DESCRIPTION

Title of Invention

REFRIGERATOR

Technical Field

[0001]

The present disclosure relates to a refrigerator.

Background Art

[0002]

Hitherto, there is a refrigerator typified by a refrigerator disclosed in Patent Literature 1. The refrigerator includes a casing having a storage compartment, a door provided on the casing to turn via a metal hinge portion and configured to open or close an opening of the storage compartment by the turn, a connection line running around the hinge portion, and a wireless communication unit including a wireless communicator, connected to the connection line, positioned behind the hinge portion, and configured to communicate with an external device. In the refrigerator disclosed in Patent Literature 1, the connection line is laid inside a wall of the casing filled with a heat insulator that is a foamed heat insulator.

Citation List

Patent Literature

[0003]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2015-17781

Summary of Invention

Technical Problem

[0004]

To lay the connection line inside the wall of the casing filled with the heat insulator as in the refrigerator disclosed in Patent Literature 1, it is necessary to fill the casing with the heat insulator and foam the heat insulator with the connection line positioned inside the wall of the casing. In this case, the connection line inside the wall of the

casing is carried away when the casing is filled with the heat insulator and the heat insulator is foamed. The connection line may be fixed to an inner wall of the casing to reduce the occurrence of the case where the connection line is carried away. However, a fixing tool and a fixing operation are needed.

[0005]

The present disclosure has an object to provide a refrigerator having an advantageous effect to prevent a connection line from being carried away due to filling with and foaming of a heat insulator.

Solution to Problem

[0006]

A first refrigerator according to one aspect of the present disclosure includes a casing having a storage space inside to store a cooling target and having a top part above the storage space, an outer box that is a part of the casing and exposed to a space outside the casing, a cooling device configured to supply cooled air to the storage space, a controller configured to control the cooling device and fixed to the casing, a wireless communication device positioned at the top part of the casing and configured to communicate with an external device wirelessly, a fastener that fixes the wireless communication device to the outer box, and a connection line laid outside the casing and communicably connecting the wireless communication device and the controller.

[0007]

A second refrigerator according to one aspect of the present disclosure includes a casing having a storage space inside to store a cooling target, a cooling device configured to supply cooled air to the storage space, a controller configured to control the cooling device and fixed to the casing, a controller cover that covers the controller, a wireless communication device configured to communicate with an external device wirelessly, a fastener that fixes the wireless communication device to the controller cover, and a connection line laid outside the casing and communicably connecting the wireless communication device and the controller.

Advantageous Effects of Invention

[0008]

In the first refrigerator and the second refrigerator according to one aspect of the present disclosure, the connection line is laid outside the casing. Thus, the first refrigerator and the second refrigerator have an advantageous effect to prevent the connection line from being carried away due to filling with and foaming of a heat insulator.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a diagram illustrating the front of a refrigerator and an external device according to Embodiment 1.

[Fig. 2] Fig. 2 is a sectional view of the refrigerator according to Embodiment 1 along a section A-A in Fig. 1.

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

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

[Fig. 5] Fig. 5 is a sectional view of the refrigerator according to Embodiment 1 along a section B-B in Fig. 3.

[Fig. 6] Fig. 6 is an enlarged view of the refrigerator according to Embodiment 1 in a region C in Fig. 5.

[Fig. 7] Fig. 7 is an enlarged view of a refrigerator according to a modified example of Embodiment 1 at a portion corresponding to the region C in Fig. 5.

[Fig. 8] Fig. 8 is an enlarged view of a refrigerator according to Embodiment 2 at a portion corresponding to the region C in Fig. 5.

[Fig. 9] Fig. 9 is a top view of a refrigerator according to Embodiment 3.

[Fig. 10] Fig. 10 is a perspective top view of the refrigerator according to Embodiment 3.

[Fig. 11] Fig. 11 is a sectional view of the refrigerator according to Embodiment 3 along a section D-D in Fig. 9.

[Fig. 12] Fig. 12 is a sectional view of a refrigerator according to Embodiment 4 at a portion corresponding to the section B-B in Fig. 3.

[Fig. 13] Fig. 13 is an enlarged view of the refrigerator according to Embodiment 4 in a region E in Fig. 12.

[Fig. 14] Fig. 14 is an enlarged view of a refrigerator according to a modified example of Embodiment 4 at a portion corresponding to the region E in Fig. 12.

[Fig. 15] Fig. 15 is a top view of a refrigerator according to Embodiment 5.

[Fig. 16] Fig. 16 is a perspective top view of the refrigerator according to Embodiment 5.

[Fig. 17] Fig. 17 is a sectional view of the refrigerator according to Embodiment 5 along a section F-F in Fig. 15.

[Fig. 18] Fig. 18 is an enlarged view of the refrigerator according to Embodiment 5 in a region G in Fig. 17.

[Fig. 19] Fig. 19 is an enlarged view of a refrigerator according to a modified example of Embodiment 5 at a portion corresponding to the region G in Fig. 17.

Description of Embodiments

[0010]

Refrigerators according to Embodiments of the present disclosure are described with reference to the drawings. The present disclosure is not limited only to Embodiments, and modifications or omissions may be made without departing from the spirit of the present disclosure. The structures of the refrigerators according to Embodiments and their modified examples and additional structures may be combined as appropriate.

[0011]

Embodiment 1.

Fig. 1 is a diagram illustrating the front of a refrigerator and an external device according to Embodiment 1. Fig. 2 is a sectional view of the refrigerator according to Embodiment 1 along a section A-A in Fig. 1. Fig. 3 is a top view of the refrigerator according to Embodiment 1. Fig. 4 is a perspective top view of the refrigerator according to Embodiment 1. A refrigerator 1 according to Embodiment 1 is described. The refrigerator 1 includes a casing 2, open/close doors 3, a plurality of drawers 4, a

cooling device 5, a plurality of hinge portions 6, a plurality of carrying handles 7, a controller 8, a wireless communication device 9, and a connection line 10.

[0012]

As illustrated in Fig. 5, the casing 2 includes a resin inner box 20, a metal outer box 21, and a heat insulator 22 between the inner box 20 and the outer box 21. A material having a lower thermal conductivity than the inner box 20 and the outer box 21 is used for the heat insulator 22, as typified by a foamed heat insulator or a vacuum heat insulator. The casing 2 has a storage space 23 and a cooling chamber space 24 inside. The casing 2 has an opening on one side to communicate the storage space 23 and a space outside the casing 2. In the following description, the part of the casing 2 having the opening is referred to as "front part". That is, the casing 2 has the opening in front of the storage space. A part of the casing 2 that faces the front part across the storage space 23 is referred to as "rear part". When viewed from the front part, a part of the casing 2 on the right of the storage space is referred to as "right part", a part of the casing 2 on the left of the storage space is referred to as "left part", a part of the casing 2 below the storage space is referred to as "bottom part", and a part of the casing 2 above the storage space is referred to as "top part 25".

[0013]

The storage space 23 of the casing 2 stores a cooling target such as food. The storage space 23 is covered with the inner box 20, the outer box 21, and the heat insulator 22 except for the opening, and is partitioned into a plurality of storage compartments by one or more partitions 26. In the refrigerator of Embodiment 1, the storage space 23 is partitioned into five storage compartments that are a refrigerator compartment 23a, an ice-making compartment 23b, a versatile compartment 23c, a freezer compartment 23d, and a vegetable compartment 23e. The refrigerator compartment 23a is closest to the top part 25 among the storage compartments. The ice-making compartment 23b is closer to the bottom part than to the refrigerator compartment 23a. The versatile compartment 23c is adjacent to the ice-making compartment 23b side by side. The freezer compartment 23d is closer to the bottom part than are the ice-making compartment 23b and the versatile compartment 23c.

