

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

Petitioners

v.

Slingshot Printing LLC,

Patent Owner

Case No. IPR2023-00309

Patent No. 7,290,864

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 7,290,864**

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EXHIBIT LIST

Ex.1001	U.S. Patent No. 7,290,864 to King <i>et al.</i>
Ex.1002	Declaration of Stephen F. Pond, Ph.D.
Ex.1003	<i>Curriculum Vitae</i> of Stephen F. Pond
Ex.1004	File History of U.S. Patent 7,290,864
Ex.1005	U.S. Patent No. 7,722,144 to Benjamin <i>et al.</i> (“Benjamin-144”)
Ex.1006	U.S. Patent No. 7,278,703 to Benjamin <i>et al.</i> (“Benjamin-703”)
Ex.1007	U.S. Patent No. 6,582,062 to Childers <i>et al.</i> (“Childers”)
Ex.1008	Japanese Patent Application Publication No. 11-245409 to Uenishi <i>et al.</i> , English Translation, and Affidavit (“Uenishi”)
Ex.1009	U.S. Patent Publication No. 2001/0045967 to Hayasaki (“Hayasaki”)
Ex.1010	Order Granting Stay of <i>Slingshot Printing LLC v. Canon U.S.A., Inc. et al.</i> , Case No. 2:22-cv-01852, Dkt. 42 (E.D.N.Y. Dec. 1, 2022)
Ex.1011	Case Management Schedule for <i>Slingshot Printing LLC v. Canon U.S.A., Inc. et al.</i> , Case No. 2:22-cv-01852, Dkt. 36-1 (E.D.N.Y. Nov. 2, 2022)
Ex.1012	Slingshot LLC’s Infringement Contentions for <i>Slingshot Printing LLC v. Canon U.S.A., Inc. et al.</i> , Case No. 2:22-cv-01852, (E.D.N.Y.)
Ex.1013	THE PENGUIN DICTIONARY OF ELECTRONICS (Valerie Illingworth ed.) (3d ed. 1998)

Ex.1014	Claim Construction Order for <i>Slingshot Printing LLC v. HP, Inc.</i> , Case No. 1:20-cv-00186-ADA, Dkt. 82 (W.D.T.X. Jan. 14, 2021)
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I. INTRODUCTION

Pursuant to 35 U.S.C. § 311 and 37 C.F.R. § 42.100 et seq., Petitioners request *Inter Partes* Review (“IPR”) of claims 1-6, 8-20 (“Challenged Claims”) of U.S. Patent No. 7,290,864 (“’864 Patent,” Ex.1001), purportedly owned by Slingshot Printing LLC (“Patent Owner”).

II. MANDATORY NOTICES

Real Party-in-Interest: The real parties-in-interest are **Canon U.S.A., Inc.** and **Canon Inc.**

Related Matters: The ’864 Patent was asserted against Petitioner Canon U.S.A., Inc. as well as Canon Solutions America, Inc. in *Slingshot Printing LLC v. Canon U.S.A., Inc., et al.*, No. 2:22-cv-01852 (E.D.N.Y.), which was filed on April 1, 2022. The ’864 Patent was previously asserted against HP Inc. in *Slingshot Printing LLC v. HP Inc.*, No. 6:19-cv-00549, reassigned as No. 1:20-00187 (W.D. Tex.). That case was dismissed with prejudice on April 1, 2021 following the parties’ joint stipulation of dismissal. Petitioners are not aware of the ’864 Patent being asserted against other parties.

Lead Counsel: Dion M. Bregman (Reg. No. 45,645); Back-up Counsel: Amanda S. Williamson (Reg. No. 73,683), Jason E. Gettleman (Reg. No. 55,202), and James J. Kritsas (Reg. No. 71,714).

Service: Service of any documents may be made on Morgan, Lewis & Bockius LLP, 1400 Page Mill Road, Palo Alto, CA, 94304 (Telephone: 650.843.4000; Fax: 650.843.4001). Petitioners consent to e-mail service at: CanonSlingshotIPRs@morganlewis.com.

III. IDENTIFICATION OF CLAIMS AND GROUNDS

'864 Patent: This patent was filed on September 30, 2005, and has an earliest possible priority date of **September 30, 2005**. It is subject to the pre-AIA provisions of 35 U.S.C. §§ 102 and 103.

Benjamin-144: U.S. Patent No. 7,722,144 titled “Fluid Ejection Device” to Trudy L. Benjamin, James P. Axtell, Joseph M. Torgerson, and Michael D. Miller (“Benjamin-144,” Ex.1005), was filed **April 19, 2004**, and published May 25, 2010, and is prior art under § 102(e).

Benjamin-703: U.S. Patent No. 7,278,703 titled “Fluid Ejection Device With Identification Cells” to Trudy L. Benjamin, Joseph M. Torgerson, and William S. Eaton (“Benjamin-703,” Ex.1006), was filed **April 19, 2004**, and published October 9, 2007, and is prior art under § 102(e).

Childers: U.S. Patent No. 6,582,062 titled “Large Thermal Ink Jet Nozzle Array Printhead” to Winthrop D. Childers and Douglas A. Sexton (“Childers,” Ex.1007), was filed October 18, 1999, and published **June 24, 2003**, and is prior art under § 102(b).

Uenishi: Japanese Patent Application Publication No. 11-245409 titled “Thermal Inkjet Head” to Katsuzo Uenishi and Morio Ota (“Uenishi,” Ex.1004), was filed on February 27, 1998 and published **September 14, 1999**, and is prior art under § 102(b).

Hayasaki: U.S. Patent Application Publication No. 2001/0045967 titled “Printhead, Printhead Driving Method, and Data Output Aparatus” to Kimiyuki Hayasaki (“Hayasaki,” Ex.1009), was filed January 29, 2001 and published **November 29, 2001**, and is prior art under § 102(b).

Petitioners request that the Board find each of the Challenged Claims invalid on the following grounds:

Ground	Prior Art	Statutory Basis	Claims
1	Benjamin-144 and Benjamin-703	§ 103	1-3, 5-6, 8-10, 13-15
2	Benjamin-144, Benjamin-703, and Childers	§ 103	4, 11-12, 16-20
3	Uenishi	§ 102	1, 3, 5-6, 8-10, 13, 15
4	Uenishi and Hayasaki	§ 103	4, 11-12

IV. CERTIFICATION AND FEES

Petitioners certify that the '864 Patent is available for IPR and that Petitioners are not barred or estopped from requesting this IPR on the grounds identified herein.

Any additional fees may be charged to Deposit Account No. 50,0310 (Order No. 132261-0003).

V. PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION

The PTAB should not discretionarily deny institution per *Fintiv*, as the Petition is particularly strong in the underlying merits. *See, e.g., Apple Inc. v. RFCyber Corp.*, IPR2022-00412, Paper 11 at 33-34 (PTAB July 21, 2022); Interim Procedure for Discretionary Denials In AIA Post Grant Proceedings With Parallel District Court Litigation, PTO Director's Memorandum, 9 (June 21, 2022).

Moreover, the stage of the parallel district court litigation does not support denying institution based on the *Fintiv* factors:

Factor 1 favors institution because the district court has granted a temporary stay and will extend that stay upon the filing of this Petition. Ex.1010.

Factor 2 favors institution because the district court litigation is in its early stage with **no trial date set**. Trial cannot occur until **after** the last set date in the parties' Case Management Schedule, i.e., **October 25, 2024**. Ex.1011. Moreover, the median time to trial in EDNY is 48.9 months (~4 years). Thus, the final written decision will be issued well before any trial date.

Factor 3 favors institution because the litigation was stayed in its early stages (no claim construction or dispositive motions have been filed). Exs.1010-1011.

Factor 4 favors institution because Petitioners challenge every claim asserted in the litigation and multiple claims that have not been asserted (claims 1-6, 8-20). *See* Ex.1012 (asserting claims 1-6, 8-17, and 19-20). The invalidity contentions include prior art cited in this Petition making it more efficient for the Board to handle the overlapping prior art.

Factor 5 is neutral because Petitioner Canon U.S.A., Inc. is a defendant in the district court litigation, but Petitioner Canon Inc. is not a party to that litigation.¹

Factor 6 favors institution and is **dispositive** under the Guidance because the **unpatentability challenges here are compelling and rely on references that were not before the Office**. This IPR is the only challenge to the '864 Patent that has been before the Board, which favors institution, and there is a strong public interest against "leaving bad patents enforceable." *Thryv, Inc. v. Click-To-Call Techs., LP*, 140 S. Ct. 1367, 1374 (2020).

Because all *Fintiv* factors favor institution or are neutral, Petitioners respectfully request that the Board decline discretionarily denying review.

¹ Canon Solutions America, Inc. in the litigation is not a real-party-in interest here.

VI. LEVEL OF SKILL

A person having ordinary skill in the art (“PHOSITA”) at the time of the alleged invention would have been a person holding a Bachelor’s or Master’s level college degree in Mechanical Engineering, Materials Science, Physics, Electrical Engineering, or a related field, and two years of training or experience in the design of inkjet printheads or semiconductor circuit layout. Ex.1002, ¶¶55-57.

VII. CLAIM CONSTRUCTION

Claims are given the same construction as they are given in district court pursuant to *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). Petitioners propose that claim terms in the Challenged Claims be afforded their plain and ordinary meaning.

Petitioners note that “ink via” in independent claims 1, 8, and 16 has not been previously construed in the context of the ’864 patent. Judge Albright in the Western District of Texas construed “ink via” as used in another Slingshot patent (U.S. Patent No. 7,559,629) during a previously litigation asserted by Slingshot to mean “[a] path to fluidly connect [a] supply of ink to one or more heaters.” Ex.1014, 4. The ’864 Patent and U.S. Patent No. 7,559,629 both have the same sole inventor, David. G. King, both were filed in 2005, and both are in the same class—B41J2/14072. Petitioners’ analysis is the same under either the plain and ordinary meaning or this construction.

VIII. ARGUMENT

A. Ground 1: Benjamin Combination Renders Obvious Claims 1-3, 5-6, 8-10, and 13-15

1. Claim 1²

a. *1[P] “A heater chip for use in a printing device”*

The preamble is non-limiting because it merely recites the purported invention’s intended use. *See, e.g., Kaidi LLC et al. v. Limoss US, LLC*, IPR2019-01184, Paper 16 at 12-13 (PTAB Dec. 11, 2019). Nonetheless, the Benjamin Combination discloses 1[P]. Ex.1002, ¶¶60-68.

Figure 1 illustrates “an inkjet printing system 20,” i.e., inkjet printer, that “includes a fluid ejection device, such as **inkjet printhead assembly 22...**,” which “includes one **printhead 40.**” Ex.1005, 3:23-27, 4:46-47.

² A full claim listing can be found in the Appendix.

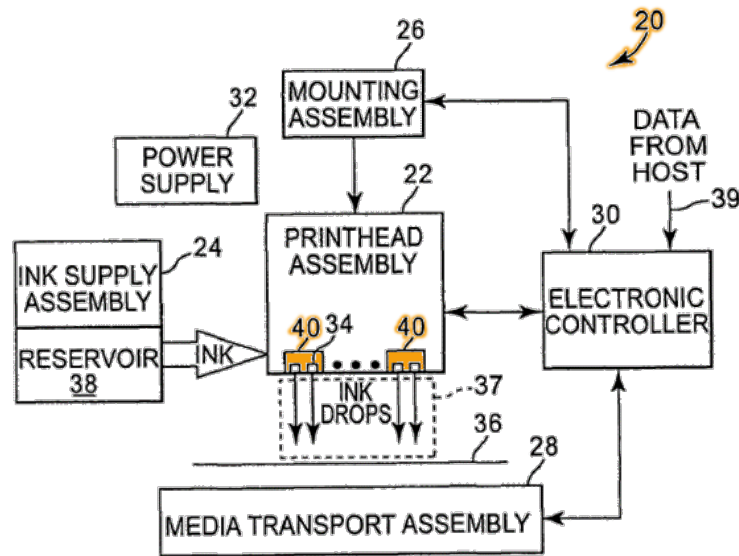


Fig. 1

Ex.1005, Figure 1³

Figure 3 “is a diagram illustrating drop generators 60 located along ink feed slot 46 in one embodiment of **printhead die 40**.” Ex.1005, 5:46-47. A “die” is defined as a “chip.” See Ex.1013, 125. Benjamin-144 explains, “[t]he **firing resistors 52** of drop generators 60 are energized in a controlled sequence to eject fluid from vaporization chambers 56 and through nozzles 34 to print an image on print medium 36.” Ex.1005, 5:64-67.

³ Color or annotations added for clarity throughout.

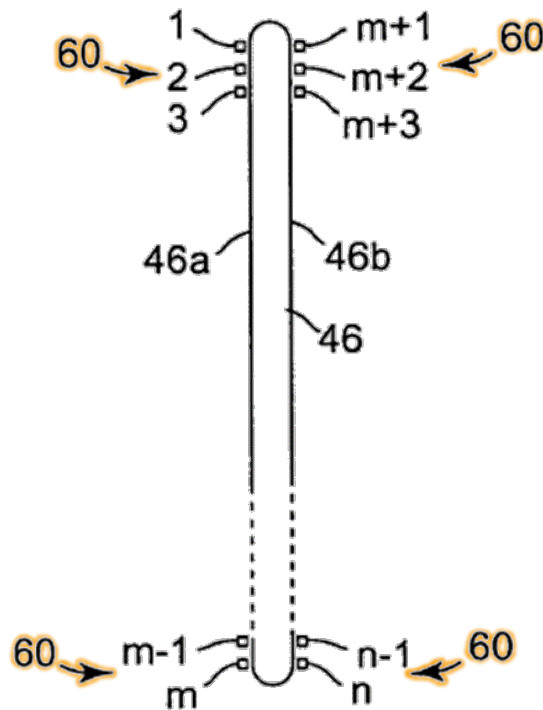
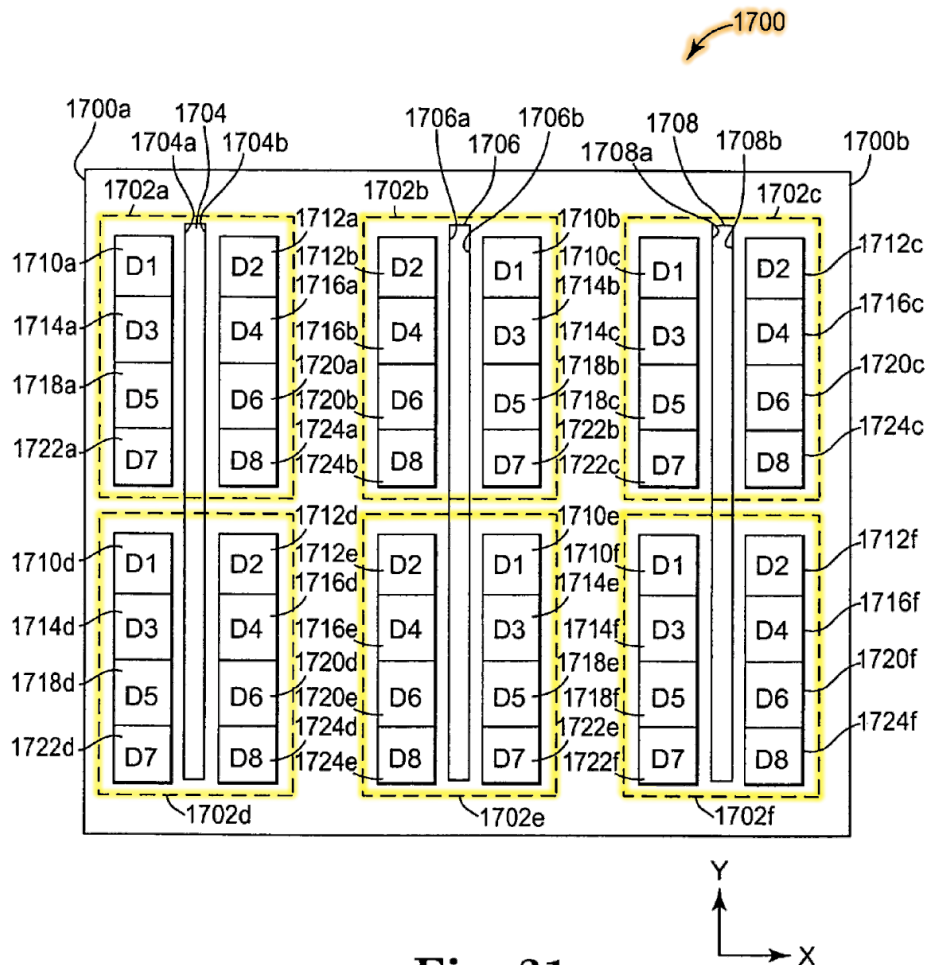
**Fig. 3****Ex.1005, Figure 3**

Figure 21 provides “a diagram illustrating an example layout of one embodiment of a **printhead die 1700**” that “includes six **fire groups 1702a-1702f...**” Ex.1005, 63:20-24.

**Fig. 21****Ex.1005, Figure 21.**

The **printhead die 1700** in Benjamin-144 corresponds to the claimed “heater chip for use in a printing device” because a PHOSITA would have understood that the claim term “heater chip” is synonymous with Benjamin-144’s **printhead die**. Ex.1002, ¶¶66-67.

Accordingly, Benjamin-144 discloses a **heater chip** [e.g., printhead die 1700] **for use in a printing device** [e.g., inkjet printer]. Ex.1002, ¶¶60-68.

b. $1[A]$ “an ink via”

The Benjamin Combination discloses $1[A]$. Ex.1002, ¶¶69-81.

Figure 21 provides “a diagram illustrating an example layout of one embodiment of a printhead die 1700.” Ex.1005, 63:20-21.

Benjamin-144 explains, that “printhead die 1700 includes six fire groups 1702a-1702f disposed along **three ink fluid feed sources**, here depicted as **feed slots 1704 [red]**, 1706 and 1708.” Ex.1005, 63:21-24.

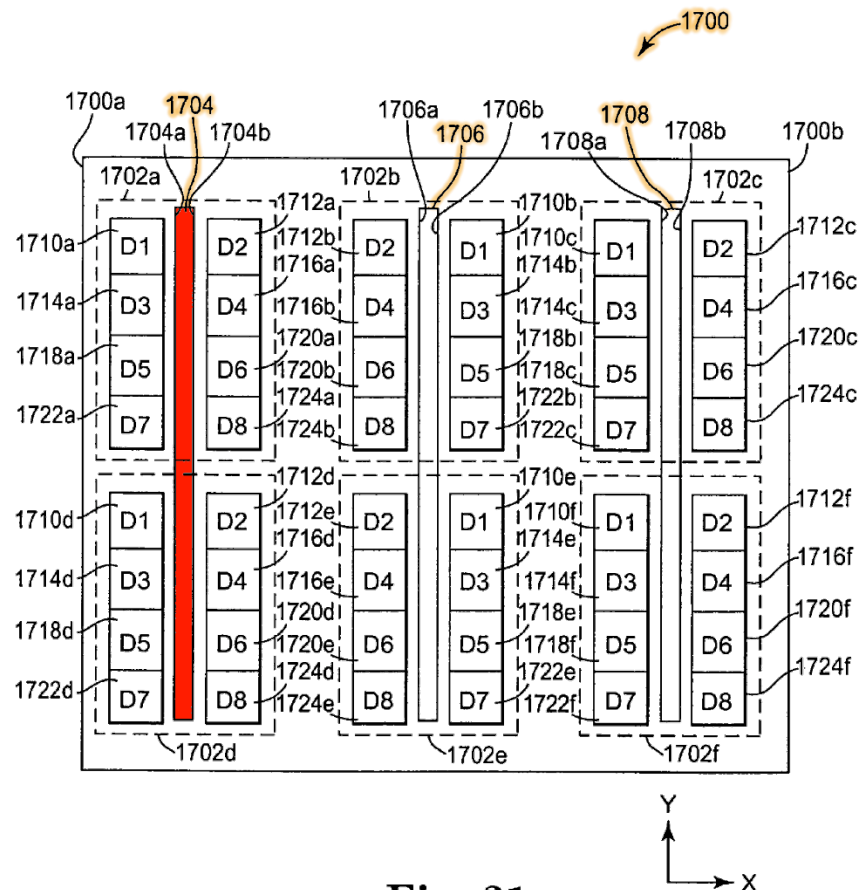


Fig. 21

Ex.1005, Figure 21.

Accordingly, Benjamin Combination discloses “an **ink via** [e.g., ink fluid feed sources, including feed slot 1704].” Ex.1002, ¶¶69-72.

- c. 1[B] “a first heater array adjacent at least a portion of one side of the ink via; a second heater array adjacent at least a portion of another side of the ink via”*

The Benjamin Combination discloses 1[B]. Ex.1002, ¶¶73-81.

Figure 21, below, shows “printhead die 1700 includes six fire groups 1702a-1702f disposed along three ink fluid feed sources, here depicted as **feed slots 1704 [red]**, 1706 and 1708.” Ex.1005, 63:21-24. Benjamin-144 explains that “[t]he fire groups 1702a-1702f are divided into eight data line groups, indicated at D1-D8” and that “[e]ach data line group D1-D8 includes **pre-charged firing cells 120** from each of the fire groups 1702a-1702f.” Ex.1005, 63:39-42. Benjamin-144 teaches “[p]re-charged firing cell 120 is one embodiment of firing cell 70” and that “[f]iring cell 70 includes a **firing resistor 52**...[that] is part of a drop generator 60.” Ex.1005, 8:7-8, 6:3-5.

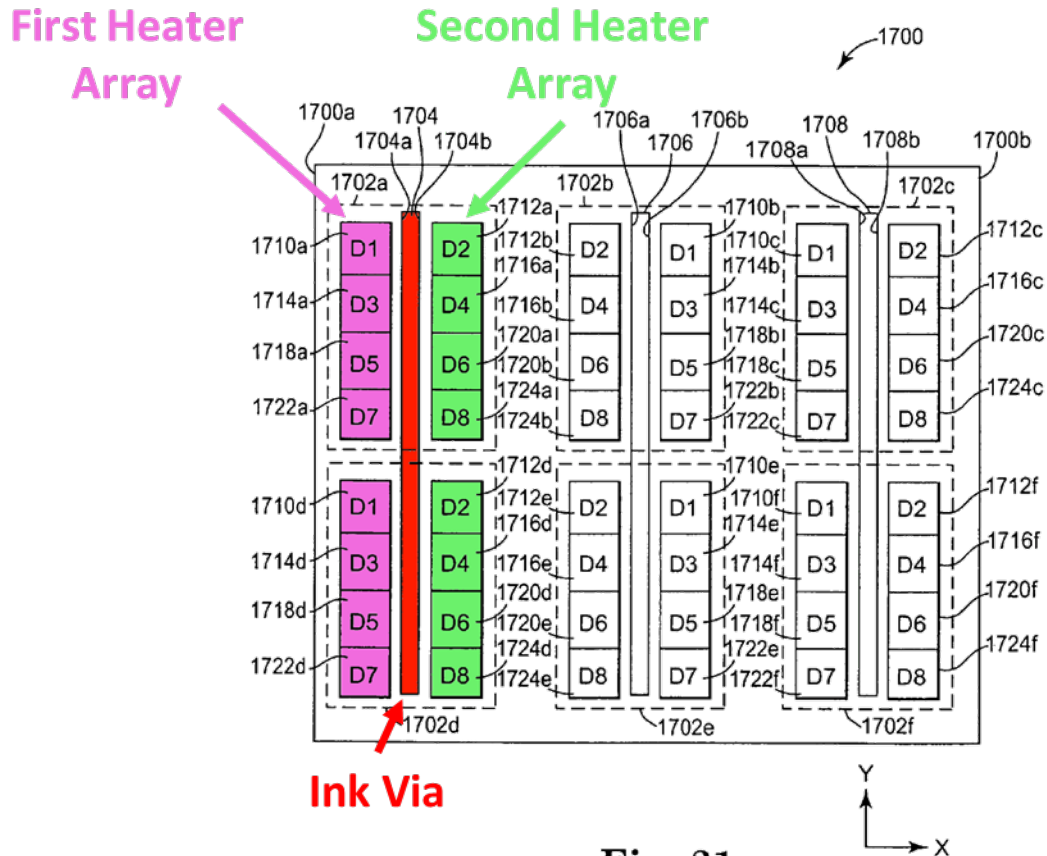


Fig. 21

Ex.1005, Figure 21.

Figure 21 shows “[d]rop generators 60 in data line groups D1, D3, D5 and D7 [magenta]...are disposed along one side 1704a of ink feed slot 1704 [red] and drop generators 60 in data line groups D2, D4, D6 and D8 [green]...are disposed along the opposing side 1704b of ink feed slot 1704.” Ex.1005, 64:9-14; *see also*, *id.*, 64:51-57, 67:36-38, Figure 22.

Accordingly, the Benjamin Combination discloses “a **first heater array** [e.g., vertical array of firing resistors 52 within drop generators 60 in 1710a-1714a-1718a-1722a-1710d-1714d-1718d and 1722d (magenta)] **adjacent** at least a **portion** of one

side of the ink via [e.g., side 1704a of ink feed slot 1704]; a **second heater array** [e.g., vertical array of firing resistors 52 within drop generators 60 in 1712a-1716a-1720a-1724a-1712d-1716d-1720d and 1724d (green)] **adjacent** at least a **portion** of **another side** of the **ink via** [e.g., side 1704b of ink feed slot 1704].” Ex.1002, ¶¶73-81.

d. 1[C] “a bondpad wherein the bondpad supplies power to at least a portion of the first heater array and to at least a portion of the second heater array”

The Benjamin Combination discloses 1[C]. Ex.1002, ¶¶82-102.

