



(11) **EP 3 106 796 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.12.2016 Bulletin 2016/51

(51) Int Cl.:
F25C 5/00 (2006.01) **F25D 23/02 (2006.01)**
F25D 11/02 (2006.01)

(21) Application number: **15186858.5**

(22) Date of filing: **25.09.2015**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA

(71) Applicant: **Dongbu Daewoo Electronics
Corporation**
Seoul 06194 (KR)

(72) Inventor: **KOO, Min Bon**
06194 Seoul (KR)

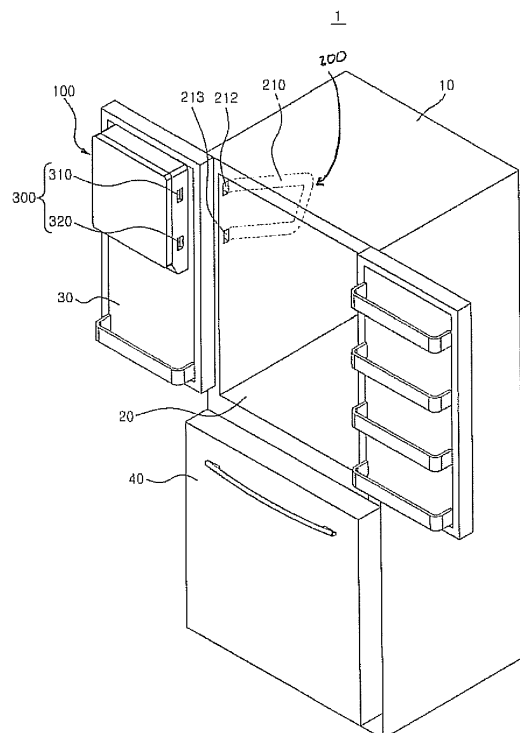
(74) Representative: **Rau, Schneck & Hübner**
Patentanwälte Rechtsanwälte PartGmbB
Königstraße 2
90402 Nürnberg (DE)

(30) Priority: **17.06.2015 KR 20150085588**

(54) **REFRIGERATOR AND ICE MAKING METHOD THEREFOR**

(57) A refrigerator and an ice making method therefor is disclosed. The refrigerator comprises a refrigerator body (10), a storage space defined in the refrigerator body, a door (30) that opens and closes the storage space, an ice making unit (100) that makes ice cubes, a cool air producing unit (200) that cools air inside a cooling duct (210) to produce cool air, and a cool air circulation unit (300) that supplies the cool air from the cool air producing unit to the ice making unit and discharges air from the ice making unit to the cool air producing unit.

FIG. 1



EP 3 106 796 A1

Description

Related Applications

[0001] This application is based on and claims priority to Korean Patent Application No. 10-2015-0085588, filed on June 17, 2015, the disclosure of which is incorporated herein in its entirety by reference. This application is related to Korean Patent Application Publication No. 10-2005-0098135 (published on October 11, 2005), the disclosure of which is incorporated herein in its entirety by reference.

Field of the Invention

[0002] Embodiments of the present invention generally relate to a refrigerator and an ice making method therefor.

Background

[0003] A refrigerator is an appliance that functions to store food at low temperatures, and may be configured to store food in a frozen state or in a cooled state according to the kinds of food to be stored.

[0004] The inside of a refrigerator is cooled by cool air continuously supplied to the inside of the refrigerator. Here, the cool air is continuously produced by a heat exchanging operation between air and refrigerant performed in a refrigeration cycle composed of four processes: compression, condensation, expansion, and evaporation that are sequentially performed. Cool air supplied to the inside of the refrigerator is evenly distributed to the interior of the refrigerator due to convection of air, so that the cool air can store food inside the refrigerator maintained at a desired temperature.

[0005] The body of a refrigerator typically has a rectangular hexahedral shape with a front opening, with a refrigerator compartment and a freezer compartment defined in the refrigerator body. The front of the refrigerator body may be provided with both a refrigerator compartment door and a freezer compartment door that can open or close the refrigerator compartment and the freezer compartment, respectively. The storage space defined inside the refrigerator may be provided with a plurality of drawers, shelves, and boxes designed to store various kinds of food in an optimal state.

[0006] In the related art, a top mount type refrigerator (in which the freezer compartment is provided in the upper part of the refrigerator body and the refrigerator compartment is in the lower part of the refrigerator body) has been commonly used. However, in recent years, for improved convenience of users, a bottom freezer type refrigerator in which the freezer compartment is in the lower part of the refrigerator body has been proposed and used. Here, the bottom freezer type refrigerator is advantageous in that the relatively frequently used refrigerator compartment is provided in the upper part of the refrigerator body and the less frequently used freezer com-

partment is provided in the lower part of the refrigerator body, thereby allowing users to more efficiently use the refrigerator compartment. However, the bottom freezer type refrigerator in which the freezer compartment is in the lower part is problematic in that to take ice cubes from the freezer compartment, requires a user to open the freezer compartment door and to bend over to take ice cubes.

[0007] In an effort to solve the problem, in recent years, a refrigerator in which an ice dispenser for dispensing ice cubes is provided in a refrigerator compartment door placed in the upper part of a bottom freezer type refrigerator has been proposed and used. In this refrigerator, an ice making device for making ice cubes may be provided in the refrigerator compartment door or inside the refrigerator compartment.

