

**UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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Canon U.S.A, Inc. and Canon Inc.,

Petitioners

v.

Slingshot Printing LLC,

Patent Owner

Case No. IPR2023-00312

Patent No. 7,484,823

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**PATENT OWNER RESPONSE**

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Patent Trial and Appeal Board  
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P.O. Box 1450  
Alexandria, Virginia 22313-1450

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## **I. INTRODUCTION**

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

Petitioners fall far short of their burden of proving that challenged claims 1-17 of U.S. Pat. No. 7,484,823 (the '823 patent) are invalid under the asserted grounds. The '823 patent discloses and claims novel configurations and a unique temperature management and control approach for inkjet printheads. The claims are directed to a printhead chip with a plurality of ink vias and temperature sensing elements substantially centrally located within regions between heater arrays adjacent the ink vias so that the temperature sensors are operable to sense a temperature representative of each region for use in regulating the temperature of the region and associated heater arrays.

Petitioners challenge the '823 patent claims as obvious, but their arguments violate established legal principles. They rely on impermissible hindsight, strained reasoning, and inaccurate and incomplete characterizations of the prior art to arrive at the inventions claimed in the '823 patent. None of the asserted references actually address the problems solved by the invention of the '823 patent claims, or even similar problems, nor do they suggest the solution.

Working backwards from the claims, the Petition follows a pattern of cherry picking select components of the printhead devices disclosed separately in the

references to supposedly show that all of the claim elements can be found in the prior art. Petitioners' arguments lack any appreciation or analysis of the interrelated teachings of each reference as a whole or of the technical complexities and drawbacks associated with the combinations they propose. Petitioners provide a litany of generic arguments claiming that the references are "in the same field" and address "similar problems" and that the proposed combinations involve only "simple, routine, and low-cost" modifications involving "generic components." When dealing with complex and specialized technology of the type involved here, such cliché arguments and superficial theories do not demonstrate that the claimed subject matter is obvious.

Patent Owner relies upon the declaration of its technical expert, Steven J. Dietl, in support of this Response. Mr. Dietl explains important aspects regarding the asserted references, the relevant technology, and the knowledge of a PHOSITA not fully or fairly presented by Petitioner.

## **II. BACKGROUND**

### **A. The '823 Patent**

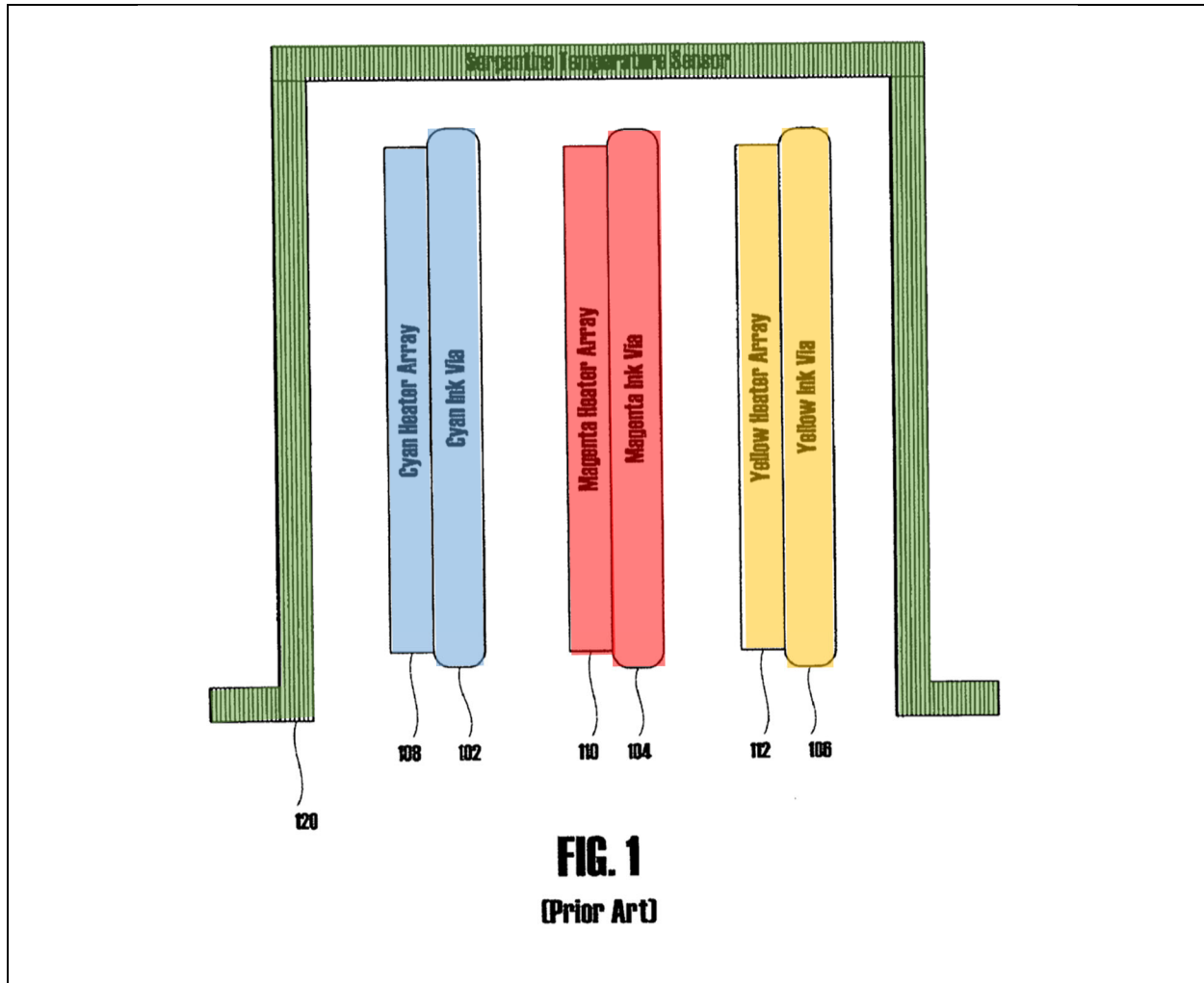
The '823 patent describes technical challenges associated with controlling the temperature of "heater chips" of ink jet printers. A heater chip is a component of the print head of the printer that discharges ink drops to form images. Such a chip may contain multiple ink "vias" or slots through which ink is supplied to the heater chip.

(Ex. 1001 col. 1 lns 21-26.) In the type of chips relevant to the '823 patent, arrays of heater resistor elements ("heaters") are positioned along ink vias to heat ink supplied through the vias, causing the ink to be discharged through associated nozzles. (*Id.* col. 1 lns 21-47 and col. 4 lns 58-60.)

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 variations in temperature that will cause inconsistent drop-weight and resulting visible hue shifts in a printed image. (*Id.* col. 1 lns 48-55.) Once the temperature of the heater chip is measured, an acceptable temperature for printing may be maintained by applying short pulses to heater arrays or by utilizing separate substrate heating elements. (*Id.* col. 2 lns 16-25.)

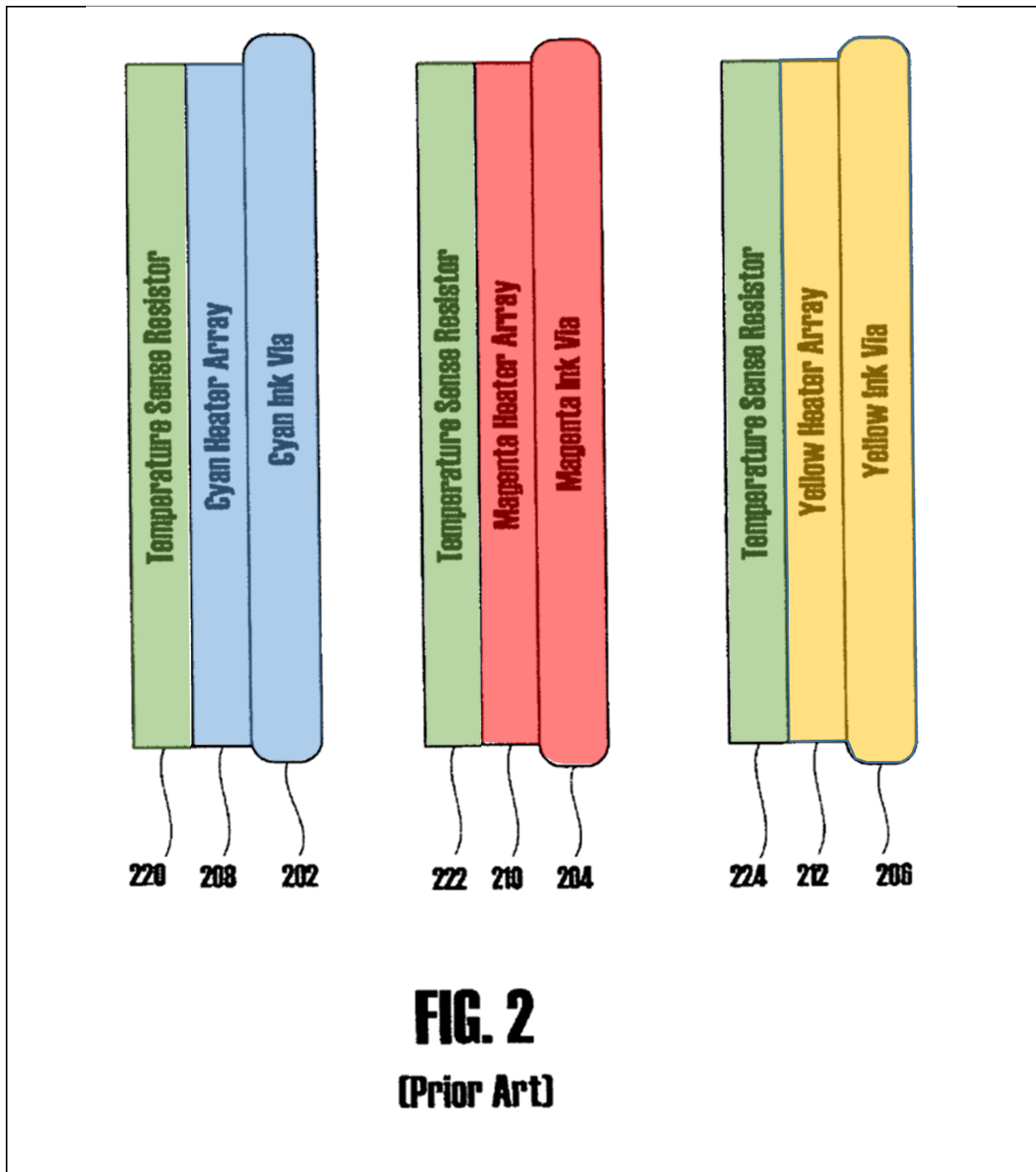
Controlling the temperature of a heater chip requires measuring its temperature. One way to do this involves attaching a temperature sense resistor (TSR) to the substrate and monitoring its current. As the substrate temperature of the heater chip increases, the resistance of the TSR increases, allowing a temperature measurement to be determined. (Ex. 1001 col. 6 lns 48-51.) At the time that the application for the '823 patent was filed, some heater chips included a single TSR regardless of the number of ink vias in a chip. For instance, the example from Fig. 1 of the '823 patent below includes one ink via for each primary color (magenta, yellow, and cyan). A metal serpentine temperature sense resistor 120 [green] is

routed around the periphery of the heater chip to detect an average temperature of the entire print head die. (Ex. 1001 col. 1 lns 56-62.)



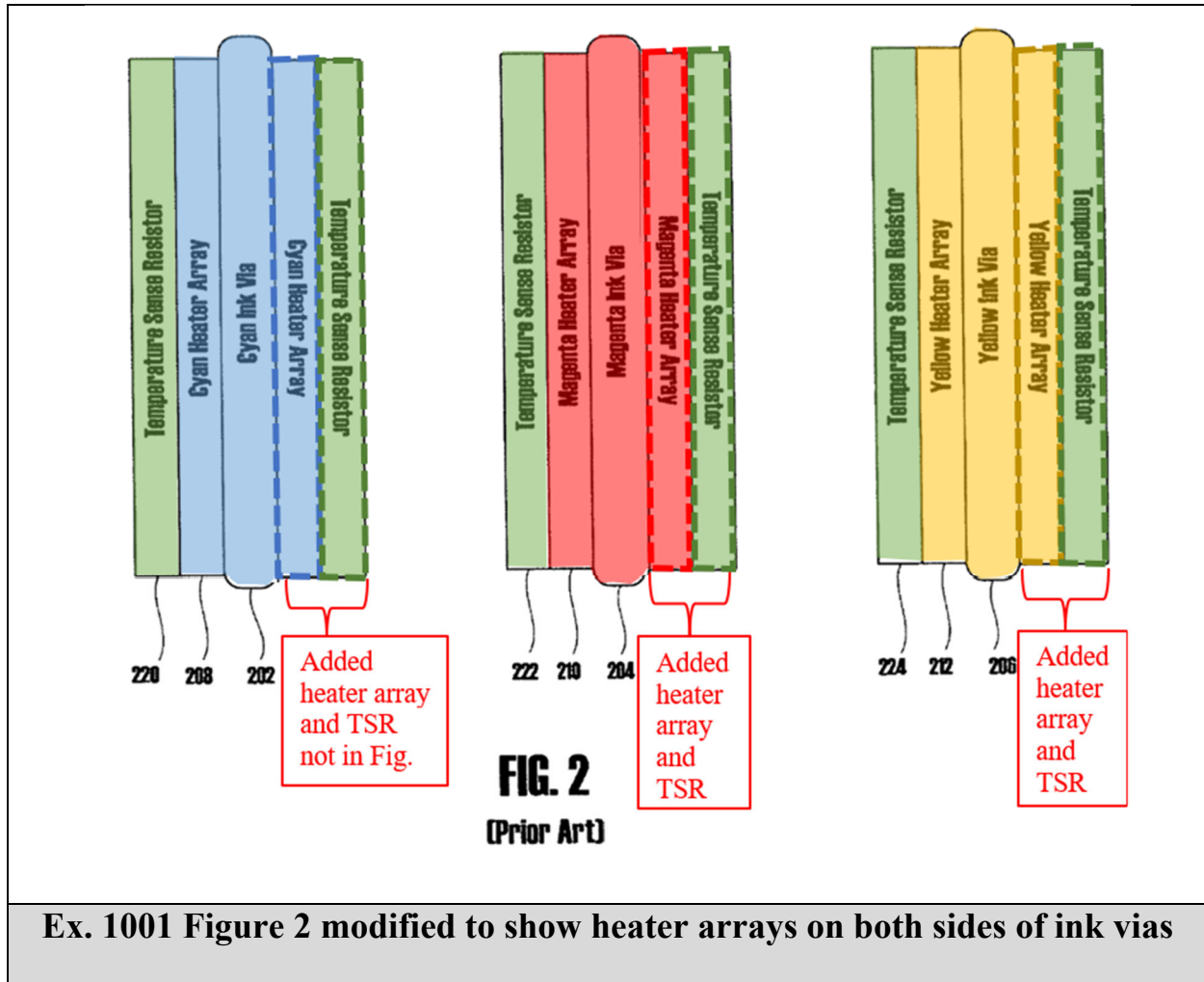
(Ex. 1001 Fig. 1.) This average measurement provides no discrimination between individual colors and does not provide any feedback on temperature differences between one area of the heater chip versus another, and thus cannot be used to control temperature on a per color or area basis. (Ex. 1001 col. 1 lns 62-65.)

In contrast, the heater chip shown in Fig. 2 includes three temperature sense resistors (220, 222, and 224), one for each heater array. Because each ink via is associated with only one heater array this configuration allows for temperature sensing on a per color basis. (Ex. 1001 col. 2 lns 1-11.)



The '823 patent explains that placing a temperature sensor immediately adjacent each heater array in a printhead having heater arrays on both sides of each via would result in the region between adjacent vias having two different TSRs. (Ex.

