

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COOLER MASTERS CO., LTD.,
Petitioner,

v.

AAVID THERMALLOY LLC,
Patent Owner.

IPR2019-00337
Patent 7,066,240 B2

Before LINDA E. HORNER, KEN B. BARRETT, and
ROBERT A. POLLOCK, *Administrative Patent Judges*.

HORNER, *Administrative Patent Judge*.

JUDGMENT

Final Written Decision

Determining Some Challenged Claims Unpatentable

35 U.S.C. § 318(a)

Denying-in-Part, Dismissing-in-Part, Patent Owner's Motion to Exclude

37 C.F.R. § 42.64(c)

I. INTRODUCTION

A. Background and Summary

Cooler Masters Co., Ltd., (“Petitioner”)¹ filed a Petition requesting *inter partes* review of U.S. Patent No. 7,066,240 B2 (“the ’240 patent,” Ex. 1001). Paper 2 (“Pet.”). The Petition challenges the patentability of claims 9–13 of the ’240 patent (“the challenged claims”) on the grounds of obviousness under 35 U.S.C. § 103. Petitioner asserts four grounds of unpatentability. *Id.* at 5. Aavid Thermalloy LLC (“Patent Owner”)² filed a Preliminary Response to the Petition. Paper 6 (“Prelim. Resp.”). On June 23, 2019, the Board instituted *inter partes* review of all the challenged claims on all of the asserted grounds. Paper 7 (“Inst. Dec.”), 45.

Subsequently, Patent Owner filed a Response (Paper 23, “PO Resp.”) to the Petition, Petitioner filed a Reply (Paper 28, “Pet. Reply”) to the Patent Owner Response, and Patent Owner filed a Sur-Reply (Paper 34, “PO Sur-Reply”). An oral hearing was held on March 5, 2020, and a transcript of the hearing is included in the record. Paper 48 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a). After consideration of the parties’ arguments and evidence, and for the reasons discussed below, we determine that Petitioner has not shown by a preponderance of the evidence that claims 11 and 12 of the ’240 patent are unpatentable, but Petitioner has shown by a preponderance of the evidence that claims 9, 10

¹ Petitioner identifies itself and CMI USA, Inc. as the real parties in interest. Pet. 1.

² Patent Owner identifies itself as the real party in interest and states that it is “wholly owned by LTI Holdings Inc. (d/b/a Boyd Corporation), which is wholly owned by Basilisk Holdings Inc.” Paper 4, 2.

and 13 of the '240 patent are unpatentable. We also deny, in part, Patent Owner's Motion to Exclude and dismiss as moot the remainder of the motion.

B. Related Matters

One or both parties identify, as matters involving or related to the '240 patent, *Aavid Thermalloy LLC v. Cooler Master Co.*, Case No. 4:17-cv-05363 (N.D. Cal.), and Patent Trial and Appeal Board cases IPR2019-00144, IPR2019-00145, IPR2019-00146, IPR2019-00147, IPR2019-00333, IPR2019-00334, IPR2019-00337, and IPR2019-00338. Pet. 1–2; Paper 4, 2. IPR2019-00144 was filed by Petitioner and involves a challenge to claims 9–13 of the '240 patent. The remaining *inter partes* reviews were filed by Petitioner and involve challenges to patents related to the '240 patent. The Board instituted each of these *inter partes* reviews, except for IPR2019-00145, IPR2019-00147, and IPR2019-00333.

C. The '240 Patent

The '240 patent is titled “Integrated Circuit Heat Pipe Heat Spreader with Through Mounting Holes.” Ex. 1001, code (54). According to the Specification, “[t]his invention relates generally to active solid state devices, and more specifically to a heat pipe for cooling an integrated circuit chip, with the heat pipe designed to be held in direct contact with the integrated circuit.” *Id.* at 1:10–13.

The disclosed heat pipe “is constructed to assure precise flatness and to maximize heat transfer from the heat source and to the heat sink, and has holes through its body to facilitate mounting.” *Id.* at 1:57–60. The heat pipe “requires no significant modification of the circuit board or socket because it is held in intimate contact with the integrated circuit chip by conventional screws attached to the integrated circuit mounting board.” *Id.* at 1:61–65.

“[T]he same screws which hold the heat spreader against the chip can also be used to clamp a finned heat sink to the opposite surface of the heat spreader.” *Id.* at 1:67–2:2. The heat pipe further includes spacers:

The internal structure of the heat pipe is an evacuated vapor chamber with a limited amount of liquid and includes a pattern of spacers extending between and contacting the two plates or any other boundary structure forming the vapor chamber. The spacers prevent the plates from bowing inward, and therefore maintain the vital flat surface for contact with the integrated circuit chip. These spacers can be solid columns, embossed depressions formed in one of the plates, or a mixture of the two.

Id. at 2:3–11. The spacers “support the flat plates and prevent them from deflecting inward and distorting the plates to deform the flat surfaces which are required for good heat transfer.” *Id.* at 2:18–21. Through holes are provided through the heat pipe via the spacers:

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

Id. at 2:29–40.

Figure 1 is reproduced below.

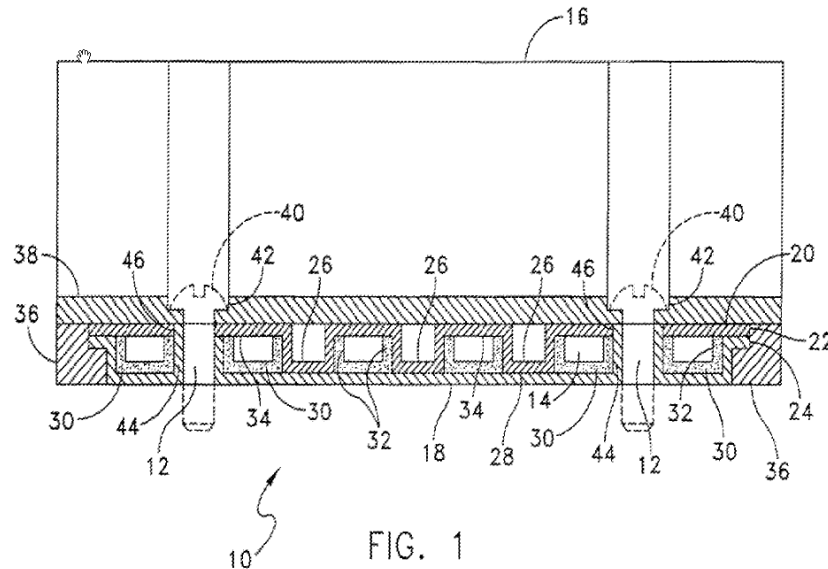


Figure 1 shows “a cross section view of the preferred embodiment of a flat plate heat pipe 10 of the invention with through holes 12 through its vapor chamber 14 and in contact with finned heat sink 16.” *Id.* at 3:21–24. “When heat pipe 10 is used to cool an integrated circuit chip (not shown) which is held against contact plate 18, cover plate 20 is held in intimate contact with fin plate 38, to which fins 16 are connected.” *Id.* at 4:9–12. “Heat pipe 10 is constructed by forming a boundary structure by sealing together two formed plates, contact plate 18 and cover plate 20.” *Id.* at 3:25–27. “Contact plate 18 and cover plate 20 are sealed together at their peripheral lips 22 and 24 by conventional means, such as soldering or brazing, to form heat pipe 10.” *Id.* at 3:27–30. The components are assembled as follows:

The entire assembly of heat pipe 10, frame 34, and fin plate 38 is held together and contact plate 18 is held against an integrated circuit chip by conventional screws 40, shown in dashed lines, which are placed in holes 42 in fin plate 38 and through holes 12 in heat pipe 10, and are threaded into the mounting plate (not shown) for the integrated circuit chip.

Id. at 4:12–18. The holes lie within sealed structures of the heat pipe:

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 [e]ffect on the interior of heat pipe 10.

Id. at 4:19–24.

In addition to the preferred embodiment described above, the Specification describes an alternate embodiment. *Id.* at 2:41–53.

This [alternate] embodiment forms the through holes in the solid boundary structure around the outside edges of the two plates. This region of the heat pipe is by its basic function already sealed off from the vapor chamber by the bond between the two plates, and the only additional requirement for forming a through hole within it is that the width of the bonded region be larger than the diameter of the hole.

Id. at 2:44–51. The Specification explains that, “with the holes located in the peripheral lips, the heat pipe boundary structure can be any shape.” *Id.* at 2:51–53. Figure 2 is reproduced below.

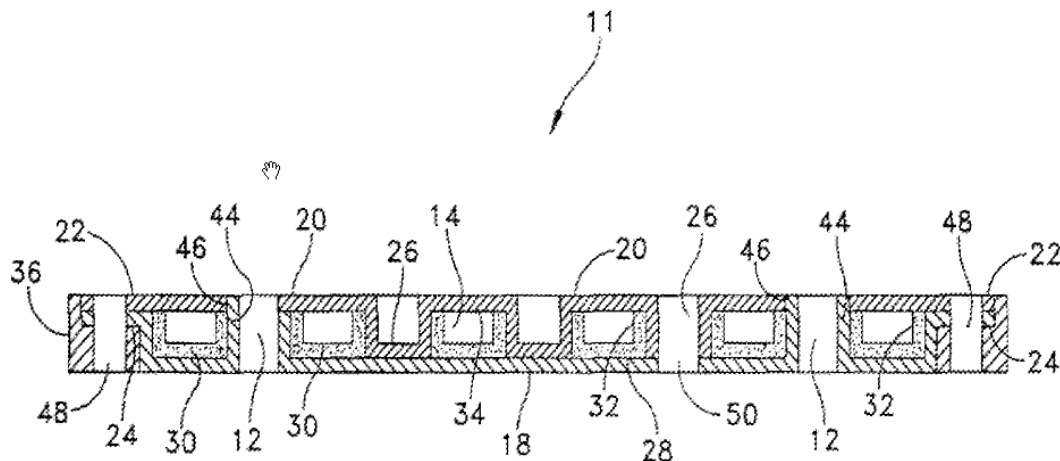


Figure 2 “is a cross section view of an alternate embodiment of the flat plate heat pipe 11 of the invention with through holes 48 located within peripheral lips 22 and 24 of the heat pipe and hole 50 shown in another sealed

structure, one of the depressions 26.” *Id.* at 4:36–40. “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.” *Id.* at 4:43–48.

D. Illustrative Claims

Of the challenged claims, claims 9, 11, 12, and 13 are independent. Claims 9 and 13 are illustrative and are reproduced below.

9. A heat pipe for spreading heat comprising:

a boundary structure including spaced-apart first and second plates that define an enclosed vapor chamber;

at least one hollow column having an exterior surface positioned within said vapor chamber with a first portion of said exterior surface sealingly bonded to at least one of said first and second plates, and having an open first end that opens through said first plate and an open second end that opens through said second plate so as to form at least one mounting hole that is isolated from said vapor chamber.

13. A heat pipe for spreading heat comprising:

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

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

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

Ex. 1001, 6:12–22, 7:7–24.

E. Evidence

Petitioner relies on the following references in the asserted grounds of unpatentability.

Reference	Date	Exhibit No.
Japanese Examined Utility Model Application Publication No. S53-32387 Y; Published August 11, 1978; Inventors: Takao Morikawa, Mitsuhiro Nakata (as translated) (“Morikawa”) ³	Aug. 11, 1978	1003
Japanese Unexamined Utility Model Application S50-55262; Year of Publication: 1975; Inventor: Kazuo Nakamura (as translated) (“Nakamura”) ⁴	1975	1004
Japanese Examined Utility Model Application Publication No. H8-10205; Published March 27, 1996; Inventors: Tadahito Takahashi, Kaoru Hasegawa, Muneaki Sokawa (as translated) (“Takahashi”) ⁵	Mar. 27, 1996	1005

Petitioner also relies on the Declaration of Dr. Himanshu Pokharna (Ex. 1002), the Supplemental Declaration of Dr. Himanshu Pokharna (Ex. 1032), the Declaration of Sylvia D. Hall-Ellis, Ph.D. (Ex. 1039), and the Declaration of Takao Miyano (Ex. 1044) in support of its arguments.

Patent Owner relies on the Declaration of Amir Faghri, Ph.D., (Ex. 2002) in support of its arguments. Patent Owner also provides an independent certified translation of Nakamura, a translation of Nakamura

³ Exhibit 1003 includes both the original Japanese-language publication and the English-language translation of Morikawa.

⁴ Exhibit 1004 includes both the original Japanese-language publication and the English-language translation of Nakamura.

⁵ Exhibit 1005 includes both the original Japanese-language publication and the English-language translation of Takahashi.

relied on by Petitioner in the related district court litigation, and two machine translations of Nakamura. Exs. 2012–2015.

The parties rely on other exhibits as discussed below.

F. Prior Art and Asserted Grounds

Petitioner asserts the following grounds of unpatentability in the Petition:

Claim(s) Challenged	35 U.S.C. §	Reference(s)
9, 10, 12	103(a) ⁶	Morikawa
9, 10	103(a)	Morikawa, Nakamura
12	103(a)	Morikawa, Takahashi
11, 13	103(a)	Morikawa, Takahashi, Nakamura

II. ANALYSIS

A. Legal Standards

Petitioner bears the burden of proving unpatentability of the claims challenged in the Petition, and that burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must establish by a preponderance of the evidence that the challenged claims are unpatentable. 35 U.S.C. § 316(e) (2018); 37 C.F.R. § 42.1(d) (2018).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406

⁶ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the application from which the ’240 patent issued was filed before this date, the pre-AIA version of § 103 applies.

(2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) any objective evidence of non-obviousness.⁷ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

In determining the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (internal quotation marks and citation omitted).

Petitioner, relying on Dr. Pokharna’s testimony, asserts that the person of ordinary skill in the art at the time of the invention 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.

Pet. 10 (citing Ex. 1002 ¶¶ 8–10).

Relying on Dr. Faghri’s testimony, Patent Owner argues for a lower level of skill in the art than that proposed by Petitioner. PO Resp. 11–12. In particular, Patent Owner disagrees with Petitioner’s requirement for an advanced degree in mechanical engineering or a closely-related field as it would, for example, exclude both the named inventors of the ’240 patent as

⁷ The parties have not directed our attention to any objective evidence of non-obviousness.

well as “a large majority of active workers in the field at the time of the invention.” *Id.* (citing Ex. 2002 ¶ 80). Rather, Patent Owner contends that the person of ordinary skill in the art at the time of the invention would have “a Bachelor of Science degree in engineering and at least 3 years of experience working or studying in the field of heat pipes; or an equivalent level of education, training, and work experience.” *Id.* at 11 (citing Ex. 2002 ¶¶ 77–79).

We determine that the definition offered by Petitioner and Dr. Pokharna comports with the qualifications a person would have needed to understand and implement the teachings of the ’240 patent and the prior art of record. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (recognizing that the prior art itself may reflect an appropriate level of skill in the art). Moreover, Petitioner concedes that this dispute as to the appropriate level of skill in the art “is immaterial because the challenged claims are invalid under both sides’ definitions.” Pet. Reply 1 n.2. We agree with Petitioner that the outcome of this proceeding is not dependent on our application of one party’s definition as compared to the other. Nonetheless, because Petitioner’s and Dr. Pokharna’s definition better reflects the level of ordinary skill in the art, we adopt and apply it here.

C. Claim Construction

For inter partes reviews filed on or after November 13, 2018, we apply the same claim construction standard used by Article III federal courts and the ITC, both of which follow *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc), and its progeny. 37 C.F.R. § 42.100(b) (2019). Because the instant Petition was filed on November 14, 2018, we apply that standard here. Accordingly, we construe each challenged claim of the ’240 patent to generally have “the ordinary and customary meaning of such claim

as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.*⁸ Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999); *see also Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.* in the context of an *inter partes* review).

Petitioner proposes claim constructions for “vapor chamber,” “lip,” “spacer,” and “hollow column.” Pet. 10–14. The Board decided that it did not need to construe “vapor chamber” and “spacer” for purposes of institution. Inst. Dec. 11. As to the claim term “lip,” the Board did not need to determine the full scope of the term, but determined, for purposes of institution, that Petitioner’s proposed construction is too broad because it reads out a structural limitation of the claim. *Id.* at 15. The Board also provided a claim construction that distinguished between a “hollow column” and a “depression” as those terms are used in the claims. *Id.* at 15–16.

Patent Owner, in response, proposes claim constructions for “vapor chamber,” “lip,” and “spacer extending between and contacting said first and second plates.” PO Resp. 13–26. Patent Owner argues that the term “hollow column” “needs no construction” but proposes that Petitioner’s

⁸ In IPR2019-00144, involving the same patent at issue here, as well as in IPR2019-00146 (involving the related ’679 patent), Petitioner filed an unopposed “Motion & Certification under 37 C.F.R. § 42.100(b) Requesting District Court-Type Claim Construction.” *See, e.g.*, IPR2019-00144, Paper 5. The Board granted each of Petitioner’s unopposed requests. *See, e.g.*, IPR2019-00144, Paper 7. Accordingly, we apply the same claim construction standard in each of the related proceedings.

construction is appropriate if the Board determines that a construction is necessary. *Id.* at 26–27.

