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(54) Title: REFRIGERATOR

(57) Abstract: Refrigerator including: a first storage room; a second storage room; a radio frequency identification tag removably disposed in the first storage room; and a radio frequency identification device, where the radio frequency identification device is used to read the radio frequency identification tag in the first storage room; and further includes an electromagnetic shielding device, where the electromagnetic shielding device forms an isolated area surrounding the second storage room, and the radio frequency identification device is located outside the isolated area to prevent the radio frequency identification device from reading the radio frequency identification tag located in the second storage room. In this way, the radio frequency identification device can be prevented from reading the radio frequency identification tag in the isolated area. In other words, the radio frequency identification device located outside the isolated area cannot read the radio frequency identification tag in the second storage room.

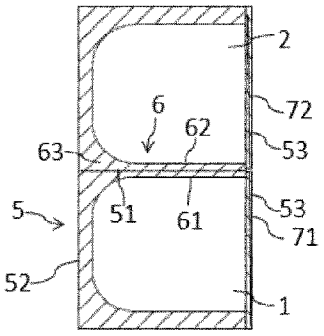

FIG. 2

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REFRIGERATOR

BACKGROUND

Technical Field

Embodiments of the present invention relate to a refrigerator.

Related Art

CN205536868U in the prior art discloses a refrigerator identifying food based on an RFID technology, including a refrigerator body. Space in the refrigerator body is partitioned by a horizontal layering board and a vertical separation board into a plurality of accommodating cavities. A first RFID device is disposed at an outer end surface of the horizontal layering board, the first RFID device includes a first antenna coil, and a torus of the first antenna coil is parallel to a surface of the horizontal layering board. A second RFID device is disposed at an outer end surface of the vertical separation board, the second RFID device includes a second antenna coil, and a torus of the second antenna coil is parallel to a surface of the vertical separation board.

SUMMARY

An objective of embodiments of the present invention is to provide an improved refrigerator.

Another objective of the embodiments of the present invention is to provide a refrigerator helping improve user experience.

A refrigerator according to one aspect of the embodiments of the present invention includes: a first storage room; a second storage room; a radio frequency identification tag removably disposed in the first storage room; and a radio frequency identification device, where the radio frequency identification device is used to read the radio frequency identification tag in the first storage room; and further includes an electromagnetic shielding device, where the electromagnetic shielding device forms an isolated area surrounding the second storage room, and the radio frequency identification device is

located outside the isolated area to prevent the radio frequency identification device from reading the radio frequency identification tag placed in the second storage room.

With this structure, the electromagnetic shielding device forms the isolated area, and the isolated area surrounds the second storage room, so that a radio frequency wave in the second storage room cannot radiate through the isolated area to outside of the isolated area, and even if the radio frequency identification tag is placed in the second storage room, the radio frequency identification tag cannot be read by the radio frequency identification device outside the isolated area. The radio frequency identification device is located outside the isolated area, and therefore can be prevented from reading the radio frequency identification tag in the isolated area. In other words, the radio frequency identification device located outside the isolated area cannot read the radio frequency identification tag in the second storage room.

In this way, even if a consumer mistakenly places the radio frequency identification tag in the second storage room, the radio frequency identification device does not read the radio frequency identification tag placed in the second storage room, and it is not mistakenly considered that an item is placed in the first storage room. This helps the radio frequency identification device accurately read the radio frequency identification tag in the first storage room, and more accurately identify items in the first storage room, to help improve user experience. For refrigerators that can intelligently manage the shelf life of food, this also reduces the likelihood that the radio frequency identification device identifies the radio frequency identification tag located in the second storage room and mistakenly assigns a wrong shelf life to food corresponding to the radio frequency identification tag.

According to an exemplary implementation of the present invention, the refrigerator further includes a separation wall located between the first storage room and the second storage room, and the electromagnetic shielding device includes an electromagnetic shield fastened to the separation wall. In this way, the electromagnetic shield is disposed between the first storage room and the second storage room, so that a radio frequency wave in the first storage room cannot radiate through the electromagnetic shield to communicate with a radio frequency wave in the second storage room, and the radio frequency identification device cannot read the radio frequency identification tag located in the second storage room. This can avoid interference from the radio frequency identification tag in the second storage room when the radio frequency identification

device reads the radio frequency identification tag in the first storage room, and help the radio frequency identification device accurately read the radio frequency identification tag in the first storage room.

