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

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Canon U.S.A., Inc., and Canon Inc. v. Slingshot Printing, LLC
IPR2023-00312 - U.S. Patent No. 7,484,823

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

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Canon U.S.A., Inc., and Canon Inc. v. Slingshot Printing, LLC
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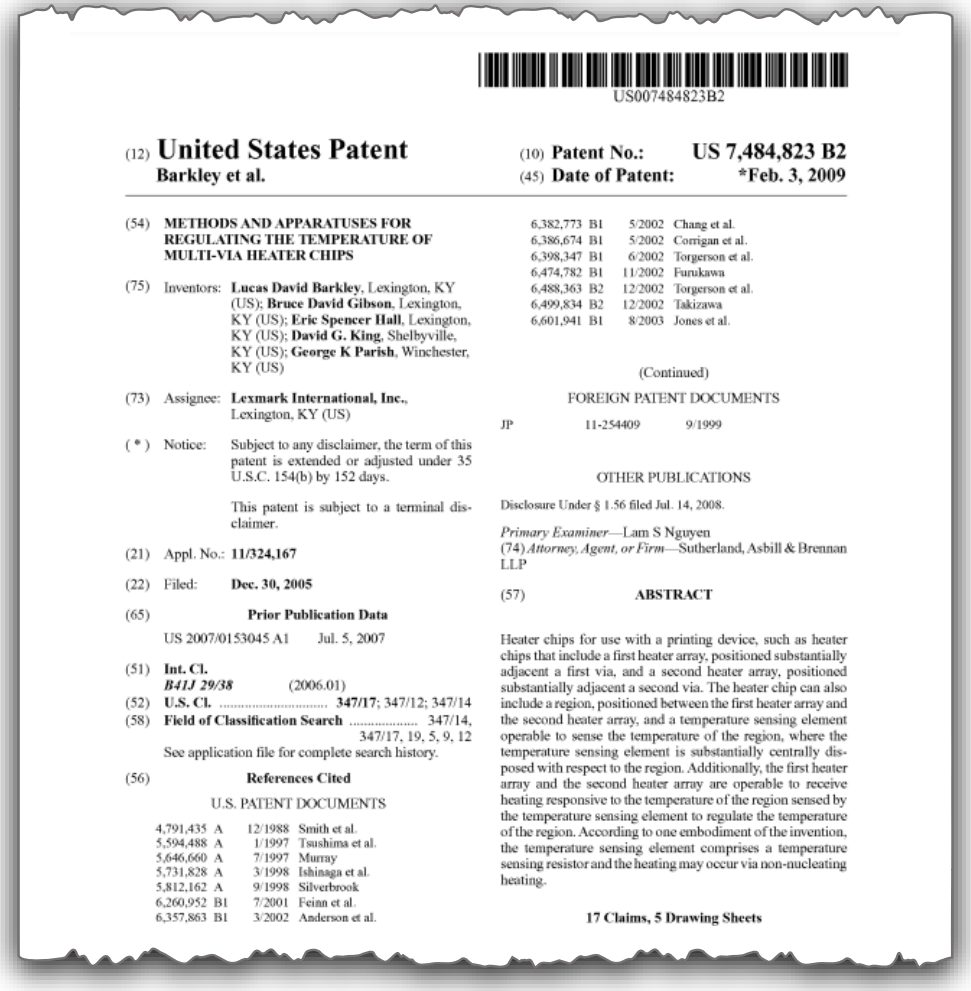
I. The ’708 and ’823 Patents

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

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IV. Grounds Unique to the ’823 Patent

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IPR2023-00312 - U.S. Patent No. 7,484,823



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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6,357,863	B1	3/2002	Anderson et al.
6,382,773	B1	5/2002	Chang et al.
6,386,674	B1	5/2002	Corrigan et al.
6,398,347	B1	6/2002	Torgerson et al.
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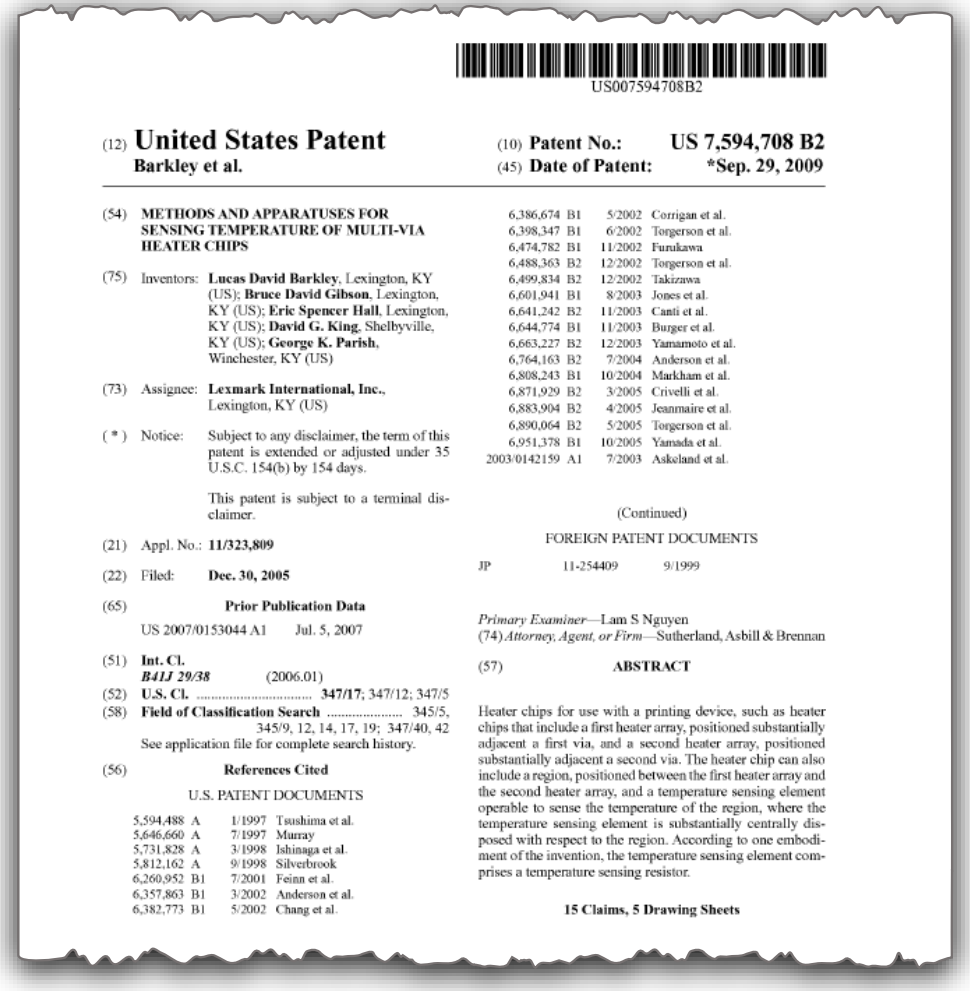
Disclosure Under § 1.56 filed Jul. 14, 2008.

Primary Examiner—Lam S Nguyen
(74) *Attorney, Agent, or Firm*—Sutherland, Asbill & Brennan LLP

(57) **ABSTRACT**

Heater chips for use with a printing device, such as heater chips that include a first heater array, positioned substantially adjacent a first via, and a second heater array, positioned substantially adjacent a second via. The heater chip can also include a region, positioned between the first heater array and the second heater array, and a temperature sensing element operable to sense the temperature of the region, where the temperature sensing element is substantially centrally disposed with respect to the region. Additionally, 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 to regulate the temperature of the region. According to one embodiment of the invention, the temperature sensing element comprises a temperature sensing resistor and the heating may occur via non-nucleating heating.

17 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)

(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 154 days.

This patent is subject to a terminal disclaimer.

(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; 347/5

(58) **Field of Classification Search** 345/5, 345/9, 12, 14, 17, 19; 347/40, 42

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.
6,382,773	B1	5/2002	Chang et al.
6,386,674	B1	5/2002	Corrigan et al.
6,398,347	B1	6/2002	Torgerson et al.
6,474,782	B1	11/2002	Furukawa
6,488,363	B2	12/2002	Torgerson et al.
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(Continued)

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JP	11-254409	9/1999

Primary Examiner—Lam S Nguyen
(74) *Attorney, Agent, or Firm*—Sutherland, Asbill & Brennan

(57) **ABSTRACT**

Heater chips for use with a printing device, such as heater chips that include a first heater array, positioned substantially adjacent a first via, and a second heater array, positioned substantially adjacent a second via. The heater chip can also include a region, positioned between the first heater array and the second heater array, and a temperature sensing element operable to sense the temperature of the region, where the temperature sensing element is substantially centrally disposed with respect to the region. According to one embodiment of the invention, the temperature sensing element comprises a temperature sensing resistor.

15 Claims, 5 Drawing Sheets

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.

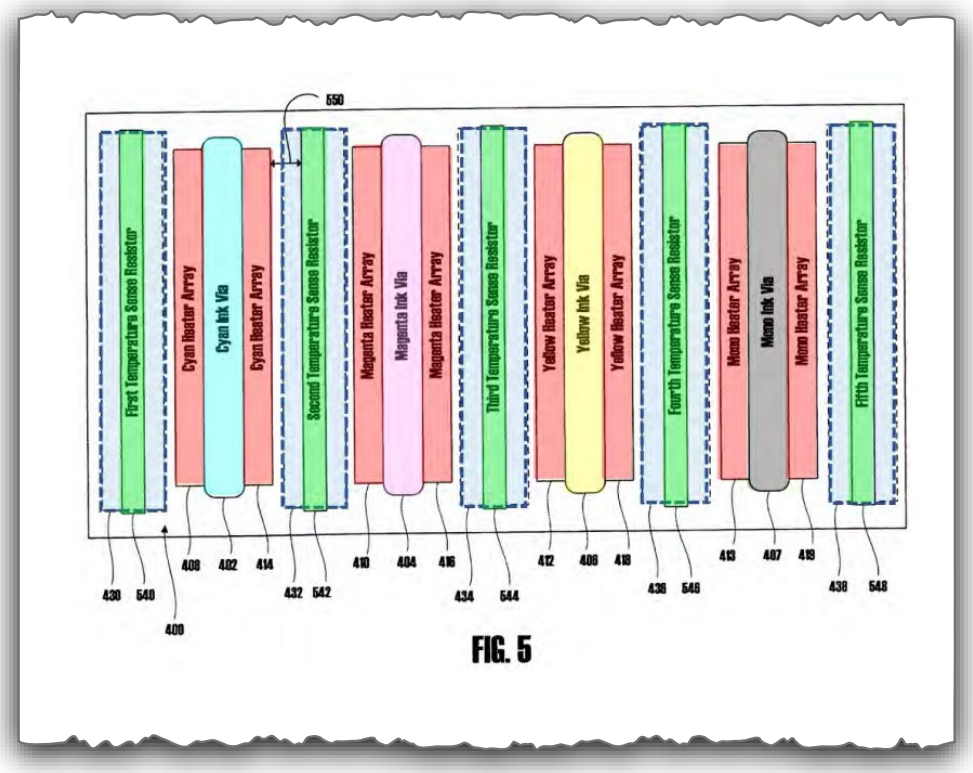


FIG. 5

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.

832 Patent at Cl. 1, Fig. 5; 708 Patent at Cl. 1, Fig. 5

Canon’s Demonstratives, not evidence

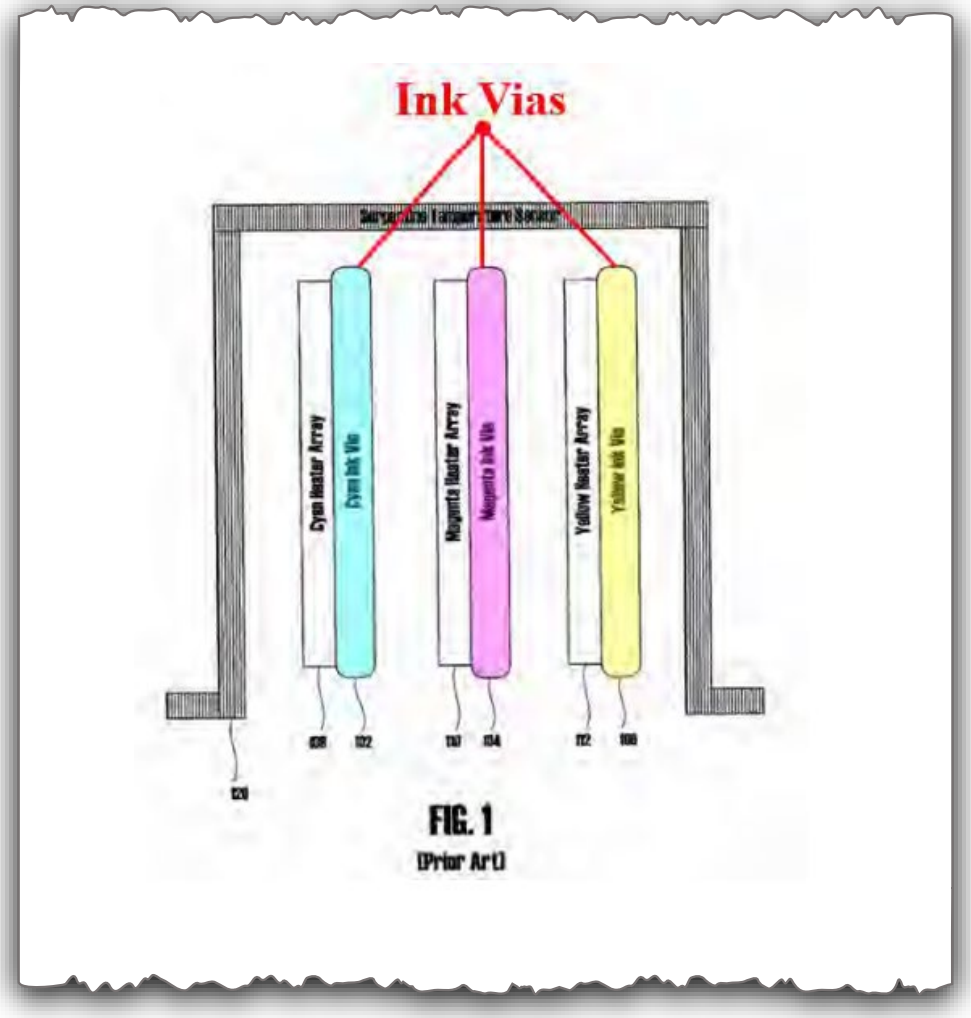


FIG. 1
(Prior Art)