[0008] For example, in a bottom freezer type refrigerator having an ice making device in the refrigerator compartment door, cool air, that has been produced by an evaporator, is divided and discharged both into the freezer compartment and into the refrigerator compartment. Here, cool air that was discharged into the freezer compartment flows to the ice making device via a cool air supply duct arranged in a sidewall of the refrigerator body, and then freezes water while circulating inside the ice making device. Thereafter, the cool air is discharged from the ice making device into the refrigerator compartment via a cool air restoration duct arranged in the sidewall of the refrigerator body, so the cool air can reduce the temperature inside the refrigerator compartment.

[0009] Here, to make ice cubes using the ice making device in the above-mentioned refrigerator, cool air flows to the ice making device via the cool air supply duct and flows from the ice making device via the cool air restoration duct, so cool air supply efficiency of the refrigerator is reduced due to the flowing of cool air via both the cool air supply duct and the cool air restoration duct.

[0010] Further, it is required to supply the cool air of the freezer compartment to the ice making device when supplying cool air to the refrigerator, so the refrigerator may waste an excessive amount of electricity during a continuous operation of the refrigerator.

SUMMARY OF THE INVENTION

[0011] Accordingly, the present invention has been made keeping in mind the above problems occurring in the related art, and the embodiments of the present invention propose a refrigerator and an ice making method therefor in which cool air produced from a cooling duct can be efficiently used to make ice cubes.

[0012] In one embodiment of the present invention, there is provided a refrigerator including: a refrigerator body; a storage space that is defined in the refrigerator body; a door that opens and closes the storage space; an ice making unit disposed on the door and configured to make ice cubes; a cool air producing unit that cools air inside a cooling duct so as to produce cool air; and a

cool air circulation unit that supplies the cool air from the cool air producing unit to the ice making unit and discharges air from the ice making unit to the cool air producing unit.

[0013] Exemplary embodiments of the present invention are advantageous in that the embodiments can make ice cubes using the cool air directly produced from the cooling duct, thereby increasing ice making efficiency and cool air supply efficiency.

[0014] Another advantage of the exemplary embodiments of the present invention resides in that the cool air circulates only a short distance within an ice making space defined between the cooling duct and the refrigerator compartment door. Accordingly, when compared to conventional techniques in which cool air produced from the lower part of a refrigerator flows to an ice making space defined in a refrigerator compartment door, the present invention can efficiently reduce loss of cool air and can save electricity during operation of the refrigerator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The above and other objects and features of the present invention will become apparent from the following description of exemplary embodiments given in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a refrigerator according to an exemplary embodiment of the present invention;

FIG. 2 is a view showing a connection between an ice making unit and a cooling duct of a cool air producing unit in the refrigerator according to an exemplary embodiment of the present invention;

FIG. 3 is a view showing an internal construction of the refrigerator according to an exemplary embodiment of the present invention;

FIG. 4 is a block diagram showing the construction of the cool air producing unit of the refrigerator according to an exemplary embodiment of the present invention; and

FIG. 5 is a block diagram showing an ice making method for the refrigerator according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings so that they can be readily implemented by those skilled in the art.

[0017] FIG. 1 is a perspective view of a refrigerator according to an exemplary embodiment of the present invention. FIG. 2 is a view showing a connection between an ice making unit and a cooling duct of a cool air producing unit in the refrigerator according to an exemplary embodiment of the present invention. FIG. 3 is a view

showing an internal construction of the refrigerator according to an exemplary embodiment of the present invention.

[0018] As shown in FIGS. 1 to 3, the refrigerator 1 according to the exemplary embodiment of the present invention may include: a refrigerator body 10 that defines a housing structure with an appearance of the refrigerator; a barrier 20 that divides a storage space of the refrigerator body 10; a door that opens and closes the storage space; an ice making unit 100 disposed on the door and configured to make ice cubes; a cool air producing unit 200 that cools air inside a cooling duct so as to produce cool air; and a cool air circulation unit 300 that supplies the cool air from the cool air producing unit 200 to the ice making unit 100 and discharges air from the ice making unit 100 to the cool air producing unit 200.

[0019] The storage space of the refrigerator body 10 may be divided into a refrigerator compartment and a freezer compartment by the barrier 20. Further, the doors may include a refrigerator compartment door 30 that is hinged to each of opposite edges of the front of the refrigerator compartment, and opens and closes the refrigerator compartment; and a freezer compartment door 40 that is hinged to an edge of the front of the freezer compartment, and opens and closes the freezer compartment.

[0020] Although the refrigerator 1 of the exemplary embodiments of the present invention is a bottom freezer type refrigerator in which the freezer compartment is provided in the lower part of the refrigerator body, it should be understood that the present invention may be adapted to various types of refrigerators without being limited to the bottom freezer type refrigerator. Further, the construction of the refrigerator body 10, the barrier 20, the refrigerator compartment door 30, and the freezer compartment door 40 remains the same as that of a refrigerator body, a barrier, a refrigerator compartment door, and a freezer compartment door of a conventional refrigerator, and further explanation is thus omitted.

