

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.

IPR2023-00312
Patent 7,484,823 B2

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

KOKOSKI, *Administrative Patent Judge*.

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

I. INTRODUCTION

Canon U.S.A., Inc. and Canon Inc. (collectively, “Petitioner”) filed a Petition to institute an *inter partes* review of claims 1–17 (the “challenged claims”) of U.S. Patent No. 7,484,823 B2 (“the ’823 patent,” Ex. 1001). Paper 2 (“Pet.”). Slingshot Printing LLC (“Patent Owner”) filed a Preliminary Response. Paper 5 (“Prelim. Resp.”).

Institution of an *inter partes* review is authorized by statute when “the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4 (2023). For the reasons discussed below, we determine that Petitioner establishes a reasonable likelihood of prevailing with respect to the unpatentability of at least one claim of the ’823 patent. Accordingly, we institute an *inter partes* review of claims 1–17 of the ’287 patent.

A. *Real Parties-in-Interest*

Petitioner and Patent Owner each identifies itself as the real parties-in-interest. Pet. 1; Paper 4, 1 (Mandatory Notice).

B. *Related Matters*

The parties indicate that the ’823 patent is at issue in *Slingshot Printing LLC v. Canon U.S.A., Inc.*, No. 2:22-cv-01852 (E.D.N.Y.). Pet. 1; Paper 4, 2. Patent Owner additionally identifies several “concurrent IPR petitions” filed by Petitioner “against patents owned by [Patent Owner], which patents are asserted along with the challenged patent in pending district court litigation.” Paper 4, 1.

C. The '823 Patent

The '823 patent generally relates “to methods and apparatuses for regulating the temperature of multi-via heater chips.” Ex. 1001, 1:15–17.

Figure 5 is reproduced below.

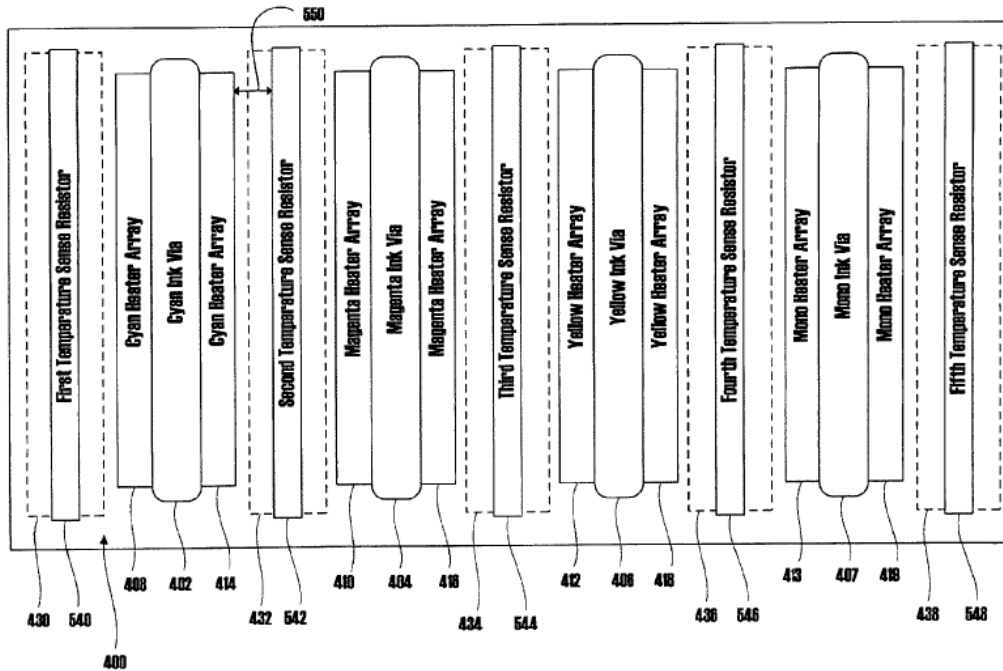


Figure 5 depicts an exemplary configuration for a heater chip described in the '823 patent. *Id.* at 4:52–54. Heater chip 400 includes cyan ink via 402 with cyan heater arrays 408 and 414, magenta ink via 404 with magenta heater arrays 410 and 416, yellow ink via 406 with yellow heater arrays 412 and 418, and mono ink via 407 with mono heater arrays 413 and 418. *Id.* at 6:24–26. Thermal regions 430, 432, 434, 436, and 438 are defined regions of the silicon substrate of heater chip 400, and are situated around and between ink vias 402, 404, 406, and 408. *Id.* at 6:34–37. “The minimum width of the thermal regions 430, 432, 434, 436, and 438 is generally limited by the heater chip 400 circuitry.” *Id.* at 6:37–39.

The '823 patent teaches that the temperature of heater chip 400 is measured on a per-thermal-region basis by placing a thermal sense resistor ("TSR") in each of the thermal regions, each of which "is operable to measure the temperature of the silicon substrate in a corresponding thermal region." Ex. 1001, 6:40–45. This is shown in Figure 5 above, with TSR 540 in thermal region 430, TSR 542 in second region 432, TSR 544 in thermal region 434, TSR 546 in thermal region 436, and TSR 548 in thermal region 438. *Id.* at 6:55–61. The '823 patent teaches that "TSRs 540, 542, 544, 546, and 548 are placed well away from the heater arrays 408, 410, 412, 413, 414, 416, 418, and 419, at a distance 550 of several hundred microns, rather than in close proximity to the heater arrays." *Id.* at 6:61–65.

The '823 patent explains that,

[d]ue to the relative high thermal conductivity of the silicon substrate, each of the thermal regions 430, 432, 434, 436, 438 have a very uniform temperature across the width of that region. Because of this conductivity, the TSRs 540, 542, 544, 546, 548 can be placed in the center of their respective thermal regions 430, 432, 434, 436, 438 and still provide an accurate temperature measurement for the region. The ink vias 402, 404, 406, 407, on the other hand, act as thermal insulators between the thermal regions 430, 432, 434, 436, 438.

Ex. 1001, 7:11–20. For example, the '823 patent also explains, "if the right cyan heater array 414 fires, then the adjacent left magenta heater array 410 will quickly be at the same temperature as the right cyan heater array 414." *Id.* at 7:20–22. Thus, the temperature reading from second region 432 represents the temperature of both cyan heater array 414 and magenta heater array 410. *Id.* at 7:23–26.

