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Paper 26
Entered: July 31, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CANON U.S.A., INC. and CANON INC.,
Petitioner,

v.

SLINGSHOT PRINTING LLC,

Patent Owner.

IPR2023-00309
Patent 7,290,864 B2

Before JO-ANNE M. KOKOSKI, GARTH D. BAER, and
JOHN D. HAMANN, *Administrative Patent Judges*.

HAMANN, Administrative Patent Judge.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

In this *inter partes* review, instituted pursuant to 35 U.S.C. § 314 (2018), Canon U.S.A., Inc. and Canon Inc. (collectively "Petitioner") challenge the patentability of claims 1–6 and 8–20 ("the challenged claims") of U.S. Patent No. 7,290,864 B2 (Ex. 1001, "the '864 patent"), owned by Slingshot Printing LLC ("Patent Owner"). We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 (2023). For the reasons discussed herein, we determine that Petitioner shows by a preponderance of the evidence that the challenged claims are unpatentable.

A. Procedural History

Petitioner filed a Petition requesting *inter partes* review of the challenged claims of the '864 patent. Paper 2 ("Pet."). Patent Owner filed a Preliminary Response. Paper 5. We instituted *inter partes* review of the challenged claims on the grounds raised in the Petition. Paper 6 ("Dec. on Inst."), 37–38.

Following institution, Patent Owner filed a Response to the Petition. Paper 9 ("PO Resp."). Petitioner filed a Reply to Patent Owner's Response. Paper 12 ("Pet. Reply"). Patent Owner filed a Sur-reply to Petitioner's Reply. Paper 13 ("PO Sur-reply").

An oral hearing was held on May 9, 2024. A transcript of the oral hearing is included in the record. Paper 25.

B. Real Parties-In-Interest

The parties identify themselves as the real parties-in-interest. Pet. 1; Paper 3, 1.

C. Related Matters

The parties identify *Slingshot Printing LLC v. Canon U.S.A., Inc.*, No. 2:22-cv-001852 (E.D.N.Y.) and *Slingshot Printing LLC v. HP Inc.,* No. 6:19-cv-00549 (W.D. Tex.) as matters that may affect, or be affected by, a decision in this proceeding. Pet. 1; Paper 3, 1.

D. The Challenged Patent

The '864 patent relates to heater chips in printheads having a reduced number of bondpads. Ex. 1001, 1:6–8. As background, the '864 patent explains that "[a] printhead is the device in printers, copiers, and multi-function products which sprays droplets of ink onto a sheet of paper," and "[a] number of [such] products utilize heater chips in their printheads for discharging ink drops from one or more ink vias." *Id.* at 1:13–17. "Inkjet heater chips typically contain one or more ink vias as well as arrays of heaters located next to an ink via," according to the '864 patent. *Id.* at 1:17–19. "The heaters provide thermal energy that causes the discharge of a droplet of ink." *Id.* 1:19–20. The '864 patent explains that "[c]hip bondpads are used to power the heaters by providing electric current to the heaters," and that "[e]ach chip bondpad usually has a corresponding tab circuit connection, tab trace, and electrical connection to the printing device." *Id.* at 1:21–24.

According to the '864 patent, "[t]ypically, in inkjet heater chips with one ink via, heater chip bondpads supply power only to heaters located on the same side of the ink via as the chip bondpads," and "[s]imilarly, in inkjet heater chips containing multiple ink vias, a given bondpad supplies power to heaters on one side of the ink via or the other, but not both." *Id.* at 1:29–34. The '864 patent explains that "[b]ondpads consume chip area," and "[t]he

on-chip routing of heater power from the bondpad to the heater arrays is also a contributing factor to overall chip size." *Id.* at 1:34–36. "The higher number of chip bondpads and power routes also increase[s] the cost of the heater chip." *Id.* at 1:37–38. "Therefore, what is needed is a way to minimize the number of chip bondpads necessary to power the heater arrays on the chip," according to the '864 patent. *Id.* at 1:38–40.

In response, the '864 patent discloses "a heater chip that includes heater power trace routes from a single bondpad to at least two different heater arrays located on both sides of an ink via," which "minimizes the number of bondpads necessary to be fabricated on a heater chip and saves a significant amount of heater chip space." *Id.* at 3:30–38. Figure 3, shown below, illustrates such an embodiment. *Id.* at 3:13–16.

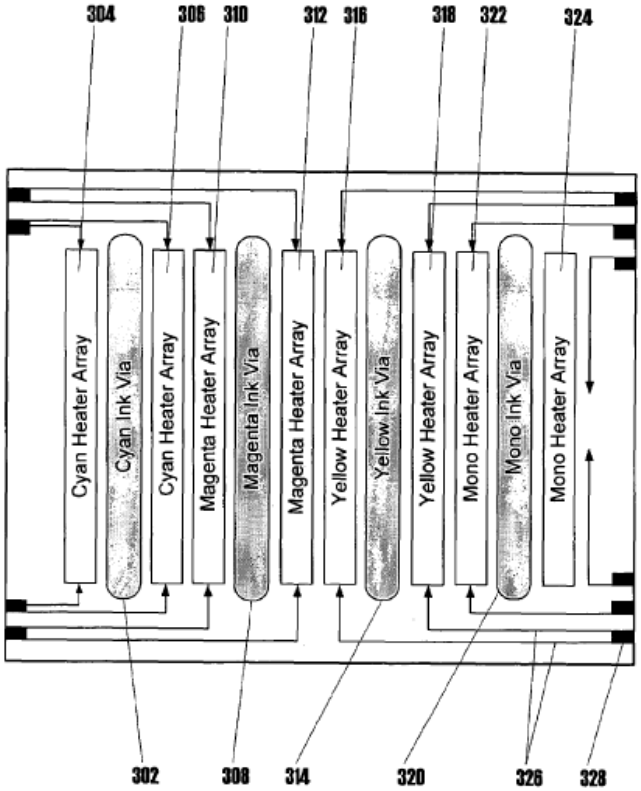

FIG. 3

Figure 3 "shows a block diagram of the configuration of heater arrays and routing of the connections to bondpads on a heater chip with multiple ink vias in accordance with" the '864 patent. *Id.* This figure illustrates a heater chip having "four ink vias each disposed between two heater arrays." *Id.* at 4:30–32. "In particular, a cyan ink via 302 is positioned between a first heater array 304 and a second heater array 306; a magenta ink via 308 is positioned between a first heater array 310 and a second heater array 312; a yellow ink via 314 is positioned between a first heater array 316 and a second heater array 318; and a monochrome (K) ink via 320 is positioned between a first heater array 322 and a second heater array 324." *Id.* at 4:32–39. The '864 patent discloses that "[w]ith the heater arrays positioned on both sides of at least a portion of the ink vias, the ink vias may provide smaller ink drops in order to achieve higher printing resolutions." *Id.* at 4:54–56.

In addition, with "the heater arrays on each side of their corresponding ink via, . . . the amount of heaters needed to be fired simultaneously in each array has been reduced," and "[t]hus the amount of current needed to be supplied from the bondpads 328 to each heater array has been reduced," the '864 patent discloses. *Id.* at 5:12–18. "Thus, the number of bondpads 328 required to fire the required number of heaters simultaneously has been reduced to the point that one bondpad 328 can supply the power needs of . . . a portion of one heater array and a portion of a second heater array," which "save[s] space on the heater chip," according to the '864 patent. *Id.* at 5:30–35, 5:38–40. Moreover, "a single bondpad 328 [can] suppl[y] power not only to heaters in multiple heater arrays, but also to heaters on both sides of an ink via." *Id.* at 5:46–49. "For example, as shown [above] in F[igure] 3,

employing this configuration with two power traces 326 stemming from a single bondpad 328 reduces the number of bondpads needed to power all the arrays from 16 to 10." *Id.* at 5:49–52.

E. Illustrative Claim

Of the challenged claims, claims 1, 8, and 16 are independent. Claim 1 is illustrative of the challenged claims and is reproduced below.

> 1. A heater chip for use in a printing device, comprising:
> an ink via;
> a first heater array adjacent at least a portion of one side of the ink via;
> a second heater array adjacent at least a portion of another side of the ink via; and
> a bondpad, wherein the bondpad supplies power to at least a portion of the first heater array and to at least a portion of the second heater array.

Ex. 1001, 6:31–39.

F. Instituted Grounds of Unpatentability

We instituted trial based on the following grounds of unpatentability, which are all the grounds raised in the Petition:

Claim(s) Challenged	35 U.S.C. §[1]	Reference(s)
1–3, 5, 6, 8–10, 13–15	103(a)	Benjamin144,[2] Benjamin703[3]
4, 11, 12, 16–20	103(a)	Benjamin144, Benjamin703, Childers[4]

[1] The Leahy-Smith America Invents Act ("AIA") included revisions to 35 U.S.C. §§ 102 and 103 that became effective on March 16, 2013. Because the '864 patent issued from an application filed before March 16, 2013, we apply the pre-AIA version of these bases for unpatentability.
[2] US 7,722,144 B2, issued May 25, 2010 (Ex. 1005, "Benjamin144").
[3] US 7,278,703 B2, issued Oct. 9, 2007 (Ex. 1006, "Benjamin703").
[4] US 6,582,062 B1, issued June 24, 2003 (Ex. 1007, "Childers").

