

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. IPR2023-00313

Patent No. 7,594,708

PATENT OWNER'S PRELIMINARY RESPONSE

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- Ex. 2001 U.S. Patent Publication No. 2003/0142159 to Askeland *et al.* (“*Askeland*”)

I. INTRODUCTION

Patent owner Slingshot Printing LLC respectfully submits this Preliminary Response to Canon's Petition.

Petitioners fall far short of their burden of proving that *inter partes* review of the challenged claims 1-15 of U.S. Pat. No. 7,594,708 (the '708 patent) is warranted under the asserted grounds. 37 C.F.R. § 42.108(c). The '708 patent discloses and claims novel configurations for inkjet printheads, specifically a chip with a plurality of ink vias and a single temperature sensing element disposed within each region existing between two adjacent ink vias, with the temperature sensing element operable to sense a temperature representative of the heater arrays adjacent to the region and disposed at a predetermined distance away from the adjacent heater arrays.

Petitioners challenge the '708 patent claims as obvious. Citing prior art disclosing that detection of the average temperature of an entire printhead die is meaningful to regulating operational temperature, Petitioners conclusorily argue that those skilled in the art would have placed numerous sensors in different regions and then calculated an average temperature using these multiple sensors instead of detecting the average temperature using a single sensor in the same manner shown in the prior art. Petitioners also make unwarranted assumptions regarding certain prior art, inferring structure that is inconsistent with the overall design of the prior

art in order to draw parallels to the prior art. On the whole, Petitioners have done nothing but use the '708 patent itself as a template to pick and choose elements from prior art references in an attempt to reconstruct the claimed invention. In the process, Petitioners have drawn unwarranted conclusions about the prior art and how those skilled in the art would have interpreted prior art teachings.

Because the Petition does not show that at least one claim is reasonably likely to be invalid, institution should be denied. 35 U.S.C. § 314.

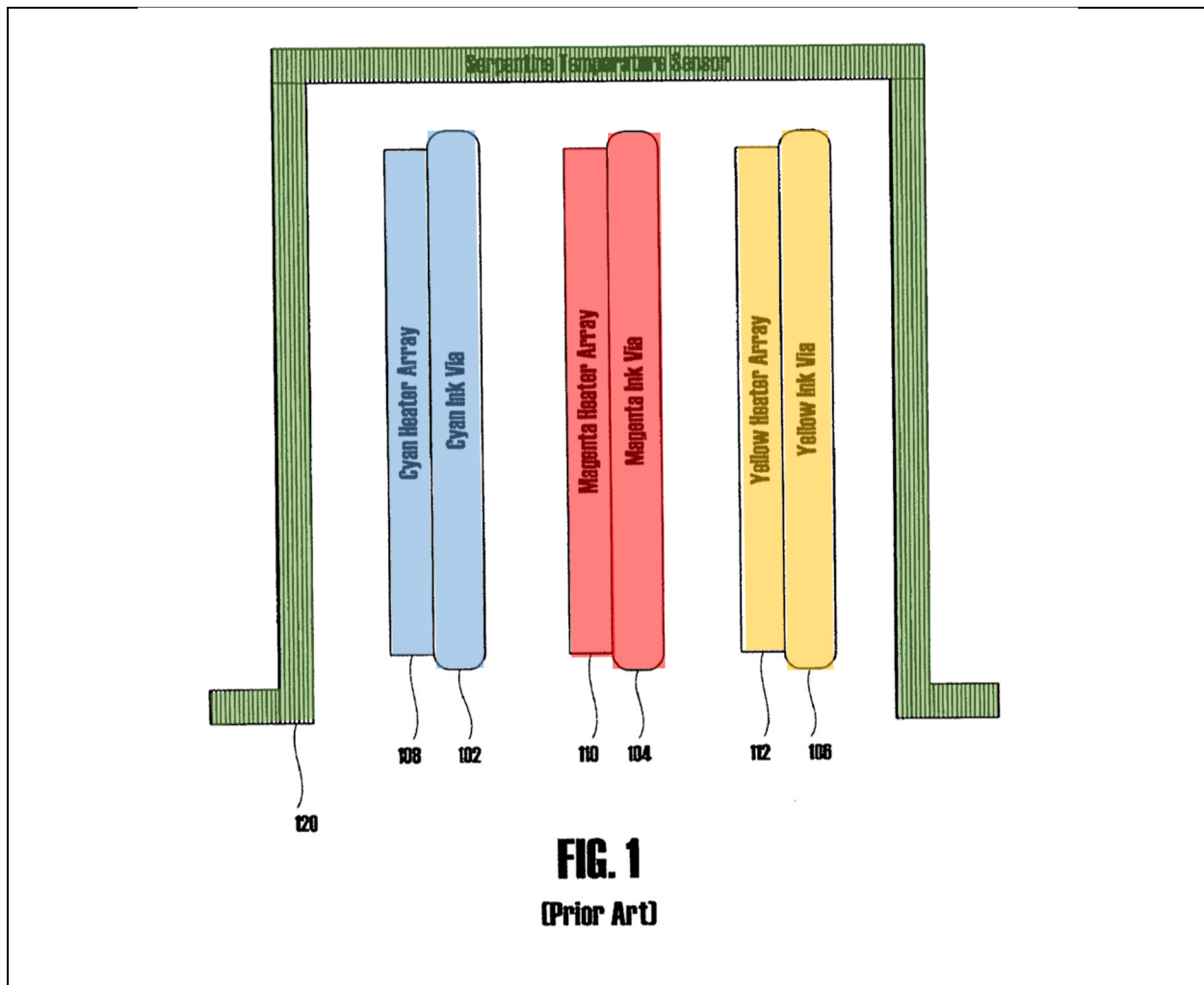
II. BACKGROUND

A. The '708 Patent

The '708 patent describes technical challenges associated with controlling the temperature of “heater chips” for discharging ink in an ink jet printer. A heater chip is a component of the print head of the printer that discharges ink drops to form images, and may contain multiple ink “vias” or slots through which ink is supplied to the heater chip. (Ex. 1001 col. 1 lns 21-26.) In the type of chips relevant to the '708 patent, arrays of heater resistor elements or “heaters” are positioned along the sides of ink vias to heat ink supplied through the vias, causing the ink to be discharged through associated nozzles. (*Id.* col. 1 lns 21-47.) In order to properly function, ink jet printers need to monitor and maintain the silicon substrate of the heater chip at an acceptable temperature for printing, avoiding low temperatures that result in formation of smaller ink drops with lower drop-weight than required for

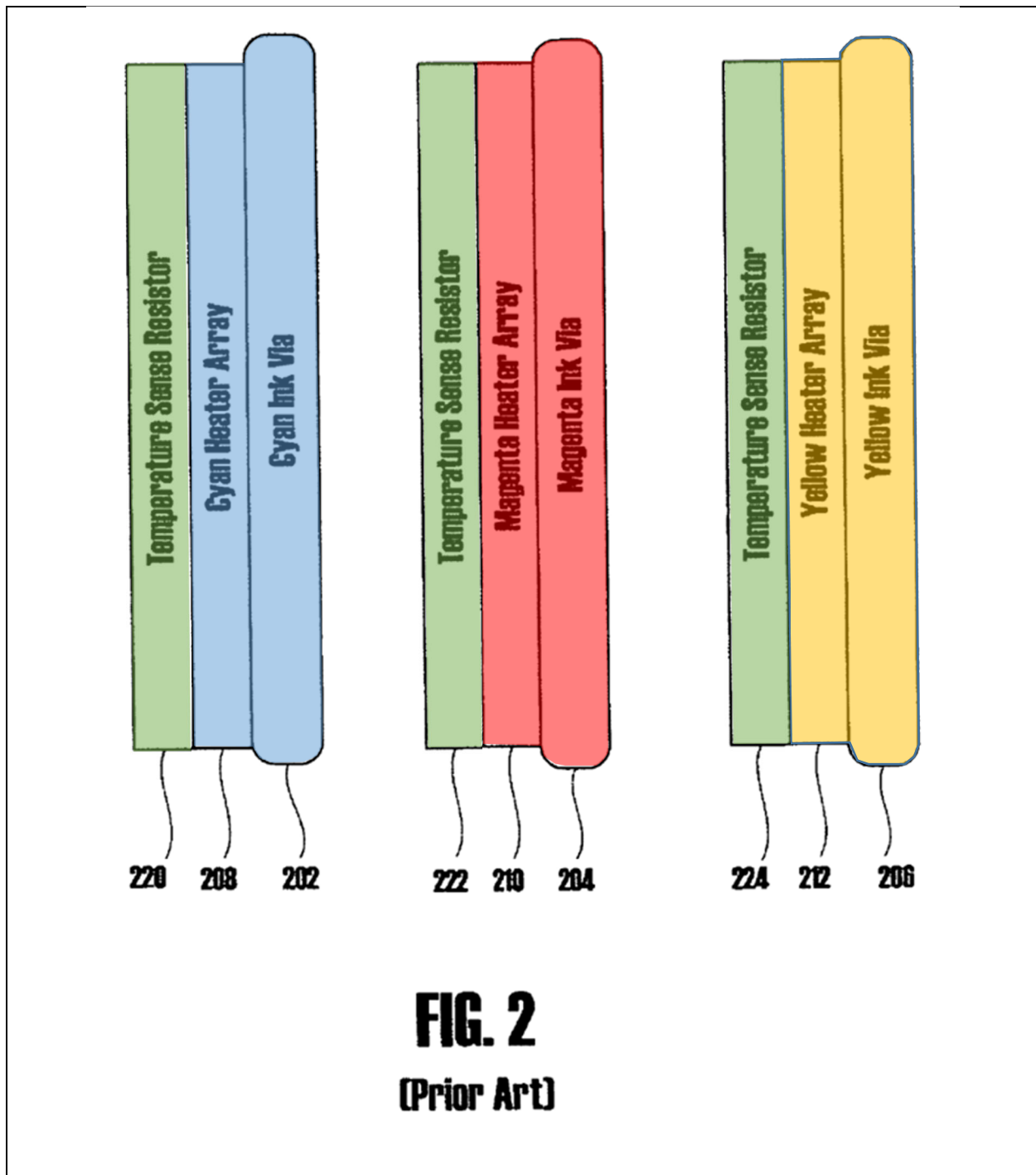
good image quality and avoiding variations in temperature that will cause inconsistent drop-weight and resulting visible hue shifts in a printed image. (*Id.* col. 1 lns 48-55.) Heater chips may apply short pulses to heater arrays in order to maintain a desired temperature, or may include separate substrate heating elements to heat the silicon substrate. (*Id.* col. 2 lns 16-25.)

Controlling the temperature of a heater chip requires the ability to detect its current temperature. At the time of the invention, traditional heater chips generally included one ink via for each primary color (magenta, yellow, and cyan), as shown below in Fig. 1. A metal serpentine temperature sense resistor 120 [green] routed around the periphery of the heater chip in such a design was capable of providing an average temperature of the entire print head die. (*Id.* col. 1 lns 56-62.)



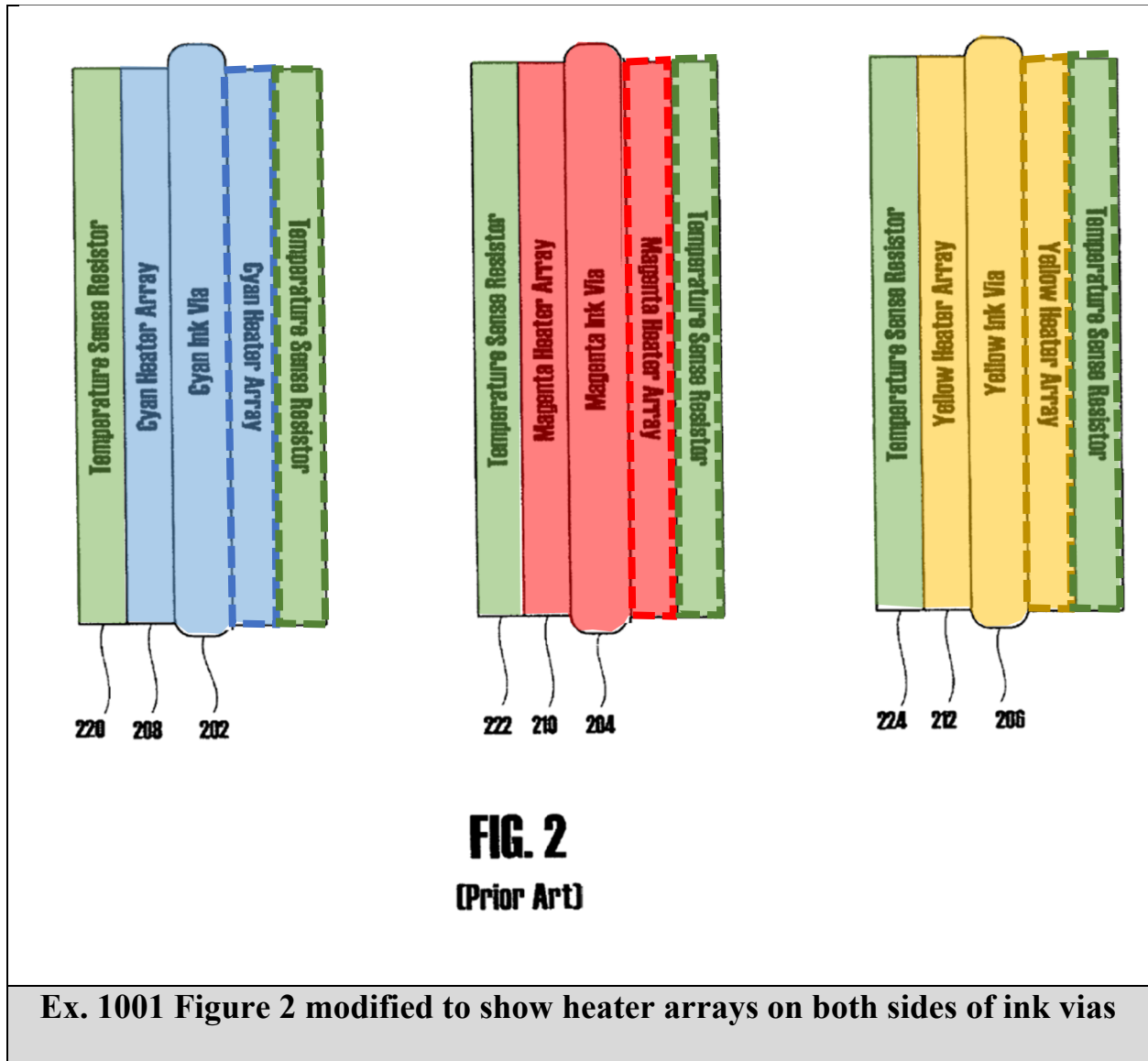
This average measurement provides no discrimination between individual colors and does not provide any feedback on temperature differences between one area of the heater chip versus another, and thus cannot be used to control temperature on a per color or area basis. (*Id.* col. 1 lns 62-65.)

The heater chip shown in Fig. 2, on the other hand, includes three temperature sense resistors (220, 222, and 224), one for each heater array, and because each ink via is associated with only one heater array this configuration allows for temperature sensing on a per color basis. (*Id.* col. 2 lns 1-11.)



However, when a heater array is positioned on both sides of an ink via, the temperature sensing and regulating devices utilized in the prior art do not provide adequate thermal control. (*Id.* col. 2 lns 36-38.) The temperature sensor shown in

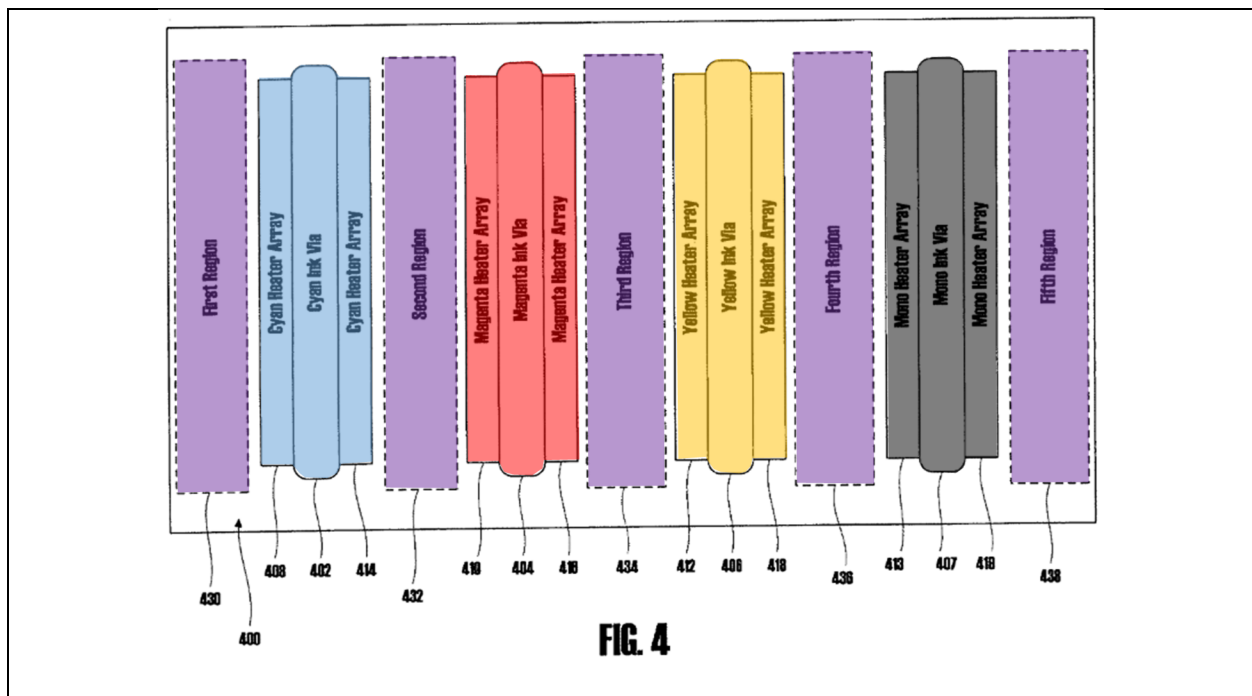
Fig. 1 determines only an average temperature of the entire die and does not provide any feedback on temperature difference between various areas of the heater chip. (*Id.* col. 1 lns 56-67 and col. 2 lns 38-43.) The temperature sensor arrangement of Fig. 2 is capable of detecting temperature on a per color basis, but if two adjacent ink vias for supplying different colors of ink each are equipped with heater arrays along both sides of each via, the region between the adjacent vias will have two different heater arrays for ejecting two different colors of ink. This is shown below in a modified version of Fig. 2 adding a second heater array and associated temperature sensor to each ink via, making it difficult to accurately detect and control temperature on a per color basis. (*Id.* col. 2 lns 35-50.)



