

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

Petitioners,

v.

SLINGSHOT PRINTING LLC,

Patent Owner.

Case No. IPR2023-00312

Patent No. 7,484,823

PETITIONER CANON'S REPLY TO PATENT OWNER'S RESPONSE

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Ex. 1002	Declaration of Stephen F. Pond, Ph.D.
Ex. 1003	File History of U.S. Patent 7,484,823
Ex. 1004	U.S. Patent No. 7,384,113 to Benjamin <i>et al.</i> (“Benjamin”)
Ex. 1005	U.S. Patent No. 6,612,673 to Giere <i>et al.</i> (“Giere673”)
Ex. 1006	U.S. Patent No. 7,163,272 to Parish <i>et al.</i> (“Parish”)
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Ex.1018	William A. Buskirk et al., Development of a High-Resolution Thermal Inkjet Printhead, Hewlett-Packard J. 39, No. 5, 55 (1988)
Ex.1019	U.S. Patent No. 7,278,703 to Benjamin <i>et al.</i> (“Benjamin703”)
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I. INTRODUCTION

The '823 patent's challenged claims are unpatentable over the asserted prior art grounds.¹ The Patent Owner Response ("POR") fails to refute the Petition's compelling showing of unpatentability, instead rehashing the arguments that the Board rejected in its institution decision ("ID"). Nor does the declaration from PO's expert, Mr. Steven J. Dietl, offer anything new. Instead, it parrots the attorney arguments. Accordingly, the challenged claims must be cancelled as unpatentable.

II. GROUND 1: BENJAMIN+GIERE673 RENDERS OBVIOUS THE CHALLENGED CLAIMS

For the first ground (Benjamin+Giere673), the parties' dispute centers on two issues—namely, whether a PHOSITA would have found it obvious to: (1) substantially centrally dispose a sensor within each of Benjamin's thermal regions separated by insulating ink vias, and (2) supply heat to adjacent heater arrays in response to sensed temperature of the region. *Compare* Pet:7-54 *with* POR:40-55. In the ID, the Board preliminarily found that Giere673's teaching's would have motivated a PHOSITA to do both. ID:18-22. Rather than squarely address these

¹ Capitalized terms not otherwise defined have the same meaning as set forth in the Petition.

findings, the POR rehashes the same arguments that the Board already addressed in the ID. POR:40-55. Nothing in the POR warrants a different finding.

A. Giere673 Teaches Disposing a Single TSR in a Thermal Region Between Two Heater Arrays, Equidistant from Each

PO argues that Ground 1 fails because “neither Benjamin nor Giere673 suggest monitoring of temperatures in regions **between ink vias**.” POR:40-41.

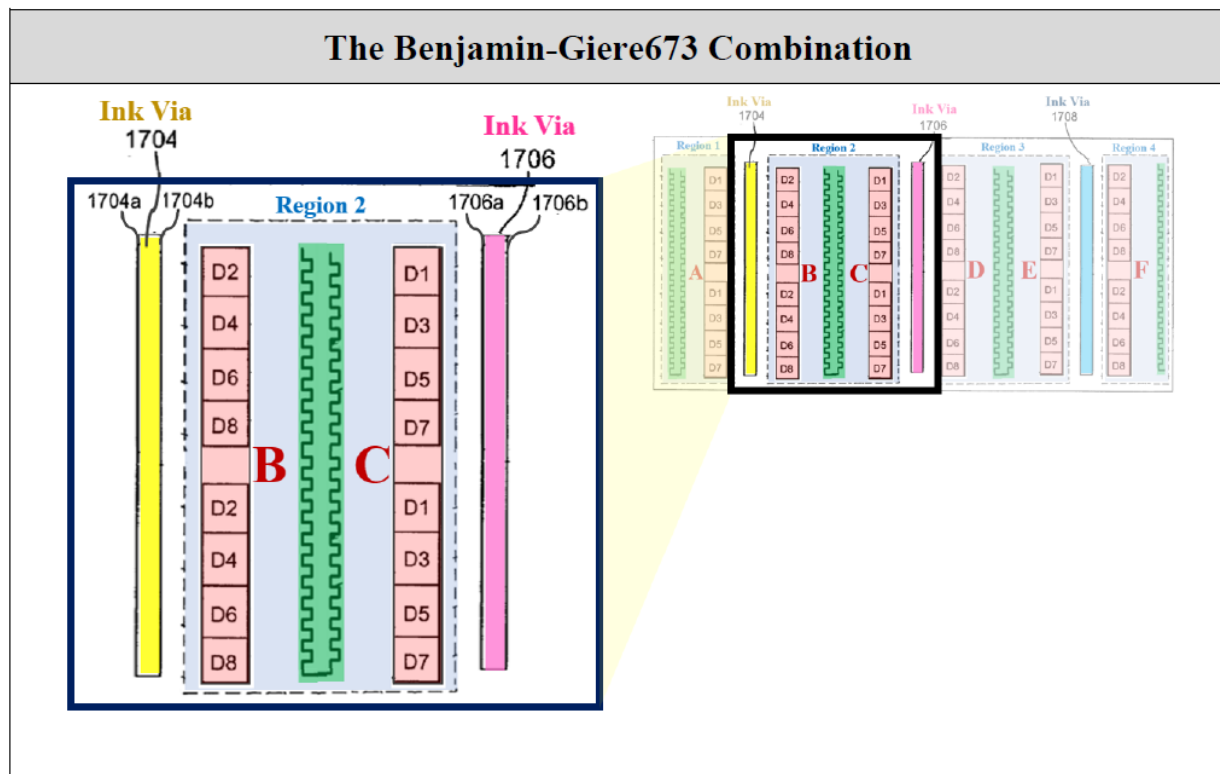
PO is wrong for several reasons.

First, PO’s attempt to recast the claim language as disposing the temperature sensing element “*between ink vias*,” rather than between heater arrays (*id.*), is classic misdirection. The claims require that each temperature sensing element be “substantially centrally disposed with respect to the region,” and the claims define each region as “positioned between the [first/third] heater array and the [second/fourth] heater array.” Ex.1001, claim1. The temperature sensing element’s sole purpose is to measure the temperature produced by the heater arrays (the heater arrays also happen to “each b[e] associated with its respective ink via”). *Id.* PO recasts the claim so that it can argue that each individual reference² does not have a temperature sensor between **ink vias**. POR:41. Of course, as established by

² The Board has already admonished PO about analyzing references in isolation, as discussed further below. ID:17-18.