The vegetable compartment 23e is closer to the bottom part than to the versatile compartment 23c, and is closest to the bottom part among the storage compartments. The refrigerator compartment 23a, the ice-making compartment 23b, the versatile compartment 23c, the freezer compartment 23d, and the vegetable compartment 23e communicate with each other through an air passage.

[0014]

In the versatile compartment 23c, various temperature zones such as a freezing temperature zone (for example, -18 degrees Celsius), a refrigerating temperature zone (for example, 3 degrees Celsius), a chilling temperature zone (for example, 0 degrees Celsius), and a soft-freezing temperature zone (for example, -7 degrees Celsius) can be switched. The various temperature zones in the versatile compartment 23c are switched by controlling the cooling device 5 by the controller 8.

[0015]

The cooling chamber space 24 of the casing 2 houses a part of the cooling device 5. The cooling chamber space 24 is positioned behind the vegetable compartment 23e. At least the heat insulator 22 is disposed between the cooling chamber space 24 and the storage space 23. A compressor 51 of the cooling device 5 described later is disposed in the cooling chamber space 24.

[0016]

The top part 25 of the casing 2 has a recessed board housing portion 29 near the rear part to house the controller 8. The top part 25 of the casing 2 has a controller cover 27 fixed near the rear part to cover the board housing portion 29. Details of the structure and fixing method of the controller cover 27 are described later.

[0017]

The open/close doors 3 close an opening that communicates the refrigerator compartment 23a and the space outside the casing 2. The right or left end of each open/close door 3 is supported by the hinge portion 6. The other end of the open/close door 3 that is not supported by the hinge portion 6 turns frontward from the refrigerator 1 about the hinge portion 6 to open the opening that communicates the refrigerator compartment 23a and the space outside the casing 2. In the refrigerator 1 of

Embodiment 1, the open/close doors 3 are two doors that are an open/close door 3a on the right and an open/close door 3b on the left. The right end of the open/close door 3a on the right is supported by the hinge portion 6. The left end of the open/close door 3b on the left is supported by the hinge portion 6. The open/close door 3a on the right can turn rightward about the right end of the open/close door 3a within a predetermined angle range. The open/close door 3b on the left can turn leftward about the left end of the open/close door 3b within a predetermined angle range. That is, the open/close doors 3 of the refrigerator 1 are double-hinged doors.

[0018]

The plurality of drawers 4 close an opening that communicates the ice-making compartment 23b and the space outside the casing 2, an opening that communicates the versatile compartment 23c and the space outside the casing 2, an opening that communicates the freezer compartment 23d and the space outside the casing 2, and an opening that communicates the vegetable compartment 23e and the space outside the casing 2. Each drawer 4 can move frontward from the refrigerator 1. The opening is opened by the frontward movement of the drawer 4. A container is provided at the rear of the drawer 4 to contain food or other things. The container is positioned in the ice-making compartment 23b, the versatile compartment 23c, the freezer compartment 23d, or the vegetable compartment 23e when the drawer 4 closes the opening. The container moves in conjunction with the drawer 4. When the drawer 4 moves frontward, the container is drawn to the space outside the casing 2 through the opening.

[0019]

The cooling device 5 cools each storage compartment to a predetermined temperature. The cooling device 5 includes the compressor 51, a cooler 52, an unillustrated expansion unit such as a capillary tube, an unillustrated condenser such as a radiating pipe, an internal fan 53, and dampers 54. The compressor 51, the cooler 52, the expansion unit, and the condenser are connected by refrigerant pipes to define a refrigeration cycle in which refrigerant circulates. The compressor 51 compresses the refrigerant in a refrigeration cycle circuit. The condenser condenses the refrigerant compressed by the compressor 51. The expansion unit expands the refrigerant

condensed by the condenser. The cooler 52 cools air passing through the cooler 52 by the refrigerant expanded by the expansion unit. The cooler 52 and the internal fan 53 are installed in the air passage in the casing 2. The air cooled by the cooler 52 flows into each storage compartment by the internal fan 53. The amount of inflow of the air cooled by the cooler 52 into each storage compartment is controlled by opening or closing the dampers 54 to control the temperature of each storage compartment. The air having flowed into each storage compartment returns to the cooler 52 and is cooled again after the inflow. The air in the refrigerator 1 is circulated by the internal fan 53.

[0020]

The hinge portions 6 support the open/close doors 3 so that the open/close doors 3 can turn within the predetermined angle ranges. Each hinge portion 6 includes a hinge fitting 61 and a hinge cover 62. The hinge fitting 61 is fixed to the top part 25 of the casing 2 so that a cylindrical hinge shaft projects relative to the front part of the casing 2. The refrigerator 1 includes two hinge portions 6. A hinge portion 6a on the right supports the open/close door 3a by the hinge shaft. A hinge portion 6b on the left supports the open/close door 3b by the hinge shaft. For example, the hinge fitting 61 is made of a metal. The hinge fitting 61 is covered with the hinge cover 62. The hinge cover 62 is non-conductive and made of, for example, a resin. The hinge cover 62 is attached to the top part 25 of the casing 2.

[0021]

The carrying handles 7 are gripped by a carrying person when the refrigerator 1 is carried. The carrying handles 7 are provided at the right rear end of the top part 25 of the casing 2 and the left rear end of the top part 25. Each carrying handle 7 is non-conductive and made of, for example, a resin.

[0022]

The controller 8 controls operations of the refrigerator 1. The controller 8 is connected to the wireless communication device 9, the compressor 51, the internal fan 53, and the dampers 54 to establish communication. The controller 8 controls the temperatures of the storage compartments by controlling the compressor 51, the internal fan 53, and the dampers 54. The controller 8 communicates with external

devices via the wireless communication device 9. Details of the structure of the controller 8 are described later.

[0023]

The wireless communication device 9 can communicate with an external device 200 described later wirelessly. Details of the structure of the wireless communication device 9 are described later.

[0024]

The connection line 10 is a wire connecting the controller 8 and the wireless communication device 9 to establish communication. The entire connection line 10 is laid outside the casing 2. Details of the structure of the connection line 10 are described later.

[0025]

Next, the external device 200 that communicates with the wireless communication device 9 wirelessly is described. The external device 200 is any device except the refrigerator 1. Examples of the external device 200 include mobile terminals such as a smartphone and a tablet terminal, household appliances such as an air-conditioning apparatus and a ventilator, and a centralized controller connected to an external network such as the Internet to establish communication. For example, the following operations can be performed by the communication between the external device 200 and the controller 8 via the wireless communication device 9. The controller 8 can acquire information related to operating conditions of other household appliances, and control the refrigerator 1 based on the information. The controller 8 can acquire information via the external network, and control the refrigerator 1 based on the information. The controller 8 can transmit information related to an operating condition of the refrigerator 1 to a cloud server on the external network, and the cloud server can accumulate the information. The controller 8 can transmit information related to the operating condition of the refrigerator 1 to the mobile terminal, and a controller of the mobile terminal can display the information on a display of the mobile terminal.

[0026]

Fig. 5 is a sectional view of the refrigerator according to Embodiment 1 along a section B-B in Fig. 3. Fig. 6 is an enlarged view of the refrigerator according to Embodiment 1 in a region C in Fig. 5. Next, description is made about details of the structures of the controller 8, the wireless communication device 9, the connection line 10, and the controller cover 27 and the structure of the casing 2 around the controller 8 and the wireless communication device 9.

