(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 April 2004 (29.04.2004)

PCT

(10) International Publication Number
WO 2004/036128 A1

(51) International Patent Classification[7]: F25D 11/02

(21) International Application Number:
PCT/EP2003/011333

(22) International Filing Date: 14 October 2003 (14.10.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
02257199.6 17 October 2002 (17.10.2002) EP

(71) Applicant *(for AE, AG, AU, BB, BZ, CA, EG, GB, GD, GH, GM, IL, KE, LC, LK, LS, MN, MW, NZ, OM, PG, SC, SD, SG, SL, TT, TZ, UG, VC, ZA, ZM, ZW, SZ, CY, IE only)*: **UNILEVER PLC** [GB/GB]; Unilever House, Blackfriars, London EC4P 4BQ (GB).

(71) Applicant *(for AL, AM, AT, AZ, BA, BG, BR, BY, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GE, HR, HU, ID, IS, JP, KG, KP, KR, KZ, LR, LT, LU, LV, MA, MD, MG, MK, MX, MZ, NI, NO, PH, PL, PT, RO, RU, SE, SK, SY, TJ, TM, TN, TR, UA, UZ, VN, YU, BE, FR, GR, IT, MC, NL, SI, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG only)*: **UNILEVER NV** [NL/NL]; Weena 455, NL-3013 AL Rotterdam (NL).

(71) Applicant *(for IN only)*: **HINDUSTAN LEVER LIMITED** [IN/IN]; Hindustan Lever House, 165/166 Backbay Reclamation, Maharashtra, 400 020 Mumbai (IN).

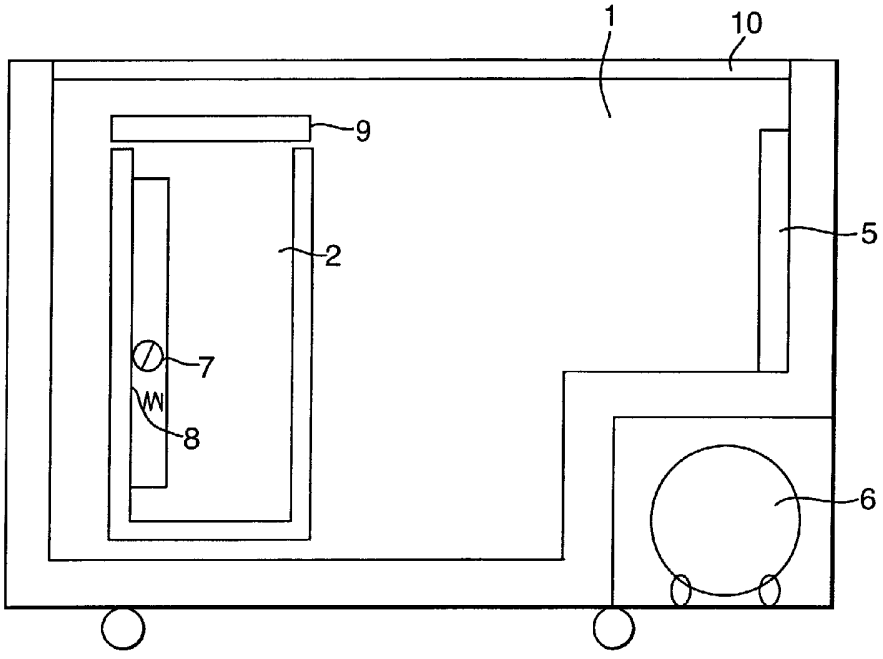
(72) Inventor: **UIJEN, Wilhelmus, Adrianus, Theodorus**; UNILEVER BESTFOODS, PRODUCTOS DE MAIZ S.A. DE C.V., Av Rio Consulado No 721, Col Santa Ma Insurgentes, 06430 Mexico (MX).

(74) Agent: **HUGOT, Alain, Eric, Philippe**; Unilever PLC, Patent Department, Colworth House, Sharnbrook, Bedford, Bedfordshire MK44 1LQ (GB).

(81) Designated States *(national)*: AE, AG, AL, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, EG, ES, FI (utility model), FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT (utility

[Continued on next page]

(54) Title: REFRIGERATION APPARATUS



(57) Abstract: A refrigeration apparatus with two compartments (1, 2) operating at two different temperatures wherein a freezer comprising a storing volume adapted to receive products to be stored at a temperature below 0oC, an evaporator (5) within said storing volume and a compressor (6) located outside said storing volume, is fitted with a storing box, adapted to receive products to be stored at a temperature above the temperature in the storing volume, located within the storing volume, said box being fitted with heating means (7).

