be connected to a clean gas providing apparatus, and the air blowing device W can continuously blow a clean gas into the first chamber D.

15 In an embodiment of the present disclosure, the storage apparatus 100 is disposed in an environment having a temperature within a range from 20°C to 25°C, and the storage apparatus 100 can further include an air suction device X. The air suction device X is connected to the air blowing device W, the air suction device X is configured to suction air outside the storage apparatus 100,
20 and the air blowing device W is configured to blow the air suctioned by the air suction device X into the first chamber D. Through the air blowing device W, the environment adjusting device G can better control an environment state (e.g., a temperature or a humidity) of the first chamber D. When the temperature of the environment in which the storage apparatus 100 is disposed
25 is substantially equal to the temperature of each of the second chambers E, the

air suction device X and the air blowing device W can be in cooperation with each other to blow air outside the storage apparatus 100 into each of the second chambers E and the first chamber D at the same time. Naturally, a related filtering component can be disposed at an air outlet of the air blowing device W according to practical requirements, so as to filter air suctioned by the air suction device X.

Referring to FIG. 1 and FIG. 2, the main body A of the storage apparatus 100 further includes an access opening A4 and a carrying platform A5. The access opening A4 is in spatial communication with the second chambers E.

10 The main body A can further include an access door A6, and the access door A6 is controllable by the processing device B, so that the access door A6 covers or does not cover the access opening A4. When the access door A6 does not cover the access opening A4, the second chambers E are in spatial communication with the external environment through the access opening A4. The carrying

15 platform A5 is disposed near the access opening A4, and the carrying platform A5 is provided so that the carrying shelf 200 (as shown in FIG. 5) and the object 2 carried by the carrying shelf 200 can be disposed on the carrying platform A5. When the access opening A4 is not covered, the holding assembly C3 can pass through the access opening A4 and hold the carrying shelf 200 that

20 is disposed on the carrying platform A5. Moreover, the carrying shelf 200 and the object 2 carried by the carrying shelf 200 that are originally disposed in the first chamber D or one of the second chambers E can also be disposed onto the carrying platform A5 by the holding assembly C3. The quantity and arrangement position of the carrying platform A5 and the access opening A4 are

25 not limited to those shown in FIG. 1. In a special application, the storage

apparatus 100 can include at least two access openings A4 and at least two carrying platforms A5.

In other embodiments, the main body A of the storage apparatus 100 can include at least one carrying platform sensor A7, the carrying platform sensor A7 is configured to sense whether the carrying platform A5 has the carrying shelf 200 disposed thereon to accordingly generate a sensing data A71, and the processing device B can control operation of the transferring device C and the access door A6 according to the sensing data A71. For example, when the carrying shelf 200 is disposed onto the carrying platform A5 by the technical personnel or a related apparatus, the processing device B receives the sensing data A71 transmitted by the carrying platform sensor A7 and accordingly controls the access door A6 to be open. The processing device B further controls operation of the transferring device C to allow the holding assembly C3 to pass through the access opening A4, and controls the transferring device C to transfer the carrying shelf 200 arranged on the carrying platform A5 into one of the second chambers E or the first chamber D.

In a practical application, the processing device B can receive a requirement data 3 transmitted by an external electronic apparatus (e.g., various types of computers, servers, smart phones, or tablets) in a wired manner or in a wireless manner, and the processing device B can control the transferring device C to take out one of the carrying shelves 200 from one of the second chambers E or the first chamber D according to the requirement data 3. Afterwards, the processing device B controls the access door A6 to be open and allows the carrying shelf 200 that is just taken out to pass through the access opening A4 and be disposed on the carrying platform A5. Finally, after the

processing device B receives the sensing data A71 transmitted by the carrying platform sensor A7, the processing device B transmits related data to the external electronic apparatus, and the external electronic apparatus informs a related apparatus or personnel to move to the carrying platform A5 and take
5 away the carrying shelf 200.