D. Illustrative Claims

Petitioner challenges claims 1–17 of the '823 patent. Pet. 1. Claims 1 and 11 are independent, illustrative of the claimed subject matter, and reproduced below.

1. A chip for use with a printing device, comprising:
 - a first heater array positioned substantially adjacent a first via;
 - a second heater array positioned substantially adjacent a second via;
 - a region, positioned between the first heater array and the second heater array, and also positioned substantially adjacent to the first heater array and the second heater array; and
 - a temperature sensing element operable to sense a temperature of the region, the temperature being representative of the region, wherein the temperature sensing element is substantially centrally disposed with respect to the region and substantially adjacent both the first heater array and the second heater array, and further extends substantially the length of the first heater array and second heater array,wherein the first heater array and the second heater array are operable to receive heating responsive to the temperature of the region sensed by the temperature sensing element, and wherein the received heating regulates the temperature of the region;
- a third heater array[] positioned substantially adjacent the second via;
- a fourth heater array, positioned substantially adjacent a third via;
- a second region, positioned between the third heater array and the fourth heater array, and also positioned substantially immediately adjacent to the third heater array and the fourth heater array; and

a second temperature sensing element operable to sense the temperature of the second region, wherein the temperature sensing element is substantially centrally disposed with respect to the second region and substantially adjacent to both the third heater array and fourth heater array,

wherein the third heater array and the fourth heater array are operable to receive heating responsive to the temperature of the second region sensed by the temperature sensing element, and wherein the received heating regulates the temperature of the region.

Ex. 1001, 8:44–9:16.

11. A method for fabricating chips for use with a printing device, comprising:

providing a first heater array, positioned substantially adjacent a first via;

providing a second heater array, positioned substantially adjacent a second via;

positioning a temperature sensing element in a region adjacent to and immediately between the first heater array and the second heater array and substantially adjacent to both the first heater array and second heater array, wherein the temperature sensing element is operable to sense a temperature of the region, the temperature being representative of the region, and wherein the temperature sensing element extends substantially the length of the first heater array and second heater array; and

responsive to the temperature of the region sensed by the temperature sensing element, heating the first heater array and the second heater array to regulate the temperature of the region;

providing at least one control element operable to receive a temperature measured by the temperature sensing element and to heat the first heater array and the second heater array;

providing a third heater array substantially adjacent the second via;

providing a fourth heater array substantially adjacent a third via; and

positioning a second temperature sensing element in a second region located between the third heater array and the fourth heater array[] wherein the temperature sensing element is operable to sense the temperature of the second region, and wherein the temperature sensing element is substantially centrally disposed with respect to the second region and substantially adjacent to both the third heater array and fourth heater array.

Id. at 9:47–10:27.

E. Evidence

Petitioner relies on the evidence listed below.

Name	Reference	Date	Exhibit No.
Yabe	US 6,527,367 B2	Mar. 4, 2003	1008
Giere178	US 6,565,178 B1	May 20, 2003	1007
Giere673	US 6,612,673 B1	Sep. 2, 2003	1005
Parish	US 7,176,272 B2	Jan. 16, 2007	1006
Benjamin	US 7,384,113 B2	Jun. 10, 2008	1004

Petitioner also relies on the Declaration of Stephen F. Pond, Ph.D. (“Pond Declaration,” Ex. 1002). Pet. 2–4.

F. Asserted Grounds

Petitioner asserts that claims 1–17 would have been unpatentable based on the following grounds:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1–3, 5–13, 15–17	103 ¹	Benjamin, Giere673

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284 (2011), revised 35 U.S.C. §§ 102 and 103 effective March 16, 2013. Petitioner argues, and Patent Owner does not contest, that the pre-

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
4, 14	103	Benjamin, Giere673, Parish
1–3, 5–13, 15–17	103	Benjamin, Giere178
1–3, 5–13, 15–17	103	Yabe, Giere673
4, 14	103	Yabe, Giere673, Parish

Pet. 3.

II. ANALYSIS

A. *Level of Ordinary Skill in the Art*

Petitioner contends that a person of ordinary skill in the art (“PHOSITA”) “would have been a person holding 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 layout.” Pet. 6 (citing Ex. 1002 ¶¶ 108–110). Although Patent Owner “disagrees that a degree in Materials Science is sufficient,” it “does not dispute [Petitioner’s] characterization of the level of ordinary skill in the art for the purposes of [the] Preliminary Response.” Prelim. Resp. 28–29.

For purposes of this Decision, and based on the current record, we adopt the assessment offered by Petitioner.

B. *Claim Construction*

We construe each claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b). Under this standard, claim terms are generally given their plain and ordinary meaning as would have been understood by a person of

AIA statutory provisions apply to this case. *See* Pet. 2. Accordingly, we apply the pre-AIA versions of §§ 102 and 103.

ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Realtime Data LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019).

Based on the record before us, we determine that no claim term requires express construction for purposes of this Decision.

C. Asserted Obviousness over Benjamin and Giere⁶⁷³

Petitioner contends that claims 1–3, 5–13, and 15–17 would have been obvious over the combined teachings of Benjamin and Giere⁶⁷³. Pet. 7–59.

1. Overview of Benjamin

Benjamin relates to fluid ejection systems, and in particular to inkjet printing systems that include a fluid ejection device, such as an inkjet printhead assembly, and a fluid supply assembly, such as an ink supply assembly. Ex. 1004, 3:24–27.

Figure 2 is reproduced below.

