



Petitioner Canon's Demonstratives

Canon U.S.A. Inc., and Canon Inc. v. Slingshot Printing LLC,

IPR2023-00312 and -00313

U.S. Patent Nos. 7,484,823 and 7,594,708

Overview

- I. The '708 and '823 Patents**
- II. Grounds Shared Between the '708 and '823 Patents**
- III. Grounds Unique to the '708 Patent**
- IV. Grounds Unique to the '823 Patent**

Overview

I. The '708 and '823 Patents

II. Grounds Shared Between the '708 and '823 Patents

III. Grounds Unique to the '708 Patent

IV. Grounds Unique to the '823 Patent

The '708 and '823 Patents Share the Same Specification



US007484823B2

(12) **United States Patent**
Barkley et al.

(10) **Patent No.:** **US 7,484,823 B2**
(45) **Date of Patent:** ***Feb. 3, 2009**

(54) **METHODS AND APPARATUSES FOR REGULATING THE TEMPERATURE OF MULTI-VIA HEATER CHIPS**

(75) Inventors: **Lucas David Barkley**, Lexington, KY (US); **Bruce David Gibson**, Lexington, KY (US); **Eric Spencer Hall**, Lexington, KY (US); **David G. King**, Shelbyville, KY (US); **George K. Parish**, Winchester, KY (US)

(73) Assignee: **Lexmark International, Inc.**, Lexington, KY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 152 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/324,167**

(22) Filed: **Dec. 30, 2005**

(65) **Prior Publication Data**
US 2007/0153045 A1 Jul. 5, 2007

(51) **Int. Cl.**
B41J 29/38 (2006.01)

(52) **U.S. Cl.** **347/17; 347/12; 347/14**

(58) **Field of Classification Search** **347/14, 347/17, 19, 5, 9, 12**
See application file for complete search history.

(56) **References Cited**
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5,812,162 A	9/1998	Silverbrook
6,260,952 B1	7/2001	Feinn et al.
6,357,863 B1	3/2002	Anderson et al.

17 Claims, 5 Drawing Sheets

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(21) Appl. No.: **11/323,809**

(22) Filed: **Dec. 30, 2005**

(65) **Prior Publication Data**
US 2007/0153044 A1 Jul. 5, 2007

(51) **Int. Cl.**
B41J 29/38 (2006.01)

(52) **U.S. Cl.** **347/17; 347/12; 347/14**

(58) **Field of Classification Search** **345/5, 345/9, 12, 14, 17, 19; 347/40, 42**
See application file for complete search history.

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6,357,863 B1	3/2002	Anderson et al.
6,382,773 B1	5/2002	Chang et al.

15 Claims, 5 Drawing Sheets



US007594708B2

(12) **United States Patent**
Barkley et al.

(10) **Patent No.:** **US 7,594,708 B2**
(45) **Date of Patent:** ***Sep. 29, 2009**

(54) **METHODS AND APPARATUSES FOR SENSING TEMPERATURE OF MULTI-VIA HEATER CHIPS**

(75) Inventors: **Lucas David Barkley**, Lexington, KY (US); **Bruce David Gibson**, Lexington, KY (US); **Eric Spencer Hall**, Lexington, KY (US); **David G. King**, Shelbyville, KY (US); **George K. Parish**, Winchester, KY (US)

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15 Claims, 5 Drawing Sheets

(10) Patent No.: **US 7,594,708 B2**
(45) Date of Patent: ***Sep. 29, 2009**

(54) **METHODS AND APPARATUSES FOR SENSING TEMPERATURE OF MULTI-VIA HEATER CHIPS**

(75) Inventors: **Lucas David Barkley**, Lexington, KY (US); **Bruce David Gibson**, Lexington, KY (US); **Eric Spencer Hall**, Lexington, KY (US); **David G. King**, Shelbyville, KY (US); **George K. Parish**, Winchester, KY (US)

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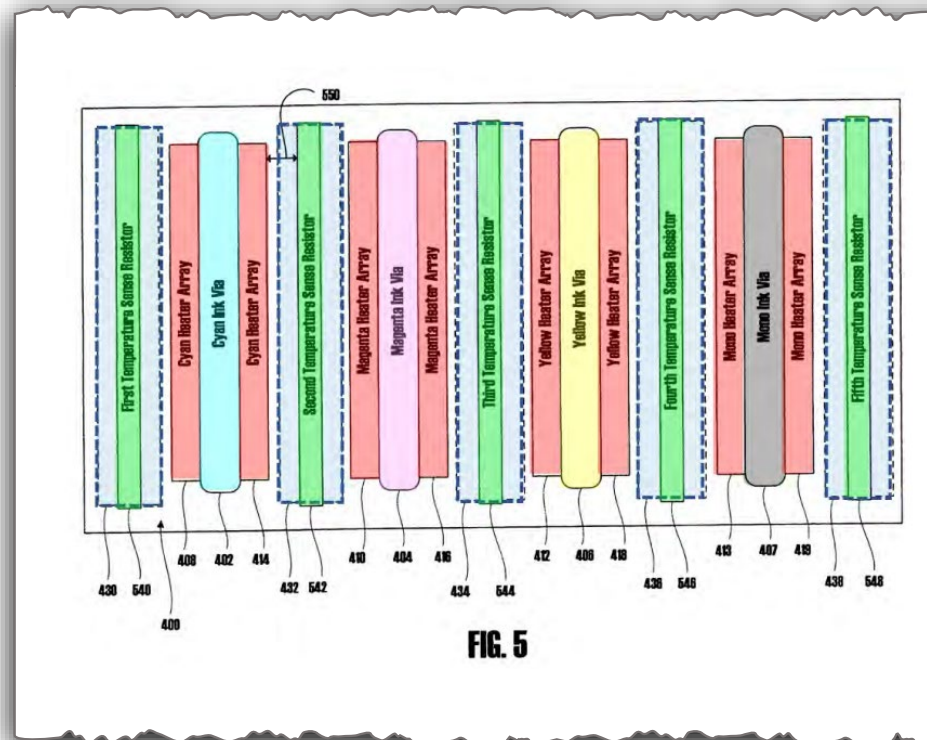
See IPR2023-00312 Ex.1001 (832 Patent) and IPR2023-00313 Ex.1001 (708 Patent)

Canon's Demonstratives, not evidence

The Claimed Heater Chip of the '708 and '823 Patents

The '708 Patent

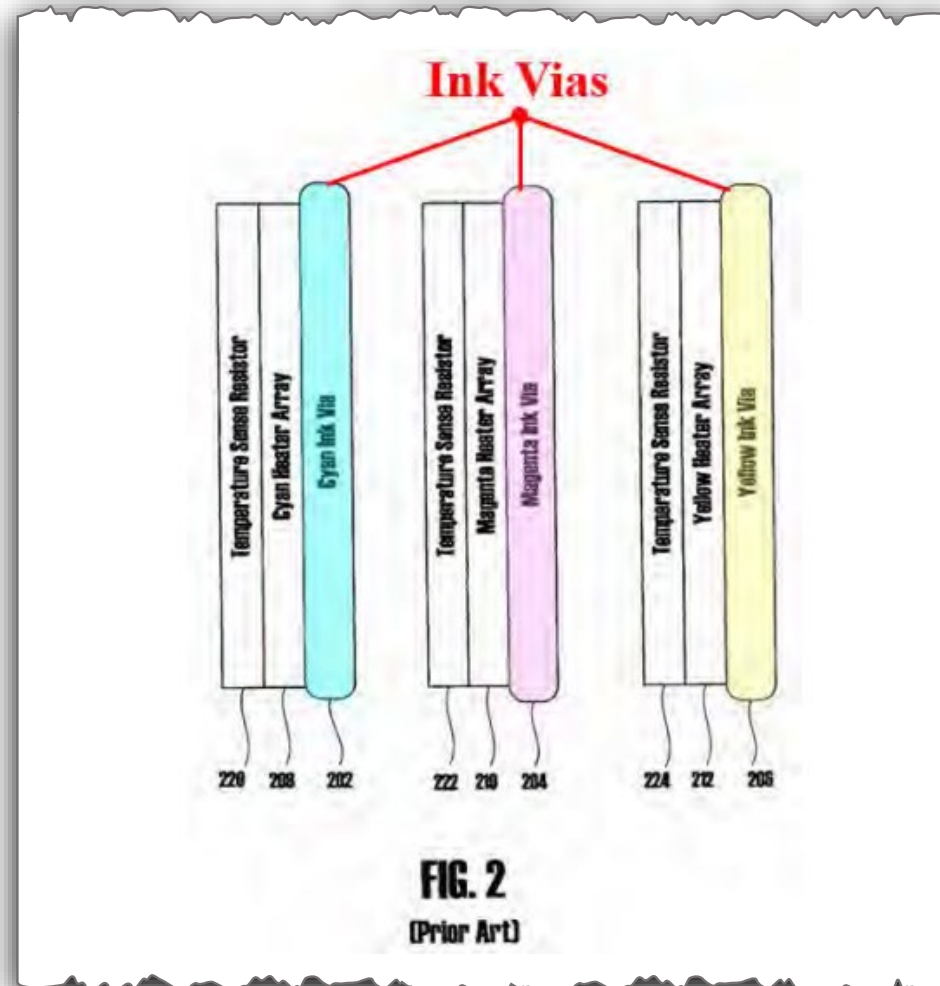
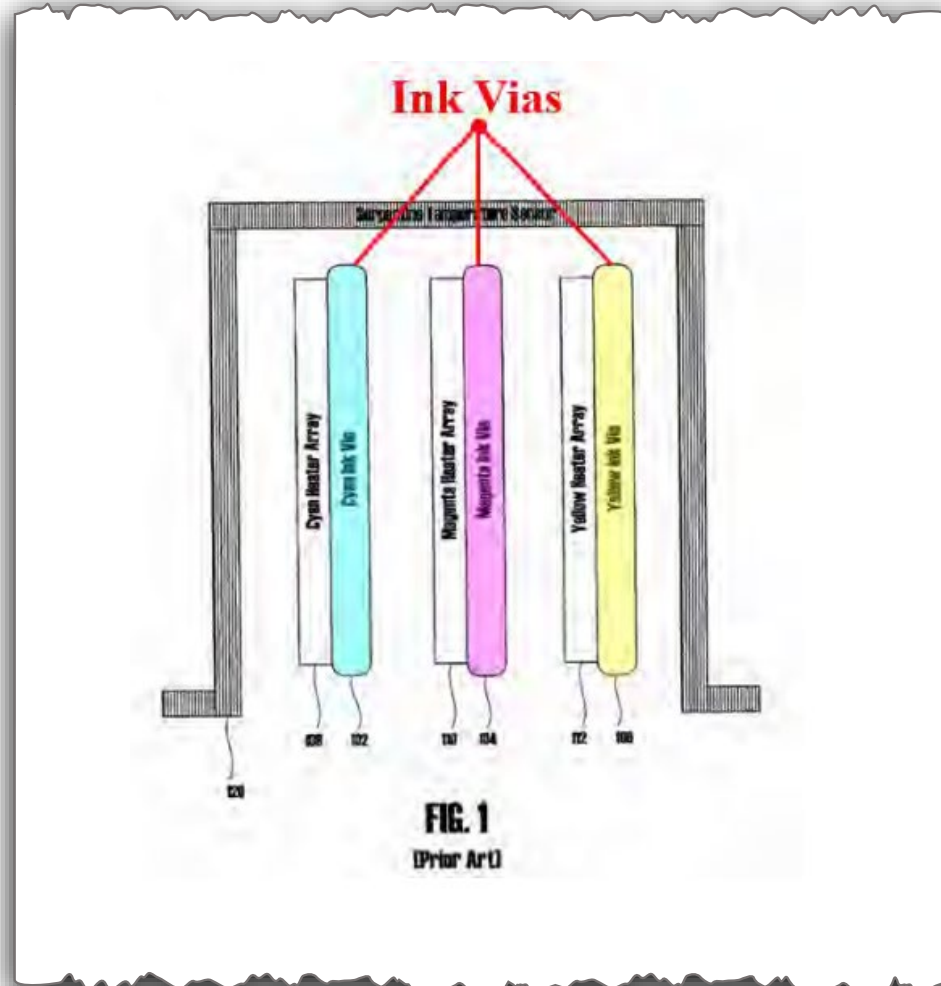
1. A chip for use with a printing device, comprising:
 - a plurality of ink vias arranged parallel to one another, each of the ink via having two longitudinal sides;
 - a heater array disposed adjacent each longitudinal side of the ink vias such that each ink via is associated with two heater arrays 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.



The '823 Patent

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

The Applicant Admitted Prior Art (AAPA)



The AAPA Discloses the Claimed Heater Chip Arrangement



*Patent Owner's Expert
Mr. Steven Dietl*

Q Do you recall that prior art system you referred to earlier that [] that met the 1200 dpi or better vertical resolution?

A **What I was thinking about was Kodak.**

Q When you were at Kodak, you remember working on a device like that?

A **Yes, I do.**

Q And that was around what time frame?

A **It was introduced in 2000- -- middle of 2004.**

Q So one of skill [] would have known that they could have achieved that [1200 dpi] printing resolution by adding heater arrays on both sides of the ink via?

A **Yes.** I think that was something that was known in the art even when it was 300 dpi printing to get to 600 dpi printing.

