Signature

(Print/Type)

SAMUEL W. APICELLI

Name

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1 3 3 5 Under the					PTO/SB/05 19th 07/31/2006, OMB 06 DEPARTMENT OF COM	51-0032			
Under the	Paperwork Reduction Act of 1995, no pa	ersons are required to re							
C	UTILITY		Attorney Docket No.	H1799-00303					
	PATENT APPLICAT	ION	First Inventor	DUSSINGER					
РТО	TRANSMITTAL		Title	INTEGRATED	GROUIT HEAT				
	new nonprovisional applications under 3	37 CFR 1.53(b))	Express Mail Label No.	EV516205990l	JS				
See MPEP	APPLICATION ELEMEN' chapter 600 concerning utility patent ap		ADDRESS TO:	Commissione P.O. Box 1450 Alexandria V					
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3. Specif	7 CFR 1.27. fication		9. Assignment Papers (cover sheet & document(s)) Name of Assignee						
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5. Oath or De	claration [Total Showly executed (original or copy)	eets 3]	10. 37 CFR 3.73(b) (when there is	Statement s an assignee)	Power of Attorney	-			
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i.	DELETION OF INVENTOR(S) Signed statement attached deleting invename in the prior application, see 37 Ct 1.63(d)(2) and 1.33(b).			sclosure Stater of citations attac	nent (PTO/SB/08 or PTo ched	O-1449)			
6. Applie	cation Data Sheet. See 37 CFR 1.	76	13. Preliminary An	nendment					
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☐ Conti	nuation	Continua	ation-in-part (CIP) of pri	or application No.:	10/626,270				
Prior application	information: Examiner	CIRIC, LJILJANA	Art Un	it: <u>3553</u>					
		19. CORRESPON	DENCE ADDRESS						
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This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Corfidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trackerark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Date

Cooler Master's Exhibit No. 1003

8/5/03 Registration No.

(Attorney/Agent)

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FEE TRANS	SMITTAL	Filing Date	Herewith						
For FY	2005	First Named Inventor	DUSSIN						
		Examiner Name	CIRIC. L	JILJANA					
Applicant claims small entity stat	us. See 37 CFR 1.27	Art Unit	3753						
TOTAL AMOUNT OF PAYMENT (\$) 1600	Attorney Docket No.	H1799-0	0303					
METHOD OF PAYMENT (check all that apply)									
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For the above-identified depos	it account, the Director is h	ereby authorized to: (chec	k all that ap	ply)					
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information and authorization on PTO-20	38.								
FEE CALCULATION									
1. BASIC FILING, SEARCH, AND FILING			MINATIOI Ilanz	N FEES Entity					
Application Type Fee (\$)				2 (\$)	Fees Paid (\$)				
Utility 300	150 500	250 20	00 10	00	1000				
Design 200	100 100	50 13	80 6	55					
Plant 200	100 300	150 16	50 8	80					
Reissue 300	150 500	250 60	00 30	00					
Provisional 200	100 0	0	0	0					
2. EXCESS CLAIM FEES Fee Description Each claim over 20 (including	Daiseuas)		Ē	ee (\$) 50	Small Entity Fee (\$) 25				
Each independent claim over 3				200	100				
Multiple dependent claims	,			360	180				
Total Claims Extra Cla		ee Paid (\$)	_		pendent Claims				
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3. APPLICATION SIZE FEE If the specification and drawings	-	aner (excluding electro	nically file	ed sequenc	ce or computer				
listings under 37 CFR 1.52(e									
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4. OTHER FEE(S) Non-English Specification,	\$130 fee (no small entity	y discount)			Fees Paid (\$)				
Other (e.g., late filing surchar									
SUBMITTED BY									
Signature Signature	()ind/ -	Registration No. (Attorney/Agent) 36,427		Telephone	717-237-5516				
Jacobs Views	Jour Jour	(Attorney/Agent) 36,427		Data a	10/2/				

Name (Print/Type) Samuel W. Apicelli 🗸 Date 8/9/05

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

CERTIFICATE OF EXPRESS MAILING

I hereby certify that these documents, namely a Divisional Utility Application and a Preliminary Amendment, in connection with the below-identified Patent Application, are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service on the date indicated below and is addressed to the Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date of Deposit Pugue Post Papers Mail" mailing label number EV516205990US

Samuel W. Apicelli, Registration No. 36,427

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.

Not yet assigned

Applicant

Peter M. Dussinger and Thomas L. Myers

Filed

Herewith

Title

INTEGRATED CIRCUIT HEAT PIPE HEAT

SPREADER WITH THROUGH MOUNTING HOLES

TC/A.U.

Not yet assigned

Examiner Docket No.

Not yet assigned H1799-00303

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Sir:

TRANSMITTAL LETTER

Please find enclosed for filing:

Divisional Patent application including 15 sheets specification & 3 drawings

Preliminary Amendment

Copy of combined Declaration and Power of Attorney

copy of Revocation and Power of Attorney

Patent application cover sheet

Eee transmittal form submitted in duplicate

Certificate of Express mailing

Transmittal letter. Please charge the application fees, namely, \$1600, in

connection with this matter, and any additional fees, to Deposit Account No. 04-1679.

Return Postcard

Date:

Respectfully Submitted

Samuel W. Apicelli

Registration No. 36,427

Customer No. 041396

DUANE MORRIS LLP

305 North Front Street, P.O. Box 1003

Harrisburg, PA 17108-1003

(717) 237-5516

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Under the Paperwork Reduction Act of 1995, no persons are require	U.S. Patent and Tra	
UTILITY	Attorney Docket No.	H1799-0030
PATENT APPLICATION	First Inventor	DUSSINGE

TRANSMITTAL

PTO/SE/05 (04-05) hrough 07/31/2006, OMB 0651-0032 S. DEPARTMENT OF COMMERCE fisplays a valid OMB control number. INTEGRATED CIRCUIT HEAT ... Title EV516205990US (Only for new nonprovisional applications under 37 CFR 1.53(b)) Express Mail Label No.

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria VA 22313-1450						
1. Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original and a duplicate for fee processing)	ACCOMPANYING APPLICATION PARTS						
2. Applicant claims small entity status. See 37 CFR 1.27.	9. Assignment Papers (cover sheet & document(s))						
3. Specification [Total Pages 15] Both the claims and abstract must start on a new page (For information on the preferred arrangement, see MPEP 608.01(e))	Name of Assignee						
4. Drawing(s) (35 U.S.C. 113) [Total Sheets3]							
5. Oath or Declaration [Total Sheets3] a. Newly executed (original or copy) b. / A copy from a prior application (37 CFR 1.63(d))	10. 37 CFR 3.73(b) Statement Power of (when there is an assignee) Attorney						
(for continuation/divisional with Box 18 completed)	11. English Translation Document (if applicable)						
Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).	12. Information Disclosure Statement (PTO/SB/08 or PTO-1449) Copies of citations attached						
6. Application Data Sheet. See 37 CFR 1.76	13. Preliminary Amendment						
7. CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix) Landscape Table on CD	14. Return Receipt Postcard (MPEP 503) (Should be specifically itemized)						
8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required)	15. Certified Copy of Priority Document(s) (if foreign priority is claimed)						
a. Computer Readable Form (CRF) b. Specification Sequence Listing on:	16. Nonpublication Request under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.						
i. CD-ROM or CD-R (2 copies); or ii. Paper	17. Other:						
c. Statements verifying identity of above copies							
18. If a CONTINUING APPLICATION, check appropriate box, and sup specification following the title, or in an Application Data Sheet under 3	ply the requisite information below and in the first sentence of the 7 CFR 1.76:						
Continuation Divisional Continua	tion-in-part (CIP) of prior application No.: 10/628,270						
Prior application information: Examiner CIRIC, LJILJANA	Art Unit: <u>3553</u>						
19. CORRESPON	DENCE ADDRESS						
The address associated with Customer Number: 0413	396 OR Correspondence address below						
Name							
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City State	Zip Code						
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Signature Xum W. And -	Date 8/5/05						
Name (Print/Type) SAMUEL W. APICELLI	Registration No. (Attorney/Agent) 36,427						

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Cooler Master's Exhibit No. 1003 Page 4

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METHOD OF PAYMENT (check all that apply)										
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FEE CALCULATION	OU AND	EVANUATION F								
1. BASIC FILING, SEAR	FILING I			CH FEES Small Entity	EXA	OITANIN	N FEES			
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Design	200	100	100	50	130	0 6	55			
Plant	200	100	300	150	160	0 8	80			
Reissue	300	150	500	250	600	0 30	00			
Provisional	200	100	0	0	(0	0	*****		
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Signature	u/W.	sud -		Registration No. (Attorney/Agent)	6,427		Telepho	one 717-237-5516		
Name (Print/Type) Samuel W	. Apicelli	<i></i>					Date §	2/9/05		

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Date of Deposit Huguri 1906. "Express Mail" mailing label number ______ EV516205990US

Samuel W. Apicelli, Registration No. 36,427

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.

Not yet assigned

Applicant

Peter M. Dussinger and Thomas L. Myers

Filed

Herewith

Title

INTEGRATED CIRCUIT HEAT PIPE HEAT

SPREADER WITH THROUGH MOUNTING HOLES

TC/A.U.

Not yet assigned

Examiner : Docket No. :

Not yet assigned H1799-00303

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Sir:

TRANSMITTAL LETTER

Please find enclosed for filing:

Divisional Patent application including 15 sheets specification & 3 drawings

Preliminary Amendment

Copy of combined Declaration and Power of Attorney

copy of Revocation and Power of Attorney

Patent application cover sheet

☐ Fee transmittal form submitted in duplicate

□ Certificate of Express mailing

Transmittal letter. Please charge the application fees, namely, \$1600, in

connection with this matter, and any additional fees, to Deposit Account No. 04-1679.

Return Postcard

Date: 1

Respectfully Submitted

Samuel W. Apicelli// Registration No. 36,427

Customer No. 041396

DUANE MORRIS LLP

305 North Front Street, P.O. Box 1003

Harrisburg, PA 17108-1003

(717) 237-5516

PH1\1479810.1

APPLICATION FOR LETTERS PATENT

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT PETER M. DUSSINGER, a resident of Lititz,
Pennsylvania, and THOMAS L. MYERS, a resident of Lititz,
Pennsylvania, both citizens of the United States of America,
have invented certain new and useful improvements in an
INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER

WITH THROUGH MOUNTING HOLES of which the following is a specification:

BACKGROUND OF THE INVENTION

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This invention relates generally to active solid state devices, and more specifically to a heat pipe for cooling an integrated circuit chip, with the heat pipe designed to be held in direct contact with the integrated circuit.

As integrated circuit chips decrease in size and increase in power, the required heat sinks and heat spreaders have grown to be larger than the chips. Heat sinks are most effective when there is a uniform heat flux applied over the entire heat input surface. When a heat sink with a large heat input surface is attached to a heat source of much smaller contact area, there is significant resistance to the flow of heat along the heat input surface of the heat sink to the other portions of the heat sink surface which are not in direct contact with the contact area of the integrated circuit chip. Higher power and smaller heat sources, or heat sources which are off center from the heat sink, increase the resistance to heat flow to the balance of the heat sink. This phenomenon can cause great differences in the effectiveness of heat transfer from various parts of a heat sink. The effect of this unbalanced heat transfer is reduced performance of the integrated circuit chip and decreased reliability due to high operating temperatures.

The brute force approach to overcoming the resistance to heat flow within heat sinks which are larger than the device

being cooled is to increase the size of the heat sink, increase the thickness of the heat sink surface which contacts the device to be cooled, increase the air flow which cools the heat sink, or reduce the temperature of the cooling air. However, these approaches increase weight, noise, system complexity, and expense.

It would be a great advantage to have a simple, light weight heat sink for an integrated circuit chip which includes an essentially isothermal surface even though only a part of the surface is in contact with the chip, and also includes a simple means for assuring intimate contact with the integrated circuit chip to provide good heat transfer between the chip and the heat sink.

SUMMARY OF THE INVENTION

The present invention is an inexpensive heat pipe heat spreader for integrated circuit chips which is of simple, light weight construction. It is easily manufactured, requires little additional space, and provides additional surface area for cooling the integrated circuit and for attachment to heat transfer devices for moving the heat away from the integrated circuit chip to a location from which the heat can be more easily disposed of. Furthermore, the heat pipe heat spreader is constructed to assure precise flatness and to maximize heat transfer from the heat source and to the heat sink, and has

holes through its body to facilitate mounting.

The heat spreader of the present invention is a heat pipe which requires no significant modification of the circuit board or socket because it is held in intimate contact with the integrated circuit chip by conventional screws attached to the integrated circuit mounting board. This means that the invention uses a very minimum number of simple parts.

Furthermore, the same screws which hold the heat spreader against the chip can also be used to clamp a finned heat sink to the opposite surface of the heat spreader.

The internal structure of the heat pipe is an evacuated vapor chamber with a limited amount of liquid and includes a pattern of spacers extending between and contacting the two plates or any other boundary structure forming the vapor chamber. The spacers prevent the plates from bowing inward, and therefore maintain the vital flat surface for contact with the integrated circuit chip. These spacers can be solid columns, embossed depressions formed in one of the plates, or a mixture of the two. Porous capillary wick material also covers the inside surfaces of the heat pipe and has a substantial thickness surrounding the surfaces of the spacers within the heat pipe, thus forming pillars of porous wick surrounding the supporting spacers. The wick material therefore spans the space between the plates in multiple locations.

The spacers thus serve important purposes. They support the flat plates and prevent them from deflecting inward and distorting the plates to deform the flat surfaces which are required for good heat transfer. The spacers also serve as critical support for the portions of the capillary wick which span the internal space between the plates. The capillary wick pillars which span the space between the plates provide a gravity independent characteristic to the heat spreader, and the spacers around which the wick pillars are located assure that the capillary wick is not subjected to destructive compression forces.

The spacers also make it possible to provide holes into and through the vapor chamber, an apparent inconsistency since a heat pipe vacuum chamber is supposed to be vacuum tight. This is accomplished by bonding the spacers, if they are solid, to both plates of the heat pipe, or, if they are embossed in one plate, bonding the portions of the depressions which contact the opposite plate to that opposite plate. With the spacer bonded to one or both plates, a through hole can be formed within the spacer and it has no effect on the vacuum integrity of the heat pipe vapor chamber, from which the hole is completely isolated.

An alternate embodiment of the invention provides the same provision for mounting the heat pipe heat spreader with simple

screws even when the heat pipe is constructed without internal spacers. This embodiment forms the through holes in the solid boundary structure around the outside edges of the two plates. This region of the heat pipe is by its basic function already sealed off from the vapor chamber by the bond between the two plates, and the only additional requirement for forming a through hole within it is that the width of the bonded region be larger than the diameter of the hole. Clearly, with the holes located in the peripheral lips, the heat pipe boundary structure can be any shape.

Another alternate embodiment of the invention provides for improved heat transfer between the integrated circuit chip and the heat pipe heat spreader. This is accomplished by using a different capillary wick material within the heat pipe at the location which is directly in contact with the chip. Instead of using the same sintered copper powder wick which is used throughout the rest of the heat pipe, the part of the wick which is on the region of the heat pipe surface which is in contact with the chip is constructed of higher thermal conductivity sintered powder. Such powder can be silver, diamond, or many other materials well known in the art. This provides for significantly better heat transfer in the most critical heat transfer area, right at the integrated circuit chip.

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The present invention thereby provides a heat pipe with superior heat transfer characteristics, and the simplest of all mounting devices, just several standard screws.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross section view of the preferred embodiment of the heat pipe of the invention with through holes through its vapor chamber and in contact with a finned heat sink.

FIG. 2 is a cross section view of an alternate embodiment of the heat pipe of the invention with through holes in the peripheral lips and in a depression in one plate.

FIG. 3 is a plan view of an internal surface the contact plate of the preferred embodiment of the invention showing the region of the capillary wick constructed of sintered higher heat conductivity powder.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is a cross section view of the preferred embodiment of a flat plate heat pipe 10 of the invention with through holes 12 through its vapor chamber 14 and in contact with finned heat sink 16.

Heat pipe 10 is constructed by forming a boundary structure by sealing together two formed plates, contact plate 18 and cover plate 20. Contact plate 18 and cover plate 20 are sealed together at their peripheral lips 22 and 24 by conventional means, such as soldering or brazing, to form heat pipe 10.

Heat pipe 10 is then evacuated to remove all non-condensible gases and a suitable quantity of heat transfer fluid is placed within it. This is the conventional method of constructing a heat pipe, and is well understood in the art of heat pipes.

The interior of heat pipe 10 is, however, constructed unconventionally. While contact plate 18 is essentially flat with the exception of peripheral lip 24, cover plate 20 includes multiple depressions 26. Depressions 26 are formed and dimensioned so that, when contact plate 18 and cover plate 20 are joined, the flat portions of depressions 26 are in contact with inner surface 28 of contact plate 18. Depressions 26 thereby assure that the spacing between contact plate 18 and cover plate 20 will be maintained even though pressure differentials between the inside volume of heat pipe 10 and the surrounding environment might otherwise cause the plates to deflect toward each other.

Heat pipe 10 also includes internal sintered metal capillary wick 30 which covers the entire inside surface of contact plate 18. As is well understood in the art of heat pipes, a capillary wick provides the mechanism by which liquid condensed at the cooler condenser of a heat pipe is transported back to the hotter evaporator where it is evaporated. The vapor produced at the evaporator then moves to the condenser where it again condenses. The two changes of state, evaporation

at the hotter locale and condensation at the cooler site, are what transport heat from the evaporator to the condenser.

In the present invention, heat pipe 10 also has capillary wick pillars 32 which bridge the space between contact plate 18 and cover plate 20. Pillars 32 thereby interconnect cover plate 16 and contact plate 14 with continuous capillary wick. This geometry assures that, even if heat pipe 10 is oriented so that cover plate 16 is lower than contact plate 14, liquid condensed upon inner surface 34 of cover plate 20 will still be in contact with capillary pillars 32. The liquid will therefore be moved back to raised surface 28 which functions as the evaporator because it is in contact with a heat generating integrated circuit (not shown). Capillary pillars 32 are wrapped around and supported by depressions 26, which prevents the structurally weaker capillary pillars 32 from suffering any damage.

FIG. 1 also shows frame 36 which is typically used to surround and protect heat pipe 10. Frame 34 completely surrounds heat pipe 10 and contacts lip 24 of contact plate 18. When heat pipe 10 is used to cool an integrated circuit chip (not shown) which is held against contact plate 18, cover plate 20 is held in intimate contact with fin plate 38, to which fins 16 are connected. The entire assembly of heat pipe 10, frame 34, and fin plate 38 is held together and contact plate 18 is

held against an integrated circuit chip by conventional screws 40, shown in dashed lines, which are placed in holes 42 in fin plate 38 and through holes 12 in heat pipe 10, and are threaded into the mounting plate (not shown) for the integrated circuit chip.

Holes 12 penetrate heat pipe 10 without destroying its vacuum integrity because of their unique location. Holes 12 are located within sealed structures such as solid columns 44, and since columns 44 are bonded to cover plate 20 at locations 46, holes 12 passing through the interior of columns 44 have no affect on the interior of heat pipe 10.

The preferred embodiment of the invention has been constructed as heat pipe 10 as shown in FIG. 1. This heat pipe is approximately 3.0 inches by 3.5 inches with a total thickness of .200 inch. Cover plate 20 and contact plate 18 are constructed of OFHC copper .035 inch thick, and depressions 26 span the .100 inch height of the internal volume of heat pipe 10. The flat portions of depressions 26 are .060 inch in diameter. Capillary wick 30 is constructed of sintered copper powder and averages .040 inch thick. Columns 44 have a .250 inch outer diameter, and holes 12 are .210 in diameter.

FIG. 2 is a cross section view of an alternate embodiment of the flat plate heat pipe 11 of the invention with through holes 48 located within peripheral lips 22 and 24 of the heat

pipe and hole 50 shown in another sealed structure, one of the depressions 26. The only requirement for forming hole 50 within a depression 26 is that the bottom of depression 26 must be bonded to inner surface 28 of contact plate 18 to prevent loss of vacuum within the heat pipe. Of course, the region of the peripheral edges is also a sealed structure since bonding between lips 22 and 24 is inherent because heat pipe 11 must be sealed at its edges to isolate the interior from the outside atmosphere.

The only differences between heat pipe 11 of FIG. 2 and heat pipe 10 of FIG. 1 are that finned heat sink 16 is not shown in FIG. 2, lips 22 and 24 are slightly longer in FIG. 2 to accommodate holes 48, and hole 50 is shown. In fact, through holes 12 shown in FIG. 12 are also included in FIG. 2. Although it is unlikely that holes 12, holes 48, and hole 50 would be used in the same assembly, manufacturing economies may make it desirable to produce all the holes in every heat pipe so that the same heat pipe heat spreader can be used with different configurations of finned heat sinks. The unused sets of holes have no effect on the operation or benefits of the invention.