[0021] Here, the ice making unit 100 is a unit that changes the phase of water to ice using cool air, and may be disposed on an inner surface of the refrigerator compartment door 30. Although the ice making unit 100 of the present embodiment is disposed on the upper part of the refrigerator compartment door 30, it should be understood that the ice making unit 100 may be disposed at another position of the refrigerator compartment door 30.

[0022] The ice making unit 100 may include an ice making cabinet 110, an ice maker 120, and an ice bank 130.

[0023] The ice making cabinet 110 may be disposed on the inside surface of the refrigerator compartment door 30, and may define an ice making space 111 in which ice cubes are produced. The ice maker 120 can freeze water using cool air flowing into the ice making space 111, can make ice cubes, and can discharge the ice cubes into the ice bank 130. The ice bank 130 is disposed at a location below the ice maker 120 so as to

receive ice cubes discharged from the ice maker 120. The ice bank 130 can store the ice cubes discharged from the ice maker 120, and can dispense ice cubes to users using an ice dispenser unit (not shown).

[0024] The cool air circulation unit 300 functions to introduce cool air from the cool air producing unit 200 into the ice making space 111 of the ice making unit 100 or to discharge the cool air from the ice making space 111 to the cool air producing unit 200.

[0025] For example, the cool air circulation unit 300 may include: an inlet hole 310 disposed on an upper part of the ice making unit 100 at a location corresponding to a first duct hole 212 of the cooling duct 210; an outlet hole 320 disposed on a lower part of the ice making unit 100 at a location corresponding to a second duct hole 213 of the cooling duct 210; and a circulation fan 330 that circulates the cool air from the inlet hole 310 to the outlet hole 320.

[0026] In one embodiment, the cooling duct 210 is disposed in the refrigerator body 10, and the ice making unit 100 is disposed on the refrigerator compartment door 30 of the refrigerator 1, so when the refrigerator compartment door 30 is closed onto the refrigerator body 10, the first duct hole 212 and the second duct hole 213 of the cooling duct 210 couple with the inlet hole 310 and the outlet hole 320 of the ice making unit 100, respectively.

[0027] Thus, when the refrigerator compartment door 30 is closed onto the refrigerator body 10, cool air inside the cooling duct 210 flows into the inlet hole 310 of the ice making unit 100 via the first duct hole 212. In the ice making unit 100, the cool air from the inlet circulates inside the ice making space 111 by the operation of the circulation fan 330, thereby freezing water inside the ice making space 111 and forming ice cubes. Thereafter, air inside the ice making unit 100 is discharged into the second duct hole 213 of the cooling duct 210 via the outlet hole 320. The air discharged from the ice making unit 100 is cooled again inside the cooling duct 210 prior to being introduced into the inlet hole 310 of the ice making unit 100.

[0028] FIG. 4 is a block diagram showing the construction of the cool air producing unit of the refrigerator according to an exemplary embodiment of the present invention.

[0029] As shown in FIG. 4, the cool air producing unit 200 can cool air flowing through the cooling duct 210, thereby producing cool air, and can supply the cool air to the ice making unit 100. The cool air producing unit 200 may be disposed inside the refrigerator body 10 of the refrigerator 1. More specifically, the cool air producing unit 200 may be disposed on the sidewall of the refrigerator body 10 and in the lower part of the refrigerator body 10.

[0030] The cool air producing unit 200 includes: the cooling duct 210 that is disposed in the sidewall of the refrigerator body so as to form a cooling path through which air flows; an evaporation coil 220 wound around the cooling duct 210 such that the air inside the cooling

duct is cooled by a heat exchanging operation between the air and a refrigerant; a compressor 230 that compresses the refrigerant discharged from the evaporation coil 220 so as to change the refrigerant to a high temperature and high pressure gas refrigerant; a condenser 240 that condenses the gas refrigerant so as to change the gas refrigerant to a high pressure liquid refrigerant; and an expansion valve 250 that performs adiabatic expansion of the liquid refrigerant and supplies the refrigerant to the evaporation coil 220. Here, the first duct hole 212 may be disposed on the upper end of the cooling duct 210 such that the first duct hole 212 can couple with the inlet hole 310, and the second duct hole 213 may be disposed on the lower end of the cooling duct 210 such that the second duct hole 213 can couple with the outlet hole 320.

[0031] In the compressor 230, the condenser 240, the expansion valve 250, and the evaporation coil 220, a refrigeration cycle composed of four processes: compression, condensation, expansion, and evaporation, is performed in which a heat exchanging operation between air and refrigerant is carried out. Accordingly, air inside the cooling duct 210 may be cooled to become cool air by a heat exchanging operation performed between the air inside the cooling duct 210 and the refrigerant inside the evaporation coil 220. Here, the evaporation coil 220 cools the cooling duct 210 through heat conduction. Further, the cooling line is sufficiently long such that air inside the cooling line can be efficiently cooled to become cool air, so when the air flows through the cooling line for a predetermined period of time, the air can be cooled to a predetermined temperature (for example, 14 degrees below zero or lower) at which the cool air can efficiently make ice cubes.

[0032] The compressor 230, the condenser 240, and the expansion valve 250 may use the elements of a refrigeration cycle that are provided to supply cool air to both the refrigerator compartment and the freezer compartment of the refrigerator 1.