WO 2004/036128 A1

model), PT, RO, RU, SC, SD, SE, SG, SK (utility model), SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) **Designated States** *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

REFRIGERATION APPARATUS

Field of the invention

The present invention refers to a refrigeration apparatus of the type comprising at least a first compartment and at least a second compartment that are cooled down at different temperatures, as well as a temperature balancing device adapted to ensure a correct operation of the apparatus.

Background of the invention

Refrigerating apparatuses, used as display cabinets, in stores and shops, are well known wherein a single compartment is maintained at a certain temperature by a refrigerating circuit comprising a single compressor and at least one evaporator. These apparatuses are equipped with a door which can be either vertical, in the case of a 'cupboard like' cabinets, or horizontal, in the case of a 'flat-top' cabinet such as described in US3,729,243. In any case the door is transparent to allow for potential customers to see what is inside the display cabinet.

More and more products are now displayed in such cabinets while they may have different storage temperature.

There is therefore a need for refrigerating apparatus of the display cabinet type which can be used for simultaneously storing products at different temperatures.

Refrigeration apparatuses are well-known in the art which comprise a refrigerating circuit provided with a single compressor and two evaporators arranged in series and associated to a refrigerated compartment and a freezer compartment,

respectively. Automatic control means enable the refrigerated compartment temperature to be set and the compressor to be caused to operate cyclically in order to keep respective pre-determined temperature ranges in the two compartments.

A temperature balancing device can be adapted in the cold storage compartment to artificially heat up the cold storage compartment when the ambient temperature is excessively low, in such a manner as to increase the rate of the operation cycles of the compressor, thereby preventing the temperature in the freezer compartment from increasing.

Such devices require the use of two evaporators, one in each compartment.

There is thus a need for refrigerating apparatuses of the display cabinet type presenting two compartments at two different temperatures, while requiring only evaporator means in one compartment.

It therefore is a purpose of the present invention to minimise the drawbacks of such prior-art solutions.

Summary description of the invention

It is a first object of the invention to provide a refrigeration apparatus, situated in an environment at temperature Te, comprising;

. a first compartment at a temperature T1, the first compartment being accessible through at least an opening , and

- a second compartment at a temperature T2, T1 being colder than T2, T1 and T2 being colder than Te, the second compartment being located inside the first compartment,
- a refrigeration circuit in the first compartment adapted to keep temperature T1 within a range R1 through a sequence of energisation and de-energisation phases triggered by comparing actual temperature T1 with a first reference temperature T1r,
- heating means in the second compartment adapted to keep temperature T2 within a range R2.

This apparatus allows for storing at two different temperatures, both lower than the temperature Te of the room in which the apparatus is located.

The opening in the first compartment can either be on the top of the first compartment or on a side face of it. If it is on the top, it does not need a door or a lid (open top freezer), if it is on a side, it is preferable to have the opening closed by a door. The second compartment can be accessed either though an opening, or through a door.

Preferably, the refrigeration circuit comprises an evaporator, the evaporator being connected to a compressor located outside the first compartment. More preferably the second compartment does not contain an evaporator.

Preferably also, the second compartment door is transparent.

In a preferred embodiment of the invention, the heating means are triggered by comparing the actual temperature T2 with a second reference temperature T2r, thus keeping temperature T2 within a range R2.

In a particularly preferred embodiment of the invention, the reference temperatures T1r and T2r are set by means of control means. T1r is comprised between -16 to -23°C and wherein T2r is comprised between -15°C and +5°C, preferably below 0°C even more preferably below -5°C.

It is a second object of the present invention to provide a process for manufacturing a refrigeration apparatus according to the invention wherein a freezer;

- comprising a storing volume adapted to receive products to be stored at a temperature below 0 C (preferably between -16°C and -23°C), an evaporator within said storing volume and a compressor located outside said storing volume,
- is fitted with a storing box, adapted to receive products to be stored at a temperature above the temperature in the storing volume (preferably between -15°C and +5°C, more preferably below 0°C, even more preferably below -5°C), located within the storing volume, said box being fitted with heating means.

The evaporator in the first compartment can be isolated from the rest of the compartment by a wall. In this case means are provided for forcing air located in the first compartment to pass in the volume limited by the wall wherein the evaporator is located, thus cooling this air.

It is therefore possible, starting from a standard freezer such as those used as display cabinets to create two compartments which can be maintained at two different temperatures, thus allowing storing products at two different temperatures without having to dispose of the original freezer.

Detailed description of the invention

The present invention will be further described by reference to the drawings wherein the sole figure represents a schematic view of a refrigeration apparatus according to the invention.

