

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG DISPLAY CO., LTD; SAMSUNG ELECTRONICS CO., LTD.; and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner

v.

POLARIS POWERLED TECHNOLOGIES, LLC,
Patent Owner

Case IPR2023-00771
U.S. Patent No. 7,259,521

PATENT OWNER'S RESPONSE UNDER 37 C.F.R. § 42.120(a)

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PATENT OWNER'S EXHIBIT LIST

Exhibit No.	Description
2001	Declaration of Thomas L. Credelle
2002	<i>Curriculum Vitae</i> of Thomas L. Credelle
2003	R. Dawson, et al., “The impact of the transient response of organic light emitting diodes on the design of active matrix OLED displays,” IEEE ELEC. DEV. MTG. DIGEST (1998) (“Dawson”)
2004	Declaration of Andrew G. Hamill in Support of Motion for <i>Pro Hac Vice</i> Admission
2005	Kim et al., “A 10-bit Linear R-string DAC Architecture for Mobile Full HD AMOLED Driver ICs,” SID DIGEST OF TECHNICAL PAPERS (2013)
2006	Excerpts from Cristaldi, Liquid Crystal Display Drivers, Springer (2009)
2007	Excerpts from Tusujimura, OLED Displays, Fundamentals and Applications, Wiley (2012)
2008	Introduction to DDIC (Display Driver IC), Utmel Electronic, accessible at https://www.utmel.com/blog/categories/integrated%20circuit/introduction-to-ddic-display-driver-ic (last accessed January 22, 2024)
2009	AMOLED DDIC-SR6541, Square Route, accessible at https://squareroute.co.jp/square-route/amoled-ddic-sr6541/ (last accessed January 22, 2024)
2010	Onoyama, “0.5-inch XGA Micro-OLED Display on a Silicon Backplane with High-Definition Technologies,” SID Digest of Technical Papers (2012)
2011	Second Declaration of Thomas L. Credelle

Exhibit No.	Description
2012	Transcript of January 19, 2024 Deposition of Alex Z. Kattamis, Ph.D., P.E.

I. INTRODUCTION

The Board should refuse to find claims 1-5 and 7 of U.S. Patent No. 7,259,521 (“the ’521 patent,” EX1001) unpatentable. Each of Petitioner’s references—Kim, Hayafuji, and Steer—fails to disclose, teach, or suggest at least two limitations in the ’521 patent’s sole independent claim.

First, the Petition’s cited art fails to disclose, teach, or suggest the limitation of “a video driver receiving the video signal and generating a video drive signal ... referenced to a positive power supply voltage of the AMOLED display panel,” which is required by independent claim 1 and, therefore, every claim of the ’521 patent.

Second, the Petition’s cited art fails to disclose, teach, or suggest the limitation of “the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage,” which is also required by independent claim 1 and, therefore, every claim of the ’521 patent.

Finally, Petitioner does not provide any reason why either of these claim limitations would have been obvious despite the missing teachings.

The Petition therefore fails to show that any of the challenged claims are anticipated or obvious.

II. THE '521 PATENT

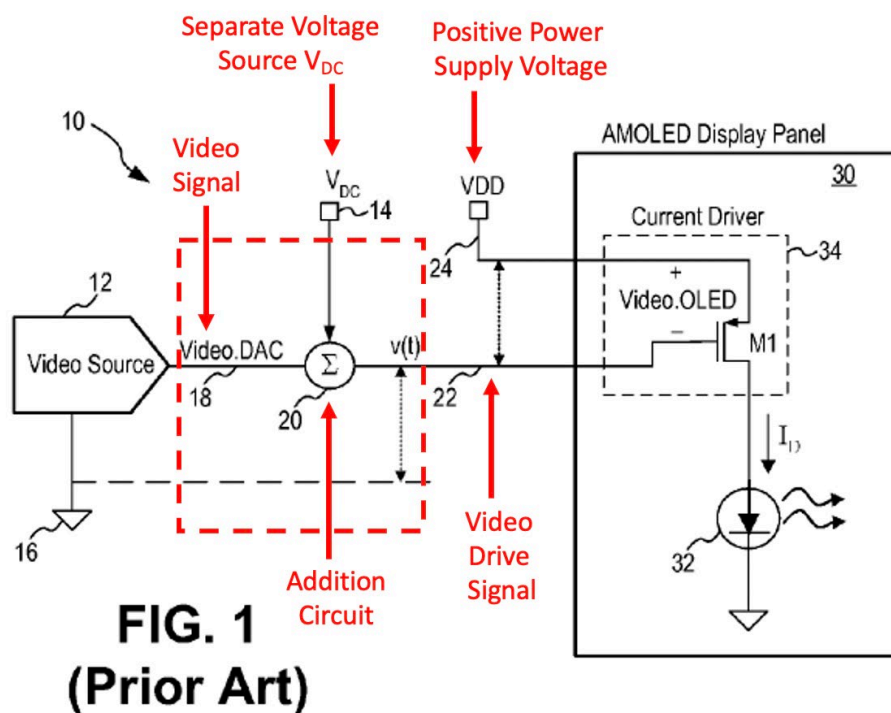
A. Summary

The '521 patent, titled "Video Driver Architecture for AMOLED Displays" issued on August 21, 2007, and was filed as Application No. 11/467,738 on August 28, 2006. EX1001, (21), (22), (45).

The '521 patent is directed to active matrix organic light emitting diode (AMOLED) displays. EX1001, 1:13-17. AMOLED displays contain many thousands of individual OLED pixel elements. *Id.*, 1:15-17. The OLED pixels have corresponding pixel circuits that are programmed via a series of row and column decoders and switches. *Id.*, 1:17-21. Each pixel circuit includes a drive transistor that provides current to the OLED pixel. The amount of current provided to each OLED pixel is proportional to the difference between the voltage levels of the video drive signal and the positive power supply voltage. *Id.*, 1:22-25. Therefore, variations in the power supply voltage will impact the brightness of the AMOLED display, causing the display to flicker. *Id.*, 1:25-26. For example, in a battery powered device, the power supply voltage will fluctuate whenever circuitry in the application device is powered up from being in a standby mode, causing the AMOLED display to flicker. Additionally, battery voltage tends to drift over time. *Id.*, 1:41-51.

The '521 patent illustrates the problems of the prior art in its discussion of

Figure 1, a schematic diagram of an exemplary prior art AMOLED display system.



EX1001, FIG. 1 (annotated).

In Figure 1, video signal, Video.DAC, is added to a DC voltage source, V_{DC} , generating the video drive signal, $v(t)$. EX1001, 1:65-2:1. DC voltage source V_{DC} is a separate voltage source than VDD, the power supply of the AMOLED display. *Id.*, 2:1-9. Video signal Video.DAC is referenced to ground and adding it to V_{DC} brings the analog video signal to within the range of the AMOLED display panel. *Id.*, 2:1-14. The result is that video drive signal $v(t)$ is referenced to the ground voltage. Its voltage value is given in the following equation:

$$\text{Eq. (1) } v(t) = \text{Video.DAC} + V_{DC}$$

Id., 2:6.

The drive current I_D at the OLED pixel 32 is a function of Video.OLED, the difference between the voltages at the source and gate terminals of transistor M1.

Id., 2:28-30. Voltage Video.OLED is referenced to the power supply voltage VDD and is given as the following equation:

$$\text{Eq. (2) Video.OLED} = \text{VDD} - v(t)$$

Id., 2:37.

The power supply voltage VDD can be described as the sum of an ideal power supply voltage VDDI and drift (Vdrift) and noise (Vnoise) components. The current driver voltage Video.OLED can be given as:

$$\begin{aligned} \text{Eq. (4) Video.OLED} &= \text{VDD} - v(t) \\ &= \text{VDDI} + \text{Vdrift} + \text{Vnoise} - \text{Video.DAC} - \text{VDDI} \\ &= \text{Vdrift} + \text{Vnoise} - \text{Video.DAC} \end{aligned}$$

Id., 2:53-60.

As can be observed in Equation (4), variations in the voltage V_{DD} (Vdrift and Vnoise) directly impact voltage Video.OLED, which determines the drive current I_D at the OLED pixel. *Id.*, 2:63-67. As a result, voltage variations in the power supply cause variations in the brightness of the AMOLED display. *Id.*, 2:67-3:4.

When the video drive signal $v(t)$ is applied to the drive transistor M1, the current drive voltage signal Video.OLED at the current driver is provided in the following equation:

$$\begin{aligned}\text{Eq. (6)} \quad \text{Video.OLED} &= VDD - v(t) \\ &= VDD - VDD + \text{Video.DAC} \\ &= \text{Video.DAC}\end{aligned}$$

Id., 5:6-15.

As illustrated by Equation (6), the current drive signal is independent of power supply voltage VDD. Any noise or drifts in the power supply voltage VDD will not impact the current drive signal Video.OLED and will not affect the brightness of the AMOLED display. *Id.*, 5:18-23.

B. Person of Ordinary Skill in the Art (POSITA)

“[T]he level of skill in the art is a prism or lens through which ... the Board views the prior art and the claimed invention.” *Okajima v. Bourdeau*, 261 F.3d 1350, 1354-55 (Fed. Cir. 2001). “This reference point prevents these factfinders from using their own insight or, worse yet, hindsight, to gauge obviousness.” *Id.*

Petitioner and Dr. Kattamis allege that a POSITA “would have a B.S. in Electrical Engineering or equivalent field, with 3-5 years of academic or industry experience in OLED display engineering or comparable industry. Additional education could compensate for less practical experience and vice versa.” Pet., 12;

EX1002, ¶44. At this stage of the proceeding, Patent Owner applies Petitioner’s definition of a POSITA, including the requirement that a POSITA would have “academic or industry experience in OLED display engineering or comparable industry.” Pet., 12; EX1002, ¶44.

C. Claim Construction

Patent Owner agrees with Petitioner that the terms of the challenged claims should be given their plain and ordinary meaning.

III. THE PETITION FAILS TO DEMONSTRATE ANTICIPATION OR OBVIOUSNESS OF ANY CHALLENGED CLAIM.

Each of Petitioner’s references—Kim, Hayafuji, and Steer—fails to disclose, teach, or suggest at least two limitations in the ’521 patent’s sole independent claim. As described below, Kim, Hayafuji, and Steer do not disclose or render obvious a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel. The alleged video driver of Kim (i) does not generate a video drive signal and (ii) would not have been considered a video driver by a POSITA. Hayafuji teaches a circuit that receives a voltage ripple value rather than the power supply voltage, and therefore does not disclose referencing the video drive signal to the power supply voltage. Steer also fails to teach referencing the video drive signal to the power supply voltage due to the use of a current feedback circuit that provides additional variable voltage inputs to the

alleged video drive signal. Accordingly, all three references fail to disclose this limitation.