Overview

Combination		'823 Patent IPR	'708 Patent IPR
A	Benjamin Combined with Giere673	Ground 1	Ground 1
B	Benjamin Combined with Giere673 in view of Parish	Ground 2	Ground 2
C	Benjamin Combined with Giere178	Ground 3	-
D	Yabe Combined with Giere673	Ground 4	-
E	Yabe Combined with Giere673 in view of Parish	Ground 5	-
F	Giere178 in view of the Knowledge of a PHOSITA	-	Ground 3
G	Giere178 Combined with Yabe	-	Ground 4
H	Giere178 (Alone or Combined With Yabe) in view of Parish	-	Grounds 5 + 6

Overview

I. Overview of the '708 and '823 Patents

II. Grounds Shared Between the '708 and '823 Patents

III. Grounds Unique to the '708 Patent

IV. Grounds Unique to the '823 Patent

II. Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

II. Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

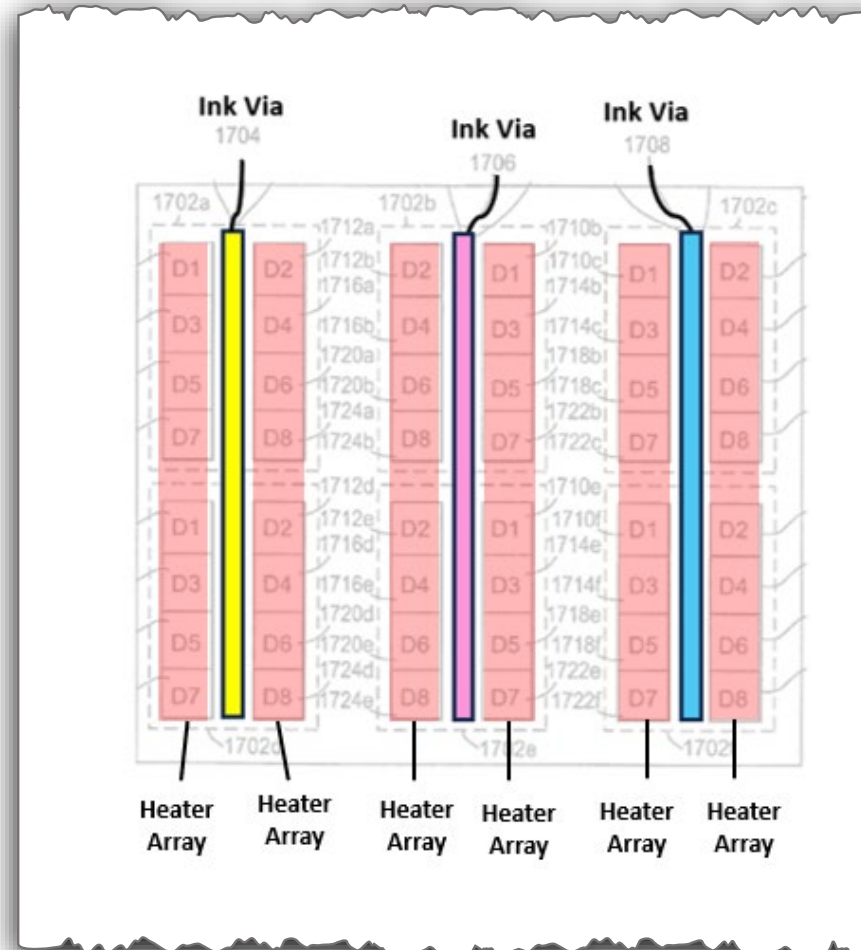
Benjamin Discloses the Claimed Heater Chip Arrangement

The '708 Patent

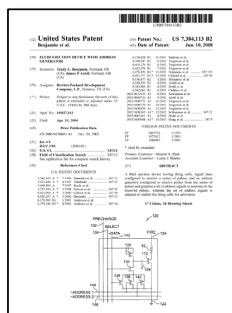
1. A chip for use with a printing device, comprising:
 - a plurality of ink vias arranged parallel to one another, each of the ink via having two longitudinal sides;
 - a heater array disposed adjacent each longitudinal side of the ink vias such that each ink via is associated with two heater arrays 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.

12

708 Pet. at 8-17; 823 Pet. at 7-17, 36-40; Ex.1004 at 5:15-21, 63:20-24, Fig. 21

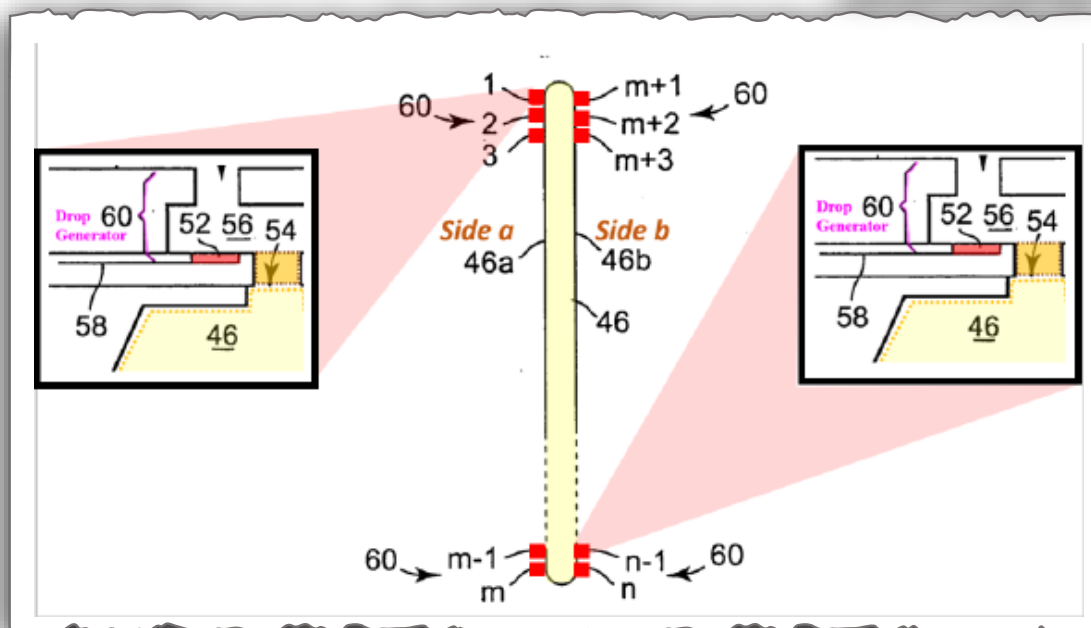


Benjamin Discloses the Claimed Heater Chip Arrangement



During printing, ink flows from ink feed slot 46 to vaporization chamber 56 via ink feed channel 54. Nozzle opening 34 is operatively associated with firing resistor 52 such that droplets of ink within vaporization chamber 56 are ejected through nozzle opening 34 (e.g., substantially normal to the plane of firing resistor 52) and toward print medium 36 upon energizing of firing resistor 52.

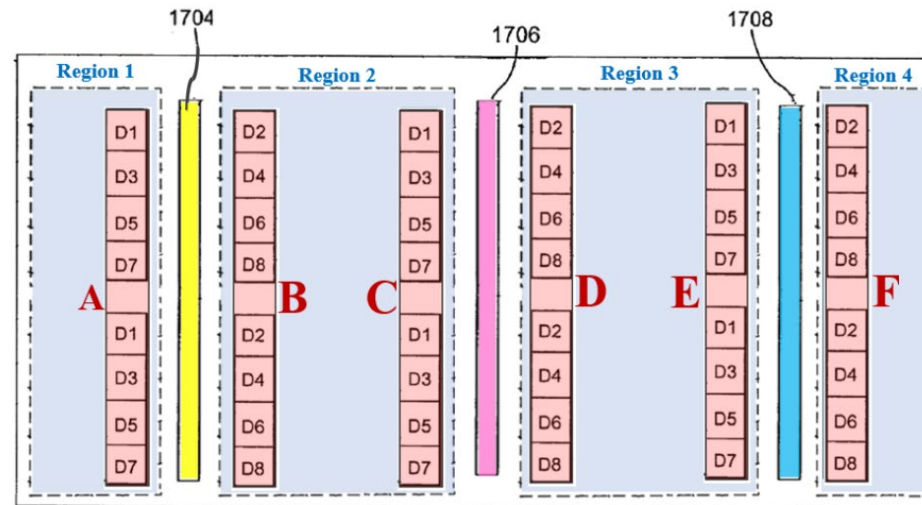
Benjamin



Benjamin Discloses the Claimed Heater Chip Arrangement

The '708 Patent

1. 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.



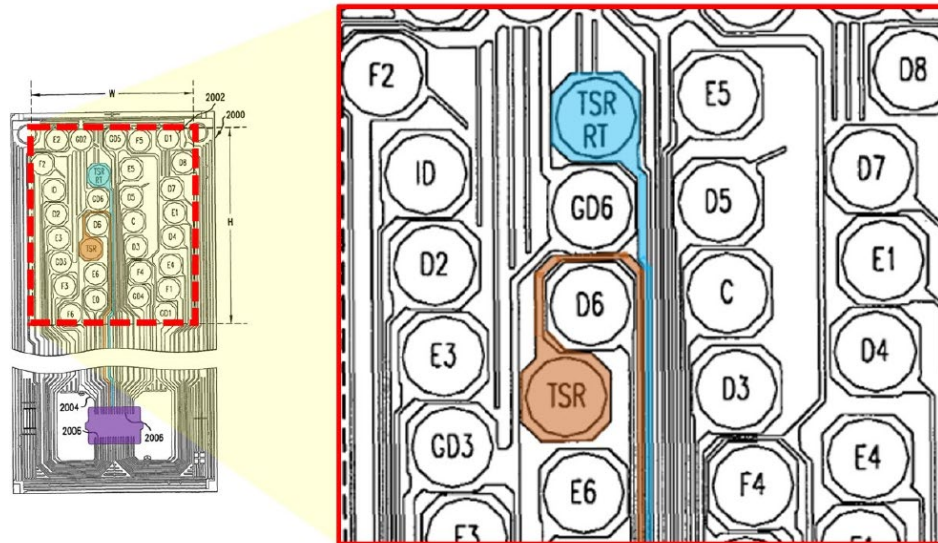
The '823 Patent

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

Benjamin in View of Giere673 Teaches Disposing a Single TSR Between Two Heater Arrays

The '708 Patent

1. 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.

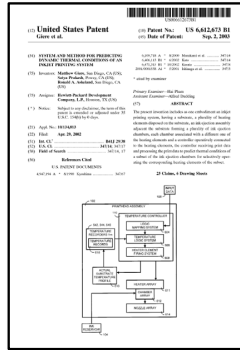


Temperature sense resistor contact area TSR allows a printer coupled to an ink jet cartridge to determine a temperature of the printhead die, based upon a measurement of the resistor. A temperature sense resistor return contact area TSR-RT provides a return path for signals provided at temperature sense resistor contact area TSR. One approach to utilize a temperature sense resistor is described in co-owned patent application serial no.

The '823 Patent

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

Giére673 Teaches Disposing a Single TSR Between Two Heater Arrays



Giére673

FIG. 5 is a top view of the substrate in one embodiment of the present invention. Referring to FIGS. 1–4 along with FIG. 5, the temperature controller 110 of FIG. 1 is coupled to at least one measurement sensor. In one embodiment, there are two measurement sensors, namely, a thermal sense resistor (TSR) 510 and a digital temperature sensor (DTS) 512. One or multiple TSRs 510 can be used to provide an approximation of the mean temperature of the substrate. Preferably, it is not located adjacent to any particular heating element and reflects the temperature of the substrate 410 after heat has moved from the heating elements to the TSR 510. The TSR 510 therefore reports a temperature that

FIG. 5

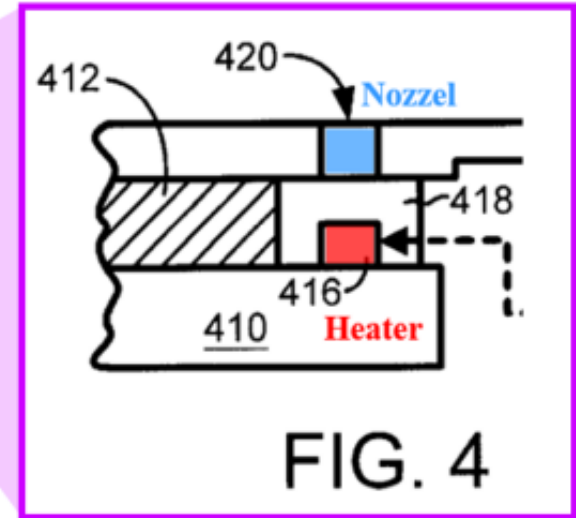
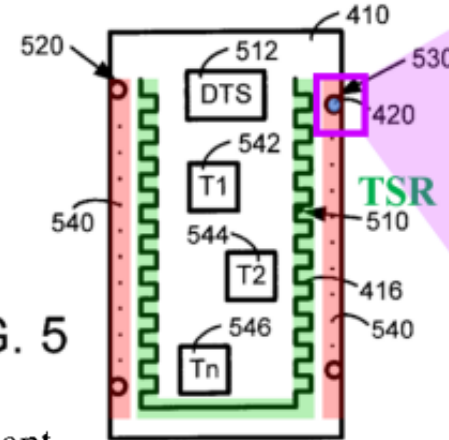
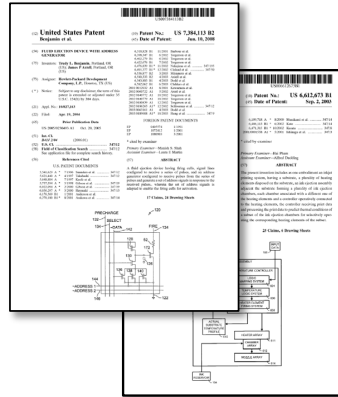
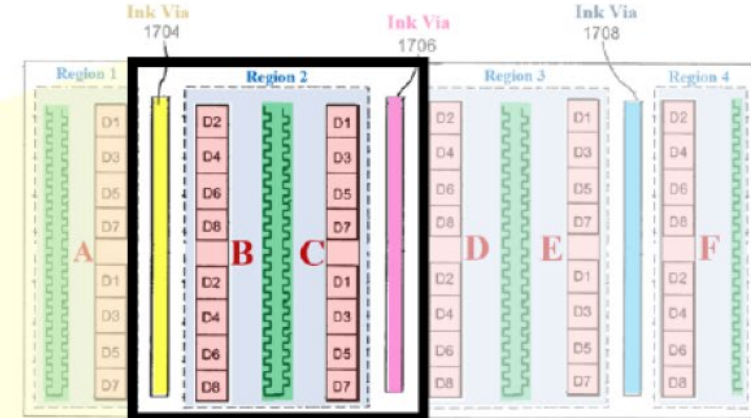
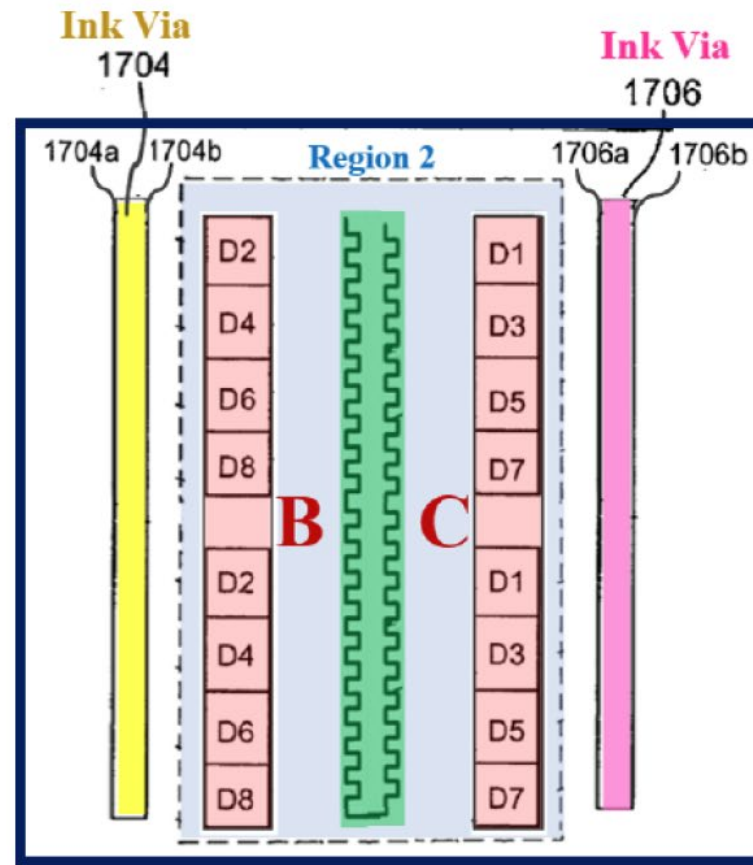


