



(11) **EP 2 434 238 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
28.03.2012 Bulletin 2012/13

(51) Int Cl.:
F25D 11/00 (2006.01) **F25D 19/00** (2006.01)
F25B 39/02 (2006.01) **F25B 5/04** (2006.01)

(21) Application number: **09844821.0**

(86) International application number:
PCT/CN2009/075208

(22) Date of filing: **30.11.2009**

(87) International publication number:
WO 2010/133069 (25.11.2010 Gazette 2010/47)

(84) Designated Contracting States:
**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 SE SI SK SM TR**

(30) Priority: **19.05.2009 CN 200910039650**

(71) Applicant: **Guangdong Homa Appliances Co., Ltd.
Guangdong 528427 (CN)**

(72) Inventors:
• **CAI, Shier**
Zhongshan
Guangdong 528427 (CN)
• **WU, Simon**
Zhongshan
Guangdong 528427 (CN)

(74) Representative: **Corradini, Corrado et al**
Ing. C. Corradini & C. S.r.l.
Via Dante Alighieri 4
IT-42121 Reggio Emilia (IT)

(54) **ENERGY-SAVING REFRIGERATOR**

(57) An energy-saving refrigerator includes an inner shell (1) and multiple layers of inner chamber evaporators (2) which are arranged inside a chamber of the inner shell (1), and outer chamber evaporators (3) are arranged on the surfaces of four sides outside the inner shell (1).. In one embodiment, the outer chamber evaporators (3) include evaporation pipes (31) and heat transmission plates (32), and the heat transmission plates (32) are arranged between the evaporation pipes (31) and the inner shell (1).. In another embodiment, the outer chamber evaporators (3) include evaporation pipes (31) and aluminium foils (33), and the aluminium foils (33) cover on the surfaces of the evaporation pipes (31) and the inner shell (1).

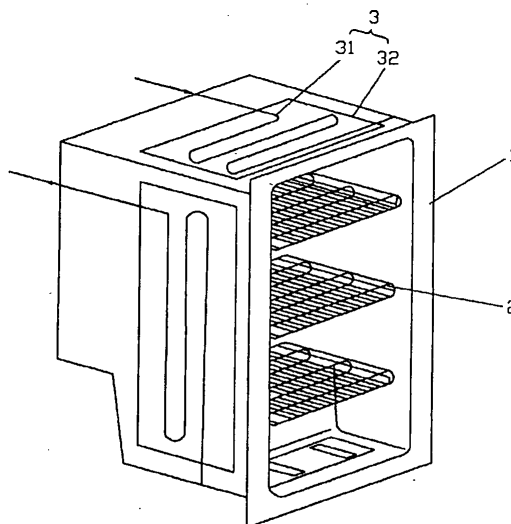


FIG. 1

Description

[Field of the invention].

[0001] The present invention relates to a refrigerating apparatus, particularly an energy-saving refrigerator.

[Description of the related art].

[0002] Currently, many kinds of resources are in shortage, so is the electric energy, therefore the energy-saving of refrigerators had already become the trend in the industrial field of refrigerators. The design for energy-saving in refrigerators could be carried out from 2 main aspects. First, when the refrigerator is starting up, increase the cooling rate of loads in the chamber by raising the temperature of the evaporators and enlarging the evaporation area. An effective solution is to increase the COP of the compressor, or optimize the evaporators in the freezing chamber. For example, sealing the evaporators, or adding heat sink fin on the evaporation pipes. Second, decrease the temperature recovering rate of loads when the refrigerator stops working, for example, thickening the thermal insulating layer of the case, employ vacuum insulation vacuum insulation technology, etc. Therefore, to achieve good performance in energy-saving of the refrigerator, improvement must be simultaneously made on thermal insulating layer, evaporators in the freezing chamber, or compressor, which is not only a waste of material resources, but also brings sophisticated process, high production costs, expensive price, thereby not satisfying the demand for energy-saving in all people.

[Summary of the Invention].

[0003] For the sake of overcoming the deficiency in existing technology, the present invention provides a refrigerator with lower cost, energy-saving and easy processed.