Referring to FIG. 1 and FIG. 2, when the storage apparatus 100 of the present disclosure is applied in an automated factory building, the storage apparatus 100 can further include a reading device Y configured to read an identification unit to generate an identification data. The identification unit can
10 be disposed on the object 2 or the carrying shelf 200. The identification unit can be various types of barcodes or radio frequency identification (RFID) labels. The identification data can include basic data related to the object 2 (e.g., a manufacturing date or a service life). In an embodiment of the present disclosure, the identification unit is a component that can be read and written
15 (e.g., the radio frequency identification label), and the reading device Y can not only read the data stored by the identification unit, but also write data into the identification unit.

The processing device B is electrically connected to the reading device Y. The processing device B can control the transferring device C to transfer the
20 carrying shelf 200 arranged at the access opening A5 into the first chamber D or one of the second chambers E according to the identification data. Conversely, the processing device B can also control the transferring device C to transfer one of the carrying shelves 200 arranged in the first chamber D or one of the shelves 200 arranged in one of the second chambers E to the access opening A4
25 according to the identification data.

The storage apparatus 100 can be applied in a semiconductor apparatus factory building, the object 2 can be a specific film used in a semiconductor manufacturing process, and the specific film refers to a kind of film that must be stored in a freezer when it is not used. When the storage apparatus 100 of
5 the present disclosure is applied in the semiconductor apparatus factory building, the storage apparatus 100 is configured to store the film.

In a conventional application, a process where a technical personnel uses a film disposed in a freezer is substantially as follows. The technical personnel determines when the film is to be used according to an operation process, and
10 takes the film out from the freezer six hours or even one day beforehand. The film is disposed on a table in a room temperature environment, so that a temperature of the film is gradually increased to the room temperature. Finally, when the technical personnel needs to use the film, the technical personnel directly takes the film disposed on the table in the room temperature
15 environment, and the temperature of the film is already substantially equal to the room temperature. In the film usage process of the conventional application, if the technical personnel does not take the film out from the freezer at a correct time, when the film needs to be used in the related operation process, the temperature of the film may be too low so that the film cannot be
20 used in the related operation process. Furthermore, if the technical personnel does not take the film out from the freezer in advance, the related operation process may even be forced to stop. In addition, since the film taken out from the freezer is directly disposed on the table in the room temperature environment, water drops condensed on a surface of the film flow to a tabletop
25 of the table, resulting in a puddle of water on the tabletop or on the ground.

Moreover, when the film is taken out from the freezer and disposed on the table in the room temperature environment by the technical personnel, if a label or a related marking is not correctly placed on the film by the technical personnel, there is a possibility of the film being mistakenly taken by another technical
5 personnel.

According to the above, in an embodiment of the present disclosure, the storage apparatus 100 of the present disclosure is applied in the semiconductor automated factory building, and a process where the carrying shelf 200 and the object 2 carried by the carrying shelf 200 are taken out from a freezer and
10 disposed in the first chamber D can be as follows. Firstly, the carrying shelf 200 and the object 2 carried by the carrying shelf 200 that are taken out from the freezer are disposed onto the carrying platform A5 by a related apparatus or the technical personnel. The processing device B receives the sensing data A71 transmitted by the carrying platform sensor A7 after the carrying platform
15 sensor A7 senses that the carrying shelf 200 is disposed on the carrying platform A5, and the processing device B can control the reading device Y to read the identification data stored by the identification unit on the carrying shelf 200 or the object 2. Afterwards, the processing device B controls the transferring device C and the access door A6 to be operated, so that the holding
20 assembly C3 moves the carrying shelf 200 and the object 2 carried by the carrying shelf 200 that are disposed on the carrying platform A5 together to a position outside the first chamber D according to the identification data and a current storage state of the first chamber D. Finally, the processing device B controls the rotatable structure C2, the movable wall rotating structure P, and
25 the movable door Q to be operated, so that the holding assembly C3 moves the

carrying shelf 200 held by the holding assembly C3 to pass through the opening N1 of the annular movable wall N and enter into the first chamber D.

