

DESCRIPTION

Title of Invention

AIR DELIVERY STRUCTURE FOR COOLING DEVICE, COOLING DEVICE EQUIPPED WITH SAME, AND COOLING SYSTEM

[Technical Field]

[0001]

The present disclosure relates to an air delivery structure of a cooling device for delivering cooling air cooled by a cooling device into a cooling chamber.

The present application claims priority based on Japanese Patent Application No. 2023-035422 filed in Japan on March 8, 2023, the contents of which are incorporated herein by reference.

[Background Art]

[0002]

The cooling device cools the inside of the cooling chamber such as a warehouse in order to store various materials, processed products, fresh food, and the like in some cases. For example, air in the cooling chamber is mixed with the atmosphere flowing in from an entry way of the cooling chamber or exhalation of a worker working in the cooling chamber in some cases, and there is a case where the amount of moisture contained therein increases. In a case where the cooling device uses an air refrigerant cycle (a method of cooling air extracted from the inside of the cooling chamber and returning the cooled air to the inside of the cooling chamber), there is a concern that the performance of the cooling device reduces or the cooling device is damaged due to the moisture contained in the air in the cooling chamber. In

order to address such a concern, for example, PTL 1 discloses a cooling device including a defroster that collects moisture contained in air flowing from an expander to a cooling chamber as frost.

[Citation List]

[Patent Document]

[0003]

[PTL 1] Japanese Patent No. 6631613

[Summary of Invention]

[Technical Subject]

[0004]

However, in the technique described in PTL 1, the cooling device needs to perform a defrost operation for removing frost from the defroster. For this reason, the cooling device requires a device for performing the defrost operation (for example, a pipe, a valve, and a heater), and there is a concern that the configuration becomes complicated.

[0005]

The present disclosure has been devised in view of the problems described above, and an object thereof is to provide an air delivery structure of a cooling device that can condense or freeze (solidify or sublimate) and remove moisture contained in intake air with a simple configuration and that can suppress a reduction in the cooling performance of the cooling device and damage to the cooling device.

[Subject to be solved]

[0006]

According to an aspect of the present disclosure, in order to achieve the object, there is provided an air delivery structure of a cooling device for delivering cooling air

cooled by the cooling device into a cooling chamber, the air delivery structure including an inflow port for flowing the cooling air cooled by the cooling device into the cooling chamber, an outflow port for flowing cooling chamber air that is the cooling air which has circulated inside the cooling chamber out from the cooling chamber, a first partition wall that partitions the inside of the cooling chamber into a cooling space and an intake space, and a second partition wall that partitions the intake space into an inflow channel that communicates with the inflow port and in which the cooling air cooled by the cooling device circulates toward the cooling space and an outflow channel that communicates with the outflow port and in which the cooling chamber air, which has circulated inside the cooling chamber, circulates toward the outflow port.

[Advantageous Effects of Invention]

[0007]

With the air delivery structure of a cooling device according to the present disclosure, a reduction in the cooling performance of the cooling device and damage to the cooling device which are caused by condensation or freezing of moisture in air can be suppressed with a simple configuration.

[Brief Description of Drawings]

[0008]

Fig. 1 is a diagram schematically showing an example of a configuration of a refrigerated container.

Fig. 2 is a diagram schematically showing an example of a configuration of a cooling device.

Fig. 3 is a diagram schematically showing a configuration of an air delivery structure according to an embodiment.

Fig. 4 is a diagram schematically showing a configuration of an air delivery structure according to some embodiments.

[Description of Embodiments]

[0009]

Hereinafter, an air delivery structure of a cooling device according to an embodiment of the present disclosure will be described based on the drawings. Such an embodiment shows one aspect of the present disclosure, is not limited to this disclosure, and can be freely changed within the scope of the technical idea of the present disclosure.