[0033] The cool air producing unit 200 may include a cooling duct 210, an evaporation coil 220, a compressor 230, a condenser 240, an expansion valve 250, an evaporator 260, a branch line 270, and a control valve 280. The construction of the cooling duct 210, the evaporation coil 220, the compressor 230, the condenser 240, and the expansion valve 250 remains the same as that of the cooling duct 210, the evaporation coil 220, the compressor 230, the condenser 240, and the expansion valve 250 that are described above, and further explanation is thus deemed unnecessary.

[0034] In one embodiment, the evaporator 260 may be provided in the lower part of the refrigerator body 10, and may produce cool air by cooling the air inside the freezer compartment or the refrigerator compartment through a heat exchanging operation between the air and the refrigerant. The cool air produced by the evaporator 260 may be supplied to the freezer compartment or to the refrigerator compartment. The branch line 270 may func-

tion to supply the liquid refrigerant processed by the expansion valve 250 to the evaporation coil 220 or to the evaporator 260. The control valve 280 is provided at a branch point of the branch line 270 and controls the flowing direction of the liquid refrigerant so as to supply the liquid refrigerant to the evaporation coil 220 or to the evaporator 260.

[0035] Accordingly, the refrigerant that branches via the branch line 270 may circulate through a refrigeration cycle composed of the evaporation coil 220, the compressor 230, the condenser 240, and the expansion valve 250, thereby cooling air supplied to the ice making unit 100. Further, the refrigerant that branches via the branch line 270 may circulate through a refrigeration cycle composed of the evaporator 260, the compressor 230, the condenser 240, and the expansion valve 250, thereby cooling air supplied to the refrigerator compartment and to the freezer compartment.

[0036] FIG. 5 is a block diagram showing an ice making method for the refrigerator according to an exemplary embodiment of the present invention.

[0037] As shown in FIG. 5, the ice making method for the refrigerator according to an exemplary embodiment of the present invention may include: cooling air using the cooling duct so as to produce cool air (S100); supplying the cool air to the ice making unit so as to make ice cubes (S200); discharging the cool air from the ice making unit to the cooling duct (S300); and cooling the discharged cool air again in the cooling duct (S400).

[0038] In the step of cooling air using the cooling duct so as to produce cool air (S100), air is cooled to become cool air by directing the air to flow through the cooling duct on which the evaporation coil is wound. The air inside the cooling duct flows through a cooling path for a predetermined period of time while losing heat to the refrigerant flowing in the evaporation coil, so air discharged from the cooling line can be cooled to a predetermined temperature (for example, 14 degrees below zero or lower) at which the cool air can efficiently make ice cubes.

[0039] In the step of supplying the cool air to the ice making unit so as to make ice cubes (S200), the cool air cooled in the cooling duct is supplied to the ice making space of the ice making unit through the inlet hole of the ice making unit. The cool air supplied to the ice making space circulates in the ice making space by the operation of a circulation fan, and can freeze water inside the ice making space, thereby making ice cubes.

[0040] In the step of discharging air from the ice making unit to the cooling duct (S300), the cool air is discharged from the ice making space into the cooling duct through the outlet hole of the ice making unit.

[0041] In the step of cooling the discharged air again in the cooling duct (S400), the cool air discharged into the cooling duct flows through the cooling path of the cooling duct for a predetermined period of time, thereby being cooled to a predetermined temperature or lower at which the cool air can freeze water to make ice cubes.

[0042] While the embodiments of the present invention

have been shown and described with respect to the exemplary embodiments, it will be understood by those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.

Claims

1. A refrigerator, comprising:
 - a refrigerator body;
 - a storage space defined in the refrigerator body;
 - a door that opens and closes the storage space;
 - an ice making unit operable to make ice cubes;
 - a cool air producing unit operable to cool air inside a cooling duct to produce cool air; and
 - a cool air circulation unit operable to supply the cool air from the cool air producing unit to the ice making unit and to discharge air from the ice making unit to the cool air producing unit.
2. The refrigerator according to claim 1, wherein the cool air producing unit comprises:
 - a cooling duct through which the air flows;
 - an evaporation coil wound around the cooling duct wherein the air is cooled by a heat exchanging operation between the air and a refrigerant;
 - a compressor configured to compress the refrigerant discharged from the evaporation coil to transform the refrigerant to a high temperature and high pressure gas refrigerant;
 - a condenser configured to condense the gas refrigerant to change the gas refrigerant to a high pressure liquid refrigerant; and
 - an expansion valve configured to perform adiabatic expansion of the liquid refrigerant and supply the refrigerant to the evaporation coil.
3. The refrigerator according to claim 1, wherein the ice making unit comprises:
 - an ice making cabinet defining an ice making space;
 - an ice maker configured to produce the ice cubes using the cool air; and
 - an ice bank configured to store the ice cubes.
4. The refrigerator according to claim 1, wherein the cool air circulation unit includes:
 - an inlet hole disposed on an upper part of the ice making unit wherein the cool air flows from the cooling duct into the ice making unit;
 - an outlet hole disposed on a lower part of the ice making unit wherein air is discharged from the ice making unit into the cooling duct; and