[0027]

The controller cover 27 is fixed to the rear part of the casing 2 to define a controller cover internal space 27a enclosed by the board housing portion 29 and the controller cover 27. The controller cover 27 has a communication portion 27b that communicates the controller cover internal space 27a and a space outside the controller cover 27. The communication portion 27b is provided frontward of the controller cover internal space 27a.

[0028]

The controller 8 includes a microcontroller 81 and a controller board 82. The microcontroller 81 includes a processor and a memory. Control and communication to be performed by the controller 8 are implemented such that the processor executes processes based on software programs stored in the memory. The microcontroller 81 is provided on the controller board 82. In addition to the microcontroller 81, electronic components necessary to operate the microcontroller 81, a controller-side connector 83 that can be connected to the connection line 10, and wires electrically connecting the microcontroller 81, the electronic components, and the controller-side connector 83 are provided on the controller board 82.

[0029]

The controller 8 is fixed to the casing 2 so that the controller 8 is housed in the controller cover internal space 27a enclosed by the board housing portion 29 and the controller cover 27.

[0030]

The wireless communication device 9 includes a wireless communication module 91, a wireless communication board 92, and a wireless communication device cover 93.

The wireless communication module 91 transmits and receives radio waves. The wireless communication module 91 is provided on the wireless communication board 92. In addition to the wireless communication module 91, electronic components necessary to operate the wireless communication module 91, a wireless communication device-side connector 94 that can be connected to the connection line 10, and wires electrically connecting the wireless communication module 91, the electronic components, and the wireless communication device-side connector 94 are provided on the wireless communication board 92. The wireless communication device 9 is positioned on the top part 25 of the casing 2.

[0031]

The wireless communication device cover 93 is fixed to the top part 25 of the casing 2 to define a wireless communication device cover internal space 93a enclosed by the top part 25 of the casing 2 and the wireless communication device cover 93. A part defining the wireless communication device cover internal space 93a is referred to as "cover portion 93b". The wireless communication device cover 93 has a communication portion 93c that communicates the wireless communication device cover internal space 93a and a space outside the wireless communication device cover 93. The communication portion 93c is provided rearward of the wireless communication device cover internal space 93a. The wireless communication device cover 93 has an attachment portion 93d where fasteners 11 are attached. The attachment portion 93d is provided along the perimeter of the cover portion 93b to run away from the wireless communication device cover internal space 93a. The wireless communication device cover 93 is non-conductive and made of, for example, a resin. Each fastener 11 fixes the wireless communication device cover 93. In Embodiment 1, the fastener 11 is a screw.

[0032]

The wireless communication module 91, the wireless communication board 92, and the wireless communication device-side connector 94 are housed in the wireless communication device cover internal space 93a enclosed by the wireless communication device cover 93 and the top part 25 of the casing 2. The wireless

communication board 92 is fixed to the wireless communication device cover 93 so that a surface of the wireless communication board 92 where the wireless communication module 91 and the wireless communication device-side connector 94 are provided faces the top part 25 of the casing 2.

[0033]

The communication portion 27b of the controller cover 27 and the communication portion 93c of the wireless communication device cover 93 are positioned to overlap each other in a vertical direction. Therefore, the controller cover internal space 27a enclosed by the board housing portion 29 and the controller cover 27 and the wireless communication device cover internal space 93a enclosed by the top part 25 of the casing 2 and the wireless communication device cover 93 communicate with each other. A seal 12 is provided between the communication portion 27b of the controller cover 27 and the communication portion 93c of the wireless communication device cover 93 to fill a gap between the communication portion 27b and the communication portion 93c.

[0034]

The attachment portion 93d of the wireless communication device cover 93 has threaded holes 93e at the rear. The controller cover 27 has threaded holes 27c positioned to overlap the threaded holes 93e in the vertical direction.

[0035]

The screws serving as the fasteners 11 are inserted and fitted into the threaded holes 27c of the controller cover 27 and the threaded holes 93e of the wireless communication device cover 93 to fix the controller cover 27 and the wireless communication device cover 93.

[0036]

The attachment portion 93d of the wireless communication device cover 93 has a threaded hole 93f at the front. The outer box 21 at the top part 25 of the casing 2 has a threaded hole 21a positioned to overlap the threaded hole 93f in the vertical direction.

[0037]

The heat insulator 22 at the top part 25 of the casing 2 has a recess 22a positioned to overlap the threaded hole 21a of the outer box 21 in the vertical direction. The recess 22a is formed on a surface of the heat insulator 22 that faces the outer box 21, and recedes toward the storage space 23 compared with the periphery. Therefore, a top space 28 is defined between the outer box 21 and the heat insulator 22 of the casing 2.

[0038]

The screw serving as the fastener 11 is inserted and fitted into the threaded hole 21a of the outer box 21 and the threaded hole 93f of the wireless communication device cover 93 to fix the casing 2 and the wireless communication device cover 93. When the casing 2 and the wireless communication device cover 93 are fixed, the shank of the screw serving as the fastener 11 is positioned at the top space 28. The screw inserted into the threaded hole 21a of the outer box 21 and the threaded hole 93f of the wireless communication device cover 93 is desirably non-conductive and made of, for example, a resin.

[0039]

The vertical dimension of the top space 28 is larger than the vertical dimension of a part of the fastener 11 in the top space 28, and the fastener 11 is not in contact with the heat insulator 22. That is, the top space 28 is sized so that the fastener 11 is not in contact with the heat insulator 22.

[0040]

A seal 12 is provided between the outer box 21 and the attachment portion 93d to fill a gap between the outer box 21 and the attachment portion 93d.

[0041]

Connection line-side connectors 101 are provided at both ends of the connection line 10. One connection line-side connector 101a can be connected to the controller-side connector 83. The other connection line-side connector 101b can be connected to the wireless communication device-side connector 94.

[0042]

The one connection line-side connector 101a of the connection line 10 is positioned in the controller cover internal space 27a enclosed by the board housing portion 29 and the controller cover 27. The other connection line-side connector 101b is positioned in the wireless communication device cover internal space 93a enclosed by the wireless communication device cover 93 and the top part 25 of the casing 2. That is, the connection line 10 is laid through a portion communicated by the communication portion 27b and the communication portion 93c. The connection line 10 is covered with the controller cover 27 and the wireless communication device cover 93.

[0043]

Next, description is made about procedures for fixing the controller 8, the wireless communication device 9, the connection line 10, and the controller cover 27.

[0044]

As a first procedure, the controller 8 is fixed to the casing 2.

[0045]

After completion of the first procedure, the one connection line-side connector 101a of the connection line 10 is connected to the controller-side connector 83 as a second procedure.

[0046]

After completion of the second procedure, the other connection line-side connector 101b of the connection line 10 is connected to the wireless communication device-side connector 94 as a third procedure.

[0047]

After completion of the third procedure, the controller cover 27 is fixed to the casing 2 as a fourth procedure. During the fourth procedure, the other connection line-side connector 101b is positioned outside the controller cover 27 enclosed by the board housing portion 29 and the controller cover 27 through the communication portion 24b.

[0048]

After completion of the fourth procedure, the wireless communication device 9 is fixed to the wireless communication device cover 93 as a fifth procedure.

[0049]

After completion of the fifth procedure, the wireless communication device cover 93 is fixed to the casing 2 and the controller cover 27 as a sixth procedure.

[0050]

The order of the second procedure and the third procedure may be changed as long as the second procedure and the third procedure are performed between the first procedure and the fourth procedure. The fifth procedure may be performed before the first to fourth procedures.