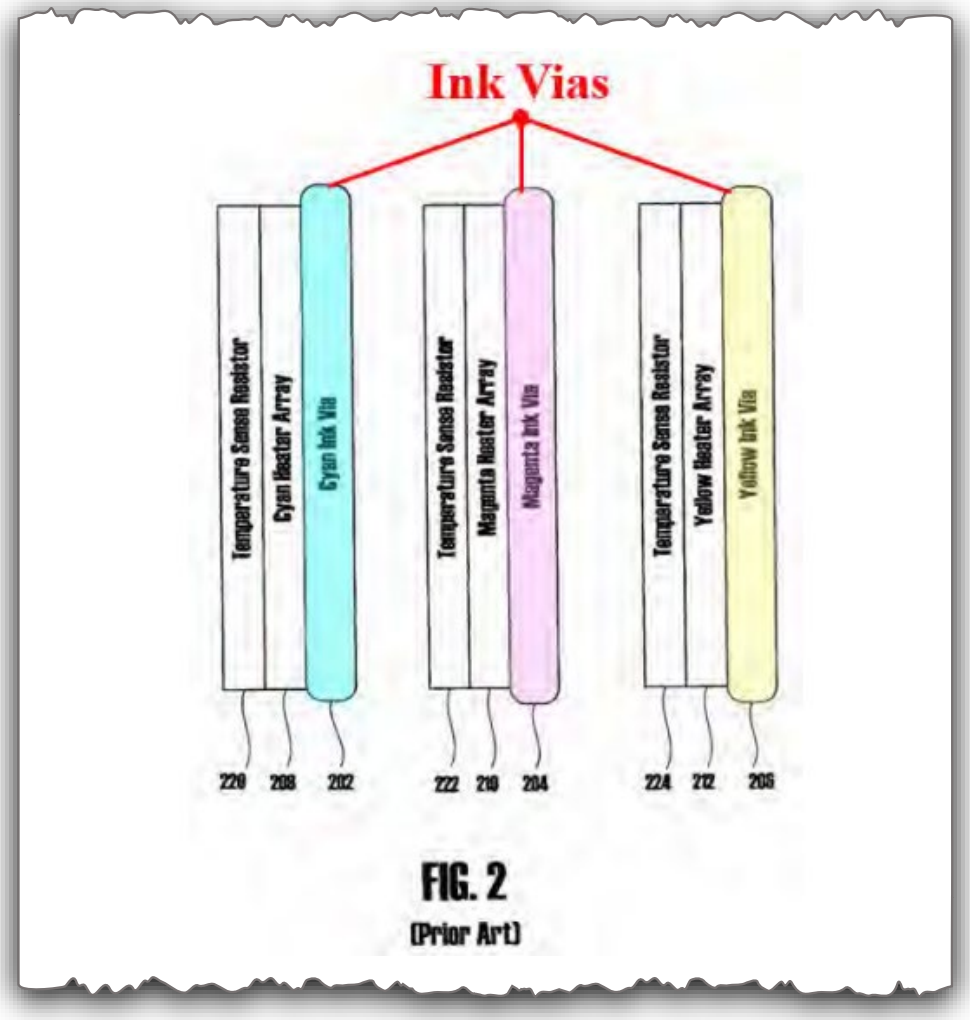


FIG. 2
(Prior Art)

832 Patent at Cl. 1, Figs. 1-2; 708 Patent at Cl. 1, Figs. 1-2

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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.**

Ex.1031 at 146:21-147:14

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	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

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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

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III. Overview of the '708 and '823 Patent

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

708 Pet. at 8-45; 708 Reply at 1-14; 823 Pet. at 7-62; 823 Reply at 1-17

Canon's Demonstratives, not evidence

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III. Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

708 Pet. at 8-43; 708 Reply at 1-13; 823 Pet. at 7-59; 823 Reply at 1-17

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Benjamin Discloses the Claimed Heater Chip Arrangement

The ‘708 Patent

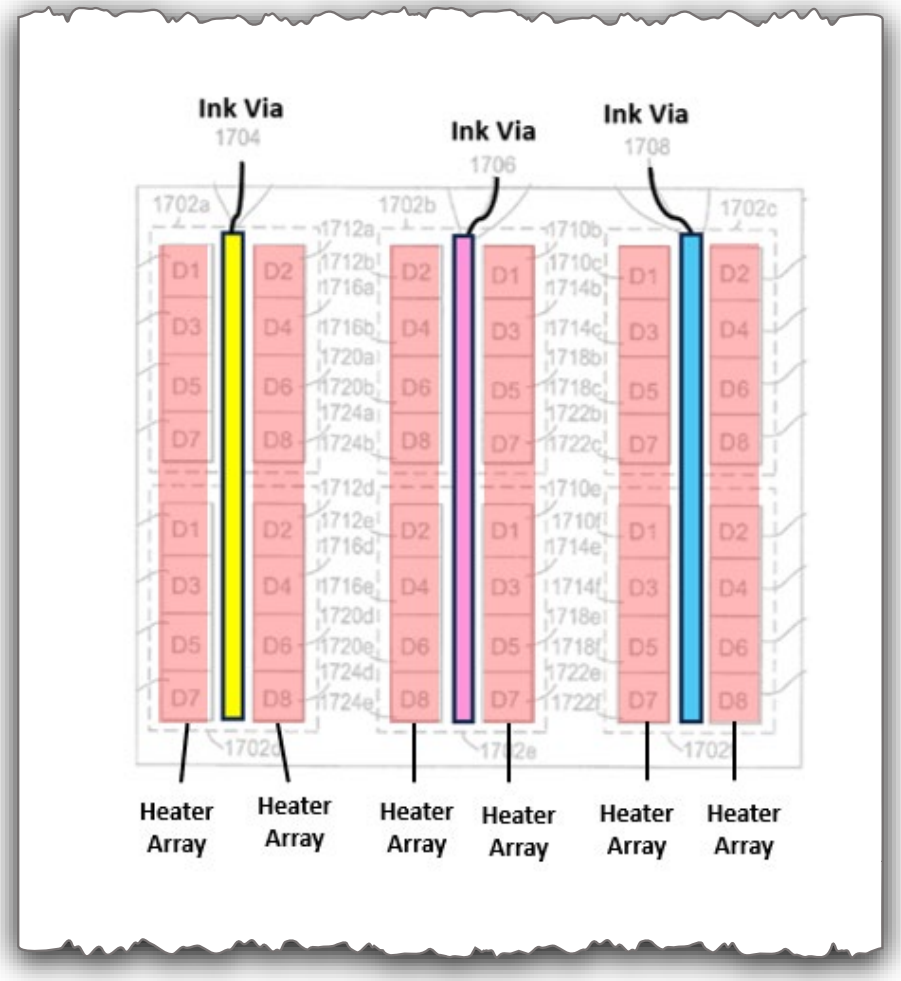
1. A chip for use with a printing device, comprising:

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.



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;

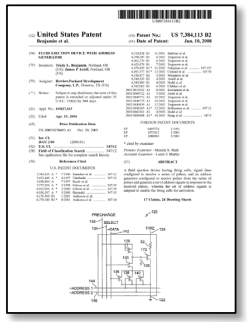
a second region, positioned between the third heater array and the fourth heater array, and also positioned substantially immediately adjacent to the third heater array and the fourth heater array; and

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,

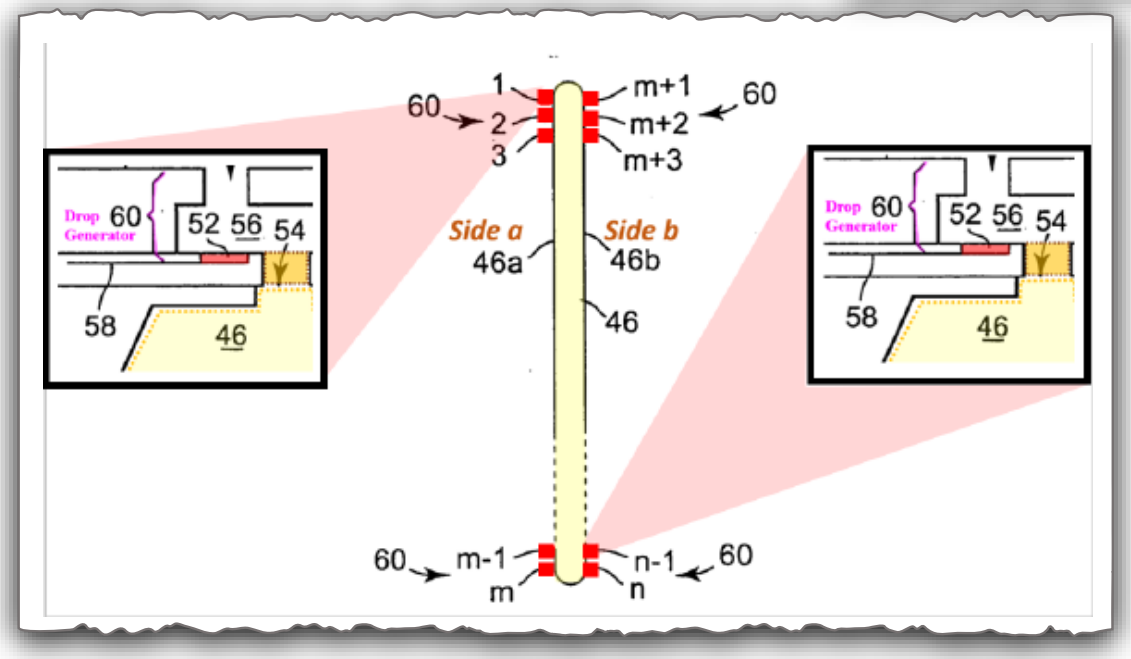
wherein the third heater array and the fourth heater array are operable to receive heating responsive to the temperature of the second region sensed by the temperature sensing element, and wherein the received heating regulates the temperature of the region.

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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**.



708 Pet. at 13-16; 823 Pet. at 14-17; Ex.1004 at 5:15-21, Figs. 2-3

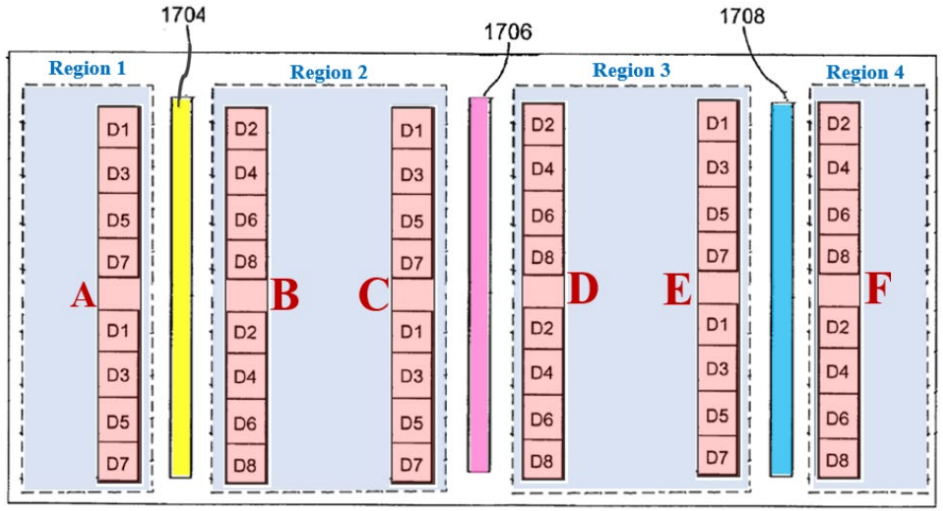
Canon's Demonstratives, not evidence

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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.

708 Pet. at 6-8, 17-18; 823 Pet. at 6-7, 19-21; Ex.1004 at Fig. 21

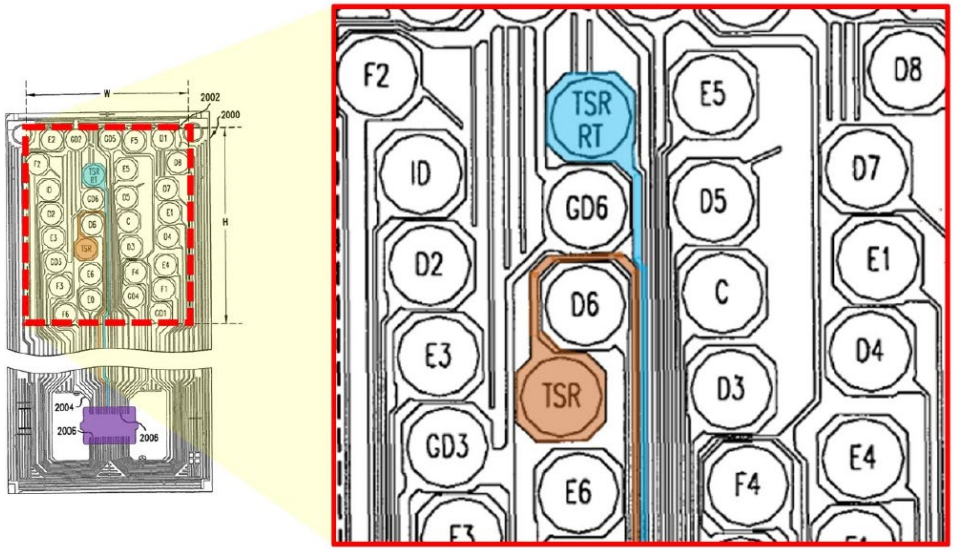
Canon’s Demonstratives, not evidence

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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.

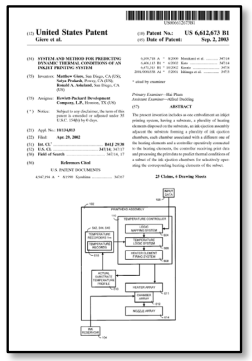
The '823 Patent

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.

708 Pet. at 17-18; 823 Pet. at 19-21; Ex.1004 at 69:60-67, Fig. 25B

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Giere673

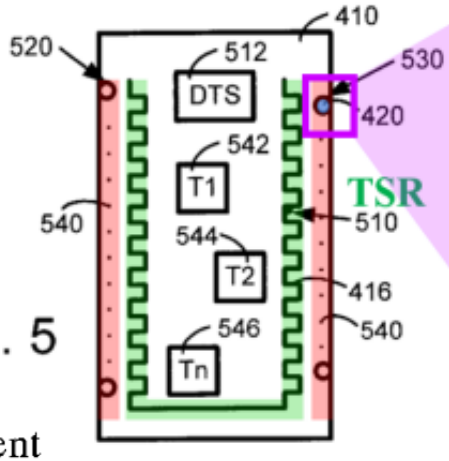


FIG. 5

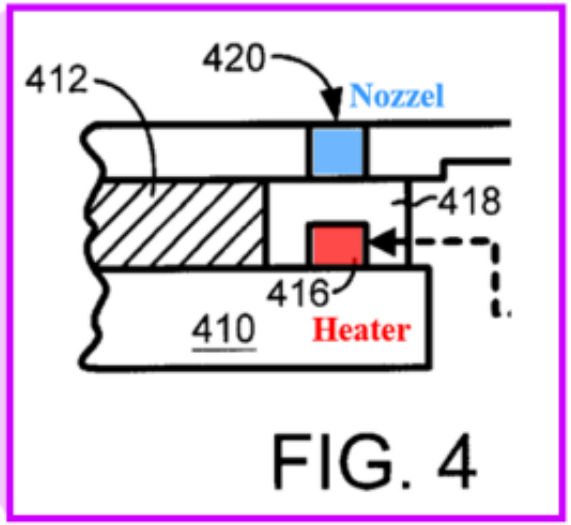


FIG. 4

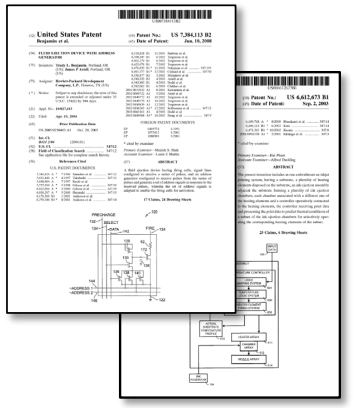
FIG. **5** is a top view of the substrate in one embodiment of the present invention. Referring to FIGS. **1–4** along with FIG. **5**, the temperature controller **110** of FIG. **1** is coupled to at least one measurement sensor. In one embodiment, there are two measurement sensors, namely, a thermal 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

