

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.

IPR2022-01541
Patent 7,152,951 B2

Before JO-ANNE M. KOKOSKI, JON B. TORNQUIST, and
JOHN D. HAMANN, *Administrative Patent Judges*.

TORNQUIST, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. *Background and Summary*

Canon U.S.A., Inc. and Canon Inc. (collectively “Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting an *inter partes* review of claims 1–7, 9, 10, 20–22, and 24 of U.S. Patent No. 7,152,951 B2 (Ex. 1001, “the ’951 patent”). Slingshot Printing LLC (“Patent Owner”) filed a Preliminary Response to the Petition. Paper 5 (“Prelim. Resp.”).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2022). The standard for institution is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted “unless the Director determines . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.”

For the reasons set forth below, Petitioner demonstrates a reasonable likelihood of prevailing with respect to claims 1–7, 9, 10, 20–22, and 24 of the ’951 patent. Accordingly, we institute an *inter partes* review with respect to all grounds asserted in the Petition. *See SAS Inst. Inc. v. Iancu*, 138 S.Ct. 1348, 1355 (2018).

B. *Real Parties in Interest*

Petitioner identifies Canon U.S.A., Inc. and Canon Inc. as the real parties in interest. Pet. 1.

Patent Owner identifies itself as the real party in interest. Paper 3, 1.

C. *Related Matter*

The parties identify the following district court proceeding as a related matter: *Slingshot Printing LLC v. Canon U.S.A., Inc. and Canon Solutions America, Inc.*, No. 2:21-cv-00123 (E.D.N.Y.). Pet. 1; Paper 3, 1.

D. The '951 Patent

The '951 patent is titled “High Resolution Ink Jet Printhead” and issued December 26, 2006, from an application filed February 10, 2004. Ex. 1001, codes (22), (45), (54).

The '951 patent explains that “[a]s the capabilities of ink jet printers are increased to provide higher quality images at increased printing rates, printheads, which are the primary printing components of ink jet printers, continue to evolve and become more complex.” *Id.* at 1:14–18. The '951 patent further explains that “[i]mproved print quality requires that the printheads provide an increased number of ink droplets,” and to achieve this goal printheads “are designed to include more nozzles and corresponding ink ejection actuators.” *Id.* at 1:19–23.

The '951 patent discloses that one way known in the art for increasing the number of nozzles and actuators is to use “an integrated nozzle plate containing nozzle holes, ink chambers, and ink channels laser ablated in a polyimide material,” with adjacent nozzles and corresponding ink chambers “typically offset from one another in a direction orthogonal to the ink feed slot.” *Id.* at 1:26–30. Such a design, however, “results in adjacent nozzles having different fluidic characteristics such as refill times which can result in quality defects and can limit high frequency operation of the ejector actuators.” *Id.* at 1:30–34. A minimum spacing is also required between adjacent ink chambers to provide sufficient chamber wall structure for the ink chambers. *Id.* at 1:35–39. “Hence, a larger nozzle plate and corresponding semiconductor substrate is required as the number of nozzles and actuators for the printhead is increased.” *Id.* at 1:39–41.

Addressing these problems, the '951 patent discloses an improved printhead that:

includes a semiconductor substrate containing at least one ink feed edge and a plurality of ink ejection actuators spaced a distance from the ink feed edge. Each of the ink ejection actuators has an aspect ratio ranging from about 1.5:1 to about 6:1. A nozzle plate is attached to the semiconductor substrate by use of an adhesive or preferably an adhesive and an intermediate polymeric layer. The nozzle plate contains a plurality of nozzle holes, ink chambers and ink channels laser ablated in the nozzle plate corresponding to the plurality of ink ejection actuators. Adjacent nozzle holes are spaced apart with a pitch ranging from about 600 to about 1200 dpi. The distance from the ink feed edge is substantially the same for each of the ink ejection actuators.

Id. at 1:52–65. In another embodiment, a “thick film layer is attached to the semiconductor substrate” and has formed therein “a plurality of ink feed chambers and ink feed channels corresponding to the plurality of ink ejection actuators.” *Id.* at 2:4–8.

The ’951 patent explains that an advantage of the invention is that it “enables production of printheads having a nozzle pitch^[1] of greater than 600 dpi without the need to provide adjacent nozzles and corresponding ink chambers that are offset from one another in a direction orthogonal to the ink feed slot.” *Id.* at 2:15–22. In this configuration, “the fluidic characteristics of each of [the] nozzles are substantially the same.” *Id.* at 2:23–24.

E. Illustrative Claim

Petitioner challenges claims 1–7, 9, 10, 20–22, and 24 of the ’951 patent. Pet. 3. Claim 1, reproduced below, is illustrative of the challenged claims:

¹ The ’951 patent defines “pitch” “to mean a center to center spacing between adjacent nozzles or ejection actuators in a direction substantially parallel with an axis aligned with a columnar nozzle array.” Ex. 1001, 2:25–29.