In light of the issues presented, we construe below the following claim terms.

1. “lip”

The claims of the ’240 patent recite structure in the form of a “lip” on each of the two plates. Specifically, the claims recite two presumptively different lips using different phrases: “a peripheral lip located at an edge of said boundary structure” (dependent claim 6 and independent claim 11 (the former claim not challenged in the Petition)) and “a circumferential edge lip bounding an inner surface” (independent claims 12, 13, and 14 (the latter claim not challenged in the Petition)). Ex. 1001, 5:64–65, 6:33–35, 6:56–57, 6:61–62, 7:8–9, 7:12–13, 8:2–3, 8:6–7; *see Karlin Tech., Inc. v. Surgical Dynamics, Inc.*, 177 F.3d 968, 971–72 (Fed. Cir. 1999) (Under the doctrine of claim differentiation, “different words or phrases used in separate claims are presumed to indicate that the claims have different meanings and scope.”). Each of the above-listed claims further explicitly requires that those lip structures are bonded together. For example, independent claim 11 requires each plate to have a peripheral lip located at an edge of the boundary structure and also recites “at which said peripheral lip of said first plate is sealingly bonded to said peripheral lip of said second plate so as to define an enclosed vapor chamber.” *Id.* at 6:33–38. Independent claims 12 and 13 require each plate to have a circumferential edge lip and also recite “said edge lips of said first and second plates being sealingly bonded together so as to define a vapor chamber.” *Id.* at 6:56–67, 7:8–16.

Petitioner argues that the meaning of “lip” is the “portion of the plate comprising a region bonded to another plate.” Pet. 13. In the context of

applying claim 11 to the prior art, Petitioner further argues that the peripheral lip in the '240 patent is met by “a portion [on the upper plate] comprising a region bonded to the lower plate at the edge, periphery, or circumference of [the prior art enclosure].” *Id.* at 73. Similarly, in the context of claim 12, Petitioner argues that “a ‘circumferential edge lip’ is met by “a portion [on the upper plate] comprising a region bonded to the lower plate at the edge, periphery, or circumference . . . of [the prior art enclosure].” *Id.* at 27.

In support of its proposed construction of “lip” as the region where one plate is bonded to another plate, Petitioner points to language in the Specification that “[c]ontact plate 18 and cover plate 20 are sealed together at their peripheral lips,” and 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.” *Id.* at 74 (quoting Ex. 1001, 3:27–30); *id.* at 27 (quoting with emphasis added Ex. 1001, 4:44–48).

We noted in our Institution Decision that the cited passages, however, occur in the context of specific embodiments illustrated in Figures 1 and 2, respectively. Inst. Dec. 13. We noted that the Figures identify the lips using element numbers with associated lead lines, and do not reference the lips conceptually as simply the place where bonding has occurred. *Id.* Thus, for purposes of the Institution Decision and on the record before us at the time, we determined that Petitioner’s proposed construction is too broad because it reads out a structural limitation of the claim.

Patent Owner agrees with the reasoning in the Institution Decision that Petitioner’s proposed construction of “lip” renders the term meaningless. PO Resp. 23. Patent Owner argues that “[t]he term ‘lip’ is

used consistently throughout the specification to identify the location at the periphery of the plates where their faces are bonded together.” PO Resp. 22 (arguing that “lip 24 is identified [in the Figures of the ’240 patent] as the peripheral flange-like structure of contact plate 18, whereas lip 22 is simply identified as the peripheral portion of the essentially flat cover plate 20.”). Patent Owner argues that “the term ‘lip’ means ‘portion of the plate defined by the bonded region of the plate’s inner or interior surface.’” *Id.* at 24 (citing Ex. 2002 ¶¶ 106–112).

Petitioner responds that the “parties’ dispute on the meaning of ‘lip’ needs no resolution because Takahashi discloses a ‘lip’ under either party’s construction, and Patentee has not contended otherwise.” Pet. Reply 12. We agree with Petitioner that we do not need to construe “lip” for purposes of assessing patentability under the grounds based on Morikawa as modified by Takahashi. To the extent that we address below Petitioner’s ground based on Morikawa alone, we adopt the same claim construction employed in our Institution Decision.

As we explained in the Institution Decision, the mention in the ’240 patent of an inherent bonding between identified plate lips in a specific embodiment cannot be extrapolated, as Petitioner implies, such that the claimed relationship is necessarily present in any sealed container. Inst. Dec. 13. Even if it were true that all sealed containers must have bonding to form the seal, it does not follow that all such containers necessarily have two spaced-apart plates with the claimed lips and with the plates being bonded together at the specifically recited location of those lips.

Petitioner’s proposed construction—in terms of where the plates of the claimed invention eventually will be bonded—places too much emphasis on the completed assembly of the heat pipe rather than on the claims’

recitation of lips on the individual plates. Under Petitioner's construction, a plate in the assembly will have a lip wherever two plates are bonded but the same plate, prior to assembly, will not have a lip as there is no region where the plate is bonded to another plate. Petitioner does not explain why that is an acceptable result of its proposed construction.

Additionally, Petitioner's proposed construction converts the term "lip" from a structural component to merely a label referring to the bonded area. As such, Petitioner's proposed construction effectively reads out or renders as surplusage the recitation of structure in the form of a "lip." This becomes evident in Petitioner's application of the prior art to the claims. Petitioner asserts that because Morikawa discloses an airtight heat pipe, a person having ordinary skill in the art would have "understood and found it obvious" that the plates would each have a peripheral portion of the plate comprising a region bonded to another plate located at the edge of the boundary structure and therefore, under Petitioner's proposed construction, Morikawa's sealed heat pipe must have bonding at the claimed lips regardless as to the type of lip recited in the claim.⁹ *E.g.*, Pet. 26–27; *see also id.* at 73. Such a proposed construction would absolve a challenger of the responsibility to explain how each of the two plates has the specifically recited type of lip and then how those lips are bonded together so as to define a vapor chamber.

⁹ To the extent that Petitioner's proposed construction implies that there is no difference between the recited peripheral lip and circumferential edge lip, we note that, under the doctrine of claim differentiation, "different words or phrases used in separate claims are presumed to indicate that the claims have different meanings and scope." *Karlin Tech.*, 177 F.3d at 971–72.

Thus, we determine that Petitioner’s proposed construction is too broad because it reads out a structural limitation of the claim. *See Unique Concepts, Inc. v. Brown*, 939 F.2d 1558, 1562 (Fed. Cir. 1991) (“All the limitations of a claim must be considered meaningful.”). We further determine that we do not need to construe “lip” independently of the specifically recited lips and the “bonded together” recitations in each of claims 11–13 to resolve Petitioner’s application of the prior art to each respective claim.

2. “hollow column”

Petitioner proposes to adopt an interpretation of “hollow column” to mean a “cylindrical structure surrounding a void or cavity.” Pet. 12 (citing Ex. 1002 ¶¶ 33–37). Patent Owner argues that the term “hollow column” needs no construction because it “is sufficiently clear on its own.” PO Resp. 26. Patent Owner urges that if the Board determines that a construction is necessary, we should construe the term to mean “a columnar structure defining an unfilled or empty space.” *Id.* (citing Ex. 2002 ¶¶ 119–122).

In the Institution Decision, we determined that the ’240 patent describes two distinct types of spacers, those formed by a solid column bonded to one or both plates and hollowed via the formation of a through hole, and those formed by a depression embossed in a plate, with the bottom of the depression bonded to the inner surface of the opposite plate, and having a hole formed at that bonded contact surface. Inst. Dec. 16. We interpreted “hollow column,” in light of the description provided in the ’240 patent, to refer to the former and not to encompass the latter. *Id.* And we found that Petitioner had failed, with respect to the challenge based on Morikawa and Nakamura (Ground 2) to “reconcile adequately its reliance on

a type of prior art depression-like spacer that the '240 patent appears to distinguish from the recited hollow column.” *Id.* at 31.

Petitioner did not address our interpretation of “hollow column” in its Petitioner Reply. Instead, Petitioner argues that Patent Owner’s construction, which is based on its litigation position, “should be applied against the Patentee” and because the '240 patent “does not expressly define ‘hollow column.’” Pet. Reply 19. Petitioner also points to depictions of solid columns 44 in Figure 2 of the '240 patent as support for this interpretation. *Id.* at 19–20.

We have reviewed the description provided in the '240 patent for spacers, and, in particular, spacers made from columns. For the reasons discussed below, we are not persuaded that our interpretation of “hollow column” adopted in the Institution Decision is incorrect or that we should adopt the broader construction proffered by the parties.

The term “hollow column” is not used anywhere in the '240 patent except for the claims. The '240 patent uses “columns,” however, to discuss one type of spacer, e.g., a spacer formed by a solid column with a hole passing through it. Ex. 1001, 2:9–11, 4:19–24.

Specifically, as discussed in our Institution Decision, the Specification of the '240 patent discusses and distinguishes two types of spacers that extend between the plates and through which a fastener hole may be drilled without breaking the air-tight seal of the vapor chamber. *See* Ex. 1001, 2:9–39.

These spacers [between plates] can be solid columns, embossed depressions formed in one of the plates, or a mixture of the two. . . .^[10]

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

Id. at 2:9–11, 29–39. Thus, the '240 patent describes one embodiment of a spacer as a depression embossed in a plate, with the bottom of the depression bonded to the *inner surface* of the opposite plate, and having a hole formed at that bonded contact surface. *See id.* at 4:40–43, Fig. 2 (hole 50 in bottom of depression 26, which is bonded to inner surface 28 of contact plate 18). A second embodiment of a spacer is a solid column bonded to one or both plates and that is hollowed via the formation of a through hole. *See id.* at 2:36–46, 4:21–24, Fig. 1 (solid column 44 bonded to cover plate 20 at location 46 with hole 12 through the interior of column 44). The Figures of the '240 patent also distinguish between columns 44, which extend from contact plate 18 to the outer surface of cover plate 20, and depressions 26, which extend from cover plate 20 to the inner surface of contact plate 18. Ex. 1001, Figs. 1, 2. In other words, “the bottom of

¹⁰ We understand that the phrase “a mixture of the two” means that a given vapor chamber may utilize the different types of spacers, not that a single spacer may be a mixture of the two types.

depression 26 must be bonded to inner surface 28 of contact plate 18.” Ex. 1001, 4:41–42.

The claim language of the ’240 patent matches this distinction made in the written description. For instance, claims 9 and 12 recite a heat pipe comprising “at least one hollow column” and claims 11 and 13 recite a heat pipe comprising “at least one depression.” Ex. 1001, 6:1–7:25. Based on the claim language and the description of spacers provided in the ’240 patent, we interpret “hollow column” in the claims to mean a spacer formed by a column that extends from one plate to the *outer surface* of the opposite plate. We do not construe “hollow column” to encompass depressions, described in the ’240 patent, that extend from one plate to the *inner surface* of the opposite plate.

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

Petitioner proposes a construction of “spacer” to refer to the “structure used to maintain a space or clearance between the plates.” Pet. 11–12. Petitioner elaborates in its Reply, arguing that “the ‘extending between and contacting’ language when read in light of the specification expressly allows for both integral and non-integral spacers.” Pet. Reply 14–15 (citing Ex. 1032 ¶¶ 35–37). Petitioner argues that support for this interpretation is found in the ’240 patent’s description of “a pattern of spacers extending between and contacting the two plates or any other boundary structure forming the vapor chamber.” *Id.* at 14 (citing Ex. 1001, 2:3–12).

Patent Owner proposes construction of the phrase “spacer extending between and contacting said first and second plates” to mean “structure separate from and in contact with the first and second plates and configured to maintain a space or clearance between the plates.” PO Resp. 24 (citing

Ex. 2002 ¶ 113). Patent Owner argues that because claim 11 separately recites a “spacer extending between and contacting” both plates and a “depression formed” in one of the plates, those elements should be interpreted as distinct components. *Id.* at 25 (citing *Becton, Dickinson & Co. v. Tyco Healthcare Grp.*, 616 F.3d 1249, 1254 (Fed. Cir. 2010)(internal quotations and brackets omitted) (“Where a claim lists elements separately, ‘the clear implication of the claim language’ is that those elements are ‘distinct component[s]’ of the patented invention.”)). Patent Owner argues that the ’240 patent “distinguishes spacers in the form of ‘solid columns’ from ‘embossed depressions’ by the surfaces they contact,” where separate spacers are bonded “to both plates” and embossed spacers are embossed in one plate and bonded “to that opposite plate.” PO Resp. 25 (citing Ex. 1001, 2:9–11, 2:33–40; Ex. 2002 ¶ 117). Patent Owner argues that only spacers that are bonded to both plates would be understood by a person having ordinary skill in the art as “extending between and contacting” both plates. *Id.* (citing Ex. 2002 ¶ 117).

Both parties rely on some of the same disclosures in the ’240 patent to support their different interpretations of the claim language. In this case, Patent Owner has the better interpretation of “spacer” when read in the context of the remainder of the language in claim 11 and the description in the specification of the ’240 patent.

First, as noted by Patent Owner, the term “spacer” is recited in claim 11, when read in the context of the surrounding claim language, to refer to a specific type of spacer that extends from and contacts both plates. This recitation is juxtaposed with the additional recitation in claim 11 of a “depression” that is “formed in said first plate” and “is sealingly bonded to said second plate.” Thus, the claim language itself distinguishes between a

separate spacer bonded to both plates and a depression that is formed in one plate and bonded to one plate. We infer from the claim language alone that the “at least one spacer” and the “depression” are distinct components of claim 11. Whereas the recited “*spacer* . . . extending between and contacting said first and second plates,” is a distinct element between and in contact with two plates, the recited “depression” is a part of one plate and contacts, or is bonded to, the opposing plate.

The description in the ’240 patent is consistent with this reading of the claim language. The ’240 patent describes 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.”

Ex. 1001, 2:3–7. The ’240 patent describes that “[t]hese spacers can be solid columns, embossed depressions formed in one of the plates, or a mixture of the two.” *Id.* at 2:9–11. The ’240 patent describes specifically that if the spacers are solid, they are bonded to both plates of the heat pipe, or if they are embossed in one plate, the portion of the depression which contacts the opposite plate is bonded to that opposite plate. *Id.* at 2:32–36. Thus, the ’240 patent describes a first type of spacer that is independent of the plates and bonded to both plates, and a second type of spacer that is formed in one plate and bonded to the opposite plate.

Considering the evidence of record, we agree with Patent Owner that “the ‘spacer’ limitation of claim 11 cannot be construed to encompass an “embossed depression formed in one of the plates” because “a depression would not be understood to *contact* the plate in which it is formed; otherwise, the word ‘contacting’ becomes meaningless.” PO Resp. 25 (citing Ex. 2002 ¶ 116) (emphasis omitted). As an example, although a

spacer formed from an embossed depression in a first plate may contact a second plate, it cannot reasonably “contact said first . . . plate” from which it is formed. Nor do we discern how such an embossed depression could “extend[] between . . . said first and second plates” when it is itself formed from—and contiguous with—one of the plates.

In view of the above, we adopt Patent Owner’s construction of “spacer . . . extending between and contacting said first and second plates” as referring to a “structure separate from and in contact with the first and second plates and configured to maintain a space or clearance between the plates.”

4. “*vapor chamber*”

Petitioner proposes that a POSITA would have understood “vapor chamber” in the context of the ’240 patent to mean an “enclosed and hermetically sealed void or cavity in which a working fluid is present to be evaporated (or vaporized) and condensed to transport or spread heat.” Pet. 12–13. Petitioner asserts that Patent Owner does not dispute that the “vapor chamber” must be “hermetically sealed,” which Patent Owner agrees means airtightly sealed. *Id.* at 13 n.4. Patent Owner proposes a construction of “vapor chamber” to mean “a vacuum sealed chamber, wherein a heat transfer fluid is evaporated and condensed and capillary forces are utilized to spread heat.” PO Resp. 14.

Petitioner argues that the parties’ dispute as to whether the “vapor chamber” is “vacuum sealed” or “hermetically sealed” need not be resolved because both Nakamura and Morikawa disclose a vacuum sealed chamber. Pet. Reply 6–7 (citing Ex. 1005, 1; Ex. 1004, 2–3). In the related IPR2019-00144, we agreed with Petitioner’s argument that reference to a “vacuum sealed” chamber unnecessarily injects ambiguity into the construction.

Thus, we adopted Petitioner’s construction of a “hermetically sealed” chamber in that related case. Because both cases involve the same challenged patent, we adopt Petitioner’s proposed construction of “vapor chamber” to include a “hermetically sealed” chamber here for consistency.