708 Pet. at 43-45; 823 Pet. at 54-59; Ex.1005 at 4:49-60; Figs. 4-5

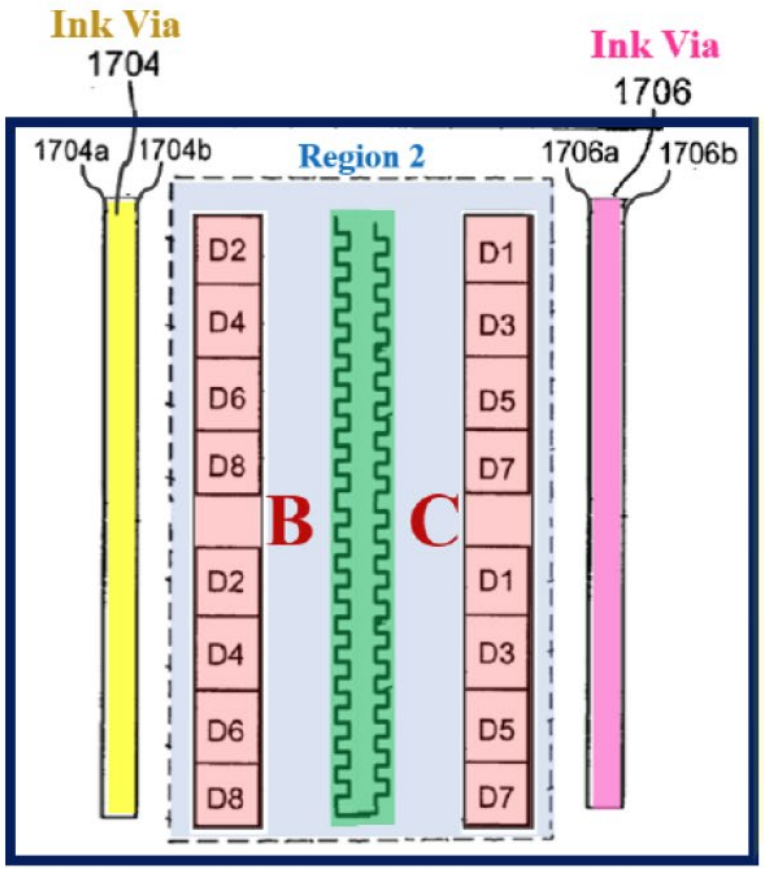
Canon's Demonstratives, not evidence

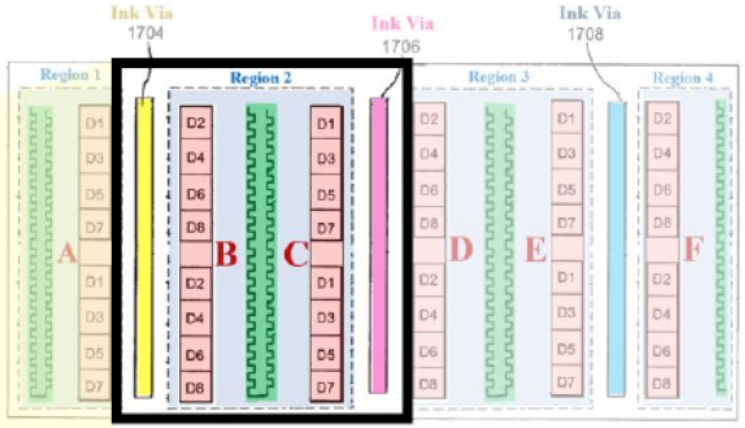
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Canon U.S.A., Inc., and Canon Inc. v. Slingshot Printing, LLC
IPR2023-00312 - U.S. Patent No. 7,484,823

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



Benjamin + Giere673



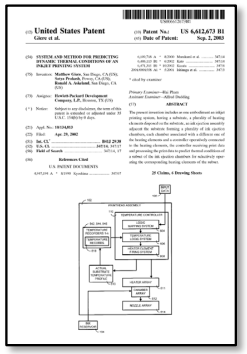


708 Pet. at 43-45; 708 Reply at 6-8; 823 Pet. at 54-59; 823 Reply at 12-14

Canon's Demonstratives, not evidence

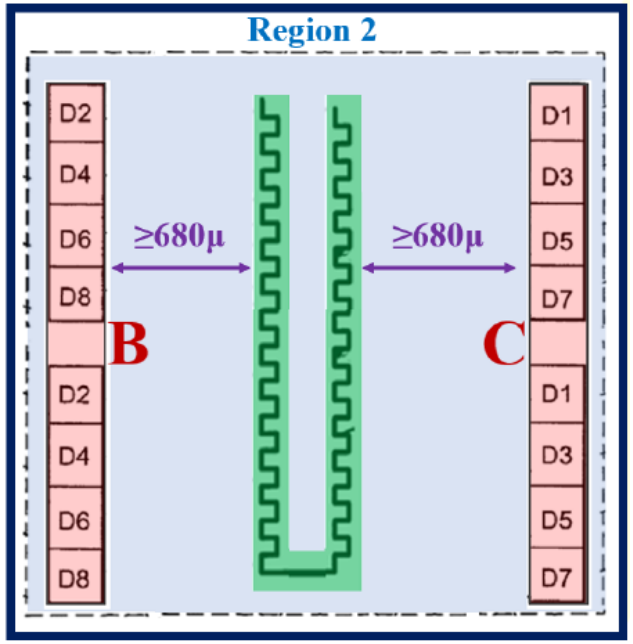
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IPR2023-00312 - U.S. Patent No. 7,484,823

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



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**.



708 Pet. at 43-45; 708 Reply at 6-8; 823 Pet. at 54-59; 823 Reply at 12-14; Ex.1005 at 4:55-61, 5:9-12

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PO

> 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

Canon's Demonstratives, not evidence

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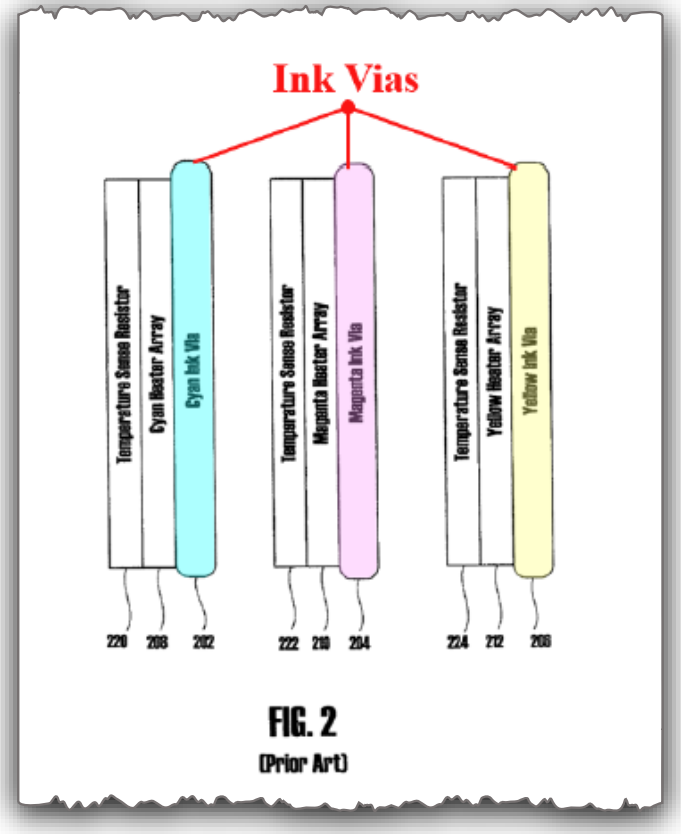


FIG. 2
(Prior Art)

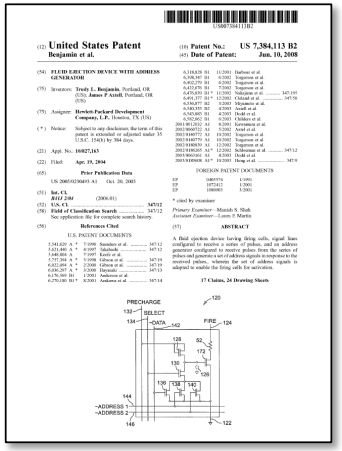
2

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.

708 Pet. at 22-24, 68; 708 Reply at 10-13; 823 Pet. at 28-30; 823 Reply at 4-5, 14-16; Ex.1001 at 2:1–15, 2:47–50

Canon's Demonstratives, not evidence

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

(10) **Patent No.: US 7,384,113 B2**
(45) **Date of Patent: Jun. 10, 2008**

(54) **FLUID EJECTION DEVICE WITH ADDRESS GENERATOR**

(75) Inventors: **Trudy L. Benjamin**, Portland, OR (US); **James P Axtell**, Portland, OR (US)

(73) Assignee: **Hewlett-Packard Development Company, L.P.**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 384 days.

(21) Appl. No.: **10/827,163**

(22) Filed: **Apr. 19, 2004**

(65) **Prior Publication Data**

US 2005/0230469 A1 Oct. 20, 2005

(51) **Int. Cl.**
B41J 2/04 (2006.01)

(52) **U.S. Cl.** **347/12**

(58) **Field of Classification Search** **347/12**
See application file for complete search history.

(56) **References Cited**

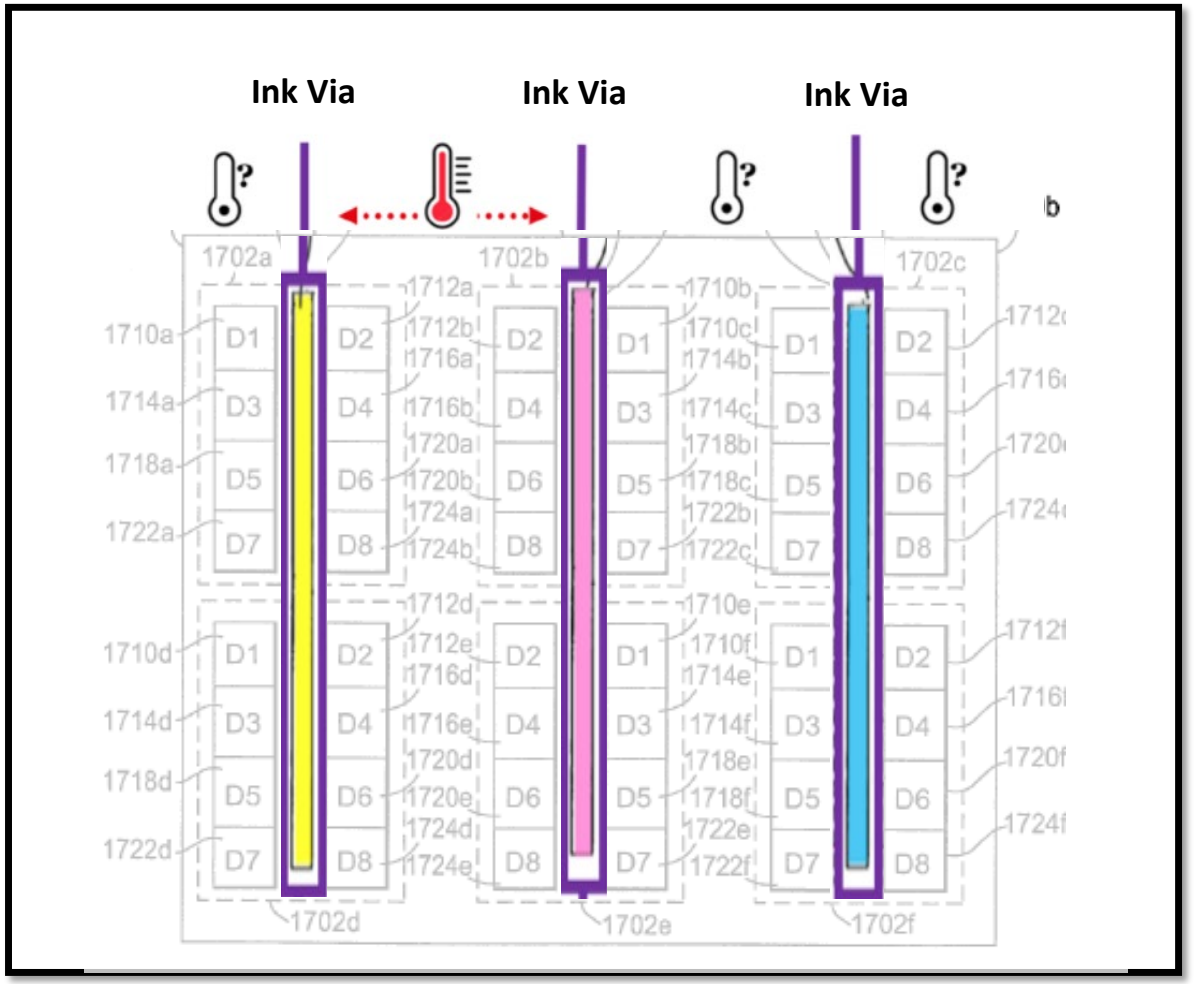
U.S. PATENT DOCUMENTS

(57) **ABSTRACT**

A fluid ejection device having firing cells, signal lines configured to receive a series of pulses, and an address generator configured to receive signals from the series of pulses and generate a set of address signals in response to the received pulses, wherein the set of address signals is adapted to enable the firing cells for activation.

17 Claims, 24 Drawing Sheets

Benjamin



708 Pet. at 22-24, 68; 708 Reply at 10-13; 823 Pet. at 28-30; 823 Reply at 4-5, 14-16; Ex.1001 at 2:1–15, 2:47–50

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FIG. 5

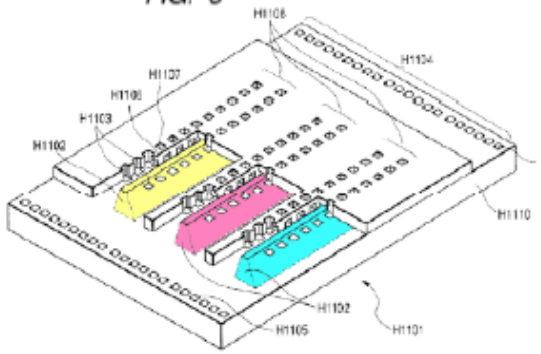
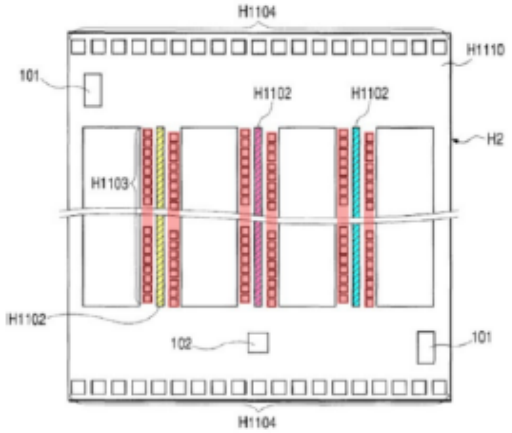


FIG. 14



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

708 Pet. at 82-92; 708 Reply at 10-13; 823 Pet. at 78-111; 823 Reply at 14-16; Ex.1008 at 3:22-27

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Petitioners Expert
Dr. Steven Pond

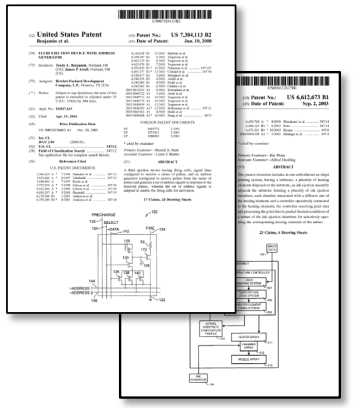
"I mean, it's obvious that if different regions are heated differently and you want to do a better job of temperature management, you need to know the temperature in the different places. ***That's common sense***."