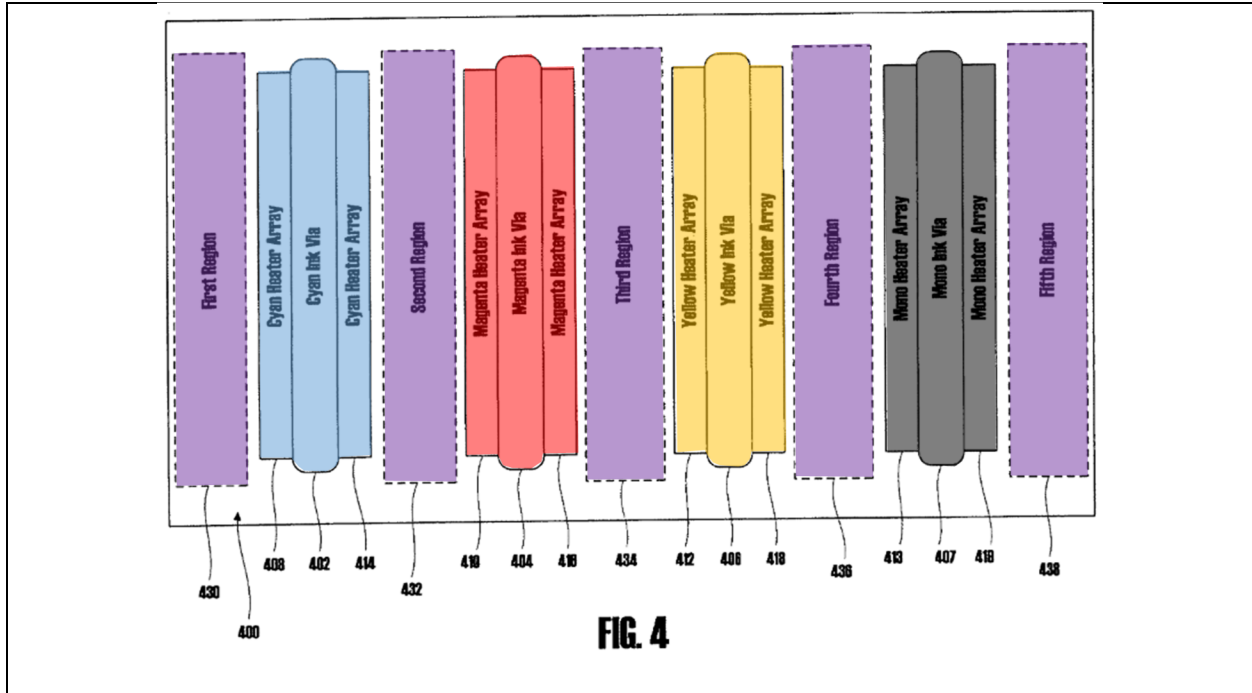
1001 col. 5 lns 56-61.) This is shown below in a modified version of Fig. 2 that adds a second heater array and associated temperature sensor to each ink via in the manner described in the '823 patent.



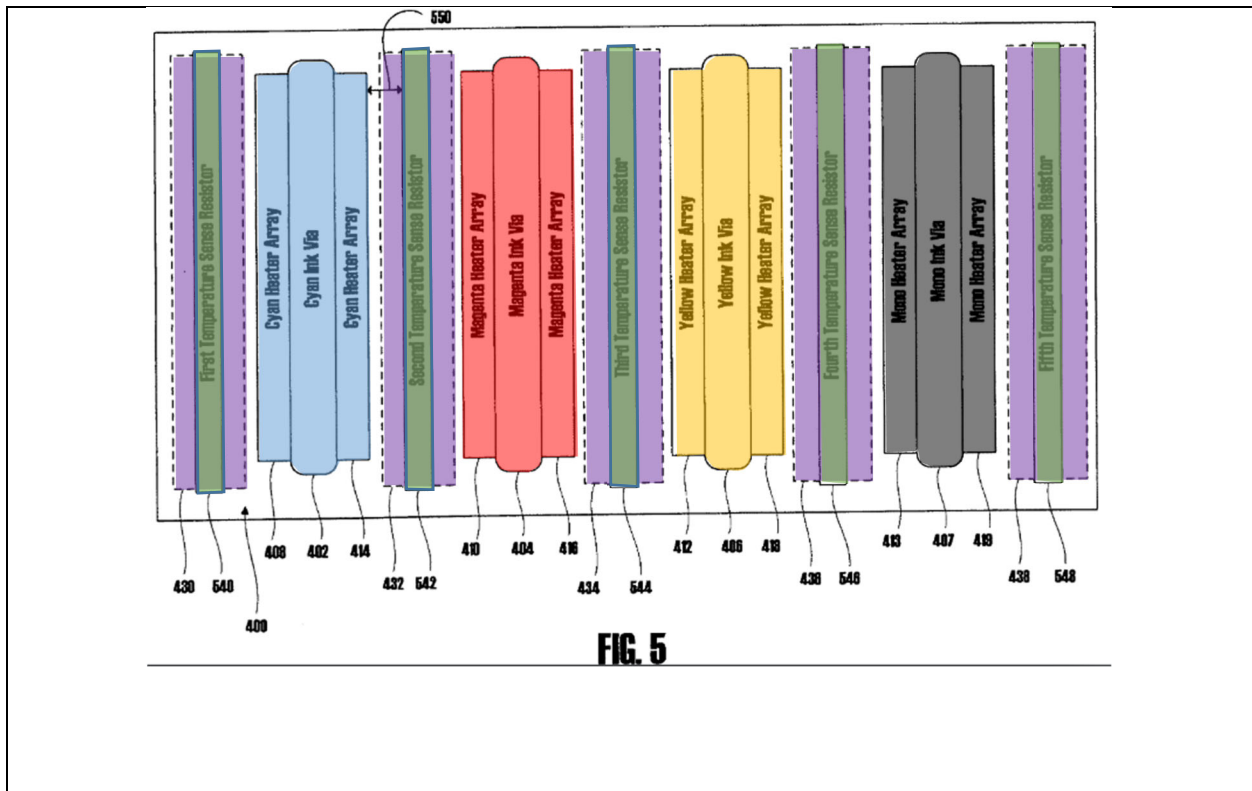
This makes it difficult to accurately detect and control temperature on a per color basis. (Ex. 1001 col. 5 ln 61 – col. 6 ln 2.) For example, if a print job is heavy in yellow and light in magenta, thermal energy generated by the yellow heaters would transfer through the common silicon to the magenta TSR positioned between the yellow and magenta ink vias, providing a false high reading for magenta. (*Id.*)

The '823 patent addresses the particular problem of detecting and controlling temperature in a printhead that has multiple parallel ink vias with heater arrays positioned on both sides of the ink vias. (Ex. 1001 col. 2 lns 51-54 and col. 5 lns 56-58; Ex. 2003 ¶44;) 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. (Ex. 1001 col. 7 lns 11-17 and 25-36; Ex. 2003 ¶46.) They 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. (Ex. 2003 ¶46.)

Fig. 4 below shows an embodiment of the invention of the '823 patent where 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).



(Ex. 1001 Fig. 4.) 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. 6 lns 55-61; Ex. 2003 ¶48.) The '823 patent teaches that a single temperature sensor in such a region can sense a temperature that represents the temperature of the two heater arrays adjacent the region. (Ex. 1001 col. 7, ln 11-17 and 5-16; Ex. 2003 ¶48.) However, that temperature may differ from the temperature of other regions of the chip because the ink vias act as thermal insulators. (*Id.* col. 7 lns 17-20; Ex. 2003 ¶46.) 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. (Ex. 2003 ¶48.)

**B. 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.) While Benjamin discloses a printhead die having multiple parallel ink vias with heater arrays on both sides of the vias, it is not directed to temperature control of such a device. The majority of Benjamin’s disclosure relates to the design and operation of firing cells, signal lines, and an address generator that generates address signals that activate firing cells in response to received pulses. (Ex. 1004 Abstract.)

Grounds 1 to 3 using Benjamin as the primary reference starting from the mistaken premise that Benjamin is directed to a controller that maintains a printhead

chip at its optimal temperature. The Petition represents that Benjamin teaches regulating the printhead's temperature to optimize printing quality. (Pet. pp. 21-22.) Benjamin contains no such teaching, and the portion of the reference cited in Petition does not say anything about a controller, temperature regulating, or optimizing print quality.

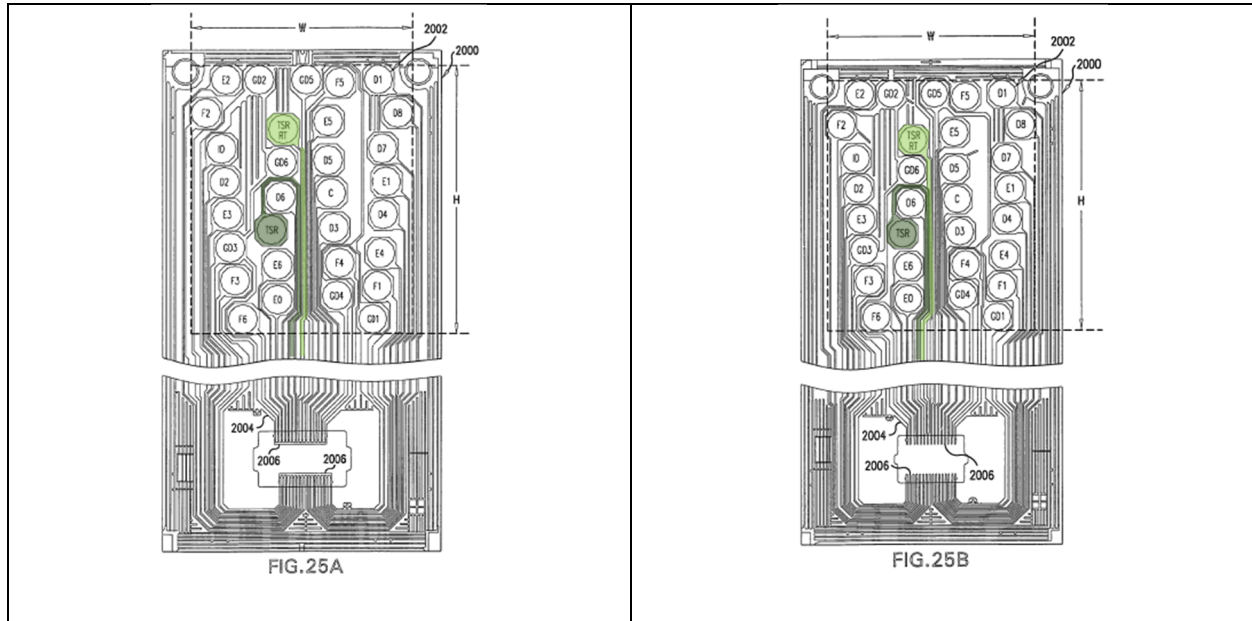
The Petition relies on Paragraphs 140-145 of Dr. Pond's declaration to fill in the missing details. Dr. Pond also fails to identify any teaching in Benjamin describing temperature control. He claims that Benjamin discloses a temperature controller by incorporating by reference U.S. Patent No. 7,278,703 (Ex. 1019; Benjamin '703). But Benjamin never actually refers to Benjamin '703, an inconvenient fact that Dr. Pond attempts to brush aside as being "a typographical error of omission." Dr. Pond insists that the author of Benjamin must have intended to incorporate Benjamin '703 by reference. (Ex. 1002 ¶142 and n. 4.) This speculation is not justified; a PHOSITA has no qualifications in the science of mind reading. Moreover, the passage of Benjamin cited by Dr. Pond refers to an application entitled "Fluid Ejection Device" (Ex. 1004 col. 71 lns 44-50), which does not correspond to Benjamin '703's title "Fluid Ejection Device With Identification Cells." (Ex. 1019 cover page.)

Not only is Benjamin '703 not incorporated by reference into Benjamin, it too discloses only a TSR for monitoring printhead temperature without mention of a

temperature controller or to even the concept of regulating printhead temperature. Dr. Pond relies on Benjamin '703's unexplained comment that "[p]rinters can use this TSR information to optimize print quality." (Ex. 1018 col. 18 lns 19-28.) That is not a disclosure of a temperature controller. There is no explanation of how a printer would use the TSR information to improve print quality, no mention of a temperature controller, and no discussion linking temperature control to print quality. Dr. Pond's does not stop there. His declaration further represents that Benjamin's disclosed temperature controller operates by manipulating the length of the firing pulses sent to the heater arrays to maintain the printhead at its optimal temperature. (Ex.1002, ¶243.) Neither Benjamin nor Benjamin '703 contains any such disclosures. (Ex. 2003 ¶¶58-60.)

In fact, Benjamin provides only brief mention of temperature monitoring of the disclosed printhead dies. Figs. 25A and 25B illustrate contact areas of a flex circuit that couples external circuitry to a printhead die, and Benjamin states that the "[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 "[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 60-65; Ex. 2003 ¶55.) 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.



(*Id.*; Ex. 1004 Figs. 25A-25B and col. 79 lns 60-65.)

Benjamin teaches that the temperature sense resistor determines “a temperature” of the “printhead die,” not temperatures of individual regions of the die. (Ex. 1004 col. 79 lns 60-63; Ex. 2003 ¶55.) Benjamin teaches nothing about where the temperature sensor is located on the semiconductor chip, nor does it indicate that the temperature sensor detects a specific region of the die rather than the temperature of the die as a whole. (Ex. 2003 ¶¶56; Ex. 2004 31:19-23.)

Benjamin lacks any discussion of how the printhead temperature monitored by the temperature sensor is used. It does not describe any components for controlling the printhead die temperature in response to the monitored temperature or any control scheme for maintaining the temperature within a desired range.

**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 and temperature 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.) Unlike Benjamin and the ’823 patent, the printhead die of Giere ’673 does not include any ink vias. The ink instead flows from ink reservoir 424 [blue] around the edges of the heater chip substrate 410 [yellow] and into vaporization chambers 418 [red] with overlying nozzles 420 as shown in the figures below.

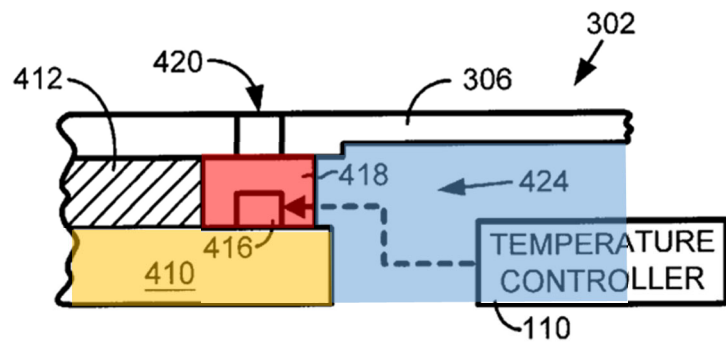


FIG. 4

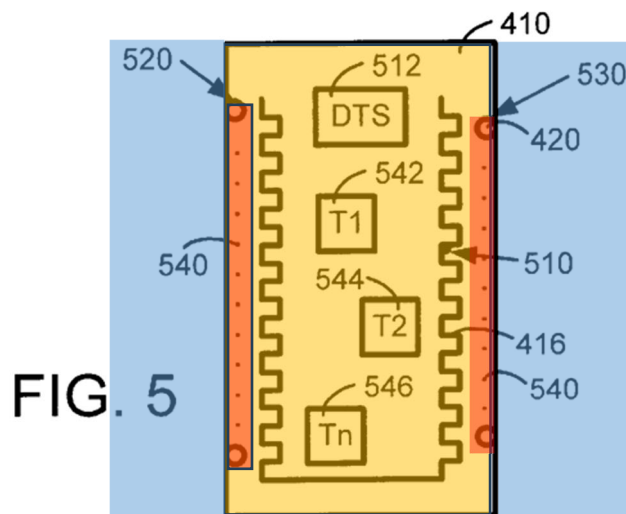


FIG. 5

(Ex. 1005 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. (Ex. 2003 ¶63.)

Fig. 5 below shows a thermal sense resistor 510 [light green], a digital temperature sensor 512 [dark green], and multiple temperature recorders 542, 544, and 546 [pink] spread across the substrate.