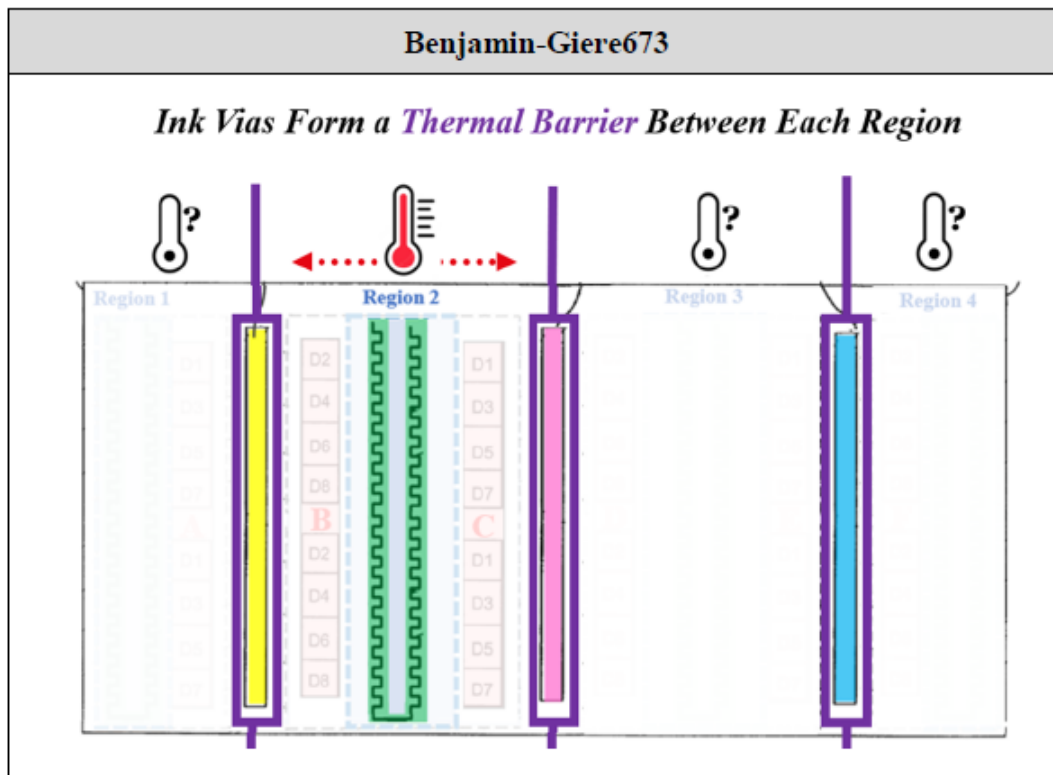
the Petition and summarized below, (i) Giere673 teaches a single temperature sensor in a region between heater arrays, and (ii) the combination includes a temperature sensor in each of Benjamin's regions between its heater arrays (and also between its ink vias). Pet:9-27.

Second, Giere673 expressly discloses a TSR in a thermal region between two heater arrays (i.e., the claimed temperature sensing element). Pet:27-33,54-56; Ex.1002, ¶¶138-156; Ex.1005, 4:55–56. The Petition noted that, while Benjamin does not identify the location of its TSR (Pet:28), Giere673 clearly discloses a single TSR disposed in a region between two heater arrays, with “two legs that are approximately 680 um inboard from the center of the columns of ink ejection elements 416” (e.g., resistor heater elements). Ex1005:4:36–39, 4:55–56, 5:10–12; Fig. 5. Benjamin uses its TSR to determine a temperature of a printhead die (Ex.1004,79:60–67, Fig. 25B), and Giere673 makes clear that its TSR 510 measured the temperature between two heater arrays after heat has moved from the heating elements to the TSR 510. Ex.1005, 4:57–60.



Pet:27-33,54-56; Ex.1001:2:1–15, 2:28–29, 2:47–49; Ex.1005, Fig.5, 4:55–56.

The Board reached the same conclusion. ID.17-19. Because “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; Ex.1001,2:1–15, 2:47–50; Ex.1002,¶¶247–249), the Board expressly found 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:18). See also Pet:28; Ex.1008,3:16–21.



Third, PO’s argument—that neither Benjamin nor Giere673 teaches substantially disposing the requisite temperature sensor within *each* region (POR:42)—also fails because it ignores black-letter law by incorrectly focusing on each reference’s individual teachings, rather than their combined teachings. ID:17 (citing *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986)). The Petition, supported by Dr. Pond, established that a PHOSITA would have positioned the TSR within each region “equidistant from the two heater arrays adjacent the region ... and not less than ‘approximately 680 μ m inboard from the center of the [heater arrays].” Pet:32; Ex. 1005, 5:9–12. In that regard, the Board specifically “credit[ed] Dr. Pond’s testimony,” which remains unrebutted, “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.” ID:19; Ex.1002,¶159.

The best PO can muster to support its position is an errant citation to *Par. Pharm.* for the proposition that “demonstrating that all claimed limitations are disclosed in the prior art is a threshold component of any obviousness challenge.” POR:40. But *Par. Pharm.* does not support that proposition. There, the Court reiterated that inherency is “a high standard” that requires “the limitation at issue necessarily must be present.” 773 F.3d 1186, 1196 (Fed. Cir. 2014). Obviousness is clearly “separate and distinct” from inherency and anticipation. *Jones v. Hardy*, 727 F.2d 1524, 1529 (Fed. Cir. 1984). Nevertheless, every claim element is present in the combination.

B. Giere673 Teaches Supplying Heat to Adjacent Heater Arrays Based on the Sensed Temperature Between Two Heater Arrays

PO contends that “Giere ’673 does not disclose temperature control by providing heat to heater arrays responsive to the temperature sensed by a temperature sensing element in an adjacent region.” POR:45-46. Not so.

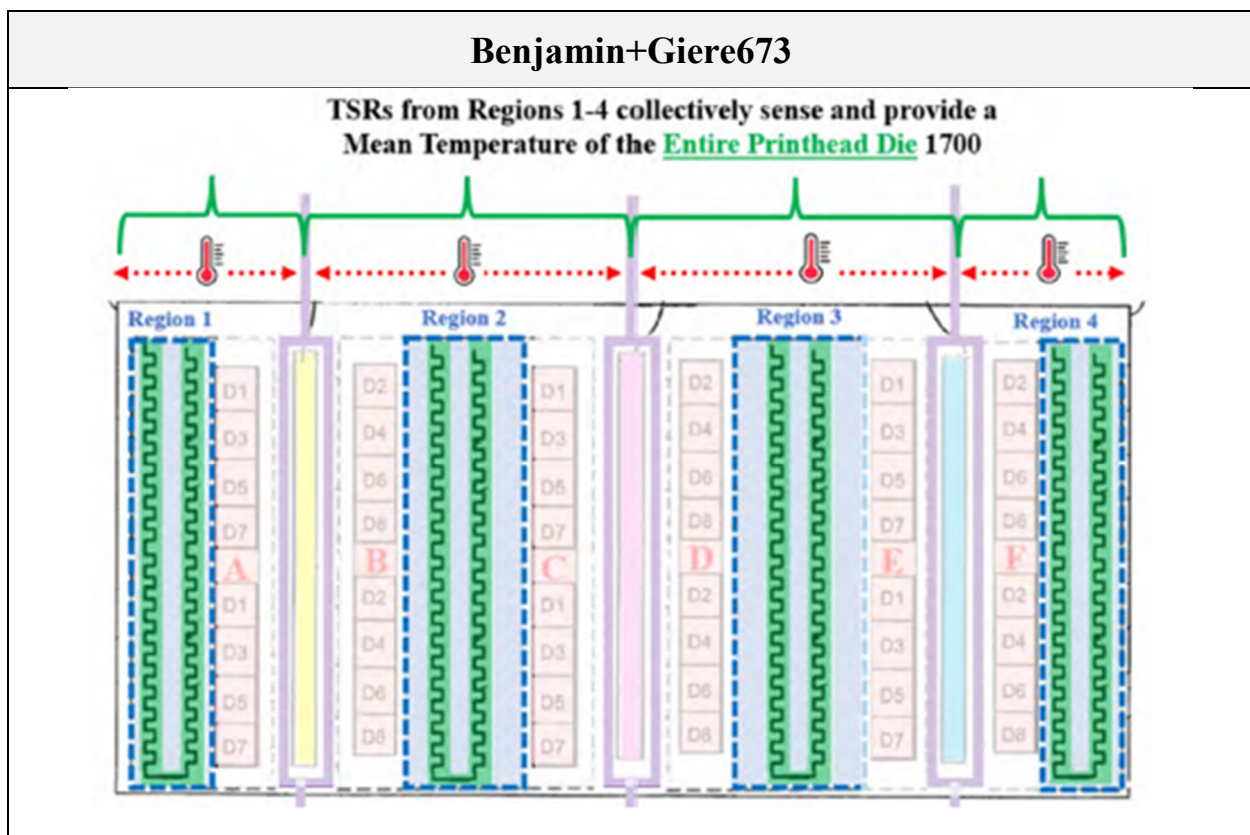
To control “the temperature of the substrate and the temperature of each ejection chamber or nozzle chamber,” Giere673 teaches that “temperature sensors .