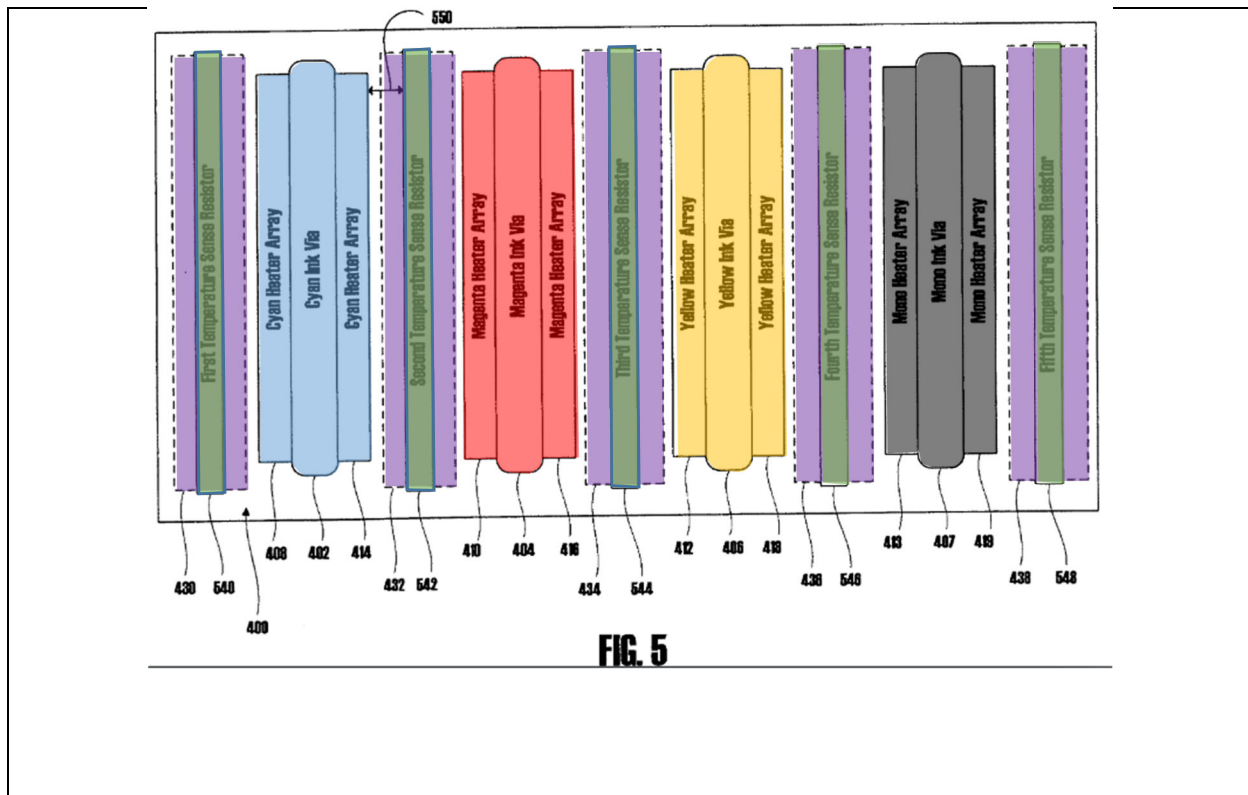
The '708 patent provides temperature monitoring and regulation of regions of a heater chip between adjacent ink vias, rather than on a color-by-color basis, when heater arrays are placed on both sides of an ink via. (*Id.* col. 2 lns 51-54 and col. 5 lns 35-51.) The inventors recognized that due to high thermal conductivity of the silicon substrate, the region between the heater array of one ink via and the opposite heater array of an adjacent ink via can have a fairly uniform temperature if the width

of the region is small enough for the temperature to equalize at the firing frequency and temperature sampling rate of the temperature sense element. (*Id.* col. 6 lns 58-64 and col. 7 lns 5-16.) However, that temperature may differ from the temperature of other regions of the chip because the ink vias act as thermal insulators. (*Id.* col. 6 lns 64-67.) Based on these principles, the inventors developed a design whereby the temperature of a heater chip is monitored and regulated on a per region basis where regions are defined by their relationship to ink vias.

For example, Fig. 4 below shows several regions [purple] defined between heater arrays associated with ink vias of different colors or between an ink via and an edge of the heater chip.



As shown in Fig. 5 below, a temperature sensor (540, 542, 546, 548) [green] may be placed in each such region.



(*Id.*, Fig. 5 and col. 5 lns 35-41.) In this configuration, the temperature sense resistors sense temperature by silicon region rather than attempting to sense temperature on a per color basis. (*Id.* col. 5 lns 48-51.) The '708 patent teaches that a single temperature sense resistor in such a region can sense a temperature that represents the temperature of the two heater arrays adjacent the region if the width of the region is small enough and the temperature sampling rate of the sensor is sufficient for the firing rate of the heater arrays. (*Id.* col. 6, ln 58 – col. 7, ln 16.) Regulating the temperature of a heater chip by regions as defined by ink vias allows for each region to be regulated at its optimal operating temperature using a simplified design.

B. Prosecution History of the '708 Patent

The application that led to the '708 patent was filed on December 30, 2005. In the first office action, the USPTO issued a provisional double patenting rejection, and in response the applicant filed a terminal disclaimer on February 1, 2008. (Ex. 1003 pp. 216-220 and 206-207.) On the same day the applicant also submitted an amendment which altered the independent claims as follows to emphasize that the recited temperature sensing element senses a temperature that is representative of the first heater array and the second heater array:

1. (Currently Amended) 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
a temperature sensing element operable to sense ~~the~~ a temperature of the region, the temperature being representative of the first heater array and the second heater array, wherein the temperature sensing element is substantially centrally disposed with respect to the region.

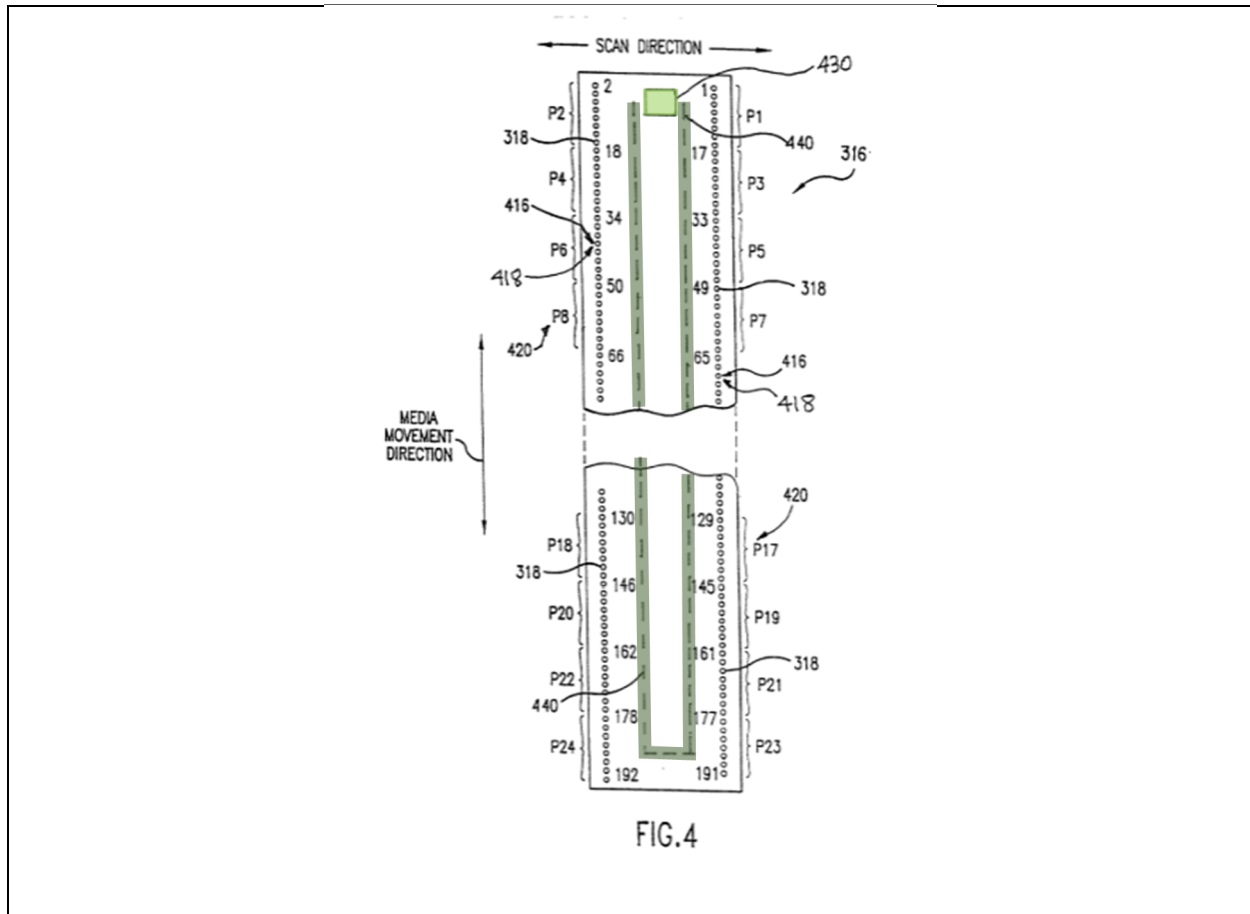
10. (Currently Amended) A method of fabricating chips for use with a printing device, comprising:
providing a first heater array, positioned substantially adjacent a first via;
providing a second heater array, positioned substantially adjacent a second via; and
positioning a temperature sensing element in a region between the first heater array and the second heater array, wherein the temperature sensing element is operable to sense

the a temperature of the region, the temperature being representative of the first heater array and the second heater array.

(Ex. 1003 pp. 192-193.) In the remarks of this amendment, the applicant distinguished prior art U.S. Patent Publication No. 2003/0142159:

In conventional printheads, such as U.S. Patent Publication No. 2003/0142159 to *Askeland, et al.* (hereinafter "*Askeland*"), a temperature sensing element resistor (TSR) (420) [sic] is located far from local ejection elements (416) such that "there are differences in the local temperature in ejection chambers 418 and the global temperature measured by the TSR 440." *See* Paragraph [0044]. *Askeland* describes the difficulties in placement of a TSR close to the ejection chambers since "heat must flow from the ejection elements 416 to the TSR before it can be measured ... [t]he time required for this heat to flow to the TSR where it can be measured creates a latency in the control system." *Id.* *Askeland* relates to an altogether different technique than described by the Applicants' claimed invention in that *Askeland* must use the TSR temperature measurements as well as the ejection history of the driver head to estimate the local ejection chamber temperature. *See* Paragraph [0047]. Instead of using a single TSR for pair of opposing local ejection elements, *Askeland* relates to a relatively complicated solution to measuring temperature.

(Ex. 1003 pp. 195-196.) Below is Fig. 4 of *Askeland* showing a digital temperature sensor 430 and a thermal sense resistor 440 [dark green] that "measures the global temperature of the driver head 316." (Ex. 2001 ¶ [30].)



(Ex. 2001 Fig. 4.) In the printhead of Askeland, the temperature sense resistor 440 forms a loop to detect an average temperature of the entire chip similar to the prior art shown as Fig. 1 in the '708 patent. The applicant further discussed how Askeland differs from the claims of the '708 patent by detecting a “global” temperature of the print head rather than a temperature of regions between adjacent ink vias. (Ex. 1003 p. 196.)

On May 19, 2008, the Examiner issued a final rejection with obviousness rejections based on “admitted prior art” (Figs. 1 and 2 of the '708 patent) and Askeland [Ex. 2001]. (Ex. 1003 pp. 175-181.) The Examiner argued that the

admitted prior art shows a chip with regions positioned between first/third heater arrays (208, 210) and second/fourth heater arrays (210, 212), with first and second temperature sensing elements (222, 224) between the first/third and second/fourth heater arrays. (Ex. 1003 pp. 177-178.) The Examiner acknowledged that the admitted prior art does not teach the temperature sensing elements being substantially centrally disposed with respect to the regions, but argued that Askeland [Ex. 2001] discloses an ink jet printhead having first and second heater arrays with a temperature sensing element substantially disposed within a region between the arrays. (Ex. 1003 p. 178.)

After presenting a set of claim amendments on May 19, 2008 (*id.* pp. 134-141) which was not entered (*id.* pp. 121-122), the applicant filed a request for continued examination along with a new amendment cancelling all prior claims and presenting a new set of claims 20-34. Independent claim 20 read as follows:

20. (New) A chip for use with a printing device, comprising:
- a plurality of ink vias arranged parallel to one another, each of the ink via having two longitudinal sides;
 - a heater array disposed adjacent each longitudinal side of the ink vias;
 - a region disposed adjacent each heater array, wherein only one region is disposed between two adjacent ink vias; and
 - a single temperature sensing element disposed within each region, the temperature sensing element operable to sense a temperature representative of the heater arrays adjacent to the region and disposed at a predetermined distance away from adjacent heater arrays.

(*Id.* p. 115.) This claim differs from the previous independent claims at least by reciting ink vias having heater arrays adjacent each side of the vias and by calling for a single temperature sensing element disposed within each region between adjacent ink vias. Independent claim 28 recited a related method for fabricating chips for use with a printing device, including placing heater arrays adjacent each longitudinal side of a plurality of ink vias and positioning a single temperature sensing element within each region alongside each heater array.

28. (New) A method of fabricating chips for use with a printing device, comprising:

arranging a plurality of ink vias parallel to one another, wherein each of the ink via has two longitudinal sides;

placing a heater array adjacent each longitudinal side of the ink via;

defining a region adjacent each heater array such that there is only one region between two ink vias; and

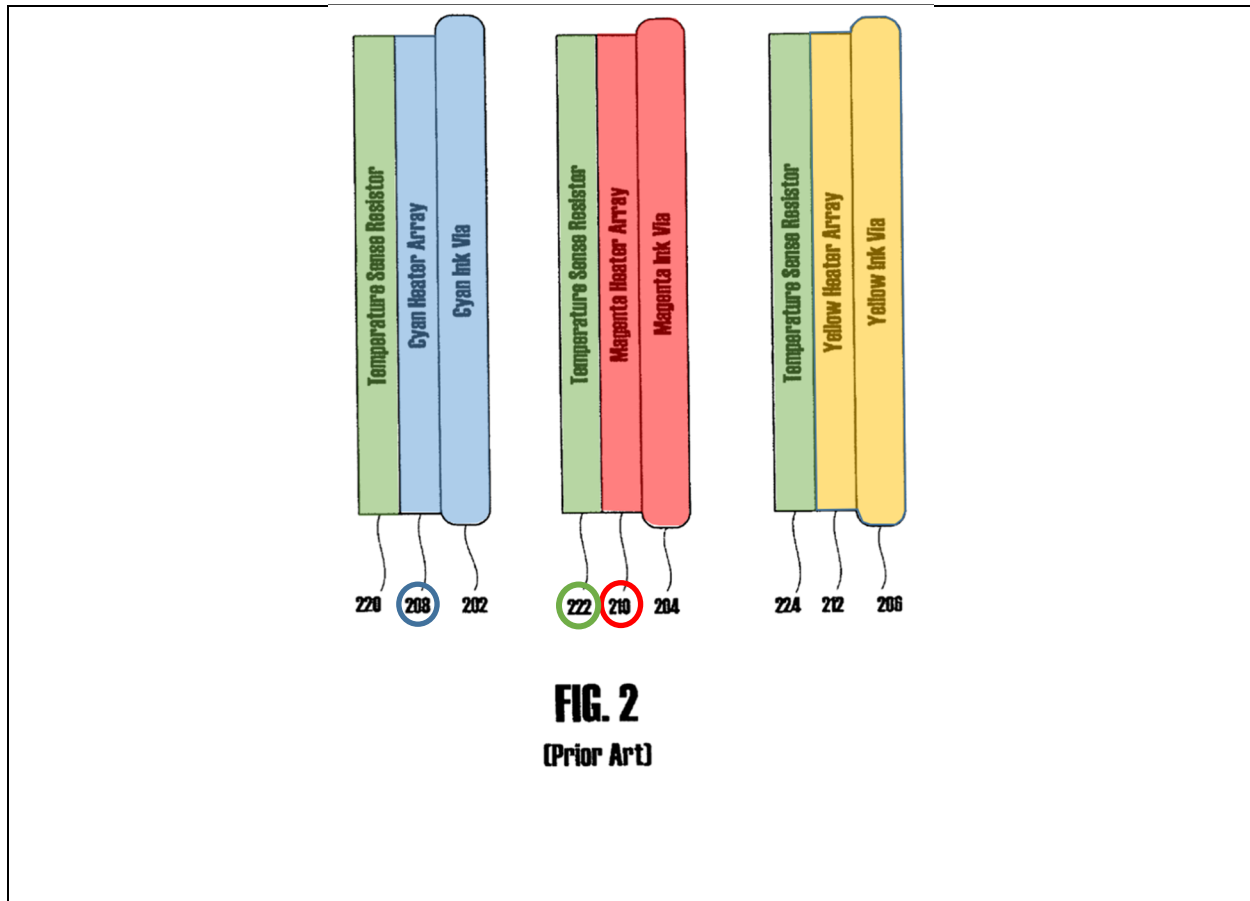
positioning a single temperature sensing element within each region, wherein the temperature sensing element is operable to sense a temperature representative of the heater arrays adjacent to the region and is disposed at a predetermined distance away from adjacent heater arrays.

(*Ex.* 1003 p. 116.) The applicant argued that admitted prior art Fig. 2 of the '708 patent does not show a temperature sense resistor that senses the temperature of a region between adjacent heater arrays:

Fig. 2 of the prior art shows a cyan heater array 208 and a magenta heater array 210. The Examiner alleged "the region defined by the cyan heater array and the magenta heater array" as the region of the claimed invention. As shown in Fig. 2 the temperature sense resistor 222 is disposed within this "region." However, as shown in Fig. 2, a Cyan ink via 202 present within the region (i.e., within the region defined by the

cyan heater array and the magenta heater array) functions as a "thermal barrier" (thermal insulator) and prevents the temperature sense resistor 222 to sense the temperature of the adjacent heater arrays (i.e., Cyan heater array 208). See paragraph 009. Therefore, the temperature sensed by the temperature sensing element 222 is not representative of the temperature of the heater arrays adjacent to the region as in the claimed invention

(Ex. 1003 p. 118.) Fig. 2 of the '708 patent is shown below, with temperature sensors (220, 222, 224) colored green and ink vias and associated actuators color-coded according to their respective inks. As indicated by the applicant, even though a temperature sense resistor (222, circled in green) is positioned between the cyan heater array (208, circled in blue) and the magenta heater array (210, circled in red), a cyan ink via 202 is also within the region between those two heater arrays. Due to the thermal insulating properties of this cyan ink via 202, the temperature sensed by element 222 is not representative of the cyan heater array 208 on the far side of the cyan ink via 202.



(Ex. 1001 Fig. 2.) The applicant also stated that if a second heater array were to be added to each color ink via in Fig. 2, then the result would be two temperature sensing elements in each region between ink vias, one for each array. (Ex. 1003 p. 118.)

On December 3, 2008, the Examiner issued a non-final office action rejecting claims 20-22, 24-31, and 33-34 as obvious in view of the admitted prior art (Figs. 1 and 2 of the '708 patent) and Askeland. (*Id.* 94-101.) Claims 23 and 32, which each recite an n-type implant donor thermal sensing resistor, were rejected in view of the same references and one additional reference, U.S. Patent Publication Number

2005/0052500 to Edelen *et al.* The Examiner found the applicant's arguments regarding the prior rejections unpersuasive, reasoning that:

the temperature of a region is contributed by both heater arrays adjacent to the region. One heater array may contribute heat to the region more than that from the other. One of ordinary skill in the art thus would locate the TSR within the region so that the TSR can detect heat from both adjacent heater arrays.

(*Id.* p. 99.) The Examiner also stated that the assertion that an ink via functions as a thermal barrier is only attorney argument, not factual evidence. (*Id.* pp. 99-100.)

