DESCRIPTION

Title of Invention

REFRIGERATOR

Technical Field

[0001]

The present invention relates to a refrigerator in which electrical cables are laid through a hinge on a door.

Background Art

[0002]

Conventionally, a refrigerator has been proposed in which electrical cables are laid through a hole provided in a door hinge, and electrical items installed in a refrigerator door are connected to a main control unit on the side of a refrigerator body via the electrical cables (see, for example, Patent Literature 1).

Citation List

Patent Literature

[0003]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2002-340472

Summary of Invention

Technical Problem

[0004]

In the refrigerator described in Patent Literature 1, in installing plural electrical items including an imaging unit in a door of a storage compartment, the number of electrical cables increases with increases in the number of electrical items. Consequently, in connecting electrical cables to the main control unit provided in the refrigerator body, thickness of a bundle of electrical cables to be passed through the hole in the hinge may be larger than the hole in the hinge. Then, it becomes necessary to expand the hole in the hinge or carry out other conversions, posing a problem in that cost is incurred in carrying out a conversion each time an electrical item is added.

[0005]

The present invention has been made in view of the above problems and has an object to provide a refrigerator that can reduce the number of electrical cables connected to a main control unit even when plural electrical items are installed in a door of a storage compartment or a main body of the refrigerator.

Solution to Problem

[0006]

A refrigerator according to an embodiment of the present invention comprises a refrigerator body; a storage compartment formed in the refrigerator body and provided with an opening in a front face; a door adapted to openably close the opening in the front face of the storage compartment; a plurality of electrical items installed on an inner surface side of the door; a sub-control unit installed in the door, connected with individual ones of the plurality of electrical items via separate cables, and adapted to turn the separate cables into a common cable; and a main control unit adapted to control the plurality of electrical items by being provided in the refrigerator body and connected with the sub-control unit via the common cable.

Advantageous Effects of Invention

[0007]

The individual cables connected to the plurality of electrical items are put together by the sub-control unit, thereby, an embodiment of the present invention provides a refrigerator in which the number of cables connected to the main control unit from the sub-control unit can be reduced.

Brief Description of Drawings

[0008]

[Fig. 1] Fig. 1 is a schematic front view of a refrigerator according to an embodiment of the present invention.

[Fig. 2] Figs. 2(a) and 2(b) are schematic diagrams of a refrigerator compartment left door of the refrigerator according to the embodiment of the present invention.

[Fig. 3] Fig. 3 is a schematic perspective view of a mounting structure of the

refrigerator according to the embodiment of the present invention.

[Fig. 4] Figs. 4(a) and 4(b) are schematic exploded diagrams of the mounting structure of the refrigerator according to the embodiment of the present invention.

[Fig. 5] Fig. 5 is a schematic exploded diagram of the mounting structure of the refrigerator according to the embodiment of the present invention with imaging units and a sub-control unit removed.

[Fig. 6] Figs. 6(a) and 6(b) are schematic diagrams showing how the imaging units and sub-control unit are connected by cables in the refrigerator according to the embodiment of the present invention.

[Fig. 7] Figs. 7(a) and 7(b) are state diagrams showing how cables are gathered together in the refrigerator according to the embodiment of the present invention.

[Fig. 8] Fig. 8 is a state diagram showing how a cable is laid from the sub-control unit to a main control unit in the refrigerator according to the embodiment of the present invention.

[Fig. 9] Fig. 9 is a schematic longitudinal sectional view of the refrigerator showing a cable is laid from the sub-control unit to the main control unit in the refrigerator according to the embodiment of the present invention.

Description of Embodiments

[0009]

An embodiment of a refrigerator according to the present invention will be described below with reference to the drawings. Note that the embodiment shown in the drawings is an example and is not intended to limit the present invention. Also, in the drawings, components denoted by the same reference numerals are identical or equivalent components. This applies throughout the entire text of the specification. Furthermore, in the following drawings, components may not be shown in their true size relations.

[0010]

Embodiment.

[Configuration of refrigerator 100]

Fig. 1 is a schematic front view of a refrigerator according to an embodiment of the present invention. Figs. 2(a) and 2(b) are schematic diagrams of a refrigerator compartment left door of the refrigerator according to the embodiment of the present invention. As shown in Fig. 1, a refrigerator body 1 has a refrigerator compartment 2 in uppermost part and double doors, and has a refrigerator compartment left door 3 and refrigerator compartment right door 4, on a front side of the refrigerator compartment 2, where the front face of the refrigerator compartment 2 is open and the double doors openably close the opening on the front side of refrigerator compartment 2. The refrigerator compartment left door 3 is openably/closably attached to the refrigerator body via a hinge 14. Also, an ice compartment 8 is provided on a lower left side of the refrigerator compartment 2 and a convertible compartment 5 is provided on a lower right side of the refrigerator compartment 2. A freezer compartment 6 is provided under the ice compartment 8 and convertible compartment 5 and a vegetable compartment 7 is provided under the freezer compartment 6. The ice compartment 8, convertible compartment 5, freezer compartment 6, and vegetable compartment 7 are all slide-out compartments. Note that the refrigerator compartment 2 corresponds to a "storage compartment" according to the present invention. Also, the refrigerator compartment left door 3 corresponds to a "door" according to the present invention.