Figures 21-22 below show the “printhead die 1700 includes data lines 208a-208h, fire lines 214a-214f [214a, 214d in orange], ink feed sources, e.g. ink feed slots 1704 [red], 1706 and 1708 and the six fire groups 1702a-1702f.” Ex.1005, 67:38-41.

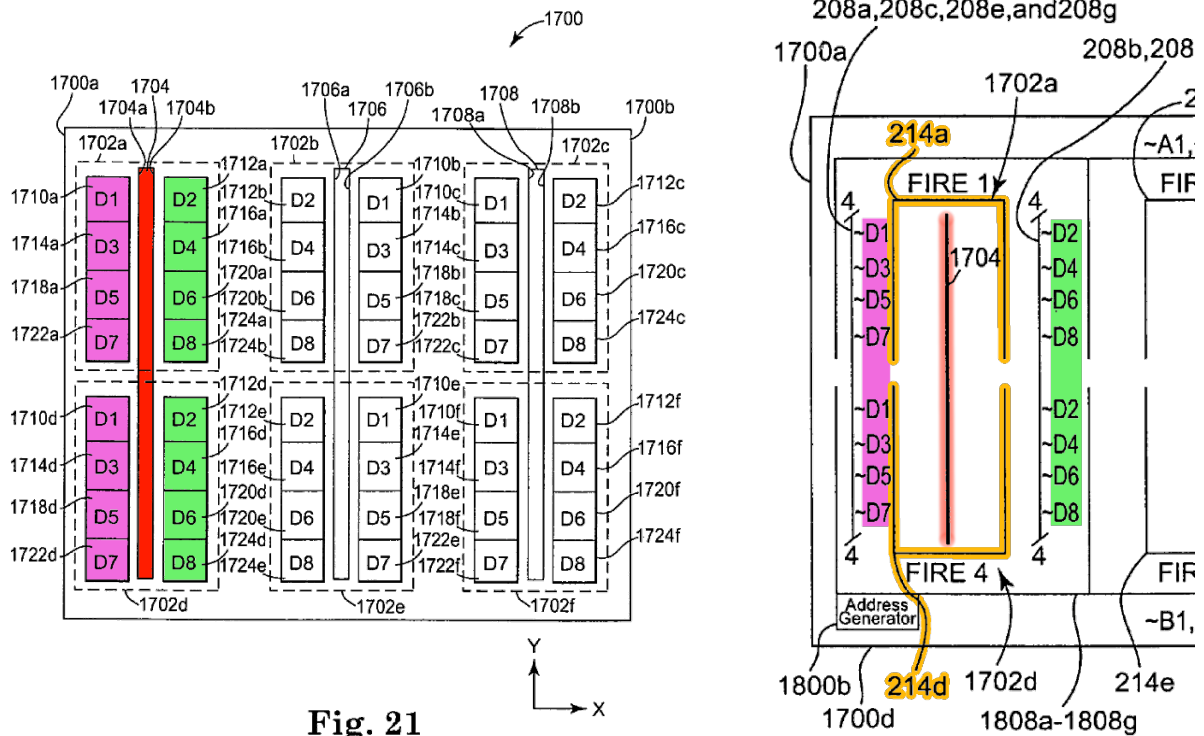


Fig. 21

Ex.1005, Figs. 21-22

Benjamin-144 explains its “fire groups 1702a-1702f are divided into eight data line groups, indicated at D1-D8,” and that “[e]ach data line group D1-D8 includes pre-charged firing cells 120 from each of the first groups 1702a-1702f.” Ex.1005, 63:39-42. Benjamin-144 teaches “[p]re-charged firing cell 120 is one embodiment of firing cell 70” and that “[f]iring cell 70 includes a **firing resistor 52**...[that] is part of a drop generator 60.” Ex.1005, 8:7-8, 6:3-5.

Benjamin-144 teaches that “fire lines **214a-214f are located along ink feed slots 1704, 1706 and 1708 to supply energy signals FIRE1, FIRE2...FIRE6 to the fire groups 1702a-1702f, respectively**” and that “**fire lines 214a-214f supply**

Benjamin-144 notes that “[e]ach of the **fire lines 214a-214f are disposed on both sides of an ink feed slot 1704, 1706 or 1708 and electrically coupled at one end of the ink feed slot 1704, 1706 or 1708 to form a substantially U-shaped fire line 214a-214f.**” Ex.1005, 70:17-21; *Id.*, 70:54-55, 71:8-9, 70:51-54, 11:5-7.

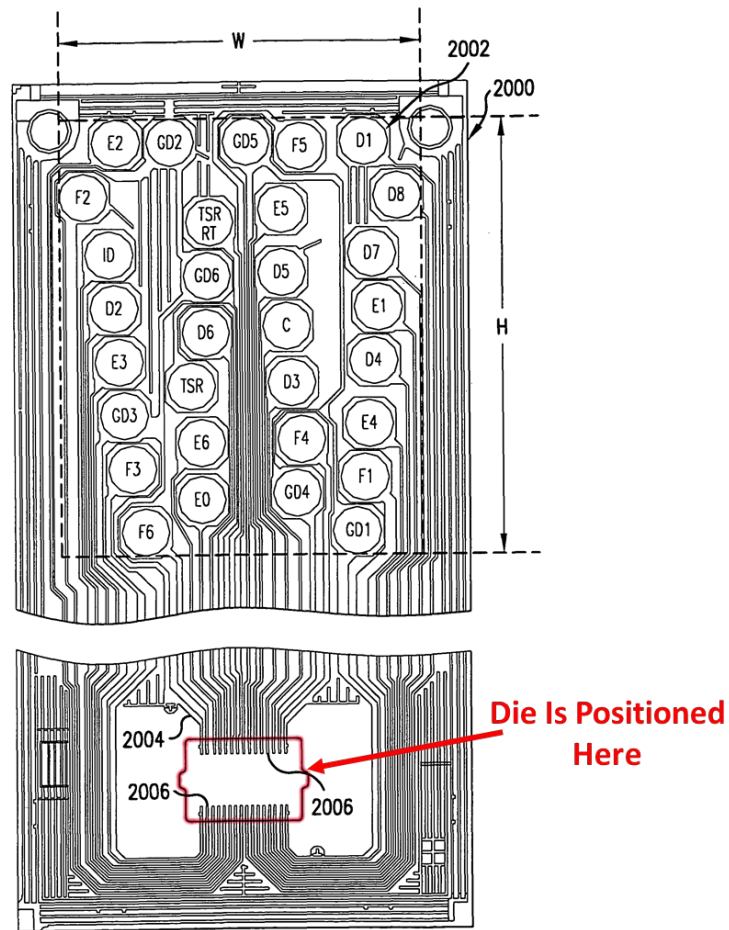


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energy signal FIRE1 to fire group 1702a and to the firing resistors 52 in fire group 1702a and that U-shaped fire line 214d (orange), located along both sides of the bottom half of ink feed slot 1704, supplies energy signal FIRE4 to fire group 1702d and to the firing resistors 52 in fire group 1702d.

Benjamin-144 teaches “**fire lines 214a-214f are electrically coupled to external supply circuitry by appropriate interface pads.** (See, FIGS. 25A and 25B).” Ex.1005, 11:9-12. Benjamin-144 refers to its **interface pads** as **bondpads** stating that “the **firing resistor 52 nearest the bond pad receiving the energy signal FIRE1, FIRE2...FIRE6,**” and uses the terms interface pads and bondpads interchangeably. Ex.1005, 75:63-67.

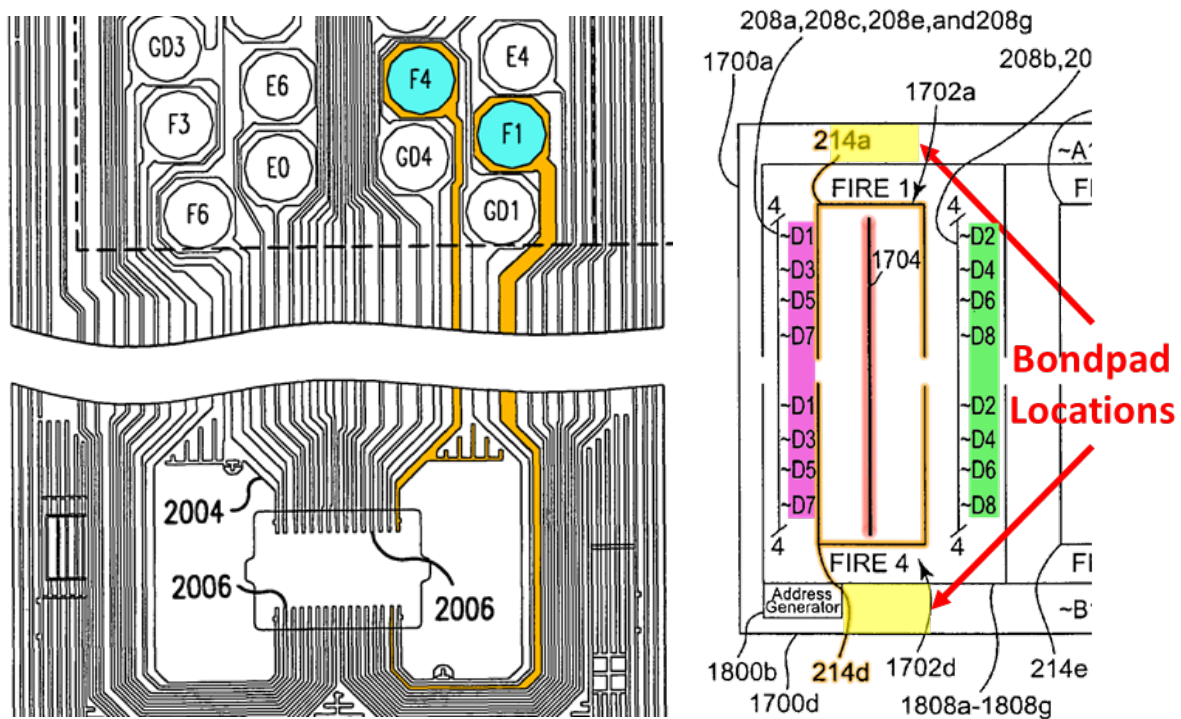
Benjamin-144’s fire line bondpads are shown in Benjamin-144’s figures. Figure 25B, below, shows “contact areas 2000 of a flex circuit 2002 that may be **utilized to couple external circuitry to a printhead die**” where the “contact areas 2000 are **electrically coupled via conductive paths 2004 to contacts 2006 which provide coupling to the printhead die.**” Ex.1005, 77:41-46.

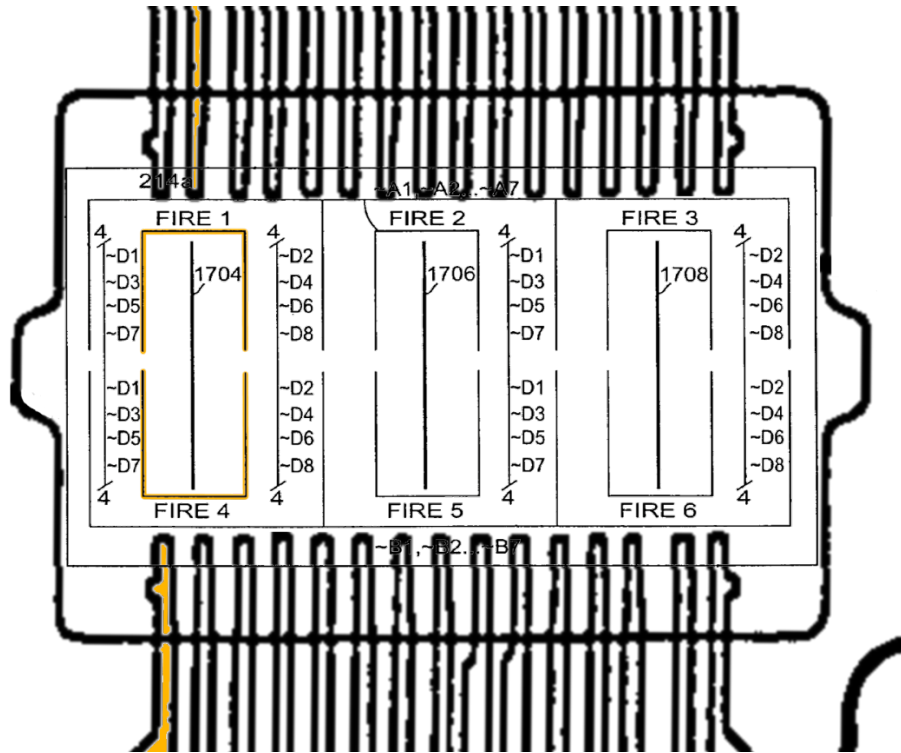


Ex.1005, Figure 25B

Benjamin-144 explains “[f]ire line contact areas **F1-F6...provide the energy signals along fire lines Fire1-Fire6 to the appropriate fire groups, e.g. fire groups 202a-202f and 1702a-1702f.**” Ex.1005, 77:61-63. Benjamin-144 further teaches “[t]he contact areas 2000 [i.e., F1-F6] are electrically coupled via conductive paths 2004 to contacts 2006 which provide coupling to the printhead die.” Ex.1005, 77:41-46.

In Figures 22 and 25B, fire line contact areas F1 and F4 [teal] send “energy pulses” from external circuitry “via conductive paths 2004 [orange] to contacts 2006 which provide coupling to the printhead die” on “flex circuit 2002.”





Ex.1005, Figs. 25B+22

Thus, Benjamin-144 teaches that an interface/bondpad supplies power to at least a portion of the first heater array and to at least a portion of the second heater array because, as seen in Figures 21-22 above, FIRE1 fire line spans heater arrays on both sides of the ink slot within fire group 1702a.

If PO contends Benjamin-144 does not expressly disclose a “bondpad wherein the bondpad supplies power to at least a portion of the first heater array and to at least a portion of the second heater array,” this would have been obvious in view of Benjamin-703.

Benjamin-703, which includes overlapping inventors, was filed on the same day as Benjamin-144 and includes identical specification portions, explicitly calls

out a bondpad (i.e., fire line input pad 704). Benjamin-703 figure 10, below, discloses that the “printhead die 40 includes...a **fire line input pad 706** [yellow].”

Ex.1006, 19:34-36.

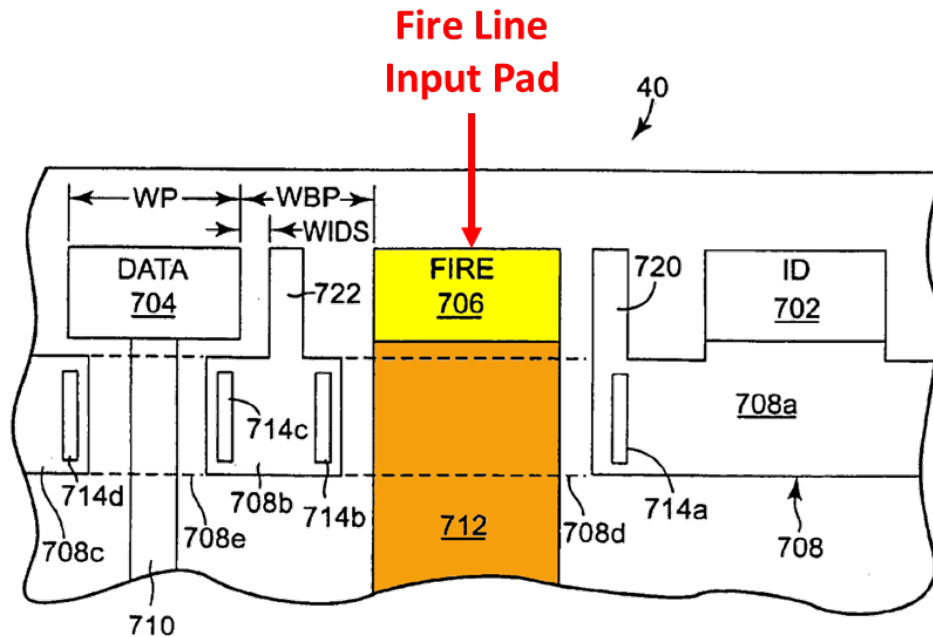


Fig. 10

Ex.1006, Figure 10

Benjamin-703 teaches “[t]he identification signal input pad 702, data line input pad 704 and **fire line input pad 706 are formed as part of the second metal layer of printhead die 40.**” Ex.1006, 19:36-39. Benjamin teaches “[t]he **fire line input pad 706 [yellow]** is electrically coupled to fire line 712 [orange] that is electrically coupled to firing cells 120 in printhead die 40.” Ex.1006, 19:45-47. Benjamin-703 is explicit that “[f]ire line 712 receives fire signal FIRE and provides fire signal FIRE to firing cells 120 in printhead die 40.” Ex.1006, 20:4-5.

A PHOSITA would have appreciated that Benjamin-144 includes the claimed bondpad or could have easily been modified to include Benjamin-703's fire line input pad 706 to "provide fire signal FIRE to firing cells 120 in printhead die 40" through "fire line 712." Ex.1002, ¶¶89-101.

Accordingly, the Benjamin Combination discloses "a **bondpad** [e.g., fire line bondpad/fire line input pad 706] wherein the bondpad **supplies power** [e.g., energy signal FIRE1 supplied by fire line contact areas F1 sent via conductive path 2004 to contact 2006 that interfaces with printhead die via a bondpad 706 that connects to fire line Fire1] **to at least a portion of the first heater array** [e.g., vertical array of firing resistors 52 within drop generators 60 in D1-D3-D5-D7 (1710a-1714a-1718a-1722a) of fire group 1702a] **and to at least a portion of the second heater array** [e.g., vertical array of firing resistors 52 within drop generators 60 in D2-D4-D6-D8 (1712a-1716a-1720a-1724a) of fire group 1702a]." Ex.1002, ¶¶82-102.

2. Claim 2

Claim 2 requires "[t]he heater chip of claim 1, further comprising a **second bondpad**, wherein the second bondpad **supplies power to another portion of the first heater array and to another portion of the second heater array**," which the Benjamin Combination discloses. Ex.1002, ¶¶104-114.

As discussed in Section VIII.A.1.d, limitation 1[C], incorporated here, each of fire lines 214a and 214d are disposed on both sides of the ink feed slot 1704.

Ex.1005, 70:17-21. Figure 2, below, shows the fire line 214d disposed on both sides of the bottom half of ink feed slot 1704. As in limitation 1[C], incorporated here, “[f]ire line 214d is electrically coupled to each of the pre-charged firing cells 120 in FG4 at 1702d.” Ex.1005, 70:54-55, 71:8-9.

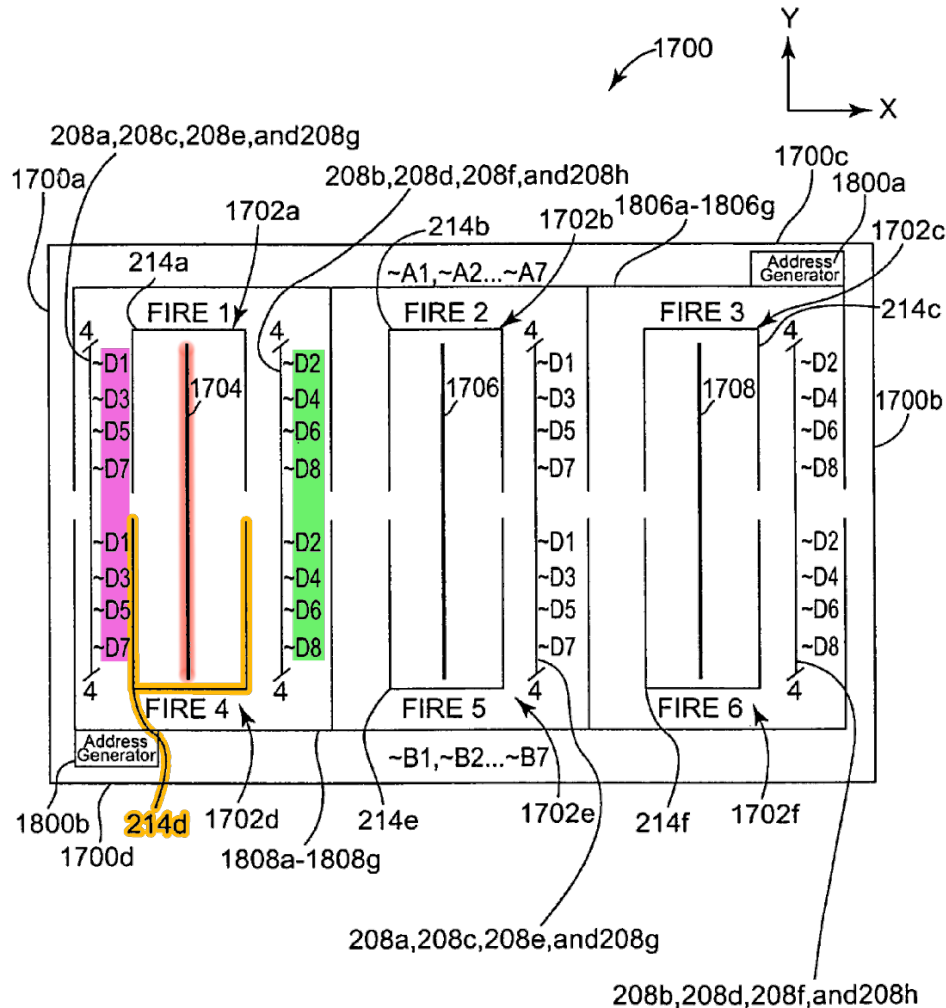


Fig. 22
Ex.1005, Figure 22

Thus, Benjamin-144 teaches that **U-shaped fire line 214d** located along both sides of the **bottom half** of ink feed slot 1704 supplies energy signal FIRE4 to the

firing resistors 52 in fire group 1702d. Fire line 214d provides energy to firing resistors located in both the first and second heater array. Section VIII.A.1.d; Ex.1005, 69:42-60.

As discussed in Section VIII.A.1.d, limitation 1[C], incorporated here, each of Benjamin-144's fire lines 214a-214f is connected to a fire line bondpad or fire line input pad 706. Ex.1005, 11:9-12, 75:63-67; Figure 25B, 77:41-46. Benjamin-703 is explicit "[t]he **fire line input pad 706 is electrically coupled to fire line 712 that is electrically coupled to firing cells 120 in printhead die 40.**" Ex.1006, 19:45-47.

Therefore, the Benjamin Combination discloses "[t]he heater chip of claim 1, further comprising a **second bondpad** [e.g., bondpad or interface pad 706], wherein the second bondpad **supplies power to** [e.g., energy signal FIRE4 supplied by fire line contact areas F4 sent via conductive path 2004 to contact 2006 that interfaces with printhead die via a bondpad that connects to fire line 214d] **another portion of the first heater array** [e.g., vertical array of firing resistors 52 within drop generators 60 in D1-D3-D5-D7 of fire group 1702d] **and to another portion of the second heater array** [e.g., vertical array of firing resistors 52 within drop generators 60 in D2-D4-D6-D8 of fire group 1702d]." Ex.1002, ¶¶104-114.

3. Claim 3

Claim 3 requires “[t]he heater chip of claim 1, wherein **the bondpad supplies power to the first heater array and the second heater array portions by power traces physically separated proximal to the bondpad,**” which the Benjamin Combination discloses. Ex.1002, ¶¶115-126.

As discussed in Section VIII.A.1.d, limitation 1[C], incorporated here, each of the Benjamin Combination’s fire lines 214a-214f supplies power to the first heater array and the second heater array portions via a bondpad or fire line input pad 706.

In figure 22, below, Benjamin-144’s fire lines 214a-214f are physically separated to form “a substantially U-shaped fire line”



26

The top of Benjamin-144's U-shaped fire line 214a is proximal to side 1700c of printhead die 1700, the location where energy signal FIRE1 is sent from interface or bondpad 706. Ex.1005, Fig.22.

Benjamin-703 teaches “[t]he **fire line input pad 706 [yellow]** is electrically coupled to **fire line 712 [orange]** that is electrically coupled to firing cells 120 in **printhead die 40.**” Ex.1006, 19:45-47. Benjamin-703 states that “[f]ire line 712 receives fire signal FIRE and provides fire signal FIRE to firing cells 120 in printhead die 40.” Ex.1006, 20:4-5. In other words in Benjamin, the fine line input pad, 706 is connected to the fire line 712, that splits on either side of the via.