708 Reply at 28; 823 Reply at 31; Ex.2004 at 153:13-18

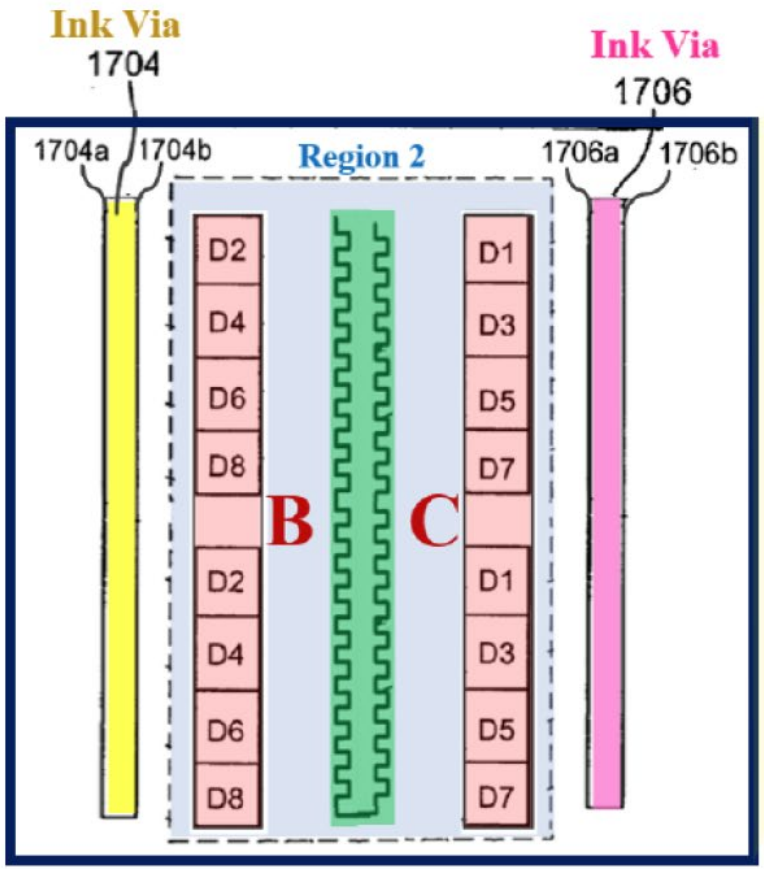
Canon's Demonstratives, not evidence

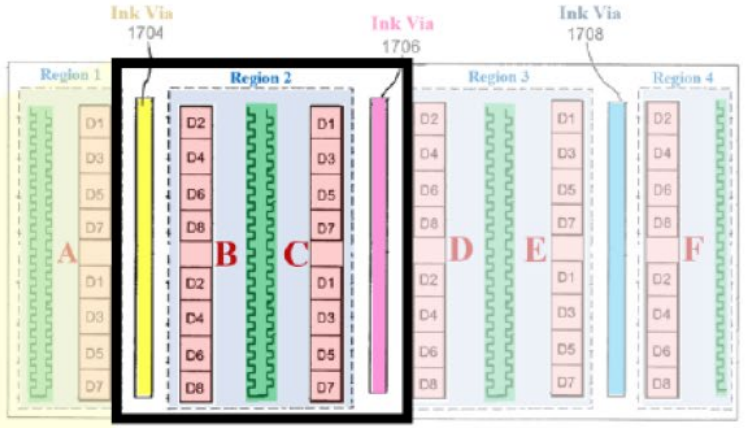
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Giere673 Motivates a PHOSITA to Dispose a Single TSR Between Two Heater Arrays



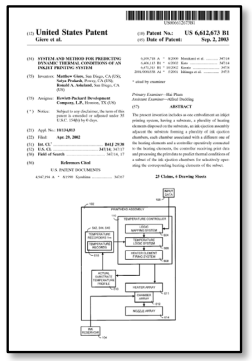
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Giere673

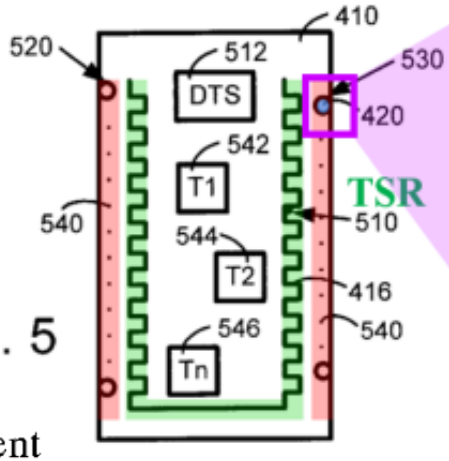


FIG. 5

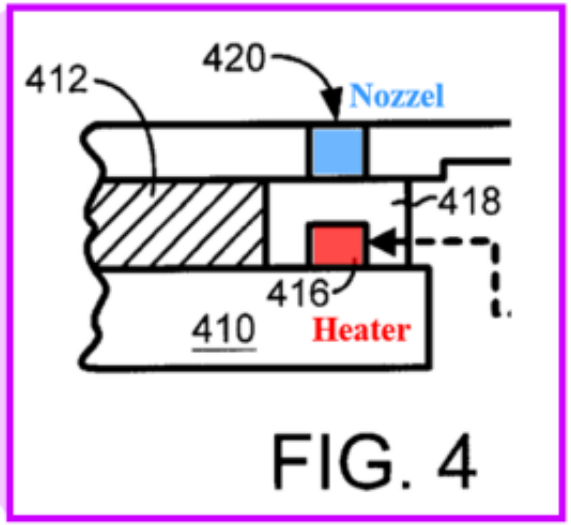


FIG. 4

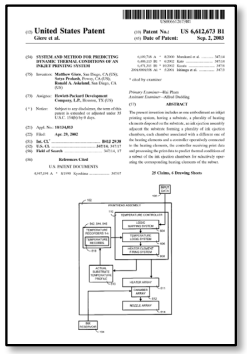
FIG. **5** is a top view of the substrate in one embodiment of the present invention. Referring to FIGS. **1–4** along with FIG. **5**, the temperature controller **110** of FIG. **1** is coupled to at least one measurement sensor. In one embodiment, there are two measurement sensors, namely, a thermal 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

708 Pet. at 43-45; 823 Pet. at 54-59; Ex.1005 at 4:49-60; Figs. 4-5

Canon's Demonstratives, not evidence

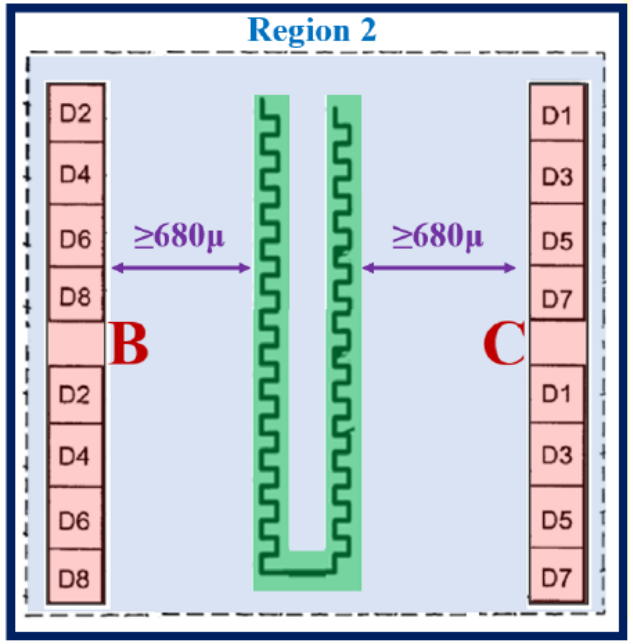
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IPR2023-00312 - U.S. Patent No. 7,484,823

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



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**.



708 Pet. at 43-45; 708 Reply at 6-8; 823 Pet. at 54-59; 823 Reply at 12-14; Ex.1005 at 4:55-61, 5:9-12

Canon's Demonstratives, not evidence

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I. Grou Overview of the '703 and '823 Patent

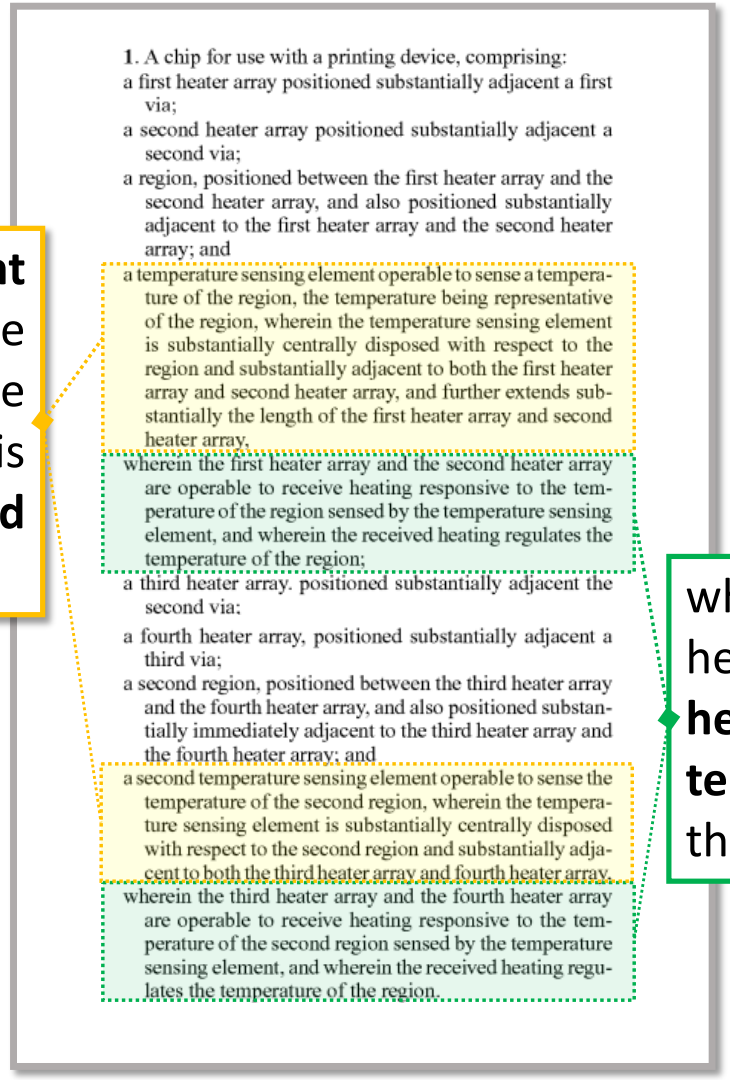
Ground 1. Benjamin Combined with Giere673

Claim Limitations Unique to the '823 Patent

Ground 2 Benjamin Combined with Giere673 in view of Parish

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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 …

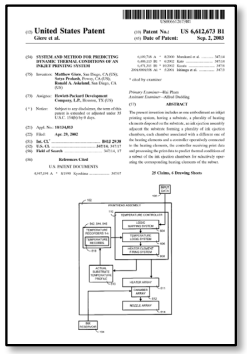


1. A chip for use with a printing device, comprising:
a first heater array positioned substantially adjacent a first via;
a second heater array positioned substantially adjacent a second via;
a region, positioned between the first heater array and the second heater array, and also positioned substantially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

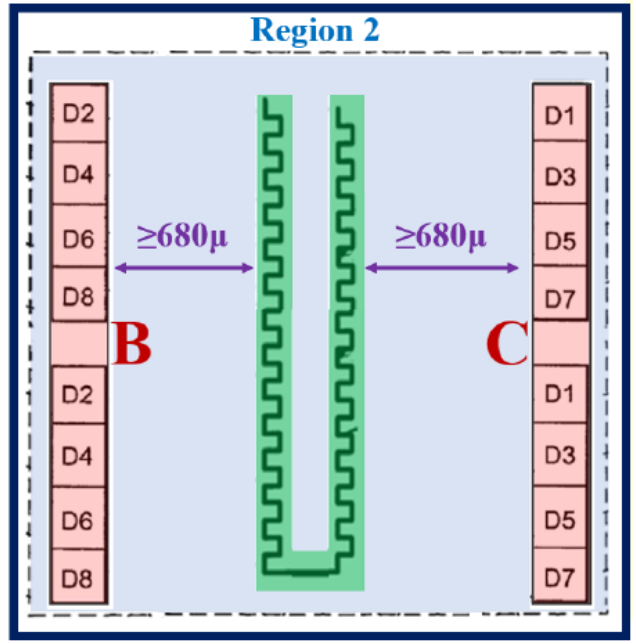
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IPR2023-00312 - U.S. Patent No. 7,484,823

Giere673 Teaches Positioning a TSR in the Center of Two Heater Arrays



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.

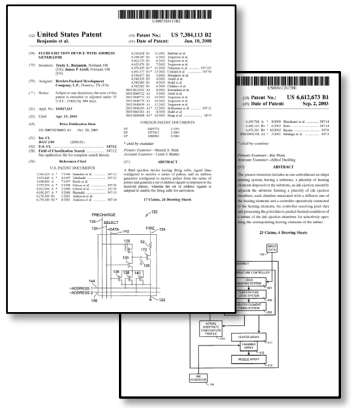
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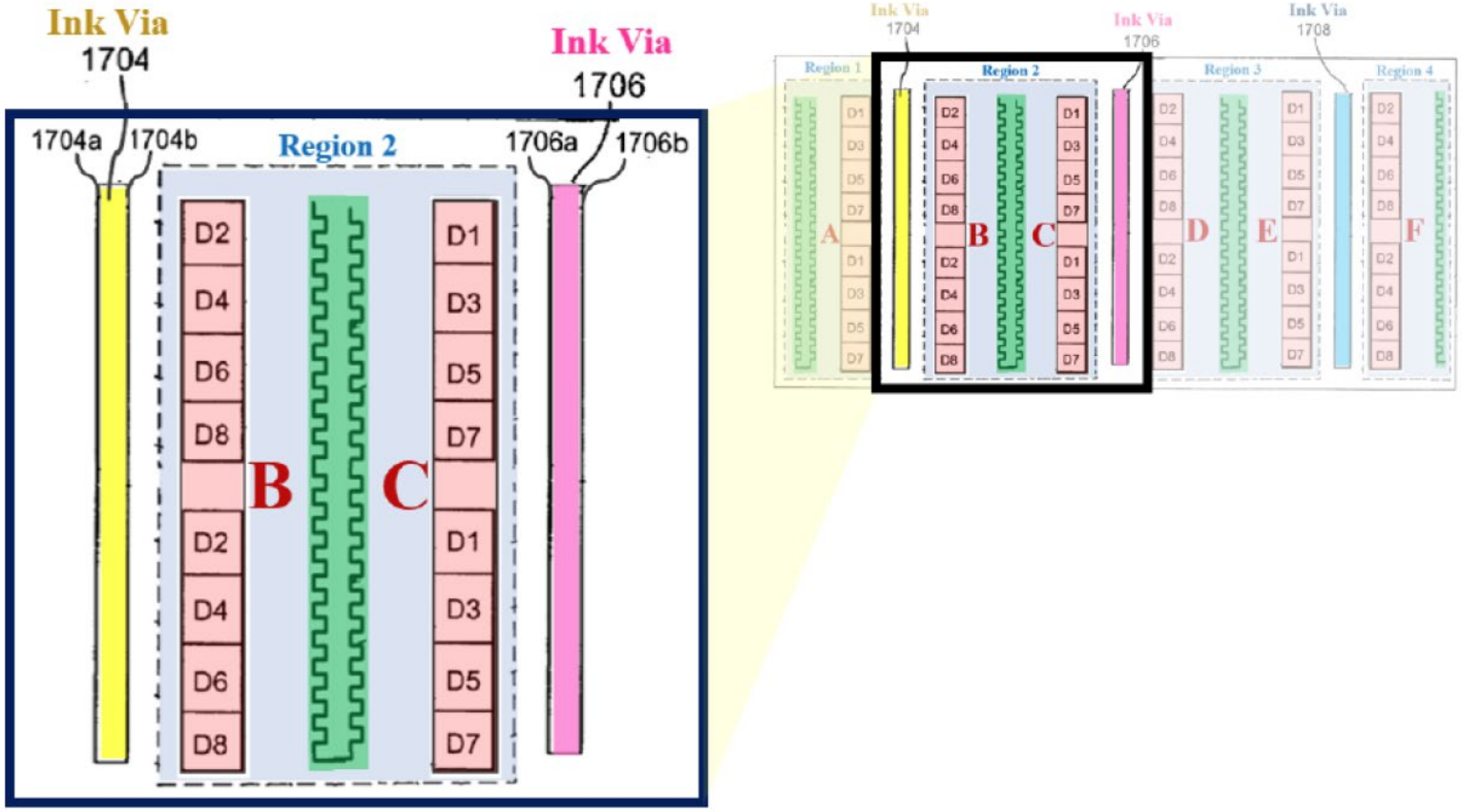
823 Pet. at 54-59; 823 Reply at 12-14; Ex.1005 at 4:55-61, 5:9-12