[0011]

Note that although in the example described in the present embodiment, the refrigerator compartment has double doors made up of the refrigerator compartment left door 3 and refrigerator compartment right door 4, the present invention is not limited to this, and the refrigerator compartment may have a sliding door. Also, although in the example described in the present embodiment, the ice compartment 8, convertible compartment 5, freezer compartment 6, and vegetable compartment 7 are slide-out compartments, the present invention is not limited to this, and these compartments may be of another type.

[0012]

Also, although in the example described in the present embodiment, the

refrigerator 100 has the refrigerator compartment 2, ice compartment 8, convertible compartment 5, freezer compartment 6, and vegetable compartment 7, the configuration of the refrigerator 100 is not limited to this, and, for example, the refrigerator 100 does not have to be equipped with the ice compartment 8 or convertible compartment 5. Also, in the present embodiment, all the storage compartments of the refrigerator 100 may be freezer compartments.

[0013]

As shown in Figs. 1 and 2, the refrigerator compartment left door 3 includes door pockets 13 for use to store food and the like, and a refrigerator compartment dew prevention heater 12 adapted to prevent dew condensation on a boundary between the refrigerator compartment left door 3 and refrigerator compartment right door 4. Also, an imaging unit 10 for use to image an interior of the refrigerator compartment 2, a mounting structure 11 for use to mount the imaging unit 10, and a mounting structure fixing unit 9 for use to fix the mounting structure 11 are provided on an inner surface side or in the refrigerator compartment left door 3. Furthermore, a hollow hinge 14 with a hole formed therein is provided in top part of the refrigerator compartment left door 3.

[0014]

Two imaging units 10, which are electrical items, are provided on the mounting structure 11 and designed to image the interior of the refrigerator compartment 2. By communicating with a main control unit 20 describing later, the two imaging units 10 adjust imaging timing and transmit information about the interior of the refrigerator compartment 2 to a user or the like out of the house via the main control unit. Also, the mounting structure 11 is provided between the refrigerator compartment dew prevention heater 12 and door pockets 13. Note that the imaging units 10 correspond to "electrical items" according to the present invention. Also, the mounting structure 11 corresponds to a "boxlike body" according to the present invention. Note that although in the example described in the present embodiment, the imaging units 10 are provided on an inner surface side or in the refrigerator compartment left door 3, the present invention is not limited to this, and the imaging

units 10 may be attached to another door of the refrigerator body 1 or to the refrigerator body 1.

[0015]

Note that although in the example described in the present embodiment, two imaging units 10 are provided on the mounting structure 11, the present invention is not limited to this, and three or more imaging units 10 may be provided depending on the size of the refrigerator 100 and the like. Also, in the example described in the present embodiment, the mounting structure 11 is provided between the refrigerator compartment dew prevention heater 12 and door pockets 13. However, the present invention is not limited to this, and an installation location of the mounting structure 11 may be changed appropriately such that the imaging units 10 can image the interior of the refrigerator compartment 2 sufficiently. Also, although in the example described in the present embodiment, the imaging units 10 are provided in or on the refrigerator compartment left door 3, the present invention is not limited to this, and the imaging units 10 may be provided in or on the refrigerator compartment right door 4 or on an inner wall surface or the like of the refrigerator body 1.

[0016]

Fig. 3 is a schematic perspective view of the mounting structure of the refrigerator according to the embodiment of the present invention. Also, Figs. 4(a) and 4(b) are schematic exploded diagrams of the mounting structure of the refrigerator according to the embodiment of the present invention. As shown in Figs. 3, 4(a), and 4(b), the mounting structure 11 is removable from the mounting structure fixing unit 9. A cover 16 is attached to a rear surface of the mounting structure 11, and when the cover 16 is removed, the imaging units 10 and sub-control unit 15 provided in the mounting structure 11 can be exposed.

