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Ono et al.

(54) **OUTDOOR UNIT OF REFRIGERATION APPARATUS**

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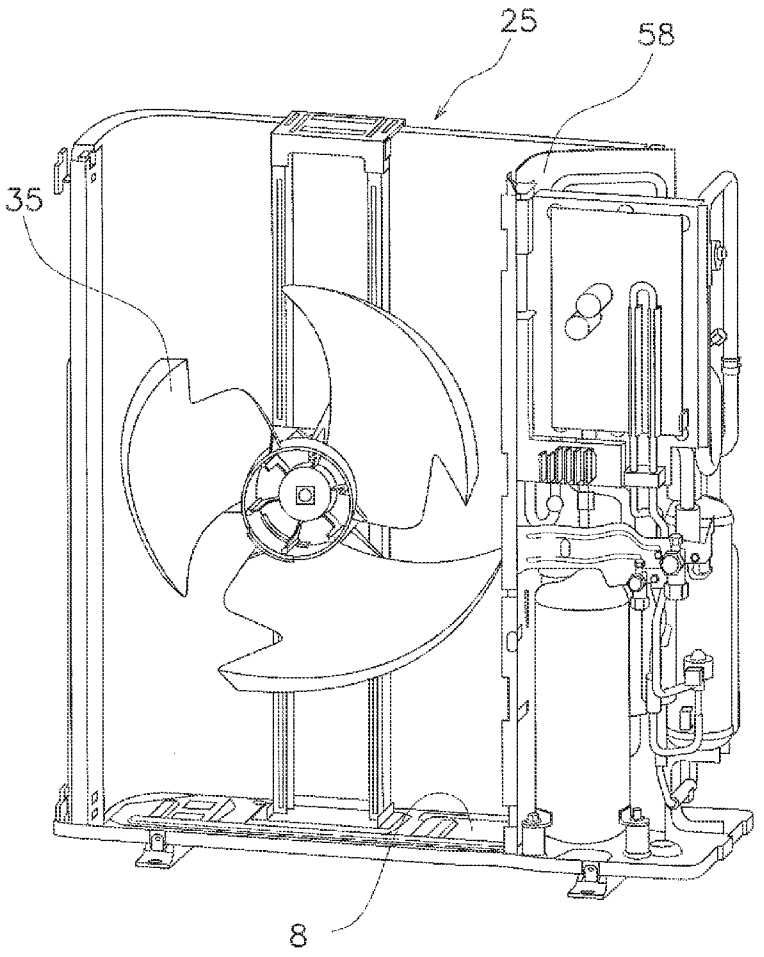
(57) **ABSTRACT**

An outdoor unit of a refrigeration apparatus includes a heat exchanger constructed of aluminum or aluminum alloy, a floor frame supporting the heat exchanger, and a spacer disposed between the heat exchanger and the floor frame. The heat exchanger has a plurality of flat pipes, a header manifold connected to the flat pipes, and a plurality of fins joined to the flat pipes. Heat exchange occurs between a fluid flowing inside the flat pipes and air flowing outside the flat pipes. The spacer has an inclined surface and a horizontal surface. The inclined surface guides condensation from the heat exchanger to the floor frame. The horizontal surface contacts the heat exchanger and the heat exchanger is horizontally mounted on the horizontal surface.