Claim(s) Challenged	35 U.S.C. §[1]	Reference(s)
1, 3, 5, 6, 8–10, 13, 15	102	Uenishi[5]
4, 11, 12	103(a)	Uenishi, Hayasaki[6]

Pet. 3, 7–101. Petitioner submits in support of its arguments the Declaration of Stephen F. Pond, Ph.D. (Ex. 1002). Patent Owner submits in support of its arguments the Declaration of Steven J. Dietl (Ex. 2004).

II. LEVEL OF ORDINARY SKILL IN THE ART

To determine whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). In assessing 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) (citing *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962–63 (Fed. Cir. 1986)). "[O]ne or more factors may predominate." *Id.*

In our Decision on Institution, we adopted the definition Petitioner proposes for one having ordinary skill in the art at the time of the invention of the '864 patent. Dec. on Inst. 8. Namely, we found that one of ordinary skill in the art would have had "a Bachelor's or Master's level college degree in Mechanical Engineering, Materials Science, Physics, Electrical Engineering, or a related field, and two years of training or experience in the design of inkjet printheads or semiconductor circuit

[5] JP 11-245409, published Sept. 14, 1999 (Ex. 1008, "Uenishi").
[6] US 2001/0045967 A1, published Nov. 29, 2001 (Ex. 1009, "Hayasaki").

layout." *Id.* at 7 (quoting Pet. 6 (citing Ex. 1002 ¶ 56)). Patent Owner "does not dispute this characterization of the level of ordinary skill in the art." PO Resp. 18.

Because Petitioner's definition of the level of skill in the art is consistent with the '864 patent and the asserted prior art, we maintain it for purposes of this Final Written Decision. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *GPAC*, 57 F.3d at 1579; *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978).

III. CLAIM CONSTRUCTION

Because the Petition was filed after November 13, 2018, we apply the same claim construction standard that would be used in a civil action under 35 U.S.C. § 282(b), following the standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b) (2019); 83 Fed. Reg. 51,340, 51,340–41, 51,343 (Oct. 11, 2018). In applying such standard, claim terms are generally given their ordinary and customary meaning, as would be 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).

Petitioner "propose[s] that claim terms in the [c]hallenged [c]laims be afforded their plain and ordinary meaning." Pet. 6. Likewise, Patent Owner "contends that all claim terms should be given their plain and ordinary

meaning as used in the '864 patent." PO Resp. 18. The parties dispute, however, what constitutes the plain and ordinary meaning of "physically separated proximal to the bondpad."[7] PO Resp. 19–21; Pet. Reply 5–8; PO Sur-reply 1–8. Thus, we need to resolve this dispute. *See Eon Corp. IP Holdings v. Silver Spring Networks*, 815 F.3d 1314, 1318 (Fed. Cir. 2016) (finding that disputes between the parties over the plain and ordinary meaning of a term should be resolved as a matter of claim construction).

Petitioner argues that "[t]he phrase 'the at least two traces are physically separated proximal to the bondpad' is a simple phrase that requires the power traces be physically separate from each other nearer (*i.e.*, proximal) to the bondpad (point of origin) than the end of the trace (*i.e.*, which is distal to the bondpad)." Pet. Reply 5. Patent Owner argues that "'physically separated proximal to the bondpad' should be interpreted consistent with the '864 patent to mean 'separated at a location nearer to the bond pad than the heater arrays.'" PO Resp. 19 (citing Ex. 2004 ¶ 55).

The parties agree that the bondpad is the first point from which to measure distance in evaluating whether the physical separation of the traces occurs proximal to the bondpad. *E.g.*, Pet. Reply 5, 15–17; PO Resp. 20. And the parties agree that if the physical separation occurs less than halfway between (i.e., nearer) the bondpad and a second point then the physical separation of the traces occurs proximal to the bondpad. *E.g.*, Pet. Reply 5, 15–17; PO Resp. 20.

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[7] The parties also dispute the meaning of "bondpad" and "power traces." PO Resp. 18–19; Pet. Reply 2–5; PO Sur-reply 1. The parties' disputes as to these terms, however, do not relate to the parties' unpatentability arguments for the grounds we analyze in this Final Written Decision. Thus, we do not construe these two terms.

The parties, however, dispute what is that second point. Petitioner argues that the second point is "the end of the trace (*i.e.*, which is distal to the bondpad)." *E.g.*, Pet. Reply 5. Patent Owner argues that the second point is "the heater arrays.'" *E.g.*, PO Resp. 19. For the reasons below, we agree with Petitioner.

We first turn to the intrinsic evidence. The term "proximal" is not used in the '864 patent, other than the claims. *See generally* Ex. 1001; Ex. 1015,[8] 69:6–12 (Patent Owner's expert, Mr. Dietl, agreeing that the term "proximal" "only exists in the claims"). Nor do the parties cite to the prosecution history to address the term "proximal."

In addition, we find inapposite Patent Owner's reliance on the '864 patent's Figure 3. PO Resp. 20; PO Sur-reply 3–6. Figure 3 shows that the traces "are physically separated as they meet the bondpad" (i.e., "two separate power traces . . . from a single bondpad"). Ex. 1001, 5:64–6:2, Fig. 3. Thus, regardless of what is chosen as the second measuring point (i.e., the distal end of the traces or the heater arrays), the physical separation of the traces always is nearer the bondpad. *Id.* Moreover, the '864 patent states that "[a]lthough not illustrated, it should also be appreciated that a single power trace may extend from the bondpad . . . , and then branch into two or more traces that extend to respective heater arrays." *Id.* at 6:6–10. As stated, this subsequent branching is not illustrated. *Id.*

Turning to the claim language, we agree with Petitioner that "proximity is measured along the trace relative to the bondpad," and "[n]othing in the claims requires a comparison to other structures, like the heater arrays." Pet. Reply 6. For example, claim 3 recites "wherein the

[8] Deposition Transcript of Steven Dietl (Dec. 19, 2023).

bondpad supplies power to the first heater array and the second heater array portions by *power traces physically separated proximal to the bondpad*." Ex. 1001, 6:43–46 (emphasis added). In this context, "proximal" relates to the power traces, and where they are separated, relative to the bondpad. *Id.* In other words, the traces are separated nearer to the bondpad (which is the traces' proximal end relative to the bondpad) then the end of the traces (which is the traces' distal end relative to the bondpad). *Id.*

This conclusion is consistent with the definitions for proximal and distal from the dictionary that Patent Owner identifies. In particular, "proximal" is defined as "situated nearer to . . . the point of attachment," and "distal" is defined as "situated away . . . from the point of attachment." Ex. 2001, 3; Ex. 1016, 3. Here, the point of attachment is the bondpad. Of note, the dictionary also states that proximal is "[t]he opposite of distal," which reinforces that the distance comparison for the separation is relative to the ends of the power traces. Ex. 2001, 3. Obviously, there are two ends to the traces with one being proximal to the bondpad and the other distal thereto. And we find that consulting the dictionary definition is appropriate here under our circumstances. *See Comaper Corp. v. Antec, Inc.*, 596 F.3d 1343, 1348 (Fed. Cir. 2010) (approving of "consult[ing] a general dictionary definition of [a] word for guidance" in determining ordinary meaning); *Praxair, Inc. v. ATMI, Inc.*, 543 F.3d 1306, 1325 (Fed. Cir. 2008) ("[O]ur decisions, including *Phillips*, do not preclude the use of general dictionary definitions as an aid to claim construction.") (citation omitted).

In addition, we find unavailing Patent Owner's argument that "an 'end of the trace' is not mentioned in the claims of the '864 patent." PO Sur-reply 2. As we discuss above, the claim language uses "proximal" with

respect to the traces, and thus, implicates the other end of the power traces for that determination.

In addition, we find unavailing Patent Owner's argument that "claim 1 is directed to a heater chip with a bondpad that supplies power to at least portions of first and second heater arrays," and that "[c]laim 3 further indicates that the bondpad supplies power to first and second heater array portions by power traces." PO Resp. 19. Patent Owner argues "[t]hus, the power traces are connected at one end to the bondpad and at the other end to heater arrays." *Id.* at 20. However, having a bondpad supply power to heater arrays via power traces does not provide a basis to argue that the heater arrays are the second point for measuring whether the traces separate proximal to the bondpad.

Lastly, we have reviewed the experts' testimony for this term. And we are persuaded by Dr. Pond's testimony as we find it consistent with the claim language and the cited dictionary definitions. Ex. 2005,[9] 16:20–19:23. In contrast, we find Mr. Dietl's testimony for this term contradicts the claim language and the cited dictionary definitions. *See* Ex. 2004 ¶¶ 55–57.