[0017]

Fig. 5 is a schematic exploded diagram of the mounting structure of the refrigerator according to the embodiment of the present invention with the imaging units and sub-control unit removed. As shown in Fig. 5, the imaging units 10 and sub-control unit 15 are housed inside the mounting structure 11. The sub-control

unit 15 is made up, for example, of a line concentrator such as a hub, and a microcomputer, and plays a role of a relay between the imaging units 10 and main control unit 20 described later. The imaging units 10 and sub-control unit 15 are detachably attached to the mounting structure 11. This makes it possible to attach and detach the imaging units 10 and sub-control unit 15 in a simplified manner at the time of assembly or parts replacement, allowing working efficiency to be increased. Also, even if an electrical item such as an imaging unit 10 or the sub-control unit 15 fails or the like, normal conditions can be restored by simply replacing the failed imaging unit 10 or sub-control unit 15. Note that although in the example described in the present embodiment, the sub-control unit 15 is housed inside the mounting structure 11, i.e., installed in the refrigerator compartment left door 3, the present invention is not limited to this, and the sub-control unit 15 may be provided in the refrigerator body 1.

[0018]

Figs. 6(a) and 6(b) are schematic diagrams showing how the imaging units and sub-control unit are connected by cables in the refrigerator according to the embodiment of the present invention. As shown in Figs. 6(a) and 6(b), the two imaging units 10 and the single sub-control unit 15 are connected by separate cables 18a and 18b. Then, the sub-control unit 15 puts together the two cables 18a and 18b into a single common cable 17, and is connected to the main control unit 20 (described later) via the common cable 17. By putting together the two cables 18a and 18b into the single common cable 17 in this way, it becomes unnecessary to make extra cables run through insulating material in the refrigerator compartment left door 3, and thus possible to prevent degradation in heat insulation performance of the refrigerator compartment 2. Note that the cable 18a, cable 18b, and common cable 17 are made up, for example, of USB cables.

[0019]

Figs. 7(a) and 7(b) are state diagrams showing how cables are gathered together in the refrigerator according to the embodiment of the present invention. As shown in Figs. 7(a) and 7(b), the common cable 17 is connected with the cable 18a

and cable 18b via the sub-control unit 15. Each of the common cable 17, cable 18a, and cable 18b includes a power wire, a GND wire, a receive wire, and a transmit wire. However, because the wires are identical in form, in the present embodiment, the transmit wire will be described as a representative, and description of the other wires will be omitted.

[0020]

As shown in Fig. 7(a), the plural imaging units 10, which are functionally identical pieces of equipment, are connected with the cables 18a and 18b via the power wires, GND wires, receive wires, and transmit wires 30a and 30b. For example, being supplied with electric power via the power wires, the imaging units 10 image the interior of the refrigerator compartment 2, and transmit data to the sub-control unit 15 via the transmit wires 30a and 30b. Also, for example, each of the imaging units 10 receives data on timing to image the interior of the refrigerator compartment 2 via the receive wire, and images the interior of the refrigerator compartment 2 via the receive wire with this timing.

[0021]

As shown in Fig. 7(b), the transmit wire 30a for the cable 18a, and transmit wire 30b for the cable 18b are connected to the sub-control unit 15. Then, the transmit wire 30a and transmit wire 30b, which are functionally identical types of wires, come together at a junction 30c provided on a substrate of the sub-control unit 15. Being functionally identical types of wires, the transmit wire 30a and transmit wire 30b coming together at the junction 30c are turned into a single common transmit wire 30 to form part of the common cable 17. The power wire, GND wire, receive wire, and transmit wire 30, each of which has been produced by unifying two wires are gathered together into a single cable by being covered with shield wires for noise reduction and are laid running to the main control unit described later.

[0022]

Fig. 8 is a state diagram showing how a cable is laid from the sub-control unit to the main control unit in the refrigerator according to the embodiment of the present invention. Also, Fig. 9 is a schematic longitudinal sectional view of the refrigerator

showing how a cable is laid from the sub-control unit to the main control unit in the refrigerator according to the embodiment of the present invention. As shown in Figs. 8 and 9, the common cable 17 resulting from unification and commonalization in the mounting structure 11 comes out of the mounting structure 11, passes through the refrigerator compartment left door 3 and through the hole in the hinge 14, and is connected the main control unit 20 provided on a back side of the refrigerator body 1.

[0023]

The main control unit 20 is made up, for example, of a microcomputer, connected to the sub-control unit 15 via the unified common cable 17, and designed to control plural devices such as the imaging units 10. The main control unit 20 assigns timings to image the interior of the refrigerator compartment 2 to the plural imaging units 10 and makes the imaging units 10 image situations in the refrigerator compartment 2. Then, the main control unit 20 acquires data on the situations in the refrigerator compartment 2 imaged by the imaging units 10, via the sub-control unit 15 and transmits the data to a portable terminal or the like owned by a user out of the house. This allows the user out of the house to learn the situations in the refrigerator compartment 2 from a remote location, improving convenience of the refrigerator 100. Note that although in the example described in the present embodiment, the main control unit 20 has a capability for external communication, the present invention is not limited to this, and the sub-control unit 15 may be equipped with a capability for external communication.