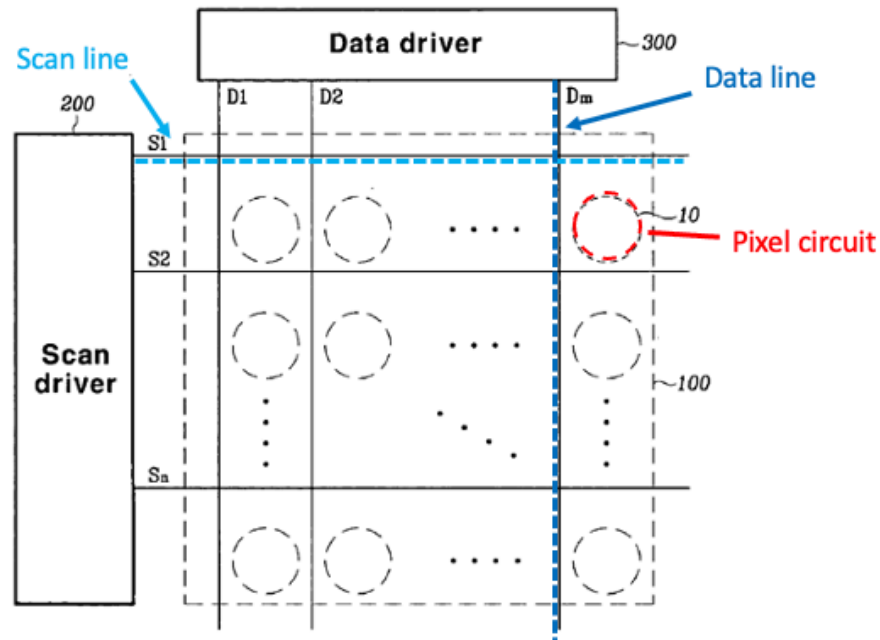
Additionally, Kim, Hayafuji and Steer do not disclose or render obvious a current driver that provides a drive current that is independent of the positive power supply voltage. Kim's drive current remains dependent on undesirable voltage variations in the positive power supply voltage. Hayafuji teaches a circuit that generates a drive current that depends on the positive power supply voltage and fails to remove either voltage noise or drift. Steer teaches a circuit that, due to amplification, generates a drive current that depends on the positive power supply voltage. Thus, again, all three references fail to disclose this limitation.

A. Grounds 1 and 2: Kim Neither Anticipates Nor Renders Obvious Claims 1, 2, and 7.

1. Summary of Kim

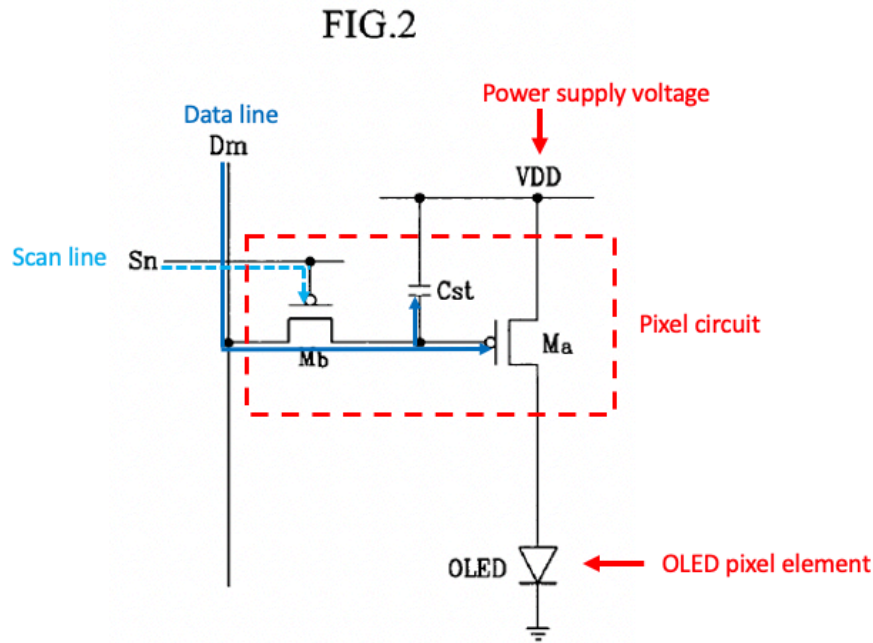
Kim relates to an organic light emitting diode (OLED) display architecture that includes a data driver, a scan driver, and a display panel comprised of a matrix of OLED pixels and corresponding pixel circuits. EX1007, Abstract, ¶¶[0045]-[0046], FIG. 3. The data driver includes a separate output and data line for each column of pixels in the matrix. *Id.*, FIG. 3. The scan driver includes a separate output and scan line for each row of pixels. *Id.*, FIGs. 2, 3.

FIG.3



EX1007, FIG. 3 (annotated).

Kim discloses a conventional AMOLED pixel circuit, which is connected to a data line, a scan line, and the power supply voltage. EX1007, ¶[0007], FIG. 2. This pixel circuit design includes two transistors, a storage capacitor (Cst), and input lines from the Data (video) driver (Dm) and Scan driver (Sn). *Id.*, FIG. 2, ¶¶[0008]-[0009]. There is a pixel circuit at every intersection of a data line and scan line in the display matrix. *Id.*, ¶[0046].

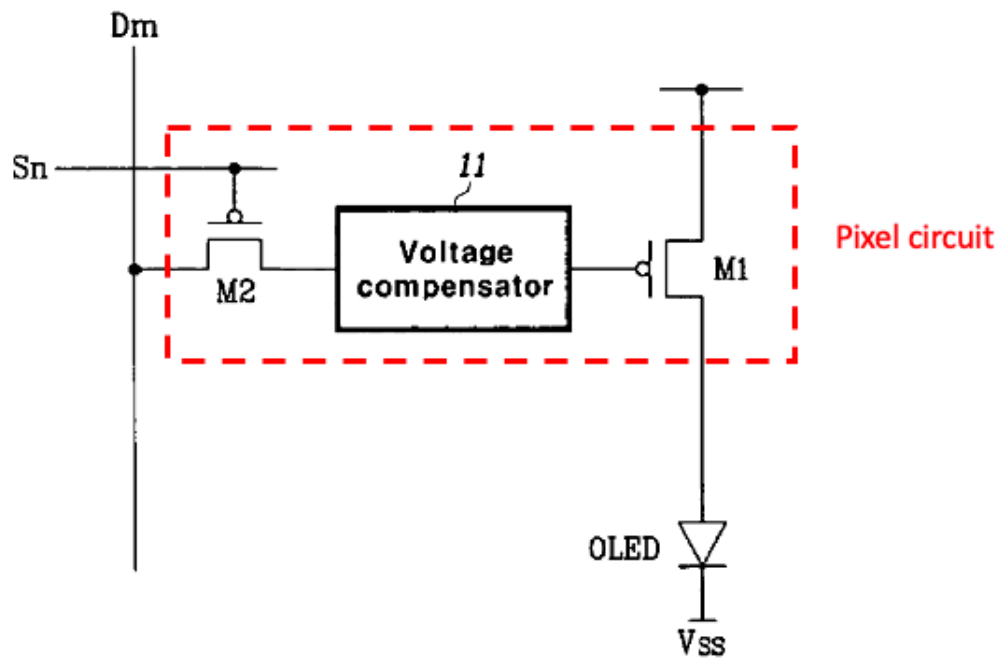


EX1007, FIG. 2 (annotated).

During operation of the display, the scan driver sequentially activates the rows in the pixel array, allowing each pixel circuit in that row to receive the video signal and store it in its capacitor. EX1007, ¶[0046], FIG. 2. When the scan line on a specific row activates, it turns “on” the transistor Mb for each pixel circuit in the row, which allows data voltage on the data line to flow to capacitor Cst, where it is stored. *Id.*, ¶[0008]-[0009], [0046]-[0047]. The scan driver then deactivates the scan line for that row and activates the scan line for the next row in the matrix. *Id.*, ¶[0046]. In each pixel circuit, the OLED pixel emits the color and brightness dictated by the voltage stored in the capacitor until it is reprogrammed during the next cycle. *Id.*, ¶[0008]-[0009].

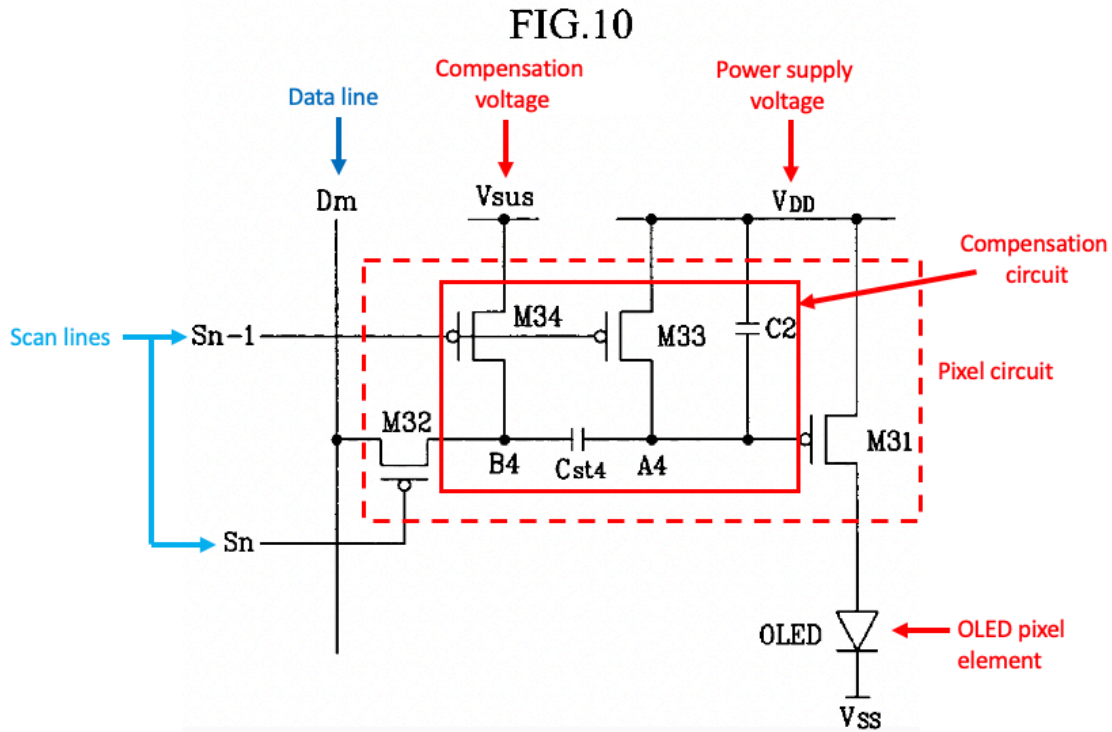
Kim identifies challenges with AMOLED pixel circuit designs, including undesirable deviation in the power supply voltage or in the threshold voltage of the drive transistor, which impacts how much current flows to the OLED pixel. *Id.*, ¶¶[0013]-[0015], [0124]. Kim teaches modifying the conventional pixel circuit design described above by including a “voltage compensator” circuit, as depicted in a simplified circuit diagram in Figure 4, to address these challenges.

