

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

COOLER MASTER CO., LTD.  
Petitioner

v.

AAVID THERMALLOY LLC.  
Patent Owner

U.S. Patent No. 7,100,680  
Filing Date: August 9, 2005  
Issue Date: September 5, 2006

Title: Integrated Circuit Heat Pipe Heat Spreader with  
Through Mounting Holes

---

**PETITION FOR *INTER PARTES* REVIEW  
OF U.S. PATENT NO. 7,100,680  
(Claims 1-3)**

*Inter Partes* Review No. \_\_\_\_\_

## Table of Contents

	Page
I. INTRODUCTION .....	1
II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(A)(1) .....	1
A. Real Party-In-Interest under 37 C.F.R. § 42.8(b)(1) .....	1
B. Related Matters under 37 C.F.R. § 42.8(b)(2) .....	1
C. Lead and Back-Up Counsel under 37 C.F.R. § 42.8(b)(3) .....	2
D. Service Information .....	3
E. Power of Attorney .....	4
III. PAYMENT OF FEES - 37 C.F.R. § 42.103 .....	4
IV. REQUIREMENTS FOR INTER PARTES REVIEW UNDER 37 C.F.R. §§ 42.104 AND 42.108 .....	4
A. Grounds for Standing under 37 C.F.R. § 42.104(a) .....	4
B. Identification of Challenge Under 37 C.F.R. § 42.104(b) and Statement of Precise Relief Requested .....	4
C. Considerations Under 35 U.S.C. § 325(d) .....	5
D. Requirements for Inter Partes Review 37 C.F.R. § 42.108(c) .....	6
V. BACKGROUND OF THE UNDERLYING TECHNOLOGY .....	6
VI. SUMMARY OF THE '680 PATENT .....	10
A. Brief Description of the '680 Patent .....	10
B. Priority Claim of the '680 Patent .....	12
VII. PERSON HAVING ORDINARY SKILL IN THE ART & STATE OF THE ART .....	12
VIII. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(B)(3) .....	15
A. "Vapor Chamber" .....	16
B. "Lip" .....	27
C. "Spacer" .....	30
D. "Hollow Column" .....	32
IX. CLAIMS 1-3 ARE OBVIOUS OVER NAKAMURA IN VIEW OF TAKAHASHI (GROUND 1) .....	33

# **Table of Contents** (continued)

	<b>Page</b>
A. Overview of the Prior Art.....	33
1. Overview of Nakamura (Ex.1004).....	33
2. Overview of Takahashi (Ex.1005).....	35
B. Independent claim 1 .....	37
1. Preamble: “A heat pipe for spreading heat comprising:” .....	37
2. “a boundary structure including a first plate and a second plate arranged in spaced apart relation,” .....	38
3. “each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together” .....	40
4. “so as to define an enclosed vapor chamber;” .....	46
5. “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;” .....	48
6. “an opening defined through said first plate depression and said second plate” .....	51
7. “wherein said depression comprises an annular outer surface that is bonded to a corresponding annular edge surface in said second plate” .....	52
8. “and further wherein said opening is isolated from said vapor chamber.” .....	55
9. “at least one spacer extending between and contacting said first and second plates; and” .....	57
10. “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.” .....	60
C. Independent claim 2 .....	62

**Table of Contents**  
(continued)

		<b>Page</b>
1.	Preamble: “A heat pipe for spreading heat comprising:” .....	62
2.	“a first plate having a circumferential edge lip bounding an inner surface and” .....	62
3.	“at least one hollow column that is integral with said first plate and which projects outwardly relative to said inner surface;” .....	65
4.	“a second plate arranged in spaced apart confronting relation to said first plate and” .....	71
5.	“a second plate ... including a circumferential edge lip bounding an inner surface and” .....	72
6.	“at least one opening through said second plate” .....	74
7.	“said edge lips of said first and second plates being bonded together” .....	76
8.	“so as to define a vapor chamber; wherein” .....	77
9.	“a hollow column bonded at one end to said second plate” .....	77
10.	“so as to coaxially align said hollow column with one of said at least one openings in said second plate” .....	78
11.	“thereby to form a mounting hole that extends through said first plate and said second plate and is isolated from said vapor chamber.” .....	79
D.	Independent claim 3 .....	81

**Table of Contents**  
(continued)

	<b>Page</b>
1. Preamble: “A heat pipe for spreading heat comprising:” .....	81
2. “a first plate having a circumferential edge lip bounding an inner surface and” .....	81
3. “a depression which projects outwardly relative to said inner surface;” .....	81
4. “a second plate arranged in spaced apart confronting relation to said first plate and” .....	83
5. “a second plate ... including a circumferential edge lip bounding an inner surface and” .....	83
6. “at least one opening through said second plate” .....	83
7. “said edge lips of said first and second plates being bonded together” .....	83
8. “so as to define an enclosed vapor chamber; wherein” .....	83
9. “said depression having an open ended tubular cross- section and an outer surface” .....	83
10. “a portion of which outer surface is bonded to said second plate” .....	86
11. “so as to coaxially align said depression with one of said at least one openings in said second plate” .....	87
12. “thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber.” .....	88
X. CONCLUSION.....	90

## List of Exhibits

<b>Ex. No.</b>	<b>Description of Document</b>
<b>1001</b>	U.S. Patent No. 7,100,680
<b>1002</b>	Declaration of Dr. Himanshu Pokharna
<b>1003</b>	File Wrapper of U.S. Patent No. 7,100,680
<b>1004</b>	Nakamura (Japanese Unexamined Utility Model Application Publication; Title: Heat Pipe; Year of Publication: 1975; Inventor: Kazuo Nakamura) (Translation and certificate are attached)
<b>1005</b>	Takahashi (Japanese Examined Utility Model Application Publication; Title: Heat Pipe; Dates of Publication: July 9, 1991 and March 27, 1996; Inventors: Tadahito Takahashi, Kaoru Hasegawa, Muneaki Sokawa) (Translation and certificate are attached)
<b>1006</b>	Excerpt from American Heritage Dictionary (4th ed. 2000)
<b>1007</b>	Excerpt from Webster's II New College Dictionary (1999)
<b>1008</b>	Excerpt from Declaration of Nelson J. Gernert in Connection with Claim Construction, <i>Aavid Thermalloy LLC v. Cooler Master Co., Ltd.</i> , No. 4:17-cv-05363-JSW (N.D. Cal.), dated July 13, 2018
<b>1009</b>	Excerpt from Merriam Webster's Collegiate Dictionary (10th ed. 1998)
<b>1010</b>	Excerpt from Webster's New Dictionary (1997)
<b>1011</b>	Excerpt from Random House Webster's Unabridged Dictionary (2nd ed. 2001)
<b>1012</b>	Excerpt from Prosecution History of U.S. Patent No. 6,302,192
<b>1013</b>	U.S. Patent No. 4,012,770
<b>1014</b>	U.S. Patent No. 4,165,472
<b>1015</b>	U.S. Patent No. 6,817,097
<b>1016</b>	Aavid Thermalloy LLC's Preliminary Proposed Claims Construction

## List of Exhibits

Ex. No.	Description of Document
	Pursuant to Patent L.R. 4-2, <i>Aavid Thermalloy LLC v. Cooler Master Co., Ltd.</i> , No. 4:17-cv-05363-JSW (N.D. Cal.), dated May 29, 2018
<b>1017</b>	Email from Kenneth M. Albridge III to Reuben Chen, Kyle Chen, dated October 31, 2017
<b>1018</b>	Joint Stipulated Request for Relief from Case Management Schedule and [Proposed] Order, <i>Aavid Thermalloy LLC v. Cooler Master Co., Ltd.</i> , No. 4:17-cv-05363-JSW (N.D. Cal.), dated November 14, 2017
<b>1019</b>	Joint Claim Construction and Prehearing Statement Pursuant to Patent L.R. 4-3, <i>Aavid Thermalloy LLC v. Cooler Master Co., Ltd.</i> , No. 4:17-cv-05363-JSW (N.D. Cal.), dated June 22, 2018
<b>1020</b>	Excerpts from Webster’s Third New International Dictionary (2002)
<b>1021</b>	U.S. Patent No. 3,680,189
<b>1022</b>	Eastman, <i>The Heat Pipe</i> , Scientific American, 218(5):38-46 (1968)
<b>1023</b>	Morikawa (Japanese Examined Utility Model Application Publication; Title: Heat Pipe; Year of Publication: 1978; Inventor: Takao Morikawa, Mitsuhiko Nakata) (Translation and certificate are attached)
<b>1024</b>	Yamamoto et al. (U.S. Patent No. 6,082,443, entitled “Cooling Device with Heat Pipe,” filed February 13, 1998)
<b>1025</b>	Supplemental Declaration of Dr. Himanshu Pokharna in Response to Declaration of Mr. Nelson Gernert, <i>Aavid Thermalloy LLC v. Cooler Master Co., Ltd.</i> , No. 4:17-cv-05363-JSW (N.D. Cal.), dated July 27, 2018

**I. INTRODUCTION**

Petitioner Cooler Master Co., Ltd. (“Petitioner” or “Cooler Master”) respectfully submits this Petition for *Inter Partes* Review (the “Petition”) of claims 1-3 (the “Petitioned Claims”) of U.S. Patent No. 7,100,680 (the “’680 patent”) (Ex.1001).

**II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(A)(1)**

**A. Real Party-In-Interest under 37 C.F.R. § 42.8(b)(1)**

Petitioner Cooler Master and CMI USA, Inc. (“CMI”), are the real parties-in-interest.

**B. Related Matters under 37 C.F.R. § 42.8(b)(2)**

The ’680 patent is asserted in one pending litigation: Aavid Thermalloy LLC v. Cooler Master Co., Case No. 3:17-cv-5363 (N.D. Cal.). That litigation commenced on September 15, 2017 when the purported owner of the ’680 patent, Aavid Thermalloy LLC (“Patent Owner” or “Aavid”), filed suit against Cooler Master. Petitioner Cooler Master was not served with the complaint and the summons under Fed. R. Civ. P. 4, but received Patent Owner Aavid’s request for waiver of service and agreed to waive service on October 31, 2017. (Ex.1017.) No executed waiver of service was filed with the district court, but a stipulation by the parties filed on November 17, 2017 noted that “Defendants will waive service of the Complaint for Patent Infringement” (Ex.1018.) Therefore, this Petition is timely



Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

filed on October 31, 2018 before the one-year statutory bar. *See, e.g., Brinkmann Corp. v. A&J Mfg., LLC*, No. IPR2015-00056, Paper 10 (P.T.A.B. Mar. 23, 2015) (holding that one year statute of limitations under 35 U.S.C. § 315(b) began to run when petitioner’s waiver of service was filed with district court); *see also* Fed. R. Civ. P. 4(d)(4) (“When the plaintiff files a waiver... these rules apply as if a summons and complaint had been served at the time of filing the waiver.”).

Petitioner is concurrently filing three other *inter partes* review petitions regarding claims 9-13 of U.S. Patent No. 7,066,240 (“the ’240 patent”); claims 1, 2, 4, and 5 of U.S. Patent No. 7,100,679 (“the ’679 patent”); and claims 5-8 of the ’680 patent, all of which claim priority from the same U.S. Patent Application No. 09/310,397 filed on May 12, 1999, leading to U.S. Patent No. 6,302,192 (“the ’192 patent”), from which the ’680 patent also claims priority. Petitioner is not aware of any other judicial or administrative matters that would affect, or be affected by, a decision in this proceeding.

**C. Lead and Back-Up Counsel under 37 C.F.R. § 42.8(b)(3)**

Petitioner provides the following designation of counsel.

<b>LEAD COUNSEL</b>	<b>BACK-UP COUNSEL</b>
Erik B. Milch (Reg. No. 42,887) emilch@cooley.com cm-aavid@cooley.com zpatdcdocting@cooley.com Cooley LLP	Andrew C. Mace (Reg. No. 63,342) amace@cooley.com Cooley LLP ATTN: Patent Group 1299 Pennsylvania Ave., NW, Suite 700 Washington, DC 20004

Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

LEAD COUNSEL	BACK-UP COUNSEL
<p>ATTN: Patent Group 1299 Pennsylvania Ave., NW, Suite 700 Washington, DC 20004 Tel: (703) 456-8573 Fax: (703) 456-8100</p>	<p>Tel: (650) 843-5808 Fax: (650) 849-7400</p> <p>Mark R. Weinstein (<i>Pro hac vice</i> pending) mweinstein@cooley.com COOLEY LLP ATTN: Patent Group 1299 Pennsylvania Avenue NW Suite 700 Washington D.C. 20004 Tel: (650) 843-5007 Fax: (650) 849-7400</p> <p>Reuben Chen (<i>Pro hac vice</i> pending) rchen@cooley.com COOLEY LLP ATTN: Patent Group 1299 Pennsylvania Ave. NW, Suite 700 Washington, DC 20004 Tel: (650) 843-5480 Fax: (650) 849-7400</p> <p>Kyle Chen (<i>Pro hac vice</i> pending) kchen@cooley.com Cooley LLP ATTN: Patent Group 1299 Pennsylvania Ave., NW, Suite 700 Washington, DC 20004 Tel: (650) 843-5019 Fax: (650) 849-7400</p>

**D. Service Information**

A copy of this Petition, in its entirety, including all Exhibits and a Power of

Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

Attorney, is being served by Federal Express, costs prepaid, to the address of the attorney or agent of record for the '680 patent: Kenneth M. Albridge III, Michael Best & Friedrich LLP. A courtesy copy is also being served upon counsel of record for the pending litigation. Petitioner may be served at the address provided above in **Section II.C** for lead and back-up counsel, and consents to electronic service at those addresses.

**E. Power of Attorney**

Filed concurrently with this Petition in accordance with 37 C.F.R. § 42.10(b).

**III. PAYMENT OF FEES - 37 C.F.R. § 42.103**

This Petition requests review of claims 1-3 of the '680 patent. A payment of \$30,500 is submitted herewith. *See* 37 C.F.R. § 42.15(a). This Petition meets the fee requirements. 35 U.S.C. § 312(a)(1).

**IV. REQUIREMENTS FOR INTER PARTES REVIEW UNDER 37 C.F.R. §§ 42.104 AND 42.108**

**A. Grounds for Standing under 37 C.F.R. § 42.104(a)**

Petitioner certifies that the '680 patent is available for *inter partes* review, and that Petitioner is not barred or otherwise estopped from requesting *inter partes* review on the grounds identified herein.

**B. Identification of Challenge Under 37 C.F.R. § 42.104(b) and Statement of Precise Relief Requested**

Petitioner respectfully requests that the Board initiate *inter partes* review of

Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

claims 1-3 of the '680 patent and requests that each claim be found unpatentable as obvious under 35 U.S.C. § 103(a) on the following grounds:

Ground	Claims	Basis for Challenge
1	1-3	Obvious over Nakamura (Ex.1004)
2	1-3	Obvious over Nakamura (Ex.1004) in view of Takahashi (Ex.1005) and further in view of Yamamoto (Ex.1024) under 35 U.S.C. § 103(a)

**Section IX** below explains in detail why the challenged claims are unpatentable based on these Grounds.

This Petition also cites additional materials for purposes of providing a technology background and describing the state of the art at the time of the alleged invention. These materials are also cited in the accompanying Declaration of Dr. Himanshu Pokharna (Ex.1002) (“Pokharna”), an expert with more than twenty (20) years of technical experience, including extensive experience in the area of thermal management and related devices in both academic and industrial settings. (Pokharna, ¶¶1-3.)

**C. Considerations Under 35 U.S.C. § 325(d)**

None of the prior art references relied upon in the challenges listed in **Section IV.B** above was cited during prosecution of the '680 patent. Accordingly, the challenges presented in this Petition rely on new art and grounds of unpatentability

different from any presented during prosecution. (*See* Ex. 1003, File Wrapper of U.S. Patent No. 7,100,680)

**D. Requirements for Inter Partes Review 37 C.F.R. § 42.108(c)**

The Board should institute *inter partes* review of claims 1-3 because this Petition establishes a reasonable likelihood of prevailing with respect to each challenged claim. *See* 35 U.S.C. § 314(a).

**V. BACKGROUND OF THE UNDERLYING TECHNOLOGY**

Despite vast improvements in computers and electronic components over the past decades, one issue has remained – heat. Key components in modern computers, such as microprocessors, can generate significant heat as electricity passes through them. If this heat is not removed, electronic components can overheat and malfunction. (Pokharna, ¶19.)

The prior art has responded to this challenge with a number of techniques for dissipating heat. One of the most common is to use the ambient air surrounding the heat-generating components to cool them by mounting fans near or onto the components to draw away the hot air and replace it with the cooler ambient air. Such conventional air cooling techniques can be supplemented with a device known as the “heat sink,” which often consists of a plate of a thermally conductive material (such as aluminum or copper) in contact with the heat-producing components. The thermally conductive material can spread heat to a larger area onto which the fan can

blow the cooler ambient air to dissipate the heat.

The heat sink may also include “fins” (as shown on the right) to increase the area available for heat dissipation. (Pokharna, ¶20.)



But as the size of the heat-generating components, gets smaller due to advancements, the contact area on the components available for heat absorption also gets smaller, making heat dissipation more difficult. (Pokharna, ¶21.)

Common materials of which the heat sink is made, such as aluminum and copper, have become inadequate in many cooling applications. This is because, relying on just their conductivity, these materials are good for transporting heat efficiently over only relatively shorter distances and thus smaller areas, rendering the heat sink ineffective when requiring much larger areas to efficiently dissipate heat into the air. (Pokharna, ¶22.)

To combat this issue, a device known as the “heat pipe” was often used to act as the heat transporting intermediate between the small heat-generating components and the ambient cooling air, or the heat sink with a large area in contact with the cooling air. A heat pipe, often larger in its size than the heat generating component, generally consists of a sealed, hollow metal device containing a suitable amount of heat transfer fluid that is volatile, and usually works as follows. First, the heat pipe is typically installed to be in contact with the heat generating components on one

side or end of the heat pipe. The heat transfer fluid inside the heat pipe absorbs the heat from the components and evaporates into vapor, which quickly travels throughout the hollow space inside the heat pipe. In doing so, the vapor carries the absorbed heat and spreads it throughout a much larger area of the heat pipe, which is often located at its other side or end exposed to the cooling air or in contact with the heat sink exposed to the air. The vapor carrying heat, once cooled by the air, condenses back into liquid and, through gravity or optionally capillary actions through a “wick,” flows back to the small area in contact with the heat generating components, and the process can be repeated. (Pokharna, ¶23.)

Heat pipes are a mainstay of thermal management in mobile computers such as laptops. The heat in laptops needs to be transported from processors and other components to the edge of the laptops where a fan can be used to blow air past an extended surface area (such as fins) to remove and dissipate the heat into the ambient air. (Pokharna, ¶24.)

Heat pipes come in different shapes. Heat pipes shaped like a square or rectangular plate (as compared to a linear shape) may provide superior performance because they can transport heat in more directions and be used with larger heat sinks with more fins for cooling. These heat pipes have sometimes been referred to as “vapor chamber” devices in the industry. In the ’680 patent, for example, the

claimed heat pipes comprises a “vapor chamber,” which is discussed in detail and construed below in **Section VIII.A.** (Pokharna, ¶25.)

Because of their larger and flatter structures, however, these heat pipes sometimes include through hole structures located at their interior regions for mounting purposes (indicated in yellow below), as shown in an example published in the 1970s. (Pokharna, ¶26 (citing Ex.1023 Examined Utility Model Application No. 253-32387 Y, published on August 11, 1978).)

FIG. 2

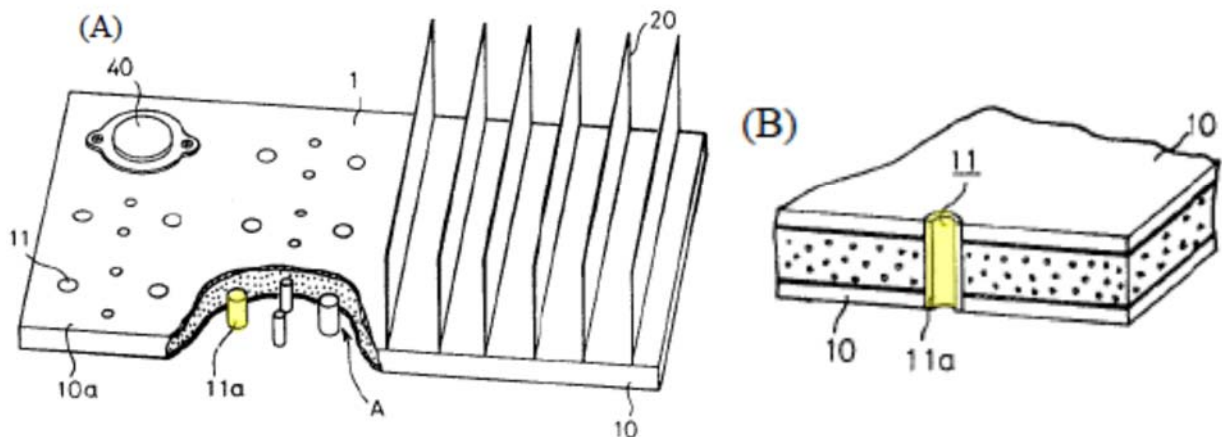
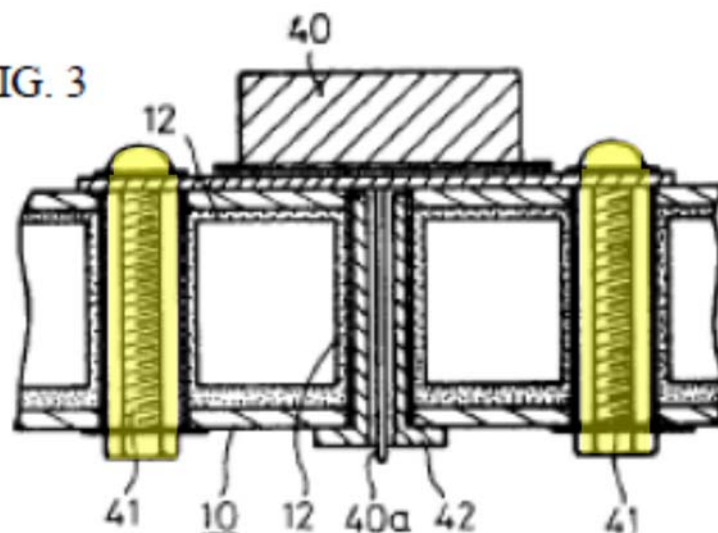


FIG. 3



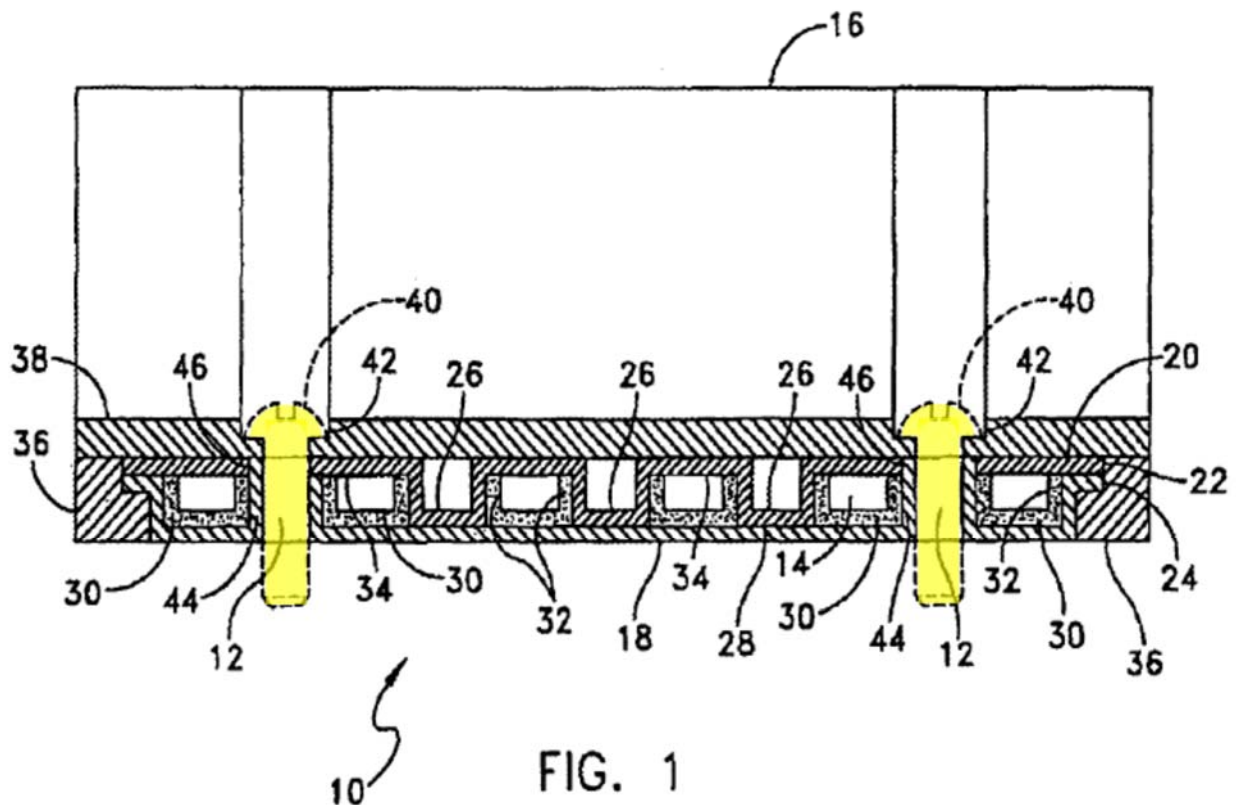


These mounting holes are for ease of attaching the heat pipes to, for example, the heat generating components (labeled as 40 above). They can also function as supporting structures, known as “spacers,” to prevent collapse of the heat pipes and to maintain their shape and internal hollow space’s integrity. (Pokharna, ¶27.)