The applicant filed a response filed on March 2, 2009, amending the independent claims as follows:

20. (Presently Amended) A chip for use with a printing device, comprising:

a plurality of ink vias arranged parallel to one another, each of the ink via having two longitudinal sides;

a heater array disposed adjacent each longitudinal side of the ink vias such that each ink via is associated with two heater arrays disposed adjacent the two longitudinal sides of the ink via;

a region disposed adjacent each heater array, wherein only one region is disposed between two adjacent ink vias and wherein the region disposed between two adjacent ink vias includes two heater arrays each heater array being associated with their respective ink via; and

a single temperature sensing element disposed within each region, the temperature sensing element operable to sense a temperature representative of the heater arrays adjacent to the region and disposed at a predetermined distance away from adjacent heater arrays.

28. (Presently Amended) A method of fabricating chips for use with a printing device, comprising:

arranging a plurality of ink vias parallel to one another, wherein each of the ink via has two longitudinal sides;

placing a heater array adjacent each longitudinal side of the ink via such that each ink via is associated with two heater arrays placed adjacent its longitudinal sides;

defining a region adjacent each heater array such that there is only one region between two ink vias and the region between two adjacent ink vias includes two heater array each heater array being associated with its respective ink via; and

positioning a single temperature sensing element within each region, wherein the temperature sensing element is operable to sense a temperature representative of the heater arrays adjacent to the region and is disposed at a predetermined distance away from adjacent heater arrays.

(*Id.* pp. 85-91.) The applicant argued that the admitted prior art shown in Figs. 1 and 2 of the '708 patent ("APA") did not disclose all of the features of these amended claims.

Amended independent claim 20 is directed to a chip for use with a printing device that requires, inter alia, that the region disposed between two adjacent ink vias includes two heater arrays each heater array being associated with their respective ink vias. APA [admitted prior art] (Figs. 1-2) does disclose a region between two adjacent ink vias (e.g., a magenta ink via 204 and a yellow ink via 206), however the region does not include two heater arrays each being associated with their respective ink vias as required by the claimed invention. Rather, the region between the magenta ink via (204) and the yellow ink via (206) includes only a single yellow heater array (212) associated with the yellow ink via (206).

Further, claim 20 requires, inter alia, a single temperature sensing element disposed within each region, the temperature sensing element operable to sense a temperature representative of the heater arrays adjacent to the region. Applicants assert that the APA (Figs. 1-2) that the Examiner relied on fails to disclose or suggest this element of the claimed invention. Fig. 2 of the admitted prior art shows a cyan heater array (208) and a magenta heater array (210) such that the cyan and the magenta heater array are adjacent to the region in which a temperature sense resistor (222) is disposed. However, as shown in Fig. 2, a cyan

ink via (202) is present in between the cyan heater array and the magenta heater array, and as it has been described with respect to Fig. 2 in paragraphs 0007 and 0009 of the specification that the ink via (202) functions as a "thermal barrier" (thermal insulator) i.e., thermal barrier in between the cyan heater array (208) and the temperature sense resistor (222), therefore Applicants assert that the temperature sense resistor (222) cannot represent the temperature of the cyan heater array (208) that is rather being represented by another thermal sense resistor (220). Thus, the temperature sensed by the temperature sense resistor (222) is not representative of the temperature of both the heater arrays (208 and 210) adjacent to the region as required by the claimed invention.

(*Id.* pp. 89-90.) The secondary reference Askeland did not cure these deficiencies as it does not disclose a region between heater arrays on either side of adjacent ink vias or the claimed relationship between a temperature sensor and such a region. The applicant argued that claim 28 was allowable for similar reasons.

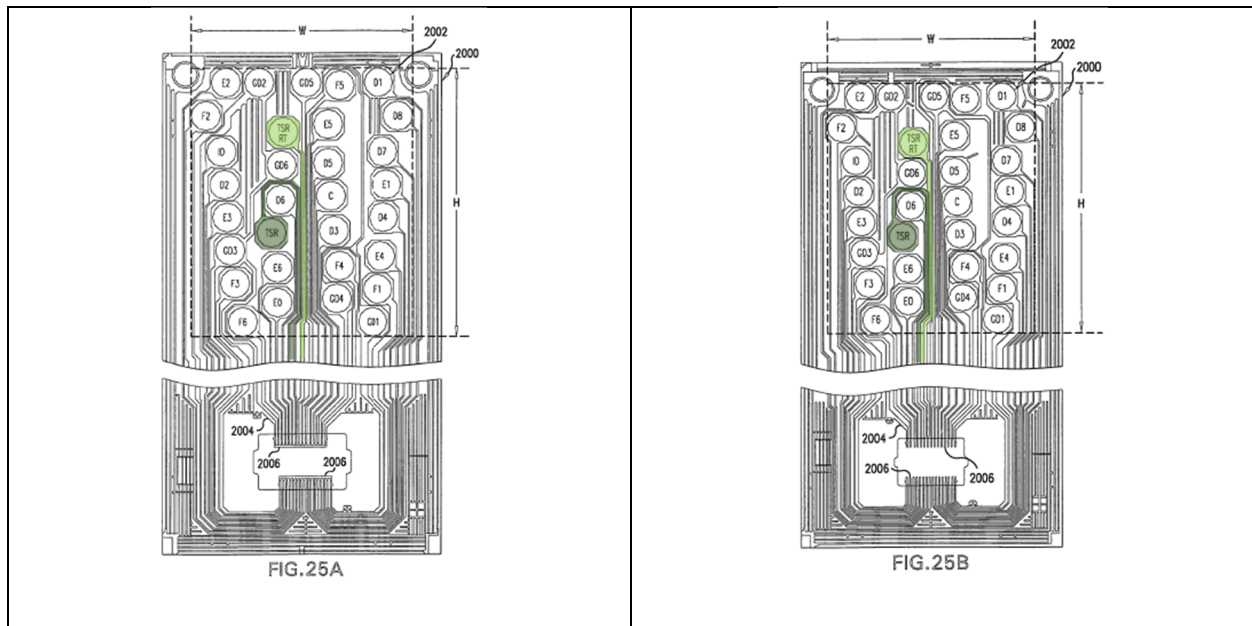
In view of the foregoing amendments and arguments, a notice of allowance issued on May 21, 2009. (*Id.* pp. 41-46.)

C. The Asserted Prior Art

1. U.S. Patent No. 7,384,113 to Benjamin *et al.* (Ex. 1004)

U.S. Patent No. 7,384,113 to Benjamin *et al.* ("Benjamin") discloses a "printhead die 40 that ejects drops of ink through a plurality of orifices or nozzles 34 toward a print medium 36." (Ex. 1004 col. 3 lns 32-36.) In reference to Figs. 25A and 25B, which illustrate contact areas of a flex circuit that couples external circuitry to a printhead die, Benjamin states that "[t]emperature sense resistor contact area TSR allows a printer coupled to an ink jet cartridge to determine a temperature of

the printhead die, based upon a measurement of the resistor” and that “[a] temperature sense resistor return contact area TSR-RT provides a return path for signals provided at temperature sense resistor contact area TSR.” (Ex. 1004 col. 3 lns 1-3 and col. 79 lns 29-35 and 60-67.) There is no indication as to where this temperature sense resistor is positioned on the printhead die itself. It is clear that the die includes only a single temperature sense resistor connected to a single contact area (TSR) [dark green] and a single return contact area (TSR-RT) [light green] of the flex circuit as shown below in both of the embodiments shown in Figs. 25A and 25B.



Benjamin teaches that the temperature sense resistor determines “a temperature” of the “printhead die,” not temperatures of individual regions of the die. (*Id.* col. 79 lns 60-63.)

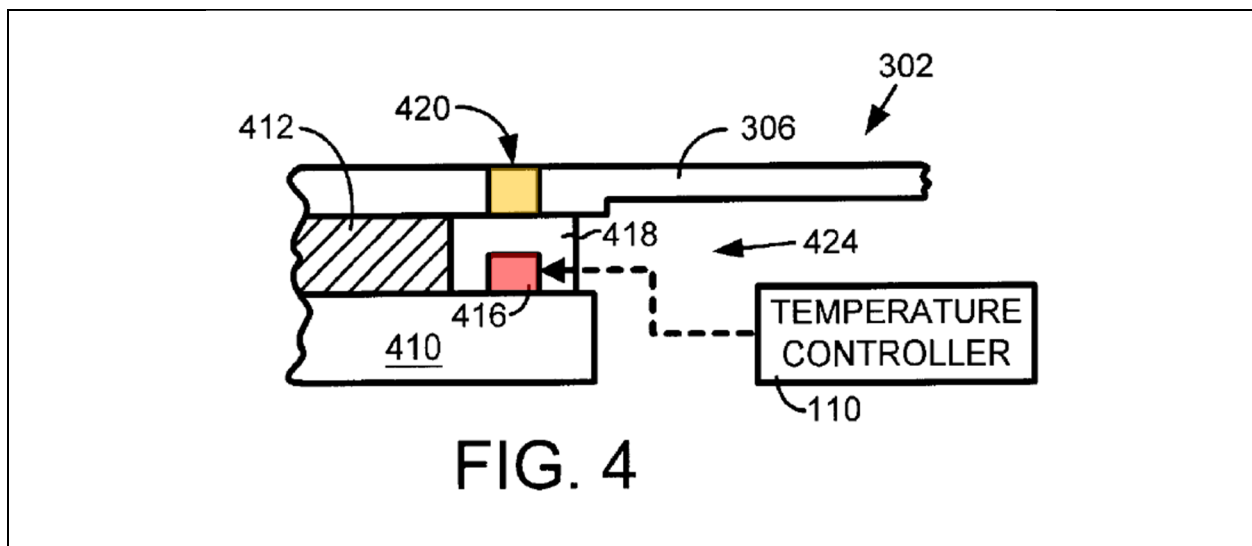
2. U.S. Patent No. 6,612,673 to Giere *et al.* (Ex. 1005)

U.S. Patent No. 6,612,673 to Giere *et al.* ("Giere '673") discloses a system including a controller that receives print data to predict thermal conditions of a subset of ink ejection chambers for selectively operating the corresponding heating elements of the subset. (Ex. 1005 Abstract.) A fundamental aspect of the disclosed temperature controller is that it is coupled to multiple temperature sensors in order to determine a mean or average temperature of the printhead substrate as well as local temperature profiles near designated ink ejection elements. (*Id.* col. 2 lns 57-62.) The system uses inputs from these multiple temperature sensors to predict thermal conditions of a subset of the ink ejection elements, and to establish operating conditions so that the corresponding heating elements operate at an optimal temperature. (*Id.* col. 6 lns 5-8.) In this elaborate system, a firing history of a plurality of subsets of ink ejection elements may also be maintained, so that when an average temperature of the printhead assembly is sensed, the firing history and the average temperature are processed to determine estimated temperatures of certain ones of the subset in order to set optimal temperature conditions for specific ink ejection elements. (*Id.* col. 6 lns 10-18.)

Like the die of Benjamin discussed above, the printhead die of Giere '673 contains a temperature sense resistor 510 for measuring an average temperature of the entire substrate. (*Id.* col. 4 lns 55-56.) However, the control system of Giere '673

also uses sense resistor 510 in conjunction with additional sensors in the form of a digital temperature sensor (DTS) 512 and multiple temperature recorders 542, 544, and 546. (*Id.* at Fig. 5 and col. 5 lns 28-31, col. 6 lns 35-40.) Also unlike Benjamin, the printhead die of Giere '673 does not include any ink vias, with ink instead flowing around the edges of the substrate and into vaporization chambers. (*Id.* col. 5 lns 42-45.) Therefore, Giere '673 teaches nothing about where to place temperature sensors in the type of printhead relevant to the challenged '708 patent claims, i.e., one having a plurality of ink vias with heaters arrays on both sides of the vias.

Fig. 4 of Giere '673 below shows that heating elements 416 [red] are positioned behind a nozzle 420 [orange] at the edge of a substrate 410 and are controlled by a temperature controller 110. (*Id.* col. 4 lns 27-32.)



The temperature controller 110 is coupled to multiple temperature sensors to measure an average temperature of the substrate and an actual local temperature near

designated ink ejection elements to aid in controlling the temperature of the substrate as well as the temperature of each nozzle chamber. (*Id.* col. 2 ln 57 through col. 3 ln 12.)

Fig. 5 below is a top view of the substrate showing a thermal sense resistor 510 [light green], a digital temperature sensor 512 [dark green], and multiple temperature recorders 542, 544, and 546 [blue].

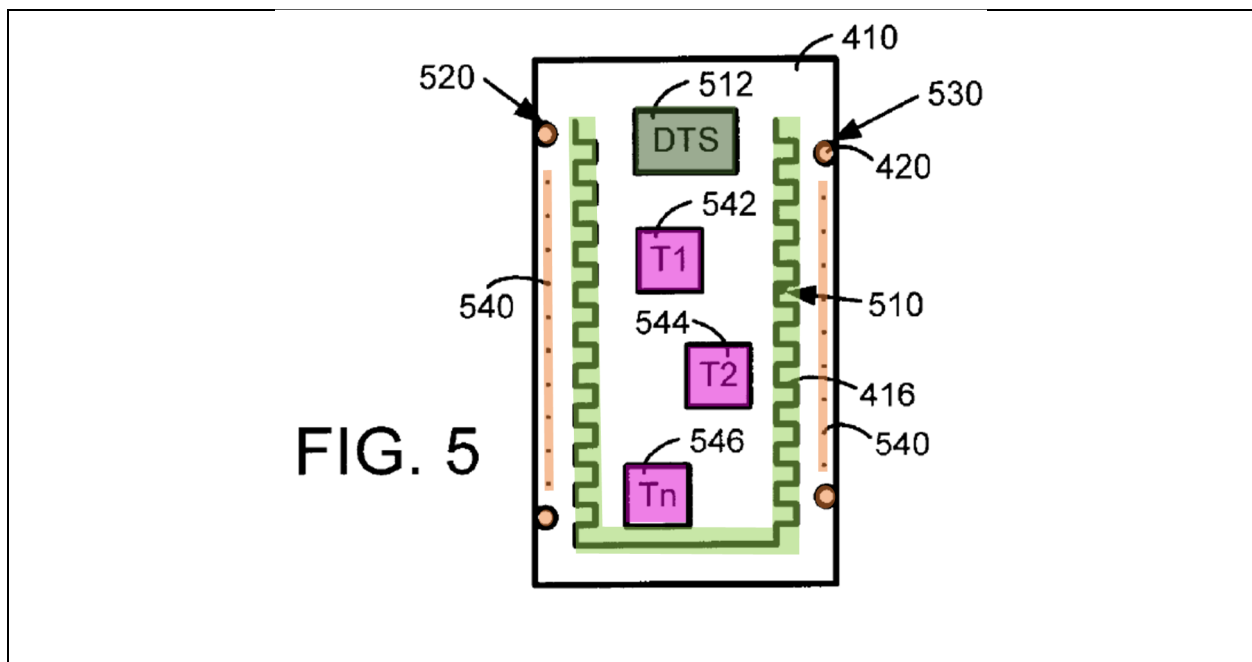


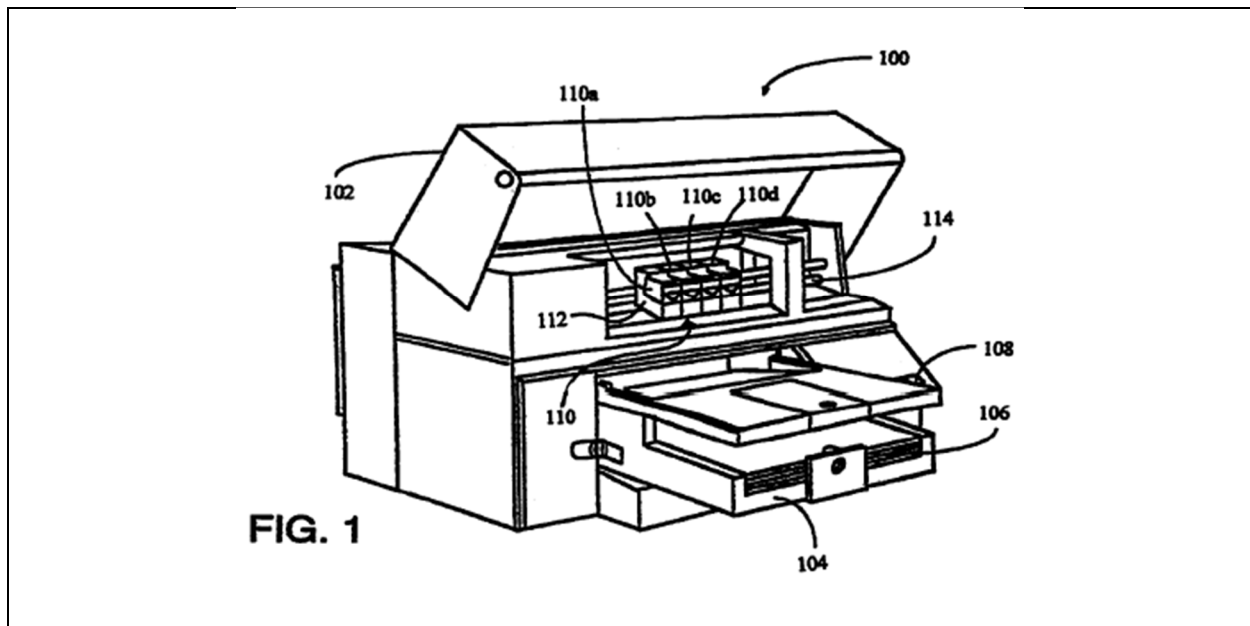
Fig. 5 shows all of the temperature sensing elements between two columns (520, 530) of nozzles 420 [orange], some of which are presented as dots (540) for simplicity. The temperature recorders [pink] are distributed around the substrate and each measure local current temperatures and store the measurements as temperature histories, and are averaged to generate a mean average temperature of the substrate. (*Id.* col. 5 lns 28-31 and col. 6 lns 35-40.) Plural thermal sense resistor temperature

recorders can also be located along paths of predefined areas near ink ejection elements for generating localized temperature profiles. (*Id.* col. 5 lns 32-36.) As mentioned, Giere '673 does not disclose ink vias or ejection heater elements on both longitudinal sides of each of a plurality of ink vias, or anything about the relationship between the temperature sensors and ink vias or corresponding heater elements.

The temperature sensing system of Giere '673 is intended to measure and store temperatures to a temperature logic system 606 along with past and future printing data from the logic mapping system 604 that is indicative of which ink ejection chambers 418 will be fired, and when each will be fired. (*Id.* col. 6 lns 35-46.) The temperature logic system uses these temperature and printing inputs along with other information to generate printing parameters in a closed loop system that approximates a temperature profile to improve ink drop quality. (*Id.* col. 6 lns 47-60.)