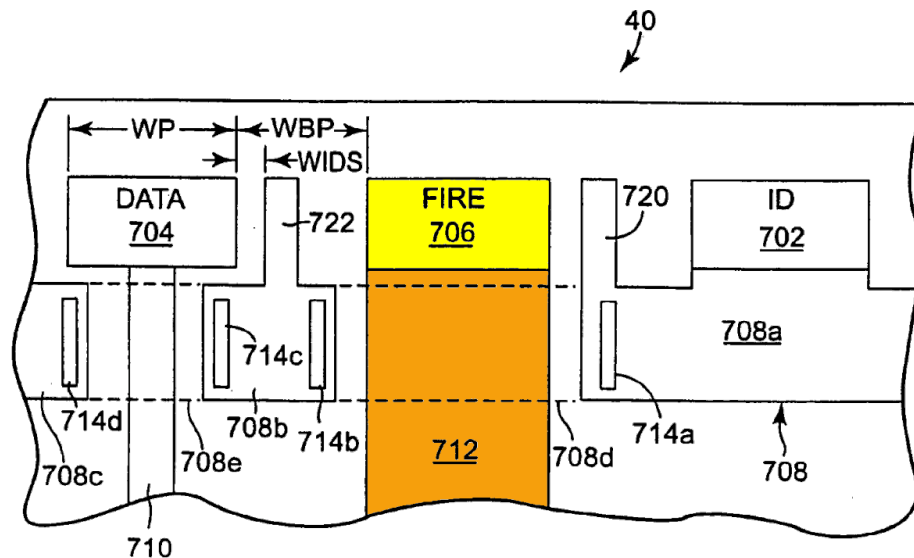


Fig. 10

Ex.1006, Figure 10

To the extent that Benjamin-144 does not disclose “power traces physically separated proximal to the bondpad,” it would have been obvious in view of

Benjamin-703. For reasons discussed in Section VIII.A.1.d, limitation 1[C], incorporated here, it would have been obvious to use a bondpad to interface with Benjamin-144's fire lines (e.g., fire line 214a) at contacts 2006. It would have been obvious that the bondpad would have been placed along a side of printhead die nearest the fire line similar to Benjamin-144's data lines. Specifically, Benjamin-144 teaches "each of the data lines 208 a, 208 c, 208 e and 208 g is routed to its respective data line group from a bondpad located along the side of printhead die 1700 **nearest the data line group** in the fire groups 1702 a-1702 f." Ex.1005, 69:3-7. Benjamin-144 teaches "[d]ata lines 208a and 208c are electrically coupled to a **bond pad alongside 1700c** of printhead die 1700" Ex.1005, 69:7-8. A PHOSITA would have appreciated that Benjamin-144's fire line input pad for fire line 214a would be placed alongside 1700c at the side nearest the fire line. Ex.1002, ¶124.

This would have been accomplished with a reasonable expectation of success as a PHOSITA could simply follow the conventional design for placement of bondpads taught by Benjamin-144 and Benjamin-703 along the nearest edge in the Benjamin Combination.

Therefore, the Benjamin Combination discloses "[t]he heater chip of claim 1, wherein the **bondpad** [e.g., fire line bondpad/fire line interface pad 706] **supplies power to the first heater array** [e.g., firing resistors 52 within drop generators 60 in D1-D3-D5-D7] **and the second heater array** [e.g., firing resistors 52 within drop

generators 60 in D2-D4-D6-D8] **portions** [e.g., top half of each] by **power traces** [e.g., fire line 214a] **physically separated proximal to the bondpad** [e.g., U-shaped fire line 214a near side 1700c].” Ex.1002, ¶¶115-126.

4. Claim 5

Claim 5 requires “[t]he heater chip of claim 1, **wherein the bondpad supplies power to the first heater array and the second heater array by at least one power trace,**” which the Benjamin Combination discloses. Ex.1002, ¶¶127-130.

As discussed in Section VIII.A.1.d, limitation 1[C], incorporated here, each Benjamin Combination bondpad supplies power to the first heater array and the second heater array portions by at least one power trace—fire line 214a. Ex.1005, 11:5-12 (“fire lines 214a-214f are electrically coupled...by **appropriate interface pads.**”), 75:60-67 (“**firing resistor 52 nearest the bond pad receiving the energy signal FIRE1...**”). *See also*, Section VIII.A.3, claim 3, regarding “at least **one power trace.**”

Therefore, the Benjamin Combination discloses “[t]he heater chip of claim 1, wherein the **bondpad** [e.g., bondpad or interface pad 706] **supplies power** [e.g., energy signal FIRE1] to the **first heater array** and the **second heater array** [e.g., firing resistors 52 of fire group 1701a] by at least **one power trace** [e.g., fire line 214a].” Ex.1002, ¶¶127-130.

5. Claim 6

Claim 6 requires “[t]he heater chip of claim 1, **wherein the first heater array and the second heater array each include a plurality of thin film resistors,**” which the Benjamin Combination discloses. Ex.1002, ¶¶131-133.

Benjamin-144 teaches that “[t]he ink is heated with small electric heaters, such as **thin film resistors** referred to herein as firing resistors,” and that “[h]eating the ink causes the ink to vaporize and be ejected through the nozzles.” Ex.1005, 1:34-37.

Therefore, the Benjamin Combination teaches “[t]he heater chip of claim 1, wherein the **first heater array** and the **second heater array** each **include a plurality of thin film resistors** [e.g., Benjamin-144’s thin film resistors or firing resistors 52].” Ex.1002, ¶¶131-133.

6. Claim 8

a. 8[P] “A heater chip for use in a printing device”

This is identical to claim limitation 1[P] and is disclosed for the reasons in Section VIII.A.1.a, incorporated here. Ex.1002, ¶135.

b. 8[A] “an ink via”

This limitation is identical to claim limitation 1[A] and disclosed for the reasons in Section VIII.A.1.b, incorporated here. Ex.1002, ¶136.

- c. 8[B] “a first heater array and a second heater array adjacent at least a portion of the ink via wherein the ink via is positioned between the first heater array and the second heater array”

This limitation is analogous to claim limitation 1[B] and disclosed for the reasons in Section VIII.A.1.c, incorporated here. Ex.1002, ¶¶137-139.

Figure 21 of Benjamin-144 discloses this limitation.

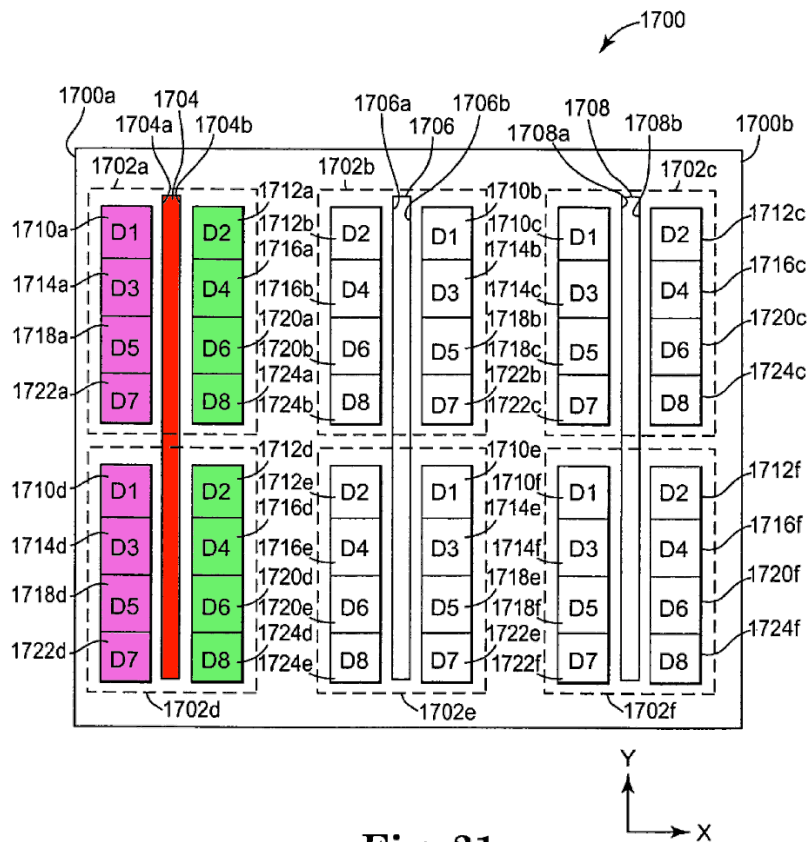


Fig. 21
Ex.1005, Figure 21

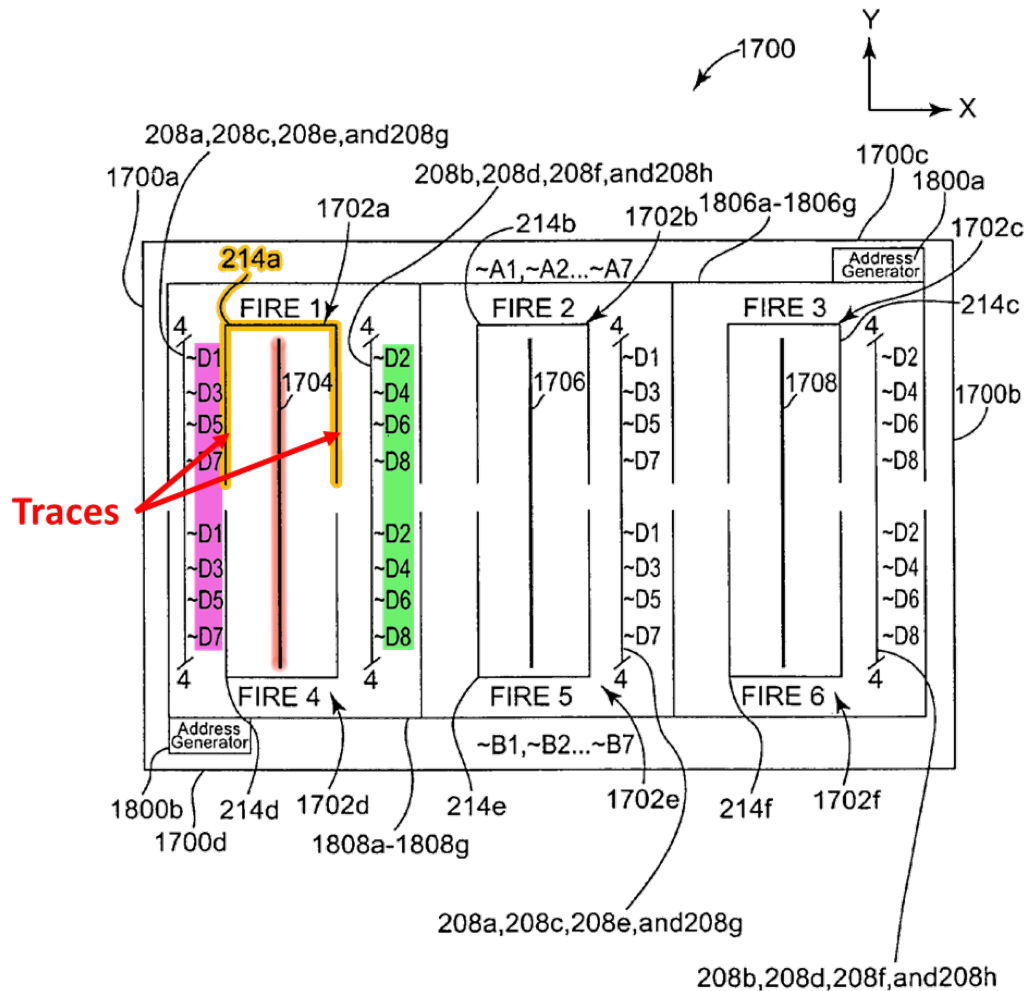
Therefore, the Benjamin Combination discloses “a **first heater array** [e.g., firing resistors 52 within drop generators 60 in D1-D3-D5-D7] and a **second heater array** [e.g., firing resistors 52 within drop generators 60 in D2-D4-D6-D8] adjacent

at least a portion of the **ink via** wherein the ink via [e.g., feed slot 1704] is **positioned between** the first heater array and the second heater array.” Ex.1002, ¶¶137-139.

- d. 8[C] “a bondpad having at least two traces stemming from the bondpad wherein at least one of the traces is operatively connected to the first heater array and at least another one of the traces is operatively connected to the second heater array”*

As discussed in Section VIII.A.1.d, limitation 1[C], incorporated here, the Benjamin Combination teaches a bondpad connected to the first heater array and the second heater array. Benjamin-144 discloses the remaining limitation “having at least two traces stemming from the bondpad.” Ex.1002, ¶¶140-143.

Specifically, the U-shaped fire line 214a corresponds to the claimed two traces stemming from the bondpad. As Benjamin-144 explains, the “U-shaped fire lines 214a-214f are electrically coupled to pre-charged firing cells 120 **located along each of the opposing sides of ink feed slots 1704**, 1706 and 1708.” Ex.1005, 70:51-59.

**Ex.1005, Figure 22**

Benjamin-144 teaches “[f]ire line 214a is electrically coupled to all pre-charged firing cells 120 in FG1 (202a).” Ex.1005, 11:1-2. Thus, the trace on the left portion of 214a is connected to the first heater array, and the trace on the right portion of 214a is connected to the second heater array. As discussed in Section VIII.A.1.d, limitation 1[C], incorporated here, each trace of fire line 214a is connected to (i.e., stem from) a bondpad.

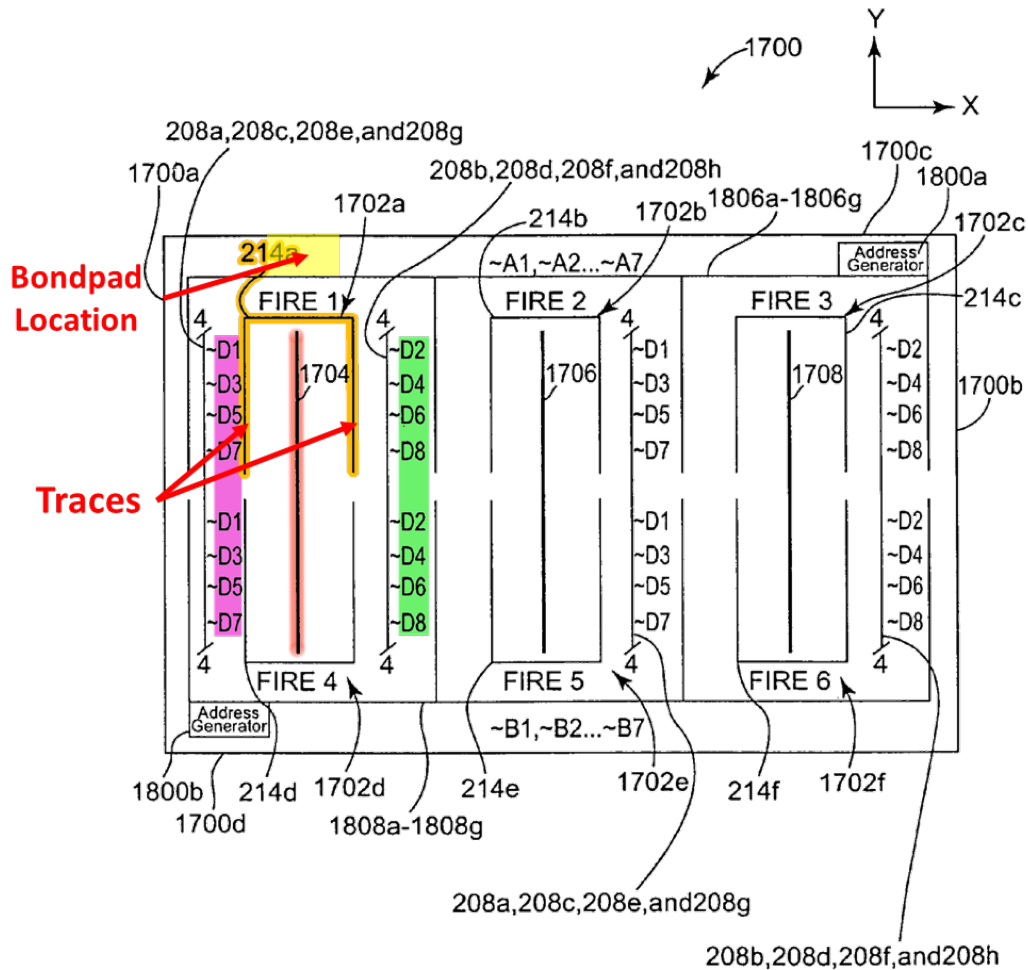
Therefore, the Benjamin Combination discloses “a **bondpad** [e.g., fire line bondpad/fire line input pad 706] having **at least two traces** [e.g., U-shaped fire line 214a] **stemming from** the bondpad [e.g., connected to bondpad/fire line input pad 706] wherein at least **one of the traces** [e.g. trace on the left portion of 214a] is **operatively connected to the first heater array** [e.g., vertical array of firing resistors 52 within drop generators 60 in 1710a-1714a-1718a-1722a-1710d-1714d-1718d and 1722d] and at least **another one of the traces** [e.g. trace on the right portion of 214a] is **operatively connected to the second heater array** [e.g., vertical array of firing resistors 52 within drop generators 60 in 1712a-1716a-1720a-1724a-1712d-1716d-1720d and 1724d].” Ex.1002, ¶¶140-143.

7. Claim 9

Claim 9 requires “[t]he heater chip of claim 8, **wherein the at least two traces are physically separated proximal to the bondpad,**” which the Benjamin Combination discloses. Ex.1002, ¶¶144-146.

This limitation is broader than claim 3 and disclosed for the reasons in Section VIII.A.3, incorporated here. Ex.1002, ¶146.

Figure 22 shows Benjamin-144’s fire lines 214a-214f are physically separated to form “a substantially U-shaped fire line”

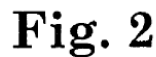


Ex.1005, Figure 22

8. Claim 10

Claim 10 requires “[t]he heater chip of claim 8, wherein the first and second heater arrays include a **plurality of thin film resistors formed**, at least **in part**, from a material selected from the group of materials consisting of platinum, **gold**, silver, copper, **aluminum**, **tantalum**, titanium tungsten, silicon-nitrogen, silicon carbide, and diamond-like carbon,” which the Benjamin Combination discloses. Ex.1002, ¶¶148-153.

With respect to figure 2, below, Benjamin-144 teaches “[t]hin-film structure 48, also, includes at least one conductive layer, **which defines firing resistor 52** and leads 58. In one embodiment, the **conductive layer comprises**, for example, **aluminum, gold, tantalum**, tantalum-aluminum, or other metal or metal alloy.” Ex.1005, 5:26-33.



Therefore, the Benjamin Combination discloses “[t]he heater chip of claim 8, wherein the first and second heater arrays include a plurality of **thin film resistors** [e.g., thin film resistors or firing resistors 52] **formed**, at least **in part**, from a **material selected from the group of** materials consisting of platinum, **gold**, silver,

copper, **aluminum**, **tantalum**, titanium tungsten, silicon-nitrogen, silicon carbide, and diamond-like carbon.” Ex.1002, ¶¶148-153.

9. Claim 13

Claim 13 requires “[t]he heater chip of claim 8, wherein the first and second heater arrays each comprise a **top portion** and a **bottom portion**, and wherein **the bondpad** is operatively connected to the **top portion** of the **first heater array** and the **top portion** of the **second heater array**,” which the Benjamin Combination discloses. Ex.1002, ¶¶154-167.

As in Sections VIII.A.1.d and VIII.A.2, limitation 1[C] and claim 2, incorporated here, the Benjamin Combination includes a bondpad operatively connected to each of fire lines 214a and 214d, which are each connected to the first heater array and the second heater array. For the following reasons, the Benjamin Combination teaches claim 13’s additional limitation.

As seen in figures 21-22, below, printhead die 1700 includes fire group 1702a [top portion, yellow] and fire group 1702d [bottom portion, blue]. Ex.1005, 67:38-41.

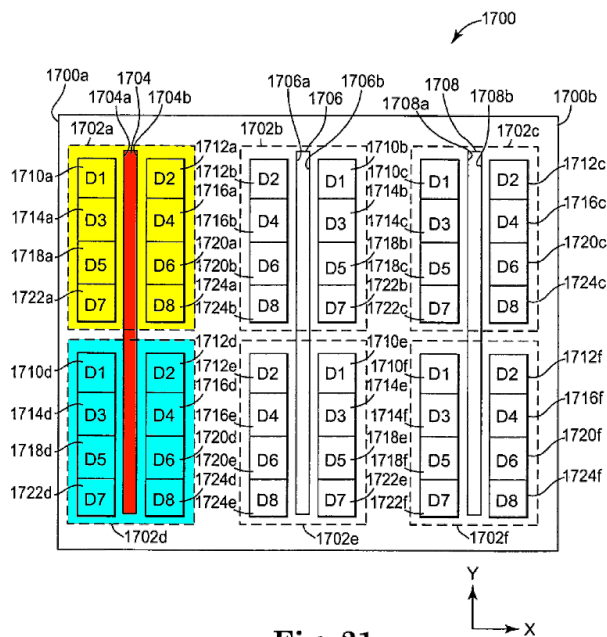


Fig. 21

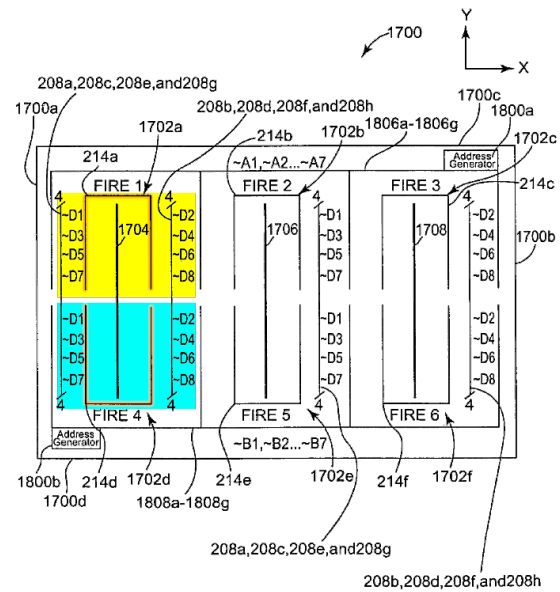


Fig. 22

Ex.1005, Figs. 21-22

Benjamin-144 teaches “conductive fire lines **214a-214f** are located along ink feed slots **1704** [red], **1706** and **1708** to supply energy signals **FIRE1**, **FIRE2...FIRE6** to the fire groups **1702a-1702f**, respectively.” Ex.1005, 69:42-45. Benjamin-144 teaches “**fire lines 214a-214f** supply energy to firing resistors **52** in conducting pre-charged firing cells **120** to heat and eject ink from drop generators **60**.” Ex.1005, 69:45-47.

Therefore, the Benjamin Combination discloses “wherein the first and second heater arrays each comprise a **top portion** [e.g. fire group **1702a** with U-shaped fire line **214a**] and a **bottom portion** [e.g. fire group **1702d** with U-shaped fire line **214d**], and wherein the **bondpad** [e.g., fire line bondpad/fire line input pad **706**] is **operatively connected to the top portion** of the **first heater array** and the **top**

portion of the **second heater array** [e.g. “the bond pad receiving the energy signal FIRE1” connected to fire line 214a].” Ex.1002, ¶¶154-167.

10. Claim 14

Claim 14 requires “[t]he heater chip of claim 13, further comprising a **second bondpad** operatively connected to the **bottom portion** of the **first heater array** and the **bottom portion** of the **second heater array**,” which the Benjamin Combination discloses. Ex.1002, ¶¶168-181.

As in Sections VIII.A.1.d and VIII.A.2, limitation 1[C] and claim 2, incorporated here, the Benjamin Combination includes a bondpad operatively connected to each of fire lines 214a and 214d, which are each connected to the first heater array and the second heater array. For the following reasons, the Benjamin Combination teaches claim 14’s additional limitations.

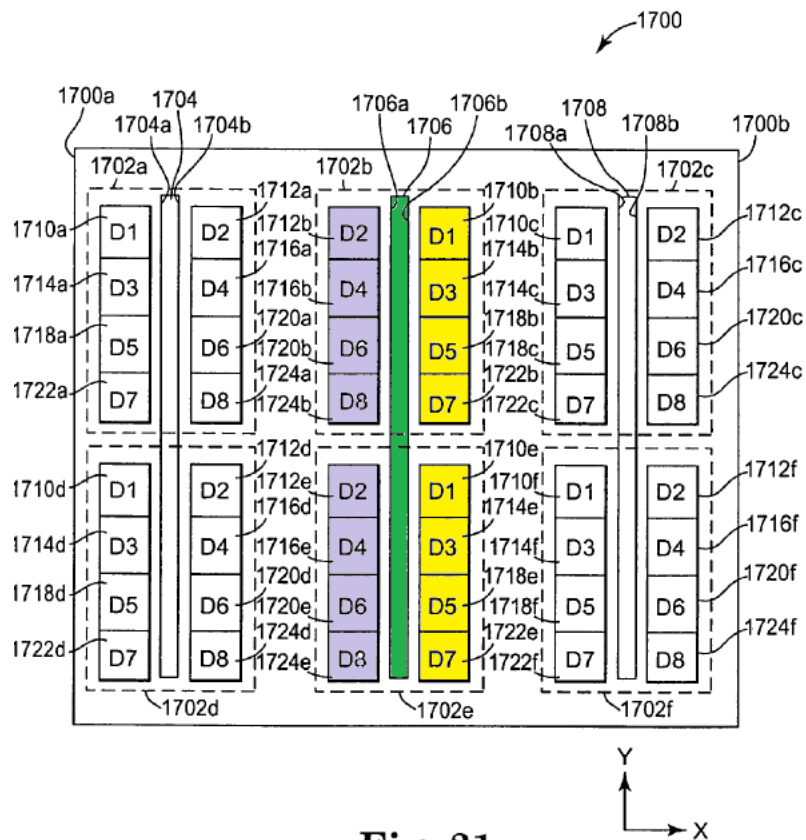
As in Section VIII.A.9, claim 13, incorporated here, the Benjamin Combination discloses “[t]he heater chip of claim 13, further comprising a **second bondpad** [e.g. fire line bondpad/fire line input pad 706 / “the bond pad receiving the energy signal FIRE4” from “contacts 2006 which provide coupling to the printhead die” via bondpad or interface pad] **operatively connected to the bottom portion** of the **first heater array** and the **bottom portion** of the **second heater array** [e.g. fire group 1702d with U-shaped fire line 214d that receives energy signal FIRE4 from the bondpad].” Ex.1002, ¶¶168-181.

11. Claim 15

- a. 15[A] “The heater chip of claim 8, further comprising: another ink via disposed between a third heater array and a fourth heater array; and”*

Benjamin Combination discloses this limitation. Ex.1002, ¶¶182-186.