## VI. SUMMARY OF THE ’680 PATENT

### A. Brief Description of the ’680 Patent

The ’680 patent, entitled “Integrated Circuit Heat Pipe Heat Spreader with Through Mounting Holes,” relates to heat pipes with “through holes” for fasteners located at the interior region of the heat pipes for “mounting” purposes, as indicated in yellow below. (Pokharna, ¶28.)



These through mounting holes are for ease of attaching the heat pipes to, for example, the heat generating components and/or the heat sinks. The specification describes purported techniques for creating such “through holes” while maintaining the sealed integrity of the heat pipes’ internal hollow space that the claims refer to as the “vapor chamber” of the heat pipes. In particular, the ’680 patent describes heat pipes with two plates that are bonded at their edges to isolate the “vapor chamber” from the outside world. Depressed areas on at least one of the two plates, referred to as “depressions,” can be formed at the interior region of the heat pipes. The two plates are also bonded *within* the area of the “depressions,” wherein the “through holes” can be formed such that they go through only the *bonded* area within the depressions without breaching the sealed integrity of the “vapor chamber” inside. Alternatively, columns can be used in the interior region of the heat pipes. The “through holes” can therefore go through these columns and the portions of the two plates respectively bonded to the two ends of the column without breaching the sealed integrity of the “vapor chamber.” These columns with the “mounting holes” going through them are recited as “hollow columns” in the claims. The term “hollow column,” however, does not appear and is not otherwise explained in the specification, which describes only certain “columns.” (Pokharna, ¶29.)

**B. Priority Claim of the '680 Patent**

The '680 patent was filed on August 9, 2005 as U.S. Patent Application No. 11/200,349. It claims priority to U.S. Patent Application No. 09/310,397 filed on May 12, 1999, leading to U.S. Patent No. 6,302,192 (“the '192 patent”). Thus, the '680 patent’s earliest possible priority date is May 12, 1999.<sup>1</sup>

**VII. PERSON HAVING ORDINARY SKILL IN THE ART & STATE OF THE ART**

Person of Ordinary Skill in the Art: At the time of the filing of the '679 patent, a person having ordinary skill in the art (“POSITA”) would have earned at least a graduate degree, such as an M.S., Ph.D., or equivalent thereof, in mechanical engineering or a closely-related field and possessed at least three years of specialized experience in designing and developing heat pipes or other heat transfer devices for thermal management in electronics and computer systems.

State of the Art: At the time of the filing of the '679 patent, the technology to build through holes for mounting purposes had existed and well-known in the industry for more than 20 years. As discussed above and in more detail below, the Utility

---

<sup>1</sup> Petitioner does not challenge the priority date of the '680 patent here; however, it reserves the right to do so in a later response or in another proceeding, if appropriate.

Model Application Publication No. S53-32387 Y, published on August 11, 1978,  
discloses:

A shape of the heat pipe is not limited to that of a so-called pipe type, and included are a shape of a panel type and shapes of other types. Because a heat pipe of a panel type readily conforms to a space of an electronic device and can be mounted with a large number of components to be cooled, generally, this type of heat pipe is often used.

(Ex.1023 at 2:8-14.) In particular, this 1978 publication recognizes that for “this type of heat pipe[s],” “[i]f the component can be made to directly contact the heat-pipe[’s] heating portion,” it would be the most preferable in terms of efficiency in thermal conductivity.” (*Id.*; 2:46-3:4.) But “opening a hole in the heat-pipe main body to fix the component to be mounted is impermissible due to an air-tight sealed-gas structure of the heat pipe[.]” (Ex.1023 at 2:31-33.) To solve this problem, this 1978 publication teaches “disposing a *through path* blocked from an interior of a heat pipe by a metal pipe in a heat-pipe heating portion and directly mounting and fixing a component to be cooled to the heat-pipe heating portion by a nut and bolt through the through path[.]” as shown below. (Ex.1023 at 3:9-14.) (*See* Figures 2-

3 of Ex.1023 reproduced and annotated on p. 9 of this Petition and again below.) In these figures, “each through path 11 is communicated to both surfaces of a panel by a metal pipe 11a provided inside the panel.” (Ex.1023 at 3:25-28.) “Accordingly, a panel interior, a so-called heat-pipe interior, and the through path 11 are completely blocked by this metal pipe 11a, and there is no fear of interior liquid and vapor escaping therethrough.” (Ex.1023 at 3:28-32.) Here, “[a] component 40 to be cooled such as a transistor element is fixed to a surface of the main-body heating portion by

FIG. 2

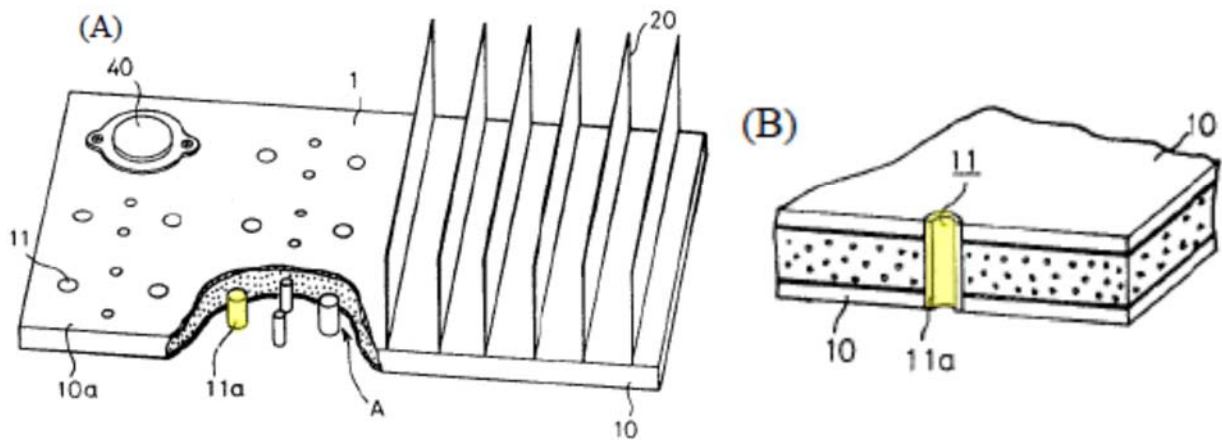
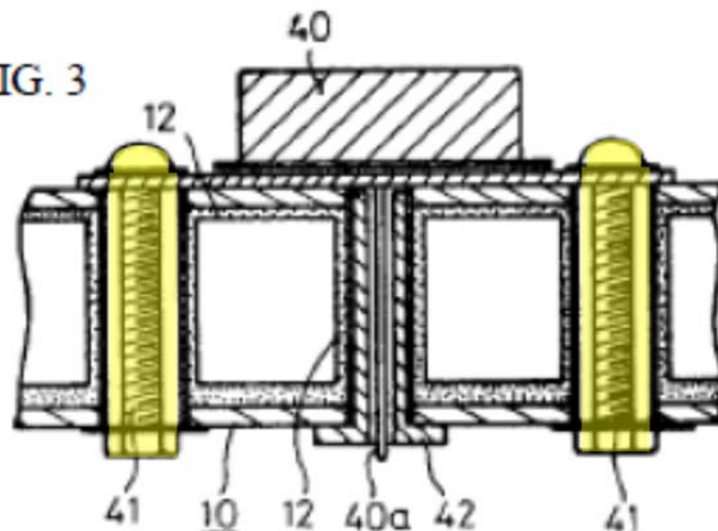


FIG. 3



nuts and bolts using the through paths 11.” (Ex.1023 at 3:32-35.) The 1978 publication further discloses:

In this manner, by adopting the heat-pipe structure of the present invention, the component can be directly mounted and fixed to the heat-pipe heating portion. Therefore, compared to a conventional structure of mounting to an installation plate, an efficiency in thermal conductivity improves remarkably and a weight of the heat pipe is reduced according to a weight of the installation plate in the conventional structure.

Furthermore, because the structure is one where the large number of through paths 11 is communicated by the metal pipes 11a, these metal pipes 11a also function as spacers of the enclosure panel and provide an effect of a reinforcing material.

(Ex.1023 at 3:43-55.)

#### **VIII. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(B)(3)**

A claim subject to *inter partes* review is given its “broadest reasonable construction in light of the specification of the patent in which it appears.” 37 C.F.R. § 42.100(b).<sup>2</sup> Accordingly, the proposed constructions represent the broadest

---

<sup>2</sup> The new claim construction rule replacing “the broadest reasonable interpretation (‘BRI’) standard” applies to only petitions filed on or after November 13, 2018. 83 FR 51340. Thus, BRI still applies to claim construction in this Petition because it is filed on October 31, 2018.

reasonable interpretation that one of ordinary skill in the art would assign to the claim terms below, and not necessarily the constructions that would be appropriate in the district court litigation.

**A. “Vapor Chamber”**

One of ordinary skill in the art would have understood, at the time of the alleged invention in the '680 patent, the term “vapor chamber” in the context of the '680 patent, as well as the state-of-the-art or background information in connection with the patent and the related field(s), to mean an “enclosed and sealed space or cavity in which a heat transfer fluid is present to be evaporated (or vaporized) and condensed to transport or spread heat.”<sup>3</sup> In the district court litigation, Patent Owner proposed a competing construction that is much narrower: “[a] vacuum sealed chamber, wherein a heat transfer fluid is evaporated and condensed and capillary forces are utilized to spread heat.” (Joint Claim Construction and Prehearing Statement (Ex.1019) at 3.)

---

<sup>3</sup> In the district court litigation, under the plain and ordinary meaning standard, Petition proposed a slightly different construction originally as “[e]nclosed and sealed void or cavity in which a suitable quantity of liquid is present to be evaporated (or vaporized) and condensed to transport or spread heat.” (*See* Ex.1019 at 3.)

Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

Based on both intrinsic and extrinsic evidence, Petitioner's proposed construction should be adopted, as explained below. (Pokharna, ¶30.)

There are three main differences between Petitioner's and Patent Owner's proposed constructions: (1) Petitioner's proposed construction requires that the "vapor chamber" be "enclosed and sealed," while Patent Owner's proposed construction requires that the "vapor chamber" be "vacuum sealed"; (2) Petitioner's proposed construction explains that the "chamber" in "vapor chamber" means a "space or cavity," while Patent Owner's proposed construction repeats the word "chamber" itself and does not explain what it means; and (3) Petitioner's proposed construction does not include the limitation, "capillary forces are utilized," which is in Patent Owner's proposed construction. (Ex. 1019 at 3.) As explained below, Petitioner's construction is correct and helpful and should therefore be adopted, while Patent Owner's proposed construction is incorrect and/or unhelpful, and thus should not be adopted. (Pokharna, ¶31.)

First of all, the specification of the '680 patent does not recite and, moreover, does not explain the phrase "vacuum sealed" included in Patent Owner's proposed construction, wherein the word "vacuum" is confusing due to its multiple meanings. For example, the American Heritage Dictionary at 1897-98 (4th ed. 2000) (Ex.1006) defined "vacuum" as "[a]bsence of matter," "[a] space empty of matter," "[a] space relatively empty of matter," "[a] space in which the pressure is significantly lower



than atmospheric pressure,” “[a] state of emptiness; a void,” or “[a] state of being sealed off from external or environmental influences; isolation.” (*See also* Webster’s II New College Dictionary at 1217 (1999) (Ex.1007), which defined “vacuum” the same way.) Among all of these meanings, only the last one, “[a] state of being sealed off from external or environmental influences; isolation” is consistent with how a person of ordinary skill in the art would have understood the word “vacuum” as used in the ’680 patent. All of the other possible meanings are actually incorrect in the context of the ’680 patent, making the phrase “vacuum sealed” confusing, as further explained below. (Pokharna, ¶32.)

The “vapor chamber” in the ’680 patent is not associated with the following definitions of “vacuum”: “[a]bsence of matter,” “[a] space empty of matter,” and “[a] state of emptiness; a void.” This is because at least “a heat transfer fluid” is present inside the “vapor chamber,” as both sides’ proposed constructions recognize. That is, the vapor chamber contains at least a “fluid” matter and thus is *not* empty. In addition, both sides also agree that this “fluid” may be “evaporated,” which a person of ordinary skill in the art would have understood generates vapor that fills up the vapor chamber and may cause the pressure inside the chamber to be even greater than the atmospheric pressure outside. Thus, the meanings of “[a] space relatively empty of matter” and “[a] space in which the pressure is significantly lower than atmospheric pressure” for

“vacuum” also do not apply in the context of the ’680 patent.<sup>4</sup> In summary, because of all of these possible yet incorrect meanings for “vacuum,” the use of the word “vacuum” in the construction for “vapor chamber” in the context of the ’680 patent is confusing and should be avoided. (Pokharna, ¶¶33, 35.)

One of ordinary skill in the art would have understood that, in the context of the ’680 patent, the word “vacuum” simply means the vapor chamber is in “[a] state of being sealed off from external or environmental influences” or in “isolation,” which is the last meaning for “vacuum” in the American Heritage Dictionary at 1897-98 (Ex.1006) mentioned above. Reproduced below are all instances of the word “vacuum” appearing in the specification for the ’680 patent, all consistent with this last meaning, as would have been understood by a person of ordinary skill in the art:

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

---

<sup>4</sup> The specification does mention that the “vapor chamber” is “evacuated” (’680, 2:12-16) and that “[h]eat pipe 10 is then evacuated to remove all non-condensable [*sic*] gases and a suitable quantity of heat transfer fluid is placed within it” (’680, 3:37-39). But neither of these statements make any of the meanings for “vacuum” correct in the context of the ’680 patent for the same reasons stated above. (Pokharna, ¶34.)

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*.

(’680, 2:36-46 (emphasis added).)

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 [*sic*] on the interior of heat pipe 10.

(’680, 4:25-30 (emphasis added).)

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.

(’680, 4:46-53 (emphasis added).)

Reading the above passages, one of ordinary skill in the art would have understood that, in the context of the ’680 patent, the word “vacuum” simply means the vapor chamber is in “[a] state of being sealed off from external or environmental influences” or in “isolation,” as mentioned before. Thus, to avoid the confusion caused by the other inappropriate meanings for “vacuum” in the context of the ’680 patent, the phrase in Petitioner’s proposed construction simply requiring the “vapor chamber” to be “enclosed and sealed” should be adopted instead of Patent Owner’s

confusing phrase requiring the “vapor chamber” to be “vacuum sealed.”<sup>5</sup> (Pokharna, ¶¶36-37.)

---

<sup>5</sup> In the district court litigation, Patent Owner insisted that the phrase “vacuum sealed” in the construction for “vapor chamber” is necessary to convey that the “seal” of the “vapor chamber” is “airtight.” (*See* Declaration of Nelson J. Gernert (Ex.1008), ¶20.) Petitioner does not dispute that the “vapor chamber” is air-tightly (or hermetically) sealed (Ex.1025), but believes (1) “vacuum” is not the right word to describe such airtight seal for the reasons explained above, and (2) under the BRI, it is unnecessary to state that the “seal” is airtight in the context of both the claim language of the ’680 patent. For example, claim 1 of the ’680 patent recites:

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*;

(’680, 5:31-38 (emphasis added).)

The claim language simply describes the “first plate” and the “second plate” are “bonded together so as to define an enclosed *vapor chamber*[.]” In reading the word “sealingly,” one of ordinary skill in the art would have understood that the “vapor chamber” is air-tightly (or hermetically) sealed. Indeed, as explained above,

Second, the word “chamber” in the term “vapor chamber” needs to be defined for clarity and consistency, and should mean the enclosed and sealed “space or cavity” as proposed by Petitioner. This is because, while stating that “[t]he 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” (’680, 2:12-16), the specification expressly acknowledges an apparent inconsistency as follows:

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

---

“the vapor chamber is in ‘[a] state of being sealed off from external or environmental influences’ or in ‘isolation,’” which supports the understanding that the “space or cavity” is air-tightly (or hermetically) sealed. The word “hermetic” is a commonly used word by a person of ordinary skill in the art to describe a seal that is airtight. Indeed, “hermetic” is defined as “a: AIRTIGHT <~ seal> b: impervious to external influence” by Merriam Webster’s Collegiate Dictionary at 543 (10th ed. 1998) (Ex.1009) and “a. of alchemy; sealed” by Webster’s New Dictionary at 142 (1997) (Ex.1010). (Pokharna, ¶¶38-39.)

Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

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.

(’680, 2:36-46 (emphasis added).)

As can be seen above, even the ’680 patent itself considers the provision of “holes into and through the vapor chamber” to be “an apparent inconsistency.” Thus, it is important to clarify what the word “chamber” in the phrase “vapor chamber” actually means in the context of the ’680 patent such that the “through holes” can be “completely isolated” from the “chamber.” One of ordinary skill in the art would have understood the word “chamber” in the phrase “vapor chamber” to mean the enclosed and sealed “space or cavity” without including the plates, the spacers, or the depressions enclosing and sealing such “space or cavity.” The applicable definition of the word “chamber” in the Merriam Webster’s Collegiate Dictionary at 190 (10th ed. 1998) (Ex.1009) supports this understanding by a person of ordinary skill in the art: “a natural or artificial enclosed space or cavity.” The Random House Webster’s Unabridged Dictionary at 343 (2nd ed. 2001) (Ex.1011) provides a similar definition: “a compartment or enclosed space; cavity: a chamber of the heart.” The Webster’s II New College Dictionary at 185 (1999) (Ex.1007) provides another similar definition: “[a]n enclosed space or compartment: CAVITY[.]” and so does the American Heritage Dictionary at 308 (4th ed. 2000) (Ex.1006) “[a]n enclosed space or compartment[.]” That is, the “chamber” includes *only* the “space or cavity” enclosed

and sealed by the bonded plates, the spacers, and/or the depressions, *without* these enclosing and sealing structures. This is because the “through holes” are formed on the plates, the spacers, and/or the depressions, and thus by definition cannot be “completely isolated” from the plates, the spacers, and/or the depressions if any of those structures are part of the definition of the “chamber.” That is, the definition of the word “chamber” must not include the plates, the spacers, or the depressions because the “chamber” must be “completely isolated” from the “through holes.” That is, it is only physically possible for the “through holes” to be “completely isolated”

from the “chamber” if not including its surrounding plates, spacers, and depressions enclosing and sealing it. Petitioner’s proposal is further supported by element 14 in Figures 1 and 2, which is “a cross section view of the preferred embodiment of a flat plate heat pipe 10 of the invention with through holes 12 through

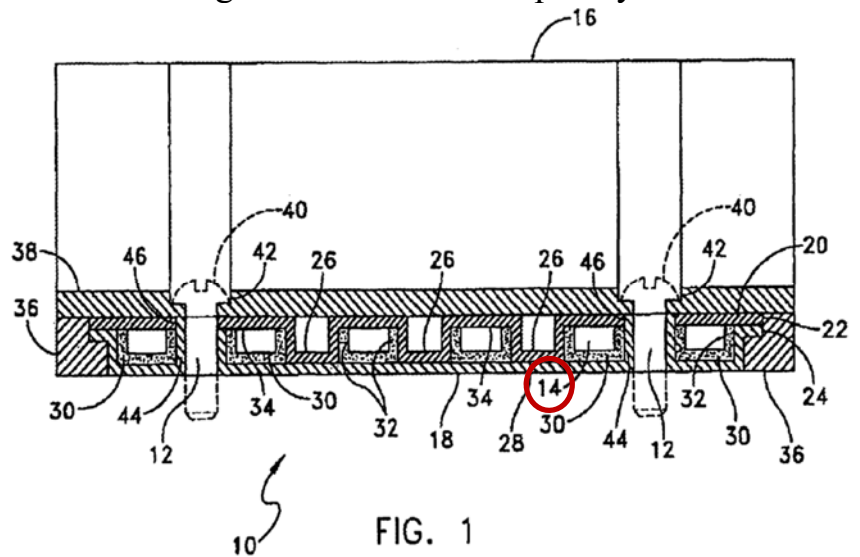


FIG. 1

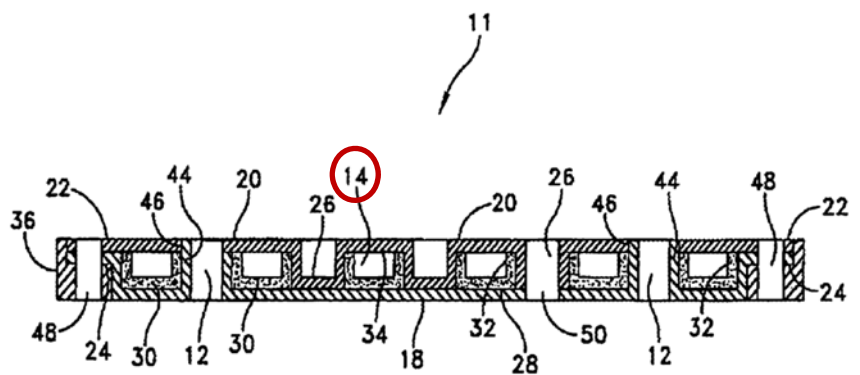


FIG. 2

its vapor chamber 14 and in contact with finned heat sink 16” (’680, 3:13-16). As shown in Figure 1, “vapor chamber 14” refers to the enclosed and sealed “space or cavity” inside “heat pipe 10.” Element 14 in Figure 2 also refers to the enclosed and sealed “space or cavity.” (Pokharna, ¶¶40-43.)

The claim language further confirms the correctness of Petitioner’s proposed construction for the term “vapor chamber.” For example, claim 1 of the ’680 patent recites: “[a] heat pipe for spreading heat comprising: a boundary structure including a first plate and a second plate arranged in spaced apart relation ... which are bonded together so as to define an enclosed vapor chamber.” (’680, 5:31-38.) The claim further recites that “said opening is isolated from said vapor chamber.” But this “opening” is “defined through said first plate depression and said second plate.” Thus, it is not physically possible for this “opening” to be “isolated from” the “first and second plates that define [the] enclosed vapor chamber” because the “opening” actually “opens through” the “first and second plates.” That is, if the “vapor chamber” were to include the “first and second plates,” then the “opening” cannot be “isolated from” the “vapor chamber” as required by the claim language. Thus, the “vapor chamber” must exclude the “first and second plates.” (Pokharna, ¶44.)

