

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COOLER MASTER CO., LTD.,
Petitioner,

v.

AAVID THERMALLOY LLC,
Patent Owner.

IPR2019-00334
Patent 7,100,680 B2

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

BARRETT, Administrative Patent Judge.

JUDGMENT

Final Written Decision

Determining Some Challenged Claims Unpatentable

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

35 U.S.C. § 318(a); 37 C.F.R. § 42.64

I. INTRODUCTION

A. Background and Summary

Cooler Master Co., Ltd. (“Petitioner”)¹ filed a Petition requesting *inter partes* review of U.S. Patent No. 7,100,680 B2 (“the ’680 patent,” Ex. 1001). Paper 2 (“Pet.”). The Petition challenges the patentability of claims 1–3 of the ’680 patent. We instituted an *inter partes* review of all challenged claims on all proposed grounds of unpatentability. Paper 7 (“Dec. to Inst.”), 38. Aavid Thermalloy LLC (“Patent Owner”)² filed a Response to the Petition. Paper 27 (“PO Resp.”). Petitioner filed a Reply (Paper 34, “Pet. Reply”) and Patent Owner filed a Sur-Reply (Paper 40, “PO Sur-Reply”). The parties filed papers addressing Patent Owner’s identification of allegedly improper arguments and evidence in Petitioner’s Reply. Papers 40 (PO Sur-Reply Appendix listing allegedly new theories and new evidence in the Reply), 43 (Petitioner’s Response to the same), Paper 49 (Petitioner’s Notice of Supplemental Authority), Paper 50 (Patent Owner’s Notice of Supplemental Authorities).

Additionally, Patent Owner filed a Motion to Exclude (Paper 46, “PO Mot. Excl.”), to which Petitioner filed an Opposition (Paper 48, “Pet. Opp. Mot. Excl.”), and Patent Owner filed a Reply (Paper 51).

An oral hearing was held on March 5, 2020, and a transcript of the hearing is included in the record. Paper 54 (“Tr.”).

¹ Petitioner identifies Cooler Master Co., Ltd. and CMI USA, Inc. as real parties-in-interest. Paper 37.

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

This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a). For the reasons discussed below, we determine that Petitioner has shown by a preponderance of the evidence that claim 3 of the '680 patent is unpatentable, but Petitioner has *not* shown by a preponderance of the evidence that claims 1 and 2 of the '680 patent are unpatentable. We also *deny* Patent Owner's Motion to Exclude.

B. Related Proceedings

One or both parties identify, as matters involving or related to the '680 patent, *Aavid Thermalloy LLC v. Cooler Master Co.*, Case No. 4:17-cv-5363 (N.D. Cal.), and Patent Trial and Appeal Board cases IPR2019-00144, IPR2019-00145, IPR2019-00146, IPR2019-00147, IPR2019-00333, IPR2019-00337, and IPR2019-00338. Papers 4; 37.

C. The '680 Patent

The '680 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 1:18–21.

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 1:66–2:2. 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 mounting board." *Id.* at 2:3–7. "[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 2:9–11.

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 2:12–20. 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 2:26–29.

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 2:36–46.

Figure 1 is reproduced below.

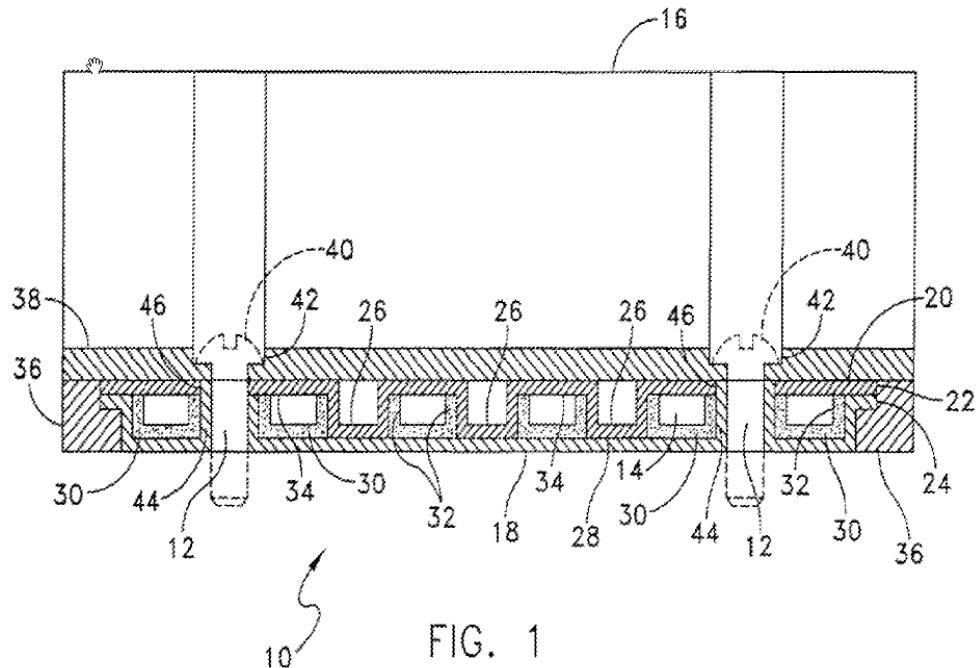


Figure 1 shows “a cross section view of the preferred embodiment of a flat plate heat pipe 10 of the invention with through holes 12 through its vapor chamber 14 and in contact with finned heat sink 16.” *Id.* at 3:28–31. “When heat pipe 10 is used to cool an integrated circuit chip (not shown) which 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 4:15–18. “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 3:32–34. “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 3:34–37.

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 4:18–24.

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

Id. at 4:25–30.

The Specification describes an alternate embodiment. *Id.* at 2:47–59.

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 2:50–57. The Specification explains that, “with the holes located in the peripheral lips, the heat pipe boundary structure can be any shape.” *Id.* at 2:57–59. Figure 2 is reproduced below.

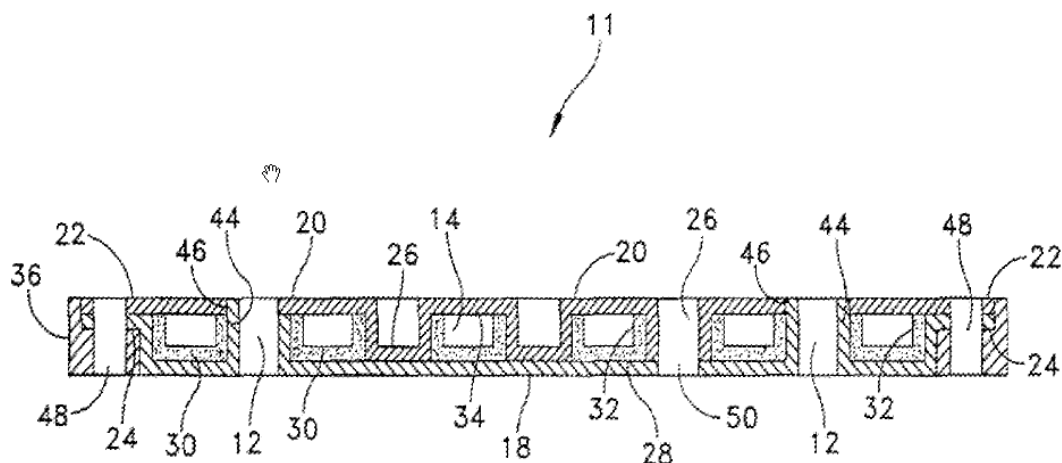


Figure 2 “is a cross section view of an alternate embodiment of the flat plate heat pipe 11 of the invention with through holes 48 located within peripheral

lips 22 and 24 of the heat pipe and hole 50 shown in another sealed structure, one of the depressions 26.” *Id.* at 4:42–46. “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 4:49–53.

D. Illustrative Claims

All of the challenged claims of the ’680 patent, claims 1–3, are independent claims. Those claims are reproduced below.

1. A heat pipe for spreading heat comprising:
 - a boundary structure including a first plate and a second plate arranged in spaced apart relation, each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together so as to define an enclosed vapor chamber;
 - a depression formed in said first plate which projects into said vapor chamber, is spaced from said peripheral lip, and is bonded to said second plate;
 - an opening defined through said first plate depression and said second plate wherein said depression comprises an annular outer surface that is bonded to a corresponding annular edge surface in said second plate and further wherein said opening is isolated from said vapor chamber;
 - at least one spacer extending between and contacting said first and second plates; and
 - a wick positioned upon said confronting interior surfaces including that portion of the interior surface of said first plate that forms a surface of said depression within said vapor chamber.
2. A heat pipe for spreading heat comprising:
 - a first plate having a circumferential edge lip bounding an inner surface and at least one hollow column that is integral

with said first plate and which projects outwardly relative to said inner surface;

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

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

3. A heat pipe for spreading heat comprising:

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

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

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

Ex. 1001, 5:32–6:21.

Challenged independent claim 3, like claim 2, recites, in pertinent part, “a circumferential edge lip bounding an inner surface” rather than “a peripheral lip located at an edge of said boundary structure” as in claim 1. *Id.* at 5:55–56, 6:5–6. Independent claim 5, challenged in a related petition but not in this case, recites “an edge lip that bounds a top surface and a

bottom surface.” *Id.* at 6:44–45; *see, e.g.*, IPR2019-00338 (challenging claims 5–8 of the ’680 patent).