Benjamin-144’s Figure 21 provides “a diagram illustrating an example layout of one embodiment of a printhead die 1700.” Ex.1005, 63:20-21. The “printhead die 1700 includes six fire groups 1702a-1702f disposed along three ink fluid feed sources, here depicted as feed slots 1704, **1706 [green]** and 1708.” Ex.1005, 63:21-24. Benjamin-144 teaches that “[t]he fire groups 1702a-1702f are divided into eight data line groups, indicated at D1-D8 and that “[e]ach data line group D1-D8 includes pre-charged firing cells 120 from each of the fire groups 1702a-1702f.” Ex.1005, 63:39-42.

**Fig. 21****Ex.1005, Figure 21**

Therefore, the Benjamin Combination discloses “**another ink via** [e.g., in feed slot 1706] disposed **between a third heater array** [e.g., firing resistors 52 within drop generators 60 in 1712b-1716b-1720b-1724b-1712e-1716e-1720e and 1724e] and a **fourth heater array** [e.g., firing resistors 52 within drop generators 60 in 1710b-1714b-1718b-1722b-1710e-1714e-1718e and 1722e].” Ex.1002, ¶¶182-186.

- b. 15[B] “a second bondpad coupled to a trace that is operatively connected to the third heater array and to a trace that is operatively connected to the fourth heater array”

The Benjamin Combination discloses this limitation. Ex.1002, ¶¶187-198.

As in Sections VIII.A.1.d and VIII.A.2, limitation 1[C] and claim 2, incorporated here, the Benjamin Combination includes a bondpad operatively connected to each of fire lines 214b and 214e, which are each connected to the third heater array and the fourth heater array. This is shown, for example, in Figures 21-22 of Benjamin-144:

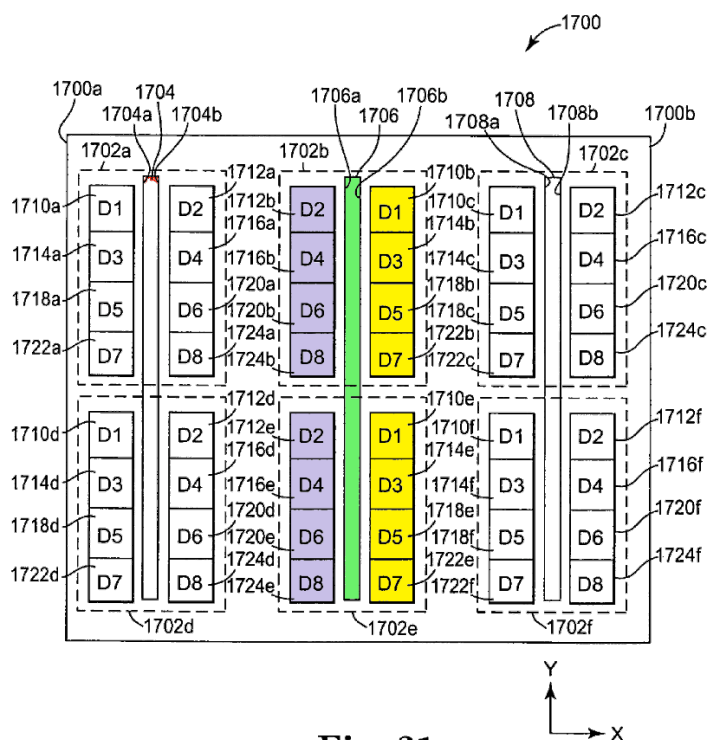
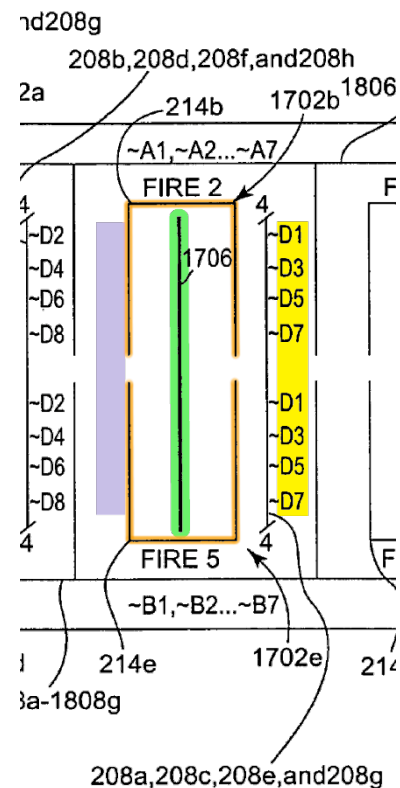


Fig. 21

Ex.1005, Figs. 21-22



Benjamin-144 teaches that the U-shaped fire line 214b [orange, top] located along both sides of the top half of ink feed slot 1706 [green] supplies energy signal FIRE2 to the firing resistors 52 in fire group 1702b. Similarly, the U-shaped fire line 214e [orange, bottom] located along both sides of the bottom half of ink feed slot 1706 [green] supplies energy signal FIRE5 to the firing resistors 52 in fire group 1702e.

Therefore, the Benjamin Combination discloses “a **second bondpad** [e.g. fire line bondpad/fire line input pad 706 / “the bond pad receiving the energy signal FIRE2” from “contacts 2006 which provide coupling to the bond or interface pad on the printhead die”] **coupled to a trace** that is operatively **connected to the third heater array** [e.g., left side of fire line 214b] and to **a trace** that is **operatively connected to the fourth heater array** [e.g., right side of fire line 214b].” Ex.1002, ¶¶187-198.

- c. 15[C] “wherein the traces coupled to the second bondpad are physically separated proximal to the second bondpad”*

As in Section VIII.A.3, claim 3, incorporated here, the Benjamin Combination teaches the traces coupled to the second bondpad are physically separated proximal to the second bondpad. Ex.1002, ¶¶199-201.

12. Motivation to Combine: Benjamin-144 and Benjamin-703

A PHOSITA would have been motivated to combine Benjamin-144 with Benjamin-703. Ex.1002, ¶¶202-208.

First, Benjamin-144 and Benjamin-703 are **analogous** to the '864 Patent's claimed subject matter as they are all within the **same field of endeavor** of heater chips for inkjet printheads. *See, e.g.*, Ex.1001, Abstract; Ex.1005, Abstract, 1:20-45; Ex.1006, Abstract, 1:19-46. The USPTO classified the '864 Patent, Benjamin-144, and Benjamin-703 under the same patent classification—class B41 (printing; etc.).

Benjamin-144 and Benjamin-703 include overlapping inventors (Trudy L. Benjamin and Joseph M. Torgerson) and were filed on the same day (April 19, 2004) by the same assignee (Hewlett Packard Development Co LP). Benjamin-144 and Benjamin-703 include many of the same figures (Figures 1-8) and significant overlap in their written specifications. *Compare* Ex.1005, 3:5-15:3 *with* Ex.1006, 2:24-14:39.

Benjamin '144 incorporates Benjamin '703 by reference: “This application is related to patent application Ser. No....11/849,078, entitled “Fluid Ejection Device With Identification Cells,” each of which are assigned to the Assignee of this application and are filed on even date herewith, and each of which **is fully incorporated by reference as if fully set forth herein.**” Ex.1005, 1:6-16. While

patent application Ser. No. 11/849,078 refers to a continuation application of Benjamin '703 **filed after Benjamin '144**, this appears to be a typographical error intended to reference Benjamin '703. Benjamin '703 was filed on the same day as Benjamin '144 and Benjamin '703 has the same specification as its referenced child application.

Second, a PHOSITA would have been motivated to modify the Benjamin Combination to utilize Benjamin-703's fire line input pad 706 to "provide fire signal FIRE" to each of Benjamin-144's fire lines 214. Benjamin-144 explicitly teaches "**fire lines 214a-214f are electrically coupled to external supply circuitry by appropriate interface pads.**" Ex.1005, 11:9-12. Benjamin-144 refers to its **interface pads** as **bondpads**. Ex.1005, 75:63-67 ("the **firing resistor 52 nearest the bond pad receiving the energy signal FIRE1, FIRE2...FIRE6,**"). Given Benjamin-144's express teachings, a PHOSITA would have looked to Benjamin-703, which teaches that the "printhead die 40 includes...a **fire line input pad 706.**" Ex.1006, 19:34-36. In view of these express teachings, it would have been obvious to a PHOSITA to modify the Benjamin-144 printhead to include fire line input pad 706 as taught by Benjamin-703. Ex.1002, ¶206.

Third, even if Benjamin-144 did not provide an express motivation (which it does), then utilizing a bondpad to supply FIRE energy signals to the fire lines 214 like in Benjamin-703 would have been an obvious combination of prior art elements

to yield predictable results. A PHOSITA could have combined Benjamin-703's fire line input pad 706 with Benjamin-144's printhead using known methods to yield predictable results. Ex.1002, ¶¶207.

Finally, a PHOSITA would have had a **reasonable expectation of success** in making this modification. The printhead components described in Benjamin-144 and Benjamin-703 are *the same components*. Compare Ex.1005, Fig. 1-8, 7:18-8:18 with Ex.1006, Fig. 1-8, 6:45-7:46. Benjamin-144 and Benjamin-703 both acknowledge that their printhead components (e.g., thermal ink jet printing, drop generators, heaters, firing cell arrays) were well-known at the time. See, e.g., Ex.1005, 1:32-45; 1:46-48; 1:64-2:2. Thus, it would have been straightforward for a PHOSITA using Benjamin-144's printhead to utilize Benjamin-703's fire line input pad 706 to "provide fire signal FIRE" to Benjamin-144's fire lines 214 because little to no modification would be necessary as the components are the same. Ex.1002, ¶¶202-208.

B. Ground 2: Benjamin Combination In View Of Childers Renders Obvious Claims 4, 11-12, and 16-20

1. Claim 16

a. 16[P] "A heater chip comprising"

To the extent the preamble is limiting, it is broader than claim limitation 1[P] and disclosed for the reasons in Section VIII.A.1.a, incorporated here. Ex.1002, ¶¶22-212.

- b. 16[A] “at least eight heater arrays wherein the at least eight heater arrays comprise four heater array pairs, and”

As in Sections VIII.A.1.b and VIII.A.1.c, limitations 1[A] and 1[B], incorporated here, the Benjamin Combination includes three ink vias or feed slots 1704, 1706 and 1708 (red) with six heater arrays—three heater array pairs (magenta and green pairs) associated with each ink via (red) as shown in Figure 21:

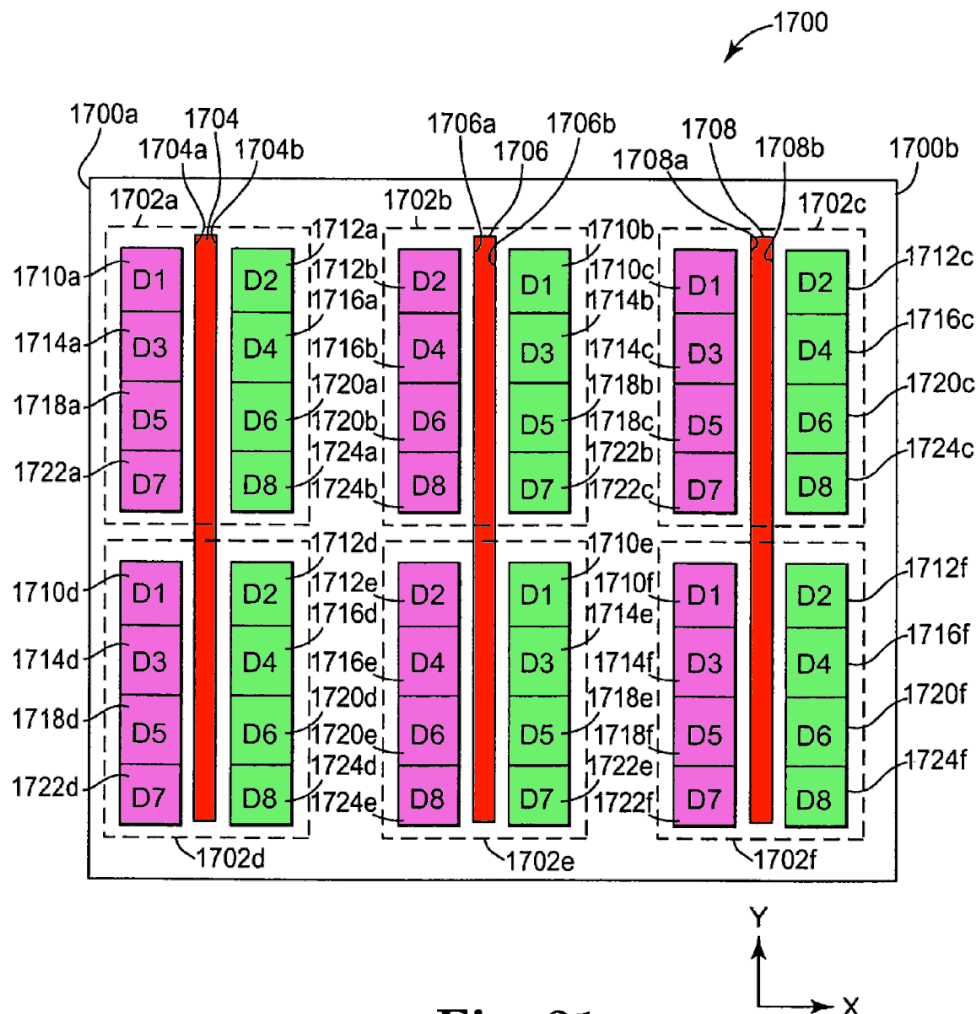


Fig. 21

Ex.1005, Figure 21

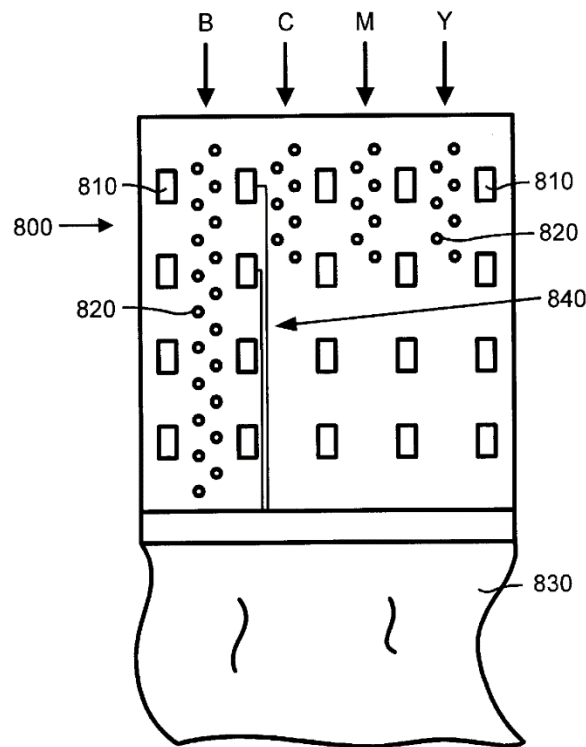
Benjamin-144 teaches “printhead die 1700 includes six fire groups 1702a-1702f disposed along **three ink fluid feed sources, here depicted as feed slots 1704, 1706 and 1708.**” Ex.1005, 63:21-24. Benjamin-144 explains that “[t]he fire groups 1702a-1702f are divided into eight data line groups, indicated at D1-D8 and that “[e]ach data line group D1-D8 includes **pre-charged firing cells 120** from each of the fire groups 1702a-1702f.” Ex.1005, 63:39-42. Benjamin-144 teaches “[p]re-charged firing cell 120 is one embodiment of firing cell 70” and that “[f]iring cell 70 includes a **firing resistor 52**...[that] is part of a drop generator 60.” Ex.1005, 8:7-8, 6:3-5.

Benjamin-144 teaches “**the printhead die may include a fewer or greater number of fluid feed sources.**” Ex.1005, 67:35-36. Benjamin teaches that its printhead die “can be arranged into **any suitable number of fire groups 102 a-102 n** and into **any suitable number of subgroups and data line groups.**” Ex.1005, 7:7-9.

While Benjamin-144 shows an exemplary embodiment including three fluid feed sources/ink vias and six fire groups, a PHOSITA would appreciate that Benjamin-144’s invention could be applied to a “greater number of fluid feed sources,” such as four to “supply any suitably colored ink of the same or different colors” (e.g., adding black). Ex.1005, 67:35-36, 63:33-37; Ex.1002, ¶¶213-217.

Childers teaches “[t]he present invention relates in general to **thermal ink jet (TIJ) printheads**...” Ex.1007, 1:6-7. Childers explains that “[t]he printhead of the present invention is suitable for **high-speed printing systems** such as large format printing systems and drum printers.” Ex.1007, 3:62-65.

Like Benjamin-144, Childers teaches “[a] ink feed channel 400...provides ink to a plurality of firing chambers (not shown) and resistors 410.” Ex.1007, 6:14-17. Childers teaches “FIG. 8 is another embodiment of the present invention showing a **multi-chamber large array printhead** of the present invention.” Ex.1007, 3:34-36.



Ex.1007, Figure 8

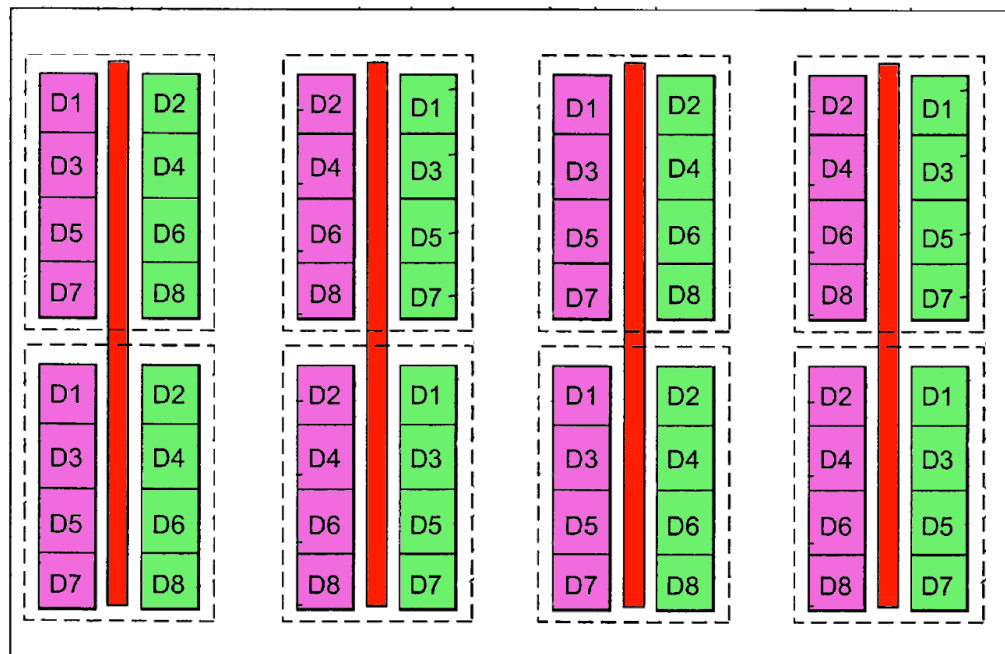
Childers teaches that “in FIG. 8 there are **four different colors of ink** on the large array printhead 800 including **black (B), cyan (C), magenta (M) and yellow**

(Y).” Ex.1007, 7:39-41. Childers, like Benjamin-144, teaches “two rows of nozzles” for each orifice array in Figure 8, above. Ex.1007, 5:30-35.

As in Section VIII.B.6 below, incorporated here, a PHOSITA would have been motivated to add an additional fluid feed source, such as black for text printing or an additional “colored ink of the same...color” to extend the useful life of the printhead die with respect to any color that is used more frequently. Ex.1002, ¶¶221, 293-301.

A PHOSITA would have accomplished this modification to Benjamin’s printhead with a **reasonable expectation of success** by following the conventional design for placement of fluid feed sources. Ex.1002, ¶¶222, 300.

Below is an exemplary figure depicting the modification:



Ex.1005, Figure 21 (Modified)

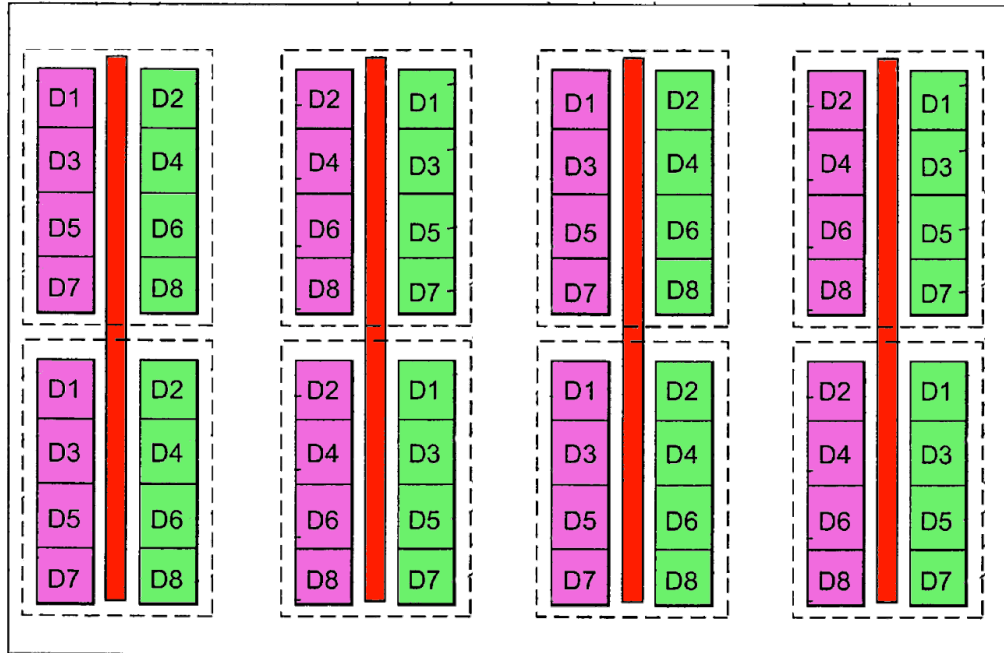
Benjamin's modified four ink-via embodiment would similarly include "[d]rop generators 60 in data line groups **D1, D3, D5 and D7 [magenta]...disposed along one side [] of [each] ink feed slot [] and drop generators 60 in data line groups D2, D4, D6 and D8 [green]...disposed along the opposing side [] of [each] ink feed slot []**." Ex.1005, 64:9-14. The Benjamin-Childers printhead would also "include **firing resistors 52** that are part of drop generators 60." Ex.1005, 64:2-4.

Therefore, Benjamin-Childers discloses "at least **eight heater arrays** [e.g., firing resistors 52 within drop generators 60 in D1-D8 for each ink feed slot (red)] wherein the at least eight heater arrays comprise **four heater array pairs** [e.g., firing resistors 52 within drop generators 60 in D1-D3-D5-D7 (magenta) paired with D2-D4-D6-D8 (green) for each ink feed slot]." Ex.1002, ¶¶213-226.

c. 16[B] "wherein the arrays in each of the heater array pairs are disposed substantially adjacent opposing sides of at least a portion of an ink via; and"

As in Section VIII.B.1.b, limitation 16[A], incorporated here, a PHOSITA would have been motivated to add an additional fluid feed source, as taught by Childers, to add an additional color to the printhead die. As shown below, Benjamin-Childers discloses eight heater arrays that comprise four heater array pairs, wherein the pairs are disposed substantially adjacent opposing sides of a portion of an ink

via—(four magenta and green pairs adjacent a portion of four red ink vias). Ex.1002, ¶¶227-233.



Ex.1005, Figure 21 (Modified)

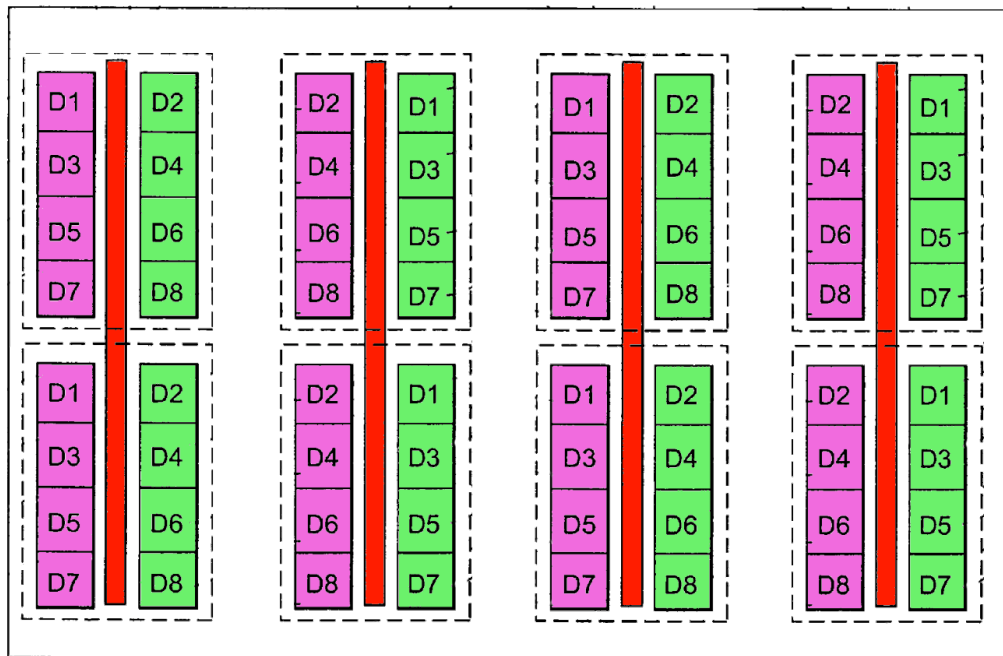
Therefore, Benjamin-Childers discloses that “**arrays in each** of the heater **array pairs** [e.g., firing resistors 52 within drop generators 60 in D1-D3-D5-D7 (magenta) paired with D2-D4-D6-D8 (green) for each ink feed slot] are **disposed substantially adjacent opposing sides** of at least **a portion of an ink via** [e.g., along each of four ink feed slots (red)].” Ex.1002, ¶¶227-233.