FIG. 4

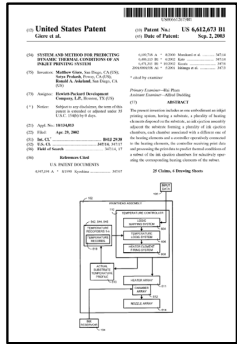
Giere673 Motivates a PHOSITA to Dispose a Single TSR Between Two Heater Arrays



Benjamin + Giere673



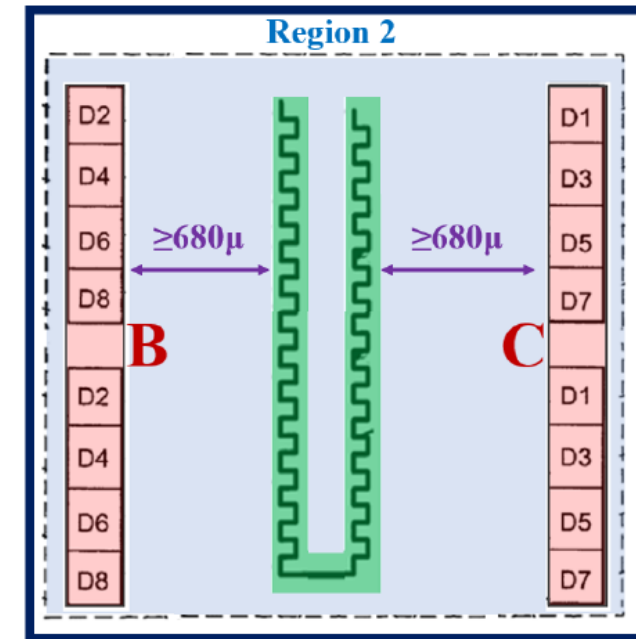
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Giere673

512. One or multiple TSRs 510 can be used to provide an approximation of the mean temperature of the substrate. Preferably, it is not located adjacent to any particular heating element and reflects the temperature of the substrate 410 after heat has moved from the heating elements to the TSR 510. The TSR 510 therefore reports a temperature that reflects heating element firings that have already occurred.

substrate. The TSR 510 is located along the length of the substrate 410. The TSR 510 can have two legs that are approximately 680 um inboard from the center of the columns of ink ejection elements 416.





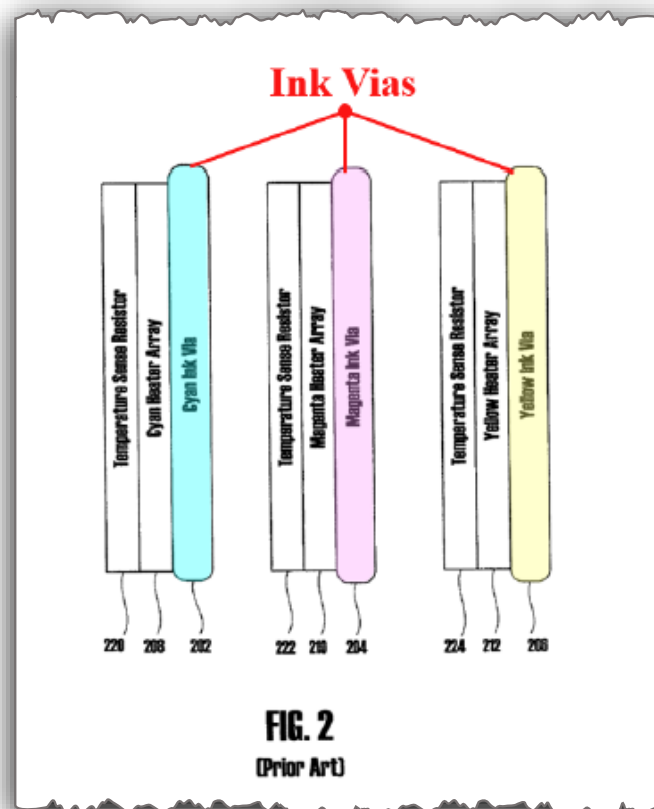
A PHOSITA would have had no reason to modify Benjamin to include a single temperature sensor in each of the multiple regions between Benjamin's ink vias in view of Giere '673.

708 POR at 42-43; see 823 POR at 48-49

A PHOSITA would not have been motivated to employ separate regional TSRs for the purpose of monitoring a temperature representative of the entire printhead, as is the end goal described by Dr. Pond, because it would unnecessarily add cost and take up space on the printhead die and/or the flex circuit shown above.

708 POR at 44; see 823 POR at 49-50

AAPA Evidences PHOSITA Knowledge that Ink Vias Act As Thermal Barriers



2

The heater chip shown in FIG. 2 improves on that of FIG. 1 by providing for temperature sensing on a per color basis. Three temperature sense resistors 220, 222, and 224 are placed in close proximity to each of the heater arrays, each situated on the same side of their respective ink vias. As shown, a first TSR 220 is situated on the left side of the cyan ink via 202 and cyan heater array 208; a second TSR 222 is situated on the left side of the magenta ink via 204 and magenta heater array 210; and a third TSR 224 is situated on the left side of the yellow ink via 206 and the yellow heater array 212. The ink vias 202, 204, and 206 act as a thermal barrier between the colors. All the thermal heater arrays 208, 210, and 212 are situated on only one side of their respective ink vias, ensuring that there is only a small amount of thermal crosstalk between the temperature sense resistors.

Benjamin's Ink Vias Were Known to Act As Thermal Barriers Between Regions



Canon's Demonstratives, not evidence

Yabe Evidences PHOSITA Knowledge that Ink Vias Act As Thermal Barriers

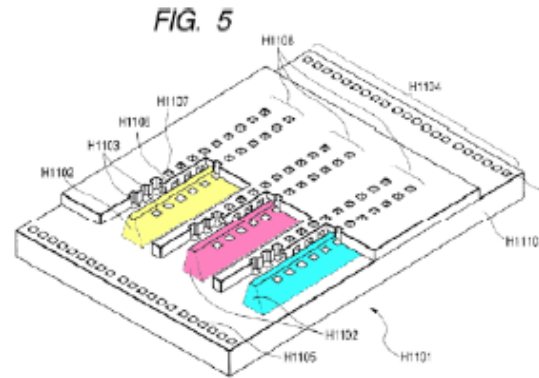
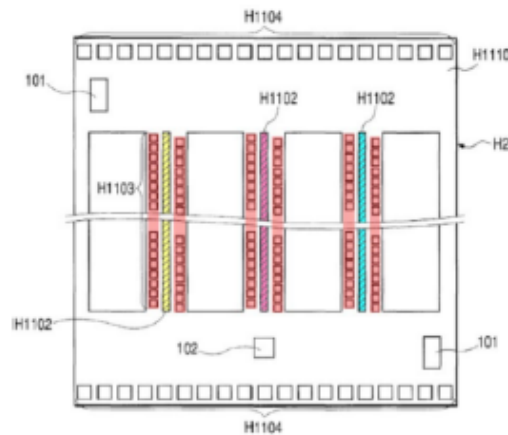


FIG. 14



characteristic against the heater board material, and that this condition is the factor that should be taken into consideration when dealing with the problems described above. In other words, depending on the layout of the diode sensors and sub-heaters, the heat radiating action and the heat conduction of the heater board are deteriorated by the presence of the plural ink supply ports that shows the heat insulating characteristics. As a result, the diode sensors cannot detect the temperature of the heater board exactly or the transfer of heat generated by the sub-heaters becomes uneven on the heater board. This condition causes the initial

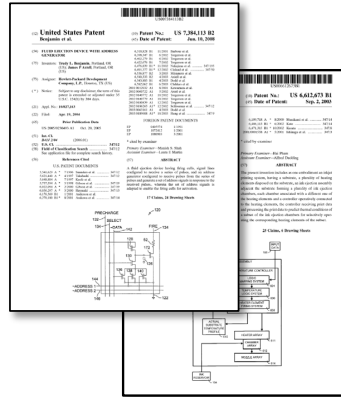
Positioning a TSR Within Each Thermal Region Is Common Sense



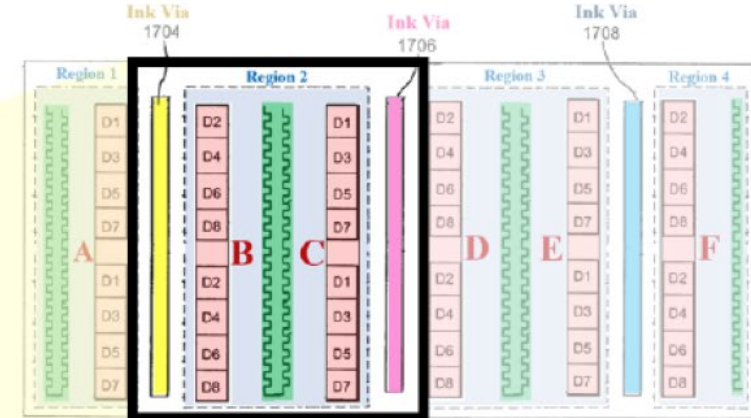
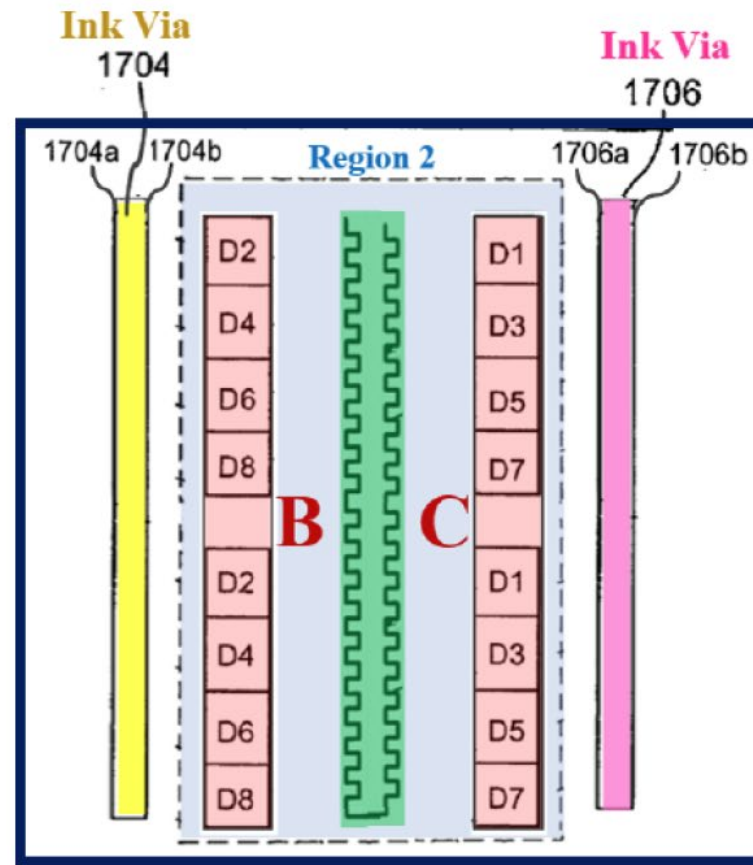
*Petitioners Expert
Dr. Steven Pond*

“I mean, it's obvious that if different regions are heated differently and you want to do a better job of temperature management, you need to know the temperature in the different places. ***That's common sense.***”

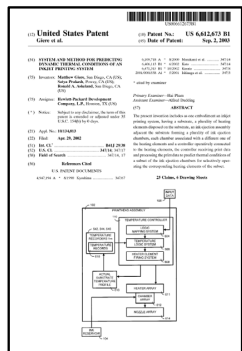
Giere673 Motivates a PHOSITA to Dispose a Single TSR Between Two Heater Arrays



Benjamin + Giere673



Giere673 Teaches Disposing a Single TSR Between Two Heater Arrays



Giere673

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FIG. 5

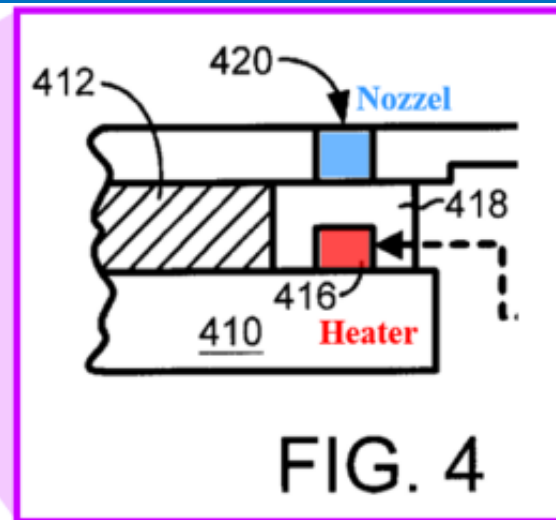
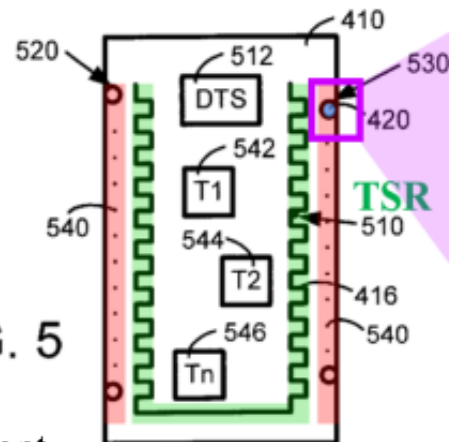
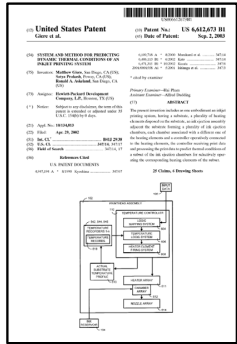


FIG. 4

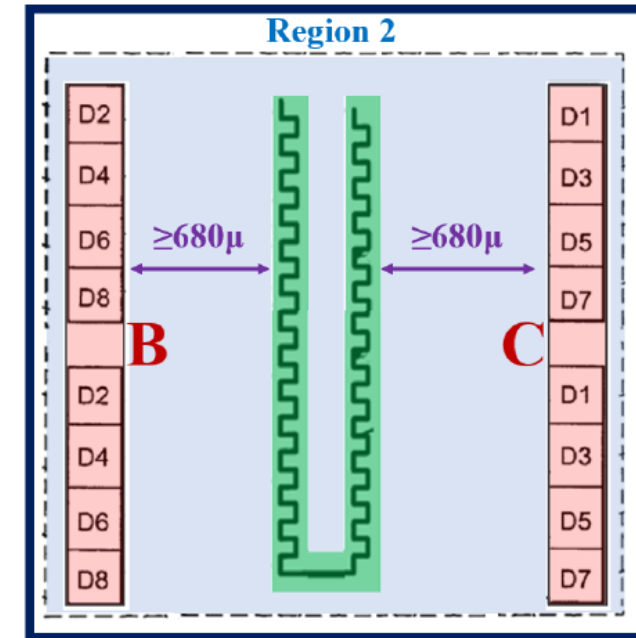
Giere673 Motivates a PHOSITA to Dispose a Single TSR Between Two Heater Arrays



Giere673

512. One or multiple TSRs 510 can be used to provide an approximation of the mean temperature of the substrate. Preferably, it is not located adjacent to any particular heating element and reflects the temperature of the substrate 410 after heat has moved from the heating elements to the TSR 510. The TSR 510 therefore reports a temperature that reflects heating element firings that have already occurred.

substrate. The TSR 510 is located along the length of the substrate 410. The TSR 510 can have two legs that are approximately 680 um inboard from the center of the columns of ink ejection elements 416.



Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Claim Limitations Unique to the '823 Patent

Ground 2 Benjamin Combined with Giere673 in view of Parish

The '823 Patent: Disputed Claim Limitations

a **temperature sensing element** operable to sense a temperature of the region, wherein the temperature sensing element is **substantially centrally disposed** with respect to the region ...

1. A chip for use with a printing device, comprising:
a first heater array positioned substantially adjacent a first via;
a second heater array positioned substantially adjacent a second via;
a region, positioned between the first heater array and the second heater array, and also positioned substantially adjacent to the first heater array and the second heater array; and

a temperature sensing element operable to sense a temperature of the region, the temperature being representative of the region, wherein the temperature sensing element is substantially centrally disposed with respect to the region and substantially adjacent to both the first heater array and second heater array, and further extends substantially the length of the first heater array and second heater array.

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

a third heater array, positioned substantially adjacent the second via;

a fourth heater array, positioned substantially adjacent a third via;

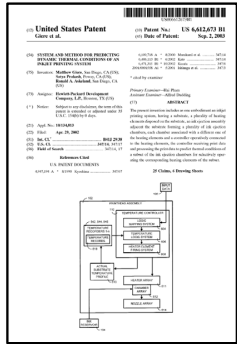
a second region, positioned between the third heater array and the fourth heater array, and also positioned substantially immediately adjacent to the third heater array and the fourth heater array; and

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

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

wherein first heater array and second heater array are operable to **receive heating responsive to the temperature of the region** sensed by the temperature sensing element ...

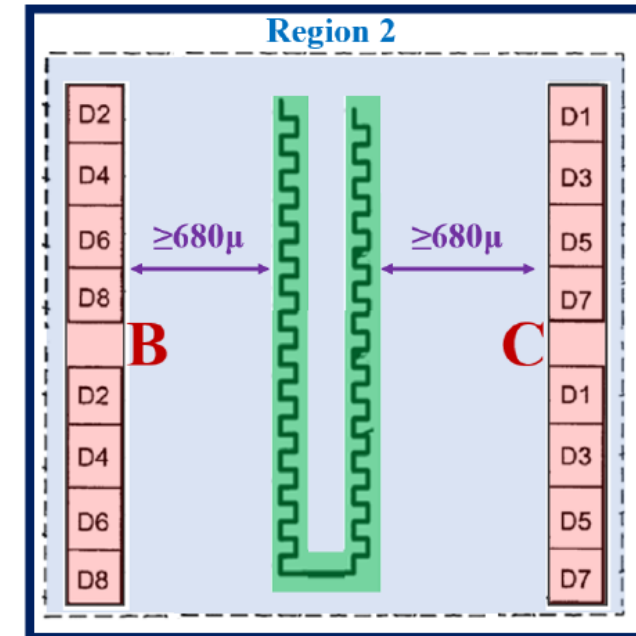
Giery673 Teaches Positioning a TSR in the Center of Two Heater Arrays



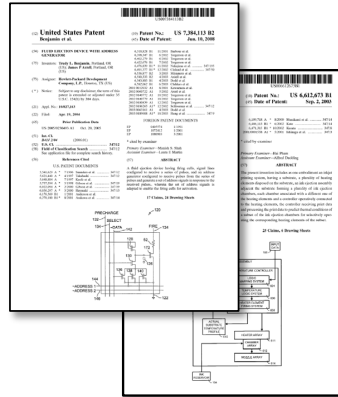
Giery673

512. One or multiple TSRs 510 can be used to provide an approximation of the mean temperature of the substrate. Preferably, it is not located adjacent to any particular heating element and reflects the temperature of the substrate 410 after heat has moved from the heating elements to the TSR 510. The TSR 510 therefore reports a temperature that reflects heating element firings that have already occurred.

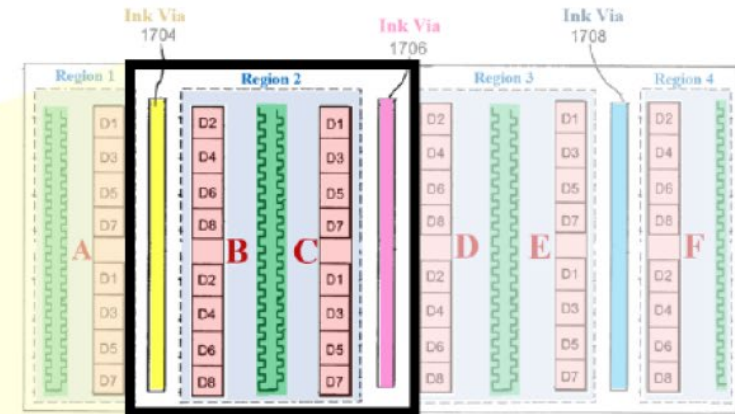
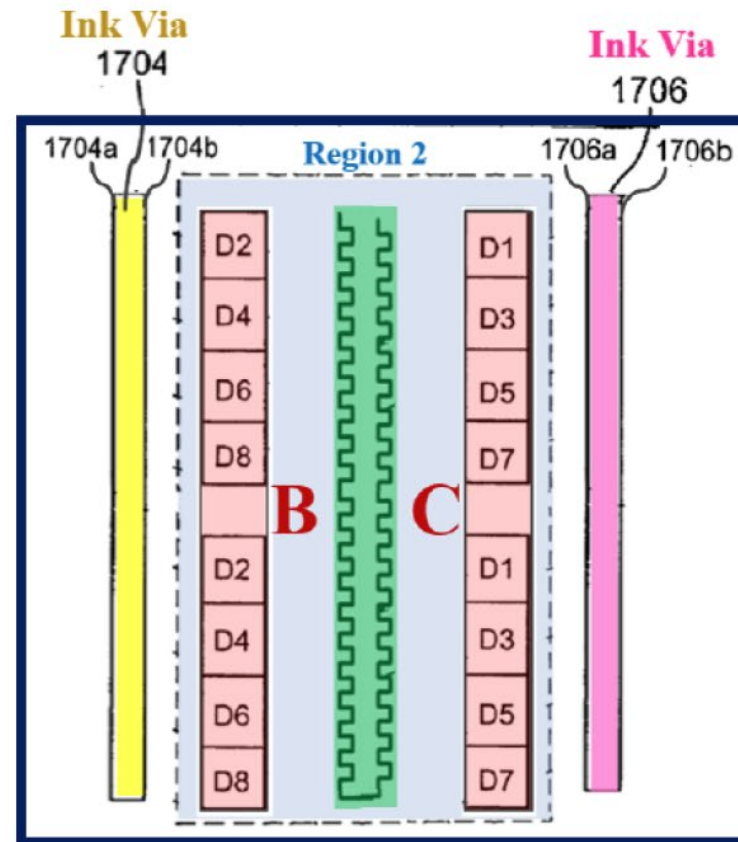
substrate. The TSR 510 is located along the length of the substrate 410. The TSR 510 can have two legs that are approximately 680 um inboard from the center of the columns of ink ejection elements 416.



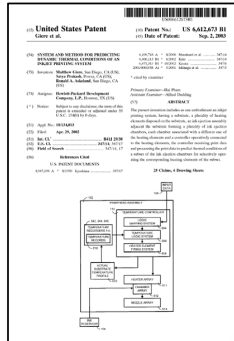
Giere673 Motivates a PHOSITA to Position Each TSR in the Center of Two Heater Arrays



Benjamin + Giere673

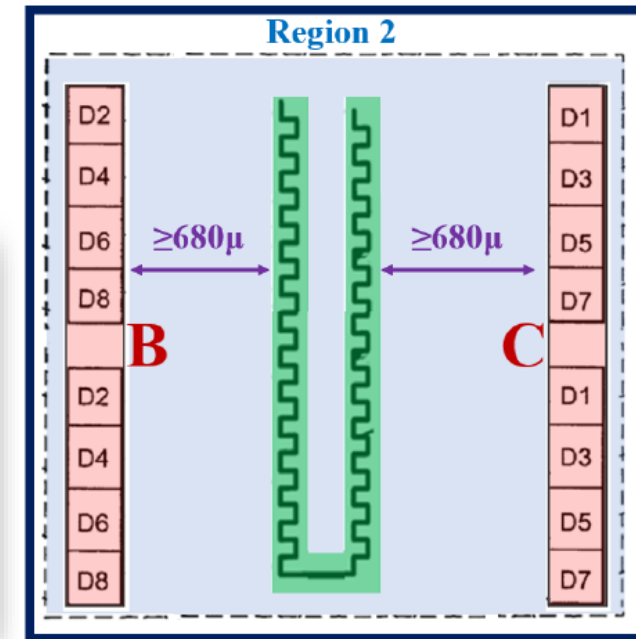


Giere673 Teaches that the TSR Senses Mean Temperature Between Two Heater Arrays

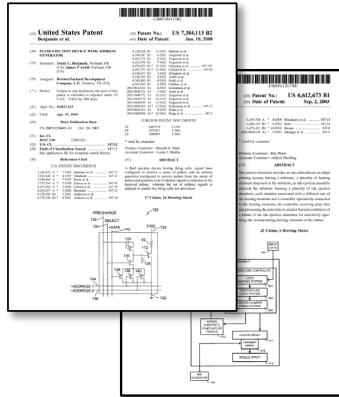


Giere673

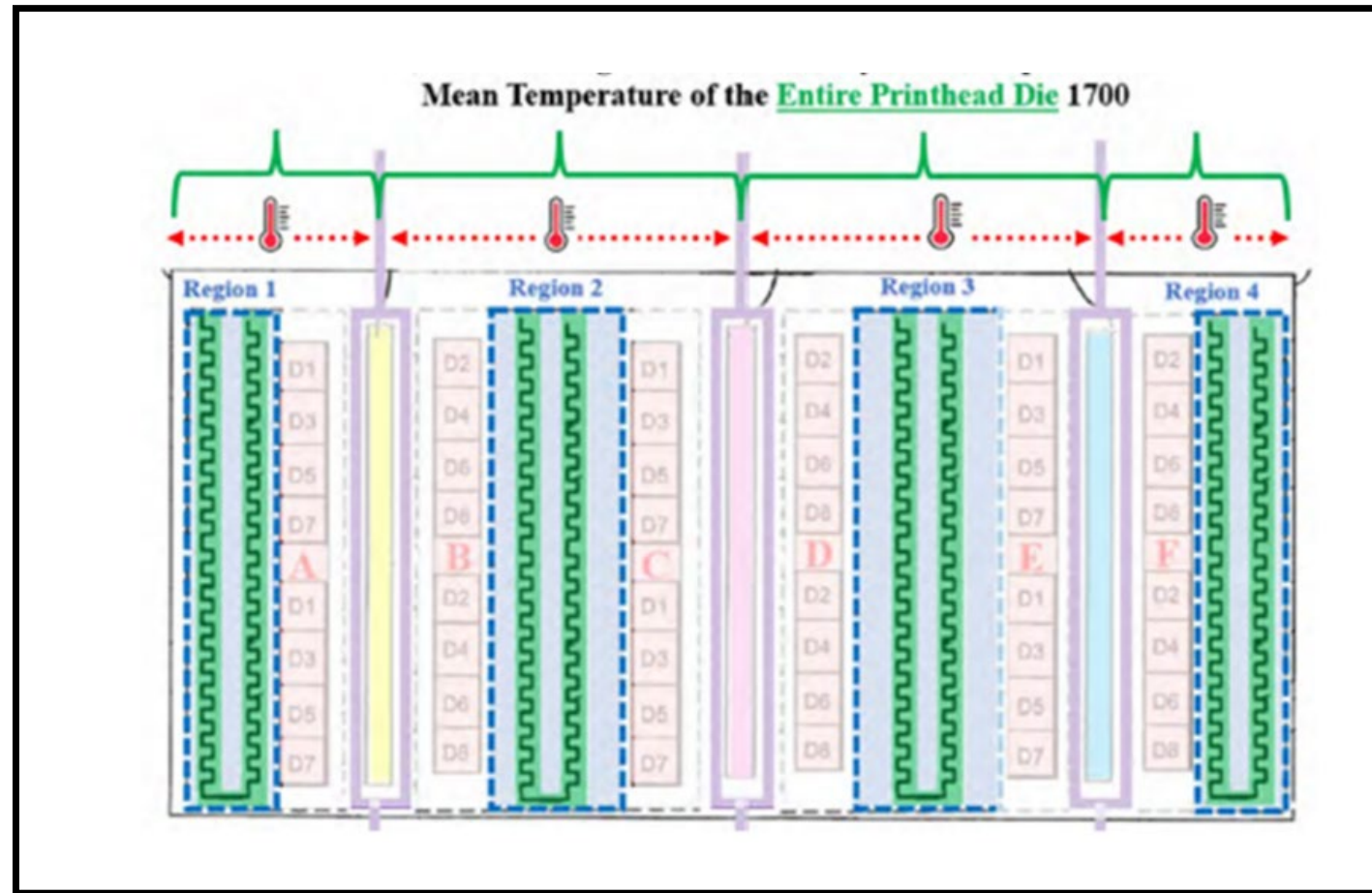
512. One or multiple TSRs **510** can be used to provide an approximation of the mean temperature of the substrate. Preferably, it is not located adjacent to any particular heating element and reflects the temperature of the substrate **410** after heat has moved from the heating elements to the TSR **510**. The TSR **510** therefore reports a temperature that reflects heating element firings that have already occurred.