According to an exemplary implementation of the present invention, the first storage room and the second storage room are disposed adjacently, and the first storage room and the second storage room are separated by the separation wall.

That "the first storage room and the second storage room are disposed adjacently" includes that the first storage room and the second storage room are disposed adjacently from left to right like, for example, a freezing chamber and a cold chamber of a side-by-side combination refrigerator; or the first storage room and the second storage room are disposed adjacently up and down like, for example, a freezing chamber and a cold chamber of a three-door refrigerator.

According to an exemplary implementation of the present invention, the electromagnetic shield is located in the separation wall. The electromagnetic shield is disposed in the separation wall, so that a radio frequency wave in the first storage room cannot radiate through the separation wall to identify and communicate with a radio frequency wave in the second storage room, and the radio frequency identification device cannot read the radio frequency identification tag in the second storage room. This also helps reduce space occupied by the electromagnetic shield in the refrigerator and improve space utilization, and can prevent the radio frequency identification device from reading the radio frequency identification tag in the second storage room when reading the radio frequency identification tag in the first storage room.

According to an exemplary implementation of the present invention, the separation wall includes a first wall, a second wall, and a thermal insulation material located between the first wall and the second wall, and the electromagnetic shield is fastened to the first wall and/or the second wall. In this way, the electromagnetic shield is easily mounted in the separation wall. That "the electromagnetic shield is fastened to the first wall and/or the second wall" includes three cases: 1. The electromagnetic shield is fastened to the first wall. 2. The electromagnetic shield is fastened to the second wall. 3. The electromagnetic shield is fastened to the first wall and the second wall. For example, a pair of electromagnetic shields may be fastened to the first wall and the second wall respectively,

or the electromagnetic shield may be divided into two parts, one part is fastened to the first wall, and the other is fastened to the second wall.

According to an exemplary implementation of the present invention, the electromagnetic shield is buried in the thermal insulation material. In this way, the electromagnetic shield is disposed and mounted in the separation wall.

According to an exemplary implementation of the present invention, the electromagnetic shield is disposed along an outer surface of the separation wall facing the first storage room or the second storage room. In this way, the electromagnetic shield may be disposed outside the separation wall. The electromagnetic shield is disposed along the outer surface of the separation wall facing the first storage room or the second storage room. Therefore, the electromagnetic shield is disposed on a wall formed by the separation wall in the first storage room or the second storage room. This helps the electromagnetic shield separate the first storage room and the second storage room.

According to an exemplary implementation of the present invention, the electromagnetic shield includes a metal sheet or an electromagnetic shielding film.

According to an exemplary implementation of the present invention, the electromagnetic shield includes a metal mesh, and an aperture of the metal mesh is less than one fourth of a wavelength of an electromagnetic wave emitted by the radio frequency identification device.

According to an exemplary implementation of the present invention, the electromagnetic shielding device further includes a metal housing surrounding the first storage room and the second storage room, and the electromagnetic shield extends along the separation wall vertically to the metal housing. In this way, the electromagnetic shield extends along the separation wall vertically to the metal housing, and the metal housing and the electromagnetic shield form an isolated area surrounding the second storage room, which better avoids communication between the first storage room and the second storage room, and effectively prevents the radio frequency identification device from reading the radio frequency identification tag in the second storage room.

According to an exemplary implementation of the present invention, a temperature in the first storage room is lower than zero degrees Celsius, and a temperature in the second storage room is higher than zero degrees Celsius. In this way, the temperature in the first storage room is lower than zero degrees Celsius, for example, the first storage room is a freezing chamber; the temperature in the second storage room is higher than zero degrees Celsius, for example, the second storage room is a fresh chamber or a cold chamber.