[0010]

The air delivery structure of a cooling device according to the present disclosure delivers cooling air cooled by a cooling device using an air refrigerant cycle into a cooling chamber. The air refrigerant cycle is a method of cooling air extracted from the inside of the cooling chamber and returning the cooled air into the cooling chamber. The cooling chamber is not particularly limited and is, for example, a cooling chamber of a frozen warehouse and a cooling chamber of a refrigerated container. In the present disclosure, the air delivery structure of a cooling device will be described with the cooling chamber of the refrigerated container as an example.

[0011]

Fig. 1 is a diagram schematically showing an example of a configuration of a refrigerated container 100 (cooling system). As shown in Fig. 1, the refrigerated container 100 includes a cooling chamber 110, a cooling device 112, and an air delivery structure of the cooling device 112 (hereinafter, referred to as an air delivery structure 1) according to the embodiment.

[0012]

The cooling chamber 110 has a rectangular tubular shape. The cooling chamber 110 includes an upper wall, a lower wall, a left wall, a right wall, and a rear wall and has an open front surface. The cooling device 112 is fitted to the front surface of the cooling chamber 110. The inside of the cooling chamber 110 is defined by being surrounded by the upper wall, the lower wall, the left wall, the right wall, the rear wall, and the cooling device 112. Although not shown, the cooling chamber 110 may be provided with a door which is openable and closable on at least one of the left wall, the right wall, and the rear wall such that a worker can enter and exit the cooling chamber 110. In some embodiments, the cooling chamber 110 includes a front wall, and the cooling device 112 is fitted to the front wall.

[0013]

The cooling device 112 supplies cooling air A1 cooled by using the air refrigerant cycle into the cooling chamber 110 via the air delivery structure 1. Then, the cooling device 112 sucks cooling chamber air A2 that is the cooling air A1 which has circulated inside the cooling chamber 110 (a cooling space 3 to be described later) via the air delivery structure 1 and cools the cooling chamber air A2 to generate the cooling air A1.

[0014]

Fig. 2 is a diagram schematically showing an example of a configuration of the cooling device 112. The cooling device 112 is configured to maintain a temperature inside the cooling chamber 110 in a range of -40 degrees or higher and lower than 20 degrees. That is, the refrigerated container 100 (a so-called reefer container) on which the cooling device 112 is mounted is a low-temperature container. In some embodiments, the refrigerated container 100 is an ultra-low temperature container or a cryogenic container that can maintain the temperature inside the cooling

chamber 110 at a temperature lower than -40 degrees.

[0015]

As shown in Fig. 2, the cooling device 112 includes an air line 120, a heat exchanger 122, a compressor 124, an air cooler 126, an expander 128, and a casing 130. In the present disclosure, the refrigerated container 100 includes each of the cooling device 112 and the air delivery structure 1, but the cooling device 112 may include the air delivery structure 1.

[0016]

The air line 120 is configured by, for example, a pipe or a duct and is a flow channel for returning the cooling chamber air A2 sucked from the air delivery structure 1 to the air delivery structure 1 as the cooling air A1. The heat exchanger 122, the compressor 124, the air cooler 126, and the expander 128 are provided at the air line 120 in order from an upstream side in a circulation direction in which the cooling chamber air A2 or the cooling air A1 circulates. In the present disclosure, the cooling chamber air A2 expanded by the expander 128 will be referred to as the cooling air A1.

[0017]

The heat exchanger 122 heats or cools the cooling chamber air A2 sucked from the air delivery structure 1 to a normal temperature (20 degrees to 40 degrees). In the form shown in Fig. 2, the heat exchanger 122 exchanges heat between the cooling chamber air A2 sucked from the air delivery structure 1 and the cooling chamber air A2 cooled to the normal temperature by the air cooler 126 via a heat transfer wall (not shown).

[0018]

The compressor 124 compresses the cooling chamber air A2 brought to a normal temperature by the heat exchanger 122 and raises the temperature and pressure

of the cooling chamber air A2. In the form shown in Fig. 2, the cooling device 112 further includes a motor 132 and a pair of drive shafts 134a and 134b coaxially extending from the motor 132. The compressor 124 is connected to the motor 132 by one drive shaft 134a and is driven by the motor 132. In addition, power generated by the expander 128 is transmitted via the pair of drive shafts 134a and 134b to the compressor 124, and the power of the expander 128 can be used as an auxiliary force for driving.

