CLAIMS

[Claim 1]

A heat insulating box body, comprising:

a rear wall;

a right lateral wall extending from a right side of the rear wall;

a left lateral wall extending from a left side of the rear wall;

an upper wall;

a lower wall;

the heat insulating box body having an opening formed on a front side thereof;

a vacuum heat insulating material arranged between a part of an internal box corresponding to an inner surface of the rear wall and a part of an external box corresponding to an outer surface of the rear wall, or between an other part of the internal box corresponding to an inner surface of one of the right lateral wall and the left lateral wall and an other part of the external box corresponding to an outer surface of the one of the right lateral wall and the left lateral wall; and

an intermediate member charged, sealed, applied, or placed between the vacuum heat insulating material and the internal box to bond, firmly attach, or fix the vacuum heat insulating material and the internal box to each other,

wherein the intermediate member comprises urethane foam, and

wherein a thickness of the intermediate member is 11 mm or less.

[Claim 2]

A heat insulating box body, comprising:

a rear wall;

a right lateral wall extending from a right side of the rear wall;

a left lateral wall extending from a left side of the rear wall;

an upper wall;

a lower wall;

the heat insulating box body having an opening formed on a front side thereof;

convex portions formed respectively at a corner portion between the right

lateral wall and the rear wall, and at a corner portion between the left lateral wall and the rear wall, the convex portions each including a step projected to the front side with respect to the rear wall;

a vacuum heat insulating material arranged, in a manner of being overlapped with the convex portions, between a part of an internal box corresponding to an inner surface of the rear wall and a part of an external box corresponding to an outer surface of the rear wall, or between an other part of the internal box corresponding to an inner surface of one of the right lateral wall and the left lateral wall and an other part of the external box corresponding to an outer surface of the one of the right lateral wall and the left lateral wall; and

an intermediate member charged, sealed, applied, or placed between the vacuum heat insulating material and the internal box, or between the vacuum heat insulating material and each of the convex portions to bond, firmly attach, or fix the vacuum heat insulating material and the internal box to each other,

wherein the intermediate member interposed between the rear wall and the vacuum heat insulating material comprises urethane foam, and

wherein a thickness of the intermediate member is 11 mm or less.

[Claim 3]

A heat insulating box body, comprising:

a rear wall;

a right lateral wall extending from a right side of the rear wall;

a left lateral wall extending from a left side of the rear wall;

an upper wall;

a lower wall;

the heat insulating box body having an opening formed on a front side thereof;

convex portions formed respectively at a corner portion between the right lateral wall and the rear wall, and at a corner portion between the left lateral wall and the rear wall, the convex portions each including a step projected to the front side with respect to the rear wall;

a vacuum heat insulating material arranged, in a manner of being overlapped with the convex portions in a width direction, between a part of an internal box corresponding to an inner surface of the rear wall and a part of an external box corresponding to an outer surface of the rear wall;

a concave portion formed of lateral surfaces of the convex portions and the part of the internal box corresponding to the inner surface of the rear wall; and

an intermediate member charged, sealed, applied, or placed between the vacuum heat insulating material and the internal box, or between the vacuum heat insulating material and each of the convex portions to bond, firmly attach, or fix the vacuum heat insulating material and the internal box to each other,

wherein a thickness of the intermediate member is 1 mm or less, and

wherein the vacuum heat insulating material has a flat plate shape larger in width than the concave portion in the width direction corresponding to a right-and-left direction of the rear wall to overlap with the each of the convex portions by a predetermined length.

[Claim 4]

A heat insulating box body, comprising:

a rear wall;

a right lateral wall extending from a right side of the rear wall;

a left lateral wall extending from a left side of the rear wall;

an upper wall;

a lower wall;

the heat insulating box body having an opening formed on a front side thereof;

convex portions formed respectively at a corner portion between the right lateral wall and the rear wall, and at a corner portion between the left lateral wall and the rear wall, the convex portions each including a step projected to the front side with respect to the rear wall;

a vacuum heat insulating material arranged, in a manner of being overlapped with the convex portions in a width direction, between a part of an internal box

corresponding to an inner surface of the rear wall and a part of an external box corresponding to an outer surface of the rear wall, or between an other part of the internal box corresponding to an inner surface of one of the right lateral wall and the left lateral wall and an other part of the external box corresponding to an outer surface of the one of the right lateral wall and the left lateral wall;

a concave portion formed of lateral surfaces of the convex portions and the part of the internal box corresponding to the inner surface of the rear wall; and

an intermediate member charged, sealed, applied, or placed between the vacuum heat insulating material and the internal box, or between the vacuum heat insulating material and each of the convex portions to bond, fix, or firmly attach the vacuum heat insulating material and the internal box to each other,

wherein a thickness of the intermediate member is 11 mm or less, and

wherein the vacuum heat insulating material has a flat plate shape larger in width than the concave portion in the width direction corresponding to a right-and-left direction of the rear wall to overlap with the each of the convex portions by a predetermined length.