In sum, we agree with Petitioner and find that "the at least two traces are physically separated proximal to the bondpad" means that "the power traces be physically separate from each other nearer (*i.e.*, proximal) to the bondpad (point of origin) than the end of the trace (*i.e.*, which is distal to the bondpad)."

[9] Deposition Transcript of Stephen F. Pond (Oct. 11, 2023).

IV. GENERAL PRINCIPLES OF LAW

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A 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 of the invention to a person having ordinary skill in the art. *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 ordinary skill in the art; and (4) objective evidence of non-obviousness, if present.[10] *See Graham*, 383 U.S. at 17–18. When evaluating a claim for obviousness, we also must "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

[10] Patent Owner does not present arguments or evidence of such objective evidence of non-obviousness. *See generally* PO Resp.

V. ALLEGED OBVIOUSNESS OVER BENJAMIN144 AND BENJAMIN703

Petitioner argues that the combination of Benjamin144 and Benjamin703 renders claims 1–3, 5–6, 8–10, and 13–15 obvious. Pet. 7–46. For the reasons that follow, we determine that Petitioner shows by a preponderance of the evidence that the combination of Benjamin144 and Benjamin703 renders these claims obvious.

A. Summary of Benjamin144

Benjamin144 is titled "Fluid Ejection Device." Ex. 1005, code (54). Benjamin144 teaches a fluid ejection device which "includes a first fire line adapted to conduct a first energy signal having energy pulses, a second fire line adapted to conduct a second energy signal having energy pulses, a first address generator configured to provide first address signals, a second address generator configured to provide second address signals, [and] first drop generators and second drop generators." *Id.* at code (57). The drop generators are electrically coupled to their respective fire line and are configured to respond to the energy signal to eject fluid based on the address signals. *Id.*

B. Summary of Benjamin703

Benjamin703 is titled "Fluid Ejection Device with Identification Cells." Ex. 1006, code (54). Benjamin703 teaches "[a] fluid ejection device comprising an identification line adapted to receive a program signal and a read signal and identification cells electrically coupled to the identification line." *Id.* at code (57). "Each of the identification cells comprises a memory circuit and a memory element," which "is adapted to receive and respond to signals in order to selectively store a value in the memory circuit, which

determines whether the identification cell is responsive to signals received on the identification line." *Id.*

C. Challenged Claim 1

1. Heater Chip (Preamble)

Claim 1's preamble recites "[a] heater chip for use in a printing device." Ex. 1001, 6:31. We agree with Petitioner and find that Benjamin144 teaches claim 1's preamble. Pet. 7–10.

More specifically, we find that Benjamin144 teaches "an inkjet printing system 20," which "includes a fluid ejection device, such as inkjet printhead assembly 22," which "includes one printhead 40." Ex. 1005, 3:23–27, 4:46–47. Benjamin144 teaches having "drop generators 60 located along ink feed slot 46 in one embodiment of printhead die 40." *Id.* at 5:46–47. And, we agree with Petitioner and find that a "die" is a "chip." *See* Ex. 1013,[11] 125; Ex. 1002 ¶ 63.

In addition, Benjamin144 teaches that "[t]he firing resistors 52 of drop generators 60 are energized in a controlled sequence to eject fluid from vaporization chambers 56 and through nozzles 34 to print an image on print medium 36." Ex. 1005, 5:64–67.

In addition, we find persuasive Dr. Pond's testimony that one of ordinary skill in the art would have understood that Benjamin144's printhead die 1700 teaches the claimed "heater chip for use in a printing device" (e.g., an inkjet printer). Ex. 1002 ¶¶ 60–68. We find that this testimony is consistent with Benjamin144's teachings we discuss above.

[11] THE PENGUIN DICTIONARY OF ELECTRONICS (Valerie Illingworth ed.) (3d ed. 1998).

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner, we are persuaded that Petitioner shows that Benjamin144 teaches "[a] heater chip for use in a printing device." In light of our finding, we need not, and thus do not, reach whether claim 1's preamble is limiting.

2. Ink Via

Claim 1 further recites "an ink via." Ex. 1001, 6:32. We agree with Petitioner and find that Benjamin144 teaches this limitation. Pet. 11–12.

Benjamin144 teaches that "[t]he printhead die 1700 includes . . . three ink fluid feed sources, . . . feed slots 1704, 1706 and 1708." Ex. 1005, 63:21–24; *see also id.* at Fig. 21 (illustrating ink feed slots 1704, 1706, and 1708). We also find persuasive Dr. Pond's testimony that Benjamin144 teaches an ink via (e.g., ink feed slot 1704), as this testimony is consistent with Benjamin144's teachings. *See* Ex. 1002 ¶¶ 69–72.

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner, we are persuaded that Petitioner shows that Benjamin144 teaches "an ink via."

3. First and Second Heater Arrays

Claim 1 further recites "a first heater array adjacent at least a portion of one side of the ink via," and "a second heater array adjacent at least a portion of another side of the ink via." Ex. 1001, 6:33–36. We agree with Petitioner and find that Benjamin144 teaches these limitations. Pet. 13–16.

Benjamin144 teaches that "printhead die 1700 includes six fire groups 1702*a*–1702*f* disposed along three ink fluid feed sources, . . . feed slots 1704, 1706 and 1708." Ex. 1005, 63:21–24, Fig. 21. Benjamin144 explains that "[t]he fire groups 1702*a*–1702*f* are divided into eight data line groups,

indicated at D1–D8" and that "[e]ach data line group D1–D8 includes pre-charged firing cells 120 from each of the fire groups 1702*a*–1702*f*." *Id.* at 63:39–42. Benjamin144 teaches that "[p]recharged firing cell 120 is one embodiment of firing cell 70" and that "[f]iring cell 70 includes a firing resistor 52 . . . [that] is part of a drop generator 60." *Id.* at 6:3–5, 8:7–8. In addition, Benjamin144 teaches that "[d]rop generators 60 in data line groups D1, D3, D5[,] and D7 [in fire groups 1702*a* and 1702*d*] are disposed along one side 1704*a* of ink feed slot 1704 and drop generators 60 in data line groups D2, D4, D6[,] and D8 [in fire groups 1702*a* and 1702*d*] are disposed along the opposing side 1704*b* of ink feed slot 1704." *Id.* at 64:9–14.

In addition, we find persuasive Dr. Pond's testimony that Benjamin144 teaches (i) a first heater array (i.e., a vertical array of firing resistors 52 within drop generators 60 in data line groups D1, D3, D5, and D7 for fire groups 1702*a* and 1702*d*) adjacent one side of an ink via (i.e., side 1704a of ink feed slot 1704); and (ii) a second heater array (i.e., a vertical array of firing resistors 52 within drop generators 60 in data line groups D2, D4, D6, and D8 for fire groups 1702*a* and 1702*d*) adjacent another side of the ink via (i.e., side 1704b of ink feed slot 1704). *See* Ex. 1002 ¶¶ 73–81.

After reviewing Petitioner's arguments and evidence, which are not addressed by Patent Owner, we are persuaded that Petitioner shows that Benjamin144 teaches "a first heater array adjacent at least a portion of one side of the ink via," and "a second heater array adjacent at least a portion of another side of the ink via."

4. Bondpad Supplies Power

Claim 1 further recites "a bondpad, wherein the bondpad supplies power to at least a portion of the first heater array and to at least a portion of the second heater array." Ex. 1001, 6:37–39. We agree with Petitioner and find that Benjamin144, as well as the combination of Benjamin144 and Benjamin703, teaches this limitation. Pet. 14–22, 32–33. We address below the parties' arguments as to each.

a. Benjamin144's Teachings

Benjamin144's Figure 21, as annotated by Petitioner, is shown below.