A refrigerator according to another aspect of the embodiments of the present invention includes: a first storage room; a second storage room; a separation wall located between the first storage room and the second storage room; a radio frequency identification tag removably disposed in the first storage room; and a radio frequency identification device, where the radio frequency identification device is used to read the radio frequency identification tag in the first storage room; and further includes an electromagnetic shield fastened to the separation wall, to prevent the radio frequency identification device from reading the radio frequency identification tag in the second storage room.

With this structure, the electromagnetic shield is disposed between the first storage room and the second storage room, so that a radio frequency wave in the first storage room cannot radiate through the electromagnetic shield to identify and communicate with a radio frequency wave in the second storage room, and the radio frequency identification device cannot read the radio frequency identification tag in the second storage room.

Even if a consumer mistakenly places the radio frequency identification tag in the second storage room, the radio frequency identification device does not read the radio frequency identification tag placed in the second storage room, and it is not mistakenly considered that an item is placed in the first storage room. In this way, an identification error caused by the misoperation of the consumer is avoided, and an item location identification error caused because the radio frequency identification tag is mistakenly placed in the second storage room is avoided. This helps the radio frequency identification device accurately read the radio frequency identification tag in the first storage room.

A refrigerator according to still another aspect of the embodiments of the present invention includes: a first storage room; a second storage room; a radio frequency identification tag removably disposed in the first storage room; and a radio frequency identification device,

where the radio frequency identification device is used to read the radio frequency identification tag in the first storage room; and further includes an electromagnetic shielding device, where the electromagnetic shielding device forms an effective working area surrounding the first storage room, and the second storage room is located outside the effective working area, to prevent the radio frequency identification device from reading the radio frequency identification tag located in the second storage room.

In this way, the electromagnetic shielding device forms the effective working area, and the first storage room is surrounded in the effective working area, so that the radio frequency identification device can read the radio frequency identification tag in the first storage room, and identify an item in the first storage room.

The second storage room is located outside the effective working area, so that the radio frequency identification device cannot read the radio frequency identification tag in the second storage room. Even if a consumer mistakenly places the radio frequency identification tag in the second storage room, the radio frequency identification device does not read the radio frequency identification tag placed in the second storage room, and it is not mistakenly considered that an item is placed in the first storage room. In this way, an identification error caused by the misoperation of the consumer is avoided, and an item location identification error caused because the radio frequency identification tag is mistakenly placed in the second storage room is avoided. This helps the radio frequency identification device accurately read the radio frequency identification tag in the first storage room, and further improves user experience.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic partial three-dimensional view of a refrigerator according to an embodiment of the present invention;

FIG. 2 is a schematic partial cross-sectional view along an A-A direction in FIG. 1 after refrigerator doors are closed;

FIG. 3 is a schematic partial cross-sectional view according to another embodiment of the present invention; and

FIG. 4 is a schematic partial cross-sectional view along a B-B direction in FIG. 1 after refrigerator doors are closed.

DETAILED DESCRIPTION

FIG. 1 is a schematic three-dimensional view of a refrigerator according to an embodiment of the present invention. As shown in FIG. 1, a refrigerator 100 includes a refrigerator body 101, and the refrigerator body 101 includes a first storage room 1 and a second storage room 2. The refrigerator 100 includes doors 71 and 72 that are used to close the first storage room 1 and the second storage room 2 respectively.

It should be understood that, the present invention is applicable to refrigerators with different structures, and not limited to preferred embodiments disclosed in the present invention. For example, the present invention is applicable to a side-by-side combination refrigerator with a first storage room 1 and a second storage room 2 distributed side by side, a refrigerator with a first storage room 1 and a second storage room 2 distributed up and down, or other refrigerators with a first storage room 1 and a second storage room 2.

A temperature in the first storage room 1 is lower than zero degrees Celsius, for example, the first storage room 1 may be a freezing chamber. A temperature in the second storage room 2 is higher than zero degrees Celsius, for example, the second storage room 2 may be a fresh chamber or a cold chamber.

The refrigerator 100 further includes a radio frequency identification tag 3 and a radio frequency identification device 4 that is used to read the radio frequency identification tag 3.