Afterwards, after the processing device B controls the holding assembly C3 to dispose the carrying shelf 200 and the object 2 carried by the carrying shelf 200 into the first chamber D, the processing device B makes a related record (e.g., the identification data stored by the identification unit on the carrying shelf 200 or the time when the carrying shelf 200 is disposed into the first chamber D). The processing device B then controls the transferring device C, the movable wall rotating structure P, and the movable door Q to be operated at a predetermined time (e.g., six to ten hours) after the carrying shelf 200 and the object 2 carried by the carrying shelf 200 are disposed into the first chamber D according to the identification data or a related requirement data, so that the holding assembly C3 moves the carrying shelf 200 into one of the second chambers E, and the carrying shelf 200 is stored therein. When the processing device B stores the carrying shelf 200 into the second chamber E, the processing device B can transmit a related notification data to a related external electronic apparatus to notify the related apparatus or the technical personnel that the temperature of the object 2 carried by the carrying shelf 200 is already substantially equal to the room temperature. When the related apparatus or the technical personnel receives the notification data transmitted by the processing device B, the related apparatus or the technical personnel can transmit a fetching data to the processing device B. After the processing device B receives the fetching data, the processing device B controls the transferring device C and the access door A6, so that the carrying shelf 200 originally disposed in the second chamber E is disposed onto the carrying platform A5.

According to the above, when the storage apparatus 100 of the present disclosure is applied to store the film that is used in the semiconductor factory building and that needs to be in frozen storage, the processing device B can implement an unfreezing process. When the processing device B implements the unfreezing process, the processing device B controls the transferring device C to transfer the carrying shelf 200 and the object 2 carried by the carrying shelf 200 that are disposed on the carrying platform A5 into the first chamber D. After the processing device B disposes the carrying shelf 200 and the object 2 carried by the carrying shelf 200 into the first chamber D for a predetermined time period, the processing device B controls the transferring device C to transfer the carrying shelf 200 and the object 2 carried by the carrying shelf 200 from the first chamber D to one of the second chambers E, and the carrying shelf 200 and the object 2 carried by the carrying shelf 200 are stored therein. Only after the related apparatus or the technical personnel transmits the related fetching data to the processing device B does the processing device B further control the transferring device C to transfer the carrying shelf 200 and the object 2 carried by the carrying shelf 200 to the carrying platform A5.

Referring to FIG. 9 to FIG. 12, FIG. 9 and FIG. 10 are schematic views of the carrying shelf of the storage apparatus from different angles according to the present disclosure, FIG. 11 is a schematic view of a stretchable structure and the holding assembly of the storage apparatus of the present disclosure, and FIG. 12 is a schematic view showing the holding assembly of the storage apparatus holding the carrying shelf according to the present disclosure. In a practical application, the storage apparatus 100 of the present disclosure can be sold with the carrying shelves 200 included therein or be sold without including the

carrying shelves 200.

Each of the carrying shelves 200 can include a top board 201, a bottom board 202, and three side boards, the top board 201, the bottom board 202, three side boards are connected to each other and jointly define an accommodating chamber 204, and the accommodating chamber 204 is configured to accommodate the object 2. The three side boards are respectively defined as two lateral boards 2031 and a rear board 2032. The two lateral boards 2031 face toward each other, and each of the lateral boards 2031 has a plurality of thru-holes 20311. Through the design of the thru-holes 20311, when the carrying shelf 200 is disposed in the first chamber D, the air blowing device W (as shown in FIG. 2) can blow air into the first chamber D, and the air can flow at an outer periphery of the object 2. Therefore, the temperature of the object 2 can quickly reach to a temperature substantially equal to the temperature of the first chamber D. The structure, the dimension, the quantity, and the arrangement positions of the thru-holes 20311 included by each of the lateral boards 2031 are not limited to those shown in FIG. 9 to FIG. 12. The rear board 2032 is connected to the two lateral boards 2031, and the rear board 2032 can include a plurality of thru-holes 20321. Each of the thru-holes 20321 penetrates through the rear board 2032. The rear board 2032 can have two auxiliary structures 205 and two abutting structures 206 disposed at a side of the rear board 2032. The two auxiliary structures 205 are spaced apart from each other, and each of the abutting structures 206 is disposed at an end of a corresponding one of the auxiliary structures 205.