1. A printhead for an ink jet printer, the printhead comprising:
 - a semiconductor substrate containing at least one ink feed edge and a plurality of ink ejection actuators spaced a distance from the ink feed edge, each of the ink ejection actuators having an aspect ratio ranging from about 1.5:1 to about 6:1;
 - a thick film layer attached to the semiconductor substrate, the thick film layer having formed therein a plurality of ink feed chambers and ink feed channels corresponding to the plurality of ink ejection actuators; and
 - a nozzle plate attached to the thick film layer, the nozzle plate containing a plurality of nozzle holes in the nozzle plate corresponding to the plurality of ink feed chambers,wherein adjacent ones of the nozzle holes are spaced apart with a pitch ranging from about 600 to about 2400 dpi and wherein the distance from the ink feed edge is substantially the same for each of the ink ejection actuators.

Ex. 1001, 6:51–7:3.

F. Prior Art and Asserted Grounds

Petitioner asserts that claims 1–7, 9, 10, 20–22, and 24 of the '951 patent would have been unpatentable on the following grounds (Pet. 3):

Claim(s) Challenged	35 U.S.C. §²	Reference(s)/Basis
1–3, 6, 9, 10	103	Powers ³ , Whitman ⁴
4, 5, 7, 20–22, 24	103	Powers, Whitman, Cleland ⁵
1–4, 6, 7, 9, 10, 20–	103	Hamafuku ⁶ , Imanaka ⁷ ,

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Petitioner contends the pre-AIA versions of § 103 applies in this proceeding. Pet. 2. Patent Owner does not dispute Petitioner’s assertions. Accordingly, on this record, we apply the pre-AIA versions of § 103. *See* 35 U.S.C. § 100(i)(1)(B).

³ US 6,719,405 B1, issued April 13, 2004. Ex. 1004 (“Powers”).

⁴ US 6,213,587 B1, issued April 10, 2001. Ex. 1005 (“Whitman”).

⁵ US 6,491,377 B1, issued December 10, 2002. Ex. 1006 (“Cleland”).

⁶ JP Application No. H09-131869, published May 20, 1997. Ex. 1007 (“Hamafuku”).

⁷ US 6,299,293 B1, issued October 9, 2001. Ex. 1008 (“Imanaka”).

Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
22, 24		Whitman
5	103	Hamafuku, Imanaka, Whitman, Cleland

In support of its grounds for unpatentability, Petitioner relies upon the declaration of Mr. Charles M. Curley. Ex. 1002.

II. ANALYSIS

A. Claim Construction

In this proceeding, the claims of the '951 patent are construed “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b). Under that standard, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have had to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc).

Neither party asserts that any claim terms of the '951 patent require construction. *See* Pet. 7; Prelim. Resp. 18–19. And, upon review of the parties' arguments and supporting evidence, we find that no terms require construction for purposes of this Decision. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”)).

B. Claims 1–3, 6, 9, and 10 over Powers and Whitman

Petitioner contends the subject matter of claims 1–3, 6, 9, and 10 would have been obvious over the combined disclosures of Powers and Whitman. Pet. 7–40.

1. Powers

Powers “relates to inkjet printheads” and, in particular, to an inkjet printhead with “a bubble chamber having a curved or convex wall portion partially surrounding a rectangular heater element.” Ex. 1004, 1:6–9.

Figures 1a and 1b of Powers are reproduced below:

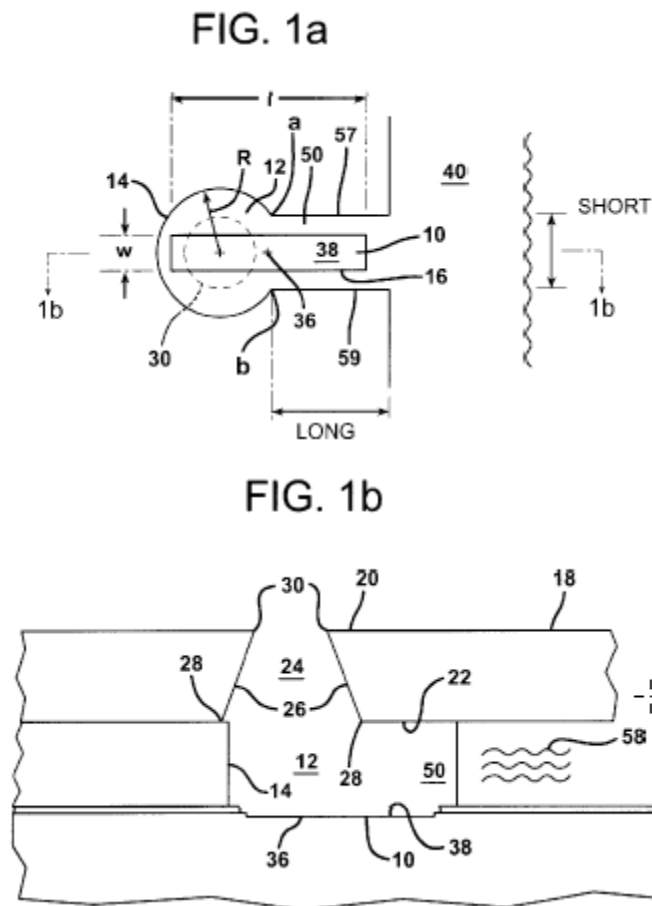


Figure 1a is a diagrammatic top view of an inkjet printhead bubble chamber having a curved or convex wall portion and Figure 1b is a partial cross

section view of the inkjet printhead bubble chamber of Figure 1a taken along line 1b-1b. *Id.* at 2:43–47.