Canon's Demonstratives, not evidence

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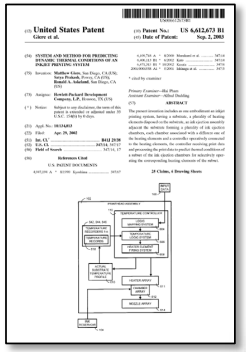
Benjamin + Giere673



823 Pet. at 54-59; 823 Reply at 12-14

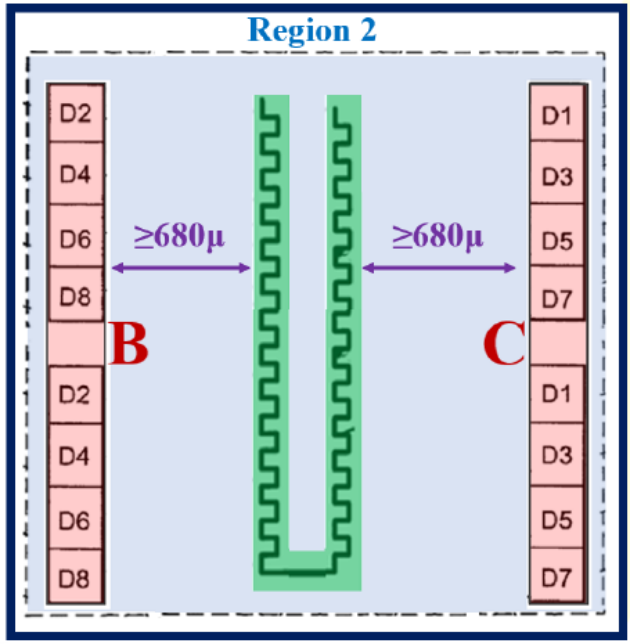
Canon's Demonstratives, not evidence

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Giere673

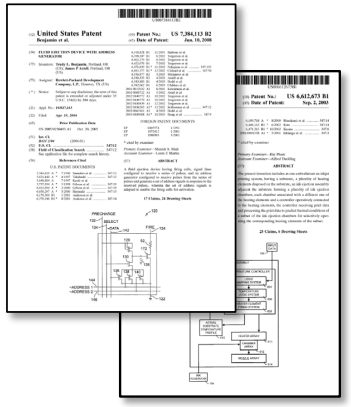
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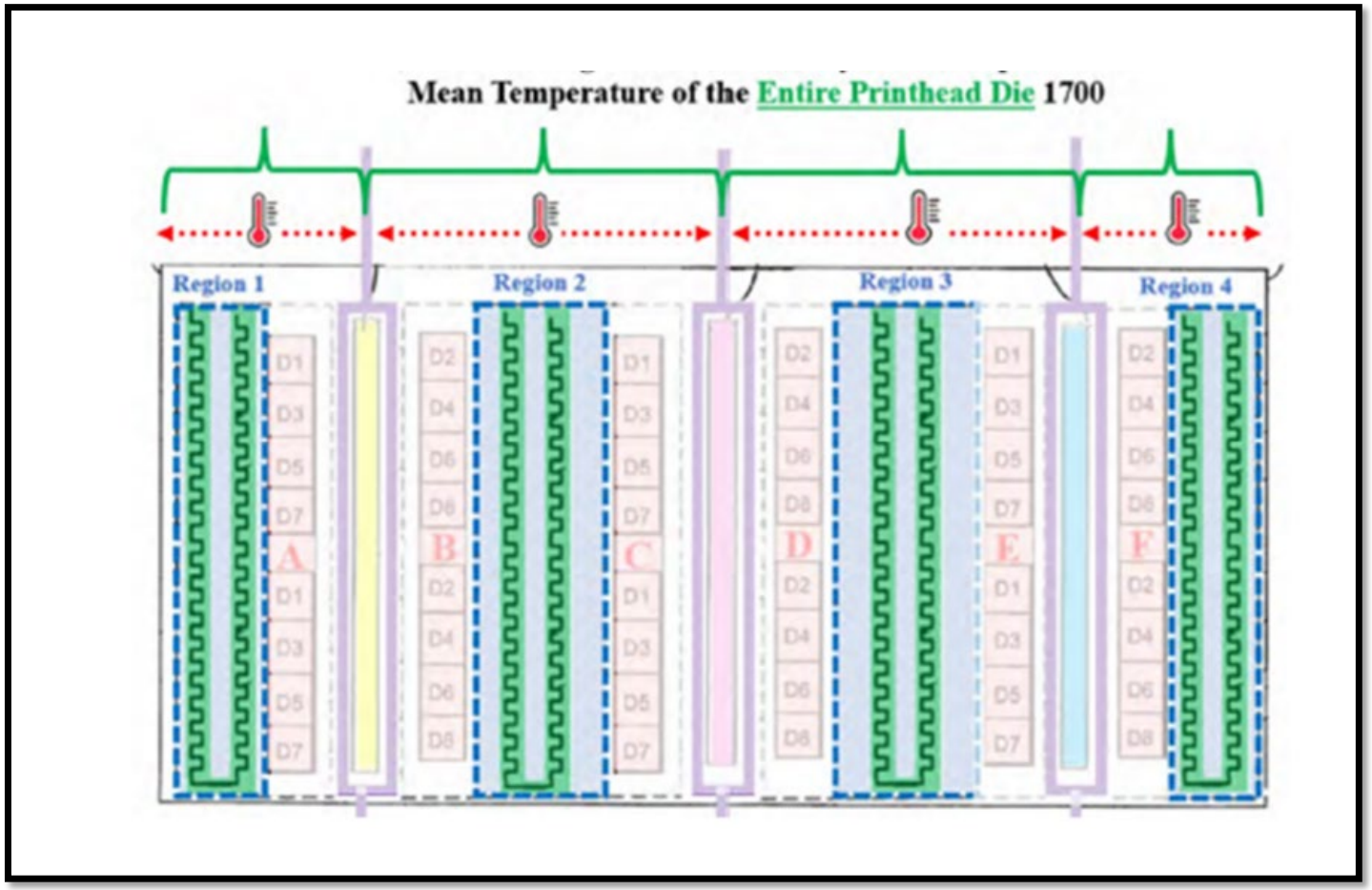
823 Pet. at 54-59; 823 Reply at 12-14; Ex.1005 at 4:55-61

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823 Pet. at 21-31; 823 Reply at 3-6, 13; Ex.1005 at 4:55-61

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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

Canon’s Demonstratives, not evidence

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III. Gr Overview of the '768 and '323 Patent

Ground 1. Benjamin Combined with Giere673

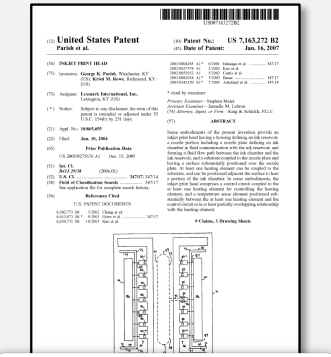
Ground 2 **Benjamin Combined with Giere673 in view of Parish**

Canon's Demonstratives, not evidence

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708/823 Patents

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



Ex. 1006 Parish

"[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."

708 Patent at Cls. 4 and 13; 708 Pet. at 42-45; 708 Reply at 13; 823 Patent at Cls. 4 and 14; 823 Pet. at 59-62; 823 Reply at 17

Canon's Demonstratives, not evidence

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PO

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

708 Pet. at 42-45; 708 Reply at 13; 823 Pet. at 59-62; 823 Reply at 17

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Grounds Shared Between the ’708 and ’823 Patents

Ground 1.	Benjamin Combined with Giere673
Ground 2	Benjamin Combined with Giere673 in view of Parish

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**

Canon’s Demonstratives, not evidence

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Grounds Shared Between the ’708 and ’823 Patents

Ground 1.	Benjamin Combined with Giere673
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Grounds 5+6	Giere178 (Alone or Combined With Yabe) in view of Parish

708 Pet. at 45-82; 708 Reply at 14-24

Canon’s Demonstratives, not evidence

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PO

> 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.)

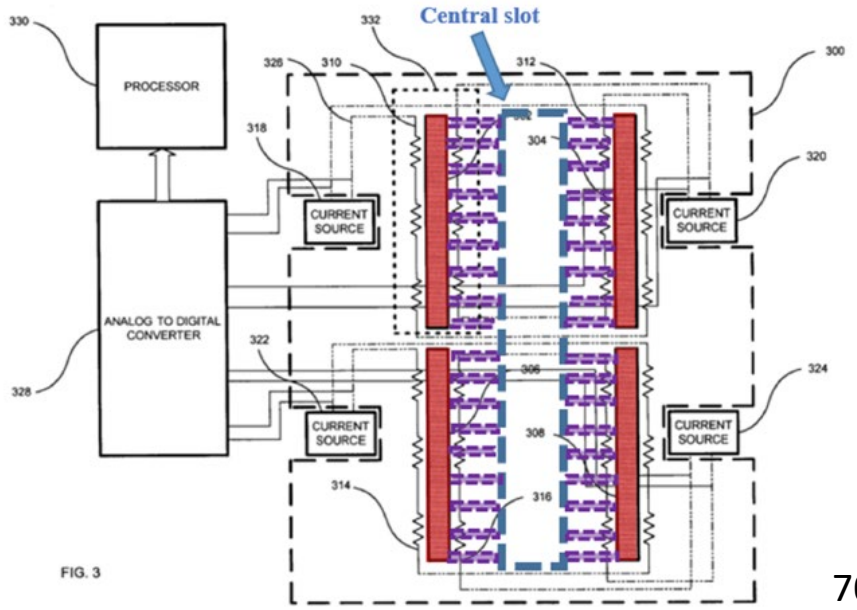


FIG. 3

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.").

708 Institution Decision at 26

Canon's Demonstratives, not evidence

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

708 Pet. at 45-82; 708 Reply at 14-24

Canon’s Demonstratives, not evidence

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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.

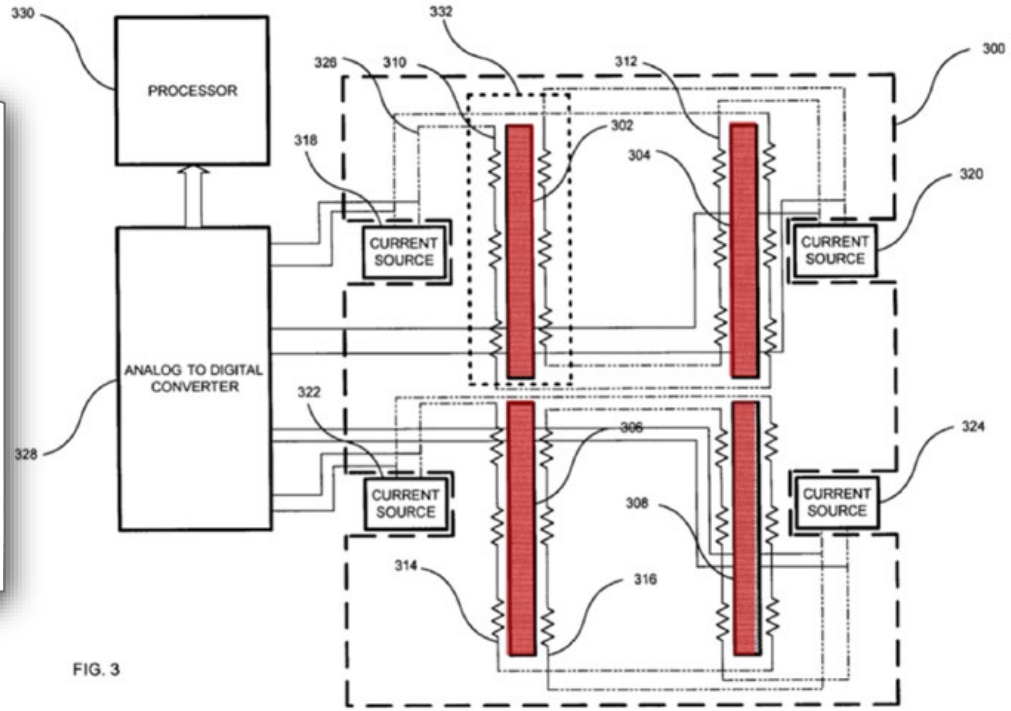
708 Pet. at 47-59; 708 Reply at 14-21; Ex.1007 at 3:51-65

Canon's Demonstratives, not evidence

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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**,



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…”

708 Pet. at 47-54; 708 Reply at 14-21; Ex.1007 at 8:45-47; Ex.2004 at 45:14-46:11

Canon’s Demonstratives, not evidence

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."