E. Evidence

Petitioner relies on the following references:

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

Petitioner also relies on the Declaration of Dr. Himanshu Pokharna (Ex. 1002) and the Supplemental Declaration of Dr. Himanshu Pokharna (Ex. 1032) in support of its arguments and Patent Owner relies on the Declaration of Dr. Amir Faghri (Ex. 2002) in support of its arguments. The parties rely on other exhibits as discussed below.

F. Asserted Grounds of Unpatentability

Petitioner asserts that the challenged claims are unpatentable on the following grounds (Pet. 6):

³ We list here Petitioner’s assertion as to the publication date of Nakamura. We address below the disputed issue of whether Nakamura is a printed publication. Patent Owner moved to exclude Nakamura as irrelevant. We, for the reasons discussed below, deny Patent Owner’s motion.

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
2	103(a)	Morikawa
2	103(a)	Morikawa, Takahashi
1–3	103(a)	Morikawa, Takahashi, Nakamura

II. ANALYSIS

A. Principles of Law

Petitioner bears the burden of persuasion to prove 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 (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.⁴ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

⁴ The parties have not directed our attention to any objective evidence of non-obviousness.

B. The 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. 11 (citing Ex. 1002 ¶ 9).

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 ’680 patent as 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 '680 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. Nevertheless, 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

In an *inter partes* review requested in a petition filed on or after November 13, 2018, we apply the same claim construction standard used in district courts, namely that articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b) (2019). The Petition in this case was filed November 14, 2018.

In applying that standard, claim terms generally are given their ordinary and customary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips*, 415 F.3d at 1312–13. “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc.*

v. Medtronic Sofamor Danek, Inc., 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

1. “*hollow column*”

Petitioner initially proposed that “hollow column” be interpreted as a “cylindrical structure surrounding a void or cavity,” and argued that the proposed construction advocated by Patent Owner in the district court litigation—“a columnar structure defining an unfilled or empty space”—should not be adopted. *See* Pet. 13 (quoting Ex. 1019, 6 (Patent Owner’s proposed construction in the District Court); citing, *inter alia*, Ex. 1002 ¶ 37 (Dr. Pokharna testifying that Patent Owner’s litigation construction is “unhelpful” and “is vague and too broad, and goes beyond what has been disclosed by the specification of the patents-in-suit.”)). However, Petitioner, in applying its proposed combination of prior art to claim 2, seemingly adopted Patent Owner’s construction. *See id.* at 79 (“Thus, similarly, the upper plate in Nakamura can form ‘a columnar structure defining an unfilled or empty space’ to meet the ‘hollow column’ limitation.” (citing Ex. 1002 ¶ 99)). Petitioner, in its articulation of the ground, points to Figures 1 and 2 of the challenged patent in arguing that “the ’680 patent discloses the hollow column as ‘columns 44’ in which ‘holes 12’ are located.” *Id.* at 77–79.

In the Institution Decision, we determined that the ’680 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. Dec. to Inst. 30–31. We found that Petitioner had failed to “reconcile adequately its reliance on a type of prior art depression-like spacer that the Specification [of the ’680

patent] appears to distinguish from the recited hollow column.” *Id.* at 31–32.

Patent Owner, in its Response, argues that the term “hollow column” needs no construction because it “is not a technical term and is used in the specification simply to refer to a column that is hollow.” PO Resp. 27 (citing Ex. 1001, 1:66–2:2, 2:16–18, 2:36–39, 2:43–46, 3:28–31, 4:26–30; Ex. 2002 ¶ 119). Patent Owner further argues that Petitioner’s initial construction (“cylindrical structure surrounding a void or cavity”) is incorrect, and that “the specification [of the ’680 patent] differentiates depressions and columns as separate types of spacers.” *Id.*

Petitioner, in its Petitioner Reply, argues that we should adopt Patent Owner’s litigation position, because “Patentee’s litigation construction . . . should be applied against the Patentee” and because the ’680 patent “does not expressly define ‘hollow column.’” Pet. Reply 19. Petitioner also points to depictions of solid columns 44 in Figure 2 of the ’680 patent as support for this interpretation. *Id.* at 19–20.

In its Sur-Reply, Patent Owner argues that its district court litigation contentions are just that—contentions—and do not constitute a proper claim construction analysis to satisfy Petitioner’s burden. PO Sur-Reply 8 (quoting *St. Jude Med., LLC v. Snyders Heart Valve LLC*, IPR2018-00106, Paper 58 at 30 (PTAB May 2, 2019)). Patent Owner, “[f]or avoidance of doubt, . . . expressly acquiesces to the Board’s distinction between ‘depressions’ and ‘hollow columns,’” and relies on its expert’s deposition testimony as support for the proposition that columns and depressions are completely different things. *Id.* (quoting Ex. 1033, 30:20–23, 41:6–14). Patent Owner concludes by asserting that this distinction “is consistent with

the Board’s interpretation in the institution decision, which [Patent Owner] agrees stays true to the claim language and naturally aligns with the specification.” *Id.* at 8–9.

We have reviewed the description provided in the ’680 patent, including the portions cited by Patent Owner in support of its proposition that the term “hollow column” “is used in the specification simply to refer to a column that is hollow.” PO Resp. 27. For the reasons discussed below, we are not persuaded that our understanding of “hollow column” in the Institution Decision is incorrect or that we should adopt the broader construction proffered by Petitioner.

The cited portions of the ’680 patent do not use the term “hollow column.” In fact, the term is not used anywhere in the ’680 patent except for the claims. The ’680 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, 2:18–20, 4:26–30.

Specifically, as discussed in our Institution Decision, the Specification of the ’680 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, 2:12–46.

These spacers [between plates] can be solid columns, embossed depressions formed in one of the plates, or a mixture of the two.^[5] . . .

The spacers also make it possible to provide holes into and through the vapor chamber, an apparent inconsistency since

⁵ 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.

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 2:18–20, 2:36–46. Thus, the '680 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 4:46–49, Fig. 2 (hole 50 in bottom of depression 26 that 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, 4:26–30, 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 '680 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 depression 26 must be bonded to inner surface 28 of contact plate 18.” Ex. 1001, 4:47–48.

The claim language of the '680 patent matches this distinction made in the written description. For instance, claim 2 recites a heat pipe comprising “at least one hollow column” and claims 1 and 3 recite a heat pipe comprising “a depression.” Ex. 1001, 5:39, 5:56, 6:6–7. Based on the claim language and the description of spacers provided in the '680 patent,

we do not construe “hollow column” to encompass depressions that are described in the ’680 patent as embossed in and extending from one plate to the inner surface of the opposite plate.

2. Vapor Chamber

Petitioner proposes that a person of ordinary skill in the art would have understood “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.” Pet. 13. 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.

In contrast to Petitioner’s proposed aspect of being “hermetically sealed,” Patent Owner argues that “the term ‘vapor chamber’ refers to a chamber that is vacuum sealed consistent with the term’s plain and ordinary meaning, and this is confirmed by the context of the ’680 Patent.” PO Resp. 17 (citing Ex. 2002 ¶¶ 33–36, 44, 90–93; Ex. 1001, 2:12–13, 2:20–46, 3:37–41, 4:46–49; Ex. 2005, 104:19–24). The parties do not identify a distinction pertinent to any dispositive issue in this case. *See* Pet. Reply 6 (Petitioner asserting that the prior art discloses a vacuum sealed chamber under Patent Owner’s construction). Accordingly, we need not reach the disputed issue as to whether a “vapor chamber” is hermetically or vacuum sealed.

Patent Owner notes that Petitioner’s proposed construction of “vapor chamber” does not refer to capillary forces. PO Resp. 18. 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 ’680 patent as important to spreading heat. *Id.* (citing

Ex. 1001, 1:66–2:2, 2:20–46, 3:54–4:8; Ex. 2002 ¶¶ 45, 96). 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 18–19 (citing Ex. 2005, 126:8–128:4) (alterations in original).

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 ’680 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 ’680 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, 1:66–2:2. This description makes no mention of capillary forces. Another cited portion of the ’680 patent describes the function of the spacers as providing support for portions of a capillary wick. *Id.* at 2:20–46. 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 ’680 patent cited by Patent Owner describes an embodiment of the heat pipe that uses a capillary wick. *Id.* at 3:54–4:8. The ’680 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 3:56–64. Thus, these portions of the ’680 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, 5:50–53 (claim 1), 6:51 (claim 5: “a capillary wick provided within said vapor chamber”).

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.” *See* 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.* at 16–17. Patent Owner argues that heat spreading refers to two- or three-dimensional heat flow and is one of the key attributes of a vapor chamber heat pipe that distinguishes it from conventional heat pipes, which, according to Patent Owner, mainly transport heat in one dimension. *Id.* at 16 (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 [person of ordinary skill in the art] at the time of the invention and does not

account for the text of the specification that repeatedly refers to spreading heat.” *Id.* at 16–17 (citing Ex. 2002 ¶ 89).

As reproduced above, the ’680 patent describes operation of the heat pipe to “transport heat from the evaporator to the condenser.” Ex. 1001, 3:56–64. 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 ’680 patent. Accordingly, we adopt and employ this aspect of Petitioner’s interpretation of “vapor chamber.”