In the embodiment shown in Figures 1a and 1b, heater element 10 is used for heating ink in an inkjet printhead and has a substantially rectangular shape defined by a periphery 16. *Id.* at 3:23–26. Bubble chamber 12 surrounds a portion of heater element 10 and, as shown in Figure 1b, curved walls 14 rise above heater element 10 to provide a chamber in which ink can be heated to form a bubble. *Id.* at 3:36–40. Above the bubble chamber is nozzle plate 18 having an orifice 24 with small diameter opening 30 through which ink is ejected and projected during use. *Id.* at 4:19–26.

Opening 30 resides directly above surface 38 of heater element 10 and may have an opening on the order of about 11 to 14 microns. *Id.* at 4:33–37. Powers reports that “[i]n the future, it is expected that this dimension will gradually shrink as printing resolutions increase from 600 DPI^[8] (dots-per-inch) to 900 or 1200 DPI or more.” *Id.* at 4:37–40.

⁸ The '951 patent uses the term “dpi,” whereas Powers uses the term “DPI.” *See* Ex. 1001, 1:62–63; Ex. 1004, 4:37–40. We understand these terms to be identical and use them interchangeably.

of orifices adheres over heater chip 251 such that the nozzle holes align with the heaters. *Id.* at 7:27–30.

2. *Whitman*

Whitman discloses an inkjet printhead with improved reliability.
Ex. 1005, code (57). Figure 5 of Whitman is reproduced below:

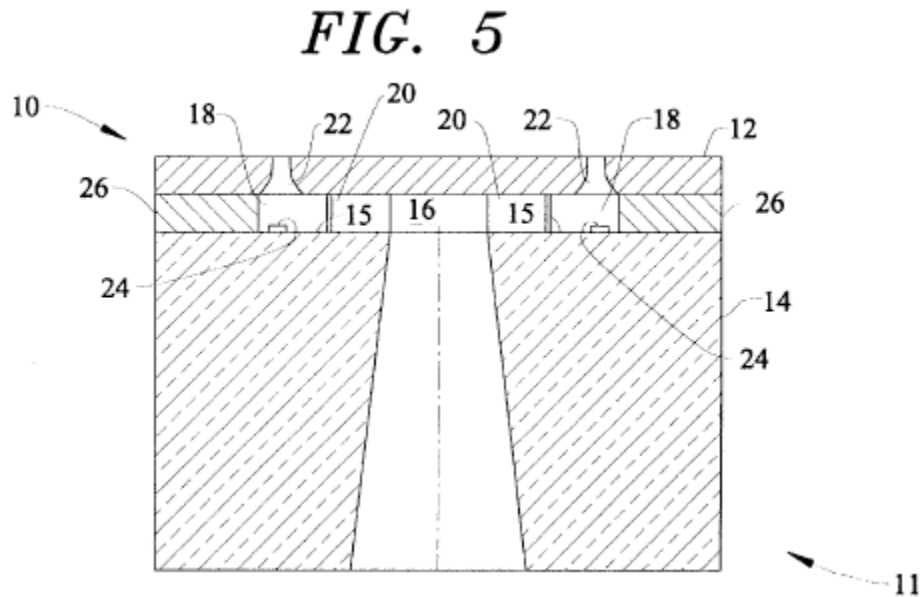


Figure 5 is an enlarged cross-sectional detail of inkjet printhead 10 comprising at least one energy-generating element or transducer, such as heater 24. *Id.* at 5:17–19. Whitman explains that heater 24 may be formed of a resistance layer that is deposited on a surface 15 of substrate base 14. *Id.* at 5:25–28.

Figure 7 of Whitman is reproduced below:

FIG. 7

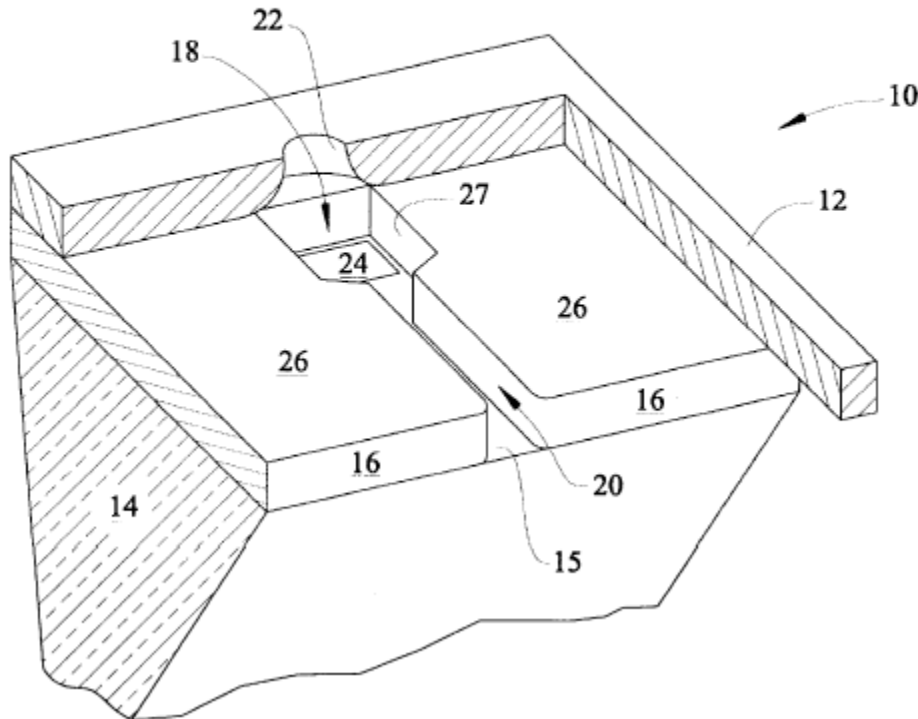


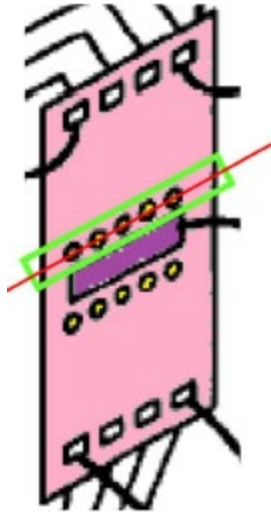
Figure 7 is a selectively sectioned perspective view of the inkjet printhead of Figure 5. *Id.* at 3:32–33. As shown in Figure 7, heater 24 is arranged within chamber 18, which has a wall or barrier 27 that extends above heater 24. *Id.* at 5:57–66. Whitman explains that chamber 18 is preferably formed in a thick spacer or insulating film 26. *Id.* at 6:21–23. Plate 12 (or a “nozzle plate”) is provided with at least one aperture 22, and plate 12 cooperates with chamber 18 to allow heater 24 to eject ink from the chamber through aperture 22. *Id.* at 6:35–38, 6:57–61.

3. Analysis: Claim 1

Petitioner contends that Powers and Whitman teach or suggest every limitation of claim 1. Pet. 7–29. In particular, Petitioner contends Powers

and Whitman disclose: (1) a printhead (the inkjet printhead of Powers) comprising a semiconductor substrate (heater chip 251) that contains at least one ink feed edge and a plurality of ink ejection actuators (heater elements 10) spaced a distance from the ink feed edge (*id.* at 7–15); (2) each ink ejection actuator having an aspect ratio ranging from 1.5:1 to about 6:1 (*id.* at 15 (citing Ex. 1004, 1:58–63) (Powers disclosing aspect ratios of “more than about 2.0,” and preferably “about 4.0 or 5.0 or greater than about 2.5”)); (3) a thick film layer attached to the semiconductor substrate (the “barrier layer” of Powers and the “thick film layer 26” of Whitman) (*id.* at 16–19 (citing Ex. 1004, 7:26–30; Ex. 1005, 5:40–43, 6:21–23, 6:31–33; Ex. 1002 ¶¶ 136–137)); (4) a plurality of ink feed chambers and ink feed channels formed in the thick film layer and corresponding to the plurality of ink ejection actuators (*id.* at 20–22 (citing and discussing Fig. 2 of Powers and Figs. 5 and 7 of Whitman)); (5) a nozzle plate attached to the thick film layer (nozzle plate 18 of Powers) (*id.* at 23–24); (6) the nozzle plate containing a plurality of nozzle holes corresponding to the plurality of ink feed chambers (nozzle plate 18 of Powers) (*id.* at 24–25 (citing Ex. 1004, 4:23–26, 7:26–29)); and (7) an ink feed edge that is substantially the same for each of the ink ejection actuators (*id.* at 27–29).

With respect to the limitation requiring that the adjacent nozzle holes are “spaced apart with a pitch ranging from about 600 to about 2400 dpi,” Petitioner provides the following annotated version of a portion of Figure 4 of Powers (*id.* at 26):



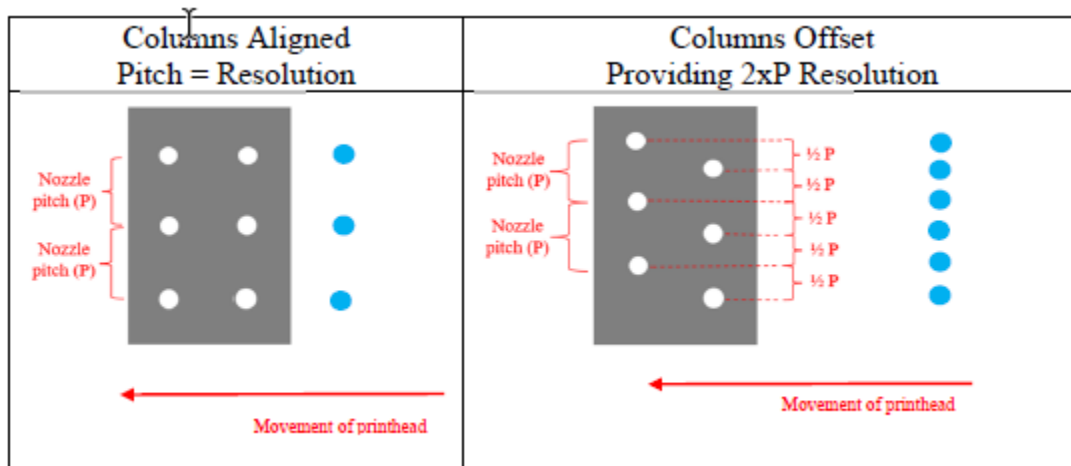
Petitioner contends this annotated figure shows heaters depicted as circles and notes that it would have been understood that each heater is aligned with a nozzle. Pet. 26; Ex. 1004, 7:22–30; Ex. 1002 ¶ 167. Petitioner contends that in annotated Figure 4 the nozzles are “arranged in a column, i.e., a direction substantially parallel with an axis (red line)” and “aligned with a columnar nozzle array (green rectangle).” Pet. 26 (citing Ex. 1002 ¶ 167). Petitioner further contends that Powers discloses that “present day printheads have small diameter openings on the order of about 11 or 14 microns” and, “[i]n the future, it is expected that this dimension [i.e., diameter opening] will gradually shrink as printing resolutions increase **from 600 DPI (dots-per-inch) to 900 or 1200 DPI or more.**” *Id.* at 26–27 (quoting Ex. 1004, 4:35–42). According to Petitioner, a person of ordinary skill in the art would understand from these disclosures that Powers teaches or suggests a pitch for its nozzles of 600 DPI, 900 DPI, or 1200 DPI. *Id.* at 27.

