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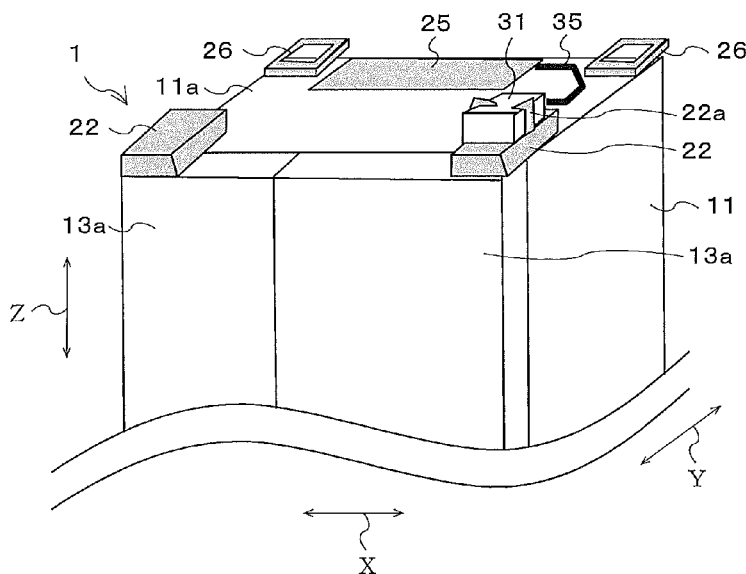
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(54) Title: REFRIGERATOR AND HOME ELECTRONICS LINKING SYSTEM

(54) 発明の名称: 冷蔵庫及び家電連携システム

[図7]



(57) Abstract: Provided are a refrigerator wherein wireless signal interference is suppressed and a home electronics linking system to which the refrigerator is connected. A refrigerator (1) has: a case (11) comprising a storage chamber (12); a door (13) that is disposed on the case (11) and that opens and closes the storage chamber (12); a hinge (21) that connects the case (11) and the door (13) and that rotatably supports the door (13) so that the same can be opened and closed; a non-conductive hinge cover (22) that is mounted on the case (11) so as to be removable and that covers the hinge (21); and a wireless adapter (31) that is disposed on the hinge cover (22) and that comprises an antenna unit (32) that transmits and receives radio waves.

(57) 要約: 無線電波の障害を抑制する冷蔵庫及びその冷蔵庫が接続された家電連携システムを提供する。冷蔵庫(1)は、貯蔵室(12)を備える筐体(11)と、筐体(11)に設置され、貯蔵室(12)を開閉する扉(13)と、筐体(11)と扉(13)とを接続し、扉(13)を開閉自在に軸支するヒンジ(21)と、筐体(11)に着脱自在に取り付けられ、ヒンジ(21)を覆う非導電性のヒンジカバー(22)と、ヒンジカバー(22)上に設置され、電波を送受信するアンテナ部(32)を備える無線アダプタ(31)と、を有する。

DESCRIPTION

Title of Invention

REFRIGERATOR AND HOUSEHOLD APPLIANCE NETWORKING SYSTEM

Technical Field

5 [0001]

The present invention relates to a refrigerator with a wireless adapter including an antenna unit for transmitting and receiving radio waves and a household appliance networking system connected to the refrigerator.

Background Art

10 [0002]

Energy saving has recently been receiving increasing attention from the viewpoint of global environment protection. Attention is being focused on a power management system, such as a home energy management system (HEMS), for managing power on a house-by-house basis. The HEMS interactively connects household appliances arranged in a house via an information network to control, for example, optimization of power consumption. A technique for connecting a household appliance, for example, a refrigerator, to such an information network is described in Patent Literature 1.

[0003]

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Patent Literature 1 discloses a refrigerator having a top surface on which a communication board including an antenna unit for transmitting and receiving radio waves is mounted. As described in Patent Literature 1, the communication board is mounted on the top surface of the refrigerator so that the antenna unit of the communication board is disposed 3 cm or more apart from a magnet disposed inside a gasket attached to a door of the refrigerator. This arrangement prevents interference of the magnet with radio wave transmission and reception of the antenna unit in this related art. In Patent Literature 1, a line connecting the communication board that controls the refrigerator to a main board is embedded in a thermally insulated box (casing) of the refrigerator. Patent Literature 2 discloses an

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information processing apparatus having as a communication network adapter provided with a light, a camera, or a human presence sensor.

Citation List

Patent Literature

[0004]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2005-140345 (claim 1, Figs. 2 and 3)

Patent Literature 2: Japanese Unexamined Patent Application Publication No. 2006-54834 (claims 12 and 14, paragraph 0053)

[0004a]

Reference to any prior art in the specification is not, and should not be taken as, an acknowledgment or any form of suggestion that this prior art forms part of the common general knowledge in any jurisdiction or that this prior art could reasonably be expected to be understood, regarded as relevant and/or combined with other pieces of prior art by a person skilled in the art.

Summary of Invention

[0004b]

As used herein, except where the context requires otherwise, the term "comprise" and variations of the term, such as "comprising", "comprises" and "comprised", are not intended to exclude further additives, components, integers or steps.

Technical Problem

[0005]

The refrigerator disclosed in Patent Literature 1, however, fails to provide a sufficient distance between the communication board and a top surface of the refrigerator. The top surface of the refrigerator is typically formed of a steel sheet. This steel sheet affects radio waves transmitted and received by the antenna unit included in the communication board, thus attenuating the intensity of radio waves. In addition, the line connecting the communication board to the main board is previously embedded in the casing, but the line is unnecessary for a user who does not connect the refrigerator to an information network, leading to an increased cost.

Furthermore, any consideration is not given to radio interference in Patent Literature 2.

[0006]

The present invention has been made in consideration of the above-described problems and provides a refrigerator that reduces or eliminates interference with radio waves and a household appliance networking system connected to the refrigerator.

Alternatively, or in addition, it would be desirable for the invention to provide the public with a useful choice.

[0007]

Disclosed within the following is a refrigerator including a casing having a storage compartment,

a non-conductive carrying handle attached to the casing, the carrying handle being used for carrying the casing; and a wireless adapter disposed on the carrying handle and including an antenna unit configured to transmit and receive radio waves.

[0007a]

According to an aspect of the invention there is provided a refrigerator comprising: a casing including a storage compartment; a door attached to the casing to expose or cover the storage compartment; a hinge connecting the door to the casing and supporting the door so that the door is openable and closable; a non-conductive hinge cover detachably attached to the casing, the hinge cover covering the hinge; and a wireless adapter disposed on the hinge cover, and detachably mounted to the casing along with the hinge cover, the wireless adapter including an antenna unit configured to transmit and receive radio waves.

[0007b]

Also disclose within the following is a refrigerator comprising: a casing including a storage compartment; a cooling device supplying cooled air to the storage compartment; a board holder included in the casing, the board holder holding a control board controlling the cooling device; a board holder cover covering the board holder; a wireless adapter disposed on the board holder cover, the wireless adapter including an antenna unit configured to transmit and receive radio waves; and a non-conductive attachment interposed between the board holder cover and the wireless adapter to increase a distance between the board holder cover and the wireless adapter and fix the board holder cover and the wireless adapter.

[0008]

According to the present invention, the wireless adapter is disposed on the hinge cover. Even when the casing is formed of a steel sheet, this

arrangement can provide a sufficient distance between the steel sheet and the wireless adapter. Consequently, the wireless adapter mounted on the refrigerator can perform stable radio communication.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a schematic diagram illustrating a household appliance networking system 2 according to Embodiment 1.

[Fig. 2] Fig. 2 is a front view of a refrigerator 1 according to Embodiment 1.

[Fig. 3] Fig. 3 is a sectional side view of the refrigerator 1 according to Embodiment 1.

[Fig. 4] Fig. 4 is a top view of the refrigerator 1 according to Embodiment 1.

[Fig. 5] Fig. 5 is a block diagram of the refrigerator 1 according to Embodiment 1.

[Fig. 6] Fig. 6 includes schematic diagrams illustrating a wireless adapter 31 in Embodiment 1.

[Fig. 7] Fig. 7 is a perspective view of the refrigerator 1 according to Embodiment 1.

[Fig. 8] Fig. 8 includes perspective views illustrating the wireless adapter 31 in Embodiment 1.

[Fig. 9] Fig. 9 is a perspective view of a refrigerator 1 according to a first modification of Embodiment 1.

[Fig. 10] Fig. 10 is a perspective view illustrating the wireless adapter 31 in a second modification of Embodiment 1.

[Fig. 11] Fig. 11 is a perspective view of a refrigerator 1 according to Embodiment 2.

5 [Fig. 12] Fig. 12 is a perspective view of a refrigerator 1 according to a first modification of Embodiment 2.

[Fig. 13] Fig. 13 is a perspective view of a refrigerator 1 according to a second modification of Embodiment 2.

10 [Fig. 14] Fig. 14 is a perspective view illustrating the wireless adapter 31 in a third modification of Embodiment 2.