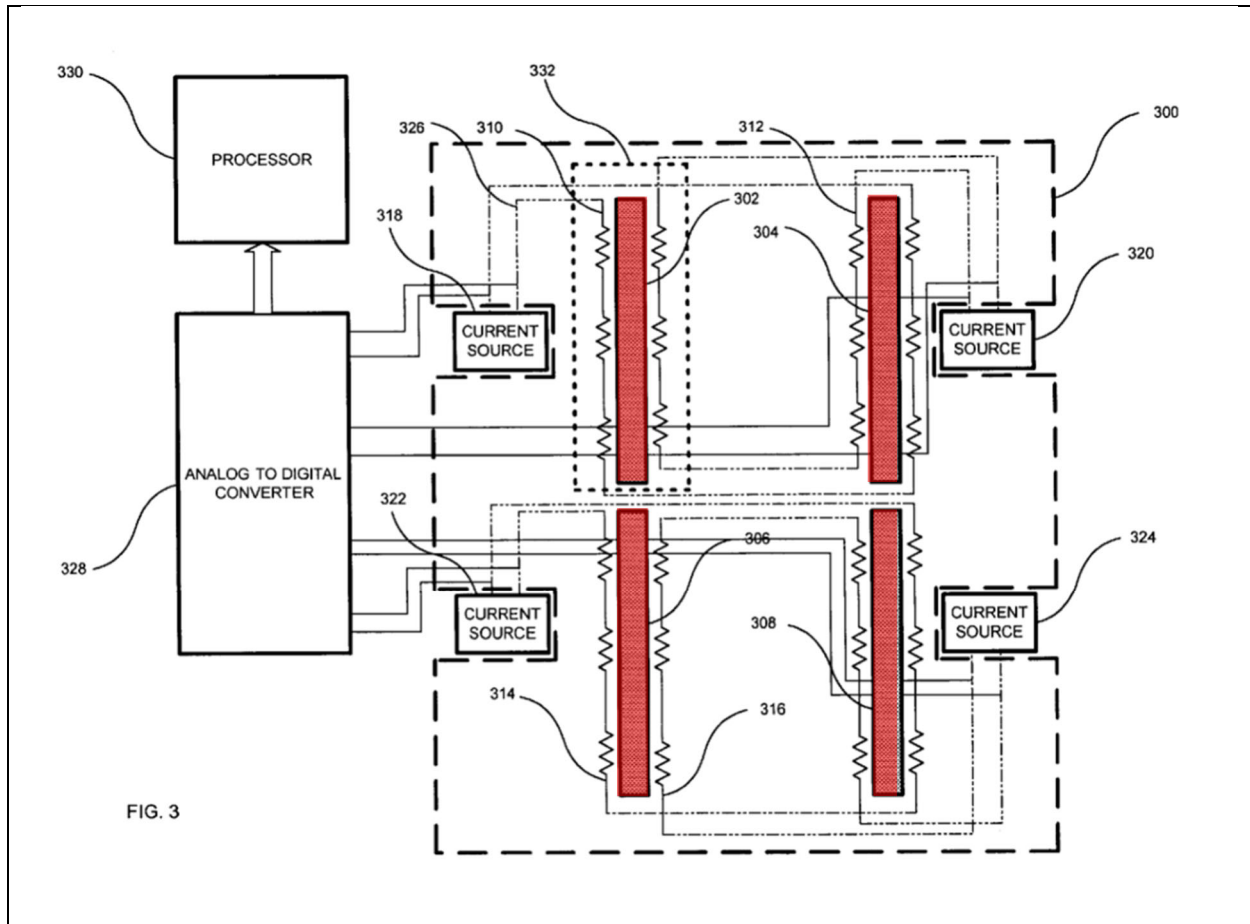
3. U.S. Patent No. 6,565,178 to Giere *et al.* (Ex. 1007)

U.S. Patent No. 6,565,178 to Giere *et al.* ("Giere '178) discloses a printer with multiple cartridges 110a (cyan cartridge), 110b (magenta cartridge), 110c (yellow cartridge), and 110d (black cartridge), as shown below:



(Ex. 1007 Fig. 1 and col. 7 lns 1-17.) Each cartridge contains its own printhead that implements parts of the temperature measurement system described by Giere '178. (*Id.* col. 7 lns 13-17.)

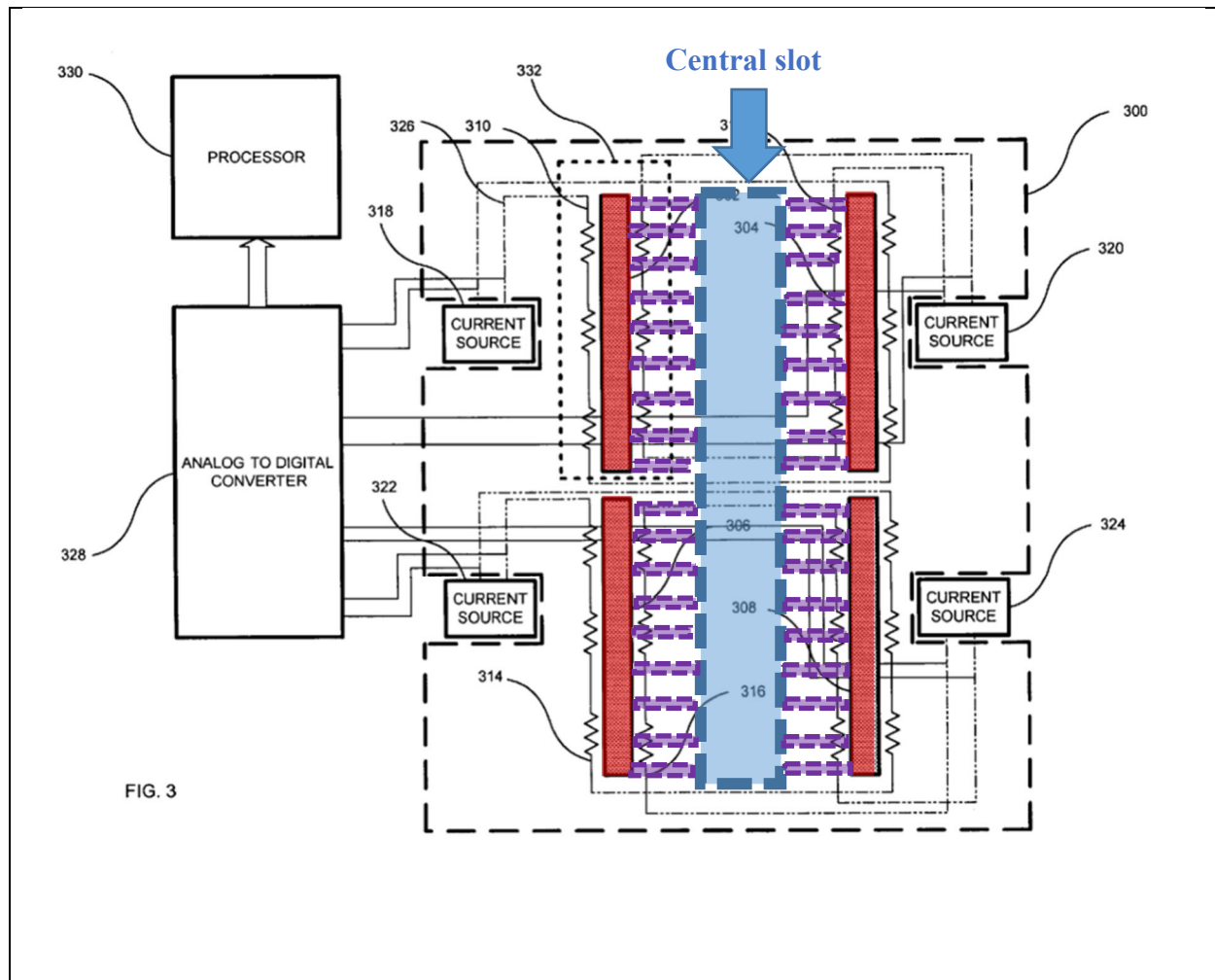
Fig. 3 of Giere '178 below is a “high level schematic diagram” of a temperature measurement system for one of the above printheads. (*Id.* col. 8 lns 41-43.)



Giere '178 states that “although 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.” Particularly, “regions 302, 304, 306, and 308 [red above] each include an array of nozzles and associated firing resistors for ejecting ink.” (*Id.* col. 8, lns 47-49.) An ink via is not shown in the substrate of Fig. 3, however the specification states that ink is fed to the ejection chambers (*i.e.* located in regions 302/304/306/308 of Fig. 3 as indicated above) “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.’” (*Id.* col. 3 lns 34-50.) Further,

“[i]n 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.” (*Id.* col. 3 lns 40-45.)

Below, a blue rectangle has been added to Fig. 3 in order to illustrate such a “central slot” in substrate 300 between the column of nozzles and ink ejection actuators on the left (regions 302 and 306) and the column of nozzles and ink ejection actuators on the right (regions 304 and 308). Channels that allow ink to flow from this slot [blue] to chambers associated with heaters of the heater arrays [red] have been added in purple below.



Alternatively, “[i]n 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” so that both the column of nozzles and ink ejection actuators on the left (regions 302 and 306) and the column of nozzles and ink ejection actuators on the right (regions 304 and 308) would be between the edges where ink is fed [indicated in blue below].

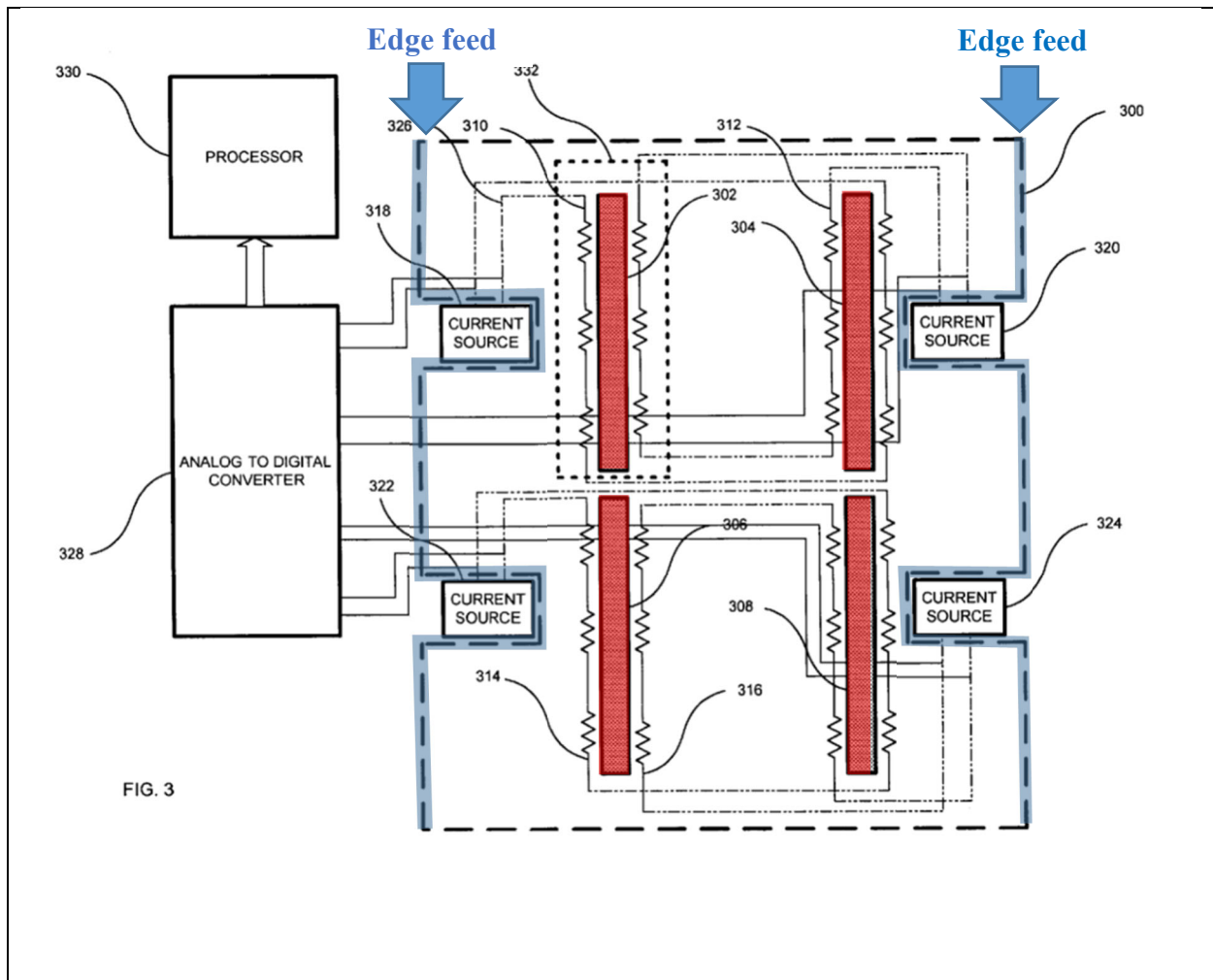
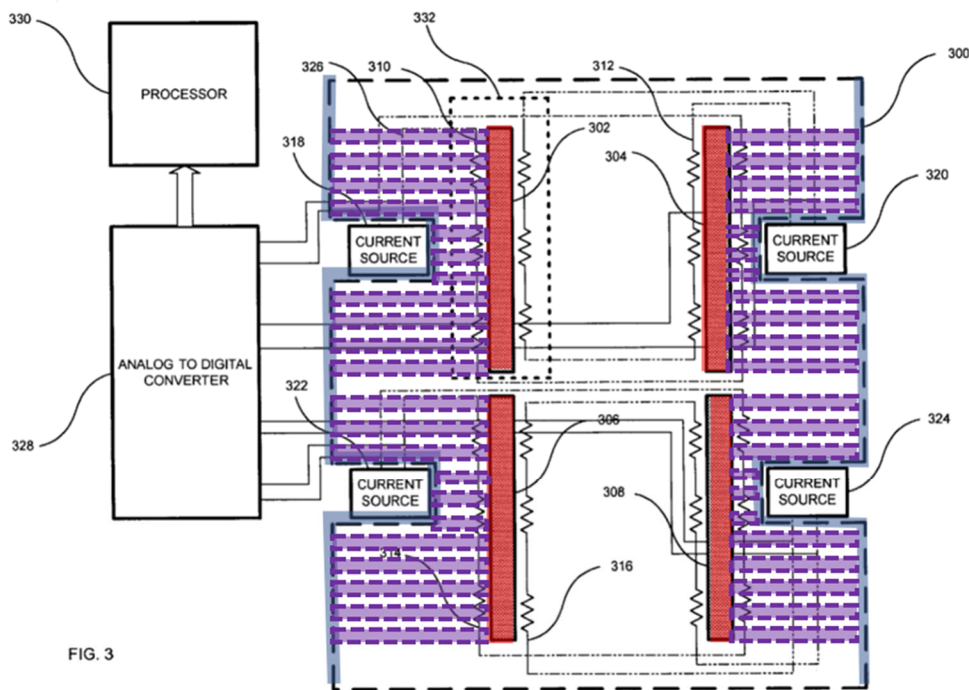
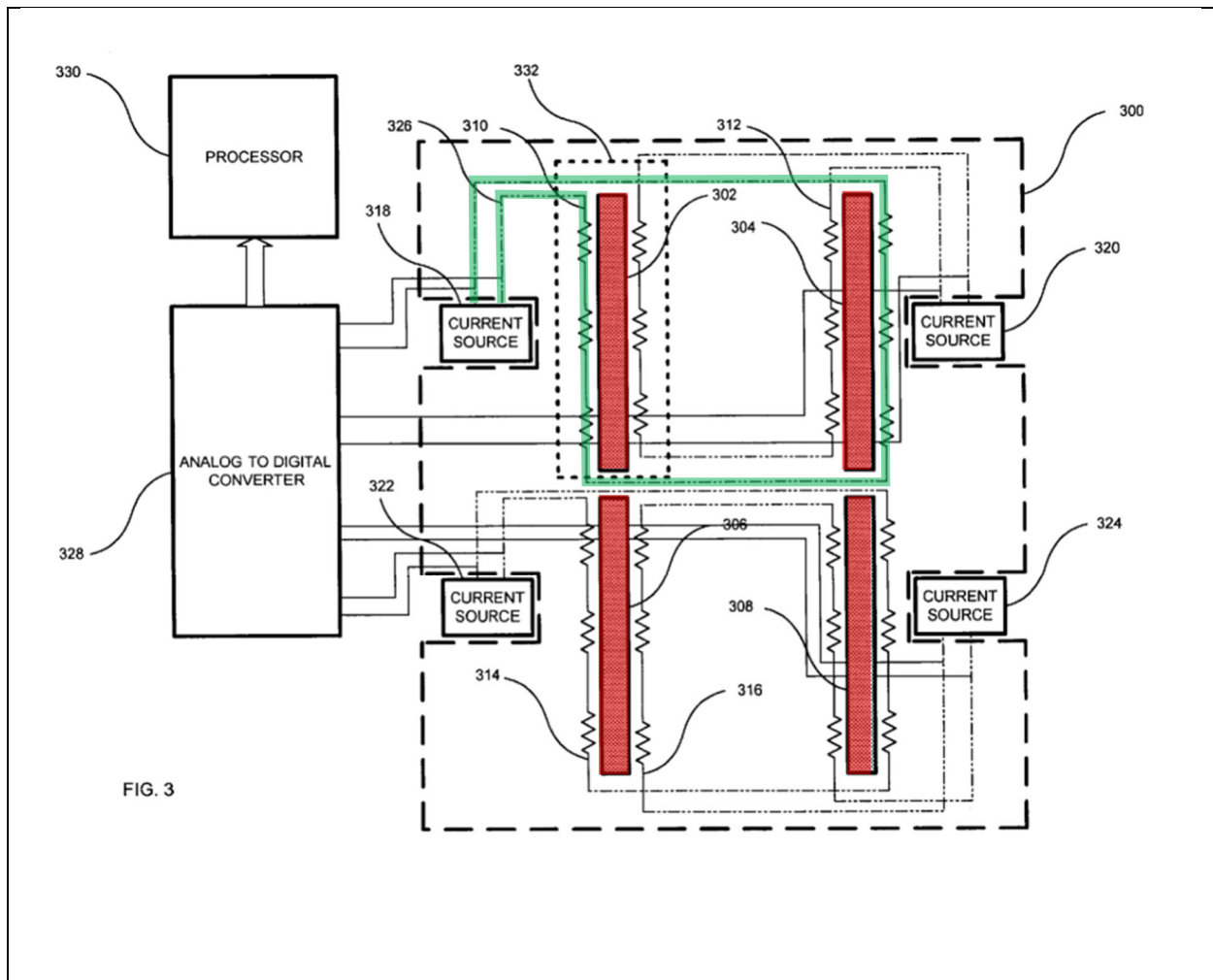


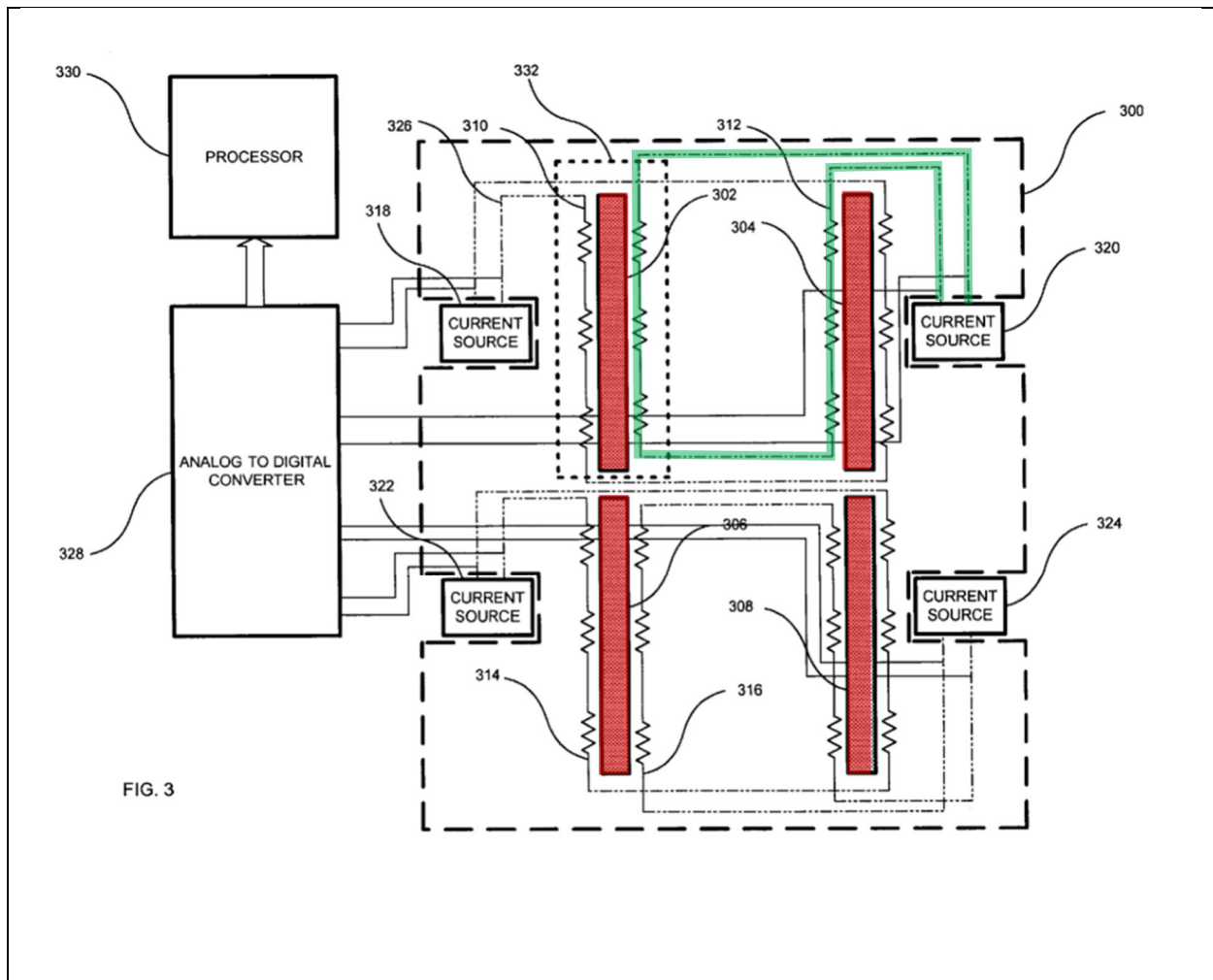
Fig. 3 has been modified below to illustrate how ink channels [purple] would allow ink to flow from the edges [blue] to heater arrays [red].