[0019]

The air cooler 126 cools the cooling chamber air A2, which is compressed by the compressor 124 to have a high temperature and a high pressure, to a normal temperature. The air cooler 126 is, for example, a fin tube type heat exchanger and includes a cooling water flow path through which cooling water flows. The air cooler 126 exchanges heat between the cooling chamber air A2 that has a high temperature and a high pressure and the cooling water and cools the cooling chamber air A2 to a normal temperature. The air cooler 126 may have any configuration insofar as the cooling chamber air A2 can be cooled to the normal temperature. For example, the air cooler 126 may cool the cooling chamber air A2, which has a high temperature and a high pressure air, to a normal temperature by using cooling air instead of the cooling water.

[0020]

The cooling chamber air A2 brought to a normal temperature by the air cooler 126 is supplied to the heat exchanger 122. Then, as described above, the heat exchanger 122 exchanges heat between the cooling chamber air A2 at the normal temperature and the cooling chamber air A2 sucked from the air delivery structure 1 (the cooling chamber air A2 brought to the normal temperature by the air cooler 126 is

precooled). Then, the cooling chamber air A2 precooled by the heat exchanger 122 is supplied to the expander 128.

[0021]

The expander 128 expands the cooling chamber air A2 precooled by the heat exchanger 122 and reduces the temperature and pressure of the cooling chamber air A2 (generates the cooling air A1). The expander 128 is connected to the motor 132 by the other drive shaft 134b and is driven by the motor 132. The cooling air A1 generated by the expander 128 is returned to the air delivery structure 1.

[0022]

The casing 130 accommodates the air line 120, the heat exchanger 122, the compressor 124, the air cooler 126, and the expander 128. The casing 130 functions as the front wall of the cooling chamber 110 when the cooling device 112 is fitted to the front surface of the cooling chamber 110. That is, a part of an outer wall surface 131 of the casing 130 faces the inside of the cooling chamber 110.

[0023]

(Configuration)

A configuration of the air delivery structure 1 according to the embodiment will be described. Fig. 3 is a diagram schematically showing the configuration of the air delivery structure 1 according to the embodiment. As shown in Fig. 3, the air delivery structure 1 includes an inflow port 2, an outflow port 4, a first partition wall 6, and a second partition wall 8.

[0024]

The cooling air A1 cooled by the cooling device 112 flows into the cooling chamber 110 through the inflow port 2. In the embodiment, as shown in Fig. 3, the inflow port 2 is formed by penetrating the outer wall surface 131 of the casing 130,

which faces the inside of the cooling chamber 110.

[0025]

The cooling chamber air A2 that has circulated inside the cooling chamber 110 flows out from the inside of the cooling chamber 110 through the outflow port 4. In the embodiment, as shown in Fig. 3, the outflow port 4 is formed by penetrating the outer wall surface 131, which faces the inside of the cooling chamber 110 of the casing 130. Both the inflow port 2 and the outflow port 4 are formed in the same outer wall surface 131. The outflow port 4 is positioned below the inflow port 2 in an up-down direction D1.

[0026]

The first partition wall 6 partitions the inside of the cooling chamber 110 into the cooling space 3 and an intake space 5. The cooling space 3 is, for example, a space for disposing an object to be stored, such as fresh food. The intake space 5 is a space in which the cooling chamber air A2 taken in from the cooling space 3 and the cooling air A1 blown to the cooling space 3 circulates. That is, as will be described later, the intake space 5 includes each of an inflow channel 7 and an outflow channel 9.

[0027]

In the embodiment, as shown in Fig. 3, the first partition wall 6 extends along the up-down direction D1. Specifically, the first partition wall 6 includes a first inner wall portion 10 extending along the up-down direction D1, a first top cover portion 12 extending from an upper end 10a of the first inner wall portion 10 toward the casing 130, and a cooling air outlet portion 14 extending from a lower end 10b of the first inner wall portion 10 toward the cooling space 3.