Third, the limitation in Patent Owner’s proposed construction requiring that “capillary forces [be] utilized” is unnecessarily and incorrectly restrictive, especially under the broadest reasonable interpretation of the term “vapor chamber.” This is



because there was no such requirement either in the context of the '680 patent nor in the general art at the time around the purported invention. A person of ordinary skill in the art would have understood that typically a structure known as a “wick” in heat pipes would have been required to generate and utilize capillary forces. But at that time, there had indeed existed “wickless” heat pipes that had not utilized or otherwise required capillary forces. (*See, e.g.,* Takahashi at 4:48-64 (Ex.1005).) The original parent application for the '680 patent that ultimately issued as the '192 patent also had claims that did not include a “wick.” (*See* Prosecution History of the '192 patent (Ex.1012), original claims 1-5.) A person of ordinary skill in the art would have understood that a “wick” might have been present in the claimed “heat pipe” in the '680 patent, but only as an additional and optional structure. It is such additional and optional “wick” that would have generated and utilized the “capillary forces” to help with the function of transporting and spreading heat. But this “wick” had not always been present in all heat pipes that had existed at the time of the purported invention, nor was it required. (*See, e.g.,* Takahashi at 4:48-64 (Ex.1005); U.S. Pat. No. 4,012,770 at 13:53-63 (Ex.1013); U.S. Pat. No. 4,165,472 at 1:53-60, 4:23-30, 6:60-7:7 (Ex.1014); U.S. Pat. No. 6,817,097 at 3:1-10, 3:22-36 (references 113, 413) claim 7 (Ex.1015).) In a heat pipe without a wick, capillary forces would not have been utilized to spread or transport heat. Thus, Patent Owner’s proposed construction

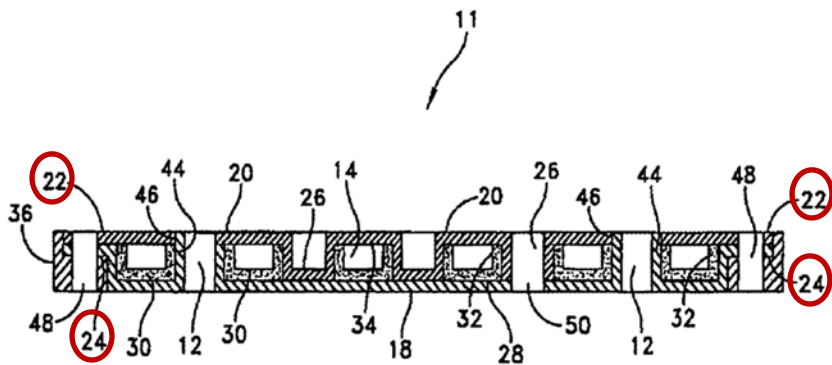
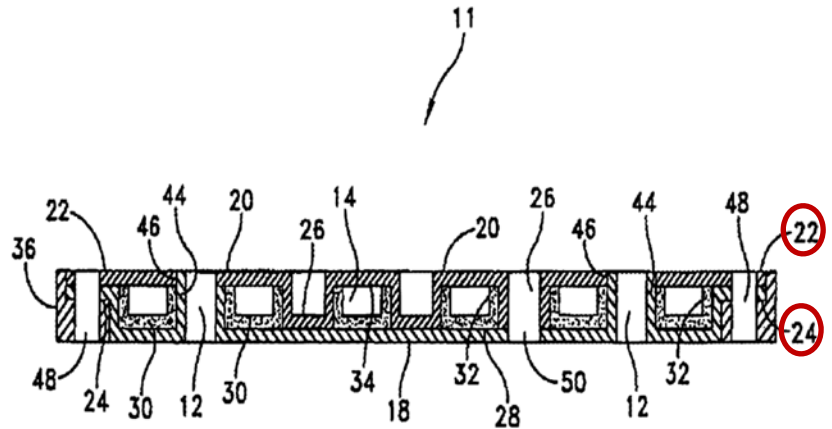
incorrectly reads in an unnecessary limitation of “capillary forces [be] utilized” for the term “vapor chamber.” (Pokharna, ¶45.)

The claim language again further confirms Petitioner’s proposal. For example, independent claims 2, 3, and 4 each include a “vapor chamber,” but do not recite a “wick,” thus no associated capillary forces are necessarily utilized in the claimed “vapor chamber” therein. But claims 1 and 5 each recite a “wick,” demonstrating that such “wick” is *optional* to the “vapor chamber” claimed in the independent claims, and thus the utilization of any capillary forces would also be optional. In summary, the correct construction of “vapor chamber” should not read in an optional feature of utilizing capillary forces as a required limitation. (Pokharna, ¶46.)

**B. “Lip”**

One of ordinary skill in the art would have understood, at the time of the purported invention in the ’680 patent, the term “lip” to mean the “portion of the plate comprising a region bonded to another plate” in the context of the ’680 patent. In the district court litigation, Patent Owner proposed a competing construction for the term “lip”: the “[p]ortion of the plate defined by the bonded region of the plate’s inner or interior surface.” (Ex.1019 at 5.) Based on both intrinsic and extrinsic evidence, Petitioner’s proposed construction should be adopted, as explained below. (Pokharna, ¶47.)

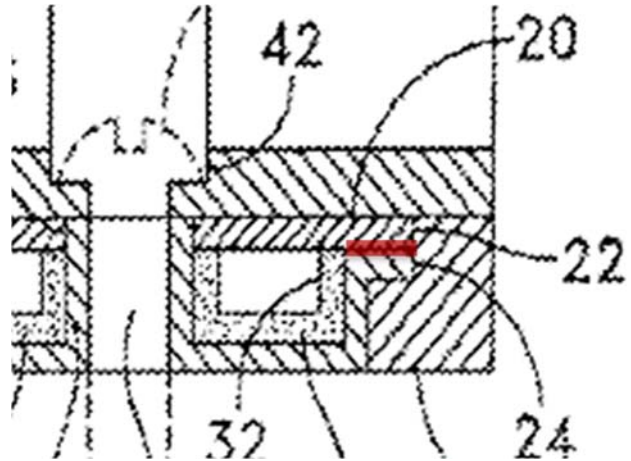
In describing Fig. 1, the specification of the '680 patent states: “[c]ontact plate 18 and cover plate 20 are sealed together at their peripheral lips 22 and 24 by conventional means, such as soldering or brazing, to form heat pipe 10.” ('680, 3:34-37 (emphasis added).) Thus, the meaning of the term “lip” in the context of the '680 patent simply refers to



the “portion of the plate comprising a region bonded to another plate” under the term’s broadest reasonable interpretation. Other disclosures regarding “lip” in the specification also support this construction. For example, the specification describes that “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.” ('680, 4:49-53 (emphasis added).) The Merriam Webster’s Collegiate Dictionary at 679 (10th ed. 1995) (Ex.1009) defined “lip” as “the edge of a hollow vessel or cavity.” And, as “bonding between

lips 22 and 24 is inherent because heat pipe 11 must be sealed at its edges,” a person of ordinary skill in the art would have understood the term “lip” in the context of the ’680 patent to simply mean the “portion of the plate comprising a region bonded to another plate” as proposed by Petitioner. (Pokharna, ¶48.)

Patent Owner’s proposed construction is problematic because it construes the term “lip” to be only the “portion of the plate defined by the *bonded region* of the plate’s inner or interior surface.” (Ex.1019 at 5 (emphasis added).) But the “inner or interior” surface, in the context of the ’680 patent, means a surface on the inside of the heat pipe, and thus the “bonded” region simply cannot be part of the plate’s “inner or interior surface,” as shown below by the red portion. The



reason is because this “bonded region” is no longer “inside” the heat pipe, and thus cannot be “the plate’s inner or interior surface.” Thus, the “bonded region of the plate’s inner or interior surface” is by definition self-contradictory and cannot exist. Patent Owner’s construction therefore is wrong and should not be adopted. (Pokharna, ¶49.)

**C. “Spacer”**

One of ordinary skill in the art would have understood the term “spacer,” at the time of the alleged invention for the ’680 patent, to simply mean the “structure used to maintain a space or clearance between the plates” recited in the claims. In the district court litigation, Patent Owner proposed a competing construction: “A structure, apart from the separately claimed depression, that is configured to maintain a space or clearance between the plates and provides support for a capillary wick.” (Ex.1019 at 5-6.) Based on both intrinsic and extrinsic evidence, Petitioner’s proposed construction should be adopted, as explained below.

The language from the specification of the ’680 patent reads:

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 ....

(’680, 2:12-18.) Reading the above passage, one of ordinary skill in the art would have understood that, in the context of the ’680 patent, the word “spacer” simply meant a structure used to create or maintain space between the plates. This understanding of spacer is further confirmed by definition found in contemporary dictionaries at that time. For example, the Webster’s Third New International Dictionary at 2180 (2002) (Ex.1020) defined “spacer” as “a device or piece for holding two members at a given distance from each other ....” In the context of the

'680 patent, the “two members” (or “two things”) are the two plates enclosing the vapor chamber. (Pokharna, ¶50.)

The definition proposed by Patent Owner is problematic because it adds other requirements such as the spacer not being the separately claimed depression and being able to provide support for a capillary wick. A person of ordinary skill in the art would have understood, however, that the claimed “depression” could have functioned as a “spacer.” In fact, the specification of the '680 patent supports this position: “These spacers can be solid columns, embossed *depressions* formed in one of the plates, or a mixture of the two.” ('680, 2:18-20 (emphasis added).) Patent Owner’s construction of “spacer” as “a structure, apart from the separately claimed depression” is inconsistent with the specification of the '680 patent. A “spacer” is simply a structure that is used to maintain a space or clearance between the plates, especially under the term’s broadest reasonable interpretation. (Pokharna, ¶51.)

The additional limitation in Patent Owner’s proposed construction requiring that a spacer “provide[] support for a capillary wick” is also unnecessarily restrictive because there is no such requirement either in the context of the '680 patent nor in the general art at the time around the purported invention. Indeed, as discussed above, there had then existed heat pipes that had not included any capillary wick, let alone any spacer providing support for such non-existent capillary wick. (*See, e.g.*, Takahashi at 4:48-64 (Ex.1005); U.S. Pat. No. 4,012,770 at 13:53-63 (Ex.1013); U.S.

Pat. No. 4,165,472 at 1:53-60, 4:23-30, 6:60-7:7 (Ex.1014); U.S. Pat. No. 6,817,097 at 3:1-10, 3:22-36 (references 113, 413) claim 7 (Ex.1015).) The original parent application for the '680 patent that ultimately issued as the '192 patent also had claims that did not include any “wick” at all. (*See* Prosecution History of the '192 patent (Ex.1012), original claims 1-5.) A person of ordinary skill in the art would have understood that a spacer might have played an additional and optional role of providing support for the capillary wick, *if* present. But a spacer would not have been required to provide support for capillary wicks in all heat pipes that had existed at the time of the purported invention. (*See, e.g.*, U.S. Patent No. 3,680,189 at 2:50-64, 5:20-59, Figs. 7-9 (Ex.1021).) (Pokharna, ¶52.)

In summary, to one of ordinary skill in the art, there is no requirement for the spacer to be “apart from the separately claimed depression” or to “provide support for a capillary wick.” Therefore, the term “spacer,” under its broadest reasonable interpretation, should simply mean a “structure used to maintain a space or clearance between the plates,” as proposed by Petitioner. (Pokharna, ¶53.)

#### **D. “Hollow Column”**

In the district court litigation, Patent Owner proposed that the term “hollow column” have a plain and ordinary meaning, and that if necessary, the term mean “a columnar structure defining an unfilled or empty space.” (Ex.1019 at 6.) Under the

term's broadest reasonable interpretation, Petitioner accepts Patent Owner's proposal for purposes of this Petition. (Pokharna, ¶54.)

**IX. CLAIMS 1-3 ARE OBVIOUS OVER NAKAMURA IN VIEW OF TAKAHASHI (GROUND 1)**

**A. Overview of the Prior Art**

**1. Overview of Nakamura (Ex.1004)<sup>6</sup>**

Nakamura is a “Japanese Unexamined Utility Model Application Publication in the Year 1975” that was filed on September 18, 1973 and published in 1975. It thus qualifies as prior art under 35 U.S.C. § 102(b).

Similar to the '680 patent, Nakamura, entitled “Heat Pipe,” relates generally to heat pipes with through holes located at the interior region of the heat pipes for mounting purposes. In particular, Nakamura describes a “heat pipe” characterized by a “sealed container made of thermally conductive metal plates and a refrigerant enclosed in the sealed container.” (Nakamura at 1.) “The heat pipe is a heat

---

<sup>6</sup> Exhibit 1004 includes a translated version of Nakamura, which is relied upon here, along with a Certificate of Translation and a copy of the original publication in Japanese.



transport system that uses

this refrigerant to absorb heat

from a high-temperature

body and transmit this heat to

a low-temperature body to be

dissipated. That is, at one

end portion (heating portion)

of the heat pipe, the

refrigerant enclosed in the

heat pipe robs an external

high-temperature body of

heat, is vaporized, and passes

through the hollow portion of the heat pipe to move to another end portion (cooling

portion). At this cooling portion, the refrigerant is refluxed back to the heating

portion through the wick by the capillary action.” (Nakamura at 2.) (Pokharna, ¶56.)

Moreover, “a portion of one or both of opposing upper and lower surfaces of the sealed container has a molded concavity and a hole for component installation is provided in a concavity joining surface where the concavity and a flat surface opposing the concavity or an opposing concavity are joined together.” Figures 3-6 above best demonstrate this disclosed “heat pipe” with the “hole” 11 in Nakamura.

Figure 3

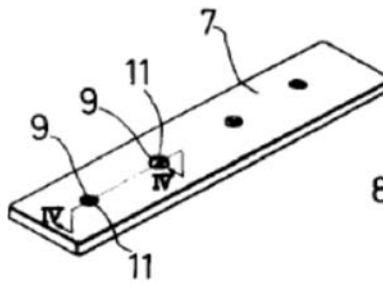


Figure 4

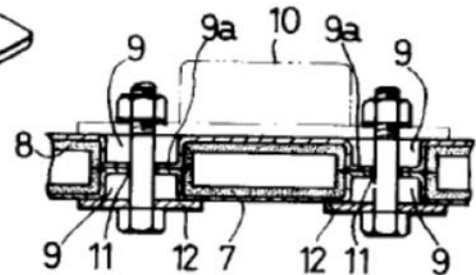


Figure 5

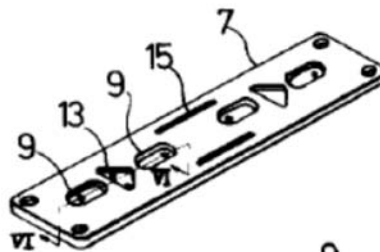
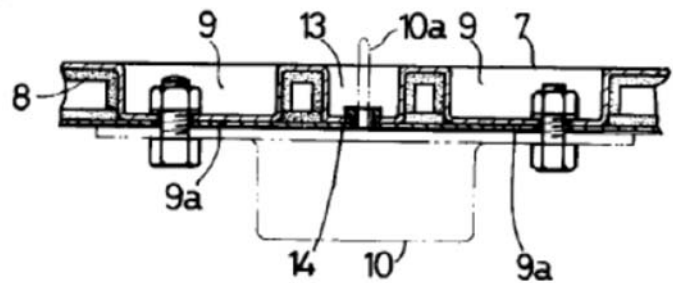


Figure 6



“In the[se] figures, 7 refers to the sealed container, 8 is the Wick, 9 and 13 areas are concavities, 9a is a concavity joining surface, 10 is a component to be cooled, 10a is a terminal, 11 is a hole for component installation, 12 is a washer, and 14 is a bushing.” (Pokharna, ¶57.)

## **2. Overview of Takahashi (Ex.1005)<sup>7</sup>**

Takahashi is a “Japanese Examined Utility Model Application Publication” that was filed on November 8, 1989 and published on July 9, 1991. It thus qualifies as prior art under 35 U.S.C. § 102(b). (Pokharna, ¶58.)

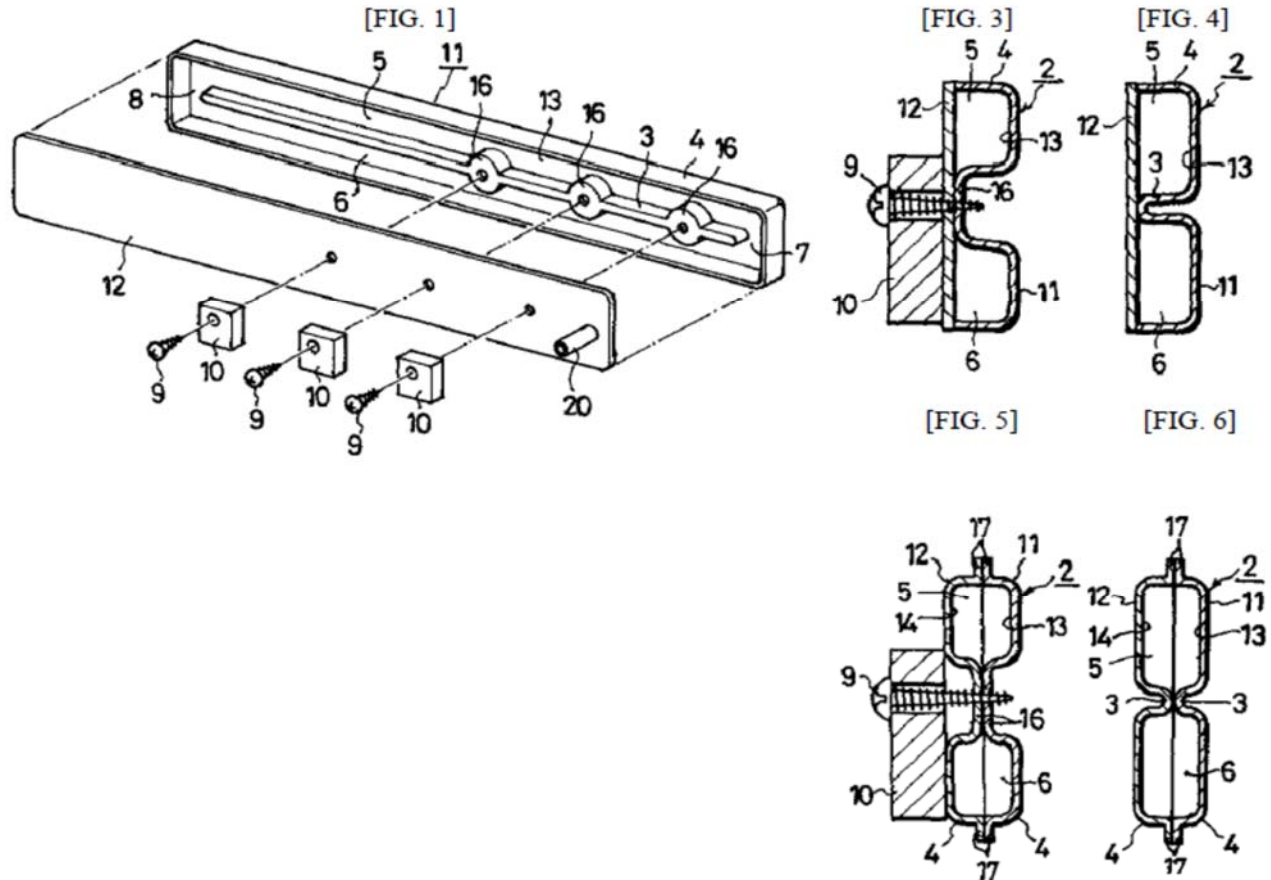
Similar to the ’680 patent and Nakamura, Takahashi, entitled “Heat Pipe,” relates generally to heat pipes with “through holes” located at the interior region of the heat pipes for “mounting” purposes. In particular, Takahashi discloses “[a] heat pipe, wherein the inside of a square tube container (2) with both ends sealed, in which a hydraulic fluid is stored, is divided into a gas-phase hydraulic fluid passage on the upper side (5) and a liquid-phase hydraulic fluid passage on the lower side (6) by an intermediate partition wall (3)[.]” (Takahashi at 1:2-7.) In particular, “screws

---

<sup>7</sup> Exhibit 1005 includes a translated version of Takahashi, which is relied on here, along with a Certificate of Translation and a copy of the original publication in Japanese.

(9) used to mount heating elements (10), such as transistors, or the like, are thrust into a container (2) in this intermediate partition wall (3) portion.” (Takahashi at 2:1-3.) “The screws (9) for mounting heating elements (10), such as transistors, or the like, are directly fastened into the container (2) in the junction portion for mounting heating elements (16) in an intermediate partition wall (3), allowing the heating elements (10) to be in direct contact with the wall surfaces of the container (2).” (Takahashi at 5:28-33.) Figures 1, 3 and 4 best demonstrate this disclosed “heat pipe” in Takahashi. In these figures, the numbers denote the following elements of the heat pipe: “(2) ... a container, (3) ... an intermediate partition wall,” (4) ... “a peripheral wall[,]” “(5) ... a gas-phase hydraulic fluid passage, (6) ... a liquid-phase hydraulic fluid passage, (7) ... a gas-phase hydraulic fluid passage portion, (8) ... a liquid-phase hydraulic fluid passage portion, (9) ... a screw, (10) ... a heating element, such as a transistor, or the like, (11) ... a first plate member, (12) ... a second plate member, (13) and (14) ... concave parts for hydraulic fluid passages.” (Takahashi at 8:21-28, 4:65-5:4.) “A junction for mounting heating elements (16) having a wide circular area as seen from three front sides is provided at the portion of the intermediate partition wall (3) on the evaporator side of the first plate member (11).” (Takahashi at 5:4-8.) “The tips of the peripheral walls (4) and (4) of both plate members (11) and (12) are provided with flanges (17) and (17), respectively, where ... the flanges (17) and (17) at the tips of the peripheral walls

(4) and (4) of both plate members (11) and (12) ... are joined to each other by a vacuum brazing method to form a [sealed] container (2).” (Takahashi at 6:14-22.)



(Pokharna, ¶59.)

## B. Independent claim 1

1. Preamble: “A heat pipe for spreading heat comprising:”

### Grounds 1 & 2:

To the extent the preamble is limiting, Nakamura discloses this preamble:  
“[A] heat pipe is a heat transport system that uses [a] refrigerant to absorb heat from a high-temperature body and transmit this heat to a low-temperature body to be

dissipated.” (Nakamura at 2.) (Pokharna, ¶60.)

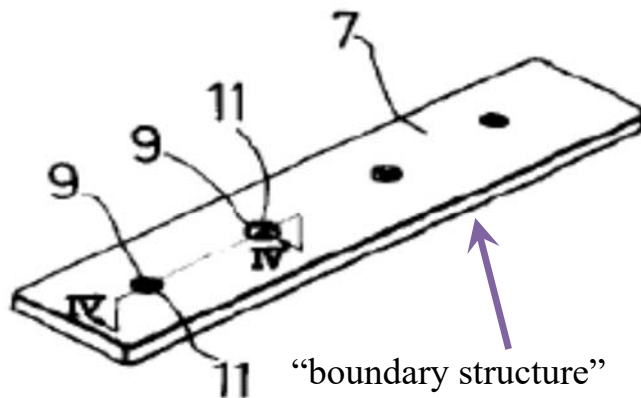
**2. “a boundary structure including a first plate and a second plate arranged in spaced apart relation,”**

**Grounds 1 & 2:**

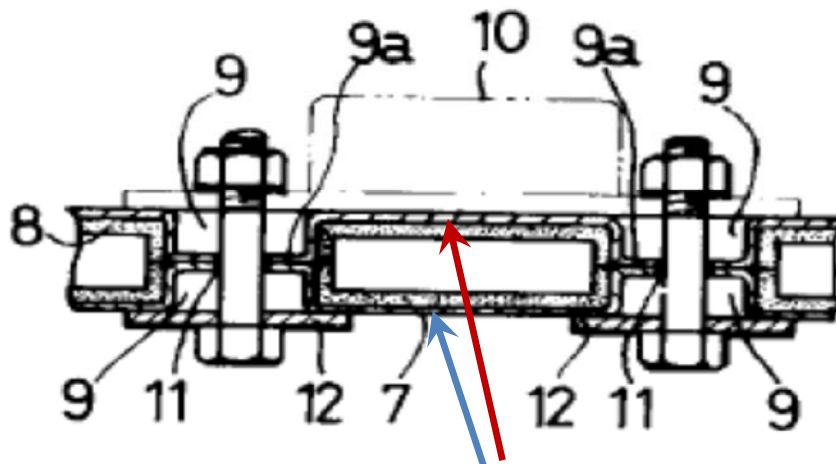
Nakamura discloses this limitation by teaching “a sealed container made of thermally conductive metal plates” with “opposing upper and lower surfaces[.]” (Nakamura at 1 (underlining added).) In particular, the “sealed container” in Nakamura corresponds to the “boundary structure” in claim 1 of the ’680 patent because Patent Owner conceded in the district court litigation that a “boundary structure” is simply a “structure forming a boundary” (Patent Owner’s Proposed Constructions, (Ex.1016), at 8), which is disclosed by Nakamura as the “sealed container” in Figure 3. As shown below right, the “thermally conductive metal plates” with “opposing upper and lower surfaces” disclosed in, e.g., Nakamura’s

Figure 4 correspond to “a first plate and a second plate arranged in spaced apart relation” in claim 1 of the '680 patent. (Pokharna, ¶61.)