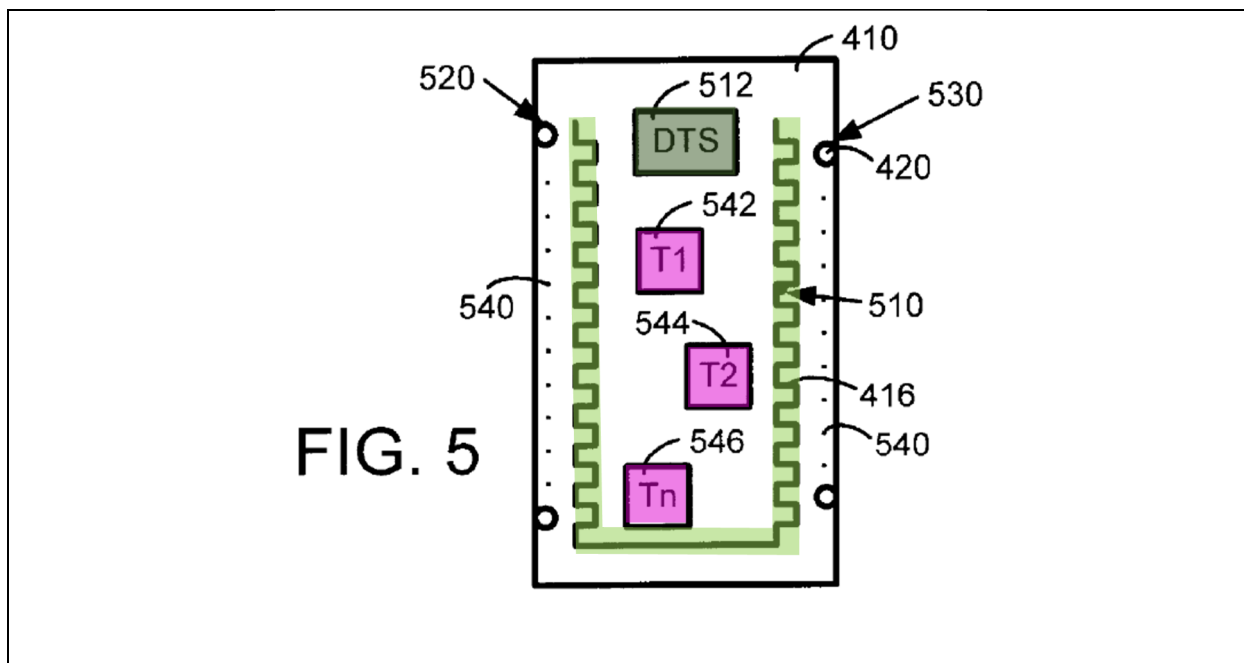


Fig. 5 shows all of the temperature sensing elements between two columns (520, 530) of nozzles 420, some of which are presented as dots (540) for simplicity. The temperature recorders [pink] are distributed around the substrate and each measure local current temperatures and store the measurements as temperature histories, and are averaged to generate a mean average temperature of the substrate. (Ex. 1005 col. 5 lns 28-31 and col. 6 lns 35-40.) The u-shaped TSR 510 is designed to sense the temperature of the substrate as a whole, and is positioned between two arrays of heaters only because those heaters are located at the edge of the chip in an edge feed design. (Ex. 1005 col. 4 lns 55-56.) The temperature controller uses inputs from

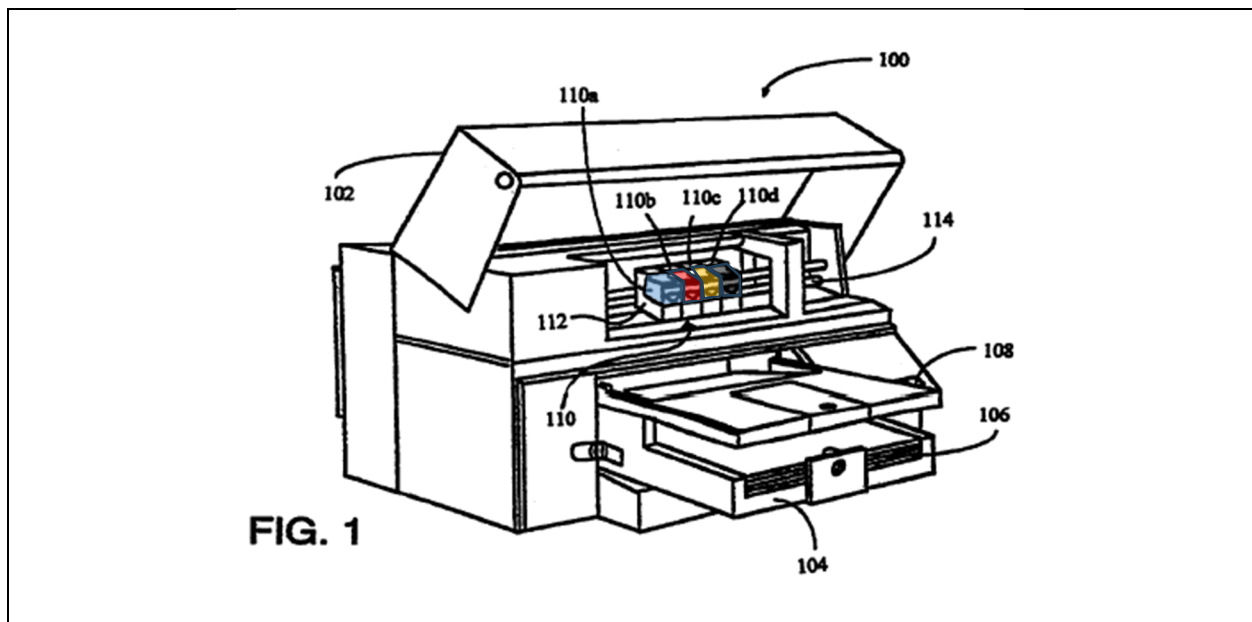
these multiple temperature sensors and other data to predict thermal conditions of a subset of the ink ejection elements, and to establish operating conditions so that the corresponding heating elements operate at an optimal temperature. (Ex. 2003 ¶¶64-65; Ex. 1005 col. 6 lns 5-8, col. 5 lns 28-31, col. 6 lns 35-40.)

In particular, the disclosed temperature controller includes logic mapping system 604, temperature logic system 606, and heater element firing system 608. (Ex. 1005 Fig. 6B.) Logic mapping system 604 defines the timing and sequencing in which certain ink ejection chambers are fired to produce the image defined by the print data. (*Id.* col. 6 lns 21-28.) Temperature logic system 606 receives temperature data from temperature recorders 542, 544 and 546 along with past firing history and future printing data from the logic mapping system 604 and uses this data and other information to generate and output printing parameters such as pulse widths, pulse rates, ink ejection chambers to be fired and when they will be fired, activation of non-ejecting changes for warming, and firing voltages optimized to improve ink drop quality. (*Id.* col. 6 lns 39-60.) The recorded firing history data of the ejection elements may also be processed along with the average temperature data to determine estimated temperatures of certain ones of the subset in order to set optimal temperature conditions for specific ink ejection elements. (Ex. 1005 col. 6 lns 10-18; Ex. 2003 ¶¶64.)

All disclosed embodiments involve these specialized systems and techniques for precisely controlling the firing parameters of subsets of ejection elements based on a variety of inputs including temperature data, past firing data, print data for the current image, etc. Giere '673 does not disclose or provide any guidance regarding how to implement 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. (Ex. 2003 ¶65.)

**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) [blue], 110b (magenta cartridge) [red], 110c (yellow cartridge) [yellow], and 110d (black cartridge) [gray], as shown in the color annotated figure below:

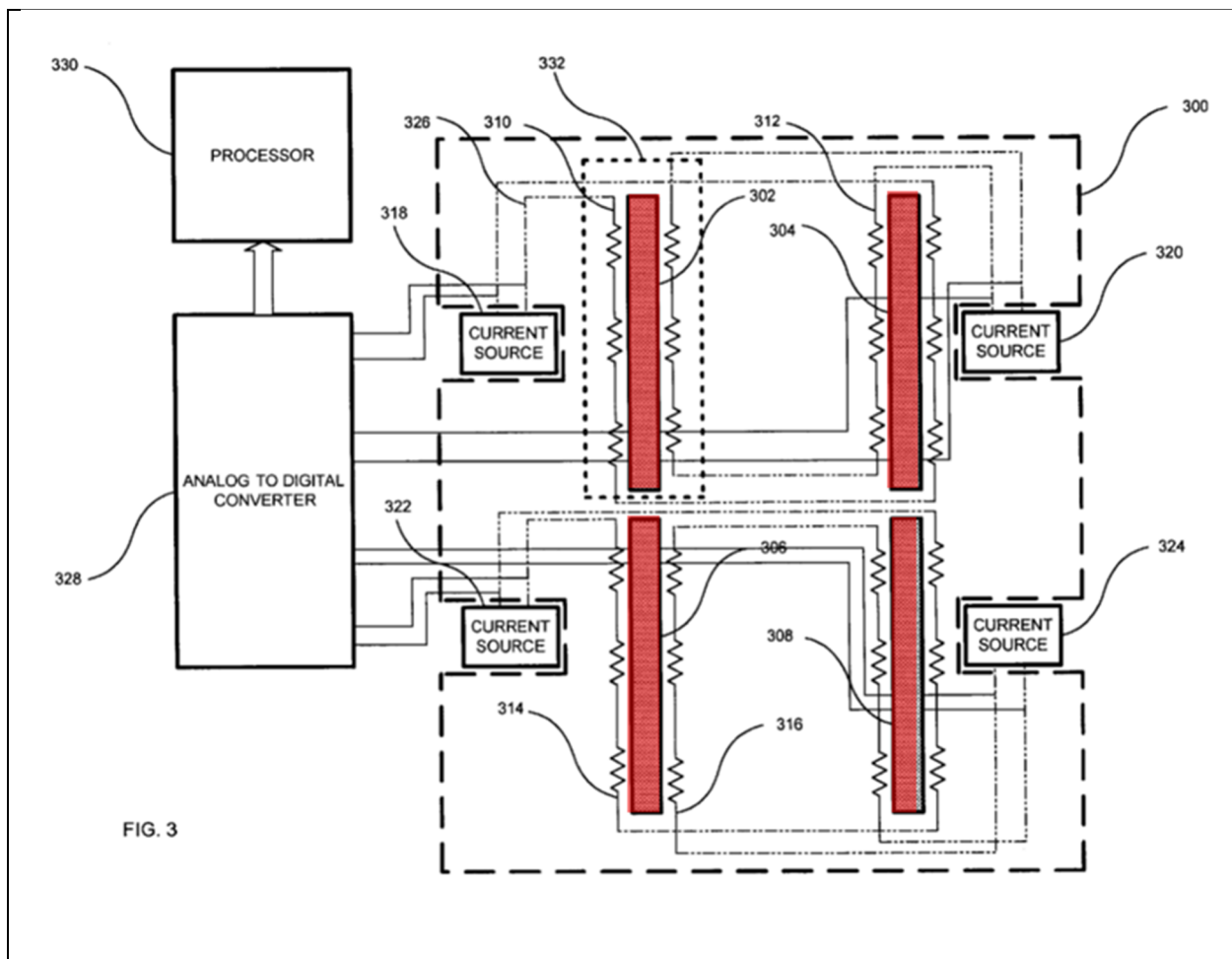


(Ex. 1007 Fig. 1 and col. 7 lns 1-17.) Each cartridge contains its own print head that implements parts of the temperature measurement system described by Giere '178.

(Ex. 1007 col. 7 lns 13-17.)

Fig. 3 of Giere '178 annotated below is a “high level schematic diagram” of a temperature measurement system for one of the printheads from the cartridge above.

(Ex. 1007 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

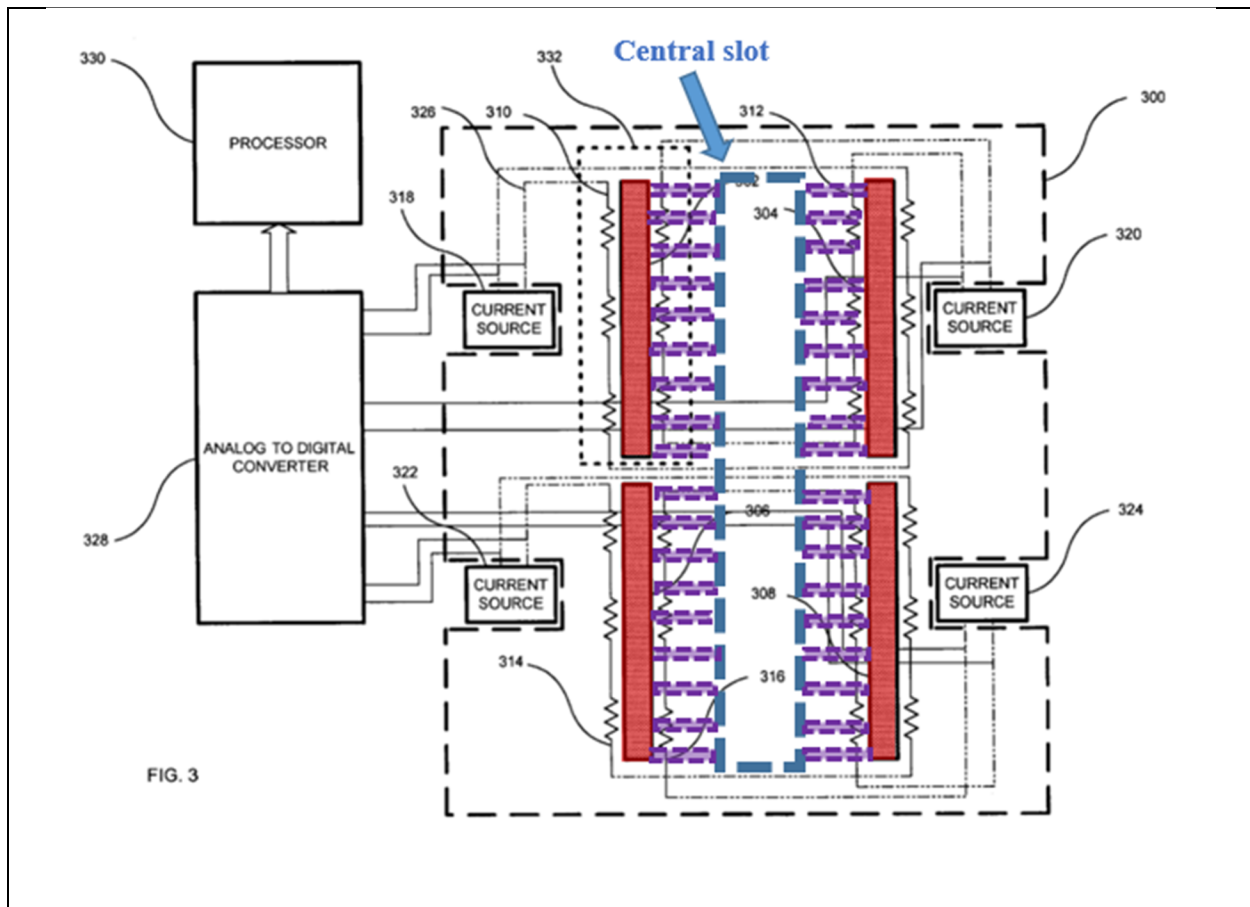
chambers, firing resistors, etc.” Particularly, “regions 302, 304, 306, and 308 [red above] each include an array of nozzles and associated firing resistors for ejecting ink.” (Ex. 1007. col. 8, lns 47-49.)