The radio frequency identification tag 3 is removably disposed in the first storage room 1, and the radio frequency identification device 4 is used to read the radio frequency identification tag 3 in the first storage room 1.

The radio frequency identification tag 3 may be detachably or undetachably fastened to a container, a packing bag, or a packing box. In some embodiments, the radio frequency

identification tag 3 may be detachably attached to food or a packing bag or a packing box of food by using a clamp.

From information obtained by the radio frequency identification device 4 by reading the radio frequency identification tag 3 in the first storage room 1, food information, for example, a type of food and a shelf life of the food, associated with the radio frequency identification tag 3 can be obtained or written.

Assuming that a consumer mistakenly places the radio frequency identification tag 3 in the second storage room 2, if the radio frequency identification device 4 can still read the radio frequency identification tag 3 in the second storage room 2, it may be mistakenly considered that an item is placed in the first storage room 1. A storage condition of the first storage room 1 is different from that of the second storage room 2. Therefore, a shelf life of the item placed in the first storage room 1 may be different from that in the second storage room 2, and if the radio frequency identification tag 3 placed in the second storage room 2 is read, a food management system error may be caused. For example, when the temperature in the first storage room 1 is set lower than a freezing temperature and the temperature in the second storage room 2 is set higher than the freezing temperature, after the radio frequency identification tag 3 associated with the food is taken out from the first storage room 1 and placed in the second storage room 2, if the radio frequency identification tag 3 is still read and the shelf life of the food is set according to the storage condition of the first storage room 1, the food may expire or spoil.

To avoid such a problem, in an embodiment, the refrigerator 100 includes an electromagnetic shielding device 5, the electromagnetic shielding device 5 forms an isolated area surrounding the second storage room 2, the radio frequency identification device 4 is located outside the isolated area, to prevent the radio frequency identification device 4 from reading the radio frequency identification tag 3 that is placed mistakenly in the second storage room 2.

A radio frequency wave in the isolated area is isolated from a radio frequency wave outside the isolated area, so that the two cannot identify or communicate with each other.

The second storage room 2 is surrounded in the isolated area, and the radio frequency identification device 4 is located outside the isolated area, so that the radio frequency

identification device 4 located outside the isolated area cannot communicate with the radio frequency identification tag 3 located in the isolated area, and the radio frequency identification device 4 cannot read the radio frequency identification tag 3 in the second storage room 2.

In this way, even if the consumer mistakenly places the radio frequency identification tag 3 in the second storage room 2, the radio frequency identification device 4 does not read the radio frequency identification tag 3 in the second storage room 2. This helps reduce the likelihood that it is mistakenly considered that the radio frequency identification tag 3 is located in the first storage room 1 and the shelf life of the food associated with the radio frequency identification tag 3 is set wrong.

The refrigerator 100 includes a separation wall 6 located between the first storage room 1 and the second storage room 2. The electromagnetic shielding device 5 includes an electromagnetic shield 51 fastened to the separation wall 6, to prevent the radio frequency identification device 4 from reading the radio frequency identification tag 3 located in the second storage room 2.

In an embodiment shown in FIG. 2, the first storage room 1 and the second storage room 2 are disposed adjacently, and the first storage room 1 and the second storage room 2 are separated by the separation wall 6. In another embodiment, the refrigerator includes a plurality of storage rooms, the first storage room 1 and the second storage room 2 are spaced, and the separation wall 6 is located between the first storage room 1 and the second storage room 2.

As shown in FIG. 2 and FIG. 3, the refrigerator body 101 includes a metal housing 52 surrounding the first storage room 1 and the second storage room 2. Each of the doors 71 and 72 is provided with a metal sheet 53. The metal housing 52 and the metal sheet 53 can shield an electromagnetic signal of the radio frequency identification device 4. The electromagnetic shield 51 may extend along the separation wall 6 vertically to the metal housing 52.

The metal housing 52, the door 72, and the electromagnetic shield 51 form an isolated area surrounding the second storage room 2. The first storage room 1 and the radio frequency identification device 4 are located outside the isolated area.