The ’240 patent describes that “[t]he internal structure of the heat pipe is an evacuated vapor chamber with a limited amount of liquid.” Ex. 1001, 2:3–4; *see also id.* at 3:30–33 (“Heat pipe 10 is then evacuated to remove all non-condensable gases and a suitable quantity of heat transfer fluid is placed within it.”). The ’240 patent also refers to the heat pipe as a “heat pipe vacuum chamber” that is “vacuum tight.” *Id.* at 2:29–32; *see also id.* at 4:40–44 (describing that bonding of the bottom of the depression to the inner surface of the contact plate prevents “loss of vacuum” with the heat pipe with the through hole is formed). The ’240 patent describes that the through holes formed within the spacers have “no effect on the vacuum integrity of the heat pipe vapor chamber.” *Id.* at 2:36–40.

Thus, the vapor chamber is not completely evacuated because it contains the heat transfer fluid. We understand references to “vacuum” in the ’240 patent to refer to the fact that the vapor chamber is “evacuated” to remove non-condensable gases and is then sealed after the heat transfer fluid has been added. Thus, Petitioner’s construction of “vapor chamber” as referring to an “enclosed and sealed space or cavity” is consistent with the description in the ’240 patent. We do not adopt Patent Owner’s construction of “vapor chamber” to require a “vacuum sealed chamber” because the term “vacuum” injects ambiguity into the term’s meaning and would require us to further construe “vacuum” to clarify the scope of this term in light of the ’240 patent.

Petitioner also argues that Patent Owner's interpretation that requires capillary forces to be utilized is too narrow and would render superfluous the separate claim recitation of a "wick." Pet. Reply 8–11.

Patent Owner argues that the use of capillary forces to spread heat is consistent with the manner in which heat pipes operated at the time of the invention and is acknowledged in the '240 patent as important to spreading heat. PO Resp. 17–18 (citing Ex. 1001, 1:57–60, 2:11–39, 3:47–66). Patent Owner argues that Dr. Pokharna acknowledges that "[a]s a general matter, [heat pipes] utilize capillary forces which may be produced by wick or by grooves." *Id.* at 18 (citing Ex. 2005, 126:8–128:4).

Patent Owner's evidence may pertain to an understanding of the term "heat pipe heat spreader" in the art, but it does not provide adequate evidence that "vapor chamber" is understood in the art to require the use of capillary forces to spread heat. We do not find that the portions of the '240 patent cited in Dr. Faghri's testimony require construction of "vapor chamber" to include the use of capillary forces. For instance, one portion of the '240 patent relied on by Patent Owner describes that "the heat pipe heat spreader is constructed to assure precise flatness and to maximize heat transfer from the heat source and to the heat sink, and has holes through its body to facilitate mounting." Ex. 1001, 1:57–60. This description makes no mention of capillary forces. Another cited portion of the '240 patent describes the function of the spacers as providing support for portions of a capillary wick. *Id.* at 2:11–40. This description pertains to an embodiment of the heat pipe that includes a wick. The description does not support an interpretation of "vapor chamber" as requiring the use of a wick. Likewise, another portion of the '240 patent cited by Patent Owner describes an

embodiment of the heat pipe that uses a capillary wick. *Id.* at 3:47–66. The '240 patent describes the heat transfer as follows:

As is well understood in the art of heat pipes, a capillary wick provides the mechanism by which liquid condensed at the cooler condenser of a heat pipe is transported back to the hotter evaporator where it is evaporated. The vapor produced at the evaporator then moves to the condenser where it again condenses. The two changes of state, evaporation at the hotter locale and condensation at the cooler site, are what transport heat from the evaporator to the condenser.

Id. at 3:50–58. Thus, these portions of the '240 patent are describing one embodiment of a heat pipe that uses a wick. These descriptions do not define or limit “vapor chamber” to use of such a wick. Patent Owner’s proposed construction requiring the use of “capillary forces” to spread heat imparts an additional structural requirement of a wick or grooves within the vapor chamber. We see no reason to read these additional structural requirements into the claim term “vapor chamber,” particularly when the claims separately recite a wick positioned within the vapor chamber. *See, e.g.*, Ex. 1001, 6:23–29 (claim 10), 6:51–54 (claim 11).

Both parties provide constructions of “vapor chamber” to include some aspect of heat transfer. Patent Owner argues that Petitioner’s construction is too broad because it refers to evaporation and condensation of a heat transfer fluid “*to transport or spread heat.*” PO Resp. 15. Patent Owner urges a narrower definition of “vapor chamber” that requires evaporation and condensation of a heat transfer fluid to “spread heat.” *Id.* Patent Owner argues that heat spreading, which refers to two- or three-dimensional heat flow, is one of the key attributes of a vapor chamber heat pipe that distinguishes it from conventional heat pipes, which mainly transport heat in one dimension. *Id.* (citing Ex. 2002 ¶ 88). Patent Owner

argues that Petitioner’s construction “disregards the significant difference between vapor chamber heat pipes and conventional heat pipes that would have been understood by a POSITA at the time of the invention and does not account for the text of the specification that repeatedly refers to spreading heat.” *Id.* (citing Ex. 2002 ¶ 89).

As reproduced above, the ’240 patent describes operation of the heat pipe to “transport heat from the evaporator to the condenser.” Ex. 1001, 3:50–58. Thus, Petitioner’s proposed construction of “vapor chamber” to encompass evaporation and condensation of a heat transfer fluid “*to transport or spread heat*” is consistent with the description provided in the ’240 patent. Thus, we adopt and employ Petitioner’s interpretation of “vapor chamber.”

With these claim interpretations in mind, we now examine the grounds asserted in the Petition.

D. Status of Nakamura as Prior Art

Petitioner contends that Nakamura is prior art under 35 U.S.C. § 102(b), asserting that “Nakamura is a ‘Japanese Unexamined Utility Model Application Publication in the Year 1975’ published in 1975.” Pet. 41; *see also id.* at viii (Exhibit list stating “Year of Publication: 1975”).

Patent Owner, in the Preliminary Response, argued that Petitioner had failed to establish that Nakamura qualifies as prior art because Petitioner’s English translation of Nakamura adds a parenthetical “(1975)” after the number “S50-55262” where no such parenthetical is included in the original document. Prelim. Resp. 14. Patent Owner also argued that Nakamura did

not contain indicia, such as INID¹¹ codes, that often qualify a foreign patent application as a “printed publication” and that “[i]f Nakamura had been published, the publication data (among other data) would be provided on the first page of the document, and identified with the appropriate INID code(s).” *Id.* at 3–7, 11–12. Patent Owner further argued that “Nakamura includes no indication that it was indexed in a meaningful way” and “does not identify any date prior to May 12, 1999 on which Nakamura was available to and locatable by the public.” *Id.* at 11, 14.

In the Institution Decision, the Board determined that Petitioner provided enough evidence, including at least the translated version of Nakamura, to make the requisite threshold showing of a reasonable likelihood of prevailing on the issue of whether Nakamura is a printed publication. Inst. Dec. 20. The Board noted that the USPTO Manual of Patent Examining Procedure (MPEP) explains that “Japanese patent application publications show the date in Arabic numerals by indicating . . . the year of the reign of the Emperor,” and observed that “[a]dding the year of the Emperor, 1925, to the numeral ‘50’ shown on the original document yields the year 1975, which corresponds to [Petitioner’s] assertion of a publication date.” *Id.* at 19 (quoting MPEP § 901.05(a) (9th ed. rev. 07.2015 Jan. 2018)). The Board further noted that Patent Owner did not provide citation to any authority for the proposition that a Japanese *unexamined* utility model application like Nakamura, if published, would be formatted with INID codes. *Id.* at 20. The Board also encouraged the parties to meet

¹¹ “‘INID’ is an acronym for ‘Internationally agreed Numbers for the Identification of (bibliographic) Data.’” Ex. 2001, 1.

and confer regarding Japan Patent Office practice in the 1970s as applied to unexamined utility model applications to try to resolve this issue. *Id.* at 21.

After institution, Patent Owner filed objections to evidence that included various objections to Nakamura. Paper 9, 2 (objecting to Exhibit 1004 under Federal Rule of Evidence (FRE) 104, FRE 401, FRE 901, and FRE 1002). Petitioner responded by serving Patent Owner with supplemental evidence, including the Chen Declaration.¹² *See* 37 C.F.R. § 42.64(b)(2) (authorizing a party relying on evidence to which an objection is timely served to respond to the objection by serving supplemental evidence within ten business days of service of the objection). Patent Owner argued in its Response that “these documents should not be considered unless and until [this supplemental evidence is] properly filed as supplemental information.” PO Resp. 34–35. We understand Petitioner to have relied on the Chen Declaration as a means to resolve Patent Owner’s objections to the relevance and authentication of Exhibit 1004. Petitioner never filed the Chen Declaration with the Board. Thus, we do not consider the content of the Chen Declaration for purposes of resolving this issue. We note, however, that attached as Exhibit B to the Chen Declaration was a copy of the condensed version of Nakamura, as published in the Japanese Gazette in 1975, and an English language translation thereof. Ex. 2011, 14–20 (Ex. B). Thus, Patent Owner apparently received a copy of the condensed version of Nakamura prior to filing its Patent Owner Response.

¹² This supplemental evidence consisted of a Declaration of Kyle Chen Responsive to Patent Owner’s Objections to Evidence with attached Exhibits A–E. Patent Owner submitted a copy of Petitioner’s Supplemental Evidence as an exhibit in order to address it in Patent Owner’s Response. Ex. 2011.

Patent Owner, in its Response, argues that Petitioner “fails to present evidence that Nakamura was a ‘patent or printed publication’ prior to the ‘240 Patent’s May 12, 1999 priority date,” and that, “based on the evidence presented, Nakamura is neither a patent nor a printed publication.” PO Resp. 28. Specifically, Patent Owner argues that “Petitioner has failed to file *any evidence* that Nakamura was actually disseminated or publicly accessible or findable before the May 12, 1999 priority date.” *Id.* at 31. Patent Owner asserts that Nakamura does not have an abstract and nothing in the record suggests that Nakamura was classified before May 12, 1999. *Id.* at 31–32. Patent Owner further asserts that “Nakamura has no INID codes to identify any relevant biographic data.” *Id.* at 32. Patent Owner argues that Petitioner has filed no evidence of any actual dissemination of Nakamura, or any means by which Nakamura might have been accessed by interested members of the public. *Id.* at 33. In sum, Patent Owner asserts that Petitioner’s evidence is not sufficient to support a finding that one skilled in the art, employing reasonable diligence, would have been able to locate and retrieve Nakamura prior to May 12, 1999. *Id.*

Petitioner, in reply to Patent Owner’s arguments regarding dissemination and public accessibility, relied on a declaration from Takao Miyano (“the Miyano Declaration”), a Japanese patent attorney, to show that, at the time of Nakamura, the Japan Patent Office provided public access to utility model applications by publishing a condensed version of the full application in the Japan Utility Model Gazette and by allowing public inspection of the full application at the Japan Patent Office. Pet. Reply 21

(citing Ex. 1044).¹³ Petitioner, thus, asserts that “the full version of Nakamura (Ex-1004) was publicly accessible as of May 26, 1975 when its condensed version was published.” *Id.* (citing Ex. 1044 ¶¶ 11–17).

Patent Owner argues that this new evidence and new arguments filed with Petitioner’s Reply are improper as untimely. PO Sur-Reply 9–10. Patent Owner argues that to rely on this new evidence, Petitioner should have sought to submit the evidence as supplemental information in accordance with 37 C.F.R. § 42.123. *Id.* Because we rely, in part, on the Miyano Declaration, we address Patent Owner’s arguments as to the timeliness of Petitioner’s presentation of this evidence.

As recently discussed in *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 (PTAB Dec. 20, 2019) (precedential), “at the institution stage, the petition must identify, with particularity, evidence sufficient to establish a reasonable likelihood that the reference was publicly accessible before the critical date of the challenged patent and therefore that there is a reasonable likelihood that it qualifies as a printed publication.” *Id.* at 13. The decision in *Hulu* further describes “limited opportunities” for the petitioner to present new evidence after the filing of the petition to support a showing that a reference is a printed publication, including “in a reply to the patent owner response” and “in a motion to file supplemental information.” *Id.* at 14. The *Hulu* decision explains that new evidence submitted in a reply must be responsive to arguments raised in the patent owner response. *Id.* The decision explains that “if the patent owner challenges a reference’s status as a printed publication, a petitioner may submit a supporting

¹³ The Miyano Declaration includes six attachments, labeled Exhibits A through F, which correspond, respectively, to Exhibits 1045 through 1050.

declaration with its reply to further support its argument that a reference qualifies as a printed publication.” *Id.* at 15.

In this case, the evidence submitted with the Petition includes Nakamura itself in the original Japanese and a certified translation. Ex. 1004. On its first page, Nakamura contains evidence in the form of certain indicia including its identification as a Japan Patent Office document (stamp at lower right), a title containing the word “Publication” followed by the number S50 55262, and the translated date of 1975 in the publication number (50 plus 1925, the year of the Emperor). *Id.* at 1.

As discussed above, Patent Owner presented arguments challenging the dissemination and public accessibility of Nakamura in its Patent Owner Response. Petitioner submitted the Miyano Declaration and supporting exhibits (Exs. 1044–1050) specifically in response to Patent Owner’s challenges to dissemination and public accessibility of Nakamura, raised in Patent Owner’s Response. We find that this new evidence is permissible here because it was filed in response to arguments raised in Patent Owner’s Response. Also, the new evidence did not amount to, or result in, a change to Petitioner’s theory in the case, and is relied on to further support Petitioner’s initial position raised in the Petition that Nakamura qualifies as a printed publication. Thus, we do not agree with Patent Owner that Petitioner’s new evidence, submitted in the Reply, was improper as untimely.

Patent Owner also argues that Petitioner’s Reply “includes scant argument or explanation as to why it believes Nakamura is a printed publication” and instead improperly incorporates by reference the arguments and explanations from the Miyano Declaration. PO Sur-Reply 11 (citing Ex. 1044). We disagree with Patent Owner that the arguments presented in

Petitioner's Reply are inadequate. The Reply explains how the Japan Patent Office provided public access to utility model applications at the time of Nakamura, including by publication of a condensed version of the application in the Japanese Utility Model Gazette and by allowing public inspection of the full application at the Japan Patent Office upon request. Pet. Reply 21. Petitioner properly refers in its Reply to the Miyano Declaration as support for these assertions. *Id.* The Reply also explains how an interested member of the public would have obtained access to the full version of the publication. *Id.* Again, Petitioner properly refers in its Reply to the Miyano Declaration for support. *Id.* Thus, we consider the arguments properly raised in Petitioner's Reply, along with the supporting evidence cited in the Reply, to ascertain whether Nakamura qualifies as prior art.

Having clarified the universe of evidence to which we will look to decide the prior art status of Nakamura, we now examine the evidence to assess whether it is sufficient to establish Petitioner's position as to Nakamura as a prior art printed publication.

In an *inter partes* review, a petitioner "may request to cancel as unpatentable 1 or more claims of a patent . . . only on the basis of prior art consisting of patents or printed publications." 35 U.S.C. § 311(b). In this case, Petitioner contends Nakamura is a "printed publication" within the meaning of § 311 and does not assert that Nakamura is a "patent." *See* Pet. 26; Pet. Reply 21.

We look to the underlying facts to make a legal determination as to whether a reference is a printed publication. *Suffolk Techs., LLC v. AOL Inc.*, 752 F.3d 1358, 1364 (Fed. Cir. 2014). The determination of whether a given reference qualifies as a prior art "printed publication" involves a case-by-case inquiry into the facts and circumstances surrounding its disclosure to

members of the public. *In re Klopfenstein*, 380 F.3d 1345, 1350 (Fed. Cir. 2004). The key inquiry is whether the reference was made “sufficiently accessible to the public interested in the art” before the critical date. *In re Cronyn*, 890 F.2d 1158, 1160 (Fed. Cir. 1989); *see In re Wyer*, 655 F.2d 221, 226 (CCPA 1981). “A given reference is ‘publicly accessible’ upon a satisfactory showing that such document has been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it. . . .” *Bruckelmyer v. Ground Heaters, Inc.*, 445 F.3d 1374, 1378 (Fed. Cir. 2006) (citation omitted). *Bruckelmyer* and *Wyer* specifically addressed the public accessibility of laid-open patent applications.

In *Bruckelmyer*, the issue was whether two figures of a Canadian application that were withdrawn, and thus, absent in the issued patent but still of record in the prosecution history, are part of the subsequently published patent. *Bruckelmyer*, 445 F.3d at 1377. *Bruckelmyer* argued that a patent application located in a foreign patent office that has been laid open for inspection is not a printed publication, especially considering absence of evidence indicating that the contents of the file wrapper were disseminated or copied. *Id.* at 1377–78.