FIG.4



EX1007, FIG. 4 (annotated).

A more detailed pixel circuit embodiment is disclosed in Figure 10, which illustrates the circuitry of the voltage compensator, which includes a compensation voltage (V_{sus}) capacitors, and transistors. EX1007, ¶¶[0104]-[0108].



EX1007, FIG. 10 (annotated).

2. **Claim [1-A]: Kim does not disclose or render obvious “a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel.”**

Claim 1 requires a “video driver receiving the video signal and generating a video drive signal ... referenced to a positive power supply voltage of the AMOLED display panel.” Petitioner argues that the compensation circuit within

the pixel circuit in Kim’s Figure 10 embodiment discloses the claimed “video driver” and that the voltage at node A4 discloses the generated “video drive signal.” Pet., 25-26, 29. Petitioner alleges that Kim discloses the “video driver” and “video drive signal” limitations, not that these limitations would have been obvious. Petitioner’s argument is incorrect for several reasons: *first*, the alleged video driver does not generate a video drive signal; *second*, the identified pixel circuit is not a *video driver* because, in AMOLED displays, video drivers are distinct from pixel circuits; and *third*, the alleged video drive signal is not referenced to the positive power supply voltage.

a. The identified portion of Kim’s pixel circuit does not generate a video drive signal.

Claim 1 recites that the video driver receives a “video signal” and “generat[es] a video drive signal.” The portion of the pixel circuit identified by Petitioner does not “generate a video drive signal.” The pixel circuit of Kim’s Figure 10 lacks the necessary components of a video driver that are responsible for generating a video drive signal. EX2011, ¶¶85-91. This makes sense, as a pixel circuit would not need any such circuitry—its function is to *receive*, not *generate* a video drive signal. *Id.*, ¶¶87, 89.

One of ordinary skill in the art would have understood that generating a video drive signal requires taking a usually digital video signal and shifting, converting to analog, and amplifying the voltage so that it can properly drive the

transistors in the display panel's pixel circuits. *Id.*, ¶86. For example, as explained in the den Boer textbook, a video driver (also referred to as source driver, column driver, and data driver) in an Active Matrix display, illustrated in Figure 4.11, uses a level shifter to shift the voltage of the video signal from the “logical levels” to a level that can drive the pixel circuit's transistors, a digital to analog converter, which also adjusts the gamma of the output voltage, and amplifiers (buffers) to provide sufficient current to the low impedance column electrodes. EX1011, 97.¹

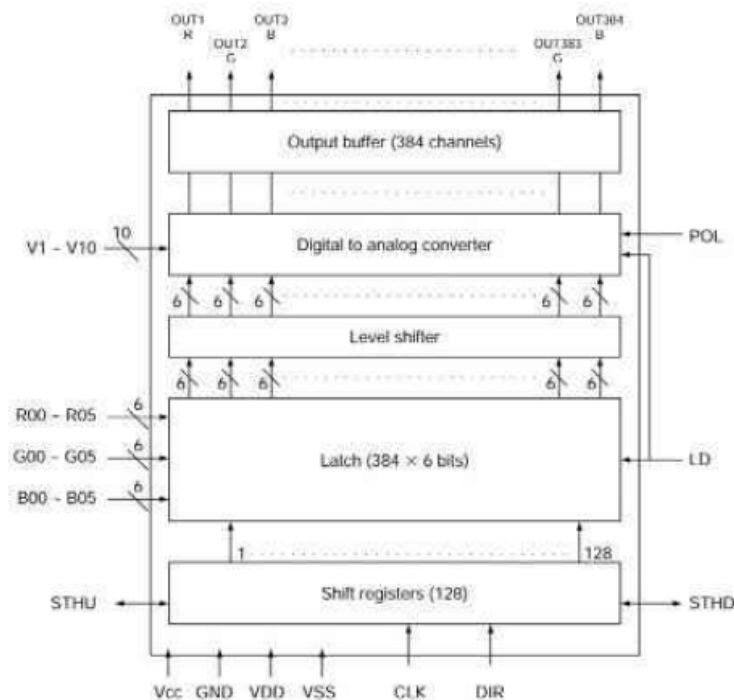


Figure 4.11: Basic architecture of a source driver IC with 384 channel outputs for use in XGA and SXGA panels (eight or ten chips per panel, respectively).

EX1011, 97 (FIG. 4.11).

¹ Citation is to original page number.

Consistent with the understanding of a POSITA, the '521 patent describes generating a video drive signal as, among other things, receiving a video signal from a video source, such as an image processor, and shifting it “to bring the DC range of the analog video signal to within the range of the AMOLED display panel.” EX1001, 1:56-2:12. The '521 patent's embodiments disclose a video driver that receives a video signal as input and uses the power supply voltage VDD as an offset to the video signal to generate a video drive signal that is within the range of the AMOLED display panel and referenced to power supply voltage VDD as illustrated in Figure 2 below. *Id.*, 4:34-37, 6:1-6, 7:4-8.

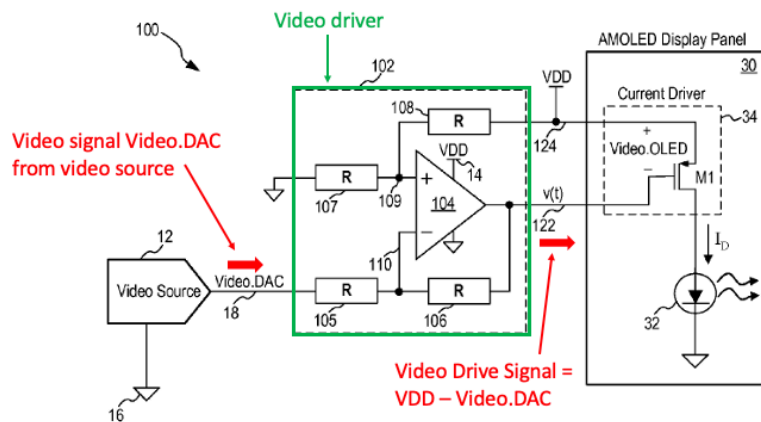
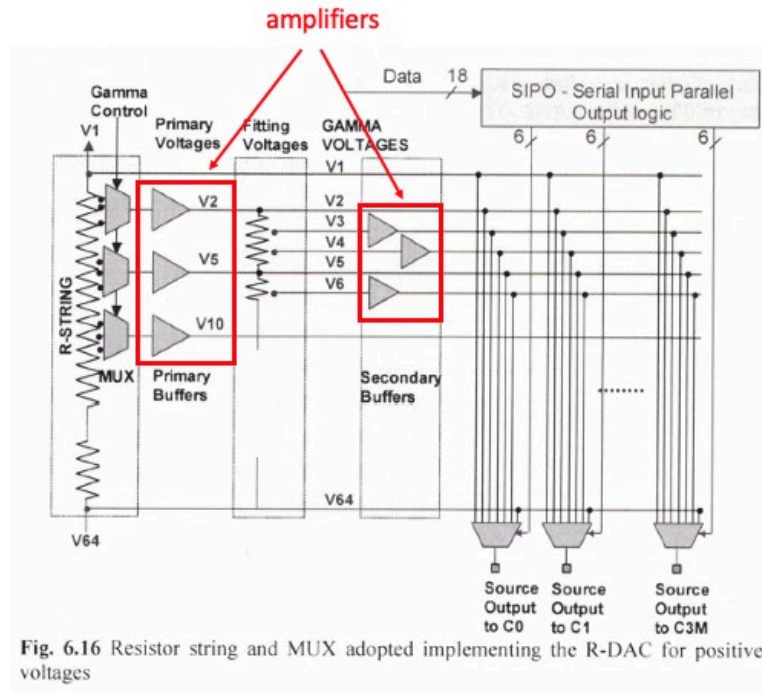


FIG. 2

EX1001, FIG. 2 (annotated).

One of ordinary skill in the art would also have understood that a video driver would use amplifiers, among other components, to generate a drive signal. EX2011, ¶88. For example, the video driver disclosed in den Boer uses output buffers to reduce the output impedance of the output channels in order to drive the

data lines that connect to the pixel circuits. EX1011, 97-98; EX2011, ¶88. Output buffers typically include amplifiers to drive current onto the data lines, as illustrated in the figure below. EX2011, ¶88.



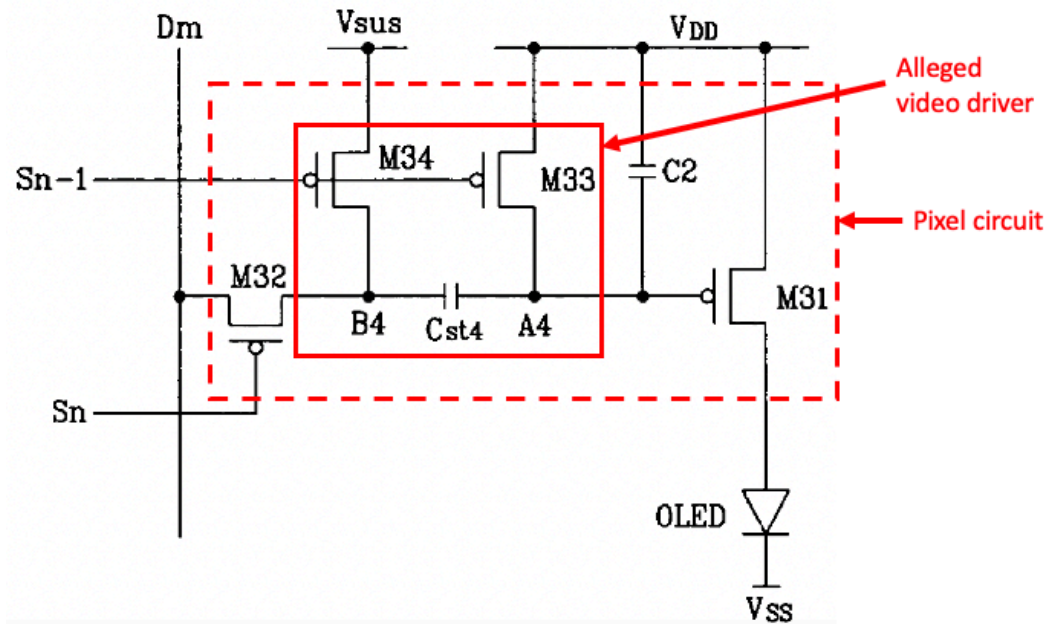
EX2006, 11 (FIG. 6.16, annotated).

