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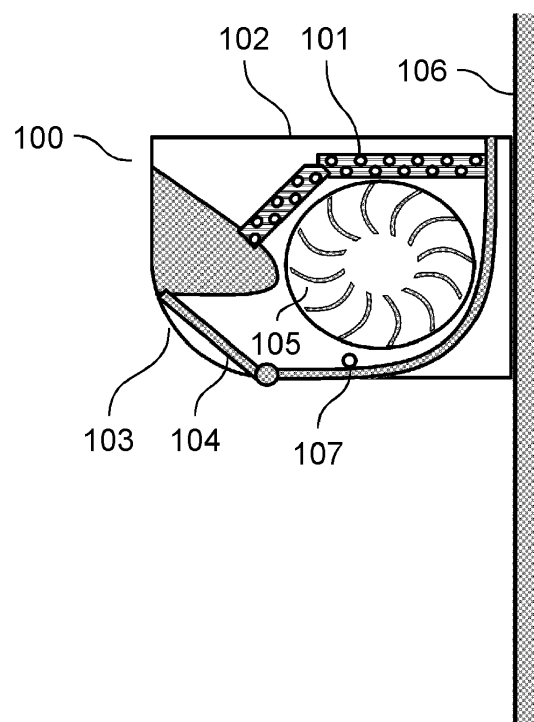
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(54) **AIR CONDITIONER**

(57) An air conditioner in the present disclosure is an air conditioner including a refrigeration cycle in which indoor heat exchanger of indoor unit and an outdoor heat exchanger of an outdoor unit, a compressor, and a throttle device are connected via pipes to one another in a closed circuit, the refrigeration cycle using a flammable coolant. The air conditioner includes: blower fan that receives air that has passed through indoor heat exchanger and blows the air to air outlet of the indoor unit; flap that adjusts an orientation of the air blown out from air outlet into a room; and a control device that controls blower fan and flap, wherein the control device closes the flap in an event of stopping the blower fan while the air conditioner keeps running.

FIG. 1



Description

BACKGROUND

1. Technical Field

[0001] The present disclosure relates to an air conditioner composed of a refrigeration cycle using a flammable coolant made of propane (R290), isobutane (R600a), ethane (R170) or the like.

2. Description of the Related Art

[0002] In order to suppress global warming, a coolant of an air conditioner is required to be switched to a coolant with a low global warming potential (GWP). Under such a circumstance, PTL 1 discloses an air conditioner using a flammable coolant such as hydrocarbon as the coolant with a low GWP. This air conditioner stops a flow of the coolant by a shutoff valve, and avoids danger of fire. This air conditioner includes sensors, each of which detects a leak of the coolant, in a heat exchange chamber and a machine chamber in an indoor unit. The air conditioner further includes, in the indoor unit, such a shutoff valve that shuts off a flow of the coolant between the indoor unit and an outdoor unit. When the leak of the coolant in the indoor unit is detected by the above-described sensors, the air conditioner stops the flow of the coolant by the above-described shutoff valve, and avoids the danger of fire.

Citation List

Patent Literature

[0003] PTL 1: Japanese Patent No. 3744330

SUMMARY

[0004] The present disclosure provides an air conditioner that does not form a flammable region immediately below the indoor unit even if the coolant leaks in the indoor unit during thermo OFF of the indoor unit.

[0005] An air conditioner in the present disclosure has a refrigeration cycle in which an indoor heat exchanger of an indoor unit and an outdoor heat exchanger of an outdoor unit, a compressor, and a throttle device are connected via pipes to one another in a closed circuit, the refrigeration cycle using a flammable coolant, the air conditioner including: a blower fan that receives air that has passed through the indoor heat exchanger and blows the air to an air outlet of the indoor unit; a flap that adjusts an orientation of the air blown out from the air outlet into a room; and a control device that controls the blower fan and the flap, wherein the control device closes the flap in an event of stopping the blower fan while the air conditioner keeps running.