. . 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; Ex.1005, 3:1–6. Because, in the combination, the ink vias act as thermal insulators between the four different regions of Benjamin’s die, the TSR value accurately represents only the temperature between the two adjacent ink vias. *Id.*; Ex.1002 ¶ 165. 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.” Pet:35; Ex.1005, 2:62–65, 7:41–45, 9:8–19.

PO next claims that “Giere ‘673 does not describe a temperature control system that regulates heat to adjacent heater arrays in response to the temperature sensed by the u-shaped TSR 510 emphasized by Petitioners.” POR:46. Wrong again. Giere673’s temperature controller is coupled to multiple temperature sensors, which determine “an actual local temperature profile near designated ink ejection elements.” Ex.1005,2:57–62, 4:55–56. The temperature controller then selectively fires particular heating elements based on thermal conditions. *Id.*, 2:57–62, 3:3–6. The Board likewise concluded that “[t]hese 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:19.

PO next faults Giere673 for failing to “provide any guidance on how to implement such an approach.” POR:46. But there is no disputing the simple, routine, and low-cost nature of the combination, including adding a temperature controller and thermal sense resistors to a printhead die; nor that it would have further motivated a PHOSITA to make the combination. Pet:56-58; Ex.1002, ¶¶258-60.



And the Board already considered— and rejected—PO’s reprised argument. ID:20 (“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.”).

Nothing in the POR justifies revisiting that finding.

C. Giere673 Provides Ample Motivation for the Benjamin+Giere673 Combination

PO next argues that “the proposed modifications to Benjamin are based on hindsight-driven cherry picking and reconstruction.” POR:47. Not so.

First, PO’s argument knocks down a straw man of its own creation. Ground 1 of the Petition never claimed that the similarity between the printheads disclosed in Benjamin and Giere ’673 would have motivated a PHOSITA to “place a single temperature sense resistor in one region between heater arrays in Benjamin’s printhead based on Giere673’s teachings due to alleged ‘structural similarities’...between the references.” POR:49. Rather, the Petition, supported by Dr. Pond’s testimony, established that the “**improved optimization** of the print quality” obtained by using Giere673’s TSR positioned between two heater arrays would have motivated one of ordinary skill in the art to modify Benjamin to include Giere673’s teachings of a TSR between heater arrays. Pet:26; KSR, 550 at 417.

Second, a PHOSITA would be motivated to implement this improvement even if “Benjamin already provides a suitable and cost-effective approach for monitoring average printhead temperature.” POR:48. Giere673 need not present the globally best temperature-sensing technique, or even the most efficient one; it need only present one that would improve Benjamin. *See In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004). Dr. Pond explained that a PHOSITA would not only have motivated by the advantages yielded by Giere673’s temperature control system, but would have recognized it as necessity for Benjamin’s die “[t]o operate over the widest range of environmental temperatures and the heaviest printing (drop firing) loads.” Ex.1002, ¶¶252-256 (combining Giere673’s temperature monitoring system with Benjamin’s die “adequately allow for countermeasures against the soft and hard failure modes known to occur” in Benjamin’s printhead die, including “reduced or unacceptable print quality” and “the ‘burn out’ of the heater resistor”), ¶257 (“excessive localized heating of the substrate without compensation for the substrate temperature change can lead to degradation in print quality.”); Ex.1007, 5:36-51 (“localized heating of the substrate can occur from firing nozzles at a greater frequency in a particular region of the printhead.”).

Tellingly, Slingshot never argues that the combination would no longer be able to sense the temperature of the entire printhead, as described in Benjamin. Nor

could it, as the information necessary to determine the temperature of the printhead, i.e., the average temperature of all regions, is not somehow lost in the modification (*id.*), and a PHOSITA would continue to monitor the temperature of the entire printhead in addition to the regions between heater arrays for improved operation. Ex.2004,106:17-108:20; *Navico Inc. v. ITC*, Appeal No. 2016-1533, at *15-16 (Fed. Cir. June 2017).

The same is true even if the Benjamin+Giere⁶⁷³ combination “would unnecessarily add cost and take up space on the printhead die and/or flex circuit,” as PO speculates. POR:44-45. *Orthopedic Equipment Co., Inc. v. U.S.*, 702 F.2d 1005, 1013, 217 U.S.P.Q. 193 (Fed. Cir. 1983) (finding irrelevant “[t]he fact that the two disclosed apparatus would not be combined by businessmen for economic reasons”). PO insists that “if a PHOSITA were somehow driven to sample the temperature in areas between ink vias, the solution consistent with the single TSR contact pad of Benjamin’s flex circuit would have been to employ one continuous TSR that winds between the vias, providing a single temperature value and requiring only a single temperature input and output.” POR:45. But neither reference uses a serpentine TSR between different regions. Moreover, Dr. Pond explained during his deposition that a PHOSITA would not do this because “you can't control [or] modulate the drop size in as short of time intervals as if you had more sensors, particularly ones in each region.” Ex:2004, 107:3-108:18.

Giere673's optimization of print quality justifies the moderate added cost of multiple sensors in the combination. *Id.*

D. Giere673 Provides the Necessary Motivation to Substantially Centrally Dispose Giere673's TSR Within Each of Benjamin's Thermal Regions

PO also claims that “[n]either Benjamin, Giere673, or any background art cited by Petitioners would have suggested to a PHOSITA that they should detect temperature on a region-by-region basis where regions are separated by ink vias having heater arrays on both sides of the via.” POR:43. This is not true.

First, per above, Giere673 provides the motivation needed to dispose a TSR between a pair of heater arrays. Pet:23–24; Ex.1002, ¶¶149–169. In particular, Giere673 undeniably teaches that using “**one** or multiple TSRs 510 [between two heater arrays] can be used to provide an approximation of the [that region] of the substrate.” Ex.1005, 2:56-3:6. Giere673's temperature controller then selectively fires particular heating elements based on thermal conditions that it measures. *Id.*, 3:3–6. To obtain Giere673's **optimized performance**, a PHOSITA would know to place a single TSR between each pair of Benjamin's heater arrays. Stated differently, it would make no sense to place a TSR only between one set of heater arrays, as that would not provide the optimized performance for the entire printhead. The Board preliminarily agreed. ID:28; Ex.1005,2:57–62, 3:3–6.

Second, Giere673 also provides the motivation for positioning a TSR equidistant from the two heater arrays but no less than “approximately 680 μm inboard from the center of the [heater arrays].” Pet:25 “By 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 [the region between the two heater arrays] and also acts as a predictive system for maintaining the substrate at an optimum temperature for producing ink droplets,” which means “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].” Pet:26; Ex.1005, 4:57–59.