* * *

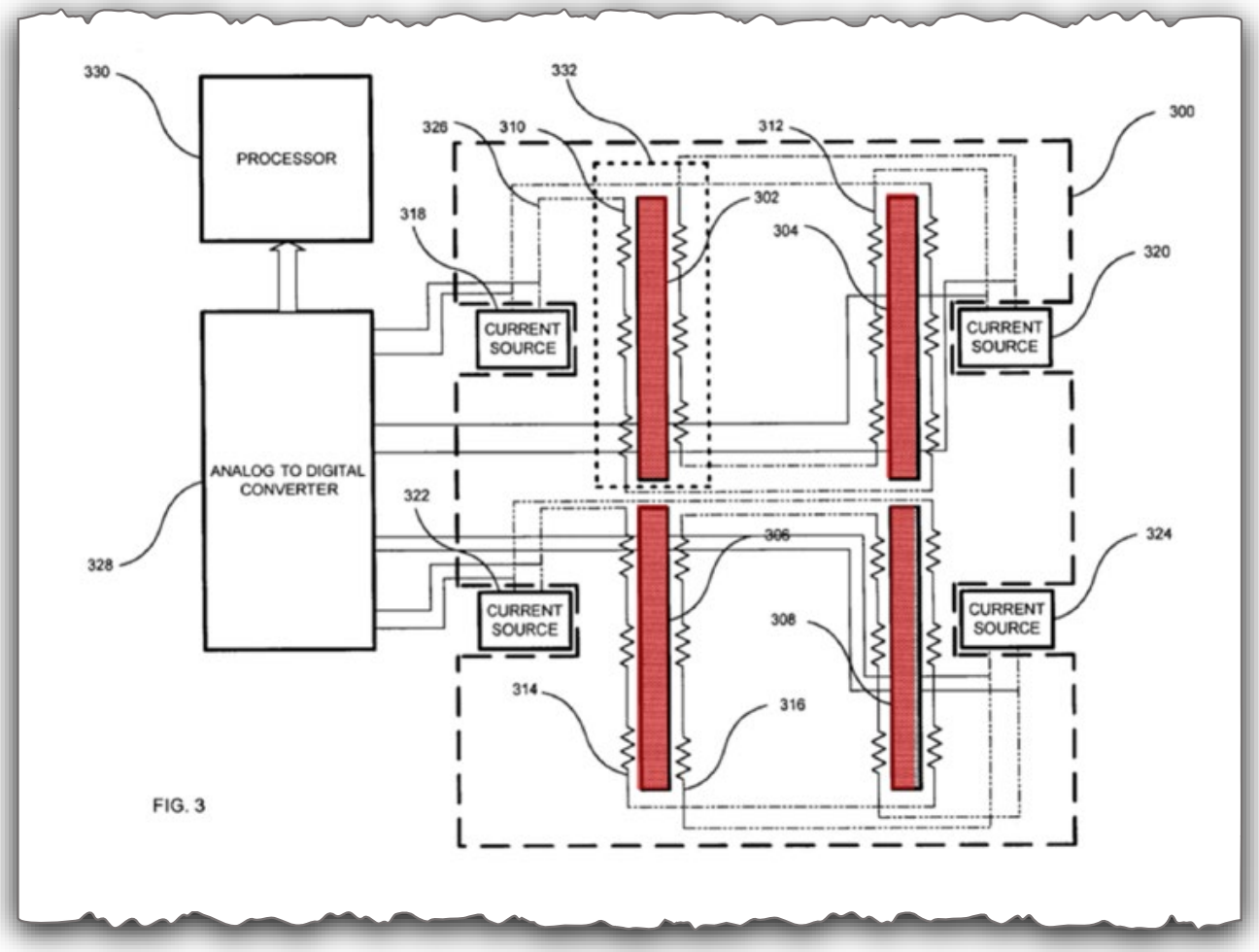
"I can't envision an ink via being brought close to the edges of those two regions without disrupting or ruining or removing his sensor 312…that's not functional with his invention here."

708 Pet. at 47-59; 708 Reply at 14-21; Ex.2004 at 75:9-14, 76:13-17

Canon's Demonstratives, not evidence

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



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 Fig. 3

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



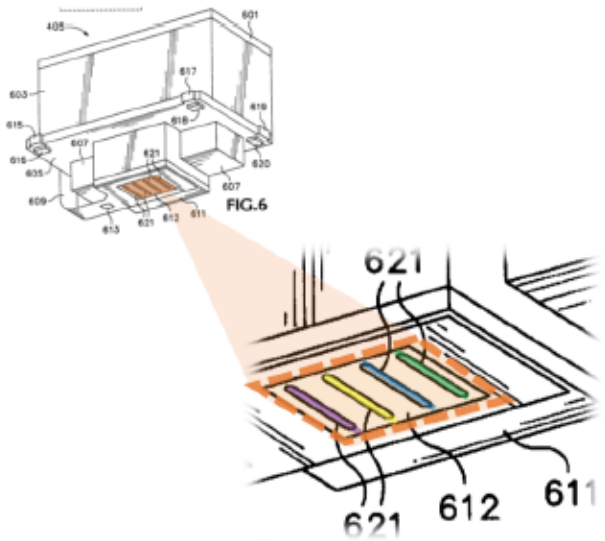
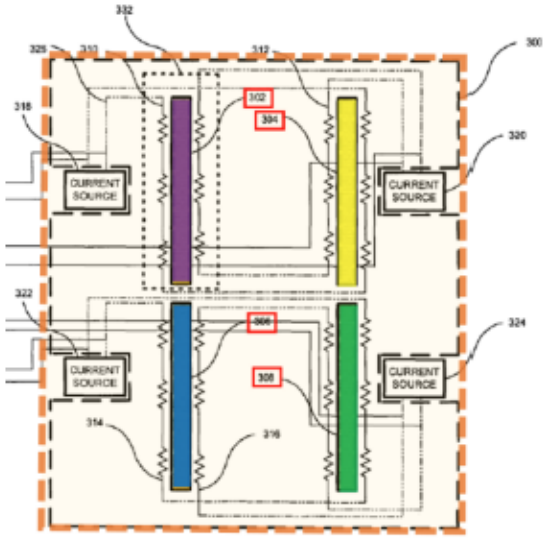
"[A] PHOSITA would look at this drawing and ***see the long and skinny shapes*** and ***recognize them*** to represent two drop generators on both sides of a via" based on "his ***ordinary knowledge***" not only because "it's an old but ***ordinary layout*** of a multicolor chip," but also because "it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

708 Pet. at 47-59; 708 Reply at 14-21; Ex.2004 at 73:16-74:10

Canon's Demonstratives, not evidence

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

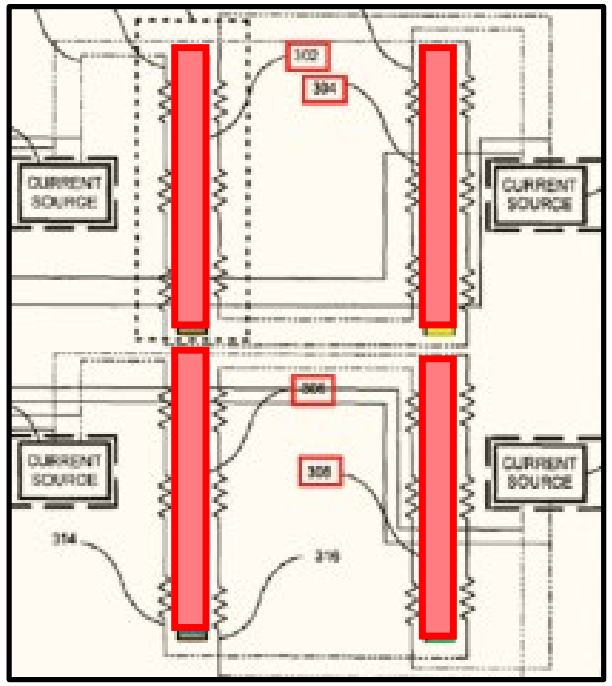
Axtel	Giere178
	

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.

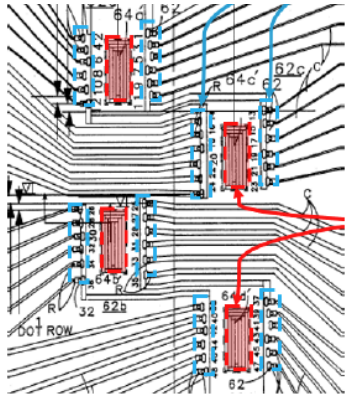
FIGS. **3** and **5**. The embodiment shown is for a full, four color printing module; therefore, four sets of ink-jet orifice arrays **621** are employed. Other arrays may be used in accordance with the intent and purpose of use of any

708 Pet. at 47-59; 708 Reply at 18-19; Ex.1007 at 8:41-49, Fig. 3; Ex.1011 at 8:30-40, 15:42-16:7

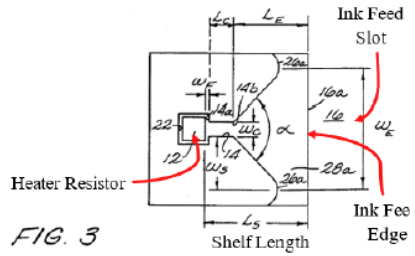
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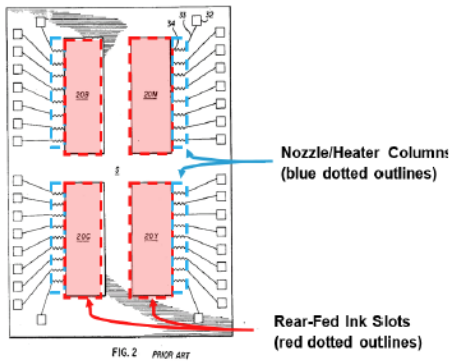
Giere178



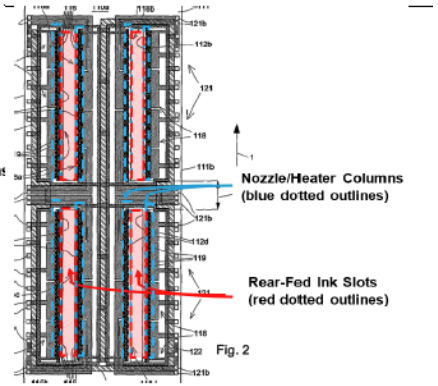
Ex.1035 (US4812859 to Chan), Fig. 5



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



Ex.1034 (US5030971 to Drake) Fig. 2



Ex.1036 (US7008047 to Conta) Fig. 2

Canon's Demonstratives, not evidence

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

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Giere178 Includes a First and Second TSR in Two Separate Regions

PO

> 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

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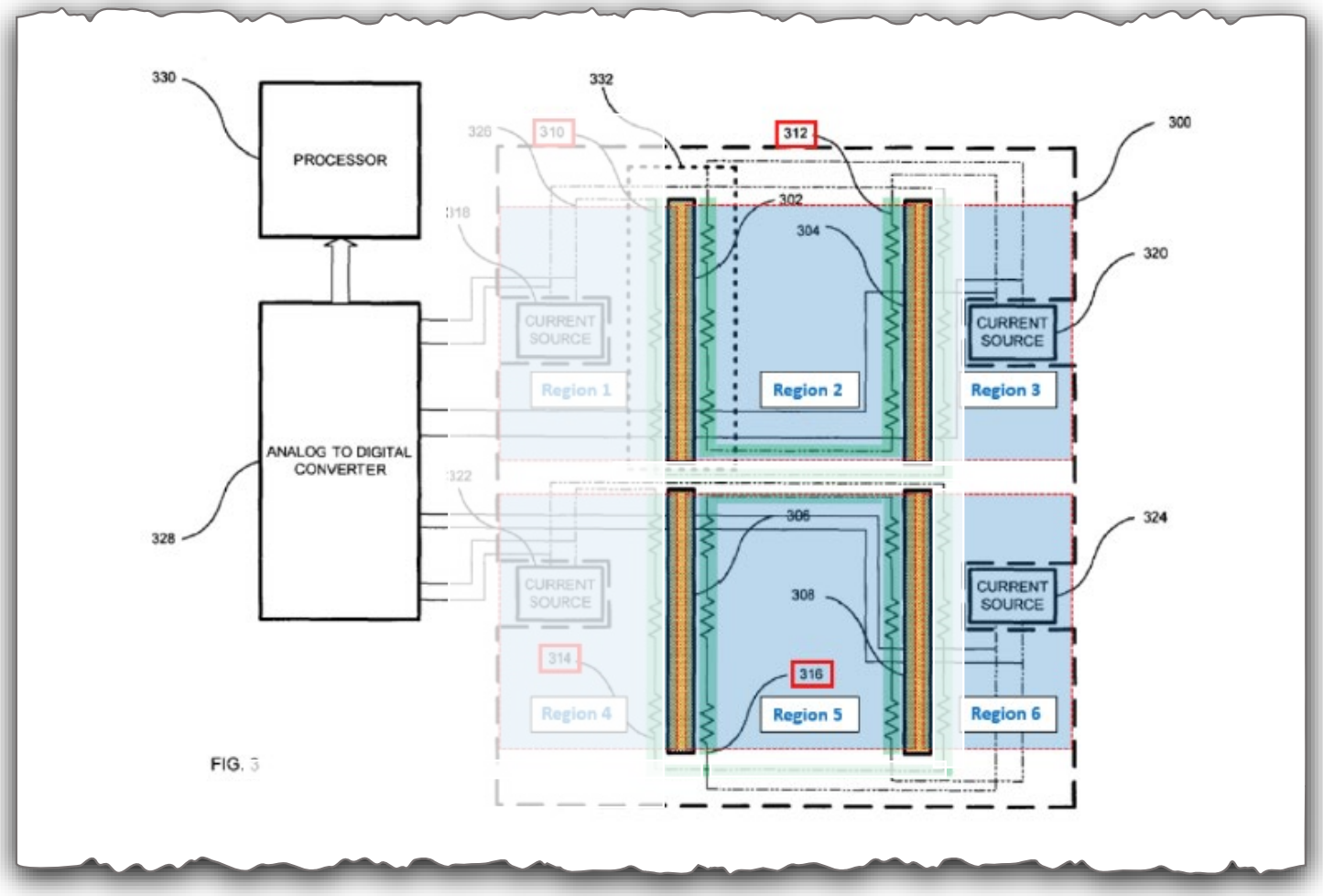


FIG. 3

Canon's Demonstratives, not evidence

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- ☑ 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

708 Pet. at 45-82; 708 Reply at 14-24

Canon’s Demonstratives, not evidence

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Grounds Shared Between the ’708 and ’823 Patents

Ground 1.	Benjamin Combined with Giere673
Ground 2	Benjamin Combined with Giere673 in view of Parish
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

708 Pet. at 82-101; 708 Reply at 24-28

Canon’s Demonstratives, not evidence

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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

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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

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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

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Yabe Is Analogous Art

FIG. 5

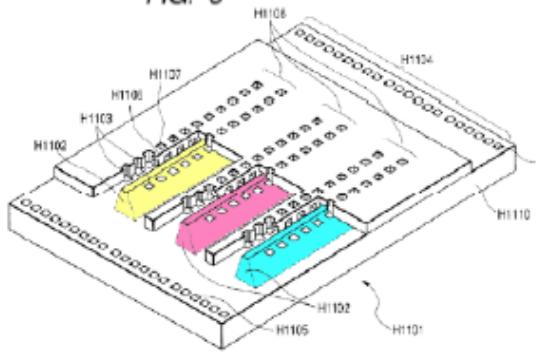
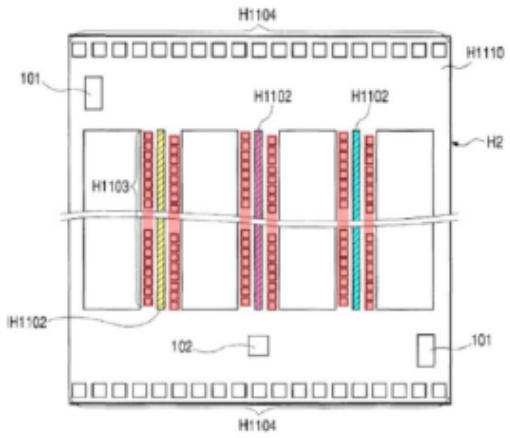
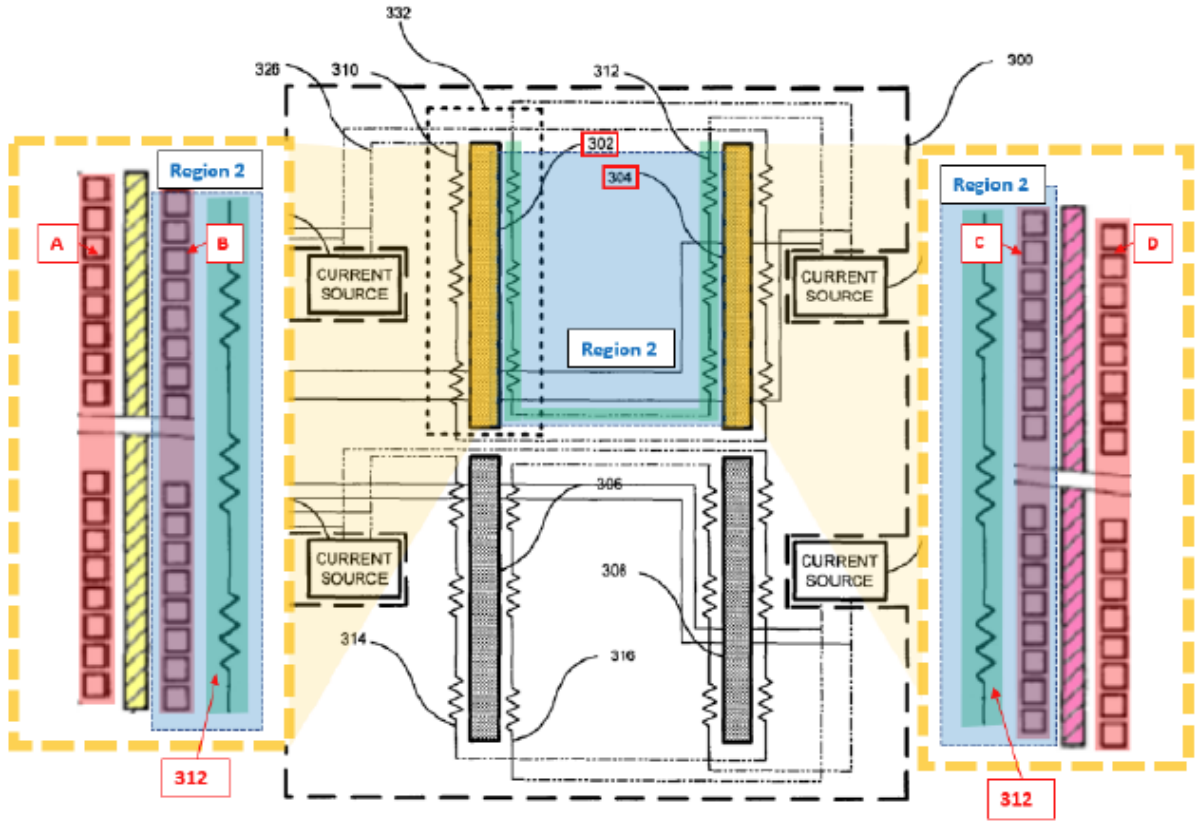