The court disagreed explaining:

[t]he “printed publication” provision of § 102(b) “was designed to prevent withdrawal by an inventor . . . of that which was already in the possession of the public.” . . . Whether a given reference is a “printed publication” depends on whether it was “publicly accessible” during the prior period. A given reference is “publicly accessible” upon a satisfactory showing that such document has been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it and recognize and comprehend therefrom the essentials of the

claimed invention without need of further research or experimentation.

Id. at 1378 (internal citations omitted); *see also Wyer*, 655 F.2d at 226.

With respect to *Wyer*, the issue was whether an Australian patent application laid open for public inspection was a printed publication if only an abstract of the application was published by the Australian Patent Office.

Wyer, 655 F.2d at 223, 226. The court found that, although there is no evidence of actual viewing or dissemination of any copy of the application:

there is no dispute that the records were maintained for this purpose. Given that there is also no genuine issue as to whether the application was properly classified, indexed, or abstracted, we are convinced that the contents of the application were sufficiently accessible to the public and to persons skilled in the pertinent art to qualify as a “printed publication.”

Id. at 226. In considering *Wyer*, the court in *Bruckelmyer* also explained:

The existence of a published abstract that would have allowed one skilled in the art exercising reasonable diligence to locate the foreign patent application and the fact that the application was classified and indexed in the patent office, were central to the *Wyer* court’s conclusion that the application was “publicly accessible.”

Bruckelmyer, 445 F.3d 1379.

In this case, Petitioner provided a certified translation of Nakamura with its Petition. *See* Ex. 1004, 12.¹⁴ The top of the first page is translated as “Japanese Unexamined Utility Model Application Publication S50–55262 (1975).” *Id.* at 1; *see also* Ex. 2012, 1 (same). The as-translated first page contains a seal of the Japan Patent Office (bottom right) and certain

¹⁴ In citing to Nakamura in this section, we refer to the page numbers of the exhibit rather than the numbers in parentheses at the bottom center of the translation.

numbered items, including “1 Title of the Invention” and “2 Inventor.” *Id.* The first page also twice recites the date of September 18, 1973 (near the top and in the seal of the Japan Patent Office.) *Id.*

Patent Owner asserts that Nakamura does not qualify as prior art because, unlike the published applications in *Wyer* and *Bruckelmyer*, Nakamura does not include an abstract, and because nothing in the record suggests that Nakamura was classified before the effective filing date of the ’240 patent, i.e., May 12, 1999. PO Resp. 30; *id.* at 31 (“Nakamura includes no indication that it was abstracted, classified, or indexed in a meaningful way.”). Patent Owner also compares Nakamura to Takahashi (Ex. 1005) and Morikawa (Ex. 1023) and notes that, unlike these published Japanese applications, Nakamura does not include INID codes. *Id.* at 31. Patent Owner argues that “[i]f Nakamura had been published, the publication date (among other data) would be provided on the first page of the document, and identified with the appropriate INID code(s).” *Id.* Patent Owner also argues that Petitioner has not filed any evidence of actual dissemination of Nakamura or any means by which Nakamura might have been accessed by interested members of the public. *Id.* at 32.

In reply, Petitioner provides evidence of Japan Patent Office procedures at the time of Nakamura that shows that under Japanese utility model law in the period of 1973–1975, the Japan Patent Office would publish a condensed version of the utility model application in the Utility Model Gazette and the complete version of the utility model application was made available for public inspection at the Japan Patent Office on the same day that the condensed version was published. Pet. Reply 21; Ex. 1044 ¶¶ 13–14 (explaining that the public could gain access to the full version by presenting identifying information such as the publication number).

Petitioner provides a copy of the condensed version of Nakamura published in the Japanese Utility Model Gazette in 1975. Ex. 1044 (Attachment C); Ex. 1047. According to Petitioner’s declarant, this condensed version of Nakamura was published on May 26, 1975. Ex. 1044 ¶¶ 11–13. We also observe that this condensed version of Nakamura includes INID codes similar to those that appear on the faces of Morikawa and Takahashi. Ex. 1047, 1 (showing circled numbers on the face of the publication that correspond to INID codes on the faces of Morikawa (Ex. 1023) and Takahashi (Ex. 1005)). We also observe that although the condensed version of the published application does not appear to include an abstract, it does include a title, drawings with a brief explanation of the drawings, a detailed explanation of the device, and claims. Ex. 1044 ¶ 12; Ex. 1047. Thus, we find that the condensed version of Nakamura, which was published in the Japanese Utility Model Gazette, was classified and sufficient detail of the contents of the application were provided such that one skilled in the art exercising reasonable diligence would have been able to locate Nakamura.

According to Petitioner’s declarant, under Japanese law in effect in 1973–1975, the complete version of Nakamura (Ex. 1004) was “made available to the public on May 26, 1975, i.e., the same day [the condensed version of Nakamura] published.” Ex. 1044 ¶ 14. Thus, according to Petitioner’s declarant, to gain access to the full version of Nakamura, a member of the public need only present identifying details of the application, available from the published condensed version, to be given access to the full version. Pet. Reply 21; Ex. 1044 ¶¶ 15–17. Based on this evidence, we find that the condensed version of Nakamura, as published in the Japanese Utility Model Gazette, would have been a roadmap to the full

version of the Nakamura application, so that the contents of the full Nakamura application were sufficiently accessible to the public and to persons skilled in the pertinent art to qualify as a “printed publication.” This is sufficient to make Nakamura (Ex. 1004) publicly accessible as of May 26, 1975.

We determine that Petitioner has provided enough evidence to show that Nakamura qualified as a printed publication more than a year before May 12, 1999, the earliest possible effective filing date of the challenged claims of the ’240 patent, including: a copy of the condensed version of Nakamura, which included classification codes and was published in the Japanese Utility Model Gazette; a copy of the complete application, available upon request from the Japan Patent Office using the information provided in the published condensed version; and Mr. Miyano’s evidence of Japan Patent Office practice at the time of Nakamura’s publication. Accordingly, Petitioner has established that Nakamura qualifies as prior art under § 102(b). *See* Pet. 41.

E. Unpatentability over Morikawa

1. Morikawa

According to Morikawa, a metal installation plate 30 for the attachment of a heat pipe is conventionally added to the distal edge of a component to be cooled. Ex. 1003, 2:15–30, 5:1–6 (referencing Fig 1). “Such a structure is conventionally adopted because opening a hole in the heat-pipe main body to fix the component to be mounted is impermissible due to a gas-sealing structure of the heat pipe.” *Id.* at 2:30–33. Accordingly, Morikawa discloses an alternative means of attaching a heat pipe to a component via a fastener passing through the heat pipe. In particular, Morikawa discloses “a through path blocked from an interior of

the heat pipe by a metal pipe is disposed in a heat-pipe heating portion, and a portion to be cooled is directly mounted and fixed to the heat-pipe heating portion by a nut and bolt through the through path.” *Id.* at 1:21–26; *see id.* at 3:10–14.

Morikawa Figures 2A, 2B, and 3 are reproduced below.

FIG. 2

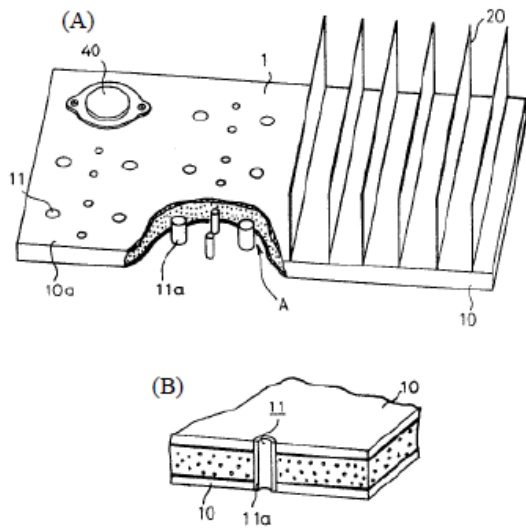
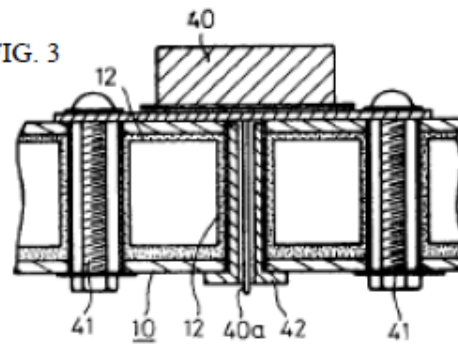


FIG. 3



The above figures show perspective and cross-sectional perspective views of the disclosed heat pipe. *Id.* at 4:49–56. In these figures, “through paths 11 [are] disposed at appropriate dimensional intervals in a main-body heating portion 10.” *Id.* at 3:23–25. “[E]ach through path 11 is communicated to both surfaces of a panel by a metal pipe 11a provided inside the panel.” *Id.* at 3:26–28. The interior of the heat pipe “and the through path 11 are completely blocked by [] metal pipe 11a, and there is no fear of interior liquid and vapor escaping therethrough.” *Id.* at 3:28–32. “A component 40 to be cooled such as a transistor element is fixed to a surface of the main-body heating portion by nuts and bolts using the through paths 11.” *Id.* at 3:32–35. Figure 3, for example, shows bolts 41 inserted through such paths (unlabeled in Figure 3). *Id.* at 3:37–42. “In this manner . . . the

component can be directly mounted and fixed to the heat-pipe heating portion.” *Id.* at 3:43–45. “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.” *Id.* at 3:51–55.

According to Morikawa, the through path formed by metal pipes 11a may be “formed by welding and fixing the metal pipe to the panel surfaces so the metal pipe is communicated to holes provided in advance in upper and lower surfaces of the panel,” or by “by welding and fixing a metal column to upper and lower inner surfaces of the panel like a conventional spacer . . . and afterward opening a hole in the panel walls and this metal column by a drill.” *Id.* at 4:25–35.

2. *Analysis of Claim 9*

For the reasons discussed below, Petitioner has shown by a preponderance of the evidence that Morikawa renders claim 9 unpatentable under 35 U.S.C. § 103(a). We address each claim limitation below.

a) “A heat pipe for spreading heat”

In its discussion of the unpatentability of claim 9 over Morikawa, Petitioner contends that Morikawa discloses a heat pipe for spreading heat comprising a boundary structure including spaced-apart first and second plates that define an enclosed vapor chamber. Pet. 15–18. Petitioner contends that Morikawa discloses a heat pipe that transfers and releases heat. *Id.* at 15–16 (citing Ex. 1003, 1:32–36 and Ex. 1002 ¶ 51).

Patent Owner argues, with reference to Dr. Faghri’s testimony, that “nothing in Morikawa discloses or teaches heat spreading, and a POSITA would not have understood Morikawa to describe heat spreading.” PO Resp. 43 (Ex. 2002 ¶¶ 67, 126, 127). Patent Owner raises this argument in the

context of arguing that Morikawa does not disclose a “vapor chamber” as recited in the body of the claim. *Id.* Patent Owner does not assert in its Response¹⁵ that the language “for spreading heat” in the preamble of claim 9 is itself limiting, and instead seeks to insert the requirement of spreading heat into the construction of “vapor chamber.”

As discussed above, both parties propose a construction of “vapor chamber” that includes an aspect of heat transfer. We adopt Petitioner’s construction of “vapor chamber” that includes the requirement that the vapor chamber transport or spread heat. We address this aspect of the claim language below in our analysis of the prior art’s disclosure of a “vapor chamber.”

Although Patent Owner does not expressly argue in its Response that the language “for spreading heat” in the preamble of claim 9 is limiting, to the extent Patent Owner’s argument that Morikawa does not disclose heat spreading incorporates this language of the preamble, we address the effect of this preamble language on the claim scope. We find that the preamble language “for spreading heat” is merely a statement of intended use and is not limiting.

“[A]s a general rule preamble language is not treated as limiting.” *Aspex Eyewear, Inc. v. Marchon Eyewear, Inc.*, 672 F.3d 1335, 1347 (Fed. Cir. 2012) (citing *Allen Eng’g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336,

¹⁵ In its Reply, Petitioner argues that the preambles of the challenged claims are not limiting. Pet. Reply 3–4. In response to this argument, Patent Owner argues, for the first time in the Sur-Reply, that because the patent title refers to heat spreading and the patent repeatedly refers to the invention as a “heat pipe heat spreader” or “heat spreader,” the preamble should be limiting. Sur-Reply 3 (citing *Poly-America LP v. FSE Lining Tech. Inc.*, 383 F.3d 1303 (Fed. Cir. 2004)).

1346 (Fed. Cir. 2002)). “In general, a preamble limits the invention if it recites essential structure or steps, or if it is ‘necessary to give life, meaning, and vitality’ to the claim.” *Catalina Mktg. Int’l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002) (quoting *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305 (Fed. Cir. 1999)). “Whether to treat a preamble as a limitation is ‘determined on the facts of each case in light of the overall form of the claim, and the invention as described in the specification and illuminated in the prosecution history.’” *Deere & Co. v. Bush Hog, LLC*, 703 F.3d 1349, 1357 (Fed. Cir. 2012) (quoting *Applied Materials, Inc. v. Advanced Semiconductor Materials America, Inc.*, 98 F.3d 1563, 1572–73 (Fed. Cir. 1996)); *see also Poly-America*, 383 F.3d at 1309–1310 (discussing same). “[A] preamble is not limiting ‘where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention.’” *Catalina*, 289 F.3d at 808 (quoting *Rowe v. Dror*, 112 F.3d 473, 478 (Fed. Cir. 1997)).

Here, the body of claim 9 recites spaced-apart first and second plates forming a boundary structure and defining an enclosed vapor chamber, and a hollow column sealingly bonded to at least one of the plates and having open ends to form a mounting hole. The body of this claim does not recite a “heat pipe for spreading heat.” The preamble’s reference to “for spreading heat” merely identifies an intended use for the claimed structure. Patent Owner has not demonstrated that this use itself imposes any structural requirement on the claimed structure beyond what is required by the body of the claim. Nor has it shown any “reliance on the preamble during prosecution to distinguish the claimed invention from the prior art.” *Catalina*, 289 F.3d at 808. As in *Catalina*, “deletion of the disputed phrase from the preamble. . .

[would] not affect the structural definition or operation of the [invention] itself.” *Id.* at 810.

To the extent the claim term “vapor chamber” includes, among other things, the function of spreading heat, we address Patent Owner’s arguments below. For the reasons discussed below, even were the preamble treated as limiting, we find that Morikawa’s device meets this limitation.

b) “*a boundary structure including spaced-apart first and second plates that define an enclosed vapor chamber*”

Petitioner asserts, with reference to annotated Figures 2A and 2B of Morikawa, that the heat pipe is an airtight enclosure 10 formed by spaced-apart first and second plates, having a working fluid present in the enclosed and sealed void within the enclosure. Pet. 16–18 (citing Ex. 1003, 1:36–41, 1:45–2:7, 5:1–2 and Ex. 1002 ¶¶ 52–54).

Patent Owner argues that Morikawa does not disclose constructing a heat pipe using two plates. PO Resp. 44. Patent Owner argues, with reference to Dr. Faghri’s testimony, that a person having ordinary skill in the art would have understood Morikawa’s heat pipe to be made from either a unitary tube or a single sheet of metal with the metal pipes 11a inserted into holes in the tube or body and then welded in place. *Id.* at 44–45 (citing Ex. 2002 ¶¶ 133–134).

Petitioner argues that Patent Owner’s argument is flawed because it fails to address Figures 2B and 3 of Morikawa, which clearly show two different plates. Pet. Reply 23–24 (citing Ex. 1032 ¶¶ 39–40). In the cited paragraphs of Dr. Pokharna’s declaration, he attests that Morikawa’s top and bottom plates, as shown in Figure 3, have different cross-hatching, which indicates that the plates are different. Ex. 1032 ¶ 40. Dr. Pokharna criticizes Dr. Faghri’s testimony for failing to address Figure 3, which Dr. Pokharna

pointed to in his original Declaration as support for first and second plates. *Id.*; Ex. 1002 ¶ 62. Petitioner challenges Dr. Faghri's testimony that only two conventional methods of making flat heat pipes were known at the time of Morikawa. Pet. Reply 24. Petitioner provides evidence that it was known at the time of Morikawa to make heat pipes using "flat-heat-pipe 'sandwich' configurations using two plates." *Id.* (citing Ex. 1032 ¶¶ 44–49; Ex. 1036; Ex. 1037). Petitioner also challenges Dr. Faghri's testimony that end caps would be used with the flat heat pipe of Morikawa. *Id.* (citing Ex. 1033, 8:9–9:25; Ex. 1034, 763, 765; Ex. 1038. Petitioner also provides testimony of Dr. Pokharna that a person having ordinary skill in the art would understand Morikawa's plates are joined using brazing or soldering, "given its similarity to Nakamura." *Id.* at 25 (citing 1032 ¶ 51).