[0051]

As described above, the refrigerator 1 according to Embodiment 1 includes the casing 2 having the storage space 23 inside to store a cooling target and having the top part 25 above the storage space 23, the outer box 21 that is a part of the casing 2 and exposed to the space outside the casing 2, the cooling device 5 configured to supply cooled air to the storage space 23, the controller 8 configured to control the cooling device 5 and fixed to the casing 2, the wireless communication device 9 positioned at the top part 25 of the casing 2 and configured to communicate with the external device 200 wirelessly, the fastener 11 (screw) that fixes the wireless communication device 9 to the outer box 21, and the connection line 10 laid outside the casing 2 and connecting the wireless communication device 9 and the controller 8 to establish communication. Since the connection line 10 is laid outside the casing 2, the refrigerator 1 according to Embodiment 1 has an advantageous effect to prevent the connection line from being carried away due to filling with and foaming of the heat insulator. Since the connection line 10 is laid outside the casing 2, the refrigerator 1 according to Embodiment 1 has an advantageous effect to increase the degree of freedom in terms of the place where the wireless communication device 9 is disposed compared with a case where the connection line is routed inside a wall of the casing 2. In particular, the refrigerator 1 according to Embodiment 1 has an advantageous effect to solve a problem that the communication between the wireless communication device and the external device is hindered by the metal hinge portion because the wireless communication device is provided around the hinge portion as in Patent Literature 1.

[0052]

As an additional structure, the refrigerator 1 according to Embodiment 1 has a structure in which the casing 2 has the opening in front of the storage space 23 and the wireless communication device 9 is fixed frontward of the controller 8 on the casing 2. With this additional structure, the refrigerator 1 according to Embodiment 1 has an advantageous effect to increase the strengths of a radio wave to be transmitted frontward from the refrigerator 1 by the wireless communication device 9 and a radio wave to be received at the front of the refrigerator 1 by the wireless communication device 9 compared with a case where the wireless communication device 9 is fixed rearward of the controller 8. Particularly in a case where the external device 200 is a tablet terminal or any other device to be manipulated or viewed by a user, the user tends to operate while standing in front of the refrigerator 1 having the opening. The increase in the strengths of a radio wave to be transmitted frontward from the refrigerator 1 and a radio wave to be received at the front of the refrigerator 1 by the wireless communication device 9 is more effective than in a case where the strength of a radio wave to be transmitted laterally or rearward from the refrigerator 1 is increased.

[0053]

As an additional structure, the refrigerator 1 according to Embodiment 1 has a structure in which the wireless communication device 9 includes the wireless communication module 91 configured to transmit and receive radio waves, and the wireless communication device cover 93 that covers the wireless communication module 91, the controller cover 27 is provided to cover the controller 8, and the connection line 10 is covered with the wireless communication device cover 93 and the controller cover 27. With this additional structure, the refrigerator 1 according to Embodiment 1 has an advantageous effect to suppress exposure of the connection line 10 to the outside. Since the exposure of the connection line 10 to the outside is suppressed, the refrigerator 1 according to Embodiment 1 has an advantageous effect to, for example, improve design or reduce the occurrence of a case where the connection line 10 is caught and broken while the refrigerator 1 is being carried.

[0054]

Modified examples of the refrigerator 1 according to Embodiment 1 are described.

[0055]

In the refrigerator 1 according to Embodiment 1, the fastener 11 is the screw, but is not limited thereto. For example, a double coated tape may be used as the fastener to fix the wireless communication device and the casing. Further, a magnet may be used as the fastener and fixed to the wireless communication device to fix the wireless communication device to the outer box of the casing by a magnetic force. In the case of fixing with the double coated tape or the magnet, the recess 22a of the heat insulator 22 is unnecessary and the top space 28 may be omitted.

[0056]

In the case where the double coated tape is used as the fastener, the adhesive strength decreases along with deterioration of the double coated tape over time, and the force for fixing the wireless communication device decreases. In the case where the magnet is used as the fastener, the transmission and reception of radio waves by the wireless communication device are hindered by the magnetic force of the magnet. As an additional structure, the refrigerator 1 according to Embodiment 1 has a structure in which the casing 2 includes the outer box 21 exposed to the space outside the casing 2, and the heat insulator 22 positioned closer to the storage space 23 than to the outer box 21, the top part 25 of the casing 2 has the top space 28 between the outer box 21 and the heat insulator 22, and at least a part of the fastener 11 is positioned at the top space 28. With this structure, the fastener 11 and a part of the outer box 21 can be fitted together, and the wireless communication device 9 can be fixed firmly.

[0057]

The fastener to be fitted into the outer box 21 need not be the screw. For example, the refrigerator 1 may be structured as the following refrigerator 1 according to a modified example of Embodiment 1. In the refrigerator 1 according to the modified example of Embodiment 1, the structure except parts described below is similar to the structure of the refrigerator 1 according to Embodiment 1, and description thereof is therefore omitted.

[0058]

Fig. 7 is an enlarged view of the refrigerator according to the modified example of Embodiment 1 at a portion corresponding to the region C in Fig. 5. In the refrigerator 1 according to the modified example of Embodiment 1, a fitting portion 95 protruding toward the storage space 23 is provided at the front of the wireless communication device cover 93 of the wireless communication device 9. The tip of the fitting portion 95 is a hook 95a protruding toward the wireless communication device cover internal space 93a. The outer box 21 of the casing 2 has a hole 21b where the fitting portion 95 can be inserted. The heat insulator 22 has the recess 22a positioned to overlap the hole 21b in the vertical direction, and the top space 28 is defined between the outer box 21 and the heat insulator 22 of the casing 2. The fore-and-aft dimension of the recess 22a is larger than the fore-and-aft dimension of the hole 21b. Therefore, the top space 28 is also positioned to overlap an edge 21c of the hole 21b in a downward direction. When the fitting portion 95 is inserted into the hole 21b, the hook 95a and the edge 21c are fitted together to fix the wireless communication device 9 to the casing 2. In the case of the refrigerator 1 according to the modified example of Embodiment 1, the fitting portion 95 corresponds to the fastener.

[0059]

In the refrigerator 1 according to Embodiment 1, the vertical dimension of the top space 28 is set so that the shank of the screw is not in contact with the heat insulator 22, but is not limited to such a dimension. For example, the heat insulator may be a urethane heat insulator. The urethane heat insulator may have no top space before the screw is inserted. When the screw is inserted into the threaded hole of the outer box and the threaded hole of the wireless communication device cover, the screw may bore a hole in the urethane heat insulator. In this case, the hole bored in the urethane heat insulator by the screw corresponds to the top space.

[0060]

In the case where the screw bores the hole in the urethane heat insulator, the heat insulation performance may decrease because urethane is cracked during the boring. As an additional structure, the refrigerator 1 according to Embodiment 1 has a

structure in which the vertical dimension of the top space 28 is larger than the vertical dimension of the part of the fastener 11 in the top space 28. With this additional structure, the fastener 11 is not in contact with the heat insulator 22. Thus, the refrigerator 1 according to Embodiment 1 has an advantageous effect to suppress the decrease in the heat insulation performance of the heat insulator 22 due to contact of the fastener 11 to be attached.

[0061]

In the refrigerator 1 according to Embodiment 1, the storage space 23 is partitioned into the plurality of storage compartments by the partitions 26, but the structure of the storage space 23 is not limited to such a structure. For example, the refrigerator may be structured such that no partition is provided and the storage space is one storage compartment.