FIG. 14





708 Pet. at 92-101; 708 Reply at 24-26; Ex.1008 at 3:17-27, 8:47:51, Figs. 5, 14

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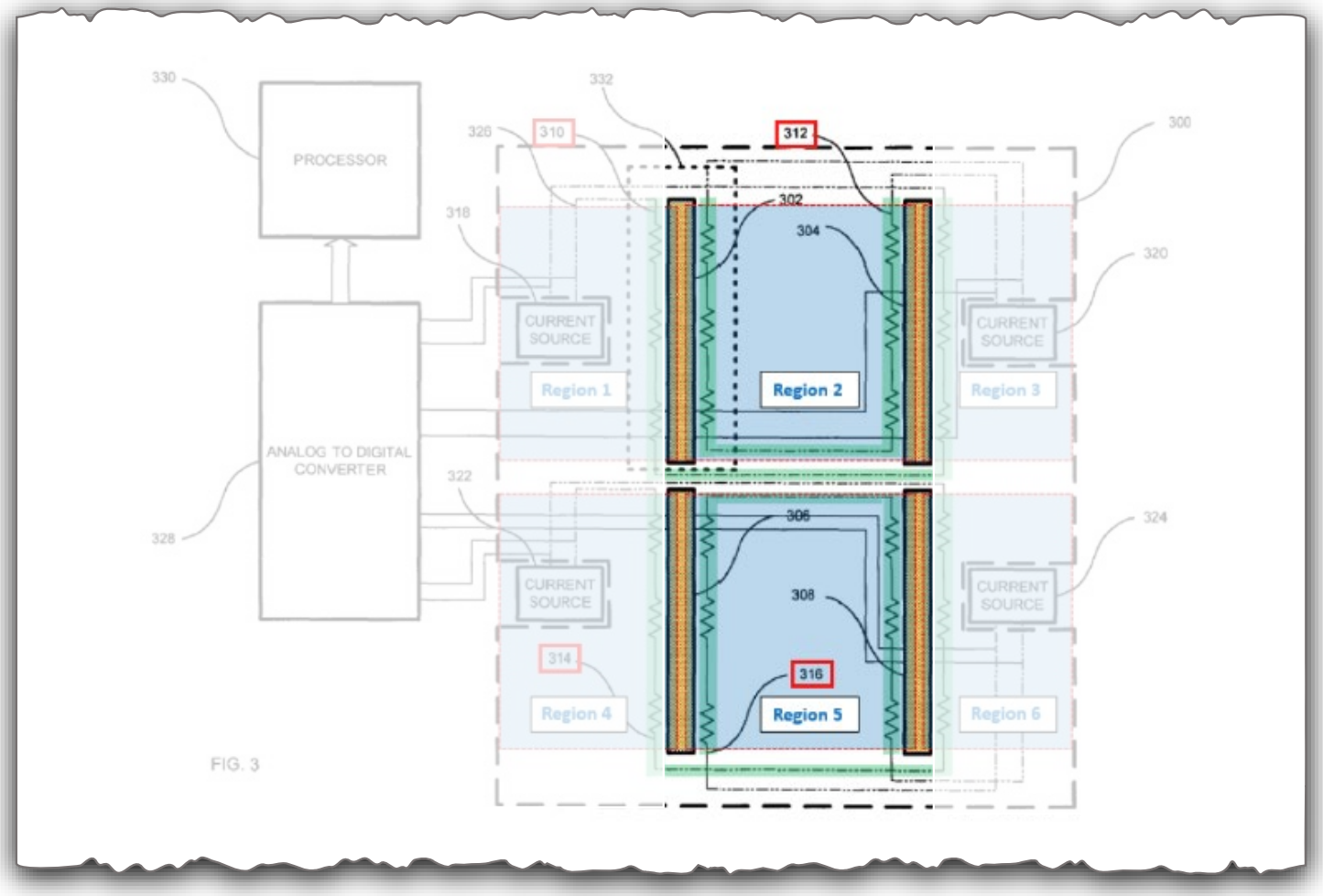
Yabe Is Analogous Art

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

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

708 Pet. at 92-101; 708 Reply at 24-26; Ex.1008 at 3:17-27, 8:47:51

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PHOSITA Can Implement Yabe within Giere178 without Undue Experimentation



Petitioners Expert
Dr. Steven Pond

708 Pet. at 51-61; 708 Reply at 21-24; Ex.2004 at 153:13-18

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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

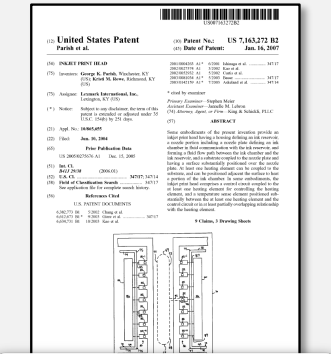
Grounds 5+6 **Giere178 (Alone or Combined With Yabe) in view of Parish**

708 Pet. at 101-105; 708 Reply at 28

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708 Patent

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



Ex. 1006 Parish

"[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."

708 Pet. at 101-105; 708 Reply at 28; Ex.1006 at 5:35-39; Ex.1002 at ¶¶446-452

PO

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

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Grounds Shared Between the ’708 and ’823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Ground 3 **Benjamin Combined with Giere178**

Ground 4 **Yabe Combined with Giere673**

Ground 5 **Yabe Combined with Giere673 in view of Parish**

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Grounds Shared Between the ’708 and ’823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Ground 3 **Benjamin Combined with Giere178**

Ground 4 Yabe Combined with Giere673

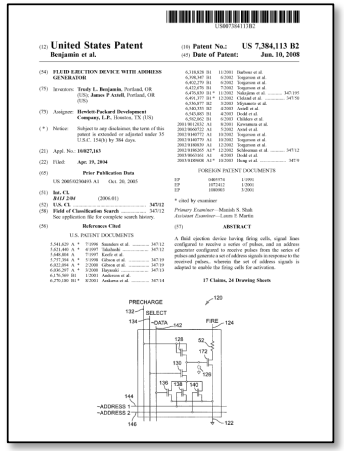
Ground 5 Yabe Combined with Giere673 in view of Parish

823 Pet. at 62-78; 708 Reply at 17-26

Canon’s Demonstratives, not evidence

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Benjamin Discloses the Claimed Heater Chip Arrangement



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

(10) **Patent No.: US 7,384,113 B2**
(45) **Date of Patent: Jun. 10, 2008**

(54) **FLUID EJECTION DEVICE WITH ADDRESS GENERATOR**

(75) Inventors: **Trudy L. Benjamin**, Portland, OR (US); **James P Axtell**, Portland, OR (US)

(73) Assignee: **Hewlett-Packard Development Company, L.P.**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 384 days.

(21) Appl. No.: **10/827,103**

(22) Filed: Apr. 19, 2004

(65) **Prior Publication Data**

US 2005/0230403 A1 Oct. 20, 2005

(51) **Int. Cl.**
B41J 2/04 (2006.01)

(52) **U.S. Cl.** 347/12

(58) **Field of Classification Search** 347/12
See application file for complete search history.

(56) **References Cited**

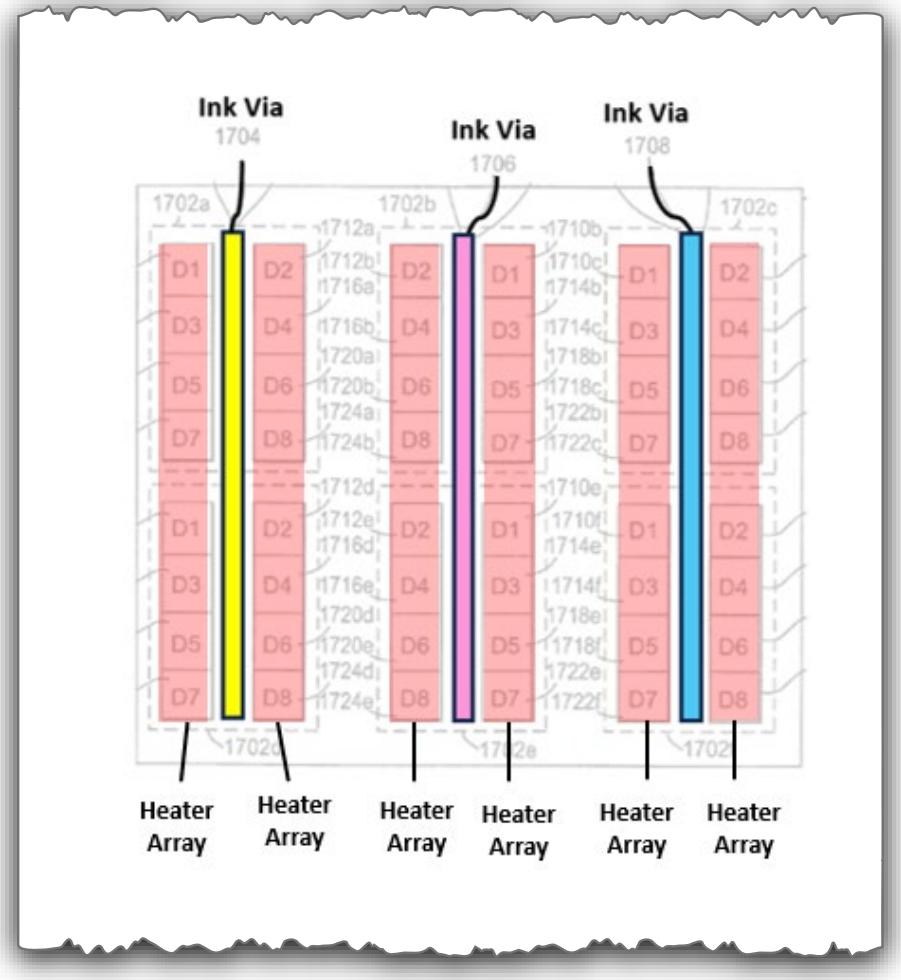
U.S. PATENT DOCUMENTS

(57) **ABSTRACT**

A fluid ejection device having firing cells, signal lines configured to receive a series of pulses, and an address generator configured to receive signals from the series of pulses and generate a set of address signals in response to the received pulses, wherein the set of address signals is adapted to enable the firing cells for activation.

17 Claims, 24 Drawing Sheets

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,

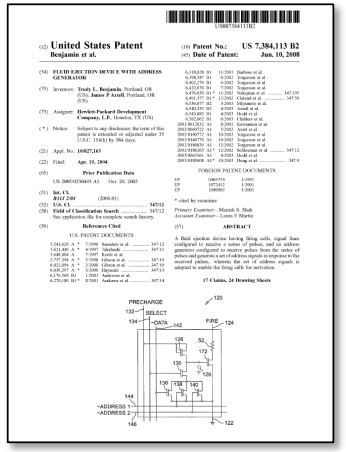
wherein the third heater array and the fourth heater array are operable to receive heating responsive to the temperature of the second region sensed by the temperature sensing element, and wherein the received heating regulates the temperature of the region.

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

Canon's Demonstratives, not evidence

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IPR2023-00312 - U.S. Patent No. 7,484,823

Benjamin Discloses the Claimed Heater Chip Arrangement



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

(10) **Patent No.: US 7,384,113 B2**
(45) **Date of Patent: Jun. 10, 2008**

(54) **FLUID EJECTION DEVICE WITH ADDRESS GENERATOR**

(75) Inventors: **Trudy L. Benjamin**, Portland, OR (US); **James P Astill**, Portland, OR (US)

(73) Assignee: **Hewlett-Packard Development Company, L.P.**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 384 days.

(21) Appl. No.: **10/827,163**

(22) Filed: Apr. 19, 2004

(65) **Prior Publication Data**

US 2005/0230469 A1 Oct. 20, 2005

(51) **Int. Cl.**
B41J 2/04 (2006.01)

(52) **U.S. Cl.** **347/12**

(58) **Field of Classification Search** **347/12**
See application file for complete search history.

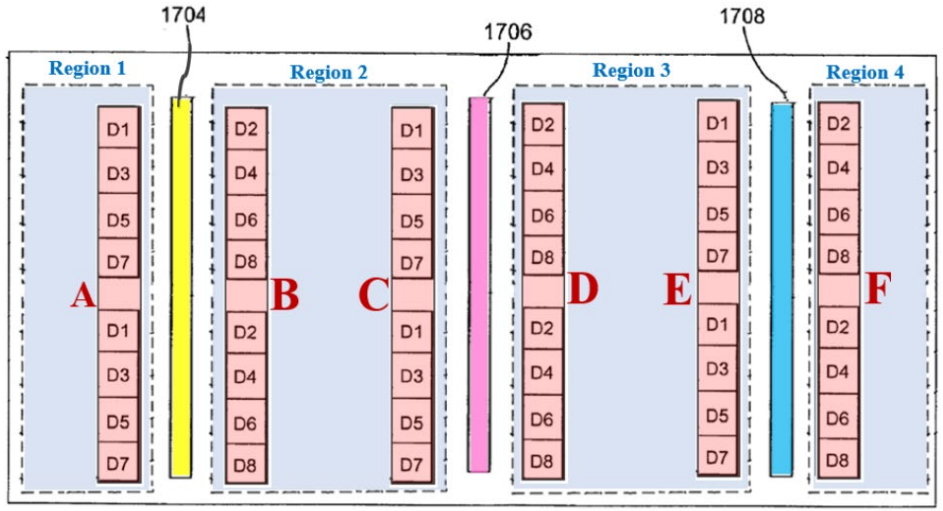
(56) **References Cited**

U.S. PATENT DOCUMENTS

FOREIGN PATENT DOCUMENTS

(57) **ABSTRACT**

17 Claims, 24 Drawing Sheets



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

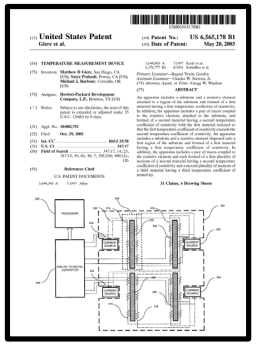
a second temperature sensing element operable to sense the temperature of the second region, wherein the temperature sensing element is substantially centrally disposed with respect to the second region and substantially adjacent to both the third heater array and fourth heater array,

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.