Third, PO again improperly analyzes each reference individually instead of analyzing the Bengamin-Giere673 combination. When the combination is properly viewed as a whole, it is clear that PO’s argument that Giere673 only discloses temperature sensing for the entire board (*compare* POPR:35-36 with POR:40-41) and not for individual regions, is incorrect. A PHOSITA familiar with both references would have modified Benjamin’s device to include a TSR in each region between adjacent heater arrays, as taught by Giere673, to measure the

temperature and optimize performance in each respective region. Ex.2004,106:17-108:20; Pet.27-30; Ex.1002, ¶¶244-248.

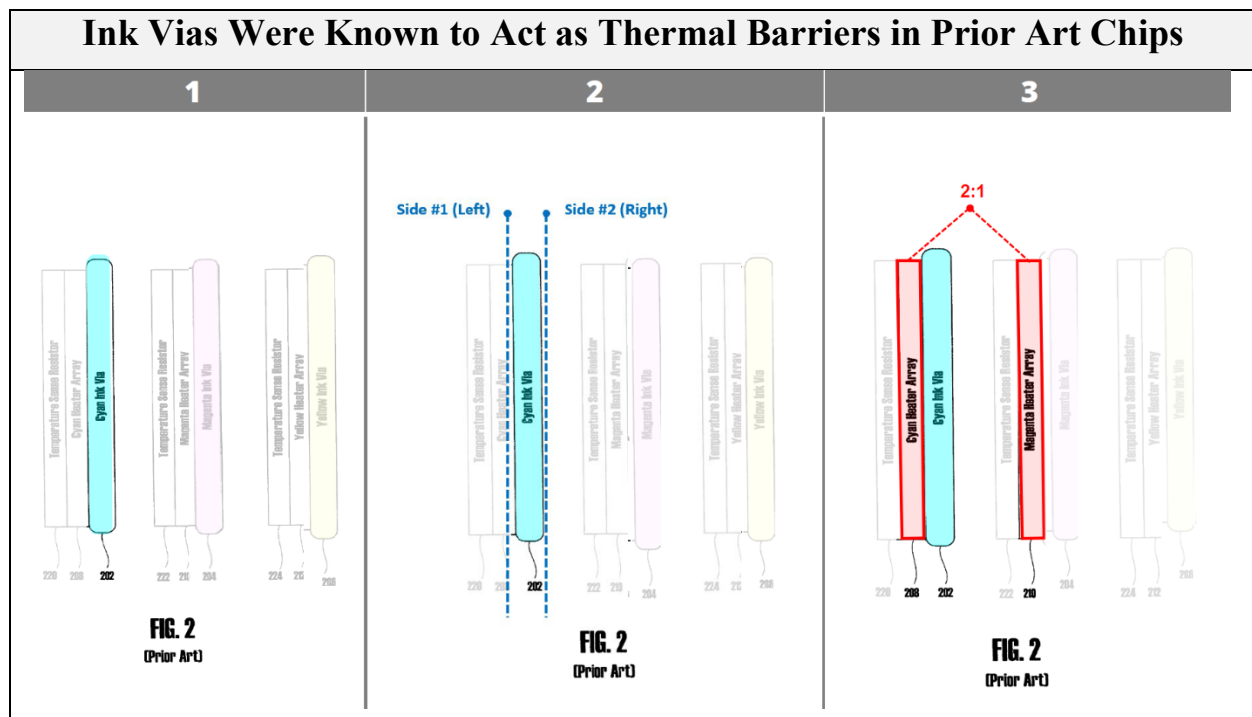
The Board reached the same conclusion. ID:17; Pet:27; Ex:1002,¶ 248.

E. The AAPA and Yabe Provide Independent Motivation to Dispose a Single TSR Within Each Region on Benjamin’s Chip

Even assuming *arguendo* that Giere673 failed to provide a motivation to place a TSR between each set of Benjamin’s heating elements, the applicant-admitted prior art (“AAPA”) and Yabe both provide “evidence of the knowledge that one of ordinary skill in the art would have had as part of [the] obviousness analysis.” *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362–63 (Fed. Cir. 2013); *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1374 (Fed. Cir. 2019).

PO argues that the AAPA never discloses the particular temperature sensing technique claimed by the ’823 patent. Once again, PO misses the point. The AAPA and Yabe provide the *motivation*, not the claim limitation (which is undeniably taught by Giere673). The AAPA admits 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.30; Ex.1002, ¶248. As such, a PHOSITA would have known to add Giere673’s TSR into each region to provide more accurate temperature measurement per color and avoid the issue of ink vias acting as thermal barriers. Pet.27-30; Ex.1002, ¶¶246-260.

Slingshot’s principal contention—that ink vias were not known to act as thermal barriers—is particularly specious given that the AAPA disposes a heater array on each longitudinal side of each ink via stating that “[t]he ink vias 202, 204, and 206 act as a **thermal barrier between the colors.**” Ex.1001, 2:11-15; Ex.2004, 107:3-108:18; Ex.1031; Ex.1032.



Moreover, PO’s contention is belied by “the ’823 patent’s discussion of [prior art] temperature sensing on a per-color basis (illustrated by Figure 2) being known,” which the Board found “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.” ID:19.

The POR next wrongly suggests that the AAPA is off-limits to the obviousness analysis. POR:39-42. Quite the opposite; “admissions in the specification regarding the prior art are binding on the patentee for purposes of a later inquiry into obviousness.” *PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*, 491 F.3d 1342, 1362 (Fed. Cir. 2007). Thus, the Board properly considered the AAPA when determining the common knowledge and creativity a PHOSITA would have exercised when making the Benjamin-Giere⁶⁷³ combinations. ID:28-32; *Sjolund v. Musland*, 847 F.2d 1573, 1577-79 (Fed. Cir. 1988).

The POR never addresses, let alone rebuts, the Board’s ID finding that Yabe “evidences that one of skill in the art would have known that ink vias act as thermal insulators between other regions, limiting the TSR’s effective reading to the region.” ID:24. Nor can it; the AAPA and Yabe each evidence not only that ink vias were known to act as thermal barriers, but also that sensing temperature on a per-color or region basis was also disclosed, each of which would have provided ample independent motivation to place a single TSR into each of Benjamin’s regions. (ID:17-20; Pet:26-30; Ex:¶160; Ex:1001, 2:1-15, 2:28-29, 2:47-49).

Thus, the AAPA and Yabe provide additional motivation to dispose a TSR within each of Benjamin’s thermal regions between two heater arrays.

**III. GROUND 2: BENJAMIN-GIERE673 IN VIEW OF PARISH
RENDERS OBVIOUS DEPENDENT CLAIMS 4 AND 14**

The POR presents no patentability argument unique to the “n-type implant donor thermal sense resistor” added by the dependent claims challenged in these grounds (Pet:59–62; Ex.1002, ¶¶ 262–283); it instead relies on the same meritless arguments against Benjamin and Giere673 raised in the prior ground (POR:55). The Board should reject these recycled arguments for the same reasons it did before. ID:23.

**IV. GROUND 3: BENJAMIN+GIERE178 RENDERS THE
CHALLENGED CLAIMS OBVIOUS**

PO raises two new challenges to Ground 3 (Benjamin+Giere178)—namely, that (i) Giere178 is non-analogous art because it only discloses a “center feed” or “edge feed” slot substrate; (ii) Giere178 does not teach or suggest positioning a single temperature sensor within each thermal region of the chip. POR:55-60. Each argument fails.