FIG. 3 is a plan view of the internal surface of the contact plate 18 of heat pipe 10 of the invention showing region 31 of capillary wick 30. Region 31 is constructed of

sintered silver powder. While the balance of capillary wick 30 is conventional sintered metal such as copper, region 31 of capillary wick 30, which is on the opposite surface of contact 3 plate 18 from the integrated circuit chip (not shown), is formed of powdered silver. The higher thermal conductivity of 5 silver yields significantly better heat conduction through 6 region 31 of the wick 30, and thereby reduces the temperature 7 difference between the integrated circuit chip and the vapor 8 within heat pipe 10. This reduction of temperature difference 9 directly affects the operation of heat pipe 10, and essentially 10 results in a similar reduction in the operating temperature of 11

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the chip.

The invention thereby furnishes an efficient means for cooling an integrated circuit and does so without the need for larger heat spreaders which not only add weight but also do not transfer heat away from the integrated circuit as efficiently as does the heat pipe of the invention.

It is to be understood that the form of this invention as shown is merely a preferred embodiment. Various changes may be made in the function and arrangement of parts; equivalent means may be substituted for those illustrated and described; and certain features may be used independently from others without departing from the spirit and scope of the invention as defined in the following

claims. For example, through holes could also penetrate heat pipe boundary structures with curved surfaces or heat pipe boundary structures with offset planes which create several different levels for contact with heat sources or heat sinks.

What is claimed as new and for which Letters patent of the United States are desired to be secured is:

- 1. In a heat pipe in which a boundary structure forms an enclosed vapor chamber, the improvement comprising: at least one mounting hole penetrating the heat pipe.
- 2. In a heat pipe in which a boundary structure forms an enclosed vapor chamber, the improvement comprising: at least one mounting hole penetrating the heat pipe, with the mounting hole isolated from the vapor chamber by being located within a sealed structure which is sealed to the boundary structure so that the mounting hole through the heat pipe has no access to the vapor chamber.
- 3. The heat pipe of claim 2 wherein the sealed structure is a column spanning the boundary structure.
- 4. The heat pipe of claim 2 wherein the sealed structure is a depression within one part of the boundary structure which contacts and is bonded to another part of the boundary structure.
- 5. The heat pipe of claim 2 wherein the sealed structure is a lip located at an edge of the boundary structure which is bonded to another lip at the edge of the boundary structure.
- 6. In a heat pipe in which a boundary structure forms an enclosed vapor chamber, with a capillary wick within the heat pipe attached to the part of the heat pipe which is in contact with a heat source, so that the capillary wick acts as the heat pipe evaporator, the improvement comprising: the capillary wick

being constructed with at least two separate sections of different materials and with a section located at the part of the heat pipe which is in contact with the heat source being formed of a material with higher heat conductivity than sections located at parts of the heat pipe not in contact with the heat source.

7. The heat pipe of claim 6 wherein the section of higher heat conductivity is constructed of sintered silver powder.

ABSTRACT OF THE DISCLOSURE

The apparatus is a heat pipe with superior heat transfer between the heat pipe and the heat source and heat sink. The heat pipe is held tightly against the heat source by mounting holes which penetrate the structure of the heat pipe but are sealed off from the vapor chamber because they each are located within a sealed structure such as a pillar or the solid layers of the casing surrounding the vapor chamber. Another feature of the heat pipe is the use of more highly heat conductive material for only that part of the wick in the region which contacts the heat source, so that there is superior heat conductivity in that region.

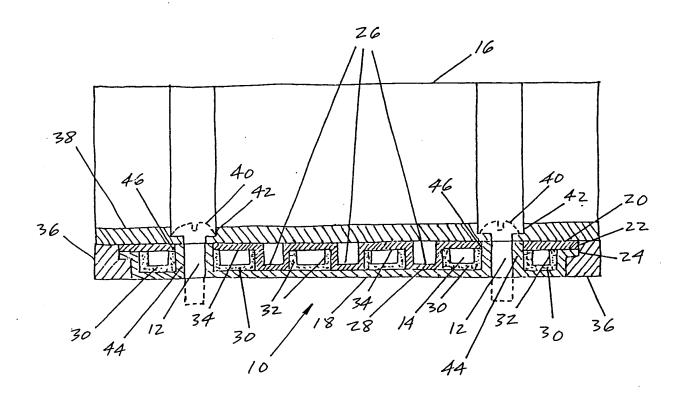
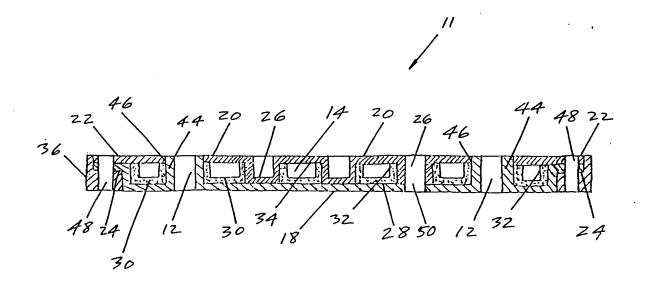
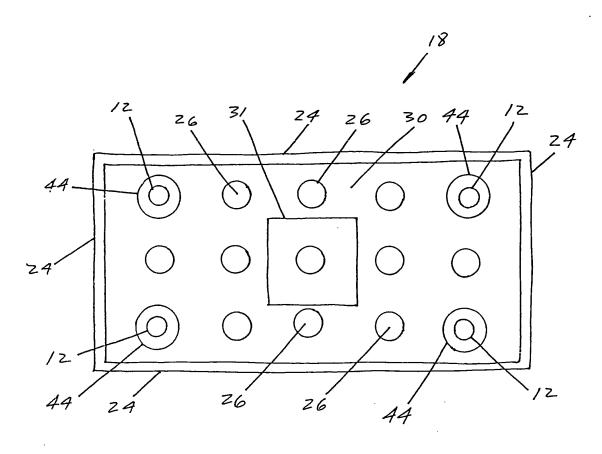


FIG. I



F16. Z



F1G. 3

DECLARATION, POWER OF ATTORNEY, AND PETITION

We, Peter M. Dussinger and Thomas L. Myers the petitioners named herein, do declare that our citizenships and residences are as stated above our respective signatures; that we have reviewed and we understand the foregoing specification and claims; that we believe ourselves to be the joint, original, first and only inventors of the invention in the patent application titled INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER WITH THROUGH MOUNTING HOLES and described and claimed in the foregoing specification; that we do not know and do not believe that the same was ever known or used in the United States before our invention thereof, or patented or described in any printed publication in any country before our invention thereof, or more than one year prior to this application; or in public use or on sale in the United States more than one year prior to this application; that this invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States on an application filed by us or our legal representatives or assigns more than twelve months prior to this application; that we acknowledge the duty to disclose information we are aware of which is material to the examination of the application in accordance with 37 C.F.R. sec. 1.56(a); and that no application for patent or inventor's certificate on this invention has been filed by us or our representatives or assigns in any country foreign to the United States.

We declare further that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and imprisonment, or both, under section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

And we hereby appoint:

Martin Fruitman Registration No. 26,890 419 N. George St. Millersville, PA 17551

our attorney with full power of substitution and revocation, to

prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Wherefore, we pray that Letters Patent be granted to us for the invention or discovery described and claimed in the foregoing specification and claims, and we hereby subscribe our names to the foregoing specification and claims, declaration, power of attorney and this petition this ______ day of ______ 1999.

Inventor's Name: Peter M. Dussinger Citizenship: United States of America

Resident of: 8 Lindside Ct., Lititz, PA 17543

Post Office Address: 8 Lindside Ct. Lititz, PA 17543

Inventor's Signature:

Inventor's Name: Thomas L. Myers

Citizenship: United States of America

Resident of: 44 Rolling Hill Dr., Lititz, PA 17543

Post Office Address: 44 Rolling Hill Dr.

Lititz, PA 17543

Inventor's Signature:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Dussinger et al.

Serial No: 09/310,397

Examiner: Atkinson, C.

Filed: 05/12/1999

Group Art Unit: 3743

I, SAMUEL W. APICELLI, REGISTRATION NO. 36,427, HEREBY CERTIF THAT THIS CORRESPONDENCE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS FIRST CLASS MAIL IN AN ENVELOPE ADDRESSED TO ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231.

CERTIFICATE UNDER 37 CFR

For: INTEGRATED CIRCUIT HEAT PIPE HEAT

SPREADER WITH THROUGH MOUNTING HOLES

SAMUEL W. APICELLI

Commissioner of Patents and Trademarks Washington, D.C. 20231

Sir:

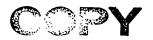
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POWER OF ATTORNEY

The undersigned, James E. Rothenberger, a representative of Assignee, Thermal Corp., in the above-identified patent application, revokes all powers of attorney previously granted, and appoints the following persons as his new attorneys, with full power of revocation and substitution, to act in his behalf in all matters affecting the above-identified patent application.

The undersigned hereby appoints the practitioners of Customer No. 08933, namely, Samuel W. Apicelli, Registration No. 36,427; William H. Murray, Registration No. 27,218; Lewis F. Gould, Jr., Registration No. 25,057; Stephan P. Gribok, Registration No. 29,643; Peter J. Cronk, Registration No. 32,021; Robert E. Rosenthal, Registration No. 33,450; Richard A. Paikoff, Registration No. 34,892;; Daniel S. Goldberg, Registration No. 39,689; N. Stephen Kinsella, Registration No. 37,657; Steven E. Koffs, Registration No. 37,163; Gail A. Dalickas, Registration No. 40,979; Darius C. Gambino, Registration No. 41,472; Anthony Colesanti, Registration No. 42,428, Joseph A. Powers, Registration No. P47,006; and Melanie S. Goddard, Registration No. P46,732, as his attorneys to prosecute this application for patent, with full power of substitution and revocation to amend or otherwise act relative to him as they may deem advisable, to transact all business in the Patent and Trademark Office

Attorney Docket No.: H1799-00025



in connection therewith and generally to do all matters and things needful in the premises and to receive the Letters Patent.

Correspondence should be directed to:

Samuel W. Apicelli, Esquire Duane, Morris & Heckscher LLP 305 North Front Street, P.O. Box 1003 Harrisburg, PA 17108-1003

and address all telephone calls to: Samuel W. Apicelli, Esq.; (717) 237-5516.

Date: 11/2/00

James E. Rothenberger

Treasurer

Thermal Corp.

HBG\64512.1

Attorney Docket No.: H1799-00025

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

	STATEMENT	NDER 37 CFR 3.73(b)
Applicant/Patent Owner:	Dussinger et al	
Application No./Patent No.:_	O9/310,39/	Filed/Issue Date: 05/12/1999
		HEAT SPREADER WITH THROUGH MOUNTING HOLES
Thermal Corp. (Name of Assignee)		elaware corporation of Assignee, e.g., corporation, partnership, university, government agency, etc.)
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[] Copies of assignments or [NOTE: A separate copy (must be submitted to Assi recorded in the records of	ie., the original assign gnment Division in acc	ment document or a true copy of the original document) cordance with 37 CFR Part 3, if the assignment is to be
The undersigned (whose title i	s supplied below) is au	uthorized to act on behalf of the assignee.
November 3, 2000 Date	<u>.</u>	Samuel W. Apircelli Reg. No. 36,427 Typed of printed name Signature
		Attorney of Record Title

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

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PTO-2202 (Replication only) (1/03)

PATENT APPLICATION SERIAL NO

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE FEE RECORD SHEET

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01 FC:1011 300.00 DA 02 FC:1111 500.00 DA 03 FC:1311 200.00 DA 04 FC:1201 600.00 DA

PTO-1556 (5/87)

U.S. Government Private Office: 2002 -- 466-267/8603

Approved for use through 7/31/2006, OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid CMB control number. PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875 Effective December 8, 2004 APPLICATION AS FILED - PART I OTHER THAN OR (Column 1) SMALL ENTITY SMALL ENTITY (Column 2) FOR NUMBER FILED NUMBER EXTRA FEE (S) RATE (\$) RATE (\$) FEE (\$) BASIC FEE NA N/A N/A 150.00 ·N/À 300.00 (37 CFR 1 16(a), (b), ar (c)) SEARCH FEE NVA N/A \$250 N/A ·N/A \$500 (37 CFR.1 16(k), (i), or (m)) **EXAMINATION FEE** NA N/A \$100 NA \$200 (37 CFR 1 16(o), (p), or (q)) TOTAL CLAIMS X**S** 25 X\$50 minus 20 = (37 OFR 1 16(i)) OR INDEPENDENT CLAIMS X100 X200 (37 CFR 1 16(h)) minus 3 = If the specification and drawings exceed 100 sheets of paper, the application size fee due APPLICATION SIZE is \$250 (\$125 for small entity) for each (37 CFR 1 16(s)) additional 50 sheets or traction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). +180= +360= MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(i)) * If the difference in column 1 is less than zero, enter "O" in column 2. TOTAL TOTAL APPLICATION AS AMENDED - PART II OTHER THAN OR (Column 2) (Column 3) (Column 1) SMALL ENTITY SMALL ENTITY CLAIMS HIGHEST **PRESENT** REMAINING NUMBER RATE (\$) ADDI-RATE (\$) ADDI-AFTER PREVIOUSLY **EXTRA** TIONAL TIONAL AMENDMENT PAID FOR FEE (S) FEE (\$) m Total (37 CFR 1.16(1) Minus X\$ 25. X\$50 ENDM OR Minus Independent (37 CFR 1.16(h)) X100 X200 OR Application Size Fee (37 CFR 1.16(s)) +180= FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1,160) +360= OR TOTAL TOTAL ADD'L FEE. OR ADO'L FEE (Column 1) (Column 3) (Column 2) CLAIMS HIGHEST REMAINING PRESENT NUMBER RATE (\$) ADDI-RATE (\$) ADDIà **PREVIOUSLY** EXTRA AFTER TIONAL TIONAL FEE (\$) AMENDMENT FEE (\$) PAID FOR 回 Total Minus X\$ 25 ENDM G7 CFR 1.16(0). X\$50 OR. Independent (37 CFR 1.16(h)) Minus X100 X200 OR Application Size Fee (37 CFR 1.16(s)) FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.160) +180= +360= OR TOTAL TÖTAL OR ADD'L FEE ADD'L FEE If the entry in column 1 is less than the entry in column 2, write "0" in column 3. "If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of Information is required by 37 CFR 1.16. The Information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office; U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1460, Alexandria, VA 22313-1450.

CERTIFICATE OF EXPRESS MAILING

I hereby certify that these documents, namely a Divisional Utility Application and a Preliminary Amendment, in connection with the below-identified Patent Application, are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service on the date indicated below and is addressed to the Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Sarguel W. Apicelli, Registration No. 36,427

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.

Not yet assigned

Applicant

Peter M. Dussinger and Thomas L. Myers

Filed

Herewith

Title

INTEGRATED CIRCUIT HEAT PIPE HEAT

SPREADER WITH THROUGH MOUNTING HOLES

TC/A.U.

Not yet assigned

Examiner

Not yet assigned

Docket No.

H1799-00303

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT

Sir:

Preliminary to the examination of the above-identified Divisional

Application, please amend the Application as follows:

Amendment to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which

begins on page 3 of this paper.

Remarks/Arguments begin on page 12 of this paper.

Docket No.: H1799-00303 Preliminary Amendment

At page 1, on the line between the title and "Background of the Invention," insert the following claim of priority:

-- This application is a Divisional application of copending U.S. Serial No. 10/626,270, filed on December 13, 2003, which is itself a Continuation application of copending U.S. Application Serial No. 09/852,322, filed on May 9, 2001, which is itself a continuation application of copending U.S. Application Serial No. 09/310,397, filed on May 12, 1999, and now issued as 6,302,192. --

Docket No.: H1799-00303

Preliminary Amendment

This listing of claims will replace all prior versions, and listings, of claims in

the application:

Listing of Claims:

1-16. (Cancelled)

17. (New Claim) A heat pipe for spreading heat comprising:

a boundary structure including spaced-apart first and second plates that

define an enclosed vapor chamber;

at least one hollow column positioned within said vapor chamber and

sealingly bonded to said first and second plates, having an open first end that

opens through said first plate and an open second end that opens through said

second plate so as to form at least one mounting hole that is isolated from said

vapor chamber.

18. (New Claim) A heat pipe for spreading heat according to claim 17

wherein said spaced-apart first and second plates include confronting interior

surfaces; and

a wick positioned upon said confronting interior surfaces of said first and

second plates the exterior surface of said at least one hollow column disposed

within said vapor chamber.

(New Claim) A heat pipe for spreading heat comprising: 19.

3 of 10

Docket No.: H1799-00303

Preliminary Amendment

a boundary structure including a first plate and a second plate arranged in spaced apart relation, each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together so as to define an enclosed vapor chamber;

a depression formed in said first plate which projects into said vapor chamber, is spaced from said peripheral lip, and is bonded to said second plate;

an opening defined through said first plate depression and said second plate wherein said depression comprises an annular outer surface that is bonded to a corresponding annular edge surface in said second plate and further wherein said opening is isolated from said vapor chamber;

at least one spacer extending between and contacting said first and second plates; and

a wick positioned upon said confronting interior surfaces including that portion of the interior surface of said first plate that forms a surface of said depression within said vapor chamber.

20. (New Claim) A heat pipe for spreading heat comprising:

a first plate having a circumferential edge lip bounding an inner surface and at least one hollow column that is integral with said first plate and which projects outwardly relative to said inner surface;

a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip bounding an inner surface and at

Page 37

Docket No.: H1799-00303 Preliminary Amendment

least one opening through said second plate, said edge lips of said first and second plates being bonded together so as to define a vapor chamber; wherein

a hollow column bonded at one end to said second plate so as to coaxially align said hollow column with one of said at least one openings in said second plate thereby to form a mounting hole that extends through said first plate and said second plate and is isolated from said vapor chamber.

21. (New Claim) A heat pipe for spreading heat comprising:

a first plate having a circumferential edge lip bounding an inner surface and a depression which projects outwardly relative to said inner surface;

a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip bounding an inner surface and at least one opening through said second plate, said edge lips of said first and second plates being bonded together so as to define a vapor chamber; wherein

said depression having an open ended tubular cross-section and an outer surface, a portion of which outer surface is bonded to said second plate so as to coaxially align said depression with one of said at least one openings in said second plate thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber.

22. (New Claim) A heat pipe for spreading heat comprising:

a first plate having a circumferential edge lip bounding an inner surface and a hollow column which projects outwardly relative to said inner surface;

Docket No.: H1799-00303

Preliminary Amendment

a second plate arranged in spaced apart confronting relation to said first

plate and including (i) a circumferential edge lip bounding an inner surface, (ii) at

least one depression which projects into said vapor chamber and that is bonded

to said inner surface of said first plate, and (iii) at least one opening through said

second plate, said edge lips of said first and second plates being bonded

together so as to define a vapor chamber; wherein

said hollow column in said first plate opens at a first end and a second end

and is bonded to said second plate at said second end so as to coaxially align

said hollow column with said at least one opening in said second plate thereby to

form a mounting hole that extends through said first plate depression and said

second plate and is isolated from said vapor chamber.

23. (New Claim) An integrated circuit chip cooling structure comprising:

a top plate having an edge lip that bounds a top surface and a bottom

surface:

a bottom plate having an edge lip that bounds a top surface and a bottom

surface, said edge lips of said top and bottom plates being bonded together so

as to define a vapor chamber;

a capillary wick provided within said vapor chamber;

wherein said top plate and said bottom plate each define at least one

opening such that the at least one opening of said top plate and the at least one

opening of said bottom plate are vertically aligned;

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at least one hollow column extending between said top plate and said

bottom plate, said at least one hollow column having a top end sealed to a

periphery of said opening defined in said top plate and a bottom end sealed to a

periphery of said opening defined in said bottom plate, said at least one hollow

column having a central passageway sized to receive a fastener.

(New Claim) The integrated circuit chip cooling structure according 24.

to claim 23 comprising at least one heat sink, said at least one heat sink having a

bottom surface attached to the top surface of said top plate and at least one

mounting hole communicating with a hollow column; and

a fastener extending through said hollow column and through said

mounting hole of said at least one heat sink to secure said heat sink to said top

and bottom plates.

25. (New Claim) The integrated circuit chip cooling structure according

to claim 23 wherein said at least one hollow column each have a top shoulder

disposed near a top end and bonded to a bottom surface of said top plate around

one opening.

(New Claim) The integrated circuit chip cooling structure according 26.

to claim 25 wherein said at least one hollow column each have a bottom end

downwardly extending out of said bottom plate through one opening defined in

said bottom plate.

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27. (New Claim) The integrated circuit chip cooling structure according to claim 24 wherein said at least one heat sink comprises a base and a plurality of fins located on one side of said base.