**Figure 3**



**Figure 4**



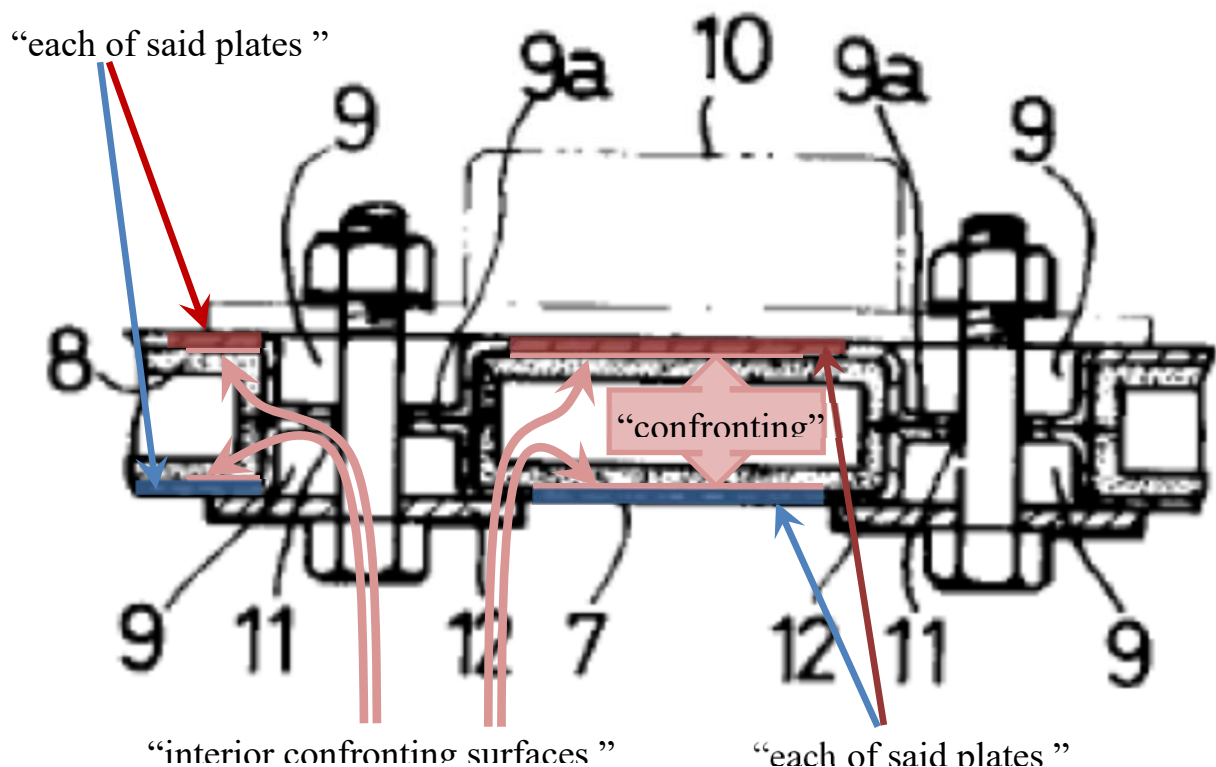
“a first plate and a second plate arranged in spaced  
apart relation”

3. “each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together”

**Grounds 1&2:**

First, Nakamura discloses “each of said plates including interior confronting surfaces” by teaching “a sealed container made of thermally conductive metal plates” with “opposing upper and lower surfaces[.]” (Nakamura at 1.) As shown below, “each of said plates” disclosed by Nakamura’s Figure 4 (pointed to by red and blue arrows, respectively) includes “interior confronting surfaces” (pointed to by pink arrows). (Pokharna, ¶62.)

**Figure 4**

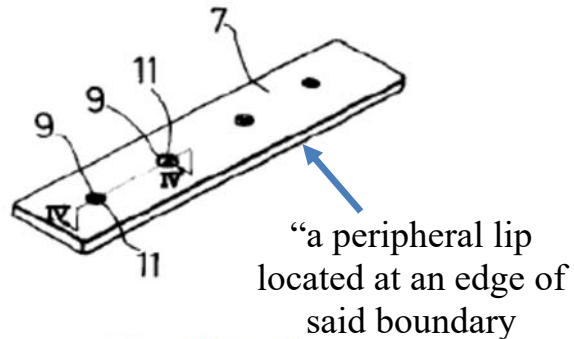


**Ground 1:**

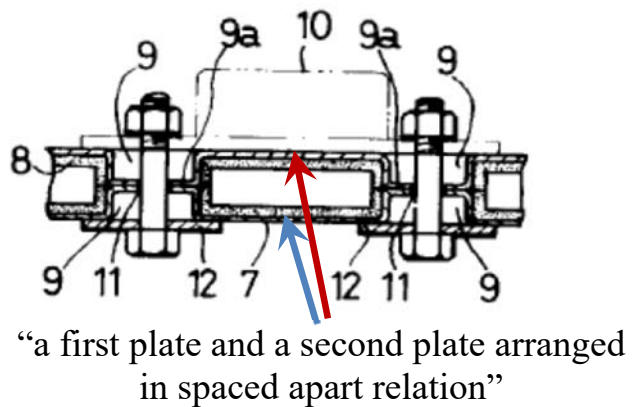
Further, a person of ordinary skill in the art would have understood and found “a peripheral lip located at an edge of said boundary structure” obvious in view of Nakamura at least under Petitioner’s proposed construction for “lip,” which is the “portion of the plate comprising a region bonded to another plate.” The “peripheral lip” in the ’680 patent, under its broadest reasonable interpretation, is nothing more

than a lip located at a periphery, edge, or circumference of the “boundary structure” discussed above in **Section IX.B.2**. The ’680 patent acknowledges that “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.” (’680,

**Figure 3**



**Figure 4**



4: 49-53 (emphasis added).) As discussed, Nakamura discloses that the “sealed container” is “of an airtight structure.” (Nakamura at 2.) That is, the first plate and the second plate arranged in the spaced apart relation in Nakamura must each have



a “portion of the plate comprising a region *bonded* to another plate” located at the periphery, edge, or circumference of the boundary structure to form the “sealed container of an airtight structure.” (Nakamura at 2.) In other words, a person of ordinary skill in the art would have found “a peripheral lip located at an edge of said boundary structure” obvious in view of Nakamura at least under Petitioner’s proposed construction for “lip.” For the same reasons stated above, Nakamura also renders it obvious that “each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure ... are bonded together.” (Pokharna, ¶63.)

**Ground 2:**

It would also have been obvious for a person of ordinary skill in the art to combine Nakamura with Takahashi to create “each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together,” as explained below. (Pokharna, ¶64.)

**a. Motivation to combine Nakamura with Takahashi regarding the “lip” limitation**

A POSITA would have been motivated to combine Nakamura and Takahashi in connection with the related features of “lips” located at the periphery, circumference, or edge of the plates of the heat pipe’s sealed container. As an initial matter, both Nakamura and Takahashi disclose heat pipes that include through holes

located at the interior regions of the heat pipes for securing them onto the heat generating elements. Thus, in general, a skilled artisan would have been motivated to combine the features in the two references already because the devices in Nakamura and Takahashi are similar and analogous. (Pokharna, ¶83.)

Further, both Nakamura and Takahashi describe related manufacturing processes of “pressing” and “brazing” for forming and sealing the heat pipe’s container plates that would have motivated a skilled artisan to combine them. In particular, Nakamura discloses that “[o]n both surfaces of the sealed container 7, a concavity 9 ... is provided via *pressing*” and that the “sealed container where thin plates of a material with favorable thermal conductivity such as copper or aluminum are formed into a sealed configuration by soldering, *brazing*, or the like.” (Nakamura at 5 (emphasis added).) Similarly, Takahashi discloses an embodiment in its Figures 5 and 6 having the “first and second plate members (11) and (12)” of the “sealed [tube]” built by a “*press-mold[ing]*” process “with both ends sealed,” and that “[t]he tips of the peripheral walls (4) and (4) of both plate members (11) and (12) are provided with *flanges* (17) and (17), respectively, where ... the *flanges* (17) and (17) at the tips of the *peripheral walls* (4) and (4) of both plate members (11) and (12) ... are joined to each other by a vacuum *brazing* method to form a [sealed] container (2).” (Takahashi at 6:4-22 (emphasis added).) In particular, a skilled artisan would have been motivated to combine Takahashi’s “flanges (17) and

(17)” with Nakamura’s sealed container because it would have made sealing the edge, periphery, or circumference of the “sealed container” in Nakamura easier by simply “pressing,” “brazing,” and or “soldering” the two “flanges (17) and (17)” together. That is, because these “flanges (17) and (17)” are protruding outwardly and exposed on the outside, it is

easier to press and clamp together

while heating them to make them

bond and seal together during the

manufacturing processes.

Because these were well-known

manufacturing processes, a skilled

artisan would have reasonably

expected the combination of

Nakamura and Takahashi to yield

predictably successful results with easier and better bonded and sealed edge,

periphery, or circumference of the sealed container in Nakamura. The combination

would have been straight forward for a skilled artisan without having to change the

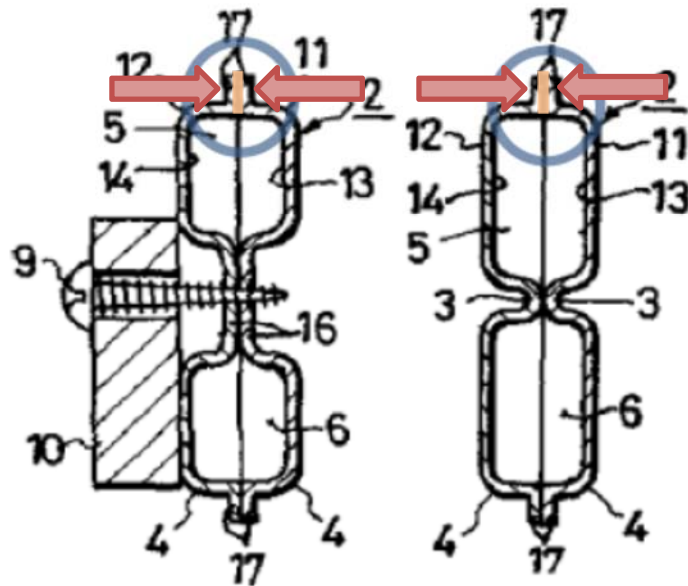
functionalities of either Nakamura or Takahashi. Thus, a POSITA would have been

motivated to combine these related features in Nakamura and Takahashi when

reading both references together. (Pokharna, ¶84.)

[FIG. 5]

[FIG. 6]



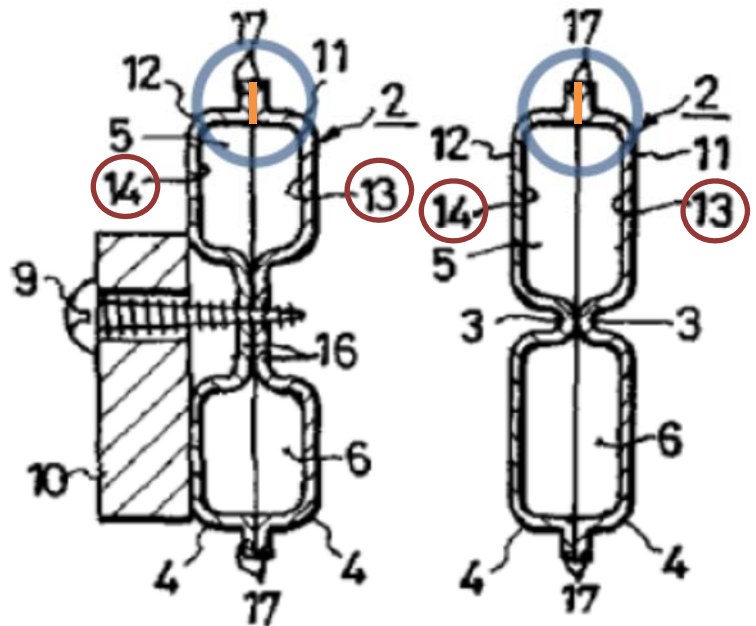
- b. Nakamura in view of Takahashi renders obvious “each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together”

The combination of Nakamura and Takahashi disclose the “lip” limitation in the '680 patent and “each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together.” In particular, the “flanges (17) and (17)” in Takahashi correspond to the limitation of “lips” in the '680 patent under both Petitioner’s and Patent Owner’s claim construction proposals. Under Petitioner’s proposal, the “flanges (17) and (17)” each have a “portion of the plate comprising a region bonded to another plate” (circled in light blue in Figures

5 and 6 of Takahashi). (Ex.1019 at 5.) Under Patent Owner’s proposal, the “flanges (17) and (17)” also each have a “portion of the plate defined by the bonded region of the plate’s inner or interior surface” (indicated in orange). (Ex.1019 at 5.) The “flanges (17) and

[FIG. 5]

[FIG. 6]



(17)” are also located at the periphery, circumference, or edge of the sealed container in Takahashi, thus corresponding to the “peripheral lip” claimed in the ’680 patent. Further, Takahashi discloses “the concave parts (13) and (14) facing inwards” that opposing inner surfaces that correspond to the “confronting interior surfaces” as claimed in the ’680 patent. (Takahashi at 6:17-18, Figs. 5-6.) Thus, Nakamura in view of Takahashi discloses “each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together.” (Pokharna, ¶67.)

**4. “so as to define an enclosed vapor chamber;”**

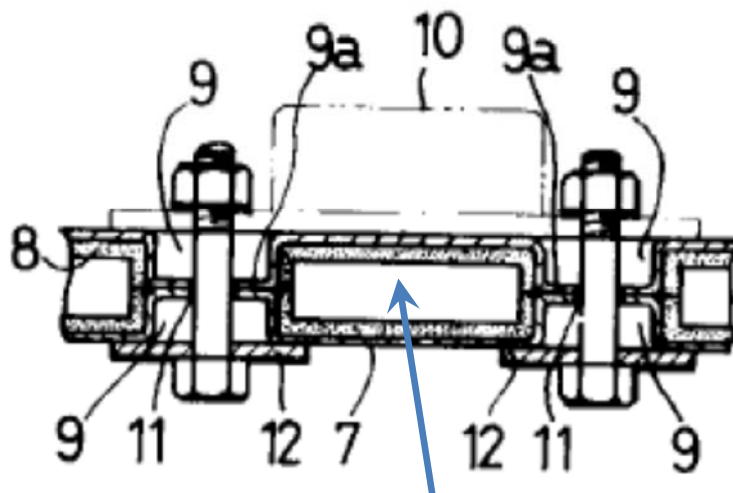
**Grounds 1&2:**

Nakamura discloses the limitation of “so as to define an enclosed vapor chamber” regardless of whether the term “vapor chamber” is construed under Petitioner’s or Patent Owner’s proposal. Under Petitioner’s proposal, Nakamura discloses the “enclosed and sealed space or cavity in which a heat transfer fluid is present to be evaporated (or vaporized) and condensed to transport or spread heat” as the “sealed container” in each of Figures 3 and 5 that encloses and seals a cavity. To the extent that the “space or cavity” needs to be “air-tightly (or hermetically) sealed,” Nakamura discloses a “sealed container of an airtight structure.” (Nakamura at 2.) Nakamura also discloses “a heat transfer fluid is present [in the enclosed and sealed space or cavity] to be evaporated (or vaporized) and condensed

to transport or spread heat” as “an appropriate amount of refrigerant.” (Nakamura at 2.) In particular, Nakamura discloses that “at one end portion (heating portion) of the heat pipe, the refrigerant enclosed in the heat pipe robs an external high-temperature body of heat, is vaporized, and passes through the hollow portion of the heat pipe to move to another end portion (cooling portion).” (Nakamura at 2.) “At this cooling portion, the refrigerant is cooled by air cooling and condenses, and the condensed refrigerant is refluxed back to the heating portion through the wick by the capillary action.” (*Id.*) This disclosure also teaches the “vacuum sealed chamber, wherein a heat transfer fluid is evaporated and condensed and capillary forces are utilized to spread heat” under Patent Owner’s proposal. In particular, Nakamura discloses the “vacuum sealed chamber” by teaching the “heat pipe ... has a wick with a capillary action affixed to

an inner wall of a sealed container of an airtight structure ... after air is extracted therefrom.” (Nakamura at 1-2.) (Pokharna, ¶68.)

**Figure 4**



“enclosed vapor chamber”

5. **“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;”**

**Grounds 1&2:**

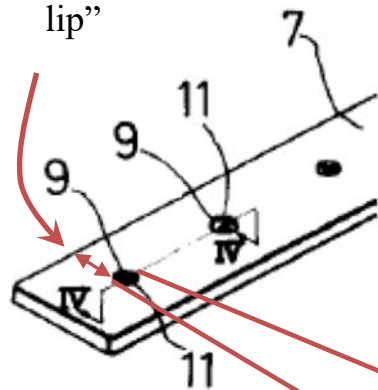
Nakamura discloses this limitation as follows. As shown below, Nakamura discloses the limitation of “a depression formed in said first plate which projects into said vapor chamber” with its “concavity” labeled as “9,” which corresponds to the “depression” in the ’680 patent. As shown below, the “concavity” labeled as “9” (indicated as a red, bowl-like structure) also “projects into said vapor chamber” (as indicated by the large, pink arrow pointing down). This is because the “concavity” labeled as “9” in Nakamura protrudes into the inside “space or cavity” of the “sealed container” labeled as “7” in Nakamura, which corresponds to the “said vapor chamber” limitation. As also shown in Nakamura’s Figure 3 reproduced below, the “concavity” labeled as “9” is also spaced apart from the edge of the “sealed container” labeled as “7,” thus meeting the limitation that the “depression ... is spaced from said peripheral lip ... [of] said first plate” in the ’680 patent. (Pokharna, ¶69.)

Nakamura also teaches that “[a] concavity joining surface 9a of the concavity 9 is finished flat after pressing is completed and is applied in advance to preliminary

soldering” and that “[t]he concavity joining surfaces 9a can then be readily and

“is spaced  
from said  
peripheral  
lip”

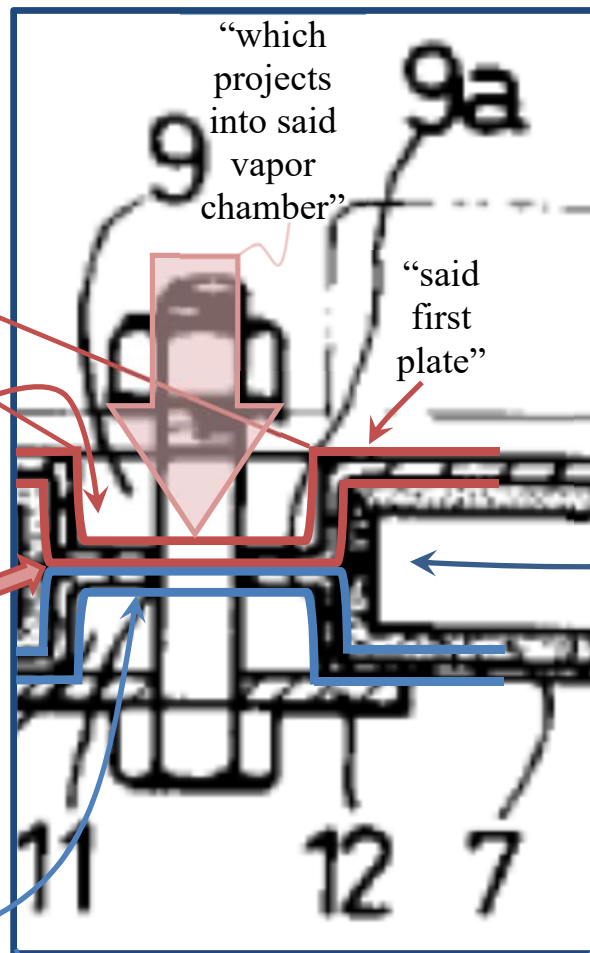
**Figure 3**



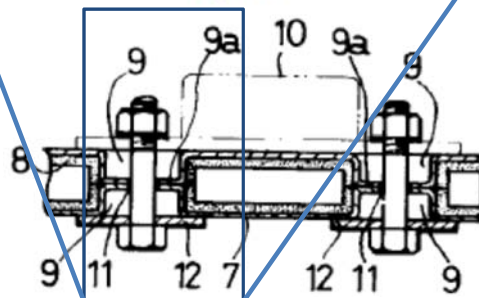
“a depression  
formed in said first  
plate”

“is bonded to said  
second plate”

“said second plate”



**Figure 4**





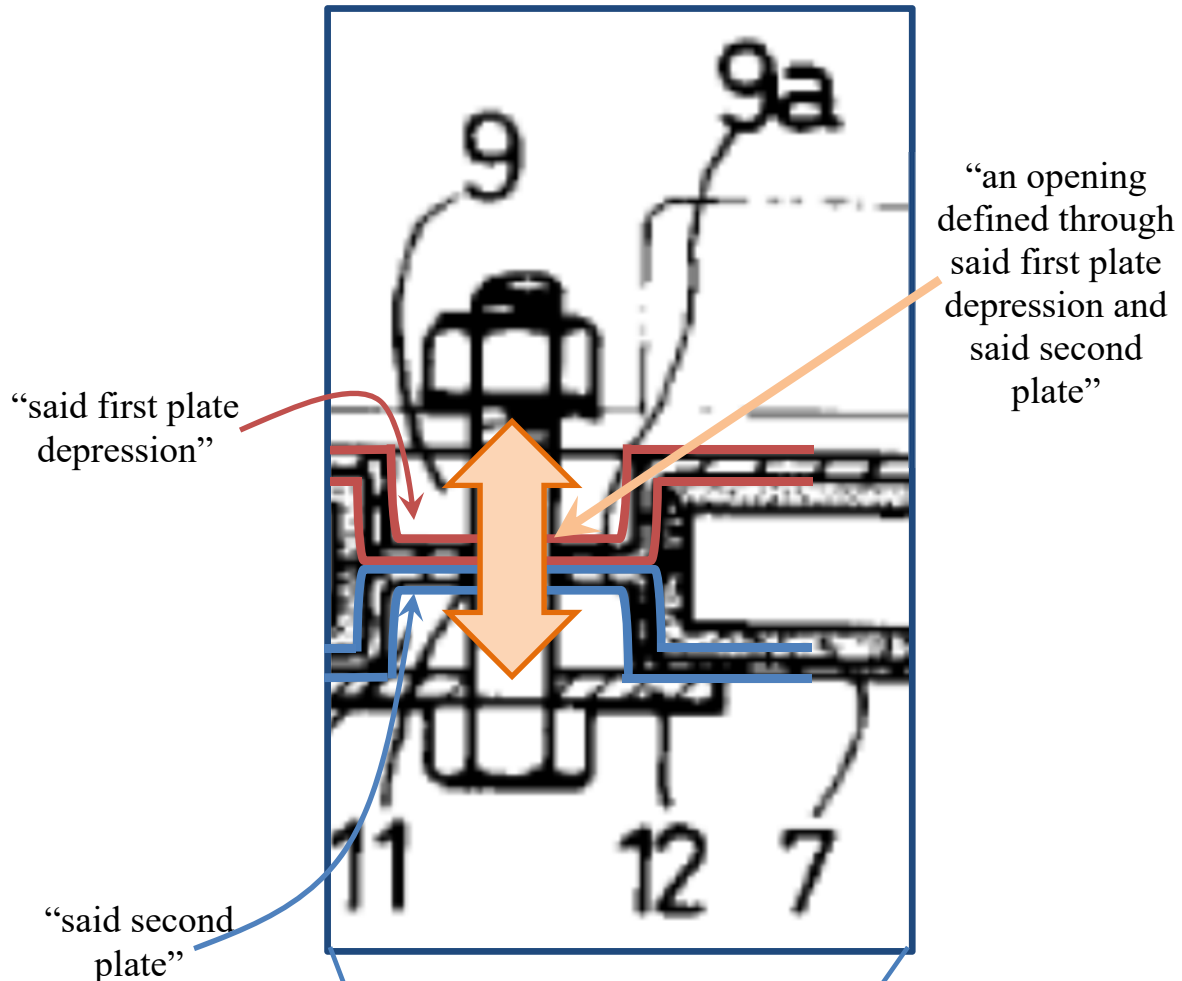
Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

reliably adhered by being pressurized and heated before and after work of forming the sealed container 7 by soldering or the like.” (Nakamura at 5.) Thus, Nakamura discloses that the “depression” in the ’680 patent “is bonded to said second plate.” (Pokharna, ¶70.)

- 6. “an opening defined through said first plate depression and said second plate”**

**Grounds 1&2:**

Nakamura discloses this limitation as shown below. The “opening” is indicated by the double-sided orange arrow above and is “defined through said first



### Figure 4

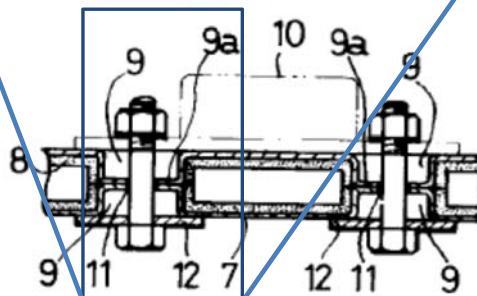


plate depression and said second plate,” which are indicated by the red and blue structures, respectively, as shown above. (Pokharna, ¶71.)