[Claim 5]

A heat insulating box body, comprising:

a rear wall;

a right lateral wall extending from a right side of the rear wall;

a left lateral wall extending from a left side of the rear wall;

an upper wall;

a lower wall;

the heat insulating box body having an opening formed on a front side thereof;

a vacuum heat insulating material arranged between a part of an internal box corresponding to an inner surface of the rear wall and a part of an external box corresponding to an outer surface of the rear wall, or between an other part of the internal box corresponding to an inner surface of one of the right lateral wall and the left lateral wall and an other part of the external box corresponding to an outer surface

of the one of the right lateral wall and the left lateral wall; and

an intermediate member charged, sealed, applied, or placed between the vacuum heat insulating material and the internal box to bond, fix, or firmly attach the vacuum heat insulating material and the internal box to each other,

wherein a density of the intermediate member is more than 60 kg/m3, and

wherein a thickness of the intermediate member is 11 mm or less.

[Claim 6]

The heat insulating box body of any one of claims 1 to 5, wherein a proportion of a volume of the vacuum heat insulating material relative to a volume of a space formed between the external box and the internal box is 40% or more.

[Claim 7]

The heat insulating box body of any one of claims 1 to 6, wherein a ratio of the thickness of the intermediate member relative to a sum of the thickness of the intermediate member and a thickness of the vacuum heat insulating material is 0.3 or less.

[Claim 8]

The heat insulating box body of any one of claims 1 to 6,

wherein the vacuum heat insulating material and the external box are bonded directly to each other with an adhesive agent other than foam heat insulating material, and

wherein a ratio of the thickness of the intermediate member relative to a sum of the thickness of the intermediate member and a thickness of the vacuum heat insulating material is 0.3 or less.

[Claim 9]

The heat insulating box body of any one of claims 1 to 8, wherein a bending elastic modulus of the vacuum heat insulating material is 20 MPa or more.

[Claim 10]

The heat insulating box body of any one of claims 1 to 9,

wherein the vacuum heat insulating material is arranged at least in the rear wall, and

wherein the vacuum heat insulating material is arranged such that a proportion of a sum of areas of projection of the vacuum heat insulating material arranged in each of the rear wall, the right lateral wall, and the left lateral wall onto the rear wall, the right lateral wall, and the left lateral wall relative to a total surface area of the rear wall, the right lateral wall, and the left lateral wall is 70% or more.

[Claim 11]

The heat insulating box body of any one of claims 1 to 10, wherein a core material to be used for the vacuum heat insulating material comprises a fibrous core material made of an organic fiber or an inorganic fiber.

[Claim 12]

A refrigerator, comprising:

the heat insulating box body of claim 3 or 4;

a storage compartment for housing items to be stored; and

a cooler for generating cooling air for cooling the storage compartment,

wherein the concave portion is formed in a vertical direction of the rear wall, and is used as a cooling air passage through which the cooling air generated by the cooler is to be supplied into the storage compartment.

[Claim 13]

The refrigerator of claim 12, further comprising a cover member for covering a part of a rear surface of an inside of the storage compartment,

wherein the cover member comprises:

an air passage cover portion for forming at least a part of the cooling air

passage or covering at least the part of the cooling air passage; and

a mount portion for mounting the air passage cover portion to at least one of the rear wall or the concave portion.

[Claim 14]

The refrigerator of claim 12 or 13, further comprising a cooler room in which the cooler is arranged,

wherein the concave portion communicates to the cooler room.

[Claim 15]

The refrigerator of any one of claims 12 to 14,

wherein the concave portion is formed on the rear surface of the storage compartment, and

wherein the refrigerator further comprises an illumination device arranged in an upper surface, a lower surface, or a lateral surface of the storage compartment, for illuminating the inside of the storage compartment.

[Claim 16]

The refrigerator of any one of claims 12 to 15, further comprising a refrigeration cycle,

wherein a pipe forming the refrigeration cycle is arranged through the each of the convex portions.

[Claim 17]

The refrigerator of any one of claims 12 to 16, further comprising:

a refrigeration cycle; and

protruding portions each formed to project to the front side in the concave portion,

wherein a pipe forming the refrigeration cycle is arranged through each of the protruding portions.

[Claim 18]

The refrigerator of any one of claims 12 to 17, further comprising control lead wires arranged through the each of the convex portions.