[0006] The air conditioner in the present disclosure

closes the flap when the blower fan stops. When the flammable coolant has leaked in the indoor unit, the flap can suppress a phenomenon that the flammable coolant leaks into the room from the air outlet and forms a flammable region containing the flammable coolant in a high concentration. The air conditioner can further enhance the safety when the flammable coolant leaks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIG. 1 is a cross-sectional view of an indoor unit of an air conditioner in a first exemplary embodiment of the present disclosure; and

FIG. 2 is a cross-sectional view of an indoor unit of an air conditioner in a second exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION

[0008] An air conditioner according to a first disclosure is an air conditioner having a refrigeration cycle in which an indoor heat exchanger of an indoor unit and an outdoor heat exchanger of an outdoor unit, a compressor, and a throttle device are connected via pipes to one another in a closed circuit, the refrigeration cycle using a flammable coolant, the air conditioner including: a blower fan that receives air that has passed through the indoor heat exchanger and blows the air to an air outlet of the indoor unit; a flap that adjusts an orientation of the air blown out from the air outlet into a room; and a control device that controls the blower fan and the flap, wherein the control device closes the flap in an event of stopping the blower fan while the air conditioner keeps running. The air conditioner closes the flap when the blower fan of the indoor unit stops. When the flammable coolant has leaked in the indoor unit, the air conditioner closes the flap, and can thereby suppress a phenomenon that the flammable coolant leaks into the room from the air outlet and forms a flammable region containing the flammable coolant in a high concentration. The air conditioner can further enhance safety when the flammable coolant leaks.

[0009] In particular, in addition to the feature of the air conditioner of the first disclosure, in an air conditioner according to a second disclosure, the indoor unit may include a leak detection sensor, and when the control device determines that the flammable coolant has leaked based on an output of the leak detection sensor, the control device may operate the blower fan, and may control the flap to turn an orientation of the air upward with respect to a horizontal plane. The control device turns the flap upward with respect to the horizontal plane in an event where the leak detection sensor has detected the flammable coolant. Thus, the air conditioner will suppress the flammable region from being formed immediately below the indoor unit, will diffuse the flammable coolant, and can further enhance the safety at the time when the

flammable coolant leaks.

[0010] In particular, in addition to the feature of the air conditioner of the first disclosure, in an air conditioner according to a third disclosure, the flap may open and close downward, and the flap may be provided with a structure of completely closing the air outlet of the indoor unit in an event of closing. In the indoor unit including the flap that opens and closes downward, a tip end of the flap is in contact with a bottom surface of the indoor unit. Therefore, if the air outlet cannot be completely closed, the flammable coolant with a high concentration leaks into the room from the bottom surface of the indoor unit. The air conditioner includes the flap having a length to make it possible to completely close the air outlet, will be thereby able to suppress the flammable region from being formed immediately below the indoor unit, and can further enhance the safety at the time when the flammable coolant leaks.

[0011] In particular, in addition to the feature of the air conditioner of any one of the first to third disclosures, in an air conditioner according to a fourth disclosure, the indoor unit may have a display unit, the display unit indicating that the air conditioner is under operation when the blower fan stops while the air conditioner keeps running. For example, a front panel of the indoor unit may include a display indicating that the air conditioner is under operation. The display can notify a user of a state in which the air conditioner is under operation even when the fan stops and the flap is closed while the air conditioner keeps running. The air conditioner can prevent a decrease of comfortability of the user due to safety measures at the time when the flammable coolant leaks.

[0012] In particular, in addition to the feature of the air conditioner of any one of the first to fourth disclosures, in an air conditioner according to a fifth disclosure, the control device may cause a remote controller for operating the air conditioner to indicate that the air conditioner is under operation, when the blower fan stops while the air conditioner keeps running. Even when the fan stops and the flap is closed while the air conditioner keeps running, the control device causes the remote controller to indicate that the air conditioner is under operation, and can thereby notify the user of an operation state. The air conditioner can prevent the decrease of comfortability of the user due to the safety measures at the time when the flammable coolant leaks.

[0013] In particular, in addition to the feature of the air conditioner of any one of the first to fourth disclosures, in an air conditioner according to a sixth disclosure, the control device may cause a communication terminal other than the remote controller to display that the air conditioner is under operation when the blower fan stops while the air conditioner keeps running. Even when the fan stops and the flap is closed while the air conditioner keeps running, the control device causes, for example, a personal communication terminal to display that the air conditioner is under operation, and can thereby notify the user of an operation state. The air conditioner can prevent

the decrease of comfortability of the user due to the safety measures at the time when the flammable coolant leaks.