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.’” (Ex. 1007 col. 3 lns 34-50; Ex. 2003 ¶67.) 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.” (Ex. 1007 col. 3 lns 40-45.) At the time that the ’823 patent was filed, those were the two common options for feeding ink to the types of ink jet devices shown in the ’708 patent and Giere ’178, and Giere does not indicate any other potential placement of ink feed regions from a reservoir to the heater chip. (Ex. 2003 ¶67.) Giere ’178 does not describe ink vias or ejection actuators on opposite sides of an ink via within each of the rectangular regions 302, 304, 306, and 308. (*Id.*)

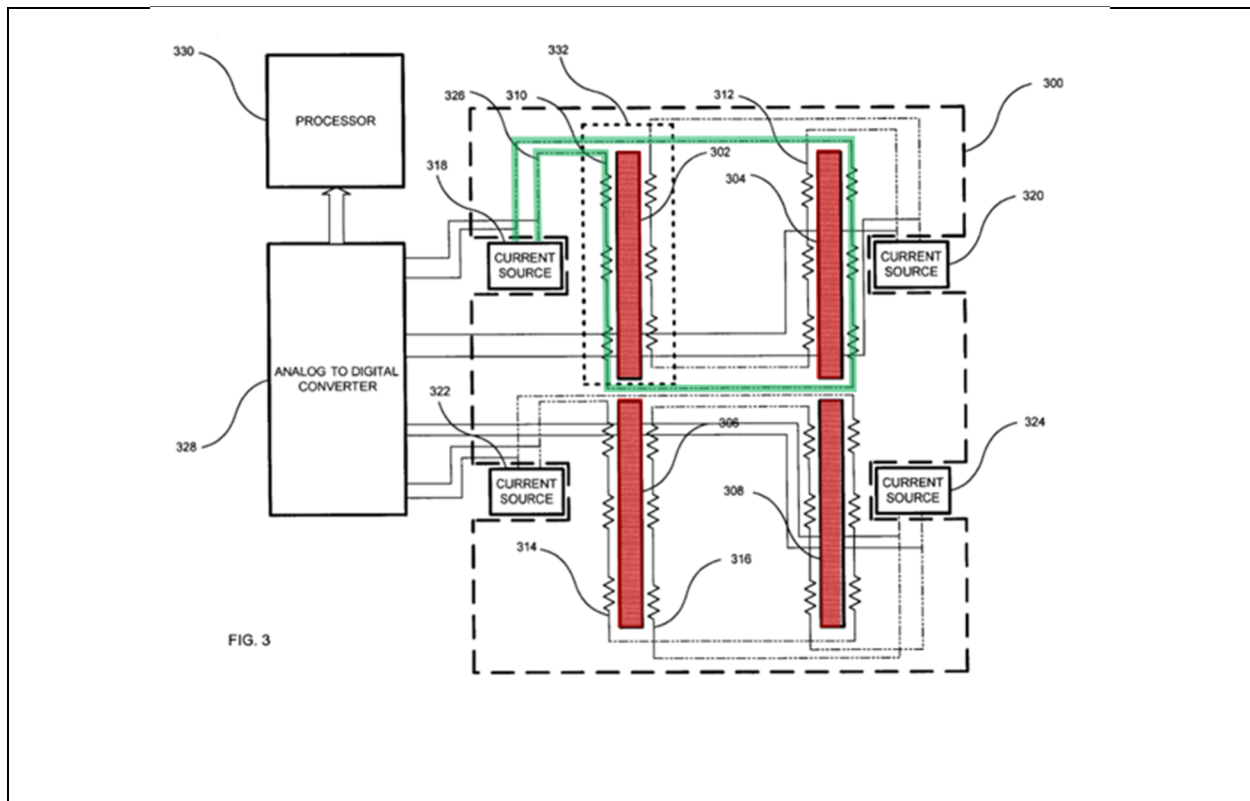
Fig. 3 of Giere ’178 is characterized as a “high level schematic diagram” (Ex. 1007 col. 8 lns 41-43), and appears to be intended to convey information regarding electrical connections of TSRs positioned adjacent both sides of groups of heaters.

Fig. 3 would not be seen by a PHOSITA as conveying details regarding the ink supply structures that deviate from the two options described in the written description, summarized above. (Ex. 2003 ¶69.)

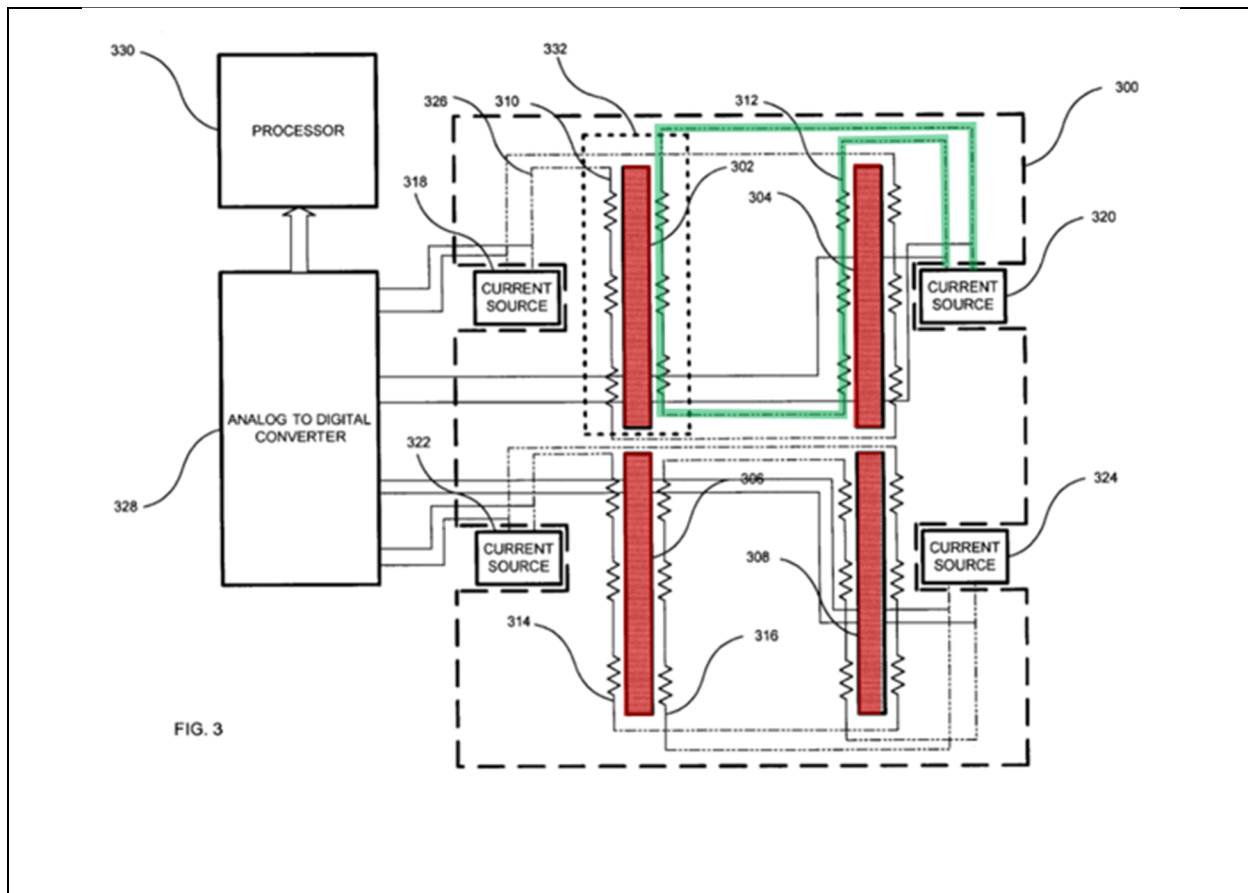
A blue rectangle has been added to Fig. 3 below to illustrate a “central slot” in substrate 300 between the column of nozzles and ink ejection actuators on the left (regions 302 and 306) and the column of nozzles and ink ejection actuators on the right (regions 304 and 308). Channels that allow ink to flow from this slot [blue outline] to chambers associated with heaters of the heater arrays [red] have been added in purple below. While Fig. 3 is a view from above, Giere ’178 describes the channels as extending from a central manifold area formed in a barrier layer between the substrate and a nozzle plate to supply ink to the various ink ejection chambers. (Ex. 1007 col. 3 lns 40-45; Ex. 2003 ¶69.)



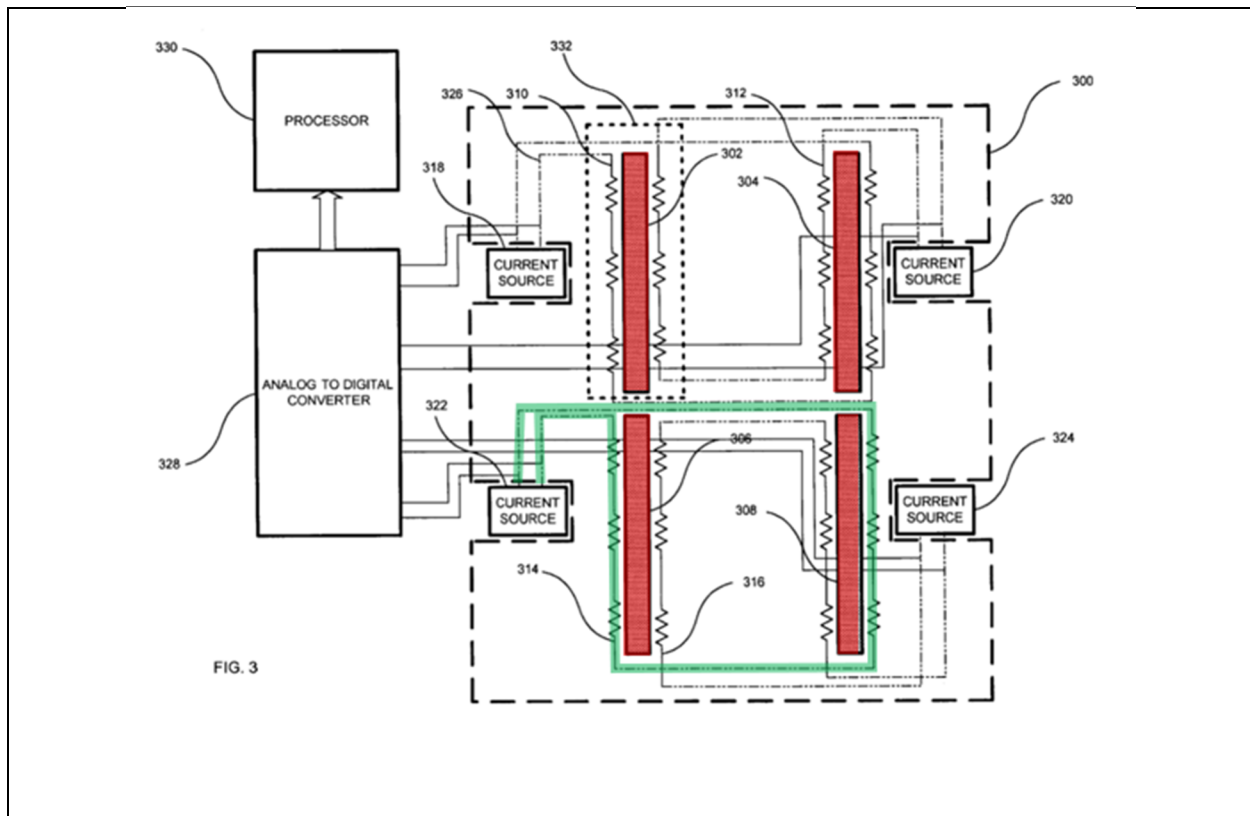
Giere '178 includes 4 temperature sensors comprising resistive elements 310, 312, 314, and 316 positioned along electrical traces formed in a loop. First, temperature sensor 310 [green below] is positioned along outside edges of the upper arrays of heating elements in regions 302/304:



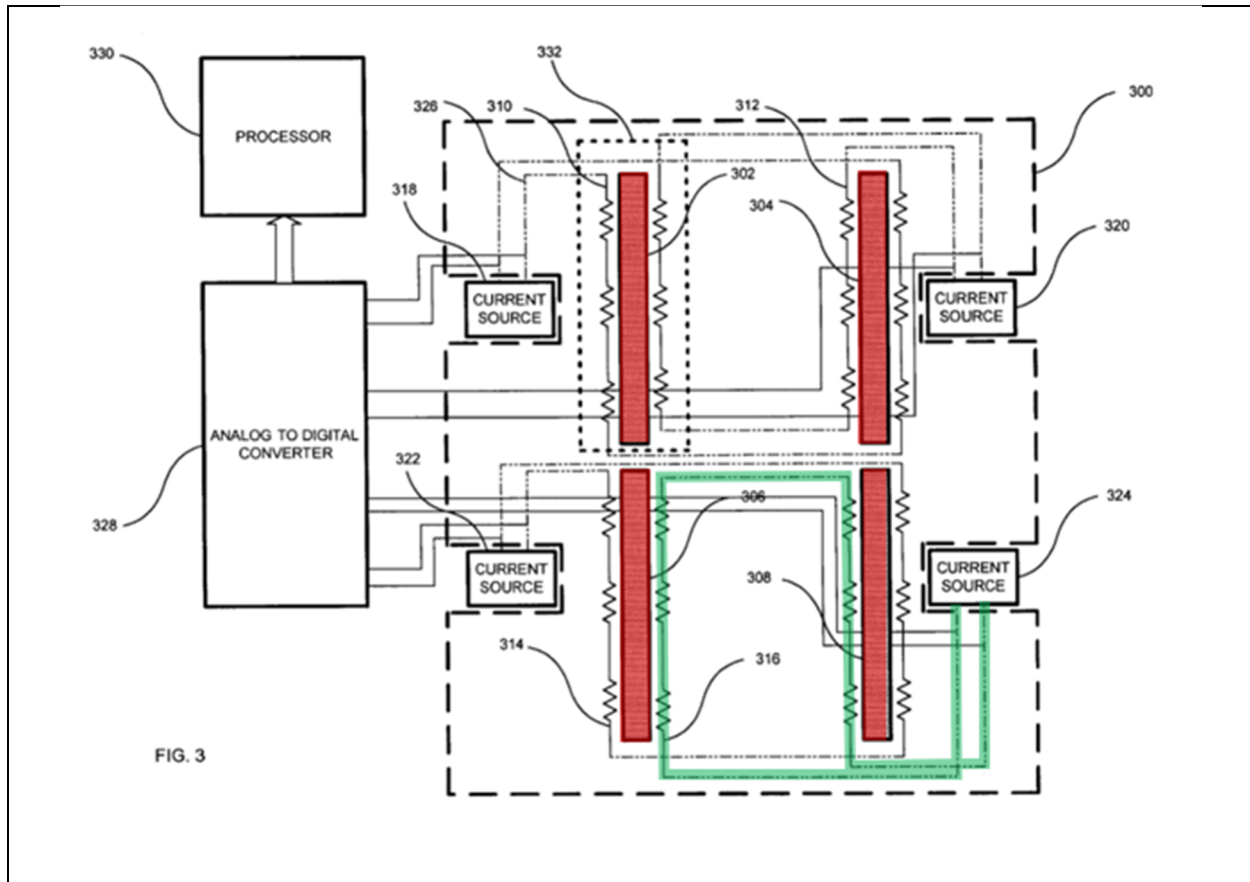
Second, temperature sensor 312 [green below] is positioned along inside edges of the upper arrays of heating elements in regions 302/304:



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:



A PHOSITA would understand that Giere '178 does not disclose a printhead with multiple adjacent ink vias having heater arrays along the two longitudinal sides of each via. (Ex. 2003 ¶71.) Giere '178 also does not teach any solution to the problems associated with measuring temperatures representative of the heater arrays in such a printhead design. (*Id.*) Giere '178's design is directed to sensing temperature along each side of multiple ink ejector heater arrays that are supplied with ink by channels extending from a single central ink via or an edge feed ink supply mechanism. (*Id.*) Giere '178's temperature sensing circuitry is adaptable to either of those two specific ink supply approaches. (*Id.*) One pair of TSRs detects

temperature on a side of the upper or lower heater array opposite the ink feed (312 and 316 in the case of edge feed or 310 and 314 in the case of a center feed), while the other two TSRs would detect the temperature of the side of the heater array closest to the ink feed. (*Id.*)

Petitioners are incorrect in arguing that the rectangular boxes 302, 304, 306, and 308 in Giere '178 would have been understood by a PHOSITA to include ink vias. (*See, e.g.*, Pet. pp. 62; Ex. 1002 ¶¶ 334-337.) There is nothing in Giere '178 to support that interpretation. Giere '178 states only that “regions 302, 304, 306, and 308 each include **an array of nozzles and associated firing resistors** for ejecting ink” without mentioning ink vias. (Ex.1007 at 8:47-49, emphasis added.) This is consistent with the rest of Giere '178's disclosure describing either a center feed design, with ink flowing through a central slot in the substrate and then through channels extending from a central manifold area formed in an adjacent barrier layer, or an edge feed design with ink flowing through channels extending from the edge. (Ex. 1007 col. 3 lns 34-50; Ex. 2003 ¶72.) Neither of those ink supply approaches, which are the only approaches described in Giere '178, would include a separate via for each of the four rectangular regions 302, 304, 306, and 308. (*Id.*)