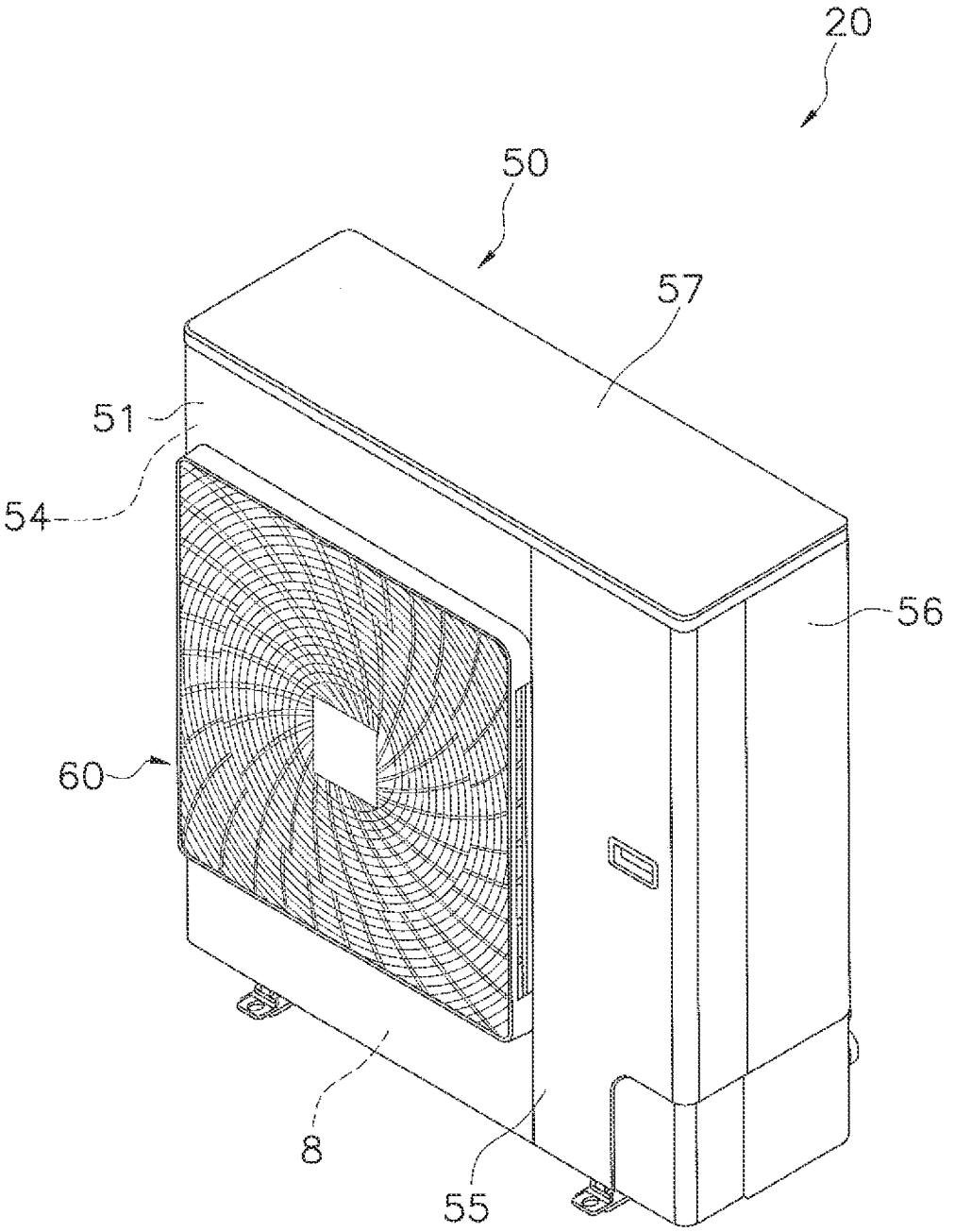


FIG. 1

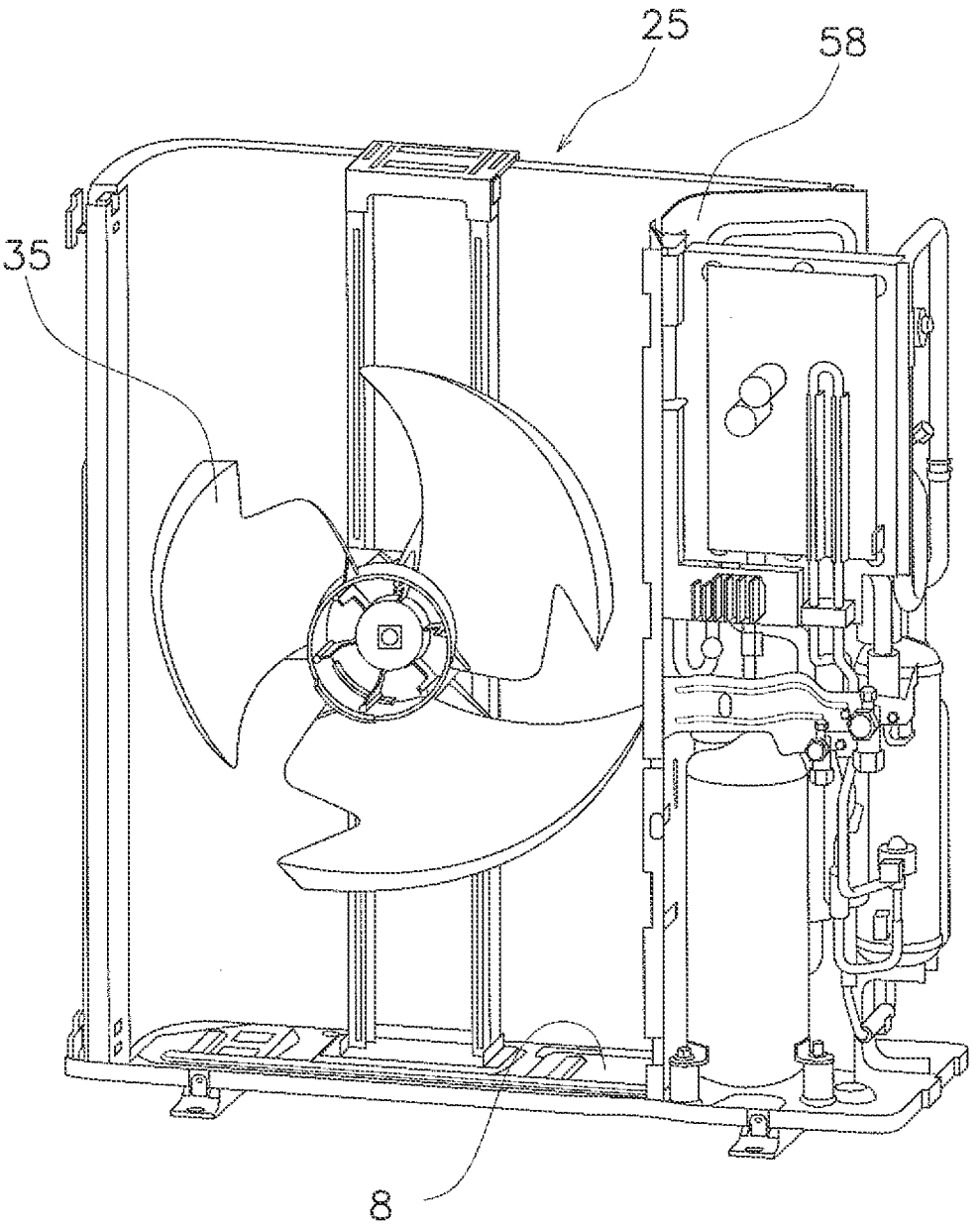


FIG. 2