[Fig. 15] Fig. 15 is a perspective view illustrating the wireless adapter 31 in a fourth modification of Embodiment 2.

[Fig. 16] Fig. 16 is a perspective view of a refrigerator 1 according to Embodiment 3.

15 [Fig. 17] Fig. 17 is a perspective view of a refrigerator 1 according to Embodiment 4.

[Fig. 18] Fig. 18 is a perspective view of a refrigerator 1 according to Embodiment 5.

Description of Embodiments

20 [0010]

Embodiments of a refrigerator and a household appliance networking system according to the present invention will be described with reference to the drawings. Embodiments, which will be described below, should not be construed as limiting the present invention. Note that the dimensional relationship among components in Fig. 1 and subsequent figures may be different from the actual relationship.

[0011]

Embodiment 1

Fig. 1 is a schematic diagram illustrating a household appliance networking system 2 according to Embodiment 1. The household appliance networking system 2 will be described below with reference to Fig. 1. As illustrated in Fig. 1, the

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household appliance networking system 2 includes a central controller 3 and a plurality of electrical apparatuses connected to the central controller 3 in a wireless manner. The electrical apparatuses include household appliances, such as a refrigerator 1 and an air conditioning apparatus 4 arranged in a house. In addition to the household appliances, the central controller 3 is connected to photovoltaic panels 5 and an electric car 6. For example, the central controller 3 controls electric power loads in the house depending on power generation by the photovoltaic panels 5 or a charge state of the electric car 6. Additionally, the central controller 3 is connected to a stationary or tablet information terminal 7. A user can check the usage of electricity and operate the electrical apparatuses by using the information terminal 7 through the central controller 3.

[0012]

The central controller 3 is also connected to an external network 8, so that, for example, power supply information from an electric power company, weather or temperature information, and information necessary for control of the devices connected to the central controller 3 can be obtained. Furthermore, the central controller 3 transmits, for example, information indicating the usage of electricity or a device operation state via the external network 8 to a data server. Although the refrigerator 1, the air conditioning apparatus 4, the photovoltaic panels 5, the electric car 6, and the information terminal 7 are connected to the central controller 3 in Fig. 1, Fig. 1 illustrates an example. The central controller 3 may be connected to other devices, for example, a water heater, a lighting device, and a television set. The central controller 3 may be connected to the other devices in a wired manner.

[0013]

The refrigerator 1 connected to the central controller 3 will be described below. Fig. 2 is a front view of the refrigerator 1 according to Embodiment 1, Fig. 3 is a sectional side view of the refrigerator 1 according to Embodiment 1, and Fig. 4 is a top view of the refrigerator 1 according to Embodiment 1. The refrigerator 1 will be described with reference to Figs. 2 to 4. As illustrated in Fig. 2, the refrigerator 1 includes a casing 11 having storage compartments 12, and doors 13.

[0014]

The storage compartments 12 includes a refrigerating compartment 12a disposed as a top compartment, an ice making compartment 12b and a first freezer compartment 12c arranged beneath the refrigerating compartment 12a, a second freezer compartment 12d disposed beneath the ice making compartment 12b and the first freezer compartment 12c, and a vegetable compartment 12e disposed as a bottom compartment. The doors 13 are opened or closed to expose or cover these storage compartments 12, and include refrigerating compartment doors 13a, an ice making compartment door 13b, a first freezer compartment door 13c, a second freezer compartment door 13d, and a vegetable compartment door 13e. The storage compartments 12 are provided with a door switch 14 for sensing opening and closing of the doors 13. In particular, when opening of any of the refrigerating compartment doors 13a is sensed in the refrigerating compartment 12a, a refrigerator light 15 disposed inside the refrigerating compartment 12a is turned on. In addition, one of the refrigerating compartment doors 13a is provided with an operation panel 16. For example, operating the operation panel 16 controls set temperatures of the storage compartments 12 and gives, for example, a rapid cooling instruction to the refrigerator 1.

[0015]

As illustrated in Fig. 3, the casing 11 includes a cooling room 17 in addition to the storage compartments 12. In this cooling room 17, a cooling device 18 is disposed. The cooling device 18 includes a refrigeration cycle including a compressor 18a, a cooler 18b, an expansion unit (not illustrated), and a condenser, and a refrigerator fan 18c. The refrigerator fan 18c sends air produced by the refrigeration cycle to the storage compartments 12 through an air passage. In the air passage, an openable and closable damper 19 is disposed. The damper 19 is opened or closed on the basis of a temperature in the storage compartments 12 sensed by a temperature sensor 20 disposed in the storage compartments 12. Opening and closing the damper 19 performs temperature control in the storage compartments 12. After cooled air is sent to the storage compartments 12, the air is

returned to the cooler 18b and is again cooled. The cooled air is sent to the storage compartments 12 by the refrigerator fan 18c. The air is circulated in that manner.

[0016]

The casing 11 is also provided with hinges 21 that support the refrigerating compartment doors 13a so that the doors are openable and closable. Each hinge 21 connects the refrigerating compartment door 13a to the casing 11. The hinge 21 is covered by a non-conductive hinge cover 22. The hinge cover 22 is made of, for example, resin. The hinge cover 22 is detachably attached to a top surface 11a of the casing 11. A wireless adapter 31 is mounted on an upper surface of one of the hinge covers 22. The top surface 11a of the casing 11 has a stepped portion adjacent to a rear surface of the casing 11. The stepped portion serves as a board holder 24 for holding a control board 23 that controls the cooling device 18. The board holder 24 is covered by a board holder cover 25, thereby protecting the control board 23. The board holder cover 25 is made of, for example, metal.

[0017]

As described above, the hinge covers 22 are attached to two corners of the top surface 11a of the casing 11 adjacent to the doors 13 as illustrated in Fig. 4. In addition, carrying handles 26 to be used for carrying the casing 11 are attached to two corners of the top surface 11a of the casing 11 adjacent to the rear surface of the casing 11. The carrying handles 26 are non-conductive members made of, for example, resin. As described above, the board holder cover 25 is attached to the top surface 11a of the casing 11 adjacent to the rear surface of the casing 11.

[0018]

The control board 23 will be described below. Fig. 5 is a block diagram illustrating the refrigerator 1 according to Embodiment 1. The control board 23 includes a microcontroller 23a that controls the refrigerator 1. The microcontroller 23a receives input signals from, for example, the temperature sensor 20, the door switch 14, the compressor 18a, and the operation panel 16. In response to receiving the input signal from the temperature sensor 20, the microcontroller 23a determines, for example, a rotation speed of the compressor 18a on the basis of a temperature in

the storage compartments 12 sensed by the temperature sensor 20, and transmits an output signal to the compressor 18a. Additionally, the microcontroller 23a outputs a signal for activating or stopping the refrigerator fan 18c and a signal for opening or closing the damper 19 disposed in the air passage to the refrigerator fan 18c and the damper 19 on the basis of the temperature in the storage compartments 12 sensed by the temperature sensor 20.

[0019]

In response to receiving the input signal from the door switch 14, the microcontroller 23a transmits an output signal for displaying, for example, open and/or closed states of the doors 13 on the operation panel 16 to the operation panel 16. Additionally, the microcontroller 23a transmits an output signal for turning on the refrigerator light 15 disposed inside the storage compartments 12 to the refrigerator light 15 in response to receiving the input signal from the door switch 14.

Furthermore, in response to receiving the input signal from the compressor 18a, the microcontroller 23a outputs a signal for activating or stopping the refrigerator fan 18c and a signal for opening or closing the damper 19 disposed in the air passage to the refrigerator fan 18c and the damper 19 on the basis of an operation state of the compressor 18a. Additionally, in response to receiving the input signal from the operation panel 16 generated by an operation on the operation panel 16, the microcontroller 23a transmits output signals to the components on the basis of the input signal. For example, when the operation panel 16 is operated to control a temperature in the storage compartments 12, the microcontroller 23a transmits an output signal to, for example, the compressor 18a, the refrigerator fan 18c, or the damper 19 on the basis of an input signal from the operation panel 16.

[0020]

The control board 23 further includes a board connector 23b for connecting the wireless adapter 31 to the control board 23. An adapter connector 36 is attached to the wireless adapter 31. Connecting the adapter connector 36 to the board connector 23b connects the wireless adapter 31 to the control board 23. Thus, the

refrigerator 1 including the control board 23 performs information communication with the central controller 3 via the wireless adapter 31.

[0021]

The wireless adapter 31 will be described below. In Fig. 6, parts (a) and (b) are schematic diagrams illustrating the wireless adapter 31 in Embodiment 1. Fig. 6 (a) is a sectional side view of the wireless adapter 31 and Fig. 6 (b) is a top view of the wireless adapter 31. As illustrated in Fig. 6 (a), the wireless adapter 31 includes an antenna unit 32 for transmitting and receiving radio waves. The antenna unit 32 is attached to a communication board 33. The communication board 33 is accommodated in a communication case 34 made of, for example, resin, and is connected to a communication line 35 extending from the adapter connector 36. As illustrated in Fig. 6 (b), the communication case 34 has a protrusion 34a having a screw hole 34b.