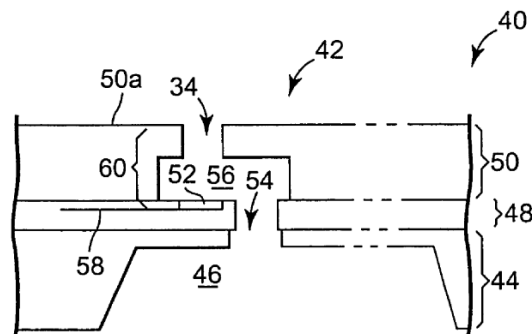


Fig. 2

Figure 2 is a diagram illustrating a portion of one embodiment of a printhead die described in Benjamin. *Id.* at 2:16–17. Printhead die 40 includes array of printing elements 42 formed on substrate 44, which also has ink feed

slot 46 formed thereon. *Id.* at 4:58–61. Ink feed slot 46 provides a supply of liquid ink to printing elements 42. *Id.* at 4:61–62. Thin film structure 48 has ink feed channel 54, which communicates with ink feed slot 46, formed therein. *Id.* at 5:1–3. Nozzle opening 34 is formed on face 50a of orifice layer 50. *Id.* at 5:3–5. Also formed on orifice layer 50 is vaporization chamber 56, which communicates with nozzle opening 34 and ink feed channel 54. *Id.* at 5:5–8. Firing resistor 52 is positioned within vaporization chamber 56, and is electrically coupled by leads 58 “to circuitry controlling the application of electric current through selected firing resistors.” *Id.* at 5:8–11.

Drop generator 60 includes firing resistor 52, vaporization chamber 56, and nozzle opening 54. Ex. 1004, 5:11–14. Benjamin teaches that ink feed slot 46 includes opposing ink feed slot sides 46a and 46b. *Id.* at 5:53–54. A total of n drop generators 60 are located along ink feed slot 46, with a total of m drop generators 60 located along ink feed slot side 46a, and n-m drop generators 60 located along ink feed slot side 46b. *Id.* at 5:53–58. Benjamin teaches that, during printing, ink feed slot 46 provides ink to each of the n drop generators 60, and firing resistors 52 in drop generators 60 “are energized in a controlled sequence to eject fluid from vaporization chamber 56 and through nozzles 34 to print an image on print medium 36.” *Id.* at 5:64–6:5.

Figure 21 is reproduced below.

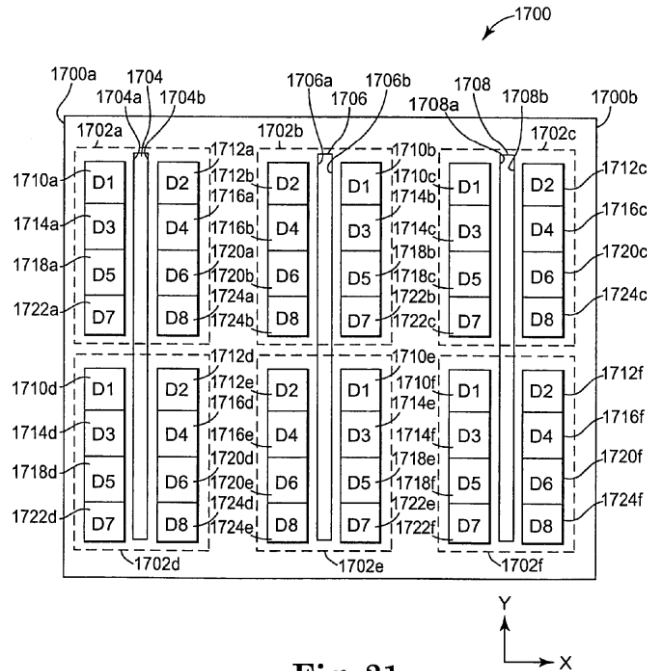


Fig. 21

Figure 21 is a diagram illustrating one embodiment of a printhead die described in Benjamin. Ex. 1004, 64:53–54. Printhead die 1700 includes six fire groups 1702a–1702f disposed along ink fluid feed slots 1704, 1706, and 1708. *Id.* at 6:54–57. Fire groups 1702a–1702f are divided into eight data line groups D1–D8, and each data line group D1–D8 includes pre-charged firing cells 120 (not shown) from each of fire groups 1702a–1702f. *Id.* at 65:5–8.

2. Overview of Giere673

Giere673 describes “an inkjet printing system, having a substrate, a plurality of heating elements disposed on the substrate, an ink ejection assembly system adjacent the substrate forming a plurality of ink ejection chambers,” wherein “each chamber [is] associated with a different one of the heating elements.” Ex. 1005, code (57). A controller is “operatively connected to the heating elements,” and “receiv[es] print data and

process[es] the print data to predict the thermal conditions of a subset of the ink injection chambers” to “selectively operat[e] the corresponding heat elements of the subset.” *Id.*

Figure 4 is reproduced below.

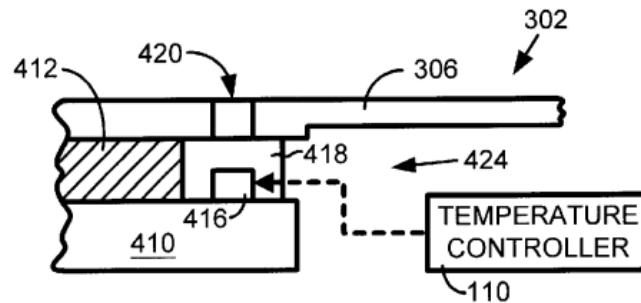


Figure 4 is a schematic cross-sectional view of a portion of the ink chamber arrangement of a printhead assembly described in Giere673. Ex. 1005, 2:5–8. Thermal head assembly 302 includes barrier layer 412 formed between nozzle member 306 and substrate 410, ink ejection chamber 418, ink ejection element 416, temperature controller 110, nozzle 420, and ink reservoir 424. *Id.* at 4:11–25, 5:41–42. Giere673 explains that, during a printing operation, ink stored in ink reservoir 424 “generally flows around the edges of the substrate 410” and into vaporization chamber 418, energization signals are sent to ink ejection element 416, and, upon energization of ink ejection element 416, “a thin layer of adjacent ink is superheated.” *Id.* at 5:41–49. Energized ink ejection element 416 “causes explosive vaporization and, consequently, causes a droplet to be ejected through” nozzle 420. *Id.* at 5:50–52.

Figure 5 is reproduced below.

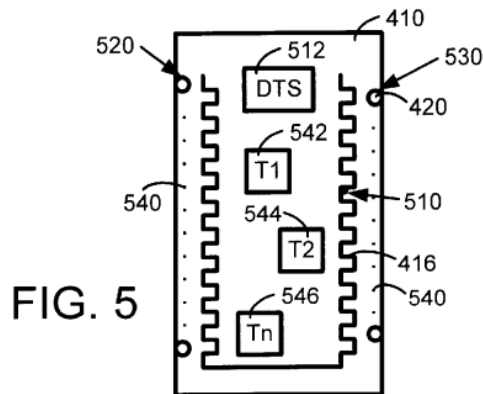


Figure 5 is a schematic top view of the substrate of the printhead assembly depicted in Figure 4. Ex. 1005, 2:9–11. Substrate 410 includes thermal sense resistor (TSR) 510, digital temperature sensor (DTS) 512, temperature recorders 542, 544, and 546, first column 520 of nozzles 420, and second column 530 of nozzles 420. *Id.* at 4:52–55, 4:62–65, 5:13–14.