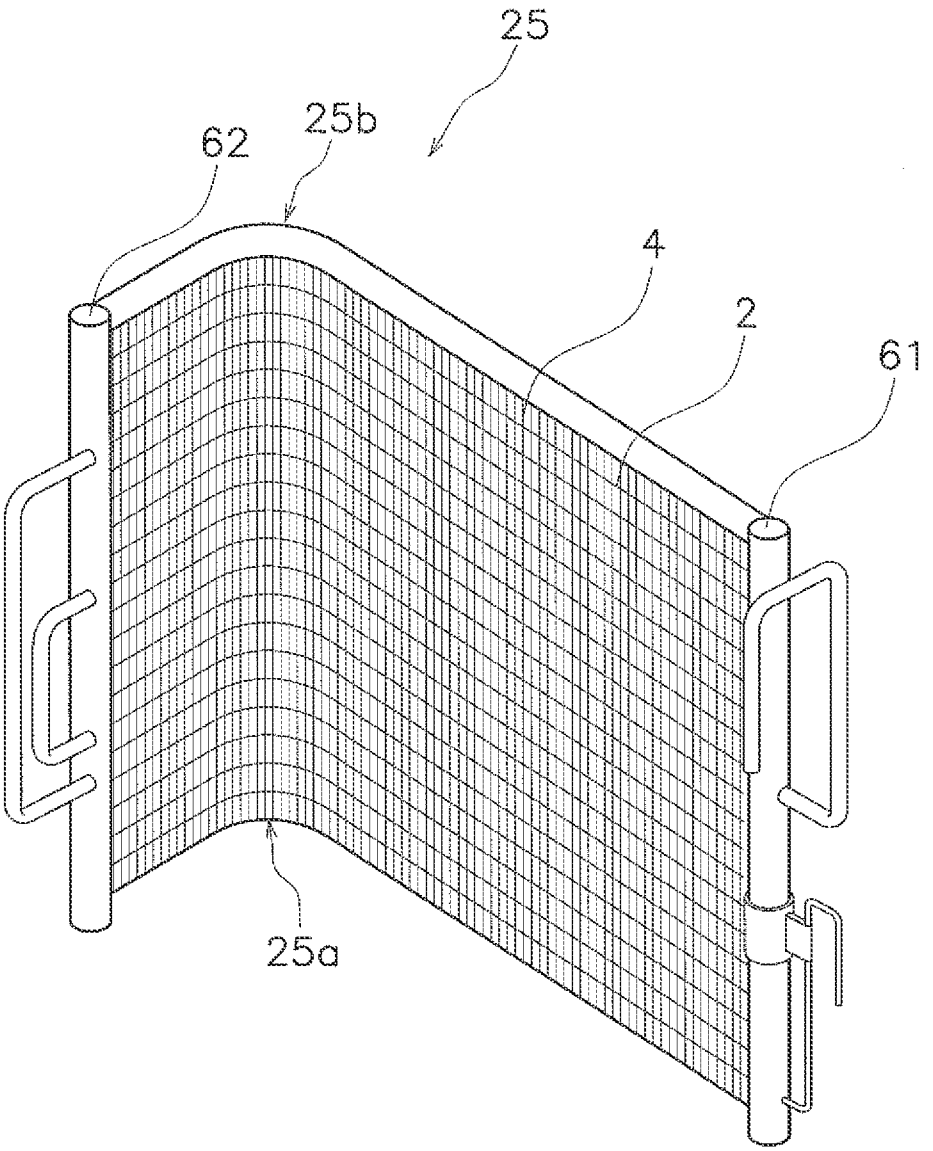


FIG. 3

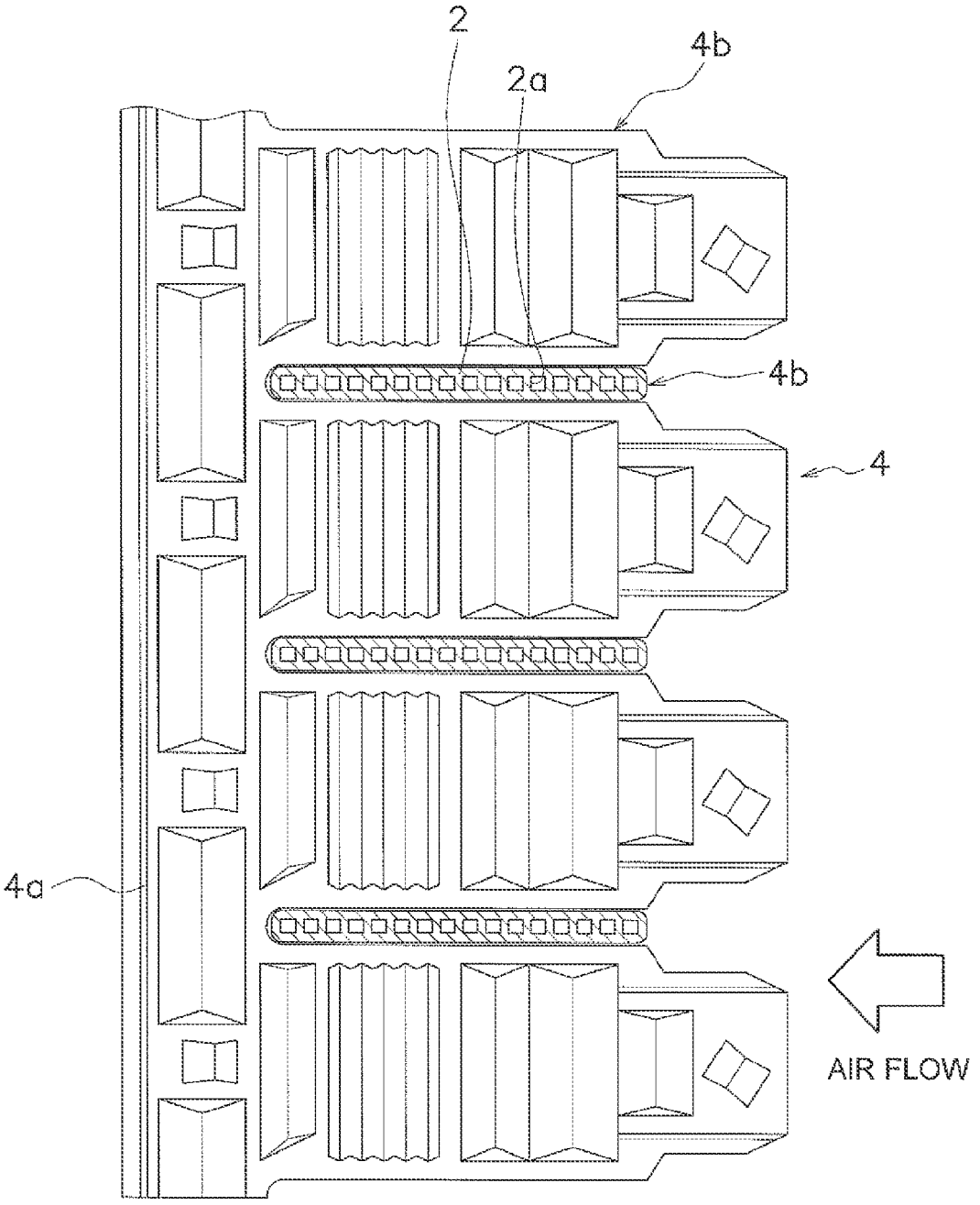


FIG. 4

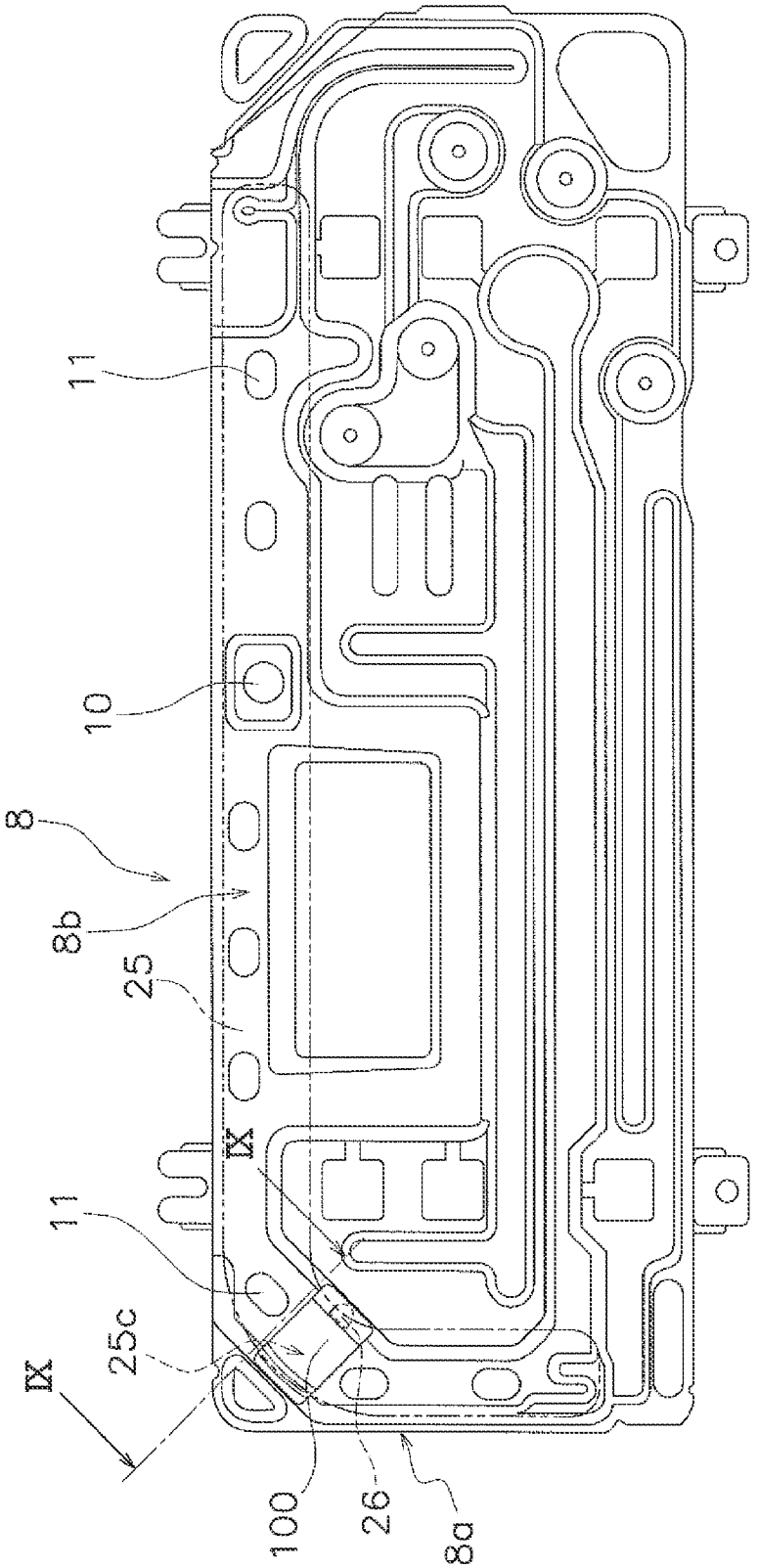