*D. The Alleged Obviousness of
Claim 2 Over Morikawa (Ground 1)*

Petitioner, in the Petition, argued that independent claim 2 of the ’680 patent would have been obvious over Morikawa alone. Pet. 6, 21–45. In the Decision instituting an *inter partes* review, we determined that Petitioner had not demonstrated a likelihood of prevailing on this challenge. Dec. to Inst. 13–14. Specifically, we determined that Petitioner had not made an adequate threshold showing with regard to the limitation reciting edge lips being bonded together. *Id.* After institution, Patent Owner opposed Petitioner’s challenge. *See, e.g.*, PO Resp. 46–49 (addressing the “edge lips” limitation). In its Reply Brief, under the heading “GROUND 1 – RETRACTED,” Petitioner states: “While Petitioner maintains that both Morikawa and Nakamura disclose the claimed ‘lips,’ Petitioner no longer relies on Ground 1 for this IPR.” Pet. Reply 22 (bolding omitted). Petitioner does not explain what it means by the term “retracted,” and we have not been presented with, for example, a motion for partial adverse judgment or a joint motion to withdraw Ground 1 from this proceeding or

otherwise limit the Petition. We proceed to reanalyze Ground 1 on the full record developed during trial.

1. Overview of Morikawa (Ex. 1003)

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

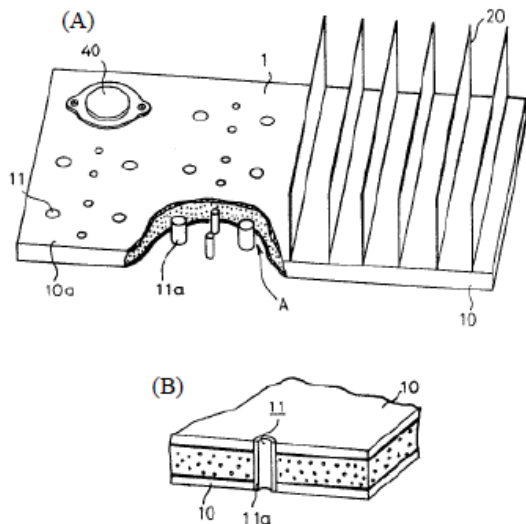
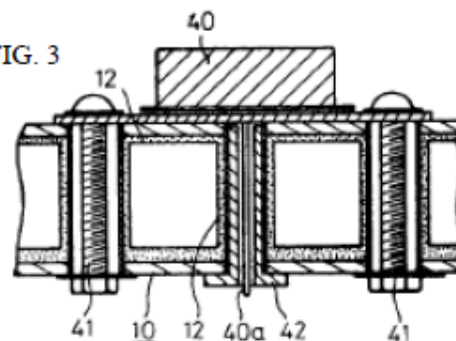


FIG. 3



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.

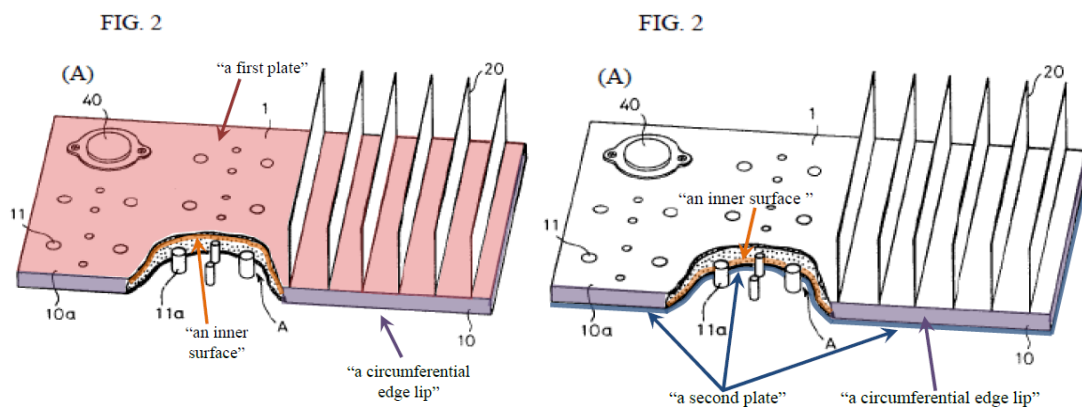
2. Analysis of the Alleged Obviousness of Claim 2 over Morikawa

The dispositive issue with regard to this ground, as it was at the institution stage, pertains to the structural configuration where the bonding occurs. Claim 2 recites:

a first plate having a circumferential edge lip bounding an 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 . . . , said edge lips of said first and second plates being bonded together so as to define a vapor chamber.

Ex. 1001, 5:55–64. Thus, the claim requires each of the two plates to have a circumferential edge lip bounding an inner surface, and for those two edge lips to be bonded together so as to define a vapor chamber.

For the recited circumferential edge lips of the first plate and of the second plate, Petitioner uses annotated versions of Morikawa's Figure 2A, shown below, to depict its contentions:



Each of the above versions of Morikawa's Figure 2A is a partially cut-out explanatory perspective view of a heat pipe with Petitioner's annotations in the form of a labeled arrow pointing, in the left figure, to the feature identified as the claimed circumferential edge lip of the first plate and, in the right figure, to the feature identified as the claimed circumferential edge lip of the second plate. Ex. 1003, 4:50–52; Pet. 24, 35. We understand

Petitioner to identify, as a circumferential edge lip, that which appears to be a vertical surface (shown in purple) spanning the distance between Morikawa's upper and lower surfaces of the panel. Thus, we understand Petitioner to identify only one circumferential edge lip. Petitioner has not explained adequately how Morikawa either discloses two edge lips bonded together so as to define a vapor chamber or renders obvious subject matter having that structure and configuration. *See* PO Resp. 47–49.

Petitioner has not demonstrated by a preponderance of the evidence that claim 2 would have been obvious over Morikawa alone.

E. The Alleged Obviousness of Claim 2 over Morikawa and Takahashi (Ground 2)

Petitioner alleges that claim 2 of the '680 patent would have been obvious over the combination of Morikawa and Takahashi. *See* Pet. 21–45. Patent Owner argues that Petitioner has failed to show that Morikawa discloses the recited hollow column that is integral with a plate. *See* PO Resp. 49–50, 55; PO Sur-Reply 21–22. Specifically, Patent Owners argues that Petitioner has applied an interpretation of “integral” that is not supported by the Specification or prosecution history of the '680 patent. PO Sur-Reply 22 (citing Ex. 1001, 2:39–46). For the reasons given below, we determine that Petitioner has not demonstrated that the challenged claim would have been obvious over Morikawa and Takahashi.

Claim 2 calls for a particular relationship between the plates and hollow columns. Specifically, claim 2 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
a hollow column bonded at one end to said second plate so as to coaxially align said hollow column with one of said at least one openings in said second plate.

Ex. 1001, 5:55–67. Thus, claim 2 calls for a first plate having an integral hollow column and a second plate having a hollow column bonded to the second plate.

For the integral aspect, Petitioner argues:

Morikawa teaches that its “metal pipe” is integral with the upper plate like the “hollow column that is integral with said first plate” in the ’680 patent. This is because Morikawa teaches “welding and fixing the metal pipe to the panel surfaces,” thus integrating the metal pipe with the upper plate.

Pet. 31–32 (quoting Ex. 1003 (Morikawa), 4:26–27)). For the bonded end of the hollow column, Petitioner argues:

Morikawa also teaches that its “metal pipe” is bonded at one end to its lower plate like the “hollow column bonded at one end to said second plate” in the ’680 patent. This is because Morikawa teaches “welding and fixing the metal pipe to the panel surfaces,” thus bonding the metal pipe with the lower plate.

Id. at 41 (quoting Ex. 1003 (Morikawa), 4:26–27).

Petitioner, thus, contends that a welded pipe is both an integral hollow column and a bonded hollow column.

The dispositive issue 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 ’680 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 sets out a genus-species argument in its Reply Brief, asserting that welding is both a type of bonding and a type of integrating, reasoning that “this is like a human can be *both* a mammal and a vertebrate, but it does not mean mammals and vertebrates are the same (*e.g.*, a bird is a vertebrate but not a mammal).” Pet. Reply 28–30. Be that as it may, Petitioner’s argument does not assist us in ascertaining the meaning of “integral” to the person of ordinary skill in the art.

Petitioner argues that “Morikawa’s hollow columns ‘fix[ed]’ and ‘weld[ed]’ to the plates can be viewed as being ‘integral’ to the plates, as the Federal Circuit held in a similar case.” Pet. Reply 29 (citing *In re Hotte*, 475 F.2d 644, 647 (CCPA 1973)). Petitioner’s reliance on *In re Hotte* is misplaced. *Hotte* did not, as Petitioner implies, hold as a matter of law that the claim term “integral” must be construed to encompass a welded joint in every patent and in every field of art. Rather, *Hotte* stands for the proposition that any claim term must be analyzed in light of the particular facts of the case. *See Hotte*, 475 F.2d at 647 (“Appellant’s specification does not expressly restrict the meaning of ‘integral’ to ‘one piece’ and such a meaning is wholly irreconcilable with the recitation in claim 1 of ‘a vitreous case surrounding and *integrally* united with the capacitor unit so formed.’”).