Giere673 explains that “[o]ne or multiple TSRs 510 can be used to provide an approximation of the mean temperature of the substrate.” *Id.* at 4:55–56. Giere673 further explains that TSR 510 “reflects the temperature of the substrate 410 after heat has moved from the heating elements to the TSR 510” and is preferably “not located adjacent to any particular heating element.” *Id.* at 4:57–60. Giere673 teaches that TSR 510, which is located along the length of substrate 410, “can have two legs that are approximately 680 μm inboard from the center of the columns of ink ejection elements 416.” *Id.* at 5:9–12.

3. Claims 1 and 11

Petitioner contends that the combined teachings of Benjamin and Giere673 disclose all of the limitations of independent claim 1. Pet. 7–44. Petitioner provides an annotated and simplified version of Benjamin’s Figure 21, reproduced below, to illustrate its contentions. *Id.* at 15.

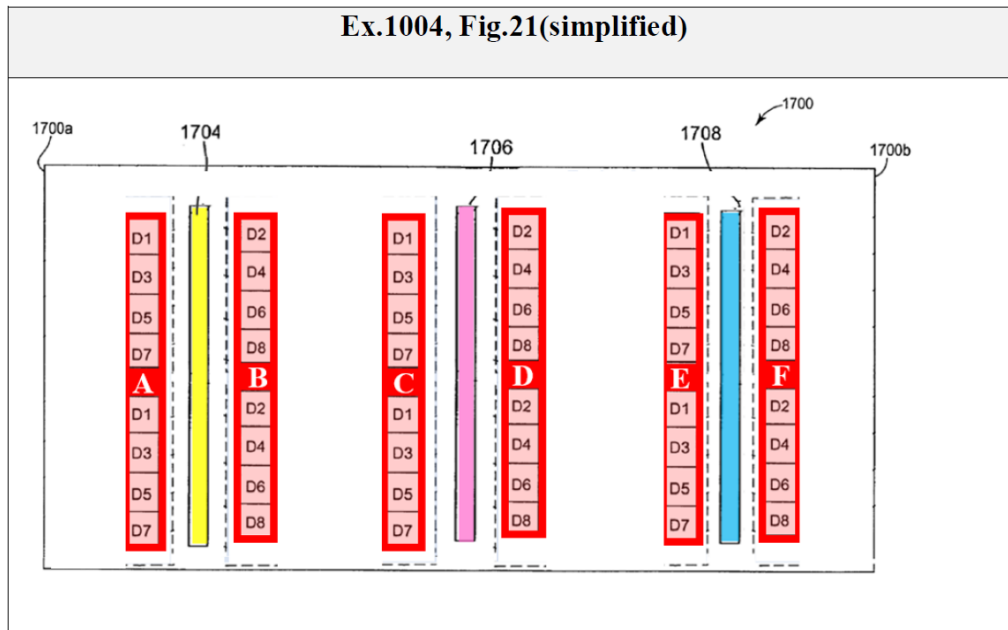


Figure 21 is a diagram of an example layout of one embodiment of a printhead die described in Benjamin. Ex. 1004, 2:62–63. Petitioner modifies Figure 21 by (i) removing the reference numerals, except those for printhead die 1700, sides 1700a and 1700b, and ink feed slots 1704, 1706, and 1708; and (ii) removing two sides of each of the six dotted boxes indicating each of the fire groups. *Compare* Ex. 1004, Fig. 21 with Pet. 15. Petitioner annotates Figure 21 by coloring ink feed slot 1704 yellow, ink feed slot 1706 magenta, and ink feed slot 1708 cyan, and the data line groups (D1–D8) for each fire group red. Pet. 15. Petitioner also adds a label to each of the six fire groups, starting with A for the first group on the left through F for the last group on the right. *Id.*

Referring to annotated Figure 21, Petitioner contends that Benjamin teaches “a first heater array positioned substantially adjacent a first via” (heater array B positioned next to yellow ink via 1704), “a second heater array positioned substantially adjacent a second via” (heater array C positioned next to magenta ink via 1706), “a third heater array positioned

substantially adjacent the second via” (heater array D positioned next to magenta ink via 1706), and “a fourth heater array positioned substantially adjacent a third via” (heater array E positioned next to cyan ink via 1708). *Id.* at 10–19, 36–40. Petitioner then identifies the area between heater array B and heater array C (which it calls “Region 2”) as the claimed “a region, positioned between the first heater array and the second heater array, and also positioned substantially adjacent to the first heater array and the second heater array,” and the area between heater array D and heater array E (which it calls “Region 3”) as the claimed “a second region, positioned between the third heater array and the fourth heater array, and also positioned substantially immediately adjacent to the third heater array and the fourth heater array.” *Id.* at 19–21, 40–42.

With respect to the “a temperature sensing element operable to sense a temperature of a region, the temperature being representative of the region,” and “a second temperature sensing element operable to sense the temperature of the second region” limitations of claim 1, Petitioner argues that, although Benjamin teaches disposing a TSR on the printhead die, “it does not say *where* on the printhead die the TSR should be disposed.” Pet. 23; *see also id.* at 21 (“Benjamin’s printhead die 1700 includes a ‘temperature sense resistor’ (TSR) [that] allows ‘a printer coupled to an ink jet cartridge to determine a temperature of the printhead die, based upon a measurement of the resistor.’” (citing Ex. 1004, 79:60–67) (emphases omitted))). Petitioner contends, however, that “Giere673 explicitly discloses *where* on the printhead the TSR should be located” in order to provide benefits such as improved print quality and printhead life. *Id.* at 23 (citing Ex. 1002 ¶¶ 147–148; Ex. 1005, 3:5–13, 4:55–56). In particular, Petitioner contends that Giere673 teaches disposing a single TSR in a region on the

printhead die adjacent two heater arrays, “and positioning that TSR equidistant from the two heater arrays but no less than ‘approximately 680 μm inboard from the center of the [heater arrays].” *Id.* at 25 (citing Ex. 1005, 4:57–59) (emphases omitted). According to Petitioner,

[b]y positioning the TSR 510 in the centre of the region, Giere673 teaches that the TSR value obtained by TSR 510 “reflects heating elements firing that have already occurred,” which “more accurately reflects the mean temperature of the substrate 410” . . . This also “acts as a predictive system for maintaining the substrate at an optimum temperature for producing ink droplets,” and as a result, the quality of the ink droplets will be increased,” less energy will be used” to fire heater arrays, and “printhead assembly [] will be easier to maintain with less residue being deposited on the [die].”