A. Giere178 Is Analogous and Includes a Plurality of Ink Vias

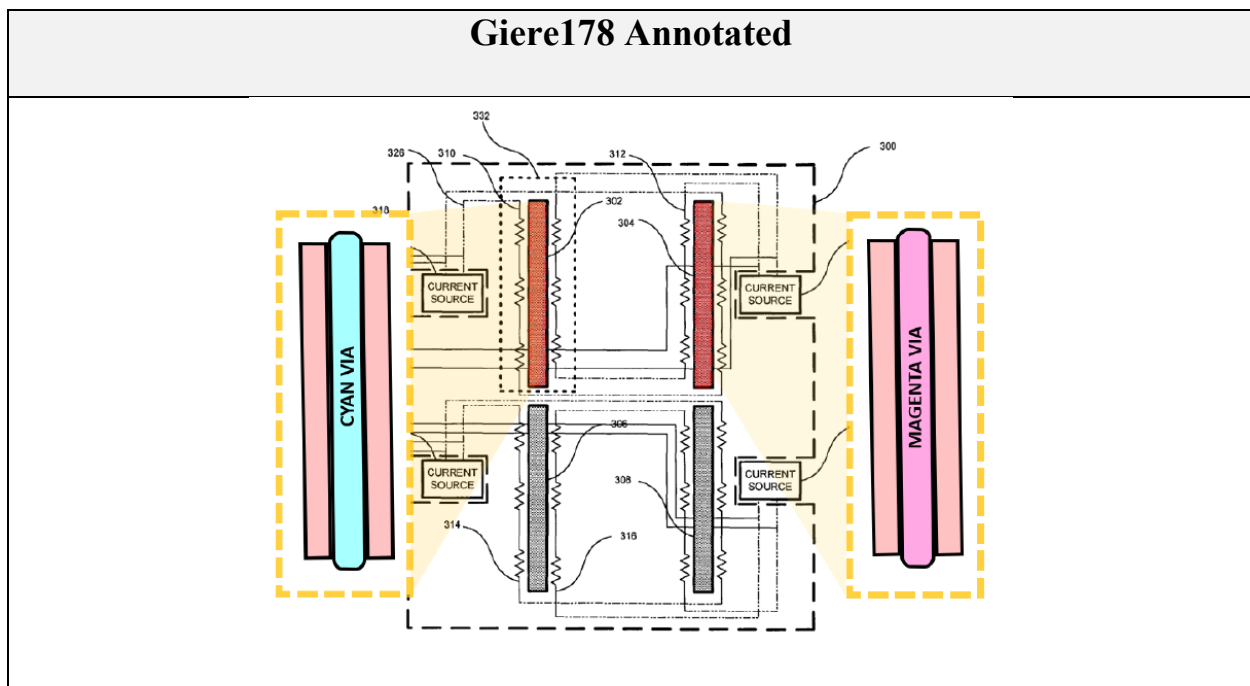
PO appears to argue that Ground 3 is not analogous to Benjamin because it “relies on the false premise that Giere178 discloses four ink feed slots/ink vias located in elongated regions 302, 304, 306, and 308 with heater arrays on both sides of each via.” POR:56. According to PO, “Giere178 makes no mention of multiple

ink vias on a single substrate or of vias located in the non-central regions 302, 304, 306, and 308.” POR:58. Not so.

First, Giere178’s written description expressly discloses that “substrate 300” in Fig. 3 “typically” includes “**ink feed slots**” (Pet:62-70; Ex.1007,8:45-47)—a term both parties’ experts agree is synonymous with the term “ink vias,” *compare* Ex.2004 (“ink feed slots” are “synonymous with ink vias” because “both are elongated holes formed in the substrate for allowing ink to pass from an ink reservoir to ink ejection chambers.”) *with* Ex.1031, 106:7-11 (“the term [ink feed slot] is “***synonymous***” because “in some patents they are called ink feed slot, and in some patents it's called via, and they *refer to the same thing* but different terminology.”). As Dr. Pond explained at his deposition, “[i]nk Feed Slots is in plural, so we know there are multiple ink feed slots and that they were typical structures found in print heads.” Ex.2004.

Figure 3 of Giere178 makes this even more clear by depicting regions 302, 304, 306, and 308 of substrate 300 as elongated rectangles, which is the ordinary shape used by skilled artisans to typify nozzle arrays and associated firing resistors for ejecting ink, which are co-located adjacent their respective ink feed slots in a typical inkjet printhead. Ex.2004,74:11-75:21; Pet.62-70; Ex.1002:¶270; Ex.1007:8:45-47, 3:36-38; Ex.1008,2:59-3:4. Because Giere178 describes these regions as including “nozzles and associated firing resistors” a PHOSITA would

have understood that these regions must also include “ink ejection chambers” because, as Giere178 explains, the inkjet printhead has nozzles and firing resistors co-located with ink ejection chambers. Ex.1002 ¶270; Ex.1007, 2:59-3:4. This is also consistent with “typical inkjet printheads”—which is how Giere178 describes “the structures” of substrate 300.



Dr. Pond confirmed that “a PHOSITA would look at this drawing and *see the long and skinny shapes* and *recognize them* to represent two drop generators on both sides of a via” based on “his *ordinary knowledge*” because “it’s an old but *ordinary layout* of a multicolor chip.” Ex.2004, 73:16-74:10. Dr. Pond even explained the reason *why* the elongated rectangle normally typifies the location of

the ink vias. Ex.2004, 74:11-75:1; 138:19-139:18. Simply put, “it just falls out of the physics and engineering.” *Id.*, 75:1-2; Ex.1031:115:11-116:2.

Attempting to rebut Dr. Pond’s opinion that Figure 3’s rectangles depict the locations of four ink feed slots, PO relies on Giere178’s description of a substrate having a “center feed” or “edge feed” slot design. POR:48. But Giere178’s disclosure is not so limited. Only one embodiment has “a central *slot* in the substrate”—*singular* (Ex.1007,3:40-45), and it cannot be the one depicted in Figure 3 because that embodiment has “ink feed *slots*”—*plural* (Ex.1007:8:45-47); Ex.2004, 123:14-124:20. “Center feed” or “edge feed” slot designs (and Giere178’s description) relate to a printhead substrate for printing a single color where ink is fed from a single compartment in the cartridge through a central channel (or over the edge) to each of the groups of heaters. Ex.1007,3:53-56.