[0028]

One surface 11a of the first inner wall portion 10 faces the cooling space 3,

and the other surface 11b on an opposite side to the one surface 11a faces the outer wall surface 131 of the casing 130. The upper end 10a of the first inner wall portion 10 is positioned below an upper wall 110a of the cooling chamber 110. The lower end 10b of the first inner wall portion 10 is positioned above a lower wall 110b of the cooling chamber 110. The first top cover portion 12 is connected to the outer wall surface 131 of the casing 130 and covers the intake space 5 from above. The cooling air outlet portion 14 is positioned above the lower wall 110b of the cooling chamber 110. A gap (an outlet 22 of the inflow channel 7) through which the cooling air A1 circulates is formed between the cooling air outlet portion 14 and the lower wall 110b.

[0029]

The second partition wall 8 partitions the intake space 5 into the inflow channel 7 and the outflow channel 9. One end of the inflow channel 7 communicates with the inflow port 2, the other end communicates with the cooling space 3, and the cooling air A1 cooled by the cooling device 112 circulates toward the cooling space 3. The inflow channel 7 includes the outlet 22 through which the cooling air A1 blows from the intake space 5. In the form shown in Fig. 3, the outlet 22 of the inflow channel 7 is formed between the cooling air outlet portion 14 and the lower wall 110b. One end of the outflow channel 9 communicates with the cooling space 3, the other end communicates with the outflow port 4, and the cooling chamber air A2 that has circulated inside the cooling chamber 110 circulates toward the outflow port 4. The outflow channel 9 includes an inlet 23 that takes in the cooling chamber air A2 into the intake space 5. In the form shown in Fig. 3, the inlet 23 of the outflow channel 9 is formed by penetrating the first top cover portion 12. The inlet 23 of the outflow channel 9, the inflow port 2, the outflow port 4, and the outlet 22 of the inflow channel 7 are positioned in order from up to down.

[0030]

In the embodiment, as shown in Fig. 3, the second partition wall 8 extends along the up-down direction D1. Specifically, the second partition wall 8 includes a second inner wall portion 16 extending along the up-down direction D1, a second top cover portion 18 extending from an upper end 16a of the second inner wall portion 16 toward the casing 130, a cooling chamber air outlet portion 20 extending from the second inner wall portion 16 toward the outflow port 4, and a lower end portion 26 extending downward from a lower end 16b of the second inner wall portion 16.

[0031]

The second inner wall portion 16 is positioned between the first inner wall portion 10 and the casing 130 in a front-rear direction D2 of the refrigerated container 100 (hereinafter, referred to as the front-rear direction D2). That is, the second inner wall portion 16 is positioned in front of the first inner wall portion 10. The upper end 16a of the second inner wall portion 16 is positioned below the upper end 10a of the first inner wall portion 10. The lower end 16b of the second inner wall portion 16 is positioned above the lower end 10b of the first inner wall portion 10. The second top cover portion 18 is connected to the outer wall surface 131 of the casing 130 and covers the inflow channel 7 from above. The cooling chamber air outlet portion 20 has a tubular shape and is connected to the outflow port 4. The cooling chamber air outlet portion 20 is positioned between the upper end 16a and the lower end 16b of the second inner wall portion 16 in the up-down direction D1. In the form shown in Fig. 3, the second partition wall 8 includes a connecting portion 24 that connects the cooling chamber air outlet portion 20 and the second inner wall portion 16. The connecting portion 24 is positioned between the cooling chamber air outlet portion 20 and the second inner wall portion 16 in the front-rear direction D2 and extends

downward toward the front. The connecting portion 24 is inclined toward the casing 130 with respect to the second inner wall portion 16. The lower end portion 26 is positioned below the outflow port 4. The lower end portion 26 approaches the first partition wall 6 toward down side.

[0032]

In the form shown in Fig. 3, the first partition wall 6 extends further downward than the second partition wall 8. The lower end 10b of the first inner wall portion 10 is positioned below the lower end portion 26 of the second partition wall 8. A gap is formed between the first inner wall portion 10 and the lower end portion 26 of the second partition wall 8. In other words, the lower end portion 26 of the second partition wall 8 forms a discharge port 28 between the lower end portion 26 and the first partition wall 6.