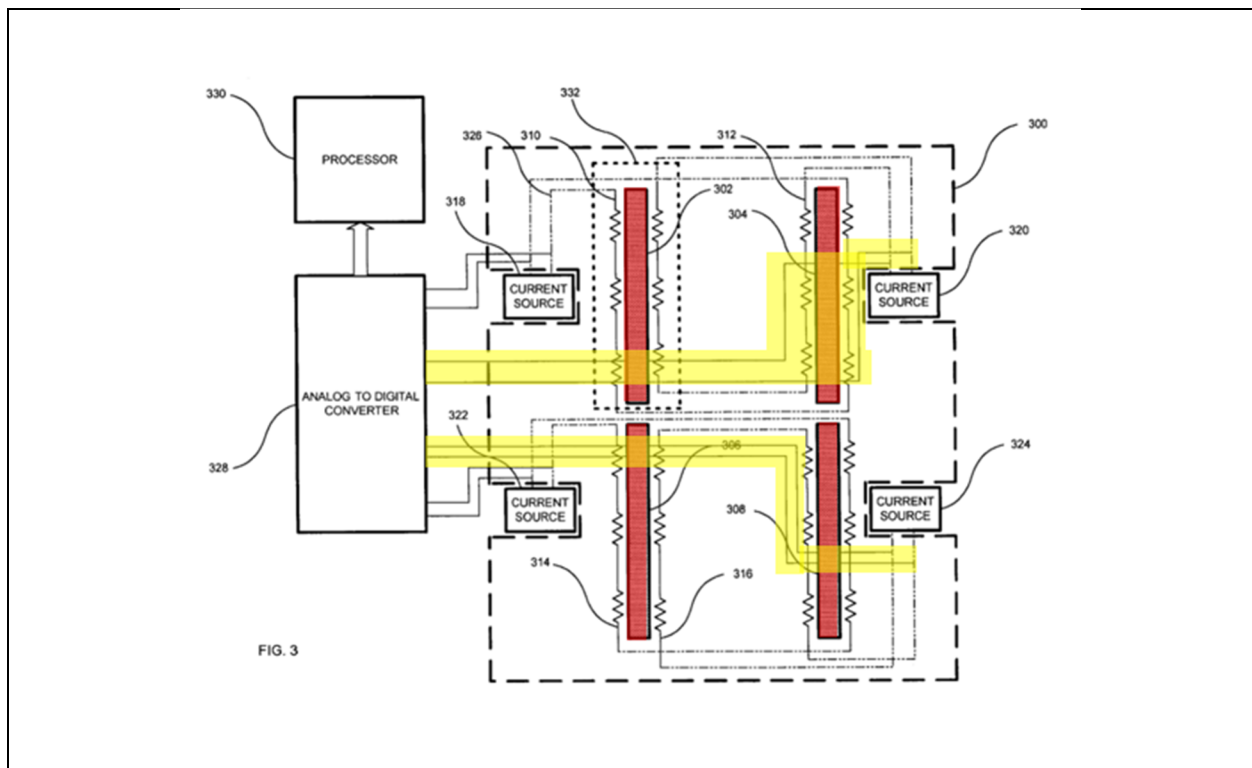
Petitioners have tried to bolster their erroneous reading of the reference in several ways. At his deposition, their expert Dr. Pond asserted that the phrase “for ejecting ink” in the sentence “Regions 302, 304, 306, and 308 each include an array

of nozzles and associated firing resistors for ejecting ink” (see Ex. 1007 col. 8 lns 47-49) would be understood to infer that all structures required for ejecting ink would be located within those rectangular regions. (Ex. 2004 44:16 - 46:23.) However, as Mr. Dietl establishes, there are many structures required for ejecting ink, including power sources, ground lines, and drive transistors, none of which would reasonably be seen as indicated by a simple rectangular box. (Ex. 2003 ¶73.) Furthermore, contrary to Dr. Pond’s characterization, a PHOSITA would recognize that an ink via is not a structure “for ejecting ink,” and is instead a structure for allowing ink to flow from an ink reservoir through the substrate and into an ink distribution system. (*Id.*)

Dr. Pond has also asserted that a central ink via would not be possible in Fig. 3 because portions of the TSRs are shown as crossing the central area of the chip. (Ex. 2004 131:4 – 132:2.) However, Giere ‘178 describes the center feed design as including an “elongated hole formed in the center of the bottom of the substrate.” (Ex. 1007 col. 3 lns 37-39.) In the chip electrical schematic depicted in Fig. 3, there are two central areas between the regions 302, 304, 306, 308 where such an elongated hole can be located without interfering with the TSR traces identified by Dr. Pond. (Ex. 2003 ¶75.) Giere ‘178 describes that 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 the nozzle member, then into a plurality of ink channels,

and finally into the various ink ejection chambers.” (Ex. 1007 col 3 lns 40-45.) Such a central manifold in an adjacent barrier layer can function to distribute ink over the region of the substrate containing the TSR traces identified by Dr. Pond.

For at least those reasons, a PHOSITA would not view Fig. 3 as being in any way inconsistent with the center feed design described in Giere ‘178. (Ex. 2003 ¶75.) Indeed, Dr. Pond’s interpretation of ink vias being located within rectangular regions 302, 304, 306, 308 encounters the same issue. (Ex. 2003 ¶76.) As shown below, connections from the analog to digital converter 328 [highlighted in yellow] are shown as traversing rectangular regions 302, 304, 306, and 308 [red] where Dr. Pond asserts that vias would be located:



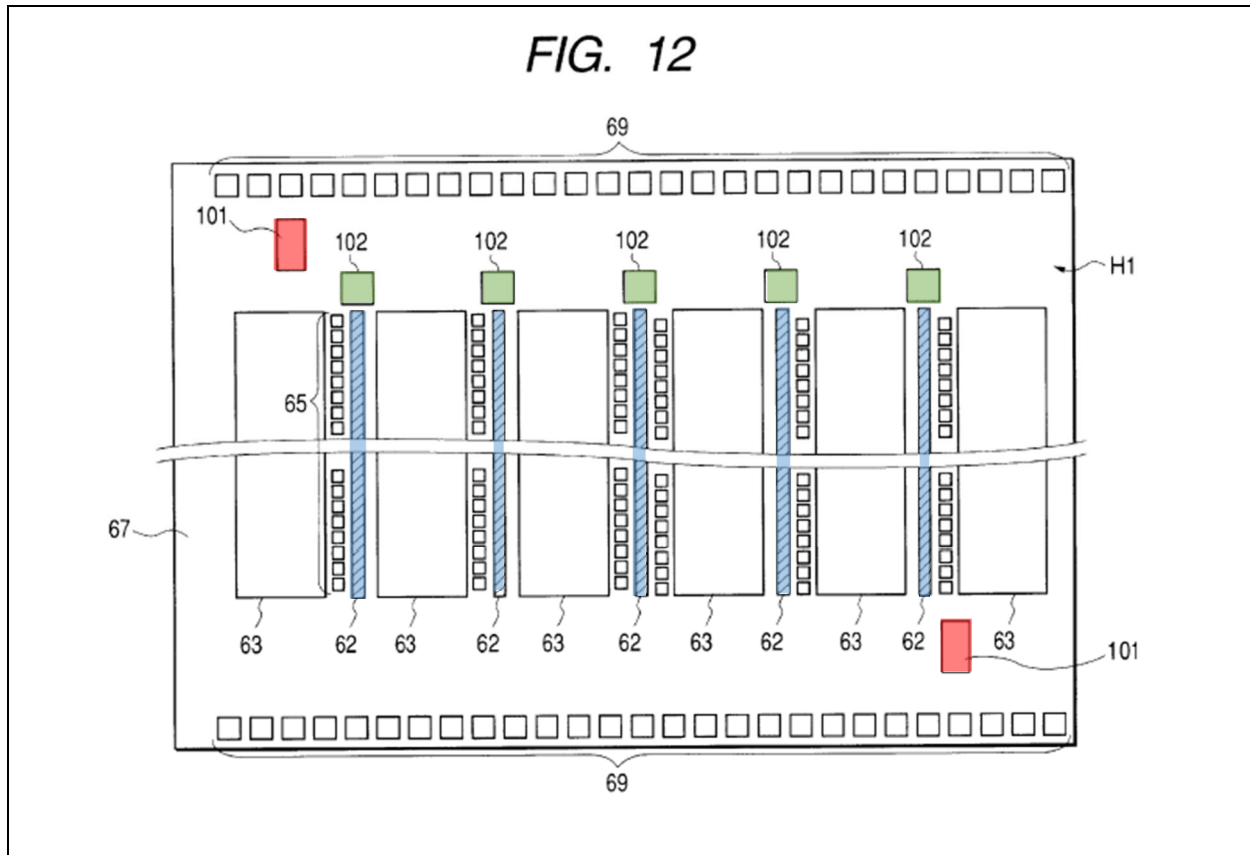
(Fig. 1007 Fig. 3.)

At his deposition, Dr. Pond has also attempted to justify his mistaken reading of Giere '178 by indicating that the rectangular regions would have called to mind earlier printhead designs not cited in his declaration or the Petition. However, one of ordinary skill in the art would not have consulted other unrelated documents when Giere '178 clearly describes the two options for ink feed positions (center feed and edge feed) applicable to the disclosed printhead chip, and provides no indication that the substrate illustrated in Fig. 3 has an entirely different structure involving separate ink vias in each of the ejector array regions. (Ex. 2003 ¶77.)

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

Yabe discloses printheads having multiple ink vias arranged in parallel with heater arrays on both sides of the vias. (Ex. 1008 Figs. 12, 14 and 15.) 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. (*Id.* col. 14 lns 27-54.) 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 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.)

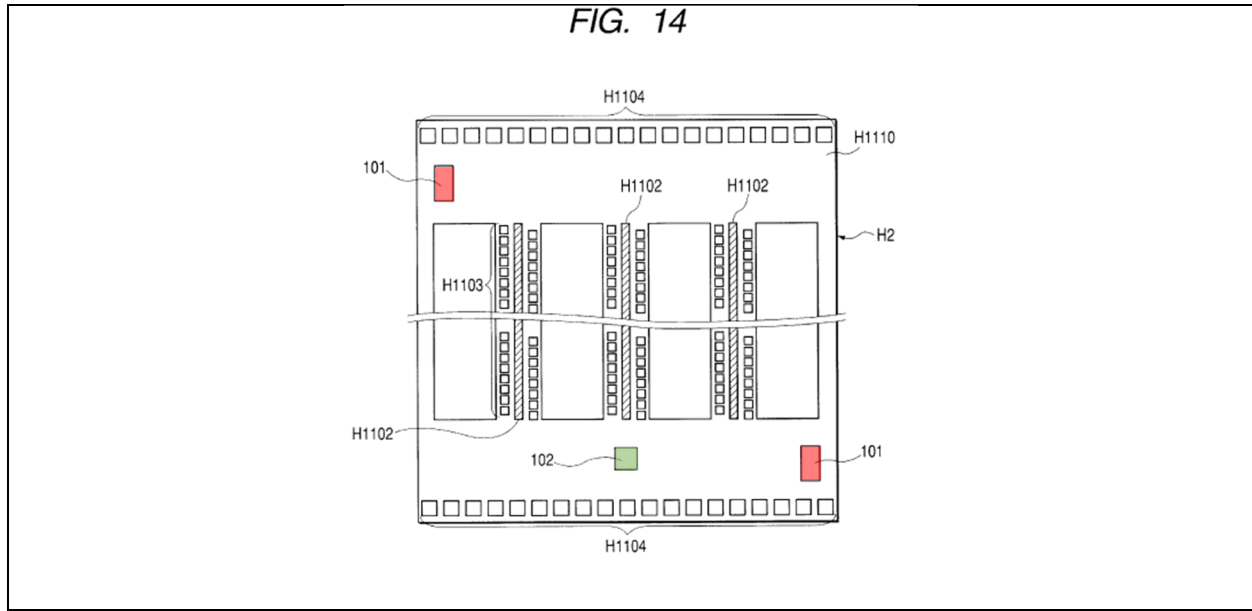
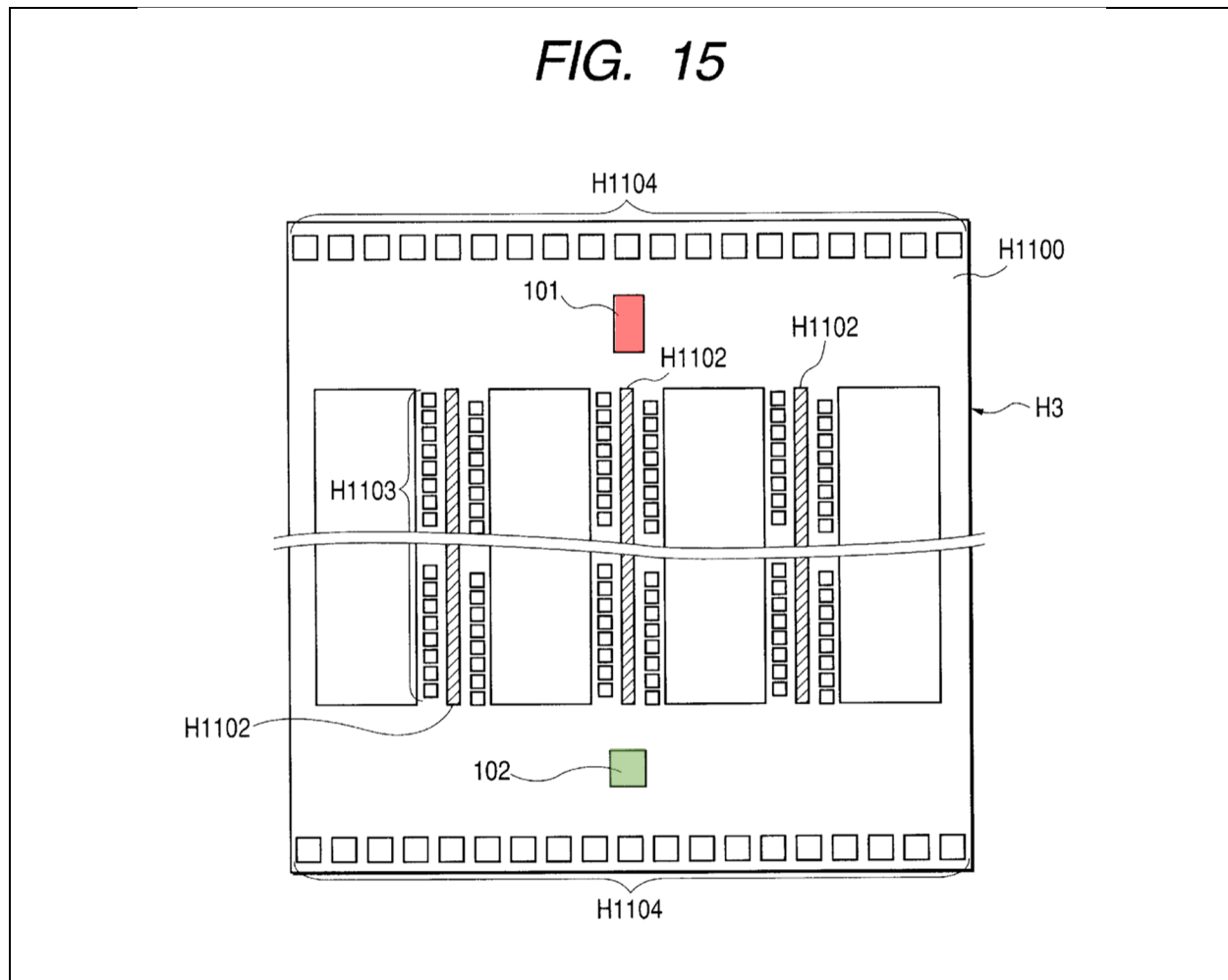


Fig. 15, meanwhile, shows only one temperature detector 102 [green] and one sub-heater [red].



In Grounds 4 and 5, Petitioners contend that a PHOSITA would have redesigned Yabe's printheads to include temperature sensors centrally disposed in each region between ink vias to determine a mean temperature of the entire printhead. Petitioners rely on Dr. Pond's reasoning that Yabe's ink vias would act as thermal insulators such that a PHOSITA would not trust a single reading from one region to reflect the mean temperature of the entire printhead or the temperature of other regions defined by ink vias of different ink color. (*see e.g.*, Pet. 92-94, 100; Ex. 1002 ¶¶ 460-468.) Those theories ignore the essence of Yabe's temperature control

approach – which is to deploy sub-heaters arranged on the heater board so that the heat they provide maintains a uniform temperature distribution across the board notwithstanding the thermal effects of the ink ejectors actuators and insulating ink vias. (*see e.g.*, Ex. 1008 col. 15 lns 35-45.) Yabe touts that his sub-heater system makes it unnecessary to position temperature sensors near the central portion of the ink vias. (*see e.g.*, *id.* col. 15 lns 54-61.)

### **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 ’823 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 Response, except that it disagrees that a degree in Materials Science is sufficient. (Ex. 2003 ¶¶33-34.)

### **IV. CLAIM CONSTRUCTION**

Petitioners propose to construe the term “adjacent” to mean “next to and can include” in the context of claims 1 and 11. Patent Owner does not agree with this construction and contends that “adjacent” carries its plain and ordinary meaning throughout the claims.

According to Petitioners, the term “adjacent” should be interpreted to mean “next to and can include,” but they offer no analysis of how that term is used in the ’823 patent. (Pet. at 6.) Instead, Petitioners state that certain portions of the specification indicate that “heaters” can be within a “region.” (*Id.*) Petitioners also refer to a different patent. (Pet. at 7.)