Consistent with this understanding, the video driver in each embodiment of the '521 patent includes at least one amplifier. EX1001, FIGs. 2-4.

In contrast, the alleged video driver of Kim does not perform these functions in creating the alleged video drive signal. EX2011, ¶89. The signal of the alleged video driver of Kim does not increase the voltage from the logical level of the video source to the level of the display. *Id.* The signal received by Kim's pixel circuit must have already undergone this voltage level shifting; otherwise, the

signal would not properly interact with the pixel circuit's transistors and capacitors. *Id.* Additionally, the alleged video driver of Kim does not have the components needed to drive current onto the column data lines. *Id.* The alleged video drive signal of Kim that actually resides within the pixel array includes only switching transistors M33 and M34 and capacitor Cst4, which one of ordinary skill in the art would expect in a pixel circuit that corrects for local non-uniformities such as threshold voltage or IR drop. *Id.* Without an amplifier, the alleged video driver within the pixel array is unable to generate the claimed video drive signal. *Id.*; EX1007, FIG. 10.

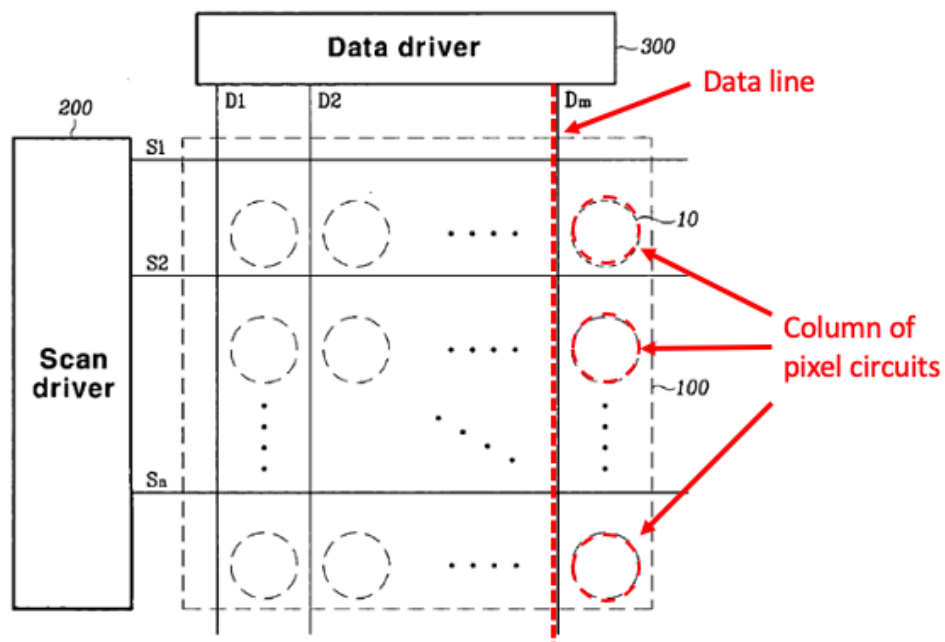
FIG.10



EX1007, FIG. 10 (annotated).

Further, because the alleged video driver in Kim is inside the pixel circuit, there is no need for it to *generate* a video drive signal because the signal is already generated by the video data driver 300. EX2011, ¶90. In an AMOLED display system, a video driver generates a video drive signal to drive an entire column of pixels in a row-by-row manner. *Id.* In contrast, the alleged video driver of Kim sends a signal only to the drive transistor within a single pixel circuit. *Id.* Thus, the alleged video driver of Kim *receives* a video drive signal from the data (video) driver, as illustrated in Figure 3. It does not *generate* a video drive signal, as required.

FIG.3



EX1007, FIG. 3 (annotated).

Additionally, the operation of the alleged “video driver” in Kim’s fourth embodiment illustrates that it does not *generate*, but rather merely makes minor adjustments to an existing video drive signal. EX2011, ¶90. As illustrated in Kim’s Figure 10, the alleged “video driver” is a portion of the pixel circuit that functions as a compensation circuit. EX1007, FIGs. 4, 10. Specifically, when the previous select line Sn-1 is set to low, switching transistor M34 turns on and compensation voltage Vsus flows to electrode B4 of capacitor Cst4. *Id.*, ¶[0107]. Switching transistor M33 also turns on and charges electrode A4 of capacitor Cst4 with the power supply voltage VDD. *Id.* When the current select line Sn becomes low, switching transistor M32 turns on and video signal Dm is applied to electrode B4 of capacitor Cst4. *Id.*, ¶[0108]. The change in voltage applied to B4 causes the voltage of electrode A4 of capacitor Cst4 to vary by the same amount as the difference between Vsus and Dm. *Id.* A POSITA would have understood that the operation of switching transistors M33 and M34 and capacitor Cst4 described above makes a local correction to the analog voltage supplied by the video driver to the drive transistor but does not *generate* the video drive signal. EX2011, ¶91.

b. The identified portion of Kim’s pixel circuit is not a video driver.

Claim 1 recites a “video driver ... generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel.” One of ordinary skill in the art would have understood

that a “video driver” (recited in claim 1) and pixel circuit (in Kim) are different components in an AMOLED display system. EX2011, ¶92. Because the alleged video driver of Kim is part of the pixel circuit it does not disclose the claimed video driver of the ’521 patent.

As discussed above in Section III.A.1, *supra*, Kim discloses an AMOLED display system, with data (video) driver, scan driver, and an array of pixel circuits. EX1007, ¶¶[0007]-[0009], [0044]-[0047], FIG. 3. Kim’s disclosure is consistent with a POSITA’s understanding of a conventional AMOLED display, where a video driver (also referred to as source drivers, column drivers, or data drivers, EX2011, ¶92) provides video data to columns of pixels and a scan driver sequentially selects rows of pixels for programming. For example, the figure below from the literature shows the same relationship between the video (data) driver and pixel circuits as Kim’s Figure 3. *Id.* Thus, a POSITA would have understood that the *video driver* of the ’521 patent, which generates an analog video drive signal with voltage and impedance levels that match the requirements of the pixel array, is the same as the data driver in Kim’s Figure 3 or Tsuimura’s Figure 4.31 below. *Id.* This is further supported by the fact that Kim does not refer to the voltage compensator within the pixel circuit as a “video driver.” EX1007; EX2012, 87:20-88:7.

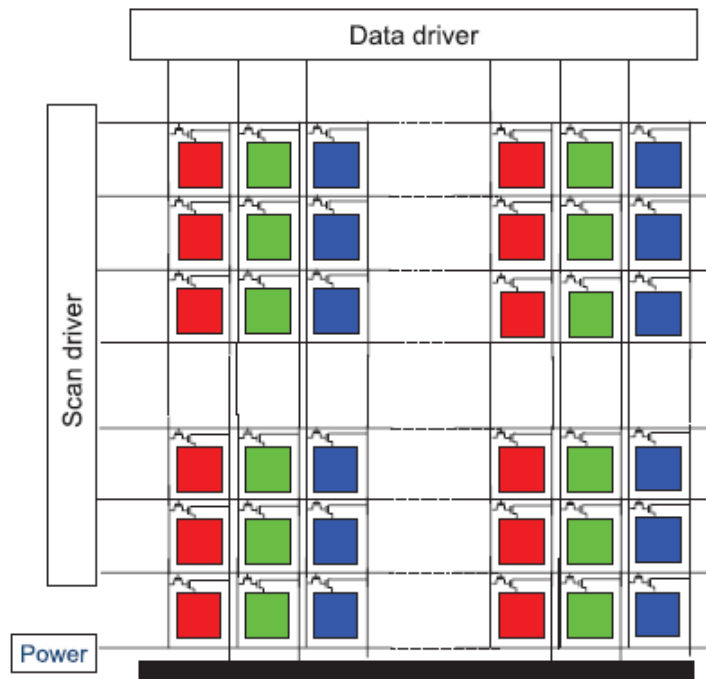


Figure 4.31 An active-matrix OLED display.

EX2007, 8 (FIG. 4.31).

Additionally, one of ordinary skill would also have understood that in AMOLED displays there is a one-to-many relationship between drivers and pixel circuits. EX2011, ¶93. The data (video) driver circuitry comprises an array of drivers where each driver in the array “drives” an entire column of pixel circuits. *Id.* The scan driver similarly is comprised of an array of drivers wherein each driver in the array “drives” a row of pixel circuits, allowing one row at a time to be programmed with the video signal in repeating cycles. *Id.* In contrast, the alleged video driver of Kim does not drive a number of pixel circuits and is therefore not a video driver. *Id.*

Given the distinct functions of video drivers and pixel circuits in AMOLED displays, it is clear that Kim's pixel circuit does not disclose the claimed video driver. *Id.*, ¶94. The invention of the '521 patent is a specific solution to the problem of power supply voltage variations that is implemented in the video driver rather than in the individual pixel circuits. *Id.*, ¶94. Consistent with the understanding of AMOLED displays that one of ordinary skill in the art would have, the '521 patent states that the invention is for a *video driver* that functions to isolate the pixel circuit from power supply variations:

The invention relates to video driver for AMOLED displays and, in particular, to a video driver for AMOLED displays that is capable of isolating the pixel circuit from power supply voltage variations.

EX1001, 1:5-10 (emphasis added). One of ordinary skill in the art would thus have understood that the invention relates to the functionality of an upstream video driver that isolates the downstream pixel circuit from the power supply voltage variations. EX2011, ¶95. Petitioner admitted that the specification refers to “*electrical* isolation” of the pixel circuit. POPR Reply, 1. Therefore, in the understanding of one of ordinary skill in the art, the claimed video driver of the '521 patent is necessarily separate and distinct from the pixel circuit, which is consistent with the general usage of these terms in the field. EX2011, ¶94. Otherwise, if the video driver was part of the pixel circuit, it would be impossible for the “video driver” to “isolat[e] the pixel circuit.” *Id.*; EX1001, 1:6-9.