[0033]

In the embodiment, as shown in Fig. 3, an opening 30 through which the inflow channel 7 and the outflow channel 9 communicate with each other is formed above the inflow port 2 in the second partition wall 8. In the form shown in Fig. 3, the opening 30 of the second partition wall 8 is formed by penetrating the second top cover portion 18. The air delivery structure 1 further includes a cover portion 32 that covers the opening 30 in a freely openable and closable manner. The opening and closing of the opening 30 by the cover portion 32 may be performed manually by the worker or may be performed automatically by a control device. The control device opens and closes the opening 30, for example, based on a measurement value of a temperature sensor, a humidity sensor, or the like provided inside the cooling chamber 110. For example, the opening 30 is opened when cooling of the inside of the cooling chamber 110 by the cooling device 112 is started and is closed when a temperature

inside the cooling chamber 110 is reduced to a temperature determined in advance.

[0034]

In the embodiment, as shown in Fig. 3, the air delivery structure 1 further includes a fin 38 provided on a surface of the second partition wall 8. The fin 38 is positioned between the inflow port 2 and the outflow port 4 in the up-down direction D1. In the form shown in Fig. 3, the fin 38 is provided on a front surface 39 of the second inner wall portion 16 of the second partition wall 8 on an inflow channel 7 side. In some embodiments, the fins 38 is provided on at least one of both surfaces of the second partition wall 8. In some embodiments, the fin 38 is provided on a rear surface 40 of the second inner wall portion 16 on an outflow channel 9 side.

[0035]

(Actions and Effects)

Actions and effects of the air delivery structure 1 according to the embodiment will be described. When the cooling chamber air A2 sucked by the cooling device 112 contains moisture, for example, the moisture adhere to the heat transfer wall of the heat exchanger 122, and there is a concern that the performance of the heat exchanger 122 is reduced. In addition, there is a concern that ice generated by freezing of the moisture contained in the cooling chamber air A2 causes mechanical damage to the expander 128.

[0036]

In order to address such a concern, according to the embodiment, the first partition wall 6 partitions the inside of the cooling chamber 110 into the cooling space 3 and the intake space 5, and the second partition wall 8 partitions the intake space 5 into the inflow channel 7 and the outflow channel 9. For this reason, the cooling air A1 circulating in the inflow channel 7 and the cooling chamber air A2 circulating in

the outflow channel 9 are caused to exchange heat with each other via the second partition wall 8, and the temperature of the cooling chamber air A2 circulating in the outflow channel 9 can be lowered. When the temperature of the cooling chamber air A2 drops, the moisture contained in the cooling chamber air A2 is condensed or frozen. For this reason, with a simple configuration where the first partition wall 6 and the second partition wall 8 are provided, it is possible to remove the moisture contained in the cooling chamber air A2 before being sucked into the cooling device 112 and to suppress a reduction in the performance of the heat exchanger 122 or mechanical damage to the expander 128. In particular, since the air delivery structure 1 according to the embodiment is applied to the low-temperature container in which the amount of moisture inside the cooling chamber 110 is likely to increase due to the entry and exit of the worker, the effect described above is greatly exhibited. The air delivery structure 1 according to the present disclosure may be applied to a cooling system other than the refrigerated container 100, such as a frozen warehouse.

[0037]

According to the embodiment, since each of the first partition wall 6 and the second partition wall 8 extends along the up-down direction D1, the width of the intake space 5 in the front-rear direction D2 can be shortened, and the cooling space 3 can be widely secured in the front-rear direction D2.