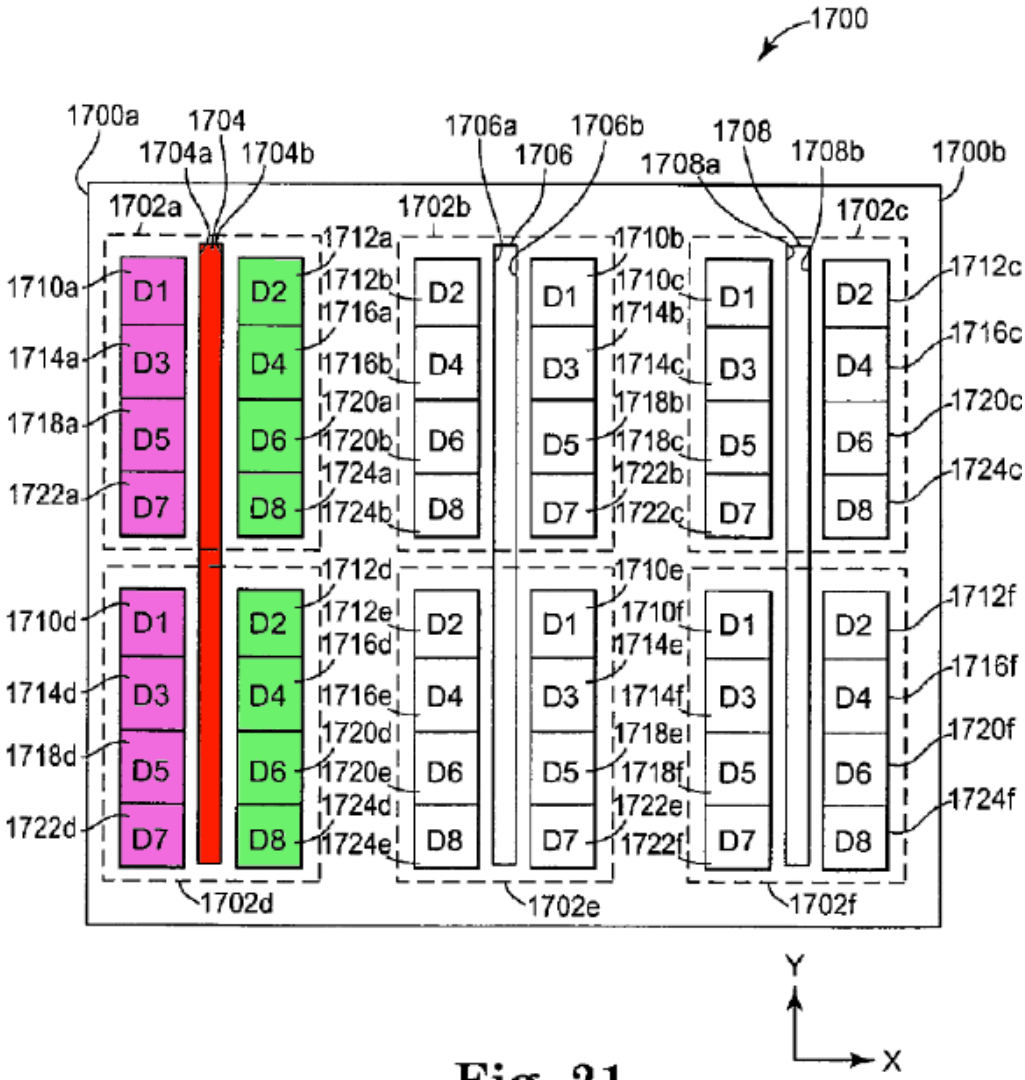

Fig. 21

Pet. 15 (annotating Ex. 1005, Fig. 21). Figure 21 "is a diagram illustrating an example layout of one embodiment of a printhead die 1700." Ex. 1005, 63:20–21. As illustrated, "[t]he printhead die 1700 includes six fire groups 1702*a*–1702*f* disposed along . . . [ink] feed slots 1704, 1706 and 1708." *Id.* at 63:21–24. More specifically, "[f]ire groups 1702*a* and 1702*d* are disposed along ink feed slot 1704, fire groups 1702*b* and 1702*e* are disposed along ink feed slot 1706 and fire groups 1702*c* and 1702*f* are disposed along ink feed slot 1708." *Id.* at 63:24–27. Figure 21 also depicts that "[t]he fire groups 1702*a*–1702*f* are [each] divided into eight data line groups, indicated at D1–D8." *Id.* at 63:39–40. Petitioner annotates Figure 21 by coloring (i) ink feed slot 1704 red; (ii) data line groups D1, D3, D5, and D7 in fire groups 1702*a* and 1702*d* purple; and (iii) data line groups D2, D4, D6, and D8 in fire groups 1702*a* and 1702*d* green. Pet. 15 (annotating Ex. 1005, Fig. 21).

Benjamin144 teaches that "[e]ach data line group D1–D8 includes pre-charged firing cells 120 from each of the fire groups 1702*a*–1702*f*," and that "[t]he pre-charged firing cells 120 . . . include firing resistors 52 that are part of drop generators 60." Ex. 1005, 63:40–42, 64:2–4. As we discuss above, the heater arrays each are comprised of a vertical array of firing resistors 52. *See supra* Section V.C.3 (finding that Benjamin144 teaches the claimed first and second heater arrays). Figure 22, shown below as annotated by Petitioner, further illustrates Benjamin144's teachings.

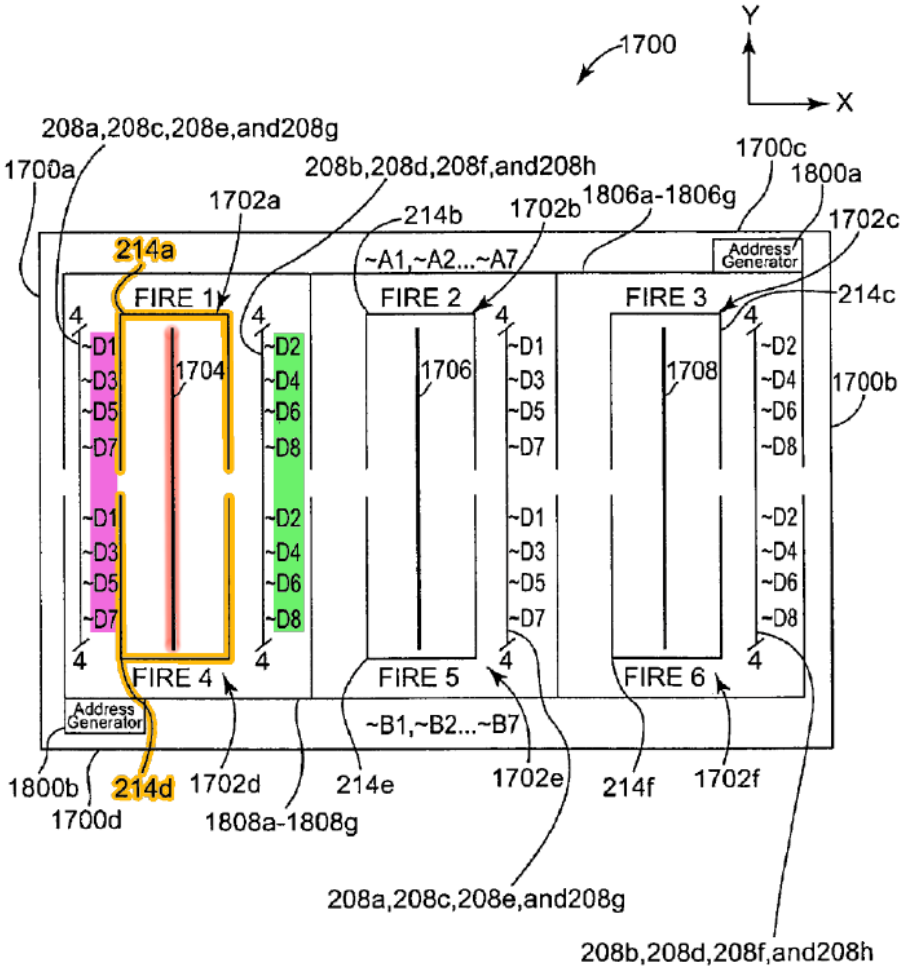

Figure 22 "is a diagram illustrating another aspect of the example layout of one embodiment of printhead die 1700." Ex. 1005, 67:36–38. As illustrated, "[t]he printhead die 1700 includes data lines 208*a*–208*h*, fire lines 214*a*–214*f*, . . . ink feed slots 1704, 1706 and 1708 and the six fire groups 1702*a*–1702*f*." *Id.* at 67:38–41. Like annotated Figure 21 above, Petitioner annotates Figure 22 by coloring (i) ink feed slot 1704 red; (ii) data line groups D1, D3, D5, and D7 in fire groups 1702*a* and 1702*d* purple; and (iii) data line groups D2, D4, D6, and D8 in fire groups 1702*a* and 1702*d* green. Pet. 16 (annotating Ex. 1005, Fig. 22).

In addition, Figure 22 illustrates that "[e]ach of the fire lines 214*a*–214*f* are disposed on both sides of an ink feed slot 1704, 1706 or 1708 and

electrically coupled at one end of the ink feed slot 1704, 1706 or 1708 to form a substantially U-shaped fire line 214*a*–214*f*." *Id.* at 70:17–21. For example, "[t]he fire line 214*d* is disposed along each of the opposing sides of ink feed slot 1704 and extends from one end of ink feed slot 1704 to half the length of ink feed slot 1704 in the y-direction." *Id.* at 71:9–12. Petitioner further annotates Figure 22 by coloring U-shaped fire lines 214*a* and 214*d* orange. Pet. 16.

Benjamin144 teaches that "fire lines 214*a*–214*f* are located along ink feed slots 1704, 1706 and 1708 to supply energy signals FIREl, FIRE2 . . . FIRE6 to the fire groups 1702*a*–1702*f*, respectively." Ex. 1005, 69:42–45. In particular, Benjamin144 teaches that "[t]he substantially U-shaped fire lines 214*a*–214*f* are electrically coupled to pre-charged firing cells 120 located along each of the opposing sides of ink feed slots 1704, 1706 and 1708." *Id.* at 70:51–54. In other words, the U-shaped fire lines (e.g., 214*a*) each comprise two traces respectively coupled to firing cells located along each of the opposing sides of ink feed slots. *Id.* "The fire lines 214*a*–214*f* supply energy to firing resistors 52 in conducting pre-charged firing cells 120 to heat and eject ink from drop generators 60." *Id.* at 69:45–47.