28. (New Claim) The integrated circuit chip cooling structure according to claim 23 wherein said at least one hollow column has a top shoulder disposed near a top end and bonded to a bottom surface of said top plate around one opening defined in said top plate and a bottom shoulder disposed near a bottom end and bonded to a top surface of said bottom plate around one opening defined in said bottom plate.

29. (New Claim) The integrated circuit chip cooling structure according to claim 23 wherein said capillary wick comprises an upper plate-like wick located on a bottom surface of said top plate, a bottom plate-like wick located on a top surface of said bottom plate, and a plurality of vertical wick elements provided between said upper plate-like wick and said bottom plate-like wick, said vertical wicks each having a first end integral with one of said top and bottom plate and a second end supported on the other of said top and bottom plates; said at least one hollow column being inserted through said top plate-like wick and said bottom plate-like wick.

REMARKS/ARGUMENTS

Upon entry of this Preliminary Amendment into the above-identified Continuing Application, claims 17-29 will be under active consideration in the application.

Claims 1-6 have been cancelled without prejudice. Applicants have added new claims 17-29 so as to define further patentable aspects of the invention. No new matter has been entered into the application as a result of these additions to the application. Claims 17-29 are allowable.

Accordingly, Applicants respectfully request the issuance of a Notice of Allowability for this case. Early and favorable consideration is respectfully requested.

If a telephone conference would be of assistance in advancing prosecution of the above-identified application, Applicants' undersigned Attorney invites the Examiner to telephone him at 717-237-5516.

Respectfully Submitted,

Samuel W. Ap#elli Registration No. 36,427 Customer No. 08933 DUANE MORRIS LLP 305 North Front Street

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Harrisburg, PA 17108-1003

(717) 237-5516

PTO/58/05 (12-04)

Approved for use through 7/31/2006, OMB 0651-0032
U.S. Petent and Tradement Office; U.S. DEPARTMENT OF COMMERCE

iction Act of 1995, no persons are required to respond to a collection of information unless it dis plays a valid OMB control number PATENT APPLICATION FEE DETERMINATION RECORD cation or Docket Number 11200349 Substitute for Form PTO-875 Effective December 8, 2004 APPLICATION AS FILED - PART I OTHER THAN OR SMALL ENTITY SMALL ENTITY (Column 1) (Column 2) · NUMBER FILED NUMBER EXTRA FOR RATE (S) RATE (\$) FEE 6 FEE (1) BASIC FEE 150.00 300.00 WA N/A . NA ·NIA (37 CFR 1 16(4), (b), a (c)) SEARCH FEE NA \$250 \$500 (37 CFR.1 16(1) (1). or (44) **FYAMINATION FEE** -N/A NA . N/A N/A : \$100 \$200 (27 CFR 1 16(q)-(p), or (q)) TOTAL CLASS X\$ 25 X\$50 mmus 20 = (37 OFR 1 16(1)) INDEPENDENT CLAIMS X100 X200 mmus 3 · (37 CFR 1 16(N)) If the specification and drawings exceed 100 sheets of paper, the application size fee due APPLICATION SIZE is \$250 (\$125 for small entity) for each FEE (37 CFR 1 16(s)) additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). +180= +360= MULTIPLE DEPENDENT CLAIM PRESENT (37 OFR 1.16(i)) TOTAL TOTAL "If the difference in column 1 is less than zero, enter "O" in column 2. APPLICATION AS AMENDED - PART II OTHER THAN OR (Column 2) (Column 3) SMALL ENTITY (Column 1) SMALL ENTITY CLAIMS HIGHEST PRESENT NIMBER REMAINING RATE (5) ADDI. RATE (S) ADDI-**EXTRA** TIONAL AFTER **PREVIOUSLY** TIONAL Ø FEE (1) AMENDMENT PAID FOR FEE (S) Total Minus X\$50 X\$ 25 ÞЮ COTOFR 1,100) ÓR ENDM Endependent -07 CFR L1604) Minus X100 X200 6. 4 OR Application Size Fee (37 CFR 1.16(s)) +180= +360= FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1:16@) OR TOTAL : TOTAL OR ADO'L FEE ADO'L FEE. (Column 1) (Column 2) (Cotumn 3) CLAIMS. HIGHEST PRESENT NUMBER REMAINING RATE (5): ADOL RATE (5) ADDIèn EXTRA **PREVIOUSLY** TIONAL TIONAL **AFTER** FEE (3) FEE (\$) WENDMENT PAID FOR Total Minus X\$ 25 X\$50 COT COFR LIGORY OR. END Minus X100 X200 O7 CFR 1,1600) OR Application Size Fee (37 CFR 1.16(s)) +360= PIRST PRESENTATION OF MALTIPLE DEPENDENT CLAIM (ST.CFR 1.16(II) +180= OR TOTAL TÖTAL OR ADO'L FEE ADD'L FEE If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
 If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
 If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The Highest Number Previously Peid For" (Total or Independent) is the highest number found in the appropriate box in column 1

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and sufmitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form end/or suggestions for reducing this burden, should be cent to the Chief Infermation Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450, DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



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APPLICATION NUMBER

FILING OR 371 (c) DATE

FIRST NAMED APPLICANT

ATTORNEY DOCKET NUMBER

11/200.349

08/09/2005

Peter M. Dussinger

H1799-00303

041396 **DUANE MORRIS LLP** IP DEPARTMENT 30 SOUTH 17TH STREET PHILADELPHIA, PA 19103-4196 **CONFIRMATION NO. 3228 FORMALITIES** LETTER

Date Mailed: 08/30/2005

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- A substitute specification in compliance with 37 CFR 1.52, 1.121(b)(3), and 1.125, is required. The substitute specification must be accompanied by a marked up copy as set forth in 37 CFR 1.125(c) and a statement that the specification contains no new matter (see 37 CFR 1.125(b)). The specification, claims, or abstract page(s) submitted is not acceptable and cannot be scanned or properly stored because:
 - Since a preliminary amendment was present on the filing date of the application and such amendment is part of the original disclosure of the application, the substitute specification must include all of the desired changes made in the preliminary amendment. See 37 CFR 1.115 and 1.215.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies should be mailed to:

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A copy of this notice <u>MUST</u> be returned with the reply.

Office of Initial Patent Examination (571) 272-4000, or 1-800-PTO-9199, or 1-800-972-6382
PART 3 - OFFICE COPY



11-2-05

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS Post 1450 Alexandria, Virginia 22313-1450 www.uspto.gov

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FILING OR 371 (c) DATE

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- A substitute specification in compliance with 37 CFR 1.52, 1.121(b)(3), and 1.125, is required. The substitute specification must be accompanied by a marked up copy as set forth in 37 CFR 1.125(c) and a statement that the specification contains no new matter (see 37 CFR 1.125(b)). The specification, claims, or abstract page(s) submitted is not acceptable and cannot be scanned or properly stored because:
 - Since a preliminary amendment was present on the filing date of the application and such amendment is part of the original disclosure of the application, the substitute specification must include all of the desired changes made in the preliminary amendment. See 37 CFR 1.115 and 1.215.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

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PART 1 - ATTORNEY/APPLICANT COPY

CERTIFICATE OF EXPRESS MAILING

I hereby certify that these documents, namely a Response to Notice to File Corrected Application Papers, in connection with the below-identified Patent Application, are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service on the date indicated below and is addressed to the Mail Stop Missing Parts, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date of Deposit

۾ الم mailin**g لم الا**el number <u>EV777687430US</u>

Samuel W. Aþicelli, Rjégistration No. 36,427

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.

11/200,349

Inventor Filed

Dussinger et al.

Title

08/09/2005 INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER

WITH THROUGH MOUNTING HOLES

Docket No.

H1799-00303

RESPONSE TO NOTICE TO FILE **CORRECTED APPLICATION PAPERS**

MAIL STOP MISSING PARTS Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Sir:

This is in response to the "NOTICE TO FILE CORRECTED APPLICATION PAPERS," mailed on August 30, 2005, in connection with the above-identified patent application. The Notice stated that a substitute specification in compliance with 37 CFR 1.52, 1.121 (b)(3), and 1.123, was required to correct various alleged informalities as stated on the Notice to File Corrected Application Papers. More particularly, the Notice alleged that the specification, claims, or abstract pages submitted were not acceptable and could not be scanned or properly stored. Specifically, the Notice alleged under 37 CFR 1.115 and 1.215, because a preliminary amendment was present as of the filing date of the application, such amendment being a part of the original disclosure of the

Appln. No. 11/200,349

Docket No. H1799-00303 🔫

Response to Notice to File Corrected Application

application, that the substitute specification must include all of the desired changes that were made in the preliminary amendment. Finally, the Notice stated that the substitute specification must be accompanied by a marked-up copy showing the changes that were made accompanied by a statement that the substitute specification contains no new matter .

In response to the Notice, Applicants respectfully submit the following:

- 1. a substitute specification, including the claims and abstract;
- 2. a version of the substitute specification showing formatting changes; and
- a copy of the NOTICE TO FILE CORRECTED APPLICATION PAPERS,
 as requested in the Notice.

The attached substitute specification, including claims and abstract, is believed to satisfy all of the requirements specified by the Office. The substitute specification includes all of the changes made in the preliminary amendment. Additionally, an inadvertent typographical error has been identified in the claim of priority. More particularly, the serial number, U.S. S/N 10/626,270 was incorrectly transcribed. The priority claim has been amended to state the correct serial number, U.S. S/N 10/739,709. Finally, the substitute specification, including claims and abstract, has been corrected to include the attorney docket number. No new matter has been introduced into the application as a result of these changes to the specification, including the claims and abstract.

Response to Notice to File Corrected Application

No fee is believed to be required, however, the Commissioner is authorized to

charge any required fees in connection with this matter, to Deposit Account No. 04-

1679. Should the attached substitute specification not be found in full compliance with

all requirements, Applicants respectfully request prompt notice by telephone in order to

accomplish expeditious correction within the term allotted.

Respectfully submitted,

toler 31,2005

Samuel W. Apicelli

Registration No. 36,427

Customer No. 0041396

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OTPE 57.005 0CT 3 1 2005

CERTIFICATE OF EXPRESS MAILING

I he concern hat these documents, namely a Response to Notice to File Corrected Application Papers, in connection with the below-identified Patent Application, are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service on the date indicated below and is addressed to the Mail Stop Missing Parts, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date of Deposit Alan 3/ Jan

Express Mail" mailing Moel number ____EV777687430US

Samuel W. Apicelli, Registration No. 36,427

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.

11/200,349

Inventor

Dussinger et al.

Filed

08/09/2005

Title

INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER

WITH THROUGH MOUNTING HOLES

Docket No.

H1799-00303

TRANSMITTAL LETTER

Mail Stop Missing Parts Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Sir:

Please find enclosed for filing:

X Response to Notice to File Corrected Application Papers

X Copy of the Notice to File Corrected Application Papers

X Substitute Specification

X Version of substitute specification showing changes

X This Transmittal Letter is submitted in duplicate. The Commissioner is authorized to charge any required fees in connection with this matter, to Deposit Account No. 04-1679.

X Certificate of Express Mailing

Dated: /0/3//05

Respectfully submitted,

Samuel W. Api¢elli

Registration No. 36,427

Customer No. 0041396

DUANE MORRIS LLP

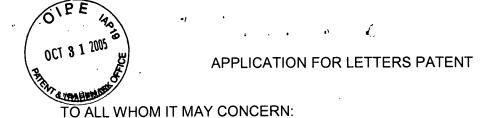
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swapicelli@duanemorris.com

PH1\1492766.1



BE IT KNOWN THAT PETER M. DUSSINGER, a resident of Lititz, Pennsylvania, and THOMAS L. MYERS, a resident of Lititz, Pennsylvania, both citizens of the United States of America, have invented certain new and useful improvements in an

INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER

WITH THROUGH MOUNTING HOLES

of which the following is a specification:

CROSS-REFERENCE TO RELATED APPLICATIONS

- 2 This application is a Divisional application of copending U.S. Serial No. 10/739,709, filed
- 3 on December 13, 2003, which is itself a Continuation application of copending U.S.
- 4 Application Serial No. 09/852,322, filed on May 9, 2001, which is itself a continuation
- 5 application of copending U.S. Application Serial No. 09/310,397, filed on May 12, 1999,
- 6 and now issued as 6,302,192.

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BACKGROUND OF THE INVENTION

This invention relates generally to active solid state devices, and more specifically to a heat pipe for cooling an integrated circuit chip, with the heat pipe designed to be held in direct contact with the integrated circuit.

As integrated circuit chips decrease in size and increase in power, the required heat sinks and heat spreaders have grown to be larger than the chips. Heat sinks are most effective when there is a uniform heat flux applied over the entire heat input surface. When a heat sink with a large heat input surface is attached to a heat source of much smaller contact area, there is significant resistance to the flow of heat along the heat input surface of the heat sink to the other portions of the heat sink surface which are not in direct contact with the contact area of the integrated circuit chip. Higher power and smaller heat sources, or heat sources which are off center from the heat sink, increase the resistance to heat flow to the balance of the heat sink. This phenomenon can cause great differences in the effectiveness of heat transfer from various parts of a heat sink. The effect of this unbalanced heat transfer is reduced

performance of the integrated circuit chip and decreased reliability due to high operating
 temperatures.

The brute force approach to overcoming the resistance to heat flow within heat sinks which are larger than the device being cooled is to increase the size of the heat sink, increase the thickness of the heat sink surface which contacts the device to be cooled, increase the air flow which cools the heat sink, or reduce the temperature of the cooling air. However, these approaches increase weight, noise, system complexity, and expense.

It would be a great advantage to have a simple, light weight heat sink for an integrated circuit chip which includes an essentially isothermal surface even though only a part of the surface is in contact with the chip, and also includes a simple means for assuring intimate contact with the integrated circuit chip to provide good heat transfer between the chip and the heat sink.

SUMMARY OF THE INVENTION

The present invention is an inexpensive heat pipe heat spreader for integrated circuit chips which is of simple, light weight construction. It is easily manufactured, requires little additional space, and provides additional surface area for cooling the integrated circuit and for attachment to heat transfer devices for moving the heat away from the integrated circuit chip to a location from which the heat can be more easily disposed of. Furthermore, the heat pipe heat spreader is constructed to assure precise

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flatness and to maximize heat transfer from the heat source and to the heat sink, and has holes through its body to facilitate mounting.

The heat spreader of the present invention is a heat pipe which requires no significant modification of the circuit board or socket because it is held in intimate contact with the integrated circuit chip by conventional screws attached to the integrated mounting board. This means that the invention uses a very minimum number of simple parts. Furthermore, the same screws which hold the heat spreader against the chip can also be used to clamp a finned heat sink to the opposite surface of the heat spreader.

The internal structure of the heat pipe is an evacuated vapor chamber with a limited amount of liquid and includes a pattern of spacers extending between and contacting the two plates or any other boundary structure forming the vapor chamber. The spacers prevent the plates from bowing inward, and therefore maintain the vital flat surface for contact with the integrated circuit chip. These spacers can be solid columns, embossed depressions formed in one of the plates, or a mixture of the two. Porous capillary wick material also covers the inside surfaces of the heat pipe and has a substantial thickness surrounding the surfaces of the spacers within the heat pipe, thus forming pillars of porous wick surrounding the supporting spacers. The wick therefore spans the space between the plates in multiple locations.

The spacers thus serve important purposes. They support the flat plates and prevent them from deflecting inward and distorting the plates to deform the flat surfaces which are required for good heat transfer. The spacers also serve as critical support for the portions of the capillary wick pillars which span the space between the plates

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provide a gravity independent characteristic to the heat spreader, and the spacers around which the wick pillars are located assure that the capillary wick is not subjected to destructive compression forces.

The spacers also make it possible to provide holes into and through the vapor chamber, an apparent inconsistency since the heat pipe vacuum chamber is supposed to be vacuum tight. This is accomplished by bonding the spacers, if they are solid, to both plates of the heat pipe, or, if they are embossed in one plate, bonding the portions of the depressions which contact the opposite plate to that opposite plate. With the spacer bonded to one or both plates, a through hole can be formed within the spacer and it has no effect on the vacuum integrity of the heat pipe vapor chamber, from which the hole is completely isolated.

An alternate embodiment of the invention provides the same provision for mounting the heat pipe spreader with simple screws even when the heat pipe is constructed without internal spacers. This embodiment forms the through holes in the solid boundary structure around the outside edges of the two plates. This region of the heat pipe is by its basic function already sealed off from the vapor chamber by the bond between the two plates, and the only additional requirement for forming a through hole within it is that the width of the bonded region be larger than the diameter of the hole. Clearly, with the holes located in the peripheral lips, the heat pipe boundary structure can be any shape.

Another alternative embodiment of the invention provides for improved heat transfer between the integrated circuit chip and the heat pipe heat spreader. This is

accomplished by using a different capillary wick material within the heat pipe at the location which is directly in contact with the chip. Instead of using the same sintered copper powder wick which is used throughout the rest of the heat pipe, the part of the wick which is on the region of the heat pipe surface which is in contact with the chip is constructed of higher thermal conductivity sintered powder. Such powder can be silver, diamond, or many other materials well known in the art. This provides for significantly better heat transfer in the most critical heat transfer area, right at the integrated circuit chip.

The present invention thereby provides a heat pipe superior heat transfer characteristics, and the simplest of all mounting devices, just several standard screws.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross section view of the preferred embodiment of a flat plate heat pipe 10 of the invention with through holes 12 through its vapor chamber 14 and in contact with finned heat sink 16.

FIG. 2 is a cross section view of an alternate embodiment of the heat pipe of the invention with through holes in the peripheral lips and in a depression in one plate.

FIG. 3 is a plan view of an internal surface the contact plate of the preferred embodiment of the invention showing the region of the capillary wick constructed of the sintered hight heat conductivity powder.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is a cross section view of the preferred embodiment of a flat plate heat pipe 10 of the invention with through holes 12 through its vapor chamber 14 and in contact with finned heat sink 16.

Heat pipe 10 is constructed by forming a boundary structure by sealing together two formed plates, contact plate 18 and cover plate 20. Contact plate 18 and cover plate 20 are sealed together at their peripheral lips 22 and 24 by conventional means, such as soldering or brazing, to form heat pipe 10. Heat pipe 10 is then evacuated to remove all non-condensible gases and a suitable quantity of heat transfer fluid is placed within it. This is the conventional method of constructing a heat pipe, and is well understood in the art of heat pipes.

The interior of heat pipe 10 is, however, constructed unconventionally. While contact plate 18 is essentially flat with the exception of peripheral lip 24, cover plate 20 includes multiple depressions 26. Depressions 26 are formed and dimensioned so that, when contact plate 18 and cover plate 20 are joined, the flat portions of depressions 26 are in contact with inner surface 28 of contact plate 18. Depressions 26 thereby assure that the spacing between contact plate 18 and cover plate 20 will be maintained even through pressure differentials between the inside volume of heat pipe 10 and the surrounding environment might otherwise cause the plates to deflect toward each other.

Heat pipe 10 also includes internal sintered metal capillary wick 30 which covers the entire inside surface of contact plate 18. As is well understood in the art of heat pipes, a capillary wick provides the mechanism by which liquid condensed at the cooler condenser of a heat pipe is transported back to the hotter evaporator where it is

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evaporated. The vapor produced at the evaporator then moves to the condenser where

2 it again condenses. The two changes of state, evaporation at the hotter locale and

condensation at the cooler site, are what transport heat from the evaporator to the

condenser.

In the present invention, heat pipe 10 also has capillary wick pillars 32 which bridge the space between contact plate 18 and cover plate 20. Pillars 32 thereby interconnect cover plate 16 and contact plate 14 with continuous capillary wick. This geometry assures that, even if heat pipe 10 is oriented so that cover plate 16 is lower than contact plate 14, liquid condensed upon inner surface 34 of cover plate 20 will still be in contact with capillary pillars 32. The liquid will therefore be moved back to raised surface 28 which functions as the evaporator because it is in contact with a heat generating integrated circuit (not shown). Capillary pillars 32 are wrapped around and supported by depressions 26, which prevents the structurally weaker capillary pillars 32

FIG. 1 also shows frame 36 which is typically used to surround and protect heat pipe 10. Frame 34 completely surrounds heat pipe 10 and contacts lip 24 of contact plate 18. When heat pipe 10 is used to cool an integrated circuit chip (not shown) which is held against contact plate 18, cover plate 20 is held in intimate contact with fin plate 38, to which fins 16 are connected. The entire assembly of heat pipe 10, frame 34, and fin plate 38 is held together and contact plate 18 is held against an integrated circuit chip by conventional screws 40, shown in dashed lines, which are placed in holes 42 in fin plate 38 and through holes 12 in heat pipe 10, and are threaded into the mounting plate (not shown) for the integrated circuit chip.

Attorney Docket: H1799-00303

from suffering any damage.