[0038]

According to the embodiment, since the inlet 23 of the outflow channel 9, the inflow port 2, the outflow port 4, and the outlet 22 of the inflow channel 7 are positioned in order from up to down, it is easy to overlap the inflow channel 7 and the outflow channel 9 each other between the inflow port 2 and the outflow port 4 in the up-down direction D1. That is, as shown in Fig. 3, a heat exchange region R suitable

for heat exchange between the cooling air A1 circulating in the inflow channel 7 and the cooling chamber air A2 circulating in the outflow channel 9 can be formed in the second partition wall 8. For this reason, heat exchange efficiency between the cooling chamber air A2 and the cooling air A1 can be improved. In the form shown in Fig. 3, the heat exchange region R is positioned above the connecting portion 24 in the second inner wall portion 16. A portion of the second partition wall 8 excluding the heat exchange region R may be configured to block heat exchange between the cooling chamber air A2 and the cooling air A1 or may be configured to allow the heat exchange between the cooling chamber air A2 and the cooling air A1.

[0039]

According to the embodiment, since the heat exchange region R is formed in the second inner wall portion 16, moisture contained in the cooling chamber air A2 circulating in the outflow channel 9 can be adhered to the rear surface 40 of the second inner wall portion 16, and the adhered moisture (condensed water or ice) can be guided downward. Then, according to the embodiment, the moisture guided downward can be discharged from the outflow channel 9 since the discharge port 28 is formed. Although not shown, in some embodiments, the air delivery structure 1 further includes a drain collector that is disposed below the discharge port 28 and that collects the moisture discharged from the outflow channel 9.

[0040]

According to the embodiment, since the lower end portion 26 of the second partition wall 8 approaches the first inner wall portion 10 of the first partition wall 6 toward down side, flowing of the cooling air A1 from the inflow channel 7 to the outflow channel 9 can be suppressed.

[0041]

According to the embodiment, since the air delivery structure 1 includes the cover portion 32 that covers the opening 30, which is formed in the second top cover portion 18 of the second partition wall 8, in a freely openable and closable manner, the cooling air A1 can flow into the outflow channel 9 to cool the cooling chamber air A2 and remove moisture contained in the cooling chamber air A2.

[0042]

According to the embodiment, since the air delivery structure 1 includes the fin 38, cooling of the cooling chamber air A2 caused by heat exchange between the cooling chamber air A2 and the cooling air A1 can be promoted.

[0043]

Fig. 4 is a diagram schematically showing a configuration of the air delivery structure 1 according to some embodiments. In the form shown in Fig. 4, the first partition wall 6 includes an up-down wall portion 50 extending along the up-down direction D1. The second partition wall 8 includes a front-rear wall portion 52 that connects the first partition wall 6 and the casing 130 and that extends along the front-rear direction D2. That is, the second partition wall 8 partitions the intake space 5 into the inflow channel 7 and the outflow channel 9 positioned above the inflow channel 7. Although not shown, a through-hole penetrating along the up-down direction D1 may be formed in the second partition wall 8. Although not shown, the second partition wall 8 may extend (be inclined) downward from the casing 130 toward the first partition wall 6. Then, a rear end of the second partition wall 8 is separated from the first partition wall 6.

[0044]

In the form shown in Fig. 4, a portion of the air line 120 from the expander 128 to the inflow port 2 will be referred to as a downstream portion 54, and a portion

from the outflow port 4 to the heat exchanger 122 will be referred to as an upstream portion 56. The air delivery structure 1 includes a connection line 58 that connects the downstream portion 54 and the upstream portion 56 of the air line 120, and a valve 60 provided at the connection line 58. When the valve 60 is opened, some of the cooling air A1 circulating in the downstream portion 54 flows into the connection line 58 and circulates toward the upstream portion 56. Then, some of the cooling air A1 flows into the upstream portion 56, and the cooling chamber air A2 circulating in the upstream portion 56 is cooled, and moisture contained in the cooling chamber air A2 is removed.

[0045]

In the form shown in Fig. 4, the air delivery structure 1 includes a separator 59 provided to include a position to which the connection line 58 is connected in the upstream portion 56 of the air line 120. The separator 59 removes moisture (condensed water or ice) generated by the cooling air A1 merging with the cooling chamber air A2 from the air line 120.

[0046]

The content described in each of the embodiments is understood, for example, as follows.