As disclosed in Figure 1, the refrigeration apparatus according to the present invention is of the type comprising a freezer compartment 1 and a cold storage compartment 2. In a known manner, the two compartments 1 and 2 are thermally insulated. Preferably, their walls comprise insulating material having a thermal conductivity in the range of 0.5 to 50 milliWatt (meter Kelvin)$^{-1}$. The insulating material can be, for example, polystyrene, fibreglass, or vacuum.

The freezer compartment 1 is fitted with an evaporator 5 connected to a compressor 6. Through a sequence of switch on and switch off periods, the freezer compartment 1 is kept at a temperature T1. The switch ons and switch offs are triggered by comparing the actual temperature T1 in the freezer compartment with a reference temperature T1r which can be set by means of control means not represented.

The freezer compartment is accessed through an opening 10 which can either be closed by a door or a lid, or left open (open top freezer).

The cold storage compartment 2 is fitted with heating means 7, a fan 8 and a door or a lid 9. The cold storage compartment is maintained at a temperature T2, higher than T1, by the heating means 7 which are triggered by comparing the actual temperature T2 with a reference temperature T2r which can be set by means of control means not represented.

As can be seen in Figure 1, an existing freezer, for example of the open top type, can be fitted with a box, said box being itself fitted with heating means 7, a fan 8 and a door or lid 9. Thus an existing freezer can easily be fitted with additional means which allow for the creation of two compartments operating at two different temperatures without the need for an additional refrigeration circuit.

In operation, temperature T1 in the first compartment is maintained at a set temperature by the evaporator 5 and the compressor 6. Through heat exchange with the second compartment, temperature T2 in the second compartment is brought down. When this temperature reaches a reference temperature, heating means 7 and fan 8 are activated.

Claim

1. Refrigeration apparatus, situated in an environment at temperature Te, comprising;

. a first compartment at a temperature T1, the first compartment being accessible through at least an opening, and
. a second compartment at a temperature T2, T1 being colder than T2, T1 and T2 being colder than Te, the second compartment being located inside the first compartment,
. a refrigeration circuit in the first compartment adapted to keep temperature T1 within a range R1 through a sequence of energisation and de-energisation phases triggered by comparing temperature T1 with a first reference temperature T1r,
. heating means in the second compartment adapted to keep temperature T2 within a range R2.

2. Refrigeration apparatus according to claim 1, wherein the refrigeration circuit comprises an evaporator, the evaporator being connected to a compressor located outside the first compartment.

3. Refrigeration apparatus according to claim 2 wherein the second compartment does not contain an evaporator.

4. Refrigeration apparatus according to claim 1 wherein the heating means are triggered by comparing the actual temperature T2 with a second reference temperature T2r.

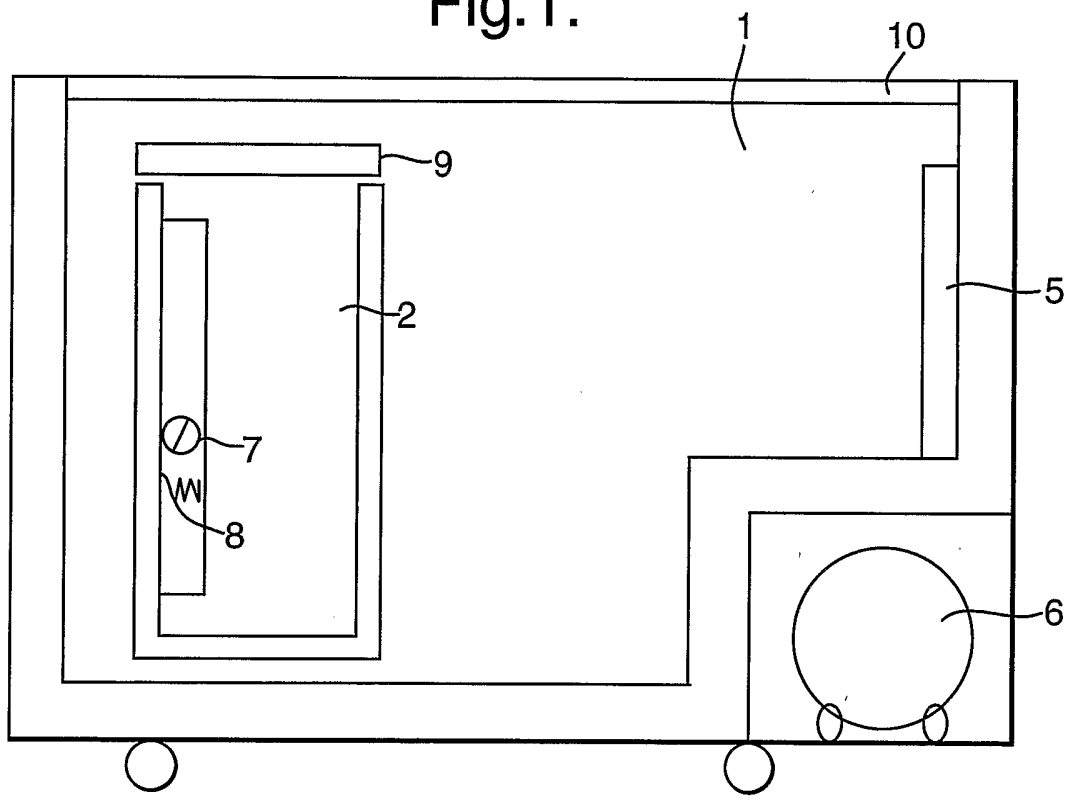
5. Refrigeration apparatus according to claim 4 wherein the reference temperatures T1r and T2r are set by means of control means.