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Holes 12 penetrate heat pipe 10 without destroying its vacuum integrity because of their unique location. Holes 12 are located within sealed structures such as solid columns 44, and since columns 44 are bonded to cover plate 20 at locations 46, holes 12 passing through the interior of columns 44 have no affect on the interior of heat pipe 10.

The preferred embodiment of the invention has been constructed as heat pipe 10 as shown in FIG. 1. This heat pipe is approximately 3.0 inches by 3.5 inches with a total thickness of .200 inch. Cover plate 20 and contact plate 18 are constructed of OFHC copper .035 inch thick, and depressions 26 span the .100 inch height of the internal volume of heat pipe 10. The flat portions of depressions 26 are .060 inch in diameter. Capillary wick 30 is constructed of sintered copper powder and averages .040 inch thick. Columns 44 have a .250 inch outer diameter, and holes 12 are .210 in diameter.

FIG. 2 is a cross section view of an alternate embodiment of the flat plate heat pipe 11 of the invention with through holes 48 located within peripheral lips 22 and 24 of the heat pipe and hole 50 shown in another sealed structure, one of the depressions 26. The only requirement for forming hole 50 within a depression 26 is that the bottom of depression 26 must be bonded to inner surface 28 of contact plate 18 to prevent loss of vacuum within the heat pipe. Of course, the region of the peripheral edges is also a sealed structure since bonding between lips 22 and 24 is inherent because heat pipe 11 must be sealed at its edges to isolate the interior from the outside atmosphere.

The only differences between heat pipe 11 of FIG. 2 and heat pipe 10 of FIG. 1 are that finned heat sink 16 is not shown in FIG. 2, lips 22 and 24 are slightly longer in

1 FIG. 2 to accommodate holes 48, and hole 50 is shown. In fact, through holes 12

shown in FIG. 12 are also included in FIG. 2. Although it is unlikely that holes 12, holes

3 48, and hole 50 would be used in the same assembly, manufacturing economies may

make it desirable to produce all the holes in every heat pipe so that the same heat pipe

heat spreader can be used with different configurations of finned heat sinks. The

unused sets of holes have no effect on the operation or benefits of the invention.

FIG. 3 is a plan view of the internal surface of the contact plate 18 of the heat pipe 10 of the invention showing region 31 of capillary wick 30. Region 31 is constructed of sintered silver powder. While the balance of capillary wick 30 is conventional sintered metal such as copper, region 31 of capillary wick 30, which is on the opposite surface of contact plate 18 from the integrated circuit chip (not shown), is formed of powdered silver. The higher thermal conductivity of silver yields significantly better heat conduction through region 31 of the wick 30, and thereby reduces the temperature difference between the integrated circuit chip and the vapor within heat pipe 10. This reduction of temperature difference directly affects the operation of heat pipe 10, and essentially results in a similar reduction in the operating temperature of the chip.

The invention thereby furnishes an efficient means for cooling an integrated circuit and does so without the need for larger heat spreaders which not only add weight but also do not transfer heat away from the integrated circuit as effectively as does the heat pipe of the invention.

It is to be understood that the form of this invention as shown is merely a preferred embodiment. Various changes may be made in the function and arrangement

- of parts; equivalent means may be substituted for those illustrated and described; and
- 2 certain features may be used independently from others without departing from the spirit
- and scope of the invention as defined in the following claims. For example, through
- 4 holes could also penetrate heat pipe boundary structures with curved surfaces or heat
- 5 pipe boundary structures with offset planes which create several different levels for
- 6 contact with heat sources or heat sinks.
- 7 What is claimed as new and for which Letters patent of the United States are
- 8 desired to be secured is:

1	WHA ⁻	TIS CLAIMED IS:
2	1-16.	(Cancelled)
3		
4	17.	(New Claim) A heat pipe for spreading heat comprising:
5		a boundary structure including spaced-apart first and second plates that
6	define an en	closed vapor chamber;
7		at least one hollow column positioned within said vapor chamber and
8	sealingly bo	nded to said first and second plates, having an open first end that opens
9	through said	first plate and an open second end that opens through said second plate
10	so as to form	at least one mounting hole that is isolated from said vapor chamber.
11		
12	18.	(New Claim) A heat pipe for spreading heat according to claim 17 wherein
13	said spaced-apart first and second plates include confronting interior surfaces; and	
14		a wick positioned upon said confronting interior surfaces of said first and
15	second plates the exterior surface of said at least one hollow column disposed within	
16	said vapor chamber.	
17		
18	19.	(New Claim) A heat pipe for spreading heat comprising:
19		a boundary structure including a first plate and a second plate arranged in
20	spaced apar	t relation, each of said plates including interior confronting surfaces and a
21	peripheral lip	located at an edge of said boundary structure which are bonded together

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22 so as to define an enclosed vapor chamber;

1	a depression formed in said first plate which projects into said vapor	
2	chamber, is spaced from said peripheral lip, and is bonded to said second plate;	
3	an opening defined through said first plate depression and said second	
4	plate wherein said depression comprises an annular outer surface that is bonded to a	
5	corresponding annular edge surface in said second plate and further wherein said	
6	opening is isolated from said vapor chamber;	
7	at least one spacer extending between and contacting said first and	
8	second plates; and	
9	a wick positioned upon said confronting interior surfaces including that	
10	portion of the interior surface of said first plate that forms a surface of said depression	
11	within said vapor chamber.	
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13	20. (New Claim) A heat pipe for spreading heat comprising:	
14	a first plate having a circumferential edge lip bounding an inner surface	
15	and at least one hollow column that is integral with said first plate and which projects	
16	outwardly relative to said inner surface;	
17	a second plate arranged in spaced apart confronting relation to said first	
18	plate and including a circumferential edge lip bounding an inner surface and at least one	
19	opening through said second plate, said edge lips of said first and second plates being	
20	bonded together so as to define a vapor chamber; wherein	
21	a hollow column bonded at one end to said second plate so as to coaxially	

align said hollow column with one of said at least one openings in said second plate

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thereby to form a mounting hole that extends through said first plate and said second 1 2 plate and is isolated from said vapor chamber.

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21. (New Claim) A heat pipe for spreading heat comprising:

a first plate having a circumferential edge lip bounding an inner surface and a depression which projects outwardly relative to said inner surface;

a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip bounding an inner surface and at least one opening through said second plate, said edge lips of said first and second plates being bonded together so as to define a vapor chamber; wherein

said depression having an open ended tubular cross-section and an outer surface, a portion of which outer surface is bonded to said second plate so as to coaxially align said depression with one of said at least one openings in said second plate thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber.

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22. (New Claim) A heat pipe for spreading heat comprising:

a first plate having a circumferential edge lip bounding an inner surface and a hollow column which projects outwardly relative to said inner surface;

a second plate arranged in spaced apart confronting relation to said first plate and including (i) a circumferential edge lip bounding an inner surface, (ii) at least one depression which projects into said vapor chamber and that is bonded to said inner surface of said first plate, and (iii) at least one opening through said second plate, said

3	said hollow column in said first plate opens at a first end and a second end
2	chamber; wherein
l	edge lips of said first and second plates being bonded together so as to define a vapor
	and the of said first and accordinates being bonded together as as to define a year

said hollow column in said first plate opens at a first end and a second end and is bonded to said second plate at said second end so as to coaxially align said hollow column with said at least one opening in said second plate thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber.

- 23. (New Claim) An integrated circuit chip cooling structure comprising:
- a top plate having an edge lip that bounds a top surface and a bottom surface;
 - a bottom plate having an edge lip that bounds a top surface and a bottom surface, said edge lips of said top and bottom plates being bonded together so as to define a vapor chamber;
 - a capillary wick provided within said vapor chamber;
 - wherein said top plate and said bottom plate each define at least one opening such that the at least one opening of said top plate and the at least one opening of said bottom plate are vertically aligned;

at least one hollow column extending between said top plate and said bottom plate, said at least one hollow column having a top end sealed to a periphery of said opening defined in said top plate and a bottom end sealed to a periphery of said opening defined in said bottom plate, said at least one hollow column having a central passageway sized to receive a fastener.

1	24. (New Claim) The integrated circuit chip cooling structure according to
2	claim 23 comprising at least one heat sink, said at least one heat sink having a bottom
3	surface attached to the top surface of said top plate and at least one mounting hole
4	communicating with a hollow column; and
5	a fastener extending through said hollow column and through said mounting hole
6	of said at least one heat sink to secure said heat sink to said top and bottom plates.

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25. (New Claim) The integrated circuit chip cooling structure according to claim 23 wherein said at least one hollow column each have a top shoulder disposed near a top end and bonded to a bottom surface of said top plate around one opening.

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26. (New Claim) The integrated circuit chip cooling structure according to claim 25 wherein said at least one hollow column each have a bottom end downwardly extending out of said bottom plate through one opening defined in said bottom plate.

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27. (New Claim) The integrated circuit chip cooling structure according to claim 24 wherein said at least one heat sink comprises a base and a plurality of fins located on one side of said base.

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28. (New Claim) The integrated circuit chip cooling structure according to claim 23 wherein said at least one hollow column has a top shoulder disposed near a top end and bonded to a bottom surface of said top plate around one opening defined in

said top plate and a bottom shoulder disposed near a bottom end and bonded to a top surface of said bottom plate around one opening defined in said bottom plate.

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29. (New Claim) The integrated circuit chip cooling structure according to claim 23 wherein said capillary wick comprises an upper plate-like wick located on a bottom surface of said top plate, a bottom plate-like wick located on a top surface of said bottom plate, and a plurality of vertical wick elements provided between said upper plate-like wick and said bottom plate-like wick, said vertical wicks each having a first end integral with one of said top and bottom plate and a second end supported on the other of said top and bottom plates; said at least one hollow column being inserted through said top plate-like wick and said bottom plate-like wick.

ABSTRACT OF THE DISCLOSURE

The apparatus is a heat pipe with superior heat transfer between the heat pipe and the heat source and heat sink. The heat pipe is held tightly against the heat source by mounting holes which penetrate the structure of the heat pipe but are sealed off from the vapor chamber because they each are located within a sealed structure such as a pillar or the solid layers of the casing surrounding the vapor chamber. Another feature of the heat pipe is the use of more highly heat conductive material for only that part of the wick in the region which contacts the heat source, so that there is superior heat conductivity in that region.

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APPLICATION FOR LETTERS PATENT

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT PETER M. DUSSINGER, a resident of Lititz, Pennsylvania, and THOMAS L. MYERS, a resident of Lititz, Pennsylvania, both citizens of the United States of America, have invented certain new and useful improvements in an

INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER

WITH THROUGH MOUNTING HOLES

of which the following is a specification:

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CROSS-REFERENCE TO RELATED APPLICATIONS

- 2 This application is a Divisional application of copending U.S. Serial No. 10/739,709, filed
- 3 on December 13, 2003, which is itself a Continuation application of copending U.S.
- 4 Application Serial No. 09/852,322, filed on May 9, 2001, which is itself a continuation
- 5 application of copending U.S. Application Serial No. 09/310,397, filed on May 12, 1999,
- 6 <u>and now issued as 6,302,192.</u>

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BACKGROUND OF THE INVENTION

This invention relates generally to active solid state devices, and more specifically to a heat pipe for cooling an integrated circuit chip, with the heat pipe designed to be held in direct contact with the integrated circuit.

As integrated circuit chips decrease in size and increase in power, the required heat sinks and heat spreaders have grown to be larger than the chips. Heat sinks are most effective when there is a uniform heat flux applied over the entire heat input surface. When a heat sink with a large heat input surface is attached to a heat source of much smaller contact area, there is significant resistance to the flow of heat along the heat input surface of the heat sink to the other portions of the heat sink surface which are not in direct contact with the contact area of the integrated circuit chip. Higher power and smaller heat sources, or heat sources which are off center from the heat sink, increase the resistance to heat flow to the balance of the heat sink. This phenomenon can cause great differences in the effectiveness of heat transfer from various parts of a heat sink. The effect of this unbalanced heat transfer is reduced

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performance of the integrated circuit chip and decreased reliability due to high operating
 temperatures.

The brute force approach to overcoming the resistance to heat flow within heat sinks which are larger than the device being cooled is to increase the size of the heat sink, increase the thickness of the heat sink surface which contacts the device to be cooled, increase the air flow which cools the heat sink, or reduce the temperature of the cooling air. However, these approaches increase weight, noise, system complexity, and expense.

It would be a great advantage to have a simple, light weight heat sink for an integrated circuit chip which includes an essentially isothermal surface even though only a part of the surface is in contact with the chip, and also includes a simple means for assuring intimate contact with the integrated circuit chip to provide good heat transfer between the chip and the heat sink.

SUMMARY OF THE INVENTION

The present invention is an inexpensive heat pipe heat spreader for integrated circuit chips which is of simple, light weight construction. It is easily manufactured, requires little additional space, and provides additional surface area for cooling the integrated circuit and for attachment to heat transfer devices for moving the heat away from the integrated circuit chip to a location from which the heat can be more easily disposed of. Furthermore, the heat pipe heat spreader is constructed to assure precise

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- 1 flatness and to maximize heat transfer from the heat source and to the heat sink, and
- 2 has holes through its body to facilitate mounting.

The heat spreader of the present invention is a heat pipe which requires no significant modification of the circuit board or socket because it is held in intimate contact with the integrated circuit chip by conventional screws attached to the integrated mounting board. This means that the invention uses a very minimum number of simple parts. Furthermore, the same screws which hold the heat spreader against the chip can also be used to clamp a finned heat sink to the opposite surface of the heat spreader.

The internal structure of the heat pipe is an evacuated vapor chamber with a limited amount of liquid and includes a pattern of spacers extending between and contacting the two plates or any other boundary structure forming the vapor chamber. The spacers prevent the plates from bowing inward, and therefore maintain the vital flat surface for contact with the integrated circuit chip. These spacers can be solid columns, embossed depressions formed in one of the plates, or a mixture of the two. Porous capillary wick material also covers the inside surfaces of the heat pipe and has a substantial thickness surrounding the surfaces of the spacers within the heat pipe, thus forming pillars of porous wick surrounding the supporting spacers. The wick therefore spans the space between the plates in multiple locations.

The spacers thus serve important purposes. They support the flat plates and prevent them from deflecting inward and distorting the plates to deform the flat surfaces which are required for good heat transfer. The spacers also serve as critical support for the portions of the capillary wick pillars which span the space between the plates

provide a gravity independent characteristic to the heat spreader, and the spacers
around which the wick pillars are located assure that the capillary wick is not subjected
to destructive compression forces.

The spacers also make it possible to provide holes into and through the vapor chamber, an apparent inconsistency since the heat pipe vacuum chamber is supposed to be vacuum tight. This is accomplished by bonding the spacers, if they are solid, to both plates of the heat pipe, or, if they are embossed in one plate, bonding the portions of the depressions which contact the opposite plate to that opposite plate. With the spacer bonded to one or both plates, a through hole can be formed within the spacer and it has no effect on the vacuum integrity of the heat pipe vapor chamber, from which the hole is completely isolated.

An alternate embodiment of the invention provides the same provision for mounting the heat pipe spreader with simple screws even when the heat pipe is constructed without internal spacers. This embodiment forms the through holes in the solid boundary structure around the outside edges of the two plates. This region of the heat pipe is by its basic function already sealed off from the vapor chamber by the bond between the two plates, and the only additional requirement for forming a through hole within it is that the width of the bonded region be larger than the diameter of the hole. Clearly, with the holes located in the peripheral lips, the heat pipe boundary structure can be any shape.

Another alternative embodiment of the invention provides for improved heat transfer between the integrated circuit chip and the heat pipe heat spreader. This is

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1	accomplished by using a different capillary wick material within the heat pipe at the
2	location which is directly in contact with the chip. Instead of using the same sintered
3	copper powder wick which is used throughout the rest of the heat pipe, the part of the
4	wick which is on the region of the heat pipe surface which is in contact with the chip is
5	constructed of higher thermal conductivity sintered powder. Such powder can be silver
6	diamond, or many other materials well known in the art. This provides for significantly
7	better heat transfer in the most critical heat transfer area, right at the integrated circuit
8	chip.

The present invention thereby provides a heat pipe superior heat transfer characteristics, and the simplest of all mounting devices, just several standard screws.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross section view of the preferred embodiment of a flat plate heat pipe 10 of the invention with through holes 12 through its vapor chamber 14 and in contact with finned heat sink 16.

FIG. 2 is a cross section view of an alternate embodiment of the heat pipe of the invention with through holes in the peripheral lips and in a depression in one plate.

FIG. 3 is a plan view of an internal surface the contact plate of the preferred embodiment of the invention showing the region of the capillary wick constructed of the sintered hight heat conductivity powder.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is a cross section view of the preferred embodiment of a flat plate heat
pipe 10 of the invention with through holes 12 through its vapor chamber 14 and in
contact with finned heat sink 16.

Heat pipe 10 is constructed by forming a boundary structure by sealing together two formed plates, contact plate 18 and cover plate 20. Contact plate 18 and cover plate 20 are sealed together at their peripheral lips 22 and 24 by conventional means, such as soldering or brazing, to form heat pipe 10. Heat pipe 10 is then evacuated to remove all non-condensible gases and a suitable quantity of heat transfer fluid is placed within it. This is the conventional method of constructing a heat pipe, and is well understood in the art of heat pipes.

The interior of heat pipe 10 is, however, constructed unconventionally. While contact plate 18 is essentially flat with the exception of peripheral lip 24, cover plate 20 includes multiple depressions 26. Depressions 26 are formed and dimensioned so that, when contact plate 18 and cover plate 20 are joined, the flat portions of depressions 26 are in contact with inner surface 28 of contact plate 18. Depressions 26 thereby assure that the spacing between contact plate 18 and cover plate 20 will be maintained even through pressure differentials between the inside volume of heat pipe 10 and the surrounding environment might otherwise cause the plates to deflect toward each other.

Heat pipe 10 also includes internal sintered metal capillary wick 30 which covers the entire inside surface of contact plate 18. As is well understood in the art of heat pipes, a capillary wick provides the mechanism by which liquid condensed at the cooler condenser of a heat pipe is transported back to the hotter evaporator where it is

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evaporated. The vapor produced at the evaporator then moves to the condenser where

2 it again condenses. The two changes of state, evaporation at the hotter locale and

condensation at the cooler site, are what transport heat from the evaporator to the

4 condenser.

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In the present invention, heat pipe 10 also has capillary wick pillars 32 which

6 bridge the space between contact plate 18 and cover plate 20. Pillars 32 thereby

7 interconnect cover plate 16 and contact plate 14 with continuous capillary wick. This

geometry assures that, even if heat pipe 10 is oriented so that cover plate 16 is lower

than contact plate 14, liquid condensed upon inner surface 34 of cover plate 20 will still

be in contact with capillary pillars 32. The liquid will therefore be moved back to raised

surface 28 which functions as the evaporator because it is in contact with a heat

generating integrated circuit (not shown). Capillary pillars 32 are wrapped around and

supported by depressions 26, which prevents the structurally weaker capillary pillars 32

14 from suffering any damage.

15 FIG. 1 also shows frame 36 which is typically used to surround and protect heat

pipe 10. Frame 34 completely surrounds heat pipe 10 and contacts lip 24 of contact

plate 18. When heat pipe 10 is used to cool an integrated circuit chip (not shown) which

is held against contact plate 18, cover plate 20 is held in intimate contact with fin plate

38, to which fins 16 are connected. The entire assembly of heat pipe 10, frame 34, and

fin plate 38 is held together and contact plate 18 is held against an integrated circuit

chip by conventional screws 40, shown in dashed lines, which are placed in holes 42 in

fin plate 38 and through holes 12 in heat pipe 10, and are threaded into the mounting

23 plate (not shown) for the integrated circuit chip.

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1	Holes 12 penetrate heat pipe 10 without destroying its vacuum integrity because
2	of their unique location. Holes 12 are located within sealed structures such as solid
3	columns 44, and since columns 44 are bonded to cover plate 20 at locations 46, holes
4	12 passing through the interior of columns 44 have no affect on the interior of heat pipe
5	10.
6	The preferred embodiment of the invention has been constructed as heat pipe 10
7	as shown in FIG. 1. This heat pipe is approximately 3.0 inches by 3.5 inches with a
8	total thickness of .200 inch. Cover plate 20 and contact plate 18 are constructed of
9	OFHC copper .035 inch thick, and depressions 26 span the .100 inch height of the
10	internal volume of heat pipe 10. The flat portions of depressions 26 are .060 inch in
11	diameter. Capillary wick 30 is constructed of sintered copper powder and averages
12	.040 inch thick. Columns 44 have a .250 inch outer diameter, and holes 12 are .210 in
13	diameter.
14	FIG. 2 is a cross section view of an alternate embodiment of the flat plate heat
15	pipe 11 of the invention with through holes 48 located within peripheral lips 22 and 24 of
16	the heat pipe and hole 50 shown in another sealed structure, one of the depressions 26.

pipe 11 of the invention with through holes 48 located within peripheral lips 22 and 24 of the heat pipe and hole 50 shown in another sealed structure, one of the depressions 26. The only requirement for forming hole 50 within a depression 26 is that the bottom of depression 26 must be bonded to inner surface 28 of contact plate 18 to prevent loss of vacuum within the heat pipe. Of course, the region of the peripheral edges is also a sealed structure since bonding between lips 22 and 24 is inherent because heat pipe 11 must be sealed at its edges to isolate the interior from the outside atmosphere.

