

Patent Owner's Oral Hearing Demonstratives

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

v.

Slingshot Printing LLC,
Patent Owner

Case No. IPR2023-00312
Patent No. 7,484,823

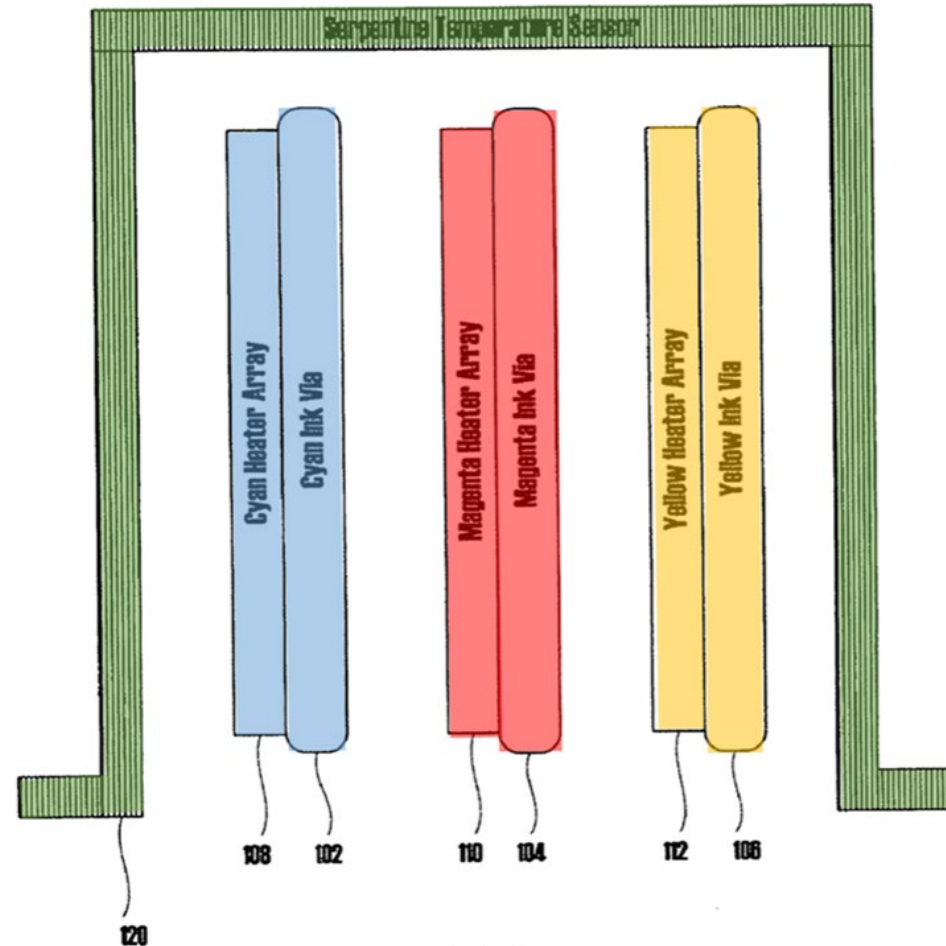
Canon U.S.A., Inc. and Canon Inc.,
Petitioners

v.

Slingshot Printing LLC,
Patent Owner

Case No. IPR2023-00313
Patent No. 7,594,708

'708 and '823 Patents



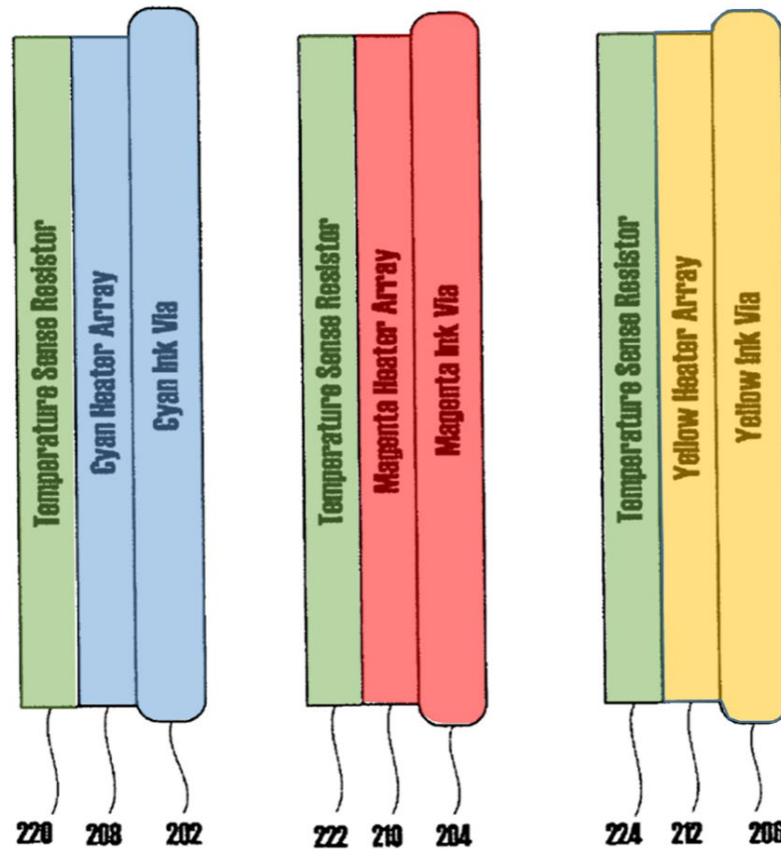
Prior art configuration

FIG. 1

[Prior Art]

'708 POR p. 4, '823 POR p. 4

'708 and '823 Patents

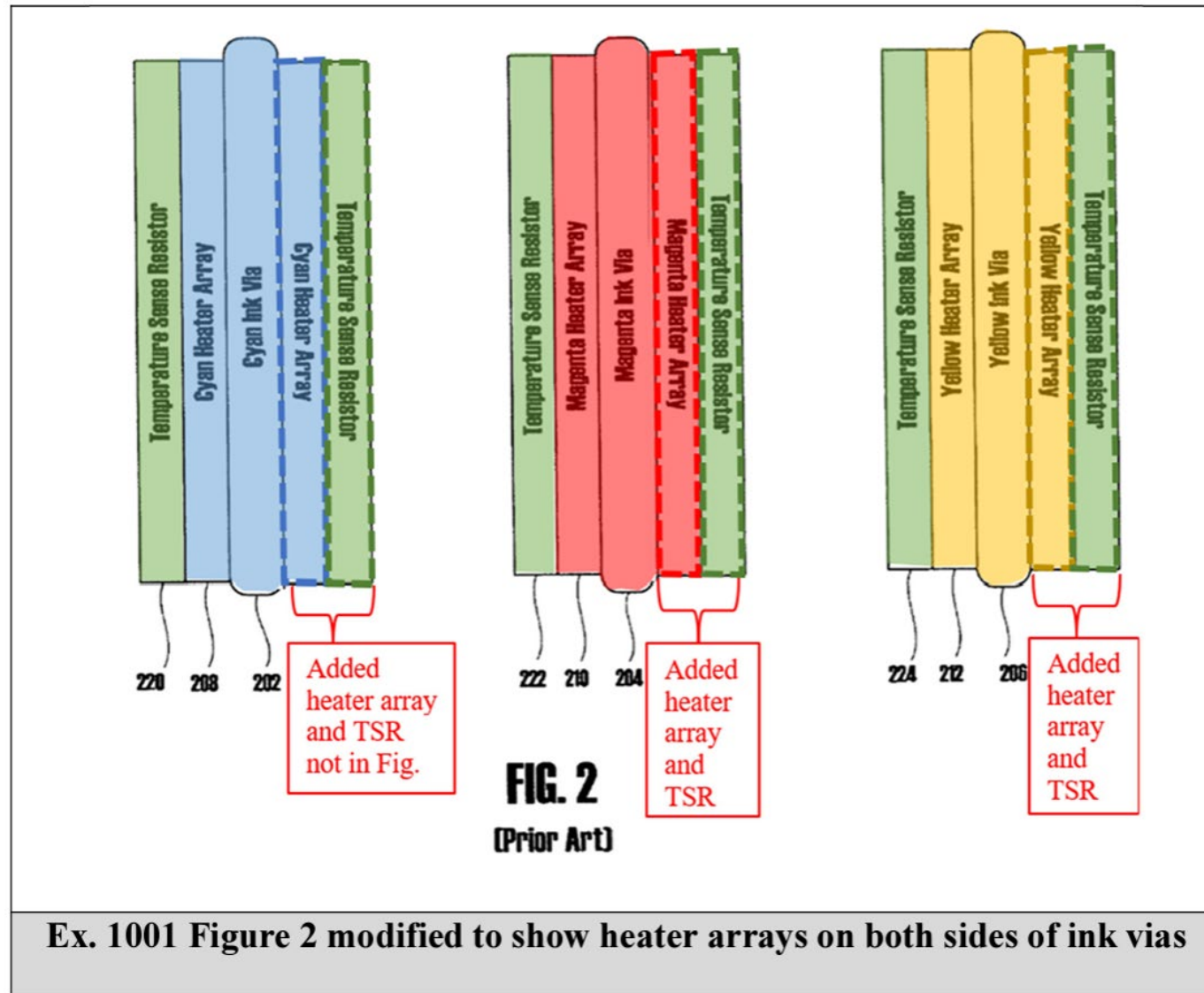


Prior art configuration

FIG. 2
[Prior Art]