[0014] Exemplary embodiments of the present disclosure will be described below with reference to the drawings. However, detailed descriptions more than necessary may be omitted. For example, a detailed description of a matter which is already well-known, or a repetitive description for a substantially identical configuration may be omitted.

[0015] Note that the attached drawings and the following description are provided for those skilled in the art to fully understand the present disclosure, and are not intended to limit the subject matter as described in the appended claims.

(First exemplary embodiment)

[0016] FIG. 1 illustrates a cross section of an indoor unit of an air conditioner in a first exemplary embodiment of the present disclosure.

[0017] The air conditioner uses a coolant gas having flammability, for example, uses a flammable coolant composed of propane (R290), isobutane (R600a), ethane (R170), or the like. Indoor unit 100 includes: indoor heat exchanger 101; and cross flow fan 105. Air is introduced from suction port 102, passes through indoor heat exchanger 101 and cross flow fan 105, and is blown out from air outlet 103. In order to adjust a direction of blowing out air, indoor unit 100 includes flap 104 in the vicinity of air outlet 103. The air conditioner has a refrigeration cycle including: indoor heat exchanger 101 of the indoor unit; and an outdoor heat exchanger of an outdoor unit, a compressor, and a throttle device; and pipes which connect these to one another.

[0018] Indoor unit 100 includes a control device that stops cross flow fan 105 in a case of a thermo OFF state even while the air conditioner keeps running. In that event, the control device closes flap 104 at the same time. Even when the flammable coolant has leaked in indoor unit 100 in the event where cross flow fan 105 of indoor unit 100 stops, the air conditioner can suppress a phenomenon that the flammable coolant leaks into a room from indoor unit 100 and forms a flammable region immediately below indoor unit 100, the flammable region containing the flammable coolant in a high concentration.

[0019] Moreover, the control device always closes flap 104 in a state where cross flow fan 105 stops. The flammable coolant that has leaked in indoor unit 100 is prone to be retained in indoor unit 100. Thus, leak detection sensor 107 can detect the flammable coolant in a short time.

[0020] In the event where the flammable coolant is detected by leak detection sensor 107, the control device may operate cross flow fan 105 and may turn an orientation of flap 104 upward with respect to a horizontal plane. Thus, the flammable coolant will be diffused, and the flammable region is suppressed from being formed immediately below indoor unit 100.

[0021] Hence, the air conditioner can further enhance safety when the flammable coolant leaks.

[0022] Note that indoor unit 100 may include a display on a panel surface in order to indicate that the air conditioner is under operation even when the fan stops. Indoor unit 100 may indicate, on a remote controller, that the air conditioner is under operation. Indoor unit 100 may transmit a notice that the air conditioner is under operation to a personal communication terminal (for example, a smartphone or a tablet). Thus, the air conditioner can notify a user of an operation state thereof even when the fan stops and the flap is closed while the air conditioner keeps running. The air conditioner can prevent the decrease of comfortability of the user due to the safety measures at the time when the flammable coolant leaks.

(Second exemplary embodiment)

[0023] FIG. 2 illustrates a cross section of an indoor unit of an air conditioner in a second exemplary embodiment of the present disclosure.

[0024] Unlike the indoor unit in the first exemplary embodiment, indoor unit 100 includes downward flap 108 that opens and closes downward. Downward flap 108 is provided with a length to completely close air outlet 103 in the event of closing. In indoor unit 100, a tip end of flap 108 comes into contact with a bottom surface of indoor unit 100. If flap 108 cannot completely close air outlet 103, the flammable coolant with a high concentration leaks from the bottom surface of indoor unit 100. Indoor unit 100 includes flap 108 with a length to make it possible to close air outlet 103. Thus, the air conditioner will be able to suppress the flammable region from being formed immediately below the indoor unit, and the safety at the time when the flammable coolant leaks can be further enhanced.

[0025] The technology disclosed in the present specification can also be applied to an instrument filled with the flammable coolant, such as a refrigerating instrument, as well as the air conditioner.

the flap,
wherein the control device closes the flap in an event of stopping the blower fan while the air conditioner keeps running.