- d. 16[C] “a plurality of bondpads operatively connected to the at least eight heater arrays, wherein at least one of the plurality of bondpads is operatively connected to both heater arrays within one of the heater array pairs”*

As in Section VIII.B.1.b, limitation 16[A], incorporated here, a PHOSITA would have been motivated to add an additional fluid feed source, as taught by

Childers, to add an additional color to the printhead die. As part of that modification, a PHOSITA would have included an additional two fire groups for the additional fluid feed source as taught by Benjamin-144. Ex.1002, ¶¶234-244.

As shown below, Benjamin-Childers discloses eight heater arrays that comprise four heater array pairs, wherein the pairs are disposed substantially adjacent opposing sides of a portion of an ink via—(four magenta and green pairs adjacent a portion of four red ink vias).

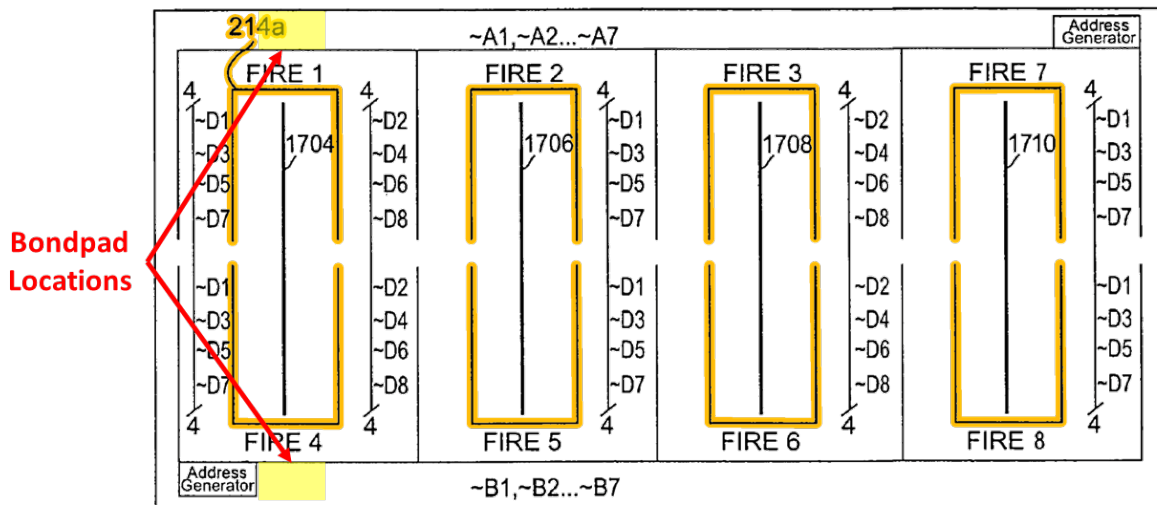


Ex.1005, Figure 21 (modified)

As in Sections VIII.A.1.d and VIII.A.2, limitation 1[C] and claim 2, incorporated here, the Benjamin Combination includes a bondpad operatively connected to each fire line 214 within each fire group 1702, which are each connected to both heater arrays in a heater array pair. For the same reasons, the

Benjamin Combination discloses two bondpads for each pair of heater arrays—i.e., one bondpad for each fire group.

An exemplary figure depicting how a PHOSITA would arrange the additional fire lines for the four ink via printhead is shown below:



Ex.1005, Figure 22 (modified)

Therefore, Benjamin-Childers discloses “a plurality of **bondpads** [e.g. fire line bondpad/fire line input pad 706 / “the bond pad receiving the energy signal FIRE1, FIRE2...FIRE6” from “contacts 2006 which provide coupling to the printhead die”] **operatively connected to** the at least **eight heater arrays** [e.g. firing resistors 52 within drop generators 60 in D1-D3-D5-D7 (magenta) and D2-D4-D6-D8 (green) for each fluid feed source] wherein **at least one** of the plurality of **bondpads** [e.g. the bondpads for each U-shaped fire line] **is operatively connected to both heater arrays within one of the heater array pairs** [e.g. firing resistors 52

within drop generators 60 in D1-D3-D5-D7 (magenta) paired with D2-D4-D6-D8 (green) via U-shaped fire line 214 for each fluid feed source].” Ex.1002, ¶¶234-244.

2. Claim 17

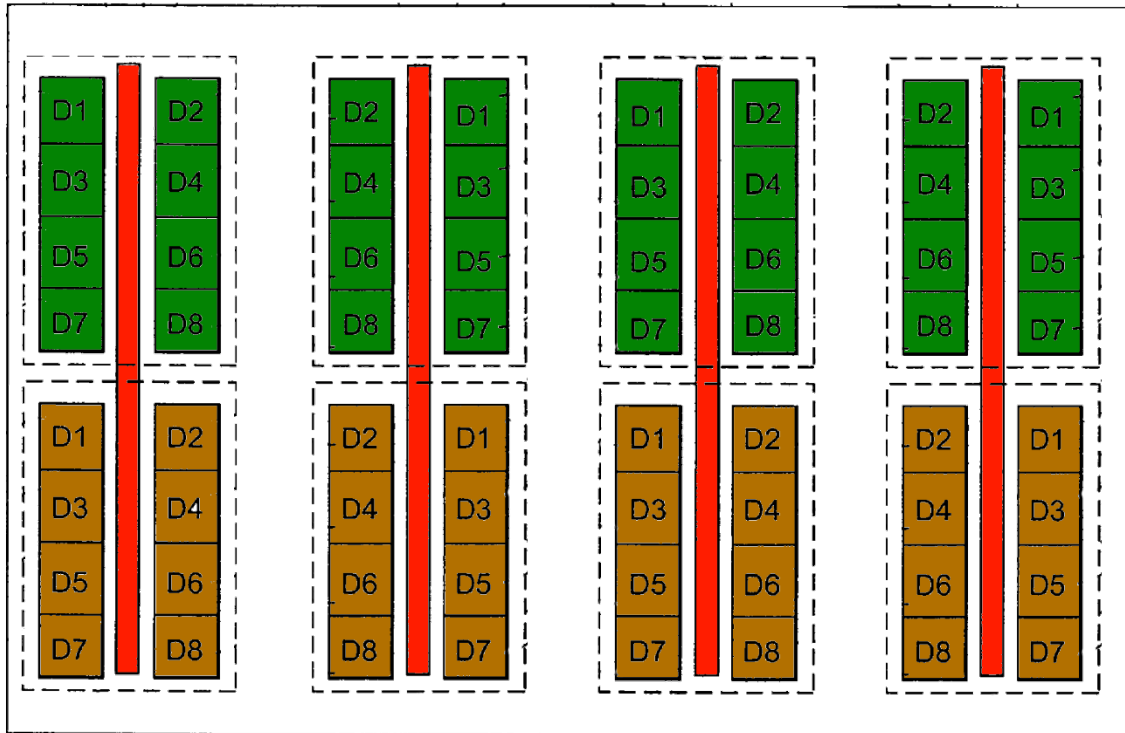
Claim 17 requires “[t]he chip of claim 16, **wherein each of the at least eight heater arrays comprises a plurality of thin film resistors,**” which Benjamin-Childers discloses. Ex.1002, ¶¶245-247.

The additional limitations of claim 17 are analogous to claim 6 and disclosed for the reasons in Section VIII.A.5, incorporated here. Ex.1002, ¶247.

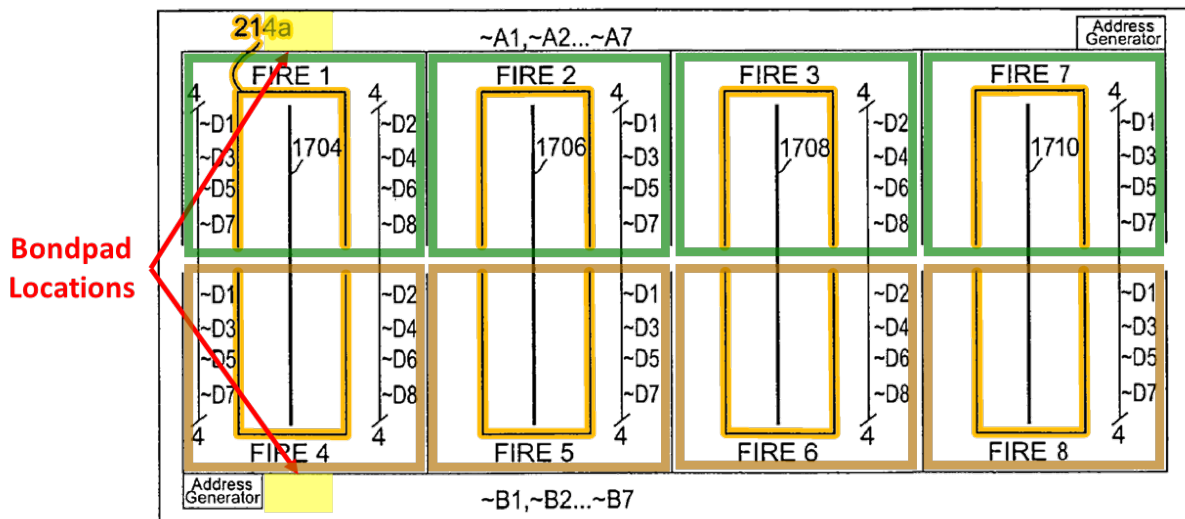
3. Claim 19

Claim 19 requires “[t]he chip of claim 16, **wherein each of the at least eight heater arrays comprises a top portion and a bottom portion, and wherein some of the plurality of bondpads are operatively connected to the top portion of one of the at least eight heater arrays and the top portion of another one of the at least eight heater arrays,**” which Benjamin-Childers discloses. Ex.1002, ¶¶248-255.

As with Claim 16, incorporated here, Benjamin discloses eight heater arrays that comprise four heater array pairs. Modified Figures 21 and 22, below, show each of Benjamin’s heater arrays includes a top portion (green) and a bottom portion (brown).



Ex.1005, Figure 21 (modified)



Ex.1005, Figure 22 (modified)

The additional limitations of claim 19 are analogous to the limitations of claim 13 and disclosed for the same reasons above in Section VIII.A.9, incorporated here.

Ex.1002, ¶¶248-255.

4. Claim 20

Claim 20 requires “[t]he chip [sic] claim 19, wherein some of the plurality of bondpads are operatively connected to the bottom portion of one of the at least eight heater arrays and to the bottom portion of another one of the at least eight heater arrays,” which Benjamin-Childers discloses. Ex.1002, ¶¶256-262.

The additional limitations of claim 20 are analogous to the limitations of claim 14 and disclosed for the same reasons above in Section VIII.A.10, incorporated here. Ex.1002, ¶¶256-262.

5. Claims 4, 11, and 18

Claims 4, 11, and 18 require a “heater chip” of independent claims 1, 4, and 18, respectively, “wherein **each of the first and second heater arrays comprise at least 320 heaters.**” Benjamin-Childers discloses each limitation. Ex.1002, ¶¶263-274.

Benjamin-144 teaches “[i]n one embodiment, printhead die 1700 includes 600 drop generators 60. Each of the six fire groups 1702 a-1702 f includes 100 drop generators 60.” Ex.1005, 67:24-26. Benjamin-144 teaches “[i]n other embodiments, **printhead die 1700 can include any suitable number of drop generators 60**, such as 400 drop generators 60 or **more than 600 drop generators 60.**” Ex.1005, 67:29-32. Benjamin-144 states that “[a] drop generator 60 as referred to herein includes **firing resistor 52,**” which is a heater. Ex.1005, 4:54-5:10.

Benjamin-144 teaches “a printhead with **more drop generators** typically prints with **higher quality and/or printing speed.**” Ex.1005, 1:67-2:2. Benjamin-144 teaches “there is a need for the present invention” to address problems that arise “[a]s **drop generator densities increase** and the number of input pads decrease, printhead die layouts can become increasingly complex.” Ex.1005, 2:5-7.

While Benjamin-144’s exemplary embodiment discloses a printhead with 100 drop generators per fire group, Benjamin-144 teaches its invention can include “any suitable number of drop generators 60” and describes the advantages of additional drop generators/heaters as including “higher quality and/or printing speed.” It would have been obvious to a PHOSITA to increase the number of drop generators, and thus heaters, to increase the printing speed and/or to increase the print quality. Benjamin-144 teaches it was known that increasing the number of drop generators resulted in “improve[d] printing speed and/or quality.” Ex.1005, 1:46-48. Benjamin-144’s invention is designed to address the complexity that results from such an increase in drop generators.

Thus, a PHOSITA would have been motivated to increase Benjamin-144’s drop generators for large format printing applications as described in Childers.

Childers teaches that “[t]he present invention relates...more specifically to **a large array printhead** having a large array of TIJ thin-film ink drop generators formed on a single monolithic substrate.” Ex.1007, 1:6-9. Childers teaches “the

present invention is embodied in **a large array printhead** having **a large array of ink drop generators** formed on a single monolithic substrate.” Ex.1007, 2:13-15. Childers explains that “[t]he printhead of the present invention is suitable for **high-speed printing systems** such as large format printing systems and drum printers.” Ex.1007, 3:62-65.

Like Benjamin-144, Childers teaches “[a] ink feed channel 400...provides ink to a plurality of firing chambers (not shown) and resistors 410.” Ex.1007, 6:14-17.

In Figure 3A, below, Childers teaches “[i]n a preferred embodiment, the orifice array 305 is...created by **two rows of nozzles** (each row having a resolution of 300 dpi).” Ex.1007, 5:30-33. Childers teaches that “[p]referably, there are approximately **1500 nozzles** formed on the printhead 300.” Ex.1007, 5:34-35. Childers teaches an ink jet print head with 750 nozzles or drop generators in each array, and 750 “electric heaters” in each array. Ex.1007, 1:44-46.

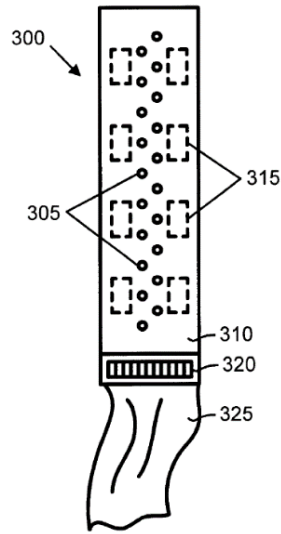


FIG. 3A

Ex.1007, Figure 3A

Like Benjamin-144, Childers teaches its “large array printhead” can be “a **multi-chamber** large array **printhead 800**” with multiple ink vias, as Figure 8, below, shows.

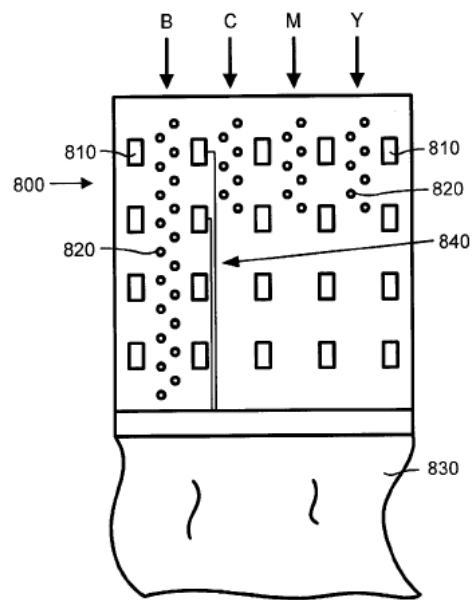


FIG. 8

Ex.1007, Figure 8

It therefore would have been obvious to modify the Benjamin Combination to utilize Childer's large array printhead with 750 heaters per array to increase the printing speed.

Therefore, Benjamin-Childers discloses "[t]he heater chip of claim 1, wherein each of the **first and second heater arrays** comprise at least **320 heaters** [i.e., 750 heaters for each array]." Ex.1002, ¶¶263-274.

6. Claim 12

Claim 12 requires "[t]he heater chip of claim 11, wherein the bondpad and the at least two traces are capable of supplying eight simultaneous fires per heater array," which Benjamin-Childers discloses. Ex.1002, ¶¶275-292.

In Figure 5, below, Benjamin-144 teaches "an inkjet printhead firing cell array, indicated at 100." Ex.1005, 6:37-38. Benjamin-144 teaches "[f]iring cell array 100 includes a plurality of firing cells 70 arranged into n fire groups 102a-102n" and "are schematically arranged into L rows and m columns." Ex.1005, 6:38-40, 45-46.

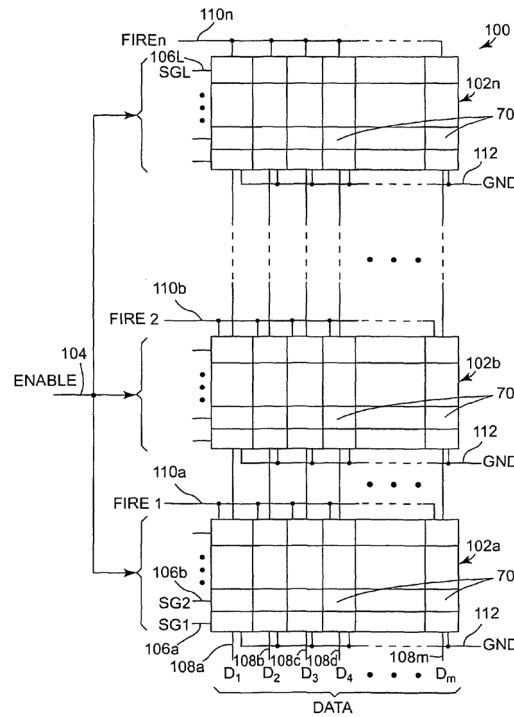


Fig. 5

Ex.1005, Figure 5

Benjamin-144 teaches that “[i]n operation, subgroup enable signals SG1, SG2,...SGL are provided on subgroup enable lines 106 a-106L to enable one subgroup of firing cells 70.” Ex.1005, 7:30-32. Benjamin-144 teaches “[t]he enabled firing cells 70 store data signals D1, D2...Dm provided on data lines 108 a-108 m...[that] sets the state of drive switch 72 in one of the enabled firing cells 70...to conduct or not conduct based on the stored data signal value.” Ex.1005, 7:32-39.

Benjamin-144 explains that “[a]fter the states of the selected drive switches 72 are set, an energy signal FIRE1-FIREn is provided on the fire line 110 a-110 n corresponding to the fire group 102 a-102 n that includes the selected subgroup of firing cells 70...to energize firing resistors 52 in firing cells 70 that have conducting

drive switches 72.” Ex.1005, 7:40-47. “The energized firing resistors 52 heat and eject ink onto print medium 36 to print an image represented by data signals D1, D2...Dm.” Ex.1005, 7:47-49.

Benjamin-144 teaches that “[i]n one embodiment, array 100 is arranged into six fire groups 102 a-102 n and each of the six fire groups 102 a-102 n includes 13 subgroups and eight data line groups.” Ex.1008, 7:4-6. Benjamin-144, however, teaches that “array 100 can be arranged into any suitable number of fire groups 102 a-102 n and into **any suitable number of subgroups and data line groups.**” Ex.1005, 7:7-14; *id.*, 7:14-17.

Benjamin-144 teaches its firing cell array 100 is organized into a three-dimensional matrix addressed by three wiring “lines”: n fire line groups, L row subgroup address lines and m data lines. In an exemplary embodiment, there are n=6 fire groups, L=13 row subgroups and m=8 data line groups, which can serve up to $6 \times 13 \times 8 = 624$ heaters. A PHOSITA would understand that the number of data lines in a fire group determines the number of simultaneous firings that can occur for that fire group because the data line data, “1” or “0,” is the final determiner of whether a drop is fired and has to be correct for whatever drop generators the other two matrix elements—fire group lines and row subgroup lines—select. Ex.1002, ¶¶278-284.

Therefore, Benjamin-144 necessarily teaches that 8 drop generators can be simultaneously fired in a particular fire group, which is confirmed in figures 21 and 22, below.

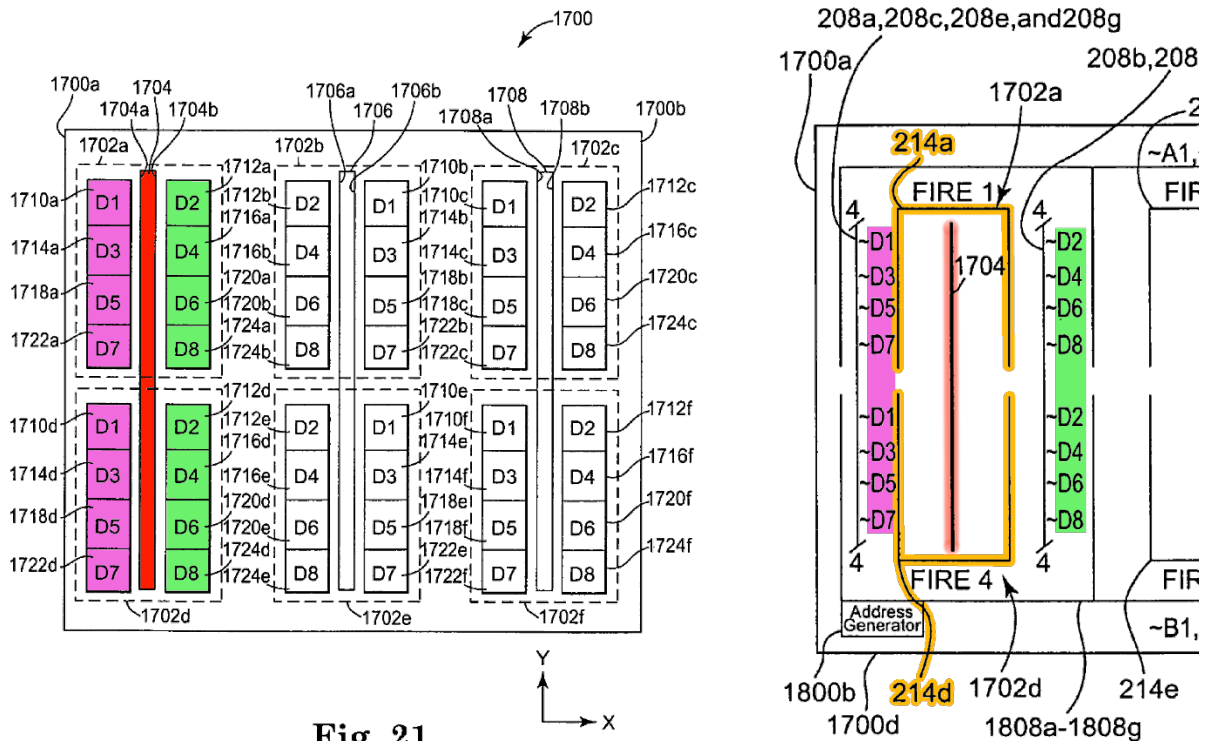


Fig. 21

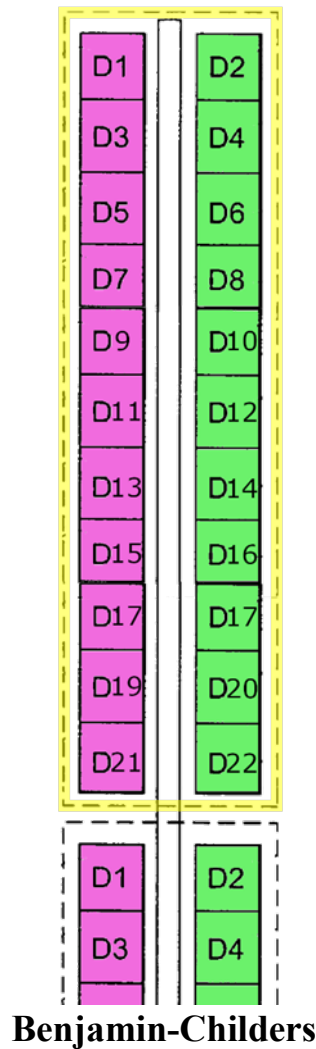
Ex.1005, Figs. 21-22

Figure 21 shows that each of the six fire groups services drop generators that are connected to all eight data lines. Thus, if an image required all eight drop generators to fire when one particular fire line was chosen and one particular row subgroup was chosen, Figures 21 and 22 show that there will be four firings (D1-D3-D5-D7) in the left trace of the firing line U and four firings (D2-D4-D6-D8) in the right trace of the firing line U. Ex.1002, ¶286.

As in Section VIII.B.5, claims 4, 11, and 18, incorporated here, Benjamin-Childers discloses 750 heaters per ink via array side, 1500 heaters per ink via in total. Keeping the structure of Benjamin-144's addressing scheme, a PHOSITA would appreciate that to accommodate the increased number of heaters, an increase in the number of data lines and subgroups would be necessary. Ex.1002, ¶287. Benjamin-144 teaches this. Ex.1005, 7:7-9 ("array 100 can be arranged into any suitable number of fire groups 102 a-102 n and into **any suitable number of subgroups and data line groups.**").