The claims of the ’823 patent use the term “adjacent” in the following context:

- “substantially adjacent a first via” (Ex. 1001 col. 8 lns 45-46 and col. 9 lns 49-50);
- “substantially adjacent a second via” (*Id.* col. 8 lns 47-48 and col. 9 lns 51-52);
- “a region, positioned between the first heater array and the second heater array, and also positioned substantially adjacent to the first heater array and the second heater array” (*Id.* col. 8 lns 49-52);
- “substantially centrally disposed with respect to the region and substantially adjacent to both the first heater array and second heater array” (*Id.* col. 8 lns 56-58);
- “substantially adjacent the second via” (*Id.* col. 8 lns 66-67 and col. 10 lns 16-17);
- “substantially adjacent a third via” (*Id.* col. 9 lns 1-2 and col. 10 lns 18-19);

- “substantially immediately adjacent to the third heater array and the fourth heater array” (*Id.* col. 9 lns 4-6);
- “a region adjacent to and immediately between the first heater array and the second heater array and substantially adjacent to both the first heater array and second heater array” (*Id.* col. 9 ln 56 through col. 10 ln 2);
- “substantially adjacent to both the third heater array and fourth heater array.” (*Id.* col. 10 lns 26-27.)

None of these phrases indicate, or raise a question regarding, whether one thing is both next to and included in something else. 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 11. 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 ’823 patent.

While not mentioned in the Petition, Dr. Pond’s Declaration also states that he has been advised that the term “ink via” was construed with regard to another unrelated patent to mean “[a] path to fluidly connect [a] supply of ink to one or more heaters,” and that he has applied that analysis to the prior art. (Ex. 1002 ¶20.) However, as Mr. Dietl notes, “ink via” has a more particular meaning in the thermal ink jet printing industry, and refers to an ink passage in or through the substrate of the heater chip. (Ex. 2003 ¶50.) An ink via in the context of a printhead is not just

any path that connects an ink supply to the heaters, but a passage in the chip itself. This is clear from the claim language of the '823 patent, which recites a “chip for use with a printing device” that comprises first, second, and third vias. (*Id.*; Ex. 1001 col. 8 lns 45-48 -24 and col. 9 lns 1-2.) The specification of the '823 patent also states that ink is supplied through one or more ink vias “in the chip” (Ex. 1001 col. 1 lns 23-24) and contains other discussion indicating that multiple vias are within the boundary of the heater chip. (Ex. 1001 col. 2 lns 58-61 and col. 5 lns 16-23.) Dr. Pond agreed in his deposition that the term “via” allows ink to be fed from some depth below the surface of a heater chip in the type of device shown in the '823 patent. (Ex. 2004 10:8 – 11:19.)

## **V. LEGAL STANDARDS**

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 THAT ANY OF CLAIMS 1-3, 5-13, AND 15-17 ARE RENDERED OBVIOUS BY BENJAMIN IN VIEW OF GIERE '673 (GROUND 1)**

Ground 1 challenges independent claims 1 and 11 and dependent claims 2-3, 5-10, 12-13, and 15-17 as obvious in view of the combination of Benjamin and Giere '673. This theory of obviousness does not withstand scrutiny and should be rejected.

Claim 1 of the '823 patent is directed to a chip for use in a printing device comprising a temperature sensing element substantially centrally disposed with respect to a region between a first heater array (substantially adjacent a first via) and second heater array (substantially adjacent a second via), and a second temperature sensor substantially centrally disposed with respect to a second region between a third heater array (substantially adjacent the second via) and fourth heater array (substantially adjacent a third via). (Ex. 1001 col. 8 lns 44-60 and col. 8 ln 66 – col. 9 ln 11.) Per claim limitations 1[F] and 1[L], the heater arrays “are operable to receive heating responsive to the temperature sensed by the temperature sensing element” such that “the received heating regulates the temperature of the region.” (*Id.* col. 8 lns 61-65 and col. 9 lns 12-16.) Independent claim 11 recites similar limitations.

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

**1. Neither Benjamin Nor Giere '673 Teach Monitoring Of Temperatures In Regions Between Ink Vias**

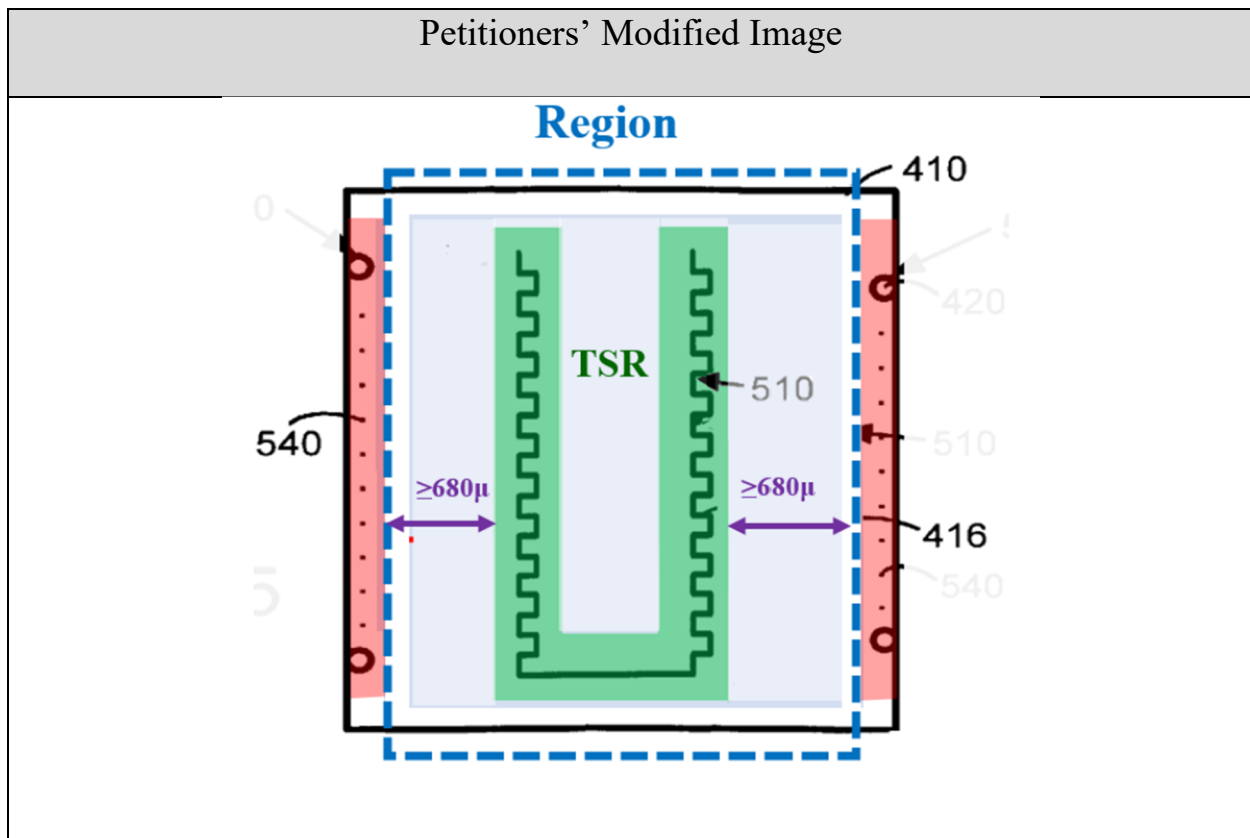
The Petition states that Benjamin discloses a plurality of ink vias each having a heater array disposed adjacent each longitudinal side of the ink vias, but it admits that Benjamin does not disclose where on the printhead die the temperature sense resistor (TSR) should be disposed. Dr. Pond admits that Benjamin discloses only a single TSR for the entire substrate and does not disclose the location of that TSR. (Ex. 1002 ¶143.)

The Petition argues that Giere '673 would have led a PHOSITA to modify Benjamin to deploy a first temperature sensing element centrally located in a region between first and second heater arrays and second temperature sensing element centrally located in a region between third and fourth heater arrays. However, Giere '673 also fails to disclose this. As discussed in Section II.B.2. above, Giere '673 does not relate to a printhead chip having any via at all, let alone multiple parallel vias with heater arrays on both sides of the vias. (Ex. 2003 ¶84.) It also fails to disclose a third heater array or fourth heater array. As such, Giere '673 teaches nothing about where to place temperature sensors in the type of printhead disclosed in Benjamin having a plurality of ink vias with heaters arrays on both sides of the vias. (*Id.*)

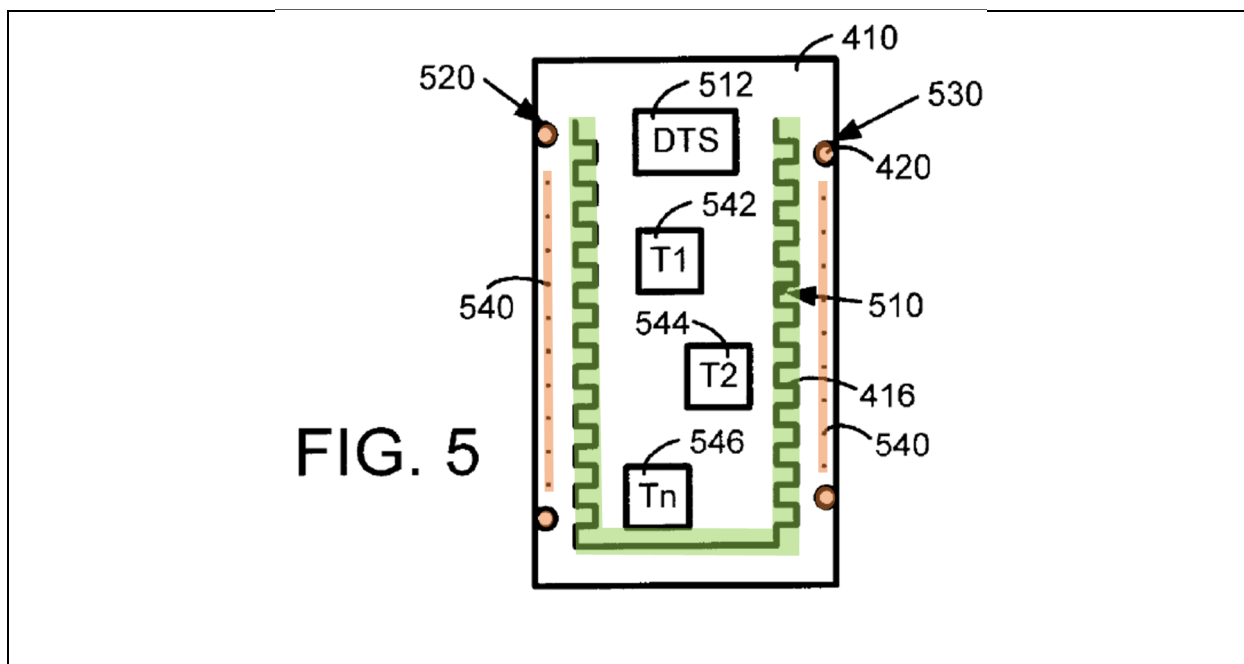
**2. Neither Benjamin Nor Giere '673 Teach Temperature Sensors Substantially Centrally Disposed In Regions Between Ink Vias**

The temperature sense resistor 510 that Petitioners emphasize in Giere '673 has two arms that extend along the outer periphery of the region between the two columns of nozzles 520, 530 and their associated heaters 416, rather than being “substantially centrally disposed with respect to the region [second region]” as recited in claims 1 and 11.

Petitioners modifying Fig. 5 to narrow the TSR by inserting a substantial space to the left and right as shown below:



Petitioners attempt to justify this by pointing to a statement that the legs of the TSR may be approximately 680  $\mu\text{m}$  inboard from the center of heater arrays (Pet. pp. 24-25). However, Giere '673 does not disclose any other dimensions, such as the distance between heaters, the width of the substrate, or alternative spacing between the TSR and heater arrays, and therefore provides no indication that the identified 680  $\mu\text{m}$  spacing is any different than what is actually illustrated in Fig. 5 below, where the legs of the TSR [light green] are closer to the edge of the substrate than they are to the center:



Petitioners also characterize Giere '673 as teaching that the center of the region “more accurately reflects the mean temperature of the substrate 410.” (Pet. p. 26.) The statement that Petitioners quotes does not appear at col. 4 lns 57-59 as

indicated by Petitioners or anywhere else in Giere '673. Therefore, this claim limitation is also missing from the proposed combination of references.

**3. Neither Benjamin Nor Giere '673 Teach Supplying Heat To Adjacent Heater Arrays In Response To A Temperature Monitored In Regions Between Ink Vias**

As discussed in Section II.B.1. above, Benjamin discloses exactly nothing about printhead temperature *control*. Petitioners and their expert have no basis to assert that Benjamin teaches that controller 100 determines the printhead temperature using a value obtained from a temperature sensor “and regulates the printhead’s temperature ‘to optimize printing quality’.” (Pet. 22, citing Ex. 1004 at col. 79 lns 60-66; Figs.25A-25B and Ex. 1002 ¶¶140-145.) Benjamin teaches nothing of the sort. Dr. Pond’s further assertion that Benjamin discloses “using a controller to maintain[s] the printhead at its optimal temperature by, for example, lengthening and shortening the firing pulses sent to the heater arrays” (Ex.1002, ¶243) is also incorrect.

Benjamin’s brief mention of temperature monitoring of printheads (Ex. 1004 col. 3 lns 1-3 and col. 79 lns 29-35 and 60-65) does not amount to any teaching of a temperature controller, let alone one that controls temperature by providing heating in response to measured printhead temperature. As Mr. Dietle explains, a PHOSITA understood that printhead temperature may be monitored for other reasons, such as

in an approach that slows printing if the monitored temperature gets too high or if the density of the image being printed is too heavy. (Ex. 2003 ¶¶89-90.)

Benjamin's deficiencies in this regard are evident in the Petitioners' analysis of claim limitations 1[F] and 1[L] (and corresponding limitations of claim 11), reciting heater arrays receiving heating in response to measured regional temperature to heat the corresponding substate region. The Petition relies exclusively on Giere '673's temperature control system in this regard, without mention of the supposedly similar temperature control system of Benjamin that supposedly would have benefited from Giere '673's guidance regarding temperature sensor placement. (Pet pp. 7 n.2, 33-36, and 43.)

However, their need to rely on Giere '673 for the temperature control aspects of the challenged claims exposes another fatal hole in Ground 1 - - 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.

The u-shaped TSR 510 is designed to sense the temperature of the substrate as a whole. (Ex. 1005 col. 4 lns 55-56.) The temperature controller disclosed in Giere '673 uses data from TSR 510 as well as inputs from several other temperature sensors and recorders, as past firing history, printing data from a logic mapping system, and other information 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. (Ex. 1005 col. 6 lns 5-8, col. 5 lns 28-31, col. 6 lns 35-40.) It uses this data and other information to generate and output printing parameters such as pulse widths, pulse rates, ink ejection chambers to be fired and when they will be fired, activation of non-ejecting changes for warming, and firing voltages optimized to improve ink drop quality. (*Id.* col. 6 lns 39-60.) All of the disclosed embodiments involve these specialized techniques for precisely controlling the firing parameters of subsets of ejection elements based on a variety of inputs including various temperature data, past firing data, print data for the current image, etc.

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, not does it provide any guidance on how to implement such an approach. (Ex. 2003 ¶91.) As Benjamin also fails to supplying heat to the substrate on a region-by-region basis in response to the measured temperature of each region, the proposed combination fails to account for this aspect of the independent claims as well.

**4. Because The Proposed Combination Does Not Account For All Claim Elements, The Board Need Not Address Motivations To Combine**

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 temperature sensing element substantially centrally disposed between heater arrays in at least two regions between heater arrays associated with separate vias, or the regulation of heater array temperatures using temperatures sensed by such temperature sensors, the proposed combination of these two references necessarily fails to render the subject matter of independent claims 1 and 11 obvious. 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). 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.” *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1164 (Fed. Cir. 2006). Ground 1 should be rejected for this reason.