The only differences between heat pipe 11 of FIG. 2 and heat pipe 10 of FIG. 1 are that finned heat sink 16 is not shown in FIG. 2, lips 22 and 24 are slightly longer in

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FIG. 2 to accommodate holes 48, and hole 50 is shown. In fact, through holes 12 shown in FIG. 12 are also included in FIG. 2. Although it is unlikely that holes 12, holes 48, and hole 50 would be used in the same assembly, manufacturing economies may make it desirable to produce all the holes in every heat pipe so that the same heat pipe heat spreader can be used with different configurations of finned heat sinks. The

unused sets of holes have no effect on the operation or benefits of the invention.

FIG. 3 is a plan view of the internal surface of the contact plate 18 of the heat pipe 10 of the invention showing region 31 of capillary wick 30. Region 31 is constructed of sintered silver powder. While the balance of capillary wick 30 is conventional sintered metal such as copper, region 31 of capillary wick 30, which is on the opposite surface of contact plate 18 from the integrated circuit chip (not shown), is formed of powdered silver. The higher thermal conductivity of silver yields significantly better heat conduction through region 31 of the wick 30, and thereby reduces the temperature difference between the integrated circuit chip and the vapor within heat pipe 10. This reduction of temperature difference directly affects the operation of heat pipe 10, and essentially results in a similar reduction in the operating temperature of the chip.

The invention thereby furnishes an efficient means for cooling an integrated circuit and does so without the need for larger heat spreaders which not only add weight but also do not transfer heat away from the integrated circuit as effectively as does the heat pipe of the invention.

It is to be understood that the form of this invention as shown is merely a preferred embodiment. Various changes may be made in the function and arrangement

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- of parts; equivalent means may be substituted for those illustrated and described; and
- 2 certain features may be used independently from others without departing from the spirit
- and scope of the invention as defined in the following claims. For example, through
- 4 holes could also penetrate heat pipe boundary structures with curved surfaces or heat
- 5 pipe boundary structures with offset planes which create several different levels for
- 6 contact with heat sources or heat sinks.
- 7 What is claimed as new and for which Letters patent of the United States are
- desired to be secured is:

1	WHAT IS CLAIMED IS:	
2	1-16.	(Cancelled)
3		
4	17.	(New Claim) A heat pipe for spreading heat comprising:
5		a boundary structure including spaced-apart first and second plates that
6	define an en	closed vapor chamber;
7		at least one hollow column positioned within said vapor chamber and
8	sealingly bo	nded to said first and second plates, having an open first end that opens
9	through said	first plate and an open second end that opens through said second plate
10	so as to form	at least one mounting hole that is isolated from said vapor chamber.
11		
12	18.	(New Claim) A heat pipe for spreading heat according to claim 17 wherein
13	said spaced-	apart first and second plates include confronting interior surfaces; and
14		a wick positioned upon said confronting interior surfaces of said first and
15	second plate	es the exterior surface of said at least one hollow column disposed within
16	said vapor cl	namber.
17		
18	19.	(New Claim) A heat pipe for spreading heat comprising:
19		a boundary structure including a first plate and a second plate arranged in
20	spaced apar	t relation, each of said plates including interior confronting surfaces and a
21	peripheral lip	located at an edge of said boundary structure which are bonded together
22	so as to defi	ne an enclosed vapor chamber;

1	a depression formed in said first plate which projects into said vapor		
2	chamber, is spaced from said peripheral lip, and is bonded to said second plate;		
3	an opening defined through said first plate depression and said second		
4	plate wherein said depression comprises an annular outer surface that is bonded to a		
5	corresponding annular edge surface in said second plate and further wherein said		
6	opening is isolated from said vapor chamber;		
7	at least one spacer extending between and contacting said first and		
8	second plates; and		
9	a wick positioned upon said confronting interior surfaces including that		
10	portion of the interior surface of said first plate that forms a surface of said depression		
11	within said vapor chamber.		
12			
13	20. (New Claim) A heat pipe for spreading heat comprising:		
14	a first plate having a circumferential edge lip bounding an inner surface		
15	and at least one hollow column that is integral with said first plate and which projects		
16	outwardly relative to said inner surface;		
17	a second plate arranged in spaced apart confronting relation to said first		
18	plate and including a circumferential edge lip bounding an inner surface and at least one		
19	opening through said second plate, said edge lips of said first and second plates being		
20	bonded together so as to define a vapor chamber; wherein		
21	a hollow column bonded at one end to said second plate so as to coaxially		
22	align said hollow column with one of said at least one openings in said second plate		

1	thereby to form a mounting hole that extends through said first plate and said second		
2	plate and is isolated from said vapor chamber.		
3			
4	21. (New Claim) A heat pipe for spreading heat comprising:		
5	a first plate having a circumferential edge lip bounding an inner surface		
6	and a depression which projects outwardly relative to said inner surface;		
7	a second plate arranged in spaced apart confronting relation to said first		
8	plate and including a circumferential edge lip bounding an inner surface and at least one		
9	opening through said second plate, said edge lips of said first and second plates being		
10	bonded together so as to define a vapor chamber; wherein		
11	said depression having an open ended tubular cross-section and an outer		
12	surface, a portion of which outer surface is bonded to said second plate so as to		
13	coaxially align said depression with one of said at least one openings in said second		
14	plate thereby to form a mounting hole that extends through said first plate depression		
15	and said second plate and is isolated from said vapor chamber.		

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22. (New Claim) A heat pipe for spreading heat comprising:

a first plate having a circumferential edge lip bounding an inner surface and a hollow column which projects outwardly relative to said inner surface;

a second plate arranged in spaced apart confronting relation to said first plate and including (i) a circumferential edge lip bounding an inner surface, (ii) at least one depression which projects into said vapor chamber and that is bonded to said inner surface of said first plate, and (iii) at least one opening through said second plate, said

1	edge lips of said first and second plates being bonded together so as to define a vapor
2	chamber; wherein

said hollow column in said first plate opens at a first end and a second end and is bonded to said second plate at said second end so as to coaxially align said hollow column with said at least one opening in said second plate thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber.

23. (New Claim) An integrated circuit chip cooling structure comprising:

a top plate having an edge lip that bounds a top surface and a bottom surface;

a bottom plate having an edge lip that bounds a top surface and a bottom surface, said edge lips of said top and bottom plates being bonded together so as to define a vapor chamber;

a capillary wick provided within said vapor chamber;

wherein said top plate and said bottom plate each define at least one opening such that the at least one opening of said top plate and the at least one opening of said bottom plate are vertically aligned;

at least one hollow column extending between said top plate and said bottom plate, said at least one hollow column having a top end sealed to a periphery of said opening defined in said top plate and a bottom end sealed to a periphery of said opening defined in said bottom plate, said at least one hollow column having a central passageway sized to receive a fastener.

1	24. (New Claim) The integrated circuit chip cooling structure according to
2	claim 23 comprising at least one heat sink, said at least one heat sink having a bottom
3	surface attached to the top surface of said top plate and at least one mounting hole
4	communicating with a hollow column; and
5	a fastener extending through said hollow column and through said mounting hole
6	of said at least one heat sink to secure said heat sink to said top and bottom plates.
7	
8	25. (New Claim) The integrated circuit chip cooling structure according to
9	claim 23 wherein said at least one hollow column each have a top shoulder disposed
10	near a top end and bonded to a bottom surface of said top plate around one opening.
11	
12	26. (New Claim) The integrated circuit chip cooling structure according to
13	claim 25 wherein said at least one hollow column each have a bottom end downwardly
14	extending out of said bottom plate through one opening defined in said bottom plate.
15	
16	27. (New Claim) The integrated circuit chip cooling structure according to
17	claim 24 wherein said at least one heat sink comprises a base and a plurality of fins
18	located on one side of said base.
19	
20	28. (New Claim) The integrated circuit chip cooling structure according to
21	claim 23 wherein said at least one hollow column has a top shoulder disposed near a
22	top end and bonded to a bottom surface of said top plate around one opening defined in

said top plate and a bottom shoulder disposed near a bottom end and bonded to a top surface of said bottom plate around one opening defined in said bottom plate.

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29. (New Claim) The integrated circuit chip cooling structure according to claim 23 wherein said capillary wick comprises an upper plate-like wick located on a bottom surface of said top plate, a bottom plate-like wick located on a top surface of said bottom plate, and a plurality of vertical wick elements provided between said upper plate-like wick and said bottom plate-like wick, said vertical wicks each having a first end integral with one of said top and bottom plate and a second end supported on the other of said top and bottom plates; said at least one hollow column being inserted through said top plate-like wick and said bottom plate-like wick.

ABSTRACT OF THE DISCLOSURE

The apparatus is a heat pipe with superior heat transfer between the heat pipe and the heat source and heat sink. The heat pipe is held tightly against the heat source by mounting holes which penetrate the structure of the heat pipe but are sealed off from the vapor chamber because they each are located within a sealed structure such as a pillar or the solid layers of the casing surrounding the vapor chamber. Another feature of the heat pipe is the use of more highly heat conductive material for only that part of the wick in the region which contacts the heat source, so that there is superior heat conductivity in that region.

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United States Patent and Trademark Office

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandria, Virginia 22313-1450 www.uspto.gov

APPLICATION NUMBER	FILING OR 371(c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/200 240	00/00/2005	D . M D .	111700 00000

11/200,349

08/09/2005

Peter M. Dussinger

H1799-00303

041396 **DUANE MORRIS LLP** IP DEPARTMENT 30 SOUTH 17TH STREET PHILADELPHIA, PA 19103-4196 **CONFIRMATION NO. 3228 WITHDRAWAL** NOTICE

Date Mailed: 11/09/2005

WITHDRAWAL OF PREVIOUSLY SENT NOTICE

It has come to the attention of the Office that the Notice mailed on 08/30/2005 was sent in error. The Notice is hereby withdrawn. The application is complete and will be processed for examination. The Official Filing Receipt is enclosed. The office regrets any inconvenience the error may have caused.

A copy of this notice MUST be returned with the reply.

Customer Service Center

Initial Patent Examination Division (571) 272-4000, or 1-800-PTO-9199, or 1-800-972-6382 PART 3 - OFFICE COPY

CERTIFICATE UNDER 37 CFR 1.8(a)
1, SAMUEL W. APICELLI, REGISTRATION NO. 36, 27, HEREBY CERTIFY THAT THIS CORRESPONDENCE IS BRING TELEPAX TO 571-273-8300 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE TO THE COMMISSION ATTENTS, WASHINGTON, D.C. 20231.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

RECEIVED **CENTRAL FAX CENTER**

MAR 1 3 2006

Attorney Docket No. H1799-00303

Filing Date: August 9, 2006

Examiner: Not Yet Known

U.S. Application Serial No.: 11/200,349

In re: Application of: Dussinger et al.

Art Group: Not Yet Known

For:

Integrated Circuit Heat Pipe Spreader With Through Mounting Holes

REQUEST FOR CORRECTED OFFICIAL FILING RECEIPT

Commissioner For Patents P.O. Box 1450 Alexandria, VA 22313-1450 TRANSMITTAL VIA FACSIMILE (571) 273-8300

Sir:

The Filing Receipt for the above-identified U.S. Patent Application contains an error regarding Domestic Priority Data. The PTO is requested to issue a corrected filing receipt, properly identifying as follows:

Domestic Priority Data as claimed by applicant

Correct

"DIV of 10/626,270, 07/24/203"

should read

DIV of 10/739,709, 12/18/2003

A copy of the incorrect filing receipt, noting the error in the identification of the item is enclosed. The incorrect priority data serial number was corrected in the preliminary amendment in the Repsonse To Notice To File Corrected Application Papers, mailing date, Ocotber 31, 2005. If there should be any charge to correct the Filing Receipt, please charge any fees to Deposit Account No. 04-1679

Respectfully submitted.

Registration No. 36,427

Customer No. 08933

Duane Morris LLP

30 South 17th Street

Philadelphia, Pennsylvania 19103-4196

(215) 979-1255

DM2\667398.1

PAGE 1/4* RCVD AT 3/13/2006 3:55:50 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/6* DNIS:2738300 * CSID:2154059823 * DURATION (mm-ss):01-32

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Duane Morris LLP

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Page 1 of 3



United States Patent and Trademark Office

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trudemark Office Address COMMISSIONER FOR PATENTS P.O. UC 1459 Advancing, Vegica 22113-1450

FILING OR 371 (c) DATE ATTY.DOCKET NO DRAWINGS TOT CLMS IND CLMS ART UNIT FIL FEE REC'D APPL NO. 1600 H1799-00303 11/200.349 08/09/2005 3753

CONFIRMATION NO. 3228

041396 DUANE MORRIS LLP IP DEPARTMENT 30 SOUTH 17TH STREET PHILADELPHIA, PA 19103-4196 NOV 1 4 2005

FILING RECEIPT | 1444|| | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 170 | | 1 OC0000000174275951

Date Mailed: 11/09/2005

Receipt is acknowledged of this regular Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please mail to the Commissioner for Patents P.O. Box 1450 Alexandria Va 22313-1450. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).

Applicant(s)

Peter M. Dussinger, Lititz, PA; Thomas L. Myers, Lititz, PA;

Power of Attorney: The patent practitioners associated with Customer Number <u>08933</u>.

Domestic Priority data as claimed by applicant

This application is a DIV of 10/626,270 07/24/2003 * which is a CON of 09/852,322 05/09/2001 which is a CON of 09/310,397 05/12/1999 PAT 6,302,192 (*)Data provided by applicant is not consistent with PTO records.

Foreign Applications

If Required, Foreign Filing License Granted: 08/29/2005

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US11/200,349**

Projected Publication Date: 02/16/2006

Non-Publication Request: No

Early Publication Request: No

PAGE 3/4 * RCVD AT 3/13/2006 3:55:50 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/6 * DNIS:2738300 * CSID:2154059823 * DURATION (mm-ss):01-32

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Duane Morris LLP

Ø 004
Page 2 of 3

Title

Integrated circuit heat pipe heat spreader with through mounting holes.

Preliminary Class

165

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process simplifies the filing of patent applications on the same invention in member countries, but does not result in a grant of "an international patent" and does_not eliminate_the need of applicants—to file additional-documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filling foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving Innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER Title 35, United States Code, Section 184 Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

PAGE 4/4 * RCVD AT 3/13/2006 3:55:50 PM [Eastern Standard Time] * SYR:USPTO-EFXRF-1/6 * DNIS:2738300 * CSID:2154059823 * DURATION (mm-ss):01-32

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application-pursuant te-37 CFR 5.15(b).



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandina, Virginia 22313-1450 www.uspto.gov

APPLICATION N	10.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO
11/200,349		08/09/2005	Peter M. Dussinger	H1799-00303	3228
41396	7590	03/23/2006		EXAM	INER
DUANE	MORR	IS LLP		CIRIC, LJI	LJANA V
IP DEPA	RTMEN'	Т			
30 SOUT	H 17TH	STREET		ART UNIT	PAPER NUMBER
PHILAD	ELPHIA,	, PA 19103-4196		3753	
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Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
	11/200,349	DUSSINGER ET AL.
Office Action Summary	Examiner	Art Unit
	Ljiljana (Lil) V. Ciric	3753
The MAILING DATE of this communication app Period for Reply	ears on the cover sheet with the c	orrespondence address
A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION. - Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication. - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication. - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).		
Status		
1) Responsive to communication(s) filed on 09 Au	igust 2005.	
2a) ☐ This action is FINAL . 2b) ☐ This	action is non-final.	
3) Since this application is in condition for allowan		
closed in accordance with the practice under E	x parte Quayle, 1935 C.D. 11, 45	53 O.G. 213.
Disposition of Claims		
4) Claim(s) 17-29 is/are pending in the application. 4a) Of the above claim(s) is/are withdrawn from consideration. 5) Claim(s) is/are allowed. 6) Claim(s) is/are rejected. 7) Claim(s) is/are objected to.		
8) Claim(s) <u>17-29</u> are subject to restriction and/or Application Papers	olodion requirement.	
9)☐ The specification is objected to by the Examine	•	
10)☐ The drawing(s) filed on is/are: a)☐ acce	epted or b) abjected to by the I	Examiner.
Applicant may not request that any objection to the		
Replacement drawing sheet(s) including the correcti		
11)☐ The oath or declaration is objected to by the Ex	aminer. Note the attached Oπice	Action or form PTO-152.
Priority under 35 U.S.C. § 119		
12) Acknowledgment is made of a claim for foreign a) All b) Some * c) None of: 1. Certified copies of the priority documents 2. Certified copies of the priority documents 3. Copies of the certified copies of the prior application from the International Bureau * See the attached detailed Office action for a list of	s have been received. s have been received in Applicati ity documents have been receive (PCT Rule 17.2(a)).	on No ed in this National Stage
Attachment(s) 1) Notice of References Cited (PTO-892) 2) Notice of Draftsperson's Patent Drawing Review (PTO-948) 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date	4) Interview Summary Paper No(s)/Mail Do 5) Notice of Informal P 6) Other:	

U.S. Patent and Trademark Office PTOL-326 (Rev. 7-05) Application/Control Number: 11/200,349 Page 2

Art Unit: 3753

Election/Restrictions

1. This application contains claims directed to the following patentably distinct species: the first

species or the embodiment of Figure 1; the second species or the embodiment of Figure 2; and the third

species or the embodiment of Figure 3. The species are independent or distinct because the various

species are not disclosed as being usable together, for example.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on

the merits to which the claims shall be restricted if no generic claim is finally held to be allowable.

Currently, no claim is generic.

Applicant is advised that a reply to this requirement must include an identification of the species

that is elected consonant with this requirement, and a listing of all claims readable thereon, including any

claims subsequently added. An argument that a claim is allowable or that all claims are generic is

considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to

additional species which depend from or otherwise require all the limitations of an allowable generic

claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which

are readable upon the elected species. MPEP § 809.02(a).

2. Applicant is advised that the reply to this requirement to be complete must include (i) an election

of a species or invention to be examined even though the requirement be traversed (37 CFR 1.143) and

(ii) identification of the claims encompassing the elected invention.

The election of an invention or species may be made with or without traverse. To reserve a right

to petition, the election must be made with traverse. If the reply does not distinctly and specifically point

out supposed errors in the restriction requirement, the election shall be treated as an election without

traverse.

Application/Control Number: 11/200,349 Page 3

Art Unit: 3753

Should applicant traverse on the ground that the inventions or species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions or species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be

3. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the

inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named

inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of

inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37

CFR 1.17(i).

4. Any inquiry concerning this communication or earlier communications from the examiner should

be directed to Ljiljana (Lil) V. Ciric whose telephone number is 571-272-4909. The examiner can

normally be reached on Mondays through Fridays from 10:00 a.m. to 6:30 p.m.

used in a rejection under 35 U.S.C.103(a) of the other invention.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gene

Mancene, can be reached at 571-272-4930.

Information regarding the status of an application may be obtained from the Patent Application

Information Retrieval (PAIR) system.

Status information for published applications may be obtained from either Private PAIR or Public

PAIR.

Status information for unpublished applications is available through Private PAIR only. For more

information about the PAIR system, see http://pair-direct.uspto.gov.

Should you have questions on access to the Private PAIR system, contact the Electronic Business

Center (EBC) at 866-217-9197 (toll-free).

PRIMARY EXAMEN

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. 11/200,349

Applicant Peter M. Dussinger and Thomas L. Myers

Filed Herewith

INTEGRATED CIRCUIT HEAT PIPE HEAT Title

SPREADER WITH THROUGH MOUNTING HOLES

TC/A.U.

: 3753 : Ciric, Liljana V : H1799-00303 Examiner Ciric, Liljana V. Docket No.

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

RESPONSE TO ELECTION OF SPECIES AND AMENDMENT

Sir:

In response to the Office action of March 23, 2006, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 8 of this paper.