FIG. 5

FIG. 6

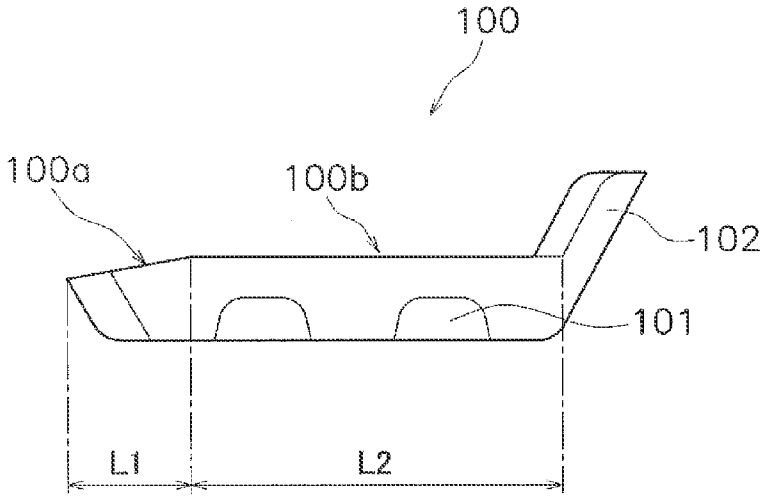
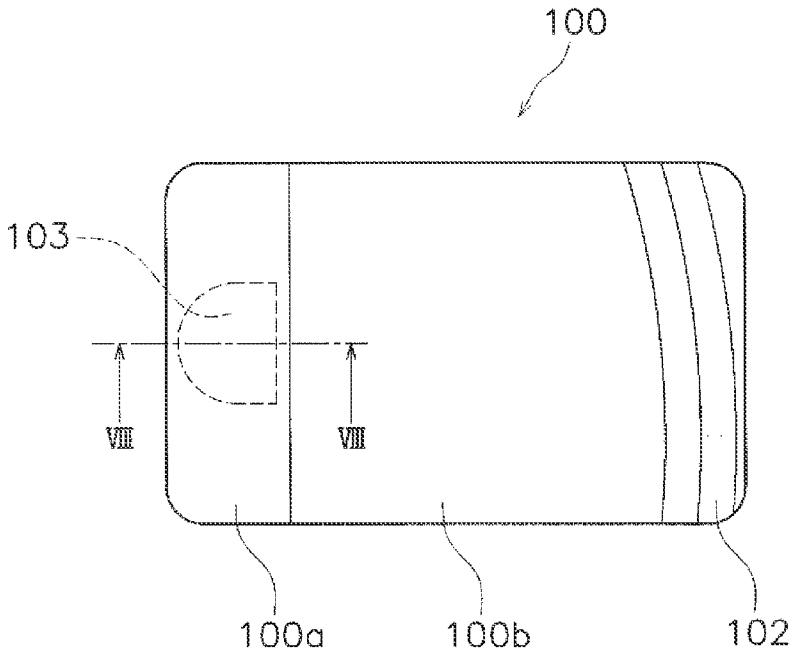