7. **“wherein said depression comprises an annular outer surface that is bonded to a corresponding annular edge surface in said second plate”**

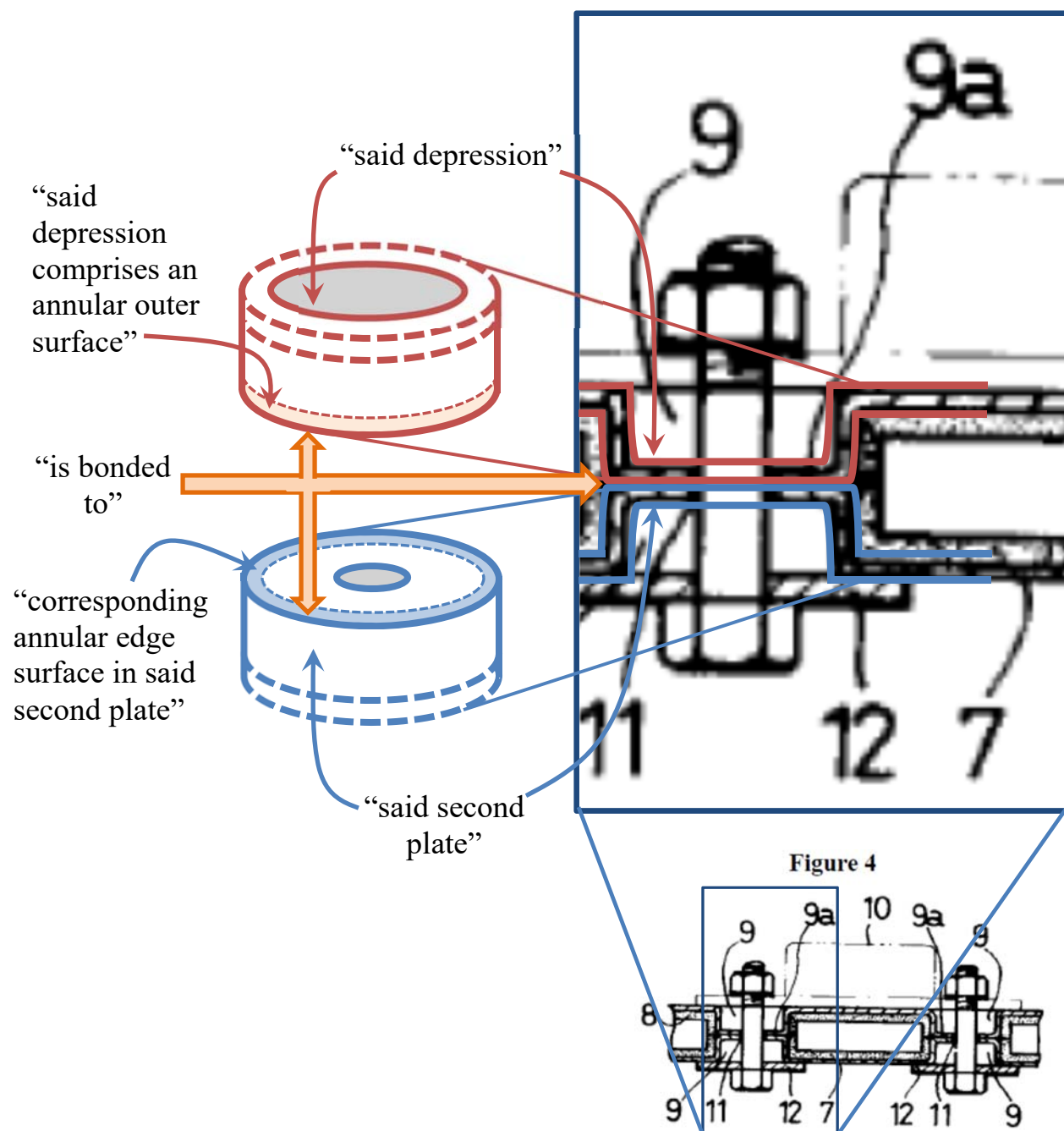
**Grounds 1&2:**

Nakamura discloses this limitation as follows. The structure indicated in red below corresponds to “said depression,” which “comprises an annular outer surface.” This is because, as shown below, the “annular outer surface” is located towards the bottom of “said depression” (indicated in red) and is the ring-shaped surface located at the bottom rim of “said depression” that is relatively “outer” to the center of “said depression.” As also shown below, the structure indicated in blue corresponds to “said second plate,” which comprises a “corresponding annular edge surface.” This is because, as shown below, the “annular edge surface” in “said second plate” (indicated in blue) is the ring-shaped surface located at the top rim of the blue structure and is “corresponding” to the “annular outer surface” of “said depression” over the blue structure. Further, as indicated by the orange four-way arrows, the “annular outer surface” of “said depression” (indicated in red) “is sealingly bonded to” (indicated in light orange) the “corresponding annular edge surface in said second plate” indicated in blue. This is because Nakamura teaches that “[t]he concavity joining surfaces 9a can ... be readily and reliably adhered by

Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

being pressurized and heated before and after work of forming the sealed container

7 by soldering or the like.” (Nakamura at 5.) (Pokharna, ¶72.)

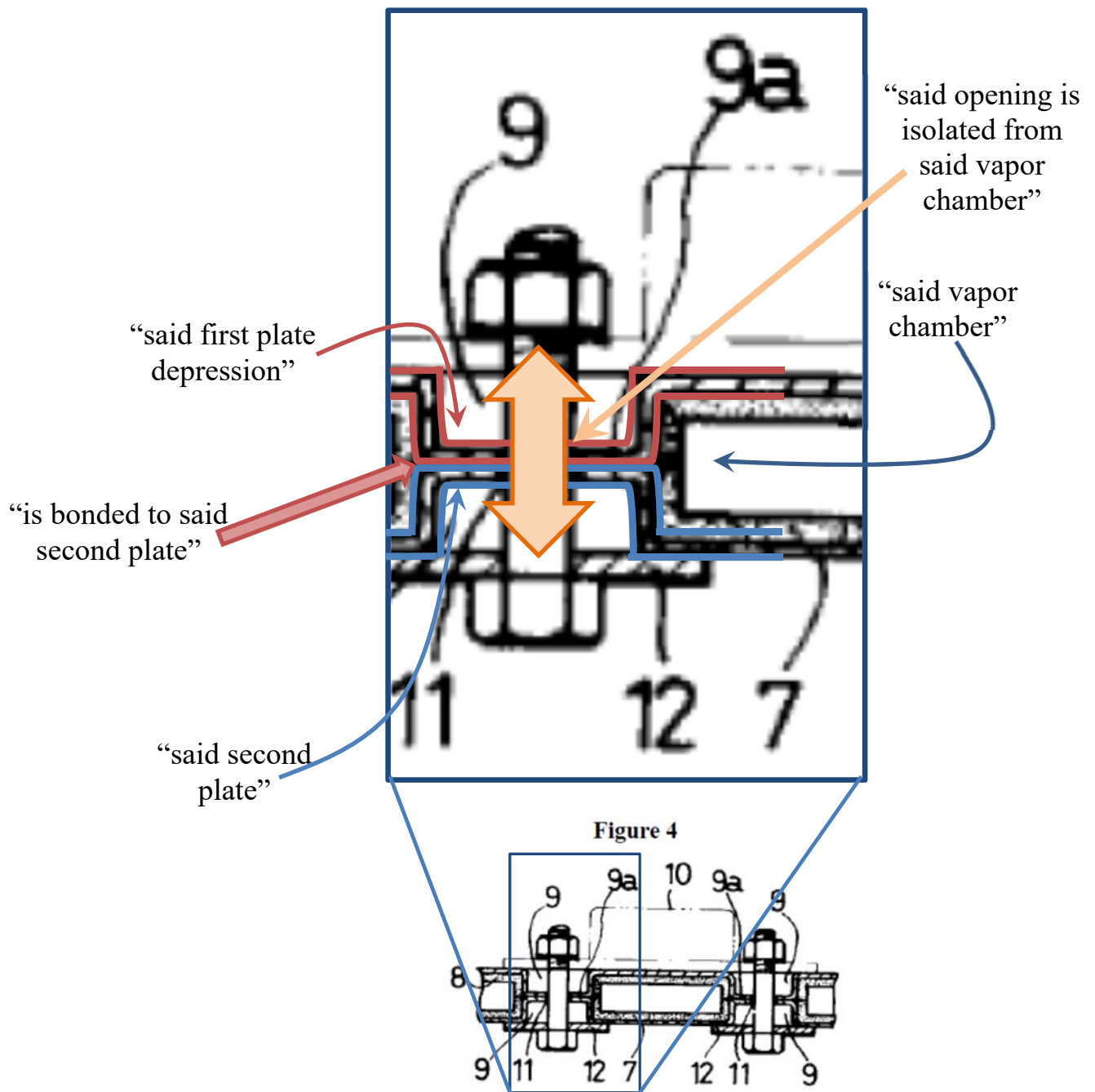


- 8. “and further wherein said opening is isolated from said vapor chamber.”**

**Grounds 1&2:**

Nakamura discloses this limitation. As discussed above, Nakamura discloses the “an opening defined through said first plate depression and said second plate.” Nakamura also teaches that “[t]he concavity joining surfaces 9a can ... be readily and reliably adhered by being pressurized and heated before and after work of forming the sealed container 7 by soldering or the like.” (Nakamura at 5.) That is, Nakamura further discloses that the “depression” in the ’680 patent is sealing “bonded to said second plate.” Thus, the “said opening is isolated from said vapor

chamber,” as shown below. (Pokharna, ¶73.)

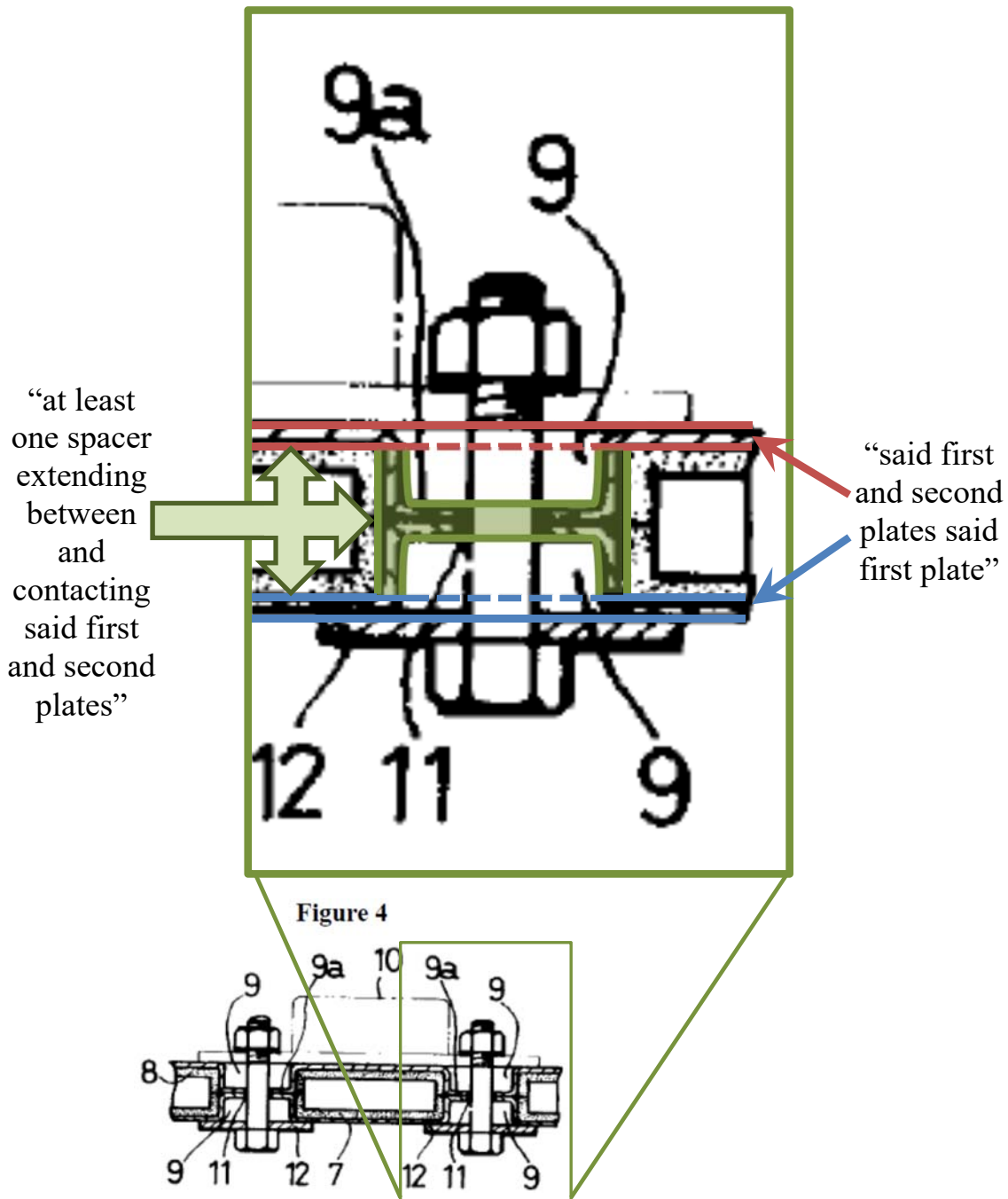


**9. “at least one spacer extending between and contacting said first and second plates; and”**

**Grounds 1&2:**

Nakamura discloses the “at least one spacer extending between and contacting said first and second plates” as follows. As shown below, a second set of “concavity” labeled as “9” and a “concavity joining surface” labeled as “9a” are disclosed in Figure 4 of Nakamura. Together, these elements form a structure with an H-shaped cross-section (indicated in green) that is “between and contacting said first and second plates” (indicated in red and blue, respectively). This structure with an H-shaped cross-section corresponds to the “at least one spacer” limitation under both Petitioner’s and Patent Owner’s claim construction proposals for “spacer.” Under Petitioner’s proposed construction, this structure with an H-shaped cross-section is a “structure used to create or maintain space between the plates.” This is because Nakamura discloses that, the “outer wall does not deform” since the “concavity” labeled as “9” is “installed.” (Nakamura at 7.) (Pokharna, ¶74.)

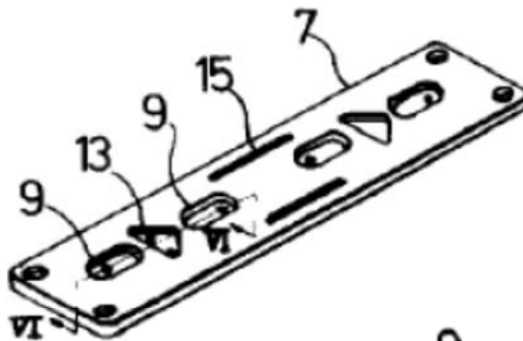




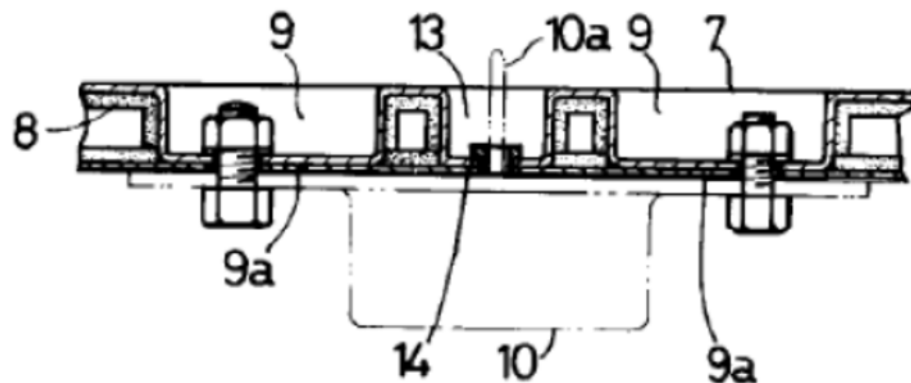
Indeed, the specification of the '680 patent acknowledges that the “spacers *extending between and contacting the two plates* ... prevent the plates from bowing inward, and ... can be ... embossed *depressions* formed in one of the plates ....”

(’680, 2:12-20 (emphasis added)). Nakamura discloses such “embossed depressions” functioning as “spacers extending between and contacting the two plates” to “prevent the plates from bowing inward.” In Nakamura’s Figures 5 and 6 (reproduced below), the “the concavity 9 is provided only in a lower surface of the sealed container 7” and because of the “provi[sion]” of this “concavity ..., the outer wall does not deform.” (Nakamura at 6-7.) Thus, Nakamura discloses the limitation of “at least one spacer extending between and contacting said first and second plates” under the term’s broadest reasonable interpretation as proposed by Petitioner. (Pokharna, ¶75.)

**Figure 5**



**Figure 6**



Nakamura also discloses this limitation under Patent Owner’s proposed construction for “spacer”: “A structure, apart from the separately claimed depression,

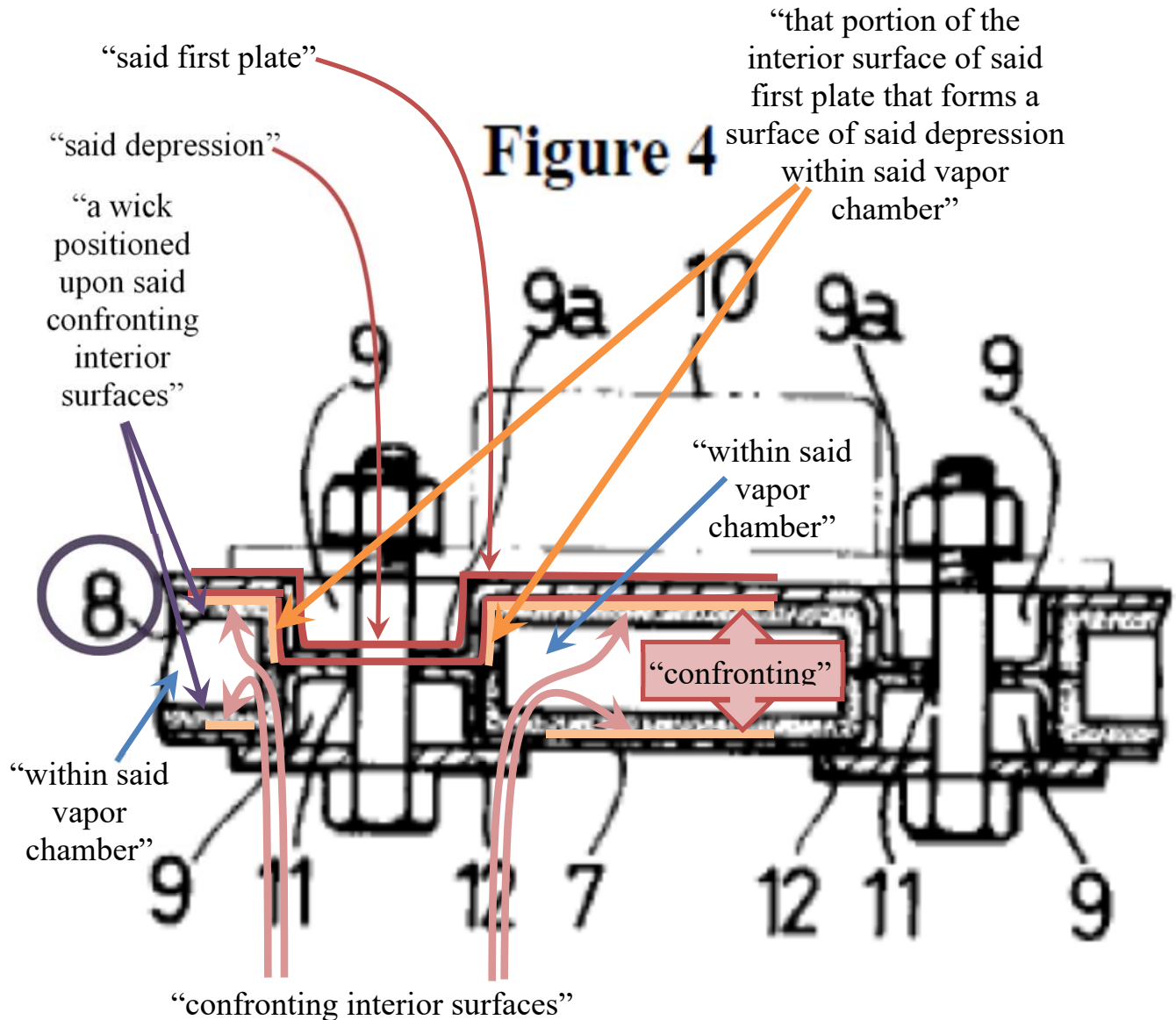
that is configured to maintain a space or clearance between the plates and provides support for a capillary wick.” (Ex.1019 at 5-6.) As shown above, Nakamura’s “sealed container” has multiple “depressions,” thus one of them “apart from the separately claimed depression” can satisfy the “spacer” limitation. Also, as shown in Nakamura’s Figures 3-6, all the concavities labeled as “9” (i.e., depressions) “provide support for a capillary wick” labeled as “8.” Therefore, Nakamura discloses the limitation of “at least one spacer extending between and contacting said first and second plates.” (Pokharna, ¶76.)

- 10. “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.”**

**Grounds 1&2:**

Nakamura discloses this limitation as follows. In particular, Nakamura discloses that element “8” is a “wick” that provides “a capillary action.” (Nakamura at 1-2, 5, and 7-8.) As shown below, Nakamura discloses “a wick” labeled as “8” (indicated by purple arrows) that is “positioned upon said confronting interior surfaces” (indicated by light orange and pointed to by pink arrows). As also shown below, Nakamura discloses that “said confronting interior surfaces” includes “that portion of the interior surface of said first plate that forms a surface of said depression within said vapor chamber.” This is because “that portion of the interior

surface of said first plate that forms a surface of said depression” (indicated in light orange and pointed to by the orange arrows) is located “within said vapor chamber” (as indicated by the blue arrows). (Pokharna, ¶77.)



**C. Independent claim 2**

**1. Preamble: “A heat pipe for spreading heat comprising:”**

**Grounds 1&2:**

See Section IX.B.1 above. (Pokharna, ¶78.)

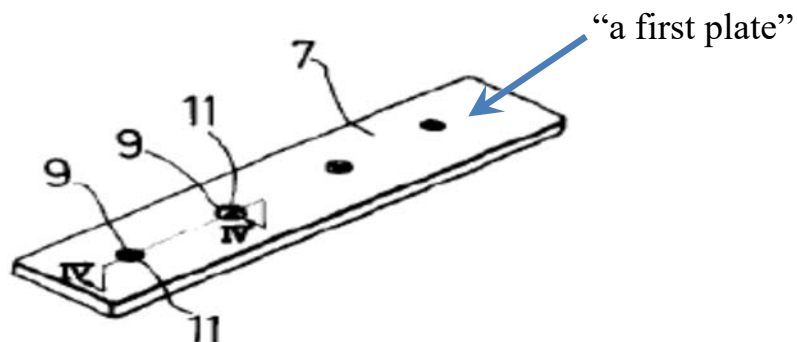
**2. “a first plate having a circumferential edge lip bounding an inner surface and”**

**a. “a first plate” and “an inner surface”**

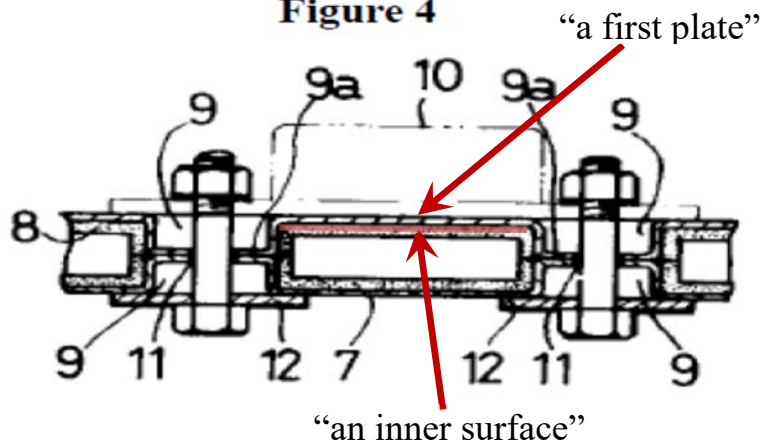
**Grounds 1&2:**

For the same reasons as stated above in Sections XI.B.2 and XI.B.3, Nakamura teaches “a first plate” and “an inner surface,” as shown below. (Pokharna,

**Figure 3**



**Figure 4**



¶79.)