Benjamin-Giere673's TSRs Collectively Sense Mean Temperature of the Entire Chip



Benjamin + Giere673



Summary: Ground 1

The '708 and '823 Patent

- ✓ ☒ Giere673 Motivates a PHOSITA to Dispose a Single TSR Between Two Heater Arrays

The '823 Patent

- ✓ ☒ Giere673 Motivates a PHOSITA to Position Each TSR in the Center of Two Heater Arrays
- ✓ ☒ The Benjamin-Giere673 Combination's TSRs Collectively Sense Mean Temperature of the Entire Chip

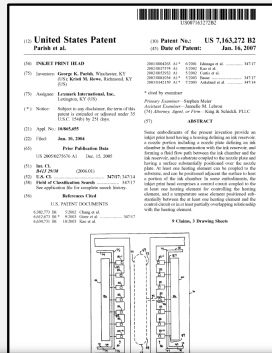
II. Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Benjamin-Giere673 In View of Parish Renders Obvious Claims 4 and 13 (708 Patent) and Claims 4 and 14 (823 Patent)

708/823 Patents



Ex. 1006 Parish

“[Claim 4/13/14] ...wherein the temperature sensing element comprises an **n-type** implant donor thermal sensing resistor.”

“[the] temperature sense resistor (TSR) 64 [on heater chip] can include a **N-type** source drain (NSD) material, a N-well layer material, a P-type source drain (PSD) material, a lightly doped drain (LDD) material or another suitable material.”

POR Presents No Patentability Arguments Unique to Ground 2



Therefore, the Ground 2 challenge fails for at least the same reasons discussed above relative to Ground 1.

823 POR at 47; 708 POR at 55

Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Grounds Unique to the '708 Patent

Ground 3 Giere178 in view of the Knowledge of a PHOSITA

Ground 4 Giere178 Combined with Yabe

Grounds 5+6 Giere178 (Alone or Combined With Yabe) in view of Parish

Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Grounds Unique to the '708 Patent

Ground 3 Giere178 in view of the Knowledge of a PHOSITA

Ground 4 Giere178 Combined with Yabe

Grounds 5+6 Giere178 (Alone or Combined With Yabe) in view of Parish



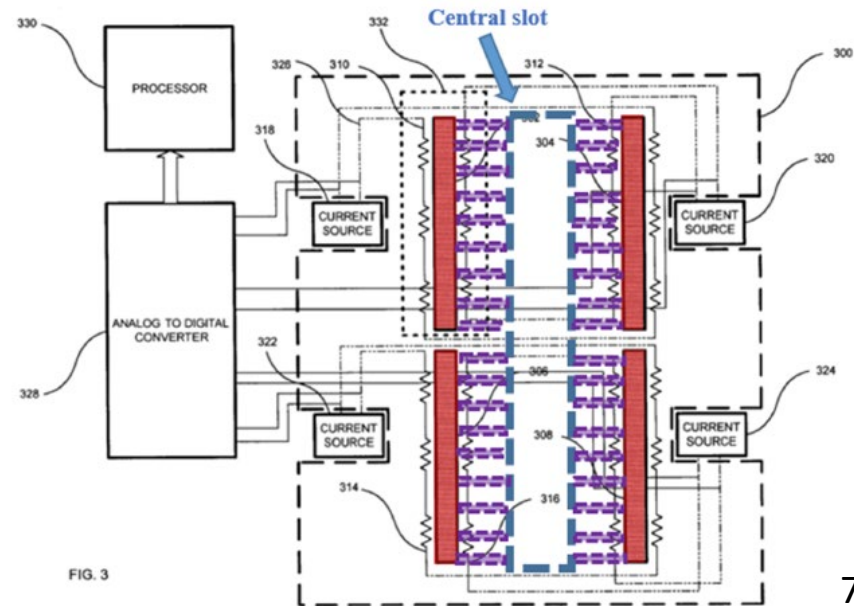
This ground should be rejected out of hand because it relies on the false premise that Giere '178 discloses four ink feed slots/ink vias located in elongated regions 302, 304, 306, and 308 with heater arrays on both sides of each via.

708 POR at 47

Canon's Demonstratives, not evidence

PO

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). (Ex. 2003 ¶71.)



708 POR at 18-19

Canon's Demonstratives, not evidence

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

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

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

PO's Interpretation Fails For Several Reasons

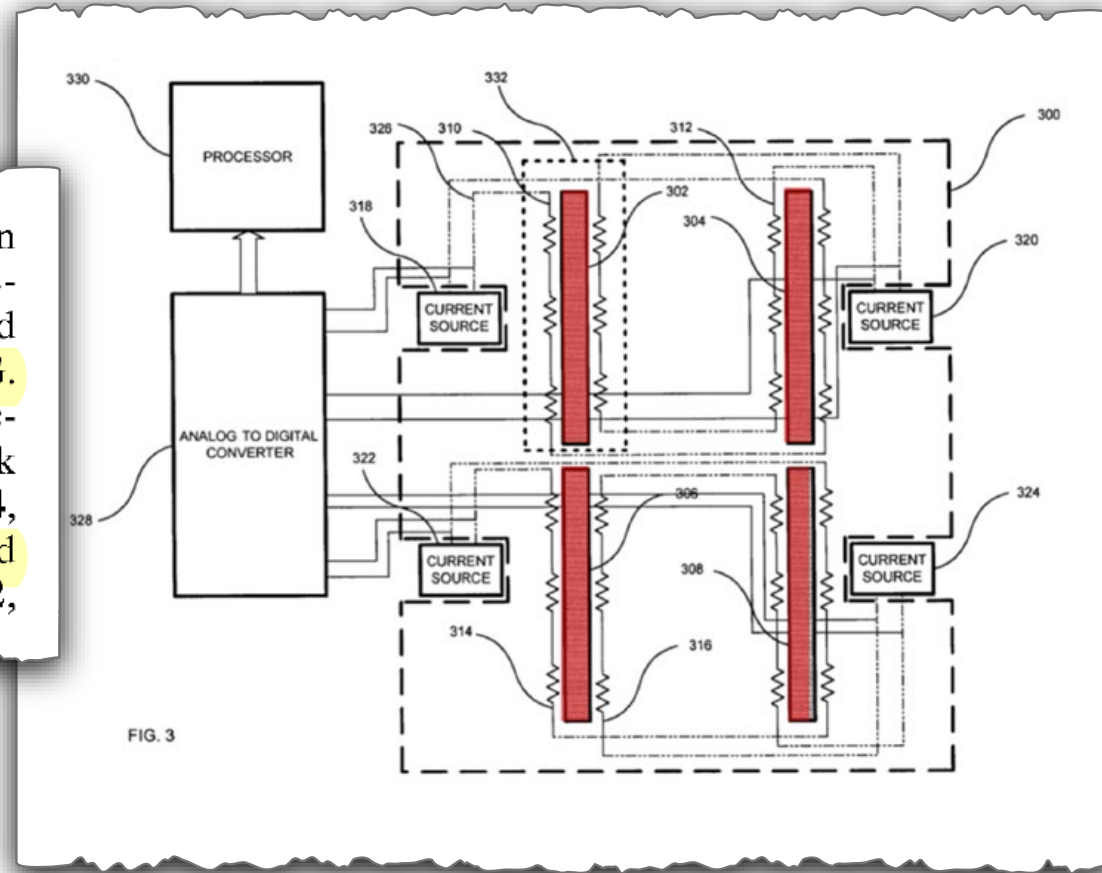
1. Giere178 Discloses a **Plurality** of “Ink Feed Slots” or Ink Vias
2. PO's Interpretation of Fig. 3 Is Not Commercially Feasible
3. A PHOSITA Would Also Understand the Rectangles include Ink Vias
4. Axtel (Incorporated Into Giere178) Discloses the Claimed Ink Vias
5. The Extrinsic Evidence Corroborates this Interpretation of Fig. 3

1. Giere178 Expressly Discloses a Plurality of “Ink Feed Slots” or Ink Vias

Color inkjet imaging devices commonly employ a plurality of print cartridges, usually two to four, mounted in the printer carriage to produce a full spectrum of colors. In a printer with four cartridges, each print cartridge can contain a different color ink, with the commonly used base colors being cyan, magenta, yellow, and black. In a printer with two cartridges, one cartridge can contain black ink with the other cartridge being a tri-compartment cartridge containing the base color cyan, magenta and yellow inks, or alternatively, two dual-compartment cartridges may be used to contain the four color inks. In addition, two tri-compartment cartridges may be used to contain six base color inks, for example, black, cyan, magenta, yellow, light cyan and light magenta. Further, other combinations can be employed depending on the number of different base color inks to be used.

1. Giere178 Expressly Discloses a Plurality of “Ink Feed Slots” or Ink Vias

Shown in FIG. 3 is a high level schematic diagram of an embodiment of the temperature measurement system implemented upon an embodiment of a printhead. The printhead is formed upon substrate 300. 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. Regions 302, 304, 306, and 308 each include an array of nozzles and associated firing resistors for ejecting ink. Resistive elements 310, 312,



Canon's Demonstratives, not evidence

708 Pet. at 47-59; 708 Reply at 14-21; Ex.2004 at 73:16-74:10, 74:11-75:1, 138:19-139:18; Ex.1031 at 115:11-116:2; Ex.1007 at 8:41-49, Fig. 3

1. Giere178 Expressly Discloses a Plurality of “Ink Feed Slots” or Ink Vias



Petitioners Expert
Dr. Steven Pond

“...in my opinion Giere's ink feed slots are located in the elongated regions 302, 304, 306, and 308 of substrate 300...”

2. PO's Interpretation Is Not Commercially Feasible



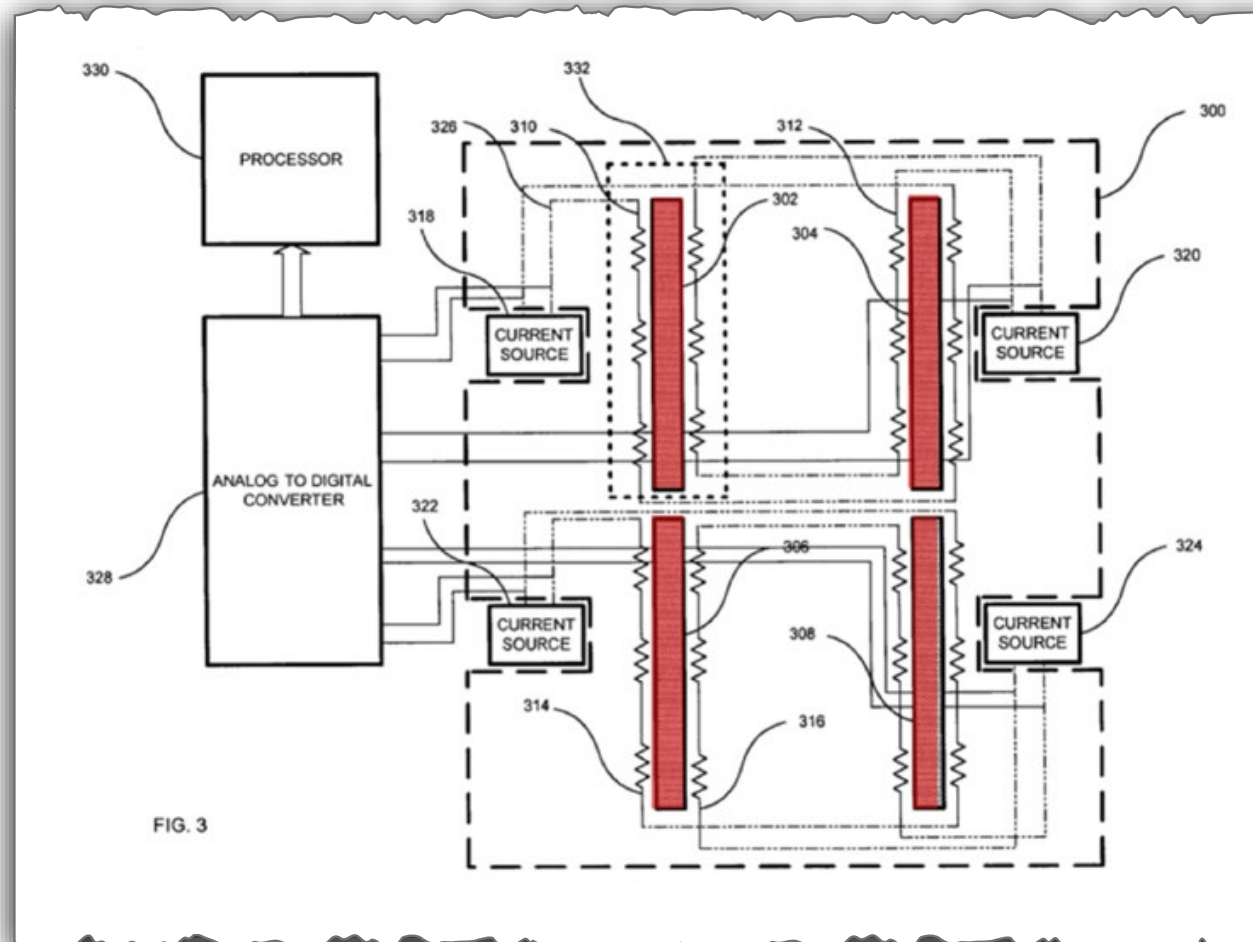
*Petitioners Expert
Dr. Steven Pond*

“[N]o PHOSITA would do that [i.e., implement a central ink feed slot design]” because it is “a very wasteful, extraordinary thing to do.”

* * *

“I can't envision an ink via being brought close to the edges of those two regions without disrupting or ruining or removing his sensor 312...that's not functional with his invention here.”