FIG. 7



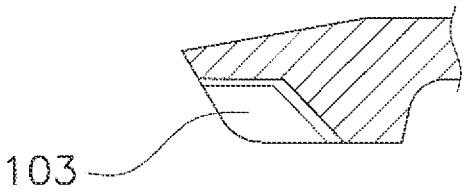


FIG. 8

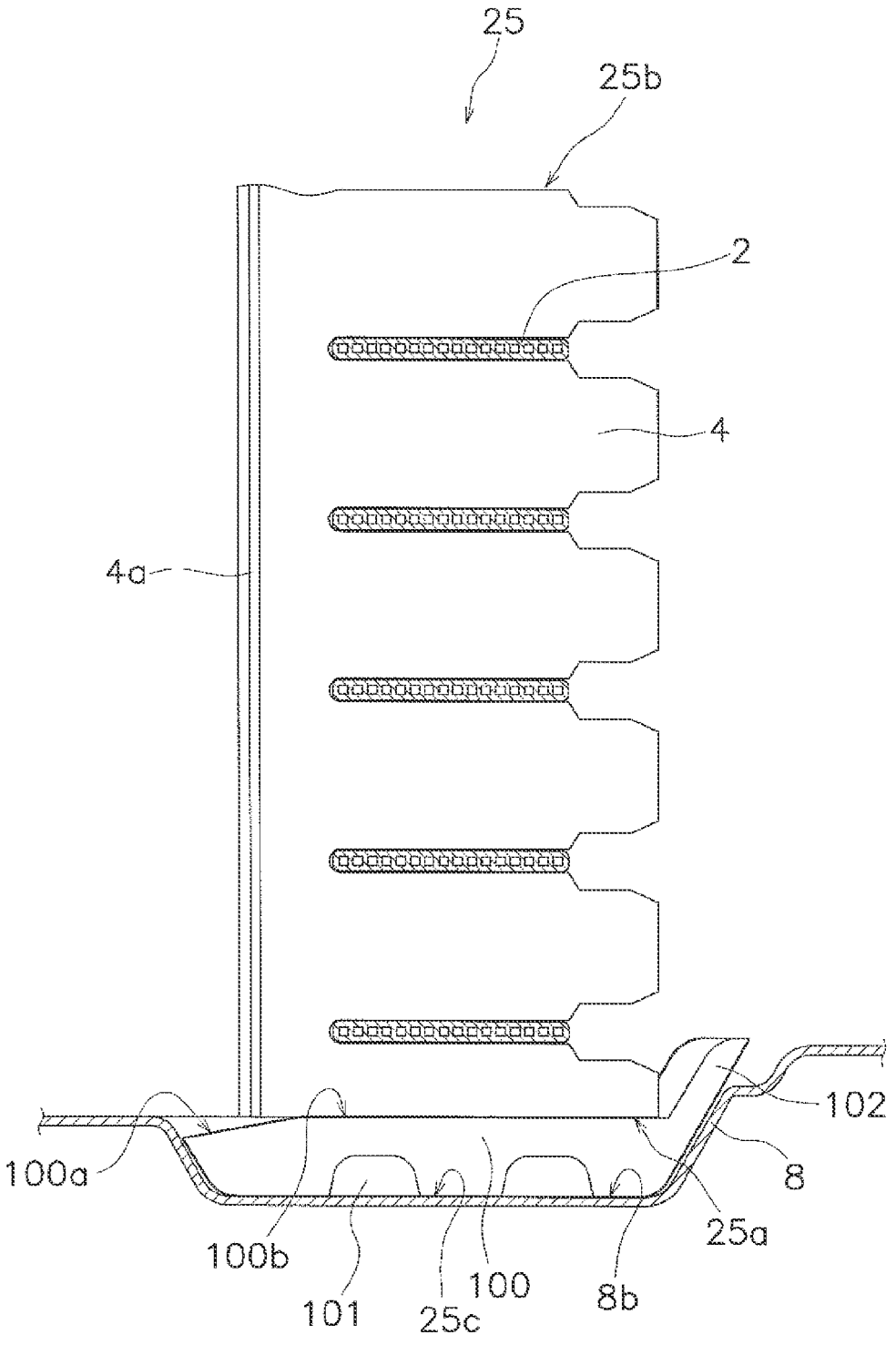


FIG. 9

OUTDOOR UNIT OF REFRIGERATION APPARATUS

TECHNICAL FIELD

[0001] The present invention relates to an outdoor unit of a refrigeration apparatus.

BACKGROUND ART

[0002] There is reported a structure of an outdoor unit of a refrigeration apparatus, for example, as in patent document 1 (Japanese Laid-open Patent Application No. 2010-151387), in which a lower end of a heat exchanger made of aluminum is formed inclined, and a spacer member having an inclined surface facing opposite the lower end of the heat exchanger is disposed to promote drainage using the inclination of the spacer member.

SUMMARY OF THE INVENTION

Technical Problem

[0003] However, in the abovementioned configuration, a problem is presented in that the lower end of the heat exchanger had to be formed inclined and manufacturing was difficult.

[0004] An object of the present invention is to provide an outdoor unit of a refrigeration apparatus that is not susceptible to the effect of metal corrosion in an outdoor unit of a refrigeration apparatus using a heat exchanger made of aluminum or aluminum alloy.

Solution to Problem

[0005] An outdoor unit of a refrigeration apparatus according to a first aspect of the present invention comprises a heat exchanger made of aluminum or aluminum alloy, a floor frame for mounting the heat exchanger, and a spacer disposed between the heat exchanger and the floor frame. The heat exchanger has a plurality of flat pipes, a header manifold to which each of said flat pipes is connected, and a plurality of fins joined to the flat pipes. The heat exchanger is arranged so that heat exchange occurs between a fluid flowing inside the flat pipes and air flowing outside the flat pipes. The spacer has an inclined surface and a horizontal surface. The inclined surface guides condensation from the heat exchanger to the floor frame. The heat exchanger makes contact with the horizontal surface and is horizontally mounted thereon.

[0006] By virtue of the fact that the surface of the spacer facing opposite the lower end of the heat exchanger is formed inclined from midcourse in a short direction of the heat exchanger, water drops falling from the heat exchanger can be guided to the floor frame and corrosion of the heat exchanger and leakage of refrigerant can be prevented. Furthermore, because the heat exchanger is mounted on the horizontal surface of the spacer, there is no need for the lower end of the heat exchanger to be formed inclined and the heat exchanger is easy to manufacture.

[0007] A ratio of a length L1 in a long direction of the inclined surface and a length L2 in a long direction of the horizontal surface in plan view is not particularly limited provided that water can be guided to the floor frame and the heat exchanger can be mounted horizontally, but the ratio can be set to L1:L2=about 1:2-5.

[0008] The inclination of the inclined surface is not particularly limited provided that condensation from the heat exchanger can be guided to the floor frame, but the inclination can be set to 7-20° downward from the horizontal direction. The drainage function is insufficient if the angle of inclination is smaller than 7°, and water is difficult to convey, particularly in the case of a water-repellent material, if the inclination is greater than 20°.

[0009] Condensation from the heat exchanger includes condensation water, rainwater, and the like.

[0010] The material of the spacer is preferably rubber from the aspects of being able to mount the heat exchanger stably and having waterproofness and anti-vibration property, and natural rubber, chloroprene rubber, nitrile rubber, butyl rubber, ethylene-propylene rubber, styrene-butadiene rubber, silicone rubber, fluorine rubber, AFLAS, hydrogenated nitrile rubber, urethane rubber, and the like, can be used.

[0011] An outdoor unit of a refrigeration apparatus according to a second aspect of the present invention is the outdoor unit of a refrigeration apparatus according to the first aspect, wherein the fin has a water-guiding part, and the inclined surface is provided on an elongated portion of the water-guiding part.