In addition, Benjamin144 teaches that "[t]he fire lines 214*a*–214*f* are electrically coupled to external supply circuitry by appropriate *interface pads*. (See, FIGS. 25A and 25B)." *Id.* at 11:9–12 (emphasis added). We agree with Petitioner and find that Benjamin144 "refers to its interface pads as bondpads stating that 'the firing resistor 52 nearest the *bond pad* receiving the energy signal FIRE1, FIRE2 . . . FIRE6,' and uses the terms interface pads and bondpads interchangeably." Pet. 17 (quoting Ex. 1005, 75:63–67) (emphases omitted and added); *see also* Ex. 1002 ¶ 90 (Dr. Pond testifying

that Benjamin144 "uses the terms interface pads and bond pads interchangeably"); Ex. 2004 ¶ 54 (Mr. Dietl testifying that one of ordinary skill in the art would have understood "bondpad" as used in the '864 patent "to refer to a relatively large area near the edge of a heater chip that facilitates connections to external structures").

Benjamin144's Figure 25B—which is cited by this "external supply circuitry" teaching—is shown below.

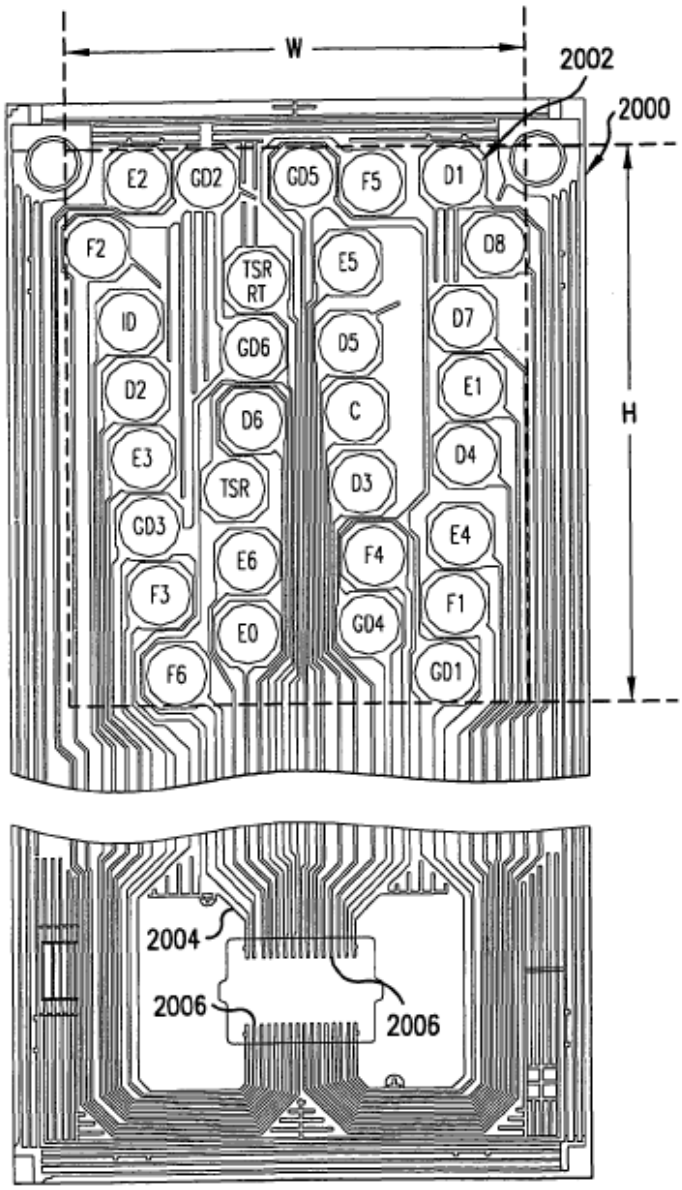

FIG.25B

Figure 25B "illustrat[es] contact areas 2000 of a flex circuit 2002 that may be utilized to couple external circuitry to a printhead die." Ex. 1005, 77:41–44. As illustrated, "[t]he contact areas 2000 are electrically coupled via conductive paths 2004 to contacts 2006 which provide coupling to the printhead die." *Id.* at 77:44–46; *see also id.* at Fig. 25B (illustrating an outline of printhead die showing the location for the die, which covers contacts 2006); Ex. 1002 ¶ 92 (testifying to the location for the die).

Benjamin144 teaches that "[f]ire line contact areas Fl–F6 [are] configured to receive energy pulses and to provide the energy signals along fire lines Firel–Fire6 to the appropriate fire groups, e.g. fire groups 202*a*–202*f* and 1702*a*–l702*f*." Ex. 1005, 77:61–63. And Benjamin144 teaches that "an electrical path between contact areas 2000 [(i.e., F1–F6)] and the pre-charged firing cells 120 comprises conductive paths 2004, contacts 2006, and the appropriate signal lines, e.g.[,] data lines 208*a*–208*h*, pre-charge lines 210*a*–210*f*, select lines 212*a*–212*f*, or ground lines." *Id.* at 78:16–20.

In addition, in view of Benjamin144's teachings we discuss above, we agree with Petitioner and find that one of ordinary skill in the art would have understood that "the approximate locations of the bondpads . . . for fire lines 214a and 214d match the locations of contacts 2006 (when chip flipped and soldered into position)." Pet. 19 (citing Ex. 1002 ¶ 95). We are persuaded by Dr. Pond's testimony on this issue as it is consistent with Benjamin144's teachings that we discuss above. Ex. 1002 ¶¶ 92–95.

Accordingly, we find that Benjamin144 teaches "a bondpad, wherein the bondpad supplies power to at least a portion of the first heater array and to at least a portion of the second heater array."

We find unavailing Patent Owner's arguments that Benjamin144 "indicates that the 'interface pad' for the U-shaped fire lines is not on the printhead die/heater chip." PO Resp. 26; PO Sur-reply 8–9. In particular, Patent Owner argues that "[t]he portion of Benjamin[]144 discussing the 'interface pad' coupled to fire lines refers to Figs. 25A and 25B," which "show contact areas 2000 . . . located on a flexible circuit 2002 that extends away from the heater chip in order to interface with external supply circuitry of the printer that is not shown." PO Resp. 26 (citing Ex. 1005, 11:9–12, 77:41–46, Figs. 25A, 25B; Ex. 2004 ¶ 59). According to Patent Owner, "[w]hile the interface pads/contact areas of the flex circuit connect to conductive paths 2004 ending in 'contacts' 2006 that touch the printhead, there is no actual description in Benjamin[]144 of how or where the contacts connect to bondpads." *Id.* at 27–28 (citing Ex. 2004 ¶ 59); PO Sur-reply 9. "Nor is there any description of a connection between U-shaped fire lines and bondpads located on the heater chip itself," Patent Owner argues. PO Resp. 28 (citing Ex. 2004 ¶ 59).

First, we disagree with Patent Owner's statement of "interface pads/contact areas of the flex circuit" to the extent that Patent Owner (i) equates interface pads and contact areas or (ii) suggests that interface pads are part of the flex circuit. Rather, as we discuss above, Benjamin144 uses the term interface pads interchangeably with bondpads, and in contrast, Benjamin teaches that contact areas 2000 are used to couple to external supply circuitry on one end of the flex circuit 2002 and to a printhead die on the other end via conductive paths 2004 and contacts 2006. *E.g.*, Ex. 1002 ¶ 90; Ex. 1005, 75:60–67, 77:41–46.

Second, Benjamin144 explicitly teaches that "[t]he highest amount of power is found in the first firing resistor 52 of a fire group 1702*a*–1702*f* as only a single firing resistor 52 is energized, where the first firing resistor 52 is the firing resistor 52 nearest the *bond pad* receiving the energy signal FIRE1, FIRE2 . . . FIRE6." Ex. 1005, 75:60–64 (emphasis added). In other words, Benjamin144 teaches that a bondpad is in the conductive path for powering heater arrays. *Id.* And as we discuss above, Benjamin144 teaches that "fire lines 214*a*–214*f* . . . supply energy signals FIREl, FIRE2 . . . FIRE6 to the fire groups 1702*a*–1702*f*, respectively." *Id.* at 69:42–45. Hence, Benjamin144 teaches a connection between U-shaped fire lines and bondpads to conduct energy signals FIRE1, FIRE2 . . . FIRE6. *Id.* at 69:42–45, 75:60–64; *see supra* (finding U-shaped fire lines).

Third, Benjamin144 teaches that bondpads are located on the heater chip itself. For example, Benjamin144 teaches that data lines are routed "from a bond pad located along the side of printhead die 1700 nearest [its] data line group in the fire groups 1702*a*-1702*f*," and "are electrically coupled to a bond pad along" a side of printhead die 1700. *Id.* at 69:3–10, Fig 22. And, we find that one of ordinary skill in the art would have understood that these teachings regarding bondpads placement are not limited to only bondpads for the data lines, but also apply to bondpads for the fire lines. *See In re Applied Materials, Inc.*, 692 F.3d 1289, 1298 (Fed. Cir. 2012) ("A reference must be considered for everything that it teaches, not simply the described invention or a preferred embodiment."); *see also* Ex. 1002 ¶¶ 121–122.