**b. “a circumferential edge lip bounding an inner surface”**

**Ground 1:**

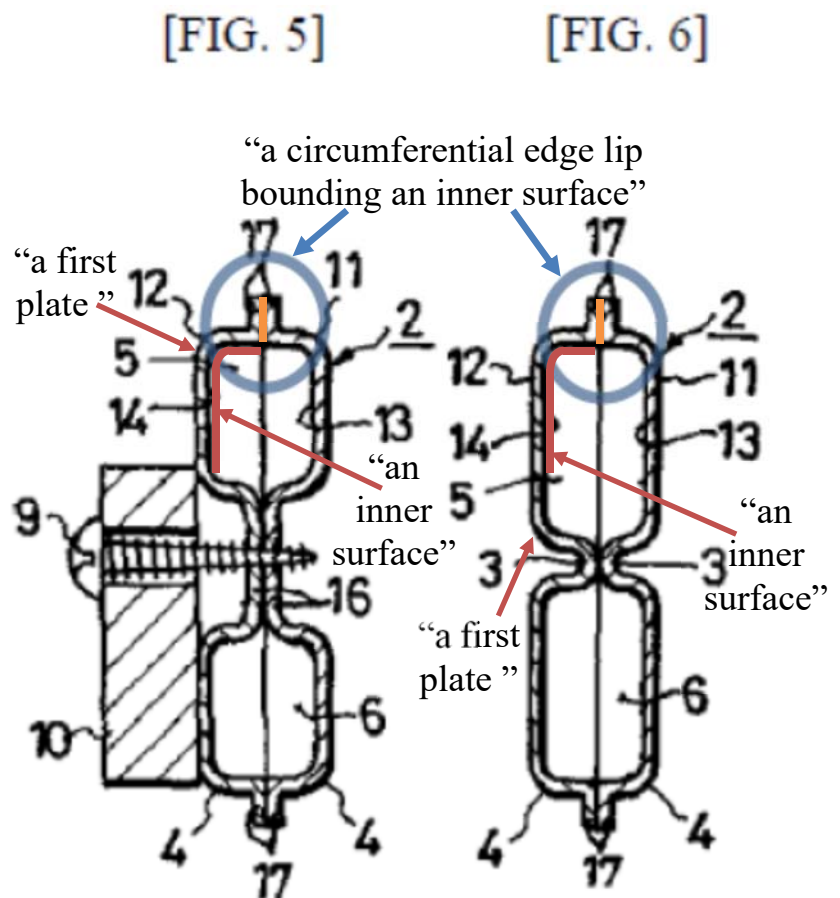
A person of ordinary skill in the art would also have understood and found obvious that the “circumferential edge lip” is “bounding an inner surface” in view of Nakamura at least under Petitioner’s proposed construction for “lip,” which is the “portion of the plate comprising a region bonded to another plate.” Here, a “circumferential edge lip” is nothing more than a “lip” located at a “circumferential edge” of the “first plate” by the term’s broadest reasonable interpretation. The ’680 patent acknowledges that “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.” (’680, 4:49-53 (emphasis added).) As discussed, Nakamura discloses that the “sealed container” is an “air-tight structure.” (Nakamura at 2.) That is, the first plate of the sealed container in Nakamura must provide the boundary of an inner surface by the “portion of the plate comprising a region bonded to another plate” located at the circumferential edge of the “sealed container of an air-tight structure.” (Nakamura at 2.) In other words, a POSITA would have understood and found obvious “a first plate having a circumferential edge lip bounding an inner surface.” (Pokharna, ¶80.)

**Ground 2:**

Further, it would have also been obvious for a skilled artisan to combine Nakamura with Takahashi to create “a circumferential edge lip bounding an inner surface.” As discussed above, a person skilled in the art would have been motivated to combine Nakamura and Takahashi in connection with the “lip” limitation. (See

Section IX.B.3.a “Motivation to combine Nakamura with Takahashi regarding the ‘lip’ limitation” above.) Takahashi discloses that “[t]he tips of the peripheral walls (4) and (4) of both plate members (11) and (12) are provided with flanges (17) and (17), respectively, where ... the flanges (17) and (17) at the tips of the

peripheral walls (4) and (4) of both plate members (11) and (12) ... are joined to each other by a vacuum brazing method to form a [sealed] container (2).” (Takahashi at 6:14-22.) As shown above, this “flange” (i.e., the “circumferential edge lip” in the ’680 patent) provides a boundary of the “inner surface” under both



Petitioner's and Patent Owner's claim construction proposals for "lip." Thus, Nakamura in view of Takahashi discloses or renders obvious "a first plate having a circumferential edge lip bounding an inner surface" (Pokharna, ¶81.)

3. **"at least one hollow column that is integral with said first plate and which projects outwardly relative to said inner surface;"**

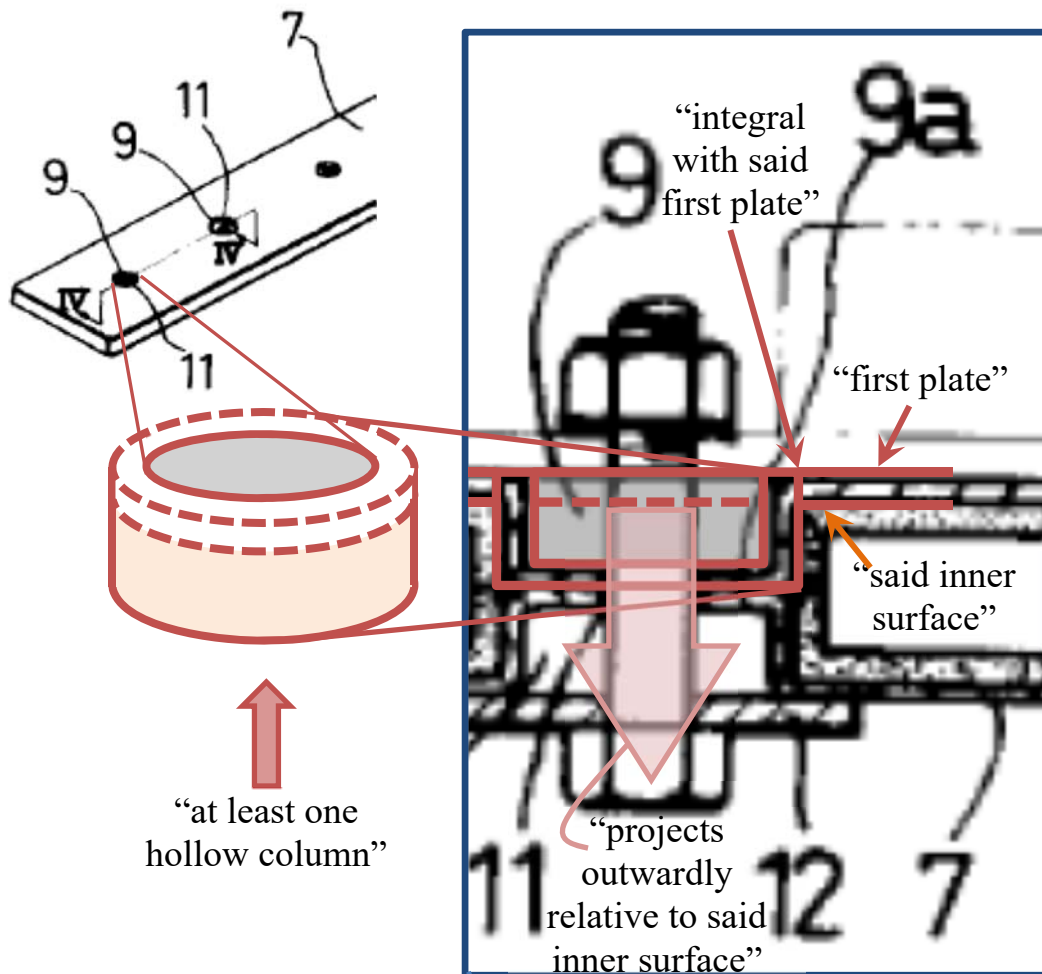
**Grounds 1&2:**

Nakamura discloses this limitation as follows. As shown below, Nakamura discloses "at least one hollow column that is integral with said first plate" as the "concavity" labeled as "9" (indicated in red). As also shown below, Nakamura discloses that this "hollow column ... projects outwardly relative so said inner surface" (indicated by the red arrow pointing down). This is because the "concavity" labeled as "9" in Nakamura extends downwardly in the direction that "said inner surface" (indicated in light orange and pointed to by the orange arrow) is facing towards, i.e., "outwardly relative to said inner surface," as shown below. Thus, Nakamura discloses "at least one hollow column that is integral with said first plate

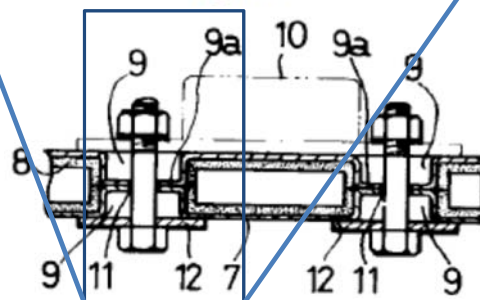


and which projects outwardly relative to said inner surface.” (Pokharna, ¶82.)

**Figure 3**

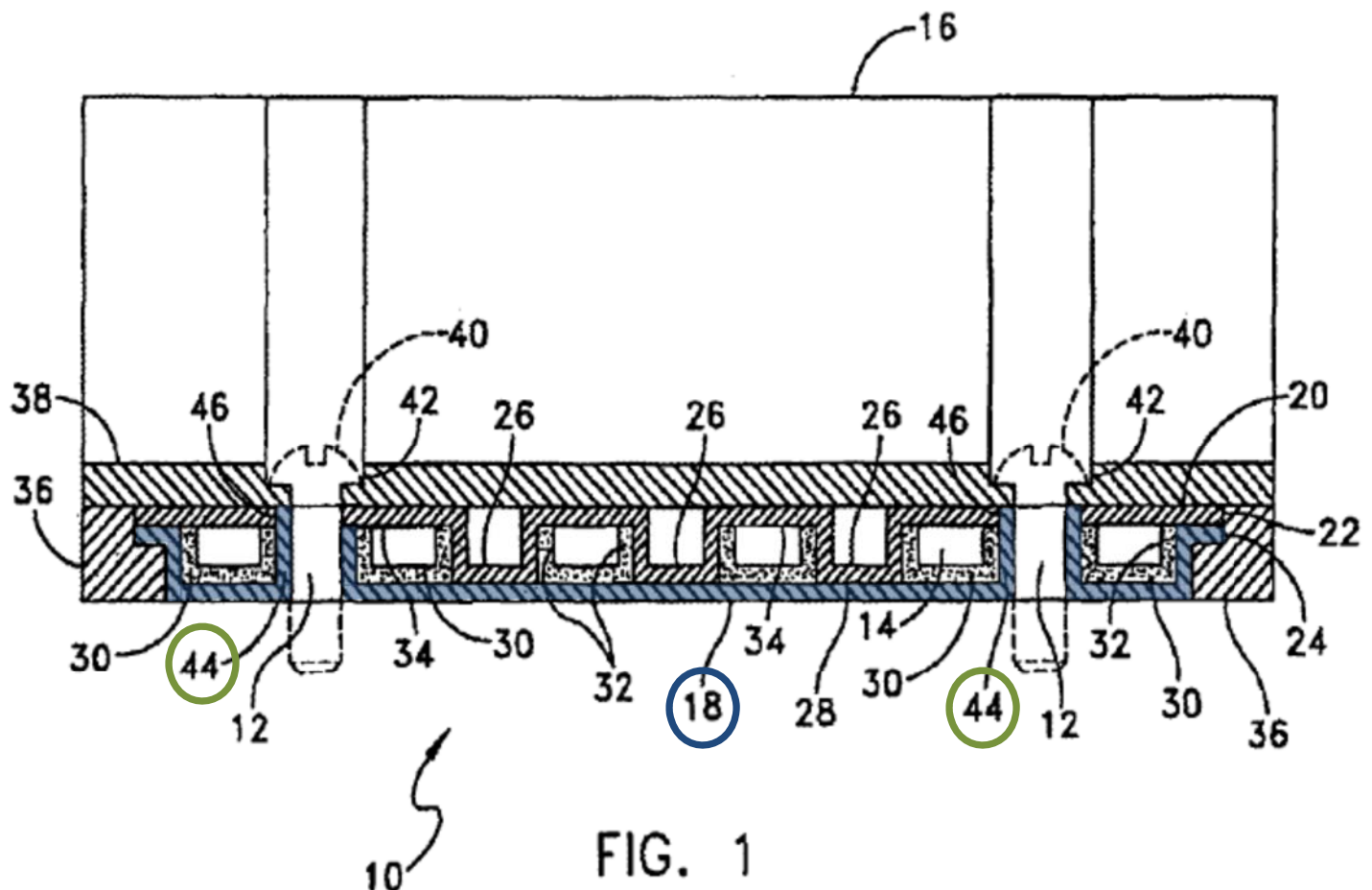


**Figure 4**



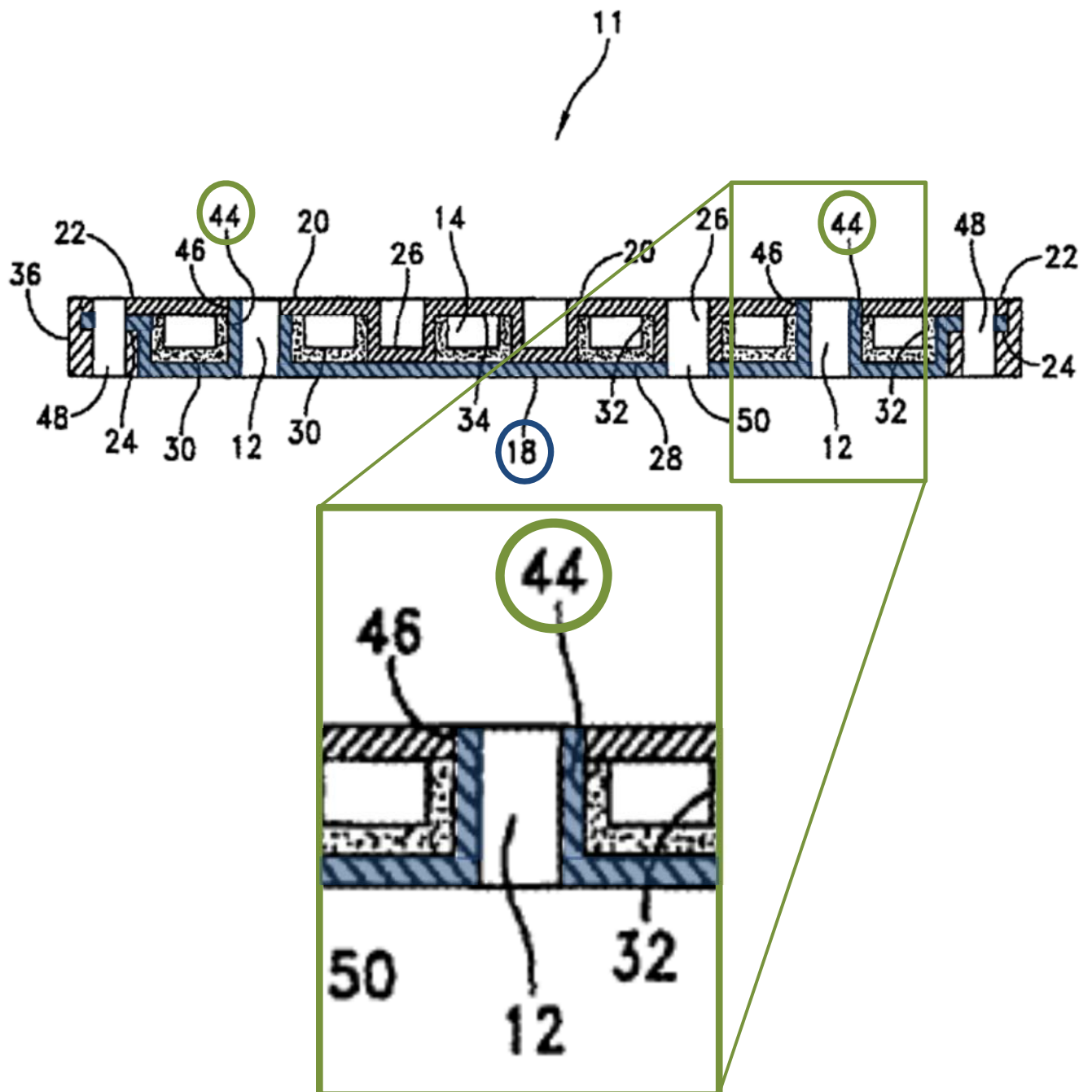
- a. The '680 patent discloses that the “hollow column” can be formed as part of a plate enclosing the “vapor chamber.”

Petitioner notes that the “hollow column” limitation can be met by a structure formed by one or both of the heat pipe’s plates, as disclosed in the '680 patent. In particular, the '680 patent discloses the hollow column as “columns 44” in which “holes 12” are located, as follows: “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 [sic]



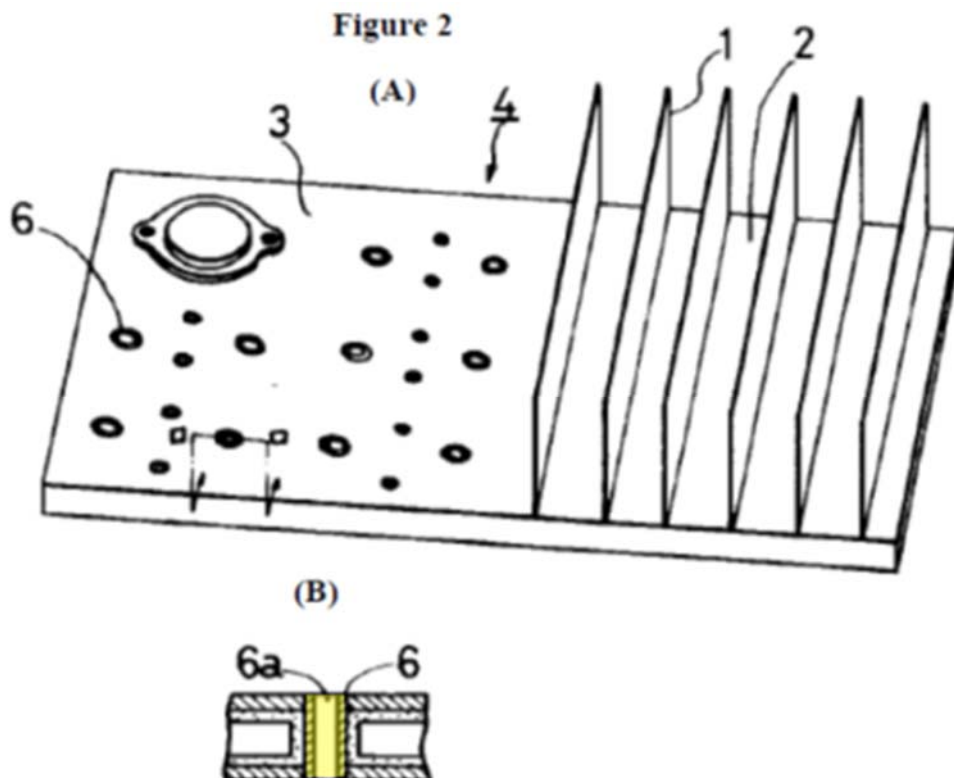
on the interior of heat pipe 10.” (’680, 4:25-30, Fig. 1.) (Pokharna, ¶83.)

As can be seen above in Figure 1 of the ’680 patent (reproduced and annotated above), columns “44” (circled in green) are formed as part of the (lower) contact plate “18” (indicated in blue). Figure 2 of the ’680 patent (reproduced below), again, shows



column “44” (circled in green) is formed as part of the (lower) contact plate “18” (indicated in blue). Thus, similarly, the upper plate in Nakamura can form “a columnar structure defining an unfilled or empty space” to meet the “hollow column” limitation. (Pokharna, ¶84.)

Petitioner also notes that Nakamura discloses another embodiment that meets the “hollow column” limitation in the ’680 patent, as indicated in yellow below. Specifically, Nakamura discloses that “as illustrated in Figure 2, a method of providing a through path 6a, blocked from an interior of the heat pipe by a metal pipe 6, in the heating portion 3 of the heat pipe 4 and directly mounting the component to be cooled to the heating portion 3 using the through path 6a is previously proposed by the present applicant as a ‘Heat Pipe’ (JP S48-63915).”



Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

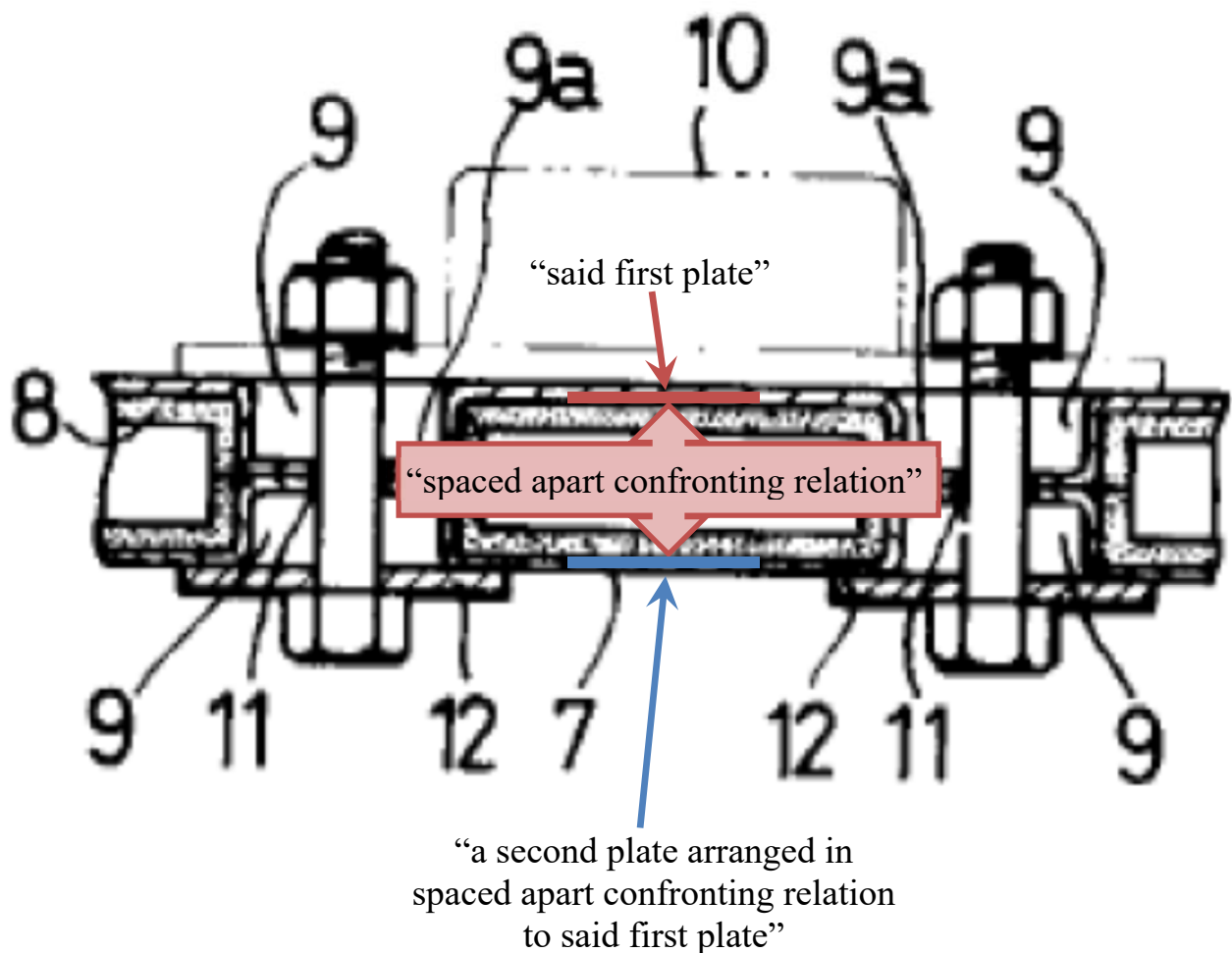
Nakamura at 3. Petitioner is not relying on this embodiment in Figure 2 directly as a separate ground to meet the “hollow column” limitation, but in his declaration, Dr. Pokharna discusses the embodiment in Nakamura’s Figure 2 as well as the actual “JP S48-63915” application, which has been attached hereto as Exhibit 1002. (Pokharna, ¶¶68-70, 85.) Petitioner also cites the related discussions in Dr. Pokharna’s declaration in **Section V** above to show this embodiment has been known in the industry since the 1970s.

4. “a second plate arranged in spaced apart confronting relation to said first plate and”

**Grounds 1&2:**

As shown below, Nakamura discloses this limitation by teaching “said first plate” (indicated in red) and “a second plate” (indicated in blue) that is “arranged in spaced apart confronting relation to said first plate.” (Pokharna, ¶86.)