The differences in the problems addressed by the '521 patent and Kim help explain why they propose different solutions. The problems Kim seeks to address—driving transistor threshold voltage variations and voltage drop—vary among the pixel circuits in a display. EX1007, ¶¶[0014], [0015]; EX2012, 55:17-56:11, 59:1-18; EX2011, ¶96. As explained in the following excerpt from a 2006 article by Han, threshold voltage non-uniformity causes undesirable variance in brightness among pixels:

[T]he *non-uniformity* of electrical properties of poly-Si TFT, such as the *threshold voltage ... causes the non-uniformity of luminance in one pixel to another one.*

EX1012, 53 (emphasis added). Similarly, Kim explains that due to “voltage drop,” “*the power supply voltage V_{DD} applied to a plurality of pixel circuits is not uniform*” and “a desired amount of current may not flow to the OLED, thereby degrading image qualities.” EX1007, ¶[0013] (emphasis added). Because these voltage disturbances are not uniform across pixel circuits, the solution must provide a form of voltage compensation to each pixel circuit separately. EX2011, ¶96. The Han article, similar to Kim, proposed providing a compensation voltage V_{SUS} to the pixel circuits to address similar challenges:

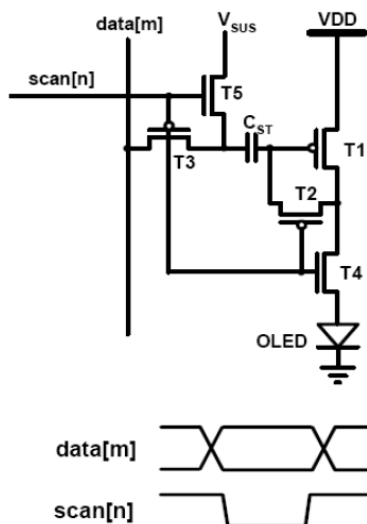


Figure 4. The reported AMOLED pixel circuit employing a reference voltage source V_{SUS} which compensates the V_{DD} supply voltage drop as well as the threshold voltage variation of poly-Si TFT [6].

EX1012, FIG. 4.

In contrast, the '521 patent provides examples of voltage variations that do not vary from pixel circuit to pixel circuit. EX2011, ¶98. The '521 patent provides the example of a component in a battery powered device turning on, causing the power supply voltage delivered to the display to fluctuate:

[W]hen the AMOLED display is incorporated in a battery powered application, the power supply voltage will inevitably fluctuate whenever circuitry in the application device is powered up from being in a standby mode.

EX1001, 1:40-56. In this example, the circuitry of a battery-powered device turning on would impact the power supply voltage for the entire display. EX2011, ¶98. Thus, the '521 patent claims a solution that is implemented in the video driver

that is *outside* of the pixel circuits. *Id.* That is, the '521 patent teaches a “global” correction to the generated video signal by referencing the video signal to VDD before the data is supplied to the pixel circuits. *Id.*

The '521 patent's discussion of a possible embodiment where the claimed “video driver of the present invention can be integrated on the same integrated circuit with ... the AMOLED display panel” does not eliminate the requirement that the claimed video driver be distinct from the pixel circuits. EX1001, 7:59-62; EX2011, ¶100. The defining features of an *Active Matrix* OLED display are distinct pixel circuits for each OLED pixel, a video driver that sends a video drive signal to columns of pixel circuits, and a scan driver that selects which row of pixel circuits is active. EX2011, ¶100; EX2012, 79:11-16. Thus, even if the video driver and display panels are integrated, a POSITA would have understood that the display would still comprise distinct pixel circuits and video drivers. EX2011, ¶100. Illustrating this, Figure 4.16 in the den Boer textbook shows an AMOLED display with the video drivers and the viewing area (the matrix of OLED pixels and pixel circuits) integrated on a single piece of glass. EX1011, 102-104; EX2012, 48:2-50:11; EX2011, ¶100.

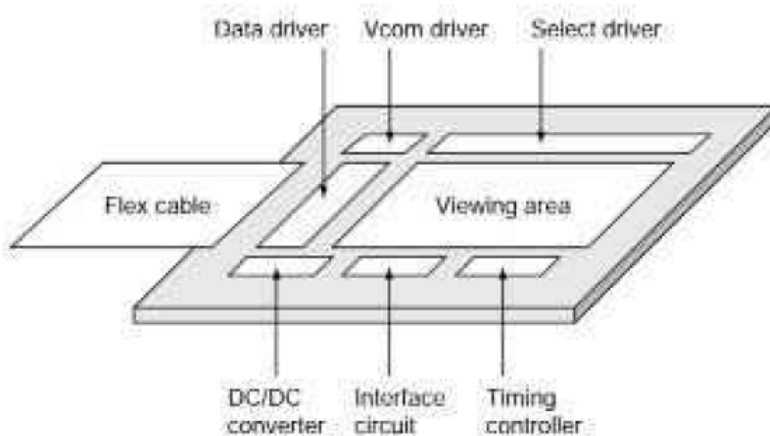


Figure 4.16: Example of configuration for a "system-on-panel."

EX1011, 104 (FIG. 4.16).

Similarly, AMOLED display systems where the video driver, scan driver, and pixel circuits are incorporated into an integrated circuit have been implemented. EX2011, ¶101. As illustrated in the figure below, in these designs, the video driver, scan driver, and pixel circuits are distinct components built on a single semiconductor substrate. *Id.*; EX2010, 1, 3.

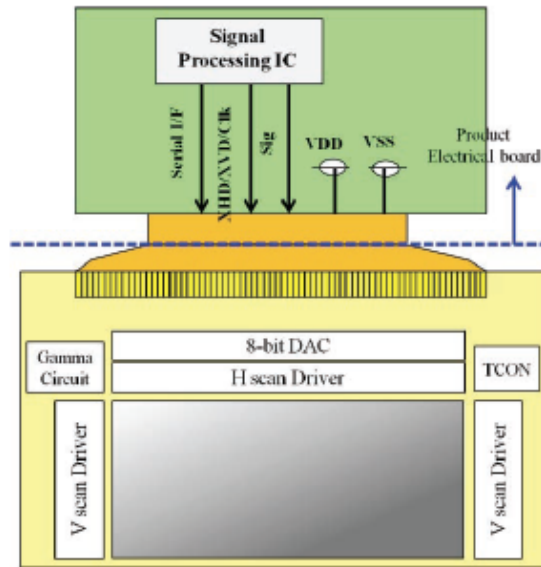


Figure 6. Block diagram of driving circuit

EX2010, 3 (FIG. 6).

Thus, even in a design where the video driver and pixel circuits are integrated with the display panel or incorporated into a single integrated circuit, the video drivers are still distinct from the pixel circuits. Thus, the compensation circuit (alleged video driver) located in the pixel circuit of Kim does not disclose the video driver of claim 1.

c. The accused video drive signal is not referenced to the power supply voltage.

Claim 1 further requires that the video drive signal is “referenced to a positive power supply voltage.” The claimed positive power supply voltage is the voltage that is applied to the drive transistor to generate the current to the OLED pixel element. EX1001, 4:7-26, 8:48-64. Petitioner argues that the voltage at electrode A4 in Kim’s Figure 10 embodiment is independent of the power supply

voltage because Kim's Equation 11 adds V_{DATA} to VDD: $V_{A4} = VDD + \Delta V_{B4} = VDD + V_{\text{DATA}} - V_{\text{sus}}$. Pet., 29-30. However, due to variations in VDD over time, the value of VDD used to calculate V_{A4} is not the same value of VDD that is applied to the drive transistor. See EX1001, 1:32-55; EX2011, ¶103. Therefore, V_{A4} is not referenced to the positive power supply voltage. EX2011, ¶103.

To determine the drive current to the OLED pixel in Kim's Figure 10 embodiment, the power supply voltage VDD and the voltage of A4 are applied to the electrodes of capacitor C2, represented by Equation 12. The corresponding current flows to the OLED pixel.

$$\text{(Eq 12) } VC2 = VDD - (VDD + V_{\text{DATA}} - V_{\text{sus}}) = V_{\text{DATA}} - V_{\text{sus}}$$

EX1007, ¶[0112].

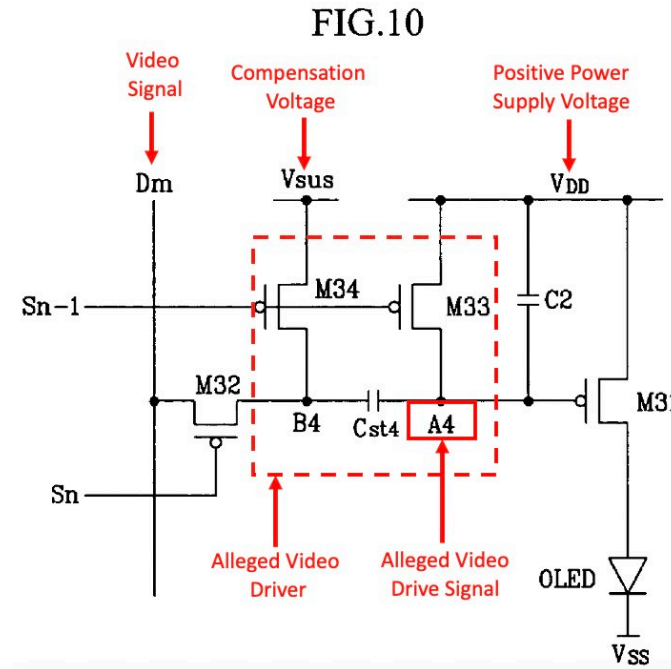
However, at a more granular level, the positive power supply voltage VDD is not constant with time. EX2011, ¶105. More accurately, VDD includes a constant ideal voltage component as well as undesirable voltage variation components such as noise and drift that vary with time:

$$VDD = VDD(t) = V_{\text{DC}} + V_{\text{drift}}(t) + V_{\text{noise}}(t)$$

Id.

The value of VDD that is used to determine V_{A4} in Equation 11 is not necessarily the same value of VDD that is applied to the source of drive transistor M31. *Id.*, ¶106. When S_n goes low, S_{n-1} goes high, the transistor M33 is turned off

and VDD is no longer applied to electrode A4 of capacitor Cst4. *Id.* Therefore, the value of VDD at A4 no longer varies with the power supply voltage connected to drive transistor M31. *Id.*



EX1007, FIG. 10 (annotated).