[0004] The technical solution adopted to solve the technical problem in the present invention is:

[0005] An energy-saving refrigerator, which comprises an inner shell and multiple layers of inner chamber evaporators arranged inside a chamber of the inner shell, wherein multiple outer chamber evaporators are arranged on the surfaces of the four sides of outside the inner shell.

[0006] As a further improvement in the present invention, the outer chamber evaporators comprise multiple evaporation pipes and heat transmission plates, wherein the heat transmission plates are arranged between the evaporation pipes and the inner shell.

[0007] As another improvement in the present invention, the outer chamber evaporators comprise multiple evaporation pipes and multiple aluminium foils, wherein the aluminium foils cover on the surfaces of the evaporation pipes and the inner shell.

[0008] The advantageous effects of the present invention

is: due to the surfaces of four sides outside the inner shell are arranged with the outer chamber evaporators, when the refrigerator starts up, the inner chamber evaporators in the chamber of the inner shell coordinate with the outer chamber evaporators outside the inner shell to form a three dimensional cool air curtain, which greatly enlarges the evaporation area and make the cool air alternately transfer, thus the refrigeration is faster and stronger; meanwhile, due to the effect of the outer chamber evaporators, the high temperature of the external environment could not affect the temperature recover of the load in the case when the refrigerator stops, further when the refrigerator starts up again, the refrigerating fluid quickly carries away the heat absorbed by the outer chamber evaporators, thus ideal heat insulation could be achieved by properly designing the scale of time interval of starting and stopping; the present design satisfies the demands for both cooling and heat insulation, thus the refrigerator is more energy-saving, and the temperature in the chamber is equalized, which is good for keeping the food fresh, also the present design simplifies the structure, which makes the fabrication very easy to process and the cost lower.

[Brief description of the Drawings].

[0009] The following is the detailed description of the present invention in conjunction with the accompanying drawings and the embodiments.

FIG. 1 is a perspective view of the first embodiment of the present invention;

FIG. 2 is a perspective view of the second embodiment of the present invention;

Fig. 3 is the functional diagram of the present invention.

[Description of the preferred embodiment].

[0010] As referring to Fig. 1, Fig. 2, Fig. 3, an energy-saving refrigerator comprises an inner shell (1) and multiple layers of inner chamber evaporators (2) which are arranged inside a chamber of the inner shell (1), and multiple outer chamber evaporators (3) are arranged on the surfaces of four sides outside the inner shell (1). And a single-cycle refrigeration system consists of the compressor (5), the condenser (6), the filter (7), the capillary (8), the inner chamber evaporators (2), the outer chamber evaporators (3), the evaporators of refrigerating chamber (4). When the refrigerator starts up the refrigeration, the refrigerating fluid out from the capillary (8) firstly pass by the inner chamber evaporators (2), the refrigeration rate is fast due to the inner chamber evaporators (2) directly contact with the loads, then the refrigerating fluid pass by the outer chamber evaporators (3), the inner chamber evaporators (2) in the chamber of the inner shell (1) coordinate with the outer chamber evaporators (3) outside the inner shell to form a three

dimensional cool air curtain, which greatly enlarges the evaporation area and make the cool air alternately transfer, thus the refrigeration is faster and stronger, and the temperature in the chamber is more equalized, and it's good for keeping the food fresh; when the refrigerator stops, the temperature of the heat transmission plates (32) is below -30 °C, and the temperature of the loads inside the chamber of the inner shell (1) stay at -18 °C, which means the temperature of the heat transmission plate (32) is at least 12°C lower than that of the food, thus the ambient high temperature could not affect the temperature recover of the loads in the case, further it's good for preventing the high temperature from the heat sink arranged on each side of the refrigerator; when the refrigerator starts up again, the refrigerating fluid quickly carries away the heat absorbed by the heat transmission plate (32) of the outer chamber evaporators (3), thus ideal heat insulation could be achieved by properly designing the scale of time interval of starting and stopping (i.e. set the time needed for the temperature of the heat transmission plates in the evaporators of the surface of four sides of the freezing chamber recovering to -18 °C after the refrigerator stops as the stopping time interval); the structure of the present design is simple, the fabrication is very easy to process, and the cost is lower, thus satisfying the demand for energy-saving in all people.

