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[Continued on next page]

(54) Title: HEAT DISSIPATION IN ELECTRONICS

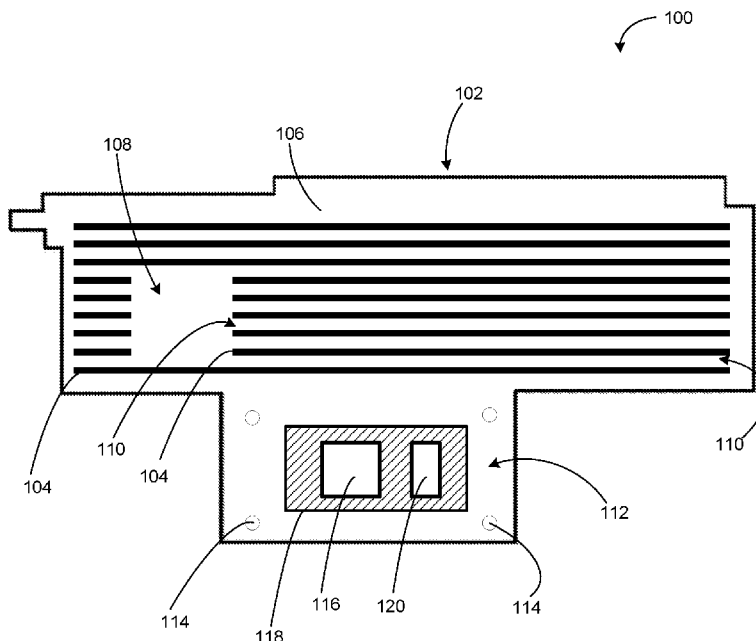


FIG. 1

(57) Abstract: Heat dissipation configurations and methods are described herein. A heat dissipation apparatus may include an individual piece of metal having a thermally conductive metal surface. The metal surface includes a plurality of ridges or protrusions extending from a base of the metal surface, wherein an air flow channel is provided between each two adjacent protrusions, therein providing a plurality of air flow channels. The apparatus is configured to dissipate heat for an electronic device having an active cooling source directing air through the plurality of air flow channels. In some examples, the heat dissipation apparatus is a vapor chamber, and the surface includes a section having a trough and a raised area or platform surrounded by the trough, wherein the raised area is configured to contact a microprocessor die in communication with the vapor chamber.

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TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
 INV. H01L23/427 H01L23/467 H01L23/367 H01L21/48 F28D15/02
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ADD.
 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)
 H01L F28F F28D

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)
 EPO-Internal, COMPENDEX, INSPEC, IBM-TDB, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/045308 A1 (WANG CHIN WEN [TW] ET AL) 3 March 2005 (2005-03-03) paragraphs [0001], [0018] - [0027]; figures 3-7 -----	1,2,5,6
X	US 2007/261242 A1 (XIA WAN-LIN [CN] ET AL) 15 November 2007 (2007-11-15) paragraphs [0016] - [0025]; figure 5 -----	1,2,6,11,12
X	US 2014/182132 A1 (CHEN CHIH-PENG [TW]) 3 July 2014 (2014-07-03)	1,2
Y	paragraphs [0002], [0003], [0023] - [0033] -----	13
X	US 2014/182820 A1 (CHEN CHIH-PENG [TW]) 3 July 2014 (2014-07-03) paragraphs [0002], [0003], [0017] - [0025] -----	1,2
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

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

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Date of the actual completion of the international search

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International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 337 162 A (FURUKAWA ELECTRIC CO LTD [JP]) 10 November 1999 (1999-11-10) page 6, line 1 - page 7, line 16; figures 1,5,7; example 1 -----	1,2,6, 11,12
X	US 2006/113065 A1 (WOLFORD ROBERT R [US] ET AL) 1 June 2006 (2006-06-01) figure 3 -----	1-3,11
X	US 6 550 531 B1 (SEARLS DAMION T [US] ET AL) 22 April 2003 (2003-04-22) figure 1 -----	1,2,6,11
X	US 2002/080583 A1 (PRASHER RAVI [US] ET AL) 27 June 2002 (2002-06-27) figure 4 -----	1,2,11
X	US 2006/203450 A1 (WEI WEN [US]) 14 September 2006 (2006-09-14) paragraph [0032]; figures 1,3 -----	1,2,11
Y	US 5 409 055 A (TANAKA SUEMI [JP] ET AL) 25 April 1995 (1995-04-25) figure 2 -----	4,13-15
X	US 6 082 443 A (YAMAMOTO MASAOKI [JP] ET AL) 4 July 2000 (2000-07-04) -----	7-10
Y	column 1, line 6 - line 9; figures 4,7 column 3, line 60 - column 4, line 18 column 11, line 47 - column 12, line 26 -----	4,14,15
X	JP H10 288481 A (FURUKAWA ELECTRIC CO LTD) 27 October 1998 (1998-10-27) figure 1 -----	7-10
X	JP H10 267571 A (FURUKAWA ELECTRIC CO LTD) 9 October 1998 (1998-10-09) figures 1, 10 -----	7-10
A	US 2011/232877 A1 (MEYER IV GEORGE ANTHONY [US] ET AL) 29 September 2011 (2011-09-29) the whole document -----	15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/042702

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-3, 11-13(completely); 5, 6(partially)

A vapour chamber with protrusions on both an upper metal surface and a lower metal surface and a method of manufacturing it.

2. claims: 4, 7-10, 14, 15(completely); 5, 6(partially)

A vapor chamber with a metal surface comprising a section with a raised area.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/042702

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005045308	A1	03-03-2005	NONE

US 2007261242	A1	15-11-2007	NONE

US 2014182132	A1	03-07-2014	NONE

US 2014182820	A1	03-07-2014	NONE

GB 2337162	A	10-11-1999	GB 2337162 A 10-11-1999 TW 378267 B 01-01-2000 US 2001025701 A1 04-10-2001 WO 9934438 A1 08-07-1999

US 2006113065	A1	01-06-2006	CN 1783462 A 07-06-2006 US 2006113065 A1 01-06-2006 US 2007044310 A1 01-03-2007

US 6550531	B1	22-04-2003	NONE

US 2002080583	A1	27-06-2002	US 2002080583 A1 27-06-2002 US 2002080584 A1 27-06-2002

US 2006203450	A1	14-09-2006	NONE

US 5409055	A	25-04-1995	DE 4310556 A1 07-10-1993 FR 2690040 A1 15-10-1993 JP H0629683 A 04-02-1994 US 5409055 A 25-04-1995

US 6082443	A	04-07-2000	DE 19805930 A1 20-08-1998 US 6082443 A 04-07-2000

JP H10288481	A	27-10-1998	JP 3106429 B2 06-11-2000 JP H10288481 A 27-10-1998

JP H10267571	A	09-10-1998	NONE

US 2011232877	A1	29-09-2011	NONE