Patent Owner responds that Petitioner's reliance on Figures 2B and 3 of Morikawa, which show only a partial cross-section, is "misguided." PO Sur-Reply 15. Patent Owner further argues that Petitioner's discussion of "different cross-hatching" between the plates in Morikawa's Figure 3 improperly raises a new theory because it was raised for the first time in Petitioner's reply. *Id.* at 16. Patent Owner also argues that to the extent the cross-hatching in Figure 3 is discernible, there appears to be no difference between the cross hatching on the asserted top and bottom plates, with similar cross-hatch lines extending at the same angle in both portions. *Id.* at 15–16 (citing Ex. 2002 ¶¶ 65, 55, 133–135). Patent Owner also argues that we should not rely on Petitioner's new evidence of two-plate heat pipe construction because Petitioner fails to establish that Exhibits 1036 and 1037 were prior art printed publications and fails to explain the significance of these documents. *Id.* at 16–17.

First, we disagree with Patent Owner's characterization of Petitioner's reply arguments regarding cross-hatching to improperly raise a new theory. In the Petition, Petitioner and Dr. Pokharna pointed to Figures 2B and 3 of Morikawa as support for the assertion that Morikawa discloses two plates. Pet. 16, 23; Ex. 1002 ¶¶ 53, 59. Petitioner's further arguments about what is shown in these Figures were raised properly in response to Patent Owner's arguments contesting Petitioner's reading of Morikawa's disclosure.

Second, we do not credit Dr. Faghri's testimony as to how a person of ordinary skill would have understood Morikawa to be constructed because this testimony lacks sufficient evidentiary support. Dr. Faghri testified that a person of ordinary skill, looking at Morikawa's figures alone, "would have expected [it] to have been constructed from either a unitary tube member that is formed with a generally rectangular profile (for example, by compressing and shaping a cylindrical pipe or by an extrusion process) or a single sheet of metal bent and sealed along one seam, and then fitted with appropriate end caps." Ex. 2002 ¶ 133. This testimony is premised on Dr. Faghri's statement that "[t]his was the conventional way that heat pipes were being constructed at the time of Morikawa's . . . asserted disclosure[]" (ca. 1973)." *Id.* Dr. Faghri fails, however, to cite any evidence to support this statement as to the conventional way of constructing heat pipes in 1973.

Third, we find contrary evidence in the record. Specifically, we agree with Petitioner that Morikawa's Figure 3 appears to show two plates with different cross-hatching. Pet. Reply 23–24. Further, Dr. Pokharna provides sound reasoning as to why, based on Morikawa's construction, one having ordinary skill in the art would have understood Morikawa's heat pipe to be made using two plates. Ex. 1032 ¶¶ 41–55. Further, Petitioner submitted evidence, circa 1973, showing that it was known in the art at the time to

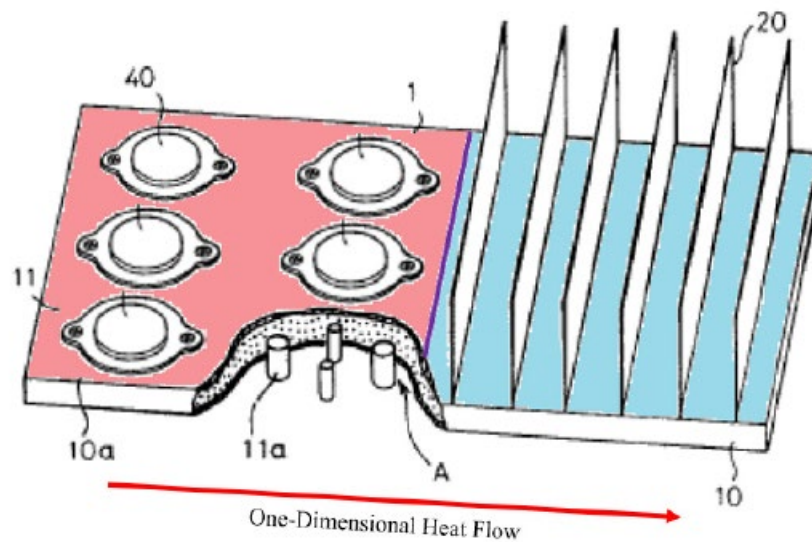
make heat pipes from two plates. Ex. 1032 ¶¶ 44–45 (citing Exs. 1036, 1037). This evidence calls into question the accuracy of Dr. Faghri’s unsupported testimony as to the conventional way heat pipes were manufactured at the relevant time. We find that this evidence supports the view that Nakamura discloses a container formed from two plates.

Patent Owner also disputes Petitioner’s contention that Morikawa’s heat pipe defines a “vapor chamber.” PO Resp. 42–44. Patent Owner’s argument is based on its proposed construction of “vapor chamber” to require two- or three-dimensional heat spreading. *Id.* 14–17; 42–44. As discussed above, we adopt Petitioner’s construction of “vapor chamber” to mean “an enclosed and hermetically sealed void or cavity in which a working fluid is present to be evaporated (or vaporized) and condensed to transport or spread heat.” *See supra* § II.C.4. We do not construe “vapor chamber” to require two- or three-dimensional transport of heat within the chamber. As discussed below, we find that the evaporation and condensation of Nakamura’s heat transfer fluid within the sealed container will result in heat being transported or spread.

We find that Petitioner has shown that Morikawa discloses that the heat pipe is an airtight enclosure having a working fluid present in the enclosed and sealed void within the enclosure. Pet. 16–18 (citing Ex. 1003, 1:36–41, 1:45–2:7, 5:1–2 and Ex. 1002 ¶¶ 52–54). Specifically, Morikawa describes a panel-type heat pipe formed as an airtight structure. Ex. 1003, 1:38–39; Figs. 2A, 2B, 3. Morikawa describes that inside the airtight structure is a liquid, acting as a refrigerant, that is added after air is extracted from the heat pipe. *Id.* at 1:36–41. Morikawa also describes the structure includes a wick exhibiting a capillary action. *Id.* Morikawa describes that the refrigerant absorbs heat from an external high-temperature body, is

vaporized, travels to a cooling portion of the heat pipe, is cooled and condensed, and refluxed back to the heating portion of the heat pipe by the wick. Ex. 1003, 1:42–2:7; Ex. 1002 ¶ 52–54.

Patent Owner argues that Morikawa teaches “one-dimensional heat flow.” PO Resp. 43 (citing Ex. 2002 ¶¶ 67, 126–127). Patent Owner provides an illustration, reproduced below, for purposes of explanation.



The illustration above appears to be based on Figure 2A of Morikawa, which depicts a perspective view of a heat pipe, in which Patent Owner has added heat sources and coloring to indicate hot areas in red and cooling portions in blue. Patent Owner argues, with reference to this illustration and Dr. Fahgri’s testimony, that “a POSITA would have understood that heat sources 40 would be replicated across the heating portion (red), and that the heat generated by these sources would flow in one dimension toward the cooling portion (blue) where fins 20 are located.” *Id.* (citing Ex. 2002 ¶ 127).

Petitioner rebuts Patent Owner’s evidence with reference to Dr. Pokharna’s testimony and its own illustrations of the heat flow in the ’240

patent and Morikawa, as shown below. Pet. Reply 5 (citing Ex. 1032 ¶¶ 26–32).

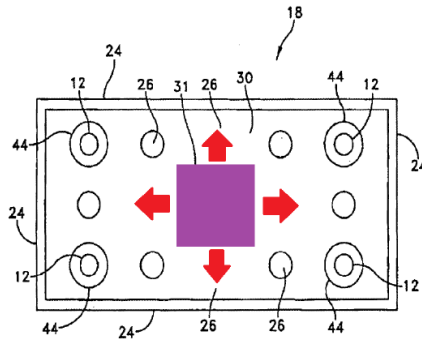
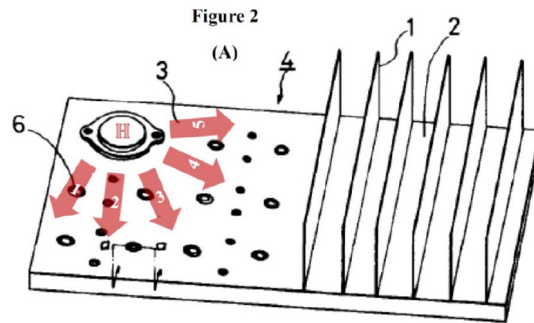


FIG. 3



The illustration on the left is based on Figure 3 of the '240 patent and shows a heat source in purple and the heat flow traveling away from the heat source as red arrows. The illustration on the right is based on Figure 2(A) of Morikawa and depicts a heat source with the heat flow traveling away from the heat source as red arrows.

Dr. Pokharna testifies that, in the device of the '240 patent, heat is transported from a heat source, which is attached to contact plate 18, to heat sink 16, which is in contact with cover plate 20. Ex. 1032 ¶ 27.

Dr. Pokharna illustrates, in the annotated illustration on the left above, an external surface of contact plate with a heat source, i.e., an integrated circuit assembly (shown in purple), attached thereon. *Id.* ¶ 28. Dr. Pokharna testifies that “[i]n operation, heat from this integrated circuit would spread radially outward, as per normal physics” as depicted with the red arrows in the annotated illustration on the left above. *Id.* ¶ 29. Dr. Pokharna also testifies that heat flows toward heat sink 16 (not shown in the annotated figure) into the page from this point of view. *Id.*

Petitioner criticizes Dr. Faghri's testimony as "faulty" because Dr. Faghri (1) "never explains how heat spreads in the ['240 patent's] heat pipe," (2) does not provide adequate foundation for his opinion that heat moves in Morikawa's heat pipe in one direction, (3) never analyzes Morikawa's heat flow when it has just one heat source. Pet. Reply 6.

To the extent we need to resolve this issue of one-dimensional versus two-dimensional heat transfer, we credit Dr. Pokharna's testimony that the heat flow in Morikawa's heat pipe includes transport of heat in more than one dimension because his testimony is based on the device shown in Morikawa having one heat source. Further, we accord Dr. Faghri's testimony little weight because it is based on a hypothetical arrangement of heat sources not shown in the prior art.

For these reasons, Petitioner has provided adequate evidence to show that Morikawa discloses the claimed "boundary structure including spaced apart first and second plates that define an enclosed vapor chamber," as recited in claim 9.

- c) *"at least one hollow column having an exterior surface positioned within said vapor chamber with a first portion of said exterior surface sealingly bonded to at least one of said first and second plates, and having an open first end that opens through said first plate and an open second end that opens through said second plate so as to form at least one mounting hole that is isolated from said vapor chamber"*

Petitioner contends that Morikawa discloses at least one hollow column having an exterior surface positioned within the vapor chamber. *Id.* at 18–19. The evidence supports this assertion. Specifically, Morikawa discloses a metal pipe 11a that forms a hollow spacer, which extends from the outer surface of a first plate to the outer surface of the second plate, and

having its exterior surface within the vapor chamber of enclosure 10. Ex. 1003, 3:25–28, Fig. 2B.

Petitioner also contends that a portion of the exterior surface of Morikawa’s hollow column is sealingly bonded to at least one of the first and second plates. Pet. 20 (citing Ex. 1003, 4:26–27). The evidence supports this assertion. Morikawa discloses metal pipe 11a can be welded to the panel surfaces. Ex. 1003, 4:26–27. As shown in Figure 2B of Morikawa, this welding would occur at a portion of the exterior surface of metal pipe 11a. Pet. 20 (annotated Figure).

Petitioner also contends that Morikawa’s hollow column is open on each end through the first and second plates to form a mounting hole isolated from the vapor chamber. *Id.* at 21–22. Again, Morikawa discloses this feature. Morikawa’s metal pipe 11a is open on each end to form a through path 11 that is blocked from the interior of the heat pipe and that can receive nut and bolt 41. Ex. 1003, 1:21–22, 3:13–14, 3:37, 4:28–32, 5:4, Fig. 3; Ex. 1002 ¶¶ 56–57.

Patent Owner does not contest Petitioner’s assertions as to Morikawa’s disclosure of the hollow column limitation. For the reasons discussed above, Petitioner has provided adequate evidence to show that Morikawa discloses the claimed “at least one hollow column having an exterior surface positioned within said vapor chamber with a first portion of said exterior surface sealingly bonded to at least one of said first and second plates, and having an open first end that opens through said first plate and an open second end that opens through said second plate so as to form at least one mounting hole that is isolated from said vapor chamber,” as recited in claim 9.

d) Conclusion

Patent Owner argues that the Petition fails to establish obviousness because it “fails to perform the requisite factual inquiries for an obviousness analysis under *Graham v. John Deere Co.*, 383 U.S. 1 (1966).” PO Resp. 41 (arguing that the Petition fails to identify any differences between the challenged claims and Morikawa and fails to identify any reasons or motivation why it would have been obvious to a person having ordinary skill in the art to modify Morikawa to address such differences). Petitioner explained in reply that due to a claim construction dispute over whether the claimed “vapor chamber” is “vacuum sealed,” Petitioner argued that it would have been obvious to vacuum seal Morikawa’s chambers under Patent Owner’s construction. Pet. Reply 25–26 (citing Pet. 17–18).

We find no deficiency in Petitioner’s approach here. Petitioner has set forth where each claim limitation is disclosed in, or rendered obvious by, Morikawa. For the reasons discussed above, we agree with the assertions presented in the Petition that Morikawa discloses each limitation of claim 9. “[I]t is well settled that a disclosure that anticipates under § 102 also renders the claim invalid under § 103, for anticipation is the epitome of obviousness.” *Realtime Data, LLC. v. Iancu*, 912 F.3d 1368, 1373 (Fed. Cir. 2019) (internal quotation marks and citations omitted) (affirming the Board’s determination of obviousness because a single reference disclosed every element of the challenged claims).

3. Analysis of Claim 10

Claim 10 depends from claim 9 and recites, “wherein said spaced-apart first and second plates include confronting interior surfaces” and “a wick positioned upon said confronting interior surfaces of said first and second plates and having a second po[r]tion of said exterior surface of

said at least one hollow column disposed within said vapor chamber.” Ex. 1001, 6:23–29.

Petitioner contends that Morikawa discloses a wick positioned upon confronting interior surfaces of the first and second plates and wherein a second portion of Morikawa’s hollow column is disposed within the vapor chamber. Pet. 23–25. The evidence supports Petitioner’s assertions.

Morikawa’s first and second plates have confronting interior surfaces. Ex. 1003, Fig. 3 (showing interior surface of top plate opposite interior surface of bottom plate); *see also* Pet. 23 (annotated Fig. 3 of Morikawa). Morikawa includes wick 12 on an outer peripheral surface of metal pipe 11a, where wick 12 also is positioned upon the confronting interior surfaces of the first and second plates. Ex. 1003, 3:37–38, 4:42–46, Fig. 3; *see also* Pet. 24 (annotated Fig. 3 of Morikawa). Morikawa also discloses a second portion of the exterior surface of metal pipe 11a, i.e., the portion between each end, is disposed in the vapor chamber. Ex. 1003, Fig. 3.

Patent Owner does not contest Petitioner’s assertions as to Morikawa’s disclosure of the limitations of claim 10. For the reasons discussed above, Petitioner has provided adequate evidence to show that Morikawa discloses the subject matter of dependent claim 10.

4. *Analysis of Claim 12*

Petitioner, in the Petition, argued that claim 12 of the ’240 patent would have been obvious over Morikawa alone. Pet. 26–96. In the Decision instituting an *inter partes* review, we determined that Petitioner had not demonstrated a reasonable likelihood of prevailing on this challenge. Inst. Dec. 25–27. Specifically, we determined that Petitioner had not made an adequate threshold showing that Morikawa alone discloses or renders obvious the claimed “circumferential edge lip” on each plate for claim 12.

Id. After institution, Patent Owner opposed Petitioner’s challenge. PO Resp. 52. In its Reply Brief, under the heading “GROUND 1 – MORIKAWA RENDERS OBVIOUS CLAIMS 9–10,” Petitioner states: “While standing by its contentions that both Morikawa and Nakamura disclose ‘lips,’ Petitioner no longer relies on Ground 1 for claim 12.” Pet. Reply 22. Petitioner does not explain what it means by the phrase “no longer relies on,” and we have not been presented with, for example, a motion for partial adverse judgment or a joint motion to withdraw Ground 1 as to claim 12 from this proceeding or otherwise limit the Petition. We proceed to reanalyze Ground 1 as to claim 12 on the full record developed during trial.