'708 POR p. 5, '823 POR p. 6

'708 and '823 Patents



'708 and '823 Patents

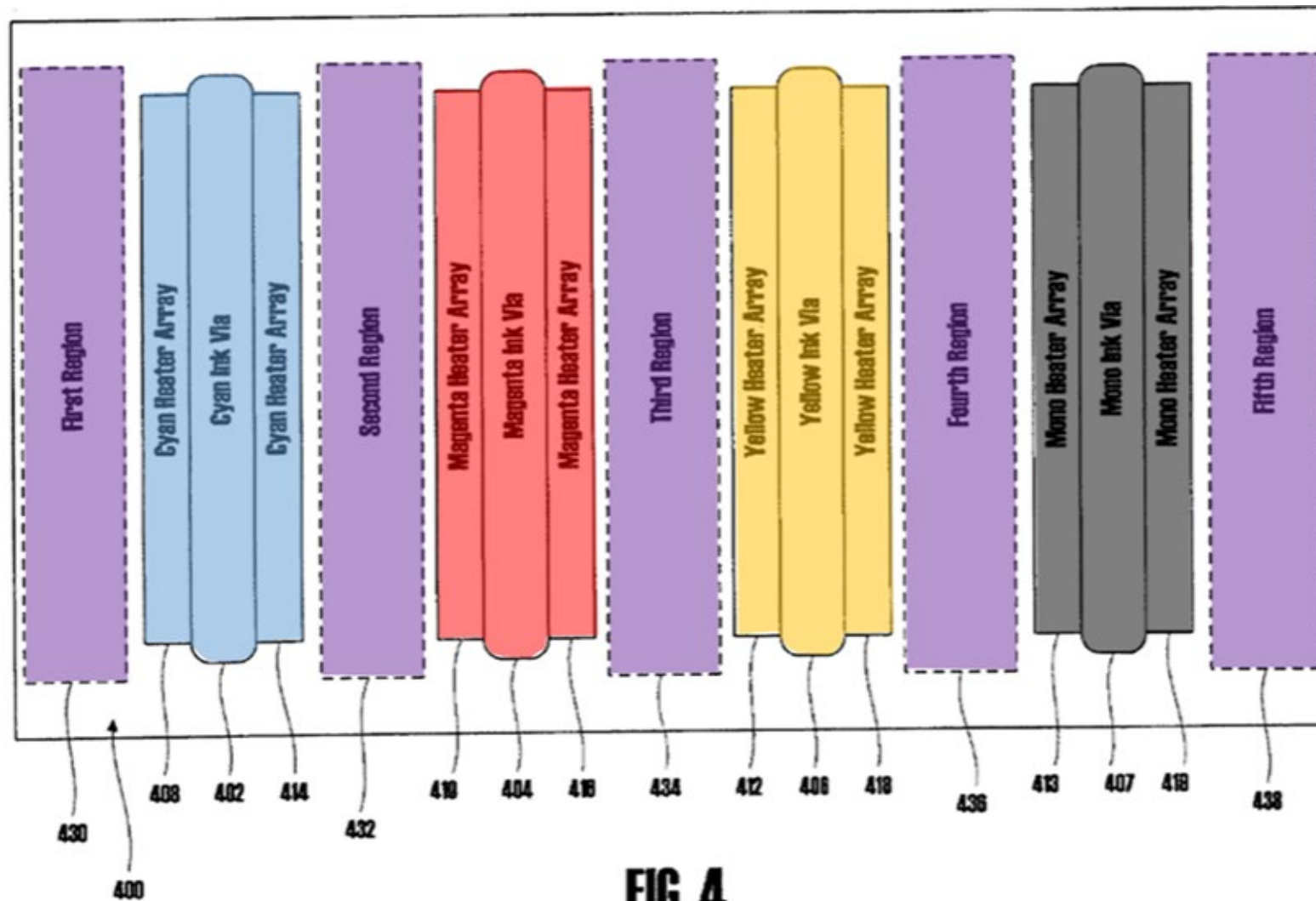


FIG. 4

'708 POR p. 8, '823 POR p. 9

'708 and '823 Patents

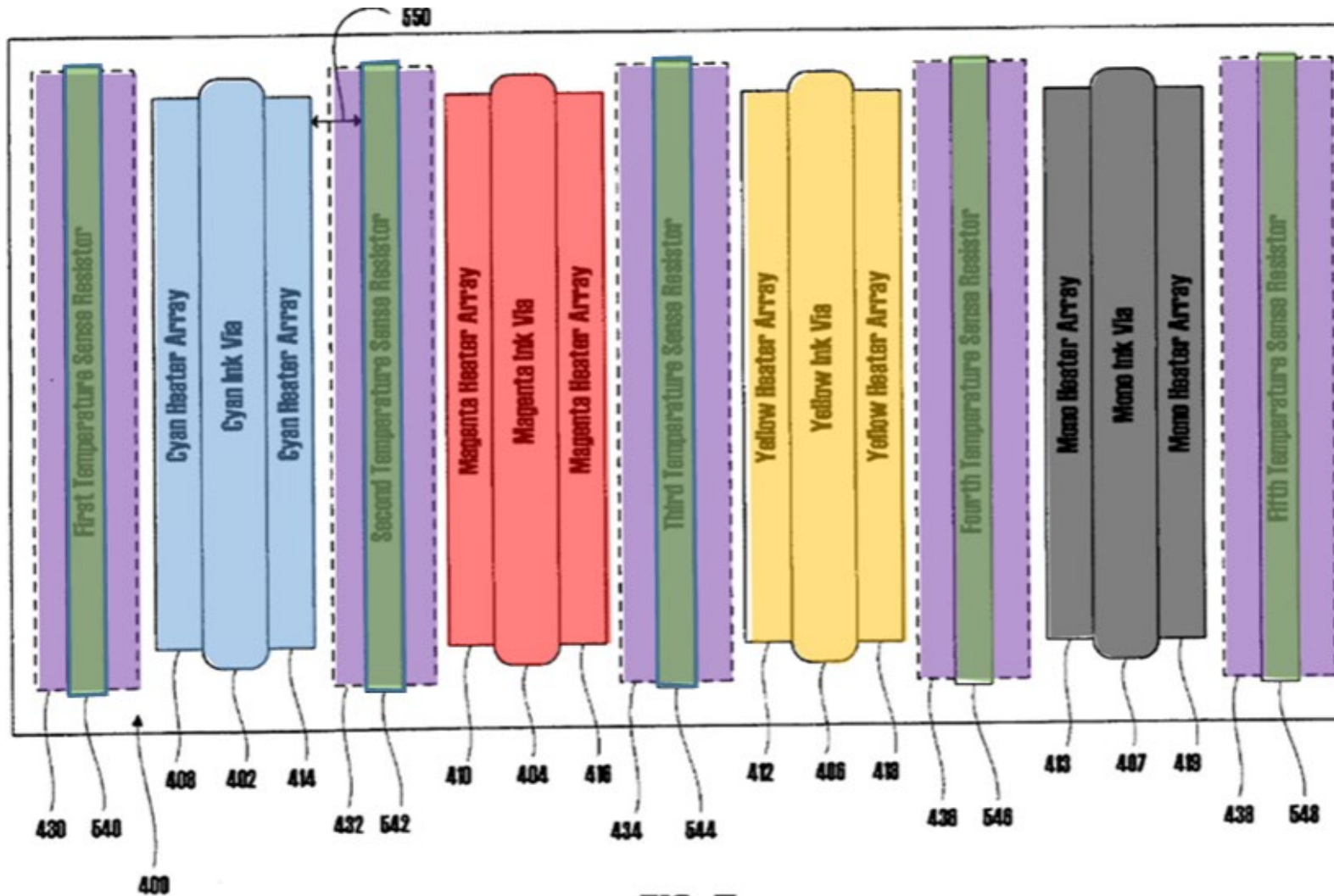


FIG. 5

'708 POR p. 9, '823 POR p. 9

Benjamin '113

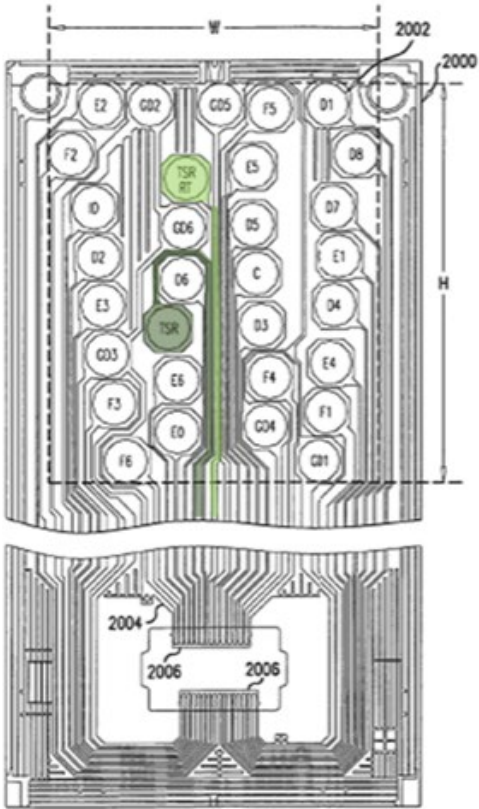


FIG. 25A

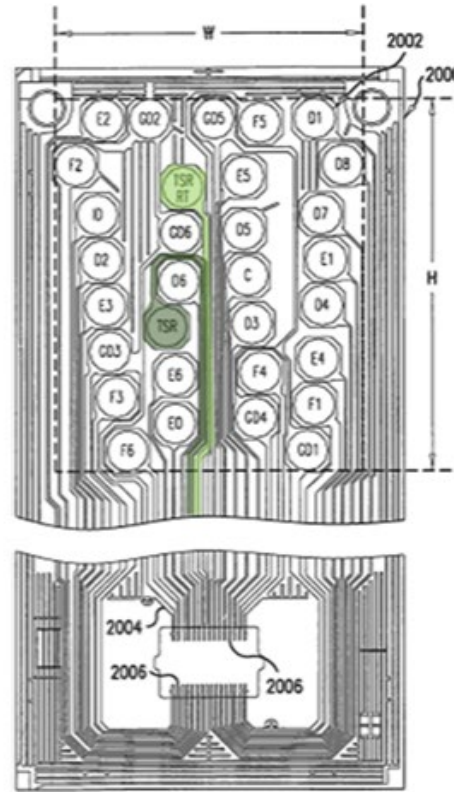


FIG. 25B

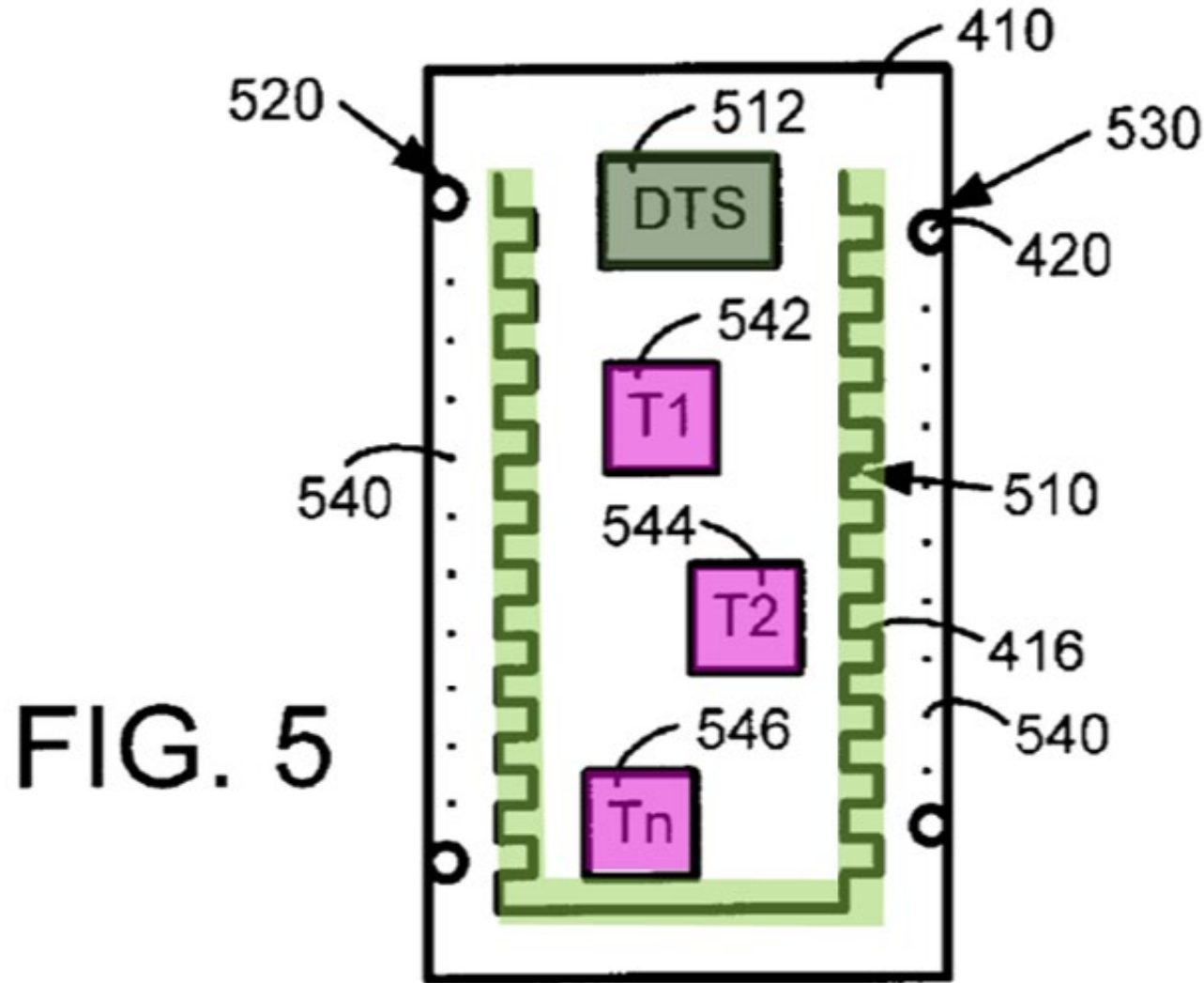
Temperature sensor not shown on chip

Figs. 25A and 25B show flex circuit to connect chip to printer.

External connections show contact area (TSR) and a single return contact area (TSR-RT)

'708 POR pp. 10-11

Giere '673



U-shaped TSR 510 senses the temperature of the substrate as a whole