Accordingly, we disagree with Patent Owner that Benjamin144 does not teach a connection between U-shaped fire lines and bondpads located on the heater chip itself.

In addition, we find unavailing Patent Owner's argument that Petitioner's argument that one of ordinary skill in the art would have understood "'the approximate locations of the bondpads . . . match the locations of contacts 2006' . . . is based on assumptions regarding drawings of Benjamin[]144 that require filling in significant details." PO Resp. 28 (citing Pet. 19). As we discuss above, we find Dr. Pond's testimony on this issue persuasive as we find it is consistent with Benjamin144's teachings. *See* Ex. 1002 ¶¶ 92–95. Moreover, Dr. Pond's testimony on this issue is consistent with Benjamin144's teaching of having "a bond pad located along the side of printhead die 1700." *Compare id.*, *with* Ex. 1005, 69:3–10. In addition, Mr. Dietl testified that "[t]he bond pads for that side of the data groups and the . . . fire groups would be along the edge of the die 1700d." Ex. 1015, 123:15–22; *see also id.* at 123:8–14 (testifying that "bondpad or bond pads" would be along the edge); *id.* at 39:20–41:12, 47:19–48:2 (testifying that bondpads are wanted close to the edge); Pet. Reply 11 & n.4.

We also find unavailing Patent Owner's argument that "without a disclosure of how one or more portions of the U-shaped fire line actually connect to contacts 2006 of the flex circuit 2000 . . . , it is not possible to determine whether the contacts of the flex circuit contact a single bondpad for each 'fire line' or contact multiple bondpads that each connect to a portion of the fire line." PO Resp. 28 (citing Ex. 2004 ¶ 60); *see also id.* at 29–30 (citing Ex. 2004 ¶¶ 63–64) (arguing that the contacts 2006 "could be capable of . . . contacting two bondpads, one for each half of the U-shape of

the fire line"). Simply put, Patent Owner ignores Benjamin144's specific teachings. For example, Benjamin144 teaches that "[t]he highest amount of power is found in the first firing resistor 52 of a fire group 1702*a*–1702*f* as only a single firing resistor 52 is energized, where the first firing resistor 52 is the firing resistor 52 nearest *the bond pad* receiving the energy signal FIRE1, FIRE2 . . . FIRE6." Ex. 1005, 75:60–64 (emphasis added). Notably, bondpad is described in the singular. *Id.* We agree with Petitioner's characterization of this passage as "explicitly teach[ing] a 'bondpad' (singular) that receives 'energy signal FIRE1' for an entire 'fire group' (i.e., the entire U-shaped fire line)." Pet. Reply 11–12 (citing Ex. 1005, 75:58–64).

In addition, we note that Mr. Dietl testifies as follows:

> Q. And you agree it could -- it could be one bondpad that's being utilized for fire line 214a, right?
>
> A. Could be one bondpad, yep, or it could be two bond pads, probably not three. I don't see why you would do three. There's no reason.

Ex. 1015, 123:1–7. We find that one of ordinary skill in the art would have found it obvious to use one bondpad for a fire line. *See KSR*, 550 U.S. at 417 ("When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.").

We also find unavailing Patent Owner's argument that "there is nothing in Benjamin[]144 that indicates that the 'U-shaped fire lines' are fully U-shaped." PO Resp. 28. Patent Owner argues that "[t]he drawing

that Petitioners rely on when superimposing contacts of the flex circuit over a printhead die drawing . . . shows a gap between the flex circuit contacts and the inboard fire lines Fire 1 and Fire 4, . . . due to Dr. Pond's desire to place the ends of the flex circuit along the edge of the substrate rather than directly contacting the U-shaped fire lines Fire 1 and Fire 4." *Id.* (citing Pet. 20; Ex. 2004 ¶ 62). Patent Owner argues that "[i]f Fire 1 and Fire 4 do connect to a bondpad located on the printhead die, then the lines are not actually U-shaped, but rather Y-shaped, and this lack of detail regarding the actual shape of fire lines in Benjamin[]144 indicates that there could be a split between the left and right sides of the fire lines that is simply not described much like the fire line's overall shape." *Id.* at 29 (citing Ex. 2004 ¶ 62).

Patent Owner, rather than addressing the substance of Benjamin144's teachings, overly relies on Patent Owner's characterizations of the drawings, and the resultant purported shape of the fire lines, to argue that Benjamin144 does not teach a single bondpad that is coupled to a fire line. As we discuss above, however, Benjamin144 teaches disposing a single bondpad, located along the chip's edge, for coupling to a fire line which supplies power to first and second heater arrays. We also note that Benjamin144 repeatedly teaches that the fire lines are "substantially U-shaped." *E.g.*, Ex. 1005, 70:17–21.

In sum, we find that Benjamin144 teaches this limitation.

b. Benjamin144 and Benjamin703's Combined Teachings

Petitioner alternatively argues that the limitation would have been obvious in view of the combination of Benjamin144 and Benjamin703. Pet. 20–22. We agree with Petitioner.

Benjamin703 explicitly teaches having a bondpad (i.e., fire line input pad 706) in a printhead die. Ex. 1006, 19:34–36. Petitioner annotates Benjamin703's Figure 10, shown below, which illustrates this teaching. Pet. 21.

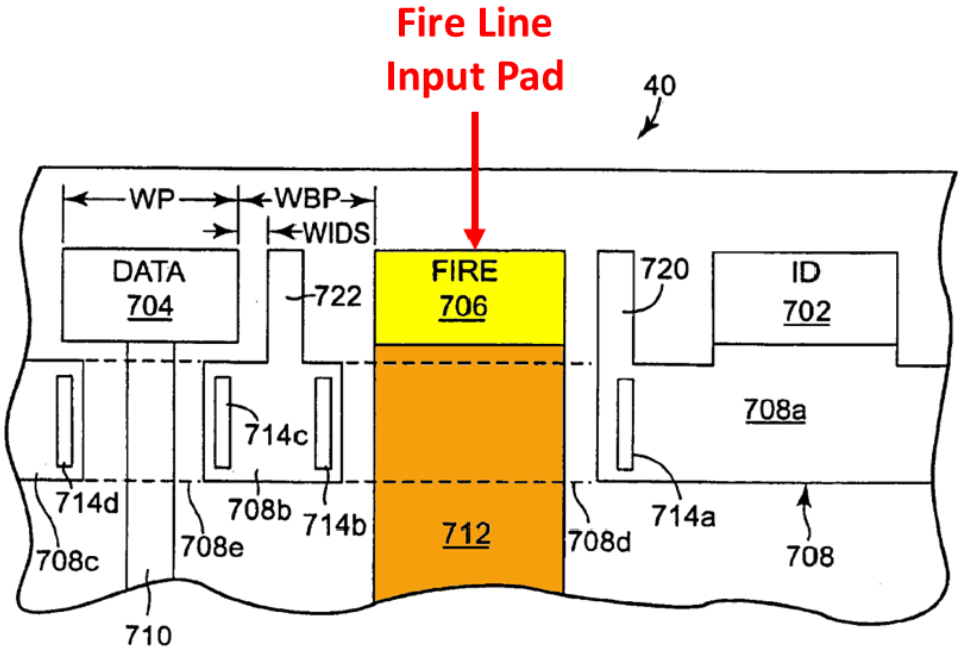

Fig. 10

Figure 10 "is a layout diagram illustrating one embodiment of a portion of a printhead die." Ex. 1006, 2:18–19. Petitioner annotates the figure by coloring fire line input pad FIRE 706 yellow and labeling it "Fire Line Input Pad." Pet. 21. Petitioner further annotates the figure by coloring fire line 712 orange. *Id.*

Benjamin703 teaches that for an embodiment in accordance with its teachings that "[t]he printhead die 40 includes an identification signal input pad 702, a data line input pad 704 and *a fire line input pad 706*," that "are formed as part of the second metal layer of printhead die 40." Ex. 1006, 19:33–39 (emphasis added). Moreover, Benjamin703 teaches that "[t]he fire line input pad 706 is electrically coupled to fire line 712 that is electrically

coupled to firing cells 120 in print head die 40." *Id.* at 19:45–47. And Benjamin703 teaches that "[f]ire line 712 receives fire signal FIRE and provides fire signal FIRE to firing cells 120 in printhead die 40." *Id.* at 20:4–5.

We find that the combined teachings of Benjamin144 (supra Section V.C.4.a) and Benjamin703 teach this limitation. More specifically, in light of the above teachings, we find that Benjamin703 teaches disposing a single bondpad, located along the chip's edge, for coupling to a fire line which supplies power to the heater arrays in a printhead die.