- a circulation fan that circulates the cool air from the inlet hole to the outlet hole.
5. The refrigerator according to claim 2, wherein the cool air producing unit further comprises: 5
- an evaporator that cools air inside at least one of a freezer compartment and a refrigerator compartment through a heat exchanging operation between the air and the refrigerant; 10
- a branch line that supplies the liquid refrigerant processed by the expansion valve to the evaporation coil or to the evaporator; and
- a control valve that controls a flowing direction of the liquid refrigerant inside the branch line. 15
6. The refrigerator according to claim 2, wherein the cool air producing unit is disposed in the refrigerator body. 20
7. The refrigerator according to claim 3, wherein the ice making unit is disposed on a refrigerator compartment door of the refrigerator.
8. The refrigerator according to claim 1, wherein the cooling duct is disposed in the refrigerator body, and the ice making unit is disposed on a refrigerator compartment door of the refrigerator, and wherein the cooling duct couples with the ice making unit when the refrigerator compartment door is closed. 25 30
9. The refrigerator according to claim 2, wherein the evaporation coil functions as an evaporator of a refrigeration cycle, and cools the cooling duct through heat conduction. 35
10. An ice making method for a refrigerator, the method comprising:
- cooling air using a cooling duct to produce cool air; 40
- supplying the cool air to an ice making unit to make ice cubes;
- discharging air from the ice making unit to the cooling duct; and 45
- cooling the discharged air again in the cooling duct.
11. The ice making method according to claim 10, wherein the cooling of the air using the cooling duct to produce the cool air comprises flowing the air through a cooling path of the cooling duct for a predetermined period of time, and is thereby cooled to a predetermined temperature or lower. 50 55
12. An apparatus, comprising:
- an ice making unit that makes ice cubes;
- a cooling duct;
- a cool air producing unit configured to cool air inside the cooling duct; and
- a cool air circulation unit that supplies the cool air from the cooling duct to the ice making unit and discharges air from the ice making unit to the cooling duct.
13. The apparatus according to claim 12, wherein the cool air producing unit comprises:
- an evaporation coil wound around the cooling duct wherein the air is cooled by a heat exchanging operation between the air and a refrigerant;
- a compressor configured to compress the refrigerant discharged from the evaporation coil to change the refrigerant to a high temperature and high pressure gas refrigerant;
- a condenser configured to condense the gas refrigerant to change the gas refrigerant to a high pressure liquid refrigerant; and
- an expansion valve configured to perform adiabatic expansion of the liquid refrigerant and supply the refrigerant to the evaporation coil.
14. The apparatus according to claim 12, wherein the ice making unit comprises:
- an ice making cabinet defining an ice making space;
- an ice maker configured to form the ice cubes using the cool air; and
- an ice bank configured to store the ice cubes.
15. The apparatus according to claim 12, wherein the cool air circulation unit comprises:
- an inlet hole disposed on an upper part of the ice making unit such that the cool air flows from the cooling duct into the ice making unit;
- an outlet hole disposed on a lower part of the ice making unit such that air is discharged from the ice making unit into the cooling duct; and
- a circulation fan that circulates the cool air from the inlet hole to the outlet hole.