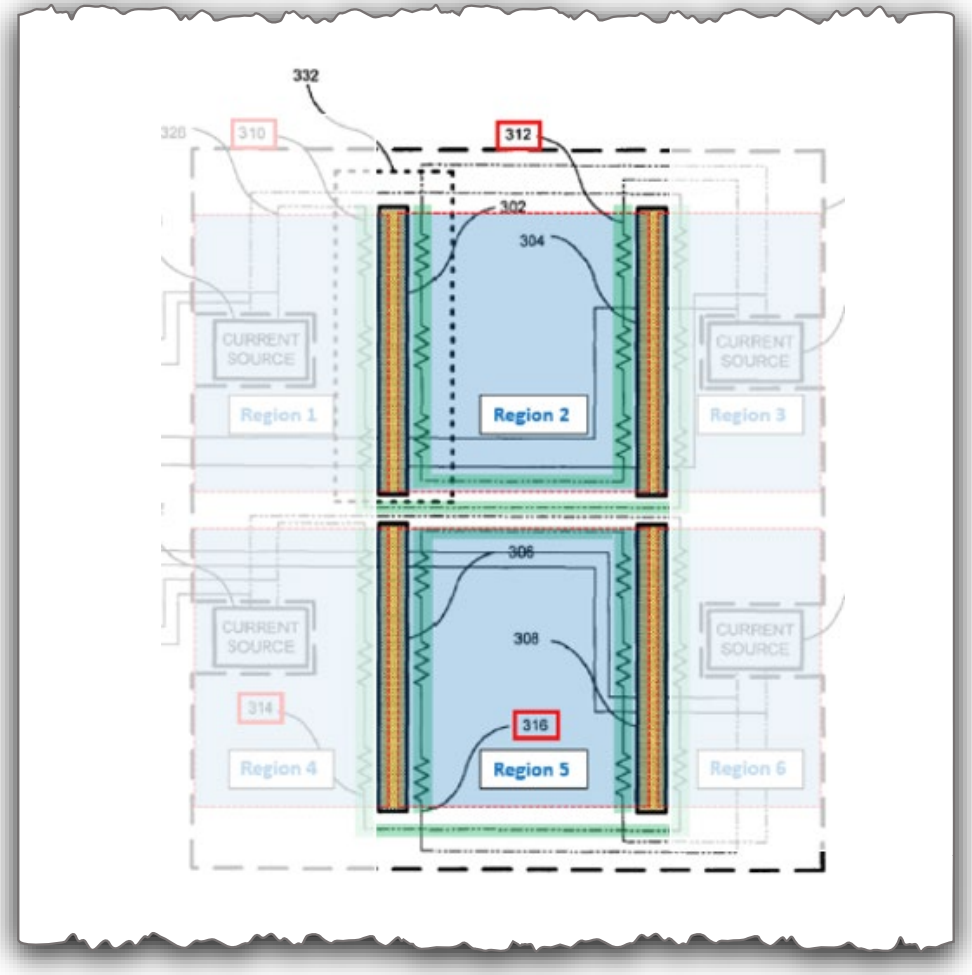
823 Pet. at 6-7, 19-21, 36-40, 64; Ex.1004 at 5:15-21, 63:20-24, Fig. 21

Canon's Demonstratives, not evidence

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;

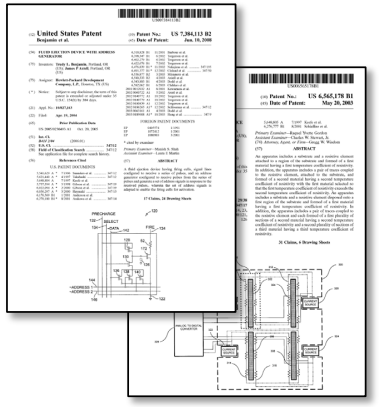
a third heater array, positioned substantially adjacent the second via;

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

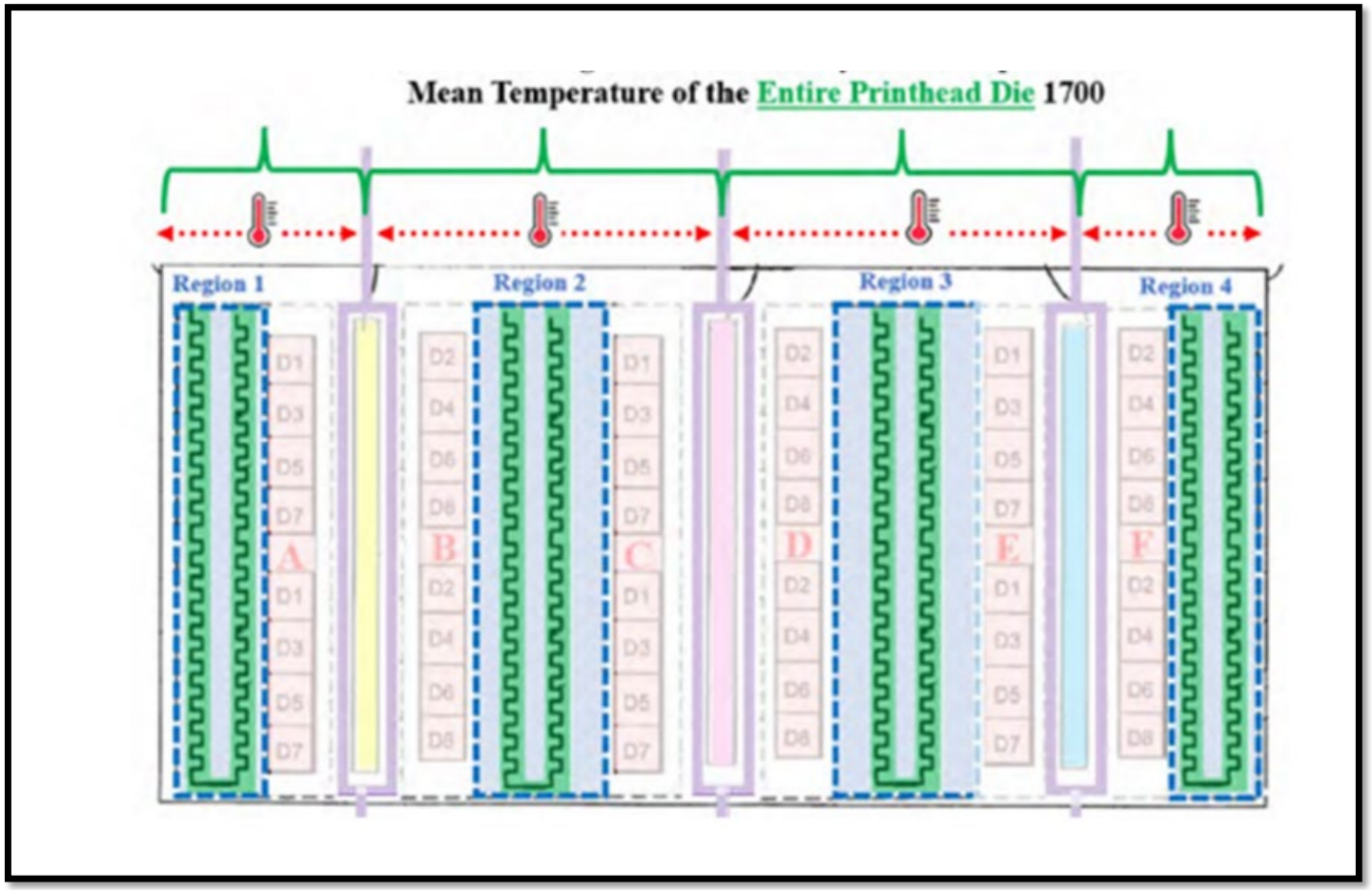
a second region, positioned between the third heater array and the fourth heater array, and also positioned substantially immediately adjacent to the third heater array and the fourth heater array; and

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



823 Pet. at 64-70; 823 Reply at 17-25; Ex.1002, ¶¶415-426

Canon's Demonstratives, not evidence

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Grounds Shared Between the ’708 and ’823 Patents

Ground 1. Benjamin Combined with Giere673

Ground 2 Benjamin Combined with Giere673 in view of Parish

Ground 3 Benjamin Combined with Giere178

Ground 4 Yabe Combined with Giere673

Ground 5 Yabe Combined with Giere673 in view of Parish

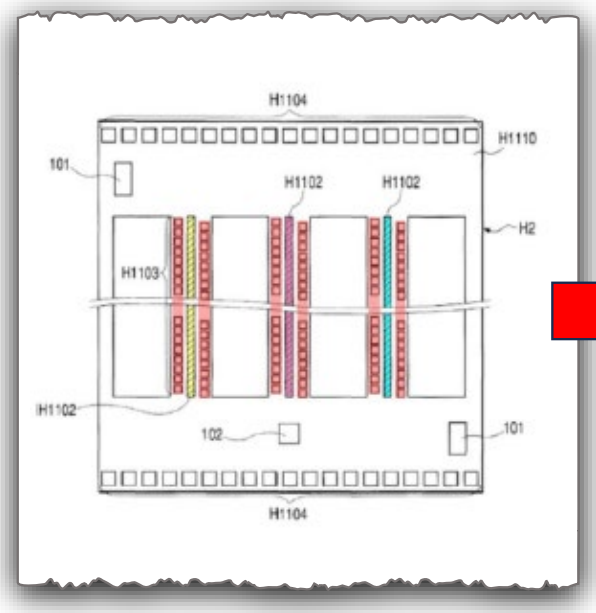
823 Pet. at 78-117; 708 Reply at 26-31

Canon’s Demonstratives, not evidence

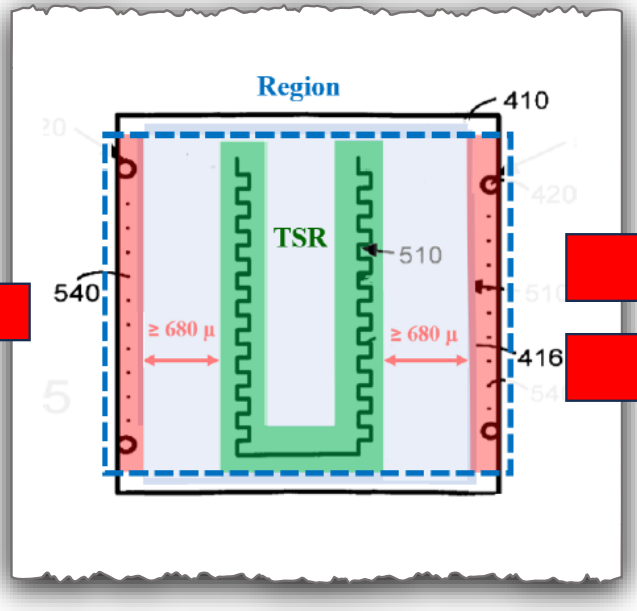
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Giere673 Centrally Disposes a TSR Between Two Heater Arrays

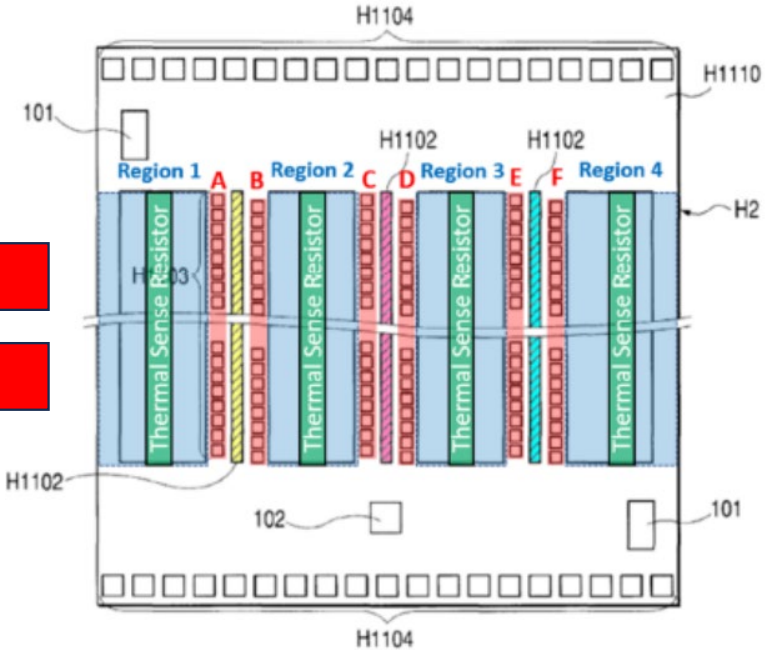
Yabe



Giere673



Yabe-Giere673



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

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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**

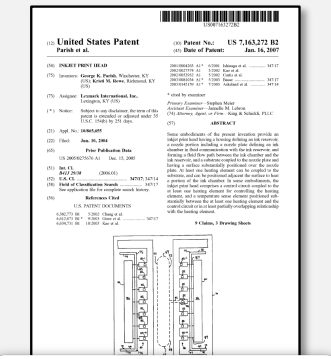
823 Pet. at 117-118; 708 Reply at 31-32

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

823 Patent

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



United States Patent
Parish et al.

(12) (10) Patent No.: US 7,163,272 B2
(45) Date of Patent: Jan. 16, 2007

(54) INKJET PRINT HEAD

(75) Inventors: George K. Parish, Winchester, KY (US); Kristi M. Howe, Richmond, 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 231 days.

(21) Appl. No.: 10/865,695

(22) Filed: Jun. 10, 2004

(65) Prior Publication Data

US 2005/0275676 A1 Dec. 15, 2005

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

(52) U.S. Cl. 347/57; 347/14

(58) Field of Classification Search 347/17
See application file for complete search history.

(56) References Cited

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6,382,771 B1 5/2002 Chung et al.
6,698,870 B2 3/2004 Kubota et al.
6,698,870 B1 10/2005 Kao et al.

* cited by examiner

Primary Examiner—Stephen Meier
Assistant Examiner—Shelby Fidler
(74) Attorney, Agent, or Firm—King & Schickli, PLLC

(57) ABSTRACT

Some embodiments of the present invention provide an inkjet print head having a housing defining an ink reservoir, a nozzle portion including a nozzle plate defining an ink ejection nozzle therethrough, a heater chip at least partially forming a fluid flow path between the ink chamber and the ink reservoir, and a substrate coupled to the nozzle plate and to the heater chip and at least partially supporting the nozzle plate. At least one bonding element can be coupled to the substrate, and can be positioned adjacent the surface to least portions of the ink chamber. In some embodiments, the inkjet print head comprises a control circuit coupled to the heater chip, a flex circuit coupled to the at least one bonding element, and a compressive sensor element positioned substantially between the at least one bonding element and the control circuit to at least partially overlapping relationship with the bonding element.

9 Claims, 3 Drawing Sheets

Ex. 1006 Parish

"[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."

823 Pet. at 117-118; 708 Reply at 31-32; Ex.1006 at 5:35-39; Ex.1002 at ¶¶601-624

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POR Presents No Patentability Arguments Unique to Grounds 5 and 6

PO

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

823 POR at 72

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