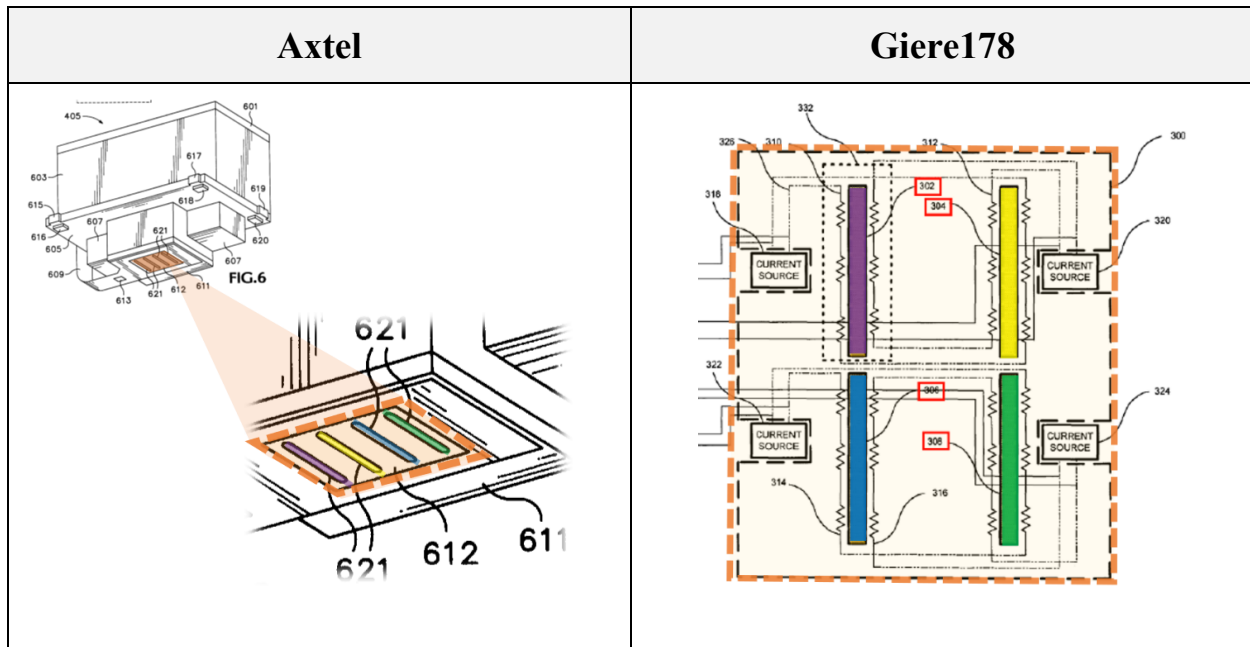
The POR fails to point out that Giere178 is not limited to “center feed” or “edge feed” slot designs (for a single-color printhead), and, instead, expressly discloses a single ink cartridge capable of printing **multiple colors**:

alternatively, **two dual-compartment cartridges may be used to contain the four color inks.**

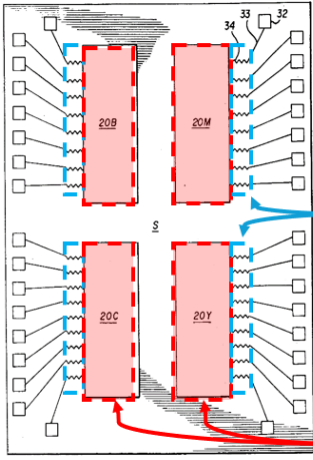
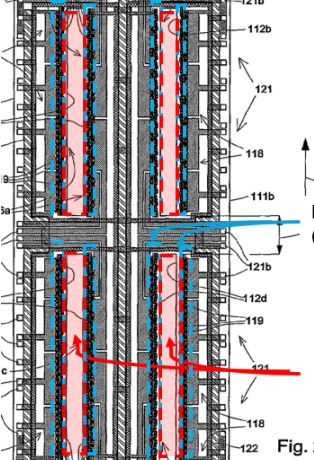
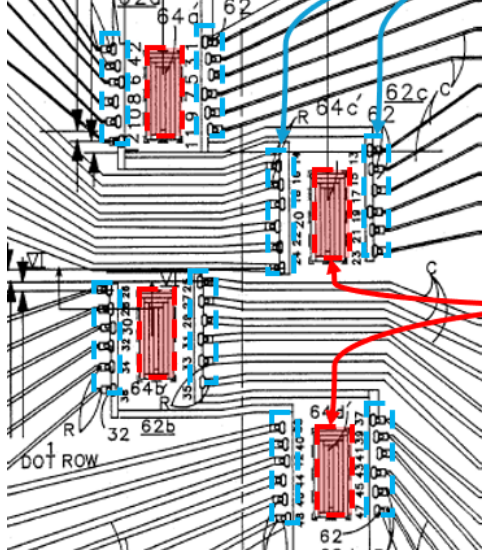
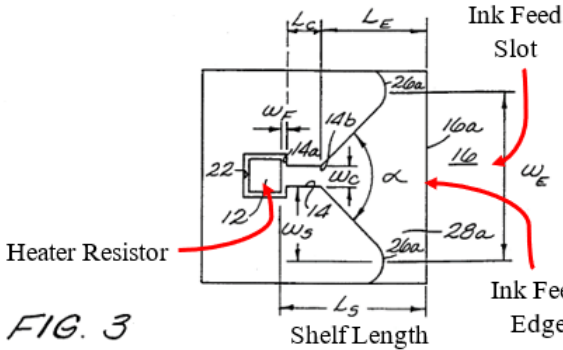
Ex.1007:3:55-65. While a center/edge feed slot designs make sense for a single-color print head, they are not useful in a multi-color printhead design which necessarily requires separation of the ink colors by having separate ink vias for

each color. Dr. Pond explained during his deposition that Mr. Dietl's re-drawing of Fig. 3 is not only "**a very wasteful, extraordinary thing to do**" because "**no PHOSITA would do that,**" it is also inconsistent with a PHOSITA's understanding. Thus, Figure 3's depiction of four rectangles is consistent with Giere178's disclosure of a substrate for use with a multi-color ink cartridge, i.e., having four ink feed slots in the substrate.

Moreover, Giere178 *incorporates by reference* a prior art patent, U.S. Patent No. 6,082,854 ("Axtel"), that discloses a typical multi-color printhead. *See* Ex.1011.8:30-40. Axtel's disclosure confirms a nozzle plate 612 (singular) shown below in Fig. 6 (left) that includes four sets of ink jet orifice arrays 621 [located adjacent to ink vias] for a "full, four color printing module." Ex.1011.15:42-16:7.



Because Giere178 teaches that Fig. 3 includes a substrate with **ink feed slots that were typical at the time**, and it also discloses **multi-color printing**, a PHOSITA familiar with typical multi-color printheads, would have appreciated that rectangles in Fig. 3 are multiple ink feed slots. For example, Dr. Pond identified several prior art patent references during his deposition (e.g., Moritz, Keefe, Courian) that describe typical Hewlett-Packard multicolor printheads from the time. Ex.2004,113:13-122:18. At the time of the Giere178 patent filing, it was typical that ink supply slots were located “very close, within a few 100 microns, of the heater arrays.” *Id.*,54:12-15; 120:11-125:6. As such, a PHOSITA reviewing Giere178 would have understood that for the multicolor design described in Giere178, the regions 302, 304, 306, 308 in Fig. 3, included different color ink fill slots close to their respective heater/nozzle arrays. Pet:69-70; Ex.1002, ¶¶312-315. The extrinsic evidence corroborating Dr. Pond’s opinion is provided below, and described in great detail by Dr. Pond during his deposition. Ex.2004, 113:11-125:6.

 Nozzle/Heater Columns (blue dotted outlines) Rear-Fed Ink Slots (red dotted outlines) FIG. 2 PRIOR ART	 Nozzle/Heater Columns (blue dotted outlines) Rear-Fed Ink Slots (red dotted outlines) FIG. 2
Ex.1034 (US5030971 to Drake) Fig. 2	Ex.1036 (US7008047 to Conta) Fig. 2
	 Heater Resistor Ink Feed Slot Ink Feed Edge FIG. 3
Ex.1035 (US4812859 to Chan), Fig. 5	Ex. 1037 (US5519423 to Moritz), Fig. 3

Dr. Pond’s opinions are further corroborated by a prior art inkjet textbook titled “Inkjet Technology and Product Development Strategies,” Torrey Pines Research (2000) (hereafter “Pond Textbook”). Dr. Pond’s prior art textbook

confirms that an ink feed slot needs to be “200 to 400 microns,” which was “just capturing this commonly acquired knowledge.”. Ex.2004,120:11-125:6 (“And when I put in my book in 2000 that region would be 200 to 400 microns, I was just capturing this commonly acquired knowledge.”), 113:21-126:2.