Using t_1 to indicate the short period of time during which VDD is applied to electrode A4 of capacitor Cst4 and t to indicate the longer time period during which VDD is applied to the source terminal of drive transistor M31 and current is flowing to the OLED, Equations 11 and 12 can be re-written as follows:

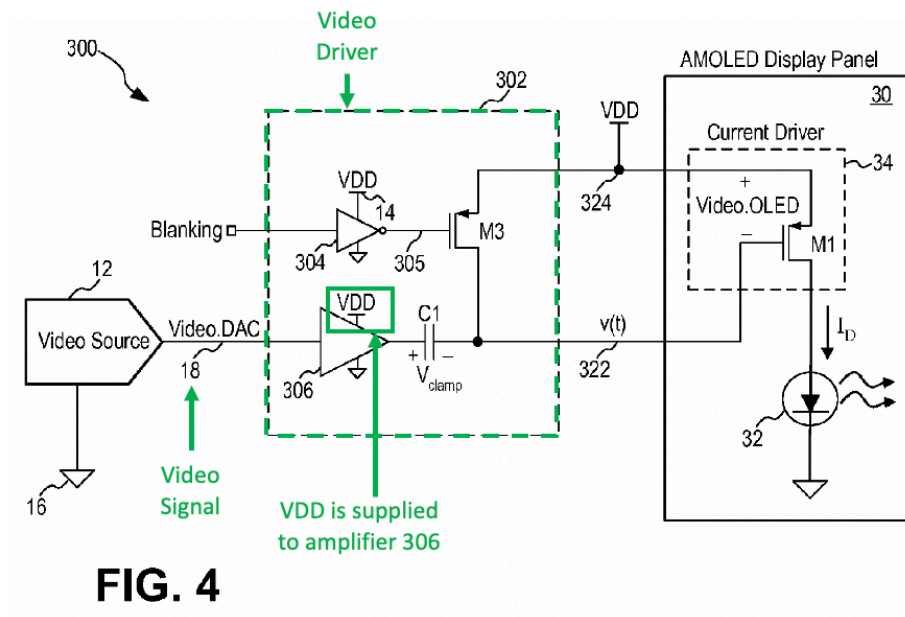
$$V_{A4} = V_{DD}(t_1) + \Delta V_{B4} = V_{DD}(t_1) + V_{DATA} - V_{sus}$$

$$V_{C2} = V_{DD}(t) - (V_{DD}(t_1) + V_{DATA} - V_{sus})$$

EX2011, ¶107.

The modified equations above illustrate that $VDD(t1)$ is a constant representing the value of VDD stored on the A4 electrode of capacitor Cst4 after transistor M33 turns off and VDD no longer is connected to the capacitor. *Id.*, ¶108. This is different than $VDD(t)$, which is the value of VDD over time and that is connected to the source terminal of drive transistor M31 when current is flowing to the pixel. *Id.* The value of $VA4$ is therefore not referenced to the relevant power supply voltage that is applied to the source terminal of drive transistor M31 while current is supplied to the pixel, which is $VDD(t)$. *Id.* Instead, $VA4$ is referenced to the value of VDD at earlier time $t1$, $VDD(t1)$. *Id.*

Petitioner argues that the operation of Kim's fourth embodiment is similar to the third embodiment of the '521 patent, which discloses a clamping voltage stored on capacitor C1, depicted in Figure 4 below. Pet., 30. However, the Petition ignores that in Figure 4 of the '521 patent, amplifier 306 receives the power supply voltage VDD , which is different than typical video driver amplifier circuits, which use a separate voltage supply (e.g., similar to V_{DC} described in the '521 patent). EX2011, ¶109; EX1001, FIG. 4. This voltage VDD varies over time just like the voltage VDD that is applied to the drive transistor in the pixel circuit. EX2011, ¶109. Therefore, the output of amplifier 306 would continue to be impacted by variations in VDD even after the clamping voltage is set on capacitor C1. *Id.*



EX1001, FIG. 4 (annotated).

Therefore, Kim does not disclose or render obvious a video drive signal referenced to the positive power supply voltage of the AMOLED display panel.

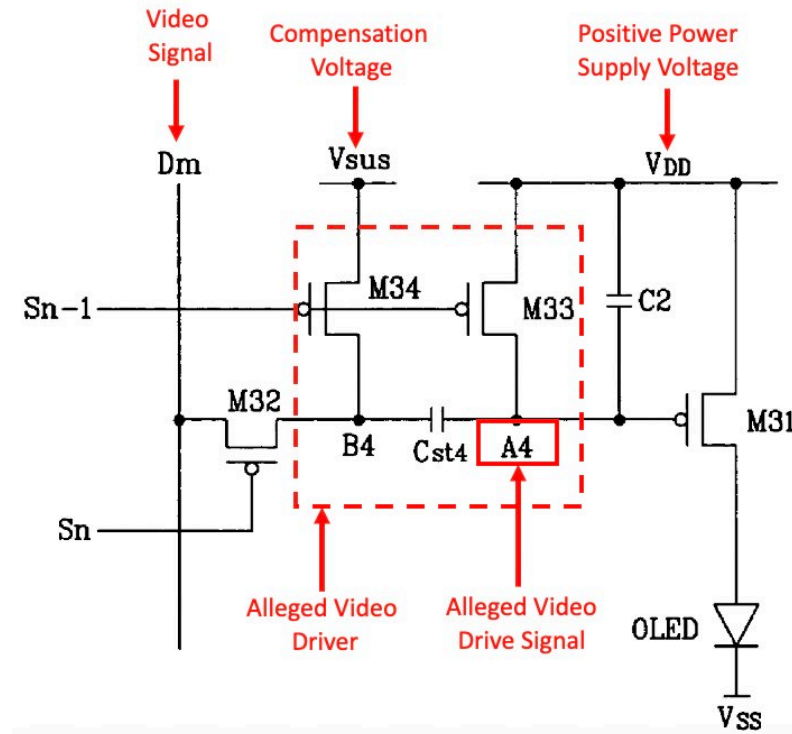
3. Claim [1-C]: Kim does not disclose or render obvious “the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.”

Claim 1 requires a “drive current being ... independent of the positive power supply voltage.” Alleging anticipation and not obviousness, the Petition argues that the drive current in Kim’s Figure 10 embodiment is independent of the power supply voltage because the Equation 13 describing the current flowing to the OLED does not include the power supply voltage VDD: $I_{\text{OLED}} = \beta/2 * (V_{\text{GS31}} - V_{\text{TH31}})^2$. Pet., 38-39. Equation 13, however, presents an overly simplistic view of the drive current, as explained below.

In the context of the '521 patent, the drive current is independent of the positive power supply voltage if the power supply voltage is not a factor in calculating the drive current and at least unwanted voltage drift is removed from the current drive voltage. EX1001, 5:6-15, 6:20-29, 7:36-43; EX2011, ¶112. Due to changes over time of unwanted voltage variations, such as noise and drift, these voltage variations are not removed from the current drive voltage in Kim. EX2011, ¶112.

The Petition alleges that the drive current to the OLED pixel in Kim's Figure 10 embodiment is independent of the positive power supply voltage. Pet., 38-39. Similar to the prior art disclosed in the '521 patent specification, Kim's fourth embodiment teaches introducing a separate supply voltage, V_{sus} , into the pixel circuit to generate a compensated signal that drives the transistor coupled to the OLED. EX1007, ¶¶[0106]-[0108]; EX2011, ¶113. As illustrated in Kim's Figure 10, data line D_m carries the video signal and V_{sus} is a compensation voltage separate from the power supply voltage V_{DD} .

FIG.10



EX1007, FIG. 10 (annotated).

When the previous select line S_{n-1} is low level, transistor M34 is turned on and compensation voltage V_{sus} is applied to electrode B4 of capacitor Cst4. EX1007, ¶[0107]. Transistor M33 is also turned on and power supply voltage V_{DD} is applied to terminal A4 of capacitor Cst4. *Id.* When the current select line S_n becomes low level, transistor M32 turns on and video signal D_m is applied to terminal B4 of capacitor Cst4. *Id.*, ¶[0108]. When this occurs, the voltage of electrode A4 of capacitor Cst4 correspondingly changes by the value of the voltage change in electrode B4 which is the difference between V_{sus} and D_m . The voltage at A4 is described in Equation 11:

$$(Eq\ 11) V_{A4} = V_{DD} + \Delta V_{B4} = V_{DD} + V_{DATA} - V_{sus}$$

Id., ¶¶[0108]-[0109].

The power supply voltage V_{DD} and the voltage of A4 are applied to the electrodes of capacitor C2, represented by Equation 12. *Id.*, ¶¶[0110]-[0112]. The corresponding current flows to the OLED pixel. *Id.*

$$(Eq\ 12) V_{C2} = V_{DD} - (V_{DD} + V_{DATA} - V_{sus}) = V_{DATA} - V_{sus}$$

Id., ¶[0112].

The current that flows through transistor M31 to the OLED pixel is given as Equation 13, where V_{GS} is the gate-source voltage of M31 and V_{TH31} is the threshold voltage of drive transistor M31:

$$(Eq\ 13) I_{OLED} = \beta/2 * (V_{GS31} - V_{TH31})^2$$

Id., ¶[0113].

However, Equation 13 ignores the variations in V_{DD} over time. EX2011, ¶117. More accurately, V_{DD} includes a constant ideal voltage component, V_{DC} , as well as undesirable voltage variation components such as noise and drift that vary with time:

$$V_{DD} = V_{DD}(t) = V_{DC} + V_{drift}(t) + V_{noise}(t)$$

Id.

To solve for the OLED pixel drive current, I_{OLED} , Kim's Equation 13, EX1007, ¶[0113], can be re-written as follows:

$$(Eq\ 13)\ I_{OLED} = \beta/2*(V_{GS31} - V_{TH31})^2$$

$$\begin{aligned} I_{OLED} &= \beta/2*(VDD(t) + V_{DATA} - V_{sus} - VDD(t1) - V_{TH1})^2 \\ &= \beta/2*(V_{DC} + V_{drift}(t) + V_{noise}(t) + V_{DATA} - V_{sus} - V_{DC} - \\ &\quad V_{drift}(t1) - V_{noise}(t1) - V_{TH1})^2 \\ &= \beta/2*(V_{drift}(t) + V_{noise}(t) + V_{DATA} - V_{sus} - V_{drift}(t1) - \\ &\quad V_{noise}(t1) - V_{TH1})^2 \end{aligned}$$