The metal housing 52, the door 71, and the electromagnetic shield 51 form an effective working area of the radio frequency identification device 4 surrounding the first storage room 1. The second storage room 2 is located outside the effective working area of the radio frequency identification device 4 to prevent the radio frequency identification device 4 from reading the radio frequency identification tag 3 located in the second storage room 2.

The radio frequency identification tag 3 can communicate with the radio frequency identification device 4 in the effective working area. The radio frequency identification tag 3 located in the effective working area can be read by the radio frequency identification device 4, and the radio frequency identification tag 3 located outside the effective working area cannot be read by the radio frequency identification device 4. In this way, the radio frequency identification device 4 can read the radio frequency identification tag 3 in the first storage room 1 located in the effective working area, but cannot read the radio frequency identification tag 3 in the second storage room 2 located outside the effective working area.

The radio frequency identification device 4 may be disposed in the first storage room 1. For example, the radio frequency identification device 4 may be disposed on a wall of the first storage room 1. As shown in FIG. 4, the radio frequency identification device 4 may be disposed between the first storage room 1 and the metal housing 52 near the first storage room 1.

As shown in FIG. 2 and FIG. 3, in this embodiment, the electromagnetic shield 51 is located in the separation wall 6. The separation wall 6 includes a first wall 61, a second wall 62, and a thermal insulation material 63 located between the first wall 61 and the second wall 62. In an embodiment, the electromagnetic shield 51 is fastened to the first wall 61 as shown in FIG. 2. In another embodiment, the electromagnetic shield 51 is fastened to the second wall 62. In still another embodiment, as shown in FIG. 3, the electromagnetic shield 51 is buried in the thermal insulation material 63, and resides in the separation wall 6 through foaming.

In another embodiment, the electromagnetic shield 51 may be located outside the separation wall 6. The electromagnetic shield 51 is disposed along an outer surface of the separation wall 6 facing the first storage room 1 or the second storage room 2.

The electromagnetic shield 51 includes a metal shield layer, which may be, for example, a metal sheet, an electromagnetic shielding film, a metal mesh, or a non-metal sheet with an electromagnetic shield layer.

When the electromagnetic shield 51 includes a shielding mesh with a mesh structure, an aperture of the shielding mesh is less than one fourth of a wavelength of a radio frequency wave emitted by the radio frequency identification device 4. For example, the wavelength of the radio frequency wave is less than 32 cm, and the aperture of the shielding mesh is less than 8 cm correspondingly. In a preferred implementation, the aperture of the shielding mesh is less than 1 cm. For example, the aperture of the shielding mesh may be 5 mm or 8 mm.

Although the present invention has been described in the above related embodiments, the embodiments are only examples for implementing the present invention. It should be noted that the disclosed embodiments do not limit the scope of the present invention. On the contrary, changes and modifications made without departing from the spirit and scope of the present invention fall within the patent protection scope of the present invention.

Reference numerals:

100: Refrigerator
101: Refrigerator body
1: First storage room
2: Second storage room
3: Radio frequency identification tag
4: Radio frequency identification device
5: Electromagnetic shielding device
51: Electromagnetic shield
52: Metal housing
6: Separation wall
61: First wall
62: Second wall
63: Thermal insulation material
71, 72: Door

CLAIMS

What is claimed is:

1. A refrigerator, characterized by comprising:
a first storage room (1);
a second storage room (2);
a radio frequency identification tag (3); and
a radio frequency identification device (4), wherein the radio frequency identification device (4) is used to read the radio frequency identification tag (3) that is removably disposed in the first storage room (1); and
characterized by further comprising an electromagnetic shielding device (5), wherein the electromagnetic shielding device (5) forms an isolated area surrounding the second storage room (2), and the radio frequency identification device (4) is located outside the isolated area to prevent the radio frequency identification device (4) from reading the radio frequency identification tag (3) placed in the second storage room (2).

2. The refrigerator according to claim 1, characterized by comprising a separation wall (6) located between the first storage room (1) and the second storage room (2), and the electromagnetic shielding device (5) comprises an electromagnetic shield (51) fastened to the separation wall (6).