FIG. 1

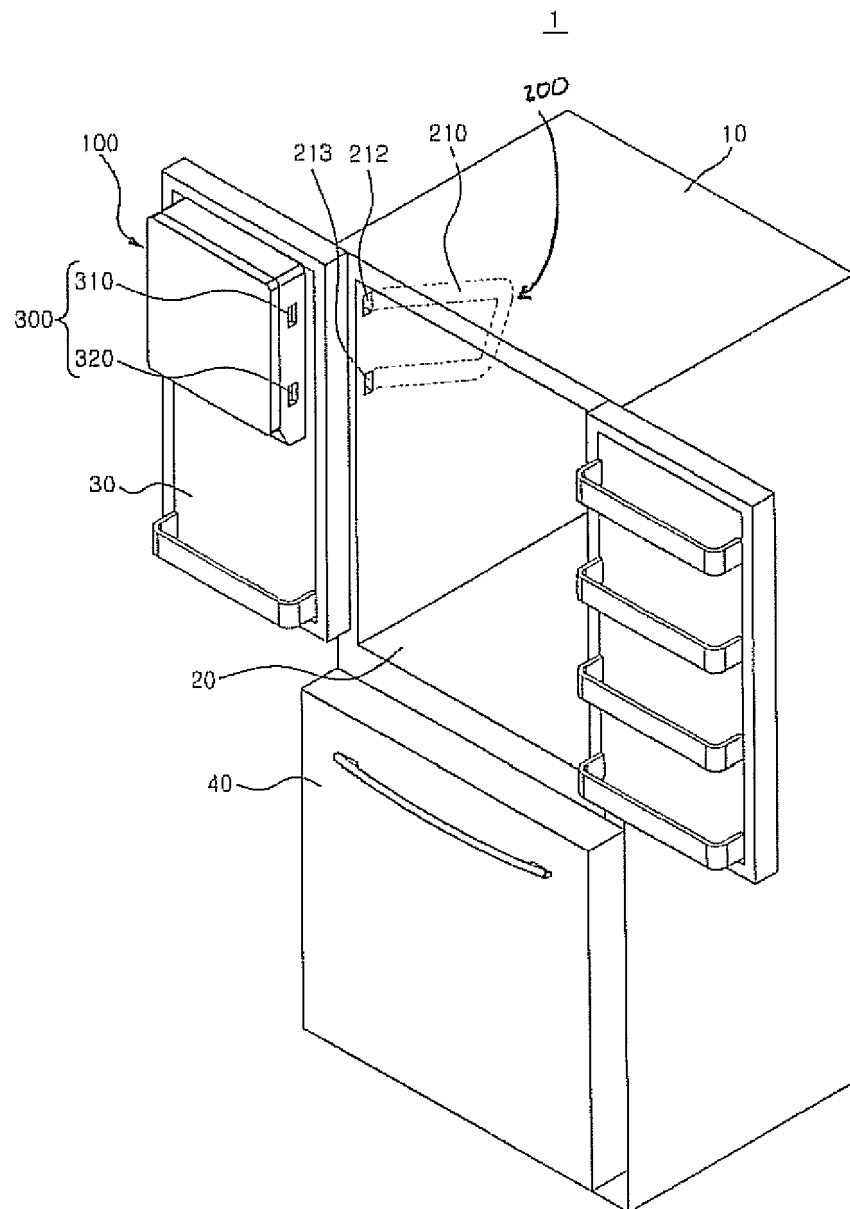


FIG. 2

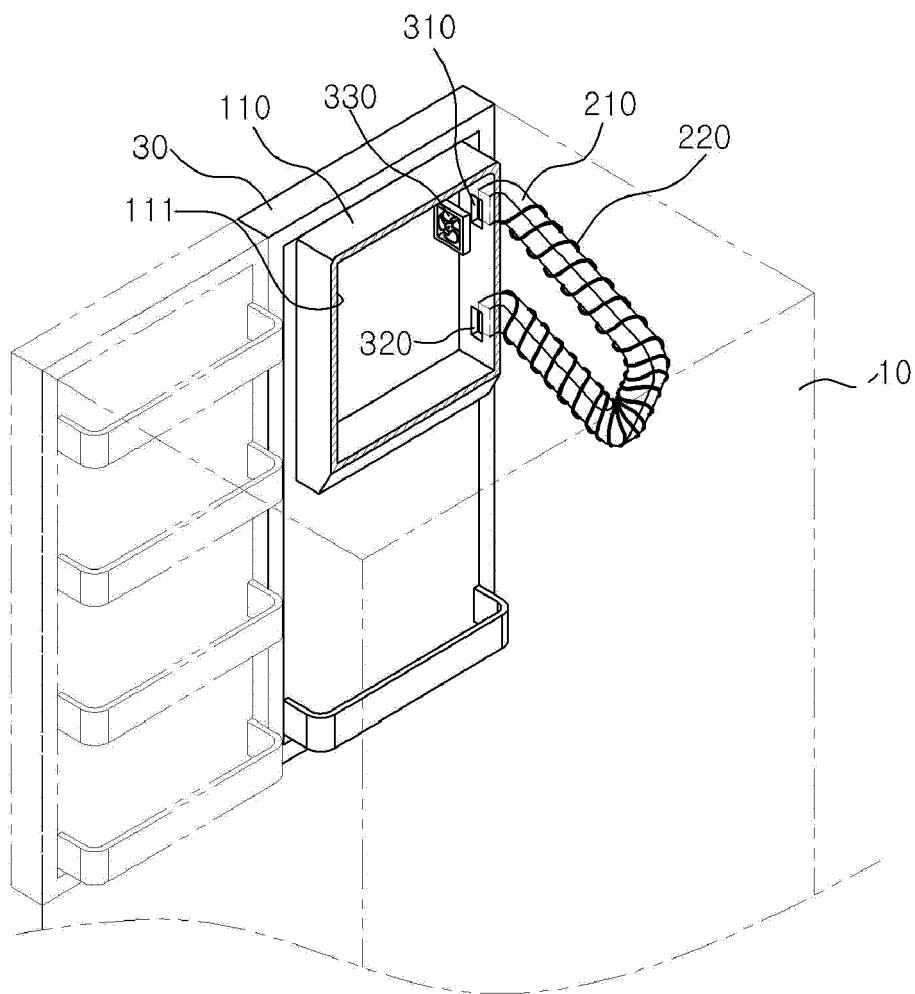


FIG. 3