[0062]

In the refrigerator 1 according to Embodiment 1, the open/close doors 3 are double-hinged doors, but are not limited to the double-hinged doors. For example, the refrigerator may be structured such that the open/close door whose right end is supported by the hinge portion or the open/close door whose left end is supported by the hinge portion serves as a single-swing door that closes the opening of the casing 2.

[0063]

Embodiment 2.

Next, a refrigerator 1 according to Embodiment 2 is described. The refrigerator 1 according to Embodiment 2 differs from the refrigerator 1 according to Embodiment 1 in terms of the structures of the top part 25 of the casing 2, the fastener 11, and the wireless communication device cover 93. The other structure of the refrigerator 1 according to Embodiment 2 except the structures of the top part 25 of the casing 2, the fastener 11, and the wireless communication device cover 93 is similar to the structure of the refrigerator 1 according to Embodiment 1, and description thereof is therefore omitted.

[0064]

Fig. 8 is an enlarged view of the refrigerator according to Embodiment 2 at a portion corresponding to the region C in Fig. 5. The outer box 21 at the top part 25 of the casing 2 has the hole 21b. The heat insulator 22 at the top part 25 of the casing 2 has the recess 22a positioned to overlap the hole 21b in the vertical direction. Therefore, the top space 28 is defined between the outer box 21 and the heat insulator 22 of the casing 2. The fore-and-aft dimension of the recess 22a is larger than the fore-and-aft dimension of the hole 21b. Therefore, the top space 28 is also positioned to overlap the edge 21c of the hole 21b in the downward direction.

[0065]

The structure of the fastener 11 is described. The fastener 11 has a base 11a, a fitting portion 11b, and a protrusion 11c. The base 11a has a flat-plate shape, and closes the hole 21b from a place near the storage space 23. The fitting portion 11b is provided on the base 11a, and protrudes toward the space outside the casing 2 through the hole 21b. A part of the fitting portion 11b is bent frontward to serve as a hook 11d. The protrusion 11c is provided on the base 11a, and protrudes toward the space outside the casing 2 through the hole 21b. The fitting portion 11b is positioned frontward of the protrusion 11c. A portion of the base 11a that is positioned frontward of the fitting portion 11b and a portion of the base 11a that is positioned rearward of the protrusion 11c are referred to as "flanges 11e".

[0066]

The flanges 11e and the edge 21c are positioned to overlap each other in the vertical direction. Seals 12 are provided between the flanges 11e and the edge 21c to fill a gap between the outer box 21 and the fastener 11.

[0067]

The wireless communication device cover 93 is described. The wireless communication device cover 93 has a catch 93g at the front of the cover portion 93b. The catch 93g protrudes toward the wireless communication device cover internal space 93a inside the wireless communication device cover 93. The structure of the wireless communication device cover 93 according to Embodiment 2 is similar to the structure of the wireless communication device cover 93 according to Embodiment 1

except that the catch 93g is provided and the attachment portion 93d has no threaded hole 93f at the front.

[0068]

When the hook 12d of the fastener 11 and the catch 93g of the wireless communication device cover 93 are fitted together, the casing 2 and the wireless communication device cover 93 are fixed. The seals 12 are provided between the attachment portion 93d and the outer box 21 and between the catch 93g and the outer box 21 to fill a gap between the outer box 21 and the wireless communication device cover 93. The fixing of the wireless communication device cover 93 and the controller cover 27 is similar to the fixing in the refrigerator 1 according to Embodiment 1.

[0069]

As described above, the refrigerator 1 according to Embodiment 2 includes, similarly to the refrigerator 1 according to Embodiment 1, the casing 2 having the storage space 23 inside to store a cooling target and having the top part 25 above the storage space 23, the outer box 21 that is a part of the casing 2 and exposed to the space outside the casing 2, the cooling device 5 configured to supply cooled air to the storage space 23, the controller 8 configured to control the cooling device 5 and fixed to the casing 2, the wireless communication device 9 positioned at the top part 25 of the casing 2 and configured to communicate with the external device 200 wirelessly, the fastener 11 that fixes the wireless communication device 9 to the outer box, and the connection line 10 laid outside the casing 2 and connecting the wireless communication device 9 and the controller 8 to establish communication. With this structure, the refrigerator 1 according to Embodiment 2 has advantageous effects similar to the advantageous effects described in Embodiment 1.

[0070]

As an additional structure, the refrigerator 1 according to Embodiment 2 has a structure in which the outer box 21 has the hole 21b that communicates the top space 28 and the space outside the casing 2, the fastener 11 has the base 11a positioned in the top space 28, and the fitting portion 11b provided on the base 11a and protruding toward the space outside the casing 2 through the hole 21b of the outer box 21, and the

wireless communication device 9 is fitted with the fitting portion 11b. With this additional structure, the refrigerator 1 according to Embodiment 2 has an advantageous effect to firmly fix the wireless communication device 9.

[0071]

As an additional structure, the refrigerator 1 according to Embodiment 2 has a structure in which the base 11a closes the hole 21b of the outer box 21 from the place near the storage space 23. With this structure, the refrigerator 1 according to Embodiment 2 has an advantageous effect to suppress leakage of a foamed heat insulator through the hole 21b when the foamed heat insulator is injected and when the foamed heat insulator is foamed.

[0072]

Embodiment 3.

Next, a refrigerator 1 according to Embodiment 3 is described. The refrigerator 1 according to Embodiment 3 differs from the refrigerator 1 according to Embodiment 1 in terms of the structures of the top part 25 of the casing 2 and the wireless communication device cover 93. The other structure of the refrigerator 1 according to Embodiment 3 except the structures of the top part 25 of the casing 2 and the wireless communication device cover 93 is similar to the structure of the refrigerator 1 according to Embodiment 1, and description thereof is therefore omitted.

[0073]

Fig. 9 is a top view of the refrigerator according to Embodiment 3. Fig. 10 is a perspective top view of the refrigerator according to Embodiment 3. Fig. 11 is a sectional view of the refrigerator according to Embodiment 3 along a section D-D in Fig. 9.

[0074]

The wireless communication device cover 93 is described. The wireless communication device cover 93 has an extended portion 93h. The attachment portion 93d has threaded holes 93f also at the rear. The structure of the wireless communication device cover 93 according to Embodiment 3 is similar to the structure of the wireless communication device cover 93 according to Embodiment 1 except that the

extended portion 93h is provided and the attachment portion 93d has the threaded holes 93f also at the rear.

[0075]

The extended portion 93h is provided between the cover portion 93b and the communication portion 93c. The front of the extended portion 93h is molded integrally with the cover portion 93b. The rear of the extended portion 93h is molded integrally with the communication portion 93c. The extended portion 93h is fixed to the top part 25 of the casing 2 to define an extended portion internal space 93i enclosed by the top part 25 of the casing 2 and the extended portion 93h. The wireless communication device cover internal space 93a enclosed by the cover portion 93b and the extended portion internal space 93i enclosed by the extended portion 93h communicate with each other. The extended portion internal space 93i communicates with an external space via the communication portion 93c. That is, the wireless communication device cover internal space 93a communicates with the external space via the extended portion internal space 93i and the communication portion 93c.

[0076]

The extended portion 93h also has the attachment portion 93d provided along the perimeter of the extended portion 93h to run away from the extended portion internal space 93i. The attachment portion 93d provided along the perimeter of the extended portion 93h also has threaded holes 93f.

[0077]

The top part 25 of the casing 2 is described. The outer box 21 at the top part 25 has threaded holes 21a positioned to overlap, in the vertical direction, the threaded holes 93f of the attachment portion 93d provided along the perimeters of the cover portion 93b and the extended portion 93h.