We also note that *Hotte*, unlike the case here, would have involved the use of the broadest reasonable interpretation standard in construing claims in a pending application. *See Henderson v. Grable*, 339 F.2d 465, 470 (CCPA 1964) (cited approvingly in *Hotte*; stating, in an interference, that “the circumstances here require that the unambiguous term ‘integral’ be given the broadest construction the language will reasonably bear without resort to the specification from which it originated,” and determining the Board erred by not “examining [the term] to see whether a reasonable interpretation, but one not so broad as to do violence to the language or the concept of the invention, would include the Henderson structure.”).

Petitioner mentions, in the Reply Brief, the person of ordinary skill in the art (“POSITA”) in arguing that:

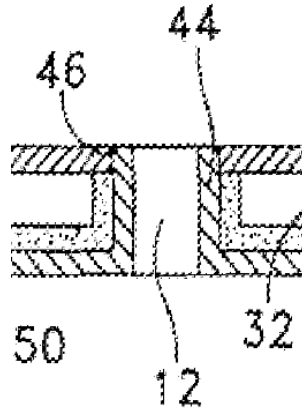
A POSITA would understand that welding, unlike lower temperature techniques such as soldering or brazing, requires extreme high heat to melt the two base metals to fuse and integrate them together to form a homogeneous continuum. If done right, the welded portion would be as strong as the surrounding base metals.

Pet. Reply 29 (citing Ex. 1032 ¶ 76). We acknowledge that the act of welding, as a conceptual matter, may result in a very strong bond and may fuse two base metals together. However, Petitioner’s contention is directed to the ordinary artisan’s understanding of the prior art reference’s “welding,” rather than a claim term. This contention omits an analysis as to how a person of ordinary skill in this particular art would have understood the claim terms “integral” and “bonded,” which is necessary before we apply those terms to the reference’s welding.

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

'680 patent.” Pet. 31–32 (citing Ex. 1002 ¶ 61). 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 '680 patent. *See id.* at 30–32. 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 flawed repetition of Petitioner’s argument. *Compare* Pet. 31–32 (Petitioner’s argument having an annotated figure interposed between “As shown below” and “As also shown above”), *with* Ex. 1002 ¶ 61 (Dr. Pokharna’s testimony repeating Petitioner’s argument but lacking any figure between “As shown below” and “As also shown above”). Dr. Pokharna, like Petitioner, fails to explain adequately why a welded component is like the integral column of the '680 patent. *See* Ex. 1002 ¶ 61 (making the statement without citing support).

The specification of the '680 patent distinguishes between a component bonded to a plate and something “embossed in one plate,” i.e. integral with the plate. *See* Ex. 1001, 2:39–43. A portion of Figure 2 of the '680 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.*, 4:42–43. The depiction shows the material of the bottom plate bent upward and with “columns 44 . . . bonded to cover plate 20 at locations 46.” *Id.*, 4:26–30. 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 3, Petitioner argues that Nakamura provides reason to replace Morikawa’s welded pipes with concavities/depressions formed from one of the plates. *See* Pet. 58–63 (citing, *inter alia*, Ex. 1002 ¶¶ 85–86). 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 60 (quoting Ex. 1004, 3). 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 58–63. 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.

Petitioner has not demonstrated by a preponderance of the evidence that claim 2 would have been obvious over Morikawa and Takahashi.

F. The Alleged Obviousness of Claims 1–3 over Morikawa, Takahashi, and Nakamura (Ground 3)

Petitioner alleges that claims 1–3 of the '680 patent would have been obvious over Morikawa, Takahashi, and Nakamura. *See* Pet. 45–98; Pet. Reply 30–35. Patent Owner offers several arguments in response to Petitioner’s challenge. *See* PO Resp. 55–64; PO Sur-Reply 22–25. For the reasons given below, we determine that Petitioner has demonstrated that claim 3 would have been obvious over Morikawa, Takahashi, and Nakamura but has not demonstrated that claims 1 and 2 would have been obvious over that same combination.

1. 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’ that was filed on September 18, 1973 and published in 1975.” Pet. 46; *see also id.* at vii (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. Paper 6 (Prelim. Resp.), 13. Patent Owner also argued that

Nakamura did not contain indicia, such as INID⁶ codes, that often qualify a foreign patent application as a “printed publication” and 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.* at 6, 10–11. 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. Dec. to Inst. 19–20. 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 17–18 (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 19. The Board also encouraged the parties to meet and confer regarding Japan Patent Office practice in the

⁶ “‘INID’ is an acronym for ‘Internationally agreed Numbers for the Identification of (bibliographic) Data.’” Ex. 2001, 1.

1970s as applied to unexamined utility model applications to try to resolve this issue. *Id.* at 20.

After institution, Patent Owner filed objections to evidence that included various objections to Nakamura. Paper 14, 1–2 (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.⁷ *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. 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, and an English language translation thereof. Ex. 2011, 14–20 (Ex. B). Thus, Patent Owner received a copy of the condensed version of Nakamura prior to filing its Patent Owner Response.

⁷ 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 ’680 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. 29. 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 32. 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.* Patent Owner further asserts that Nakamura does not include INID codes. *Id.* at 33. 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. *See 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).⁸ 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 9–11. 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

⁸ 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. The decision further describes that a petitioner may move to submit new evidence as supplemental information if the patent owner does not challenge the reference’s status as a printed publication. *Id.*

In this case, the evidence submitted with the Petition includes Nakamura itself in the original Japanese language 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).

As discussed above, Patent Owner presented arguments challenging the dissemination and public accessibility of Nakamura in its Patent Owner Response. *See, e.g.*, PO Resp. 32 (“Petitioner has failed to file ***any evidence*** that Nakamura was actually disseminated or publicly accessible or findable before the May 12, 1999 priority date.”). 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. The Reply also explains how an interested member of the public would obtain access to the full version of the publication. Again, Petitioner properly refers in its Reply to the Miyano Declaration for support. Thus, we consider the arguments raised in Petitioner's Reply, along with the supporting evidence cited in the Reply, to ascertain whether Nakamura qualifies as prior art.

Now that we have 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) (2018). 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. 46; 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 provides a certified translation of Nakamura. *See* Ex. 1004, 12.⁹ The top of the first page is translated as “Japanese Unexamined Utility Model Application Publication S50–55262 (1975).” *Id.* at 1. The as-translated first page contains a seal of the Japan Patent Office (bottom right) and certain 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.* This 1973 date coincides with that which Petitioner contends is the application filing date. Pet. 46.

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 ’680 patent, i.e., May 12, 1999. PO Resp. 30; *id.* at 33 (“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. 1003) and notes that, unlike these published Japanese applications, Nakamura does not include INID codes. *Id.* at 32–33. 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.* at 33.

⁹ 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.

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.*

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. Ex. 1044 ¶¶ 13–15 (explaining that the public would 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. 1003) 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 one skilled in the art exercising reasonable diligence would have been able to locate Nakamura.

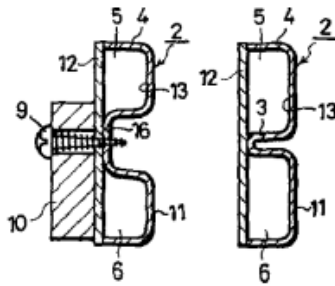
According to Petitioner’s declarant, under Japanese law in effect in 1973–1975, the complete version of Nakamura (Ex. 1004) was “made available to the public on May 26, 1975, i.e., the same day [the condensed version of Nakamura] published.” Ex. 1044 ¶ 14. Thus, according to Petitioner’s declarant, to 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 ’680 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, to show that Nakamura qualifies as a printed publication at the time of the invention. Accordingly, Petitioner has established that Nakamura qualifies as prior art under § 102(b).

2. Overview of Takahashi (Ex. 1005)

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.

[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

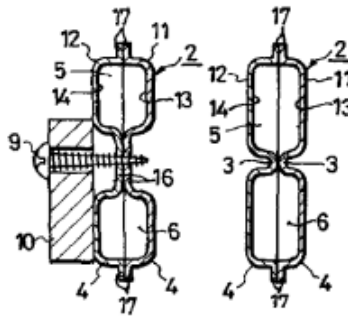
peripheral edge part of the second plate member (12) in a strip shape, the tip of the intermediate partition wall (3) of the first plate member (11), and the facing surface of the junction for mounting heating elements (16) and the second plate member (12).

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 5:28–38.

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.

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.

3. *Overview of Nakamura (Ex. 1004)*

According to Petitioner’s translation, 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, 4.¹⁰ *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:

¹⁰ 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.

Figure 3

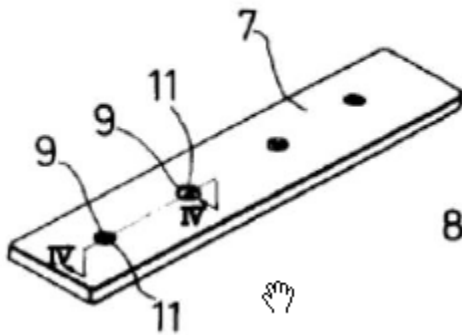
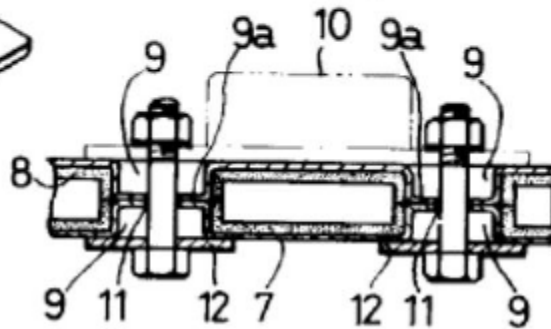


Figure 4



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.” *Id.* at 5. *See also* Ex. 2012, 6 (describing that reference numeral 7 denotes a sealed container “made of a thin sheet of a 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).