Referring to FIG. 11, the holding assembly C3 can include a holding body C31 and four movable holding structures C32 that correspond to the design of

the auxiliary structures 205 and the abutting structures 206 of the carrying shelf 200. Two of the four movable holding structures C32 face toward each other, and other two of the four movable holding structures C32 face toward each other. Two of the movable holding structures C32 facing toward each other can
5 be controlled to hold one of the auxiliary structures 205 of the carrying shelf 200. Each of the movable holding structures C32 can further include an engaging portion C321, the engaging portion C321 is configured to be engaged with the abutting structure 206 of the carrying shelf 200, and the carrying shelf 200 can be hung on the holding assembly C3 through the abutting structures
10 206 and the engaging portions C321.

Referring to FIG. 9 to FIG. 12, more specifically, each of the abutting structures 206 and the rear board 2032 can jointly define an accommodating slot 207, and each of the engaging portions C321 can be correspondingly engaged in the corresponding one of the accommodating slots 207. In this way, when the
15 holding assembly C3 holds the carrying shelf 200, the holding assembly C3 not only holds the two auxiliary structures 205 through the four movable holding structures C32, but is also connected to the carrying shelf 200 through each of the engaging portions C321 and the corresponding one of the accommodating slots C32 that are engaged with each other. Therefore, it can be effectively
20 ensured that the holding assembly C3 stably holds the carrying shelf 200.

Referring to FIG. 1 to FIG. 3 and FIG. 13, FIG. 13 is a block diagram of a storage system of the present disclosure. A storage system 1 of the present disclosure includes the storage apparatus 100 mentioned above, a transferring apparatus 400, and a processing apparatus 300. The description of the storage
25 apparatus 100 will not be reiterated herein. The transferring apparatus 400 is

configured to transfer the carrying shelf 200 and the object 2 carried by the carrying shelf 200 from a freezer to the carrying platform A5 of the storage apparatus 100. The processing apparatus 300 is configured to receive a requirement data 3. The processing apparatus 300 can control the transferring apparatus 400 to take out and transfer at least one of the carrying shelves 200 and the object 2 carried by the carrying shelf 200 from the freezer to the carrying platform A5.

The processing device B of the storage apparatus 100 can also receive the requirement data 3, and the processing device B can control the transferring device C to transfer the carrying shelf 200 and the object 2 carried by the carrying shelf 200 that are disposed on the carrying platform A5 into the first chamber D according to the requirement data 3. After the carrying shelf 200 and the object 2 carried by the carrying shelf 200 are disposed in the first chamber D for a predetermined time period, the processing device B can transfer the carrying shelf 200 and the object 2 carried by the carrying shelf 200 into one of the second chambers E according to the requirement data 3. After the carrying shelf 200 and the object 2 carried by the carrying shelf 200 are disposed in the second chamber E for another predetermined time period, the processing device B controls the transferring device C to transfer the carrying shelf 200 and the object 2 carried by the carrying shelf 200 from the second chamber E to the carrying platform A5 according to the requirement data 3.

In addition, the processing apparatus 300 can further receive a fetching data 4. The processing apparatus 300 can control the storage apparatus 100 according to the fetching data 4, so that the processing device B controls the transferring device C to transfer one of the carrying shelves 200 and the object 2

carried by the carrying shelf 200 that are disposed in one of the second chambers E to the carrying platform A5. The processing apparatus 300 can control the transferring apparatus 400 according to the fetching data 4, so as to transfer the carrying shelf 200 and the object 2 carried by the carrying shelf 200 that are disposed on the carrying platform A5 to a specific work station or a work apparatus.