Id. at 26 (citing Ex. 1005, 4:57–59) (emphases omitted).

With respect to the “wherein the first/third heater array and the second/fourth heater array are operable to receive heating responsive to the temperature of the region/second region sensed by the temperature sensing element, and wherein the received heating regulates the temperature of the region” limitations of claim 1, Petitioner contends that, to control “the temperature of the substrate and the temperature of each ejection chamber or nozzle chamber,” Giere673 teaches that “temperature sensors . . . determine, at a given time, a mean or average temperature of the substrate and an actual local temperature profile near designated ink ejection elements.” Pet. 33 (citing Ex. 1005, 3:1–6) (emphases omitted). Petitioner then contends that, “[b]ecause the ink vias act as thermal insulators between the four different regions of Printhead Die 1700, the TSR value accurately represents only the temperature between the two adjacent ink vias.” *Id.* (citing Ex. 1002 ¶ 165).

Petitioner further contends:

Based upon the temperature sensed by the TSR, Giere673 teaches that the heater arrays receive heating “so that the temperature of the heater array [], and therefore the temperature of the ink in the chamber array [], are maintained at an optimum temperature for the formation of ink droplets”—e.g., by generat[ing] firing Voltages 814 and activates heater elements that do not eject ink 816.

Id. at 35 (citing Ex. 1005, 2:62–65, 7:41–45, 9:8–19) (alterations in original, emphases omitted).

Patent Owner responds that Petitioner “cannot show that Benjamin discloses multiple temperature sensors,” and that “Benjamin also fails to disclose the other particulars of the temperature sensors recited in the claims.” Prelim. Resp. 35. Patent Owner also argues that Giere673 “doesn’t describe a second heater array and third heater array positioned substantially adjacent the same (second) via with a first heater array adjacent a first via and a fourth heater array adjacent a third via.” *Id.* at 36. Patent Owner further argues that, because Giere673’s printhead die “does not include any ink vias, with ink instead flowing around the edges of the substrate into vaporization chambers,” Giere673 “teaches nothing about where to place temperature sensors in the type of printhead relevant to the challenged ’823 patent claims, i.e., one having a plurality of ink vias with heater arrays on both sides of the vias.” *Id.* (citing Ex. 1005, 5:42–45). These arguments improperly attack the references individually, rather than as part of the asserted combination. Nonobviousness cannot be established by attacking the references individually when the ground of unpatentability is predicated upon a combination of prior art disclosures. *See In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

Patent Owner also argues that Giere673 does not disclose the “first temperature sensing element centrally located in a region between first and second heater arrays and second temperature element centrally located in a region between third and fourth heater arrays.” Prelim. Resp. 35–36. In that regard, Patent Owner argues that Giere673’s temperature monitoring and control system “includes a temperature sense resistor 510, a digital temperature sensor 512 and multiple temperature recorders 542, 544 and 546 between only two arrays of heaters, and does not disclose a third heater array or a fourth heater array.” *Id.* at 36 (citing Ex. 1005, 4:55–56, 5:28–31, 6:35–40, Fig. 5). Petitioner, however, relies on Benjamin as disclosing the first, second, third, and fourth heater arrays. Pet. 10–19, 36–40.

Moreover, on the current record, we are persuaded by Petitioner’s arguments that “a PHOSITA would have applied Giere673’s teachings to Benjamin by . . . disposing a single TSR between each adjacent pair of ink vias on the printhead die” and “positioning the TSR equidistant from both heater arrays within the region but no less than approximately 680 μm inboard from the center of the heater arrays . . . to ensure that the temperature value provided by the TSR reflects the mean temperature of the region.” Pet. 27 (citing Ex. 1002 ¶ 248). First, Giere673 teaches that “one or multiple TSRs 510 can be used to provide an approximation of the mean temperature of the substrate.” Ex. 1005, 4:55–56. In addition, Giere673 teaches a temperature controller coupled to multiple temperature sensors, which determine a mean temperature of the substrate “and an actual local temperature profile near designated ink ejection elements.” *Id.* at 2:57–62. Giere673 teaches that the temperature controller selectively fires particular heating elements based on thermal conditions. *Id.* at 3:3–6. These teachings support disposing multiple TSRs across the substrate (e.g., one in each

region) to measure the substrate's temperature near each of the heater arrays for selectively firing particular heating elements for print quality optimization. *Id.* at 2:57–62, 3:3–6.

Petitioner also sufficiently establishes, for purposes of institution, that it was known in the prior art (i) to sense temperature on a per-color basis, and (ii) that ink vias act as a thermal barriers between the colors. Pet. 29–30 (citing Ex. 1001, 2:1–15, 2:47–50; Ex. 1002 ¶¶ 247–249). Accordingly, on this record, we agree with Petitioner that a PHOSITA would have known that placing a TSR within a single region would not accurately report the mean temperature of the entire printhead die. *Id.* at 28 (citing Ex. 1001, 5:52–55; Ex. 1008, 3:16–21).

At this stage, we are also persuaded that Petitioner sufficiently establishes that a PHOSITA would have been motivated to position the TSR within each region “equidistant from the two heater arrays adjacent the region . . . and not less than ‘approximately 680 μm inboard from the center of the [heater arrays].” Pet. 32 (citing Ex. 1002 ¶ 159); *see also* Ex. 1005, 5:9–12 (“The TSR 510 is located along the length of the substrate 410. The TSR 510 can have two legs that are approximately 680 μm inboard from the center of the columns of ink ejection elements 416.”). In that regard, we credit Dr. Pond’s testimony, which is unrebutted at this stage of the proceeding, that, with this positioning, “*individually*, each TSR provides a temperature value reflective of the temperature of its region, including the heater arrays adjacent those regions, *and collectively*, the values provided by the TSRs reflect the mean temperature of the entire printhead die.” Ex. 1002 ¶ 159.