Moreover, we agree with Petitioner and find that Benjamin144 incorporates Benjamin703 by reference. Pet. 44–45. Benjamin144 recites the following:

> This application is related to patent application Ser. No. 10/827,030, entitled "Fluid Ejection Device," patent application Ser. No. 10/827,163, entitled "Fluid Ejection Device With Address Generator," patent application Ser. No. 10/827,045, entitled "Device With Gates Configured In Loop Structures," patent application Ser. No. 10/827,142, entitled "Fluid Ejection Device," and *patent application Ser. No. 11/849,078, entitled "Fluid Ejection Device With Identification Cells,"* each of which are assigned to the Assignee of this application and are filed on even date herewith, and each of which is fully incorporated by reference as if fully set forth herein.

Ex. 1005, 1:6–16 (emphasis added). We find persuasive Petitioner's argument that reference to Ser. No. 11/849,078 is a typographical error, and reference to Benjamin703, which was filed on the same day as Benjamin144 and has the same specification as its referenced child application, was intended. Pet. 45.

Thus, we view the combination of Benjamin144 and Benjamin703 as comprising a single disclosure in view of the incorporation by reference. *See, e.g.*, *Advanced Display Sys., Inc. v. Kent State Univ.*, 212 F.3d 1272, 1282 (Fed. Cir. 2000). Or at a minimum, the incorporation by reference provides an explicit motivation for one of ordinary skill in the art to combine the references' teachings. *See Kahn*, 441 F.3d at 988; *see also Boston Scientific Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009) ("Combining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap of inventiveness."). In addition, however, Petitioner argues that "utilizing a bondpad to supply FIRE energy signals to the fire lines 214 like in Benjamin[]703 would have been an obvious combination of prior art elements to yield predictable results." Pet. 45–46; Ex. 1002 ¶¶ 207–208. We agree with Petitioner's argument and find that one of ordinary skill in the art would have found it obvious to combine Benjamin144 and Benjamin703 in the manner Petitioner does.

In sum, we find that Petitioner shows that the combination of Benjamin144 and Benjamin703 teaches the bondpad limitation and provides sufficiently articulated reasoning with rational underpinning to support combining Benjamin144 and Benjamin703's teachings.

We find unavailing Patent Owner's argument that Benjamin703 "does not disclose a single bondpad coupled to firing cells on one side and another side of an ink via . . . , and therefore, even taken together, the Benjamin combination does not disclose all aspects of the claimed invention." PO Resp. 30. Patent Owner adds that "[t]here is no reason to assume that Benjamin[]144's U-shaped fire lines are connected to a single bondpad rather than, for instance, two bondpads that are each contacted by a single

conductive path from the flex circuit." *Id.* (citing Ex. 2004 ¶ 64). We view these arguments as incorrectly focusing on Benjamin144 and Benjamin703's teachings individually, rather than their combined teachings. *See In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) ("Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references"). The relevant inquiry is whether the claimed subject matter would have been obvious to those of ordinary skill in the art in light of the combined teachings of Benjamin144 and Benjamin703. *See In re Keller*, 642 F.2d 413, 425 (CCPA 1981). As we discuss above, we find that this limitation would have been obvious in view of the combined teachings.

In addition, we find Patent Owner's arguments concerning inherency are inapposite. *See* PO Resp. 30–31. As Patent Owner acknowledges, Petitioner does not make such arguments. *Id.* at 31. And as we discuss above, Benjamin144, as well as the combination, teaches this limitation. We also note that a finding of obviousness can rely on supported expert testimony to supply a missing element of a claim, contrary to Patent Owner's arguments. *Id.* at 30; *see Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1338 (Fed. Cir. 2020). To be clear, we view no element to be missing here.

c. Summary for Bondpad Limitation

We are persuaded that Petitioner shows that Benjamin144, as well as the combination of Benjamin144 and Benjamin703, teach "a bondpad, wherein the bondpad supplies power to at least a portion of the first heater array and to at least a portion of the second heater array." We also find that Petitioner has provided sufficiently articulated reasoning with rational

underpinning to support Petitioner's combining of Benjamin144 and Benjamin703's teachings. *See Kahn*, 441 F.3d at 988.

5. Summary for Claim 1

In summary, we determine that Petitioner shows by a preponderance of the evidence that claim 1 would have been obvious to one of ordinary skill in the art in view of the combination of Benjamin144 and Benjamin703.

D. Challenged Claims 3 and 9

Claim 3 recites "[t]he heater chip of claim 1, wherein the bondpad supplies power to the first heater array and the second heater array portions by power traces physically separated proximal to the bondpad." Ex. 1001, 6:43–46. Claim 9 recites "[t]he heater chip of claim 8, wherein the at least two traces are physically separated proximal to the bondpad." *Id.* at 7:4–5. Each of these claims recite that the traces are "physically separated proximal to the bondpad." *Id.* at 6:43–46, 7:4–5. The parties dispute whether Benjamin144, as well as the combination of Benjamin144 and Benjamin703, teach this recital. *See* Pet. 25–29, 34–35; Pet. Reply 14–17; PO Resp. 33–36; PO Sur-reply 10–12.

As we discuss above, we agree with Petitioner and find that Benjamin144's Figure 22, shown below as annotated by Petitioner, shows that fire lines 214*a*–214*f* are physically separated to form substantially U-shaped fire lines with the top of each U-shaped fire line being located along a side of the printhead die. Ex. 1005, Fig. 22; Pet. 27; *supra* Section V.C.4.

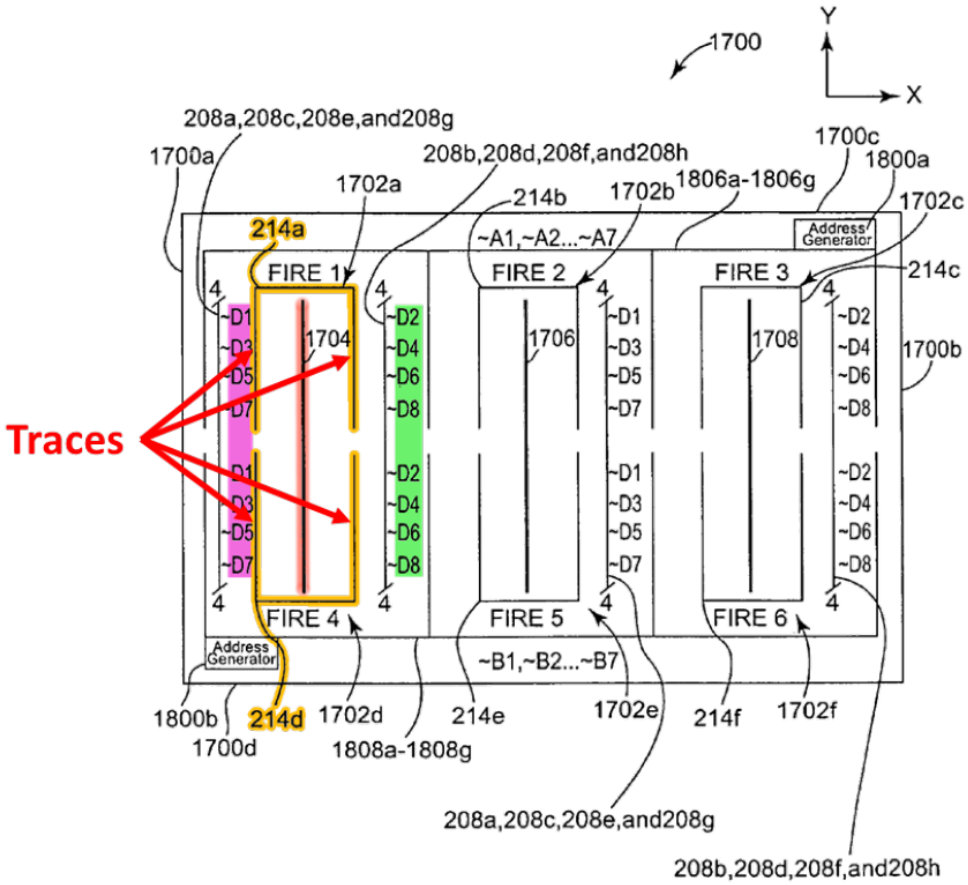

Figure 22 "is a diagram illustrating an[] aspect of the example layout of one embodiment of printhead die 1700." Ex. 1005, 67:36–38. Petitioner annotates Figure 22 by coloring (i) ink feed slot 1704 red; (ii) data line groups D1, D3, D5, and D7 in fire groups 1702*a* and 1702*d* purple; (iii) data line groups D2, D4, D6, and D8 in fire groups 1702*a* and 1702*d* green; and (iv) U-shaped fire lines 214*a* and 214*d* orange. Pet. 26 (annotating Ex. 1005, Fig. 22). In addition, Petitioner (i) draws a red arrow to each of the two legs of each of the U-shaped fire groups 214*a* and 214*d*, and labels the four arrows "Traces." *Id.*

As we also discuss above, we find that Benjamin144 and Benjamin703 each teach disposing single bondpads along the chip's edge for

supplying power to the U-shaped fire lines for the heater arrays. *See supra* Section V.C.4.