PO’s other arguments that Fig. 3 is a center-feed slot design lack merit. PO criticizes Dr. Pond’s interpretation of Fig. 3 because “connections from the analog to digital converter 328 are shown as traversing rectangular regions 302, 304, 306, and 308 where Dr. Pond asserts that vias would be located.” POR:26-27. But those are ‘off-chip’ connections. Put differently, the analog to digital converter 328 is not physically on the chip, but located off the “off” the chip and remotely connected to the chip vis-à-vis external wirings, such as flexible cables. Thus, there is no contradiction even if the connections from the analog to digital converter 328 are shown as traversing rectangular regions 302, 304, 306, and 308 in Fig. 3. Ex.2004,126:12-133:3. PO does not dispute that rectangular regions 302, 304, 306, and 308 also include nozzles and associated firing resistors (Ex.1007:8:47-49), so any contention that the yellow highlighted lines interferes with the contents of the region must be disregarded, Ex.2004.

B. Giere178 Provides Ample Motivation to Position a TSR in Each Thermal Region Between the Heater Arrays

PO argues that Giere178 also fails to disclose “placing a temperature sensor centrally in each region between adjacent vias operable to sense a temperature representative of the adjacent heater arrays for use in supplying heating to the arrays. POR:61. But PO ignores that Giere178 teaches using a heating pulse history to sense a temperature representative of each heater array within these regions. In other words, while the shared temperature sensor for Region 1 and 3 can measure the temperature of the heater arrays adjacent Region 1 and 3, the heaters in those regions are not firing at the same time, so the measured temperature is for whichever heater arrays happen to be firing. More specifically, Giere178 purposefully applies heating pulses to only one of the two heater arrays at a time to thereby sense a temperature representative of each. Ex.2004,28:1-14, 26:12-24

Dr. Pond further confirmed not only that temperature changes in Regions 1 and 3 depend on the firing pulse history of each of the heater arrays associated with Regions 1 and 3, but also that temperature changes could only be sensed by the Giere178 sensor 310 if the heaters adjacent to Region 1 were pulsed. *Id.*,25:21-28:9; 26:21-27:4 (confirming that one “could pulse heaters in different areas and watch it and learn about different regions from the single output.”). Additionally,

Dr. Pond explained that a PHOSITA would be motivated to arrange Giere178's sensors in Regions 1 and 3 in this fashion to save the cost of an additional current source and two additional bondpad and A/D unit connections. *Id.*,152:9-153:23; 106:3-107:5.

V. GROUND 4: YABE+GIERE673 RENDERS THE CLAIMS OBVIOUS

The POR presents two patentability arguments unique to the Yabe-Giere178 combination. PO argues that Yabe-Giere673 fails to render the challenged claims obvious because (1) “[t]he combination of Yabe and Giere673 does not disclose all limitations of the independent claims,” and (2) [t]he alleged motivations are illogical in view of Yabe’s teachings as a whole.” POR:67-70. Both arguments fail.

A. Both Yabe And Giere673 Teach Disposing a Temperature Sensor in Each Thermal Region Between Two Heater Arrays

PO contends that “neither Yabe nor Giere ’673 teach monitoring of temperature Regions between ink vias.” POR:67. This is false. For one, this argument recasts the claim language as disposing the temperature sensing element “*between ink vias*” instead of heater arrays; for another, the Petition established that (i) Giere673 teaches disposing a single temperature sensor in a region between heater arrays, and (ii) the combination disposes a temperature sensor in each of

Yabe’s thermal regions between its heater arrays (and also between its ink vias).

Pet:9-27.

B. Giere673 Teaches Substantially Centrally Disposing the Temperature in Each Region Between Two Heater Areas

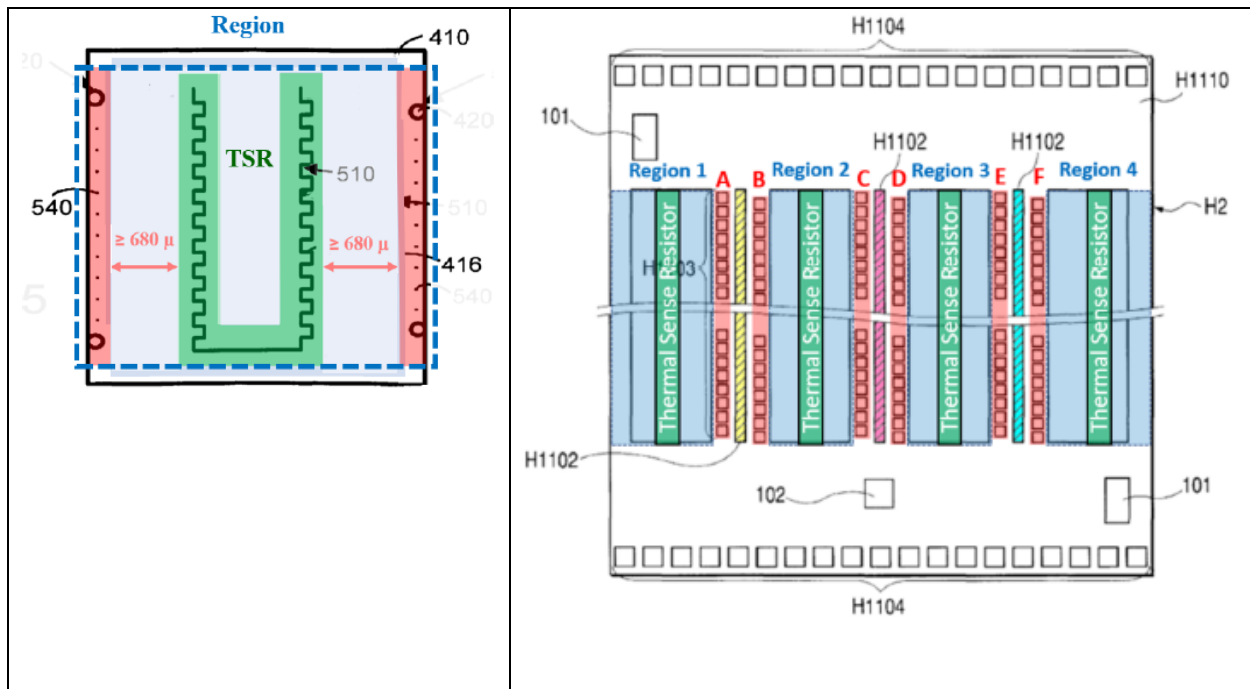
The POR next claims that “[n]either Yabe nor Giere ’673 teach temperature sensors substantially centrally disposed in regions between ink vias.” POR:67. Yet again, PO misses the point.

First, PO’s argument again improperly attacks the references individually, rather than as part of the asserted combination. *See In re Merck*, 800 F.2d at 1097; *see also* Ground 1 (the POR raising similar arguments for Giere673).

Second, the Petition relies on Giere673, not Yabe, for the location of the temperature sensors. Pet:88; Ex:1008, 2:11–12, 2:49–54; Ex:1002 ¶ 454.

Giere673 clearly teaches disposing a single TSR in the center of 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].’” Ex. 1005, 4:57–59). Pet:94-96; Ex.1002, ¶473; Ex.1005, 4:31-5:6.

Giere673	Yabe+Giere673
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“By positioning the TSR 510 in the centre of the region,” Dr. Pond explained that a PHOSITA would have understood from Giere673 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.” Ex.1002, ¶¶471-74 (explaining that “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].”); Pet:26; Ex. 1005, 4:57–59. The Board reached the same conclusion. ID:28; Pet:89; Ex.,1002 ¶467.