Docket No.: H1799-00303

Response to Office Action dated March 23, 2006

This listing of claims will replace all prior versions, and listings, of claims in

the application:

Listing of Claims:

1-18. (Cancelled)

19. (Previously Presented) A heat pipe for spreading heat

comprising:

a boundary structure including a first plate and a second plate arranged in

spaced apart relation, each of said plates including interior confronting surfaces

and a peripheral lip located at an edge of said boundary structure which are

bonded together so as to define an enclosed vapor chamber;

a depression formed in said first plate which projects into said vapor

chamber, is spaced from said peripheral lip, and is bonded to said second plate;

an opening defined through said first plate depression and said second

plate wherein said depression comprises an annular outer surface that is bonded

to a corresponding annular edge surface in said second plate and further wherein

said opening is isolated from said vapor chamber;

at least one spacer extending between and contacting said first and

second plates; and

Docket No.: H1799-00303

Response to Office Action dated March 23, 2006

a wick positioned upon said confronting interior surfaces including that

portion of the interior surface of said first plate that forms a surface of said

depression within said vapor chamber.

20. (Previously Presented) A heat pipe for spreading heat

comprising:

a first plate having a circumferential edge lip bounding an inner surface

and at least one hollow column that is integral with said first plate and which

projects outwardly relative to said inner surface;

a second plate arranged in spaced apart confronting relation to said first

plate and including a circumferential edge lip bounding an inner surface and at

least one opening through said second plate, said edge lips of said first and

second plates being bonded together so as to define a vapor chamber; wherein

a hollow column bonded at one end to said second plate so as to coaxially

align said hollow column with one of said at least one openings in said second

plate thereby to form a mounting hole that extends through said first plate and

said second plate and is isolated from said vapor chamber.

21. (Previously Presented) A heat pipe for spreading heat

comprising:

a first plate having a circumferential edge lip bounding an inner surface

and a depression which projects outwardly relative to said inner surface;

Docket No.: H1799-00303

Response to Office Action dated March 23, 2006

a second plate arranged in spaced apart confronting relation to said first

plate and including a circumferential edge lip bounding an inner surface and at

least one opening through said second plate, said edge lips of said first and

second plates being bonded together so as to define a vapor chamber; wherein

said depression having an open ended tubular cross-section and an outer

surface, a portion of which outer surface is bonded to said second plate so as to

coaxially align said depression with one of said at least one openings in said

second plate thereby to form a mounting hole that extends through said first plate

depression and said second plate and is isolated from said vapor chamber.

22. (Previously Presented) A heat pipe for spreading heat

comprising:

a first plate having a circumferential edge lip bounding an inner surface

and a hollow column which projects outwardly relative to said inner surface;

a second plate arranged in spaced apart confronting relation to said first

plate and including (i) a circumferential edge lip bounding an inner surface, (ii) at

least one depression which projects into said vapor chamber and that is bonded

to said inner surface of said first plate, and (iii) at least one opening through said

second plate, said edge lips of said first and second plates being bonded

together so as to define a vapor chamber; wherein

said hollow column in said first plate opens at a first end and a second end

and is bonded to said second plate at said second end so as to coaxially align

Docket No.: H1799-00303

Response to Office Action dated March 23, 2006

said hollow column with said at least one opening in said second plate thereby to

form a mounting hole that extends through said first plate depression and said

second plate and is isolated from said vapor chamber.

23. (Previously Presented) An integrated circuit chip cooling

structure comprising:

a top plate having an edge lip that bounds a top surface and a bottom

surface;

a bottom plate having an edge lip that bounds a top surface and a bottom

surface, said edge lips of said top and bottom plates being bonded together so

as to define a vapor chamber;

a capillary wick provided within said vapor chamber;

wherein said top plate and said bottom plate each define at least one

opening such that the at least one opening of said top plate and the at least one

opening of said bottom plate are vertically aligned;

at least one hollow column extending between said top plate and said

bottom plate, said at least one hollow column having a top end sealed to a

periphery of said opening defined in said top plate and a bottom end sealed to a

periphery of said opening defined in said bottom plate, said at least one hollow

column having a central passageway sized to receive a fastener.

Docket No.: H1799-00303

Response to Office Action dated March 23, 2006

24. (Previously Presented) The integrated circuit chip cooling

structure according to claim 23 comprising at least one heat sink, said at least

one heat sink having a bottom surface attached to the top surface of said top

plate and at least one mounting hole communicating with a hollow column; and

a fastener extending through said hollow column and through said

mounting hole of said at least one heat sink to secure said heat sink to said top

and bottom plates.

25. (Previously Presented) The integrated circuit chip cooling

structure according to claim 23 wherein said at least one hollow column each

have a top shoulder disposed near a top end and bonded to a bottom surface of

said top plate around one opening.

26. (Previously Presented) The integrated circuit chip cooling

structure according to claim 25 wherein said at least one hollow column each

have a bottom end downwardly extending out of said bottom plate through one

opening defined in said bottom plate.

27. (Previously Presented) The integrated circuit chip cooling

structure according to claim 24 wherein said at least one heat sink comprises a

base and a plurality of fins located on one side of said base.

Docket No.: H1799-00303

Response to Office Action dated March 23, 2006

28. (Previously Presented) The integrated circuit chip cooling structure according to claim 23 wherein said at least one hollow column has a top shoulder disposed near a top end and bonded to a bottom surface of said top plate around one opening defined in said top plate and a bottom shoulder disposed near a bottom end and bonded to a top surface of said bottom plate around one opening defined in said bottom plate.

29. (Previously Presented) The integrated circuit chip cooling structure according to claim 23 wherein said capillary wick comprises an upper plate-like wick located on a bottom surface of said top plate, a bottom plate-like wick located on a top surface of said bottom plate, and a plurality of vertical wick elements provided between said upper plate-like wick and said bottom plate-like wick, said vertical wicks each having a first end integral with one of said top and bottom plate and a second end supported on the other of said top and bottom plates; said at least one hollow column being inserted through said top plate-like wick and said bottom plate-like wick.

Docket No.: H1799-00303

Response to Office Action dated March 23, 2006

REMARKS/ARGUMENTS

In the Official Action, claims 17-29 stand subject to an election of species

under 35 USC 121, as follows:

A) an alleged species illustrated by Figure 1;

B) an alleged species illustrated by Figure 2; and

C) an alleged species illustrated by Figure 3.

In response, Applicants elect the invention of the alleged species shown in

Figure 2. At least claims 19-29 read on the elected species. Applicants have

cancelled claims 17 and 18. Applicants expressly reserve the right to prosecute

the non-elected subject matter in related applications.

No additional fees are believed to be necessary, however, the

Commissioner of Patents if authorized to charge any additional fees in

connection with this matter to Deposit Account No. 04-1679.

In view of the foregoing, Applicants respectfully submit that at least claims

19-29 are in condition for allowance. Favorable consideration is therefore

requested.

8 of 9

Page 104

Appl. No.: 11/200,349 Docket No.: H1799-00303

Response to Office Action dated March 23, 2006

Applicants respectfully request that a timely Notice of Allowance be issued in this case.

If a telephone conference would be of assistance in advancing prosecution of the above-identified application, Applicants' undersigned Attorney invites the Examiner to telephone him at <u>215-979-1255</u>.

Respectfully submitted,

Dated:04/13/2006

/Samuel W. Apicelli/ Samuel W. Apicelli Registration No. 36,427 Customer No. 0041396 DUANE MORRIS LLP 30 S. 17th Street Philadelphia, PA 19103-4196

Tel.: (215)979-1255 Fax: (215) 979-1020

swapicelli@duanemorris.com

Electronic Acknowledgement Receipt		
EFS ID:	1023201	
Application Number:	11200349	
Confirmation Number:	3228	
Title of Invention:	Integrated circuit heat pipe heat spreader with through mounting holes	
First Named Inventor:	Peter M. Dussinger	
Customer Number:	41396	
Filer:	Samuel W. Apicelli/Sue Seiler	
Filer Authorized By:	Samuel W. Apicelli	
Attorney Docket Number:	H1799-00303	
Receipt Date:	13-APR-2006	
Filing Date:	09-AUG-2005	
Time Stamp:	18:32:02	
Application Type:	Utility	
International Application Number:		

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part	Pages
1		h1799-00303speciesrespons e.pdf	82284	yes	9

	Multipart Description					
	Doc Desc	Start	End			
	Response to Election / Restriction Filed		1			
	Claims		7			
	Applicant Arguments/Remarks Made in an Amendment	8	9			
Warnings:						
Information	:					
	Total Files Size (in bytes): 82284					

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

PT0/58/06 (12-0t)

CUS. DEPARTMENT OF COMMERCE PATENT APPLICATION FEE DETERMINATION RECORD Effective December 8, 2004 Substitute for Form PTO:875 APPLICATION AS FILED - PART I OTHER THAN OR. SMALL ENTITY SMALL ENTITY (Column 2) · (Cotumn 1) HUNDER FLED MAINSER EXTRA RATE (S) FATE (5) FOR FEE G FEE (I) BASIC FEE 150.00 NA. wi 300.00 WA NA COT CORE I TOPO DE . O POT SPARCH FEE \$250 ·NA NA . 845 NEA \$500 CO COR I HOW BY - CHI EXAMPLATION FEE NA ·NO \$100 NA \$200 07 CFR 1 1804-01 - NO TOTAL CLAMS X\$ 25 X\$50 2 **CR** Q7 CFR 1 1520 THEOEPENDENT CLAIMS (37 CFR 1 1509) X100 X20Ó • 600 If the specification and drawings exceed 100 : sheets of paper, the application size fee due APPLICATION SIZE is \$250 (\$125 for small entity) for each additional 50 sheets or traction thereof. See (DT CFR 1 16(H) 35 U.S.C. 41(e)(1)(G) and 37 CFR 1.16(s). +180= +360= MULTIPLE DEPENDENT CLAM PRESENT (07 OFR 1.160) of the difference in column 1 letiess than zero, enter "O" in column 2. TOTAL TOTAL APPLICATION AS AMENDED - PART II OTHER THAN OR (Cotune 2) (Column 3) SMALL ENTITY SMALL ENTITY CLASAS HIGHEST ADOL TIONAL FEE (8) ADDI-TIONAL DOPRENİT RATE-(\$) REMAINING EXTRA APTER AMENDMENT PREVIOUSLY 8 8' FEE (A) PAID FOR Tetal XS 25 X\$50 θĠ OF CORE LE **ÖR** X200 ٠٠٠ع X100. OR ation Size Fee (37 CFR 1.15(s)) +180= +360= FRIST PRESENTATION OF MULTIPLE DEPENDENT CLASM (37 CFR (160)) OR TOTAL TOTAL : ADO'L FEE ADD'L FEE. (Cotumn 3) (Cok CLAMS. REMANING HIGHEST NUMBER 41306. PRESENT ADOI-TIONAL ADDI-TIONAL RATE (1) RATE (5) EXTRA - AFTER **PREVIOUSLY** FEE (A) AMENOMENT PAID FOR FEE (1) Total 20 X3.25 X\$50 COLUMNY QR. X100 X200 OR etion Size Fee (37 CFR 1.16(s)) +350= PRIST PRESENTATION OF ROLTIFLE OFFICIONT CLAIM (ST.CFR 1.16(1) +180= OR TOTAL . TOTAL OR ADD'L FEE ADD'L FEE If the entry is column 1 is type than the entry in column 2, write '17' in square 3.
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" If the "Highest Number Previously Paid For" IN THUS SPACE is less than 30, enter "20".

"If the "Highest Number Previously Paid For" (IN THUS SPACE is less than 3, enter "20".

The, "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of internation is required by 37 CFR 1.16. The internation is required to obtain or retain a benefit by the public which is to till (and by the USPTQ to proceed) an application. Confidentially is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 aphrates to complete, including patheting, property, and estimating the completed application form to the USPTQ. Then will very depending upon the instituted case. Any commission in the mount of the year require the symmetry of the year require the symmetry of the year required to Complete, C.P. Patent and Tradement Office, U.S. Coopertment of Completes, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need essistance in completing the form, CSE 1-800-PTO-9199 and coloci option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Dussinger et al. Attorney Docket No.: H1799-00303

Filed Date: December 18, 2003 Examiner: Ciric, Ljiljana V.

Serial No.: 11/200,349 Group Art: 3753

For: Intergrated Circuit Heat Pipe Heat Spreader With Through

Mounting Holes

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Electronically Filed

Sir:

Pursuant to the Duty of Disclosure set forth in 37 CFR 1.56, the materials listed on the attached form PTO-1449 are hereby brought to the attention of the Examiner.

The above-identified patent application is a divisional from co-depending U.S. Application Serial No. 10/739,709, which itself is a Continuation of 09/852,322. Paper copies of all references have been previously submitted in the Information Disclosure Statements of the family applications, and as such, paper copies of these references have not been submitted in this application in order to reduce the burden of paperwork.

This Information Disclosure Statement is submitted prior to the mailing date of the first Office Action on the merits received by Applicants.

Item NNN on the attached PTO-1449 Form is an Engineering Drawing that shows a Japanese language date of H19.2.26, which in English corresponds to February 26, 1998. The

drawing contains Japanese characters above that date indicating that this drawing shows, a hole, a lid, and a base. Applicant submits that there is no representation of a heat pipe for spreading heat comprising, a boundary structure including spaced-apart first and second plates that define an enclosed vapor chamber, at least one depression formed in the first plate which projects into the vapor chamber and that is bonded to the second plate, and an opening defined through the at least one depression and the second plate so that the opening is isolated from the vapor chamber, as claimed in the above-identified application.

French Patent No. 2,579,371, discloses a semiconductor to be cooled clamped between two evaporation exchangers containing internal cooling fins in a hollow interior. An electrically non-conductive fluid partly fills the interiors, which are sealed by insulators and pressure spreader plates. The heat conducted from the semiconductor evaporates the fluid which passes through flexible tubes to a condenser and is cooled by air convection. The condensate passes through a return tube back to the exchangers. To ensure a symmetrical thermal flux on the component, the exchangers share a common condenser. The Examiner's attention is directed to Figures 1 and 2, as well as the English Language Abstract.

Japanese Patent Number 54-154277 provides a pair of heat sinks attached to a print circuit to be cooled. At least one of the heat sinks appear to comprise a heat pipe. The Examiner's attention is directed to Figures 1 - 4, and the English Abstract.

Soviet Union Patent Number 987,357 provides a heat transfer tube that incorporates evaporating and condensing zones formed from a capillary porous structure with fins. The condensing zone includes a layer of absorbent material to remove non-condensable gases from the recirculating heat transfer fluid. The unit comprises evaporating and condensing zones that are interconnected by a vapour duct with apertures. The non-condensable gases are drawn by the flow of heat transfer fluid vapour through channels over the layer of porous absorbent material on the support, thereby keeping the evaporating zone virtually free from non-condensable gases. The Examiner's attention is directed to Figures 1 and 2, as well as the English Abstract.

Attorney Docket No. H1799-00303

reservoir for a non-condensating gas. The evaporator is divided into two cavities by a partition. The partition has ducts connecting the cavities. A capillary-porous coating is disposed on the duct surface. The cavity is connected to the internal pipe cavity and the cavity to the clearance. Heat is transferred along the evaporator partition to the duct surfaces where boiling of a working liquid occurs. The working liquid vapours travel to the reservoir, through the cavity, pipes and condenser clearance. From the reservoir, the vapours are directed to the evaporator cavity,

through a ring duct clearance. The Examiner's attention is directed to Figures 1 and 2.

English translations of Soviet Union Patent Numbers 407,160, 589531, 1476297; and German Patent No. 1 284 506 have been previously submitted in connection with U.S. Application Serial Nos. 10/739,709 and 09/852,322.

The claimed invention is patentable over the enclosed references. No representations are made regarding the references other than those set forth above.

The Examiner is requested to acknowledge consideration of the information provided in this paper in accordance with prescribed procedures.

No fee is believed to be due in connection with this Information Disclosure Statement. However, if the Examiner determines that a fee is required, he is hereby authorized to charge any additional fees in connection with this matter to Deposit Account No. 04-1679.

Date: May 31, 2006

Respectfully submitted,

Samuel W. Apicelli

Registration No. 36,427

Customer No. 41396 DUANE MORRIS, LLP

30 South 17th Street

Philadelphia, Pennsylvania 19103

(215) 979-1255

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	В		90,718	Jan. 1970		Vary						
	С		19,067	July 1970		Schmidt						
	D		43,841	Dec. 1970		Eastman						
	E	3,68	30,189	Aug. 1972		Noren						
	F	3,82	27,480	Aug. 1974		Gammel et al.						
	G	3,83	34,457	Sept. 1974		Madsen						
	Н	4,04	46,190	Sept. 1977		Marcus et al.						
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	J		18,756	Oct. 1978		Nelson et al.			<u> </u>		<u> </u>	
	K		45,708	March 1979		Ferro et al.					<u> </u>	
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	W		5,323,292	June 1994		Brzezinsł	ki								
	Х		5,386,143	Jan. 1995		Fitch									
	Υ		5,390,077	Feb. 1995	Paterson										
	Z		5,427,174	June 1995		Lomolino, Sr. et al.									
	AA		5,465,782	Nov. 1995		Sun et al						<u></u>			
	BB		5,513,070	April 1996		Xie et al.							ļ		
	CC		5,642,776	July 1997	Meyer, IV et al.			·				ļ			
	DD		5,694,295	Dec. 1997		Mochizul							—		
	EE		5,754,401	May 1998		Saneinej	ad et al.	•					ļ		
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Electronic Ac	knowledgement Receipt
EFS ID:	1062673
Application Number:	11200349
Confirmation Number:	3228
Title of Invention:	Integrated circuit heat pipe heat spreader with through mounting holes
First Named Inventor:	Peter M. Dussinger
Customer Number:	41396
Filer:	Samuel W. Apicelli/Therese McKinley
Filer Authorized By:	Samuel W. Apicelli
Attorney Docket Number:	H1799-00303
Receipt Date:	31-MAY-2006
Filing Date:	09-AUG-2005
Time Stamp:	15:25:03
Application Type:	Utility
International Application Number:	

Payment information:

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part	Pages
1	Information Disclosure Statement (IDS) Filed	H179900303IDS.pdf	980508	no	8

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

11/200,349

Interference search.

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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S1	8	(((vapor adj chamber) or (heat adj pipe)) and wick and plate and (lip or edge or peripher\$3) and (bonded or joined or seal\$3) and (spacer or column)).clm.	US-PGPUB; USPAT	OR	OFF	2006/06/26 14:11

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandria, Virginia 22313-1450

NOTICE OF ALLOWANCE AND FEE(S) DUE

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06/29/2006

DUANE MORRIS LLP IP DEPARTMENT 30 SOUTH 17TH STREET PHILADELPHIA, PA 19103-4196 EXAMINER

CIRIC, LJILJANA V

ART UNIT PAPER NUMBER

3753 DATE MAILED: 06/29/2006

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/200 349	08/09/2005	Peter M. Dussinger	H1799-00303	3228

TITLE OF INVENTION: INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER WITH THROUGH MOUNTING HOLES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1400	\$300	\$1700	09/29/2006

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

Page 1 of 3

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This for appropriate. All further cor indicated unless corrected by maintenance fee notification	below or directed otherwise	smitting the ISSU Patent, advance ordin Block 1, by (a)	E FEE and F ders and notif) specifying a	new co	orrespondence address	; and/or (b) indicating a ser	should be completed where t correspondence address as parate "FEE ADDRESS" for					
	E ADDRESS (Note: Use Block 1 for	any change of address)		-	Note: A certificate of mailing can only be used for domestic mailings of the Fec(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.							
041396 75	90 06/29/2006				Certificate of Mailing or Transmission							
DUANE MORRI					I hereby certify that this Fee(s) Transmittal is being deposited with the Unite States Postal Service with sufficient postage for first class mail in an envelop addressed to the Mail Stop ISSUE FEE address above, or being facsimil transmitted to the USPTO (571) 273-2885, on the date indicated below.							
IP DEPARTMENT					addressed to the Mai	1 Stop ISSUE FEE address	s above, or being facsimile					
30 SOUTH 17TH S					transmitted to the USF							
, , ,	11117100 1170						(Depositor's name)					
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APPLICATION NO.	FILING DATE	I	FIRST NAMED	INVEN	TOR .	ATTORNEY DOCKET NO.	CONFIRMATION NO.					
11/200,349	08/09/2005		Peter M. D	Oussinge	r	H1799-00303	3228					
	VTEGRATED CIRCUIT HE											
APPLN. TYPE	SMALL ENTITY	ISSUE FE	EE	PU	BLICATION FEE	TOTAL FEE(S) DUE	DATE DUE					
nonprovisional	NO	\$1400)		\$300	\$1700	09/29/2006					
EXAM	IINER	ART UN	IT	CL	ASS-SUBCLASS]						
CIRIC, LJ	ILJANA V	3753			165-104260							
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Please check the appropriate	assignee category or catego	ries (will not be pri	inted on the pa	atent):	☐ Individual ☐ C	corporation or other private g	roup entity Government					
4a. The following fce(s) are ☐ Issue Fee ☐ Publication Fee (No s ☐ Advance Order - # of	small entity discount permitte		Payment 1	n the an	nount of the fee(s) is entered to the feet of the feet		redit any overpayment, to tra copy of this form).					
~ .	(from status indicated above MALL ENTITY status. See		☐ h Annlica	ant is no	longer claiming SMA	LL ENTITY status. See 37 (CFR 1.27(g)(2).					
The Director of the USPTO NOTE: The Issue Fee and P interest as shown by the rece	is requested to apply the Issu bublication Fee (if required) words of the United States Pate	ue Fee and Publicate will not be accepted ent and Trademark	tion Fee (if and from anyone Office.	y) or to other th	re-apply any previous han the applicant; a reg	ly paid issue fee to the applications attorney or agent; or	cation identified above. the assignce or other party in					
Typed or printed name _						No						
Alexandria, Virginia 22313-	-1430.					the public which is to file (a minutes to complete, includomments on the amount of a Trademark Office, U.S. De S. SEND TO: Commissione	nd by the USPTO to process) ing gathering, preparing, and time you require to complete partment of Commerce, P.O. r for Patents, P.O. Box 1450,					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandria, Virginia 22313-1450