**B. Ground 1 Fails Because The Proposed Modifications Represent Hindsight-Driven Reconstruction That Is Inconsistent With Fundamental Operating Principals Of The References**

Petitioners conjure up a printhead that does not comport with the design or operating principles of the devices disclosed in either prior art reference. Petitioners fail 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, (iii) that Giere '673 teaches a TSR positioned closer to the

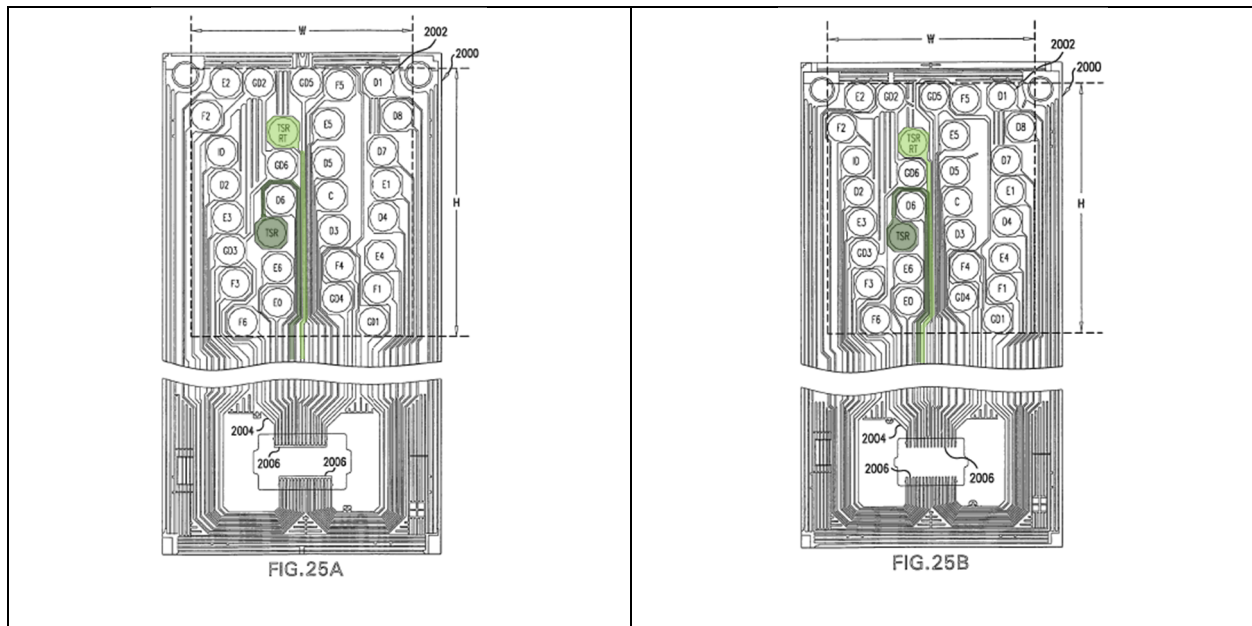
edges of the substrate than its center, (iv) that Giere '673's temperature control system is very specialized and takes into account far more than a single temperature measurement, or (v) that Benjamin already provides a suitable and cost-effective approach for monitoring average printhead temperature

According to the Petition, "a PHOSITA would have applied Giere '673's teachings to Benjamin by (i) disposing a single TSR within each adjacent pair of ink vias ...and (ii) positioning the TSR equidistant from both heater array[s] within the region but no less than approximately 680  $\mu\text{m}$  inboard from the center of the heater arrays...to ensure that the temperature value provided by the TSR reflects the mean temperature of the region." (Pet. p. 27.) According to Petitioner's backwards reasoning, a PHOSITA desiring to monitor the mean temperature of Benjamin's printhead would have also realized that placing a temperature sense resistor in only one region between heater arrays would not accurately report the mean temperature of the entire printhead due to the insulating effect of the ink vias, and consequently would have placed additional temperature sense resistors to measure other individual regions and then used those measurements to compute a mean temperature of the entire substrate. (Pet. pp. 28-31.)

The proposed combination is inconsistent with Benjamin. The Petition acknowledges that it is the "temperature of the **entire printhead die**" that Benjamin monitors. (Pet. p. 28, emphasis in original.) Benjamin already discloses a suitable

way of achieving this using only a single temperature sensor on the printhead die that measures the temperature of the entire printhead. (Ex. 1004 col. 79 lns 60-67.) It simply does not comport with Benjamin's design and teachings to utilize a more complex and costly approach to measure mean printhead temperature.

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.)



Deploying separate regional TSRs for the purpose of computing a temperature representative of the entire printhead would unnecessarily add cost and take up space on the printhead die and/or the flex circuit shown above. (Ex. 2003 ¶93.) As Mr.

Dietl points out, in designing printheads the space on the printhead chip and attached flex circuit are very valuable, and a PHOSITA would have been motivated to keep the size of both the chip and flex circuit to a minimum not only to reduce the size of the printhead and related ink cartridge, but also to reduce manufacturing cost and complexity. (*Id.*) This hypothetical approach would also necessitate other modifications involving additional circuitry to compute the average temperature. A PHOSITA would not have added more temperature sensors or made other changes that increase the design complexity and operational complexity and cost to achieve what Benjamin's design already achieves.

It is also inconsistent with Giere '673 to select only the u-shaped TSR 510, which functions only in the context of its complex control system involving other interrelated components, data inputs, and processing. Giere '673 does not provide printhead temperature control utilizing only the mean substrate temperature sensed by TSR 510.

Furthermore, to the extent that Giere '673 uses mean substrate temperature as one input to its advanced control logic, it teaches using a single u-shaped TSR 510 spanning a substantial portion of the chip to measure this. The only approach for monitoring mean printhead temperature consistent with the teachings of both references would have been to deploy a single TSR on the heater chip rather than multiple TSRs each located in a different region separated by ink vias. 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. This would also avoid any need for having a device located on the substrate capable of averaging multiple TSR values. (Ex. 2003 ¶94.)

Petitioner's assertion that a PHOSITA would have realized that ink vias are insulating is a red herring, because none of the prior art cited by Petitioners showing multiple vias on a single chip suggests an approach of placing a temperature sensor in each region separated by vias to detect individual regional temperatures. For instance, Petitioners point to U.S. Patent No. 6,527,367 to Yabe as recognizing that ink vias are insulating. (Pet. p. 28.) Yet, as discussed above at Section II.B.4, Yabe teaches measuring mean temperature of a printhead with sensors in the peripheral region of the die and does not disclose temperature sensors between ink vias.

Because Benjamin and Giere '673 disclose a TSR that provides a single temperature value for the printhead as a whole, and because the end goal of the combination as articulated by Petitioners is to monitor the average temperature of the printhead, the manner in which Petitioners suggest combining Benjamin and Giere '673 would have been counter-intuitive to a PHOSITA and is not consistent with the operating principles of either reference.

The only source that would have led a PHOSITA to the overall printhead structure and the temperature monitoring approach recited in claims 1 and 11 is the '823 patent specification. But that 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.”).

**C. Ground 1 Fails Because The Alleged Motivations Are Illogical And Are Based On Inaccurate Characterizations Of Benjamin**

The Board need not address alleged motivations to combine Benjamin and Giere '673 because their combined teachings do not account for all elements of the claimed invention.

Moreover, the Petition indicates that Benjamin discloses a printhead temperature control system and suggests that its only shortcoming is its failure to disclose placing a temperature sensor centrally in each region between adjacent ink vias. (Pet. pp. 8-23.) The Petition asserts that a PHOSITA would have consulted Giere '673 for where to place the sensors for optimal substrate temperature control using techniques such as regulating the firing pulses sent to the ejector devices. (Pet. pp. 23-24; 55-56.) This reasoning that a PHOSITA would have followed the temperature sensor arrangement taught by Giere '673 to improve the control system supposedly disclosed in Benjamin fails from the onset because Benjamin does not

disclose any temperature control system and is not directed to optimizing ink ejector temperature.

Petitioners’ argument regarding motivations to combine are deficient in other respects. Petitioners and their expert reason that a PHOSITA would have been motivated to monitor the mean temperature of the entire Benjamin substrate. Dr. Pond first discusses motivations to control printhead temperature based on mean temperature in general. (Ex. 1002 ¶¶252-254.) That discussion does not identify any benefit of the proposed approach for monitoring the mean substrate temperature. (*Id.*) Dr. Pond then addresses the insulating effects of ink vias in multi-color printheads. (*Id.* ¶¶255-257.) He then reiterates his conclusion that a PHOSITA would not have deployed a TSR in only one of the regions between Benjamin’s ink vias but would have done this in each region “so that the TSR’s collectively determine a mean temperature of Benjamin’s printhead die . . . .” (*Id.* ¶¶257-258.) Dr. Pond also mentions regulating or temperature on a “per-color basis” (*id.*) but provides no analysis regarding how the proposed modifications for computing a mean temperature of Benjamin’s substrate would somehow provide for temperature regulation on a per-color basis. (*Id.*) None of these reasons provide evidence that a PHOSITA should monitor mean substrate temperature per the approach of the alleged combination rather than by using a single temperature sensor placed at a

location outside of the regions between ink vias to avoid the drawbacks of that approach emphasized by Dr. Pond.

Petitioners' cursory recitation of other generic motivations such as same field of endeavor, simple/routine/low-cost nature of the combination, and reasonable expectation of success are also misplaced. (Pet. pp. 57-58.) Those assertions at most argue that a PHOSITA *could* make the claimed invention; but there must be evidence demonstrating that they *should* make the claimed invention. *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. Their heavy, and misplaced, reliance on the '823 patent in justifying the proposed combination of prior art references is telling. Neither of the references on their own suggests the '823 patent's approach for monitoring temperature of individual regions between ink vias in a multi-via substrate.

Petitioners' conclusory Ground 1 arguments with regard to independent claims 1 and 11, which fail to account for all elements of the claims and rely on improper hindsight, should be rejected. The challenged dependent claims 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 THAT CLAIMS 4 AND 14 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 14 in view of Parish. Those dependent claims include the limitations of corresponding independent claims 1 and 11. 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 THAT ANY OF CLAIMS 1-3, 5-13, AND 15-17 ARE RENDERED OBVIOUS BY BENJAMIN IN VIEW OF GIERE '178 (GROUND 3)**

Ground 3 challenges claims 1-3, 5-13, and 15-17 based on Benjamin and Giere '178. This ground must also be rejected.

**A. Ground 3 Fails Because It Is Based On The Same Inaccurate Characterizations Of Benjamin Asserted In Ground 1**

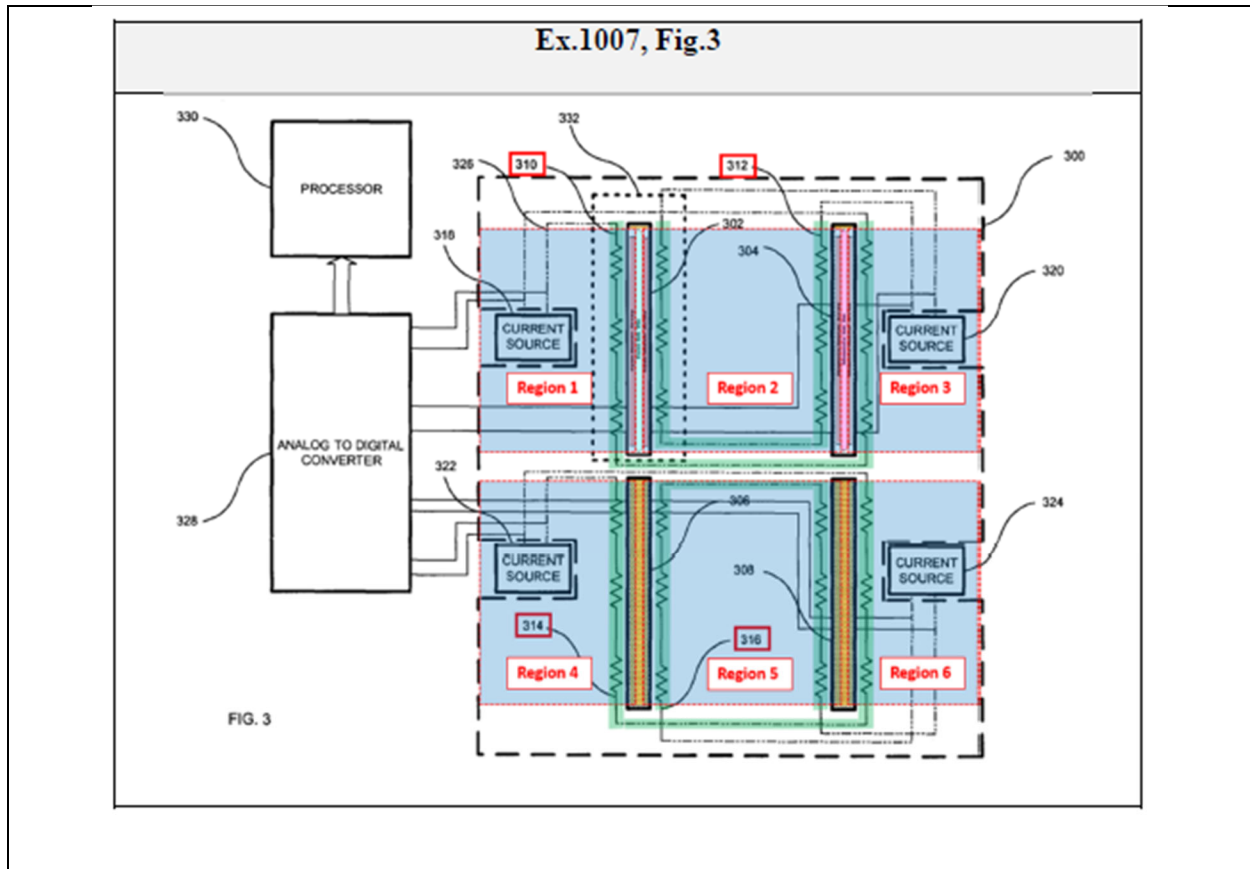
Ground 3 parallels Ground 1 except that it relies on Giere '178 for the guidance that supposedly would have led a PHOSITA to modify Benjamin to position a temperature sensing element in every thermal region between the ink vias of Benjamin's printhead substrate. As such, this ground incorporates the same erroneous factual assumptions and flawed reasoning regarding Benjamin's disclosed

printhead and motivations to modify it that undermine Ground 1. Those assumptions, including the notion that Benjamin discloses a temperature controller that manipulates firing pulse characteristics to maintain individual ejection actuators within an optimal temperature range, are equally baseless as incorporated by reference into Ground 3. This provides ample reason for rejecting Ground 3.

**B. Ground 3 Fails Because It Is Based On Inaccurate Characterizations Of Giere '178**

This ground should be rejected for the independent reason that it presumes a fictitious reading of Giere '178 as disclosing four ink vias located in elongated regions 302, 304, 306, and 308 with heater arrays on both sides of each via so that a single TSR is located within every thermal region between ink vias. (Pet. pp. 62-63.) As discussed in Section II.B.3. above and further addressed below, Giere '178 simply does not disclose this and so the entire ground falls apart.

Petitioners emphasize that Giere '178 has temperature sensors in local regions for “solving a problem of excessive *localized* heating of the substrate in each region” (Pet. pp. 66-67) rather than monitoring an average temperature of an entire die as in Benjamin. Petitioners present the following illustration based on a fundamental misunderstanding of Giere '178 in an attempt to show that Fig. 3 of that reference discloses a multi-via heater chip with regions between ink vias:



(Pet. at 67.) 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 so as to create six “thermal regions” separated by the heat insulating vias.

This wishful interpretation of the reference is directly contrary to its express teachings. The Petition fails to provide any analysis in support of this erroneous reading. Dr. Pond also merely advances this reading based on doctored version of Fig. 3 and without any supporting evidence or explanation. (Ex. 1002 ¶¶ 336-337.)

As discussed above, Giere '178 indicates that heaters and nozzles are arranged in the rectangular regions shown in its Fig. 3 without any mention of ink vias in those

regions. The only portion of Giere '178 describing the ink feed to ejection chambers 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; Ex. 2003 ¶97.) The description of an "elongated hole" formed in the center of the substrate, also described as a "central slot" in the substrate, would have been readily understood by a PHOSITA to refer to a central slot feeding both the left column (rectangular regions 302 and 304) and right column (rectangular regions 306 and 308) of heaters through a manifold and channels formed in an adjacent barrier layer. (Ex. 2003 ¶98.) The only disclosed alternative is a feed mechanism extending "around the outer edges of the substrate," which would require no ink vias. (*Id.*) Both of these designs were known and common for cartridges having only a single color (as shown in Fig. 1 of Giere '178) at the time that the '823 patent was filed. Giere '178 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. (*Id.*)

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 about the four rectangular regions mocked up by Petitioners to appear as ink vias with accompanying columns of heater arrays on each side. 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.) Giere '178 never states or implies that these regions further include their own separate ink via, or more than one column of firing resistors [heaters]. (*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. A PHOSITA would not backfill in undisclosed structural details based on operational aspects of the temperature monitoring system that are also not described in Giere '178. (Ex. 2003 ¶¶99-100.) Furthermore, a PHOSITA would appreciate the operational benefits of the disclosed temperature monitoring system in the context of the substrate structure that Giere '178 does disclose. (*Id.*) In particular, a PHOSITA understands that each array of firing resistors generates heat that contributes to substrate temperature in the adjacent regions. The temperature sensor 310 extends through two outer regions between a single heater array (302 or 304) and a substrate edge, and the temperature of each outer region is impacted mainly by the corresponding adjacent heater array. (Ex. 2003 ¶100.) Temperature sensor 312 extends through a central region between both heater arrays 302 and 304 where the temperature is

affected by heat generated by both adjacent arrays. (*Id.*) Because the temperatures of the outer and central regions can differ, monitoring those regions separately provides useful data and Giere '178 provides a way to achieve this. (*Id.*) Temperature sensors 314 and 316 similarly provide temperature data for the regions separated by heater arrays 306 and 308, which may differ from the data detected from the other regions.