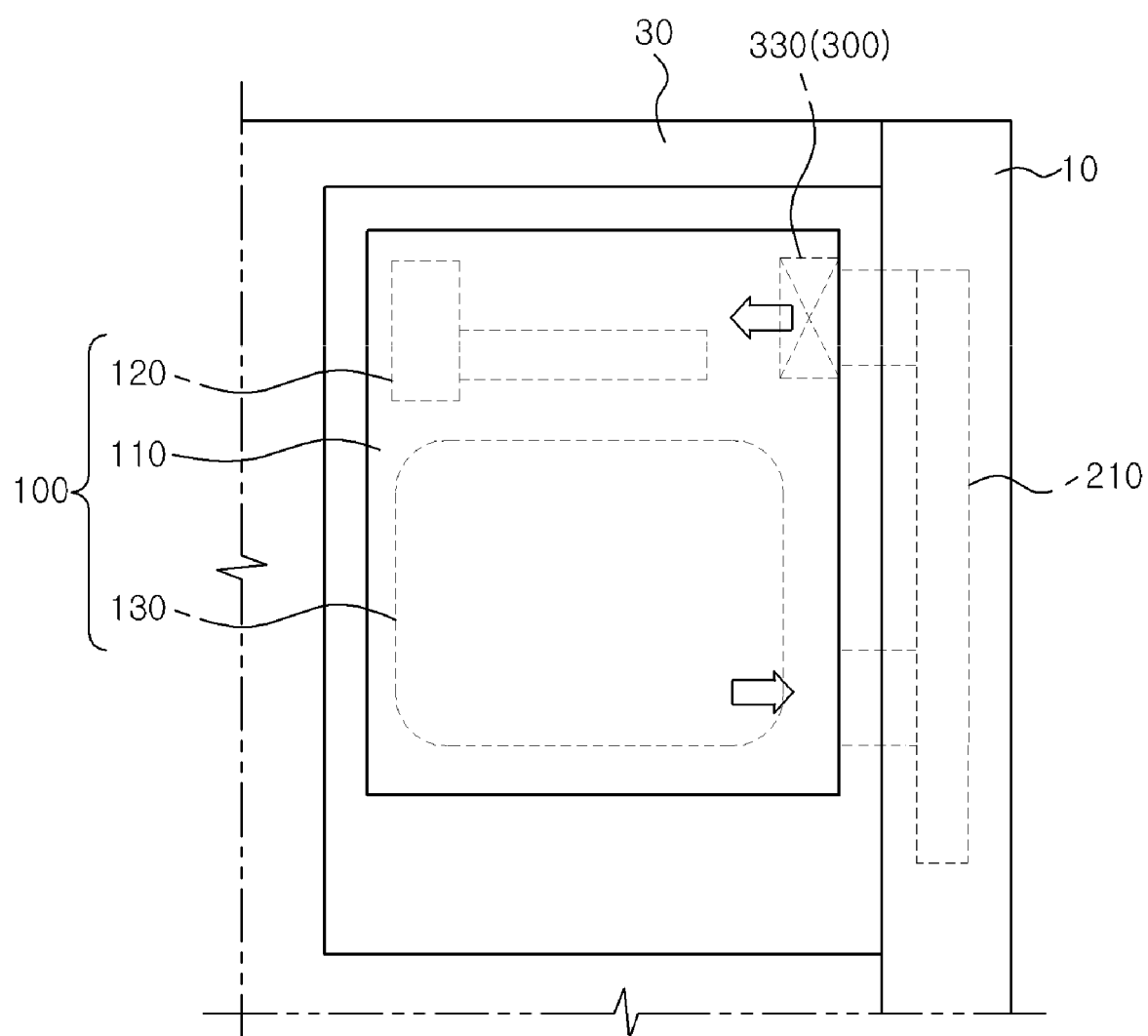


FIG. 4

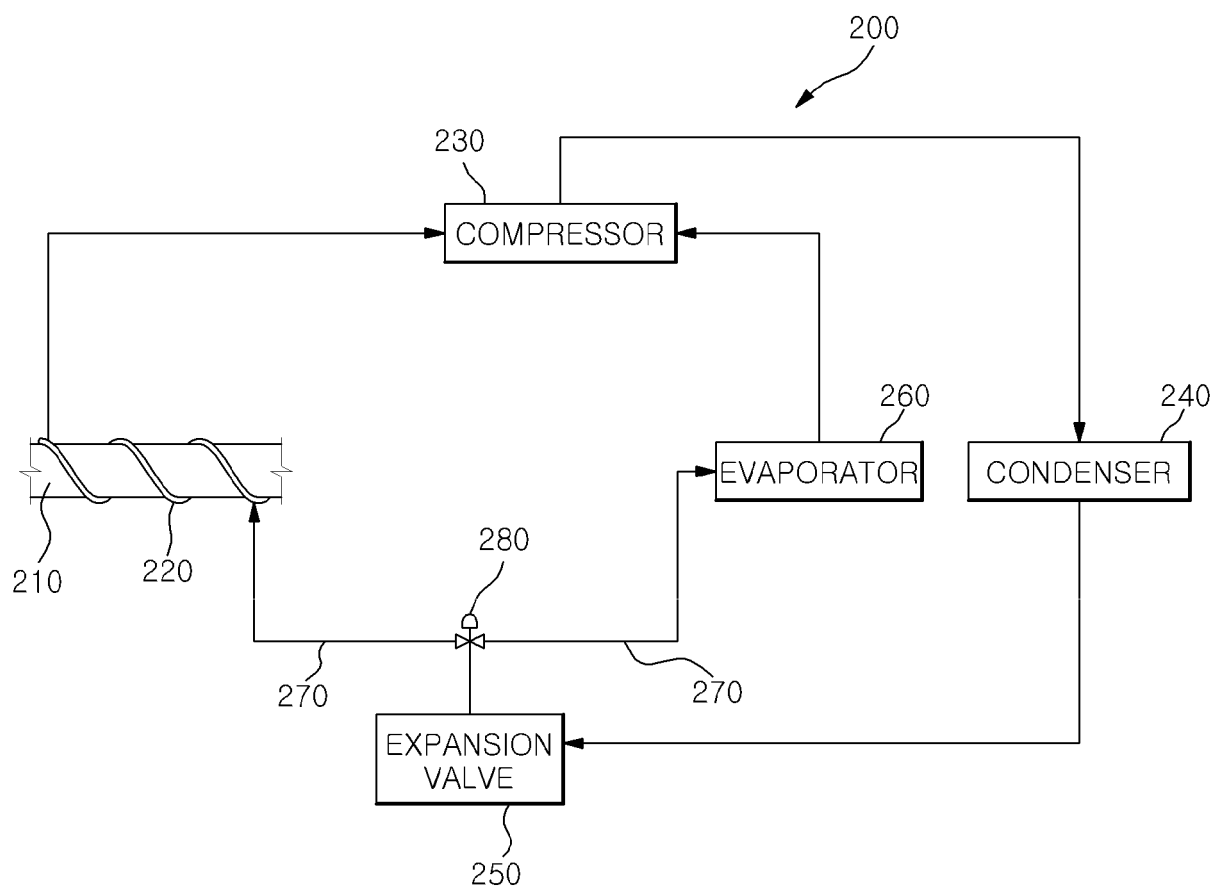
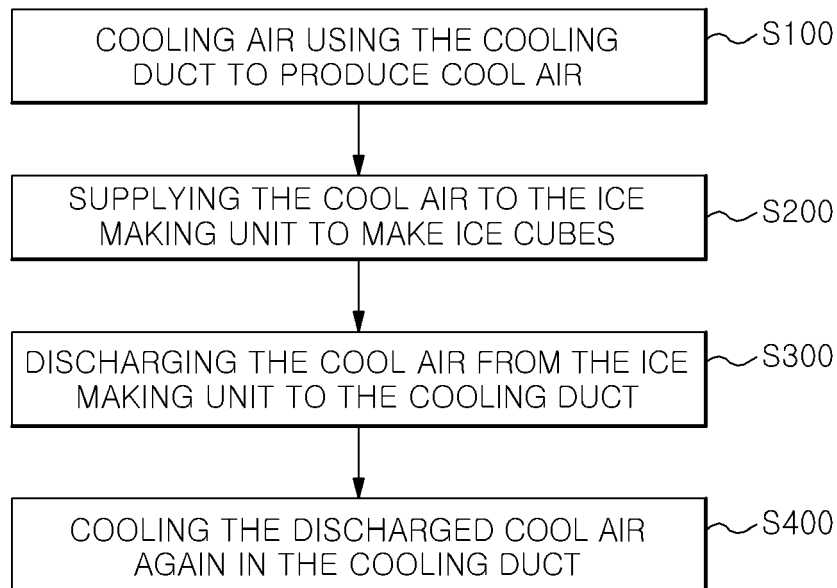