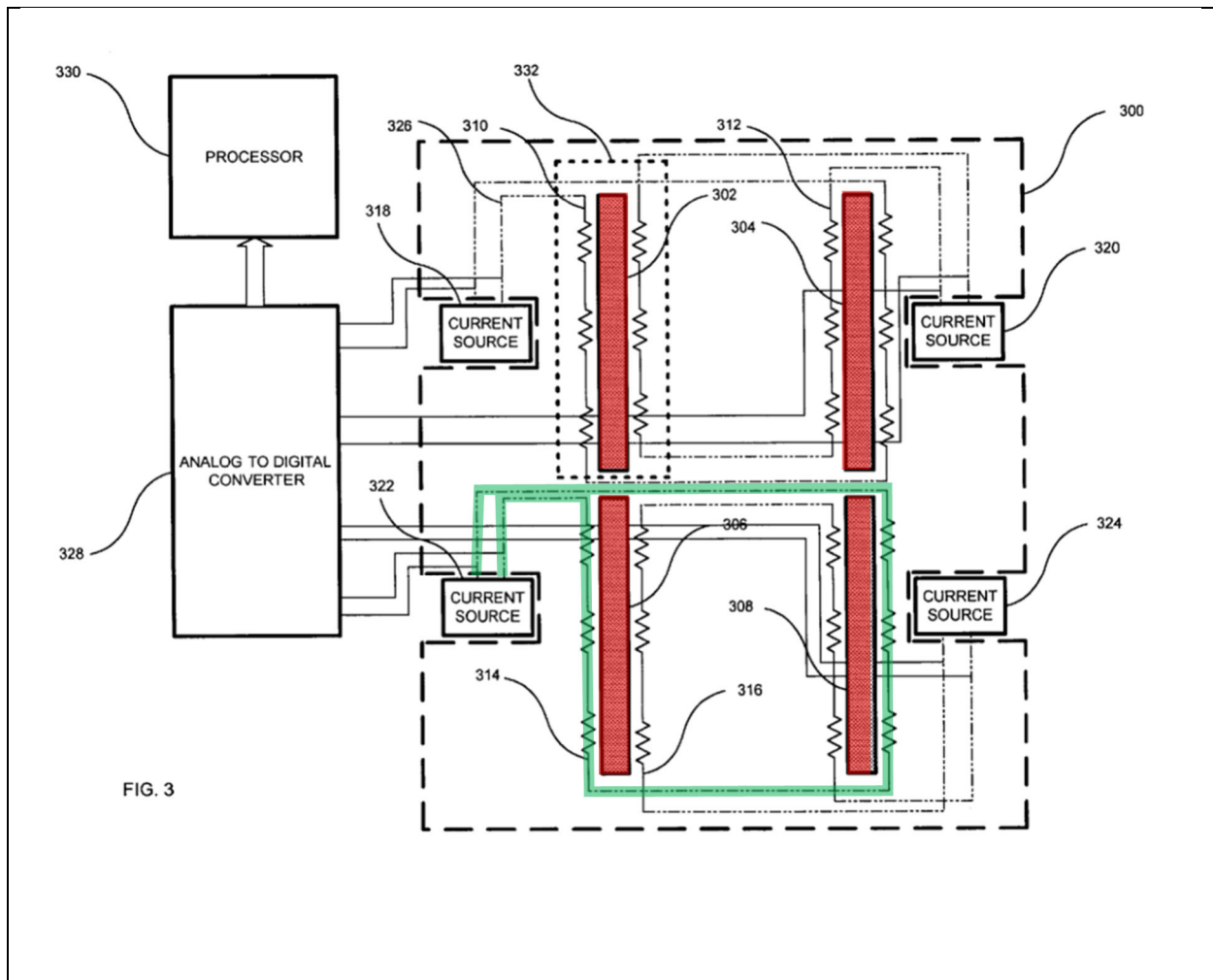
Giere '178 discloses resistive elements 310, 312, 314, and 316 that assume the local temperature of a region. Unlike the '708 patent, Giere '178 does not disclose a printhead having multiple vias, nor does it suggest implementing a single temperature sensing element in a region between two ink vias. Instead, Giere '178 includes 4 temperature sensing resistors. First, temperature sensor 310 [green below] is positioned along outside edges of the upper arrays of heating elements in regions 302/304:



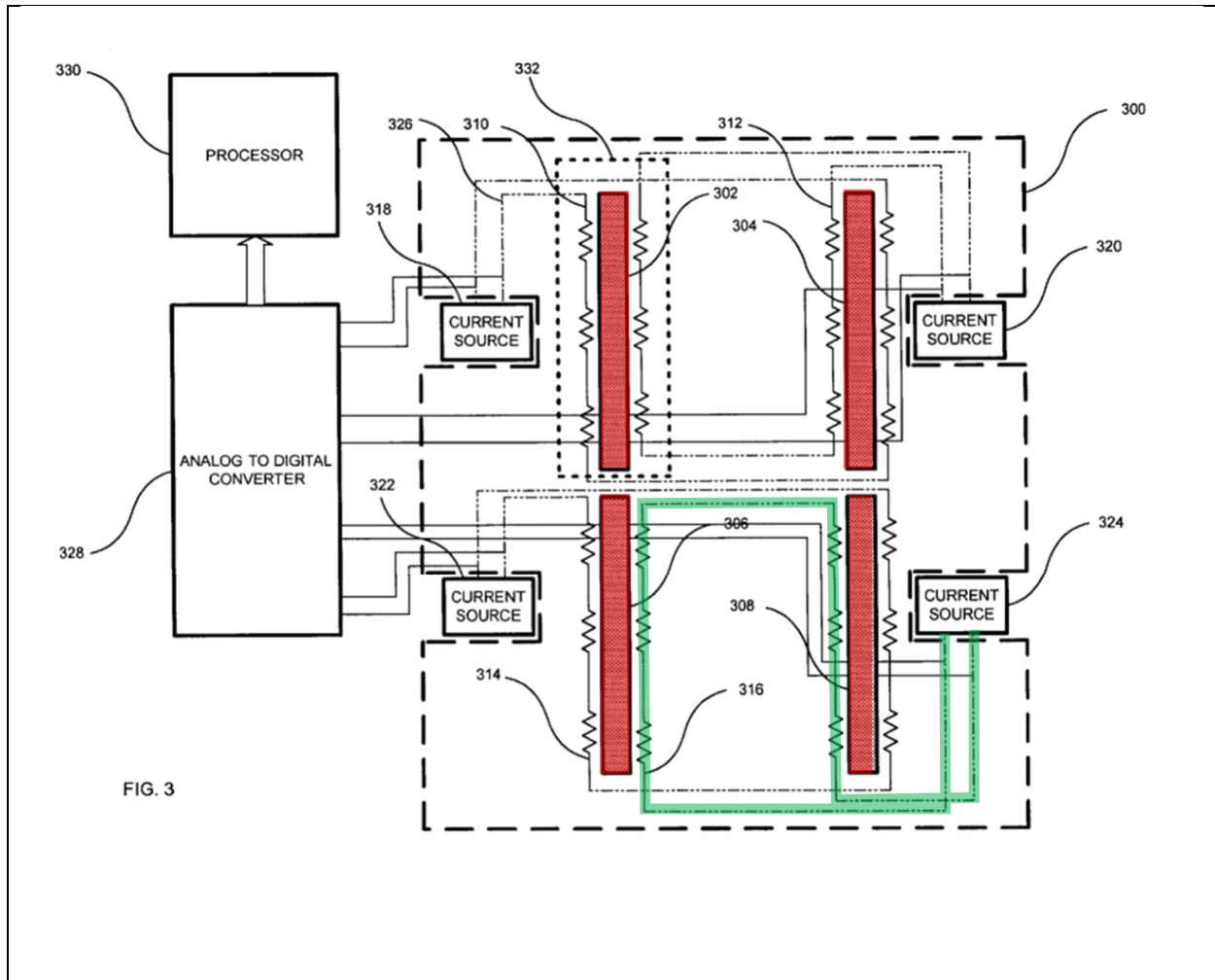
Second, temperature sensor 312 [green below] is positioned along inside edges of the upper arrays of heating elements in regions 302/304:



Third, temperature sensor 314 [green below] is positioned along outside edges of the lower arrays of heating elements in regions 306/308:



Finally, temperature sensor 316 [green below] is positioned along inside edges of the lower arrays of heating elements in regions 306/308:



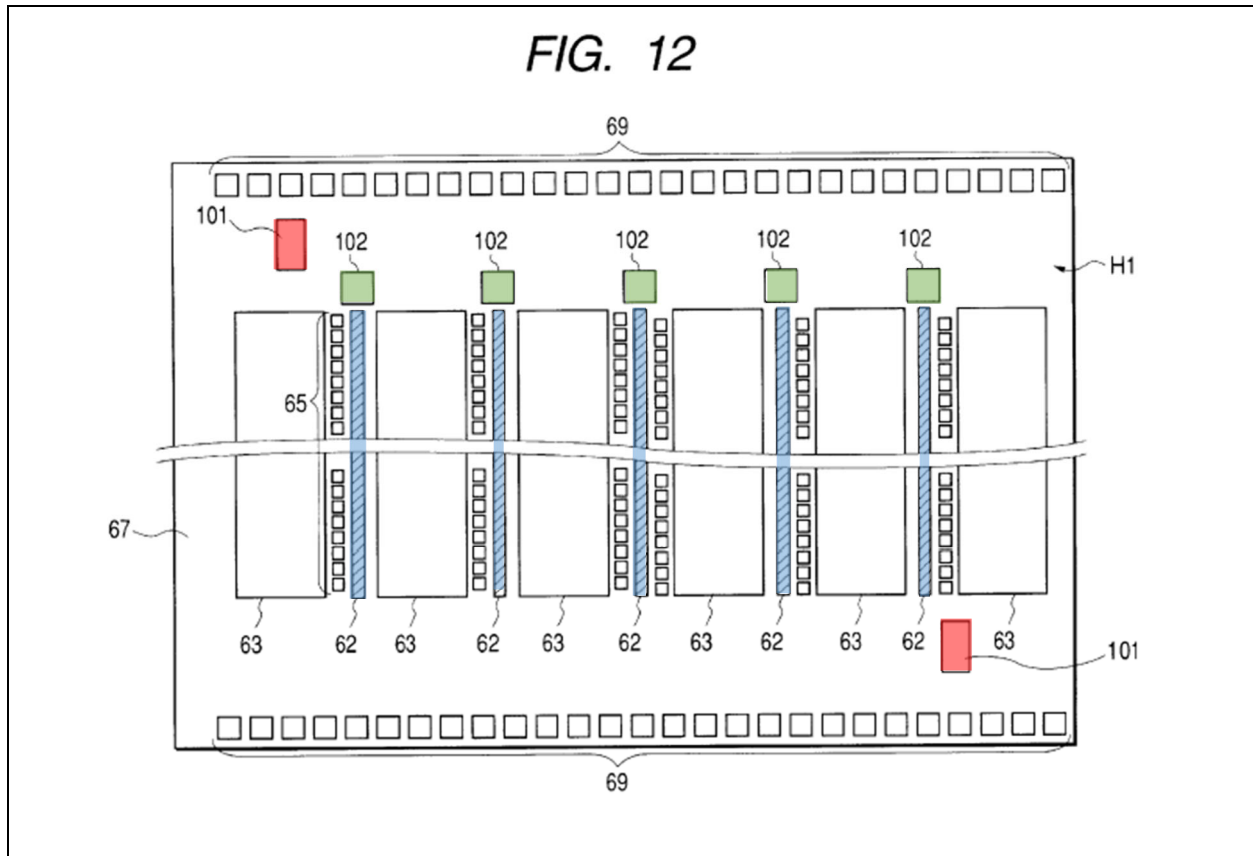
Thus, Giere '178 does not disclose a printhead with multiple adjacent ink vias having heater arrays along the two longitudinal sides of each via. It teaches nothing useful to a PHOSITA interested in developing a temperature sensing system for such a printhead design. Giere's design is directed to separately sensing each side of multiple ink ejector arrays associated with a central ink via or an edge feed ink supply mechanism. In the case of Giere '178's center feed via as illustrated above, there are four temperature sensors on each side the central ink via used to measure the upper left, upper right, lower left, and lower right of the columns of ink ejection

actuators. If an edge feed design is utilized instead, the region between the two edges will have four temperature sensors in order to measure the upper left, upper right, lower left, and lower right of the columns of ink ejection actuators.

4. U.S. Patent No. 6,527,367 to Yabe (Ex. 1008)

In Yabe, temperature detectors are placed to detect the temperature of the substrate as a whole, and one or more “sub-heater” devices other than ink ejection actuators are provided to heat the substrate. (Ex. 1008 col. 14 lns 27-54.) Specifically, there are “temperature detecting means for detecting the temperature of the heater board, and the heat generating resistive elements (sub-heaters) serving as means for heating the base plate in order to control temperature to make the temperature distribution of the heater board uniform in accordance with the detection result of the temperature detecting means.” (*Id.* col. 14 lns 29-37.)

In Fig. 12, Yabe discloses a substrate with multiple temperature detecting means 102 [green below], but “each of the temperature detecting means 102 is arranged only on one side in the vicinity of each end portion of the ink supply ports 105 [blue].” (Ex. 1008 col.15 lns 51-61.)



This arrangement is provided in order to “detect the temperature of the heater board H1.” (*Id.* col. 15 lns 61-64.) There is no suggestion in Yabe to position the temperature sensors between arrays of heaters or between ink supply ports [ink vias], such as in the areas occupied by driving circuits 63. Two sub-heaters 101 [red] are provided in order to keep temperature as uniform as possible. (*Id.* col. 15 lns 36-44.)

Alternatively, in Fig. 14 only one temperature detecting means 102 is arranged in the vicinity of one end of a central ink supply port because the size of the “base plate” is smaller than in Fig. 12. (*Id.* col. 16 lns 35-44.)

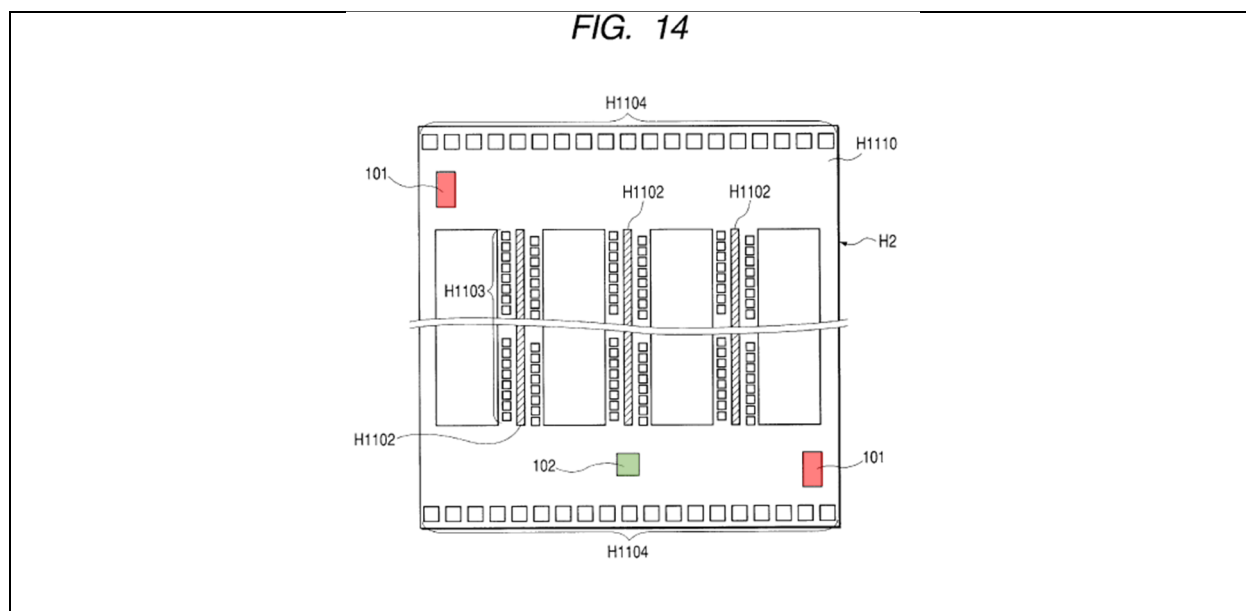
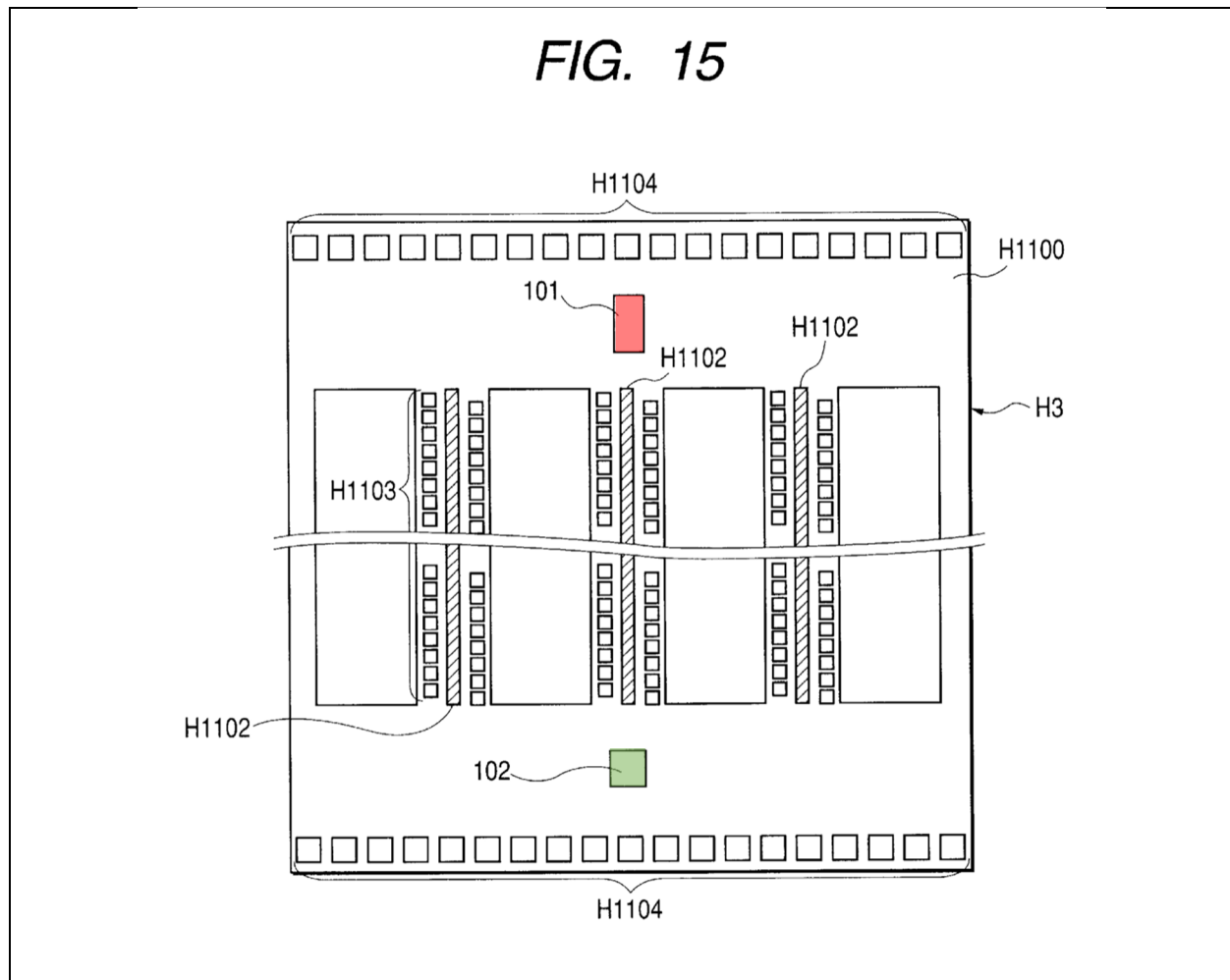


Fig. 15, meanwhile, shows only one temperature detector 102 [green] and sub-heater [red].



