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(54) Thermal management system

(57) A system (100) includes a primary evaporator (115) facilitating heat transfer by evaporating liquid to obtain vapor. The primary evaporator (115) receives the liquid from a liquid line (125) and outputs the vapor to a vapor line (130). The primary evaporator (115) also outputs excess liquid received from the liquid line to an excess fluid line. A condensing system (120) receives the vapor from the vapor line (120), and outputs the liquid and excess liquid to the liquid line (125). The excess liquid

is obtained at least partially from a reservoir (147). A primary loop (105) includes the condensing system (120), the primary evaporator (115), the liquid line (125), and the vapor line (130), and provides a heat transfer path. Similarly, a secondary loop (110) includes the condensing system (122), the secondary evaporator (150), the liquid line (160), the vapor line (130), and the excess fluid line. The secondary loop provides a venting path for removing undesired vapor within the liquid or excess liquid from the primary evaporator.

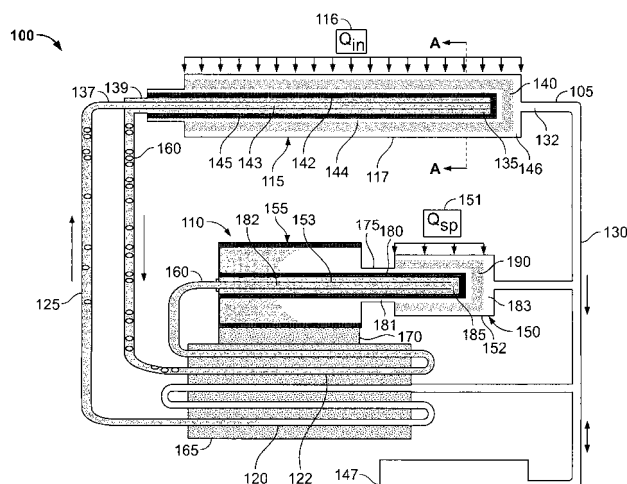


FIG. 1



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EUROPEAN SEARCH REPORT

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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 2002/007937 A1 (KROLICZEK EDWARD J ET AL) 24 January 2002 (2002-01-24) * paragraphs [0048] - [0063]; figures 8-10 *	1-4,14,16,18-20,22,23,30-34,41,44-46	INV. F28D15/04
Y	-----	28,29	
Y	US 2003/051857 A1 (CLUZET GERARD ET AL) 20 March 2003 (2003-03-20) * abstract; figures *	28,29	
X	US 4 470 450 A (BIZZELL ET AL) 11 September 1984 (1984-09-11) * column 5, line 33 - column 9, line 2; figure 1 *	1,2,5,6,9,28-32,35,37	
P,X	WO 2004/031675 A (SWALES & ASSOCIATES, INC; KROLICZEK, EDWARD, J; NIKITKIN, MICHAEL; WOL) 15 April 2004 (2004-04-15) * page 8, line 9 - page 18; figures 1-9 *	1-4,14-18,22,28-34,39-41,44-46	TECHNICAL FIELDS SEARCHED (IPC) F28D
P,X	WO 2004/040218 A (SWALES & ASSOCIATES, INC; KROLICZEK, EDWARD, J; NIKITKIN, MICHAEL; WOL) 13 May 2004 (2004-05-13) * page 10, line 6 - page 20; figures 1-9 * ----- -/--	1-4,14-18,22,28-34,39-41,44-46	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 15 May 2006	Examiner Van Dooren, M
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			

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European Patent
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Application Number
EP 04 01 6584

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
E	US 7 004 240 B1 (KROLICZEK EDWARD J ET AL) 28 February 2006 (2006-02-28) * the whole document *	1-4, 14-18, 28-34, 39-41, 44-46	
X	US 4 890 668 A (CIMA ET AL) 2 January 1990 (1990-01-02) * column 8, line 6 - column 9, line 57; figure 1 * * column 10, lines 33-48; figure 3 *	1,2,5,9, 13,18, 19,22, 30-32, 35,37, 41,42	
X A	DE 199 41 398 A1 (MITSUBISHI DENKI K.K., TOKIO/TOKYO) 31 August 2000 (2000-08-31) * column 6, line 53 - column 9, line 14; figures 1-3 *	1,2,21, 30-32 41	
A	WO 03/054469 A (TTH RESEARCH, INC) 3 July 2003 (2003-07-03) * page 5, line 16 - page 9, line 10; figure *	1-4, 14-16, 30-32,41	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
Place of search The Hague		Date of completion of the search 15 May 2006	Examiner Van Dooren, M
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			

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EPO FORM 1503 03.02 (P04C01)

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

EP 04 01 6584

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
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15-05-2006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2002007937	A1	24-01-2002	NONE	
US 2003051857	A1	20-03-2003	AT 274448 T	15-09-2004
			DE 60201054 D1	30-09-2004
			EP 1293428 A1	19-03-2003
			FR 2829746 A1	21-03-2003
US 4470450	A	11-09-1984	NONE	
WO 2004031675	A	15-04-2004	NONE	
WO 2004040218	A	13-05-2004	AU 2003285045 A1	25-05-2004
			BR 0315812 A	13-09-2005
			EP 1588113 A2	26-10-2005
			JP 2006508324 T	09-03-2006
			MX PA05004443 A	18-10-2005
US 7004240	B1	28-02-2006	NONE	
US 4890668	A	02-01-1990	NONE	
DE 19941398	A1	31-08-2000	JP 2000241089 A	08-09-2000
			US 6840304 B1	11-01-2005
WO 03054469	A	03-07-2003	AU 2002366705 A1	09-07-2003