[0022]

The refrigerator 1 on which the wireless adapter 31 is mounted will be described below in detail. Fig. 7 is a perspective view of the refrigerator 1 according to Embodiment 1. In Fig. 8, parts (a) and (b) are perspective views illustrating the wireless adapter 31 in Embodiment 1. Fig. 8 (a) is a perspective view illustrating the wireless adapter 31 fastened with claws 22a. Fig. 8 (b) is a perspective view illustrating the wireless adapter 31 fastened with a screw 34ba. As illustrated in Fig. 7, the wireless adapter 31 is fastened to the upper surface of the hinge cover 22 disposed on the top surface 11a of the casing 11. As illustrated in Fig. 8 (a), the hinge cover 22 includes the claws 22a extending from the upper surface of the hinge cover 22 to tightly hold the wireless adapter 31. The wireless adapter 31 is fastened to the hinge cover 22 with the claws 22a.

[0023]

As regards the manner of fastening the wireless adapter 31, as illustrated in Fig. 8 (b), the protrusion 34a of the communication case 34 of the wireless adapter 31 may be brought into contact with the hinge cover 22, and the screw 34ba extending through the screw hole 34b of the protrusion 34a may be screwed into the hinge

cover 22 to fasten the wireless adapter 31 to the hinge cover 22. Alternatively, the wireless adapter 31 may be fixed to the hinge cover 22 with a double-faced tape. As illustrated in Fig. 7, the communication line 35 connecting the wireless adapter 31 to the adapter connector 36 extends from the wireless adapter 31 into the board holder cover 25 so that the communication line 35 is laid on the top surface 11a (shell) of the casing 11. The adapter connector 36 at the end of the communication line 35 is connected to the board connector 23b of the control board 23.

[0024]

An operation of the refrigerator 1 according to Embodiment 1 will be described below. As described above, the wireless adapter 31 is fastened to the upper surface of the hinge cover 22 attached to the top surface 11a of the casing 11. For example, when the top surface 11a of the casing 11 is formed of a steel sheet, this arrangement can provide a sufficient distance between the steel sheet and the wireless adapter 31. Consequently, the influence of the steel sheet is reduced, so that the wireless adapter 31 mounted on the refrigerator 1 achieves stable radio communication.

[0025]

The hinge covers 22 are provided for typical refrigerators 1 in most cases. In Embodiment 1, the wireless adapter 31 is mounted on the hinge cover 22. Since the hinge cover 22 is also used as a mounting component for the wireless adapter 31, the hinge cover 22 offers considerably enhanced versatility. Additionally, the hinge covers 22 are detachably attached to the casing 11. Before shipment from a factory, a hinge cover having no fastening structure, such as the claws 22a, for fastening the wireless adapter 31 may be attached to the casing 11. This hinge cover can be replaced by the hinge cover 22 having a structure for fastening the wireless adapter 31 prior to use of the wireless adapter 31. As described above, if the wireless adapter 31 is not used, the hinge cover having no structure for fastening the wireless adapter 31 can be used, preventing degradation in design quality of the refrigerator 1.

[0026]

(First Modification of Embodiment 1)

A refrigerator 1 according to a first modification of Embodiment 1 will be described. Fig. 9 is a perspective view of the refrigerator 1 according to the first modification of Embodiment 1. The first modification differs from Embodiment 1 in that the wireless adapter 31 is mounted on the carrying handle 26 attached to the casing 11 of the refrigerator 1. As illustrated in Fig. 9, the carrying handles 26 to be used for carrying the casing 11 are attached to the top surface 11a of the casing 11 as in Embodiment 1. The carrying handles 26 are arranged at two corners of the top surface 11a of the casing 11 adjacent to the rear surface of the casing 11. In the first modification, the wireless adapter 31 is fastened to an upper surface of one of the carrying handles 26. Since the carrying handles 26 are arranged adjacent to the rear surface of the casing 11, the wireless adapter 31 fastened to the upper surface of the carrying handle 26 is difficult to be noticed when the refrigerator 1 is viewed from the front. As described above, the first modification advantageously enhances the design quality of the refrigerator 1 in addition to achieving the advantages offered by Embodiment 1.

[0027]

(Second Modification of Embodiment 1)

A refrigerator 1 according to a second modification of Embodiment 1 will be described. Fig. 10 is a perspective view illustrating the wireless adapter 31 in the second modification of Embodiment 1. The second modification differs from Embodiment 1 in that a wireless adapter shield 41 is interposed between the wireless adapter 31 and the hinge cover 22 of the refrigerator 1. As illustrated in Fig. 10, the wireless adapter shield 41 is disposed on an attachment surface of the wireless adapter 31 facing the casing 11, that is, the attachment surface of the wireless adapter 31 facing the hinge cover 22. The wireless adapter shield 41 absorbs radio waves and has, for example, a sheet-like shape. Consequently, when the top surface 11a of the casing 11 is formed of a steel sheet, the wireless adapter shield 41 reduces reflection of radio waves caused by the steel sheet. The second modification therefore allows further reduction of the influence of the steel sheet on radio waves in addition to achieving the advantages offered by Embodiment 1.

[0028]

Embodiment 2

A refrigerator 1 according to Embodiment 2 will be described. Fig. 11 is a perspective view of the refrigerator 1 according to Embodiment 2. Embodiment 2 differs from Embodiment 1 in that an attachment 42 is interposed between the wireless adapter 31 and the hinge cover 22. In Embodiment 2, components common to Embodiment 1 are designated by the same reference signs and an explanation of these components is omitted. The following description will be focused on differences from Embodiment 1.

[0029]

According to Embodiment 2, as illustrated in Fig. 11, the attachment 42, which is non-conductive, is interposed between the wireless adapter 31 and the hinge cover 22. The attachment 42 is a non-conductive member made of, for example, resin. As regards the manner of fixing the wireless adapter 31 to the attachment 42, the attachment 42 may include claws extending from an upper surface of the attachment 42 to tightly hold the wireless adapter 31. The wireless adapter 31 may be fixed to the attachment 42 with these claws. Alternatively, the wireless adapter 31 may be fixed to the attachment 42 with a screw or a double-faced tape. Furthermore, the claws 22a of the hinge cover 22 for tightly holding the wireless adapter 31 may be used as components for fixing the attachment 42 to the hinge cover 22. Alternatively, the attachment 42 may be fixed to the hinge cover 22 with a screw or a double-faced tape.

[0030]

Since the attachment 42 is interposed between the wireless adapter 31 and the hinge cover 22 as described above, the distance between the hinge cover 22 and the wireless adapter 31 is increased. Consequently, when the top surface 11a of the casing 11 is formed of a steel sheet, the distance between the steel sheet and the wireless adapter 31 can be further increased as compared with that in Embodiment 1. The refrigerator 1 allows further reduction of the influence of the steel sheet and accordingly achieves stable radio communication. The hinge covers 22 are

detachably attached to the casing 11. Before shipment from a factory, a hinge cover having no fastening structure, such as the claws 22a, for fastening the wireless adapter 31 may be attached to the casing 11. This hinge cover can be replaced by the hinge cover 22 having the structure for fastening the wireless adapter 31 prior to use of the wireless adapter 31. As described above, if the wireless adapter 31 is not used, the hinge cover having no structure for fastening the wireless adapter 31 can be used, preventing degradation in design quality of the refrigerator 1 as in Embodiment 1.

[0031]

10 (First Modification of Embodiment 2)

A refrigerator 1 according to a first modification of Embodiment 2 will be described. Fig. 12 is a perspective view of the refrigerator 1 according to the first modification of Embodiment 2. The first modification differs from Embodiment 2 in that, as illustrated in Fig. 12, the wireless adapter 31 is mounted on the carrying handle 26 attached to the casing 11 of the refrigerator 1 and the attachment 42 is interposed between the wireless adapter 31 and the carrying handle 26. Since this carrying handle 26 is disposed adjacent to the rear surface of the casing 11, the wireless adapter 31 and the attachment 42 fastened to the upper surface of the carrying handle 26 are difficult to be noticed when the refrigerator 1 is viewed from the front. As described above, the first modification advantageously enhances the design quality of the refrigerator 1 in addition to achieving the advantages offered by Embodiment 2.