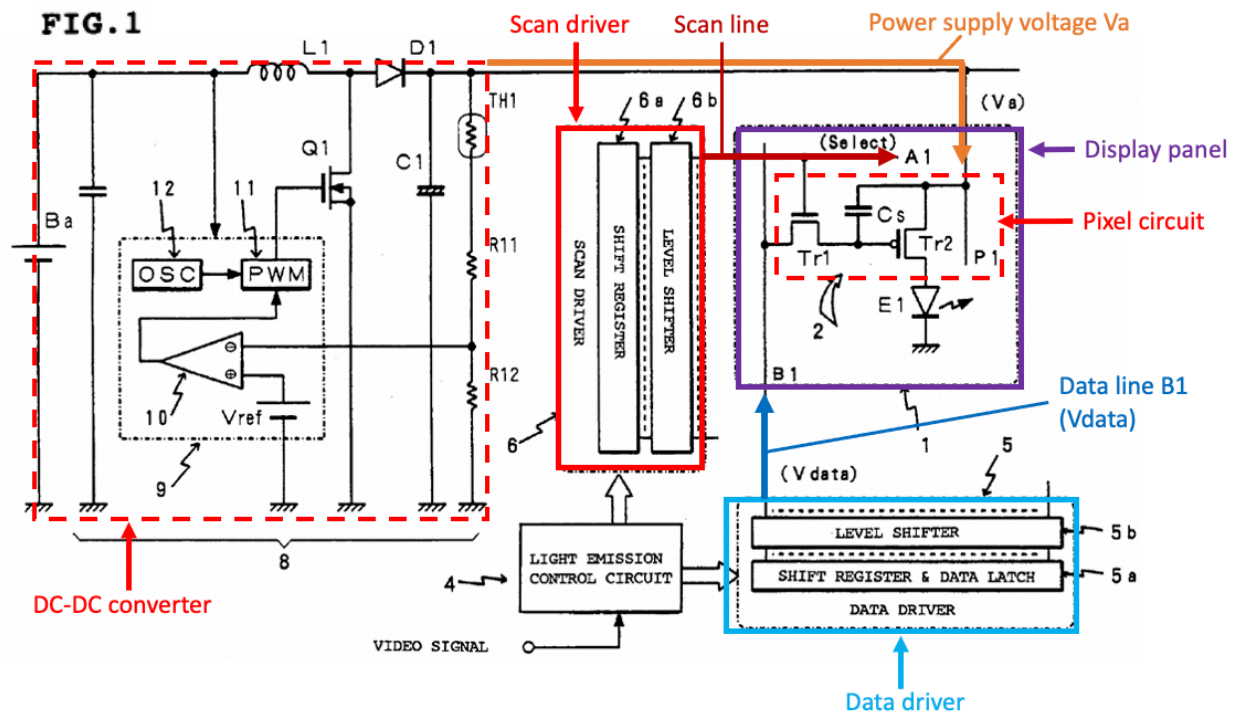
Id., ¶97; EX2011, ¶118.

In this analysis, t1 is the time before new data is written and t is the time after data is written and when current is flowing to the OLED (the majority of time). EX2011, ¶119. The V_{DC} components in $VDD(t1)$ and $VDD(t)$ cancel out but the differences in undesirable voltage variations between $VDD(t1)$ and $VDD(t)$ do not. *Id.* The Petition ignores these voltage fluctuations that are present during the period in which current flows to the pixel. These voltage variations in the current drive voltage in Kim's fourth embodiment would be greater than any potential voltage variations taught in any of the '521 patent's embodiments. *Id.* Therefore, the drive current in Kim's Figure 10 is not independent of the power supply voltage.

B. Ground 3: Hayafuji Does Not Anticipate Claims 1 and 2.

1. Summary of Hayafuji

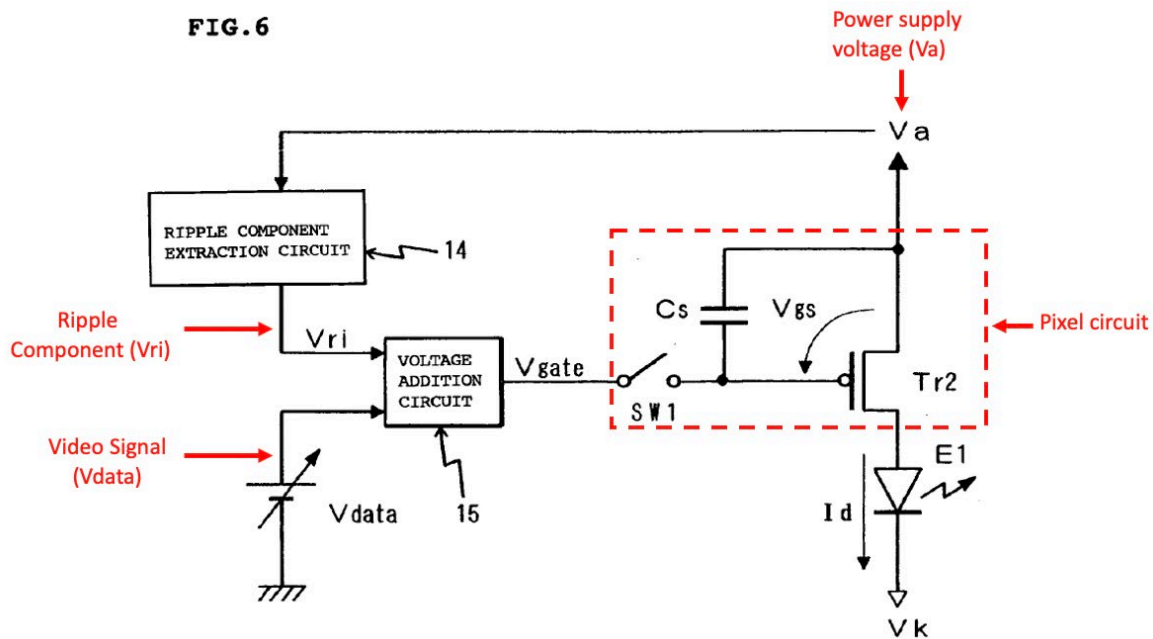
Hayafuji discloses a display system with pixel circuits that receive power supply voltage V_a , display data V_{data} , and select signals, as illustrated in Figure 1 below.



EX1006, FIG. 1 (annotated).

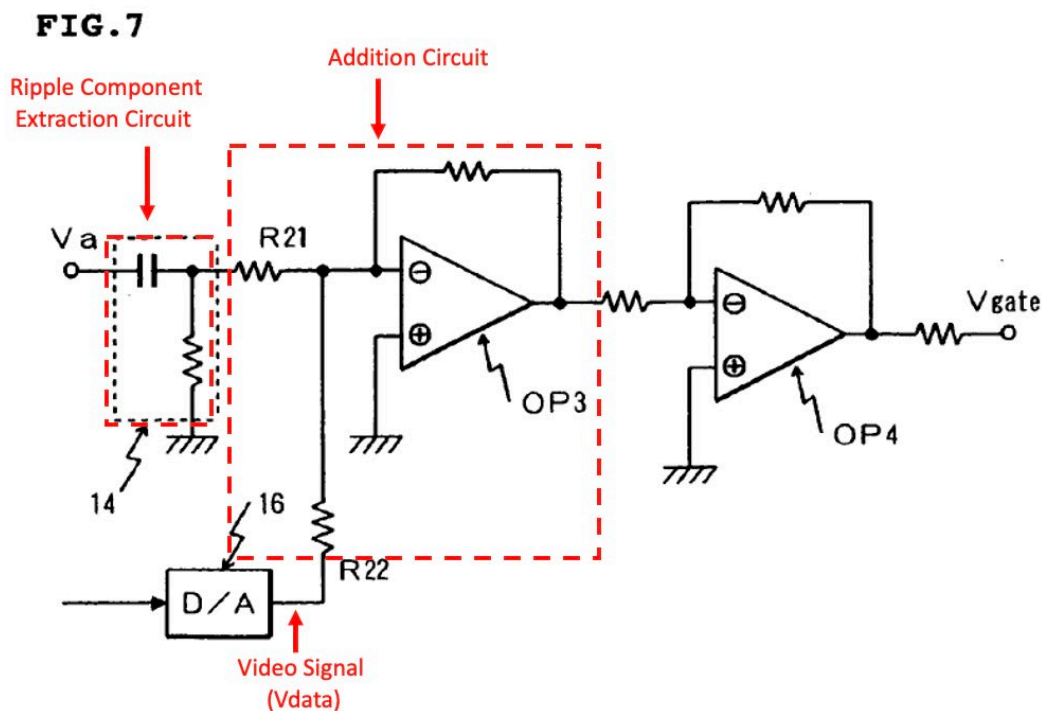
Hayafuji teaches that a DC-DC converter introduces ripple noise to the power supply voltage. EX1006, ¶¶[0017], [0018], [0022]. As illustrated in Figure 6, Hayafuji teaches that the problem of ripple noise can be addressed by using a ripple extraction circuit and voltage addition circuit. *Id.*, FIG. 6, ¶[0048]. The power supply voltage V_a is fed into the ripple extraction circuit, which outputs the

ripple component of the power supply voltage, V_{ri} . *Id.*, ¶[0048]. The video data from the video driver and V_{ri} are then fed into a voltage addition circuit, which sums V_{ri} and V_{data} . *Id.*, ¶[0048]-[0049]. The output of the voltage addition circuit, V_{gate} , feeds into the gate of the drive transistor $Tr2$ in the pixel circuit of the display panel. *Id.*, ¶[0049].



EX1006, FIG. 6 (annotated)

Hayafuji teaches that the ripple extraction circuit is implemented as a bypass filter, as depicted in Figure 7. EX1006, ¶[0050], FIG. 7. The bypass filter allows the ripple component V_{ri} to pass and filters out the rest of the drive voltage V_a . *Id.*, ¶[0050]. The voltage addition circuit is implemented using resistors $R21$, $R22$ and an operational amplifier $OP3$. *Id.*, ¶[0051]. The positive terminals of operational amplifiers $OP3$ and $OP4$ are connected to ground. *Id.*, FIG. 7.

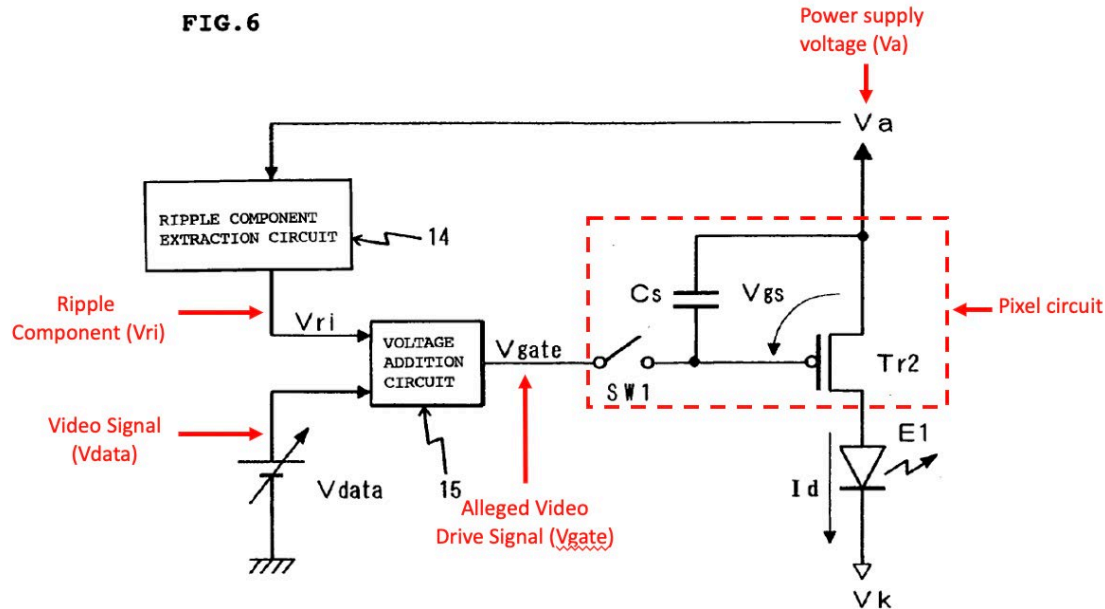


EX1006, FIG. 7 (annotated).