To the extent that Powers does not disclose “a thick film layer attached to the semiconductor substrate,” Petitioner contends Whitman discloses this feature and one of ordinary skill in the art would have sought

to utilize such a thick film layer in Powers in order to improve the reliability of the printhead. Pet. 16–22, 38–39. Petitioner further contends that modifying the printhead of Powers to include Whitman’s structures and dimensions would constitute the use of known prior art elements, using known methods, to yield a predictable result. *Id.* at 39.

Patent Owner contends this ground “must fail at least because neither reference relied on by Petitioners discloses a printhead ‘wherein adjacent ones of the nozzle holes are spaced apart with a pitch ranging from about 600 to about 2400 dpi.’” Prelim. Resp. 26. Patent Owner notes that the ’951 patent expressly defines “pitch” as “a center to center spacing between adjacent nozzles or ejection actuators,” and contends this center to center spacing cannot be inferred from print resolution alone because print resolution can be increased by using multiple columns of nozzles that are “slightly offset” from one another. *Id.* at 27–29; Ex. 1001, 2:25–29.

To explain its argument, Patent Owner provides the following illustration of aligned versus offset nozzles.



The figure above depicts two different printheads each having two columns of nozzles. *Id.* at 28. In the printhead on the left, the two columns of nozzles are aligned with each other. *Id.* In the printhead on the right, the

two columns of nozzles are offset from one another by a distance of $\frac{1}{2}$ nozzle pitch (P). *Id.* Pointing to the figure above, Patent Owner explains that when a printhead with columns of aligned nozzles (or a single column of nozzles) moves over paper, it will leave a series of dots spaced apart by a distance equal to nozzle pitch. *Id.* at 29. In contrast, if two offset columnar nozzle arrays are utilized, “the combination of columns results in ink drops spaced by $\frac{1}{2}$ of the pitch of nozzles in one column alone,” resulting in a doubling of the dpi. *Id.*

Upon review of the parties’ arguments and supporting evidence, we determine that Petitioner presents sufficient argument and evidence to support institution. Although Powers expressly notes that the nozzles of the printhead may have “various vertical and horizontal alignments, offsets,” etc., Figure 4 of Powers does not depict the nozzles of the printhead as being offset. Ex. 1004, Fig. 4. This supports Mr. Curley’s testimony that one of ordinary skill in the art would have understood that Powers teaches or suggests a pitch (center-to-center spacing of adjacent nozzles) of at least 600 dpi. Ex. 1002 ¶¶ 165–170. Accordingly, at a minimum, we are left with a disputed issue of material fact regarding nozzle pitch that is best resolved on a full trial record.

4. *Conclusion: Claim 1*

For the reasons discussed above, Petitioner sufficiently identifies where Powers and Whitman teach or suggest every limitation of claim 1 of the ’951 patent. Petitioner also sufficiently explains why one of ordinary skill in the art would have sought to combine Powers and Whitman to arrive at the subject matter of claim 1 with a reasonable expectation of success. Thus, Petitioner demonstrates a reasonable likelihood that claim 1 of the

'951 patent would have been obvious over the combined disclosures of Powers and Whitman.⁹

5. *Claims 2, 3, 6, 9, and 10*

Claims 2, 3, 6, 9, and 10 all depend, directly or indirectly, from independent claim 1. Petitioner identifies where it contends Powers and Whitman teach or suggest every limitation of claims 2, 3, 6, 9, and 10. Pet. 29–36.

Patent Owner does not address Petitioner's arguments with respect to these claims, but contends these claims would not have been obvious for the reasons discussed above with respect to claim 1. Prelim. Resp. 30.

Upon review of Petitioner's arguments and supporting evidence, and for the reason discussed above with respect to claim 1, we determine that Petitioner demonstrates a reasonable likelihood that claims 2, 3, 6, 9, and 10 would have been obvious over Powers and Whitman.

C. *Claims 4, 5, 7, 20–22, and 24 over Powers, Whitman, and Cleland*

Petitioner contends the subject matter of claims 4, 5, 7, 20–22, and 24 would have been obvious over the combined disclosures of Powers, Whitman, and Cleland. Pet. 40–49. In support of this ground, Petitioner identifies where it contends the three references teach or suggest every limitation of the challenged claims, and provides reasoning as to why one of ordinary skill in the art would have sought to combine the references to

⁹ Whitman is relied upon in this ground only to the extent that it is determined that Powers does not disclose the “thick film layer” recited in claim 1. Pet. 16–22, 24, n.12–14; Prelim. Resp. 26. At this stage of the proceeding, Patent Owner does not dispute that Powers discloses the claimed “thick film layer.”

arrive at the subject matter of the challenged claims with a reasonable expectation of success. *Id.*

Patent Owner contends this ground fails for the reasons discussed above with respect to claim 1. Prelim. Resp. 31.