[0032]

(Second Modification of Embodiment 2)

A refrigerator 1 according to a second modification of Embodiment 2 will be described. Fig. 13 is a perspective view of the refrigerator 1 according to the second modification of Embodiment 2. The second modification differs from Embodiment 2 in that the wireless adapter 31 is mounted on the board holder cover 25 attached to the casing 11 of the refrigerator 1 and the attachment 42 is interposed between the wireless adapter 31 and the board holder cover 25. As illustrated in Fig. 13, the

board holder cover 25 that covers the board holder 24 holding the control board 23 is attached to the top surface 11a of the casing 11 in a manner similar to Embodiments 1 and 2. The board holder cover 25 is disposed on the top surface 11a of the casing 11 adjacent to the rear surface of the casing 11. Since the board holder cover 25 is disposed adjacent to the rear surface of the casing 11 as described above, the wireless adapter 31 and the attachment 42 on an upper surface of the board holder cover 25 are difficult to be noticed when the refrigerator 1 is viewed from the front. The second modification advantageously enhances the design quality of the refrigerator 1 in addition to achieving the advantages offered by Embodiment 2.

[0033]

(Third Modification of Embodiment 2)

A refrigerator 1 according to a third modification of Embodiment 2 will be described. Fig. 14 is a perspective view illustrating the wireless adapter 31 in the third modification of Embodiment 2. The third modification differs from Embodiment 2 in that the wireless adapter shield 41 is interposed between the wireless adapter 31 and the attachment 42 in the refrigerator 1. As illustrated in Fig. 14, the wireless adapter shield 41 is disposed on the attachment surface of the wireless adapter 31 facing the casing 11, that is, the attachment surface of the wireless adapter 31 facing the attachment 42. The wireless adapter shield 41 absorbs radio waves and has, for example, a sheet-like shape. Consequently, when the top surface 11a of the casing 11 is formed of a steel sheet, the wireless adapter shield 41 reduces reflection of radio waves caused by the steel sheet. The third modification therefore allows further reduction of the influence of the steel sheet on radio waves in addition to achieving the advantages offered by Embodiment 2.

[0034]

(Fourth Modification of Embodiment 2)

A refrigerator 1 according to a fourth modification of Embodiment 2 will be described. Fig. 15 is a perspective view illustrating the wireless adapter 31 in the fourth modification of Embodiment 2. The fourth modification differs from Embodiment 2 in that an attachment shield 43 is interposed between the attachment

42 and the hinge cover 22 of the refrigerator 1. As illustrated in Fig. 15, the attachment shield 43 is disposed on an attachment surface of the attachment 42 facing the casing 11, that is, the attachment surface of the attachment 42 facing the hinge cover 22. Like the wireless adapter shield 41 in the third modification, the attachment shield 43 also absorbs radio waves and has, for example, a sheet-like shape. Consequently, when the top surface 11a of the casing 11 is formed of a steel sheet, the attachment shield 43 reduces reflection of radio waves caused by the steel sheet. The fourth modification therefore allows further reduction of the influence of the steel sheet on radio waves in addition to achieving the advantages offered by Embodiment 2.

[0035]

Embodiment 3

A refrigerator 1 according to Embodiment 3 will be described. Fig. 16 is a perspective view of the refrigerator 1 according to Embodiment 3. Embodiment 3 differs from Embodiment 2 in that the attachment 42 is provided with a lighting unit 44. In Embodiment 3, components common to Embodiments 1 and 2 are designated by the same reference signs and an explanation of these components is omitted. The following description will be focused on differences from Embodiments 1 and 2.

[0036]

In Embodiment 3, as illustrated in Fig. 16, the attachment 42 is provided with the lighting unit 44. The lighting unit 44 is provided to illuminate an area around the refrigerator 1. The lighting unit 44 is electrically connected to the control board 23. For example, when the operation panel 16 is operated, or alternatively, when the door switch 14 senses opening of any of the doors 13, the microcontroller 23a in the control board 23 transmits an output signal to the lighting unit 44, thus turning on the lighting unit 44. Since the attachment 42 is provided with the lighting unit 44 as described above, the refrigerator 1 advantageously enables an area around the user to be illuminated while the user uses the refrigerator 1, even if the user does not turn on a lighting device for a room where the refrigerator 1 is installed, in addition to providing the advantages offered by Embodiments 1 and 2.

[0037]

Embodiment 4

A refrigerator 1 according to Embodiment 4 will be described. Fig. 17 is a perspective view of the refrigerator 1 according to Embodiment 4. Embodiment 4 differs from Embodiments 2 and 3 in that the attachment 42 is provided with a camera 45. In Embodiment 4, components common to Embodiments 1, 2, and 3 are designated by the same reference signs and an explanation of these components is omitted. The following description will be focused on differences from Embodiments 1, 2, and 3.

[0038]

In Embodiment 4, as illustrated in Fig. 17, the attachment 42 is provided with the camera 45. The camera 45 is provided to capture an image of the area around the refrigerator 1. The camera 45 is electrically connected to the control board 23. The user can view an image captured by the camera 45 on the information terminal 7 connected to the household appliance networking system 2 through the wireless adapter 31 connected to the control board 23 and the central controller 3. Since the attachment 42 is provided with the camera 45 as described above, the refrigerator 1 enables the user to check the area around the refrigerator 1, for example, the kitchen where the refrigerator 1 is installed while the user is in a room other than the room where the refrigerator 1 is installed or while the user is on the go.

[0039]

In addition to the camera 45, the attachment 42 may be provided with the lighting unit 44 as in Embodiment 3. In this case, the lighting unit 44 can illuminate the area around the refrigerator 1 when the camera 45 captures an image of the area around the refrigerator 1. Advantageously, a clear image of the area around the refrigerator 1 can be captured during dark time, for example, at night. Consequently, the user can more clearly check the area around the refrigerator 1, for example, the kitchen where the refrigerator 1 is installed.

[0040]

Embodiment 5

A refrigerator 1 according to Embodiment 5 will be described. Fig. 18 is a perspective view of the refrigerator 1 according to Embodiment 5. Embodiment 5 differs from Embodiments 2, 3, and 4 in that the attachment 42 is provided with a human presence sensor 46. In Embodiment 5, components common to those in Embodiments 1, 2, 3, and 4 are designated by the same reference signs and an explanation of these components is omitted. The following description will be focused on differences from Embodiments 1, 2, 3, and 4.

[0041]

In Embodiment 5, as illustrated in Fig. 18, the attachment 42 is provided with the human presence sensor 46. The human presence sensor 46 senses the presence of a person in the area around the refrigerator 1. The human presence sensor 46 is electrically connected to the control board 23. When a person approaches the refrigerator 1, the human presence sensor 46 senses the person. Consequently, the user can check the person approaching the refrigerator 1 by using the information terminal 7 connected to the household appliance networking system 2 through the wireless adapter 31 connected to the control board 23 and the central controller 3.

[0042]

In addition to the human presence sensor 46, the attachment 42 may be provided with the lighting unit 44 as in Embodiment 3. In this case, when the human presence sensor 46 senses a person approaching the refrigerator 1, the lighting unit 44 can illuminate the area around the refrigerator 1. If a person other than the user, for example, a burglar, approaches the refrigerator 1, the human presence sensor 46 will sense the burglar and the lighting unit 44 will be turned on, thereby causing the burglar to feel someone in the house, enabling enhancement of security.

[0043]

Furthermore, in addition to the human presence sensor 46, the attachment 42 may be provided with the camera 45 as in Embodiment 4. In this case, when the human presence sensor 46 senses a person approaching the refrigerator 1, the camera 45 is activated. Consequently, the user can check the area around the

refrigerator 1, for example, the kitchen where the refrigerator 1 is installed while the user is in a room other than the room where the refrigerator 1 is installed or while the user is on the go. Additionally, in addition to the human presence sensor 46, the attachment 42 may be provided with the lighting unit 44 and the camera 45. In this case, when the human presence sensor 46 senses a person approaching the refrigerator 1 during dark time, for example, at night, the lighting unit 44 provides illumination, so that the user can more clearly check the area around the refrigerator 1, for example, the kitchen where the refrigerator 1 is installed while the user is in a room other than the room where the refrigerator 1 is installed or while the user is on the go.

Reference Signs List

[0044]

1 refrigerator 2 household appliance networking system 3 central controller 4 air conditioning apparatus 5 photovoltaic panel 6 electric car 7 information terminal 8 external network 11 casing 11a top surface 12 storage compartment 12a refrigerating compartment 12b ice making compartment 12c first freezer compartment 12d second freezer compartment 12e vegetable compartment 13 door 13a refrigerating compartment door 13b ice making compartment door 13c first freezer compartment door 13d second freezer compartment door 13e vegetable compartment door 14 door switch 15 refrigerator light 16 operation panel 17 cooling room 18 cooling device 18a compressor 18b cooler 18c refrigerator fan 19 damper 20 temperature sensor 21 hinge 22 hinge cover 22a claw 23 control board 23a microcontroller 23b board connector 24 board holder 25 board holder cover 26 carrying handle 31 wireless adapter 32 antenna unit 33 communication board 34 communication case 34a protrusion 34b screw hole 34ba screw 35 communication line 36 adapter connector 41 wireless adapter shield 42 attachment 43 attachment shield 44 lighting unit 45 camera 46 human presence sensor

CLAIMS

[Claim 1]

A refrigerator comprising:
a casing including a storage compartment;
a door attached to the casing to expose or cover the storage compartment;
a hinge connecting the door to the casing and supporting the door so that the door is openable and closable;
a non-conductive hinge cover detachably attached to the casing, the hinge cover covering the hinge; and
a wireless adapter disposed on the hinge cover, and detachably mounted to the casing along with the hinge cover, the wireless adapter including an antenna unit configured to transmit and receive radio waves.