Furthermore, we are persuaded, on this record, that Petitioner sufficiently establishes that a PHOSITA would have had a reasonable

expectation of success in combining Benjamin and Giere673's teachings. Pet. 58–59. Benjamin and Giere673 teach similar printing system technologies, and we are persuaded by Dr. Pond's testimony that a PHOSITA would have found it a routine and obvious matter to combine, replace, and modify various features from Benjamin with features taught by Giere673. Ex. 1002 ¶¶ 259–260. At this stage of the proceeding, we do not find including TSRs in each of Benjamin's regions would have been uniquely challenging or difficult for one of ordinary skill in the art. *See Leapfrog Enterprises, Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007) (citing *KSR*, 550 U.S. at 419–20) (finding that obviousness was supported because there was no evidence that making the combination was uniquely challenging or difficult for one of ordinary skill in the art).

Accordingly, on this record, we find that Petitioner sufficiently articulates reasoning with rational underpinning to support combining Benjamin and Giere673 in the manner Petitioner proposes. *See In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006); *see also Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1379 (Fed. Cir. 2023) (“The motivation-to-combine analysis is a flexible one.”); *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1374 (Fed. Cir. 2019) (“A motivation to combine may be found ‘explicitly or implicitly in market forces; design incentives; . . . and the background knowledge, creativity, and common sense of the person of ordinary skill.’”) (quoting *ZUP, LLC v. Nash Mfg., Inc.*, 896 F.3d 1365, 1371 (Fed. Cir. 2018)).

We have considered Patent Owner's arguments and find them unavailing. For example, Patent Owner's argument that “the Benjamin device can accommodate only one temperature sense resistor because there is only a single contact area (TSR)” and a single return area (TSR-RT) on

the flex circuit, is akin to arguing that Benjamin and Giere⁶⁷³'s teachings cannot be physically combined, which is an improper focus for determining whether the claim would have been rendered obvious by the prior art as a whole. Prelim. Resp. 41 (citing Ex. 1004, 79:29–34, 79:63–65, Figs. 25A, 25B); *see also Allied Erecting & Dismantling Co. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016) (quoting *In re Sneed*, 710 F.2d 1544, 1550 (Fed. Cir. 1983)); *see also id.* (quoting *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (en banc)) (“Etter’s assertions that Azure cannot be incorporated in Ambrosio are basically irrelevant, the criterion being not whether the references could be physically combined but whether the claimed inventions are rendered obvious by the teachings of the prior art as a whole.”).

Patent Owner also argues that the ’823 patent does not admit that ink vias acting as thermal barriers were well known in the art. Prelim. Resp. 44. The ’823 patent’s discussion of temperature sensing on a per color basis (illustrated by Figure 2) being known also admits that it was known that the ink vias act as thermal barriers and that the implications of such were appreciated for design purposes. Ex. 1001, 2:1–15. In particular, the ’823 patent explains that Figure 2’s traditional heater chip’s design discloses: (i) “[t]hree temperature sense resistors 220, 222, and 224 are placed in close proximity to each of the heater arrays, each situated on the same side of their respective ink vias;” (ii) “[t]he ink vias 202, 204, and 206 act as a thermal barrier between the colors”; and (iii) “[a]ll the thermal heater arrays 208, 210, and 212 are situated on only one side of their respective ink vias, ensuring that there is only a small amount of thermal crosstalk between the temperature sense resistors.” *Id.* The discussion of the temperature sense resistors being situated on the same side of their respective ink vias to ensure

only a small amount of thermal crosstalk evidences that ink vias acting as thermal barriers were well known, and its implications were appreciated for design purposes. *Id.*

Moreover, the '823 patent's labeling Figure 2 as "Prior Art" "thereby qualifies that system as [Applicant Admitted Prior Art ('AAPA')] available for Petitioner's use in the Petition, including to supply a missing claim element." Ex. 1001, Fig. 2; *Solaredge Techs. Ltd. v. SMA Solar Tech. AG*, IPR2020-00021, Paper 34 at 10 (PTAB June 8, 2023) (Director Vidal). "Thus, whether the substance of the admission was 'known' in the art is an inquiry that does not impact the use of this admission as AAPA." *Solaredge Techs.*, Paper 34 at 10.

Having reviewed Petitioner's and Patent Owner's arguments and the evidence of record, we are persuaded that Petitioner sufficiently establishes, for purposes of institution, that the combined teachings of Benjamin and Griere673 account for all of the recitations of claims 1 and 11,² and that a PHOSITA would have been motivated to combine the teachings as proposed with a reasonable expectation of success. *See* Pet. 7–44, 54–59; Ex. 1002 ¶¶ 111–189, 226, 227, 239–261.

4. *Claims 2, 3, 5–10, 12, 13, and 15–17*

Petitioner contends that Benjamin and Giere673 teach or suggest all of the limitations of dependent claims 2, 3, 5–10, 12, 13, and 15–17. Pet. 44–54. At this stage of the proceeding, Patent Owner does not address Petitioner's specific contentions with respect to these claims.

² Petitioner contends that "[t]he limitations of claim 11 mirror those of claim 1, and therefore are disclosed by Benjamin-Giere673 for the same reasons as Claim 1." Pet. 7 n.2 (citing Ex. 1002 ¶¶ 226–227).

We have reviewed the arguments and evidence of record thus far and find that, for purposes of institution, Petitioner adequately shows how Benjamin and Giere673 teach or suggest each limitation of claims 2, 3, 5–10, 12, 13, and 15–17. Pet. 44–54; Ex. 1002 ¶¶ 190–225, 228–238. Petitioner also sufficiently shows that a person of ordinary skill in the art would have had a reason to combine the teachings of Benjamin and Giere673 with a reasonable expectation of success. Pet. 54–59; Ex. 1002 ¶¶ 239–261.