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.				
11/200,349	08/09/2005	Peter M. Dussinger	H1799-00303	3228				
041396 7	590 06/29/2006		EXAMINER					
DUANE MORR	IS LLP	CIRIC, LJI	LJANA V					
IP DEPARTMEN			ART UNIT PAPER NUMBER					
30 SOUTH 17TH PHILADELPHIA		3753 DATE MAILED: 06/29/200	6					

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

			L
	Application No.	Applicant(s)	
	11/200 240	DUSSINGER ET AL.	
Notice of Allowability	11/200,349 Examiner	Art Unit	
	Ljiljana (Lil) V. Ciric	3753	
The MAILING DATE of this communication apperature All claims being allowable, PROSECUTION ON THE MERITS IS herewith (or previously mailed), a Notice of Allowance (PTOL-85) NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIOF the Office or upon petition by the applicant. See 37 CFR 1.313	ears on the cover sheet with (OR REMAINS) CLOSED in to or other appropriate communi (GHTS. This application is su	his application. If not included ication will be mailed in due cours	
1. \boxtimes This communication is responsive to <u>the reply filed on 13 A</u>	April 2006 and to the telephon	ic interview on 26 June 2006.	
2. The allowed claim(s) is/are 19-29.			
 3.	e been received. e been received in Application cuments have been received in Application of this communication to file a lENT of this application. etted. Note the attached EXAM as reason(s) why the oath or contact be submitted. et be submitted. es Amendment / Comment or in a least contact of the least cording to 37 CFR least of BIOLOGICAL MATER	No In this national stage application from this national stage application from this national stage application from the requirements. INTER'S AMENDMENT or NOTIC lectaration is deficient. nents E OF	
Attachment(s) 1. ☐ Notice of References Cited (PTO-892) 2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) 3. ☑ Information Disclosure Statements (PTO-1449 or PTO/SB/0 Paper No./Mail Date 20060531 4. ☐ Examiner's Comment Regarding Requirement for Deposit	6. ⊠ Interview Sur Paper No./M 8), 7. ⊠ Examiner's A	rmal Patent Application (PTO-152 nmary (PTO-413), ail Date <u>20060626</u> . mendment/Comment tatement of Reasons for Allowanc	,
of Biological Material	9. 🗌 Other	Maria	

LHLIANA CIRIC PRIMARY EXAMINER

U.S. Patent and Trademark Office PTOL-37 (Rev. 7-05)

Notice of Allowability

Part of Paper No./Mail Date 20060626

Application/Control Number: 11/200,349 Page 2

Art Unit: 3753

EXAMINER'S AMENDMENT/COMMENTS

1. Applicant's election of the second species or the embodiment of Figure 2 in the reply filed on April 13, 2006 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). Claims 19 through 29, all readable on the elected second species, remain in the application.

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Attorney Samuel W. Apicelli, Registration No. 36,427. on June 26, 2006.

1. The application has been amended as follows:

In the claims:

Claim 24, line 4: Delete "a hollow column" and replace with -said at least one hollow column--.

Claim 25, line 2: Immediately preceding "said at least one hollow column", insert -each of--.

Claim 25, line 3: Delete "have" at the beginning of the line and replace with -has--.

Claim 26, line 2: Immediately preceding "said at least one hollow column", insert -each of--.

Claim 26, line 3:Delete "have" at the beginning of the line and replace with -has--.

Claim 29, line 3: Delete "plate-like" (two occurrences) and replace with -planar ---.

Claim 29, line 5: Delete "plate-like" (two occurrences) and replace with -planar--.

Claim 29, line 8: Delete "plate-like" and replace with -planar--.

Claim 29, line 9: Delete "plate-like" and replace with -planar --.

2. The following is an examiner's statement of reasons for allowance: The prior art of record does not disclose, for example, a first and a second plate including inner confronting surfaces and a peripheral

Application/Control Number: 11/200,349 Page 3

Art Unit: 3753

lip located at an edge of the boundary structure bonded together to form an enclosed vapor chamber, a depression formed in the first plate and projecting from the plate into the vapor chamber, an opening defined through the depression in the first plate and the second plate where the depression comprises an annular outer surface that is bonded to a corresponding annular surface in the second plate and isolated from the vapor chamber, at least one spacer or hollow column extending between and contacting the first and second plates, and a wick positioned upon the inner confronting surfaces of the plates.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

3. New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because the line quality of the originally-filed drawings is uneven and generally of insufficient quality.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filling date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). The objection to the drawings will not be held in abeyance.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ljiljana (Lil) V. Ciric whose telephone number is 571-272-4909. The examiner can normally be reached on Mondays through Fridays from 10:00 a.m. to 6:30 p.m.

Application/Control Number: 11/200,349 Page 4

Art Unit: 3753

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eric Keasel, can be reached at 571-272-4929.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ljiljana (Lil) V. Cirio Primary Examiner Art Unit 3753

	Application No.	Applicant(s)							
Interview Summary	11/200,349	DUSSINGER ET	AL.						
merview Summary	Examiner	Art Unit							
	Ljiljana (Lil) V. Ciric	3753	·						
All participants (applicant, applicant's representative, PTO	personnel):								
(1) <u>Ljiljana (Lil) V. Ciric</u> .	(3)								
(2) Samuel W. Apicelli, Reg. No. 36,427.	(4)								
Date of Interview: 26 June 2006.									
Type: a)⊠ Telephonic b)☐ Video Conference c)☐ Personal [copy given to: 1)☐ applicant 2	e) applicant's representative	e]							
Exhibit shown or demonstration conducted: d) ☐ Yes e) ☒ No. If Yes, brief description:									
Claim(s) discussed: <u>19-29</u> .									
Identification of prior art discussed: <u>US Patent No. 6,535,38</u> <u>December 5, 2000); US Patent No. 6,650,544 B1 (issued to</u>	36 B2 (issued to Sathe et al. o Lai on November 18, 2003,	on March 18, 200 filed September	<u>3, filed</u> 18, 2002).						
Agreement with respect to the claims f)⊠ was reached. g)☐ was not reached. h)☐ t	N/A.							
Substance of Interview including description of the general reached, or any other comments: <u>See Continuation Sheet</u> .	nature of what was agreed to	if an agreement	was						
(A fuller description, if necessary, and a copy of the amend allowable, if available, must be attached. Also, where no callowable is available, a summary thereof must be attached.	opy of the amendments that v								
THE FORMAL WRITTEN REPLY TO THE LAST OFFICE A INTERVIEW. (See MPEP Section 713.04). If a reply to the GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER INTERVIEW DATE, OR THE MAILING DATE OF THIS INT FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW on reverse side or on attached sheet.	last Office action has already OF ONE MONTH OR THIRT ERVIEW SUMMARY FORM,	/ been filed, APPI Y DAYS FROM T WHICHEVER IS	LICANT IS HIS						
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Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.	1/1/00	M nature, if required							

U.S. Patent and Trademark Office PTOL-413 (Rev. 04-03)

Interview Summary

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by
 attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does
 not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,

(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)

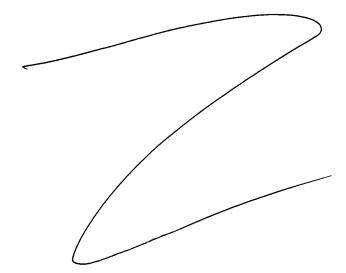
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Examiner Ciric telephoned Attorney Apicelli in order to propose various changes to the claims correcting minor informalities in the claims. Attorney Apicelli approved the proposed changes to the claims (see attached copy of Examiner's Amendment), thus placing the application in condition for allowance. Examiner Ciric noted that the only art of record which disclosed applicant's invention consisted of the abovecited US patents, both previously made of record via IDS by applicant), neither of which had a good priority date to constitute prior art..



Form P	orm PTO-1449 U.S. Department of ommerce Patent and Trademark Office IFORMATION DISCLOSURE					ket No. H179	9-0030	03	Serial No. 11/200,349				
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	BB	,	5,513,070	April 1996		Xie et al.							
	CC		5,642,776	July 1997		Meyer, IV et al.							
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Paper No. 2006 0531

Issue	Classification	

Application/Control No.	Applicant(s)/Patent t	ınder				
11/200,349	DUSSINGER ET AL.					
Examiner	Art Unit					
Ljiljana (Lil) V. Ciric	3753					

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ORIGINAL CROSS REFERENCE(S)									
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U.S. Patent and Trademark Office

Part of Paper No. 20060626



United States Patent and Trademark Office

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandra, Virginia 22313-1450 www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 3228

SERIAL NUMBE 11/200,349	FILING OR 371(c) DATE 08/09/2005 RULE	CLASS 165	GROUP ART 3753	UNIT	ATTORNEY DOCKET NO. H1799-00303		
Thomas L. M ** CONTINUING DA This applicati which is a CO ** FOREIGN APPLIC	singer, Lititz, PA; yers, Lititz, PA; TA ************************************	/	f 09/852,322 05/09. -BVC	/2001 PA	т 7,066,:	240	
Foreign Priority claimed yes ano 35 USC 119 (a-d) conditions met yes after Allowance Verified and Acknowledged Examiner's Signature Initials STATE OR COUNTRY DRAWING PA 3 TOTAL CLAIMS CLAIMS CLAIMS ADDRESS							
041396 TITLE Integrated circuit hea	at pipe heat spreader with th	rough mounting holes	☐ All Fe	ees Fees (Fil	ling)		
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Search Notes						

Application/Control No

11/200,349

Ljiljana (Lil) V. Ciric

Applicant(s)/Patent under Reexamination

DUSSINGER ET AL.

Art Unit

3753

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U.S. Patent and Trademark Office

Part of Paper No. 20060626

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE

Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450

or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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11/200:349 TITLE OF INVENTION: IN	08/09/2005 ITEGRATED CIRCUIT HE	AT PIPE HEAT SPI	Peter M. Dussings READER WITH TH		H1799-00303 NG HOLES	3228	
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a Applicant claims S	(from status indicated above MALL, ENTITY status, See	37 CFR. 1.27.	☐ b. Applicant is n	o longer claiming SN	IALL ENTITY status. Sec 37 t	CFR 1.27(g)(2).	
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Authorized Signature	Xermel W. AM	₩		Date	7/13/06_		
Typed or printed name	Samuel W. Ap	loelli			n No. 36, 1127	D. A. Menrel	
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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal							
Application Number:	11200349						
Filing Date:	09	-Aug-2005					
Title of Invention:	INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER WITH THROUGH MOUNTING HOLES						
First Named Inventor:	Pe	eter M. Dussinger					
Filer:	Samuel W. Apicelli/Sue Seiler						
Attorney Docket Number:	H1799-00303						
Filed as Large Entity							
Utility Filing Fees							
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)		
Basic Filing:							
Pages:							
Claims:							
Miscellaneous-Filing:							
Petition:							
Patent-Appeals-and-Interference:							
Post-Allowance-and-Post-Issuance:							
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Extension-of-Time:				
Miscellaneous:				
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Electronic Acknowledgement Receipt							
EFS ID:	1111719						
Application Number:	11200349						
Confirmation Number:	3228						
Title of Invention:	INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER WITH THROUGH MOUNTING HOLES						
First Named Inventor:	Peter M. Dussinger						
Customer Number:	41396						
Filer:	Samuel W. Apicelli/Sue Seiler						
Filer Authorized By:	Samuel W. Apicelli						
Attorney Docket Number:	H1799-00303						
Receipt Date:	13-JUL-2006						
Filing Date:	09-AUG-2005						
Time Stamp:	14:12:46						
Application Type:	Utility						
International Application Number:							

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	\$1700
RAM confirmation Number	808
Deposit Account	041679

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 and 1.17

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part	Pages
1		h1799-00303correcteddrawi ngs.pdf	273260	yes	5
	Multipart Description				
	Doc Desc		Start	End	
	Miscellaneous Incoming Letter		1	2	
	Drawings		3	5	
Warnings:					
Information:					
2	Issue Fee Payment Recorded	h1799-00303issuefee.pdf	321287	no	1
Warnings:					
Information:					
3	Fee Worksheet (PTO-875)	fee-info.pdf	8311	no	2
Warnings:		,			
Information:					
	Total Files Size (in bytes): 602858				

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 11/200,349
Applicant : Dussinger et al.
Filed : 08/09/2005

Title : INTEGRATED CIRCUIT HEAT PIPE HEAT

SPREADER WITH THROUGH MOUNTING HOLES

TC/A.U. : 3753

Examiner : Ciric, Ljiljana V. Docket No. : H1799-00303

TRANSMITTAL LETTER

Mail Stop Issue Fee Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450 Sir:

Please find enclosed for filing:

X Issue Fee Transmittal form Part B

X Submission of corrected Drawings with 3 sheets of replacement Drawings X Transmittal letter. The Commissioner is authorized to charge the amount of \$1700 for issue &publication fees, and any additional fees, or credit any overpayment, to Deposit Account No. 04-1679.

Respectfully submitted,

Dated: July 13, 2006 /Samuel W. Apicelli/

Samuel W. Apicelli Registration No. 36,427 Customer No. 0041396 DUANE MORRIS LLP 30 S. 17th Street

Philadelphia, PA 19103-4196

Tel.: (215)979-1255 Fax: (215) 979-1020

swapicelli@duanemorris.com

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. 11/200,349 Applicant Dussinger et al. Filed 08/09/2005

INTEGRATED CIRCUIT HEAT PIPE HEAT Title

SPREADER WITH THROUGH MOUNTING HOLES

TC/A.U. 3753

Examiner Ciric, Ljiljana V. H1799-00303 Docket No.

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

SUBMISSION OF CORRECTED DRAWINGS

Sir:

Corrected Drawings were required by the Examiner as indicated on to the Notice of Allowance. Applicants herewith submit three (3) sheets of corrected drawings, and marked as replacement sheets, that are believed to satisfy all requirements identified in the Examiner's amendment/comments. These drawings are direct copies of the drawings of record. No new matter is presented.

Should the attached drawings not be found fully in compliance with all requirements, Applicant respectfully requests prompt notice by telephone in order to accomplish expeditious correction within the term allotted.

Respectfully submitted,

Dated: /July 13, 2006/ /Samuel W. Apicelli/

> Samuel W. Apicelli Registration No. 36,427 Customer No. 0041396 **DUANE MORRIS LLP** 30 S. 17th Street

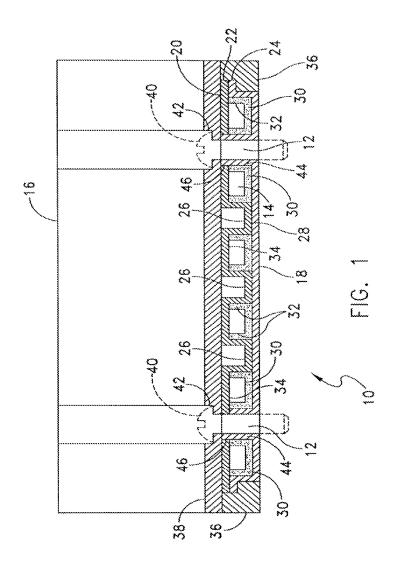
Philadelphia, PA 19103-4196

Tel.: (215)979-1255 Fax: (215) 979-1020

swapicelli@duanemorris.com

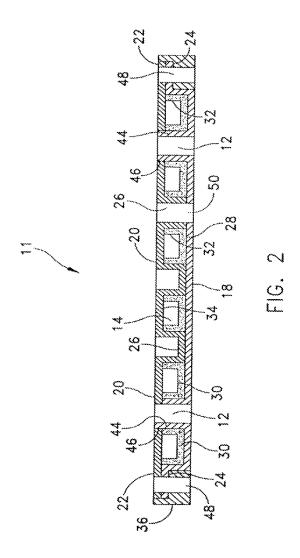
Appl. No.11/200,349 Docket No.:H1799-00303 Response to Notice of Allowablity

Replacement Sheet



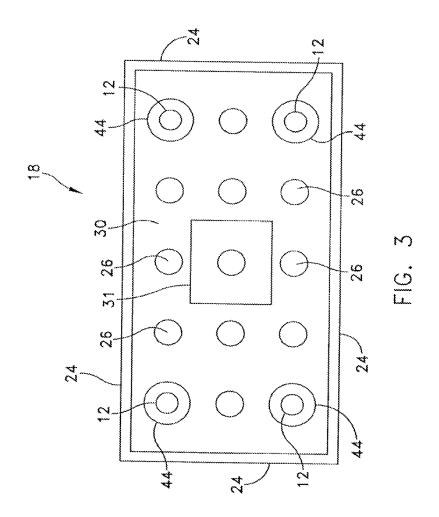
Appl. No.11/200,349 Docket No.:H1799-00303 Response to Notice of Allowablity

Replacement Sheet



Appl. No.11/200,349 Docket No.:H1799-00303 Response to Notice of Allowablity

Replacement Sheet



PTO/SB/28 (09-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. Docket Number (Optional) TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING H1799-00303 **REJECTION OVER A "PRIOR" PATENT** In re Application of: Dussinger et al. Application No.: 11/200,349 Filed: 08-09-2005 FOI. INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER WITH THROUGH MOUNTING HOLES percent interest in the instant application hereby disclaims, 100. The owner*, THERMAL CORP. of 100 percent interest in the instant application hereby discialms, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond as the term of said prior patent is defined in 35 U.S.C. 154 the expiration date of the full statutory term prior patent No. 7,068,240 and 173, and as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns. In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later. expires for failure to pay a maintenance fee; is held unenforceable; is found invalid by a court of competent jurisdiction; is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; has all claims canceled by a reexamination certificate; is reissued; or is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer. Check either box 1 or 2 below, if appropriate. For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization. 1. 1 I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 16 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. 2. The undersigned is an attorney or agent of record Rea. No. SAMUEL W. APICELLI REG. NO. 36,427 Typed or printed name 215-979-1255 Telephone Number Terminal disclaimer fee under 37 CFR 1.20(d) included. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. *Statement_under 37 CFR 3,73(b) is required if terminal discialmer is signed by the assignee (owner). Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief information Officer, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PAGE 2/2 * RCVD AT 7/18/2006 2:58:51 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-2/6 * DNIS:2734909 * CSID:2154059823 * DURATION (mm-ss):01-06

CERTIFICATE OF FACSIMILE TRANSMISSION 37 C.F.R. 1.6 &1.8

I CERTIFY THAT THIS CORRESPONDENCE IS BEING TRANSMITTED BY FACSIMILE TO THE PATENT AND TRADEMARK OFFICE ON THE DATE AND TO THE NUMBER SHOWN BELOW. FAX. NO. 571-273-4909 COMPRISING TWO (2) SHEETS INCLUDING THIS PAGE.

Date: July / 1, 2006

Samuel W. Apidell Reg, No. 36,427

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.

11/200,349

Applicant

Dussinger et al.

Filed

08/09/2005

Title

INTEGRATED CIRCUIT HEAT PIPE HEAT

SPREADER WITH THROUGH MOUNTING HOLES

TC/A.U.

3753

Examiner Docket No.

Ciric, Ljiljana V. H1799-00303

TRANSMITTAL LETTER

Attn. Examiner Ciric Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450 Sir:

As requested, please find the enclosed for filing:

X TERMINAL DISCLAIMER

Transmittal letter. The Commissioner is authorized to charge the amount of \$130 for the terminal disclaimer fees, and any additional fees, or credit any overpayment, to Deposit Account No. 04-1679.