[Beneficial Effects of the Embodiments]

In conclusion, through the design of the transferring device, the first chamber, and the second chambers, the storage apparatus provided by the present disclosure allows the technical personnel to conveniently store the carrying shelves and the objects carried by the carrying shelves that are just taken out from the freezer. Through the design of the storage apparatus, the transferring apparatus, and the processing apparatus, in the storage system provided by the present disclosure, the technical personnel can transmit the requirement data to the processing apparatus, so that the storage system automatically takes out the carrying shelves and the objects carried by the carrying shelves from the freezer and sequentially dispose them into the first chamber and one of the second chambers for unfreezing according to the requirement data.

The foregoing description of the exemplary embodiments of the disclosure has been presented only for the purposes of illustration and description and is not intended to be exhaustive or to limit the disclosure to the precise forms disclosed. Many modifications and variations are possible in light of the above teaching.

The embodiments were chosen and described in order to explain the

principles of the disclosure and their practical application so as to enable others skilled in the art to utilize the disclosure and various embodiments and with various modifications as are suited to the particular use contemplated. Alternative embodiments will become apparent to those skilled in the art to
5 which the present disclosure pertains without departing from its spirit and scope.

CLAIMS

What is claimed is:

1. A storage apparatus, wherein the storage apparatus is configured to store a plurality of carrying shelves, and each of the carrying shelves is configured to carry an object, the storage apparatus comprising:
 - a main body having an access opening;
 - a processing device;
 - a transferring device including a stretchable structure, a rotatable structure, and a holding assembly, wherein the stretchable structure is connected to the rotatable structure, the holding assembly is connected to the stretchable structure, and the holding assembly is configured to hold one of the carrying shelves, wherein the transferring device is electrically connected to the processing device, and the processing device is configured to control the stretchable structure to allow the holding assembly to move forward or backward relative to the rotatable structure, and wherein the processing device is configured to control the rotatable structure to allow the stretchable structure and the holding assembly to rotate;
 - at least one first chamber disposed surrounding the transferring device and configured to accommodate the carrying shelves;
 - at least one second chamber disposed surrounding the transferring device, wherein the at least one second chamber is disposed above the at least one first chamber, and the at least one second chamber is configured to accommodate the carrying shelves;
 - a temperature barrier disposed between the at least one first chamber and the at least one second chamber, wherein the temperature barrier is

configured to prevent heat inside the at least one first chamber and heat inside the at least one second chamber from mutual transfer; and

at least one environment adjusting device electrically connected to the processing device, wherein the processing device is configured to control the at least one temperature adjusting device so that a temperature of the at least one first chamber is less than or equal to a first temperature and a temperature of the at least one second chamber is less than or equal to a second temperature, and wherein the second temperature is less than 30°C, the first temperature is greater than -10°C, and the first temperature is less than or equal to the second temperature,

wherein the processing device is configured to control the transferring device to allow the holding assembly to transfer and dispose one of the carrying shelves arranged at the access opening into the at least one first chamber or the at least one second chamber, and the control device is configured to control the transferring device to allow the holding assembly to transfer one of the carrying shelves arranged in the at least one first chamber or the at least one second chamber to the access opening.

2. The storage apparatus according to claim 1, further comprising at least one base seat arranged in the at least one first chamber, wherein the at least one base seat is in an annular shape, and the at least one base seat is configured to carry the carrying shelves, and wherein the at least one base seat includes a plurality of draining grooves and a draining channel, an end of each of the draining grooves is in spatial communication with the draining channel, a liquid in each of the draining grooves is guided to the draining channel, and

the liquid in the draining channel is guided and expelled.

