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(54) COOLING SYSTEM FOR A COMPUTER SYSTEM

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(51) **Int. Cl. F28F** 7/00 (2006.01) **G06F** 1/20 (2006.01)

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(58) Field of Classification Search

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(Continued)

(56) References Cited

U.S. PATENT DOCUMENTS

3.810,509 A 5 1974 Kon 4.109,707 A 8 1978 Wilson et al. (Continued)

FOREIGN PATENT DOCUMENTS

"N 2514544 Y 10 2002 "N 1387311 A 12 2002 (Continued)

OTHER PUBLICATIONS

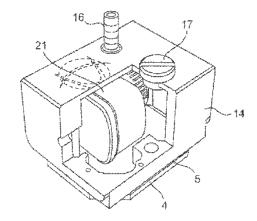
Notice of Allowability with Examiner's Reason for Allowance dated May 17, 2012 in U.S. Appl. No. 12 826,768 (4 pages). (Continued)

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(57) ABSTRACT

The invention relates to a cooling system for a computer system, said computer system comprising at least one unit such as a central processing unit (CPU) generating thermal energy and said cooling system intended for cooling the at least one processing unit and comprising a reservoir having an amount of cooling liquid, said cooling liquid intended for accumulating and transferring of thermal energy dissipated from the processing unit to the cooling liquid. The cooling system has a heat exchanging interface for providing thermal contact between the processing unit and the cooling liquid for dissipating heat from the processing unit to the cooling liquid. Different embodiments of the heat exchanging system as well as means for establishing and controlling a flow of cooling liquid and a cooling strategy constitutes the invention of the cooling system.