[Claim 19]

The refrigerator of any one of claims 12 to 18, further comprising:

a refrigeration cycle; and

protruding portions each formed to project to the front side in the concave portion,

wherein the control lead wires are arranged through each of the protruding portions.

[Claim 20]

The refrigerator of any one of claims 12 to 19, further comprising charging ports for the foam heat insulating material, the charging ports being formed in the external box,

wherein the vacuum heat insulating material is arranged without closing the charging ports.

[Claim 21]

A device, comprising the heat insulating box body of any one of claims 1 to 11.

CLAIMS

[Claim 1]

A heat insulating box body, comprising:

a rear wall;

a right lateral wall and a left lateral wall;

an upper wall;

a lower wall;

the heat insulating box body having an opening formed on a front side thereof;

convex portions formed on the rear wall at corner portions between the lateral walls and the rear wall and projected to the front side;

a concave portion formed on the rear wall in a manner of being recessed to the rear side with respect to the convex portions;

a vacuum heat insulating material arranged between a part of an internal box corresponding to an inner surface of the rear wall and a part of an external box corresponding to an outer surface of the rear wall, or between an other part of the internal box corresponding to an inner surface of the lateral wall and an other part of the external box corresponding to an outer surface of the lateral wall;

a first intermediate member charged, sealed, or applied between the vacuum heat insulating material and the internal box corresponding to an inner surface of the rear wall, or between the vacuum heat insulating material and the internal box corresponding to an inner surface of the lateral wall to bond, attach, or fix the vacuum heat insulating material and the internal box to each other; and

a second intermediate member bonding the vacuum heat insulating material with the external box corresponding to an outer surface of the rear wall,

wherein the vacuum heat insulating material is arranged to be partially overlapped

with the convex portions,

wherein the first intermediate member is a foam heat insulating material charged, sealed, or applied between the vacuum heat insulating material and the internal box corresponding to an inner surface of the rear wall, or between the vacuum heat insulating material and the internal box corresponding to an inner surface of the lateral wall,

wherein a thickness of the first intermediate member is 10 mm or less, and

wherein the second intermediate member is an adhesive agent different from the foam heat insulating material.

[Claim 2]

The heat insulating box body of claim 1,

wherein a thickness of the first intermediate member is smaller than a thickness of the vacuum heat insulating material.

[Claim 3]

A heat insulating box body, comprising:

a rear wall;

a right lateral wall and a left lateral wall;

an upper wall;

a lower wall;

the heat insulating box body having an opening formed on a front side thereof;

convex portions formed at corner portions between the lateral walls and the rear wall, the convex portions each projecting to the front side with respect to the rear wall;

a concave portion formed on the rear wall in a manner of being recessed to the rear side with respect to the convex portions;

a vacuum heat insulating material arranged, larger in width than the concave portion in a manner of being overlapped with the convex portions in a width direction, between a part of an internal box corresponding to an inner surface of the rear wall and a part of an external box corresponding to an outer surface of the rear wall;

a first intermediate member charged, sealed, or applied between the vacuum heat insulating material and the internal box corresponding to an inner surface of the rear wall, to bond, attach, or fix the vacuum heat insulating material and the internal box to each other, and

a second intermediate member bonding the vacuum heat insulating material with the external box,

wherein the first intermediate member between the internal box forming the concave portion and the vacuum heat insulating material is a foam heat insulating material charged, sealed, or applied between the vacuum heat insulating material and the internal box, and a thickness of the first intermediate member is 10 mm or less,

wherein the second intermediate member is an adhesive agent different from the first intermediate member, and the vacuum heat insulating material is directly bonded to the external box via the second intermediate member,

wherein in the convex portions, the first intermediate member is arranged between the vacuum heat insulating material and the internal box to mainly perform heat insulation,

wherein in the concave portion, the first intermediate member is arranged between the vacuum heat insulating material and the internal box to mainly perform bonding, and

wherein a thickness of the first intermediate member of a portion to mainly perform the bonding is thinner than that of a portion to mainly perform the heat insulation.

[Claim 4]

The heat insulating box body of claim 2 or 3,

wherein the foam heat insulating material is charged or sealed between the vacuum heat insulating material and the internal box forming the convex portions.

[Claim 5]

The heat insulating box body of any one of claims 1 to 4,

wherein the foam heat insulating material is a rigid urethane foam and a density after foaming is set to more than 60 kg/m^3.

[Claim 6]

The heat insulating box body of any one of claims 1 to 5,

wherein the first intermediate member is charged or applied to a part of a range of a space between the internal box forming the concave portion and the vacuum heat insulating material.