Claim 12 is directed to a heat pipe and recites “a first plate having a circumferential edge lip bounding an inner surface,” “a second plate . . . including a circumferential edge lip bounding an inner surface,” and “said edge lips of said first and second plates being sealingly bonded together so as to define a vapor chamber.” Ex. 1001, 6:58–59, 6:62–64, 6:65–67. Petitioner contends that “[a] POSITA would have understood and found it obvious that the upper plate . . . has a portion comprising a region bonded to the lower plate at the edge, periphery, or circumference . . . of enclosure 10 in Morikawa.” Pet. 27 (citing Ex. 1002 ¶ 64); *see also id.* at 28 (annotated Figure 2 of Morikawa identifying a circumferential edge lip on the upper plate of enclosure 10 as a vertical surface spanning the distance between Morikawa’s upper and lower plates). The cited paragraph of the Pokharna Declaration appears to be the same or substantively the same as the arguments in the Petition without further elaboration by Dr. Pokharna. *Compare* Pet. 26–27, *with* Ex. 1002 ¶ 64.

As to the requirement that the edge lips are “sealingly bonded together,” the Petition appears to rely on the disclosure in the ’240 patent that bonding between lips 22 and 24 is inherent as the basis for its assertion that the upper plate of Morikawa’s enclosure 10 has “an edge, periphery, or circumference . . . that corresponds to ‘a circumferential edge lip’ in the ’240 patent.” *Id.* at 27. The Petition relies on this same theory as the basis for asserting that Morikawa’s lower plate also includes the claimed circumferential edge lip. *Id.* at 31–32 (identifying the same vertical surface spanning the distance between Morikawa’s upper and lower plates in Figure 2 as the circumferential edge lip on the lower plate of enclosure 10).

Notwithstanding the multiple uses of the word “obvious,” we understand Petitioner to contend that the recited circumferential edge lips that are “sealingly bonded together” are inherently disclosed in Morikawa and that this inherency proposition flows, in part, from Petitioner’s proposed construction of “lip.” As discussed above in the claim construction section, we do not adopt Petitioner’s proposed construction involving inherency of the specifically recited lips in a sealed vessel.

Petitioner does not direct our attention to any description in Morikawa of the relationship between the spaced apart upper and lower plates other than by providing the annotated Figure 2 discussed above. *See* Pet. 28, 32. Figure 2 does not help Petitioner’s case as that figure depicts a six-sided heat pipe having what could be a separate vertical wall between the spaced apart top plates, which would seemingly thereby preclude those two plates from being bonded directly to each other. *Cf.* Ex. 1005, 3, Fig. 8 (Takahashi disclosing a heat pipe utilizing end caps 18 and 19 to seal the gap between two plate members 11 and 12 rather than bonding together the two plates at

those ends). Thus, any inherency or obviousness-by-inherency argument as to the bonding together of the edge lips is not persuasive.

If our understanding is incorrect and Petitioner's theory is not one of inherency, then the assertions of obviousness are mere conclusory statements. We are unable to recognize any proffered reasoning underlying the assertions of obviousness. "[Challenges] on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006).

As yet another possible alternative, Petitioner may be basing its case on improper hindsight by relying on and quoting the Specification of the '240 patent in its obviousness analysis. *See* Pet. 27. That, too, is unpersuasive.

Regardless as to its theory of the case, we determine that Petitioner has failed to explain sufficiently why the claimed heat pipe having a configuration of two plates having bonded together circumferential edge lips would have been obvious. Accordingly, Petitioner has not shown by a preponderance of the evidence that claim 12 is unpatentable over Morikawa alone.

F. Unpatentability over Morikawa and Nakamura

1. Nakamura

Nakamura discloses:

a heat pipe that transfers heat by a sealed container made of thermally conductive metal plates and a refrigerant enclosed in the sealed container, wherein 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.

Ex. 1004, 4;¹⁶ *see also* Ex. 2012, 5 (describing a sealed container made of “sheet metal,” a coolant in the sealed container, recessed portions in the upper and lower faces of the sealed container, and holes in the recess joint surfaces). Figures 3 and 4 are reproduced below:

Figure 3

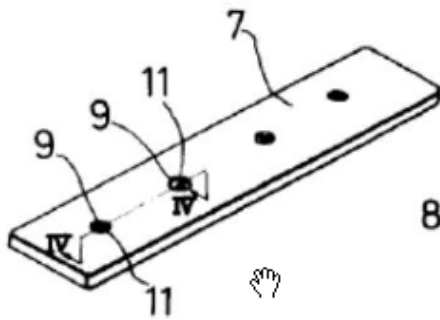
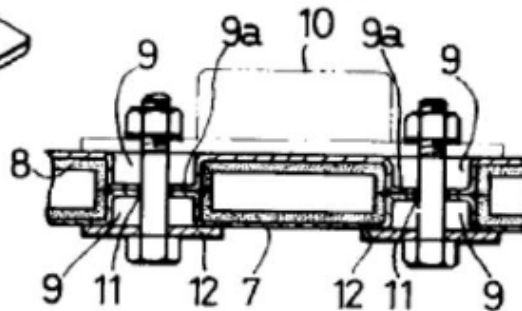


Figure 4



Figures 3 and 4 illustrate examples of a heat pipe of Nakamura’s invention, with Figure 3 being a perspective view and Figure 4 being a partial cross-sectional view of Figure 3 at cutting plane line IV–IV. Ex. 1004, 4, 7; Ex. 2012, 5–6, 8. “In Figures 3 and 4, 7 is a 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 and 8 is a wick that . . . is affixed to an inner-wall surface of the sealed container 7. . . .” Ex. 1004, 5; *see also* Ex. 2012, 6 (describing that reference numeral 7 denotes a sealed container “made of a thin sheet of a

¹⁶ In citing to Nakamura in this and following sections, we follow Petitioner’s convention of citing to the numbers in parentheses at the bottom center of the translation rather than those used in numbering the pages of the exhibit overall. We also omit the translator’s marginalia, parentheticals, and italics.

high thermal conductivity material” that is formed to be “airtight by soldering, brazing or the like” and has wick 8 attached to the interior wall surfaces of sealed container 7). Nakamura describes concavities in the sealed container:

On both surfaces of the sealed container 7, a concavity 9 of a depth one-half of a thickness of the sealed container 7 is provided via pressing or the like in a state of the thin plate prior to being assembled into the sealed configuration. A concavity joining surface 9a of the concavity 9 is finished flat after pressing is completed and is applied in advance to preliminary soldering. The concavity joining surfaces 9a can then 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. Then, after air inside the sealed container 7 is extracted, a refrigerant is enclosed in an interior hollow portion.

Ex. 1004, 5; *see also* Ex. 2012, 6 (similar translation).

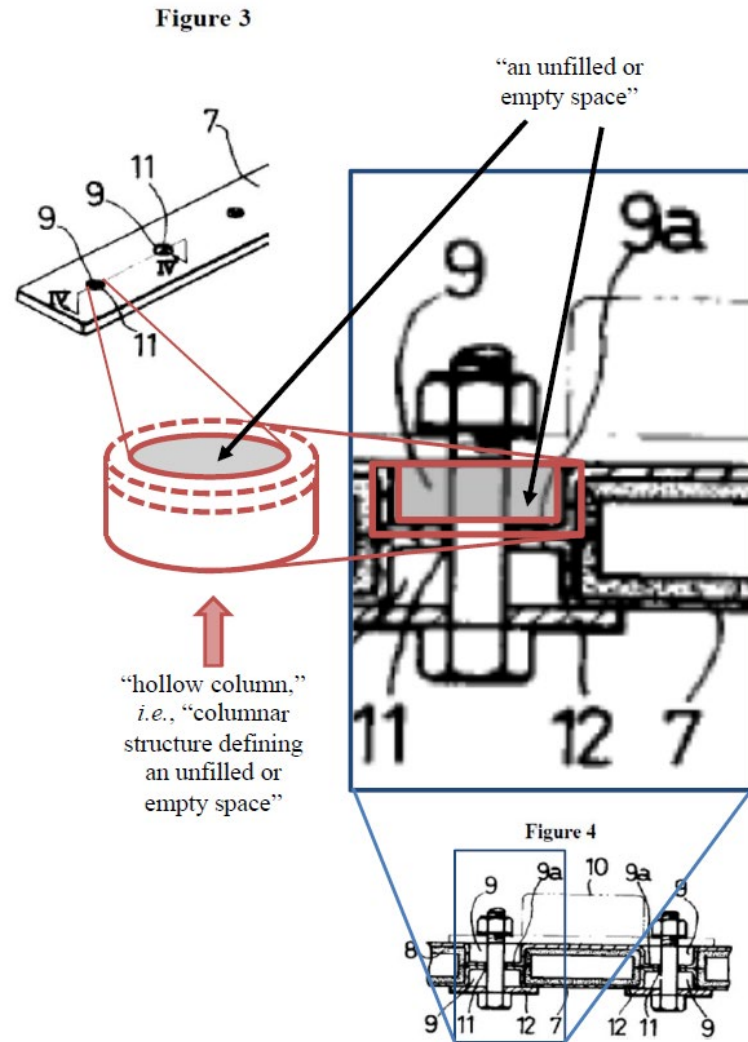
To install the heat pipe to component 10 to be cooled, holes 11 “can be drilled into the concavity joining surfaces 9a and installation can be performed via a bolt or the like via a washer 12.” Ex. 1004, 5–6; *see also* Ex. 2012, 6–7 (similar translation). “By mounting the component to be cooled in this manner, the component to be cooled can be made to directly contact the heat panel [and, t]herefore, an efficiency of heat transfer is very favorable.” Ex. 1004, 6; *see also* Ex. 2012, 7 (similar translation).

2. Analysis of Claims 9 and 10

Independent Claim 9 recites “at least one hollow column having an exterior surface positioned within said vapor chamber with a first portion of said exterior surface sealingly bonded to at least one of said first and second plates, and having an open first end that opens through said first plate and an open second end that opens through said second plate so as to form at least

one mounting hole that is isolated from said vapor chamber.” Ex. 1001, 6:15–22. By virtue of its dependency from claim 9, claim 10 also includes the “hollow column” limitation. *Id.* at 6:23–29.

Petitioner’s assertion of unpatentability of claims 9 and 10 over Morikawa and Nakamura is based on a proposed modification of Morikawa to replace its metal pipe 11a with Nakamura’s concavities 9 to meet the claimed “hollow column” limitation. Pet. 43–57. Thus, this ground is premised on its assertion that the term “hollow column” means “a columnar structure defining an unfilled or empty space.” Pet. 12 (quoting Ex. 1019, 6 (Patent Owner’s proposed construction in the district court)); *see id.* at 44–45 (quoting this same language in comparing Nakamura to the claim recitation). We understand Petitioner to contend that concavity 9 in Nakamura’s top plate constitutes the hollow column. Pet. 43–45. Some of Petitioner’s contentions are explained via the annotated figures reproduced below.



Pet. 51. The figures above are an enlarged and annotated portion of Nakamura's Figures 3 and 4, annotated by Petitioner, and depict concavity 9 formed in the top plate with a depth of one-half the thickness of the overall container 7. Ex. 1004, 5; Ex. 2012, 6. Nakamura's concavity joining surface 9a of the concavity formed in the top plate is sealed together by soldering or the like to an opposite concavity joining surface 9a of a concavity formed in the bottom plate, and bolt hole 11 is drilled through the concavity joining surfaces. Ex. 1004, 5–6; Ex. 2012, 6–7. Petitioner contends, as indicated in the annotated figure, that that the "concavity '9,' corresponding to the 'void or cavity' or the 'unfilled or empty space'

(colored in grey above), is ‘surround[ed]’ or ‘defin[ed]’ by the cylindrical-bowl shaped structure (indicated in red above), which corresponds to the ‘cylindrical’ or ‘columnar structure.’” Pet. at 51–52.

As discussed above in our claim interpretation analysis, the Specification of the ’240 patent distinguishes between spacers formed by “depressions” and spacers formed by “hollow columns.” See Ex. 1001, 2:12–46. Specifically, we interpret “hollow column” in the claims to mean a spacer formed by a column that extends from one plate to the outer surface of the opposite plate. See *supra* § II.B.2. We do not construe “hollow column” to encompass depressions, described in the ’240 patent, that extend from one plate to the inner surface of the opposite plate. *Id.*

In keeping with our understanding of “hollow column,” Petitioner asserts that the second spacer embodiment in the ’240 patent, that of a column 44 with a through-hole 12, is the ’240 patent’s disclosure of the recited “hollow column.” Pet. 43–44 (quoting Ex. 1001, 4:20–24). Despite this admission, however, Petitioner bases its grounds on the assertion that the “hollow column” in Nakamura is a concavity, which is a depression-like structure similar to the ’240 patent’s first spacer embodiment (depression 26). See *id.* at 51. Specifically, as shown in Figure 4 relied on by Petitioner,¹⁷ Nakamura’s concavity 9 extends from one plate to the inner surface of the opposite concavity 9 formed in the opposite plate. Ex. 1004,

¹⁷ Petitioner points to Nakamura’s disclosure of another heat pipe utilizing a pipe as a fastener hole rather than concavities. Pet. 46–47 (discussing Nakamura, Fig. 2). Petitioner makes clear that it is not relying on that disclosure to meet the “hollow column” limitation and does not argue, with any accompanying reasoning, that the disclosure renders the claimed subject matter obvious. See *id.*

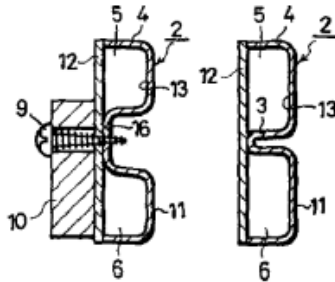
Fig. 4; Ex. 2012, Fig. 4. As noted above, this depression-like spacer is not a disclosure of a “hollow column” as claimed.

For these reasons, Petitioner has failed to show by a preponderance of the evidence that the combination of Morikawa and Nakamura renders claims 9 and 10 unpatentable under 35 U.S.C. § 103(a).

G. Unpatentability over Morikawa and Takahashi

1. Takahashi

Takahashi discloses a heat pipe “fixed with screws for mounting heating elements, such as transistors, or the like.” Ex. 1005, 3:14–15, 26–29. By way of illustration, Takahashi Figures 3 and 4 are reproduced below.



Figures 3 (left) and 4 (right) show cross-sectional views of one embodiment of the disclosed heat pipe “wherein the inside of a square tube container (2) with both ends sealed [and] made of aluminum . . . is divided into a gas-phase hydraulic fluid passage (5) on the upper side and a liquid-phase hydraulic fluid passage (6) on the lower side by an intermediate partition wall (3).” *Id.* at 4:48–57; *see id.* at 8:9–11. The container is formed as follows:

[T]he container (2) is provided with a first plate member (11) that has a concave part for hydraulic fluid passage (13) over almost the total length on one side, a peripheral wall (4) surrounding it, and an intermediate partition wall (3); and a second plate member (12) in a strip shape for covering the opening of the concave part for hydraulic fluid passage (13).

Id. at 4:65–5:4.

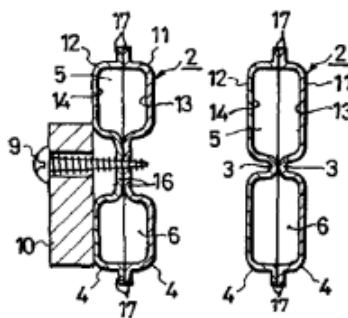
The container (2) is formed by mutually superimposing the first and second plate members (11) and (12) that constitute a container (2) and bonding by a vacuum brazing method the tip of the peripheral wall (4) of the first plate member (11), the peripheral edge part of the second plate member (12) in a strip shape, the tip of the intermediate partition wall (3) of the first plate member (11), and the facing surface of the junction for mounting heating elements (16) and the second plate member (12).

Id. at 5:12–20.

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). Therefore, thermal resistance of a heat pipe (1) is small, and even when the pipe is installed horizontally, for example, it can be operated normally, and has excellent heat radiation performance. The plate fins (15) [(shown in Figure 2)] are mounted in parallel at the end of the evaporator side of the container (2).

Id. at 5:27–38.

Takahashi Figures 5 and 6 are reproduced below.



Figures 5 (left) and 6 (right) show cross-sectional views of a second embodiment with plate members (11) and (12) “constitut[ing] a square tube container (2) with both ends sealed [and] both built by press-molded

aluminum plates.” *Id.* at 6:4–9; *see id.* at 8:12–16. This square tube container includes flanges:

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 these plate members (11) and (12) are superimposed with the concave parts (13) and (14) facing inwards, for example, the flanges (17) and (17) at the tips of the peripheral walls (4) and (4) of both plate members (11) and (12), and the tips of intermediate partition walls (3) and (3) are joined to each other by a vacuum brazing method to form a container (2).

Id. at 6:14–22.

2. Analysis of Claim 12

For the reasons discussed below, Petitioner has not shown by a preponderance of the evidence that the combination of Morikawa and Takahashi renders claim 12 unpatentable under 35 U.S.C. § 103(a). Claim 12 calls for a particular relationship between the plates and hollow column. Specifically, claim 12 recites, in pertinent part:

a first plate having . . . at least one hollow column that is integral with said first plate . . . ;

a second plate . . . including . . . at least one opening through said second plate . . . ; wherein

said at least one hollow column being sealingly bonded at one end to said second plate so as to coaxially align said at least one hollow column with said at least one opening in said second plate

Ex. 1001, 6:57–7:4. Thus, claim 12 calls for a first plate having an integral hollow column and the hollow column bonded to a second plate.