2. The air conditioner according to claim 1, wherein the indoor unit includes a leak detection sensor, and when the control device determines that the flammable coolant has leaked based on an output of the leak detection sensor, the control device operates the blower fan, and controls the flap to turn an orientation of the air upward with respect to a horizontal plane.
3. The air conditioner according to claim 1, wherein the flap opens and closes downward, and the flap is provided with a structure of completely closing the air outlet of the indoor unit in an event of closing.
4. The air conditioner according to any one of claims 1 to 3, wherein the indoor unit includes a display unit, the display unit indicating that the air conditioner is under operation, when the blower fan stops while the air conditioner keeps running.
5. The air conditioner according to any one of claims 1 to 4, wherein the control device causes a remote controller for operating the air conditioner to indicate that the air conditioner is under operation, when the blower fan stops while the air conditioner keeps running.
6. The air conditioner according to any one of claims 1 to 4, wherein the control device causes a communication terminal other than a remote controller to display that the air conditioner is under operation when the blower fan stops while the air conditioner keeps running.

Claims

1. An air conditioner including a refrigeration cycle in which an indoor heat exchanger of an indoor unit and an outdoor heat exchanger of an outdoor unit, a compressor, and a throttle device are connected via pipes to one another in a closed circuit, the refrigeration cycle using a flammable coolant, the air conditioner comprising:

a blower fan that receives air that has passed through the indoor heat exchanger and blows the air to an air outlet of the indoor unit;
a flap that adjusts an orientation of the air blown out from the air outlet into a room; and
a control device that controls the blower fan and

FIG. 1

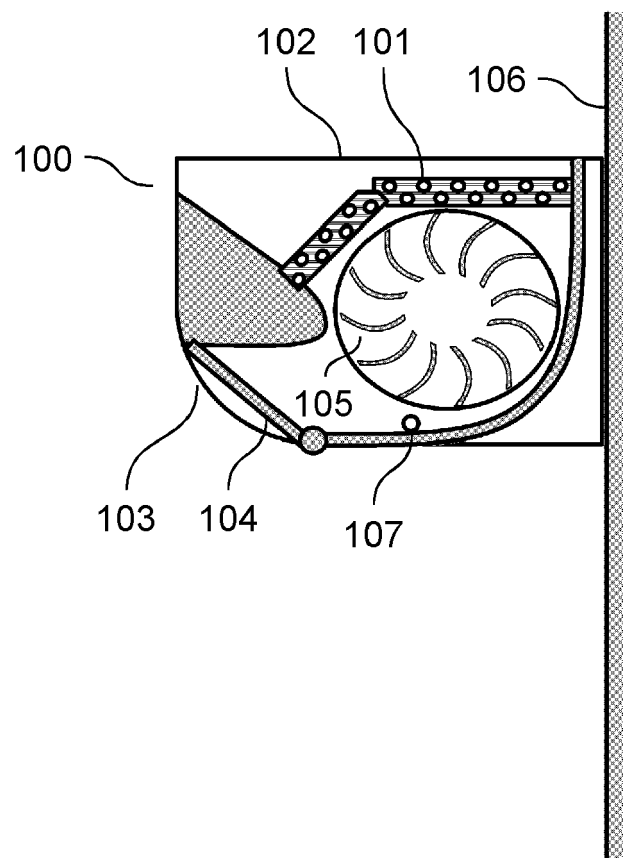
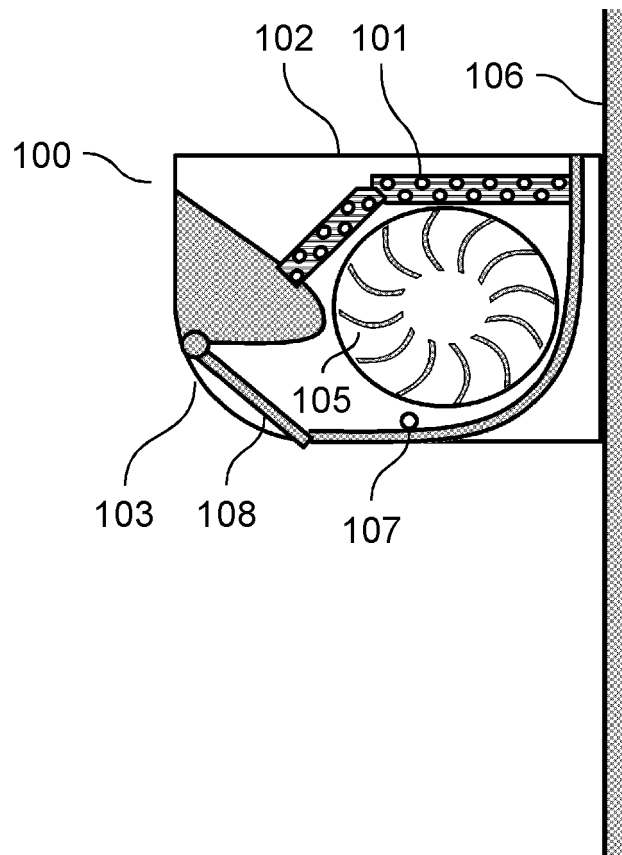