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, 6; *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, 6–7; *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, 7; *see also* Ex. 2012, 7 (similar translation).

4. The Alleged Obviousness of Claim 1 over Morikawa, Takahashi, and Nakamura

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 1 unpatentable under 35 U.S.C. § 103(a). Claim 1 recites both “a depression formed in said first plate” and “at least one spacer extending between and contacting said first and second plates.” Ex. 1001, 5:39, 5:48–49.

Petitioner asserts that Nakamura’s concavities 9 correspond to the claimed “depression” and that a person having ordinary skill in the art would have been led to replace Morikawa’s metal pipes 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. 55–63. 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. 71 (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 72. Thus, Petitioner proposes to modify Morikawa to replace metal pipes with concavities and to replace metal pipes with conventional spacers that are not, as Morikawa teaches, drilled to form metal pipes. *See* Ex. 1003, 4:25–41.

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 or columns with Nakamura’s concavities. PO Resp. 57. Patent Owner argues that Petitioner 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 or columns. *Id.* at 57–58. 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 or columns with Nakamura’s concavities. *See id.* at 58.

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 31 (citing Pet. 71–73).

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 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 1. For this reason, Petitioner has not shown by a preponderance of the evidence that claim 1 is unpatentable under 35 U.S.C. § 103(a).

5. The Alleged Obviousness of Claim 2 over Morikawa, Takahashi, and Nakamura

Independent claim 2 recites a hollow column to form a mounting hole rather than, as in independent claim 1, a depression in a first plate bonded to the second plate and having an opening through a bonded annular surface.

For independent claim 2, Petitioner's proposed combination substitutes Nakamura's concavities for the metal pipes in Morikawa. *See* Pet. 76–81, 83–87. In its Reply, Petitioner confirms its articulation of Ground 3, maintaining 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 31. However, Petitioner, for claim 2, relies on what it calls the “concavities/depression,” rather than Morikawa's drilled columns (pipes), for the recited “hollow column” of claim 2. Petitioner argues

Nakamura's “concavities” formed in the plates can meet the '680 patent's “hollow column” related limitations The reason is the '680 patent discloses that the “hollow column” can be formed as part of a plate enclosing the “vapor chamber.”

That is, the “hollow column” limitation can be met by a structure formed by one or both of the heat pipe’s plates.

Pet. 76–77.

Patent Owner argues that Nakamura’s Figures 3 and 4 show concavities but “do[] not disclose a ‘hollow column’ as claimed.” PO Resp. 60–61 (citing Ex. 2002 ¶¶ 147, 149–152).

Petitioner’s articulated ground is premised on its assertion that the term “hollow column” means “a columnar structure defining an unfilled or empty space.” Pet. 79 (citing Ex. 1002 ¶ 99). Petitioner contends that concavity 9 in Nakamura’s top plate constitutes the hollow column. *See, e.g., id.* at 80. Some of Petitioner’s contentions are explained via the annotated figures reproduced below.

Figure 3

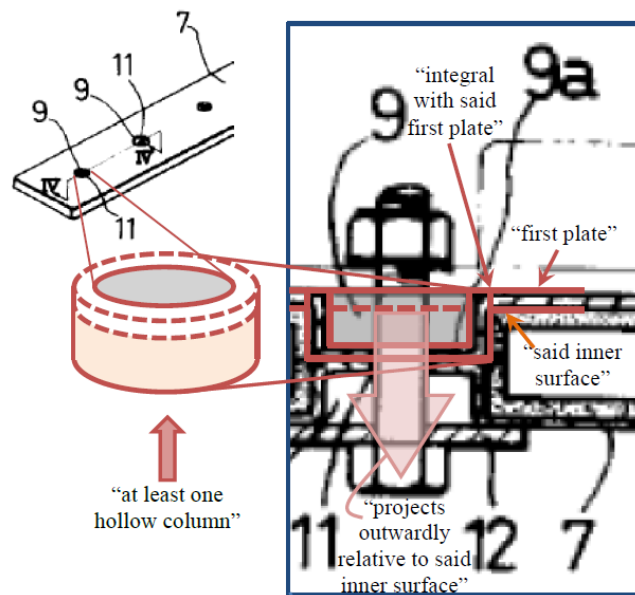
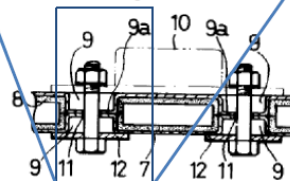


Figure 4



Pet. 80. The figures above are an enlarged and annotated portion of Nakamura's Figures 3 and 4, 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 surfaces 9a are sealed together by soldering or the like, and bolt hole 11 is drilled through the concavity joining surfaces. Ex. 1004, 5–6; Ex. 20212, 6–7. Petitioner contends, as indicated in the annotated figure, that the concavity labeled as 9 and indicated by Petitioner in red is the recited “at least one hollow column that is integral with said first plate.” Pet. 79–81.

As discussed above in our claim interpretation analysis, the Specification of the '680 patent distinguishes between spacers formed by “depressions” and spacers formed by “hollow columns.” *See* Ex. 1001, 2:12–46. Specifically, we do not construe “hollow column” to encompass depressions, described in the '680 patent as embossed in and extending 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 '680 patent, that of a column with a through hole, is the Specification's disclosure of the recited “hollow column.” Pet. 77 (quoting Ex. 1001, 4:25–30). 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 '680 patent's first spacer embodiment. *See id.* at 80 (annotated Figure 4 of Nakamura). Accordingly, Petitioner has not demonstrated a likelihood of prevailing in this challenge to claim 2. Specifically, as shown in Figure 4 relied on by Petitioner, Nakamura's concavity 9 is embossed in and extends from one plate to the inner surface

of the opposite concavity 9 formed in the opposite plate. Ex. 1004, 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, Takahashi, and Nakamura renders claim 2 unpatentable under 35 U.S.C. § 103(a).

6. The Alleged Obviousness of Claim 3 over Morikawa, Takahashi, and Nakamura

Independent claim 3 recites a heat pipe comprising two plates each having a circumferential edge lip with the edge lips bonded together to define a vapor chamber, the first plate having a depression bonded to the second plate, and an opening in the second plate aligning with the open end of the depression so as to form a mounting hole through the two plates and that is isolated from the vapor chamber. Ex. 1001, 6:4–21.

a. “A heat pipe for spreading heat”

The preamble of independent claim 3 recites “[a] heat pipe for spreading heat comprising” Ex. 1001, 6:4. Petitioner, relying on the testimony of Dr. Pokharna, contends that, “[t]o the extent that the preamble is limiting,” Morikawa discloses a heat pipe for spreading heat. Pet. 21–22, 87 (incorporating the analysis in Section IX.B.1 on Pet. 21–22; collectively citing Ex. 1002 ¶¶ 55, 109).

Morikawa explicitly discloses a “heat pipe” and, as Petitioner notes (*id.* at 21), explains that “[a] heat pipe is widely used as a means of releasing heat from an internal component of a computer, as a heat-control means of a nuclear reactor, as a heat-control means of an artificial satellite, and in other uses as an effective means of efficient heat transfer.” Ex. 1003, 1:28–36. Dr. Pokharna testifies that, “[b]y disclosing a ‘heat pipe’ that transfers and

releases heat, Morikawa discloses “[a] heat pipe for spreading heat comprising.” Ex. 1002 ¶ 55.

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. 44 (citing 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.* at 43–44. Patent Owner does not assert in its Response¹¹ that the language “for spreading heat” in the preamble of claim 3 is itself limiting, and instead seeks to insert the requirement of spreading heat into the construction of “vapor chamber.”

As discussed above, both parties proposed a construction of “vapor chamber” that includes an aspect of heat transfer. We adopted the aspect of 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 3 is limiting, to the extent Patent Owner’s argument that Morikawa does not disclose heat

¹¹ In its Reply, Petitioner argues that the preamble of claim 3 is 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. PO Sur-Reply 2–3 (citing *Poly-America LP v. GSE Lining Tech. Inc.*, 383 F.3d 1303 (Fed. Cir. 2004)).

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, 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 3 recites a complete structure including a first plate and a second plate arranged in spaced apart relation, with each plate including a circumferential edge lip and with those lips bonded together so

as to define a vapor chamber, a depression that is formed in the first plate and bonded to the second plate, the first plate depression having an open ended cross-section and an outer surface bonded to the second plate so as to align the depression with an opening in the second plate such that the mounting hole formed thereby is isolated from the vapor chamber. 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.