[Claim 2]

The refrigerator of claim 1, further comprising
a non-conductive attachment interposed between the hinge cover and the wireless adapter to increase a distance between the hinge cover and the wireless adapter and fix the hinge cover and the wireless adapter.

[Claim 3]

The refrigerator of claim 2, further comprising
a lighting unit provided for the attachment, the lighting unit configured to illuminate a surrounding area.

[Claim 4]

The refrigerator of claim 2 or 3, further comprising
a camera provided for the attachment, the camera capturing an image of a surrounding area.

[Claim 5]

The refrigerator of any one of claims 2 to 4, further comprising
a human presence sensor provided for the attachment, the human presence sensor sensing a presence of a person in a surrounding area.

[Claim 6]

The refrigerator of any one of claims 2 to 5, further comprising
an attachment shield disposed on an attachment surface of the attachment
facing the casing, the attachment shield absorbing radio waves.

[Claim 7]

The refrigerator of any one of claims 1 to 6, further comprising
a wireless adapter shield disposed on an attachment surface of the wireless
adapter facing the casing, the wireless adapter shield absorbing radio waves.

[Claim 8]

A household appliance networking system comprising:
the refrigerator of any one of claims 1 to 7;
an electrical apparatus; and
a central controller configured to control the refrigerator and the electrical
apparatus,
the refrigerator and the electrical apparatus being connected through the
central controller.