[0078]

Although illustration is omitted, similarly to Embodiment 1, the heat insulator 22 at the top part 25 of the casing 2 has the recess 22a positioned to overlap the threaded holes 21a of the outer box 21 in the vertical direction. The recess 22a of the heat insulator 22 is formed at the top part 25, and recedes toward the bottom compared with

the periphery. Therefore, the top space 28 is defined between the outer box 21 and the heat insulator 22 of the casing 2.

[0079]

The screws serving as the fasteners 11 are inserted and fitted into the threaded holes 21a of the outer box 21 and the threaded holes 93f of the wireless communication device cover 93 to fix the casing 2 and the wireless communication device cover 93. When the casing 2 and the wireless communication device cover 93 are fixed, the shanks of the screws serving as the fasteners 11 are positioned at the top space 28. The seal 12 is provided between the outer box 21 and the attachment portion 93d to fill a gap between the outer box 21 and the attachment portion 93d. Although illustration is omitted, the seal 12 is also provided between the outer box 21 and the attachment portion 93d provided along the perimeter of the extended portion 93h.

[0080]

The vertical dimension of the top space 28 is larger than the vertical dimension of a part of each fastener 11 in the top space 28, and the fastener 11 is not in contact with the heat insulator 22. That is, the top space 28 is sized so that the fastener 11 is not in contact with the heat insulator 22.

[0081]

The fixing of the controller cover 27 and the wireless communication device cover 93 of the refrigerator 1 according to Embodiment 3 is similar to the fixing in the refrigerator 1 according to Embodiment 1. Therefore, the wireless communication device cover internal space 93a enclosed by the cover portion 93b and the controller cover internal space 27a enclosed by the controller cover 27 communicate with each other via the communication portion 27b, the communication portion 93c, and the extended portion internal space 93i enclosed by the extended portion 93h.

[0082]

The connection line 10 is laid through the communication portion 27b, the communication portion 93c, and the extended portion internal space 93i enclosed by the extended portion 93h.

[0083]

As described above, the refrigerator 1 according to Embodiment 3 includes, similarly to the refrigerator 1 according to Embodiment 1, the casing 2 having the storage space 23 inside to store a cooling target and having the top part 25 above the storage space 23, the outer box 21 that is a part of the casing 2 and exposed to the space outside the casing 2, the cooling device 5 configured to supply cooled air to the storage space 23, the controller 8 configured to control the cooling device 5 and fixed to the casing 2, the wireless communication device 9 positioned at the top part 25 of the casing 2 and configured to communicate with the external device 200 wirelessly, the fastener 11 that fixes the wireless communication device 9 to the outer box, and the connection line 10 laid outside the casing 2 and connecting the wireless communication device 9 and the controller 8 to establish communication. With this structure, the refrigerator 1 according to Embodiment 3 has advantageous effects similar to the advantageous effects described in Embodiment 1.

[0084]

As an additional structure, the refrigerator 1 according to Embodiment 3 has a structure in which the controller cover 27 defines the space that houses the controller 8 (controller cover internal space 27a), the wireless communication device cover 93 has the cover portion 93b defining the space that houses the wireless communication module 91 (wireless communication device cover internal space 93a), and the extended portion 93h provided rearward of the cover portion 93b and defining the space (extended portion internal space 93i) that communicates with the space defined by the cover portion 93b (wireless communication device cover internal space 93a), the controller cover 27 and the wireless communication device cover 93 have the communication portions 27b and 93c that allows the space defined by the controller cover 27 (controller cover internal space 27a) to communicate with the space defined by the extended portion 93h (extended portion internal space 93i), and the connection line 10 is laid through the communication portions 27b and 93c and the space defined by the extended portion 93h (extended portion internal space 93i). With this additional structure, the refrigerator 1 according to Embodiment 3 has an advantageous effect to provide the wireless communication module 91 closer to the front of the refrigerator 1

than in the refrigerator 1 according to Embodiment 1 with the connection line 10 covered with the controller cover 27 and the wireless communication device cover 93.

[0085]

Modified examples of the refrigerator 1 according to Embodiment 3 are described.

[0086]

In the refrigerator 1 according to Embodiment 3, the cover portion 93b and the extended portion 93h are integrated together, but are not limited to such a structure. For example, the wireless communication device cover may be formed by separately molding the cover portion and the extended portion, and fixing the cover portion and the extended portion with a fastener such as a screw. In this case, the cover portion can be made of a non-conductive material such as a resin, and the extended portion can be made of a conductive material such as a metal. With the extended portion made of the conductive material such as a metal, the extended portion can block an electromagnetic force generated from the connection line laid in the space in the extended portion.

[0087]

In the refrigerator 1 according to Embodiment 3, the fastener 11 is the screw, but is not limited thereto. For example, the wireless communication device may be fixed by using the fitting portion 95 described in the refrigerator 1 according to the modified example of Embodiment 1. The wireless communication device may be fixed by using the fastener 11 described in the refrigerator 1 according to Embodiment 2.

[0088]

Embodiment 4.

Next, a refrigerator 1 according to Embodiment 4 is described. The refrigerator 1 according to Embodiment 4 differs from the refrigerator 1 according to Embodiment 1 in terms of the structure of the heat insulator 22. The other structure of the refrigerator 1 according to Embodiment 4 except the structure of the heat insulator 22 is similar to the structure of the refrigerator 1 according to Embodiment 1, and description thereof is therefore omitted.

[0089]

Fig. 12 is a sectional view of the refrigerator according to Embodiment 4 at a portion corresponding to the section B-B in Fig. 3. Fig. 13 is an enlarged view of the refrigerator according to Embodiment 4 in a region E in Fig. 12.

[0090]

The heat insulator 22 is described. The heat insulator 22 includes a foamed heat insulator 22b such as urethane, and a vacuum heat insulator 22c having a core enclosed by a film in a vacuum. The vacuum heat insulator 22c is positioned closer to the outer box than to the foamed heat insulator 22b. That is, at the top part 25, the vacuum heat insulator 22c is positioned above the foamed heat insulator 33b.

[0091]

The vacuum heat insulator 22c has the recess 22a positioned to overlap the threaded hole 21a of the outer box 21 in the vertical direction. The recess 22a is formed on a surface of the vacuum heat insulator 22c that faces the outer box 21, and recedes toward the storage space 23 compared with the periphery. Therefore, the top space 28 is defined between the outer box 21 and the vacuum heat insulator 22c of the casing 2.

[0092]

The vertical dimension of the top space 28 is larger than the vertical dimension of the part of the fastener 11 in the top space 28, and the fastener 11 is not in contact with the vacuum heat insulator 22c. That is, the top space 28 is sized so that the fastener 11 is not in contact with the vacuum heat insulator 22c.

[0093]

As described above, the refrigerator 1 according to Embodiment 4 includes, similarly to the refrigerator 1 according to Embodiment 1, the casing 2 having the storage space 23 inside to store a cooling target and having the top part 25 above the storage space 23, the outer box 21 that is a part of the casing 2 and exposed to the space outside the casing 2, the cooling device 5 configured to supply cooled air to the storage space 23, the controller 8 configured to control the cooling device 5 and fixed to the casing 2, the wireless communication device 9 positioned at the top part 25 of the casing 2 and configured to communicate with the external device 200 wirelessly, the

fastener 11 that fixes the wireless communication device 9 to the outer box, and the connection line 10 laid outside the casing 2 and connecting the wireless communication device 9 and the controller 8 to establish communication. With this structure, the refrigerator 1 according to Embodiment 4 has advantageous effects similar to the advantageous effects described in Embodiment 1.