16 Claims, 17 Drawing Sheets



CoolIT Systems, Inc. Ex. 1001

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	3	ed U.S. A	Application Data		.215.546			Hata et al.			
	continua	ation	of applic	ation No. 11/919,974, filed as		,298,617			Campbell et al. Malone et al.		
				/DK2005/000310 on May 6,		,325,591			Duan et al.		
	2005.	iou ,	140. 1 6 1	The 2005 to 005 To 011 That y 0.		,359,197		4/2008	Stefanoski et al.		
	2005.					,455,103			Sato et al.		
(51)	Int. Cl.					,544,049		6/2009			
(31)	HOIL 2		2	(2006.01)		.971.632			Lenchan et al. Eriksen		
	F04D 15/00 (2006.01)				.240.362			Eriksen			
	H05K 7			(2006.01)		,733,681			Eriksen	G06F 1/206	
((2)				(2000.01)		0117291		8/2002			
(52)						0171388		1/2002	Seki Scott		
	CPC			473 (2013.01); H05K 7/20263		0039097		2/2003			
		(201		05K 7/20272 (2013.01); G06F		0056939		3/2003	Chu et al.		
	2200/201 (2013.01); H01L 2924/0002					0151895		8/2003	Zuo		
			(2013.01)		0042176		3/2004 3/2004	Niwatsukino et al. Wu et al.			
(58)	58) Field of Classification Search					0052049			Wu et al.		
	USPC 165/80.4					0052663			Laing et al.		
	See application file for complete search history.					0105232			Ito et al.		
			4 10 1			0141275		7/2004	Athari Hu et al.		
(56)			Referen	ces Cited		0190254 0233632		11/2004			
		TTC	DATEMT	DOCUMENTS		0052847			Hamman		
		U.S.	PATENT	DOCUMENTS		0061482			Lee et al.		
	4,520,298	Α	5/1985	Abbondanti		0069432			Tomioka		
	4,563,620	A	1/1986	Komatsu		0083656			Hamman Lee et al.		
	4,777,578		10/1988	Jahns		0126750			Yokozawa et al.		
	4,898,579		2/1990	Groshong et al.		0128705			Chu et al.		
	5,001,548 5,006,924			Frankeny et al.		0183848			Cheng et al.		
	5,070,936			Carroll et al.		0243518		6/2006	Hata et al. Mongia et al.		
	5,142,214			Purson et al.		0157230		7/2006	Kawahara et al.		
	5,316,077			Reichard		0161311			Vinson et al.		
	5,441,102 5,566,745			Burward-Hoy Hill et al.		0169440			Chou et al.		
	5,708,564		1/1998		2007	0000268	AI	1/2007	Crocker et al.		
	5,731,954		3/1998			EO	DEIG	M DATE	NT DOCUMENTS		
	5,763,951 A 6/1998 Hamilton et al.				10	KENO	IN TAILS.	INT DOCUMENTS			
	5,784,257 5,825,622		7/1998 10/1998	Tata Rife et al.	CN		1510	310 A	7/2004		
	5,890,880			Lustwerk	CN		M24		9/2004		
	5,901,037			Hamilton et al.	CN			8823 Y	11/2004		
	6,019,165			Batchelder Batchelder	DE EP			423 AI 687 AI	3/1997 4/1984		
	6,021,844 6,114,827			Alvaro	EP			455 AL	5/1990		
	6.141,217			Nakahama et al.	EP			1823 A2	12/1993		
	6,166,907		12/2000		EP	20		0826 A2	8/1994		
	6,170,563		1/2001		JP JP	20	3452	638 A	5/2002 9/2003		
	6,263,957 6,305,463			Chen et al. Salmonson	KR	10-200			4/2003		
	6,343,478		2/2002		TW		159	299	1/1995		
	6,408,937		6/2002	Roy	TW			588	2/2004		
	6,415,860			Kelly et al.	TW			1468 1442 U	8/2004 11/2004		
	6,447,270		9/2002		TW			682 U	2/2005		
	6,529,376		3/2003	Hamman	WO		01/25	881 A	4/2001		
	6,551,734			Simpkins et al.	WO			468 A2	2/2005		
	6,580,610			Morris et al.	WO	WO 20		654 A2	5/2005 11/2006		
	6,668,911 6,702,002		12/2003 3/2004		110	11 () 20	00/113	701	11/2000		
	6,725,682		4/2004				OT	TOD DIE	DI ICATIONIO		
	6,728,107		4/2004	Tseng et al.			OT	HER PU	BLICATIONS		
	6,749,012			Gwin et al.	Notice	of Alloy	vahilit	v with E	xaminer's Reason for	Allowance	
	6,796,370 6,892,802		9/2004	Kelly et al.					ol. No. 13/269,234 (8		
	6,894,899			Wu et al.	Notice of Allowability with Examiner's Reason for Allowance						
	6,915,653	B2	7/2005	Nakano et al.	dated Apr. 8, 2011 in U.S. Appl. No. 10/578,578 (5 pages).						
	6,945,315	BI		Gektin et al.		Order re: Claim Construction for U.S. Pat. Nos. 8,240,362 and					
	6,952,345 6,967,841			Weber et al. Chu et al.		8,245,764 in U.S. District Court, Northern District of California.					
	6,972,954			Minamitani et al.		Case Nos. C-12-4498 EMC and C-13-0457 JST, filed Dec. 3, 2013					
	6,992,887 B2 1/2006 Jairazbhoy et al.					ges).					
	7,055,581	BI	6/2006	Roy					ean Application No. EP2	0080100686	
	7,057,894		6/2006				No.	2014 (8 p		0000100606	
	7,100,389 7,156,160			Wayburn Lee et al.				2014 (7 p	ean Application No. EP2	000010000	
	111 01100	24	1,2001		oscialit.		6. 10.	2011(/)	-6-1/1		



(56) References Cited

OTHER PUBLICATIONS

Office Action dated Aug. 22, 2007 in U.S. Appl. No. 10:578,578 (9

Office Action dated Apr. 25, 2008 in U.S. Appl. No. 10 578,578 (11

Office Action dated Aug. 18, 2008 in U.S. Appl. No. 10 578,578 (12 pages).

Office Action dated Mar. 20, 2009 in U.S. Appl. No. 10 578,578 (14 pages)

Office Action dated Jul. 15, 2009 in U.S. Appl. No. 10 578,578 (14 pages).