[Claim 7]

The heat insulating box body of any one of claims 1 to 6, further comprising

injection ports provided near the widthwise end portions of the external box forming the rear wall or at positions near four corners of the external box forming the rear wall and charging or injecting the first intermediate member,

wherein the injection ports are provided in the range of the convex portions and arranged such that the vacuum heat insulating material does not interfere with the injection ports.

[Claim 8]

The heat insulating box body of claim 7,

wherein the convex portions are a triangular shape having an the oblique side in a horizontal cross section and the injection ports are provided in the range of the oblique side.

[Claim 9]

The heat insulating box body of claim 7 or 8,

wherein the vacuum heat insulating material is a flat plate shape, cutout portions are formed at the corner portions of the flat plate shape, and the cutout portions are arranged at positions corresponding to the injection ports.

[Claim 10]

The heat insulating box body of any one of claims 7 to 9,

wherein when a widthwise length of the convex portions is A, a thickness of the lateral wall is T1, and the length from an outer surface of each of the lateral walls to an outer edge of the injection ports added by a widthwise length of the injection ports is Y1,

"Y1 is (T1 + A) or more".

[Claim 11]

The heat insulating box body of any one of claims 1 to 10, wherein a proportion of a volume of the vacuum heat insulating material relative to a volume of a space formed between the external box and the internal box is 40% or more.

[Claim 12]

The heat insulating box body of any one of claims 1 to 11, wherein a ratio of a thickness of the first intermediate member relative to a sum of the thickness of the first intermediate member and a thickness of the vacuum heat insulating material is 0.3 or less.

[Claim 13]

The heat insulating box body of any one of claims 1 to 12, wherein a bending elastic modulus of the vacuum heat insulating material is 20 MPa or more.

[Claim 14]

The heat insulating box body of any one of claims 1 to 13,

wherein the vacuum heat insulating material is arranged such that a proportion of a sum of areas of projection of the vacuum heat insulating material arranged in each of the rear wall, the right lateral wall, and the left lateral wall onto the rear wall, the right lateral wall, and the left lateral wall relative to a total surface area of the rear wall, the right lateral wall, and the left lateral wall is 70% or more.

[Claim 15]

The heat insulating box body of any one of claims 1 to 14, wherein a core material of the vacuum heat insulating material comprises a fibrous core material made of an organic fiber or an inorganic fiber.

[Claim 16]

A refrigerator, comprising:

the heat insulating box body of any one of claims 1 to 15;

a storage compartment for housing items to be stored; and

a cooler for generating cooling air for cooling the storage compartment,

wherein the concave portion is formed in a vertical direction of the rear wall, and is used as a cooling air passage through which the cooling air generated by the cooler is supplied into the storage compartment.

[Claim 17]

The refrigerator of claim 16, further comprising a cover member for covering a part of a rear surface in the storage compartment, and

a protruding portion provided in the concave portion,

wherein the cover member comprises:

an air passage cover portion for forming at least a part of the cooling air passage or covering at least the part of the cooling air passage; and

a mount portion for mounting the air passage cover portion to the protruding portion.

[Claim 18]

The refrigerator of claim 17,

wherein the mount portion is fixed or held onto the protruding portion by a screw, a hooking structure, or a fitting structure.

[Claim 19]

The refrigerator of any one of claims 16 to 18,

wherein the concave portion is formed on the rear surface of the storage compartment, and

wherein the refrigerator further comprises an illumination device arranged in an upper surface, a lower surface, or a lateral surface of the storage compartment, for illuminating the inside of the storage compartment.

[Claim 20]

The refrigerator of any one of claims 16 to 19,

wherein a pipe forming a refrigeration cycle is arranged through at least one of the convex portions.

[Claim 21]

The refrigerator of any one of claims 17 to 19,

wherein a pipe forming a refrigeration cycle is arranged through the protruding portion.

[Claim 22]

The refrigerator of any one of claims 16 to 21, wherein control lead wires are arranged through at least one of the convex portions.

[Claim 23]

The refrigerator of any one of claims 17 to 21,

wherein control lead wires are arranged through the protruding portion.

[Claim 24]

A device, comprising the heat insulating box body of any one of claims 1 to 15.

[Claim 25]

A refrigerator, comprising:

a heat insulating box body of claim 1 or 3;

a storage compartment for housing items to be stored;

a pull-out case housed in the storage compartment and pulled out through rail members each arranged on the lateral walls of the storage compartment;

a vacuum heat insulating material arranged between the internal box and the external box at a position facing the rail members; and

a foam heat insulating material charged between the internal box and the vacuum heat insulating material at the position facing the rail members;

wherein a thickness of the foam heat insulating material is less than 10 mm at a position facing the rail members.

[Claim 26]

The refrigerator of claim 25,

Wherein a reinforcing member for fixing the rail members is arranged between the vacuum heat insulating material and the internal box.