Digital temperature sensor 512 and multiple **temperature recorders 542, 544, and 546** are also positioned between heater arrays

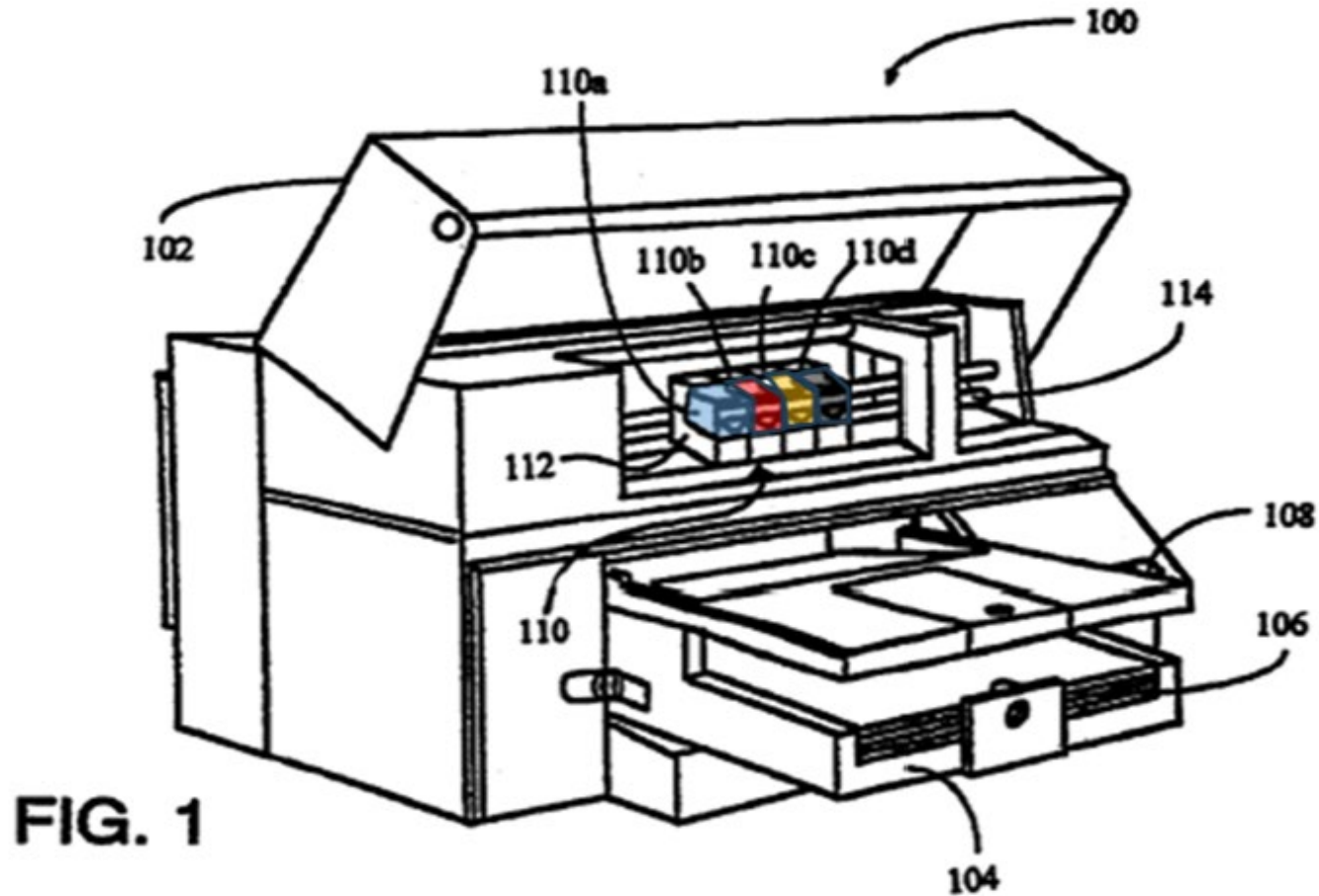
'708 POR pp. 12-13



ink flows from **ink reservoir 424** around the edges of the heater chip **substrate 410** and into **vaporization chambers 418**



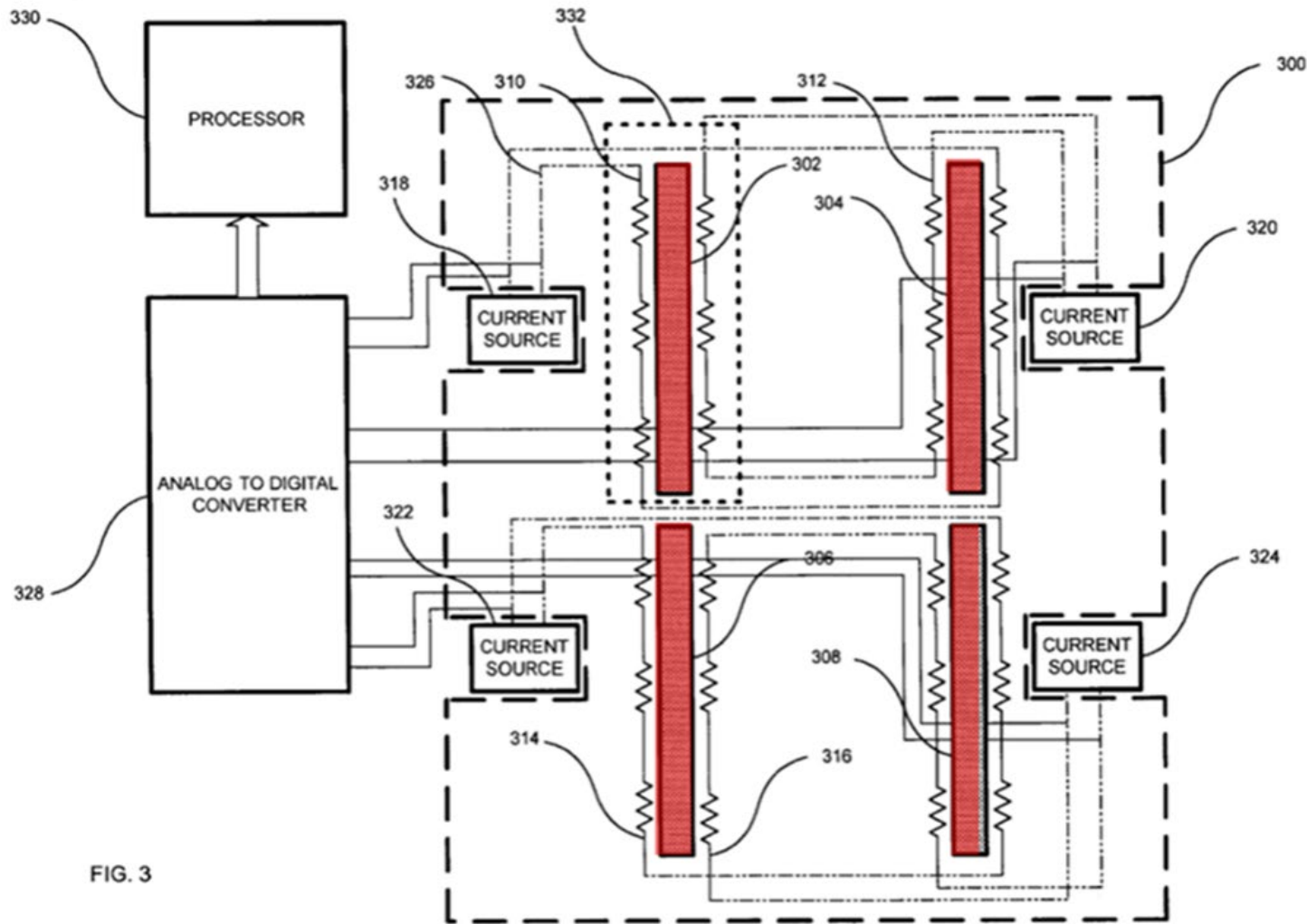
Giere '178



Different color inks each stored in different cartridges

'708 POR pp. 15-16

Giere '178



“high level schematic diagram”

“although not shown in Fig. 3 for ease of illustration, substrate 300 includes the structures of a typical printhead such as, ink feed slots, ink ejection chambers, firing resistors, etc.”