[0011] The outer chamber evaporators (3) comprise the evaporation pipes (31) and the heat transmission plates (32), wherein the heat transmission plates (32) are arranged between the evaporation pipes (31) and the inner shell (1), so that the heat transmission plate (32) could sufficiently contact with the inner shell (1), which is good for the refrigeration; in addition, the outer chamber evaporators (3) could be designed in another way, i.e. the outer chamber evaporators (3) comprise the evaporation pipes (31) and the aluminium foils (33), wherein the evaporation pipes (31) is wound on the inner shell (1), and the aluminium foils (33) cover the evaporation pipes (31) and the inner shell (1), which could effectively apply the refrigeration. The present invention is not limited to above modes of carrying out the utility model, any other ones that basically using the same means for the same technical effect should fall into the scope of protection of the present invention.

oration pipes (31) and heat transmission plates (32), wherein the heat transmission plates (32) are arranged between the evaporation pipes (31) and the inner shell (1).

3. The energy-saving refrigerator according to the claim 1, which is **characterized in that** the outer chamber evaporators (3) comprises multiple evaporation pipes (31) and aluminium foils (33), wherein the aluminium foils (33) cover on the surfaces of the evaporation pipes (31) and the inner shell (1).

Claims

1. An energy-saving refrigerator, which comprises an inner shell (1) and multiple layers of inner chamber evaporators (2) arranged inside a chamber of the inner shell (1), **characterized in that** multiple outer chamber evaporators (3) are arranged on the surfaces of four sides outside the inner shell (1).
2. The energy-saving refrigerator according to the claim 1, which is **characterized in that** the outer chamber evaporators (3) comprises multiple evap-