[0012] Here, because the fin has a water-guiding part, condensation from the heat exchanger can be guided to the spacer. Furthermore, because the inclined surface is provided on an elongated portion of the water-guiding part, water guided from the heat exchanger to the spacer can be guided along the inclined surface to the floor frame, and therefore corrosion of the heat exchanger and leakage of refrigerant can be prevented.

[0013] An outdoor unit of a refrigeration apparatus according to a third aspect of the present invention is the outdoor unit of a refrigeration apparatus according to the first or second aspect, wherein a drainage structure is provided on a lower part of the spacer. Examples of each drainage structure include openings, cutouts, and gutters.

[0014] Here, because water falling onto the spacer from the heat exchanger can be guided to the floor frame from the drainage structure on the lower part of the spacer, corrosion of the heat exchanger and leakage of refrigerant can be prevented.

[0015] An outdoor unit of a refrigeration apparatus according to a fourth aspect of the present invention is the outdoor unit of a refrigeration apparatus according to any of the first to third aspects, wherein the spacer is disposed on a lower end of a bent part of the heat exchanger.

[0016] Here, because a place for the spacer can be secured while making the outdoor unit compact, corrosion of the heat exchanger and leakage of refrigerant can be prevented.

[0017] An outdoor unit of a refrigeration apparatus according to a fifth aspect of the present invention is the outdoor unit of a refrigeration apparatus according to any of the first to fourth aspects, wherein an extended part extending diagonally upward from the horizontal surface is provided on the spacer.

[0018] Here, because condensation from the heat exchanger can be guided to the drainage structure more effectively by the extended part, corrosion of the heat exchanger and leakage of refrigerant can be prevented.

Advantageous Effects of Invention

[0019] In the outdoor unit of a refrigeration apparatus according to the first aspect of the present invention, water drops falling from the heat exchanger can be guided to the floor frame, and corrosion of the heat exchanger and leakage

of refrigerant can be prevented. Furthermore, there is no need for the lower end of the heat exchanger to be formed inclined, and the heat exchanger can be manufactured easily.

[0020] In the outdoor unit of a refrigeration apparatus according to the second aspect of the present invention, because condensation from the heat exchanger can be guided to the spacer and furthermore can be guided from the inclined surface to the floor frame, corrosion of the heat exchanger and leakage of refrigerant can be prevented.

[0021] In the outdoor unit of a refrigeration apparatus according to the third aspect of the present invention, water falling onto the spacer from the heat exchanger can be guided effectively to the floor frame, and corrosion of the heat exchanger and leakage of refrigerant can be prevented.

[0022] In the outdoor unit of a refrigeration apparatus according to the fourth aspect of the present invention, a place for the spacer can be secured while making the outdoor unit compact, and corrosion of the heat exchanger and leakage of refrigerant can be prevented.

[0023] In the outdoor unit of a refrigeration apparatus according to the fifth aspect of the present invention, condensation from the heat exchanger can be guided to the drainage structure more effectively, and corrosion of the heat exchanger and leakage of refrigerant can be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] FIG. **1** is a general perspective view of an outdoor unit of a refrigeration apparatus according to one embodiment of the present invention.

[0025] FIG. **2** is a general perspective view of an outdoor unit of a refrigeration apparatus according to one embodiment of the present invention in a condition having removed a ceiling plate, left side plate, right front plate, and right rear plate.

[0026] FIG. **3** is a general perspective view of an outdoor heat exchanger.

[0027] FIG. **4** is a partially enlarged view cut in a vertical direction of flat pipes and fins of an outdoor heat exchanger. Some reference numerals are omitted with respect to identical members.

[0028] FIG. **5** is a plan view of a floor frame of an outdoor unit of a refrigeration apparatus according to one embodiment of the present invention.

[0029] FIG. **6** is a front view of a spacer according to one embodiment of the present invention.

[0030] FIG. **7** is a plan view of a spacer according to one embodiment of the present invention.

[0031] FIG. **8** is a sectional view along VIII-VIII in FIG. **7**.

[0032] FIG. **9** is a sectional view along IX-IX in FIG. **5**.

DESCRIPTION OF EMBODIMENTS

[0033] An embodiment of the present invention is described below while referring to the drawings.

[0034] The outdoor unit of a refrigeration apparatus of the present embodiment is used as an outdoor unit of an air-conditioning apparatus.

(1) General Configuration of the Outdoor Unit

[0035] The outdoor unit of an air-conditioning apparatus according to one embodiment of the present invention is illustrated in FIG. **1**. FIG **1** is a perspective view illustrating the outdoor unit **20** of an air-conditioning apparatus. The outdoor unit **20** is placed outside a space to be air-conditioned (indoors) where air conditioning is to be performed, and an interior of a roughly rectangular box-form casing **50** is divided into a ventilation compartment and a machine compartment by a partitioning plate (not illustrated) extending vertically. The outdoor unit **20** is connected via refrigerant-communicating piping (not illustrated) to an indoor unit (not illustrated) disposed inside the space to be air conditioned.

[0036] The outdoor unit **20** mainly comprises a roughly box-form casing **50**, an outdoor fan (not illustrated), refrigerant circuit-configuring parts (not illustrated) including a heat exchanger, compressor, valves, pipes, and the like, to configure a refrigerant circuit, and an electrical unit (not illustrated) for performing operation and control.

[0037] A blow-out port positioned at the center and to the left of a front face **51** is formed on the casing **50**, and air sent out by the outdoor fan is blown out forward from the blow-out port.

[0038] The casing **50** has a ceiling plate **57**, a right rear plate **56**, and a right front plate **55**, and additionally has a left side plate **54** and a floor frame **8**. "**60**" indicates a fan grill attached on the outside of the casing **50**.

[0039] FIG. **2** is a general perspective view of an outdoor unit of a refrigeration apparatus according to one embodiment of the present invention in a condition having removed a ceiling plate, left side plate, right front plate, and right rear plate. A heat exchanger **25** is mounted on the floor frame **8**, and an outdoor fan **35** is disposed in front thereof. The floor frame **8** has a portion **8***a* standing upright in a vertical direction (see FIG. **5**) on an edge portion. Facing the partitioning plate **58**, the left side is the ventilation compartment and the right side is the machine compartment.

[0040] FIG. **3** is a general perspective view of an outdoor heat exchanger **25**. As illustrated in FIG. **3**, the outdoor heat exchanger **25** has a flat pipe **2**, fins **4**, and header manifolds **61** and **62**. The fins **4** are omitted in the illustration in FIG. **3**. Some of the reference numerals of the flat pipes **2** also are omitted. The fin **4** has a bent part **25***b*. A spacer to be described is disposed beneath the outdoor heat exchanger **25** in a manner connected to a lower end **25***a* of the bent part **25***b*.