To accommodate 750 heaters per array, which is equivalent to 750 heaters per Benjamin-144 fire group or 375 heaters per U-shaped fire line side, a PHOSITA would implement a commensurate increase in the number of data lines and subgroups. Ex.1002, ¶288. Keeping Benjamin-144's structure of 2 U-shaped fire lines per ink via, a PHOSITA would choose the addressing matrix formed by m data lines and L subgroups to support addressing at least 750 members, i.e. $(m)(L) \geq 750$ and would allow for a substantial increase in printing speed. *Id.* Further, a PHOSITA would maintain Benjamin-144's ratio of subgroups to data lines (13:8), arriving at 35 subgroups and 22 data lines, providing capacity for 770 heaters per fire group. ¶289. This would result in capacity for 22 simultaneous firings within a fire group. A PHOSITA would know to balance the 22 data groups between the two via sides of each U-shaped fire line to balance the simultaneous heater firing current in the

fire line, resulting in 11 simultaneous firings on each left and right trace of the U-shaped firing line. Ex.1002, ¶289. Below is an exemplary figure showing the Benjamin-Childer's data line arrangement for a single fire group:



Therefore, Benjamin-Childers discloses “[t]he heater chip of claim 11, wherein the bondpad and the at least two traces are capable of **supplying eight simultaneous fires per heater array** [e.g., 11 simultaneous fires].” Ex.1002, ¶¶275-292.

**7. Ample Motivation Existed to Combine Benjamin-144,
Benjamin-703, and Childers**

A PHOSITA would have been motivated to combine Benjamin-144 with Benjamin-703 for the reasons explained in Section VIII.A.12, incorporated here, and to modify the Benjamin Combination based on Childers for the following reasons. Ex.1002, ¶¶293-301.

First, like Benjamin-144 and Benjamin-703, Childers is **analogous** to the '864 Patent's claimed subject matter and within the **same field of endeavor** of heater chips for inkjet printheads. *See, e.g.*, Ex.1007, Abstract, 1:42-52. The USPTO classified all into the same patent class—B41 (printing; etc.). Ex.1002, ¶294.

Second, a PHOSITA would have been motivated to modify the Benjamin Combination to utilize 750 heaters per array, as described in Childers for large format print media. Benjamin-144 explicitly teaches “a printhead with **more drop generators** typically prints with **higher quality and/or printing speed.**” Ex.1005, 1:67-2:2. Benjamin-144 also expressly teaches that “**printhead die 1700 can include any suitable number of drop generators 60**, such as 400 drop generators 60 or **more than 600 drop generators 60.**” Ex.1005, 67:29-32. Given Benjamin-144's express teachings, a PHOSITA would have looked to Childers, which teaches “**a large array printhead having a large array of ink drop generators** formed on a single monolithic substrate.” Ex.1007, 2:13-15. Childers teaches the advantages of thermal inkjet printers like Benjamin-144 (Ex.1007, 1:12-20) and explicitly

teaches how such benefits can be applied to large format devices for large print media, “such as architectural drawings.” Ex.1007, 1:53-2:7. Childers teaches that “[t]he printhead of the present invention is suitable for **high-speed printing systems...**” Ex.1007, 3:62-65. Childers teaches that in its exemplary embodiment “[p]referably, there are approximately **1500 nozzles** formed on the printhead 300.” Ex.1007, 5:30-35. Given these advantages, it would have been obvious to a PHOSITA to modify the Benjamin Combination printhead to include 1500 nozzles per color as taught by Childers. By making such a modification, a PHOSITA would have understood that this could create “a dimensionally precise large array printhead suitable for high-speed printing systems.” Ex.1007, 2:1-2. Ex.1002, ¶295.

A PHOSITA would have been motivated to modify the Benjamin Combination’s firing cell array to accommodate the increased number of heaters. A PHOSITA would have understood that these heaters would need to be activated efficiently to provide the desired printing speed and density. A PHOSITA would have modified the Benjamin Combination firing cell array as described in Section VIII.B.6. This would have resulted in a substantial increase in printing speed. Ex.1002, ¶296.

A PHOSITA would have been motivated to modify the Benjamin Combination to include **Childer’s multi-chamber printhead** to facilitate color and black text printing with a single printhead. Ex.1007, 3:34-36, 7:39-41; *see also*

Ex.1002, ¶297. Benjamin-144 explicitly teaches “**the printhead die may include a fewer or greater number of fluid feed sources.**” Ex.1005, 67:35-36. It would have been obvious for a PHOSITA to try increasing the number of ink vias from three to four and would have yielded predictable results (as demonstrated by Childers). There a finite number of ways a PHOSITA can add black ink printing to the Benjamin Combination’s printhead: either add a separate black printhead or add a fourth black ink via. Thus, a POSITA wanting black ink printing in addition to color ink would have been motivated to modify the Benjamin Combination to include Childer’s multi-chamber printhead. Ex.1002, ¶297.

Further, a PHOSITA would have been motivated to modify the Benjamin Combination’s firing cell array to accommodate the additional fluid feed source. Ex.1002, ¶298. Benjamin-144 is explicit that its printhead die “can be arranged into **any suitable number of fire groups 102 a-102 n** and into **any suitable number of subgroups and data line groups.**” Ex.1005, 7:7-9. When a PHOSITA added the additional fluid feed source, he would also have been motivated to add the necessary components to eject ink from that fluid feed source, including additional fire groups and their respective U-Shaped fire lines 214 and associated fire line bondpads. Ex.1002, ¶298.

Third, increasing the number of nozzles and fluid feed sources in the Benjamin Combination like Childer’s large array printhead would have been an

obvious combination of prior art elements to yield predictable results. A PHOSITA could have combined Childer's large array 1500 nozzle per color, 4 fluid feed source printhead with Benjamin-144's printhead using known methods, such as Childers teachings, e.g., an increase in nozzles and fluid feed sources and printing larger swaths at higher speeds. The combination would have resulted in higher printing speed and additional capability for text printing and would have been predictable to a PHOSITA. Ex.1002, ¶299.

Finally, a PHOSITA would have had a *reasonable expectation of success* in making this modification. The printhead components described in the Benjamin Combination and Childers (e.g., thermal ink jet printing, drop generators, heaters, firing cell arrays) were well-known at the time. *See, e.g.*, Ex.1005, 1:32-45; 1:46-48; 1:64-2:2; Ex.1007, 1:12-13; 1:13-52; 1:53-57. Thus, it would also have been straightforward for a PHOSITA to modify the Benjamin Combination to increase the number of drop generators and the number of fluid feed sources taught by Childers and such a system would work. Ex.1002, ¶300. A PHOSITA would have accomplished such modifications to Benjamin's printhead with a reasonable expectation of success by simply following the conventional design for placement of drop generators and fluid feed sources in the Benjamin Combination. Ex.1002, ¶300.

Because Benjamin-Childers discloses all limitations of claim 4, 11-12, and 16-20, those claims are obvious. Ex.1002, ¶¶209-301.

C. Ground 3: Uenishi Anticipates Claims 1, 3, 5-6, 8-10, 13 and 15

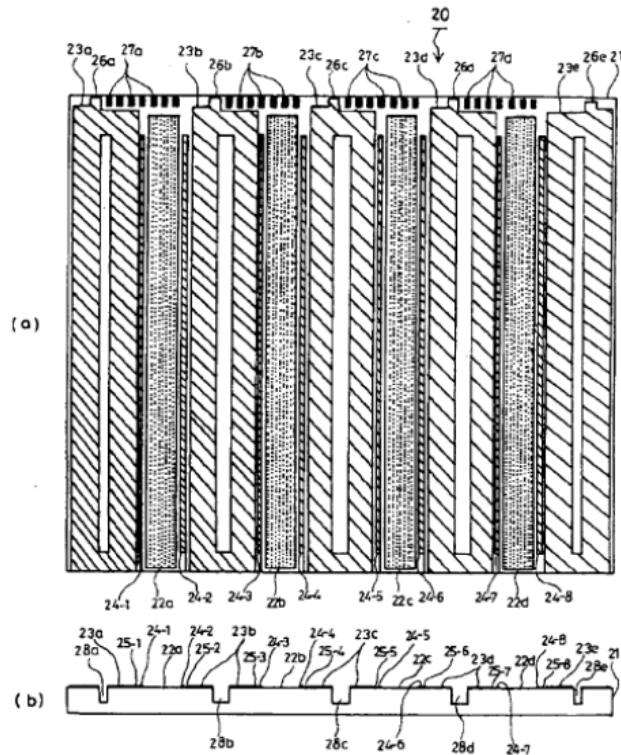
1. Claim 1

a. 1[P] “A heater chip for use in a printing device”

To the extent the preamble is limiting, *see* Section VIII.A.1.a, Uenishi discloses “[a] **heater chip for use in a printing device.**” Ex.1002, ¶¶304-310.

Uenishi teaches “[t]he present invention relates to **thermal inkjet heads.**” Ex.1008, [0001]. Uenishi teaches a “**thermal inkjet system heats a heater and forms nucleus bubbles on the heater surface.**” Ex.1008, [0002].

Uenishi teaches “each **heating head**” has a “**silicon chip.**” Ex.1008, [0021]. Uenishi teaches that “[its] embodiment **can shrink the chip size** without increasing the size of the **thermal inkjet head...**” Ex.1008, [0046]. Uenishi’s heater “chip” for use in a printing device is shown below:



Ex.1008, Figure 1

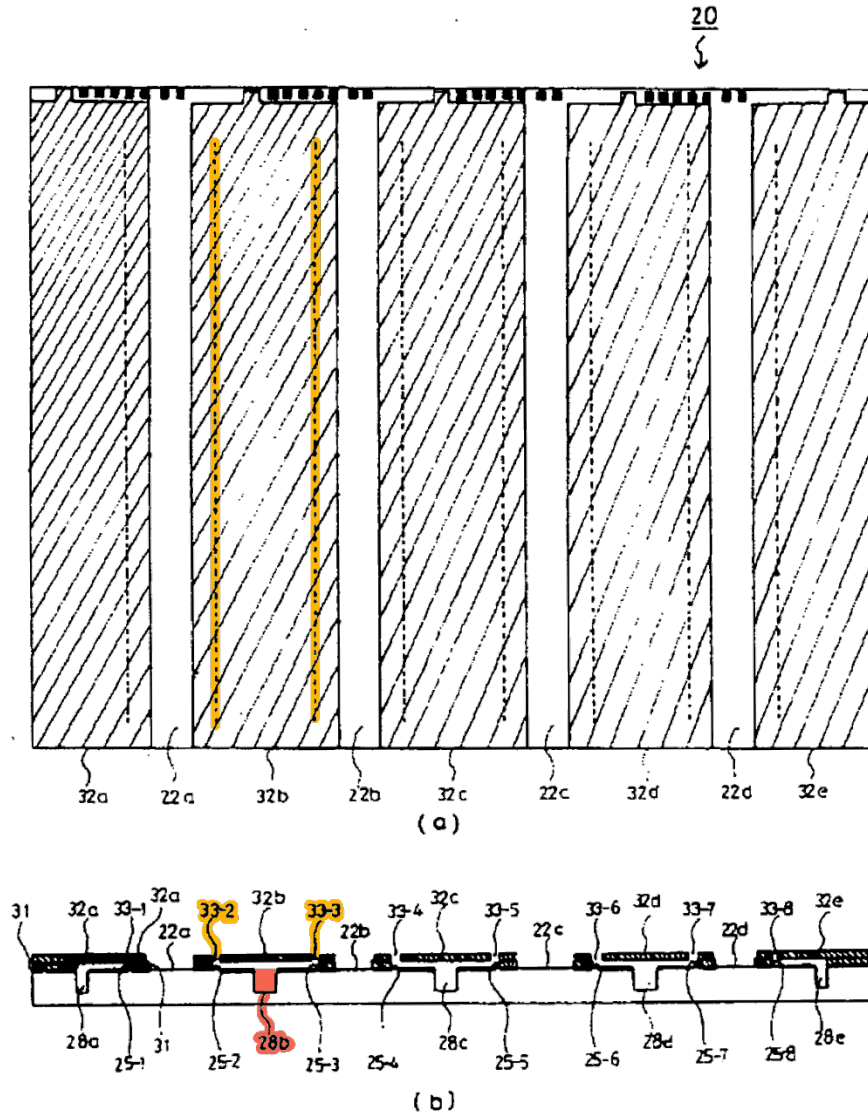
Accordingly, Uenishi discloses **a heater chip** [e.g., chip of thermal inkjet head] **for use in a printing device** [e.g., thermal inkjet printer]. Ex.1002, ¶¶304-310.

b. I[A] “an ink via”

Uenishi discloses this limitation. Ex.1002, ¶¶311-318.

Uenishi teaches “a thermal inkjet head...that is constituted having a single **ink supply channel** installed between adjacent heating heads **that supplies the ink in common to the heating elements of the heating elements on both said sides.**” Ex.1008, [0024]; *id.*, [0034], [0040].

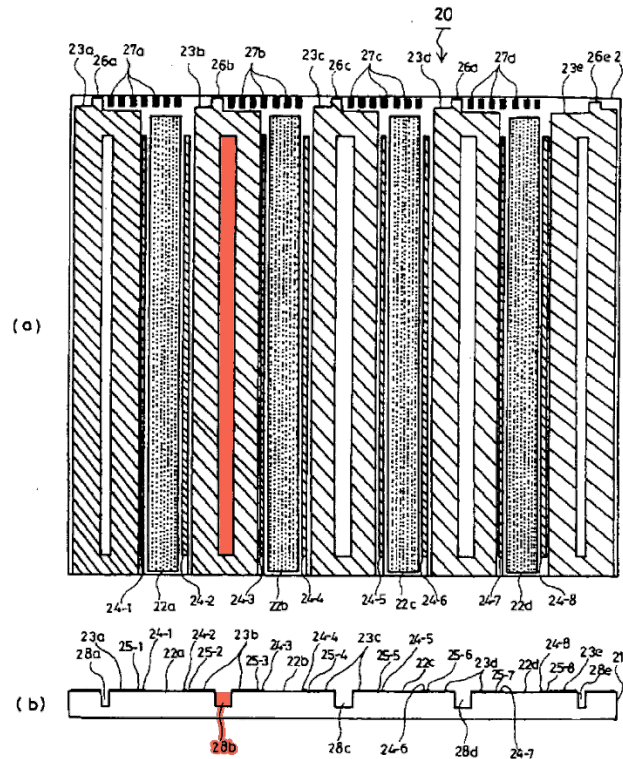
Uenishi Figures 2(a) and 2(b), below show the arrangement of Uenishi's ink supply channel 28 [red] and nozzle ports 33 [orange].



Ex.1008, Figure 2

Figure 1, below, shows “the Y ink of the second ink supply channel 28b [red] is supplied to the nozzle column of the nozzle port 33-2 and the nozzle column of the nozzle port 33-3 of the orifice plate 32b.” Ex.1008, [0039].

As seen in Figure 1, Uenishi's print head includes an ink supply channel 28b [i.e ink via] (red).



Ex.1008, Figure 1

Accordingly, Uenishi discloses “an ink via [e.g., ink supply channel 28b, red].” Ex.1002, ¶¶311-318.

- c. 1[B] “a first heater array adjacent at least a portion of one side of the ink via; a second heater array adjacent at least a portion of another side of the ink via”

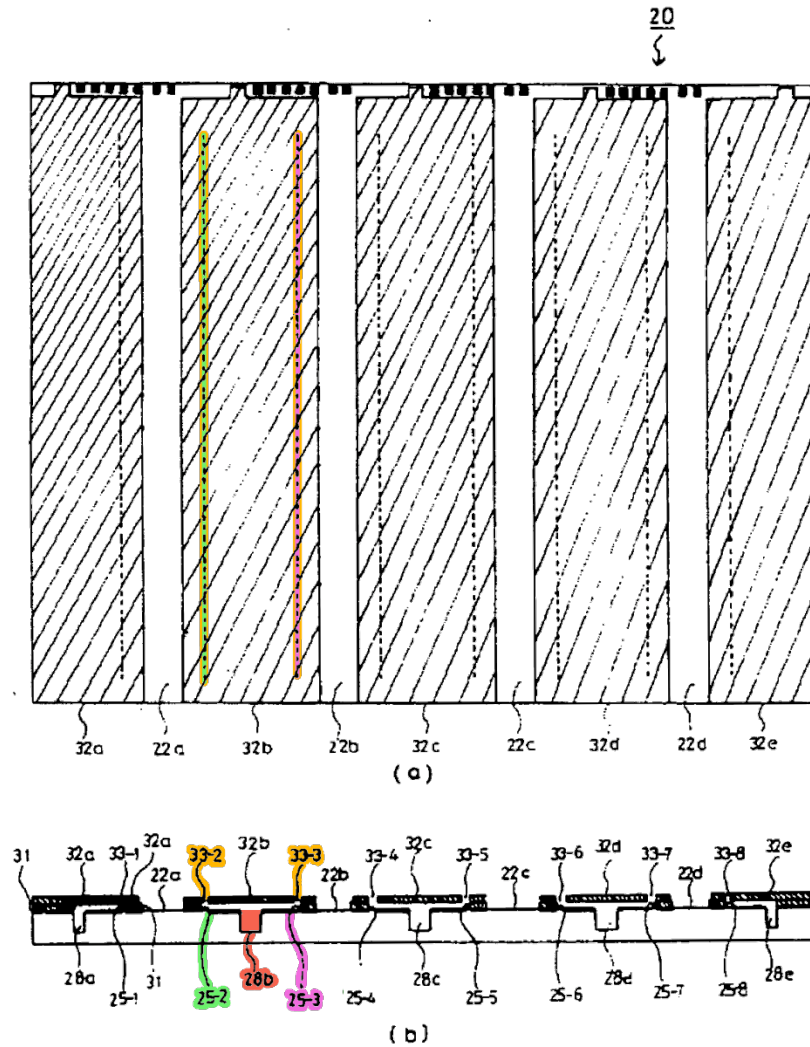
Uenishi discloses this limitation. Ex.1002, ¶¶319-325.

Uenishi teaches “a thermal inkjet head equipped with a **plurality of heating heads that disposes a plurality of heating elements in an array form...**” Ex.1008, [0024]. Uenishi teaches the “ink supply channel [ink via] installed between adjacent

heating heads that **supplies the ink in common to the heating elements of the heating elements on both said sides.**” Ex.1008, [0024].

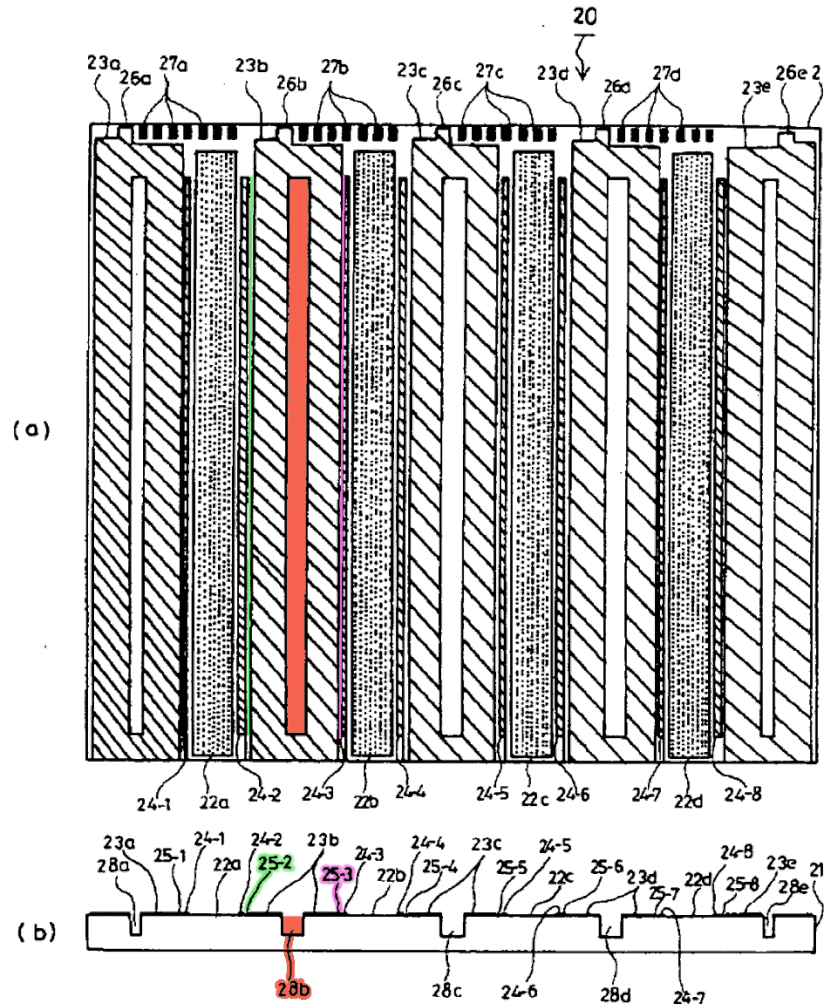
Uenishi teaches that its “thermal inkjet head 20 forms four drive circuits 22a, 22b, 22c and 22d on the silicon substrate 21, as Figs. 1(a) and (b) show. Ex.1008, [0029]. Uenishi explains that “[t]o the second drive circuit 22b, **a resistor 25-3 is formed connected thereto on the one side** via the individual wiring electrode 24-3 between the drive circuit 22b and the second common electrode 23b, while **a resistor 25-4 is formed connected thereto on the other side** via the individual wiring electrode 24-4 between the drive circuit 22b and the third common electrode 23c.” Ex.1008, [0030]; *see id.*, [0029], [0031]-[0032]. Uenishi identifies its resistors 25 as “**heating elements.**” Ex.1008, Legend (“25 (25-1, 25-2, ..., 25-7, 25-8) Resistors (heating elements)”).

Figure 2, below, shows this arrangement of Uenishi’s first heating resistors 25-2 (green), second heating resistors 25-3 (magenta), and nozzle ports 33 (orange).



Ex.1008, Figure 2

Figure 1 shows that the first heater array 25-2 (green) is adjacent at least a portion of one side of the ink via 28b (red) and the second heater array 25-3 (magenta) is adjacent at least a portion of another side of the ink via 28b.



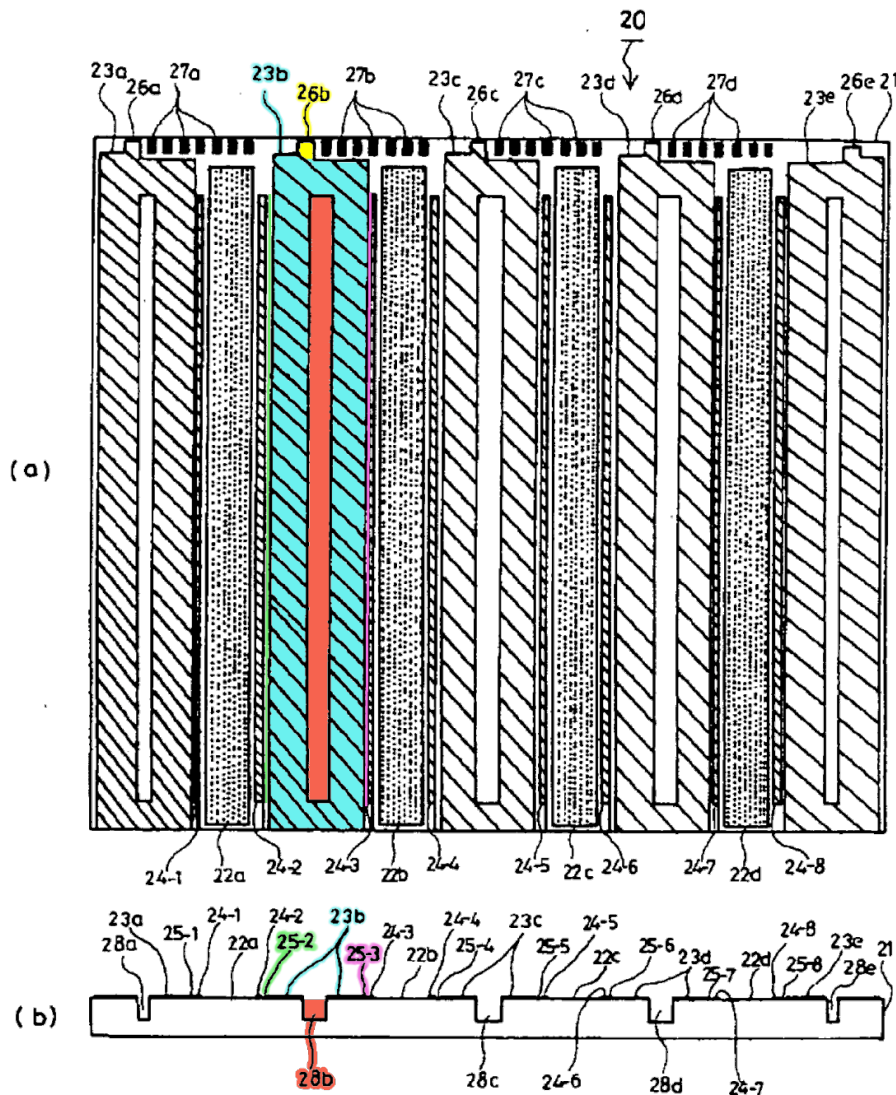
Ex.1008, Figure 1

Accordingly, Uenishi discloses “a **first heater array** [e.g., resistor array 25-2 (green)] **adjacent** at least a **portion of one side of the ink via** [e.g., left of ink supply channel 28b (red)]; a second heater array [e.g., resistor array 25-3 (magenta)] **adjacent** at least a **portion of another side of the ink via** [e.g., right of ink supply channel 28b (red)].” Ex.1002, ¶¶319-325.