[0047]

[1] An air delivery structure of a cooling device (1) according to the present disclosure is an air delivery structure of a cooling device for delivering cooling air (A1) cooled by a cooling device (112) using an air refrigerant cycle into a cooling chamber (110) and includes:

an inflow port (2) for flowing the cooling air cooled by the cooling device into the cooling chamber;

an outflow port (4) for flowing cooling chamber air (A2) that is the cooling air which has circulated inside the cooling chamber out from an inside of the cooling chamber;

a first partition wall (6) that partitions the inside of the cooling chamber into a cooling space (3) and an intake space (5); and

a second partition wall (8) that partitions the intake space into an inflow channel (7) that communicates with the inflow port and in which the cooling air cooled by the cooling device circulates toward the cooling space and an outflow channel (9) that communicates with the outflow port and in which the cooling chamber air, which has circulated inside the cooling chamber, circulates toward the outflow port.

[0048]

With the configuration according to [1], the first partition wall partitions the inside of the cooling chamber into the cooling space and the intake space, and the second partition wall partitions the intake space into the inflow channel and the outflow channel. Therefore, the cooling air circulating in the inflow channel and the cooling chamber air circulating in an outflow channel can be caused to exchange heat with each other, and the temperature of the cooling chamber air circulating in the outflow channel can be lowered. When the temperature of the cooling chamber air drops, moisture contained in the cooling chamber air is condensed or frozen. For this reason, with a simple configuration where the first partition wall and the second partition wall are provided, it is possible to remove the moisture contained in the cooling chamber air before being sucked into the cooling device and to suppress a reduction in the performance of the cooling device or damage to the cooling device.

[0049]

[2] In some embodiments, in the configuration according to [1],

each of the first partition wall and the second partition wall extends in an up-down direction (D1).

[0050]

With the configuration according to [2], one length (for example, a width in the front-rear direction) of the intake space in a horizontal direction can be shortened, and the cooling space can be widely secured.

[0051]

[3] In some embodiments, in the configuration according to [2], the inflow channel includes an outlet (22) through which the cooling air blows from the intake space,

the outflow channel includes an inlet (23) through which the cooling chamber air is taken into the intake space, and

the inlet of the outflow channel, the inflow port, the outflow port, and the outlet of the inflow channel are positioned in order from up to down.

[0052]

With the configuration according to [3], it is easy to overlap the inflow channel and the outflow channel each other between the inflow port and the outflow port in the up-down direction. For this reason, heat exchange efficiency between the cooling chamber air and the cooling air can be improved.

[0053]

[4] In some embodiments, in the configuration according to [3], the first partition wall extends further downward than the second partition wall, and

the second partition wall includes a lower end portion (26) that is positioned below the outflow port and that has a discharge port (28) formed between the lower

end portion and the first partition wall.

[0054]

With the configuration according to [4], moisture (condensed water or ice) generated by cooling of the cooling chamber air circulating in the outflow channel can be discharged from the outflow channel.

[0055]

[5] In some embodiments, in the configuration according to [4], the lower end portion of the second partition wall approaches the first partition wall toward down side.

[0056]

With the configuration according to [5], flowing of the cooling air from the inflow channel to the outflow channel can be suppressed.

[0057]

[6] In some embodiments, in the configuration according to any one of [3] to [5],

an opening (30) through which the inflow channel and the outflow channel communicate with each other is formed above the inflow port in the second partition wall, and

the air delivery structure further comprises a cover portion (32) that covers the opening in a freely openable and closable manner.

[0058]

With the configuration according to [6], the cooling chamber air can be cooled by causing the cooling air to flow into the outflow channel, and moisture contained in the cooling chamber air can be removed.

[0059]

[7] In some embodiments, in the configuration according to any one of [3] to [6],

a fin (38) that is provided on a surface of the second partition wall and that is positioned between the inflow port and the outflow port in the up-down direction is further included.

[0060]

With the configuration according to [7], cooling of the cooling chamber air caused by heat exchange between the cooling chamber air and the cooling air can be promoted.

[0061]

[8] A cooling device according to the present disclosure including:

the air delivery structure of a cooling device according to any one of [1] to [7].