[0041] The outdoor heat exchanger **25** allows refrigerant flowing inside to be condensed or evaporated by heat exchange with outside air. The outdoor heat exchanger **25** is made entirely of aluminum or aluminum alloy. The outdoor heat exchanger **25** is disposed inside the casing **50**, with a space being opened between the outdoor heat exchanger and the casing **50** or with a resin member, or the like, being placed between the casing **50** and the outdoor heat exchanger **25**, so as not to be in direct contact with the casing **50** (see FIG. **1**).

[0042] The outdoor heat exchange **25**, as illustrated in FIG. **2**, extends along the back face of the casing **50** toward the left from near an end part of the partitioning plate **58**, changes in direction at near a left rear corner part of the casing **50**, and extends toward the front along the left side plate **54** (see FIG. **1**).

[0043] Header manifolds **61** and **62** are connected to both ends of flat pipes **2** disposed in a plurality of stages in the vertical direction. The header manifolds **61** and **62** have a function of supporting the flat pipes **2**, a function of guiding refrigerant to internal channels (not illustrated) of the flat pipes **2**, and a function of collecting refrigerant discharged from the internal channels.

[0044] FIG. **4** is a partially enlarged view out in the vertical direction of flat pipes **2** and fins **4**. The flat pipe **2** has a vertical planar part serving as a heat-conducting surface, and a plu-

rality of internal channels **2***a* in which the refrigerant flows. The flat pipes **2** are disposed in a plurality of stages with spacing between in a state in which the planar parts are oriented vertically. The fin **4** is connected to the flat pipe **2**. A plurality of cutouts **4***b* extending horizontally in a long and slender form are formed on the fins **4** so that the fins **4** are interleaved with the plurality of stages of flat pipes **2** arrayed between the header manifolds **61** and **62**. The shape of the cutout parts **4***b* of the fins **4**, as illustrated in FIG. **4**, is nearly consistent with the external shape in section of the flat pipe **2**. The fin **4** is provided with waffles or louvers, and has one water-guiding part **4***a* connected in the vertical direction at a most downstream side of the fin. Condensation is guided along the water-guiding part **4***a* to the lower part of the heat exchanger.

[0045] The floor frame **8**, as illustrated in FIG. **5**, mainly has a roughly rectangular shape in plan view, and has a drain part (drain pan) **8***b*. The heat exchanger not illustrated is mounted on the drain pan, and a first drainage opening **10** and a plurality of other openings **11** are provided on the drain pan. Water accumulating inside the floor frame **8** is drained basically from these openings **10** and **11**. The first drainage opening **10** is disposed in the lowest position in the vertical direction, and condensation water is drained therefrom.

[0046] A spacer **100** is disposed in a portion of the drain pan indicated by "**25***c*," and the bent part **25***b* of the heat exchanger is mounted thereon. "**26**" indicates a boss for fixing the spacer **100** in position. The spacer **100** is disposed in a manner so that a long direction of the spacer **100** coincides with a short direction of the heat exchanger **25**. By the fact that the spacer **100** is disposed on the lower end **25***a* (FIG. **3**) of the bent part of the heat exchanger **25**, the drainage mechanism of the heat exchanger **25** can be provided compactly.

(**2**) Spacer

[0047] FIGS. **6** to **8** illustrate a front view, a plan view, and a sectional view of a spacer **100**. On the spacer **100**, an inclined surface **100***a* for guiding condensation from the heat exchanger **25** to the floor frame **8** and a horizontal surface **100***b* for contacting with the heat exchanger **25** and mounting the heat exchanger **25** horizontally are provided on a surface facing opposite the lower end of the heat exchanger **25**. The inclination of the inclined surface **100***a* is 10° downward from the horizontal direction.

[0048] The inclined surface **100***a* is provided so as to incline from midcourse in a short direction of the heat exchanger **25**. Water drops falling from the heat exchanger **25** can thereby be led to the floor frame **8**. As illustrated in FIG. **5**, an opening **11** is provided on the floor frame **8** near a position **25***c* where the spacer **100** is disposed, and drainage is therefore achieved smoothly.

[0049] A ratio of a length L1 in a long direction of the inclined surface **100***a* and a length L2 in a tong direction of the horizontal surface **100***b* in plan view is L1:L2=about 1:3. By providing the inclined surface **100***a* and the horizontal surface **100***b* with such ratio, drainage of condensation from the heat exchanger **25** is promoted, and at the same time, there is no need for the tower end of the heat exchanger **25** to be inclined and the heat exchanger **25** can be easily mounted horizontally.

[0050] A drainage opening **101** is provided on a lower part of the spacer **100**. The portion where the drainage opening **101** is provided is thinner than a thickness of the spacer **100**, and water is therefore easily guided to the drainage opening **101**.

[0051] The spacer **100** is furthermore provided with an extended part **102** extending diagonally upward from the horizontal surface **100***b*. The heat exchanger **25** can be anchored by the extended part **102**, an anti-vibration property is improved, and drainage is further promoted. The heat exchanger also can be prevented from contacting the upright portion of the floor frame when the heat exchanger is shifted by vibration.

[0052] A depression **103** is provided on a surface of the spacer **100** on an opposite side to the surface facing opposite the heat exchanger. A boss **26** (FIG. **5**) provided on the floor frame **8** is inserted into the depression **103**, and the position of the spacer **100** relative to the floor frame **8** is determined.

[0053] FIG. **9** illustrates a condition in which the outdoor heat exchanger **25** is mounted on the floor frame **8** via the spacer **100**. FIG. **9** is a sectional view along IX-IX in FIG. **5**. The spacer **100** is disposed in the position **25***c* where the spacer is disposed on the floor frame **8**. The heat exchanger **25** is mounted on the spacer **100**, with the horizontal surface **100***b* provided on the side of the spacer **100** opposite the surface facing opposite the floor frame **8** contacting with the lower end **25***a* of the bent part **25***b* of the heat exchanger **25** having the flat pipes **2** and the fins **4**. The side face of the heat exchanger **25** is disposed so as to be prevented from directly contacting with the floor frame **8** by the extended part **102**. The anti-vibration property of the heat exchanger can thereby be increased and water is effectively guided to the opening **11** of the floor frame **8**.

[0054] Condensation from the heat exchanger **25** is guided along the water-guiding part **4***a* of the fin **4** to the spacer **100**, and is guided by the inclined surface **100***a* to the floor frame **8**. Because the drainage opening **101** on the spacer **100** is provided on a portion on a lower end of the fin **4**, a portion of the condensation dripping on the horizontal surface **100***b* of the spacer **100** is guided to the floor frame **8** by the drainage opening **101**.