**Figure 4**

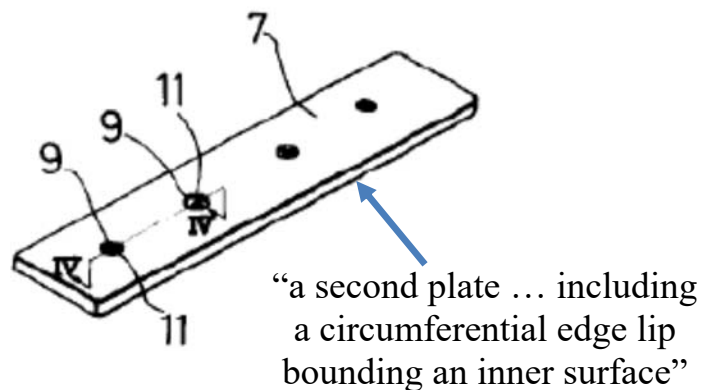


5. “a second plate ... including a circumferential edge lip bounding an inner surface and”

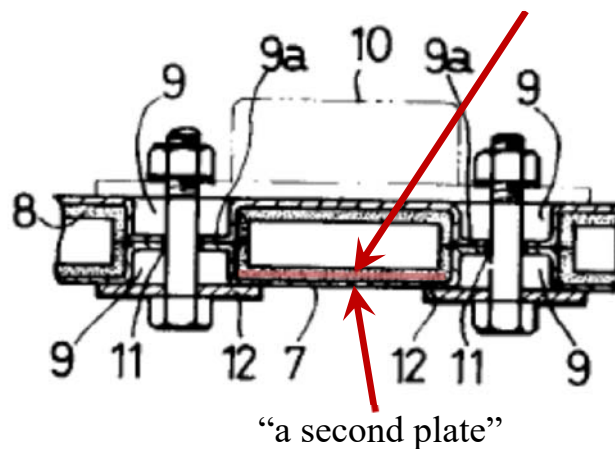
**Ground 1:**

For the same reasons as discussed in **Section X.C.2** above, a skilled artisan would have understood and found obvious “a second plate ... including a circumferential edge lip bounding an inner surface” in view of Nakamura at least under Petitioner’s proposed construction for “lip,” as shown below. (Pokharna, ¶87.)

**Figure 3**



**Figure 4** “an inner surface”

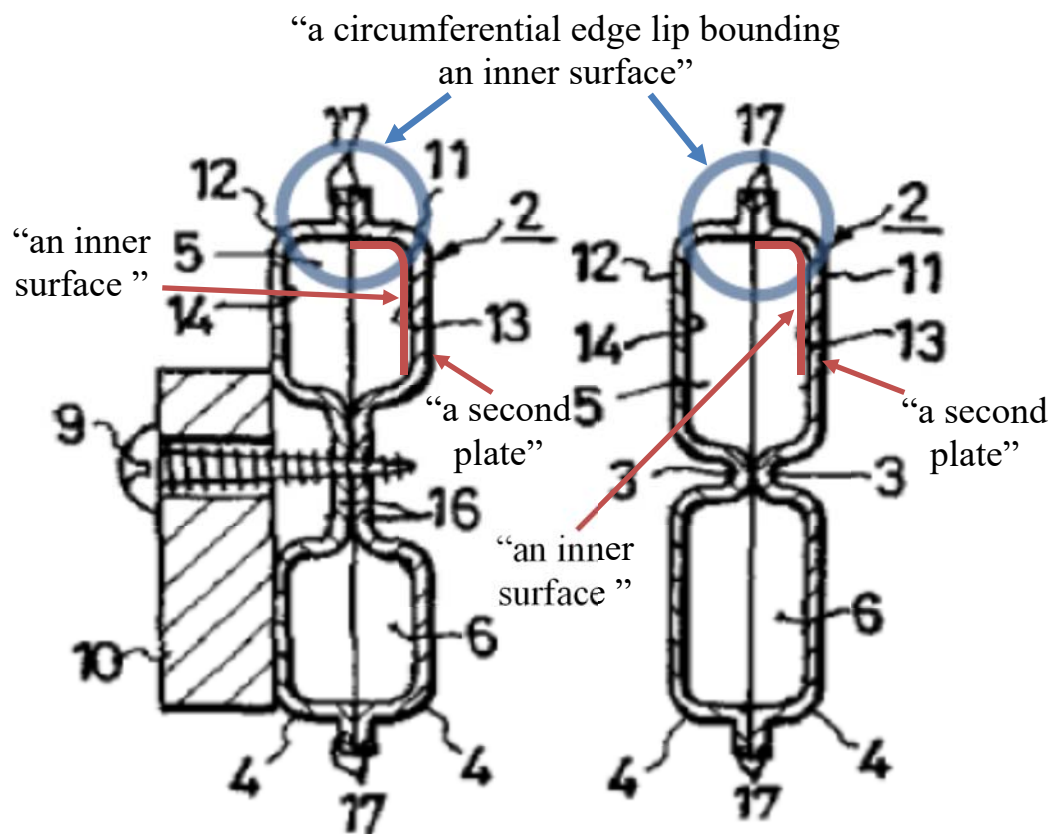


**Ground 2:**

For the same reasons stated in **Section X.C.2** above, it also would have been obvious for a skilled artisan to combine Nakamura with Takahashi to disclose this

[FIG. 5]

[FIG. 6]



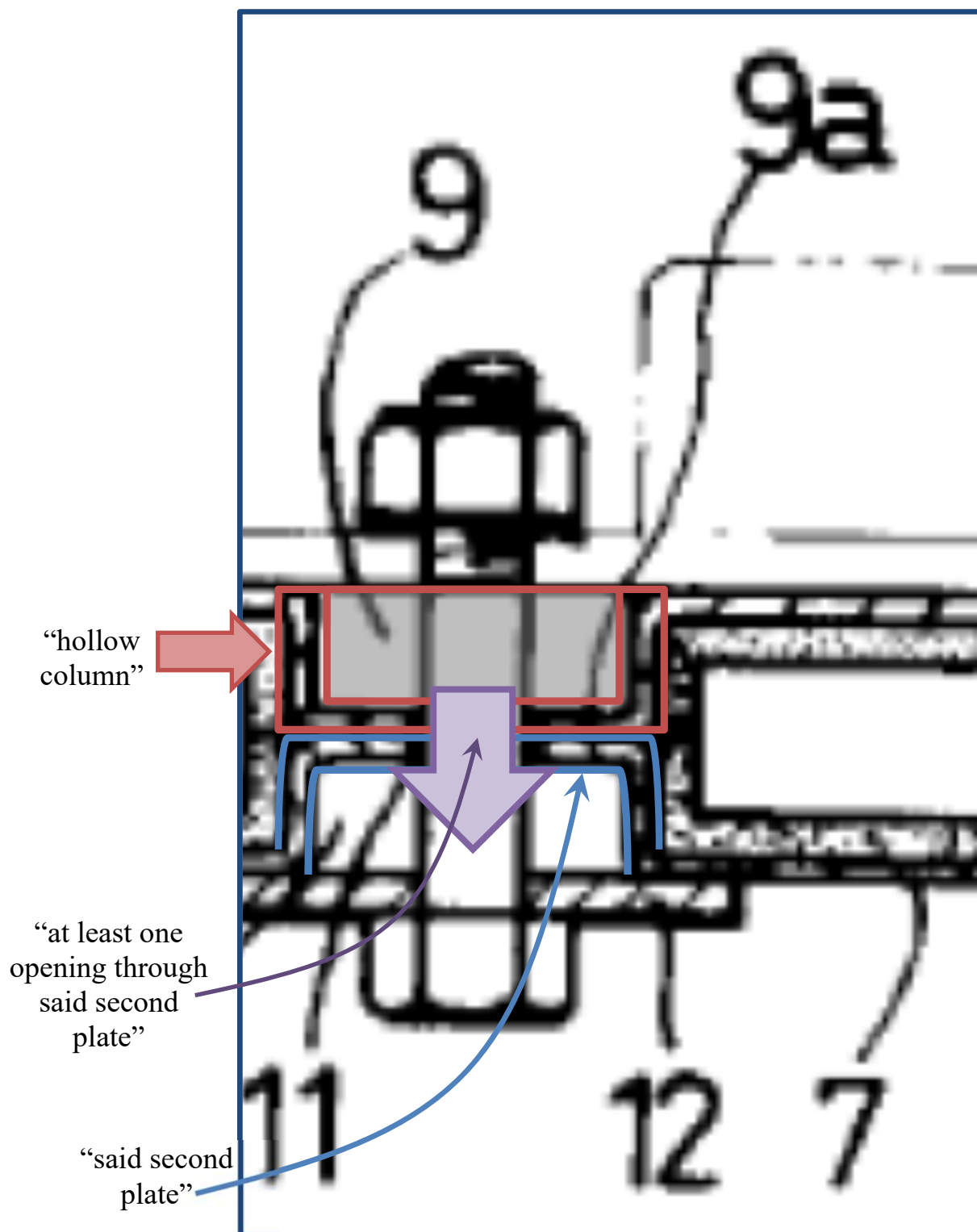
limitation under both Petitioner's and Patent Owner's claim construction proposals for "lip," as discussed above. (Pokharna, ¶88.)



**6. “at least one opening through said second plate”**

**Grounds 1&2:**

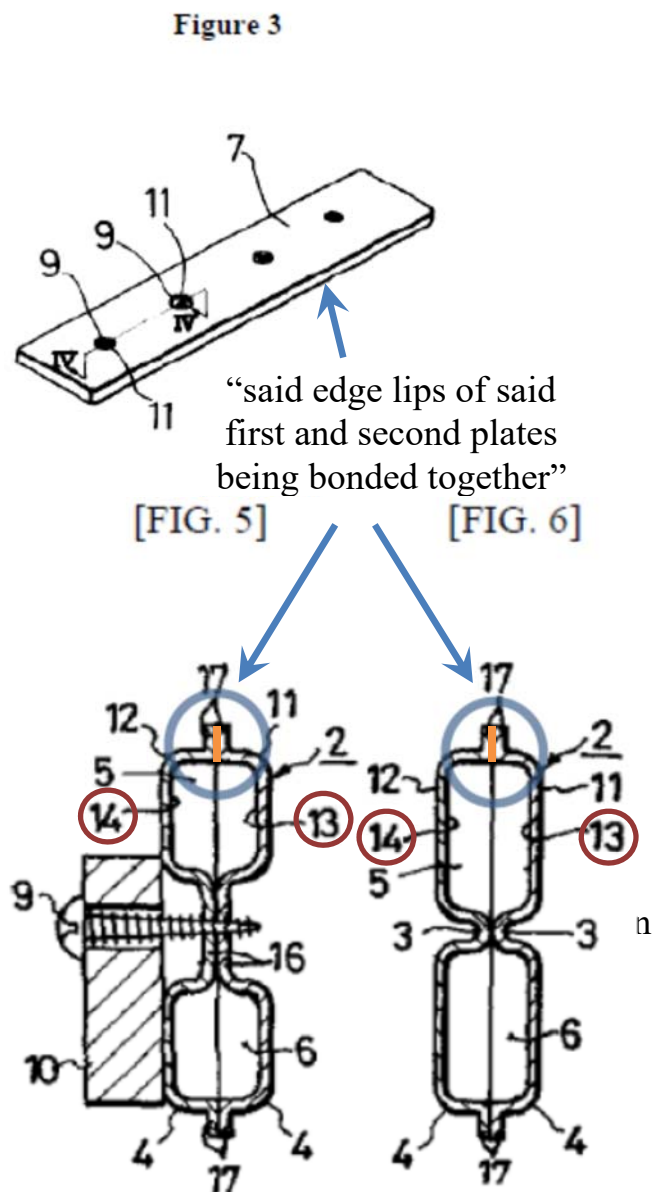
Nakamura discloses this limitation. As shown below, Nakamura discloses that its “hollow column” (the cylindrical, bowl-like structure in red) has “at least one opening” (in purple, facing down) that opens “through said second plate” (as indicated by the light purple arrow pointing down). The “said second plate” limitation is satisfied by the bottom plate in Nakamura (colored in blue). (Pokharna, ¶89.)



7. “said edge lips of said first and second plates being bonded together”

**Grounds 1&2:**

A skilled artisan would have found it obvious that Nakamura alone (Ground 1) or Nakamura in view of Takahashi (Ground 2) discloses this limitation for the same reasons as stated above in **Section IX.B.3** concerning “each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together.” See Nakamura at Figure 3 and Takahashi at Figs. 5-6. (Pokharna, ¶90.)



**8. “so as to define a vapor chamber; wherein”**

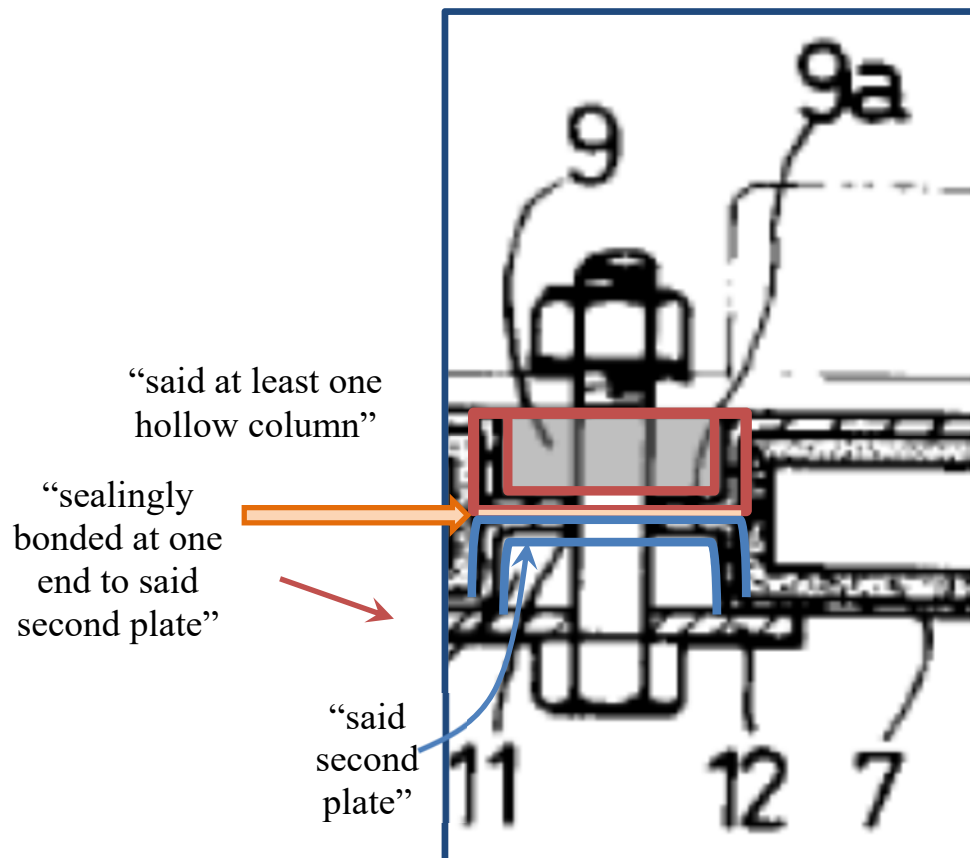
**Grounds 1&2:**

*See Section IX.B.4* above. (Pokharna, ¶91.)

**9. “a hollow column bonded at one end to said second plate”**

**Grounds 1&2:**

Nakamura discloses this limitation as follows. Nakamura discloses that “said



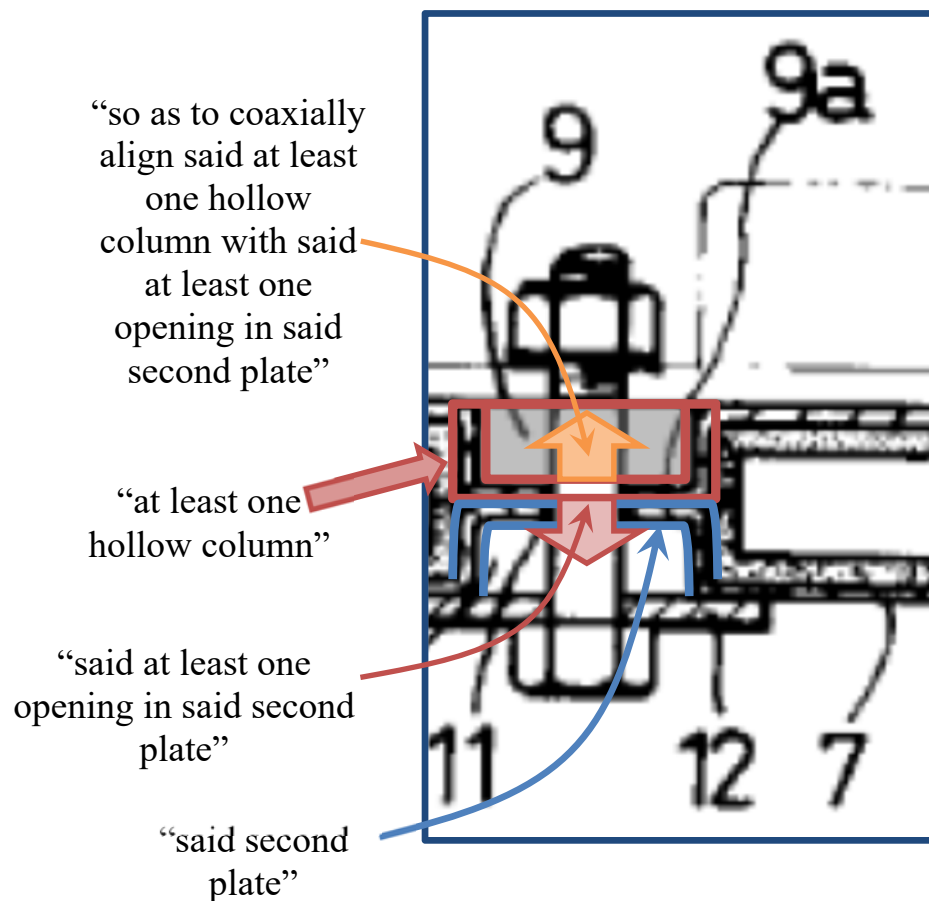
at least one hollow column” (indicated in red above) is “sealingly bonded at one end” (indicated in light orange above) “to said second plate” (indicated in blue above) by teaching that “[t]he concavity joining surfaces 9a can ... be readily and

reliably adhered by being pressurized and heated before and after work of forming the sealed container 7 by soldering or the like.” (Nakamura at 5.) (Pokharna, ¶¶92.)

**10. “so as to coaxially align said hollow column with one of said at least one openings in said second plate”**

**Grounds 1&2:**

Nakamura discloses this limitation as follows. As shown below, “said at least



one hollow column” (indicated in red) is bonded to “said second plate” (indicated in blue) “so as to coaxially align said at least one hollow column with said at least one opening in said second plate.” This is because, as Nakamura discloses, “holes 11 ...

can be drilled into the concavity joining surfaces 9a and installation can be performed via a bolt or the like.” (Nakamura at 6.) Thus, the “concavity joining surfaces” labeled as “9a” must be bonded to coaxially align the “concavity” labeled as “9” with the hole “11” for “component installation” on the second plate (indicated in blue). In other words, a POSITA would have understood and found it obvious to coaxially align said hollow column with one of said at least one openings in said second plate. (Pokharna, ¶93.)

11. **“thereby to form a mounting hole that extends through said first plate and said second plate and is isolated from said vapor chamber.”**

**Grounds 1&2:**

Nakamura discloses this limitation as follows. As shown below, the hole “11” for “component installation” in Nakamura extends through “said first plate” (indicated in red) and “said second plate” (indicated in blue). Further, Nakamura teaches that “[t]he concavity joining surfaces 9a can ... be readily and reliably adhered by being pressurized and heated before and after work of forming the sealed container 7 by soldering or the like.” (Nakamura at 5.) Thus, the hole “11” for “component installation” is isolated from the inside space of Nakamura’s “sealed container” labeled as “7.” That is, Nakamura discloses that “a mounting hole that extends through said first plate and said second plate and is isolated from said vapor chamber” (indicated below by the dark blue arrow on the right). (Pokharna, ¶94.)

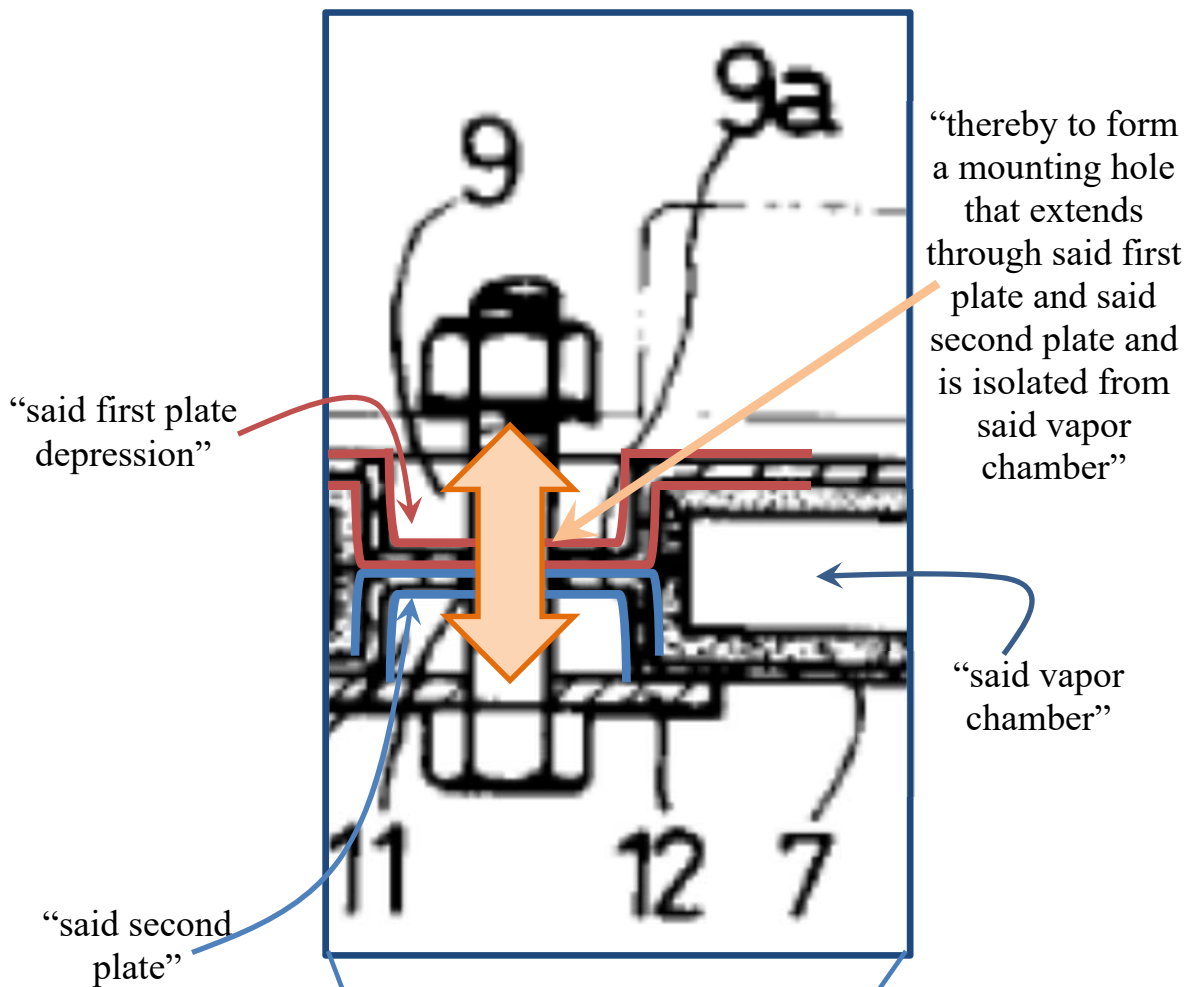
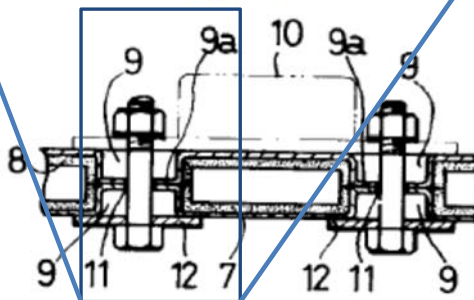


Figure 4



**D. Independent claim 3**

**1. Preamble: “A heat pipe for spreading heat comprising:”**

**Grounds 1&2:**

*See Section IX.C.1 above.* (Pokharna, ¶95.)

**2. “a first plate having a circumferential edge lip bounding an inner surface and”**

**Grounds 1&2:**

*See Section IX.C.2 above.* (Pokharna, ¶96.)

**3. “a depression which projects outwardly relative to said inner surface;”**

**Grounds 1&2:**

Nakamura discloses this limitation because its “concavity” labeled as “9” (indicated in red below) corresponds to the “depression” in the ’680 patent and extends downwardly in the direction that “said inner surface” is facing towards. That is, Nakamura’s “concavity” labeled as “9” extends “outwardly relative to said inner surface” (indicated by the red arrow pointing down), as shown below. Thus, Nakamura discloses “at least one depression which projects outwardly relative to said inner surface.” (Pokharna, ¶97.)