3. The storage apparatus according to claim 1, further comprising a movable wall rotating structure, an annular movable wall, and a movable door, wherein the annular movable wall is connected to the movable wall rotating structure, the annular movable wall has an opening, the movable door is movably disposed on the annular movable wall, and the movable door is configured to be operated to cover the opening, or be operated to not cover the opening, wherein the movable wall rotating structure is configured rotate the annular movable wall relative to the at least one first chamber, and wherein, when the opening is not covered by the movable door, the holding assembly is configured to penetrate through the opening to hold one of the carrying shelves in the at least one first chamber.
4. The storage apparatus according to claim 3, wherein the movable door is an arc-shaped board, the storage apparatus further includes a door opening assembly, the door opening assembly is connected to the rotatable structure, and the door opening assembly and the stretchable structure are configured to jointly follow the rotatable structure to rotate relative to the at least one first chamber, and wherein the door opening assembly is configured to open the movable door so that the opening is exposed, or configured to close the movable door so that the opening is not exposed.
5. The storage apparatus according to claim 1, further comprising an air blowing device electrically connected to the processing device, wherein the

air blowing device is controllable by the processing device to blow a gas to the at least one first chamber, and wherein the storage apparatus includes two of the environment adjusting devices respectively defined as a first environment adjusting device and a second environment adjusting device, the first environment adjusting device is configured to control a temperature and a humidity of the at least one first chamber, and the second environment adjusting device is configured to control a temperature and a humidity of the at least one second chamber.

6. The storage apparatus according to claim 5, further comprising an air suction device connected to the air blowing device, wherein the air suction device is configured to suction air outside the storage apparatus, and the air blowing device is configured to blow the air suctioned by the air suction device to the at least one first chamber.
7. The storage apparatus according to claim 1, further comprising at least one first base seat arranged in the at least one first chamber, wherein the at least one first base seat is in an annular shape, and the at least one first base seat is configured to carry the carrying shelves, wherein the at least one first base seat includes a plurality of positioning structures, and the positioning structures are configured to limit a movement range of the carrying shelves in the at least one first chamber relative to the at least one first base seat, and wherein the storage apparatus further includes a plurality of sensors, each of the sensors is electrically connected to the processing device, the sensors are disposed on the at least one first base seat, and each of the sensors is

configured to sense whether each of the carrying shelves in the at least one first chamber is correctly disposed on the at least one base seat.

8. The storage apparatus according to claim 1, further comprising a reading device configured to read an identification unit to generate an identification data, wherein the identification unit is configured to be disposed on the object or one of the carrying shelves, wherein the processing device is electrically connected to the reading device, wherein the processing device is configured to control the transferring device to transfer one of the carrying shelves arranged at the access opening into the at least one first chamber or the at least one second chamber according to the identification data, and wherein the processing device is configured to control the transferring device to transfer one of the carrying shelves arranged in the at least one first chamber or one of the carrying shelves arranged in the at least one second chamber to the access opening according to the identification data.
9. The storage apparatus according to claim 8, further comprising an access door and a carrying platform, wherein the access door is controllable to be open so that the at least one second chamber is in spatial communication with an external environment, or is controllable to be closed so that the at least one second chamber is not in spatial communication with the external environment, and wherein the carrying platform is arranged outside the at least one second chamber, the carrying platform is configured to carry one of the carrying shelves, the reading device is disposed near the carrying

platform, and the reading device is configured to read the identification unit of one of the carrying shelves disposed on the carrying platform.

10. The storage apparatus according to claim 1, further comprising an access door, a carrying platform, and at least one carrying platform sensor, wherein the access door is controllable to be open so that the at least one second chamber is in spatial communication with an external environment, or is controllable to be closed so that the at least one second chamber is not in spatial communication with the external environment, and wherein the carrying platform is arranged outside the at least one second chamber, the carrying platform is configured to carry one of the carrying shelves, the carrying platform sensor is configured to sense whether the carrying platform has one of the carrying shelves disposed thereon and generate a sensing data accordingly, and the processing device is configured to control the transferring device and the access door according to the sensing data.
11. The storage apparatus according to claim 1, wherein the processing device is configured to implement an unfreezing process, wherein, when the processing device implements the unfreezing process, the processing device controls the transferring device to transfer one of the carrying shelves and the object carried by the one of the carrying shelves that are arranged at the access opening to the at least one first chamber, and wherein, after the one of the carrying shelves and the object carried by the one of the carrying shelves are disposed in the at least one first chamber for a predetermined time period, the processing device controls the transferring device to

transfer and dispose the one of the carrying shelves and the object carried by the one of the carrying shelves from the at least one first chamber into the at least one second chamber.