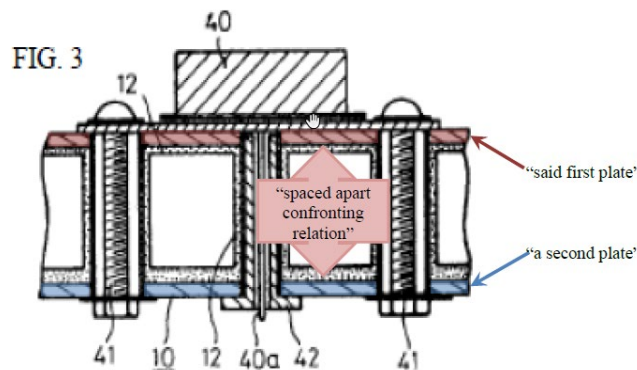
b. “a first plate having a circumferential edge lip bounding an inner surface . . . [and] a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip bounding an inner surface . . . , said edge lips of said first and second plates being bonded together so as to define a vapor chamber”

For these limitations, Petitioner’s proposed combination is Morikawa’s heat pipe modified to have the flanges of Takahashi. Pet. 88–90 (incorporating the analysis in Section IX.B.2 on Pet. 22–30, in Section IX.B.4 on Pet. 32–36, and in Section IX.B.7 on Pet. 38–41; collectively

citing Ex. 1002 ¶¶ 56–60, 109, 111, 114). Petitioner contends that the proposed combination yields a structure formed from two plates with circumferential edge lips bonded together so as to define a vapor chamber. *Id.* Patent Owner argues that Petitioner has failed to show that a person of ordinary skill in the art would have had a reason to make the proposed combination and that the combination lacks the recited first and second plates, circumferential edge lips, and a vapor chamber. PO Resp. 55–64.

1. Two Plates with Circumferential Edge Lips Bonded Together

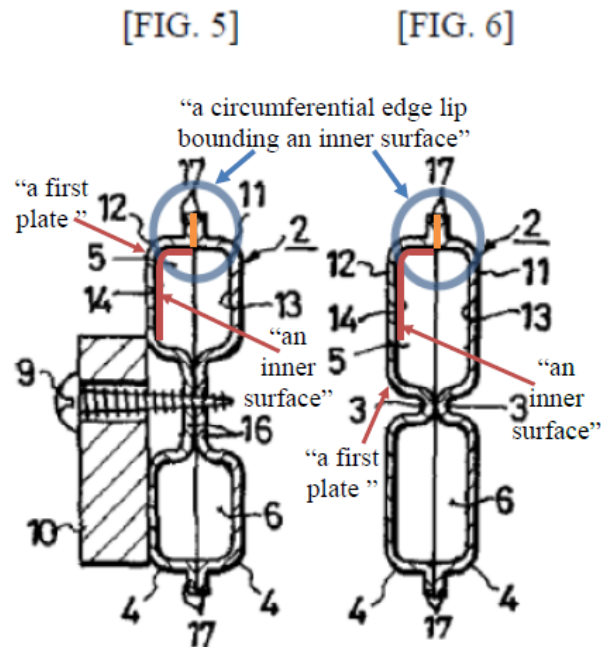
Petitioner contends that Morikawa discloses a structure including a first plate and a second plate arranged in spaced apart relation and with each plate having inner surfaces. Pet. 22, 32–33. Petitioner provides the following annotated version of Morikawa’s Figure 3.



Id. at 33. Above is Petitioner’s annotated version of an explanatory cross-sectional view illustrating the structure of Morikawa’s heat pipe. *Id.*; Ex. 1003, 4:54–55. Petitioner shows, in other annotated versions of Figure 3 of Morikawa, how these plates each have an inner surface. Pet. 22, 34.

Petitioner contends that it would have been obvious to combine Takahashi’s flanges with Morikawa’s heat pipe in a manner resulting in each plate having a circumferential edge lip bounding an inner surface and which are bonded together. *Id.* at 25–26, 35–36.

For the aspect of circumferential edge lips bounding an inner surface and bonded together, Petitioner refers to its arguments made in the context of the first and second grounds. *Id.* at 88, 90 (referring to Sections IX.B.2, IX.B.5, and IX.B.7 (*id.* at 22–30, 33–36, 38–41)). Petitioner utilizes an annotated version of Takahashi's Figures 5 and 6, shown below, in explaining its contentions.



The above figures depict cross sectional views of a heat pipe of Takahashi with Petitioner's annotations identifying "circumferential edge lip[s]." Pet. 25; Ex. 1005, 8:12–15.

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. 26. 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 ¶ 59).

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. 26–28 (citing Ex. 1002 ¶ 60). 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 28 (citing Ex. 1002 ¶ 60).

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. (Pokharna, ¶60.) 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 ’680 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 29 (citing Ex. 1002 ¶ 60).

Patent Owner argues that “Morikawa . . . does not teach (or even contemplate) the concept of constructing a heat pipe using two ‘plates.’” PO Resp. 45 (citing Ex. 2002 ¶ 132); *see also id.* at 56 (“Petitioner fails to identify any rationale or motivation to modify Morikawa or combine it with Takahashi or Nakamura to provide a ‘first plate’ and ‘second plate.’”).

Patent Owner argues, with reference to Dr. Faghri’s testimony, that a person of ordinary skill in the art would have understood Morikawa’s heat pipe container to be made from a single plate. *Id.* at 45 (citing Ex. 2002 ¶¶ 133).

Patent Owner argues that a person of ordinary skill in the art would have understood that Nakamura’s heat pipe would be constructed from either a unitary tube member formed with a generally rectangular profile or a single sheet of metal bent and sealed along one seat and then fitted with end caps.

Id. (citing Ex. 2002 ¶ 133).

Petitioner argues that Morikawa’s Figures 2B and 3 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 this Figure, which Dr. Pokharna

pointed to in his original Declaration as support for first and second plates. *Id.*; *see* Ex. 1002 ¶ 78.

Patent Owner responds that Petitioner’s reliance on Figures 2B and 3 “is misguided, as the Figures only show a partial cross-section without illustrating the sides of the upper and lower portions.” PO Sur-Reply 15. Patent Owner further argues that Petitioner’s discussion of “different cross-hatching” improperly raises a new theory because it was raised for the first time in Petitioner’s Reply. *Id.* Patent Owner also argues that to the extent the cross-hatching in Morikawa is discernible, there appears to be no difference between them, with similar cross-hatch lines extending at the same angle in both portions. *Id.* (citing Ex. 2002 ¶¶ 65, 66, 133–134).

First, we disagree with Patent Owner’s characterization of Petitioner’s Reply arguments regarding cross-hatching to improperly raise a new theory. Petitioner and Dr. Pokharna pointed to Figure 3 of Morikawa as support for the assertion that Morikawa discloses two plates. *See, e.g.*, Pet. 22, 33–34, 50; Ex. 1002 ¶¶ 62, 63, 78. Petitioner’s further arguments about what is shown in this Figure were properly raised in response to Patent Owner’s arguments contesting Petitioner’s reading of Morikawa’s disclosure.

Further, we do not credit Dr. Faghri’s testimony regarding how a person of ordinary skill would have understood Morikawa to be constructed because it 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.

Patent Owner argues that the assembly process of Morikawa’s heat pipe is consistent with it being formed of only a single plate. PO Resp. 46. Patent Owner contends that “Morikawa describes providing holes in the ‘upper and lower surfaces of the panel’ and then inserting metal pipes 11a into the holes and welding and fixing the pipes in place.” *Id.* (citing Ex. 2002 ¶ 133; Ex. 1003, 4:25–29). We fail to see how the cited portion of Morikawa supports Patent Owner’s proposition. The cited portion does not indicate that the hole is large enough for the pipe to pass through, as Patent Owner urges, but merely states that the pipe is welded to the panel such that “the metal pipe is communicated to holes provided in advance in upper and lower surfaces of the panel.” Ex. 1003, 4:25–29. That is consistent with an assembly where the inside diameter of the pipe is the same as the pre-drilled hole and with the pipe’s inside diameter and the hole being aligned during welding. Patent Owner also contends that Morikawa “describes inserting a metal column into the hollow region of the heat pipe to block the holes, where the columns are then welded, fixed in place, and drilled through to form the through path.” PO Resp. 46 (citing Ex. 2002 ¶ 134; Ex. 1003, 4:29–41). According to Patent Owner, “[t]his approach . . . would not be necessary in a two-plate construction since [the pipes] could be inserted or fixed in the structure of the container before it is fully assembled.” *Id.* (citing Ex. 2002 ¶ 134). Neither Patent Owner nor Dr. Faghri explain

adequately why, even assuming that the approach would “not be necessary” in a two-plate assembly, the approach is exclusively limited to single-plate assemblies and could not also be utilized with two-plates.

Patent Owner asserts that, “according to Petitioner’s translation, Morikawa repeatedly refers to ‘upper and lower surfaces of the panel,’ (Ex. 1003 at 4:28–29, 4:36–37) and ‘upper and lower inner surfaces of the panel’ (Ex. 1003 at 4:32–33),” and argues that “[t]he references to plural ‘surfaces’ of a single ‘panel’ undermines Petitioner’s argument that Morikawa discloses two plates.” PO Sur-Reply 15–16. However, Morikawa refers to the entire heat pipe as a “panel,” thus it is not surprising that the term is singular. *See, e.g.*, Ex. 1003, 2:8–10 (“A shape of the heat pipe is not limited to that of a so-called pipe type, and included are a shape of a panel type and shapes of other types.”), 3:15–17 (“FIG. 2A illustrates a partially cut-out explanatory perspective view of a structure of a heat pipe of a panel type of the present invention.”), 3:25–28 (referring to a component “inside the panel”). We do not find persuasive Patent Owner’s implied argument that Morikawa’s reference to a singular “panel” supports a finding that the disclosed device is manufactured from a single plate.