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

‘708 POR pp. 16-17

Giere '178

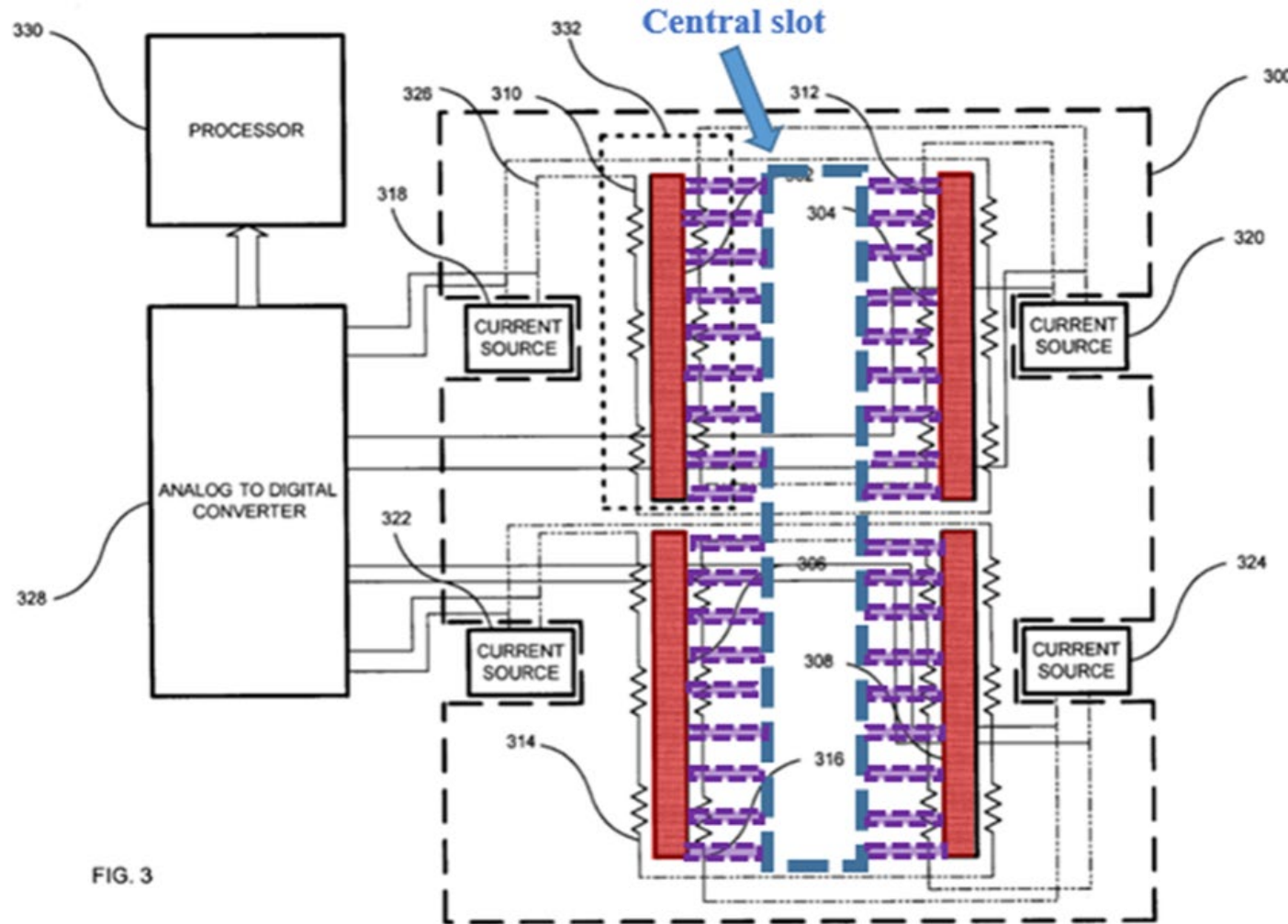


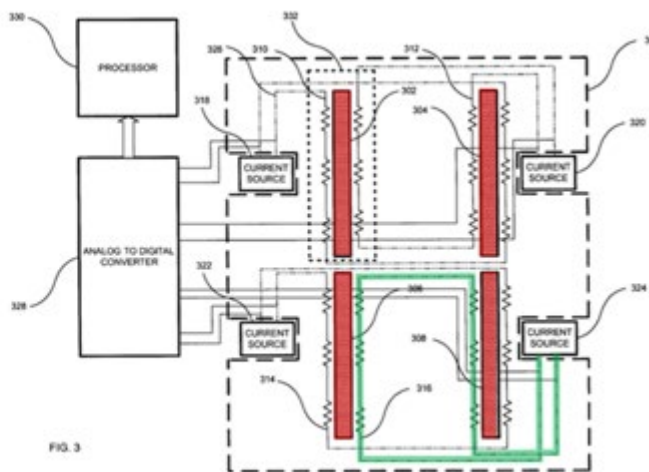
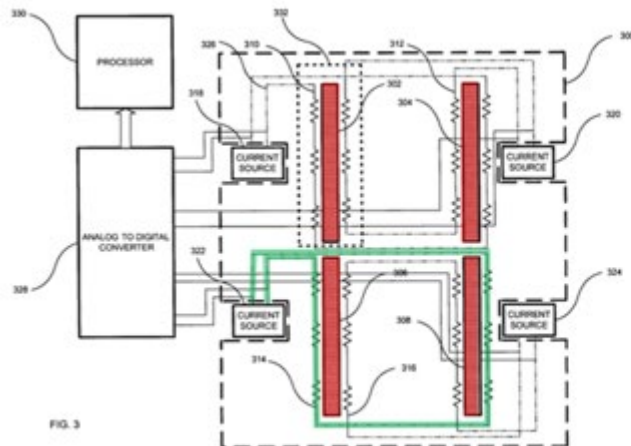
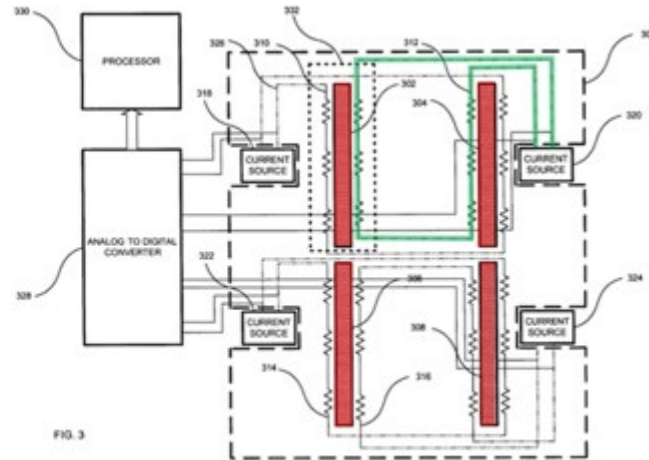
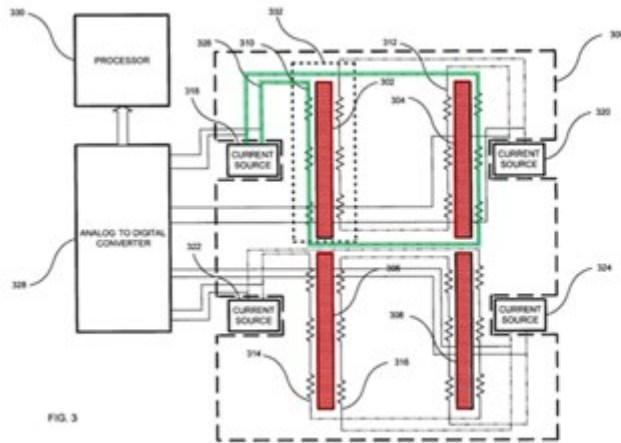
FIG. 3

Ink is fed “either through an elongated hole formed in the center of the bottom of the substrate, ‘center feed,’ or around the outer edges of the substrate, ‘edge feed.’”

“In **center feed** the ink then flows through a central slot in the substrate into a central manifold area formed in a barrier layer between the substrate and a nozzle member, then into a plurality of ink channels, and finally into the various ink ejection chambers.”

‘708 POR pp. 16-19

Giere '178



4 temperature sensors comprising resistive elements 310, 312, 314, and 316.

temperature detected along each side of multiple ink ejector heater arrays.