X Certificate of Facsimile

Respectfully submitted,

Dated: 7/18/06

Samuel'W. Apicelli Registration No. 36,427 Customer No. 0041396 DUANE MORRIS LLP

30 S. 17th Street

Philadelphia, PA 19103-4196

Tel.: (215)979-1255 Fax: (215) 979-1020

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Document code: WFEE

United States Patent and Trademark Office Sales Receipt for Accounting Date: 07/27/2006

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Application Number	Application/Co		Applicant(s)/Patent under Reexamination DUSSINGER ET AL.
Document Code - DISQ		Internal Do	ocument – DO NOT MAIL
TERMINAL DISCLAIMER	⊠ APPROV	ED	☐ DISAPPROVED
Date Filed : 7/18/06	to a Te	t is subject erminal aimer	
Approved/Disapproved b	oy:		
ANDRE ROBINSON			

U.S. Patent and Trademark Office

PTC/SB/28 (09-04)

Approved for use through 07/31/2008, CMB 0851-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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TERMINAL DISCLAIMED TO OBVIATE A DOUBLE CONTROL OF THE PROPERTY OF THE PROP

:	TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) H1789-00303
,	In re Application of: Dussinger et al.	
	Application No.: 11/200,349	
	Filed: 08-09-2005	
·	FOI. INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER WITH THROUGH MOUNTING HOLES	
7. 7.	except as provided below, the terminal part of the statutory term of any patent granted on the instant the expiration date of the full statutory term prior patent No. 7.088.240 as the term of said and 173, and as the term of said prior patent is presently shortened by any terminal disclaimer. The granted on the instant application shall be enforceable only for and during such period that it and the agreement runs with any patent granted on the instant application and is binding upon the grantee, its	prior patent is defined in 35 U.S.C. 154 owner hereby agrees that any patent so prior patent are commonly owned. This successors or assigns.
37	In making the above disclaimer, the owner does not disclaim the terminal part of the term of any pater would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 164 and 173 of the patent is presently shortened by any terminal disclaimer," In the event that said prior patent later: expires for failure to pay a maintenance fee; is held unerforceable;	n granted on the instant application that is prior patent, "as the term of said prior
8	is found invalid by a court of competent jurisdiction; is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; has all claims canceled by a reexamination certificate; is reissued or.	
4	is in any manner terminated prior to the expiration of its full statutory term as presently shortened	by any terminal disclaimer.
3	Check either box 1 or 2 below. if appropriate.	
} }	1. For submissions on behalf of a business/organization (e.g., corporation, partnership, university etc.), the undersigned is empowered to act on behalf of the business/organization.	y, government agency,
7 3	I hereby declare that all statements made herein of my own knowledge are true and that a belief are believed to be true; and further that these statements were made with the knowledge that made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United statements may jeopardize the validity of the application or any patent issued thereon.	withing false statements and the like so i
) }	2. The undersigned is an attorney or agent of record Reg. No. 25,427	7/18/06 Date
\sim	SAMUEL W. APICELLI REG. NO. 38,	4 97
3	Typed or printed name	Tb1
`		215-979-1255
Ž	·	Telephone Number
,	✓ Terminal disciaimer fee under 37 CFR 1.20(d) included.	
; ;	WARNING: Information on this form may become public. Credit card inform be included on this form. Provide credit card information and authorization	nation should not on PTO-2038.
	*Statement under 37 CFR 3.73(b) is required if terminal discialmer is signed by the assignee (owner). Form PTO/SB/96 may be used for making this certification. See MPEP § 324.	

This collection of Information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-600-PTO-9199 and select option 2.



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APPLICATION NO. FILING DATE FIRST NA		FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.					
11/200,349	11/200,349 08/09/2005		Peter M. Dussinger	H1799-00303	3228				
41396	41396 7590 08/14/2006		EXAM	INER					
DUANE M		LLP		CIRIC, LJI	LJANA V				
IP DEPART 30 SOUTH		REET		ART UNIT	PAPER NUMBER				
		A 19103-4196		3753	3753				
				DATE MAILED: 08/14/200	6				

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	,	
Application No.	Applicant(s)	
11/200,349	DUSSINGER ET AL	
Examiner	Art Unit	
Ljiljana (Lil) V. Ciric	3753	
ars on the cover sheet with the co OR REMAINS) CLOSED in this apport of the appropriate communication GHTS. This application is subject to and MPEP 1308.	olication. If not include will be mailed in due	ed course. THIS
w of 18 July 2006 and terminal disci	laimer filed on 18 July	2006 .
der 35 U.S.C. § 119(a)-(d) or (f).		
been received. been received in Application No uments have been received in this r		tion from the
of this communication to file a reply of this communication.	complying with the red	quirements
tted. Note the attached EXAMINER' s reason(s) why the oath or declarate		OTICE OF
t be submitted. on's Patent Drawing Review (PTO-	948) attached	
Amendment / Comment or in the O	ffice action of	
84(c)) should be written on the drawin e header according to 37 CFR 1.121(c		back) of
it of BIOLOGICAL MATERIAL n FOR THE DEPOSIT OF BIOLOGICA		Note the
5. Notice of Informal Page	atent Application (PT0	O-152)
6. ⊠ Interview Summary Paper No./Mail Dat		
Paper No./Mail Dat	E 20000/10.	

Supplemental	11/200,349	DUSSINGER ET AL.			
Notice of Allowability	Examiner	Art Unit			
	Ljiljana (Lil) V. Ciric	3753			
The MAILING DATE of this communication appear All claims being allowable, PROSECUTION ON THE MERITS IS herewith (or previously mailed), a Notice of Allowance (PTOL-85) NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RI	(OR REMAINS) CLOSED in this appropriate communication IGHTS. This application is subject to	plication. If not included will be mailed in due course. THIS			
1. This communication is responsive to the telephonic intervie	ew of 18 July 2006 and terminal disc	laimer filed on 18 July 2006 .			
2. The allowed claim(s) is/are <u>19-29</u> .					
Acknowledgment is made of a claim for foreign priority ur a) □ All b) □ Some* c) □ None of the: 1. □ Certified copies of the priority documents have	e been received.				
2. Certified copies of the priority documents have	• • • • • • • • • • • • • • • • • • • •				
3. Copies of the certified copies of the priority do	cuments have been received in this	national stage application from the			
International Bureau (PCT Rule 17.2(a)).					
* Certified copies not received:					
Applicant has THREE MONTHS FROM THE "MAILING DATE" noted below. Failure to timely comply will result in ABANDONM THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.		complying with the requirements			
4. A SUBSTITUTE OATH OR DECLARATION must be subm INFORMAL PATENT APPLICATION (PTO-152) which give					
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") mus (a) ☐ including changes required by the Notice of Draftspers 1) ☐ hereto or 2) ☐ to Paper No./Mail Date	son's Patent Drawing Review (PTO-	948) attached			
(b) ☐ including changes required by the attached Examiner's Paper No./Mail Date					
Identifying indicia such as the application number (see 37 CFR 1 each sheet. Replacement sheet(s) should be labeled as such in t	.84(c)) should be written on the drawir he header according to 37 CFR 1.121(c	ngs in the front (not the back) of d).			
6. DEPOSIT OF and/or INFORMATION about the depo attached Examiner's comment regarding REQUIREMENT	SIT OF BIOLOGICAL MATERIAL R FOR THE DEPOSIT OF BIOLOGICA	nust be submitted. Note the AL MATERIAL.			
Attachment(s)	_				
1. Notice of References Cited (PTO-892)		atent Application (PTO-152)			
2. Notice of Draftperson's Patent Drawing Review (PTO-948)	6. ⊠ Interview Summary Paper No./Mail Dat				
3. Information Disclosure Statements (PTO-1449 or PTO/SB/0	08). 7. ⊠ Examiner's Amendr	nent/Comment			
Paper No./Mail Date 4. Examiner's Comment Regarding Requirement for Deposit	8. Examiner's Statement	7/9/2006 ent of Reasons for Allowance			
of Biological Material	9. 🗌 Other	Vicic .			
	LJI PRMJ	LIANA CIRIC ARY EXAMINER			

U.S. Patent and Trademark Office PTOL-37 (Rev. 7-05)

Notice of Allowability

Part of Paper No./Mail Date 20060809

Application/Control Number: 11/200,349 Page 2

Art Unit: 3753

EXAMINER'S COMMENT

1. The terminal disclaimer filed on July 18, 2006 disclaiming the terminal portion of any patent

granted on this application which would extend beyond the expiration date of prior U.S. Patent No.

7,066,240, has been reviewed and is accepted. The terminal disclaimer has been recorded.

2. Any inquiry concerning this communication or earlier communications from the examiner should

be directed to Ljiljana (Lil) V. Ciric whose telephone number is 571-272-4909. The examiner can

normally be reached on Mondays through Fridays from 10:00 a.m. to 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eric

Keasel, can be reached at 571-272-4929.

Information regarding the status of an application may be obtained from the Patent Application

Information Retrieval (PAIR) system. Status information for published applications may be obtained from

either Private PAIR or Public PAIR. Status information for unpublished applications is available through

Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC)

at 866-217-9197 (toll-free).

Ljiljana (Lil) V. Ciric Primary Examiner

Art Unit 3753

	Application No. Applicant(s)					
Interview Summary	11/200,349	DUSSINGER ET AL.				
interview Summary	Examiner	Art Unit				
	11/200,349 DUSSINGER ET AL Examiner					
All participants (applicant, applicant's representative, PTO	personnel):					
(1) Ljiljana (Lil) V. Ciric.	(3)					
(2) Samuel W. Apicelli, Reg.No. 36,427.	(4)					
Date of Interview: 18 July 2006.						
Type: a)⊠ Telephonic b)□ Video Conference c)□ Personal [copy given to: 1)□ applicant 2	²)☐ applicant's representative	e]				
Exhibit shown or demonstration conducted: d) Yes If Yes, brief description:	e) No.					
Claim(s) discussed: <u>19-29</u> .						
Identification of prior art discussed: <u>US Patent No. 7,066,24</u>	40 (issued to Dussinger on 27	June 2006.				
Agreement with respect to the claims f)⊠ was reached. g)□ was not reached. h)□ N	I/A.				
reached, or any other comments: <u>Examiner Ciric telephone</u> filed ASAP so as to obviate double patenting issues between Patent No. 7,066,240 (see above). Attorney Apicelli filed a support (A fuller description, if necessary, and a copy of the amend allowable, if available, must be attached. Also, where no continuous allowable is available, a summary thereof must be attached. THE FORMAL WRITTEN REPLY TO THE LAST OFFICE A INTERVIEW. (See MPEP Section 713.04). If a reply to the GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER	and Attorney Apicelli to request the instant allowed applicate corresponding terminal disclar ments which the examiner agroup of the amendments that will.) CTION MUST INCLUDE THE last Office action has already OF ONE MONTH OR THIRTY ERVIEW SUMMARY FORM,	that a terminal division and recently imer later the same reed would render the could rende	sclaimer be issued U.S. ne day. er the claims claims of THE			
Examiner Note: You must sign this form unless it is an . Attachment to a signed Office action.	LILIANA CIR PRIMARY EXAM	IC INER				

U.S. Patent and Trademark Office PTOL-413 (Rev. 04-03)

Interview Summary

Paper No. 20060718

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,

(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)

- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.



Application/Control No.	Applicant(s)/Patent under Reexamination
11/200,349	DUSSINGER ET AL.
Examiner	Art Unit
Liiliana (Lil) V. Ciric	3753

,	ISSUE CLASSIFICATION											
	ORIGINAL		CROSS REFERENCE(S)									
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)									
165	104.26	165	104.21	83	185	76						
INTERNATIO	NAL CLASSIFICATION	361	700	•								
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U.S. Patent and Trademark Office

Part of Paper No. 20060809



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandria, Vignia 22313-1450 www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 3228

SERIAL NUMBE 11/200,349	ER	FILING OR 371(c) DATE 08/09/2005 RULE	C	LASS GROUP ART 165 3753			UNIT ATTORNEY DOCKET NO. H1799-00303				
APPLICANTS Peter M. Dus Thomas L. N	lyers, Liti										
This applicat which is a Co ** FOREIGN APPLI IF REQUIRED, FOR	This application is a DIV of 10/739,709 12/18/2003 which is a CON of 09/852,322 05/09/2001 PAT 7,066,240 which is a CON of 09/310,397 05/12/1999 PAT 6,302,192 OK -AVC ** FOREIGN APPLICATIONS ************************************										
Foreign Priority claimed 35 USC 119 (a-d) conditi	35 USC 119 (a-d) conditions met yes yes Met after Allowance Verified and Acknowledged Examiner's Signature Initials								INDEPENDENT CLAIMS		
041396 TITLE	at pipe he	eat spreader with throu	gh mountir	ng holes							
FILING FEE RECEIVED 1600 FEES: Authority has been given in Paper No to charge/credit DEPOSIT ACCOUNT No for following: All Fees 1.16 Fees (Filing) 1.17 Fees (Processing Ext.) 1.18 Fees (Issue) Other Credit							g Ext. of time)				

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OCT 0 3 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF FACSIMILE TRANSMISSION 37 C.F.R. 1.6 &1.8
I CERTIFY THAT THIS CORRESPONDENCE IS BEING TRANSMITTED BY
FACSIMILE TO THE PATENT AND TRADEMARK OFFICE ON THE DATE AND TO
THE NUMBER SHOWN BELOW. FAX. NO. 571-273-8300 COMPRISING TWENTY- SIX
FIVE (26) SHEETS INCLUDING THIS PAGE.

Date: 10 3/06

Samuel W. Apicelli Reg, No. 36,427

H1799-60272- H1799-60331

OCT 0 3 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Assignee: THERMAL CORP.

Patent No: 7,100,680

Serial No.: 11/200,349

Issue Date: 9/5/2006

Filed: 8/9/2005

Atty. Dkt. H1799-00303

For: INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER WITH THROUGH Date: 3 October 2006

MOUNTING HOLES

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

REQUEST FOR WITHDRAWAL AS ATTORNEY OR AGENT AND CHANGE OF CORRESPONDENCE ADDRESS

Dear Sir:

The undersigned Attorney of Record on behalf of himself and all Partners and associates of Duane Morris LLP, and the attorneys/agents associated with Customer number 41396 or Customer number 08933, hereby applies to withdraw as attorney(s) of record, and requests approval and acknowledgment by the Office.

The reason for this request is that the assignee of record has requested that the file be transferred to the below-named attorney and law firm. All related property concerning the subject patent has been delivered to this alternate counsel. Due notice to the Assignee has been provided, by copy of this Request, mailed concurrently to the address of the assignee as stated hereinafter. To the best of my knowledge and belief, there is no near or impending response period applicable to the matter and the Applicant has obtained other representation.

Please change the correspondence address and direct all future correspondence to:

Christopher B. Austin Michael Best & Friedrich, LLP 100 E. Wisconsin Avenue, Suite 3300 Milwaukee, WI 53202.

Respectfully submitted,

Reg. No. 36,427 Duane Morris LLP 30 S. 17th Street

Philadelphia, PA 19103-4196

215-979-1255



United States Patent and Trademark Office

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS PO. Box 1450 Alexandria, Vriginia 22313-1450 www.uspto.gov

APPLICATION NUMBER

FILING OR 371 (c) DATE

FIRST NAMED APPLICANT

ATTY. DOCKET NO./TITLE

11/200,349

08/09/2005

Peter M. Dussinger

H1799-00303

CONFIRMATION NO. 3228

OC00000020977752

041396 DUANE MORRIS LLP IP DEPARTMENT 30 SOUTH 17TH STREET PHILADELPHIA, PA 19103-4196

Date Mailed: 10/25/2006

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/03/2006.

• The withdrawal as attorney in this application has been accepted. Future correspondence will be mailed to the new address of record. 37 CFR 1.33.

HOMA SARWARI

PTOSS (703) 305-0677 EXT 146

OFFICE COPY



United States Patent and Trademark Office

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS PO. Box 1450 Alexandria, Virginia 22313-1450 www.unpto.gov

APPLICATION NUMBER

FILING OR 371 (c) DATE

FIRST NAMED APPLICANT

ATTY. DOCKET NO./TITLE

11/200,349

100 E. Wisconsin Avenue Milwaukee, WI 53202

Christopher B. Austin Michael Best & Friedrich, LLP

Suite 3300

08/09/2005

Peter M. Dussinger

H1799-00303

Date Mailed: 10/25/2006

CONFIRMATION NO. 3228

OC000000020977835

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/03/2006.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

HOMA SARWARI

PTOSS (703) 305-0677 EXT 146

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11/200 349

PTO/SB/96 (09-06)

Approved for use through 03/31/2007. OMB 0651-0031

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STATEMENT UNDER 37 CFR 3.73(b)							
Applicant/Patent Owner: Thermal Corp.							
Application No./Patent No.: 7,100,680 Fi	iled/Issue Date: September 5, 2006						
Entitled: INTEGRATED CIRCUIT HEAT PIPE HEAT SPREAM	DER WITH THROUGH MOUNTING HOLES						
Thermal Corp, a (Name of Assignee)	<u>Corporation</u> (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)						
states that it is: 1. the assignee of the entire right, title, and interest;	or						
2. an assignee of less than the entire right, title and in (The extent (by percentage) of its ownership interests.							
in the patent application/patent identified above by virtue	e of either:						
A An assignment from the inventor(s) of the patent a in the United States Patent and Trademark Office thereof is attached.	application/patent identified above. The assignment was recorded at Reel 009961 , Frame 0197 , or for which a copy						
OR B. A chain of title from the inventor(s), of the patent a	application/patent identified above, to the current assignee as follows:						
From: The document was recorded in the United To: States Patent and Trademark Office at							
	, or for which a copy thereof is attached.						
2. From: The document was recorded in the United	To:States Patent and Trademark Office at						
Reel, Frame	, or for which a copy thereof is attached.						
3. From:	To: States Patent and Trademark Office at						
The document was recorded in the United	States Patent and Trademark Office at, or for which a copy thereof is attached.						
<u> </u>							
Additional documents in the chain of title are li	isted on a supplemental sheet.						
As required by 37 CFR 3.73(b)(1)(i), the document assignee was, or concurrently is being, submitted for reconcurrently is being.	tary evidence of the chain of title from the original owner to the cordation pursuant to 37 CFR 3.11.						
	ginal assignment document(s)) must be submitted to Assignment record the assignment in the records of the USPTO. <u>See</u> MPEP						
The undersigned (whose title is supplied below) is author	orized to act on behalf of the assignee.						
Chille	12/20/06						
Signature	Date						
Christopher B. Austin	(414) 271-6560						
Printed or Typed Name	Telephone Number						
Attorney for Assignee (022232-900 Title	06-06)						

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



PTO/SB/80 (01-96)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).									
I hereby	appoint:								
X Prac	23409								
Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):									
		Name	Re	gistration	П		Name		Registration
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any and an	patent applica	to represent the undersign altims assigned only to the cordance with 37 CFR 3.	e undersigned	ne United S according	lates lo (h	Patent and Tradem e USPTO assignme	ark Office nt records	(USPTO) in coor assignment	onnection with I documents
Please cha	nge the corres	pondence address for the	s application is	dentified In	(he	attached statement u	inder 37 C	FR 3.73(b) to:	
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mea iu ea	ich applicati	ogether with a statem on in which this form	is used. T	he statem	ent	under 37 CFR 3	73/h) ms	v ha comple	to one ve but
the practi	tioners appo	pinted in this form if t	he appointe	ed practiti	ione	er is authorized to	act on	behalf of the	assignee,
ano must	and must identify the application in which this Power of Attorney is to be filed.								
	The ind	lividual whose signature	BITON ATURE	of Assign	W 13	Record authorized to act on	behalfol	The assignee	
Signature		the 12	16/9				D-4-	12/01/06	
Name	DEAN R	ZAKOS					Telephoi		,
Title		***	SSI8TAN	T . SECR	ET	ARY			

This collection of information is required by 97 CFR 1.31. N32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) en explication. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.31 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, prepending, and automitting the completed application form to the USPTO. Time with vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Petent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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APPLICATION NUMBER

FILING OR 371 (c) DATE

FIRST NAMED APPLICANT

ATTY. DOCKET NO./TITLE

11/200,349

08/09/2005

Peter M. Dussinger

H1799-00303

CONFIRMATION NO. 3228

23409 MICHAEL BEST & FRIEDRICH, LLP 100 E WISCONSIN AVENUE MILWAUKEE, WI 53202

OC000000022094674

Date Mailed: 01/22/2007

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/08/2007.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

SHARON KUANG PTOSS (703) 305-3006

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE Group Art Unit 3753

In re

Patent Application of

Peter M. Dussinger

Application No. 11/200,349

Patent No. 7,100,680

Confirmation No.: 3228

Filed: August 9, 2005

Examiner: CIRIC, LJILJANA V.

"INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER WITH THROUGH

MOUNTING HOLES"

I, Kate J. Sturdevant, hereby certify that this correspondence is being deposited with the US Postal Service as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 32343-1450, on the date of my signature.

Date of Signature

ASSERTION OF SMALL ENTITY STATUS

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Sir:

The assignee of the above-identified application is entitled to small entity status.

Respectfully submitted

Stephen A. Gigot Reg. No. 5/1,232

022232-9006 US 06

Michael Best & Friedrich LLP 100 East Wisconsin Avenue Suite 3300 Milwaukee, Wisconsin 53202-4108 414.271.6560

T:\CLIENTA\022232\9006\A3102602.1