[0094]

As an additional structure, the refrigerator 1 according to Embodiment 4 has a structure in which the vacuum heat insulator 22c is used as the heat insulator 22. Unlike the foamed heat insulator, the vacuum heat insulator cannot be bored. Therefore, the following problem arises in a case where the connection line is laid inside the wall of the casing as in the refrigerator disclosed in Patent Literature 1 and the vacuum heat insulator is used as the heat insulator. When the connection line laid inside the wall is led out to the top part, the vacuum heat insulator cannot be disposed at a portion where the connection line is led out. In the refrigerator 1 according to Embodiment 4, the vacuum heat insulator can be disposed over the entire top part because the connection line 10 is laid outside the casing 2. Therefore, the heat insulation performance is higher than in the case where the connection line is laid inside the wall. With this additional structure, the refrigerator 1 according to Embodiment 4 has a more remarkable advantageous effect.

[0095]

As an additional structure, the refrigerator 1 according to Embodiment 4 has a structure in which the casing 2 includes the heat insulator 22 positioned closer to the storage space 23 than to the outer box 21, the heat insulator 22 includes the foamed heat insulator 22b and the vacuum heat insulator 22c, the vacuum heat insulator 22c is positioned closer to the outer box 21 than to the foamed heat insulator 22b, the top space 28 is defined between the outer box 21 and the vacuum heat insulator 22c, and at least a part of the fastener 11 is positioned at the top space 28. With this additional structure, the refrigerator 1 according to Embodiment 4 has an advantageous effect to suppress, by the top space 28, a decrease in the heat insulation performance of the vacuum heat insulator 22c due to damage to the film of the vacuum heat insulator 22c

that is caused by contact between the fastener 11 and the vacuum heat insulator 22c. In general, the inner box 20 has, for example, an unillustrated internal light. In a case where the vacuum heat insulator 22c is positioned closer to the inner box 20 than to the foamed heat insulator 22b, the film of the vacuum heat insulator 22c may be damaged by, for example, an attachment that fixes the internal light. In this additional structure, the vacuum heat insulator 22c is positioned closer to the outer box 21 than to the foamed heat insulator 22b. Thus, the refrigerator 1 according to Embodiment 4 has the advantageous effect to suppress the decrease in the heat insulation performance of the vacuum heat insulator 22c.

[0096]

A modified example of the refrigerator 1 according to Embodiment 4 is described.

[0097]

Fig. 14 is an enlarged view of a refrigerator according to the modified example of Embodiment 4 at a portion corresponding to the region E in Fig. 12. In the refrigerator 1 according to Embodiment 4, the fastener 11 is the screw, but is not limited thereto. For example, as in the modified example of Embodiment 4, the wireless communication device may be fixed by using the fastener 11 described in the refrigerator 1 according to Embodiment 2. The wireless communication device may be fixed by using the fitting portion 95 described in the refrigerator 1 according to the modified example of Embodiment 1.

[0098]

Embodiment 5.

Next, a refrigerator 1 according to Embodiment 5 is described. The refrigerator 1 according to Embodiment 5 differs from the refrigerator 1 according to Embodiment 1 in terms of the structures of the top part 25 of the casing 2, the controller cover 27, and the wireless communication device cover 93. The other structure of the refrigerator 1 according to Embodiment 5 except the structures of the top part 25 of the casing 2, the controller cover 27, and the wireless communication device cover 93 is similar to the structure of the refrigerator 1 according to Embodiment 1, and description thereof is therefore omitted.

[0099]

Fig. 15 is a top view of the refrigerator according to Embodiment 5. Fig. 16 is a perspective top view of the refrigerator according to Embodiment 5. Fig. 17 is a sectional view of the refrigerator according to Embodiment 3 along a section F-F in Fig. 15. Fig. 18 is an enlarged view of the refrigerator according to Embodiment 3 in a region G in Fig. 17.

[0100]

The top part 25 of the casing 2 is described. The outer box 21 at the top part 25 of the casing 2 has no threaded hole 21a unlike Embodiment 1. The heat insulator 22 at the top part 25 of the casing 2 has no recess 22a unlike Embodiment 1. Therefore, the top space 28 is not defined between the outer box 21 and the heat insulator 22 of the casing 2. The top part 25 according to Embodiment 5 is similar to the top part 25 according to Embodiment 1 except for the omission of the threaded hole 21a, the recess 22a, and the top space 28

[0101]

The controller cover 27 is described. In the controller cover 27, the communication portion 27b is provided above the controller cover internal space 27a. That is, the communication portion 27b is provided at the top of the controller cover 27. The top of the controller cover 27 has threaded holes 27c in front of and behind the communication portion 27b. The controller cover 27 according to Embodiment 5 is similar to the controller cover 27 according to Embodiment 1 except that the communication portion 27b and the threaded holes 27c are provided at the top of the controller cover 27.

[0102]

The wireless communication device cover 93 is described. The wireless communication device cover 93 is fixed to the controller cover 27 to define a wireless communication device cover internal space 93a enclosed by the top surface of the controller cover 27 and the wireless communication device cover 93. A part defining the wireless communication device cover internal space 93a is referred to as "cover portion 93b". The attachment portion 93d is provided along the perimeter of the cover

portion 93b to run away from the wireless communication device cover internal space 93a. Unlike Embodiment 1, the controller cover 27 has no communication portion 93c behind the controller cover internal space 27a.

[0103]

The wireless communication device cover 93 is fixed to cover the communication portion 27b of the controller cover 27. Therefore, the controller cover internal space 27a enclosed by the board housing portion 29 and the controller cover 27 and the wireless communication device cover internal space 93a enclosed by the top surface of the controller cover 27 and the wireless communication device cover 93 communicate with each other via the communication portion 27b.

[0104]

The attachment portion 93d of the wireless communication device cover 93 has threaded holes 93e positioned to overlap the threaded holes 27c of the controller cover 27 in the vertical direction.

[0105]

The screws serving as the fasteners 11 are inserted and fitted into the threaded holes 27c of the controller cover 27 and the threaded holes 93e of the wireless communication device cover 93 to fix the wireless communication device cover 93 to the controller cover 27. When the controller cover 27 and the wireless communication device cover 93 are fixed, the shanks of the screws serving as the fasteners 11 are positioned in the controller cover internal space 27a defined by the wireless communication device cover 93.

[0106]

A seal 12 is provided between the controller cover 27 and the attachment portion 93d to fill a gap between the controller cover 27 and the attachment portion 93d.

[0107]

The connection line 10 is laid in the controller cover internal space 27a enclosed by the board housing portion 29 and the controller cover 27 and the wireless communication device cover internal space 93a enclosed by the top surface of the

controller cover 27 and the wireless communication device cover 93 through the communication portion 27b.

[0108]

As described above, the refrigerator 1 according to Embodiment 5 includes the casing 2 having the storage space 23 inside to store a cooling target, the cooling device 5 configured to supply cooled air to the storage space 23, the controller 8 configured to control the cooling device 5 and fixed to the casing 2, the controller cover 27 that covers the controller 8, the wireless communication device 9 configured to communicate with the external device 200 wirelessly, the fastener 11 (screw) that fixes the wireless communication device 9 to the controller cover 27, and the connection line 10 laid outside the casing 2 and connecting the wireless communication device 9 and the controller 8 to establish communication. Since the connection line 10 is laid outside the casing 2, the refrigerator 1 according to Embodiment 5 has an advantageous effect to prevent the connection line from being carried away due to filling with and foaming of the heat insulator. Since the connection line 10 is laid outside the casing 2, the refrigerator 1 according to Embodiment 5 has an advantageous effect to relax limitations on the laying of the connection line 10 compared with the case where the connection line is routed inside the wall of the casing 2.