'708 POR pp. 19-24

Giere '178

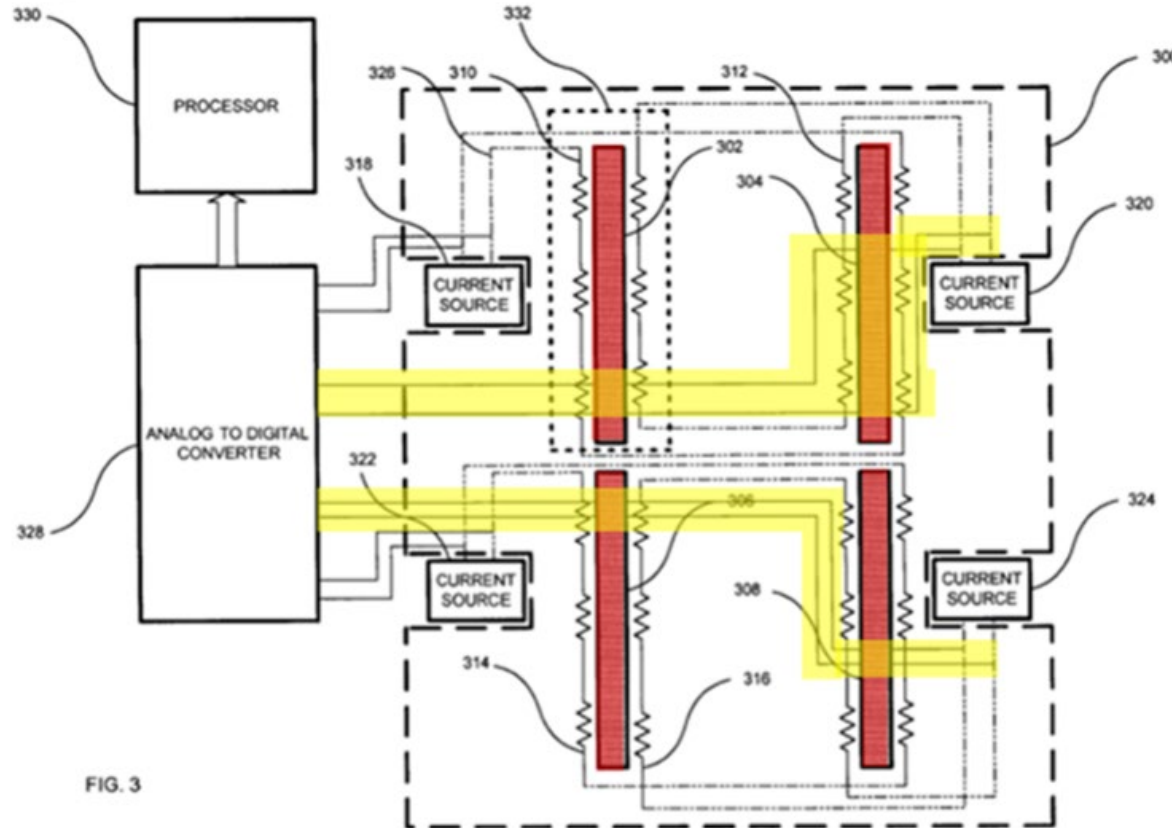


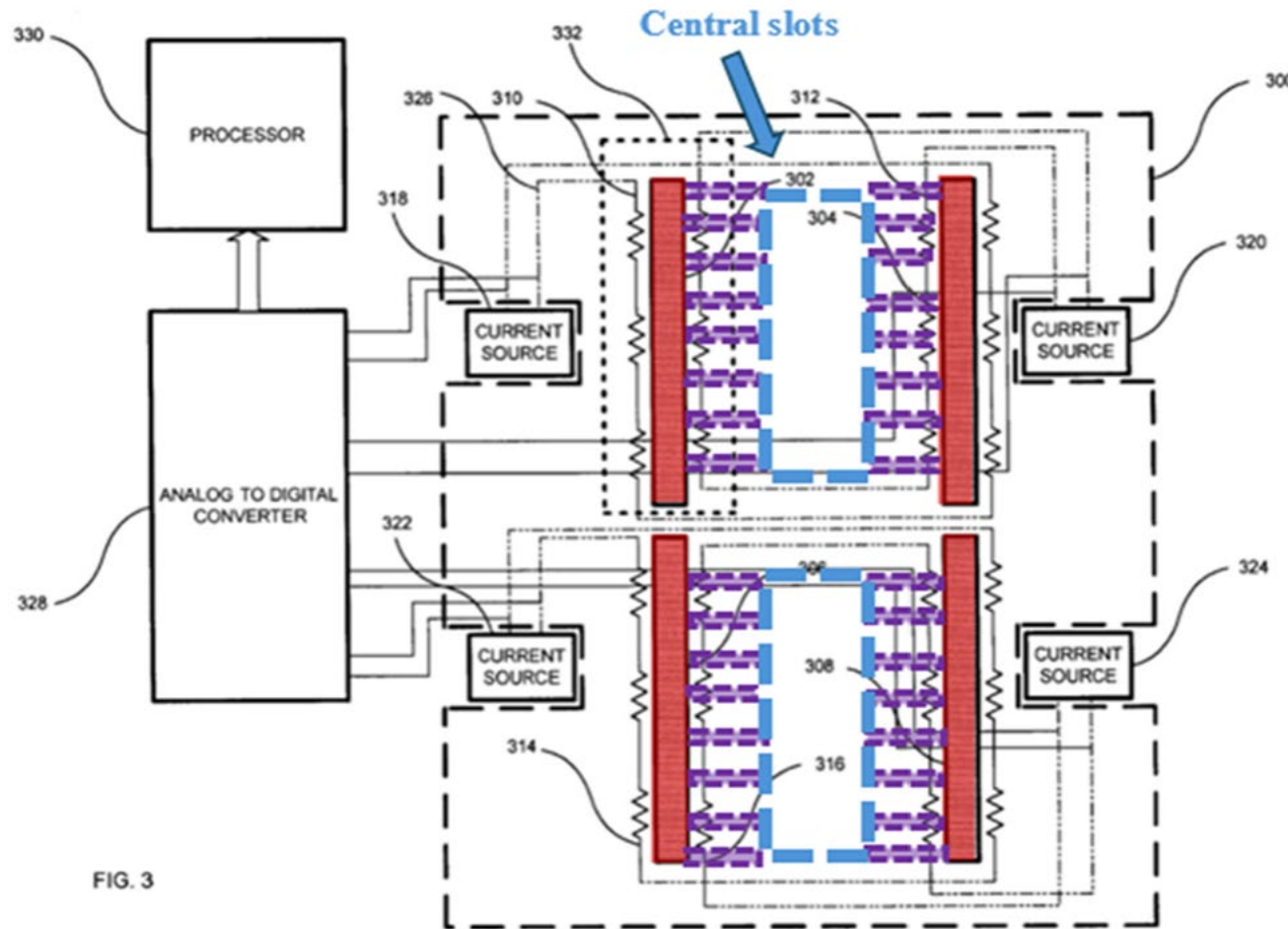
FIG. 3

Petitioners' contention that TSRs preclude central placement of ink via is unsupported.

connections from the analog to digital converter 328 are also shown traversing rectangular regions 302, 304, 306, and 308

'708 POR pp. 26-28

Giere '178

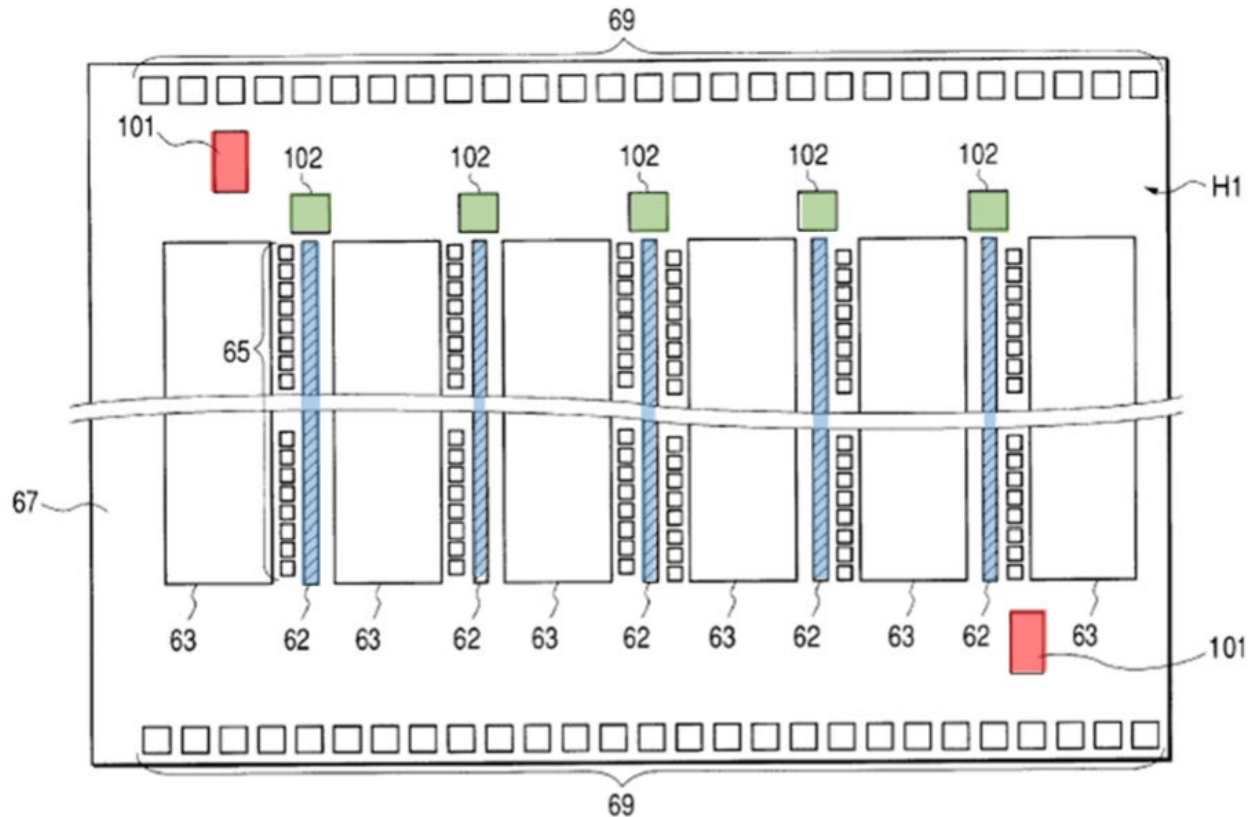


two central areas where an elongated hole can be located and not cross TSR traces.

'708 POR p. 26 and POSR pp. 13-15

Yabe

FIG. 12



substrate with **multiple temperature detecting means 102**

“each of the **temperature detecting means 102** is arranged **only on one side** in the vicinity of each end portion of the **ink supply ports 105**”

sub-heaters 101 keep temperature as uniform as possible

‘708 POR pp. 28-29

Yabe

FIG. 14

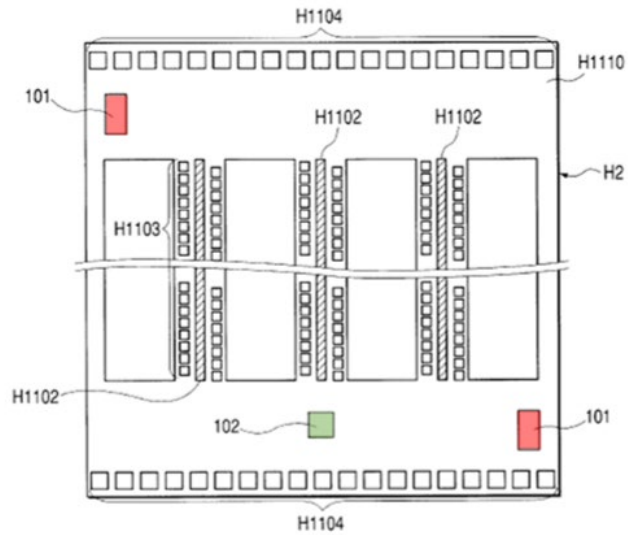
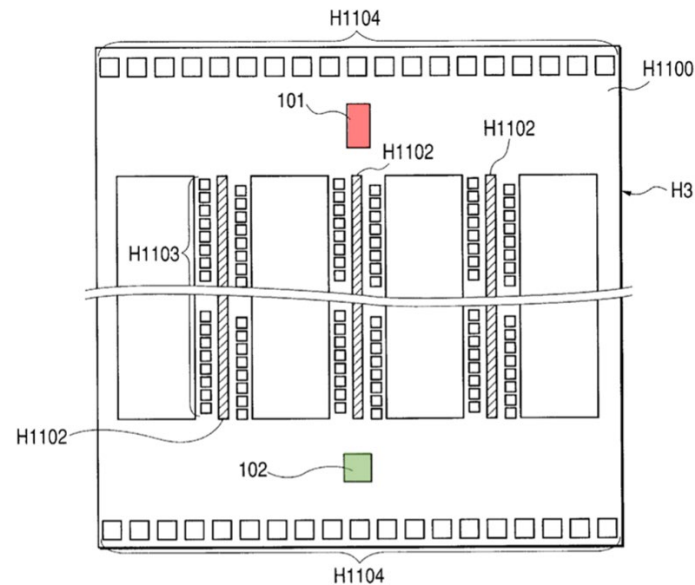