12. The storage apparatus according to claim 1, further comprising the plurality of carrying shelves, wherein each of the carrying shelves includes a top board, a bottom board, and a plurality of side boards, the top board, the bottom board, and the side boards jointly define an accommodating chamber, the accommodating chamber is configured to carry the object, at least one of the side boards has at least one thru-hole penetrating there-through, and the accommodating chamber is in spatial communication with an external environment through the at least one thru-hole, wherein one of the side boards includes at least one auxiliary structure and at least one abutting structure at a side thereof, and wherein the holding assembly includes two movable holding members, the two movable holding members are controllable to jointly hold the at least one auxiliary structure, each of the movable holding members includes an engaging portion, and the two engaging portions included by the holding assembly are configured to be engaged with the at least one abutting structure, so that one of the carrying shelves is configured to be hung on the holding assembly.

13. A storage system comprising:

a storage apparatus configured to store a plurality of carrying shelves, wherein each of the carrying shelves is configured to carry an object, and the storage apparatus includes:

a main body including a carrying platform and an access

opening, wherein the carrying platform is provided so that one of the carrying shelves is configured to be disposed thereon;

a processing device;

a transferring device including a stretchable structure, a rotatable structure, and a holding assembly, wherein the stretchable structure is connected to the rotatable structure, the holding assembly is connected to the stretchable structure, and the holding assembly is configured to hold one of the carrying shelves, wherein the transferring device is electrically connected to the processing device, and the processing device is configured to control the stretchable structure to allow the holding assembly to move forward or backward relative to the rotatable structure, and wherein the processing device is configured to control the rotatable structure to allow the stretchable structure and the holding assembly to rotate;

at least one first chamber disposed surrounding the transferring device and configured to accommodate the carrying shelves;

at least one second chamber disposed surrounding the transferring device, wherein the at least one second chamber is disposed above the at least one first chamber, and the at least one second chamber is configured to accommodate the carrying shelves;

a temperature barrier disposed between the at least one first chamber and the at least one second chamber, wherein the temperature barrier is configured to prevent heat inside the at least one first chamber and heat inside the at least one second chamber from mutual transfer; and

at least one environment adjusting device electrically connected to the processing device, wherein the processing device is configured to control the at least one temperature adjusting device so that a temperature of the at least one first chamber is less than or equal to a first temperature and a temperature of the at least one second chamber is less than or equal to a second temperature, and wherein the second temperature is less than 30°C, the first temperature is greater than -10°C, and the first temperature is less than or equal to the second temperature,

wherein the processing device is configured to control the transferring device so that the holding assembly allows one of the carrying shelves arranged at the carrying platform to pass through the access open and be moved and disposed into the at least one first chamber or the at least one second chamber, and wherein the processing device is configured to control the transferring device so that the holding assembly allows one of the carrying shelves arranged in the at least one first chamber or the at least one second chamber to pass through the access opening and be disposed on the carrying platform;

a transferring apparatus configured to transfer one of the carrying shelves and the object carried by the one of the carrying shelves from a freezer to the carrying platform of the storage apparatus; and

a processing apparatus configured to receive a requirement data, wherein the processing apparatus is configured to control the transferring apparatus to take out and transfer at least one of the carrying shelves and

the object carried by the at least one of the carrying shelves from the freezer to the carrying platform according to the requirement data, wherein the processing device is configured to control the transferring device to transfer the at least one of the carrying shelves and the object carried by the at least one of the carrying shelves that are arranged at the carrying platform into the at least one first chamber according to the requirement data, and wherein, after the at least one of the carrying shelves and the object carried by the at least one of the carrying shelves are disposed in the at least one first chamber for a predetermined time period, the processing device is configured to control the transferring device to transfer the at least one of the carrying shelves and the object carried by the at least one of the carrying shelves into the at least one second chamber according to the requirement data.