FIG. 2





EUROPEAN SEARCH REPORT

Application Number

EP 21 20 3572

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EPO FORM 1503 03/82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2017 053501 A (DAIKIN IND LTD) 16 March 2017 (2017-03-16)	1-5	INV. F24F1/0003
Y	* paragraph [0046]; figures 1-13 * -----	6	F24F11/36 F24F11/52
X	WO 2019/077696 A1 (MITSUBISHI ELECTRIC CORP [JP]) 25 April 2019 (2019-04-25)	1-5	F24F11/63 F24F11/77
Y	* paragraphs [0032], [0033]; figures 1-9 * -----	6	F24F11/79
X	JP 2016 217567 A (MITSUBISHI HEAVY IND LTD) 22 December 2016 (2016-12-22) * paragraphs [0042] - [0044]; figures 1-8 * -----	1-3	
X	JP 2019 052785 A (FUJITSU GENERAL LTD) 4 April 2019 (2019-04-04) * paragraphs [0031] - [0034], [0047] - [0048]; figures 1-5 * -----	1-3	
Y	JP 6 408324 B2 (HITACHI APPLIANCES INC) 17 October 2018 (2018-10-17) * paragraph [0052] * -----	6	TECHNICAL FIELDS SEARCHED (IPC) F24F
Y	EP 2 857 771 A1 (DAIKIN IND LTD [JP]) 8 April 2015 (2015-04-08) * paragraph [0033] * -----	6	
A	JP 2015 094512 A (DAIKIN IND LTD) 18 May 2015 (2015-05-18) * paragraphs [0042], [0048], [0050] - [0052]; figures 1-7 * -----	1-6	
A	JP 2011 127847 A (MITSUBISHI ELECTRIC CORP) 30 June 2011 (2011-06-30) * paragraph [0013]; figures 1-2 * -----	1-6	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 March 2022	Examiner Valenza, Davide
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 20 3572

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-03-2022

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50

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2017053501 A	16-03-2017	JP 6638266 B2	29-01-2020
		JP 2017053501 A	16-03-2017
WO 2019077696 A1	25-04-2019	JP 6958627 B2	02-11-2021
		JP WO2019077696 A1	10-09-2020
		WO 2019077696 A1	25-04-2019
JP 2016217567 A	22-12-2016	JP 6479569 B2	06-03-2019
		JP 2016217567 A	22-12-2016
JP 2019052785 A	04-04-2019	NONE	
JP 6408324 B2	17-10-2018	JP 6408324 B2	17-10-2018
		JP 2016070568 A	09-05-2016
EP 2857771 A1	08-04-2015	CN 104364585 A	18-02-2015
		EP 2857771 A1	08-04-2015
		JP 2013250038 A	12-12-2013
		US 2015159931 A1	11-06-2015
		WO 2013183414 A1	12-12-2013
JP 2015094512 A	18-05-2015	NONE	
JP 2011127847 A	30-06-2011	JP 5208100 B2	12-06-2013
		JP 2011127847 A	30-06-2011

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 3744330 B [0003]