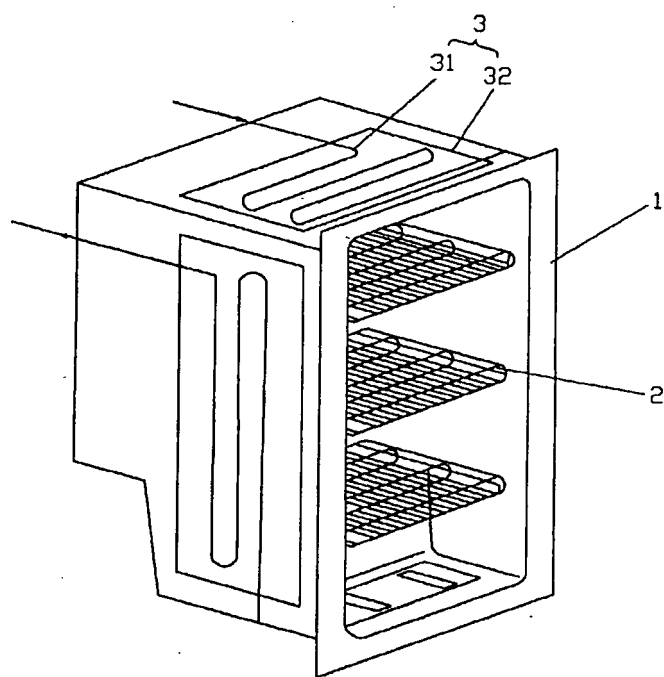


FIG. 1

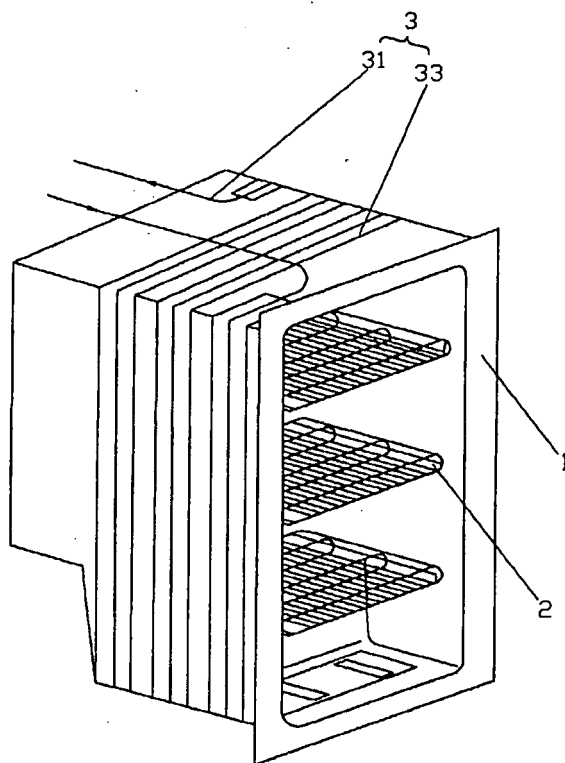


FIG. 2

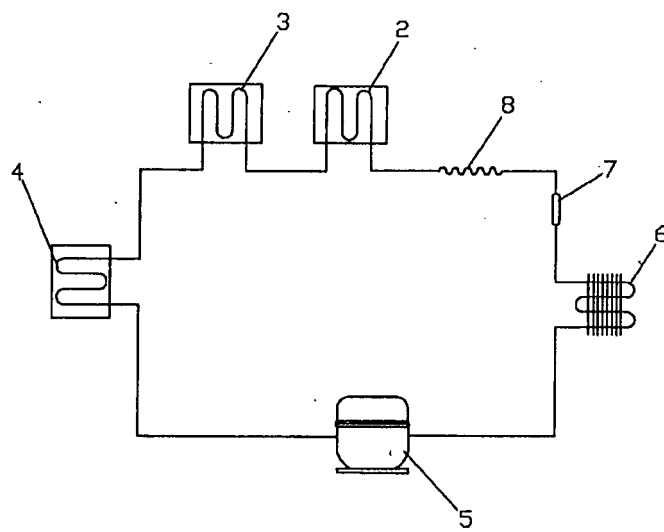


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/075208

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F25D, F25B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT,CNKI,WPI,EPODOC refrigerator, evaporator, inside, outside, exterior, interior

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN2672578Y(XINFEI ELECTRIC APPLIANCE CO L) 19 Jan.2005(19.01.2005) description page 1 paragraph 4 to page 2 last paragraph, figure 2	1-3
Y	CN1862180A(LEJIN ELECTRONIC TIANJIN ELEC APPLIANCE) 15 Nov. 2006(15.11.2006) description page 4 line 21 to page 7 line 3, figures 6a-6b	1-3
Y	EP1801523A2(THETFORD CORP) 27 Jun.2007(27.06.2007) description column 4 paragraph 0027, figure 3	2
P, X	CN101566415A(GUANGDONG HOMA APPLIANCES CO LTD) 28 Oct.2009(28.10.2009) claims 1-3	1-3
A	US6293124B1(Robin P.Roth et al.) 25 Sep.2001(25.09.2001) the whole document	1-3
A	US2004/0144129A1(Tae Hee Lee et al.) 29 Jul.2004(29.07.2004) the whole document	1-3
A	US3520581A(GIOVANNI BORGHI) 14 Jul.1970(14.07.1970) the whole document	1-3

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
14 Jan.2010(14.01.2010)Date of mailing of the international search report
11 Feb. 2010 (11.02.2010)Name and mailing address of the ISA/CN
The State Intellectual Property Office, the P.R.China
6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China
100088
Facsimile No. 86-10-62019451Authorized officer
SUN, Ping
Telephone No. (86-10)62084861

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2009/075208

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN2672578Y	19.01.2005	None	
CN1862180A	15.11.2006	None	
EP1801523A2	27.06.2007	US2007144204A1	28.06.2007
		EP1801523A3	01.04.2009
CN101566415A	28.10.2009	None	
US6293124B1	25.09.2001	US5722254A	03.03.1998
		US6244067B1	12.06.2001
US2004/0144129A1	29.07.2004	EP1443290A1	04.08.2004
		JP2004233036A	19. 08.2004
		CN1519522A	11. 08.2004
		KR20040069476A	06. 08.2004
		US7124602B2	24.10.2004
		CN1263991C	12.07.2006
US3520581A	14.07.1970	NL6803055A	09.09.1968
		ES351180 A1	01.06.1969
		FR1580170A	05.09.1969
		GB1216693 A	23.12.1970
		DE1601868A1	21.01.1971

Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/075208

CLASSIFICATION OF SUBJECT MATTER

F25D11/00 (2006.01) i
F25D19/00 (2006.01) i
F25B39/02 (2006.01) i
F25B5/04 (2006.01) i