We find evidence in the record contrary to Patent Owner’s arguments and Dr. Faghri’s opinions. Specifically, we agree with Petitioner that Morikawa’s Figures 2B and 3 appear to show two plates. Pet. Reply 23. Further, Dr. Pokharna provides sound reasoning as to why, based on Nakamura’s construction, one having ordinary skill in the art would have understood Nakamura’s heat pipe to be made using two plates. Ex. 1032 ¶¶ 41–55. Additionally, 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 the evidence supports the view that Nakamura discloses a container formed from two plates.

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. *See* PO Resp. 63–64 (referring to argument in Sections VII.C and VI.D); *id.* at 52–53 (Section VII.C referring to argument in Section VI.C).

Specifically, as to a reason to combine, Patent Owner argues that:

Morikawa’s heat pipe container is not made from two “plates.” . . . As a result, 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, which a POSITA would have been motivated to avoid. Ex. 2002 ¶ 154.

. . .

A POSITA at the time of the invention would have recognized that replicating “flanges (17) and (17)” of Takahashi in Morikawa’s heat pipe could create gaps in the capillary structure and adversely affect performance of the heat pipe, which a POSITA would have been motivated to avoid. Ex. 2002 ¶ 155.

PO Resp. 53.

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 ¶¶ 154–155. As discussed above, Morikawa discloses a heat pipe formed of two plates. *See* Ex. 1003, Figs. 2(A), 2(B), 3.

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. 29–30 (citing Ex. 1002 ¶ 60). 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 at the time of filing for the '680 patent” and that “a [person of ordinary skill in the art] would have reasonably expected the combination of Morikawa and Takahashi to yield predictably successful results.” Ex. 1002 ¶ 60.

Dr. Faghri testifies that adopting Takahashi's flanges would have complicated Morikawa's construction because it *could* have created gaps in Morikawa's capillary structure. Ex. 2002 ¶ 155. However, as Dr. Pokharna opines (Ex. 1032 ¶ 63), Morikawa likely used the known method of brazing or soldering to form the assembly, so it is unclear how use of Takahashi's flanges, joined by brazing or soldering, would disrupt the capillary action in Morikawa's heat pipe. Further, Dr. Faghri testifies that this purported problem—that capillary gaps merely *could* result—would have been recognized by persons of ordinary skill in the art, but does not testify that this would have been viewed as an insurmountable problem without an existing known solution or one that would offset the benefits of using flanged joints. *See* Ex. 2002 ¶ 155. Dr. Faghri's position is also belied by the '680 patent itself, which describes the joining of plates by soldering or brazing as “well understood” “conventional means” of joining plates. Ex. 1001, 3:32–41 (“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. . . . This is the conventional method of constructing a heat pipe, and is well understood in the art of heat pipes.”).

We find that Petitioner has provided adequate evidence and reasoning of a reason to employ Takahashi’s flanges in Morikawa’s heat pipe, and that the resulting modification would result in a structure having two plates with circumferential edge lips bonded together.

Patent Owner contends that the recited “circumferential edge lip” “requires lips extending around the circumference of the plates that are bonded together.” PO Resp. 46–47; *see also* PO Sur-Reply 5 (“[C]ircumferential edge lips’ must extend circumferentially around the edges of the boundary structure.”).¹² Patent Owner contests Petitioner’s assertion that Takahashi’s flanges extend about the entire circumference of each plate. PO Resp. 52; *cf. id.* at 53–54 (arguing that Morikawa’s heat pipe, purportedly made from a single plate, uses end caps, and Takahashi’s embodiment with end caps omits its flanges and therefore the combination will lack flanges) (citing Ex. 2002 ¶ 157)). We understand Takahashi’s embodiment shown in Figures 5 and 6 to include flanges extending around the circumference of the container when Takahashi is considered in its entirety. Takahashi discloses sealing its heat pipe around its entire circumference by vacuum brazing. Ex. 1005, 5:12–20, 6:4–22, 8:7–16 (discussing the flange-less embodiment (a) shown in Figures 1–4).

¹² Petitioner asserts that “the meaning of ‘lip’ needs no resolution because Takahashi discloses a ‘lip’ under either party’s construction” (Pet. Reply 12), and that “the pertinent figures of Takahashi . . . clearly show that the Takahashi apparatus is sealed about its periphery” (*id.* at 26). We agree that no explicit construction of “circumferential edge lip” is necessary to resolve the parties’ disputes here.

Takahashi further describes that the flanged embodiment shown in cross-section in Figures 5 and 6 is “equivalent” to the embodiment shown in Figures 3 and 4. We agree with Dr. Pokharna that a person having ordinary skill in the art would have read Takahashi’s additional 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 26–28 (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.

2. *Vapor Chamber*

In independent claim 3, the phrase “so as to define a vapor chamber” comes at the end of the limitations:

a first plate having a circumferential edge lip bounding an inner surface . . . [and] a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip bounding an inner surface . . . , said edge lips of said first and second plates being bonded together so as to define a vapor chamber.

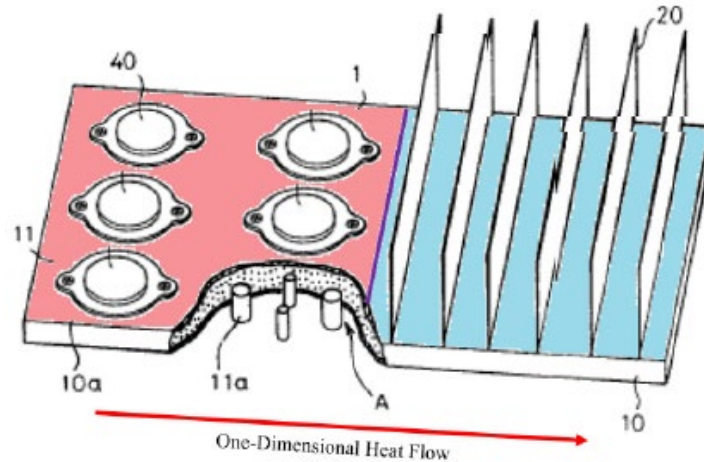
Ex. 1001, 6:5–13. Petitioner contends that Morikawa, as modified to have Takahashi’s flanges, results in such a “vapor chamber” under either party’s proposed construction for that phrase. Pet. 53–55; *see id.* at 38–40, 90 (referring to argument at Section IX.B.7).

Patent Owner contends that Morikawa does not disclose a “vapor chamber.” PO Resp. 56 (incorporating the analysis in Section VI.B on PO Resp. 43–45). This contention is based on Patent Owner’s proposed construction of “vapor chamber” to require heat spreading in the form of heat flow in more than one dimension. *See id.* at 3–4, 43–45, 56. As

discussed above, we adopt the aspect of Petitioner’s proposed construction of “vapor chamber” to encompass evaporation and condensation of a heat transfer fluid “to *transport or spread* heat.” We do not construe “vapor chamber” to require two- or three-dimensional movement of heat within the chamber. We acknowledge, however, that the evaporation and condensation of the heat transfer fluid within the vapor chamber will result in heat being transported or spread.

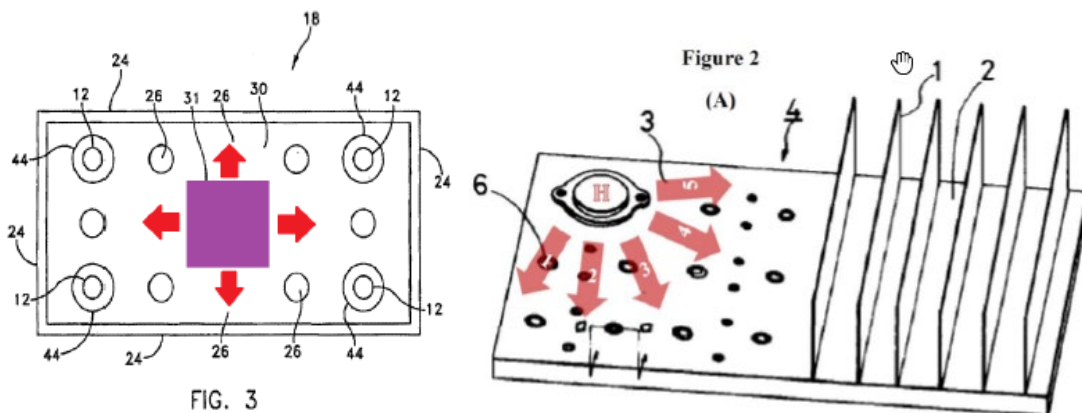
We find that Petitioner has shown that Takahashi discloses that its flanges are joined to each other by vacuum brazing to form a sealed container, and Morikawa discloses that its sealed container provides a sealed space in which a heat transfer fluid is evaporated and condensed to transport heat. *See* Pet. 25 (citing Ex. 1005, 6:14–22), *id.* at 38–39 (citing Ex. 1003, 1:36–2:7). Specifically, Morikawa discloses a heat pipe formed as a sealed container under either party’s proposed construction—an enclosed and hermetically sealed void or cavity (Pet. 13) and a vacuum sealed chamber (PO Resp. 14). Ex. 1003, 1:36–41; Ex. 1002 ¶ 67. Morikawa further discloses that the container has a refrigerant that is added to the container after air is extracted therefrom, and that the refrigerant can be evaporated and condensed to transport or spread heat. Ex. 1003, 1:36–2:7; Ex. 1002 ¶ 67.