[0062]

With the configuration according to [8], the cooling system that can suppress a reduction in the performance of the cooling device or damage to the cooling device can be provided with a simple configuration.

[0063]

[9] A cooling system (100) according to the present disclosure includes:

a cooling chamber (110) that has a tubular shape;

a cooling device (112) that cools air inside the cooling chamber; and

the air delivery structure of a cooling device according to any one of [1] to [7].

[0064]

With the configuration according to [9], the cooling system that can suppress a reduction in the performance of the cooling device or damage to the cooling device can be provided with a simple configuration.

[Reference Signs List]

[0065]

1 air delivery structure

2 inflow port

3 cooling space

4 outflow port

5 intake space

6 first partition wall

7 inflow channel

8 second partition wall

9 outflow channel

10 first inner wall portion

12 first top cover portion

14 cooling air outlet portion

16 second inner wall portion

18 second top cover portion

20 cooling chamber air outlet portion

22 outlet of inflow channel

23 inlet of outflow channel

24 connecting portion

26 lower end portion

28 discharge port

30 opening

32 cover portion

38 fin

50 up-down wall portion
52 front-rear wall portion
54 downstream portion
56 upstream portion
58 connection line
60 valve
100 refrigerated container
110 cooling chamber
112 cooling device
120 air line
122 heat exchanger
124 compressor
126 air cooler
128 expander
130 casing
131 outer wall surface
132 motor
A1 cooling air
A2 cooling chamber air
D1 up-down direction
D2 front-rear direction

Claims

[Claim 1]

An air delivery structure of a cooling device for delivering cooling air cooled by the cooling device into a cooling chamber, the air delivery structure comprising:

an inflow port for flowing the cooling air cooled by the cooling device into the cooling chamber;

an outflow port for flowing cooling chamber air that is the cooling air which has circulated inside the cooling chamber out from an inside of the cooling chamber;

a first partition wall that partitions the inside of the cooling chamber into a cooling space and an intake space; and

a second partition wall that partitions the intake space into an inflow channel that communicates with the inflow port and in which the cooling air cooled by the cooling device circulates toward the cooling space and an outflow channel that communicates with the outflow port and in which the cooling chamber air, which has circulated inside the cooling chamber, circulates toward the outflow port.

[Claim 2]

The air delivery structure of a cooling device according to Claim 1,

wherein each of the first partition wall and the second partition wall extends in an up-down direction.

[Claim 3]

The air delivery structure of a cooling device according to Claim 2,

wherein the inflow channel includes an outlet through which the cooling air

blows from the intake space,

the outflow channel includes an inlet through which the cooling chamber air is taken into the intake space, and

the inlet of the outflow channel, the inflow port, the outflow port, and the outlet of the inflow channel are positioned in order from up to down.

[Claim 4]

The air delivery structure of a cooling device according to Claim 3,

wherein the first partition wall extends further downward than the second partition wall, and

the second partition wall includes a lower end portion that is positioned below the outflow port and that has a discharge port formed between the lower end portion and the first partition wall.

[Claim 5]

The air delivery structure of a cooling device according to Claim 4,

wherein the lower end portion of the second partition wall approaches the first partition wall toward down side.

[Claim 6]

The air delivery structure of a cooling device according to any one of Claims 3 to 5,

wherein an opening through which the inflow channel and the outflow channel communicate with each other is formed above the inflow port in the second partition wall, and

the air delivery structure further comprises a cover portion that covers the opening in a freely openable and closable manner.

[Claim 7]

The air delivery structure of a cooling device according to any one of Claims 3 to 5, further comprising:

a fin that is provided on a surface of the second partition wall and that is positioned between the inflow port and the outflow port in the up-down direction.

[Claim 8]

A cooling device comprising:

the air delivery structure of a cooling device according to any one of Claims 1 to 5.

[Claim 9]

A cooling system comprising:

a cooling chamber that has a tubular shape;

a cooling device that cools air inside the cooling chamber; and

the air delivery structure of a cooling device according to any one of Claims 1 to 5.