FIG. 15



Alternatives still show
single temperature
detecting means 102

'708 POR pp. 28-29

'708 Patent Is Not Obvious

- Multiple claim elements not shown in any reference
- Petitioners rely on mischaracterization of references and ignore fundamental aspects of prior art
- Alleged motivations to combine are illogical and benefits alleged by Petitioners have no connection to proposed modifications

'708 Patent, Claim 1

1. A **chip for use with a printing device**, comprising: a plurality of ink vias arranged parallel to one another, each of the ink via having two longitudinal sides;

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

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

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

'708 Patent Claims Dependent On Claim 1

2. The chip of claim 1, wherein the temperature sensing element comprises a temperature sensing resistor.
3. The chip of claim 2, wherein the temperature sensing element comprises a thermal sense resistor.
4. The chip of claim 3, wherein the temperature sensing element comprises an n-type implant donor thermal sensing resistor.
5. The chip of claim 1, wherein the predetermined distance is at least 300 microns.
6. The chip of claim 1, wherein the temperature sensing element is positioned substantially planar to each of the adjacent heater arrays.
7. The chip of claim 1, further comprising at least one control element operable to receive a temperature measured by the temperature sensing element.
8. The chip of claim 1, wherein the chip has at least one edge and at least one region is disposed between one of the plurality of ink vias and the at least one edge.

'708 Patent, Claim 9

9. A **method of fabricating chips** for use with a printing device, comprising:arranging a plurality of ink vias parallel to one another, wherein each of the ink via has two longitudinal sides;

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

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

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

'708 Patent Claims Dependent On Claim 9

10. The method of claim 9, wherein positioning a temperature sensing element in the region comprises positioning a temperature sensing element in substantially a center portion of the region.

11. The method of claim 9, wherein positioning a temperature sensing element in the region comprises positioning a temperature sensing resistor in the region.

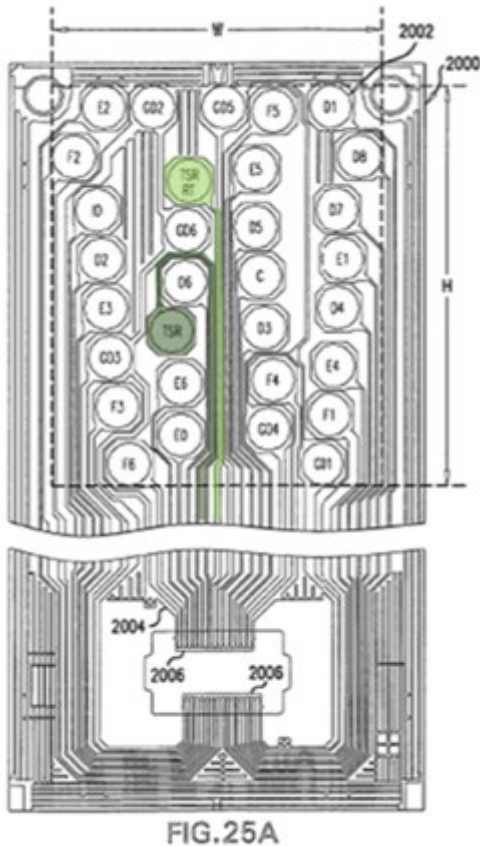
12. The method of claim 9, wherein positioning a temperature sensing element in the region comprises positioning a thermal sense resistor in the region.

13. The method of claim 11, wherein positioning a temperature sensing element in the region comprises positioning an n-type implant donor thermal sensing resistor in the region.

14. The method of claim 9, wherein positioning a temperature sensing element in the region between the adjacent heater arrays comprises positioning the temperature sensing element at least 300 microns from each of the adjacent heater arrays.

15. The method of claim 9, wherein positioning a temperature sensing element in the region between the adjacent heater arrays comprises positioning the temperature sensing element substantially planar to each of the heater arrays.

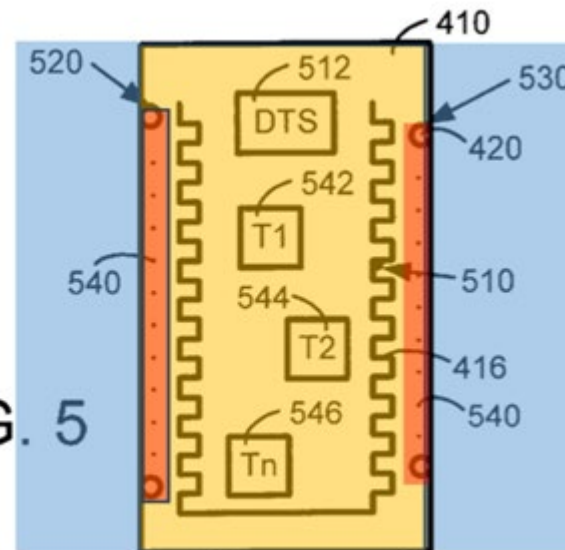
'708 Patent – Grounds 1 and 2



Benjamin

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FIG. 5



Giere '673

- Neither suggests monitoring of temperatures between ink vias
- Both use a TSR to monitor temperature of entire printhead die
- Alleged motivations to combine ignore fundamental principles of prior art and the alleged benefits are not connected to the actual modifications proposed by Petitioners
- No cited prior art suggests monitoring regions between ink vias, but does teach the opposite
- Parish cited only for specific type of sensor and does not cure above deficiencies