3. A PHOSITA Would Understand that the Rectangles Include Ink Vias



Canon's Demonstratives, not evidence

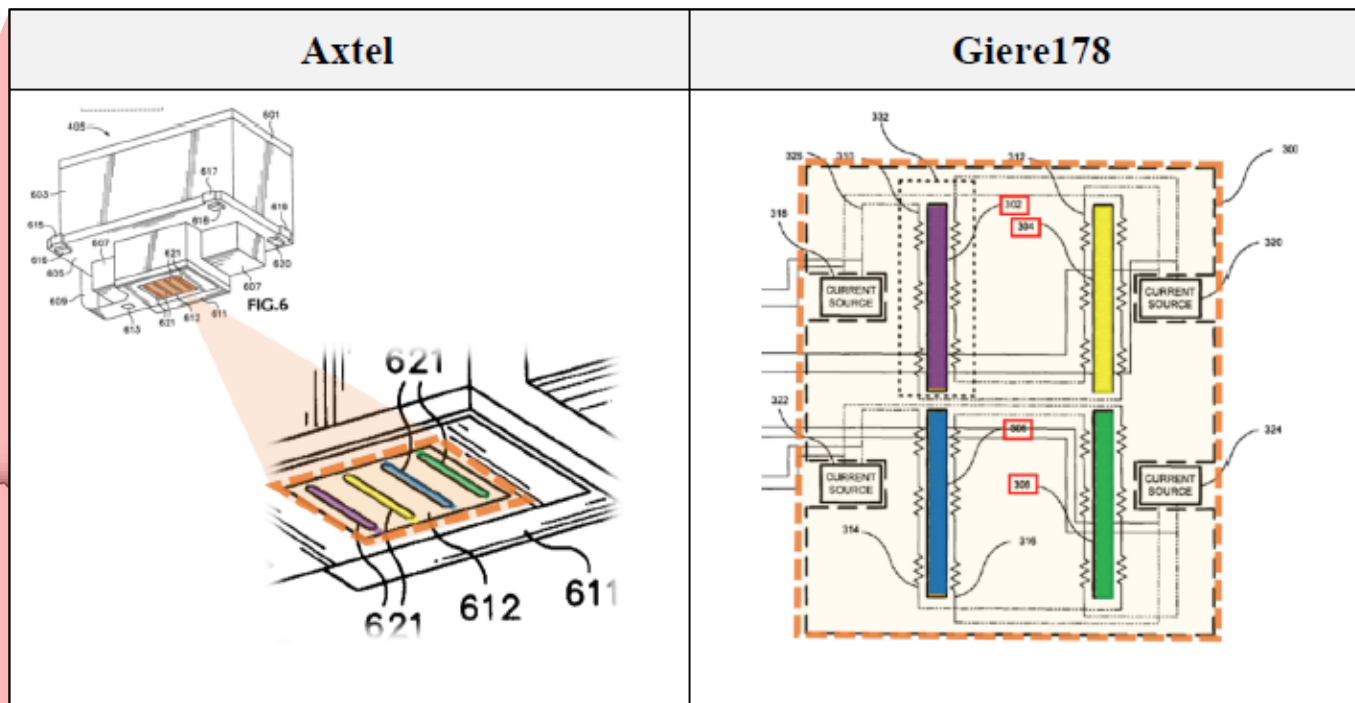
3. A PHOSITA Would Also Understand that Rectangular Shapes Mean Ink Vias



*Petitioners Expert
Dr. Steven Pond*

“[A] PHOSITA would look at this drawing and *see the long and skinny shapes* and *recognize them* to represent two drop generators on both sides of a via” based on “his *ordinary knowledge*” not only because “it’s an old but *ordinary layout* of a multicolor chip,” but also because “it just falls out of the physics and engineering.”

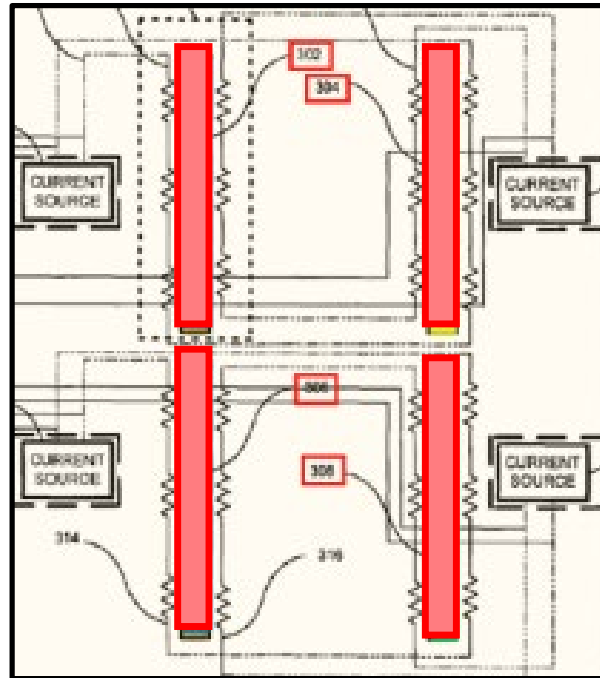
4. Axtel (Incorporated Into Giere178) Discloses the Claimed Ink Vias



The printheads included within these ink cartridges include hardware associated with an embodiment of the temperature measurement system described later in this specification. Further detail on embodiments of imaging mechanisms used in color inkjet printers can be found in U.S. Pat. No. 6,082,854, entitled MODULAR INK-JET HARD COPY APPARATUS AND METHODOLOGY, issued to Axtell et al., and assigned to Hewlett-Packard Company, and U.S. Pat. No. 5,399,039, entitled INK-JET PRINTER WITH PRECISE PRINT ZONE MEDIA CONTROL, issued to Giles et al., and assigned to Hewlett-Packard Company. Each of these two patents is incorporated by reference in their entirety into this specification.

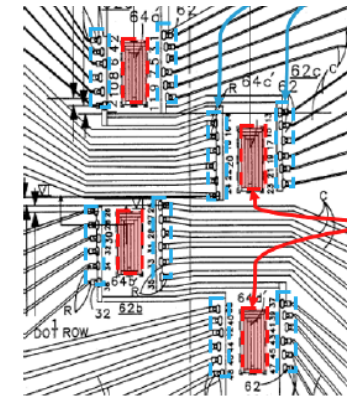
FIGS. 3 and 5. The embodiment shown is for a full, four color printing module; therefore, four sets of ink-jet orifice arrays 621 are employed. Other arrays may be used in accordance with the intent and purpose of use of any

5. Extrinsic Evidence Corroborates Dr. Pond's Interpretation of Fig. 3

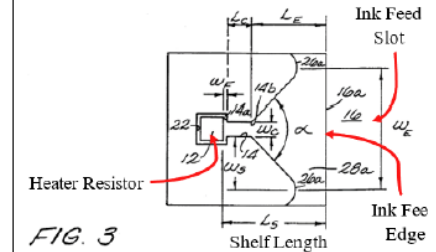


Giere178

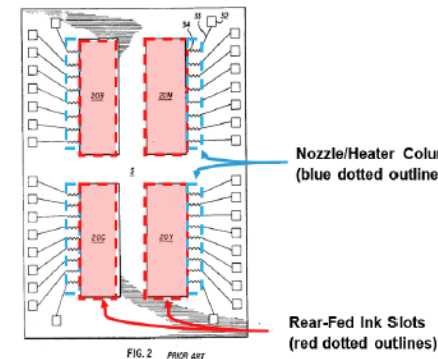
Canon's Demonstratives, not evidence



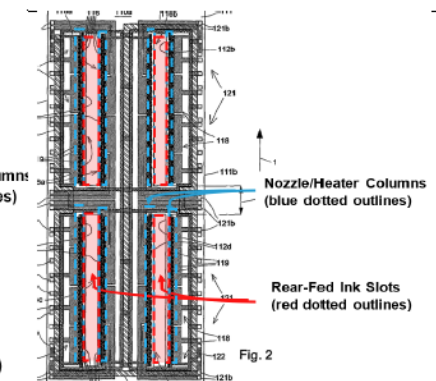
Ex.1035 (US4812859 to Chan), Fig. 5



Ex. 1027 (US5519423 to Moritz), Fig. 3



Ex.1034 (US5030971 to Drake) Fig. 2



Ex.1036 (US7008047 to Conta) Fig. 2

708 Pet. at 47-59; 708 Reply at 19-21; Ex.1007 at 8:41-49, Fig. 3; Ex.2004 at 113:11-125:6; Ex.1035 at Fig. 5, Ex.1027 at Fig. 3; Ex.1034 at Fig.2; Ex.1036 at Fig. 2

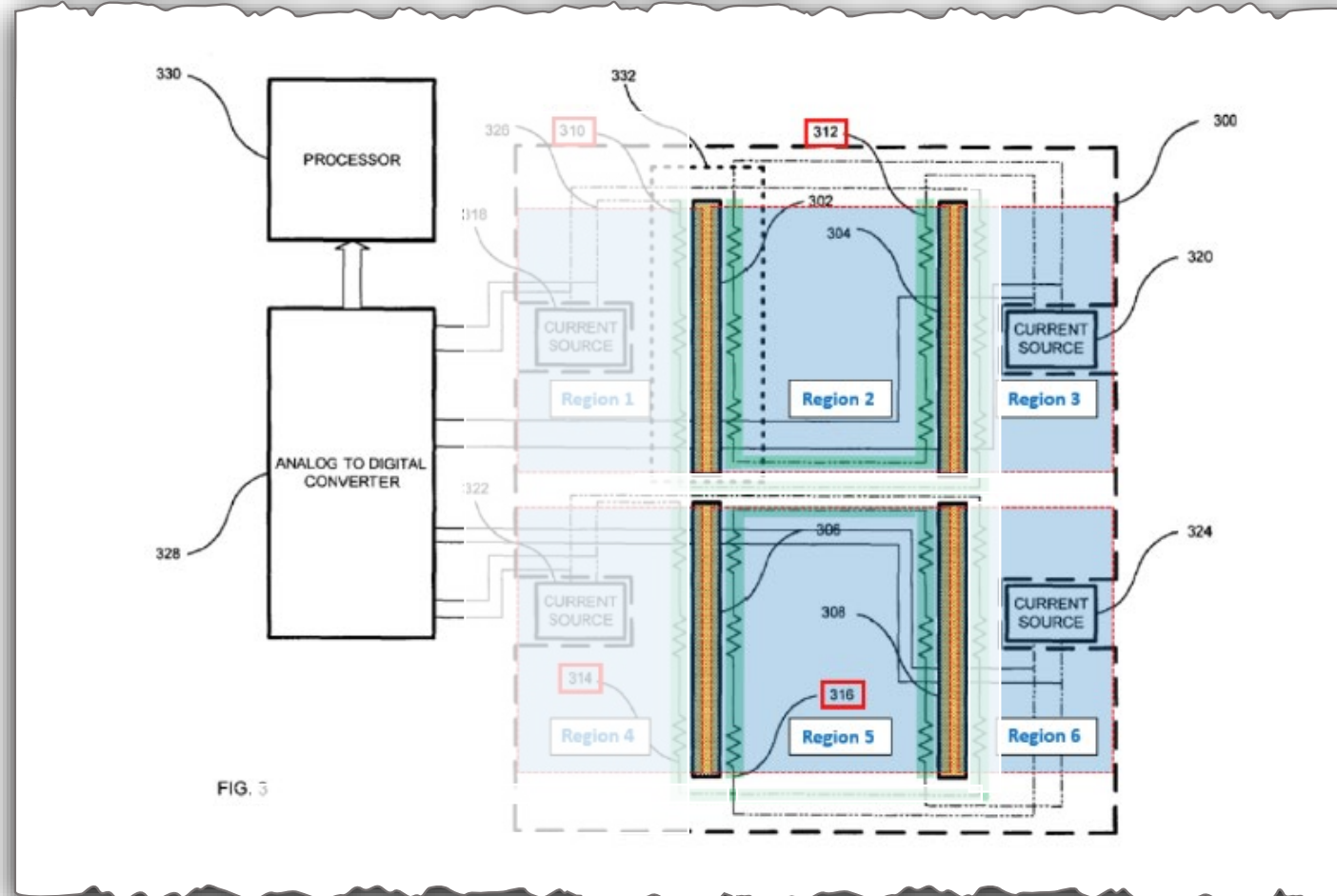
Giere178 Includes a First and Second TSR in Two Separate Regions



As a result, the configuration suggested by Petitioners would not have “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*” as required by claim 1. Similarly, the configuration would

708 POR at 57-58

Giére178 Includes a First and Second TSR in Two Separate Regions



Summary: Ground 3 for the '708 Patent

- ✓ ☒ Giere178 Expressly Discloses a Plurality of “Ink Feed Slots” or Ink Vias
- ✓ ☒ The Benjamin-Giere178 Combination’s TSRs Sense the Temperature of the Heater Arrays Adjacent Each Region

Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Grounds Unique to the '708 Patent

Ground 3 Giere178 in view of the Knowledge of a PHOSITA

Ground 4 Giere178 Combined with Yabe

Grounds 5+6 Giere178 (Alone or Combined With Yabe) in view of Parish



PO

To a large extent, Ground 4 is based on the same incorrect reading of Giere '178. (Pet. pp. 82-87 and 92-94; Ex. 2003 ¶100.)

708 POR at 58



PO

via because more nozzles would be advantageous. (Ex. 2003 ¶104.) A PHOSITA would not interpret Giere '178 as disclosing the multiple ink via structure in the first place, and would not have followed any of the obviousness rationales that start from the erroneous assumptions regarding the substrate structure disclosed in Giere '178.