3. The refrigerator according to claim 2, characterized in that the first storage room (1) and the second storage room (2) are disposed adjacently, and the first storage room (1) and the second storage room (2) are separated by the separation wall (6).

4. The refrigerator according to claim 2 or 3, characterized in that the electromagnetic shield (51) is located in the separation wall (6).

5. The refrigerator according to claim 2, characterized in that the separation wall (6) comprises a first wall (61), a second wall (62), and a thermal insulation material (63) located between the first wall (61) and the second wall (62), and the electromagnetic shield (51) is fastened to the first wall (61) and/or the second wall (62).

6. The refrigerator according to claim 5, characterized in that the electromagnetic shield (51) is buried in the thermal insulation material (63).

7. The refrigerator according to claim 2, characterized in that the electromagnetic shield (51) is disposed along an outer surface of the separation wall (6) facing the first storage room (1) or the second storage room (2).

8. The refrigerator according to claim 2, characterized in that the electromagnetic shield (51) comprises a metal sheet or an electromagnetic shielding film.

9. The refrigerator according to claim 2, characterized in that the electromagnetic shield (51) comprises a metal mesh, and an aperture of the metal mesh is less than one fourth of a wavelength of an electromagnetic wave emitted by the radio frequency identification device (4).

10. The refrigerator according to claim 2, characterized in that the electromagnetic shielding device (5) further comprises a metal housing (52) surrounding the first storage room (1) and the second storage room (2), and the electromagnetic shield (51) extends along the separation wall (6) vertically to the metal housing (52).

11. The refrigerator according to claim 1, characterized in that a temperature in the first storage room (1) is lower than zero degrees Celsius, and a temperature in the second storage room (2) is higher than zero degrees Celsius.

12. A refrigerator, characterized by comprising:
a first storage room (1);
a second storage room (2);
a separation wall (6) located between the first storage room (1) and the second storage room (2);
a radio frequency identification tag (3); and
a radio frequency identification device (4), wherein the radio frequency identification device (4) is used to read the radio frequency identification tag (3) that is removably disposed in the first storage room (1); and
characterized by further comprising an electromagnetic shield (51) fastened to the separation wall (6), to prevent the radio frequency identification device (4) from

reading the radio frequency identification tag (3) placed in the second storage room (2).

13. A refrigerator, characterized by comprising:
a first storage room (1);
a second storage room (2); and
a radio frequency identification tag (3) removably disposed in the first storage room (1); and a radio frequency identification device (4), wherein the radio frequency identification device (4) is used to read the radio frequency identification tag (3) located in the first storage room (1); and
characterized by further comprising an electromagnetic shielding device (5), wherein the electromagnetic shielding device (5) forms an effective working area surrounding the first storage room (1), and the second storage room (2) is located outside the effective working area.