- d. 1[C] “a bondpad wherein the bondpad supplies power to at least a portion of the first heater array and to at least a portion of the second heater array”

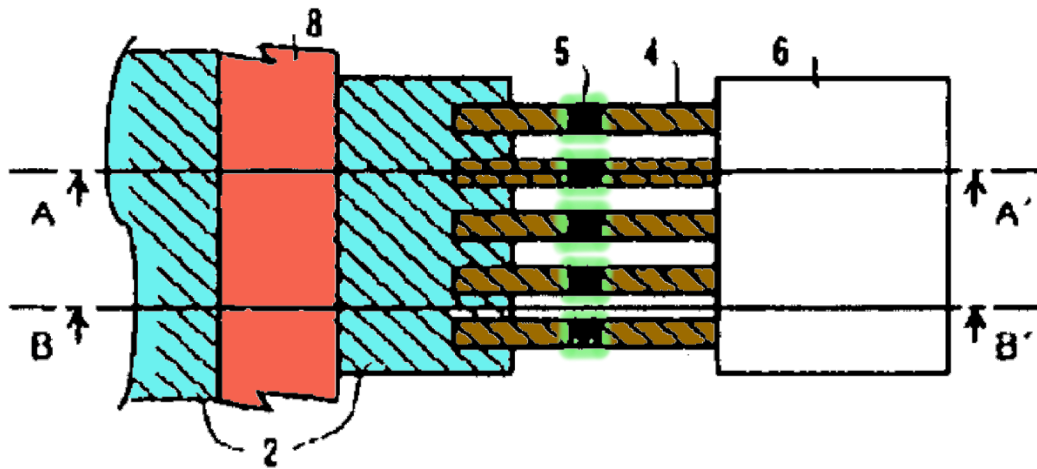
Uenishi discloses this limitation. Ex.1002, ¶¶326-332.

Uenishi teaches the electricity-feed terminals 26 (yellow) supplies power to at least a portion of the first and second heater array resistor arrays 25-2, 25-3 (green and magenta) via a common electrode 23 (blue).



Ex.1008, Figure 1

Uenishi states that the thermal inkjet head 20 includes “five common electrodes 23a-23e.” Ex.1008, [0033]. Uenishi explains “resistor 25-2 [green] **is formed connected...**via the individual wiring electrode 24-2 [brown] between the drive circuit 22a and the second **common electrode 23b [teal]...a resistor 25-3 is formed connected thereto** on the one side via the individual wiring electrode 24-3 between the drive circuit 22b and **the second common electrode 23b...**”as shown in Figure 7, below. Ex.1008, [0029]-[0030].



Ex.1008, Figure 7 (excerpt)

Uenishi’s figure 1, above, shows the electricity-feed terminals 26 (yellow) supply power to the common electrodes 23 (teal), which themselves provide power to at least a portion of the first heater array 25-2 (green) and to at least a portion of the second heater array 25-3 (magenta).

Accordingly, Uenishi discloses “a **bondpad** [e.g., electricity-feed terminal 26b (yellow)] wherein the bondpad **supplies power** [e.g., via common electrodes

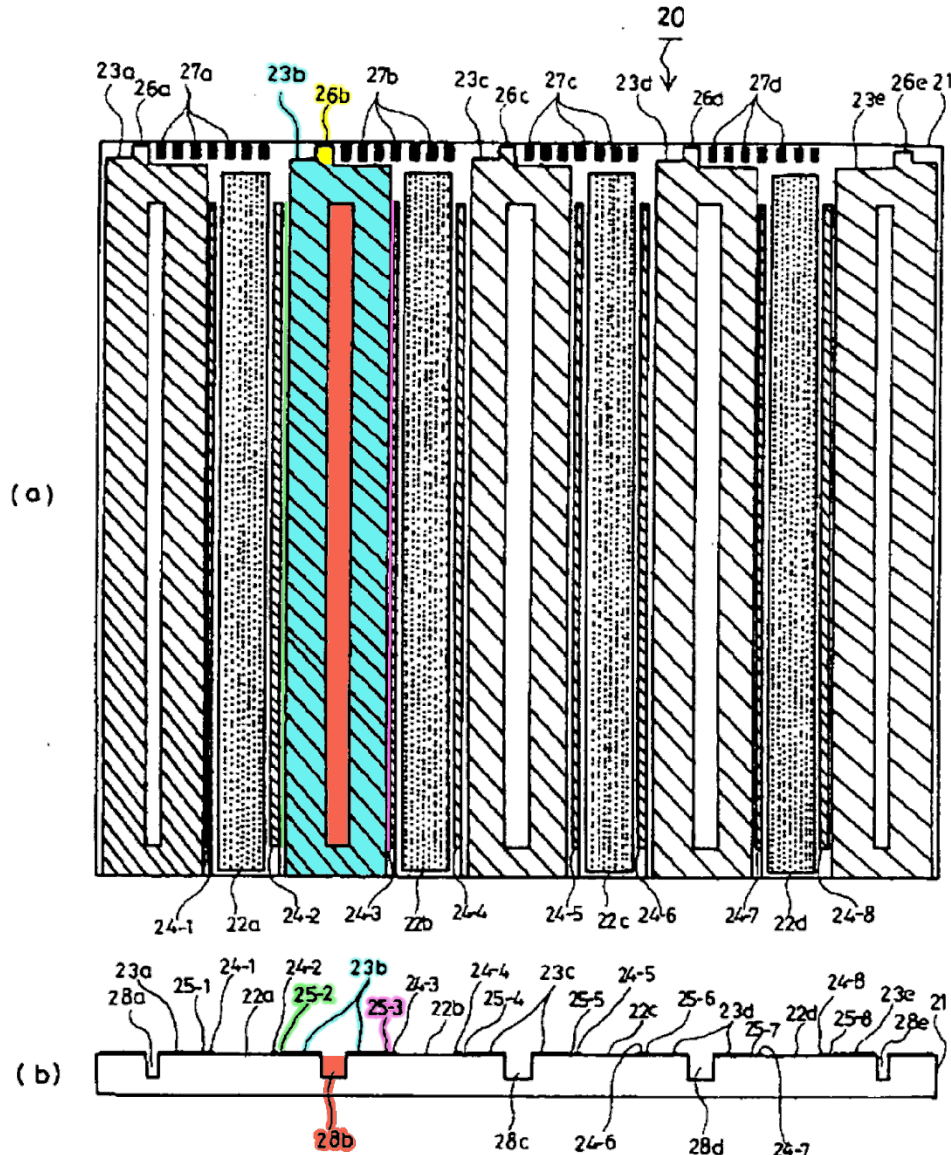
23b (teal)] to at least a **portion of the first heater array** [e.g., resistor array 25-2 (green)] **and** to at least a **portion of the second heater array** [e.g., resistor array 25-3 (magenta)].” Ex.1002, ¶¶326-332.

2. Claim 3

Claim 3 requires “[t]he heater chip of claim 1, wherein **the bondpad supplies power to the first heater array and the second heater array portions by power traces physically separated proximal to the bondpad,**” which Uenishi discloses. Ex.1002, ¶¶333-341.

As discussed in Section VIII.C.1.d, limitation 1[C], incorporated here, Uenishi’s common electrode 23b supplies power to the first heater array portion 25-2 and the second heater array portion 25-3 via a bondpad or electricity-feed terminal 26b.

In Figure 1, Uenishi teaches that “the **center parts in the direction of length are cut out from their respective common electrodes 23a–23e** and ink supply channels 28a–28d are formed in their lower areas.” Ex.1008, [0034]. Uenishi teaches that its common electrode includes traces that are physically separated from one another to accommodate the ink supply channels 28. Ex.1002, ¶339.



Ex.1008, Figure 1

These portions or traces of the common electrode 23b (teal left and right sides) are physically separated proximal to the electricity-feed terminal 26. Ex.1002, ¶¶339-340.

Thus, Uenishi discloses “[t]he heater chip of claim 1, wherein the bondpad [e.g., electricity-feed terminals 26b (yellow)] supplies power [e.g., via common

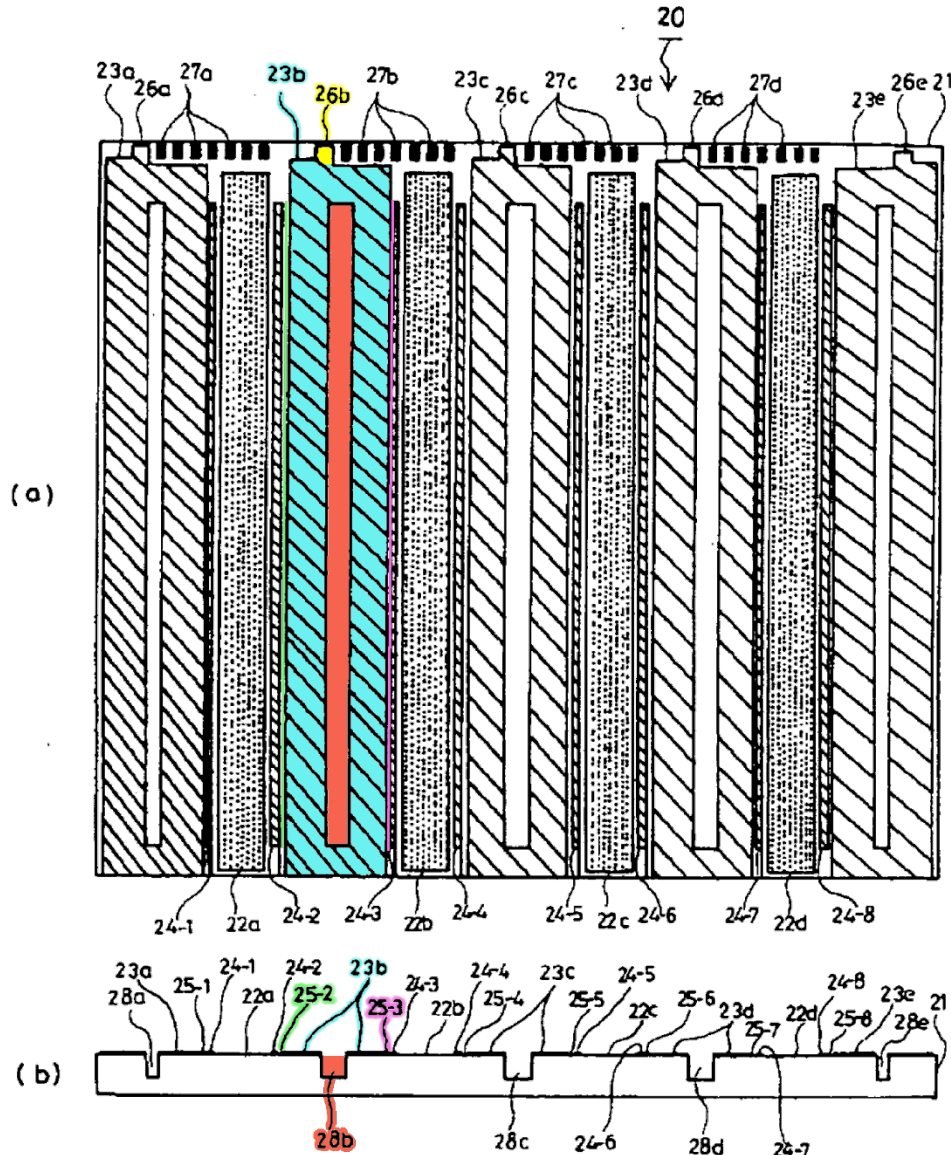
electrodes 23b (teal)] to the first heater array [e.g., resistor array 25-2 (green)] and the second heater array [e.g., resistor array 25-3 (magenta)] portions **by power traces** [e.g., common electrodes 23] **physically separated proximal to the bondpad** [e.g., common electrode 23b splitting in two, from the cutout of the center section of common electrodes 23b, near electricity-feed terminal 26b].” Ex.1002, ¶¶333-341.

3. Claim 5

Claim 5 requires “[t]he heater chip of claim 1, **wherein the bondpad supplies power to the first heater array and the second heater array by at least one power trace,**” which Uenishi discloses. Ex.1002, ¶¶342-346.

As in Section VIII.C.2, claim 3, incorporated here, Uenishi teaches the bondpad supplies power to the first heater array and the second heater array portions by power traces physically separated proximal to the bondpad.

Uenishi figure 1, below, teaches the bondpad (yellow) supplies power to the first heater array (green) and second heater array (magenta) by at least one power trace (teal).



Ex.1008, Figure 1

Thus, Uenishi discloses “[t]he heater chip of claim 1, wherein the bondpad [e.g., electricity-feed terminal 26b (yellow)] **supplies power** [e.g., via common electrode 23b (teal)] to the **first heater array** [e.g., resistor array 25-2 (green)] and the **second heater array** [e.g., resistor array 25-3 (magenta)] by **at least one power trace** [e.g., common electrodes 23b].” Ex.1002, ¶¶342-346

4. Claim 6

Claim 6 requires “[t]he heater chip of claim 1, **wherein the first heater array and the second heater array each include a plurality of thin film resistors,**” which Uenishi discloses. Ex.1002, ¶¶347-351.

Uenishi teaches “electrodes comprised of Ni or the like and **miniature resistors of Ta-Si-SiO or the like are formed using thin-film technology**...ports of 20–40µm are created in areas corresponding to the **miniature resistors** on the thin-plate material...” Ex.1008, [0006]; *id.*, [0004], [0024], [0028].

Therefore, Uenishi teaches “[t]he heater chip of claim 1, wherein the first heater array [e.g., resistor array 25-2 (green)] and the second heater array [e.g., resistor array 25-3 (magenta)] each include a **plurality of thin film resistors** [e.g., miniature resistors using thin-film technology].” Ex.1002, ¶¶347-351.

5. Claim 8

a. 8[P] “A heater chip for use in a printing device”

This limitation is identical to claim limitation 1[P] and disclosed for the same reasons in Section VIII.C.1.a, incorporated here. Ex.1002, ¶353.

b. 8[A] “an ink via”

This limitation is identical to claim limitation 1[A] and disclosed for the same reasons in Section VIII.C.5.b, incorporated here. Ex.1002, ¶354.

- c. 8[B] *“a first heater array and a second heater array adjacent at least a portion of the ink via wherein the ink via is positioned between the first heater array and the second heater array”*

This limitation is analogous to claim limitation 1[B] and disclosed for the same reasons in Section VIII.C.5.c, incorporated here. Ex.1002, ¶¶355-358.

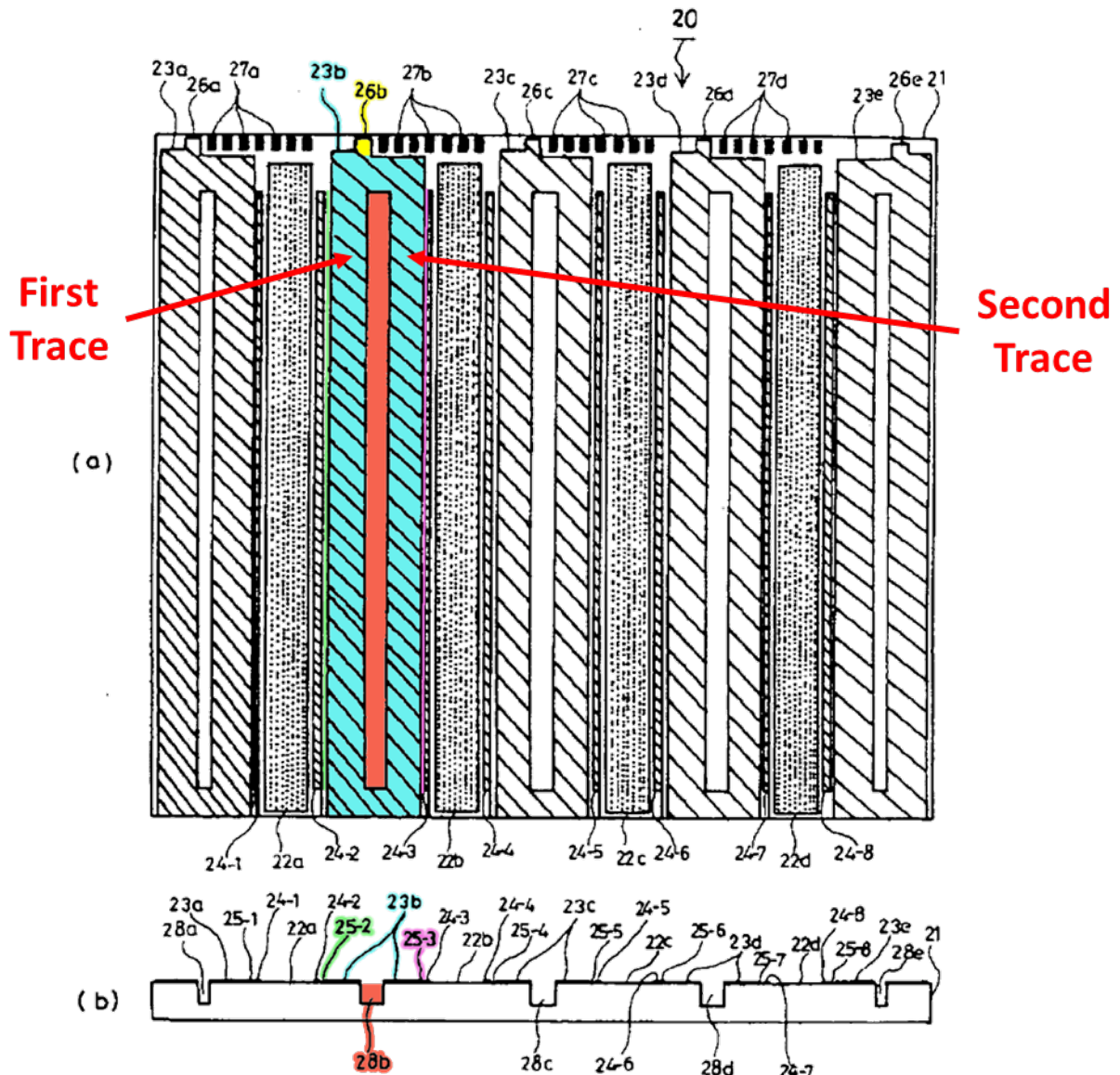
- d. 8[C] *“a bondpad having at least two traces stemming from the bondpad wherein at least one of the traces is operatively connected to the first heater array and at least another one of the traces is operatively connected to the second heater array”*

Uenishi discloses this limitation. Ex.1002, ¶¶359-367.

As in Section VIII.C.1.d, limitation 1[C], incorporated here, Uenishi teaches a bondpad connected to the first heater array and the second heater array. Uenishi discloses the remaining limitation “having at least two traces stemming from the bondpad.” Ex.1002, ¶¶326-332, 359.

As in Section VIII.C.2, claim 3, incorporated here, Uenishi teaches a bondpad having two traces, where one of the traces is operatively connected to the first heater array and at least another one of the traces is operatively connected to the second heater array. Ex.1002, ¶¶333-341.

Uenishi’s figure 1, below, shows the traces of the common electrode 23b (left and right sides) stem from the electricity-feed terminal 26.



Ex.1008, Figure 1

Therefore, Uenishi discloses “a **bondpad** [e.g., electricity-feed terminal 26b (yellow)] having at least **two traces** [e.g., common electrodes 23b (teal)] stemming from the bondpad [e.g., resulting from cutout of center section of common electrode 23b] wherein **at least one of the traces is operatively connected to** [e.g., via left branch of common electrodes 23b] the **first heater array** [e.g., resistor array 25-2

(green)] **and** at least **another one of the traces** is operatively connected to [e.g., via right branch of common electrodes 23b] the **second heater array**[e.g., resistor array 25-3 (magenta)].” Ex.1002, ¶¶359-367.

6. Claim 9

Claim 9 requires “[t]he heater chip of claim 8, **wherein the at least two traces are physically separated proximal to the bondpad,**” which Uenishi discloses. Ex.1002, ¶¶368-370.

This limitation is broader than claim 3 and disclosed for the same reasons in Section VIII.C.2, incorporated here. Ex.1002, ¶¶333-341, 368-370.

7. Claim 10

Claim 10 requires “[t]he heater chip of claim 8, wherein the first and second heater arrays include a **plurality of thin film resistors** formed, at least in part, from a material selected from the group of materials consisting of platinum, gold, silver, copper, aluminum, **tantalum**, titanium tungsten, silicon-nitrogen, silicon carbide, and diamond-like carbon,” which Uenishi discloses. Ex.1002, ¶¶371-376.

As in Section VIII.C.4, claim 6, incorporated here, Uenishi teaches the first and second heater arrays include a plurality of thin film resistors.

Uenishi teaches “electrodes comprised of Ni or the like and **miniature resistors of Ta-Si-SiO or the like are formed using thin-film technology**...ports

of 20–40µm are created in areas corresponding to the **miniature resistors** on the thin-plate material...” Ex.1008, [0006]; *id.*, [0028].

Accordingly, Uenishi discloses “[t]he heater chip of claim 8, wherein the **first** [e.g., resistor array 25-2 (green)] **and second** [e.g., resistor array 25-3 (magenta)] **heater arrays** include a **plurality of thin film resistors** [e.g., miniature resistors using thin-film technology] **formed**, at least **in part**, from **a material selected from the group of** materials consisting of platinum, gold, silver, copper, aluminum, **tantalum**, titanium tungsten, silicon-nitrogen, silicon carbide, and diamond-like carbon. [e.g., Ta-Si-SiO or the like].” Ex.1002, ¶¶371-376.

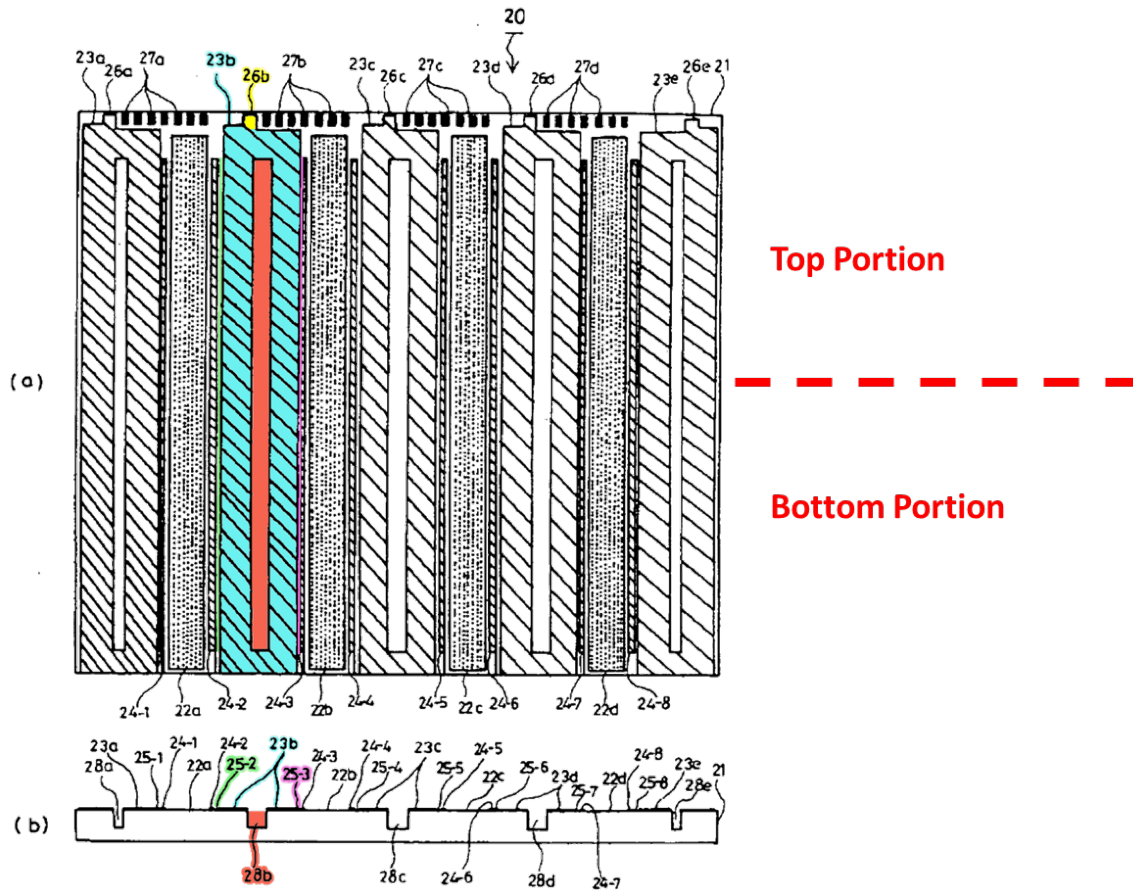
8. Claim 13

Claim 13 requires “[t]he heater chip of claim 8, wherein the first and second heater arrays each comprise a **top portion** and a **bottom portion**, and wherein the **bondpad** is operatively connected to the **top portion** of the **first heater array** and the **top portion** of the **second heater array**,” which Uenishi discloses. Ex.1002, ¶¶377-384.

As in Section VIII.C.1.d, limitation 1[C], incorporated here, Uenishi includes a bondpad operatively connected to each of resistor arrays 25-2 and 25-3. Uenishi teaches Claim 13’s remaining limitation.

Uenishi’s Figure 1 shows heating resistors 25-2 and 25-3 (green and magenta) form an array comprising a top portion and a bottom portion in which the electricity-

feed terminal 26b (yellow) supplies power to the top portion of the array of heating resistors 25-2, 25-3 (green and magenta) via the common electrodes 23b (teal).



Ex.1008, Figure 1

Accordingly, Uenishi discloses “wherein the **first** [e.g., resistor arrays 25-2 (green)] and **second** [e.g., resistor arrays 25-3 (magenta)] **heater arrays** each comprise a **top portion** and a **bottom portion** [e.g., top half and bottom half of each array], and wherein the **bondpad** [e.g., electricity-feed terminal 26b (yellow)] is operatively connected to the **top portion** of the **first heater array** and the **top portion** of the **second heater array** [e.g., via common electrodes 23b (teal)].”