III. THE PERSON OF ORDINARY SKILL IN THE ART

Petitioners contend that a person of ordinary skill in the art (“PHOSITA”) at the time of the priority date of the ’708 patent would have had at least a bachelor’s level college degree in Mechanical Engineering, Materials Science, Physics, Electrical Engineering, or a related field, and at least two years of training or experience in the design of inkjet printheads. (Pet. at 6). Slingshot does not dispute this characterization of the level of ordinary skill in the art for the purpose of this

Preliminary Response, except that it disagrees that a degree in Materials Science is sufficient.

IV. CLAIM CONSTRUCTION

Petitioners propose to construe the term “adjacent” to mean “next to and can include” in the context of claims 1 and 9. Patent Owner does not agree with this construction and contends that “adjacent” carries its plain and ordinary meaning throughout the claims.

According to Petitioners, claims 1 and 9 recite a region that is both disposed “adjacent each heater array” and also “includes two heater arrays.” (Pet. at 7.) But Petitioners parse the claims incorrectly, ellipting out additional words that clarify the structure being described. Claim 1 recites a plurality of parallel ink vias with heater arrays on each longitudinal side of the ink vias. The claim then recites “a region disposed adjacent each heater array” and that a “region is disposed between two adjacent ink vias.” A PHOSITA would readily understand that this reflects the layouts shown in Figures 4 and 5, in which there is a region disposed adjacent pair of heater arrays (such as 432, 434 and 436 in Fig. 4) which is part of a broader region disposed between two adjacent ink vias. Per the claim language, it is the broader “region *disposed between two adjacent ink vias* [that] includes two heater arrays.” Claim 9 describes essentially the same structure in the context of a method of fabricating a printing chip.

Thus, the claims do not say that the region disposed adjacent two heater arrays also includes the two heater arrays. The claims say that there is a region between two heater arrays and there is region between two ink vias that also includes the two heater arrays. Accordingly, Petitioners' proposed construction of "adjacent" to mean "next to and can include" is not necessary to a proper understanding of the scope and meaning of claims 1 and 9. The proposed construction does not reflect the ordinary meaning of "adjacent" and is not supported by a proper reading of the claims or specification of the '708 patent.

The proposed construction should be rejected for the additional reason that the term "adjacent" appears six times in claim 1 and five times in claim 9. Petitioners focus solely on the usage of "adjacent" in the phrase "a region disposed adjacent each heater array" of claim 1 and the phrase "a region adjacent each heater array" of claim 9. Petitioners have not shown that their nonconventional construction would be appropriate for any other claim limitations reciting "adjacent," and, indeed, it would potentially distort those limitations in unintended ways. Therefore, any consideration given to Petitioners' construction of "adjacent" should be limited to construing the meaning of those two phrases as a whole and not the word "adjacent" per se.

V. LEGAL STANDARDS

A. Anticipation

“[R]ejections under 35 U.S.C. § 102 are proper only when the claimed subject matter is identically disclosed or described in ‘the prior art. . . .’ The [prior art] reference must clearly and unequivocally disclose the claimed [invention] or direct those skilled in the art to the [invention] without any need for picking, choosing, and combining various disclosures not directly related to each other by the teachings of the cited reference.” *In re Arkley*, 455 F.2d 586, 587 (CCPA 1972). Thus, “unless a reference discloses within the four corners of the document not only all of the limitations claimed but also all of the limitations arranged or combined in the same way as recited in the claim, it cannot be said to prove prior invention of the thing claimed and, thus, cannot anticipate under 35 U.S.C. § 102.” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008).

“To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.” *Continental Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991) (citing *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981)). “Inherency, however, may not be established by

probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient.” *Id.* at 1268–69 (quoting *Hansgird v. Kemmer*, 102 F.2d 212, 214 (CCPA 1939)).

B. Obviousness

Petitioners’ obviousness grounds are not supported by the required § 103 analysis. Petitioners must prove that the claimed subject matter would have been obvious to a PHOSITA at the time of the invention. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). A complete analysis requires that the Board determine (1) the scope and content of the prior art, (2) differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) relevant objective indicia of non-obviousness (also known as secondary considerations). *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17 (1966).

An invention “composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR*, 550 U.S. at 418. Rather, Petitioners must show, but do not, that a PHOSITA would have been motivated to pick out the asserted multiple references and combine them in a way the claimed invention does. *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 993–94 (Fed. Cir. 2017). This showing must be made without any “hint of hindsight,” *Star Scientific, Inc. v. R.J. Reynolds Tobacco Co.*, 655 F.3d 1364, 1375 (Fed. Cir. 2011), so as to avoid “reconstruction by using the patent in

suit as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claims in suit.” *In re NTP, Inc.*, 654 F.3d 1279, 1299 (Fed. Cir. 2011) (internal citations omitted). A challenger cannot, as Petitioners do here, pick and choose among individual parts of assorted prior art references as a mosaic to recreate a facsimile of the claimed invention. *Akzo N.V. v. United States ITC*, 808 F.2d 1471, 1481 (Fed. Cir. 1986).

The test for obviousness is what the combined teachings of the references would have suggested to a PHOSITA. *In re Young*, 927 F.2d 588, 591 (Fed. Cir. 1991). Each reference must be evaluated in its entirety. *In re Evanega*, 829 F.2d 1110, 1112 (Fed. Cir. 1987). A reference must be considered for all that it teaches, including disclosures that teach away from the invention at hand. *In re Dow Chem. Co.*, 837 F.2d 469, 473 (Fed. Cir. 1988). A reference teaches away when a skilled artisan would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path taken by the inventor. *Monarch Knitting Mach. Corp. v. Sulzer Morat GmbH*, 139 F.3d 877, 885 (Fed. Cir. 1998).

If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984). Similarly, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the

teachings of the references are not sufficient to support a theory of obviousness. *In re Ratti*, 270 F.2d 810, 813 (CCPA 1959).

Petitioners must support their obviousness contentions with articulated reasoning and based on rational, factual underpinnings; conclusory statements of obviousness will not suffice. *KSR*, 550 U.S. at 418; *In re NuVasive*, 842 F.3d 1376, 1382–83 (Fed. Cir. 2016). Similarly, any expert testimony must explain in detail how specific references could be combined, which combinations of elements in specific references would yield a predictable result, and how any specific combination would operate or read on the asserted claims. *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1327 (Fed. Cir. 2012).

VI. THE PETITION FAILS TO ESTABLISH A REASONABLE LIKELIHOOD THAT ANY OF CLAIMS 1-3, 5-12, AND 14-15 WOULD HAVE BEEN OBVIOUS IN VIEW OF BENJAMIN IN VIEW OF GIERE '673 (GROUND 1)

Ground 1 challenges independent claims 1 and 9 and dependent claims 2-3, 5-8, 10-12, and 14-15 as obvious in view of the combination of Benjamin and Giere '673. For the reasons explained below this theory of obviousness does not withstand scrutiny, and should be rejected.

A. Ground 1 Fails Because The Combination Of Benjamin And Giere '673 Does Not Disclose All Limitations Of The Independent Claims

The Petition states that Benjamin discloses a plurality of ink vias each having a heater array disposed adjacent each longitudinal side of the ink vias, but admits

that Benjamin does not disclose anything regarding where on the printhead die the temperature sense resistor (TSR) should be disposed. (Pet. pp. 13-16 and 21-22.) Thus, Benjamin indisputably fails to disclose a fundamental aspect of the independent claim 1 – “a single temperature sensing element disposed within each region [disposed adjacent each heater array], the temperature sensing element operable to sense a temperature representative of the heater arrays adjacent to the region . . . ” – and also fails to disclose the corresponding limitation of independent claim 9.

Petitioners resort to Giere ’673 for the missing single temperature sensing limitation. However, Giere ’673 also fails to disclose this. As discussed above, the temperature monitoring and control system disclosed in Giere ’673 includes a temperature sense resistor 510, a digital temperature sensor 512 and multiple temperature recorders 542, 544 and 546 in the region between adjacent heater arrays. (Ex. 1005 at Fig. 5 and col. 4 lns 55-56, col. 5 lns 28-31, col. 6 lns 35-40.) Giere ’673 relates exclusively to a system that requires inputs from these multiple temperatures sensors, together with firing history data, to monitor and predict substrate thermal conditions of particular ink ejection elements and to set operating conditions so as to maintain optimal temperatures. (*Id.* col. 6 lns 5-18.)

Establishing obviousness requires proving the scope and content of the prior art. *Graham*, 383 U.S. at 17–18. Because Benjamin and Giere ’673 each fail to

disclose a printhead chip having a single temperature sensing element in each region disposed between the heater arrays associated with two parallel ink vias, the proposed combination of these two references necessarily fails to render the subject matter of independent claims 1 and 9 obvious. Indeed, demonstrating that all claimed limitations are disclosed in the prior art is a threshold component of any obviousness challenge. *Par Pharm., Inc. v. TWi Pharms., Inc.*, 773 F.3d 1186, 1194 (Fed. Cir. 2014) (citing *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1164 (Fed. Cir. 2006) (stating that motivation to combine and reasonable expectation of success considered only “if all the elements of an invention are found in a combination of prior art references”)). Ground 1 must be rejected for this threshold reason.

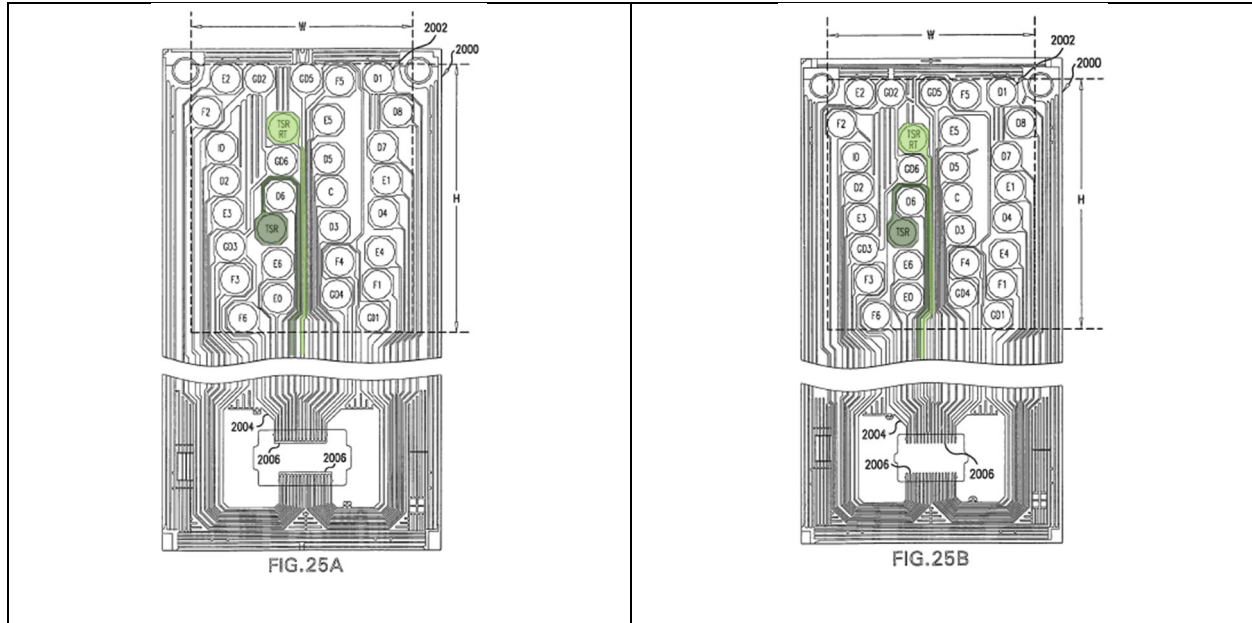
B. Ground 1 Fails Because The Proposed Modifications To Benjamin Are Based On Hindsight-Driven Cherry Picking And Reconstruction

Unable to show that all of the claimed limitations are disclosed in the prior art as the first step of a proper obviousness theory, Petitioners resort to selecting discrete elements to conjure up a printhead that does not comport with the design or operating principles of the devices disclosed in either of the prior art references. According to the Petition, “a PHOSITA would have applied Giere ’673’s teachings to Benjamin by (i) disposing a single TSR within a region of Benjamin’s printhead formed between two adjacent heater arrays...and (ii) positioning the TSR equidistant from both heater array[s] 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.” (*Id.* p. 22.) However, because Giere '673 neither discloses nor suggests a printhead chip having a single temperature sensor in the region between the heater arrays of two adjacent ink vias, applying its teachings to Benjamin would not have led a PHOSITA to the claimed invention. The relevant teachings of Giere '673 are limited to its fundamentally different temperature monitoring circuitry involving no fewer than five temperatures sensors in that region.

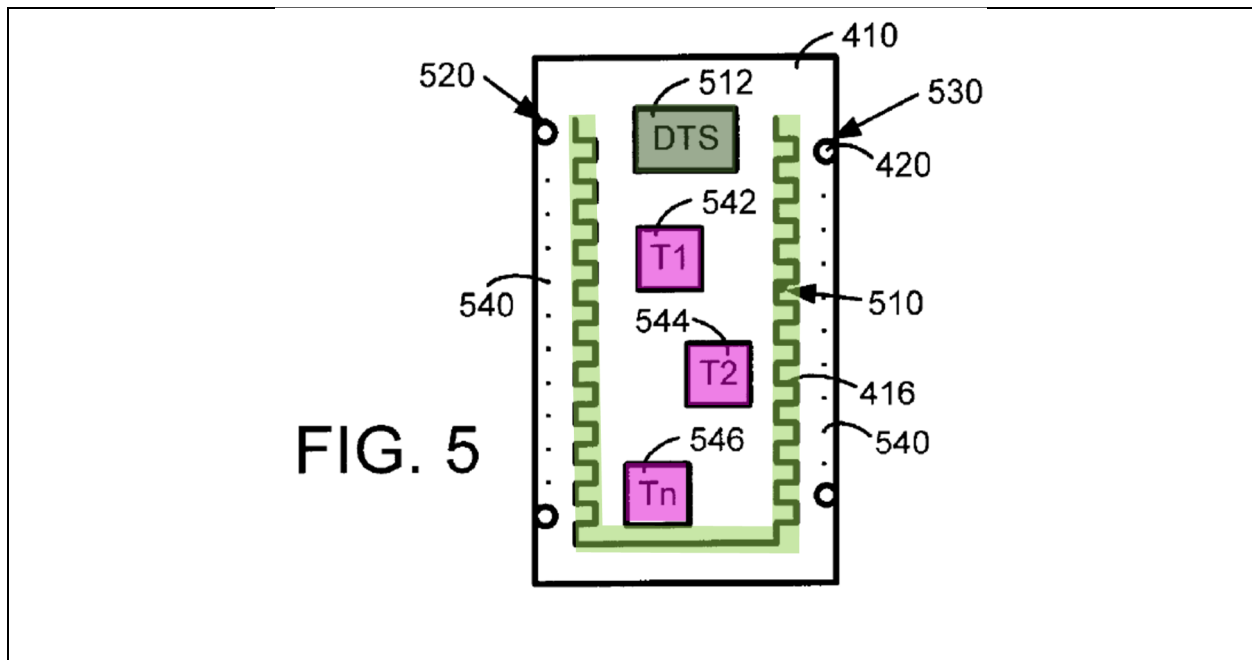
Another fatal flaw with Petitioners' logic is that neither Benjamin nor Giere '673 are directed to monitoring the temperature of individual regions between two heater arrays on a printhead having a plurality of such regions. Benjamin discloses a printhead having multiple such regions. However, Benjamin discloses that only a single temperature sensor is on the printhead die and that the temperature sensor measures the temperature of the entire printhead: “[t]emperature sense resistor contact area TSR allows a printer coupled to an ink jet cartridge to determine *a temperature of the printhead die*, based upon a measurement of *the resistor*” (Ex. 1004 col. 79 lns 60-67.) As discussed above, the Benjamin device can accommodate only one temperature sense resistor because there is only a single contact area (TSR) [dark green] on the flex circuit shown in Figs. 25A and 25B below, and a single

return contact area (TSR-RT) [light green]. (*Id.* Figs. 25A-B and col. 79 lns 29-34 and 63-65.)



A PHOSITA would understand that this could be accomplished, for example, using the known approach discussed as background in the '708 patent of a single temperature sense resistor extending along the periphery of the entire silicon substrate to measure the average temperature of the printhead regardless of the number of ink vias. (Ex. 1001 Fig. 1 and col. 1 lns 56-67.) Because Benjamin discloses only a single temperature sensor and detects only a temperature for the printhead as a whole, it would have provided no reason for one of ordinary skill in the art to measure and/or control the temperature of a printhead die on a region-by-region basis.

Giere '673 does not cure this deficiency. Fig. 5 below is a top view of the substrate showing a thermal sense resistor 510 [light green], a digital temperature sensor 512 [dark green], and multiple temperature recorders 542, 544, and 546 [pink]. The temperature sense resistor [light green] forms a u-shape near the edges of the printhead die.