D. Alleged Obviousness over Benjamin, Giere673, and Parish

Petitioner contends that the combined teachings of Benjamin, Giere673, and Parish disclose all of the limitations of claim 4, which indirectly depends from claim 1, and claim 14, which indirectly depends from claim 11. Pet. 59–62; Ex. 1002 ¶¶ 262–283. Patent Owner argues that this challenge “fails for at least the same reasons discussed above relative to” the challenge based on Benjamin and Giere673. Prelim. Resp. 48–49.

We have reviewed the arguments and evidence of record thus far and find that, for purposes of institution, Petitioner adequately shows how Benjamin, Giere673, and Parish teach or suggest each limitation of claims 4 and 14, and that Petitioner sufficiently shows that a person of ordinary skill in the art would have had a reason to combine the teachings of Benjamin, Giere673, and Parish with a reasonable expectation of success. Pet. 59–62; Ex. 1002 ¶¶ 262–283.

E. Asserted Obviousness over Benjamin and Giere178

Petitioner contends that claims 1–3, 5–13, and 15–17 would have been obvious over the combined teachings of Benjamin and Giere178. Pet. 62–77. Having already determined that Petitioner shows a reasonable likelihood of establishing that all of the elements of the challenged claims are taught or

suggested by the prior art as discussed above, we need not address this ground in full. We offer the following comments in response to the parties' arguments and evidence to provide guidance to the parties.

Giere178 teaches an apparatus that includes (i) “a substrate and a resistive element attached to a region of the substrate and formed of a first material having a first temperature coefficient of resistivity,” (ii) “a pair of traces coupled to the resistive element, attached to the substrate, and formed of a second material having a second temperature coefficient of resistivity with the first material selected so that the first temperature coefficient of resistivity exceeds the second temperature coefficient of resistivity,” (iii) “a substrate and a resistive element disposed onto a first region of the substrate and formed of a first material having a first temperature coefficient of resistivity,” and (iv) “a pair of traces coupled to the resistive element and each formed of a first plurality of sections of a second material having a second temperature coefficient of resistivity and a second plurality of sections of a third material having a third temperature coefficient of resistivity.” Ex. 1007, code (57).

Giere178's Figure 3, as annotated by Petitioner, is reproduced below.

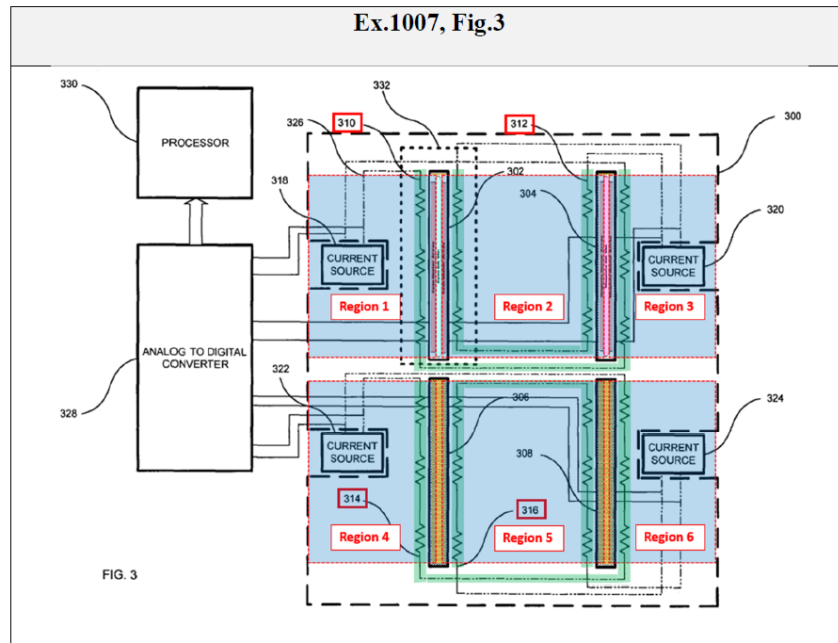


Figure 3 “is a high level schematic diagram of an embodiment of the temperature measurement system” described in Giere178. Ex. 1007, 1:56–57. Petitioner annotates Figure 3 by coloring resistive elements 310, 312, 314, and 316 green, and by coloring areas it labels as Regions 1–6 blue. Pet. 67. Referring to annotated Figure 3, Petitioner contends that “[e]ach region of Giere178’s substrate 300 includes a single temperature sensing resistive element [green].” *Id.* at 66 (citing Ex. 1002 ¶ 323). Petitioner further contends that “[a] PHOSITA would also know that Giere178 includes a temperature sensor in each region because [it is] solving a problem of excessive *localized* heating of the substrate in each region.” *Id.* at 67 (citing Ex. 1007, 5:36–51, 5:52–6:3, 8:51–54; Ex. 1002 ¶¶ 324–325). Petitioner contends that “[t]he temperature sensed by the resistor also senses the temperature of the adjacent heater arrays because the substrate’s temperature in that region changes based on the heat generated by the firing resistors.” *Id.* (citing Ex. 1007, 5:39–46; Ex. 1002 ¶ 335).

Patent Owner argues that Petitioner’s contentions “rel[y] on the false premise that [Giere178] discloses four ink feed slots/ink vias located in elongated regions 302, 304, 306, and 308 with heater arrays on both sides of each via so that a single TSR is located within every thermal region between ink vias.” Prelim. Resp. 49. Patent Owner also argues that Petitioner “confusingly illustrate[s] the alleged combination using the modified and multiplied temperature sense resistor from Ground 1 that was based on an alleged modification of [Giere673] (which is not even a part of Ground 2’s combination).” *Id.*

On this record, we find that Patent Owner’s arguments have merit. As Patent Owner points out, Giere178 states that “[a]lthough not shown in FIG. 3 for ease of illustration, substrate 300 includes the structures of a typical printhead such as, ink feed slots, ink ejection chambers, firing resistors, etc.” Prelim. Resp. 51(citing Ex. 1007, 8:41–47). Giere178 separately teaches that ink is

fed to the various ink ejection chambers either through an elongated hole formed in the center of the bottom of the substrate, “center feed,” or around the outer edges of the substrate, “edge feed.” In center feed the ink then flows through a central slot in the substrate into a central manifold area formed in a barrier layer between the substrate and a nozzle member, then into a plurality of ink channels, and finally into the various ink ejection chambers. In edge feed ink from the ink reservoir flows around the outer edges of the substrate into the ink channels and finally into the ink ejection chambers.