Office Action dated Apr. 13, 2010 in U.S. Appl. No. 10 578,578 (14 pages).

Office Action dated Nov. 24, 2010 in U.S. Appl. No. 10 578,578 (11 pages).

Office Action dated Nov. 23, 2011 in U.S. Appl. No. 12-826,802 (11 pages).

Office Action dated Dec. 5, 2011 in U.S. Appl. No. 12 826,768 (14 pages).

Office Action dated Dec. 20, 2011 in U.S. Appl. No. 13 269,234 (9 pages).

Office Action dated Mar. 13, 2012 in U.S. Appl. No. 13 269,234 (11 pages).

Office Action dated Mar. 27, 2012 in U.S. Appl. No. 11 919,974 (16 pages).

Office Action dated Sep. 12, 2012 in U.S. Appl. No. 13 547,240 (15 pages).

Office Action dated Jan. 16, 2013 in U.S. Appl. No. 13 547,240 (9 pages).

Office Action dated Mar. 23, 2016 in U.S. Appl. No. 13 942,922 (13 pages).

Office Action dated Aug. 10, 2016 in U.S. Appl. No. 13 942,922 (18 pages).

Office Action dated Feb. 24, 2017 in U.S. Appl. No. 15 347,938 (11 pages).

Notice of Allowance dated May 15, 2017 in U.S. Appl. No. 15 347,938 (18 pages).

Office Action dated Oct. 12, 2012 in U.S. Appl. No. 11 919,974 (14 pages).

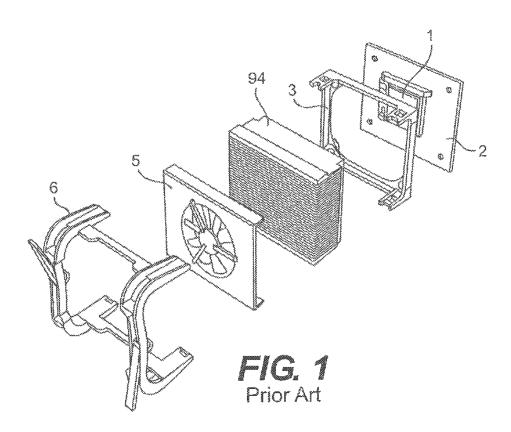
Office Action dated Oct. 6, 2016 in U.S. Appl. No. 13 861,593 (8 pages).

Office Action dated Feb. 3, 2017 in U.S. Appl. No. 13 861,593 (18 pages).

Notice of Allowance dated Jun, 7, 2017 in U.S. Appl. No. 13, 861,593 (16 pages).

* cited by examiner





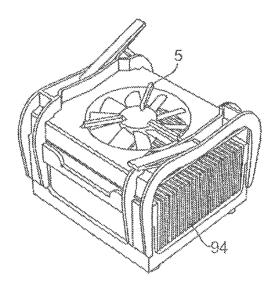
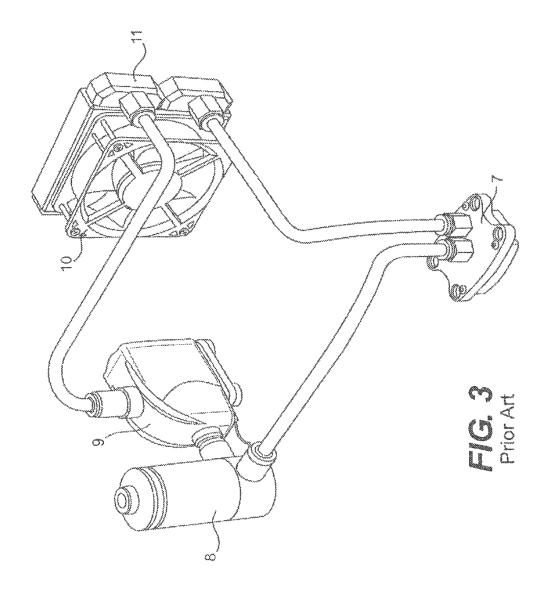


FIG. 2 Prior Art



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