As Mr. Dietl explains, this temperature monitoring scheme provides additional utility by generating temperature data on the side of the array near the ink feed (310 and 314 in the case of edge feed or 312 and 316 in the case of a center feed) and separate temperature readings on the side further away from the ink feed (312 and 316 in the case of edge feed or 310 and 314 in the case of a center feed). (Ex. 2003 ¶100.) This makes the chip readily adaptable to both of the disclosed ink supply approaches. (*Id.*) Thus, the layout of the temperature monitoring system disclosed in Giere '178 makes perfect sense in the context of what the reference actually discloses and would not have suggested a different chip design in which each region has two independent heater arrays supplied by an intervening ink via. (*Id.*)

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).

Neither the center-feed nor the edge-feed printhead embodiment actually disclosed in Giere ’178 is 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 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, as is recited in independent claims 1 and 11. Because it materially relies on an inaccurate depiction of the disclosure of Giere ’178, Ground 3 must be rejected.

**C. Ground 3 Fails Because The Alleged Motivations To Combine Are Illogical And Are Based On Inaccurate Characterizations Of The References**

Petitioners’ arguments regarding motivations to modify Benjamin to incorporate temperature sensors in each region between ink vias are similar to those articulated for Ground 1 while citing Giere ’178 for the supposed benefits of

monitoring temperature in those regions. Those assertions are unpersuasive for similar reasons.

Petitioners allege first and foremost that a PHOSITA would have combined Benjamin and Giere ‘178 because both are directed to maintaining the optimal temperature of a multi-via printhead substrate using techniques such as lengthening and shortening the firing pulses sent to the heater arrays. (Pet. p. 76-77.) This reasoning is contrary to the evidence. Benjamin does not disclose a controller that maintains optimal temperature of a substrate, let alone one that does so by manipulation of firing pulses. Thus a PHOSITA would not have followed teachings of Giere ‘673 for the purpose of improving such a controller. Giere ‘178 does not disclose temperature monitoring or control in a multi-via substrate. Thus, a PHOSITA would not have looked to that reference for guidance regarding monitoring temperature in Benjamin’s multi-via substrate.

Petitioners and their expert emphasize the capabilities of Giere ‘178’s system to detect localized temperature deviations and to react by controlling firing pulses for particular firing resistors (Pet. pp. 68-69, 77; Ex. 1002 ¶¶415-426.) That reasoning does not comport with their stated motivation to modify Benjamin in the first place, which is to measure “the mean temperature of Benjamin’s *entire printhead die*.” (Pet. p. 63 (emphasis in original).) There is no analysis of what the PHOSITA would have supposedly done with the measured localized temperatures

beyond computing the average, and any notion of modifying Benjamin for the different purpose of regulating local temperature makes little sense when Benjamin discloses nothing about temperature regulation at all.

Finally, the Petition also contains a single sentence purporting to incorporate twenty-four paragraphs of Dr. Pond’s declaration regarding motivation to combine. (Pet. p. 76.) However, those paragraphs address motivations to combine Benjamin with Giere ‘673 and are irrelevant to the asserted combination of Ground 3. (Ex. 1002 ¶¶239-262.)

The Ground 3 challenges to independent claims 1 and 11 and the challenged dependent claims misrepresent the disclosures of the prior art, fail to account for all elements of the claims, and rely on improper hindsight. Ground 3 should be rejected.

**IX. THE PETITION FAILS TO ESTABLISH THAT ANY OF CLAIMS 1-3, 5-10, 11-13, AND 15-17 ARE RENDERED OBVIOUS BY YABE AND GIERE ’673 (GROUND 4)**

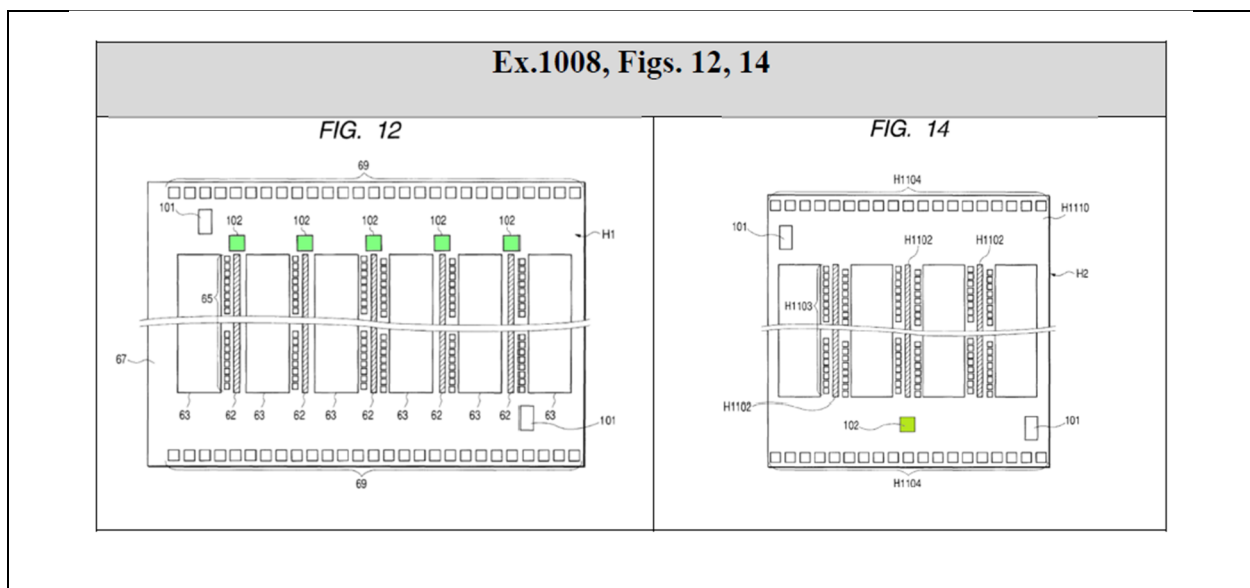
Ground 4 challenges claims 1-3, 5-10, 11-13, and 15-17 based on Yabe and Giere ’673. This ground also fails to demonstrate invalidity of any of these claims and should also be rejected.

**A. Ground 4 Fails Because The Proposed Modifications To Yabe’s Printhead Are Contrary To Its Fundamental Design And Operating Characteristics**

According to the Petition, Yabe does not “explicitly disclose” placing temperature sensors centrally within regions between the parallel ink vias and heater

arrays of its printhead substrate; however, because Giere ‘673 “explicitly discloses” a temperature sensor between heater arrays a PHOSITA would have modified Yabe’s printhead by placing a temperature sensor in each region as a way to determine a mean temperature of the entire printhead. (Pet. p. 88-92.) A PHOSITA would supposedly have redesigned Yabe’s printhead in this manner because Yabe’s ink vias would act as thermal insulators such that a single reading from one region may not reflect the mean temperature of the entire printhead. (*See e.g.*, Pet. 92-94, 100; Ex. 1002 ¶¶ 460-468.) This reasoning ignores Yabe’s disclosed teachings and operating characteristics.

Yabe explicitly teaches where one or more temperature detecting means 102 should be positioned - - on the periphery of the substrate, not centrally between ink vias. This is illustrated in the figures excerpted from page 89 of the Petition below showing temperature detecting means 102 in green:



As the figures illustrate, whether using a single temperature sensor or multiple sensors, they are to be located along the periphery and not in the regions between the heater arrays of adjacent ink vias.

As discussed in Section II.B.4. above, Yabe also explains this approach in relation to the temperature control approach that Yabe is directed to. 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.” (Ex. 1008 col. 14 lns 29-37.) Yabe emphasizes that the sub-heaters are arranged and controlled “so as to keep the temperature distribution uniformly in the base plate.” (Ex. 1008 col. 15 lns 35-40.) Yabe’s design achieves this temperature uniformity notwithstanding the thermal effects of the ink ejectors actuators and insulating ink vias:

In this way, it becomes possible to keep the temperature distribution as uniform as possible in the heater board H1 without being affected by a plurality of ink supply ports 65 and many numbers of heaters 65.

(*Id.* col. 15 lns 40-45.) Yabe emphasizes this throughout the discussion of the various embodiment disclosed. (*See e.g., id.* col. 16 lns 35-44, col. 17 lns 20-27.) Yabe also touts that this sub-heater system makes it unnecessary to position temperature sensors near the central portion of each ink supply port/via. (*Id.* col. 15 lns 54-61,)

Yabe's teachings as a whole would have led a PHOSITA directly away from the modifications proposed in Ground 4. Yabe instructs a PHOSITA to utilize sub-heaters to maintain a relatively uniform temperature across a printhead substrate having multiple ink vias. There is no reason to monitor localized temperatures between ink vias in a substrate that Yabe characterizes as having a uniform temperature distribution throughout. Ground 4 therefore fails for this threshold reason. *In re Dow Chem. Co.*, 837 F.2d at 473; *Monarch Knitting Mach. Corp.*, 139 F.3d 877 at 885.

The proposed modification would also change the principle of operation of Yabe's printheads, which utilize sensors placed along the periphery and to monitor overall printhead temperature and sub-heaters to control the temperature to be uniform throughout. Monitoring and controlling temperature on a region-by-region basis per the proposed combination is a fundamentally different approach rendered unnecessary by Yabe's design. The proposed combination does not establish obviousness of the challenged '823 patent claims for this additional reason. *In re Ratti*, 270 F.2d at 813.

**B. Ground 4 Fails Because The Combination Of Yabe And Giere '673 Does Not Disclose All Limitations Of The Independent Claims**

**1. Neither Yabe Nor Giere '673 Teach Monitoring Of Temperatures In Regions Between Ink Vias**

Yabe indisputably fails to disclose the arrangement of temperature sensors recited in claims 1 and 11, instead disclosing sensors arranged along the periphery of the printhead die at locations outside of the regions between ink vias. Nor does Yabe disclose the other particulars of the temperature sensors recited in the claims or any heater arrays operable to receive heating responsive to temperature sensed in an adjacent substrate region.

Gierye '673 also fails to disclose a temperature sensing element centrally located in a region between heater arrays of parallel ink vias. As discussed in Ground 1, Gierye '673 does not relate to a printhead chip having any via at all, let alone multiple parallel vias with heater arrays on both sides of the vias. (Ex. 2003 ¶106.) It also fails to disclose a third heater array or fourth heater array. As such, Gierye '673 teaches nothing about where to place temperature sensors in the type of printhead disclosed in Yabe having a plurality of ink vias with heaters arrays on both sides of the vias. (*Id.*)

**2. Neither Yabe Nor Giere '673 Teach Temperature Sensors Substantially Centrally Disposed In Regions Between Ink Vias**

As discussed in relation to Ground 1, the u-shaped temperature sensor 510 that Petitioners emphasize in Gierye '673 has two arms of sense resistors that extend

along the outer periphery of the region between the two columns of nozzles 520, 530 and their associated heaters 416, rather than being “substantially centrally disposed with respect to the [second] region” as required by claims 1 and 11. Therefore, this claim limitation is also missing from the proposed combination of references.

**3. Neither Yabe Nor Giere '673 Teach Supplying Heat To Adjacent Heater Arrays In Response To A Temperature Monitored In Regions Between Ink Vias**

Yabe does not disclose supplying heat to heater arrays in response to temperature detected in the regions between the arrays. Nor does Giere '673 disclose this.

As discussed, TSR 510 is designed to sense the temperature of the substrate as a whole. (Ex. 1005 col. 4 lns 55-56.) The temperature controller disclosed in Giere '673 uses data from the u-shaped TSR 510 as well as inputs from several other temperature sensors and recorders, as past firing history, printing data from a logic mapping system, and other information 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. (Ex. 1005 col. 6 lns 5-8, col. 5 lns 28-31, col. 6 lns 35-40.) It uses this data and other information to generate and output printing parameters such as pulse widths, pulse rates, ink ejection chambers to be fired and when they will be fired, activation of non-ejecting changes for warming, and firing voltages optimized to improve ink drop quality. (*Id.*

col. 6 lns 39-60.) 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. Giere '673 does not provide any guidance on how to implement such an approach. (Ex. 2003 ¶107.)

The proposed combination fails to account for this aspect of the independent claims as well.

**4. Because The Proposed Combination Does Not Account For All Claim Elements, The Board Need Not Address Motivations To Combine**

Yabe and Giere '673 each fail to disclose a printhead chip having a temperature sensing element substantially centrally disposed between heater arrays in at least two regions between heater arrays associated with separate vias, or the regulation of heater array temperatures using temperatures sensed by such temperature sensors. The proposed combination of these two references necessarily fails to render the subject matter of independent claims 1 and 11 obvious because demonstrating that all claimed limitations are disclosed in the prior art is a threshold component of any obviousness challenge. Ground 4 must be rejected for this threshold reason, and consideration of motivations to combine is unnecessary. *Medichem, S.A.*, 437 F.3d at 1164.

**C. Ground 4 Fails Because The Alleged Motivations Are Illogical In View Of Yabe's Teachings As A Whole**

As explained, Yabe 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 because its design maintains a uniform substrate temperature using sub-heaters. The motivations to combine articulated by Petitioners attempt to turn Yabe's teachings inside out, while ignoring this fundamental aspect of Yabe's disclosure. (Pet pp. 105-111.) A proper obviousness analysis must address the motivations of PHOSITA who has evaluated each reference in its entirety, including teachings that lead away from the claimed invention. *In re Evanega*, 829 F.2d at 1112; *In re Dow Chem. Co.*, 837 F.2d at 473. Petitioners provide no evidence or explanation demonstrating why a PHOSITA would have modified Yabe's design in a manner that is directly contrary to its express teachings to address a problem of localized temperature deviations that is not applicable to Yabe's design. The various random observations regarding the disclosures of Yabe and Giere '673 put forth in the Petition and the Pond declaration cannot remedy the fundamental logical holes in this theory.

The Petition also cites the Pond declaration to argue that Giere '673 motivates the combination because it "discloses that regulating the substrate temperature on a per color basis can result in improved print quality" (Pet. p. 110 citing Ex.1002 ¶ 591), despite the fact that Giere '673 does not disclose ink vias for multiple colors

on a single substrate as discussed above relative to Ground 1. 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. (Ex. 1005 col. 5 lns 42-45.) Therefore, Giere '673 provides no motivation to place temperature sensors in the type of printhead relevant to the challenged '823 patent claims, i.e., one having a plurality of ink vias with heaters arrays on both sides of the vias defining regions in between.

The only source that relates to the overall printhead structure and the temperature monitoring and control approach recited in claims 1 and 11 is the '823 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 PHOSITA. *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.*

Petitioners’ *ex post facto* reasoning bears little relation to the actual teachings of Yabe or Giere ’673. The Ground 4 challenges to independent claims 1 and 11 and the challenged dependent claims misrepresent and are fundamentally inconsistent with the disclosures of those references, fail to account for all elements of the claims, and rely on improper hindsight. Ground 4 should be rejected.

**X. THE PETITION FAILS TO ESTABLISH THAT CLAIMS 4 OR 14 ARE REDERED IN VIEW OF YABE, GIERE ’673, AND PARISH (GROUND 5)**

Ground 5 relies on the same arguments as Ground 4, 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 14 in view of Parish. Those dependent claims include the limitations of corresponding independent claims 1 and 11. Therefore, the Ground 5 challenge fails for at least the same reasons discussed above relative to Ground 4.

**XI. CONCLUSION**

For the reasons described above, and because Petitioners have not shown that any challenged claims are unpatentable, the Board should affirm their patentability.

Respectfully submitted,  
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IPR2023-00312: Patent Owner 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 Patent Owner's Response contains 13,473 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 RESPONSE was served this 30th day of October, 2023, by e-mail upon the following:

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