



(11) **EP 1 798 498 A3**

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
09.07.2008 Bulletin 2008/28

(51) Int Cl.:
F25B 9/00 (2006.01)

(43) Date of publication A2:
20.06.2007 Bulletin 2007/25

(21) Application number: **06125926.3**

(22) Date of filing: **12.12.2006**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**
Designated Extension States:
AL BA HR MK RS

(72) Inventors:
• **Matsumoto, Yuuichi**
Isesaki-shi Gunma 372-8502 (JP)
• **Suzuki, Kenichi**
Isesaki-shi Gunma 372-8502 (JP)
• **Tsuboi, Masato**
Isesaki-shi Gunma 372-8502 (JP)

(30) Priority: **13.12.2005 JP 2005358659**

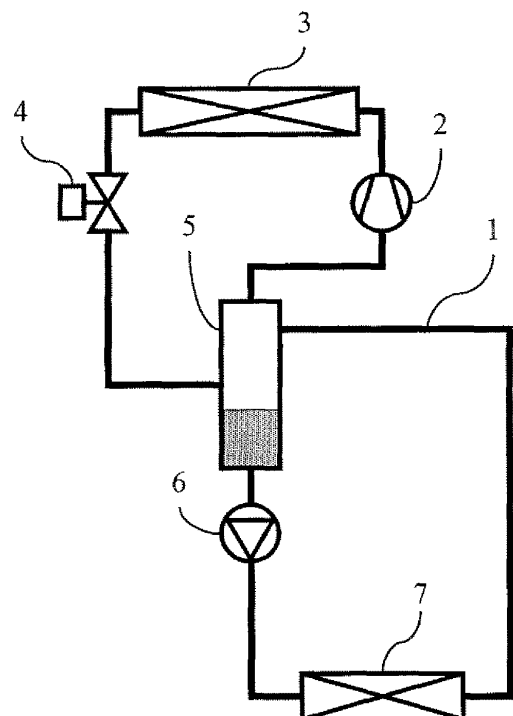
(71) Applicant: **Sanden Corporation**
Isesaki-shi,
Gunma 372-8502 (JP)

(74) Representative: **Haley, Stephen**
Gill Jennings & Every LLP
Broadgate House
7 Eldon Street
London EC2M 7LH (GB)

(54) **Vapor compression refrigerating systems**

(57) A vapor compression refrigerating system includes a compressor configured to compress a refrigerant, and a radiator connected to the compressor, in which the radiator is configured to receive the refrigerant from the compressor and to reduce a temperature of the refrigerant. The system also includes a pressure reducing mechanism connected to the radiator, and the pressure reducing mechanism is configured to receive the refrigerant from the radiator and to reduce a pressure of the refrigerant. The system also includes a separator connected to the pressure reducing mechanism and to the compressor, a pump connected to the separator, and an evaporator connected to the pump and to the separator. The separator is configured to receive the refrigerant from the pressure reducing mechanism, to separate a liquid portion of the refrigerant from a gas portion of the refrigerant, and to transmit the gas portion to the compressor. Moreover, the pump is configured to pump the liquid portion from the separator to the evaporator, and the evaporator is configured to evaporate the liquid portion into an evaporated portion, and to transmit the evaporated portion to the separator.

FIG. 1



EP 1 798 498 A3



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	HAFNER A: "COMPACT HEAT EXCHANGERS FOR MOBILE CO2 SYSTEMS" IIR GUSTAV LORENTZEN CONFERENCE ON NATURAL WORKING FLUIDS. JOINT CONFERENCE OF THE INTERNATIONAL INSTITUTE OF REFRIGERATION SECTION B AND E, XX, XX, 17 September 2002 (2002-09-17), pages 224-231, XP001176587	1-6, 10-12	INV. F25B9/00
Y	* figure 2.1 *	7-9	
X	DE 100 01 470 A1 (KARSCH MAX [DE]; HASSEL KARL HEINZ [DE]) 19 July 2001 (2001-07-19) * column 2, line 65 - column 3, line 59; figures 2,3,5-7,11 *	1-6, 10-12	TECHNICAL FIELDS SEARCHED (IPC) F25B
X	SCHIESARO P ET AL: "DEVELOPMENT OF A TWO STAGE CO2 SUPERMARKET SYSTEM" IIR CONFERENCE. NEW TECHNOLOGIES IN COMMERCIAL REFRIGERATION, XX, XX, 22 July 2002 (2002-07-22), pages 1-10, XP001169091 * paragraph [03.1]; figure 1 *	1-6, 10-12	
A	DE 103 58 428 A1 (GRASSO GMBH REFRIGERATION TECH [DE]) 7 July 2005 (2005-07-07) * the whole document *	1-12	
X	EP 0 260 367 A (KNOCHE GES FUR KALTE UND KLIMA [DE]) 23 March 1988 (1988-03-23) * column 2, line 5 - column 4, line 54; figures 1-3 *	1,2,4, 11,12	
Y	DE 28 06 729 A1 (VOLKSWAGENWERK AG) 23 August 1979 (1979-08-23) * page 5, paragraph 3; figure 1 *	13-22	
	----- -/--		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 June 2008	Examiner Ritter, Christoph
CATEGORY OF CITED DOCUMENTS		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	
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			

5
EPO FORM 1503 03/02 (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)
Y	JP 2003 121018 A (DAIKIN IND LTD) 23 April 2003 (2003-04-23) * abstract; figures * -----	14, 15	
Y	DE 197 02 097 A1 (NIPPON SOKEN [JP]) 24 July 1997 (1997-07-24) * column 3, line 24 - column 4, line 6; figures 1,8,12 * -----	7-9, 16-18	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 June 2008	Examiner Ritter, Christoph
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	

5
EPO FORM 1503 03.02 (P04C01)

**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

- Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-12

claim 1 concerns features of a vapor compression refrigerating system with an evaporator connected to a separator.

2. claims: 13-22

claim 13 concerns features of a vapor compression refrigerating system using an expander driving pumping means.

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

EP 06 12 5926

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.

04-06-2008

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 10001470	A1	19-07-2001	NONE	

DE 10358428	A1	07-07-2005	NONE	

EP 0260367	A	23-03-1988	AT 51440 T DE 3669916 D1	15-04-1990 03-05-1990

DE 2806729	A1	23-08-1979	US 4269040 A	26-05-1981

JP 2003121018	A	23-04-2003	JP 4039024 B2	30-01-2008

DE 19702097	A1	24-07-1997	JP 9196478 A US 5752391 A	31-07-1997 19-05-1998