Figure 3

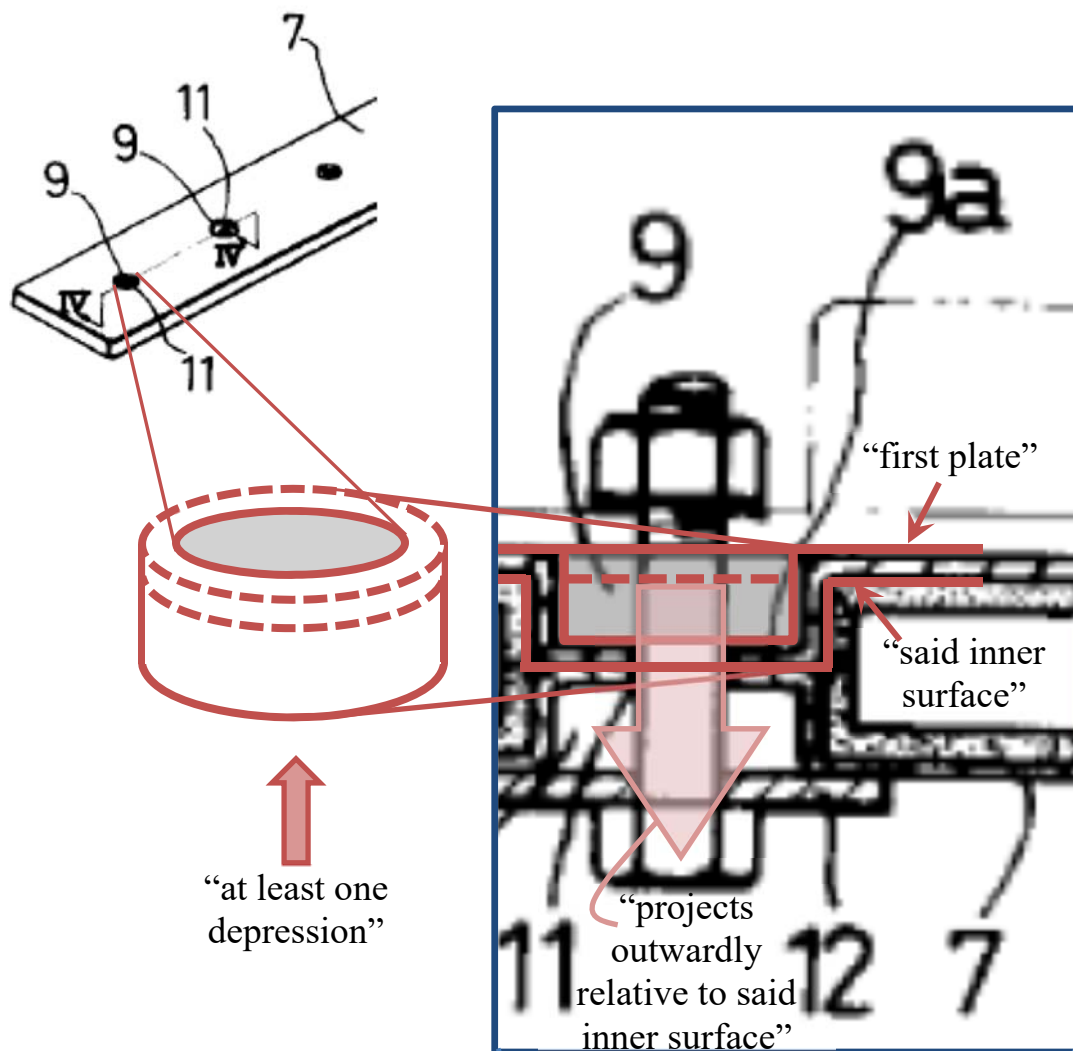
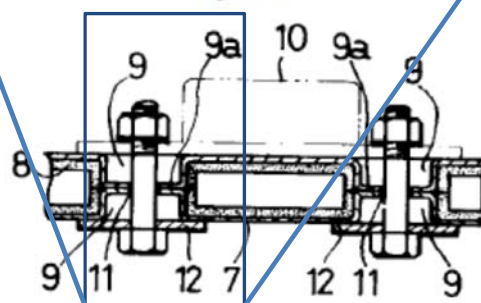


Figure 4



4. “a second plate arranged in spaced apart confronting relation to said first plate and”

**Grounds 1&2:**

*See Section IX.C.4 above.* (Pokharna, ¶98.)

5. “a second plate ... including a circumferential edge lip bounding an inner surface and”

**Grounds 1&2:**

*See Section IX.C.5 above.* (Pokharna, ¶99.)

6. “at least one opening through said second plate”

**Grounds 1&2:**

*See Section IX.C.6 above.* (Pokharna, ¶100.)

7. “said edge lips of said first and second plates being bonded together”

**Grounds 1&2:**

*See Section IX.C.7 above.* (Pokharna, ¶101.)

8. “so as to define an enclosed vapor chamber; wherein”

**Grounds 1&2:**

*See Section IX.C.8 above.* (Pokharna, ¶102.)

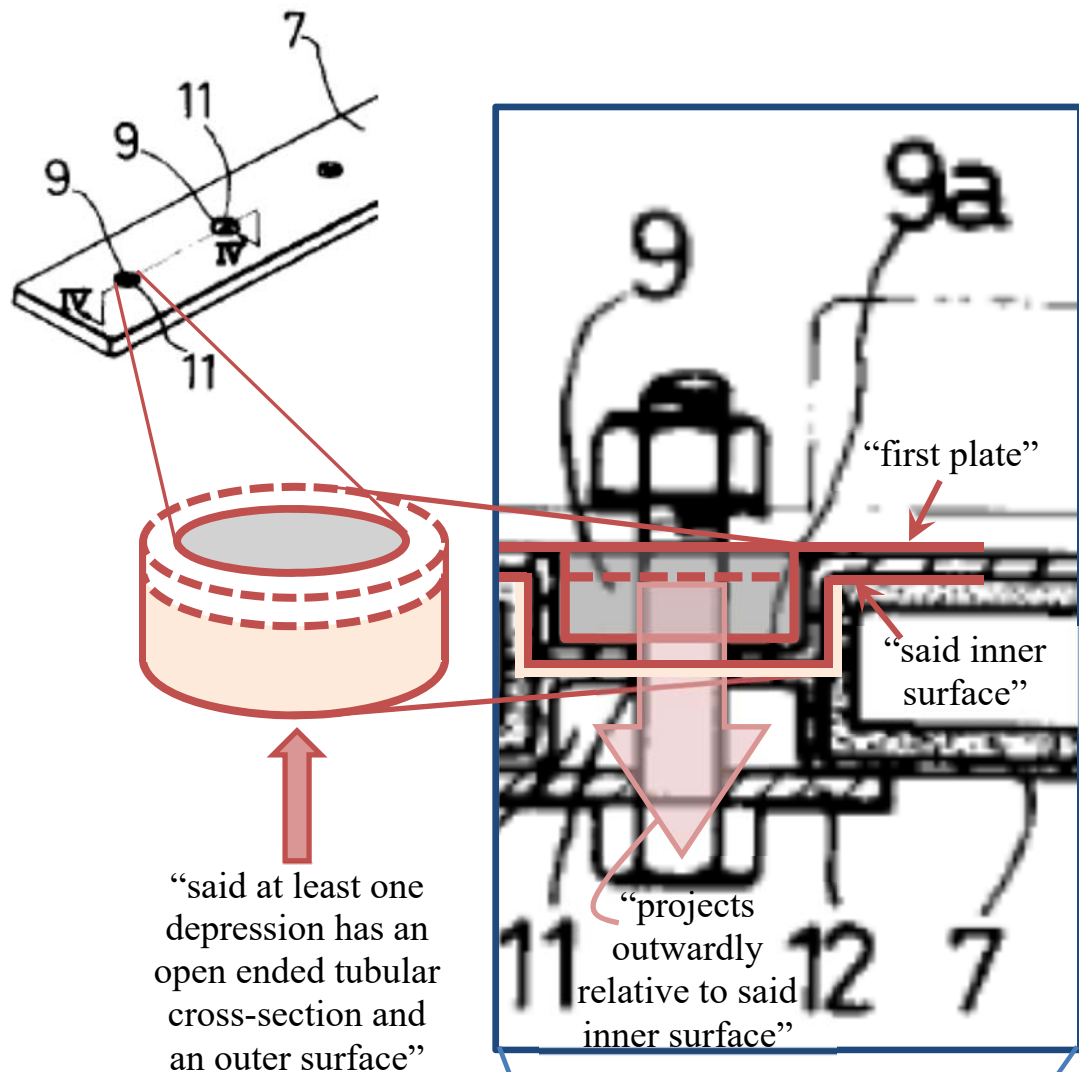
9. “said depression having an open ended tubular cross-section and an outer surface”

**Grounds 1&2:**

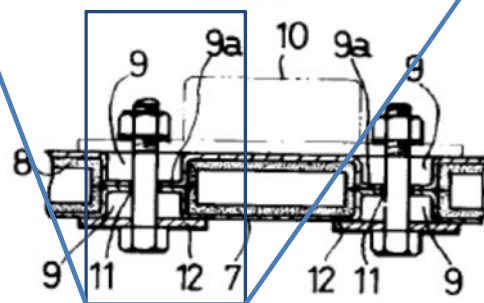
Nakamura discloses this limitation as follows. As shown below, Nakamura discloses that “said at least one depression” (indicated in red below) has an “open

ended tubular cross-section” (indicated in red below) and “an outer surface” (indicated in light orange). As shown below, the structure forming the “concavity” labeled as “9” (indicated in red) has a “tubular cross-section” because the structure (indicated in red) is shaped like a cylindrical bowl, thus having a cross-section shaped like a tube. Further, its top end of the structure is “open” upward, and its “outer surface” (in light orange) is relatively “outer” with respect to the inside of the structure forming the “concavity” labeled as “9.” Thus, the “depression” disclosed by Nakamura below “has an open ended tubular cross-section and an outer surface.” (Pokharna, ¶103.)

**Figure 3**



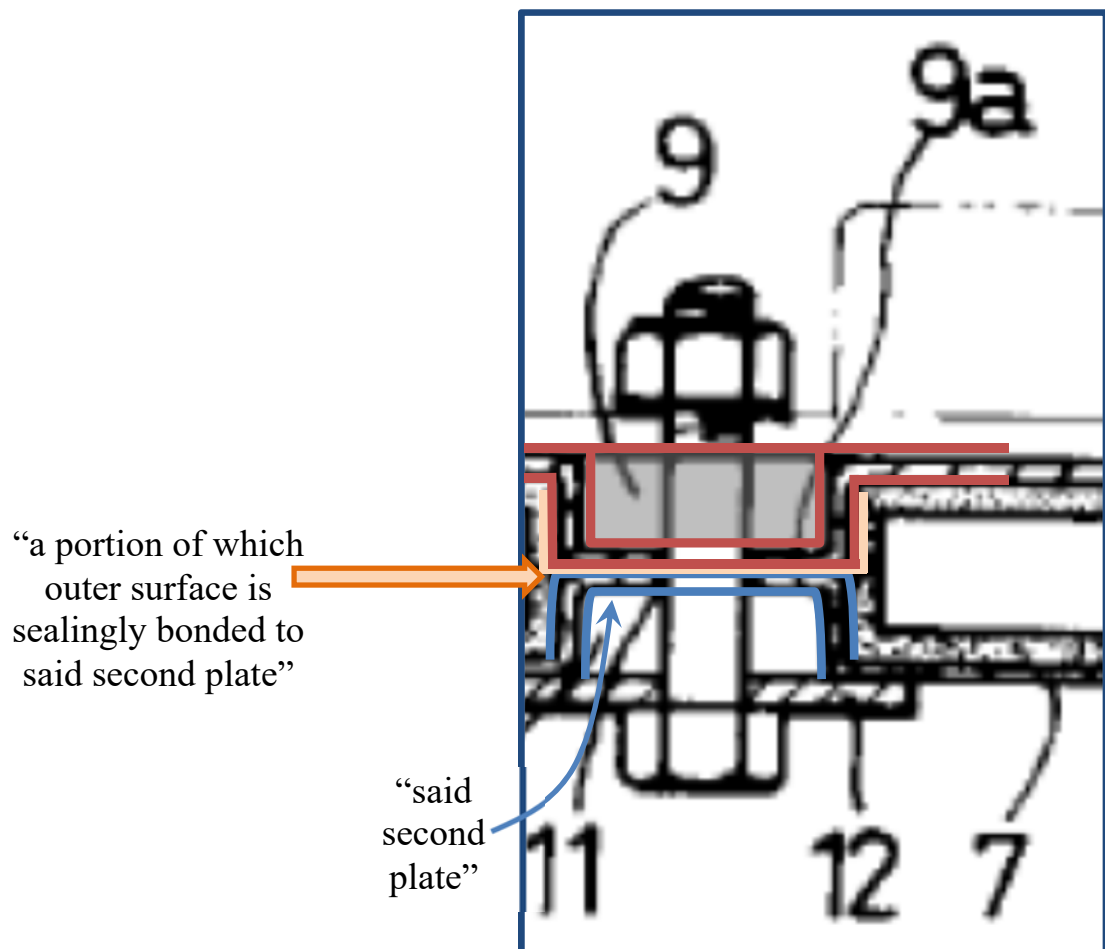
**Figure 4**



**10. “a portion of which outer surface is bonded to said second plate”**

**Grounds 1&2:**

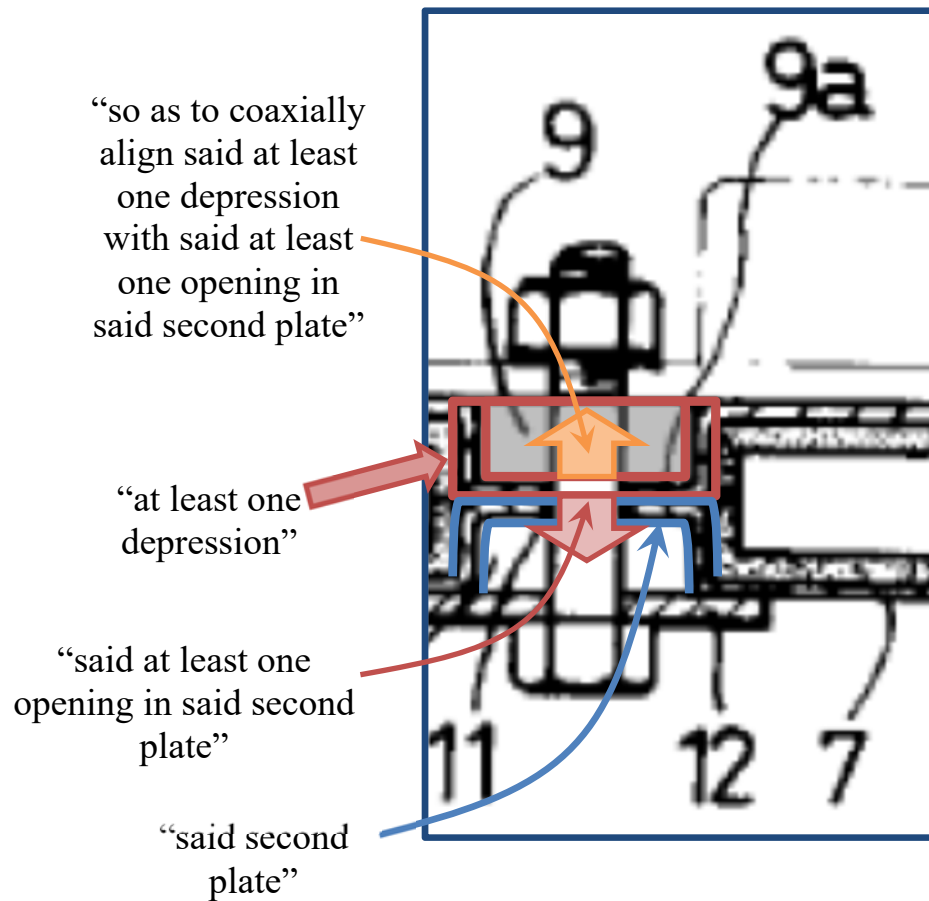
Nakamura discloses this limitation as follows. As shown below, at least the bottom part of the “outer surface” is “sealingly bonded to said second plate” (indicated in blue). This is because Nakamura teaches that “[t]he concavity joining surfaces 9a can ... be readily and reliably adhered by being pressurized and heated before and after work of forming the sealed container 7 by soldering or the like.” (Nakamura at 5.) Thus, Nakamura discloses this limitation. (Pokharna, ¶104.)



**11. “so as to coaxially align said depression with one of said at least one openings in said second plate”**

**Grounds 1&2:**

Nakamura discloses this limitation as follows. As shown below, “said at least



one depression” (indicated in red) is bonded to “said second plate” (indicated in blue) “so as to coaxially align said at least one depression with said at least one opening in said second plate.” This is because, as Nakamura discloses, a bolt must be able to “pierc[] the Hole 11” that goes through both the first and the second plates in the “concavity” labeled as “9” in Nakamura. Thus, the “concavity joining surfaces”

labeled as “9a” must be boned to coaxially align the “concavity” labeled as “9” with the hole “11” for “component installation” on the second plate (indicated in blue). In other words, a POSITA would have understood and found it obvious to “coaxially align said hollow column with one of said at least one openings in said second plate.” (Pokharna, ¶105.)

12. **“thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber.”**

**Grounds 1&2:**

Nakamura discloses this limitation as follows. As shown below, the hole “11” for “component installation” in Nakamura extends through “said first plate depression” (indicated in red) and “said second plate” (indicated in blue). Further, Nakamura teaches that “[t]he concavity joining surfaces 9a can ... be readily and reliably adhered by being pressurized and heated before and after work of forming the sealed container 7 by soldering or the like.” (Nakamura at 5.) Thus, the hole “11” for “component installation” is isolated from the inside space of Nakamura’s “sealed container” labeled as “7.” That is, Nakamura discloses that “a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber” (indicated below by the dark blue arrow on the right). (Pokharna, ¶106.)

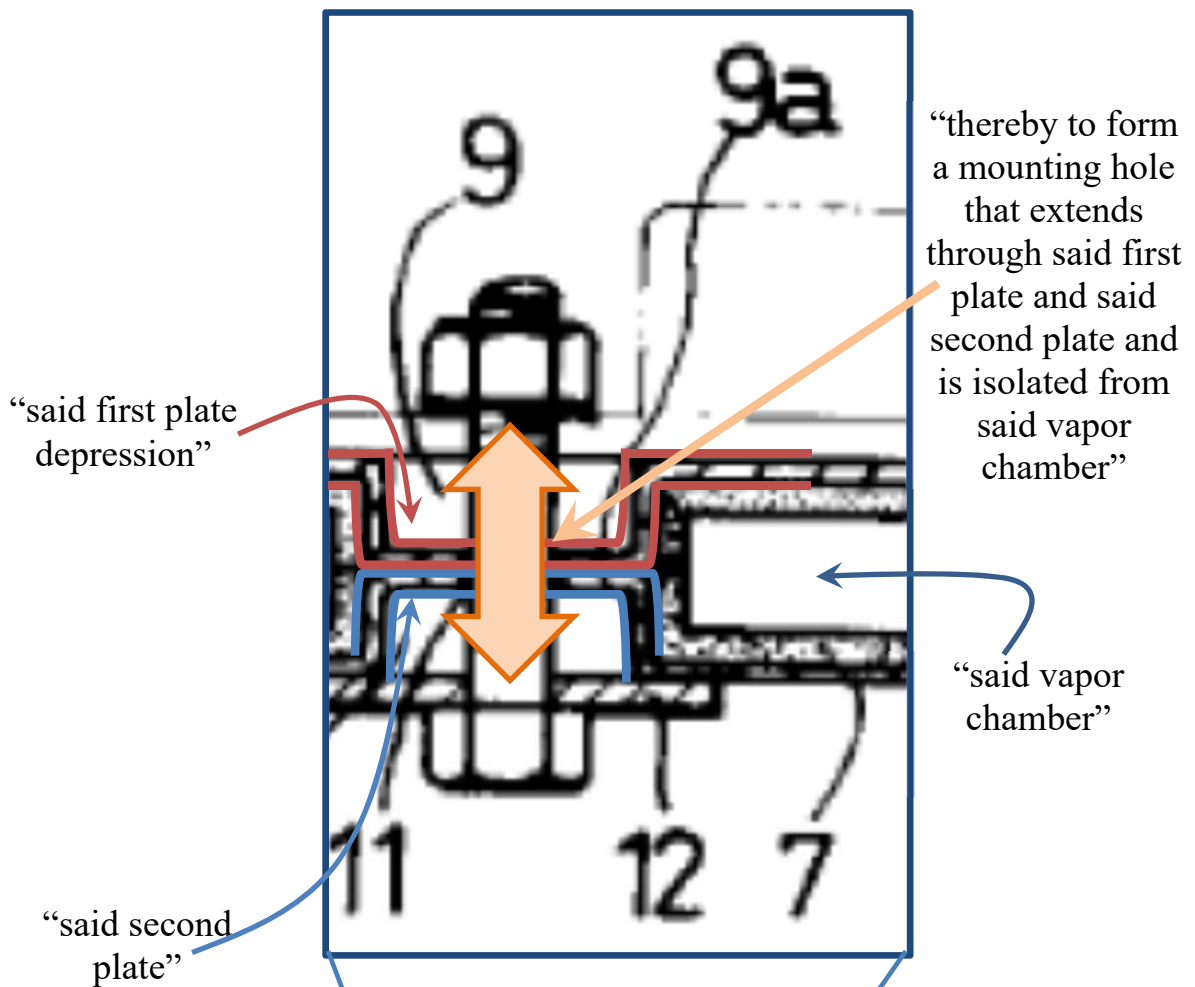
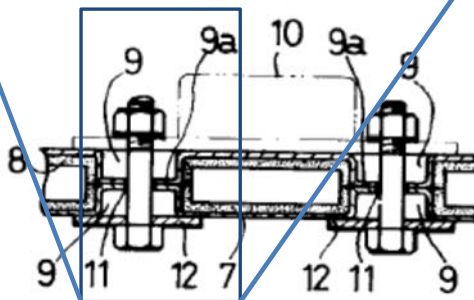


Figure 4





**X. CONCLUSION**

Petitioner respectfully requests institution of *inter partes* review of claims 1-3,  
and a finding that those claims are unpatentable.

Dated: October 31, 2018

COOLEY LLP  
ATTN: Patent Group  
1299 Pennsylvania Ave., NW, Suite 700  
Washington, DC 20004  
Tel: (703) 456-8000  
Fax: (703) 456-8100

Respectfully submitted,

By: /Erik B. Milch/  
Erik B. Milch  
Reg. No. 42,887  
Counsel for Petitioner

**CERTIFICATE OF COMPLIANCE WITH WORD COUNT**

Pursuant to 37 C.F.R. § 42.24(d), I certify that this petition complies with the type-volume limits of 37 C.F.R. § 42.24(a)(1)(i) because it contains 13,208 words, according to the word-processing system used to prepare this petition, excluding the parts of this petition that are exempted by 37 C.F.R. § 42.24(a) (including the table of contents, a table of authorities, mandatory notices, a certificate of service or this certificate word count, appendix of exhibits, and claim listings).

Dated: October 31, 2018

COOLEY LLP  
ATTN: Patent Group  
1299 Pennsylvania Ave., NW, Suite 700  
Washington, DC 20004  
Tel: (703) 456-8000  
Fax: (703) 456-8100

Respectfully submitted,

By: /Erik B. Milch/  
Erik B. Milch  
Reg. No. 42,887  
Counsel for Petitioner

**CERTIFICATE OF SERVICE**

I hereby certify, pursuant to 37 C.F.R. Sections 42.6 and 42.105, that a complete copy of the attached **PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 7,100,680**, including all exhibits (**Nos. 1001-1025**) and related documents, are being served on October 31, 2018, the same day as the filing of the above-identified document in the United States Patent and Trademark Office/Patent Trial and Appeal Board, via Federal Express upon the Patent Owner by serving the correspondence address of record with the USPTO as follows:

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

and, via Federal Express upon counsel of record for the Patent Owner in the litigation pending before the U.S. District Court for the Northern District of California entitled *Aavid Thermalloy LLC, v. Cooler Master Co., LTD. and CMI USA, Inc.*, Case No. 4:17-cv-05363-JSW as follows:

Frank L. Bernstein  
Squire Patton Boggs (US) LLP  
1801 Page Mill Road, Suite 110  
Palo Alto, CA 94304  
frank.bernstein@squirepb.com

Jonathan H. Margolies  
Michael Best & Friedrich LLP  
100 E. Wisconsin Avenue, Suite 3300  
Milwaukee, WI 53202-4108  
jhmargolies@michaelbest.com

J. Donald Best  
Kenneth M. Albridge III  
Michael Best & Friedrich LLP  
One South Pinckney Street, Suite 700  
Madison, WI 53703  
jdbest@michaelbest.com  
kmalbridge@michaelbest.com

Petition for *Inter Partes* Review of  
U.S. Patent No. 7,100,680

DATED: OCTOBER 31, 2018

COOLEY LLP  
ATTN: Erik B. Milch  
1299 Pennsylvania Ave. NW,  
Suite 700  
Washington, D.C. 20004  
Tel: (703) 456-8000  
Fax: (703) 456-8100

/Erik B. Milch/  
Erik B. Milch  
Reg. No. 42,887