FIG. 5





EUROPEAN SEARCH REPORT

Application Number
EP 15 18 6858

5

10

15

20

25

30

35

40

45

50

55

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	US 2010/326096 A1 (JUNGE BRENT ALDEN [US] ET AL) 30 December 2010 (2010-12-30)	1,3,7,8, 10-12,14	INV. F25C5/00
Y	* paragraphs [0028], [0031], [0035]; figures 2,3,5,6 *	2,4-6,9, 13,15	F25D23/02
X	US 2010/101260 A1 (LEE BOK DONG [KR] ET AL) 29 April 2010 (2010-04-29)	1,10,12	ADD. F25D11/02
Y	* figures 3,8,11 *	4,15	
X	US 2010/011796 A1 (LEE SEUNG-MOK [KR]) 21 January 2010 (2010-01-21)	1,10,12	
Y	* figures 2,4,5 *		
Y	US 3 568 465 A (JUNG ROBERT C) 9 March 1971 (1971-03-09)	2,5,6,9, 13	
Y	* page 2; figure 1 *		
A	US 2009/173086 A1 (GUFFLER THOMAS [DE] ET AL) 9 July 2009 (2009-07-09)	5	
A	* figure 1 *		
			TECHNICAL FIELDS SEARCHED (IPC)
			F25C F25D F25B F28D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		2 November 2016	Canköy, Necdet
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			

EPO FORM 1503 03.82 (P04C01)

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

EP 15 18 6858

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.

02-11-2016

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010326096 A1	30-12-2010	US 2010326096 A1	30-12-2010
		US 2016161167 A1	09-06-2016

US 2010101260 A1	29-04-2010	EP 1856463 A1	21-11-2007
		EP 2623905 A2	07-08-2013
		EP 2623906 A2	07-08-2013
		EP 2623907 A2	07-08-2013
		EP 2642225 A2	25-09-2013
		ES 2550139 T3	04-11-2015
		US 2010101257 A1	29-04-2010
		US 2010101258 A1	29-04-2010
		US 2010101259 A1	29-04-2010
		US 2010101260 A1	29-04-2010
		US 2010101263 A1	29-04-2010
		WO 2006083111 A1	10-08-2006

US 2010011796 A1	21-01-2010	US 2010011796 A1	21-01-2010
		WO 2008054152 A1	08-05-2008

US 3568465 A	09-03-1971	NONE	

US 2009173086 A1	09-07-2009	CN 101416005 A	22-04-2009
		DE 102006015989 A1	11-10-2007
		EP 2005076 A1	24-12-2008
		RU 2008142980 A	10-05-2010
		US 2009173086 A1	09-07-2009
		WO 2007115879 A1	18-10-2007

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

- KR 1020150085588 [0001]
- KR 1020050098135 [0001]