'708 POR pp. 38-46 and '708 POSR pp. 1-13

'708 Patent – Grounds 3 and 5

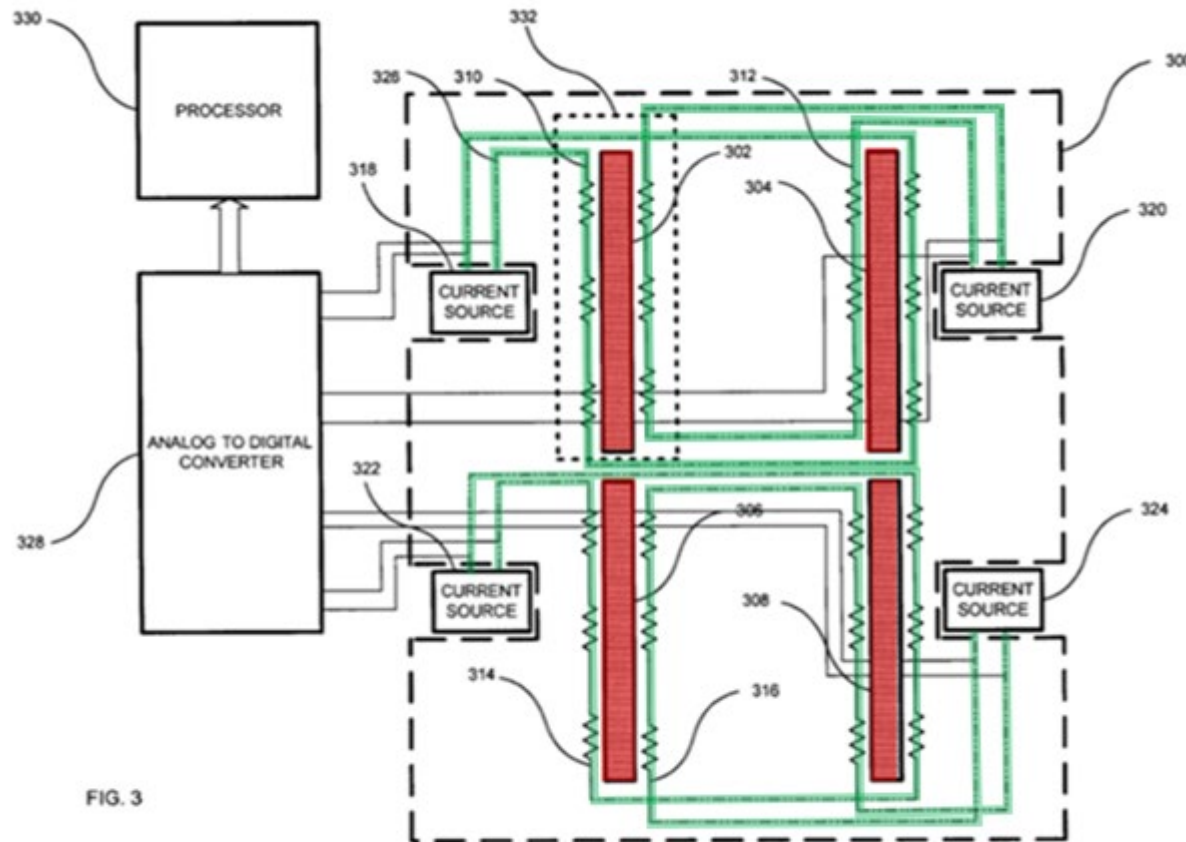


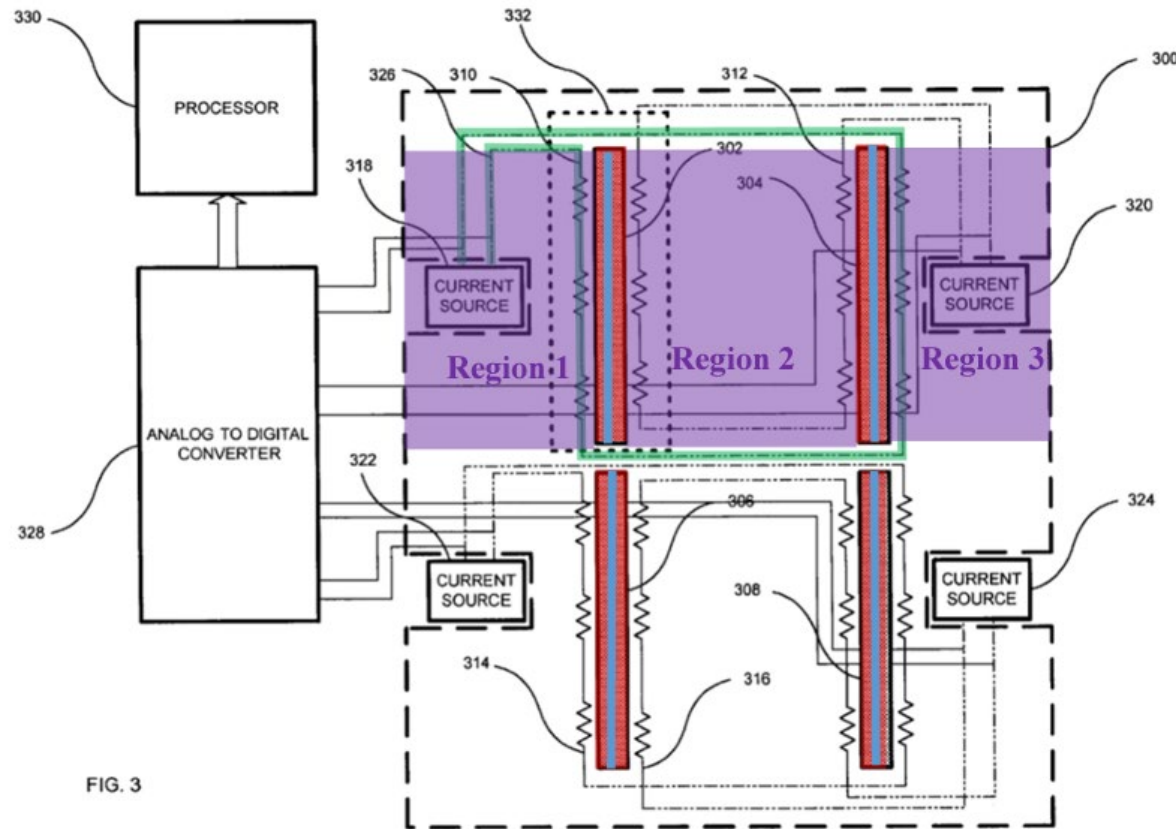
FIG. 3

- Reference does not suggest monitoring temperature between multiple ink vias
- TSRs placed along both sides of heater arrays
- No reason to change positioning of ink vias, heaters, nozzles, and related components but keep temperature sensors in place
- Petitioners' theory does not align with claim language
- Parish cited only for specific type of sensor and does not cure above deficiencies

Giere '178

'708 POR pp. 47-55 and '708 POSR pp. 13-23

'708 Patent – Grounds 3 and 5

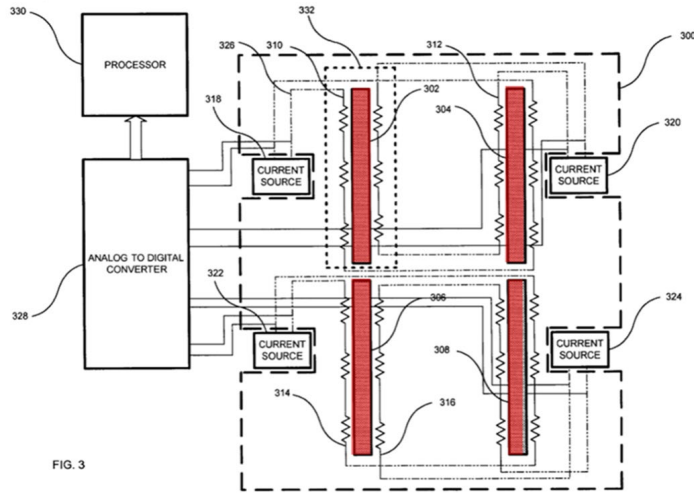


Giere '178

- Even if Giere '673 were modified to match Petitioners' incorrect analysis, TSR 310 cannot distinguish between outside Regions (Region 1 and Region 3)
- Same is true of TSR 314

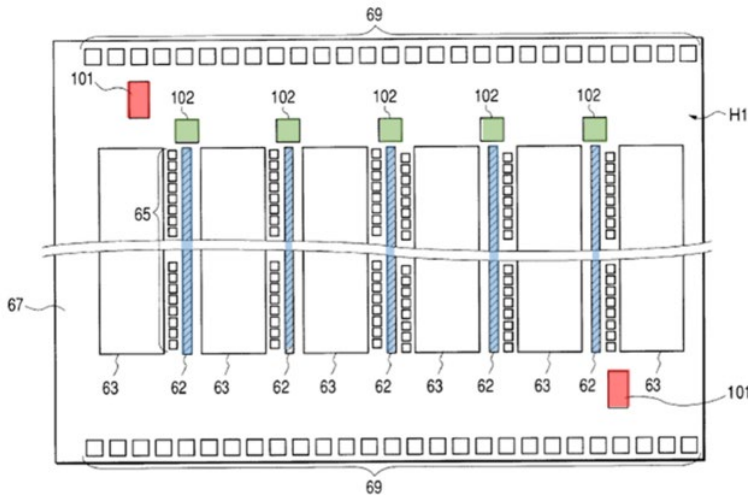
'708 POR pp. 56-58

'708 Patent – Grounds 4 and 6



Giere '178

FIG. 12

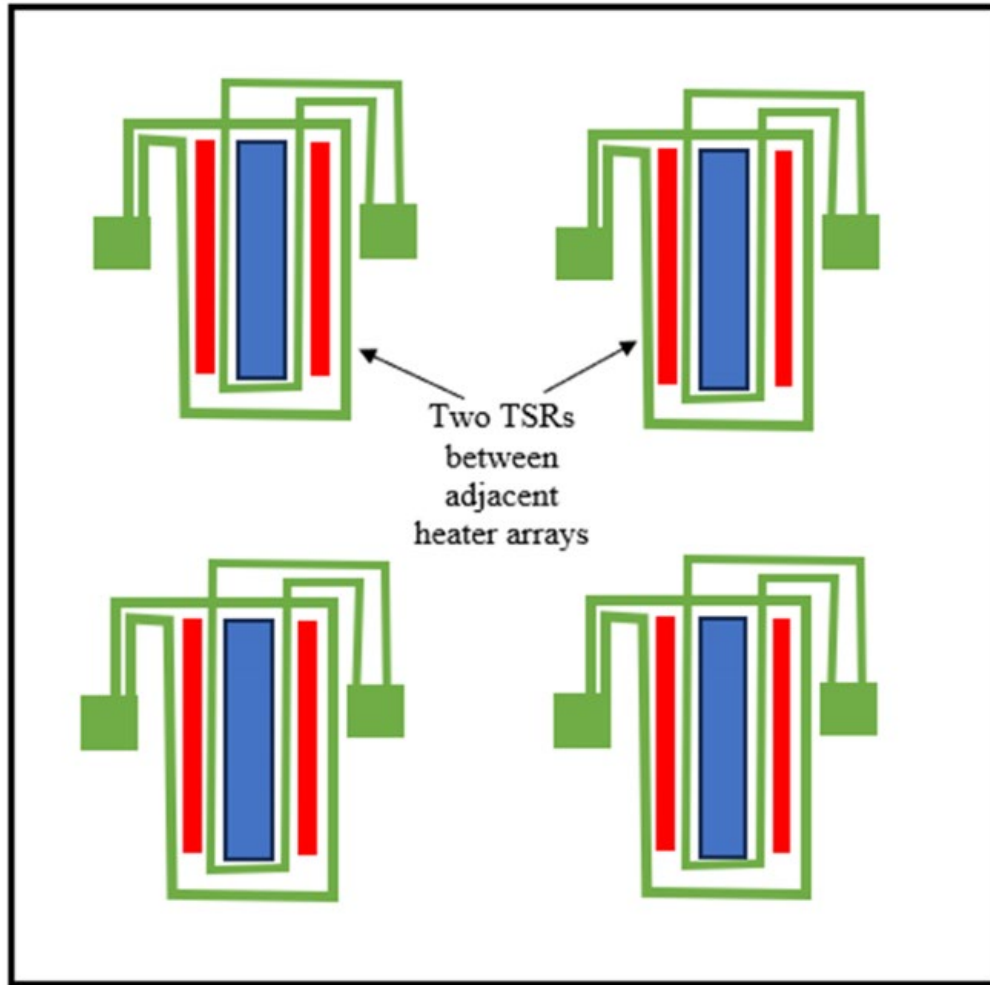


Yabe

- Based on erroneous reading of Giere '178
- Neither reference discloses a single temperature sensor in every region separated by ink vias
- Yabe avoids temperature sensors between ink vias altogether
- Petitioners' theory does not align with claim language
- Parish cited only for specific type of sensor and does not cure above deficiencies

'708 POR pp. 38-46 and '708 POSR pp. 23-26

'708 Patent – Grounds 4 and 6



- Adapting Yabe's ink via/heater structure into Giere '178 would fundamentally change the entire printhead
- Those changes would also result in multiple temperature sensors in regions between ink vias

'708 POR pp. 38-46

'823 Patent Is Not Obvious

- Multiple claim elements not shown in any reference
- Petitioners rely on mischaracterization of references and ignore fundamental aspects of prior art
- Alleged motivations to combine are illogical and benefits alleged by Petitioners have no connection to proposed modifications

'823 Patent, Claim 1

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

a **first heater array** positioned substantially adjacent a **first via**;

a **second heater array** positioned substantially adjacent a **second via**;

a **region, positioned between the first heater array and the second heater array**, and also positioned substantially adjacent to the first heater array and the second heater array; and

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

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

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

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

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

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

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

'823 Patent, Claims Dependent on Claim 1

2. The chip of claim 1, wherein the temperature sensing element comprises a temperature sensing resistor.
3. The chip of claim 2, wherein the temperature sensing element comprises a thermal sense resistor.
4. The chip of claim 3, wherein the temperature sensing element comprises an n-type implant donor thermal sensing resistor.
5. The chip of claim 1, wherein the temperature sensing element is positioned at least 300 microns from each of the first heater array and the second heater array.
6. The chip of claim 5, wherein the temperature sensing element is positioned substantially planar to each of the first heater array and the second heater array.
7. The chip of claim 1, further comprising at least one control element operable to receive a temperature measured by the temperature sensing element and to heat the first heater array and the second heater array.
8. The chip of claim 1, wherein the temperature sensing element positioned between the first heater array and the second heater array is different than the second temperature sensing element positioned between the third heater array and the fourth heater array.
9. The chip of claim 1, wherein the first heater array and the second heater array are operable to receive non-nucleating heating responsive to the temperature of the region sensed by the temperature sensing element.
10. The chip of claim 9, wherein the non-nucleating heating is of a short duration such that ink will not be ejected from the first via or the second via during the non-nucleating heating.