Upon review of the parties' arguments and supporting evidence, we determine that Petitioner demonstrates a reasonable likelihood that claims 4, 5, 7, 20–22, and 24 would have been obvious over Powers, Whitman, and Cleland.

D. Claims 1–4, 6, 7, 9, 10, 20–22, and 24 over Hamafuku, Imanaka, and Whitman

Petitioner contends the subject matter of claims 1–4, 6, 7, 9, 10, 20–22, and 24 would have been obvious over the combined disclosures of Hamafuku, Imanaka, and Whitman. Pet. 50–90.

1. Hamafuku

Hamafuku discloses an inkjet head that can be miniaturized without reducing the number of inkjet parts. Ex. 1007, code (57). Figures 1–3 of Hamafuku are reproduced below:

FIG. 1

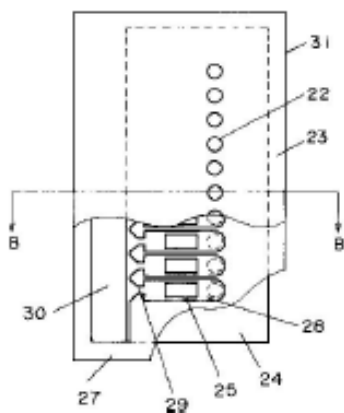
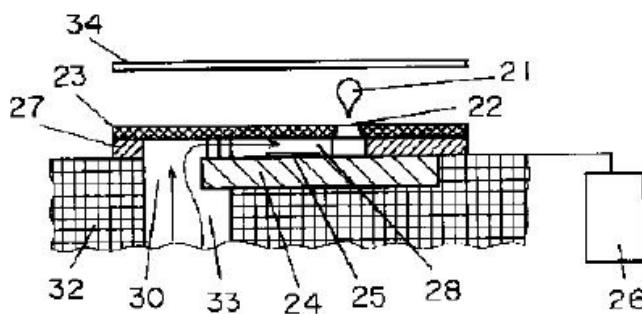


FIG. 2



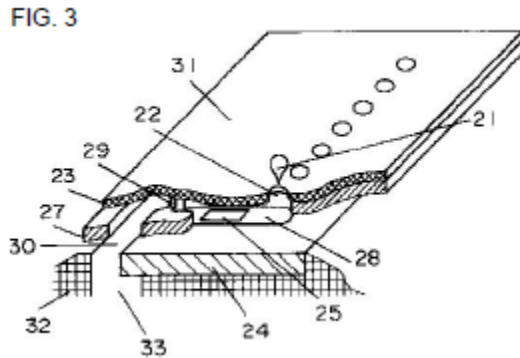


Figure 1 is a partial cross-sectional view of an inkjet head of Hamafuku, Figure 2 is a cross-sectional view taken along line B-B' of the inkjet head of Figure 1, and Figure 3 is a perspective view with a portion of the inkjet head cut away. *Id.* ¶44. Hamafuku explains that

[In Figures 1–3], 21 represents ink; 22 represents a nozzle which is an ejection port for the ink 21; 23 represents a nozzle plate having the nozzle 22; 24 represents a substrate facing the nozzle plate 23; 25 represents a heater part for generating bubbles, which is provided on the surface of the substrate 24 on the nozzle plate 23 side; 26 represents a signal generator that applies a voltage to the heater part 25; 27 represents a flow path member provided between the nozzle plate 23 and the substrate 24; 28 represents a pressure chamber including the nozzle plate 23, the substrate 24, and the flow path member 27; and 29 represents an ink flow path for supplying ink 21 to the pressure chamber 28.

...

30 represents a common ink chamber that supplies ink 21 to the pressure chamber 28 through the ink flow path 29; 31 represents an inkjet head including the nozzle plate 23, the substrate 24, the flow path member 27, and has an ink ejection part including a plurality of nozzles 22, the heater part 25, a pressure chamber 28, and an ink flow path 29; 32 represents an ink cartridge to which the inkjet head 31 is attached; and 33 represents an ink introduction groove, which is opened in ink cartridge 32 and supplies ink to the common ink chamber 30.

Id. ¶¶ 17–18.

Hamafuku explains that, given the structure of the disclosed printhead, “it is possible to achieve a high-density arrangement of ink ejection parts in a row, which would not have been possible with a conventional configuration unless the ink ejection parts are in a staggered arrangement.” *Id.* ¶ 17. Hamafuku further explains that the result is “a miniature inkjet head that can form high density dots.” *Id.* ¶ 12.

2. *Imanaka*

Imanaka discloses a liquid discharge head that may be used in ink jet printers. Ex. 1008, 1:7–38. Imanaka discloses that the heaters used in this discharge head may be arranged “with a high density, providing a resolution of 600 dpi (dot per inch) or higher in the recorded image.” *Id.* at 7:7–10. The pitch of the heater drivers is selected in a range of 15 to 42 μm . *Id.* at 7:16–19.