Ex. 1007, 3:37–47. In other words, Giere178 does not teach a plurality of ink vias. *Id.*; *see also* Prelim. Resp. 51 (“There is no mention or suggestion of multiple ink slots or of slots located in the non-central regions 302, 304, 306, and 308.”).

As a result, Petitioner’s argument that “Benjamin and Giere178 are both reasonably pertinent to maintaining the optimal temperature of a multi-via heater chip allegedly solved by the inventors of the ’823 patent” appears to be contradicted by Giere178’s disclosures. Pet. 76 (citing Ex. 1002 ¶ 240). Moreover, Petitioner relies on its arguments with respect to the combination of Benjamin and Giere673 when arguing that a PHOSITA would have been motivated to combine Benjamin and Giere178. *See, e.g., id.* at 76 (citing to ¶¶ 239–262 of the Pond Declaration, which discuss the combination of Benjamin and Giere673, to support the contention that “ample motivation existed to combine Benjamin with Giere178”). In light of the differences between the disclosures in Giere178 and Giere673, Petitioner’s reliance on the arguments made with respect to the combination of Benjamin and Giere673 do not appear to be sufficient to support a motivation to combine Benjamin and Giere178.

We invite the parties to develop these arguments further at trial, to the extent permitted by our rules.

F. Alleged Obviousness over Yabe and Giere673

Petitioner contends that claims 1–3, 5–13, and 15–17 would have been obvious over the combined teachings of Yabe and Giere673. Pet. 78–117. Having already determined that Petitioner establishes a reasonable likelihood of showing that all of the elements of the challenged claims are taught or suggested by the prior art as discussed above, we need not address this ground in full. We offer the following comments in response to the parties’ arguments and evidence to provide guidance to the parties.

Yabe “relates to the structure of the element base plate (heater board) of an inkjet recording head.” Ex. 1008, 1:9–11. In particular, Yabe describes a plurality of heat generating resistive elements arranged on a base

plate for generating thermal energy for discharging ink as ink droplets, a plurality of ink discharge ports each arranged in a position facing each of the heat generating resistive elements, a plurality of ink flow paths each communicated with each of the ink discharge ports, and elongated ink supply ports arranged on the base plate along the lines of the heat generating elements for use of ink discharges, being communicated with the plurality of ink flow paths. *Id.* at code (57). The base plate also has means for detecting the temperature of the base plate, and means for heating the base plate, arranged on the base plate in the vicinity of the end portion of the ink supply ports in the longitudinal direction. *Id.*

Petitioner contends that, although Yabe discloses one or more temperature detecting means, it does not explicitly teach disposing the temperature detecting means “substantially centrally with respect to the region substantially adjacent to both the first heater array and the second heater array and further extending substantially the length of the first heater array and second heater array.” Pet. 88 (citing Ex. 1008, 2:11–12, 2:49–54; Ex. 1002 ¶ 454). Petitioner then contends that Giere673, like Yabe, “optimizes the print quality of the inkjet printer based upon the temperature value provided by the TSR,” and, unlike Yabe, “explicitly discloses putting the TSR between the heater arrays (and extending the length of the arrays) to provide a sufficiently accurate temperature value to meaningfully improve print quality.” *Id.* at 89 (citing Ex. 1002 ¶ 467) (emphases omitted).

Petitioner contends that

[a] PHOSITA would have understood that the temperature sense resistor . . . is at least in substantially centrally—if not exactly the centre—of each region because [Giere673 discloses that] the TSR 510 “preferably is not located adjacent to any particular heating elements” so that the obtained TSR value “reflects the

temperature of the substrate 410 after heat has moved from the heating elements to the TSR 510.”

Id. at 94 (citing Ex. 1005, 4:51–61, 2:50; Ex. 1002 ¶ 312) (emphases omitted).

Patent Owner argues that Yabe “fails to disclose fundamental aspects of independent claims 1 and 11, instead disclosing sensors arranged along the periphery of the printhead die at locations outside of the regions between ink vias” and also does not disclose “any heater arrays operable to receive heating responsive to temperature sensed in an adjacent substrate region.” Prelim. Resp. 58. Petitioner, however, relies on Giere673 with respect to the location of the temperature sensors and the operability of the heater arrays to respond to the sensed temperature. *See* Pet. 91, 94–95, 97–99. Patent Owner also argues that Giere673 does not disclose the claimed centrally-located temperature sensing element, second and third heater arrays, or multiple ink vias. Prelim. Resp. 58–59. These arguments improperly attack the references individually, rather than as part of the asserted combination. *See In re Merck*, 800 F.2d at 1097; *see also* Section II.C.3 *supra* (making similar arguments with respect to Giere673).

We invite the parties to develop these arguments further at trial, to the extent permitted by our rules.

G. Alleged Obviousness over Yabe, Giere673, and Parish

Petitioner contends that the combined teachings of Yabe, Giere673, and Parish disclose all of the limitations of claim 4, which indirectly depends from claim 1, and claim 14, which indirectly depends from claim 11. Pet. 117–119; Ex. 1002 ¶¶ 601–625. Patent Owner argues that this challenge “fails for at least the same reasons discussed above relative to” the challenge based on Yabe and Giere673. Prelim. Resp. 63. Having already

determined that Petitioner establishes a reasonable likelihood of showing that all of the elements of the challenged claims are taught or suggested by the prior art as discussed above, we need not address this ground.

III. CONCLUSION

Based on the arguments in the Petition and the Preliminary Response, and the evidence of record, we determine that Petitioner establishes a reasonable likelihood that it will prevail on its challenge to at least one claim of the '823 patent. Accordingly, we institute an *inter partes* review of all the challenged claims on all the grounds presented in the Petition.

The factual findings set forth in this Decision are preliminary and provided for the sole purpose of deciding whether to institute a review. Any final findings will be based on the full trial record, including any information presented in a timely filed response to the Petition. *See Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016) (noting that “there is a significant difference between a petitioner’s burden to establish a ‘reasonable likelihood of success’ at institution, and actually proving invalidity by a preponderance of the evidence at trial”) (quoting 35 U.S.C. § 314(a); comparing *id.*, with § 316(e)).

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that that an *inter partes* review is instituted with respect to all of the grounds asserted in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which shall commence on the entry date of this Decision.

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