Petitioner asserts that Morikawa’s metal pipe 11a is the claimed “hollow column that is integral with said first plate.” Pet. 28. Petitioner explains that Morikawa’s metal pipe 11a is integral with the upper plate

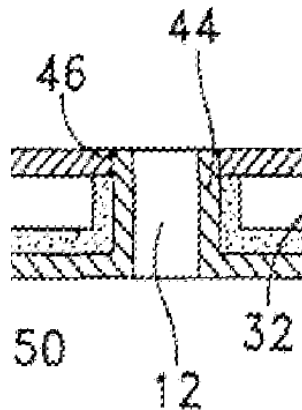
“because Morikawa teaches ‘welding and fixing the metal pipe to the panel surfaces,’ thus integrating the metal pipe with the upper plate.” *Id.* at 29 (citing Ex. 1003, 4:26–27). Petitioner further explains that Morikawa’s “metal pipe” 11a is “bonded” at one end to its lower plate “because Morikawa teaches ‘welding and fixing the metal pipe to the panel surfaces,’ thus sealing[ly] bonding the metal pipe with the lower plate.” *Id.* at 36 (citing Ex. 1003, 4:26–27). Petitioner, thus, contends that a welded pipe creates both an integral hollow column on one end and a bonded hollow column on the other end.

The question presented in this ground is the meaning of “integral” to a person of ordinary skill in the art at the time of invention and with that term read in the context of the entire disclosure of the ’240 patent. Under the circumstances of this case, Petitioner has not adequately addressed that issue. *Cf.* 37 C.F.R. § 42.104(b) (The petition must identify how the challenged claim is to be construed and how the construed claim is unpatentable); Patent Trial and Appeal Board Consolidated Trial Practice Guide (Nov. 2019), 44–45, *available at* <https://www.uspto.gov/TrialPracticeGuideConsolidated> (“If a petitioner believes that a claim term requires an express construction, the petitioner must include a statement identifying a proposed construction of the particular term and where the intrinsic and/or extrinsic evidence supports that meaning.”).

Petitioner contends that Morikawa’s metal pipe welded to the upper plate is “like the ‘hollow column that is integral with said first plate’ in the ’240 patent.” Pet. 29 (citing Ex. 1002 ¶ 65). This is an important assertion as it is an implied argument that the intrinsic evidence supports its position. However, Petitioner does not provide a citation to the Specification for this proposition and does not elaborate, in the pertinent section of the Petition, on

the assertion that a welded component is like the integral hollow column of the '240 patent. *See id.* at 29–30. Additionally, we find that the relied-upon testimony of Petitioner’s expert, Dr. Pokharna, on this issue lacks credibility. Dr. Pokharna’s declaration includes a repetition of Petitioner’s argument. *Compare* Pet. 29–30 *with* Ex. 1002 ¶ 65. Dr. Pokharna, like Petitioner, fails to explain adequately why a welded component is like the integral column of the '240 patent. *See* Ex. 1002 ¶ 65 (making the statement without citing support).

The specification of the '240 patent distinguishes between a component bonded to a plate and something “embossed in one plate,” i.e., integral with the plate. *See* Ex. 1001, 2:32–35. A portion of Figure 2 of the '240 patent is shown below.



The depiction above is a portion of Figure 2, which is “a cross section view of an alternate embodiment of the flat plate heat pipe 11.” *Id.* at 4:36–37. The depiction shows the material of the bottom plate bent upward and with “columns 44 . . . bonded to cover plate 20 at locations 46.” *Id.*, 4:20–24. One of ordinary skill would understand this to disclose an example of a column integral with one plate and bonded to another plate.

Lastly, Petitioner effectively concedes, via its own arguments, its expert’s testimony, and the references relied on, that a person of ordinary

skill in the art of heat pipes would understand there to be a distinction between a welded component and an integral one. In the context of Ground 2, Petitioner argues that Nakamura provides reason to replace Morikawa's welded pipes with concavities/depressions formed from one of the plates. *See* Pet. 40–57; Ex. 1002 ¶¶ 82–83). According to Petitioner, Nakamura evidences that the bonded pipes of Morikawa are difficult to manufacture and can result in refrigerant leaks at the pipe-to-plate junction. *Id.* at 46–49 (quoting Ex. 1004, 3–4). Petitioner contends that a person of ordinary skill would recognize these problems and would be motivated to use depressions in the plates instead. *Id.* at 49–50. These arguments and evidence are consistent with the conclusion that the recited “hollow column that is integral with said first plate” does not encompass a pipe welded to a plate.

For this reason, Petitioner has not shown by a preponderance of the evidence that claim 12 is unpatentable over Morikawa and Takahashi under 35 U.S.C. § 103(a).

H. Unpatentability over Morikawa, Takahashi, and Nakamura

1. Analysis of Claim 11

For the reasons discussed below, Petitioner has not shown by a preponderance of the evidence that the combination of Morikawa, Takahashi, and Nakamura renders claim 11 unpatentable under 35 U.S.C. § 103(a). Claim 11 recites both “at least one depression formed in said first plate” and “at least one spacer extending between and contacting said first and second plates.” Ex. 1001, 6:39–42, 50–51.

Petitioner asserts that Nakamura's concavities 9 correspond to the claimed “at least one depression” and that a person having ordinary skill in the art would have been led to replace Morikawa's metal pipes 11a with

Nakamura's concavities 9 because Nakamura directly names Morikawa and describes the shortcomings with joining Morikawa's metal pipe and an outer wall of the heat pipe by brazing and the potential for leakage. Pet. 46–50, 84–85. Petitioner also asserts that Morikawa teaches a conventional spacer that is formed by a metal column welded to the upper and lower inner surfaces of the panel and that person having ordinary skill in the art would have understood that, “when combined with Nakamura, Morikawa no longer needs to create the ‘through path’ inside such ‘metal column.’” Pet. 88 (citing Ex. 1003, 4:30–35; Ex. 1002 ¶ 93). Petitioner argues that Morikawa's “conventional spacer” would have been obvious as a “structure used to maintain a space or clearance between the plates” and to support the wick. *Id.* at 88–89.

Patent Owner points out that Petitioner's challenge relies on a combination of Morikawa and Nakamura where Morikawa is modified to replace some, but not all, of Morikawa's metal pipes 11a with Nakamura's concavities. PO Resp. 57–58. Patent Owner argues that Petitioner's expert fails to provide a rationale for why a person having ordinary skill in the art would have replaced only some of Morikawa's metal pipes. *Id.* at 58. Patent Owner further asserts that were one to make the proposed modification, a person having ordinary skill would have been led to replace all of Morikawa's metal pipes 11a with Nakamura's concavities. *Id.*

Petitioner replies by reiterating the arguments presented in the Petition, namely that “it would be obvious to use Nakamura's concavities/depressions to form the ‘through path’ while also employing Morikawa's columns as spacers to help maintain a clearance between the two plates and/or to act as a supporting structure for the wick.” Pet. Reply 32 (citing Pet. 88–89).

We agree with Patent Owner that Petitioner has not explained adequately and persuasively what would have led one having ordinary skill in the art to replace only some of Morikawa's metal pipes 11a with Nakamura's depressions so as to have led one to a heat pipe containing both a depression and a spacer extending between and contacting both plates, as recited in claim 11. *See* Ex. 1002 ¶ 124 (analysis of claim 11, in which Dr. Pokharna opines that Morikawa's metal pipes 11a correspond to the "at least one spacer extending between and contacting said first and second plates" of claim 11). For this reason, Petitioner has not shown by a preponderance of the evidence that claim 11 is unpatentable under 35 U.S.C. § 103(a).

2. Analysis of Claim 13

For the reasons discussed below, Petitioner has shown by a preponderance of the evidence that the combination of Morikawa, Takahashi, and Nakamura renders claim 13 unpatentable under 35 U.S.C. § 103(a). We address each claim limitation below.

a) "A heat pipe for spreading heat"

In its discussion of the unpatentability of claim 13 over Morikawa, Takahashi, and Nakamura, Petitioner contends that Morikawa discloses a heat pipe for spreading heat. Pet. 92 (incorporating the analysis in Section IX.B.1 on Pet. 15–16). According to Petitioner, Morikawa discloses a heat pipe that "transfers and releases heat." Pet. 15–16 (citing Ex. 1003, 1:32–36; Ex. 1002 ¶ 51).

As discussed above (*see* § II.E.2.a), Patent Owner argues that Morikawa's heat pipe does not "spread heat." PO Resp. 43 (Ex. 2002 ¶¶ 67,

126, 127). Patent Owner does not assert in its Response¹⁸ that the language “for spreading heat” in the preamble of claim 13 is itself limiting, and instead seeks to insert the requirement of spreading heat into the construction of “vapor chamber.” We adopt Petitioner’s construction of “vapor chamber” that includes the requirement that the vapor chamber transport or spread heat. We address this aspect of the claim language below in our analysis of the prior art’s disclosure of a “vapor chamber.”

Although Patent Owner does not expressly argue in its Response that the language “for spreading heat” in the preamble of claim 13 is limiting, to the extent Patent Owner’s argument that Morikawa does not disclose heat spreading incorporates this language of the preamble, we address the effect of this preamble language on the claim scope. We find that the preamble language “for spreading heat” is merely a statement of intended use and is not limiting.

The body of claim 13 recites a first plate having a circumferential edge lip and a depression, a second plate including a circumferential edge lip and an opening, the edge lips of the plates sealingly bonded together to define a vapor chamber, where the depression is sealingly bonded to the second plate to align with the opening to form a mounting hole. The body of this claim does not recite a “heat pipe for spreading heat.” The preamble’s reference to “for spreading heat” merely identifies an intended use for the

¹⁸ In its Reply, Petitioner argues that the preambles of the challenged claims are not limiting. Pet. Reply 3–4. In response to this argument, Patent Owner argues, for the first time in the Sur-Reply, that because the patent title refers to heat spreading and the patent repeatedly refers to the invention as a “heat pipe heat spreader” or “heat spreader,” the preamble should be limiting. Sur-Reply 3 (citing *Poly-America LP v. FSE Lining Tech. Inc.*, 383 F.3d 1303 (Fed. Cir. 2004)).

claimed structure. Patent Owner has not demonstrated that this use itself imposes any structural requirement on the claimed structure beyond what is required by the body of the claim. Nor has it shown any “reliance on the preamble during prosecution to distinguish the claimed invention from the prior art.” *Catalina*, 289 F.3d at 808. As in *Catalina*, “deletion of the disputed phrase from the preamble. . . [would] not affect the structural definition or operation of the [invention] itself.” *Id.* at 810.

To the extent the claim term “vapor chamber” includes, among other things, the function of spreading heat, we address Patent Owner’s arguments below. For the reasons discussed below, even were the preamble treated as limiting, we find that Morikawa’s device meets this limitation.

b) “a first plate having a circumferential edge lip bounding an inner surface and at least one depression which projects outwardly relative to said inner surface”

In its discussion of the unpatentability of claim 13 over Morikawa, Takahashi, and Nakamura, Petitioner contends that Morikawa, as modified by Takahashi, discloses a first plate having a circumferential edge lip bounding an inner surface. Pet. 92 (incorporating the analysis in Section XI.B.1 on Pet. 64–69). Petitioner asserts, with reference to annotated Figures 2A and 2B of Morikawa, that the heat pipe is an airtight enclosure 10 formed by spaced-apart first and second plates, having a working fluid present in the enclosed and sealed void within the enclosure. Pet. 16–18 (citing Ex. 1003, 1:36–41, 1:45–2:7, 5:1–2 and Ex. 1002 ¶¶ 52–54). As discussed above in Section II.E.2.b, we agree with Petitioner that Morikawa discloses a heat pipe having a top, first plate. Ex. 1003, Figs. 2B, 3.

Petitioner asserts that Takahashi discloses a heat pipe formed with a first plate having a circumferential edge lip because each of Takahashi’s

plates contain flanges 17 at the tips, which are brazed together to form a sealed container. Pet. 64. Petitioner asserts that it “would have been obvious to combine Morikawa with Takahashi in a manner resulting in the first plate “having a circumferential edge lip bounding an inner surface.” *Id.*

We agree with Petitioner that Takahashi discloses a heat pipe (2) having a first plate (11). Ex. 1005, 6:7–9, Figs. 5, 6. Takahashi’s plate (2) includes a flange (17) at the tip of the peripheral wall (4) of the plate. *Id.* at 6:14–16; Figs. 5, 6. Takahashi teaches 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) . . . are joined to each other by a vacuum brazing method to form a [sealed] container (2).” Ex. 1005, 6:14–22.

Patent Owner contests Petitioner’s assertion that Takahashi’s flanges extend about the entire circumference of each plate. PO Resp. 53 (citing Ex. 2002 ¶ 156). We disagree with Patent Owner. For the reasons that follow, we understand Takahashi’s second embodiment, shown in Figures 5 and 6, to include flanges extending around the entire circumference of the container. Takahashi describes, in detail, a first embodiment of heat pipe, shown in Figures 1 through 4. Ex. 1005, 4:48–6:3; 8:7–11. Figure 1 shows container (2) provided with first plate member (11) with concave fluid passage (13) and “peripheral wall (4) surrounding [concave fluid passage (13)].” *Id.* at 4:65–5:1, Fig. 1. Thus, as shown in Figure 1, peripheral wall (4) extends around the entire circumference of first plate member (11). *Id.* Takahashi describes that container (2) also includes second plate member (12). *Id.* at 5:1–4; Fig. 1. Takahashi discloses sealing its heat pipe around its entire circumference by vacuum brazing the tip of “peripheral wall (4) of first plate member (11) and the peripheral edge part of second plate member

(12) in a strip shape.” *Id.* at 5:12–20 (discussing the first embodiment). Takahashi then describes that the second embodiment, shown in cross-section in Figures 5 and 6, is “equivalent” to the first embodiment. *Id.* at 8:12–16 (describing the Figures).

Takahashi describes that this second embodiment is different from the first embodiment in that first and second plate members (11) and (12) are built by press-molded aluminum plates with concave parts for hydraulic fluid passages (13) and (14) facing each other and “peripheral walls (4) (4) surrounding these [concaves].” *Id.* at 6:4–13. Thus, we find that Takahashi discloses that peripheral walls (4) on each of first and second plate members (11) and (12) of this second embodiment extend around the entire circumference of each plate, similar to peripheral wall (4) of the first embodiment. Takahashi describes that the tips of peripheral walls (4) and (4) of both plate members (11) and (12) are provided with flanges (17) and (17) and these flanges are joined to each other by vacuum brazing to form container (2). *Id.* at 6:14–22. We agree with Dr. Pokharna that a person having ordinary skill in the art would have read Takahashi’s second embodiments as likewise having a seal about the entire periphery, despite the fact that the Figures of these additional embodiments depict only a cross-section. Pet. Reply 32 (citing Ex. 1032 ¶ 65). As explained by Dr. Pokharna, “implementing a flange about the entire perimeter of those devices would help to ensure to that those devices are vacuum sealed and operate correctly.” Ex. 1032 ¶ 65. Thus, we find that Petitioner has shown that Morikawa discloses a first plate and Takahashi discloses a first plate with a circumferential edge lip. We now turn to Petitioner’s reason to combine these teachings.

As to motivation to combine, Petitioner asserts that “both Morikawa and Takahashi concern heat pipe structures that include through holes located at the body region of the heat pipes for securing them onto the heat generating elements.” Pet. 65. Based on this assertion, Petitioner argues, “[t]hus, in general, a skilled artisan would have been motivated to combine the features in the two references already because the devices in Morikawa and Takahashi are similar and analogous.” *Id.* (citing Ex. 1002 ¶ 98).

Simply noting that Morikawa and Takahashi disclose similar devices made using related processes, however, says nothing about *why* one of ordinary skill in the art would combine them in a manner that renders the claimed subject matter obvious. *See Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1368 (Fed. Cir. 2012) (quoting *Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1374 n.3 (Fed. Cir. 2008) (“We must still be careful not to allow hindsight reconstruction of references to reach the claimed invention without any explanation as to how or why the references would be combined to produce the claimed invention.”)). Petitioner’s argument that the references are “similar and analogous” is not adequate reasoning, by itself, to support a conclusion of obviousness.