[0024]

[Advantageous effects of embodiment]

Thus, the present embodiment provides a refrigerator 100 including: the refrigerator body 1; the refrigerator compartment 2 formed in the refrigerator body 1 and provided with an opening in the front face; the refrigerator compartment left door 3 adapted to openably close the opening in the front face of the refrigerator compartment 2; the plural imaging units 10 installed on an inner surface side or in the refrigerator compartment left door 3; the sub-control unit 15 installed in the refrigerator compartment left door 3, connected with individual ones of the plural imaging units 10

via the separate cables 18a and 18b, and adapted to turn the separate cables into a common cable; and the main control unit 20 adapted to control the plural imaging units 10 by being provided in the refrigerator body 1 and connected with the sub-control unit 15 via the common cable 17.

This provides the refrigerator 100 in which the number of common cables 17 connected from the sub-control unit 15 to the main control unit 20 can be reduced because the individual cables 18a and 18b connected to the plural imaging units 10 are put together into a common cable by the sub-control unit 15.

[0025]

Also, the plural imaging units 10 and the sub-control unit 15 are housed in the same mounting structure 11.

This enables the imaging units 10 and sub-control unit 15 installed in the refrigerator compartment left door 3 to be removed easily from the refrigerator compartment left door 3. Also, by housing the imaging units 10 and sub-control unit 15 in the same mounting structure 11, it is possible to simplify a configuration on an inner side of the refrigerator compartment left door 3, thereby improving design.

[0026]

Also, the common cable 17 resulting from unification and commonalization is gathered into a single cable by being covered with shield wires for noise reduction.

This enables the sub-control unit 15 and imaging units 10 to exchange data reliably with the main control unit 20 without exposing the common cable 17 to noise.

[0027]

Also, the sub-control unit 15 has a capability for external communication.

This makes it possible to simplify a configuration of the main control unit 20 and thereby slash manufacturing costs of the main control unit 20. Also, since the sub-control unit 15 has a capability for external communication, there is no need to exchange data with the main control unit 20, which makes it possible to further reduce thickness of the common cable 17.

Reference Signs List

[0028]

1 refrigerator body 2 refrigerator compartment 3 refrigerator compartment left door 4 refrigerator compartment right door 5 convertible compartment 6 freezer compartment 7 vegetable compartment 8 ice compartment 9 mounting structure fixing unit 10 imaging unit 11 mounting structure 12 refrigerator compartment dew prevention heater 13 door pocket 14 hinge 15 sub-control unit 16 cover 17 common cable 18a cable 18b cable 20 main control unit 30 transmit wire 30a transmit wire 30b transmit wire 30c junction 100 refrigerator

CLAIMS

[Claim 1]

A refrigerator comprising:

a refrigerator body;

a storage compartment formed in the refrigerator body and provided with an opening in a front face;

a door configured to openably close the opening in the front face of the storage compartment;

a plurality of imaging units configured to photograph an interior of the storage compartment;

a sub-control unit connected with individual ones of the plurality of imaging units via separate cables, and configured to turn the separate cables into a common cable; and

a main control unit provided in the refrigerator body and connected with the sub-control unit via the common cable, and configured to control the plurality of imaging units

wherein the plurality of imaging units and the sub-control unit are housed in a same mounting structure provided in the door or the refrigerator body.

[Claim 2]

The refrigerator of claim 1, wherein the same mounting structure is provided on an inner surface side or in the door.

[Claim 3]

The refrigerator of claim 1 or 2, wherein the sub-control unit is configured to put together a plurality of wires having a same function into the common cable from among the respective separate cables.

[Claim 4]

The refrigerator of any one of claims 1 to 3, wherein the common cable is gathered into a single cable by being covered with shield wires for noise reduction.

[Claim 5]

The refrigerator of any one of claims 1 to 4, wherein the sub-control unit has a

capability for external communication.

[Claim 6]

The refrigerator of any one of claims 1 to 5, wherein when the plurality of imaging units are pieces of equipment of a same type and the separate cables contain a plurality of types of wires having different functions, the sub-control unit is configured to turn wires having a same function from among a plurality of the separate cables into common wires.

[Claim 7]

The refrigerator of any one of claims 1 to 6,

wherein the door is attached to the refrigerator body via a hinge,

wherein the mounting structure is installed in the door, and

wherein the common cable comes out of the mounting structure, passes through a hole in the hinge, and is connected to the main control unit.