FIG. 1

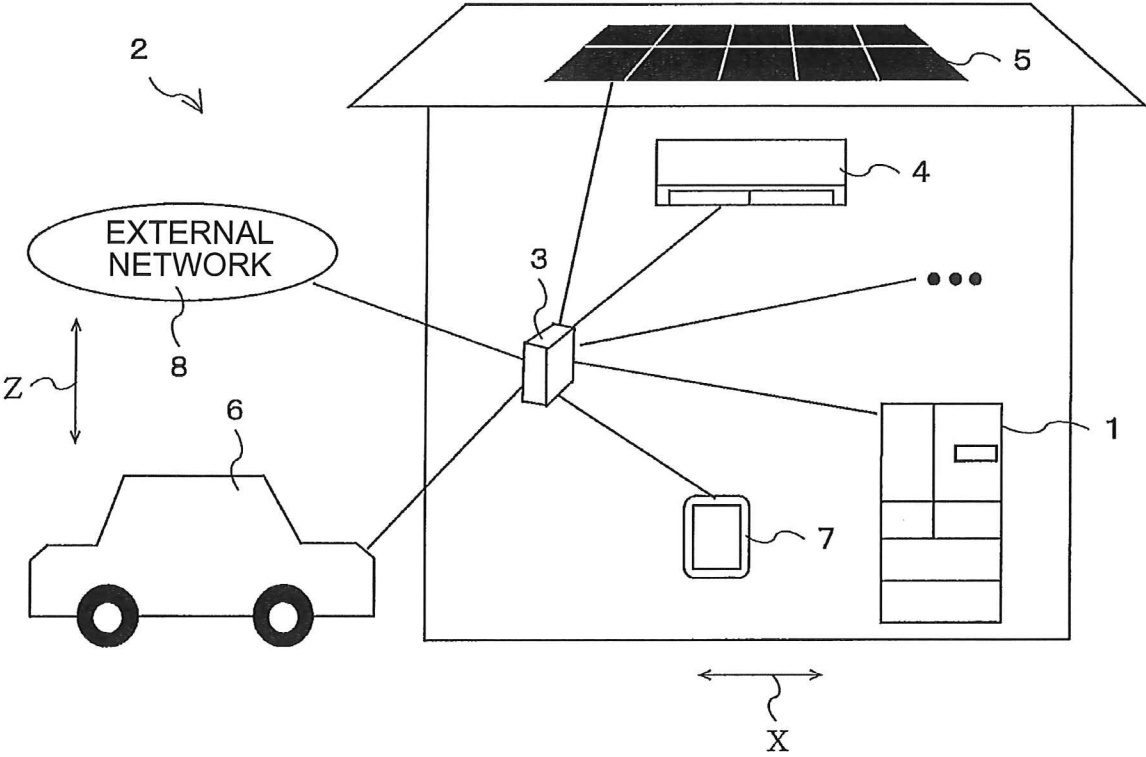


FIG. 2

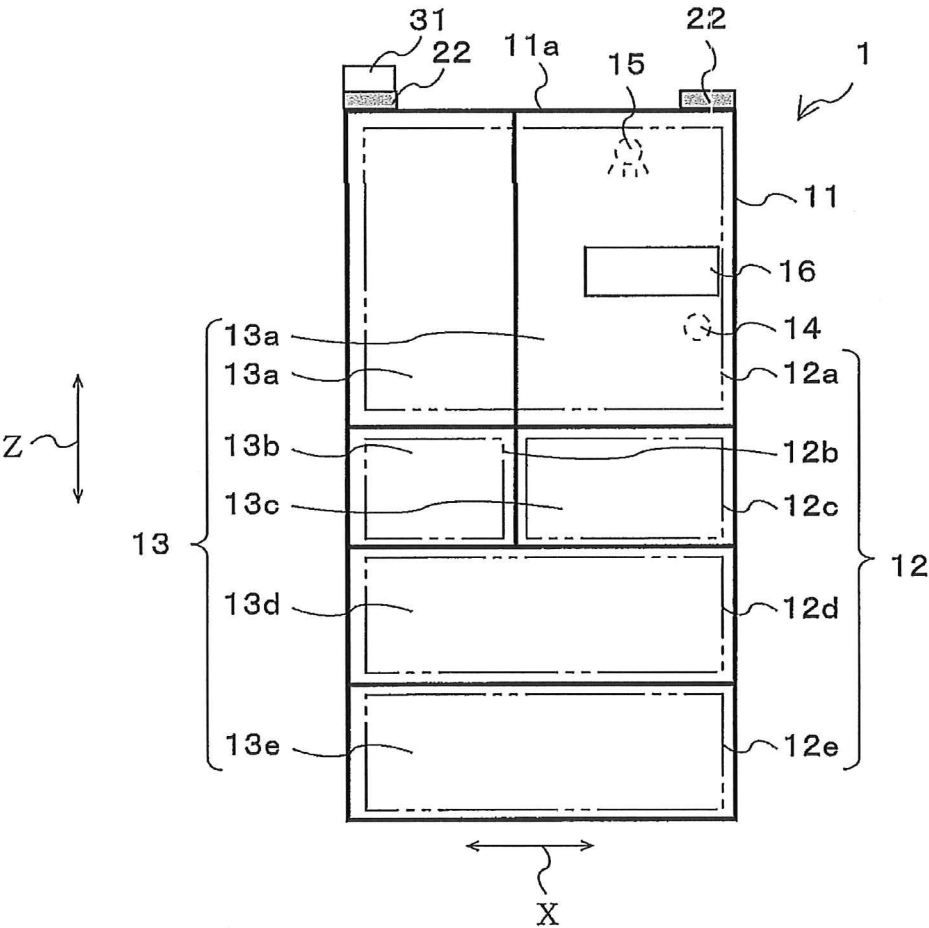


FIG. 3

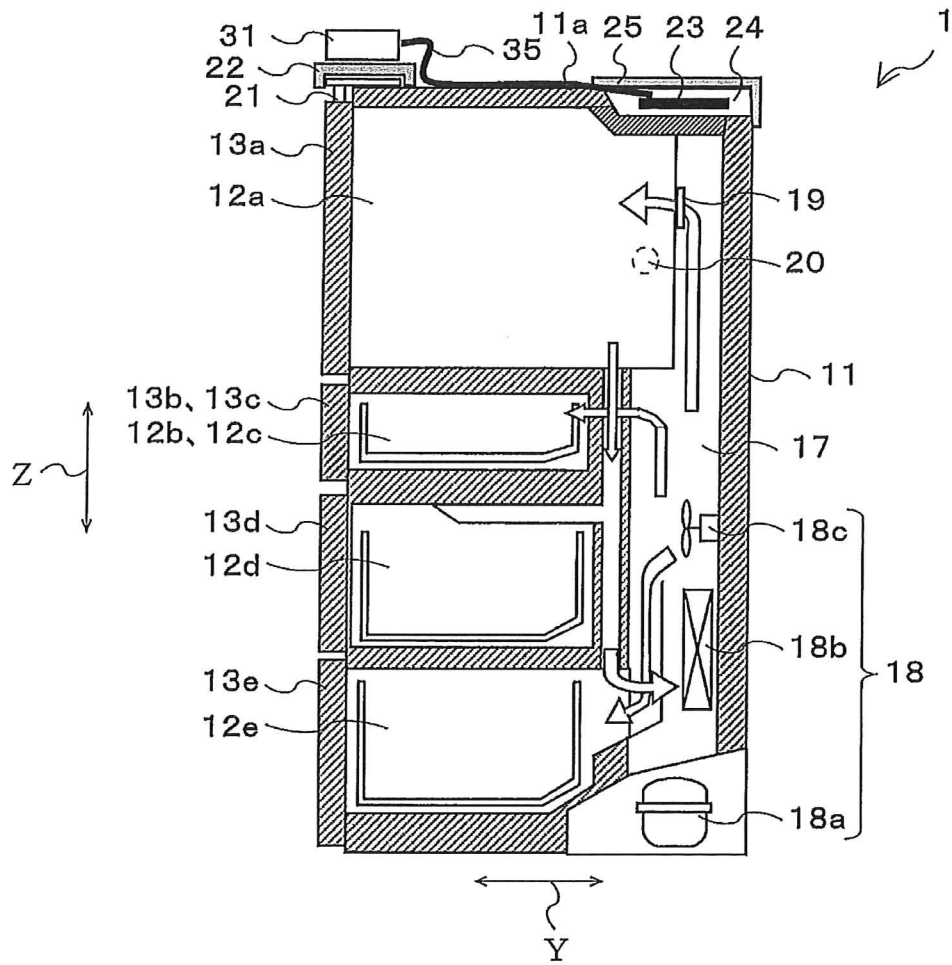


FIG. 4

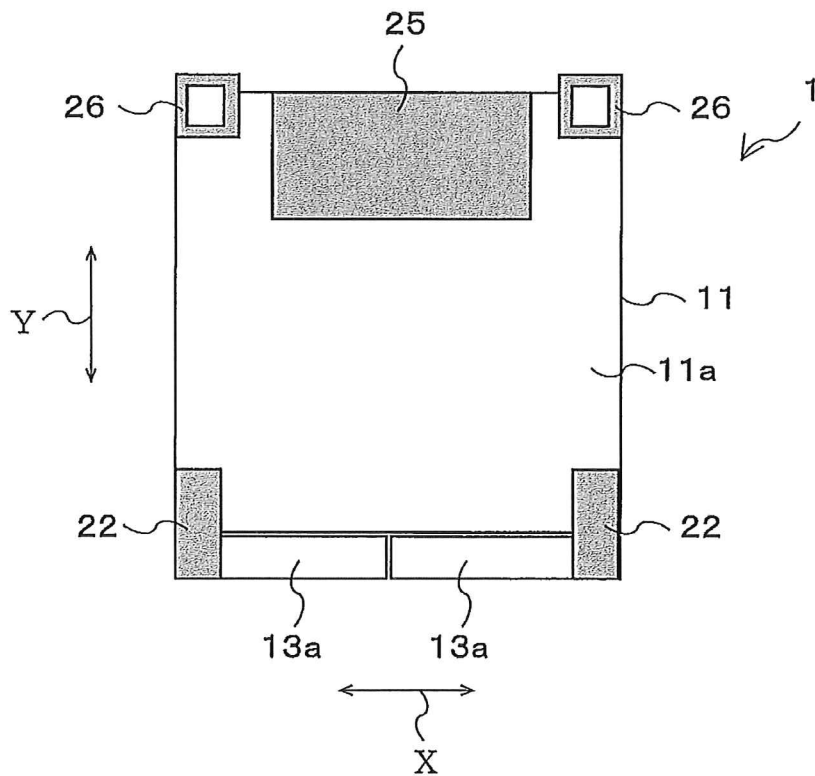


FIG. 5