6. Refrigeration apparatus according to claim 5 wherein T1r is comprised between -16 to -23°C and wherein T2r is comprised between -15°C and +5°C.

7. Process for providing a refrigeration apparatus according to any preceding claim wherein a freezer;

- comprising a storing volume adapted to receive products to be stored at a temperature below 0°C, an evaporator within said storing volume and a compressor located outside said storing volume,
- is fitted with a storing box, adapted to receive products to be stored at a temperature above the temperature in the storing volume, located within the storing volume, said box being fitted with heating means.

Fig.1.



INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 03/11333

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F25D11/02

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 7 F25D A47F

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 practical, search terms used)

WPI Data, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1 434 356 A (HILLIER C N) 5 May 1976 (1976-05-05) page 1, line 29 -page 1, line 114; figures	1-5,7
X	EP 0 509 476 A (MERLONI ELETTRODOMESTICI SPA) 21 October 1992 (1992-10-21) abstract; figures column 1, line 1 -column 3, line 25	1,2,4,5, 7
X	US 5 388 427 A (LEE SUN G) 14 February 1995 (1995-02-14) abstract; figures column 3, line 36 -column 3, line 43 column 4, line 13 -column 4, line 30 column 5, line 34 -column 5, line 41 column 6, line 24 -column 6, line 55	1-5,7

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"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)

"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

"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

"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

"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.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 January 2004	29/01/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	MacCormick, D

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 03/11333

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 782 106 A (PARK SANG TAE) 21 July 1998 (1998-07-21) column 1, line 29 -column 2, line 67	1-3,7
A	---	6
X	EP 1 245 918 A (SAMSUNG ELECTRONICS CO LTD) 2 October 2002 (2002-10-02) abstract; figures column 1, line 13 -column 3, line 55	1,2,4,5, 7
A	---	1-7
	EP 1 074 802 A (CANDY SPA) 7 February 2001 (2001-02-07) abstract; figures column 1 -column 4	
A	---	1-7
	US 6 092 382 A (GROENNE EBBE) 25 July 2000 (2000-07-25) abstract; figures column 4, line 4 -column 5, line 5	
A	---	1-7
	EP 0 798 521 A (AEG HAUSGERAETE GMBH) 1 October 1997 (1997-10-01) abstract; figures	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 03/11333

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
GB 1434356	A	05-05-1976	NONE		
EP 0509476	A	21-10-1992	IT	1245076 B	13-09-1994
			EP	0509476 A2	21-10-1992
US 5388427	A	14-02-1995	KR	117766 Y1	15-07-1998
			CN	1085648 A ,B	20-04-1994
			JP	6046278 U	24-06-1994
			RU	2110738 C1	10-05-1998
US 5782106	A	21-07-1998	CN	1160178 A ,B	24-09-1997
			IT	MI962756 A1	30-06-1998
EP 1245918	A	02-10-2002	KR	2002075616 A	05-10-2002
			CN	1376889 A	30-10-2002
			EP	1245918 A2	02-10-2002
			JP	2002303484 A	18-10-2002
			US	2002134545 A1	26-09-2002
EP 1074802	A	07-02-2001	IT	MI991771 A1	05-02-2001
			EP	1074802 A2	07-02-2001
US 6092382	A	25-07-2000	DK	9400457 U3	08-03-1996
			AT	190582 T	15-04-2000
			AU	4252796 A	26-06-1996
			DE	69515689 D1	20-04-2000
			DE	69515689 T2	02-11-2000
			WO	9617796 A1	13-06-1996
			EP	0794911 A1	17-09-1997
			JP	10511919 T	17-11-1998
			NO	972552 A	17-07-1997
EP 0798521	A	01-10-1997	DE	19612594 A1	02-10-1997
			EP	0798521 A2	01-10-1997