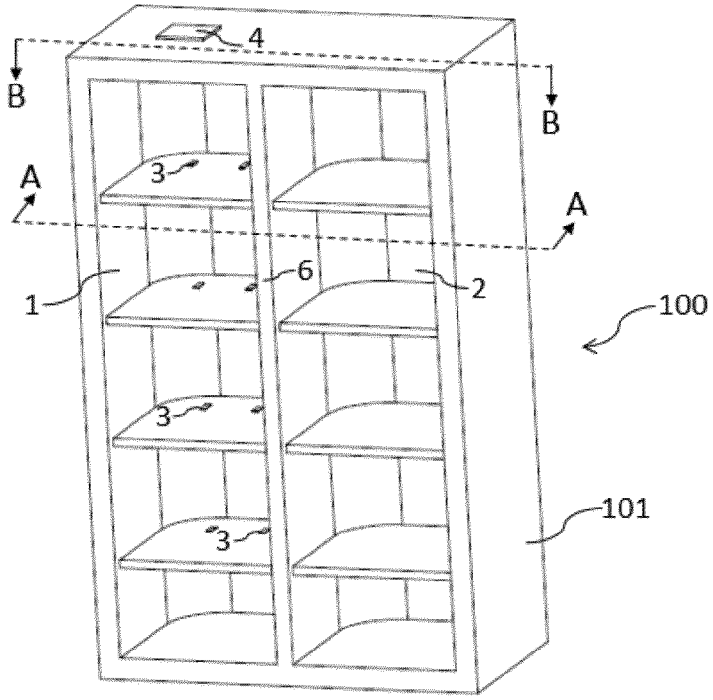

FIG. 1

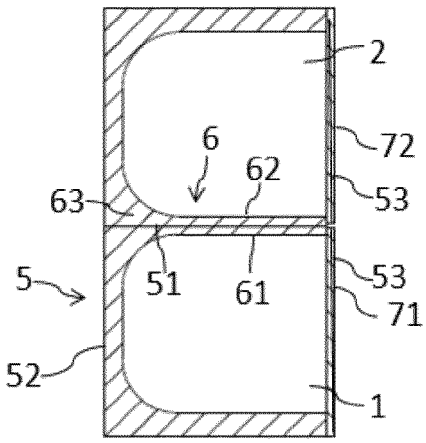

FIG. 2

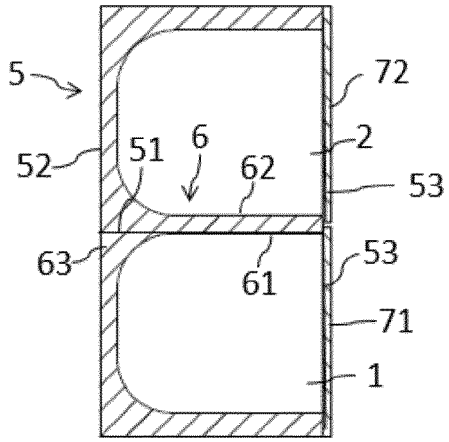

FIG. 3

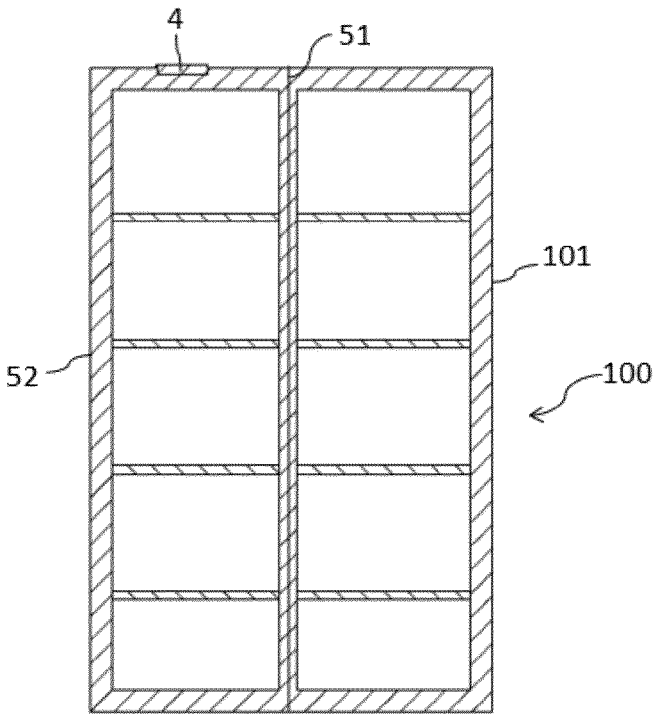

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/084153

A. CLASSIFICATION OF SUBJECT MATTER
INV. F25D29/00 F25D13/02
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F25D G06Q

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 100 837 050 B1 (DAEWOO ELECTRONICS CORP [KR]) 12 June 2008 (2008-06-12) abstract figures 1-5	1-13
X	DE 10 2016 209440 A1 (BSH HAUSGERÄTE GMBH [DE]) 30 November 2017 (2017-11-30) paragraph [0020] - paragraph [0022] figure 1	1-4,8, 11-13
X	KR 100 898 526 B1 (EMW ANTENNA CO LTD [KR]) 20 May 2009 (2009-05-20) abstract figure 2	1-4,8, 11-13

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
6 March 2020	16/03/2020

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