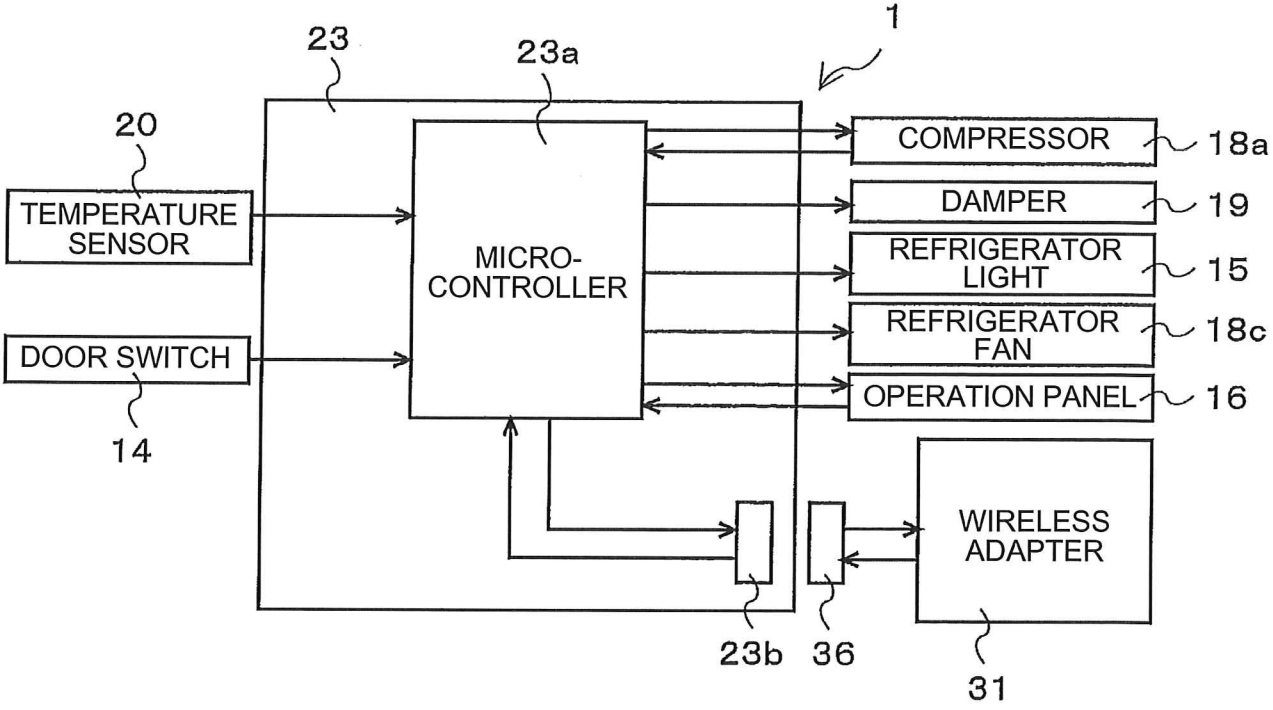


FIG. 6

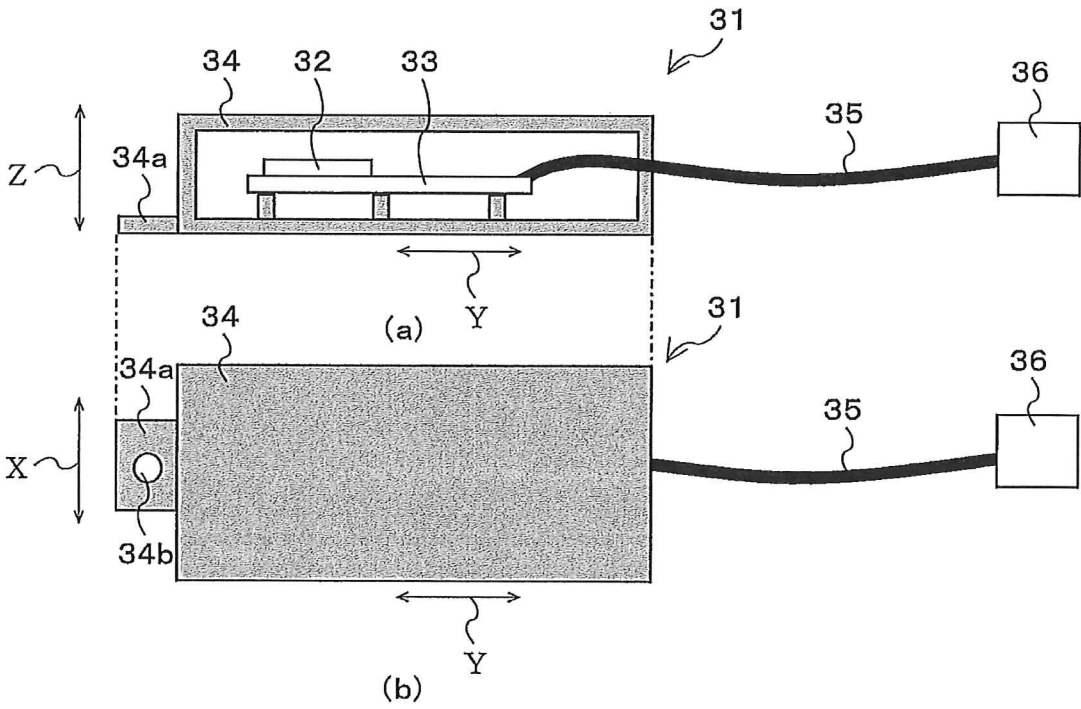


FIG. 7

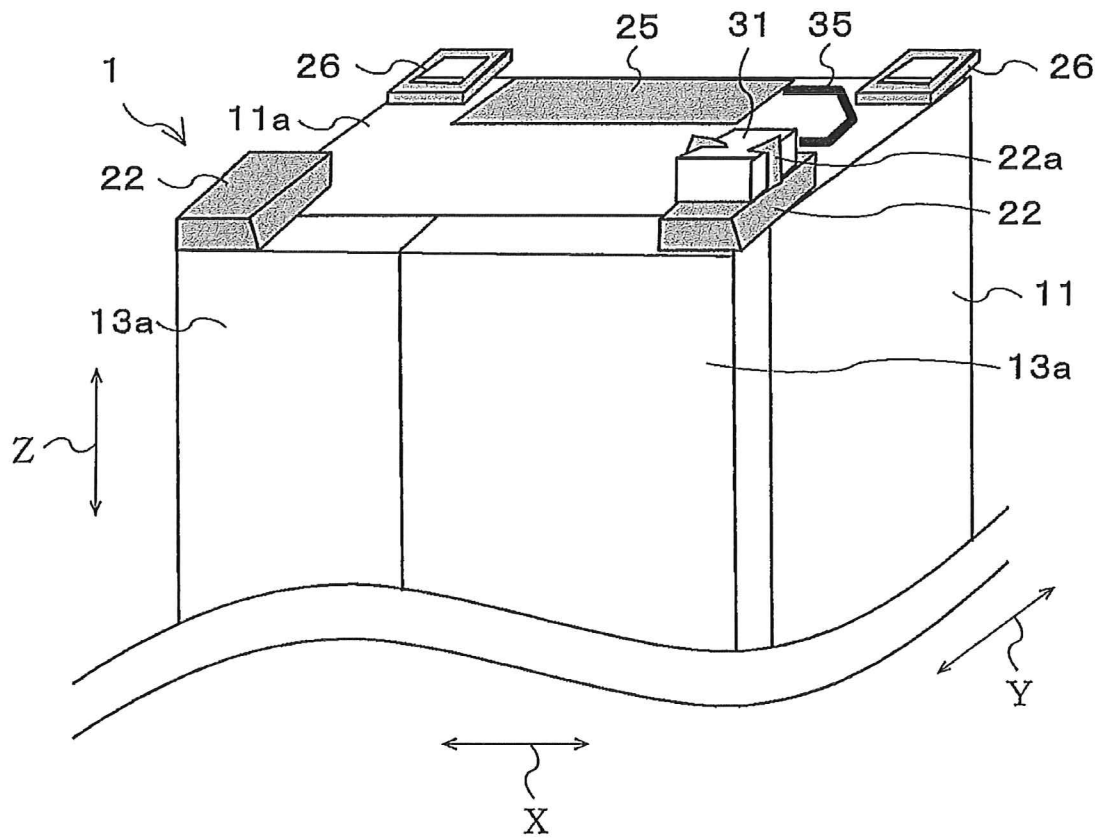


FIG. 8

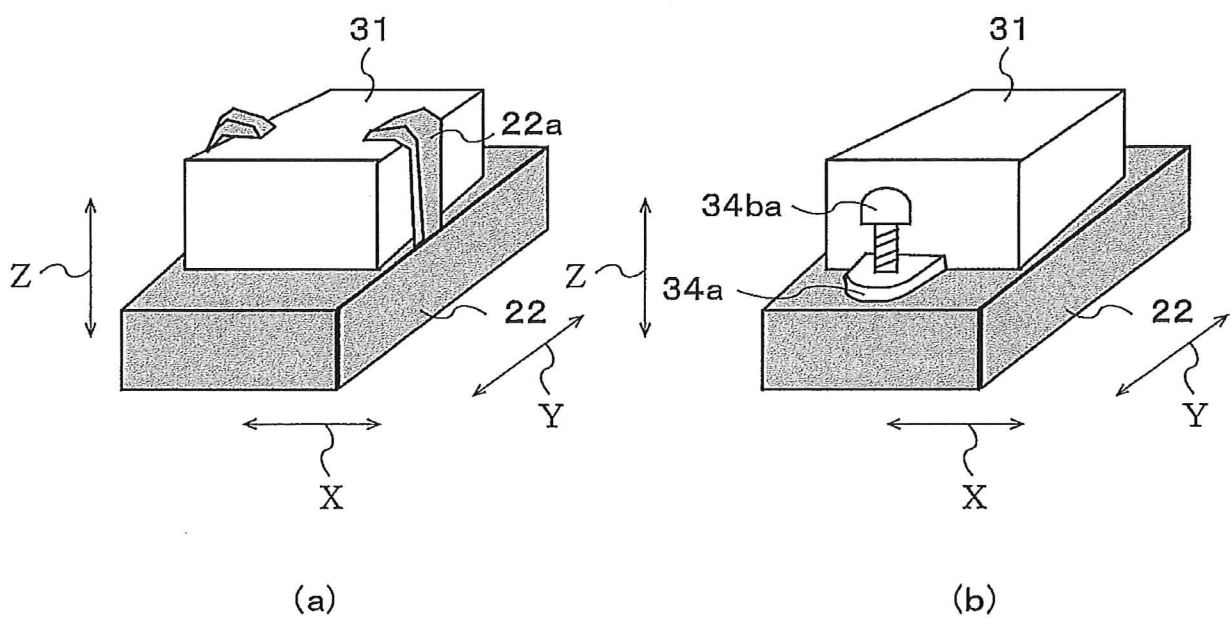


FIG. 13

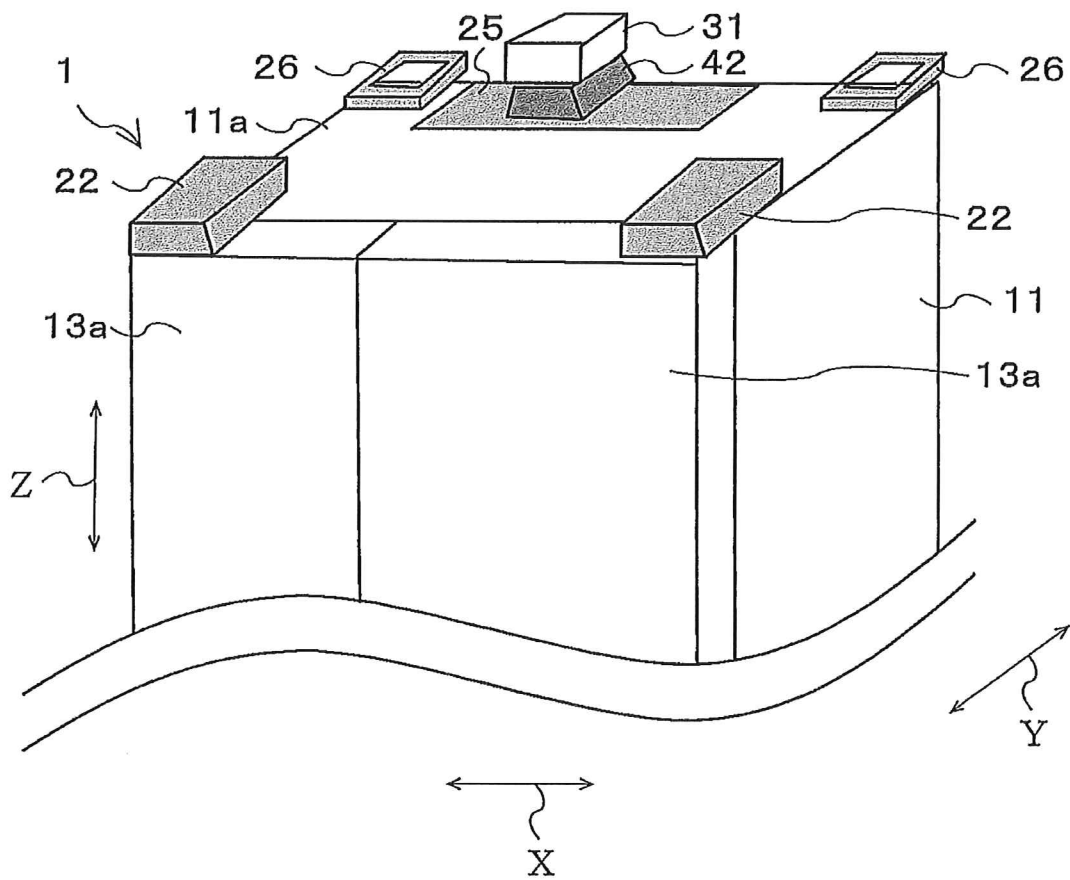