3. *Analysis: Claim 1*

Petitioner contends that Hamafuku discloses every limitation of claim 1, but to the extent any limitations are found lacking in this reference, they would have been obvious over Whitman and Imanaka. Pet. 50–73, n.33–36. In particular, Petitioner contends Whitman expressly discloses using a “thick film layer having formed therein a plurality of ink feed chambers and ink feed channels corresponding to the plurality of ink ejection actuators” and Imanaka discloses a configuration in which nozzles are spaced apart with a pitch ranging from 600 to 1200 DPI. Pet. 58–64, 67–71.

Patent Owner contends this combination fails because Hamafuku and Imanaka do not disclose or render obvious the limitations of claim 1 related

to nozzle pitch.¹⁰ Prelim. Resp. 32–35. Patent Owner further contends that Petitioner has not sufficiently explained why one of ordinary skill in the art would have combined Imanaka with Hamafuku and Whitman. *Id.* at 35–36. We address both issues below.

a) Nozzle Pitch

Petitioner contends that Figure 1 of Hamafuku discloses heaters and nozzles that are arranged in a column. Pet. 67–68. Petitioner further contends that Hamafuku discloses that the nozzles of the printhead are part of the “ink ejection parts” and that the “ink ejection parts” of the printhead are arranged in a high-density arrangement. *Id.* at 69. Mr. Curley testifies that in the relevant time period “common ‘high-density’ heater/nozzle arrangements were considered to be at least 600 DPI up to 1200 DPI or more.” Ex. 1002 ¶ 321; Pet. 68 (citing Ex. 1007 ¶¶ 17, 43; Ex. 1008, 7:7–10; Ex. 1025, 4:63–65, 6:32–34). Given these disclosures and testimony, Petitioner contends one of ordinary skill in the art would have understood that Hamafuku “includes nozzles that are spaced apart with a pitch ranging from **at least 600 dpi** (e.g., 600 DPI up to 1200 DPI or greater),” as these “were the pitches for high-density arrangements of inkjet nozzles on an inkjet printhead chip at the time.” Pet. 69 (citing Ex. 1002 ¶¶ 322–323).

To the extent that Hamafuku does not disclose this limitation, Petitioner contends Imanaka does. *Id.* In particular, Petitioner contends that Imanaka’s heat generating members are spaced to attain a resolution of 1200 dpi and a person of ordinary skill in the art would have understood that each of Imanaka’s heat generating members has a corresponding nozzle. *Id.*

¹⁰ Independent claim 20 contains the same limitation. Ex. 1001, 8:17–20; Prelim. Resp. 35. Accordingly, Patent Owner’s arguments with respect to claim 1 apply equally to claim 20. Prelim. Resp. 35.

at 70–71. Petitioner further contends that the known desire in the art for printheads with higher resolution would have motivated one of ordinary skill in the art “to modify Hamafuku in view of Imanaka’s teachings to incorporate Imanaka’s heaters having the size and spacing to produce a high density nozzle arrangement.” *Id.* at 87–88.

Patent Owner contends that in Hamafuku only the “ink ejection parts” are provided in a high-density arrangement and Petitioner does “not even attempt to demonstrate what ‘high density’ might mean in the context of ‘ink ejection parts.’” Prelim. Resp. 32. Patent Owner further contends that Petitioner relies on a “very specific” interpretation of “high density” provided in Mr. Curley’s declaration, which is 232 pages long “and references 20 exhibits that are not even cited, let alone discussed, in the Petition proper.” *Id.* at 32–33; *see also id.* at 22–26 (asserting that Mr. Curley’s declaration improperly cites documents without sufficiently explaining their relevance).

The ink ejection parts of Hamafuku are in a “high-density arrangement,” allowing for an increased density of dots to be formed on the recording paper. Ex. 1007 ¶¶ 10–12, 17. One aspect of the “ink ejection parts” is the row of nozzles 22. *Id.* ¶¶ 17–18, 43, Fig. 1. In light of these disclosures, Mr. Curley testifies that one of ordinary skill in the art would have understood that the nozzles of Hamafuku are arranged in a row at “high density,” which was considered to be 600 dpi or higher in the relevant time period. Ex. 1002 ¶¶ 321–323. We find this testimony sufficient to present, at a minimum, a material issue of fact as to whether Hamafuku teaches or suggests nozzles that are spaced apart with a pitch ranging from about 600 to about 2400 dpi, as recited in claim 1.

Patent Owner's concerns regarding the scope of Mr. Curley's declaration are not persuasive. The Petition clearly details why Petitioner contends one of ordinary skill in the art would have understood Hamafuku to teach or suggest a nozzle pitch of between about 600 and 2400 dpi. Pet. 67–69. The Petition supports this conclusion with citation to prior art references and Mr. Curley's declaration testimony. *Id.* In his declaration, Mr. Curley supports his conclusions with respect to the “high density” disclosure of Hamafuku with specific references to the same prior art disclosures that are cited in the Petition. Ex. 1002 ¶¶ 318–323; Pet. 68 (both citing to disclosures in Exhibit 1008 and Exhibit 1025). We find this approach is appropriate.