708 POR at 60-61

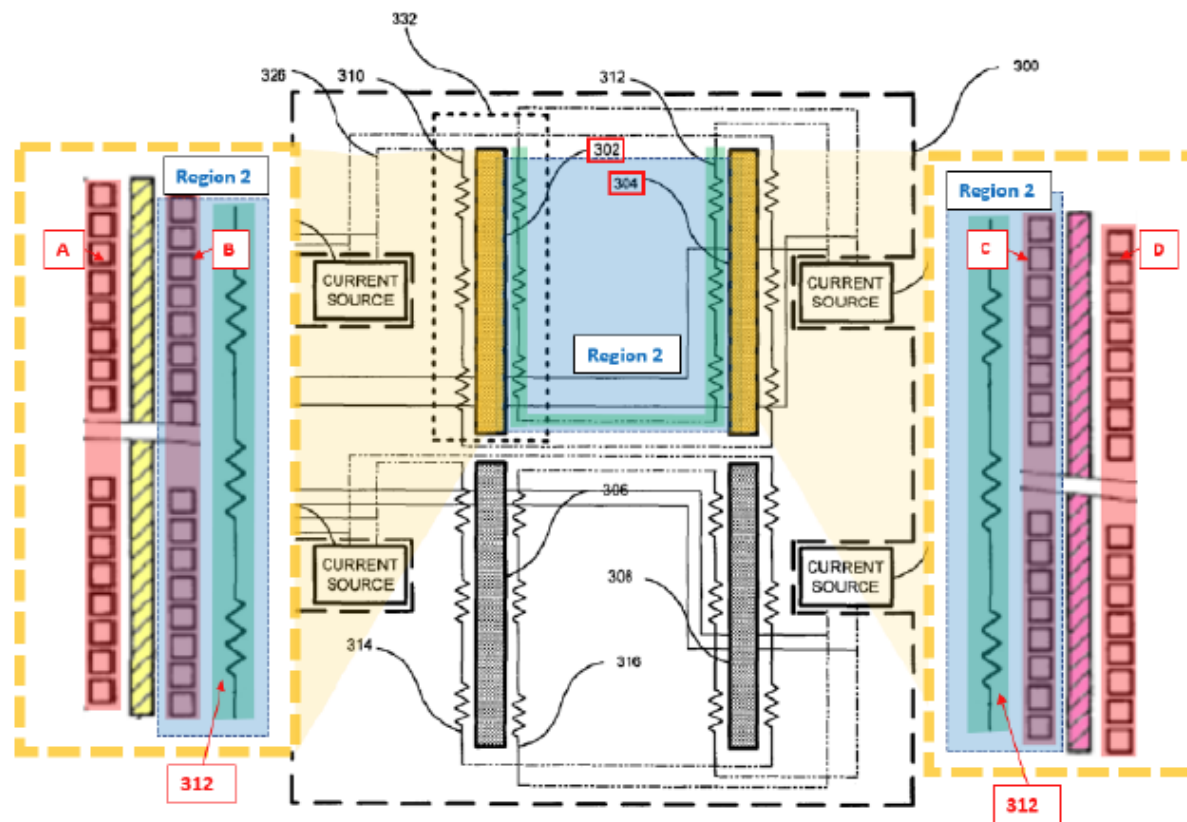
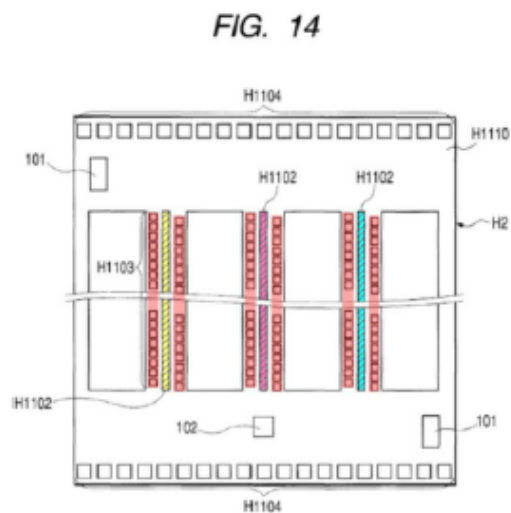
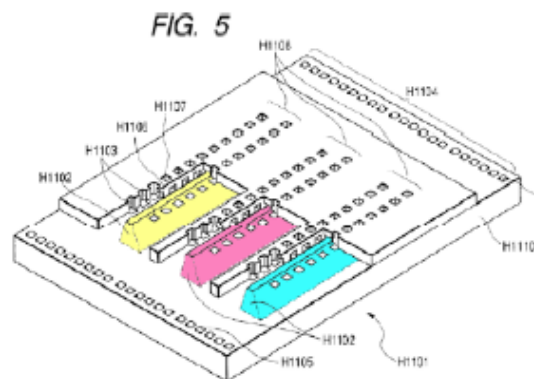


PO

Yabe already discloses a multi-via chip and an efficient multi-via temperature management system and that the temperature management system of Giere '178 relates to an entirely different substrate design, Dr. Pond's proposal of incorporating the ink vias and heater arrays of Yabe into the four-quadrant design and temperature management system of Giere '178 is entirely arbitrary.

708 POR at 61-62

Yabe Is Analogous Art



Yabe Is Analogous Art

More precisely, it is found that in the mode of the side shooter recording head, a plurality of ink supply ports provided for the heater board demonstrate the heat insulating characteristic against the heater board material, and that this condition is the factor that should be taken into consideration when dealing with the problems described above. In other words, depending on the layout of the diode sensors and sub-heaters, the heat radiating action and the heat conduction of the heater board are deteriorated by the presence of the plural ink supply ports that shows the heat insulating characteristics. As a result, the diode sensors

Also, FIG. 5 is a partly broken perspective view which illustrates the structure of the second recording element base plate H1101. The second recording element base plate H1101 is the one for discharging ink of three colors. Three ink supply ports H1102 are formed in parallel, and electro-thermal converting devices H1103 and ink discharge ports H1107 are formed on both sides having each of the ink supply ports H1102 between them. In the same manner as

Giere178 (and the AAPA) Motivates a PHOSITA to Position a TSR in Each Region

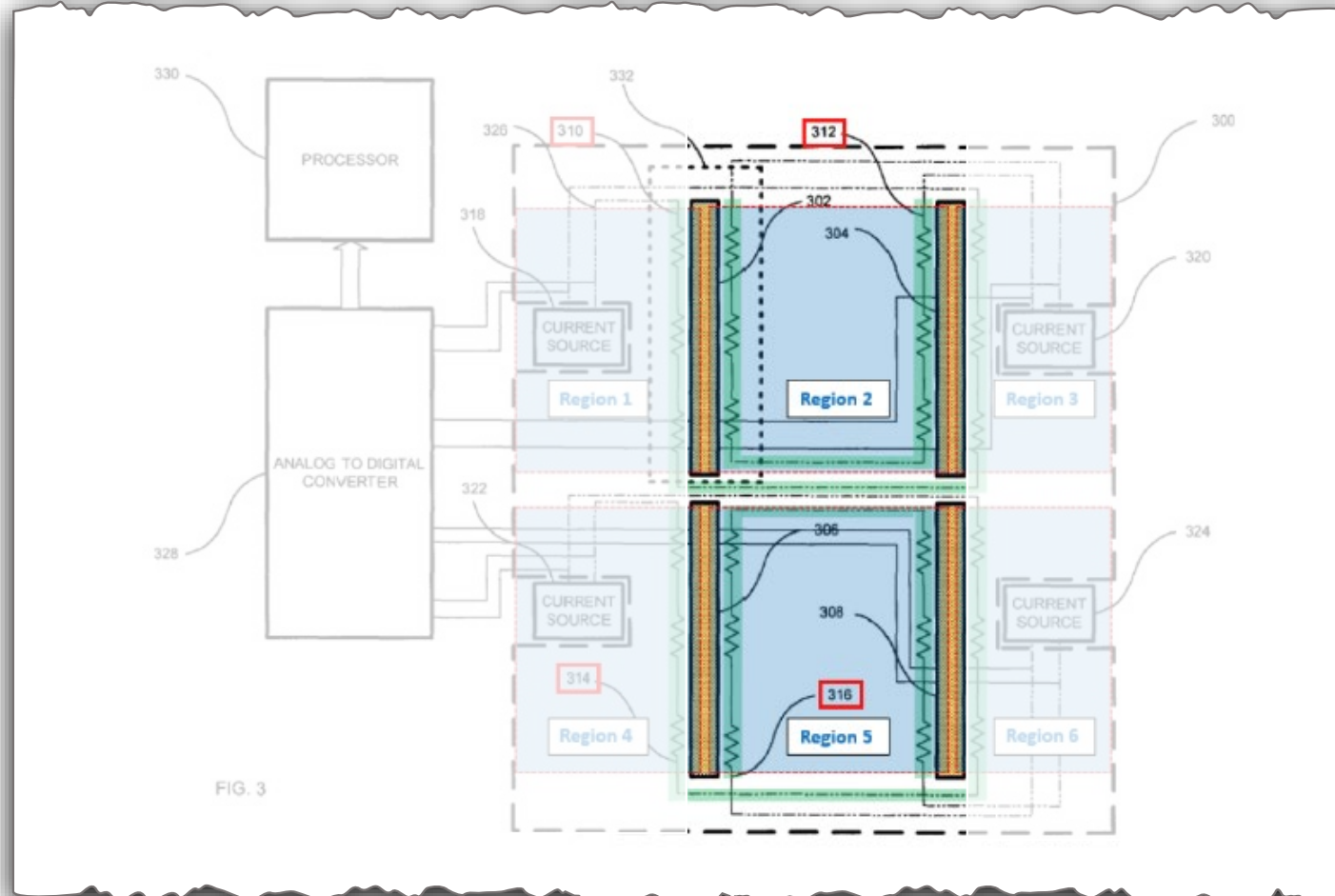


FIG. 3

PHOSITA Can Implement Yabe within Giere178 without Undue Experimentation



*Petitioners Expert
Dr. Steven Pond*

“I mean, it's obvious that if different regions are heated differently and you want to do a better job of temperature management, you need to know the temperature in the different places. ***That's common sense.***”

Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Grounds Unique to the '708 Patent

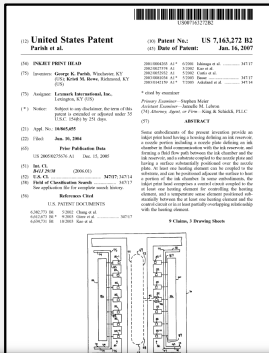
Ground 3 Giere178 in view of the Knowledge of a PHOSITA

Ground 4 Giere178 Combined with Yabe

Grounds 5+6 **Giere178 (Alone or Combined With Yabe) in view of Parish**

Benjamin-Giere673 In View of Parish Renders Obvious Claims 4 and 13

708 Patent



Ex. 1006 Parish

“[Claim 4/13] ...wherein the temperature sensing element comprises an **n-type** implant donor thermal sensing resistor.”

“[the] temperature sense resistor (TSR) 64 [on heater chip] can include a **N-type** source drain (NSD) material, a N-well layer material, a P-type source drain (PSD) material, a lightly doped drain (LDD) material or another suitable material.”

POR Presents No Patentability Arguments Unique to Grounds 5 and 6



The Ground 5 challenge therefore fails for at least the same reasons discussed above relative to Ground 3.

708 POR at 67

The Ground 5 [sic] challenge therefore fails for at least the same reasons discussed above relative to Ground 4.

708 POR at 67

Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Grounds Unique to the '823 Patent

Ground 3 Benjamin Combined with Giere178

Ground 4 Yabe Combined with Giere673

Ground 5 Yabe Combined with Giere673 in view of Parish

Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

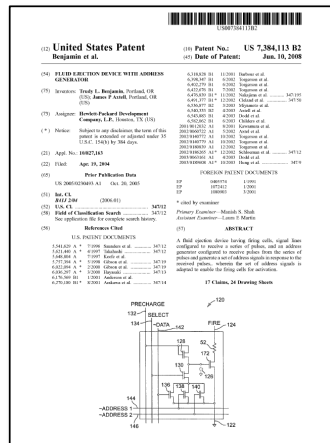
Grounds Unique to the '823 Patent

Ground 3 Benjamin Combined with Giere178

Ground 4 Yabe Combined with Giere673

Ground 5 Yabe Combined with Giere673 in view of Parish

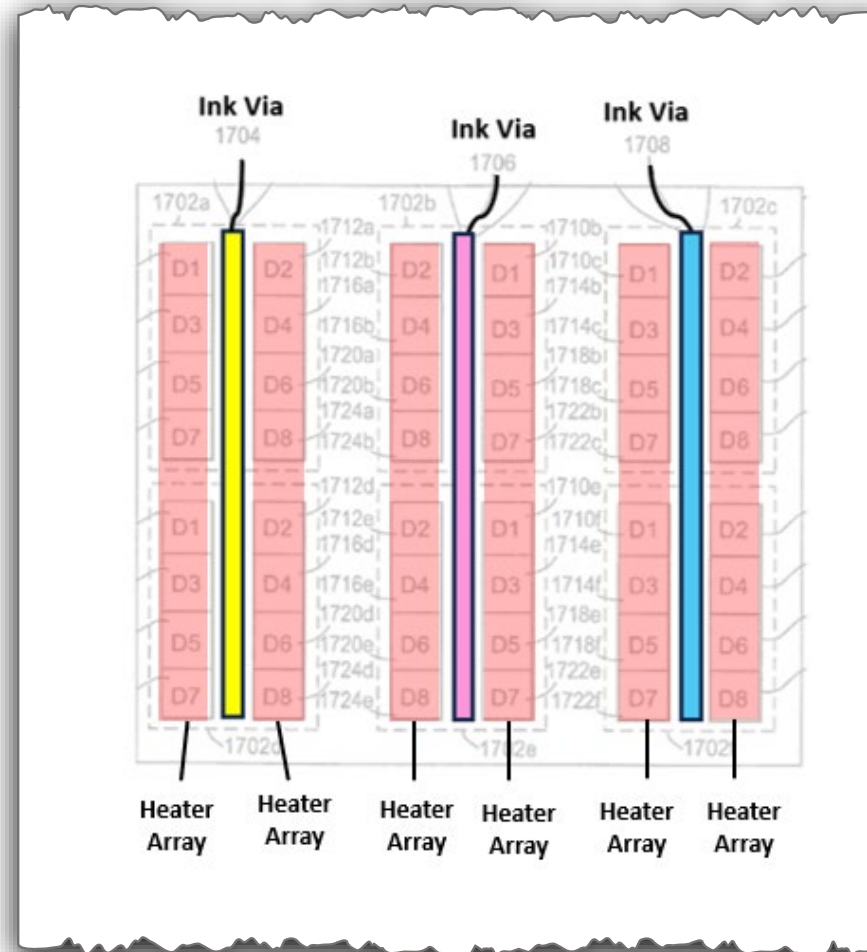
Benjamin Discloses the Claimed Heater Chip Arrangement