FIG. 14

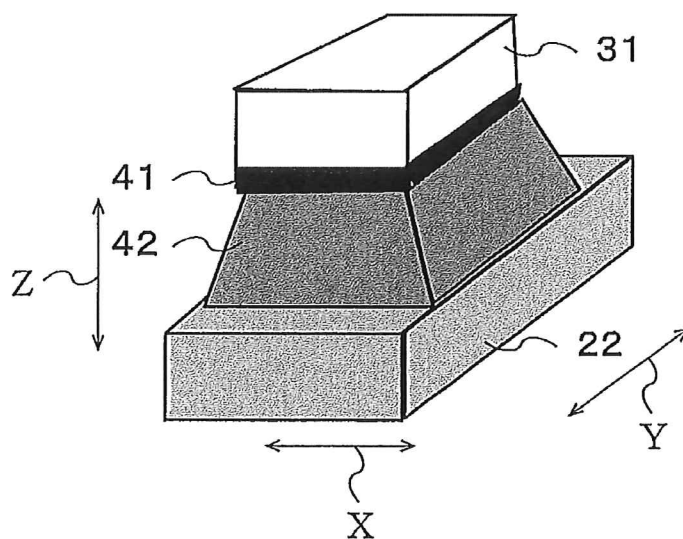


FIG. 15

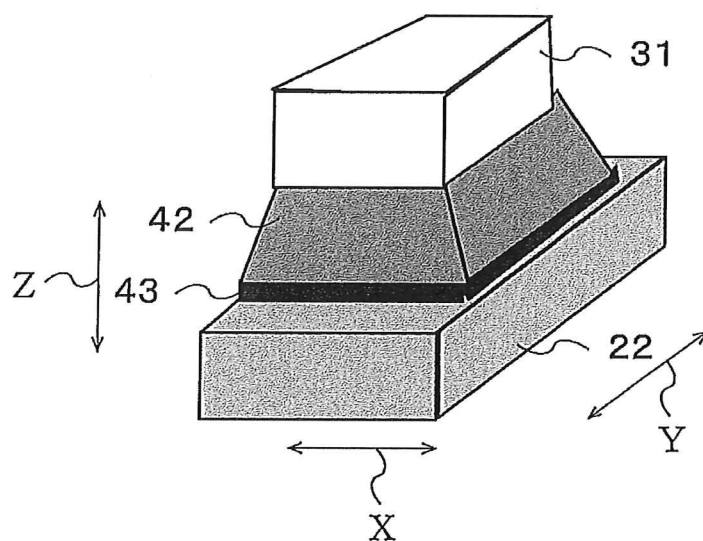


FIG. 16

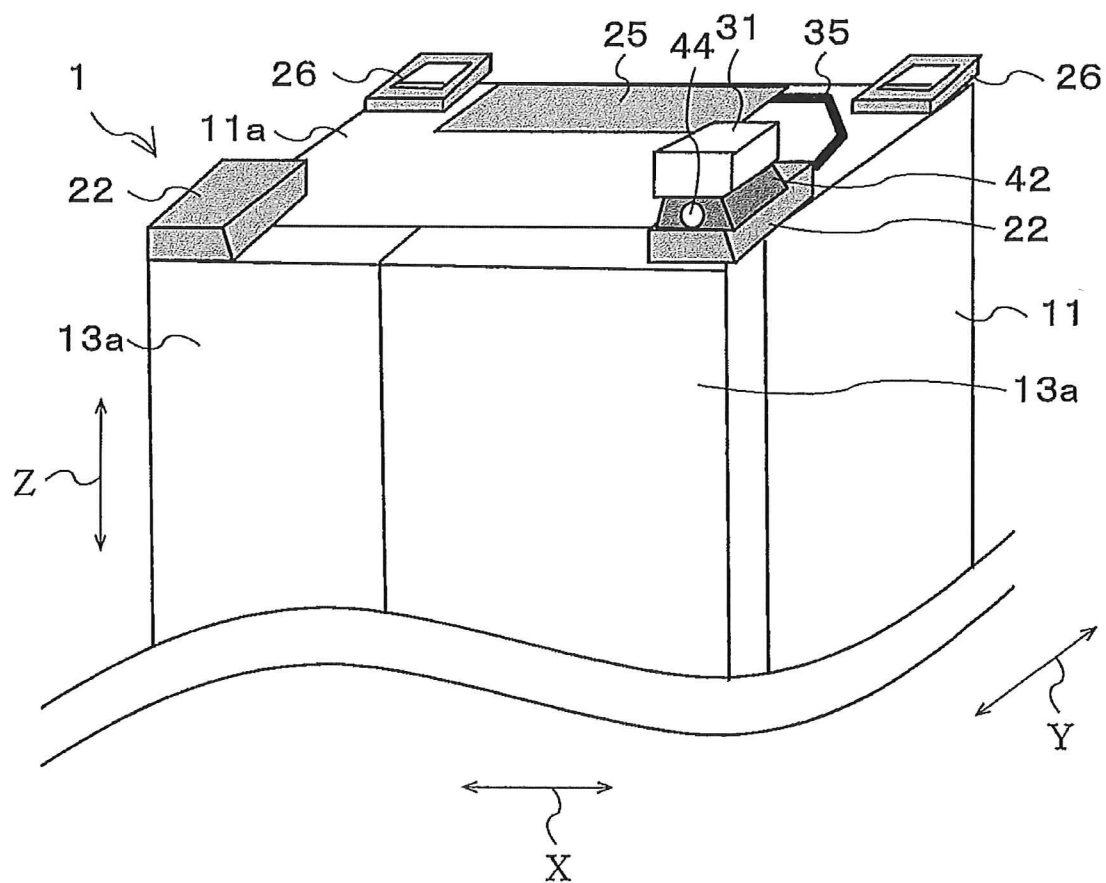


FIG. 17

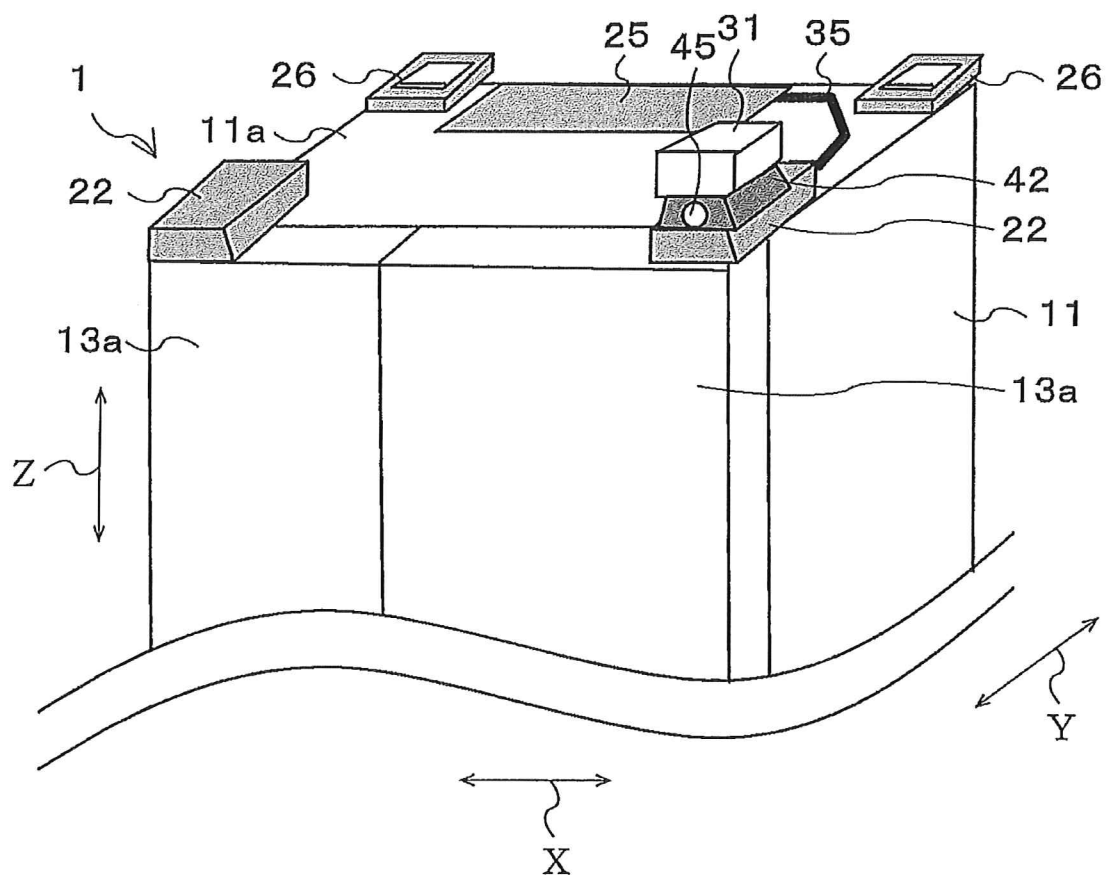


FIG. 18