Ex.1002, ¶¶377-384.

9. Claim 15

- a. 15[A] “The heater chip of claim 8, further comprising: another ink via disposed between a third heater array and a fourth heater array; and”*

Uenishi discloses this limitation. Ex.1002, ¶¶387-392.

As in Sections VIII.C.1.b-VIII.C.1.c, limitations 1[A]-1[B], incorporated here, Uenishi teaches **another ink via** disposed between a third heater array and a fourth heater array.

Uenishi teaches its thermal inkjet head 20 as “equipped **with two columns of nozzles for each color** for a total of eight columns of nozzles for the four colors together, and **the ink supply channel 28 that supplies ink to the nozzle ports 33** of these columns is configured of **five channels**, three fewer than the number of nozzle columns.” Ex.1008, [0040]; *see id.*, [0024], [0029]-[0034].

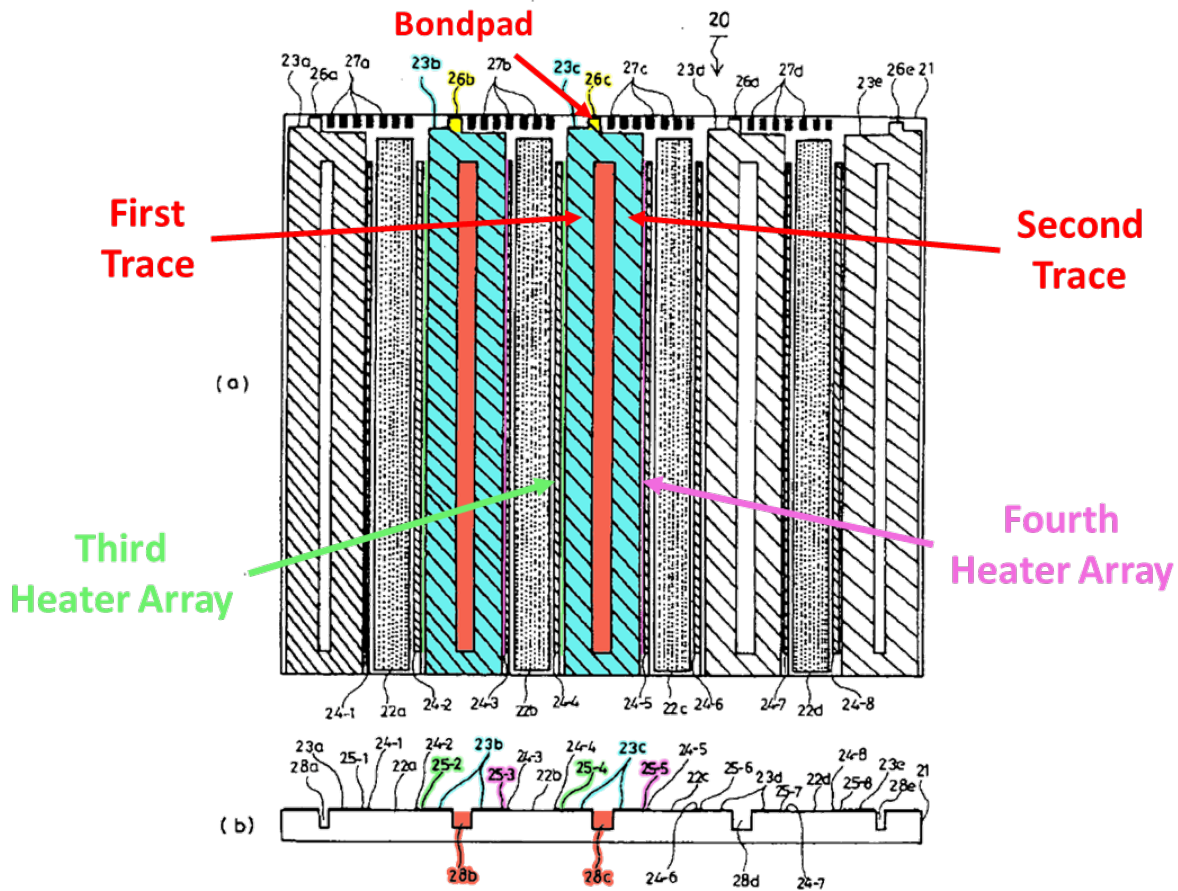
As seen in Figure 1, a second ink supply channel 28c (red) is disposed between a third resistor array 25-4 (green) and a fourth resistor array 25-5 (magenta).



b. 15[B] “a second bondpad coupled to a trace that is operatively connected to the third heater array and to a trace that is operatively connected to the fourth heater array”

Uenishi discloses this limitation. Ex.1002, ¶¶393-396.

As in Sections VIII.C.1.d and VIII.C.5.d, limitations 1[C] and 8[D], incorporated here, Uenishi includes a bondpad operatively connected to each of resistor arrays 25-4 and 25-5 as shown in Figure 1.



Ex.1008, Figure 1

Figure 1 shows a second electricity-feed terminal 26c (yellow) connect to portions or traces (left and right sides) of a second common electrode 23c to supply power to heating resistors 25-4, 25-5 (green and magenta) via the common electrodes 23c (teal).

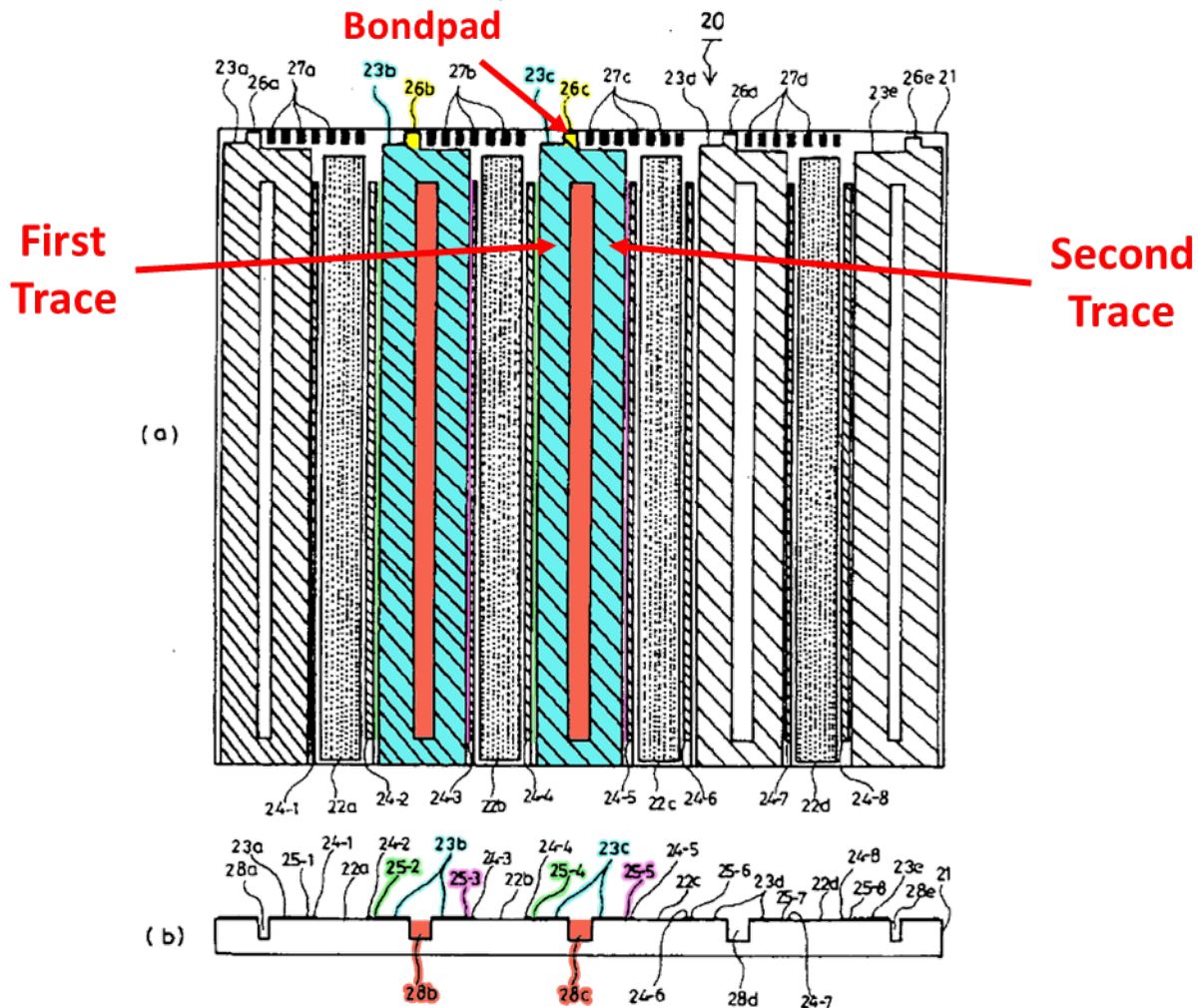
Accordingly, Uenishi discloses “a **second bondpad** [e.g., electricity-feed terminal 26c (yellow)] **coupled to a trace** [e.g., common electrodes 23c (teal)] that

is operatively connected to the **third heater array** [e.g., resistor arrays 25-4 (green)] and **to a trace** [e.g., common electrodes 23c] that is operatively connected to the **fourth heater array** [e.g., resistor array 25-5 (magenta)].” Ex.1002, ¶¶393-396.

c. 15[C] “wherein the traces coupled to the second bondpad are physically separated proximal to the second bondpad”

As in Sections VIII.C.2 and VIII.C.6, claims 3 and 9, incorporated here, Uenishi teaches the traces coupled to the second bondpad are physically separated proximal to the second bondpad. Ex.1002, ¶¶397-400.

Uenishi’s figure 1, below, shows the portions or traces of the common electrode 23c (teal left and right sides) are physically separated proximal to the electricity-feed terminal 26c. Ex.1002, ¶399.



Ex.1008, Figure 1

Therefore, Uenishi discloses “the **traces** [e.g., common electrode 23c (teal)] coupled to the **second bondpad** [e.g., electricity-feed terminals 26c (yellow)] are **physically separated proximal to the second bondpad** [e.g., resulting from cutout of center section of common electrodes 23c].” Ex.1002, ¶¶397-400.

D. Ground 4: Uenishi-Hayasaki Combination Renders Obvious Claims 4, 11, and 12

1. Claims 4 and 11

Claims 4 and 11 each require “wherein each of the first and second heater arrays comprise at least 320 heaters,” which Uenishi-Hayasaki discloses. Ex.1002, ¶¶402-410.

Uenishi teaches its heater columns include “256 nozzles in one column at a resolution of 360dpi.” Ex.1008, [0052]. However, Uenishi also teaches that “for a resolution of 720dpi, **four columns** of 256 nozzles (**1280 nozzles**) will be formed...” Ex.1008, [0016]. A PHOSITA would appreciate that 1280 nozzles distributed across four columns provided for 320 nozzles per column. Ex.1002, ¶405.

To the extent the Board finds Uenishi does not disclose 320 heaters, Hayasaki discloses this limitation. Hayasaki teaches “**to increase the printing speed or printing density, the number of printing elements arranged in the printhead increases, and the density of printing elements also increases.**” Ex.1009, [0015]. Hayasaki teaches “a printhead capable of **high-density, high-speed printing** can be provided **by increasing the number of printing elements** or arraying printing elements in various patterns **without changing the size and cost of the printhead.**” Ex.1009, [0032].

In one embodiment, Hayasaki teaches a “printhead...[that] has **352 printing elements×2 rows**, i.e., a total of 704 printing elements...” Ex.1009, [0081]. Hayasaki teaches that its “printing elements” are “**heaters.**” Ex.1009, [0012].

As discussed in Section VIII.D.3, it would have been obvious to modify the configuration of Uenishi to utilize 352 heaters per array, as described in Hayasaki. Ex.1002, ¶¶442-429.

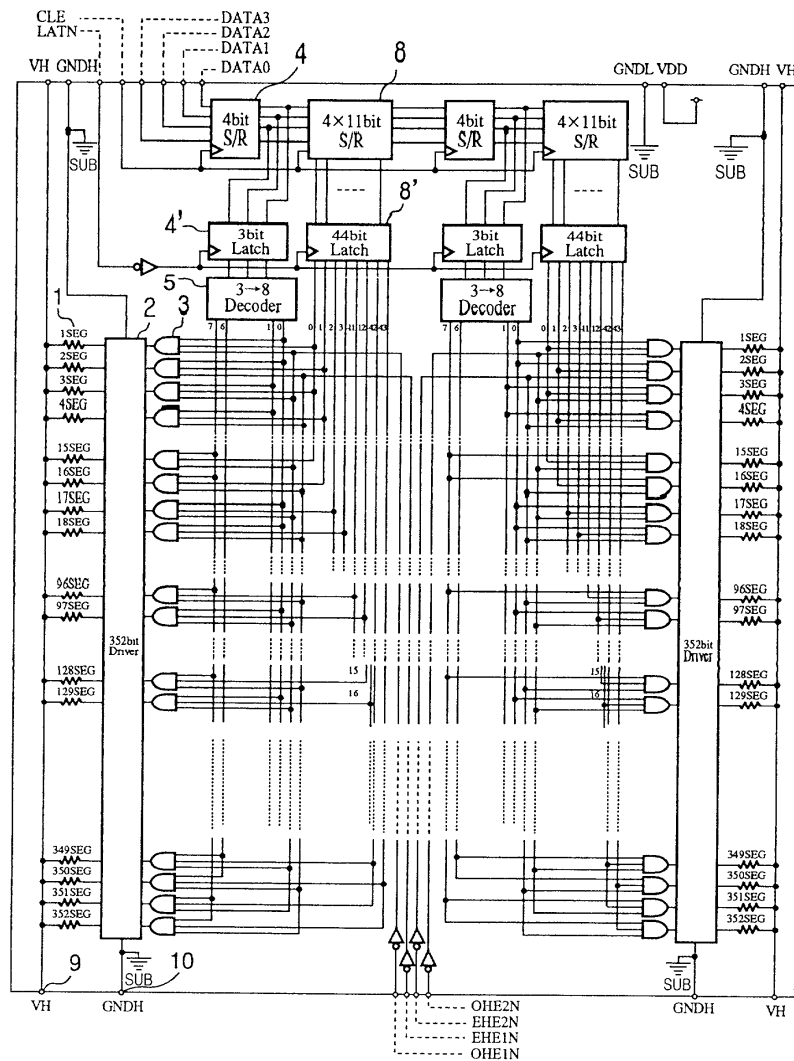
Accordingly, Uenishi-Hayasaki discloses “wherein **each of the first and second heater arrays** comprise **at least 320 heaters** [e.g., 352 printing elements].” Ex.1002, ¶¶402-410.

2. Claim 12

Claim 12 requires “[t]he heater chip of claim 11, wherein the bondpad and the at least two traces are capable of supplying **eight simultaneous fires per heater array**,” which Uenishi-Hayasaki discloses. Ex.1002, ¶¶411-421.

Hayasaki teaches “[t]he present invention relates to...a printhead which **selects a block consisting of a plurality of printing elements that can be simultaneously driven...**” Ex.1009, [0001]. Hayasaki explains its invention “**can speed up** transfer of image data and driving of printing elements **without increasing the number of signal lines and connection terminals....**” Ex.1009, [0026]. This is consistent with Uenishi’s goal of reducing the number of components. Ex.1008, [0023], [0040]-[0041].

Hayasaki teaches “[t]he printhead of this embodiment has 352 printing elements×2 rows...” Ex.1009, [0081]. Figure 3, below, discloses each 352 printing element row controlled by a column of AND circuits 3, each having three inputs. Ex.1009, [0062].

FIG. 3**Ex.1009, Figure 3**

Hayasaki’s three AND circuit inputs include a control line (e0-e7) from coder 5, a data line (B0-B43) from 44 bit latch 8’, and an odd/even control line

(OHE1N/EHE1N). Ex.1009, [0088]-[0091]; Ex.1002, ¶¶414-419. A PHOSITA would appreciate that a printing element will fire when its AND circuit has all three control input lines activated and firing power line VH is energized. Ex.1002, ¶415.

Hayasaki teaches “[e]ach of the signals e0 to e7 can **simultaneously activate 44 distributed printing elements**” and is “the first printing control signal.” Ex.1009, [0088]. Hayasaki then teaches “[t]he second printing control signals generated in the circuit include BLK outputs B0 to B43” and that “[e]ach output can simultaneously activate eight printing elements.” Ex.1009, [0089]. Hayasaki teaches that “[o]dd- and even-numbered elements are respectively driven at different timings.” Ex.1009, [0082].

A PHOSITA would appreciate this arrangement allows **simultaneous firing of 22 printing elements**. Ex.1002, ¶419. 44 printing elements are enabled by the first printing control signal (e0-e7), half of these, 22, are enabled by the third control signal (OHE1N/EHE1N), and all are potentially enabled by the second control signal corresponding to user image data (B0-B43). *Id.*

As discussed in Section VIII.D.3, It would have been obvious to modify Uenishi’s printhead to provide for 22 simultaneous fires per heater array, as described in Hayasaki. Ex.1002, ¶¶422-429.

Accordingly, Uenishi-Hayasaki discloses “wherein the bondpad and the at least two traces are capable of supplying **eight simultaneous fires per heater array** [e.g., 22 simultaneous fires].” Ex.1002, ¶¶411-421.

3. Ample Motivation Existed to Combine Uenishi and Hayasaki

A PHOSITA would have been motivated to combine Uenishi with Hayasaki. Ex.1002, ¶¶422-429.

First, both Uenishi and Hayasaki are **analogous** to the claimed subject matter in the '864 Patent and within the **same field of endeavor** of heater chips for inkjet printheads. *See, e.g.*, Ex.1001, Abstract; Ex.1008, [0023]; *id.* at claims 1-6; Ex.1009, [0001, 0131]. All are also in the same patent class—B41 (printing; etc.).

Second, a PHOSITA would have been motivated to modify the heater chip of Uenishi to utilize 352 heaters per array and increase the number of simultaneous fires, described in Hayasaki, and would have understood that this could “increase the printing speed or printing density,” without having to change the size, and thus the cost, of the printhead. Ex.1009, [0015, 0032]; Ex.1002, ¶424.

As Hayasaki explains, by increasing the number of heaters used, it provides **increased printing speed and printing density**. Ex.1009, [0015]. A PHOSITA would also have understood that these heaters would need to be activated efficiently to provide the desired printing speed and density and would provide for eight simultaneous fires per heater array. Ex.1002, ¶¶425-426. Hayasaki explains that this

increased amount of heaters is **done without increasing the chip size, and thus the cost of manufacturing the chip.** Ex.1009, [0032]. This is consistent with Uenishi's objective: **maintaining a reduced chip size.** Ex.1008, [0023]. As such, a PHOSITA would have understood that modifying Uenishi to have the increased number of heaters per array as described by Hayasaki would have been obvious and would have **increased printing speed and density without increasing chip size or cost.**

Hayasaki notes that because of its configuration having an output that can simultaneously activate twenty-two printing elements, Ex.1009, [0001], [0026], [0089]-[0091], this “can speed up transfer of image data and driving of printing elements without increasing the number of signal lines and connection terminals” needed. Ex.1009, [0026]. A PHOSITA would have been motivated to make this same change in Uenishi with respect to the eight simultaneous fires per heater array to capture this speed up transfer of image data and driving of printing elements without increasing the number of signal lines and connection terminals, which would necessarily reduce the cost. Ex.1002, ¶427. Making such a modification in Uenishi is consistent with its discussion of maintaining a reduced heater chip size and goal of providing “a high-resolution, small-volume thermal inkjet head.” Ex.1008, [0023].

Finally, a PHOSITA would have had a **reasonable expectation of success** in making this modification. The printhead components described in Uenishi and Hayasaki (e.g., thermal ink jet printing, drop generators, heaters) were well-known at the time. *See, e.g.*, Ex.1008, [0002]-[0005]; Ex.1009, [0002]-[0025]. As such, it would have been straightforward for a PHOSITA to modify Uenishi's printhead to increase the number of drop generators taught by Hayasaki and such a system would work. Ex.1002, ¶428.

IX. SECONDARY CONSIDERATIONS

To the extent that Patent Owner raises any secondary considerations arguments in its Preliminary Response, Petitioners request authorization to respond thereto before any Institution Decision.

X. CONCLUSION

Trial should be instituted, and the Challenged Claims should be cancelled as unpatentable.

Dated: December 30, 2022

Respectfully Submitted,

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

U.S. PATENT NO. 7,290,864 – Claim Listing

No.	Claim Elements
Claim 1[P]	A heater chip for use in a printing device, comprising:
1[A]	an ink via;
1[B]	a first heater array adjacent at least a portion of one side of the ink via; a second heater array adjacent at least a portion of another side of the ink via; and
1[C]	a bondpad, wherein the bondpad supplies power to at least a portion of the first heater array and to at least a portion of the second heater array.
Claim 2	The heater chip of claim 1, further comprising a second bondpad, wherein the second bondpad supplies power to another portion of the first heater array and to another portion of the second heater array.
Claim 3	The heater chip of claim 1, wherein the bondpad supplies power to the first heater array and the second heater array portions by power traces physically separated proximal to the bondpad.
Claim 4	The heater chip of claim 1, wherein each of the first and second heater arrays comprise at least 320 heaters.
Claim 5	The heater chip of claim 1, wherein the bondpad supplies power to the first heater array and the second heater array by at least one power trace.
Claim 6	The heater chip of claim 1, wherein the first heater array and the second heater array each include a plurality of thin film resistors.
Claim 8[P]	A heater chip for use in a printing device, comprising
8[A]	an ink via;
8[B]	a first heater array and a second heater array adjacent at least a portion of the ink via, wherein the ink via is positioned between the first heater array and the second heater array; and
8[C]	a bondpad having at least two traces stemming from the bondpad, wherein at least one of the traces is operatively connected to the first heater array and at least another one of the traces is operatively connected to the second heater array.
Claim 9	The heater chip of claim 8, wherein the at least two traces are physically separated proximal to the bondpad.
Claim 10	The heater chip of claim 8, wherein the first and second heater arrays include a plurality of thin film resistors formed, at least in

	part, from a material selected from the group of materials consisting of platinum, gold, silver, copper, aluminum, tantalum, titanium tungsten, silicon-nitrogen, silicon carbide, and diamond-like carbon.
Claim 11	The heater chip of claim 8, wherein each of the first and second heater arrays contain at least 320 heaters.
Claim 12	The heater chip of claim 11, wherein the bondpad and the at least two traces are capable of supplying eight simultaneous fires per heater array.
Claim 13	The heater chip of claim 8, wherein the first and second heater arrays each comprise a top portion and a bottom portion, and wherein the bondpad is operatively connected to the top portion of the first heater array and the top portion of the second heater array.
Claim 14	The heater chip of claim 13, further comprising a second bondpad operatively connected to the bottom portion of the first heater array and the bottom portion of the second heater array.
Claim 15[A]	The heater chip of claim 8, further comprising: another ink via disposed between a third heater array and a fourth heater array; and
15[B]	a second bondpad coupled to a trace that is operatively connected to the third heater array and to a trace that is operatively connected to the fourth heater array,
15[C]	wherein the traces coupled to the second bondpad are physically separated proximal to the second bondpad.
Claim 16[P]	A heater chip comprising:
16[A]	at least eight heater arrays, wherein the at least eight heater arrays comprise four heater array pairs, and
16[B]	wherein the arrays in each of the heater array pairs are disposed substantially adjacent opposing sides of at least a portion of an ink via; and
16[C]	a plurality of bondpads operatively connected to the at least eight heater arrays, wherein at least one of the plurality of bondpads is operatively connected to both heater arrays within one of the heater array pairs.
Claim 17	The chip of claim 16, wherein each of the at least eight heater arrays comprises a plurality of thin film resistors.
Claim 18	The chip of claim 16, wherein each of the at least eight heater arrays comprises at least 320 heaters.

Claim 19	The chip of claim 16, wherein each of the at least eight heater arrays comprises a top portion and a bottom portion, and wherein some of the plurality of bondpads are operatively connected to the top portion of one of the at least eight heater arrays and the top portion of another one of the at least eight heater arrays.
Claim 20	The chip claim 19, wherein some of the plurality of bondpads are operatively connected to the bottom portion of one of the at least eight heater arrays and to the bottom portion of another one of the at least eight heater arrays.

CERTIFICATION OF COMPLIANCE WITH TYPE-VOLUME LIMITS

This Petition includes 13,992 words as counted by Microsoft Word and is therefore in compliance with the 14,000-word limit established by 37 C.F.R.

42.24(a)(1)(i). Accordingly, pursuant to 37 C.F.R. 42.24(d), lead counsel for the Petitioners hereby certify that this petition complies with the type-volume limits established for a petition requesting IPR.

Dated: December 30, 2022

Respectfully Submitted,

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

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. 42.6(4) and 42.105, lead counsel for Petitioners hereby certify that on December 30, 2022, copies of this Petition and all supporting exhibits were sent via Priority Mail Express to the correspondence address of record for the '864 patent:

133676 - Goldberg Segalla LLP
711 3rd Avenue, Suite 1900
New York, NY 10017

A courtesy copy of this Petition and supporting exhibits was also served via email on December 30, 2022 on Patent Owner's counsel of record in the district court litigation against Slingshot Printing LLC involving this patent:

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Dated: December 30, 2022

Respectfully Submitted,

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