Giere '673 does not disclose ink vias, let alone multiple parallel ink vias having heater arrays adjacent each longitudinal side resulting in multiple regions between heater arrays, as is relevant to claims 1 and 9 and as disclosed in Benjamin. The printhead of Giere '673 has two columns of nozzles at opposite ends of the substrate with each column receiving ink flowing around the edges of the substrate and having a single heater array at the inboard side of the column. (Ex. 1005 col. 5 lns 42-50.)

Giere '673 therefore does not teach anything about the placement of the temperature sensor in the multi-via type of printhead disclosed on Benjamin.

Petitioners' failure to take into account (i) the significant differences between the printheads disclosed in Benjamin and Giere '673, (ii) that Giere '673 teaches nothing about monitoring or controlling temperature in a multi-region substrate of the type disclosed in Benjamin, or (iii) that Giere '673 teaches multiple temperatures sensors to monitor temperature in a region between heater arrays, exposes Petitioners' hindsight-driven approach. The only source that relates to the overall printhead structure and the temperature monitoring approach recited in claims 1 and 9 is the '708 patent specification. But the specification of the challenged patent may not be used as a template to pick and choose favorable teachings from otherwise incompatible prior art references. *In re NTP, Inc.*, 654 F.3d at 1299 (cautioning against "reconstruction by using the patent in suit as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claims in suit."). Rather than using hindsight reconstruction, the prior art references must be considered in their entirety to fully appreciate what a reference suggests to a POSITA. *In re Wesslau*, 353 F.2d 238, 241 (CCPA 1965). As the *Wesslau* court explained, "[i]t is impermissible within the framework of section 103 to pick and choose from any one reference only as much of it as will support a given position, to the exclusion of other parts necessary to the full

appreciation of what such reference fairly suggests to one of ordinary skill in the art.” *Id.*

The Petition acknowledges that it is the “temperature of the **entire printhead die**” that Benjamin utilizes to regulate operational temperature. (Pet. p. 23, emphasis in original.) Although Benjamin itself discloses doing this using one temperature sensor, Petitioners counter-intuitively suggest that a PHOSITA would have placed a temperature sense resistor in a region between heater arrays in Benjamin’s printhead based on Giere ’673’s teachings due to alleged “structural similarities” between the references, but then would have recognized that this “would not be an ideal location to accurately report the mean temperature of the entire printhead die” and consequently would have placed additional temperature sense resistors to measure other individual regions of the die of Benjamin. (Pet. pp. 21-24; Ex. 1002 ¶¶ 182-188.) Petitioners then imply that the PHOSITA somehow would have used those measurements, in a manner unexplained in the Petition, to determine an average temperature of the entire substrate. (Pet. pp. 23-24; Ex. 1002 ¶¶ 177 and 188.) But this *ex post facto* reasoning bears no relation to either Benjamin or Giere ’673. Neither reference teaches computing an average temperature of an entire substrate from multiple individual temperature measurements taken in discrete regions. That Petitioners’ expert could envision such an approach in the context of challenging the validity of the ’708 patent is not sufficient to show what the teachings of the

references would have suggested to a PHOSITA at the time of the invention. Such conclusory statements of an expert do not suffice to show that an element is present or would have been obvious to those skilled in the art. *In re NuVasive*, 842 F.3d at 1382–83; *see also K/S HIMPP v. Hear-Wear Techs., LLC*, 751 F.3d 1362, 1365–67 (Fed. Cir. 2014) (conclusory arguments and expert testimony may not be used to compensate for shortcomings in the prior art.).

Petitioners further attempt to support their position by arguing that it was well known at the time of the '708 patent that ink vias act as thermal insulators between regions, and therefore a PHOSITA would have placed individual temperature sensors in each region between ink vias to measure and calculate the mean temperature of the printhead. (Pet. at top of p. 23.) This is inaccurate and unsupported in the record. Petitioners first cite their expert's declaration (Ex. 1002) at ¶ 161, which is a paragraph that says nothing about the insulating properties of ink vias being well known and only makes conclusory assertions regarding what a PHOSITA supposedly would have done to determine the mean temperature of a printhead die. Petitioners then cite the '708 patent itself, which reveals that the ink vias act as thermal barriers but does not indicate that this was well known at the time or that other investigators appreciated the implications of this when designing temperature sensing circuitry for printheads having multiple parallel ink vias. Furthermore, Petitioners do not even attempt to show evidence that placing

individual sensors in multiple regions between ink vias was a known manner of obtaining the mean temperature of the printhead die as a whole.

Finally, Petitioners point to U.S. Patent No. 6,527,367 to Yabe, which at the cited passage mentions the heat insulating characteristic of ink supply ports in “side shooter” printheads. (Ex. 1008 col. 3 lns 16-21.) Petitioners do not attempt to explain how “side shooter mode” is applicable here, or that Benjamin and Giere '673 disclose “side shooter” printheads. Nevertheless, as discussed above at Section II.C.4, Yabe does not disclose temperature sensors between ink vias, and instead measures mean temperature of a printhead (the purported goal of a PHOSITA throughout Ground 1) with sensors in the peripheral region of the die instead of between ink vias.

C. Ground 1 Fails Because The Petition Fails To Address How Benjamin Would Have Been Modified Without Changing Its Fundamental Operating Principles

Ground 1 is deficient for the additional reason that Petitioners have failed to establish how Benjamin could be modified in the manner proposed. *ActiveVideo*, 694 F.3d at 1327 (theory of obviousness must show how specific references could be combined, which combinations of elements in specific references would yield a predictable result, and how any specific combination would operate). Providing individual temperature sensors in each of the areas between ink vias in Benjamin would require additional resources, and would require a contact and return for each

sensor on the flexible circuit connected to the printhead die, multiplying the number of components connected to the die and taking up space on the cartridge containing the printhead. (Ex. 1004 Figs. 25A-B.) This hypothetical approach would also necessitate other modifications involving additional circuitry to compute the average temperature. The required modifications would change the principles of operation of Benjamin's disclosed device, which is another reason why the proposed combination is not sufficient to support a theory of obviousness. *In re Ratti*, 270 F.2d at 813.

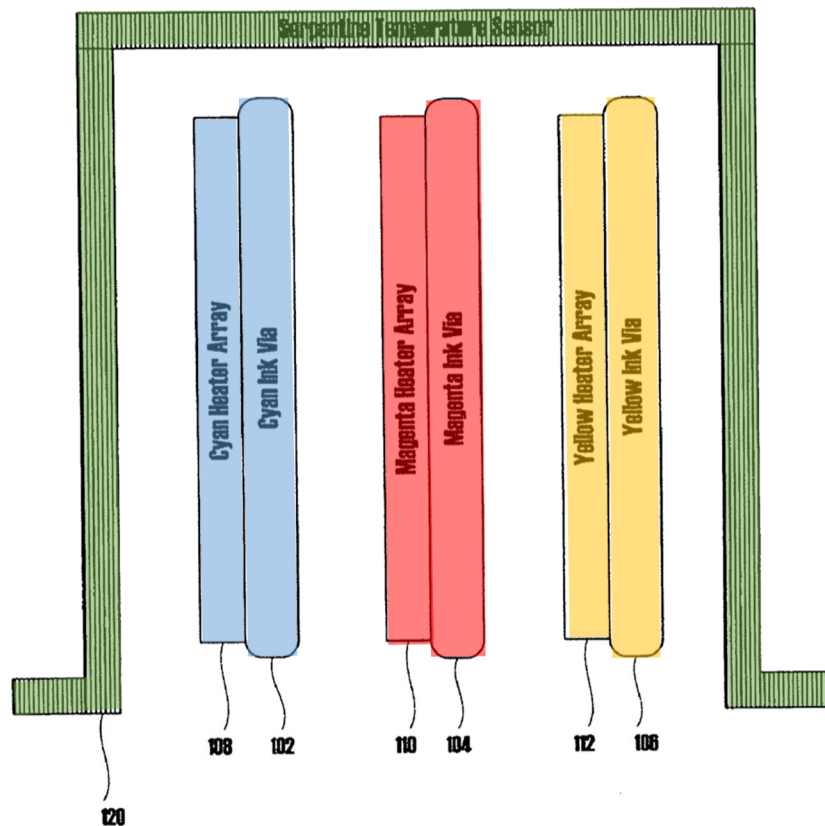


FIG. 1
(Prior Art)

D. Ground 1 Fails Because A POSA Would Not Have Been Motivated To Modify Benjamin To Incorporate A Single Temperature Sensor In Each Region

The Board need not address alleged motivations to combine Benjamin and Giere '673 because their combined teachings plainly do not account for all elements of the claimed invention. Moreover, Petitioners allege only generic motivations that are unpersuasive. First they allege that both references are from the same field of endeavor, regulating operational temperature of a printhead die for a printhead device. While it is true that both references relate to printheads, Petitioners ignore significant structural differences in the printheads, most notably that Benjamin relates to temperature monitoring of a printhead having multiple regions between parallel ink vias while Giere '673 does not. Even if considered to be within the same field of endeavor, this does not demonstrate that a PHOSITA would have combined elements of their disclosed devices in the specific manner proposed in the Petition. Indeed, combining the two references would not have resulted in the claimed invention for the reasons discussed above.

Petitioners also argue that Benjamin and Giere '673 address similar problems, that a PHOSITA would have had a reasonable expectation of success, and that both references expressly articulate the interchangeability and modification of the disclosed embodiments, but none of those factors indicate that aspects of the references would have been combined in the precise manner alleged by Petitioners.

Indeed, it is not enough to suggest that a PHOSITA *could* make the claimed invention; there must be evidence demonstrating that they *should* make the claimed invention and that they would have a reasonable expectation of success in doing so. *In re NuVasive, Inc.*, 842 F.3d at 1381–82. Petitioners simply cannot, and make no attempt to, explain why a PHOSITA would have modified Benjamin to replace its single temperature sensor for measuring average substrate temperature with a more complex system involving a separate temperature sensor between each pair of ink vias and the additional circuitry, connections, and processing components required to derive the average substrate temperature from those measurements. Neither of the references suggest such an approach for monitoring average temperature of an entire substrate. Petitioners have failed to establish any reason why a PHOSITA would have utilized that approach for providing the average substrate temperature value utilized in Benjamin's device. The Petition lacks any credible evidence of a motivation to combine the references in a manner that results in the subject matter of claims 1 or 9.

Petitioners' conclusory Ground 1 arguments with regard to independent claims 1 and 9, which fail to account for all elements of the claims and rely on improper hindsight, should be rejected. The challenged dependent claims 2-3, 5-8, 10-12, and 14-15 include the limitations of the corresponding independent claims. Therefore, Petitioners' Ground 1 challenge to the dependent claims also fails.

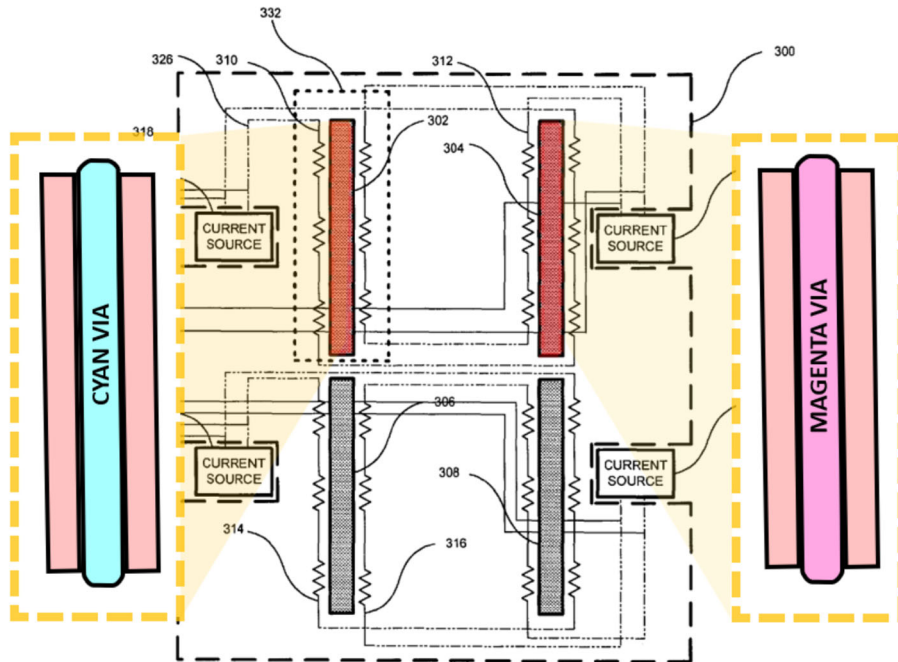
VII. THE PETITION FAILS TO ESTABLISH A REASONABLE LIKELIHOOD THAT CLAIMS 4 AND 13 WOULD HAVE BEEN OBVIOUS IN VIEW OF BENJAMIN, GIERE '673, AND PARISH (GROUND 2)

Ground 2 relies on the same arguments as Ground 1, and Petitioners further argue that a PHOSITA would have found it obvious to use a specific type of thermal sensor recited in dependent claims 4 and 13 in view of Parish. Those dependent claims include the limitations of corresponding independent claims 1 and 9. Therefore, the Ground 2 challenge also fails for at least the same reasons discussed above relative to Ground 1.

VIII. THE PETITION FAILS TO ESTABLISH A REASONABLE LIKELIHOOD THAT ANY OF CLAIMS 1-3, 5-12, AND 14-15 ARE RENDERED OBVIOUS BY GIERE '178 AND KNOWLEDGE OF A PHOSITA (GROUND 3)

Ground 3 challenges claims 1-3, 5-12, and 14-15 based on Giere '178 and the knowledge of a PHOSITA. This ground should be rejected out of hand because it relies on the false premise that Giere '178 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. (Pet. pp. 48-50.) Giere '178 discloses no such thing, and Petitioners' interpretation of the reference is directly contrary to its express teachings.

Petitioners present the following illustration:



(Pet. at 50.) This reimagines Fig. 3 of Giere '178 as if it had disclosed four separate ink slots/vias with heater arrays positioned along both sides of each slot. Petitioners attempt to justify their fanciful interpretation as follows:

- Giere '178 explains that “ink then flows through a central slot in the substrate . . . and finally into the various ink ejection chambers.” (Pet. at 48 (citing Ex. 1007 col. 3 lns 33-49).)
- Because the regions 302, 304, 306, and 308 would be understood to include ejection chambers, and because ink slots/vias are used to supply ink to ejection chambers in a typical printhead, a PHOSITA would have understood Giere '178 to disclose separate ink slots/vias for each of the regions 302, 304, 306, and 308. Such a design would supposedly ensure that ink can refill quickly into the ejection chambers. (Pet. at 48-49.)
- It would also be understood that Giere '178 discloses heater arrays positioned on both sides of each of the four ink vias because the temperature sensors positioned around the regions could sense heat generated by both heater arrays in such a design. (Pet. at 51-52.)

These assertions are *non-sequiturs* and simply untenable in view of the express teachings of the reference.

To begin with, the relevant passage describing the central slot of Giere '178 actually states:

Ink is then 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.

(Ex. 1007 col. 3 lns 37-45.) The description of an *elongated hole formed in the center of the substrate* and *a central slot in the substrate* means what it says – one slot at a central location of the substrate. The only disclosed alternative is a feed mechanism extending around the outer edges of the substrate. There is no mention or suggestion of multiple ink slots or of slots located in the non-central regions 302, 304, 306, and 308. Indeed, the passage also discloses a central manifold and a plurality of ink channels for directing ink from the central slot to the ink ejection chambers. This further defeats the notion of four separate ink slots that feed directly into adjacent sets of heater arrays and ejection chambers. The Petition ellipses out and

attempts to draw attention away from this additional description of a central manifold and ink distributing channels.¹

The assertion that Giere ’178 discloses four separate ink vias having heater arrays on both longitudinal sides also runs directly counter to what the reference actually describes. Giere ’178 unequivocally states that “regions 302, 304, 306, and 308 each include *an array* of nozzles and associated firing resistors for ejecting ink.” (Ex. 1007 col. 8, lns 47-49.) Furthermore, Giere ’178 never states or implies that these regions further include their own separate ink via. (*Id.*)

Accordingly, there is no basis for interpreting Giere ’178 as disclosing a printhead having four ink slots with one ink slot positioned in each quadrant, nor is there any indication that Giere ’178 even discloses multiple ink slots. Instead, Giere ’178 teaches that ink is supplied to the inkjet printhead through a central slot in the substrate, then into a central manifold, then into ink channels, and then into various ink ejection chambers. (*Id.* col. 3 lns 34-44.) Alternatively, the ink may be fed around the outer edges of the substrate instead of through a central via, which would result in the printhead die having no ink vias. (*Id.*)

¹ The fact that Petitioners and their expert present their “annotated” version of Fig. 3 as a way of supplying different ink colors to separate ejector regions is also misleading. Not only does Giere ’178 not teach this, Fig. 1 of the reference shows each color of ink in a separate cartridge 110a-d. (Ex. 1007 Fig. 1 and col. 7 lns 1-17.)

Neither of these printhead embodiments actually disclosed in Giere '178 are relevant to the challenged claims because they do not have multiple parallel ink vias having heater arrays placed along both longitudinal sides of the vias. Nor does either embodiment disclose placing a single temperature sensor in each region between adjacent vias operable to sense a temperature representative of the adjacent heater arrays, as is further recited in independent claims 1 and 9.

Petitioners may not advance an inaccurate, embellished reading of Giere '178 through the artifice of expert opinion testimony purporting to interpret the reference based on the "knowledge of a PHOSITA." Conclusory arguments and expert testimony, unsupported by any corroborating evidence, may not be used to compensate for shortcomings in the prior art. *K/S HIMPP*, 751 F.3d at 1365–67; *see also Arendi S.A.R.L. v. Apple*, 832 F.3d 1355, 1361-62 (Fed. Cir. 2016) (cautioning against invoking a PHOSITA's common sense or knowledge to supply claim limitation missing from a prior art reference); *Homeland Housewares, LLC v. Whirlpool Corp.*, 865 F. 3d 1372, 1378 (Fed. Cir. 2017) (disregarding expert testimony where it contradicts disclosure of patent specification). A PHOSITA would not ignore that Giere '178 discloses ink feed regions along the edges of the substrate or through one via at the center of the substrate, or its failure to make any mention of ink vias in regions 302, 304, 306, and 308 that are explicitly disclosed to be occupied by heaters and associated nozzles. A PHOSITA would interpret the

reference based on what it actually discloses, not as a result-based argument created solely to mimic the elements of the ’708 patent claims.

The interpretation advanced by Petitioners is neither supported by the express teachings of Giere ’178 nor inherent in those teachings. To invoke inherency to establish the existence of a claim limitation in the prior art for an obviousness analysis, “the limitation at issue necessarily must be present, or the natural result of the combination of elements explicitly disclosed by the prior art.” *Par Pharm.*, 773 F.3d at 1195–96. The Petition makes no such showing, and it cannot do so.

Because it depends on a grossly inaccurate depiction of the disclosure of Giere ’178, Ground 3 must be rejected.