C. Giere673 Teaches Supplying Heat to Adjacent Heater Arrays Based on the Sensed Temperature of the Region Between the Two Heater Arrays

The POR argues that “neither Yabe nor Giere ’673 teach supplying heat to adjacent heater arrays in response to a temperature monitored in regions between ink vias.” POR:68. Not true. As explained in Ground 1 above, Giere673 discloses this limitation. Pet:35; Ex. 1005, 2:62–65, 7:41–45, 9:8–19.

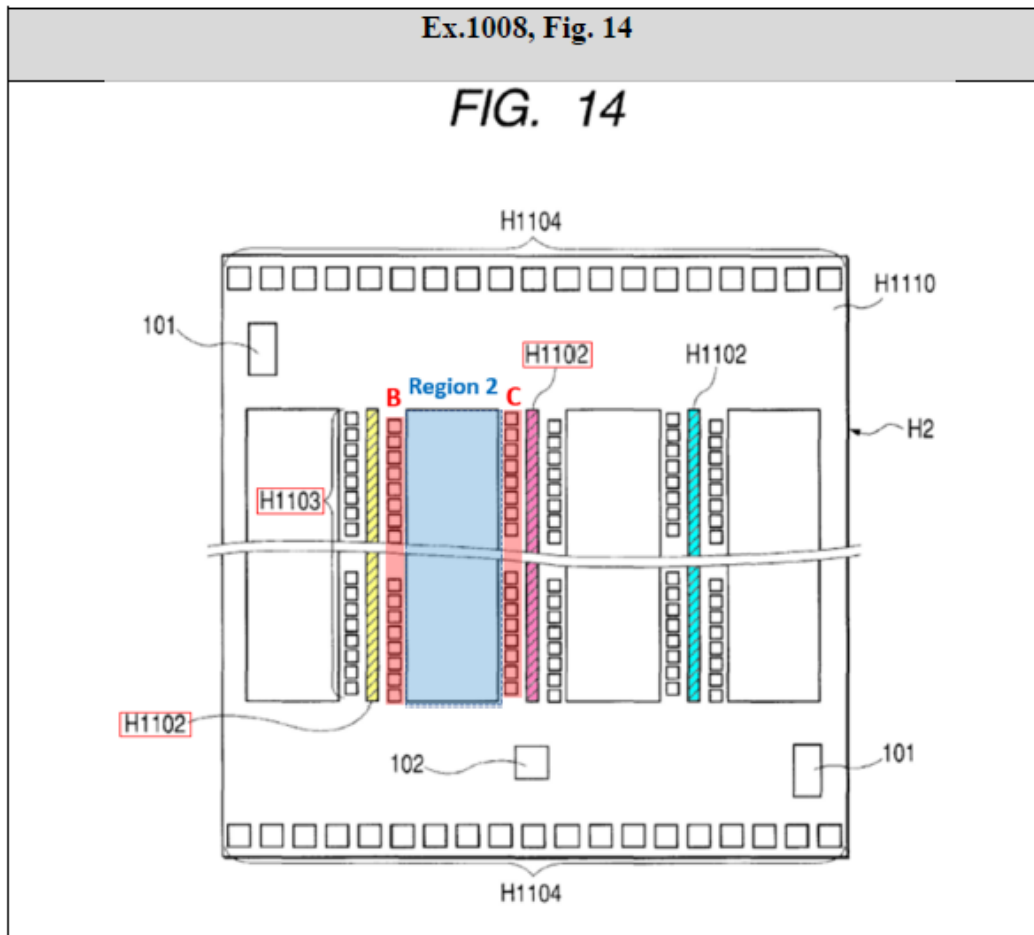
D. The Board Should Reject PO’s Invitation to Commit Legal Error by Not Addressing the Petition’s Motivations to Combine

After insisting that neither Yabe nor Giere673 individually disclose all claim limitations, PO concludes that “[t]he proposed combination of [Yabe and Giere673] necessarily fails” because “demonstrating that all claimed limitations are disclosed in the prior art is a threshold component of any obviousness challenge.” POR:69. That is wrong, both on the facts and the law.

First, despite PO’s contrary claim, Yabe and Giere 673 in combination disclose “a printhead chip having a temperature sensing element substantially centrally disposed between heater arrays,” and the combination regulates “heater array temperatures using temperatures sensed by such temperature sensors.” Pet:91-94; Ex:1002, ¶¶310-316; Ex.1005, 4:51–61, 2:50.

Second, PO’s argument yet again ignores that this is an obviousness analysis and thus such express disclosure in each individual reference is not required,

particularly here where Dr. Pond testified that in view of Giere673's disclosure, a PHOSITA would have been motivated to combine Yabe and Giere673 to arrive at the claimed invention:



Pet:90-96; Ex:1002, ¶¶306-320; *Nike, Inc. v. Adidas AG*, 812 F.3d 1326, 1335 (Fed. Cir. 2016) (“A claimed invention may be obvious even when the prior art does not teach each claim limitation, so long as the record contains some reason why one of skill in the art would modify the prior art to obtain the claimed invention.”). While Mr. Dietl repeats PO’s criticism that an express disclosure is

missing from the prior art, he never bothers to addresses Dr. Pond’s testimony that the claim limitations purportedly missing from the individual references would have been obvious in the combination. Ex.2003 ¶107. *In re Harza*, 274 F.2d 669, 671 (CCPA 1960) (“It is well settled that the mere duplication of parts has no patentable significance unless a new and unexpected result is produced”).

E. Both Yabe and Giere673 Provide Ample Motivation to Make the Combination Without Undue Experimentation

Desperate to avoid unpatentability, the POR claims that the “alleged motivations are illogical in view of Yabe’s teachings as a whole” because “Giere ’673 provides no motivation to place temperature sensors in the type of printhead relevant to the challenged ’823 patent claims POR:59-62.” Not true. For the reasons provided in Ground 1, Giere673 provides ample motivation to substantially centrally dispose a TSR within each of Yabe’s thermal regions between heater arrays. Ex.1002, ¶¶411-421; Ex. 2004,152:9-153:23. At bottom, PO provides no reason to disturb the Board’s findings underlying its conclusion of obviousness.

VI. GROUND 5: YABE AND GIERE673 IN VIEW OF PARISH RENDERS OBVIOUS DEPENDENT CLAIMS 4 AND 14

The POR presents no patentability argument unique to the “n-type implant donor thermal sense resistor” added by the dependent claims challenged in these grounds; it instead relies on the same meritless arguments it raised in Ground 4.

POR:72. The Board should reject these recycled arguments for the same reasons it did before. ID:28-30.

VII. CONCLUSION

Canon requests that the Board cancel each challenged claim as unpatentable.

Dated: February 12, 2024

/ Dion M. Bregman /
Dion M. Bregman, Reg. No. 45,645

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(a), Petitioner hereby certifies that Petitioner's Reply to Patent Owner's Response contains 5558 words according to the word count provided by the word processing program used to prepare this Reply (Microsoft Word). Pursuant to 37 C.F.R. §42.24(c), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing.

Dated: February 12, 2024

/ Dion M. Bregman /

Dion M. Bregman, Reg. No. 45,645

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e)(4), it is hereby certified that on February 12, 2024 an electronic copy of this PETITIONER’S REPLY TO PATENT OWNER’S RESPONSE AND EXHIBITS, were served via email to Patent Owner’s counsel of record in this proceeding:

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