Benjamin

67

823 Pet. at 7-17, 36-40, 64; Ex.1004 at 5:15-21, 63:20-24, Fig. 21

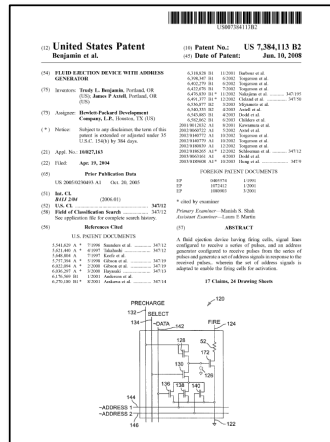


Canon's Demonstratives, not evidence

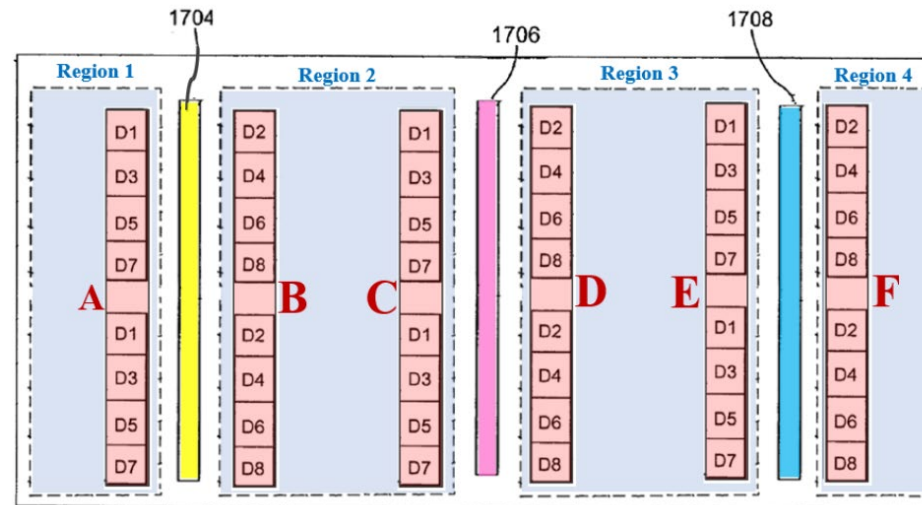
The '823 Patent

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

Benjamin Discloses the Claimed Heater Chip Arrangement



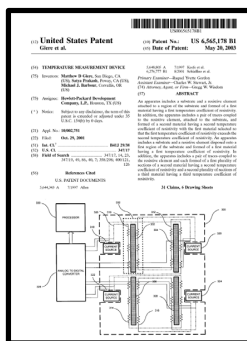
Benjamin



The '823 Patent

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

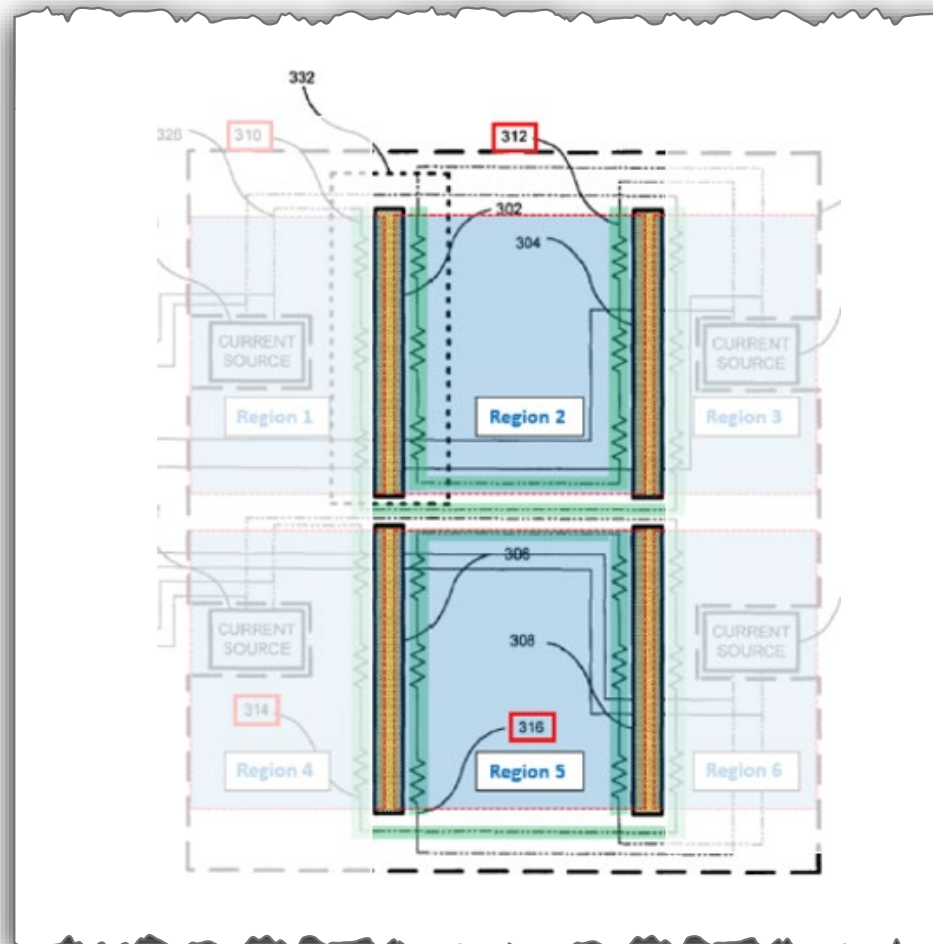
Giere178 Discloses the Remaining Limitations



Giere178

Canon's Demonstratives, not evidence

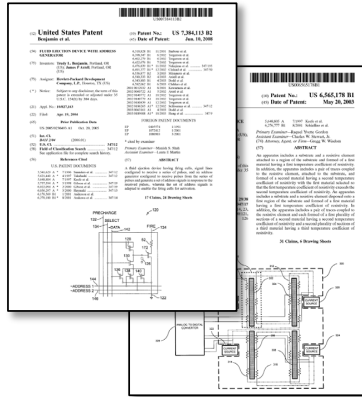
823 Pet. at 64-70; 823 Reply at 17-25; Ex.1007 at 8:49-51, 10:24-29, Fig. 3



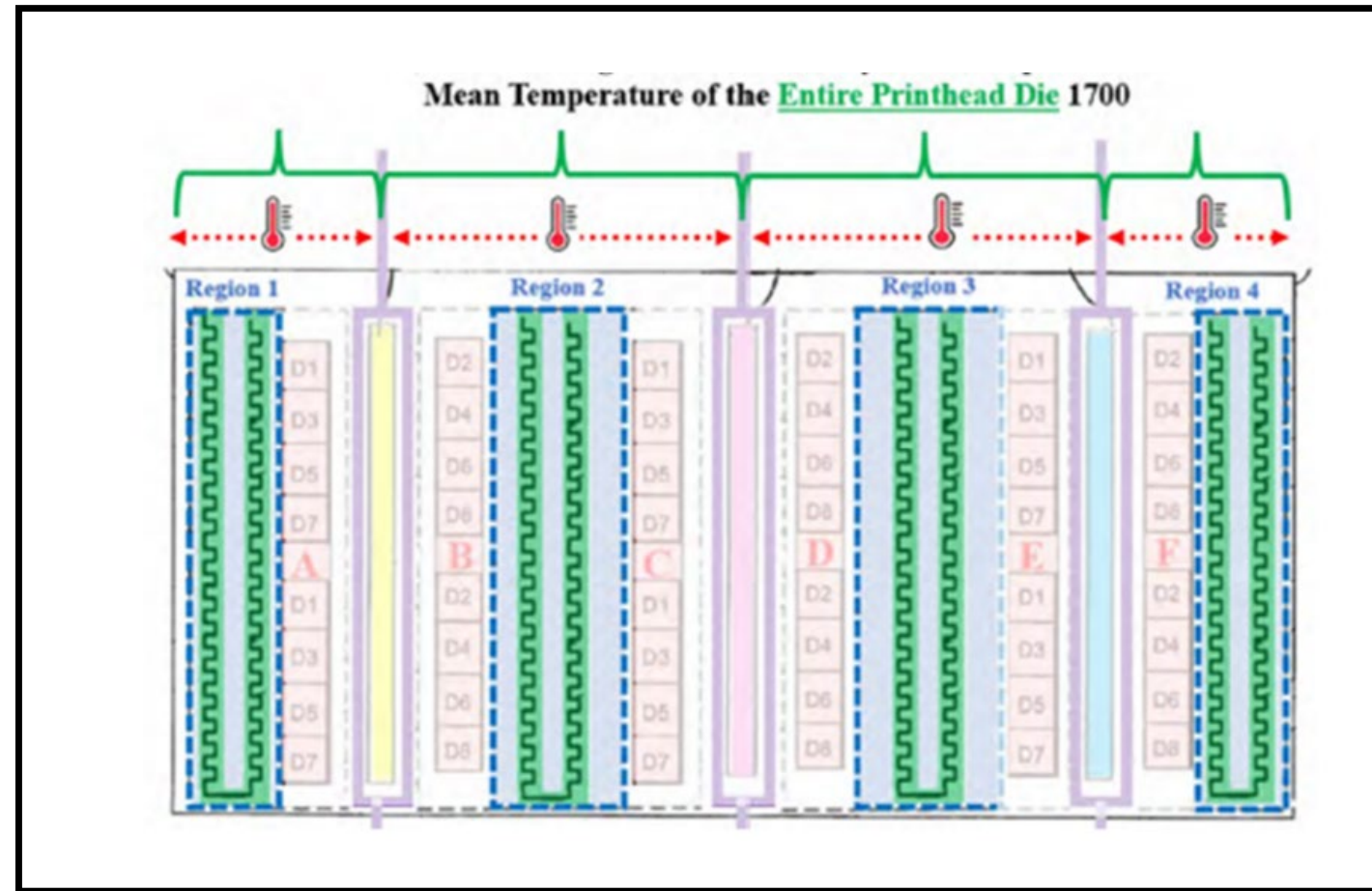
The '823 Patent

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

Benjamin-Giere178's TSRs Collectively Sense Mean Temperature of the Entire Chip



Benjamin + Giere178



Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

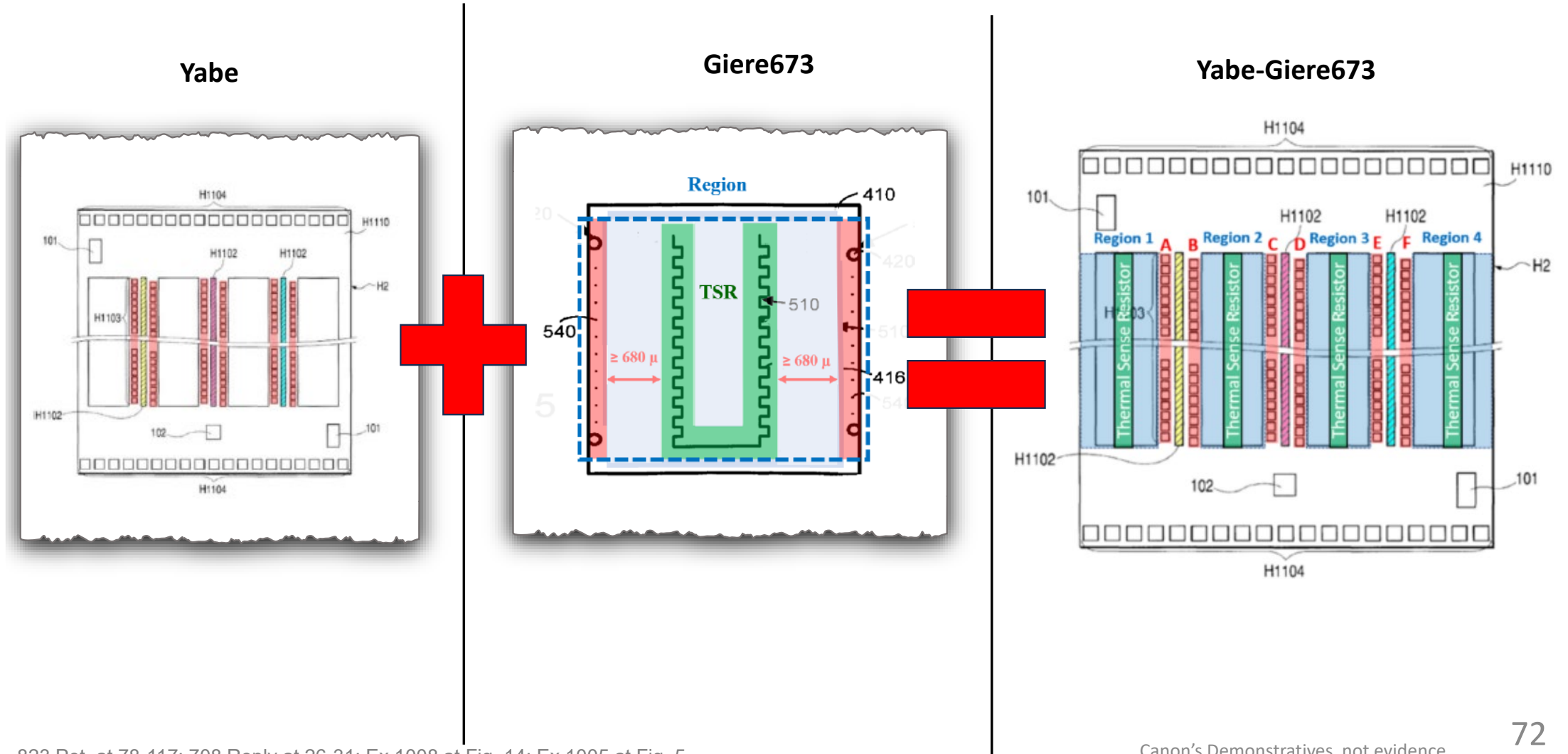
Grounds Unique to the '823 Patent

Ground 3 Benjamin Combined with Giere178

Ground 4 Yabe Combined with Giere673

Ground 5 Yabe Combined with Giere673 in view of Parish

Giére673 Centrally Disposes a TSR Between Two Heater Arrays



823 Pet. at 78-117; 708 Reply at 26-31; Ex.1008 at Fig. 14; Ex.1005 at Fig. 5

Canon's Demonstratives, not evidence

Grounds Shared Between the '708 and '823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Grounds Unique to the '823 Patent

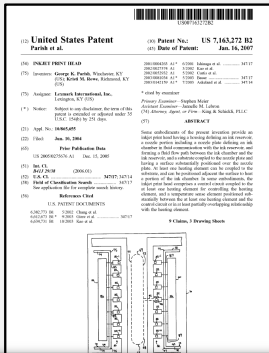
Ground 3 Benjamin Combined with Giere178

Ground 4 Yabe Combined with Giere673

Ground 5 Yabe Combined with Giere673 in view of Parish

Yabe-Giere673 In View of Parish Renders Obvious Claims 4 and 13

823 Patent



Ex. 1006 Parish

“[Claim 4/13] ...wherein the temperature sensing element comprises an **n-type** implant donor thermal sensing resistor.”

“[the] temperature sense resistor (TSR) 64 [on heater chip] can include a **N-type** source drain (NSD) material, a N-well layer material, a P-type source drain (PSD) material, a lightly doped drain (LDD) material or another suitable material.”

POR Presents No Patentability Arguments Unique to Grounds 5 and 6



The Ground 5 challenge therefore fails for at least the same reasons discussed above relative to Ground 4.

823 POR at 72