[0109]

Modified examples of the refrigerator 1 according to Embodiment 5 are described.

[0110]

In the refrigerator 1 according to Embodiment 5, the fastener 11 is the screw, but is not limited thereto. For example, a double coated tape may be used as the fastener to fix the wireless communication device and the casing. Further, a magnet may be used as the fastener and fixed to the wireless communication device to fix the wireless communication device to the outer box of the casing by a magnetic force.

[0111]

As described in Embodiment 1, the force for fixing the wireless communication device decreases in the case where the double coated tape is used as the fastener, and

the transmission and reception of radio waves by the wireless communication device are hindered in the case where the magnet is used as the fastener. As an additional structure, the refrigerator 1 according to Embodiment 5 has a structure in which the controller cover 27 and the casing 2 define the controller cover internal space 27a that houses the controller 8, and at least a part of the fastener 11 is positioned at the controller cover internal space 27a. With this additional structure, the refrigerator 1 according to Embodiment 5 has an advantageous effect to fit the fastener 11 and a part of the controller cover 27 together and firmly fix the wireless communication device 9.

[0112]

The fastener to be fitted into the outer box 21 need not be the screw. For example, the refrigerator 1 may be structured as the following refrigerator 1 according to a modified example of Embodiment 5. In the refrigerator 1 according to the modified example of Embodiment 5, the structure except parts described below is similar to the structure of the refrigerator 1 according to Embodiment 5, and description thereof is therefore omitted.

[0113]

Fig. 19 is an enlarged view of the refrigerator according to the modified example of Embodiment 5 at a portion corresponding to the region G in Fig. 17. In the refrigerator 1 according to the modified example of Embodiment 5, fitting portions 95 protruding toward the controller cover internal space 27a are provided at two places on the wireless communication device cover 93 of the wireless communication device 9. The tip of each fitting portion 95 is a hook 95a protruding toward the wireless communication device cover internal space 93a. The controller cover 27 has holes 27d where the fitting portions 95 can be inserted. When the fitting portions 95 are inserted into the holes 27d, the hooks 95a and the perimeters of the holes 27d are fitted together to fix the wireless communication device 9 to the controller cover 27. In the case of the refrigerator 1 according to the modified example of Embodiment 5, the fitting portion 95 corresponds to the fastener.

Reference Signs List

[0114]

1: refrigerator, 2: casing, 3: open/close door, 3a: open/close door, 3b: open/close door, 4: drawer, 5: cooling device, 6: hinge portion, 6a: hinge portion, 6b: hinge portion, 7: carrying handle, 8: controller, 9: wireless communication device, 10: connection line, 11: fastener, 11a: base, 11b: fitting portion, 11c: protrusion, 11d: hook, 11e: flange, 12: seal, 20: inner box, 21: outer box, 21a: threaded hole, 21b: hole, 21c: edge, 22: heat insulator, 22a: recess, 22b: foamed heat insulator, 22c: vacuum heat insulator, 23: storage space, 23a: refrigerator compartment, 23b: ice-making compartment, 23c: versatile compartment, 23d: freezer compartment, 23e: vegetable compartment, 24: cooling chamber space, 25: top part, 26: partition, 27: controller cover, 27a: controller cover internal space, 27b: communication portion, 27c: threaded hole, 27d: hole, 28: top space, 29: board housing portion, 51: compressor, 52: cooler, 53: internal fan, 54: damper, 61: hinge fitting, 62: hinge cover, 81: microcontroller, 82: controller board, 83: controller-side connector, 91: wireless communication module, 92: wireless communication board, 93: wireless communication device cover, 93a: wireless communication device cover internal space, 93b: cover portion, 93c: communication portion, 93d: attachment portion, 93e: threaded hole, 93f: threaded hole, 93g: catch, 93h: extended portion, 93i: extended portion internal space, 94: wireless communication device-side connector, 95: fitting portion, 95a: hook, 101: connection line-side connector, 101a: one connection line-side connector, 101b: other connection line-side connector, 200: external device

CLAIMS

[Claim 1]

A refrigerator comprising:

a casing having a storage space inside to store a cooling target and having a top part above the storage space;

an outer box that is a part of the casing and exposed to a space outside the casing;

a cooling device configured to supply cooled air to the storage space;

a controller configured to control the cooling device and fixed to the casing;

a wireless communication device positioned at the top part of the casing and configured to communicate with an external device wirelessly;

a fastener that fixes the wireless communication device to the outer box; and

a connection line laid outside the casing and communicably connecting the wireless communication device and the controller.

[Claim 2]

The refrigerator of claim 1,

wherein the casing has an opening in front of the storage space, and

wherein the wireless communication device is fixed frontward of the controller on the casing.

[Claim 3]

The refrigerator of claim 1 or 2,

wherein the casing includes a heat insulator positioned closer to the storage space than to the outer box,

wherein a top part of the casing has a top space between the outer box and the heat insulator, and

wherein at least a part of the fastener is positioned at the top space.

[Claim 4]

The refrigerator of claim 3,

wherein the heat insulator includes a foamed heat insulator and a vacuum heat insulator,

wherein the vacuum heat insulator is positioned closer to an outer box than to the foamed heat insulator, and

wherein the top space is defined between the outer box and the vacuum heat insulator.

[Claim 5]

The refrigerator of claim 3 or 4,

wherein the fastener is a screw, and

wherein a part of the screw is positioned at the top space.

[Claim 6]

The refrigerator of claim 3 or 4,

wherein the outer box has a hole that allows the top space to communicate with a space outside of the casing,

wherein the fastener has a base positioned in the top space, and a fitting portion provided on the base and protruding toward the space outside the casing through the hole of the outer box, and

wherein the wireless communication device is fitted with the fitting portion.

[Claim 7]

The refrigerator of claim 6, wherein the base closes a hole of the outer box from a place near the storage space.

[Claim 8]

The refrigerator of any one of claims 1 to 7,

wherein the wireless communication device includes a wireless communication module configured to transmit and receive radio waves, and a wireless communication device cover that covers the wireless communication module,

wherein the refrigerator includes a controller cover that covers the controller, and

wherein the connection line is covered with the wireless communication device cover and the controller cover.

[Claim 9]

The refrigerator of claim 8,

wherein the controller cover defines a space that houses the controller,

wherein the wireless communication device cover has a cover portion defining a space that houses the wireless communication module, and an extended portion provided rearward of the cover portion and defining a space that communicates with a space defined by the cover portion,

wherein the controller cover and the wireless communication device cover have communication portions respectively that allow the space defined by the controller cover to communicate with the space defined by the extended portion, and

wherein the connection line is laid through the space defined by the communication portions and extended portion.

[Claim 10]

A refrigerator comprising:

a casing having a storage space inside to store a cooling target;

a cooling device configured to supply cooled air to the storage space;

a controller configured to control the cooling device and fixed to the casing;

a controller cover that covers the controller;

a wireless communication device configured to communicate with an external device wirelessly;

a fastener that fixes the wireless communication device to the controller cover; and

a connection line laid outside the casing and communicably connecting the wireless communication device and the controller.

[Claim 11]

The refrigerator of claim 10,

wherein the controller cover and the casing define a space that houses the controller, and

wherein at least a part of the fastener is positioned at the space.