IX. THE PETITION FAILS TO ESTABLISH A REASONABLE LIKELIHOOD THAT ANY OF CLAIMS 1-3, 5-12, AND 14-15 WOULD HAVE BEEN OBVIOUS IN VIEW OF GIERE ’178 AND YABE (GROUND 4)

Ground 4 argues that it would have been obvious to modify the printhead of Giere ’178 based on Yabe to arrive at the same structure that it alleges to be shown by Giere ’178 alone in Ground 3 above. While Petitioners (incorrectly) continue arguing that Giere ’178 discloses every limitation of claims 1 and 9, they also assert that Yabe discloses every limitation except for limitations 1[E] (single temperature sensing element disposed within each region), 1[F] (operable to sense a temperature), and [1G] (predetermined distance), which are the elements relating to a temperature sensor. (Pet. pp. 82-92.)

Ground 3 is undeveloped and should be rejected out of hand because a petition must “identif[y], in writing and with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3). Further, 37 C.F.R. § 42.22(a)(2) states that the petition must include “[a] full statement of the reasons for the relief requested, including a detailed explanation of the significance of the evidence including material facts, and the governing laws, rules, and precedent.” Ground 3 presumes that the elements of the independent claims are all present in Giere ’178, and thus does not clearly identify any combination of elements from the two separate references or explain which element would allegedly have been selected from which reference, how the elements would have been combined, why a PHOSITA would have combined the elements in that manner, and how this could have been done consistent with the fundamental operating principles of the disclosed devices. Ground 3 should be rejected as lacking a proper analysis.

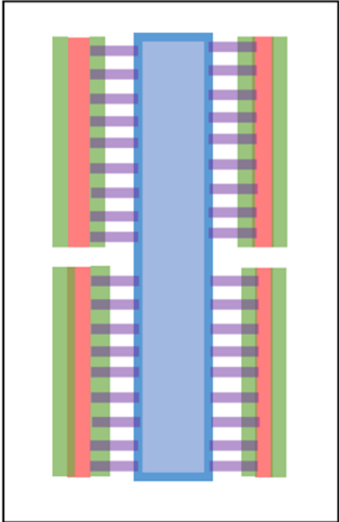
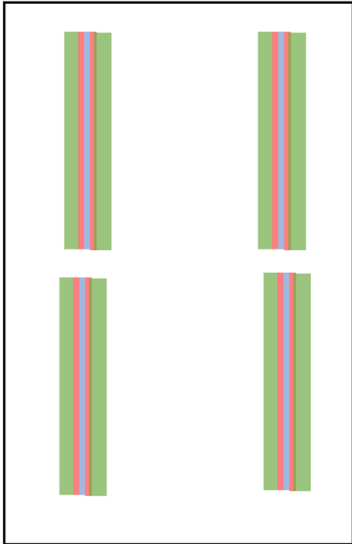
To the extent the specific Ground 3 theory of obviousness can be discerned at all, it relies on the same false reading of Giere ’178 as supposedly disclosing separate ink vias in each of the four regions 302, 304, 306, and 308 and uses Yabe to buttress the assertion that it would have been obvious to place heater arrays on both sides of such ink vias. As explained above in relation to Ground 3, the notion of four ink vias

arranged in quadrants is fundamentally inconsistent with Giere '178's full disclosure and explicit description of ink via, heater, and temperature sensor placement. Thus, Ground 4 is flawed for the same fundamental reason.

In a section allegedly setting forth motivations to combine, Petitioners argue that, using their incorrect interpretation of Giere '178 as a foundation, a PHOSITA would have either understood that each of the heater groups of Giere '178 (302, 304, 306, 308 in Fig. 3) includes an ink via and two sets of heaters, or would have modified those regions to include such structures. (Pet. pp. 92-101.) This is an improper obviousness theory because it contradicts the teachings of Giere '178 and would fundamentally alter the entire design principle of the printheads disclosed in that reference.

As discussed above relative to Ground 3, and as shown in a simplified illustration below at left, Giere '178 discloses a central ink via [blue] (“an elongated hole formed in the *center* of the bottom *of the substrate*”; “a *central slot* in the substrate” (Ex. 1007 col. 3 lns 37-45, emphasis added)) with associated channels [purple] that allow ink to flow to columns of heaters [red] on each side of the central ink via (arranged as two arrays per column), and temperature sensors [green] on each side of each heater array in order to detect temperature in the region near the heater arrays. As discussed above, Giere '178 also discloses a central manifold and a network of channels for directing the ink from the central slot to the ink ejection

chambers. (*Id.*) Petitioners’ proposed modification of replacing each heater array of Giere ’178 with an ink via and two heater arrays, but, for unexplained reasons maintaining the other structures of Giere ’178, fundamentally alters the structures of Giere ’178’s printhead as shown below at right so that each heater array has a temperature sensor on only one side instead of two as intended by Giere ’178.

What Giere ’178 Actually Discloses	Petitioners’ Proposed Alteration
	

Because neither Giere ’178 nor Yabe disclose a “region disposed between two adjacent ink vias includes two heater arrays each heater array being associated with their respective ink via; and a single temperature sensing element disposed within each region” as recited in the ’708 patent claims, Petitioners propose that a PHOSITA would have derived such an arrangement from the disclosed references by (i) miniaturizing, multiplying, and relocating Giere 178’s ink vias; (ii) doubling

the number of heater arrays and associated structures (nozzles, and all the circuitry that accompanies them); and (iii) eliminating the disclosed manifold and channel ink distribution structures while making other changes to supply ink from an ink reservoir to four separate ink vias; while (iv) selectively (but inexplicably) avoiding any modifications to the temperature sensors associated with those structures. Rather than presenting an obvious modification of Giere 178's printhead, this theory presents a wholesale reconstruction resulting in a printhead that does not remotely resemble the device disclosed in that reference. Where the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, as it plainly does here, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d at 813.

Whereas Giere 178's design contains a central ink via [blue] and a manifold and channel system [purple] to feed ink to heaters [red] within ejection chambers spaced from the ink via on both sides, the proposed alterations would render Giere '178's central ink via, manifold, and channel system unnecessary. It further replaces the four groups of heaters and ejection chambers with a much more complicated arrangement in which each of the four regions have their own ink via that presumably feeds ink directly into ejection chambers and associated heaters immediately adjacent on both sides. Petitioners invoke Yabe for its disclosure of ink

vias having heater arrays on both sides, but Yabe does not relate to the type of four-quadrant arrangement disclosed in Giere '178. Petitioners and their expert make superficial arguments regarding supposed benefits of Yabe's design, but they make no attempt to substantiate why the central ink via and manifold/channel ink distribution structure of Giere '178 would be replaced with four separate and miniature ink vias in an unconventional 4-quadrant arrangement, or how this would affect the overall design and operation of such a highly specialized device.

Petitioners also fail to consider or explain how cramming an ink via and two columns of heater arrays into a space intended for a single heater array would affect the performance of the printhead. It is inescapable that the proposed modifications necessarily require significantly shrinking the ink vias and heaters to fit within the regions 302, 304, 306, and 308 sized only for ejection chambers and associated heaters, or significantly expanding the printhead substrate to accommodate ink vias and double the number of ejection chambers in those regions.

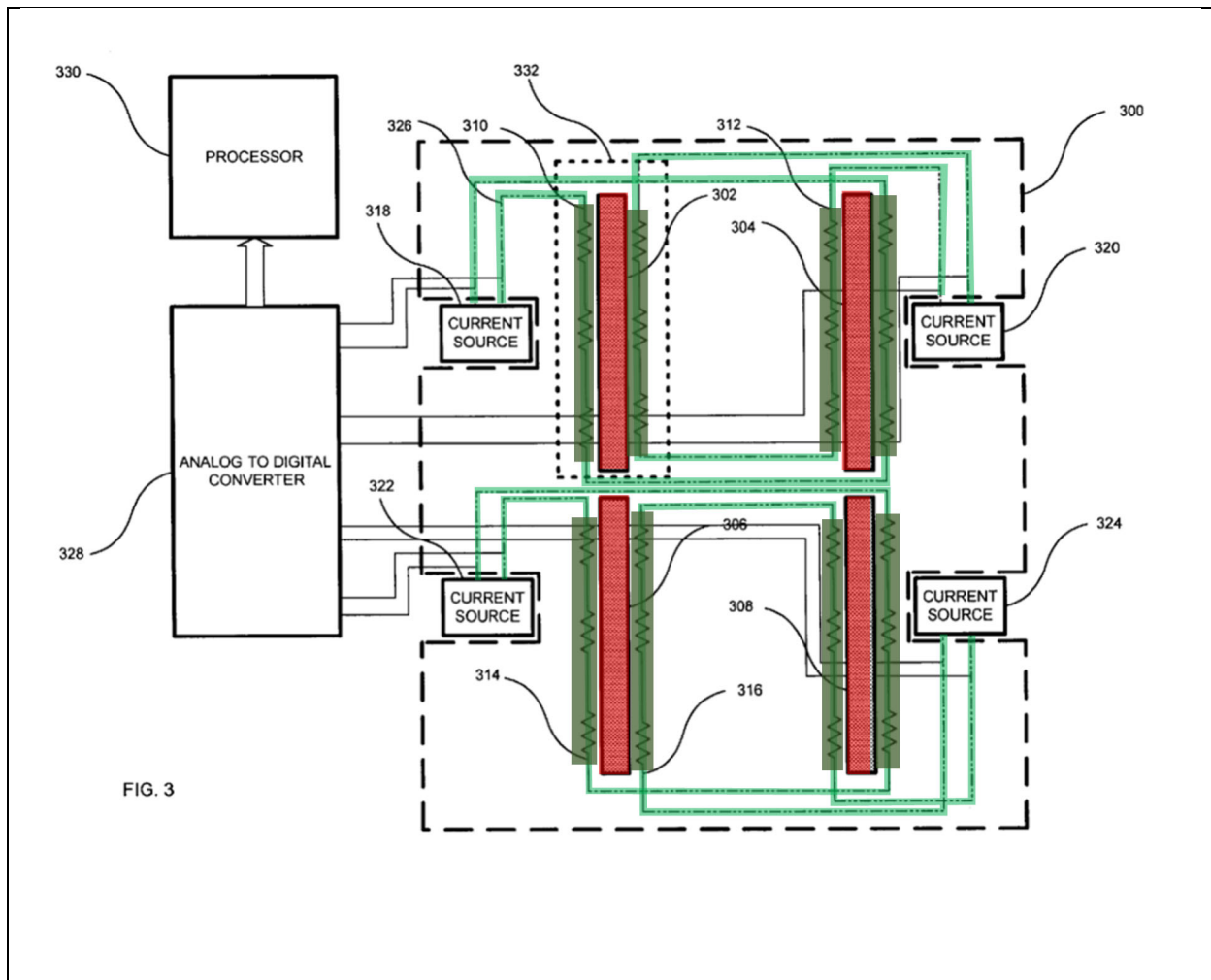
Furthermore, the arrangement would require a fundamental alteration in how Giere '178's printhead deposits ink as it moves back and forth in order to account for two *rows* of separate ink vias and associated heaters (which is not a feature shown in Giere, Yabe, or any other reference cited in the Petition) in addition to multiple *columns* of ink vias and heaters. Each heater array also requires circuitry to cause the heaters to heat and eject ink, and Petitioners provide no indication as to how

Giere's printhead would be modified to adapt heater circuitry to the unconventional 4-quadrant arrangement that they propose.

Despite all of the above wholesale changes, Petitioners inexplicably would leave the temperature sensors of Giere '178 in place, for no other reason than to suit their arguments. Petitioners do not even attempt to explain why the temperature sensors, initially designed to monitor both sides of the single heater array of each region, would not be modified despite the fact that the structures around them have fundamentally changed. Petitioners also make no attempt to explain why Yabe's temperature sensing approach, which places the sensors at the periphery of the substrate and not in the regions between parallel ink vias, would not be the preferred approach in a system utilizing Yabe's ink via and heater array constructs. This is blatant cherry-picking in order to reconstruct the invention of the '708 patent in hindsight.

Petitioners and their expert have failed to even consider the actual purpose and configuration of Giere '178's temperature sensors and how they would be affected by the proposed changes. Their theory ignores that by keeping Giere '178's temperature sensors in place while altering the size, location, and number of ink vias and heater arrays, Petitioners' theory would completely change Giere '178's temperature monitoring scheme and what the temperature sensors detect.

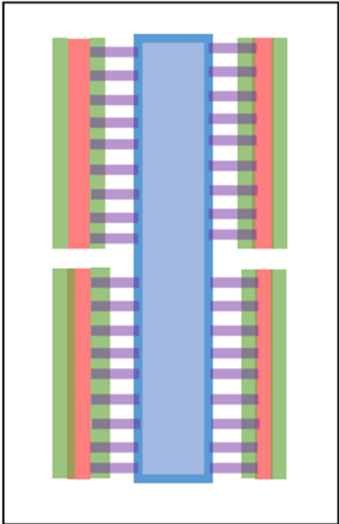
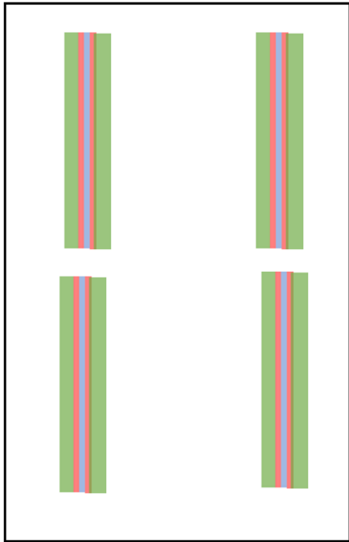
Giere '178 recognizes that “[i]n general, the quantity of ink drops ejected from a printhead nozzle will change as *the temperature of the structure surrounding the ink ejection chamber associated with the nozzle* changes” and that “*localized heating* of the substrate can occur from firing nozzles at a greater frequency *in a particular region of the printhead.*” (*Id.* col. 5 lns 20-23 and 44-46, emphasis added.) As shown below, the four temperature sense resistors 310, 312, 314, and 316 of Giere '178 [shown in dark green with connecting traces in light green] collectively detect temperatures along both sides of the ink ejector actuator arrays located in regions 302, 304, 306, and 308 [red] along both sides of an ink via in the center of the substrate [not shown].



(Ex. 1007 Fig. 3.) Indeed, the resistive elements 310, 312, 314, and 316 [dark green] adjacent heater arrays [red] are designed to contribute a large fraction of resistance change relative to the thinner connecting traces 318, 320, 322, and 324 [light green] that are not located near the heaters. The traces thus intentionally have a reduced contribution to the measured temperature to improve the effectiveness of Giere '178's temperature compensation system. (*Id.* col. 10 lns 17-22.)²

² Indeed, the inventions claimed in Giere '178, as well as most of its description, relate to the manner in which long traces can sense temperature primarily in specific

Thus, as shown below at left, Giere '178 includes a temperature sense element [green] at *both sides of each heater array* [red]. Petitioners' proposed alteration keeps those temperature sensors in place but replaces the single array [red] of heaters between each pair of sensors [green] with an ink via [blue] sandwiched between two heater arrays [red]. As a result, the temperature sensors [green] now measure only one side of each heater array, not both sides.

What Giere '178 Actually Discloses	Petitioners' Proposed Alteration
	

regions adjacent to heater arrays. Giere '178 describes two ways in which to create temperature sensors with increased contribution of resistive elements adjacent heaters and decreased contribution of traces connecting those resistive elements: (i) routing traces in a serpentine pattern in an area near the heater arrays (Ex. 1007 col. 10 lns 23-55 and shown at Fig. 4) or (ii) using materials having different temperature coefficients of resistivities for the resistive elements and traces (*Id.* col. 10 ln 56 through col. 11 ln 42 and shown in Figs. 4, 5A, and 5B.)

By keeping the temperature sensors in place but moving and altering the arrangement of heaters, Giere 178's purpose of carefully monitoring localized heating on both sides of each heater array in particular regions of the printhead is thwarted. Petitioners' analysis must fail because they do not even attempt to explain the impact of their changes on this fundamental aspect of Giere '178.³

Petitioners' cursory statements that the proposed modifications would have been obvious due to the field of endeavor, solutions to similar problems, reasonable expectation of success, interchangeable nature of embodiments, and routine modification are based, at best, on a fundamental misunderstanding of what the prior art actually teaches and a lack of awareness of how expansive their proposed modifications are. Their allegations that the prior art references suggest advantages of such a combination similarly fall short of establishing a reasonable likelihood of obviousness. Petitioners devote several paragraphs to arguing that Yabe suggests advantages of a plurality of ink vias (Pet. pp. 95-96), but this would at best argue for the entire structure of Giere '178 to be duplicated, which would not result in the arrangement claimed in the '708 patent and would instead result in multiple temperature sensors in each region between ink vias. General advantages relating to

³ If Petitioners' modifications further included moving and duplicating Giere '178's temperature sensors along with its movement and duplication of heater arrays, this would result in more than a single temperature sensor in each region between heater arrays, contrary to each independent claim of the '708 patent.

a plurality of vias in no way suggest the cherry-picking advocated by Petitioners in which everything about Giere 178's design except for its sensor arrangement is eliminated or fundamentally altered.

Likewise, Yabe's indication of advantages of heater arrays on both sides of an ink via (Pet. pp. 96-97) do not suggest Petitioners' proposed modification, because Giere '178 already discloses arrays of heaters on both sides of a central ink via, and any advantages from such a structure do not require completely altering the via, manifold, channels, nozzles, heaters, nozzles, and associated circuitry of Giere '178. While Petitioners refer to Giere '178's objective of maintaining high print quality, the cited statements relate to Giere '178's temperature management system. (Pet. p. 98.) As explained, Petitioners' modifications would undermine Giere '178's temperature management system by adding and repositioning ink ejection chambers and heater arrays in a manner that prevents monitoring temperature on both sides of each heater array. Petitioners' cherry-picking of snippets from prior art without an appreciation for the overall context of that prior art's teachings is not a proper analysis of obviousness.

For at least these reasons, Ground 4 must be rejected.

X. THE PETITION FAILS TO ESTABLISH A REASONABLE LIKELIHOOD THAT CLAIMS 4 AND 13 WOULD HAVE BEEN OBVIOUS IN VIEW OF GIERE '178 AND PARISH (GROUND 5)

Ground 5 relies on the same arguments as Ground 3, and Petitioners further argue that a PHOSITA would have found it obvious to add a specific type of thermal sensor recited in dependent claims 4 and 13 in view of Parish. Those dependent claims include the limitations of corresponding independent claims 1 and 9. Therefore, the Ground 5 challenge fails for at least the same reasons discussed above relative to Ground 3.

XI. THE PETITION FAILS TO ESTABLISH A REASONABLE LIKELIHOOD THAT CLAIMS 4 AND 13 WOULD HAVE BEEN OBVIOUS IN VIEW OF GIERE '178, YABE, AND PARISH (GROUND 6)

Ground 6 relies on the same arguments as Ground 4, and further argues that a PHOSITA would have found it obvious to add a specific type of sensor of dependent claims 4 and 13 in view of Parish. The Ground 5 challenge also fails for at least the same reasons discussed above relative to Ground 4.

XII. CONCLUSION

For the reasons described above, and because Petitioners have not shown a reasonable likelihood that any of the challenged claims are unpatentable, the Board should deny institution.

Respectfully submitted,
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IPR2023-00313: Patent Owner's Preliminary Response

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CERTIFICATE OF WORD COUNT

The undersigned hereby confirms that the foregoing Preliminary Response complies with the type-volume limitation of 37 C.F.R. § 42.24(a). Excluding the items listed in 37 C.F.R. § 42.24(a) as not included in the word count, this Preliminary Response contains 13,606 words, calculated by the word-processing system used to prepare it.

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned hereby certifies that a true copy of the foregoing PATENT OWNER'S PRELIMINARY RESPONSE was served this 6th day of May, 2023, by e-mail upon the following:

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