Patent Owner argues that Morikawa teaches “one-dimensional heat flow.” PO Resp. 44 (citing Ex. 2002 ¶¶ 67, 126–127, 130, 131). Patent Owner provides an illustration, reproduced below, for purposes of explanation.



PO Resp. 44. The illustration above appears to be based on Figure 2A of Morikawa, in which Patent Owner has added heat sources and coloring to indicate the heating portion in red and cooling portions in blue. *Id.* 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 ’680 patent and Morikawa, as shown below. Pet. Reply 4–5 (citing Ex. 1032 ¶¶ 26–32).



The illustration on the left is based on Figure 3 of the '680 patent and shows a heat source in purple and the heat flow traveling away from the heat source as red arrows. Ex. 1032 ¶ 28–29. The illustrations on the right are based on Morikawa as shown in Figure 2(A) of Nakamura and depict a heat source with the heat flow traveling away from the heat source as red arrows. Pet. Reply 4–5; Ex. 1032 ¶ 30.

Dr. Pokharna testifies that in the device of the '680 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 ¶¶ 27–29.

Dr. Pokharna illustrates, in the annotated illustration on the left above, an internal 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 outwards, 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 [’680 patent’s] heat pipe,” (2) does not provide adequate foundation for his opinion that heat moves in Morikawa’s device 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- or three-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 as relied upon in Petitioner's challenge.

We find that Morikawa as modified by Takahashi discloses the recited "vapor chamber" under either party's proposed construction.

For these reasons, Petitioner has provided adequate evidence to demonstrate that the combination of Morikawa and Takahashi discloses the recited "a first plate having a circumferential edge lip . . . [and] a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip . . . , said edge lips of said first and second plates being bonded together so as to define a vapor chamber."

c. "a first plate having . . . a depression which projects outwardly relative to said inner surface"

Petitioner contends that Nakamura discloses the claimed "first plate having . . . a depression which projects outwardly relative to said inner surface." Pet. 88–89 (citing Ex. 1002 ¶ 110). Specifically, Petitioner identifies, as the recited depression, Nakamura's concavity 9 of the top plate, with that concavity being adhered to an opposing concavity of the bottom plate. *Id.* Petitioner asserts that "'concavity' labeled as '9' . . . extends downwardly in the direction that 'said inner surface' is facing towards." *Id.* at 88 (citing Ex. 1002 ¶ 110); *see id.* at 89 (Petitioner's annotated version of Nakamura's Figure 3 depicting the subject feature in red). Petitioner proposes to substitute Nakamura's concavity for the pipe of Morikawa. *Id.* at 88 (referring to argument at Sections X.B.5.b and X.B.5.c).

As for a reason to combine Nakamura with Morikawa, Petitioner argues, *inter alia*, that:

[A] POSITA would have understood that the concavities / depressions allow fasteners to go through the body region of the heat pipes onto which the heat-generating elements can be secured. (Pokharna, ¶85.)

Further, Nakamura expressly provides a POSITA with the motivation to combine it with Morikawa because, for starters, Nakamura directly names Morikawa, describes its shortcomings, and offers the solutions to resolve such shortcomings.

Id. at 58 (citing Ex. 1002 ¶ 85; Ex. 1003, 1:3; Ex. 1004, 3–4). Petitioner notes that these shortcomings pertain to the difficulty of brazing Morikawa’s pipe to an outer wall in order to create a non-leaking seal. *See id.* at 58–63 (citing Ex. 1002 ¶ 86). Petitioner argues that, “when reading Morikawa and Nakamura together, a POSITA would have been motivated to combine Nakamura with Morikawa because Nakamura expressly provides the solution, and thus the motivation to combine Nakamura with Morikawa to solve the problems in Morikawa.” *Id.* at 63 (citing Ex. 1002 ¶ 86).

Petitioner has demonstrated adequately that 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 ’680 patent. *Compare* Pet. 57 (showing annotated Figure 4 of Nakamura), *with* Ex. 1001, Figs. 1, 2 (showing depressions 26). We further find that Petitioner has shown that a person having ordinary skill in the art would have had a reason to modify Morikawa’s heat pipe to employ the depressions of Nakamura. Pet. 58–63 (citing Ex. 1002 ¶¶ 85–86).

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

Petitioner asserts that Nakamura discloses the recited “at least one opening through said second plate.” Pet. 81–82; *see id.* at 90 (referring to argument at Section X.C.6; citing Ex. 1002 ¶ 113). Specifically, Petitioner

contends that the hole in the bottom plate concavity of Nakamura corresponds to the recited opening. *Id.* (providing an annotated version of Nakamura's Figure 4). We agree with Petitioner and, for the reasons given below, find that an opening in a concavity also is an opening in a plate.

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

Claim 3 calls for the first plate depression to have an open ended tubular cross-section and an outer surface bonded to the second plate so as to align the second plate opening with the depression and thereby forming a mounting hole isolated from the vapor chamber. Ex. 1001, 6:14–21.

Petitioner contends that the proposed combination discloses this limitation, asserting that Nakamura's first plate depression comprises an outer surface that is bonded to a corresponding annular surface in the second plate concavity such that the aligned openings create a hole that is isolated from the vapor chamber. Pet. 90–98 (citing Ex. 1002 ¶¶ 115–118); *see id.* at 66–71 (asserting that Nakamura's plates each have an opening in the concavity through which the bolt passes, that the area of the concavity is an annular surface, and that those surfaces are bonded together) (citing Ex. 1002 ¶¶ 89–91). Nakamura shows, in Figure 4, plates having inwardly formed concavities 9 that are adhered together by soldering or the like and with a hole formed in the mating concavities for accommodating a bolt and with the hole being isolated from the interior. *See* Ex. 1004, 5, Fig. 4; Ex. 2012, 6, Fig. 4.

As mentioned, claim 3 calls for a depression in the first plate bonded to the second plate with the second plate having an opening. Patent Owner argues that this structural relationship is not disclosed by Nakamura. PO Resp. 59–60. Patent Owner argues that Nakamura describes one concavity (depression) bonded to another concavity but not to an opposite plate. *Id.* at 60. Patent Owner further argues that Nakamura’s hole is formed in the two concavities and, therefore, the hole is not formed in the second plate as recited in claim 3. *Id.*

We do not find Patent Owner’s arguments persuasive. Nakamura’s concavities are formed in the plates—each concavity is an embossed part of the respective plate. *See* Ex. 1004, 6 (“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.”); *see also* Ex. 2012, 6. Thus, a concavity bonded to an opposing concavity also is bonded to the opposing plate. Also, 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 such that the hole is formed in the second plate.

We find that Nakamura discloses the subject limitations and specifically a depression (concavity 9) in one plate that is bonded to another plate and aligned openings forming a mounting hole isolated from the vapor chamber.

f. Conclusion as to Ground 3, Claim 3

Based on the foregoing, Petitioner has established that independent claim 3 is unpatentable over the combination of Morikawa, Takahashi, and Nakamura.

III. PATENT OWNER'S 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. PO Mot. Excl. 1–2. Petitioner opposes. *See, e.g.*, Pet. Opp. Mot. Excl. 1–2.

Patent Owner contends that “Exhibit 1004 [Nakamura] is not relevant to the proceedings and should be excluded.” PO Mot. Excl. 4 (citing Fed. R. Evid. 104, 401). Patent Owner argues that, “[f]or Exhibit 1004 to be relevant, Petitioner was required to introduce sufficient proof that Exhibit 1004 was publicly accessible such that it qualifies as a prior art printed publication under United States law.” *Id.* at 3 (citing Fed. R. Evid. 104). We disagree.

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 in this Decision the substance of any version of Exhibit 1040, Exhibit 1041, Exhibits 3 and 4 and Attachment 3a to Exhibit 1039.

IV. CONCLUSION¹³

Petitioner has shown by a preponderance of the evidence that claim 3 of the '680 patent would have been obvious over Morikawa, Takahashi, and Nakamura. Petitioner has not shown by a preponderance of the evidence that claims 1 and 2 of the '680 patent would have been obvious. We also deny-in-part and dismiss-in-part Patent Owner's Motion to Exclude.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
2	103(a)	Morikawa		2
2	103(a)	Morikawa, Takahashi		2
1–3	103(a)	Morikawa, Takahashi, Nakamura	3	1, 2
Overall Outcome			3	1, 2

¹³ 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).

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, claims 1 and 2 of the '680 patent have *not* been proven to be unpatentable;

FURTHER ORDERED that claim 3 of the '680 patent has been proven to be unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Exclude is *denied-in-part and dismissed-in-part*; 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.

IPR2019-00334
Patent 7,100,680 B2

PETITIONER:

Erik Milch
emilch@cooley.com

Andrew Mace
amace@cooley.com

Reuben Chen
rchen@cooley.com

PATENT OWNER:

Kenneth Albridge, III
kmalbridge@michaelbest.com

Kevin Moran
kpmoran@michaelbest.com

Brian Marstall
bjmarstall@michaelbest.com