(**3**) Features of the Outdoor Unit

[0055] (3-1) The outdoor unit **20** of the air-conditioning apparatus **1** according to the present embodiment comprises a heat exchanger **25** made of aluminum or aluminum alloy, a floor frame **8** for mounting the heat exchanger **25**, and a spacer **100** disposed between the heat exchanger **25** and the floor frame **8**. The spacer **100** has an inclined surface **100***a* and a horizontal surface **100***b*. The inclined surface **100***a* guides condensation from the heat exchanger **25** to the floor frame **8**. The horizontal surface **100***b* contacts with the heat exchanger **25** and mounts the heat exchanger **25** horizontally.

[0056] Here, by virtue of the fact that the surface of the spacer facing opposite the lower end of the heat exchanger is formed inclined from midcourse in a short direction of the heat exchanger, water drops falling from the heat exchanger can be guided to the floor frame and corrosion of the heat exchanger and leakage of refrigerant can be prevented. Furthermore, because the heat exchanger is mounted on the horizontal surface of the spacer, there is no need for the lower end of the heat exchanger to be formed inclined and the heat exchanger is easy to manufacture.

[0057] (3-2) In the outdoor unit **20** of the air-conditioning apparatus **1** of the present embodiment, the fin **4** has a water-

guiding part **4***a*, and the inclined surface **100***a* is provided on an elongated portion of the water-guiding part **4***a*.

[0058] Here, condensation from the heat exchanger is guided along the water-guiding part to the spacer. Condensation is also guided from the inclined surface of the elongated portion of the water-guiding part, and corrosion of the heat exchanger and leakage of refrigerant are prevented.

[0059] (3-3) In the outdoor unit **20** of the air-conditioning apparatus **1** according to the present embodiment, a drainage opening **101** is provided on a lower part of the spacer **100**.

[0060] Here, because water falling onto the spacer **100** from the heat exchanger **25** is guided to the floor frame **8** from the drainage opening **101** on the lower part of the spacer **100**, corrosion of the heat exchanger **25** and leakage of refrigerant are prevented.

[0061] (3-4) In the outdoor unit **20** of the air-conditioning apparatus **1** according to the present embodiment, the spacer is disposed on a lower end of a bent part of the heat exchanger.

[0062] Here, because a place for the spacer can be secured while making the outdoor unit compact, corrosion of the heat exchanger and leakage of refrigerant are prevented.

[0063] (3-5) In the outdoor unit **20** of the air-conditioning apparatus **1** according to the present embodiment, an extended part extending diagonally upward from the horizontal surface is provided on the spacer.

[0064] Here, because condensation from the heat exchanger can be guided to the drainage structure more effectively by the extended part, corrosion of the heat exchanger and leakage of refrigerant are prevented.

(4) Modified Example

[0065] A modified example of the present embodiment is presented below. A plurality of modified examples may be appropriately combined.

(4-1) Modified Example A

[0066] Although the outdoor unit **20** illustrated in the above embodiment is used in an air-conditioning apparatus **1**, the outdoor unit is not limited to this and may be used in another refrigeration apparatus.

INDUSTRIAL APPLICABILITY

[0067] According to the present invention as above, susceptibility to an effect of metal corrosion can be suppressed, and this is useful for an outdoor unit of a refrigeration apparatus.

REFERENCE SIGNS LIST

[0068] **2** Flat pipe
[0069] **4** Fin
[0070] **4***a* Water-guiding part
[0071] **61**, **62** Header manifold
[0072] **8** Floor frame
[0073] **8***b* Drain part (drain pan)
[0074] **10** First drainage opening
[0075] **11** Opening
[0076] **20** Outdoor unit
[0077] **25** Outdoor heat exchanger (heat exchanger)
[0078] **25***b* Bent part
[0079] **35** Outdoor fan
[0080] **50** Casing
[0081] **51** Front plate
[0082] **54** Left side plate
[0083] **55** Right front plate
[0084] **56** Right rear plate
[0085] **57** Ceiling plate
[0086] **58** Partitioning plate
[0087] **60** Fan grill
[0088] **100** Spacer
[0089] **100***a* Inclined surface
[0090] **100***b* Horizontal surface
[0091] **101** Drainage opening
[0092] **102** Extended part

CITATION LIST

Patent Literature

[0093] Patent document 1: Japanese Laid-open Patent Application No. 2010-151387

1. An outdoor unit of a refrigeration apparatus, the outdoor unit comprising:
a heat exchanger constructed of aluminum or aluminum alloy, the heat exchanger having
a plurality of flat pipes,
a header manifold, each of said flat pipes being connected to said header manifold, and
a plurality of fins joined to said flat pipes,
heat exchange occurring between a fluid flowing inside said flat pipes and air flowing outside said fiat pipes;
a floor frame supporting said heat exchanger; and
a spacer disposed between said heat exchanger and said floor frame,
said spacer having
an inclined surface arranged and configured to guide condensation from said heat exchanger to said floor frame, and
a horizontal surface, said heat exchanger making contact with said horizontal surface, and said heat exchanger being horizontally mounted on said horizontal surface.

2. The outdoor unit according to claim **1**, wherein
said fin has a water-guiding part, and said inclined surface is disposed on an elongated portion of said water-guiding part.

3. The outdoor unit according to claim **1**, wherein
said spacer includes a drainage structure disposed on a lower part of said spacer.

4. The outdoor unit according to claim **1**, wherein
said spacer is disposed on a lower end of a bent part of said heat exchanger.

5. The outdoor unit according to claim **1**, wherein
said spacer includes an extended part extending diagonally upward from said horizontal surface on said spacer.

6. The outdoor unit according to claim **2**, wherein
said spacer includes a drainage structure disposed on a lower part of said spacer.

7. The outdoor unit according to claim **6**, wherein
said spacer is disposed on a lower end of a bent part of said heat exchanger.

8. The outdoor unit according to claim **7**, wherein
said spacer includes an extended part extending diagonally upward from said horizontal surface on said spacer.

9. The outdoor unit according to claim **2**, wherein
said spacer is disposed on a lower end of a bent part of said heat exchanger.

10. The outdoor unit according to claim **2**, wherein
said spacer includes an extended part extending diagonally upward from said horizontal surface on said spacer.

11. The outdoor unit according to claim **3**, wherein said spacer is disposed on a lower end of a bent part of said heat exchanger.

12. The outdoor unit according to claim **3**, wherein said spacer includes an extended part extending diagonally upward from said horizontal surface on said spacer.

13. The outdoor unit according to claim **4**, wherein said spacer includes an extended part extending diagonally upward from said horizontal surface on said spacer.

* * * * *