'823 Patent, Claim 11

11. *A method of fabricating chips for use with a printing device, comprising:*

providing a first heater array, positioned substantially adjacent a first via;

providing a second heater array, positioned substantially adjacent a second via;

positioning a temperature sensing element in a region adjacent to and immediately between the first heater array and the second heater array and substantially adjacent to both the first heater array and second heater array, wherein the temperature sensing element is operable to sense a temperature of the region, the temperature being representative of the region, and wherein the temperature sensing element extends substantially the length of the first heater array and second heater array; and

responsive to the temperature of the region sensed by the temperature sensing element, heating the first heater array and the second heater array to regulate the temperature of the region;

providing at least one control element operable to receive a temperature measured by the temperature sensing element and to heat the first heater array and the second heater array;

providing a third heater array substantially adjacent the second via;

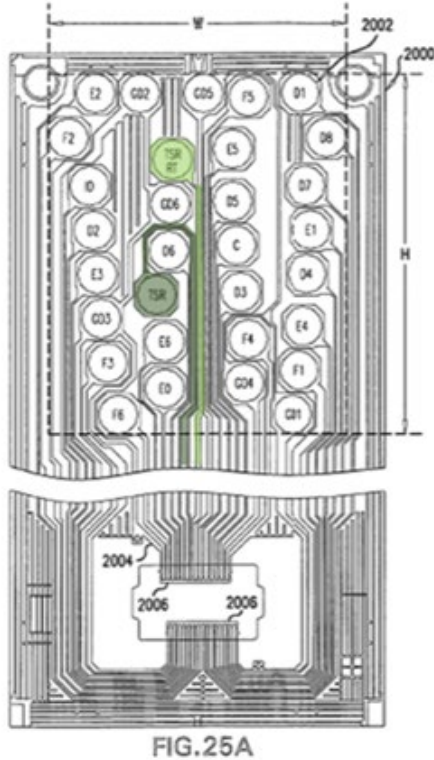
providing a fourth heater array substantially adjacent a third via; and

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

'823 Patent, Claims Dependent on Claim 11

12. The method of claim 11, wherein positioning a temperature sensing element in the region comprises positioning a temperature sensing element in substantially the center of the region.
13. The method of claim 11, wherein positioning a temperature sensing element in the region comprises positioning a thermal sense resistor in the region.
14. The method of claim 13, wherein positioning a temperature sensing element in the region comprises positioning an n-type implant donor thermal sensing resistor in the region.
15. The method of claim 11, wherein positioning a temperature sensing element in the region between the first heater array and the second heater array comprises positioning the temperature sensing element at least 300 microns from each of the first heater array and the second heater array.
16. The method of claim 15, wherein positioning a temperature sensing element in the region between the first heater array and the second heater array comprises positioning the temperature sensing element substantially planar to each of the first heater array and the second heater array.
17. The method of claim 11, wherein heating the first heater array and the second heater array to regulate the temperature of the region comprises heating the first heater array and the second heater array using non-nucleating heating.

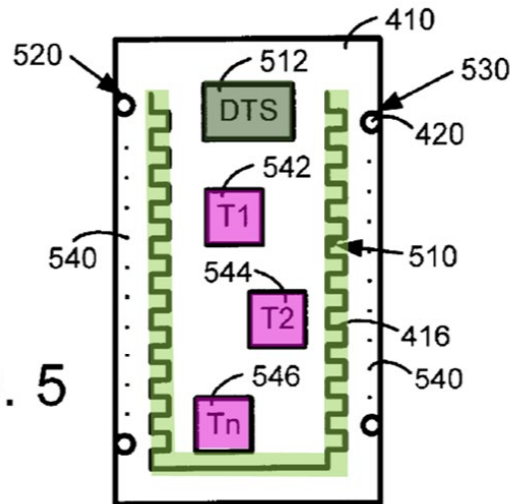
'823 Patent – Grounds 1 and 2



Benjamin

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FIG. 5



Giere '673

- Neither suggests monitoring of temperatures between ink vias

Neither disclose a centrally disposed TSR

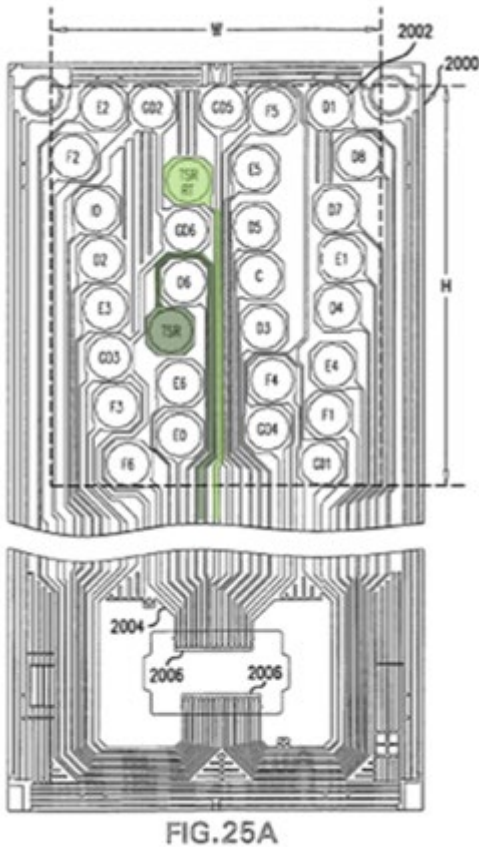
Neither disclose supplying heat in response to monitored temperature

Petitioners ignore actual function of temperature sensing in these references and mischaracterize temperature sensing of both references

- Alleged motivations to combine ignore fundamental operating principles of both references and increase cost/complexity with no benefit
- Parish cited only for specific type of sensor and does not cure above deficiencies

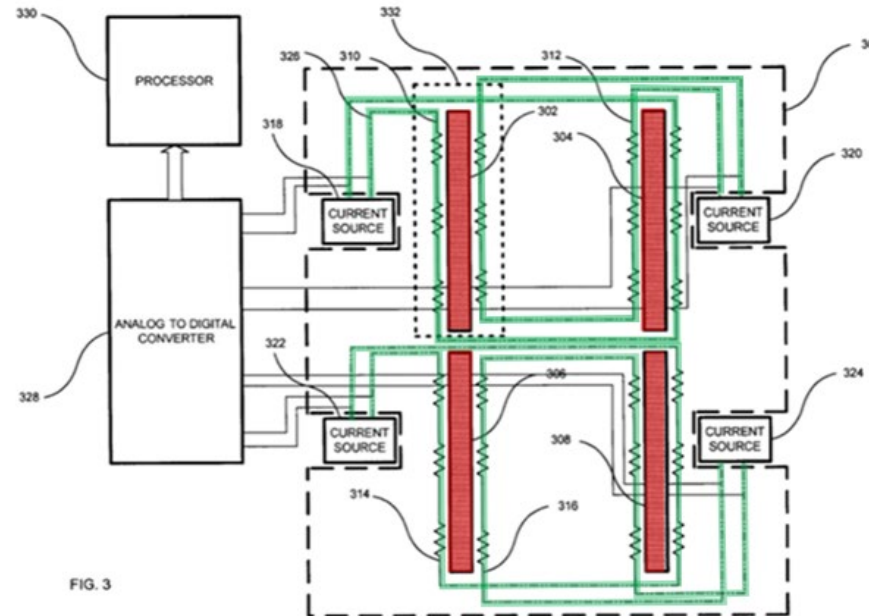
'823 POR pp. 41-54 and '823 POSR 1-14

'823 Patent – Ground 3



Benjamin

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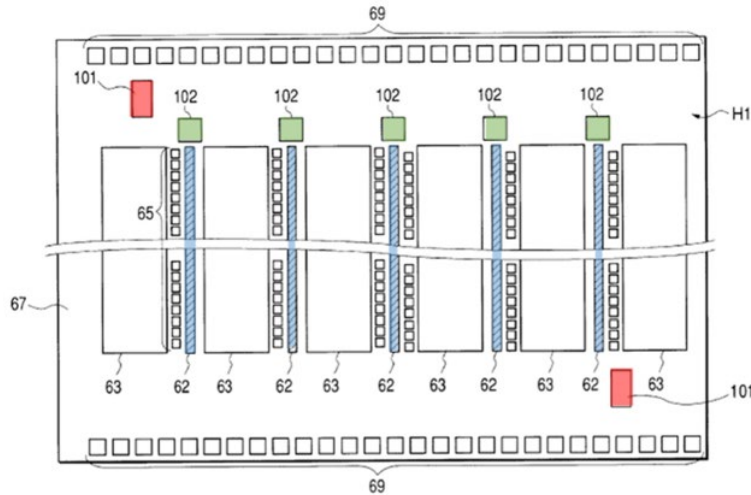
Giere '178

- Relies on same inaccurate characterization of Benjamin in Ground 1
- Relies on mischaracterization of Giere '178
- Alleged motivations to combine are illogical and rely on out-of-context sound bites

'823 POR pp. 55-63 and '823 POSR 14-23

'823 Patent – Grounds 4 and 5

FIG. 12

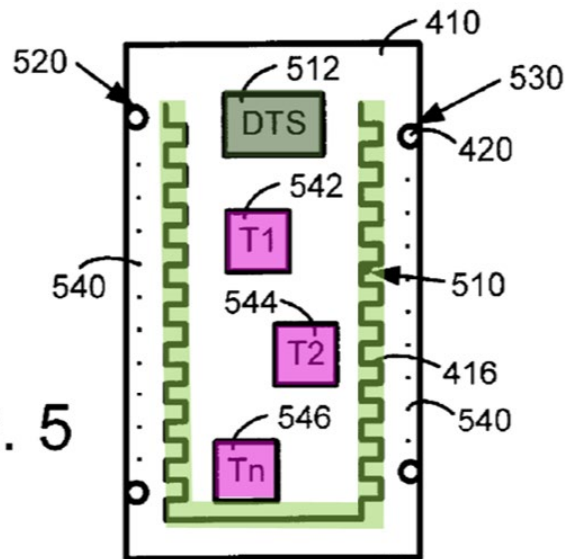


Yabe

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Giere
'673

FIG. 5



- Neither reference discloses TSRs centrally disposed between ink vias
- Proposed change is contrary to Yabe's fundamental design
- Neither reference teaches monitoring between vias, centrally located sensors, or supplying heat in response to temperature detected between vias
- Yabe's solution to insulating properties of ink vias is to avoid placement of temperature sensors between vias
- Alleged motivations to combine are illogical and rely on mischaracterization of references
- Parish cited only for specific type of sensor and does not cure above deficiencies

'823 POR pp. 63-72 and '823 POSR 23-26