Petitioner, relying on the testimony of Dr. Pokharna, further reasons that a person of ordinary skill in the art would have understood that it would not be easy to bond and seal the edges of Morikawa’s plates and would have been motivated to seek a better way to form and bond the plates at their edges. Pet. 66 (citing Ex. 1002 ¶ 99). Petitioner contends that “Takahashi, teaches this ‘better way’ (which a POSITA would have been motivated to seek for improving Morikawa) by describing the manufacturing processes of ‘pressing’ and ‘brazing’ for forming and bonding/sealing [sic] a heat pipe’s container plates.” *Id.* at 66–67. Specifically, Petitioner argues:

A POSITA would have been motivated to combine Takahashi's "flanges (17) and (17)" with Morikawa's sealed enclosure 10 because it would have made bonding and sealing the plates at their edge, periphery, or circumference in Morikawa easier by "pressing," "brazing," and/or "soldering" the two "flanges (17) and (17)" in Takahashi together. This is because these "flanges (17) and (17)" are protruding and exposed outwardly, and thus are easier to be pressed and clamped together while being heated to make them bond and seal together during the manufacturing processes. . . . Because the "flanges (17) and (17)" structures and the associated manufacturing processes in Takahashi were well-known at the time of filing for the '240 patent, a POSITA would have reasonably expected the combination of Morikawa and Takahashi to yield predictably successful results with an easier and better bonded and sealed edge, periphery, or circumference of the sealed enclosure in Morikawa.

Id. at 67–68 (citing Ex. 1002 ¶ 99); Pet. Reply 29 (citing Ex. 1032 ¶¶ 57–65).

Patent Owner attacks Petitioner's evidence of a reason to combine Morikawa and Takahashi and Petitioner's assertion that, as combined, the modified heat pipe of Morikawa would have circumferential edge lips. Specifically, as to a reason to combine, Patent Owner argues that "rather than make bonding or sealing the periphery, circumference or edge of Morikawa's heat pipe container 'easier,' Takahashi's 'flanges (17) and (17)' would have created additional junction points where leakage could occur." PO Resp. 54 (citing Ex. 2002 ¶ 154).

We do not give much weight to Dr. Faghri's testimony because it is based on an incorrect premise that Morikawa is not constructed of two plates. *See* Ex. 2002 ¶ 154. As discussed above in our analysis of the challenge to claim 9, Morikawa discloses a heat pipe formed of two plates. *See supra* § II.E.2.b. We are convinced by Dr. Pokharna's testimony that Takahashi's flanges would have been seen by a person having ordinary skill

in the art as an improvement to the method of joining the edges of Morikawa's heat pipe because it would be easier to press or clamp together the flanges protruding from the edges of the plates to bond the plate edges together. Pet. 67–68; Ex. 1002 ¶ 99; *Id.* at 92 (citing Ex. 1002 ¶ 138).

We further find that Petitioner has shown that a person having ordinary skill in the art would have had a reasonable expectation of success in modifying Morikawa to improve sealing by employing Takahashi's flanges. Pet. 68–69 (citing Ex. 1002 ¶ 99); *id.* at 92 (citing Ex. 1002 ¶ 138). For instance, we credit Dr. Pokharna's testimony that the manufacturing processes disclosed in Takahashi of pressing together the flanges and brazing or soldering them to form a sealed container “were well-known” manufacturing processes and that “a skilled artisan would have reasonably expected the combination of Morikawa and Takahashi to yield predictably successful results.” Ex. 1002 ¶ 99.

Dr. Faghri testifies that adopting Takahashi's flanges would have complicated Nakamura's and Morikawa's conventional heat pipe construction because it would have created gaps in their capillary structure. Ex. 2002 ¶ 155. Nakamura, however, already describes using brazing or soldering to form the assembly, so it is unclear how Dr. Faghri proposes that use of Takahashi's flanges, joined by brazing or soldering, would disrupt the capillary action in Nakamura's and Morikawa's conventional heat pipes. Ex. 1004, 3, 6; Ex. 2012, 3, 6. Dr. Faghri's position is also belied by the '240 patent itself, which describes the joining of plates by soldering or brazing as “conventional means” of joining plates. Ex. 1001, 3:26–35.

Patent Owner argues that because Takahashi fails to teach that the “flanges” extend around the circumference of Takahashi's container, the proposed modification of Morikawa with Takahashi's flanges would not

result in “circumferential edge lips.” PO Resp. 54–55 (arguing that Morikawa’s heat pipe uses end caps, and Takahashi’s embodiment with end caps omits its flanges) (citing Ex. 2002 ¶¶ 156–158). We disagree with Patent Owner’s reading of Takahashi. As discussed above, we find that Takahashi discloses flanges (17) that extend around the entire circumference of each of plates (11) and (12).

Dr. Faghri also opines that Takahashi discloses a container with flange-like structures “at the tips of the peripheral walls” in embodiment (b) (i.e., the second embodiment of Figures 5 and 6) and a container with end caps and no flanges in embodiment (c) (i.e., the third embodiment of Figures 7 and 8), and Takahashi does not teach any reason for replacing end caps, such as in Morikawa, with flanges. Ex. 2002 ¶¶ 156, 157. As discussed above, we agree with Dr. Pokharna’s reasoning as to why a person having ordinary skill in the art would have found it beneficial to use Takahashi’s flanges, in place of Morikawa’s end caps, to seal the heat pipe. Ex. 1002 ¶ 99.

Turning back to the remainder of this claim limitation, Petitioner contends that Nakamura discloses at least one depression that projects outwardly relative to the inner surface of the first plate. Pet. 92–93 (asserting that Nakamura’s concavity 9 extends downwardly from the top plate such that it projects outwardly relative to the inner surface of the top plate) (citing Ex. 1002 ¶ 142). We find adequate evidence in Nakamura to support this finding. Nakamura’s concavity 9 extends from its top plate in a manner similar to the way depressions 26 project outwardly relative to inner surface 34 of cover 20 in Figures 1 and 2 of the ’240 patent. *Compare* Pet. 94 (showing annotated Figure 3 of Nakamura) *with* Ex. 1001, Figs. 1, 2 (showing depressions 26).

Patent Owner does not contest that Nakamura's concavity 9 is a depression. Rather, Patent Owner contests Petitioner's assertion that Nakamura's concavity 9 is sealingly bonded to a second plate. PO Resp. 59–61. This contention is addressed below.

Thus, Petitioner has demonstrated by a preponderance of the evidence that Morikawa, as modified by Takahashi and Nakamura, would have led one having ordinary skill in the art to “a first plate having a circumferential edge lip bounding an inner surface and at least one depression which projects outwardly relative to said inner surface,” as recited in claim 13.

- c) *“a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip bounding an inner surface and at least one opening through said second plate”*

In its discussion of the unpatentability of claim 13 over Morikawa, Takahashi, and Nakamura, Petitioner contends that Morikawa's heat pipe includes a second plate arranged in spaced apart confronting relation to the first plate. Pet. 95 (incorporating the analysis in Sections IX.D.4 on Pet. 30). Patent Owner argues that Morikawa does not disclose constructing a heat pipe using two plates. PO Resp. 57. For the same reasons discussed above in our analysis of claim 9 (*see supra* § II.E.2.b), we agree with Petitioner that Morikawa discloses a two-plate construction.

Turning to the remainder of the claim limitation, Petitioner contends that it would have been obvious to modify Morikawa's second plate with Takahashi's flanges to result in “a circumferential edge lip bounding an inner surface” of the second plate. Pet. 95 (referring back to Section IX.D.5 on Pet. 31–32). For the same reasons discussed above with reference to the first plate limitation, we find that Petitioner has met its burden to show that this proposed modification would have been obvious to a person having

ordinary skill in the art and that the combination would have led to the circumferential edge lip as claimed. *See supra* § II.H.2.b.

Petitioner also contends that Morikawa, as modified by Takahashi and Nakamura would have rendered obvious a second plate containing “at least one opening” therethrough. Pet. 95–96 (asserting that Nakamura’s bottom plate corresponds to the second plate, and that the bottom plate has an opening through which the bolt passes) (citing Ex. 1002 ¶ 142). Nakamura shows in Figure 4 a bottom plate having an upwardly formed concavity 9 with a hole formed in the concavity for accommodating a bolt. Ex. 1004, Fig. 4; Ex. 2012, Fig. 4.

Patent Owner argues that Nakamura’s hole is formed in the concavity so that it is not formed in the second plate. PO Resp. 60–61. We fail to find that this fact distinguishes the claim from Nakamura. Because Nakamura’s concavity is formed in the plate (i.e., the concavity is an embossed part of the second plate), the fact that the hole is formed in the concavity does not mean that the hole is not also formed in the plate. The concavity is part of the second plate so that the hole is formed in the second plate.

For these reasons, Petitioner has provided adequate evidence to demonstrate that Morikawa, as modified by Takahashi and Nakamura, would have led one having ordinary skill in the art to “a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip bounding an inner surface and at least one opening through said second plate,” as recited in claim 13.

d) *“said edge lips of said first and second plates being sealingly bonded together so as to define a vapor chamber”*

Petitioner contends that Morikawa, as modified to add the flanges of Takahashi, results in a heat pipe in which the edge lips of the first and

second plates are sealingly bonded together so as to define a vapor chamber. Pet. 96–97 (incorporating the analysis in Section IX.D.7¹⁹ on Pet. 34–36 and Section IX.D.8 on Pet. 36–37); Ex. 1002 ¶ 143–144). As discussed above, we find that Petitioner has provided adequate evidence and reasoning of a motivation to employ Takahashi’s flanges in Morikawa’s heat pipe. Further, we agree that the modification to add Takahashi’s flanges to Morikawa’s heat pipe results in the circumferential edges lips on each plate being sealingly bonded together.

Patent Owner argues that Petitioner’s typographical error in its cross-reference to a non-existent section in the Petition renders this ground inadequate because the Petition fails to address how the structure resulting from the combination defines a “vapor chamber.” PO Resp. 56. First, we understand the Petitioner’s improper cross-reference to refer to the analysis in Sections XI.D.7 and XI.D.8, which address similar claim limitations to those at issue in claim 13. Second, these sections of the Petition address the “vapor chamber” limitation, and for the same reasons discussed above in our analysis of claim 9, we agree with Petitioner that Morikawa’s heat pipe defines a “vapor chamber,” as recited in claim 13. *See supra* §II.E.2.b.

For these reasons, Petitioner has provided adequate evidence to show that Morikawa, as modified by Takahashi and Nakamura, would have led one having ordinary skill in the art to “said edge lips of said first and second plates being sealingly bonded together so as to define a vapor chamber,” as recited in claim 13.

¹⁹ The Petition refers to non-existent sections XI.B.7 and XI.B.8. We understand Petitioner to have intended to refer to IX.D.7 and IX.D.8, which address the same limitations as in claim 13.

- e) *“said at least one depression has an open ended tubular cross-section and an outer surface, a portion of which outer surface is sealingly bonded to said second plate so as to coaxially align said at least one depression with said at least one opening in said second plate thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber”*

Petitioner contends that Nakamura discloses its depression has an open ended tubular cross-section and an outer surface, a portion of which outer surface is sealingly bonded to the second plate, so as to coaxially align the depression with the opening in the second plate to form a mounting hole that extends through the first plate depression and the second plate and is isolated from the vapor chamber. Pet. 97–104 (by reference to annotations on Figure 4 of Nakamura) (citing Ex. 1002 ¶¶ 145–148; Ex. 1004, 5). We agree with Petitioner’s assertions as explained in the annotated Figure 4 of Nakamura in the Petition.

Specifically, this annotated Figure 4 shows that Nakamura’s concavity in the top plate has an open ended tubular cross-section (i.e., it is open at the top of the tubular cross-section), and that this concavity is coaxially aligned with an opening through a concavity in Nakamura’s bottom plate to form a mounting hole for a bolt. Further Nakamura teaches that concavity joining surfaces 9a can be adhered by being pressurized and sealed by soldering or the like. Ex. 1004, 5; Ex. 2012, 6. Thus, the portion of the outer surfaces of the concavities surrounding each hole are sealingly bonded together. Nakamura also discloses that hole 11 formed through the bonded concavities is isolated from the interior of the sealed container. Ex. 1004, Fig. 4; Ex. 2012, Fig. 4; Ex. 1002 ¶ 148.

Patent Owner argues that Nakamura does not disclose a depression having a portion of its outer surface “sealingly bonded to said second plate.”

PO Resp. 60. Patent Owner argues that Nakamura describes “one concavity bonded to *another concavity* formed in the container walls.” *Id.* (arguing “neither concavity is bonded to an opposite plate; the concavities are instead bonded to each other.”). Likewise, Patent Owner asserts that “because the openings identified by Petitioner are formed in the concavities (not [the alleged] plates) of Nakamura’s Figure 4, neither concavity aligns with an opening in an opposite plate.” *Id.* at 60–61.

As discussed above, we do not find Patent Owner’s argument availing. Nakamura’s concavity formed in its lower plate is part of the lower plate. Thus, the upper concavity, which corresponds to the claimed depression, is sealingly bonded to the lower plate, by virtue of being bonded to the lower concavity, and the upper concavity (depression) aligns with a hole in the lower plate, by virtue of aligning with the hole in the lower concavity.

For these reasons, Petitioner has provided adequate evidence to show that Morikawa, as modified by Takahashi and Nakamura, would have led one having ordinary skill in the art to “said at least one depression has an open ended tubular cross-section and an outer surface, a portion of which outer surface is sealingly bonded to said second plate so as to coaxially align said at least one depression with said at least one opening in said second plate thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber,” as recited in claim 13.

f) Conclusion

Based on the foregoing, Petitioner has established that claim 13 is unpatentable over the combination of Morikawa, Takahashi, and Nakamura.

III. MOTION TO EXCLUDE

Patent Owner moves to exclude Exhibits 1004, 1040, and 1041, as well as exhibits 3 and 4 and attachment 3a to Exhibit 1039, pursuant to 37 C.F.R. § 42.64(c). Paper 46; Paper 40. Petitioner opposes the motion. Paper 42.

Patent Owner first requests that we exclude Exhibit 1004 (Nakamura) as not relevant under FRE 104 on the grounds that Petitioner failed “to introduce sufficient proof that Exhibit 1004 was publicly accessible such that it qualifies as a prior art printed publication under United States law.” Paper 46, 3; *see also id.* at 4 (citing Fed. R. Evid. 104, 401). As set forth in section II.D, above, the evidence of record leads us to an entirely different conclusion regarding Nakamura’s prior art status. Because Petitioner persuades us that Nakamura qualifies as a prior art printed publication as of the earliest possible effective filing date of the challenged claims of the ’240 patent, we deny Patent Owner’s request on its merits.

Moreover, the test for relevance is found in Federal Rule of Evidence 401, which provides:

Evidence is relevant if:

(a) it has any tendency to make a fact more or less probable than it would be without the evidence; and

(b) the fact is of consequence in determining the action.

Fed. R. Evid. 401. The pertinent purported fact is that Nakamura is a printed publication. That fact is of consequence in our determination as to whether Petitioner has satisfied its burden on the patentability challenges involving Nakamura. As discussed above, the parties’ dispute involves certain indicia contained in or missing from (as Patent Owner argues) the Nakamura reference itself. Those indicia or the lack thereof in the document have a

tendency to make the fact that Nakamura is a printed publication more or less probable. Thus, the Nakamura reference, Exhibit 1004, is relevant as to whether Nakamura is a printed publication. Accordingly, we deny Patent Owner's motion to exclude Nakamura (Ex. 1004).

We dismiss Patent Owner's remaining requests as moot, because we do not address the substance of any version of Exhibits 1040 or 1041, or exhibits 3 and 4 and attachment 3a to Exhibit 1039, in this Decision.

IV. CONCLUSION²⁰

For the reasons discussed above, Petitioner has *not* shown by a preponderance of the evidence that challenged claims 11 and 12 of the '240 patent are unpatentable. But Petitioner has shown by a preponderance of the evidence that challenged claims 9, 10, and 13 are unpatentable.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, claims 11 and 12 of the '240 patent have *not* been proven to be unpatentable;

FURTHER ORDERED that claims 9, 10, and 13 of the '240 patent have been proven to be unpatentable;

²⁰ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

FURTHER ORDERED that Patent Owner's Motion to Exclude Exhibit 1004 is *denied* and the remainder of Patent Owner's Motion to Exclude is *dismissed as moot*; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
9, 10, 12	103(a)	Morikawa	9, 10	12
9, 10	103(a)	Morikawa/Nakamura		9, 10
12	103(a)	Morikawa/Takahashi		12
11, 13	103(a)	Morikawa, Takahashi, Nakamura	13	11
Overall Outcome			9, 10, 13	11, 12

IPR2019-00337
Patent 7,066,240 B2

FOR PETITIONER:

Erik B. Milch
Andrew C. Mace
Reuben Chen
COOLEY LLP
emilch@cooley.com
amace@cooley.com
rchen@cooley.com

FOR PATENT OWNER:

Kenneth M. Albridge
Kevin P. Moran
Brian J. N. Marstall
MICHAEL BEST & FRIEDRICH LLP
kmalbridge@michaelbest.com
kpmoran@michaelbest.com
bjmarstall@michaelbest.com