In addition, we agree with Petitioner and find that Benjamin144 teaches that a substantially U-shaped fire line (e.g., fire line 214a) branches into two traces proximal to its bondpad, and the traces separately extend to their respective heater arrays (e.g., (i) to firing resistors 52 for data line groups D1, D3, D5, and D7 for fire group 1702*a*; and (ii) to firing resistors 52 for data line groups D2, D4, D6, and D8 for fire group 1702*a*). Ex. 1005, Fig. 22; *supra* Section V.C.4; Pet. 25–26. In other words, each fire line is physically separated (into two traces) nearer to the fire line's bondpad than the distal end of the traces. Ex. 1005, Fig. 22; Pet. Reply 16–17.

We find persuasive Dr. Pond's testimony that Benjamin144's U-shaped fire line 214a branches into two traces that extend to respective heater arrays proximal to its bondpad, and that the top of Benjamin144's U-shaped fire line 214a is proximate the edge of the die where the firing signal is received at the bondpad. Ex. 1002 ¶ 120 (citing Ex. 1005, Fig. 22); *see also* Ex. 2005, 18:13 (Dr. Pond testifying that "the 214 U-shape has a crossbar of the U at the top, and so the separation will be somewhere along that crossbar."). We find that this testimony is consistent with Benjamin144's teachings that we discuss above.

In addition, we agree with Petitioner and find that the combination of Benjamin144 and Benjamin703 teaches that the bondpad (fire line bondpad / fire line input pad 706) supplies power to the first heater array (firing resistors 52 within drop generators 60 in D1, D3, D5, and D7) and the second heater array (firing resistors 52 within drop generators 60 in D2, D4, D6, and D8) by power traces physically separated proximal to the bondpad

(the U-shaped fire line 214a near side 1700c which separates into traces to supply power to the resistors on each side of the ink via). Ex. 1002 ¶¶ 115–126; Pet. 28–29.

We find unavailing Patent Owner's argument that Benjamin144 does not teach this limitation because "the U-shaped fire line 1702a . . . of Benjamin[]144 is very close to ink via 1704, and branching of the structure occurs proximal to the heater arrays positioned next to their associated ink via . . . rather than proximal to any alleged placement of a bondpad." PO Resp. 34; *see also* PO Sur-reply 11–12 (making same argument). This argument is premised on Patent Owner's proposed construction, which we do not adopt. *See supra* Section III (construing "physically separated proximal to the bondpad").

In addition, we find unavailing Patent Owner's argument that "[t]here are numerous problems associated with interpreting . . . figure[s] to show a distance relationship between power traces, a bondpad, and heater arrays." PO Sur-reply 10. For example, Patent Owner argues that the cited figures are schematics, and there is absolutely no indication that they show any parts to scale. *Id.* And as to Petitioner's annotated and modified Figure 22, Patent Owner argues that Petitioner adds a box to argue where a bondpad is positioned, and adds a line to depict how a purported bondpad connects to the U-shaped fire line. *Id.* at 11 (citing Pet. Reply 16). Patent Owner argues that the figure does not show a bondpad or heater arrays—D1–D8 data line groups, are "not heaters, and the actual relationship between the U-shaped fire line and heater arrays is not depicted." *Id.*

Petitioner, however, does not rely on just Figure 22 (as modified and annotated), but also relies on Benjamin144's teachings and the testimony of

Dr. Pond, as we cite above. Moreover, drawings can be relied upon in an obviousness analysis for what they reasonably disclose and suggest to one of ordinary skill in the art. *In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979); *In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972) (holding that things shown clearly in patent drawings are not to be disregarded). This reasonable disclosure can include the relative proportions of items illustrated in the drawings. *See Mraz*, 455 F.2d at 1072; *In re Wolfsen-Sperger*, 302 F.2d 950, 959 (CCPA 1962). Considering Benjamin144's teachings and the testimony of Dr. Pond, in conjunction with Figure 22, we find Petitioner's arguments are supported by a preponderance of the evidence.

In addition, we find inapposite Patent Owner's argument that "[n]either of the Benjamin references contain any teachings like the '864 patent's teachings regarding the advantages of separating traces proximal to the bondpad rather than proximal to associated heater arrays." This is the incorrect focus. *See EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985) ("A reference must be considered for everything it *teaches* by way of technology and is not limited to the particular *invention* it is describing and attempting to protect."); *In re Heck*, 699 F.2d 1331, 1333 (Fed. Cir. 1983) ("The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned. They are part of the literature of the art, relevant for all they contain.").

In sum, we determine that Petitioner shows by a preponderance of the evidence that claims 3 and 9 would have been obvious to one of ordinary skill in the art in view of the combination of Benjamin144 and Benjamin703.

E. Challenged Claims 2, 5, 6, 8, 10, and 13–15

Patent Owner does not address separately Petitioner's arguments and evidence as to how Benjamin144 and Benjamin703 teach the limitations of claims 2, 5, 6, 8,[12] 10, and 13–15. *See* PO Resp. 32, 36–37. And as we find above, Petitioner shows by a preponderance of the evidence that the combination of Benjamin144 and Benjamin703 teaches claim 1. *See supra* Section V.C.

Based on the evidence and arguments of record, we find that Petitioner demonstrates by a preponderance of the evidence that claims 2, 5, 6, 8, 10, and 13–15 would have been obvious over the combination of Benjamin144 and Benjamin703. Pet. 22–24, 29–43.

VI. ALLEGED OBVIOUSNESS OVER BENJAMIN144, BENJAMIN703, AND CHILDERS

Petitioner argues that the combination of Benjamin144, Benjamin703, and Childers renders claims 4, 11, 12, and 16–20 obvious. Pet. 46–71. Patent Owner does not separately address Petitioner's showings directed to these claims for this ground. Instead, Patent Owner relies on its arguments for claim 1 from the Benjamin144 and Benjamin703 ground. PO Resp. 37.

As we discuss above, we find unavailing Patent Owner's arguments directed to claim 1. *See supra* Section V.C. And we are persuaded by Petitioner's showings for claims 4, 11, 12, and 16–20, and for the claims from which they depend, and Petitioner's provided reasoning for combining the references. Pet. 46–71; *supra* Sections V.C, E.

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[12] Patent Owner argues that independent claim 8 is patentable based on its same arguments for independent claim 1, rather than providing separate arguments for claim 8. *See generally* PO Resp. 25–32, 36.

Accordingly, we find that Petitioner demonstrates by a preponderance of the evidence that claims 4, 11, 12, and 16–20 would have been obvious to one of ordinary skill in the art over the combination of Benjamin144, Benjamin703, and Childers.

VII. REMAINING GROUNDS

Petitioner argues that claims (i) 1, 3, 5, 6, 8–10, 13, and 15 are anticipated by Uenishi and (ii) 4, 11, and 12 are rendered obvious by the combination of Uenishi and Hayasaki. Pet. 71–101. Thus, these grounds of unpatentability challenge claims which we already determine are unpatentable. *See supra* Sections V.C–E, VI (determining Petitioner shows the challenged claims are unpatentable). Under the circumstances of this case, analyzing additional grounds challenging the same claims, which we have determined to be unpatentable, would not be an efficient use of the Board's time and resources. *See Bos. Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. 2020) ("We agree that the Board need not address issues that are not necessary to the resolution of the proceeding."). Accordingly, we do not reach these remaining grounds. *Cf. In re Gleave*, 560 F.3d 1331, 1338 (Fed. Cir. 2009) (not reaching other grounds of unpatentability after affirming the anticipation ground); *see also Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (determining once a dispositive issue is decided, there is no need to decide other issues).

VIII. CONCLUSION[13]

Based on the full record, we determine that Petitioner shows by a preponderance of the evidence that claims (i) 1–3, 5, 6, 8–10, and 13–15 are obvious in view of the combination of Benjamin144 and Benjamin703 and (ii) 4, 11, 12, and 16–20 are obvious in view of the combination of Benjamin144, Benjamin703, and Childers.

Claim(s)	**35 U.S.C. §**	**Reference(s) /Basis**	**Claims Shown Unpatentable**	**Claims Not Shown Unpatentable**
1–3, 5, 6, 8–10, 13–15	103(a)	Benjamin144, Benjamin703	1–3, 5, 6, 8–10, 13–15	
4, 11, 12, 16–20	103(a)	Benjamin144, Benjamin703, Childers	4, 11, 12, 16–20	
1, 3, 5, 6, 8–10, 13, 15	102	Uenishi[14]		
4, 11, 12	103(a)	Uenishi, Hayasaki[15]		
Overall Outcome			1–6, 8–20	

[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).

[14] Because we determine that the challenged claims are unpatentable under another ground, we decline to address it for this ground.

[15] Because we determine that the challenged claims are unpatentable under another ground, we decline to address it for this ground.

IX. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, pursuant to 35 U.S.C. § 314(a), Petitioner has shown by a preponderance of the evidence that claims 1–6 and 8–20 of the '864 patent are unpatentable; and

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

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