As noted by Patent Owner, Mr. Curley's declaration spans over two hundred pages and contains a more extensive discussion of the prior art and the knowledge of one of ordinary skill in the art in the relevant time period. A declaration containing an in-depth discussion of the background of the relevant art, as well as a more complete analysis of the relevant prior art disclosures, is often more persuasive than a declaration that merely parrots the Petition, or vice versa, as it not only assists the panel in understanding the relevant technology, but also tends to demonstrate the declarant's knowledge in the relevant field and his or her depth of analysis pertaining to the issues at hand. Of course, this extended analysis may not be incorporated-by-reference wholesale into a petition, but we discern no attempt to do so here, at least with respect to the nozzle pitch limitation disputed by the parties at this stage of the proceeding.

b) Reason to Combine

Petitioner contends that there was a desire in the art for printheads that had higher resolution and could operate at higher ejection frequencies.

Pet. 87. Petitioner further contends that because Hamafuku does not disclose the dimensions of certain printhead structures, one of ordinary skill in the art would have looked to Imanaka and Whitman to determine effective dimensions for these elements, with Imanaka disclosing dimensions and configurations that allow for higher density nozzle arrangements and faster ejection of ink. *Id.* at 87–88. Petitioner further contends that one of ordinary skill would have sought to implement Whitman’s teachings of a thick film layer in order to provide a more reliable printhead with improved “median time to failure.” *Id.* at 88–89.

Patent Owner contends that Petitioner’s motivation to combine arguments “attempt to pluck a specific aspect from Imanaka using hindsight in order to fill in missing details of Hamafuku because they both relate to ink jet printers.” Prelim. Resp. 35. Patent Owner further contends that Imanaka discloses a different type of printhead than Hamafuku, with a different nozzle placement and use of a movable member in its ejection mechanism. *Id.* at 36. According to Patent Owner, Petitioner has “completely disregarded these differences,” and has not attempted to explain “why those skilled in the art would have been motivated to pluck one aspect from Imanaka and implement it in a different type of ink jet printing head.” *Id.*

Petitioner articulates a reasoned argument, supported by rational underpinning, to explain why one of ordinary skill in the art would have seen a benefit in combining the disclosures of Hamafuku, Whitman, and Imanaka to arrive at the subject matter of claim 1. Pet. 87–89 (asserting that the combination would provide a printhead with higher resolution and increased reliability). We find these arguments sufficient to support institution of an *inter partes* review.

As noted by Patent Owner, the printheads of Hamafuku and Imanaka do not operate in the same manner. Prelim. Resp. 36. Mr. Curley testifies, however, that the printhead components in the three references were “well-known at the time” and one of ordinary skill in the art would have had a reasonable expectation of success in modifying Hamafuku’s printhead to include Imanaka’s and Whitman’s structures. Ex. 1002 ¶¶ 43–60 (discussing the background of inkjet printheads), ¶ 409 (asserting that one of ordinary skill in the art would have had a reasonable expectation of success in combining Hamafuku, Whitman, and Imanaka, as such a combination would have been “straightforward”); Pet. 90. At this stage of the proceeding, Patent Owner’s attorney argument is not sufficient to call Mr. Curley’s conclusions into question.

In view of the foregoing, we determine that Petitioner demonstrates a reasonable likelihood that claim 1 would have been obvious over the combined disclosures of Hamafuku, Whitman, and Imanaka.

4. *Analysis: Claims 2–4, 6, 7, 9, 10, 20–22, and 24*

Petitioner identifies where it contends Hamafuku, Imanaka, and Whitman teach or suggest every limitation of claims 2–4, 6, 7, 9, 10, 20–22, and 24. Pet. 73–86. In support of these arguments, Petitioner provides citations to the asserted prior art and Mr. Curley’s declaration testimony.

Patent Owner does not address Patent Owner’s arguments with respect to these claims, apart from its arguments set forth above with respect to independent claim 1. Prelim. Resp. 31–37.

Upon review of the parties’ arguments and supporting evidence, we determine that Petitioner demonstrates a reasonable likelihood that claims 2–4, 6, 7, 9, 10, 20–22, and 24 would have been obvious over Hamafuku, Imanaka, and Whitman.

E. Claim 5 over Hamafuku, Imanaka, Whitman, and Cleland

Petitioner contends the subject matter of claim 5 would have been obvious over the combined disclosures of Hamafuku, Imanaka, Whitman, and Cleland. Pet. 90. In support of this ground, Petition identifies where it contends these references teach or suggest the limitations of claim 5. *Id.* at 90–91. Petitioner also provides reasoning as to why one of ordinary skill in the art would have sought to combine the identified disclosures to arrive at the subject matter of claim 5. *Id.* at 91–93.

Patent Owner does not address Petitioner’s arguments with respect to this ground, apart from arguing that Cleland does not cure the deficiencies identified above with respect to the combination of Hamafuku, Imanaka, and Whitman. Prelim. Resp. 37.

Upon review of the parties’ arguments and evidence, we determine that Petitioner demonstrates a reasonable likelihood that claim 5 would have been obvious over Hamafuku, Imanaka, Whitman, and Cleland.

III. CONCLUSION

For the reasons discussed above, Petitioner demonstrates a reasonable likelihood that it would prevail in showing that at least one claim of the ’951 patent would have been obvious.

IV. ORDER

Accordingly, it is:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–7, 9, 10, 20–22, and 24 of the ’951 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the ’951 patent shall commence

IPR2022-01541
Patent 7,152,951 B2

on the date of this Decision, and notice is hereby given of the institution of trial.

IPR2022-01541
Patent 7,152,951 B2

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