2. **Claim [1-A]: Hayafuji does not disclose “a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel.”**

Claim 1 recites “a video driver receiving the video signal and generating a video drive signal ... referenced to a positive power supply voltage of the AMOLED display panel.” Alleging this limitation is disclosed (not obvious), Petitioner argues that Hayafuji’s ripple extraction circuit and addition circuit, depicted in Figure 6 below, disclose the claimed video driver and that V_{gate} discloses the claimed video drive signal. Pet., 53-55. However, because the voltage of signal V_{gate} is not referenced to the positive power supply voltage V_a in

Hayafuji, V_{gate} does not disclose the claimed video drive signal. EX2011, ¶¶125-133.



EX1006, FIG. 6 (annotated).

Hayafuji discloses a circuit that purports to compensate for undesirable ripple variations in the power supply voltage that are introduced by the use of a DC-DC converter in the system. EX1006, ¶¶[0017], [0018], [0022], [0028], [0030]. In Hayafuji, the power supply voltage V_a is delivered to a ripple component extraction circuit that extracts *only* the ripple component, V_{ri} , of power supply voltage V_a . *Id.*, FIG. 6, ¶¶[0048]-[0049]. The ripple component V_{ri} is then supplied to an addition circuit where it is added to the video signal V_{data} to produce V_{gate} . *Id.* The Petition argues that adding the ripple component V_{ri} to the

data signal Vdata generates a video drive signal, Vgate, that is referenced to the positive power supply Va. Pet., 54-55.

In the context of the '521 patent, a video drive signal is referenced to the positive power supply when the positive power supply is used as a baseline to measure the voltage. EX2011, ¶127. This is analogous to having a voltage that is referenced to the ground. *Id.* As illustrated by the following equations, each embodiment of the '521 patent uses either the entire power supply voltage, VDD, or the main component of the power supply voltage, V_{DC}, as a baseline to measure the voltage of the video drive signal:

First embodiment: $v(t) = VDD - \text{Video.DAC}$

Second embodiment: $v(t) = VDD - \text{Video.DAC}$

Third embodiment: $v(t) = V_{DC} + V_{\text{drift}} + \text{Video.DAC}$

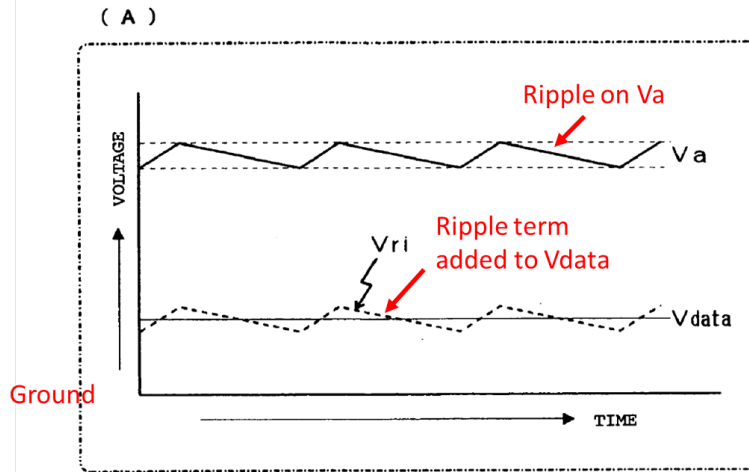
EX1001, 4:65-5:1, 6:8-13, 7:28-33.

In contrast to the '521 patent, the alleged video drive signal Vgate of Hayafuji is not calculated using the positive power supply as a baseline and is thus not “referenced to a positive power supply voltage.” EX2011, ¶128. As illustrated in Hayafuji’s Figure 6, only the ripple component Vri, not power supply voltage Va, is combined with the video signal Vdata in the addition circuit. EX1006, FIG. 6, ¶[0049]. Vgate is therefore the sum of ripple component Vri and video signal Vdata: $Vgate = Vri + Vdata$. *Id.* Because the positive power supply voltage Va of

Hayafuji does not even appear in the calculation for V_{gate} , it is not referenced to the positive power supply voltage. EX2011, ¶128.

The Institution Decision states that “Patent Owner does not explain why combining the ripple component V_{ri} , which is included in power supply voltage V_a with the relevant portion of the video signal V_{data} , is not sufficient to show that the video drive signal V_{gate} is referenced to the power supply voltage V_a .” DI, 44. However, the non-ripple component of V_a , which includes noise and drift, is completely filtered out in Hayafuji’s ripple extraction circuit before it is added to the video signal. EX2011, ¶129. Petitioner admits that V_a can be expressed as $V_{DC} + V_{ri}$, where V_{DC} is the non-ripple power supply voltage. Pet., 59. V_{DC} is the main component of the power supply voltage and is not added to the video signal V_{data} . EX2011, ¶129; EX2012, 93:15-94:6. This is illustrated clearly in Hayafuji’s Figure 8, annotated below, where V_{ri} is added to V_{data} and V_{data} is referenced to ground and not V_a . EX1006, FIG. 8, ¶¶[0052]-[0053].

FIG. 8



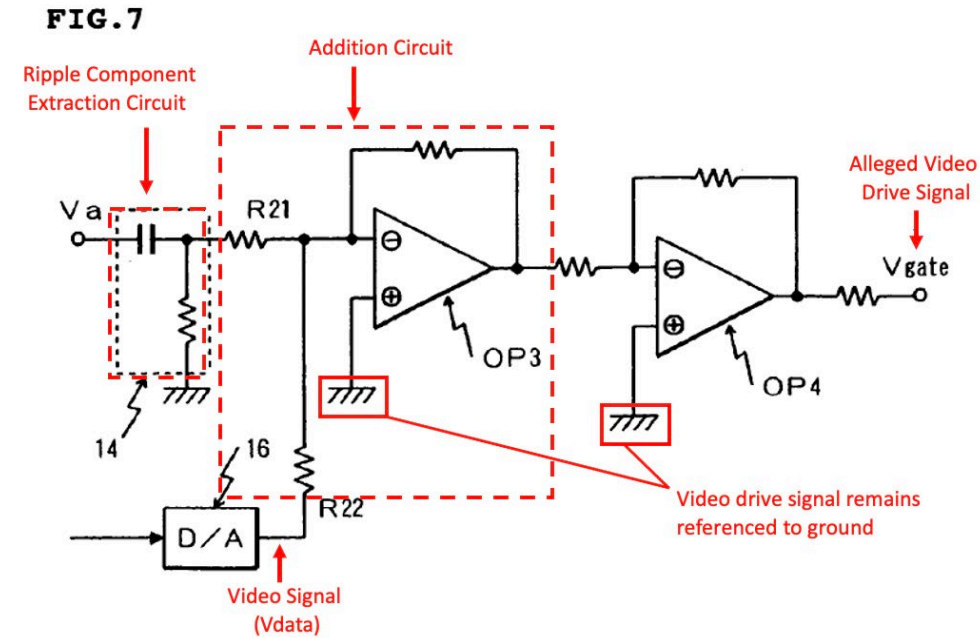
EX1006, FIG. 8 (annotated).

Therefore, because V_{DC} is not part of the alleged video drive signal, the alleged video drive signal is not referenced to the positive power supply voltage. EX2011, ¶130.

The differences in the designs of Hayafuji's circuit and the '521 patent's video driver impact the operation of the AMOLED display. Hayafuji's ripple component extraction circuit is designed to compensate for voltage ripple, which is a voltage disturbance that results in undesirable AC voltage signals being superimposed onto the DC power supply voltage signal. *Id.*, ¶131. Ripple is consistently introduced by the normal operation of the DC-DC converter in the power supply system. *Id.* Hayafuji uses a high-pass filter to extract only the ripple component that is on the power supply voltage. *Id.* If the power supply voltage experiences fluctuations other than the ripple, the solution of Hayafuji will not

work. *Id.* For example, voltage drift refers to a gradual decrease in the voltage provided by the power supply system over time due to factors such as temperature or the gradual degradation of a battery over time. *Id.* If the value of V_a in Hayafuji drifts downwards over time, adding V_{ri} to V_{data} will not provide any compensation for this drift, causing a change in pixel brightness over time. *Id.* The high-pass filter of Hayafuji compensates *only* for the ripple that is consistently and predictably superimposed onto the power supply voltage by the DC-DC converter. *Id.*

Additionally, the implementation of Hayafuji's ripple component extraction and addition circuits, illustrated in Figure 7, further demonstrates that the alleged video signal is not referenced to the positive power supply. Hayafuji's circuit includes two operational amplifiers, one in the voltage addition circuit (OP3) and another in a voltage buffer circuit (OP4). EX1006, ¶¶[0050]-[0051], FIG. 7. In each operational amplifier in Hayafuji, the positive input terminal is connected directly to ground (i.e., *referenced to ground*) rather than to the positive power supply. EX2011, ¶132.



EX1006, FIG. 7 (annotated).

For these reasons, Hayafuji does not disclose a video driver that generates a video drive signal referenced to a positive power supply of the AMOLED display panel.

3. **Claim [1-C]: Hayafuji does not disclose “the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.”**

Claim 1 also requires “the drive current being ... independent of the positive power supply voltage.” In the context of the ’521 patent, the drive current flowing to the OLED pixel is independent of the power supply voltage if the power supply voltage V_{DD} is not a factor in calculating the current drive voltage. EX2011, ¶134. The equations for current drive voltage Video.OLED in the ’521 patent’s three embodiments illustrate this concept:

First embodiment: $\text{Video.OLED} = \text{Video.DAC}$

Second embodiment: $\text{Video.OLED} = \text{Video.DAC}$

Third embodiment: $\text{Video.OLED} = V_{\text{noise}} - \text{Video.DAC}$

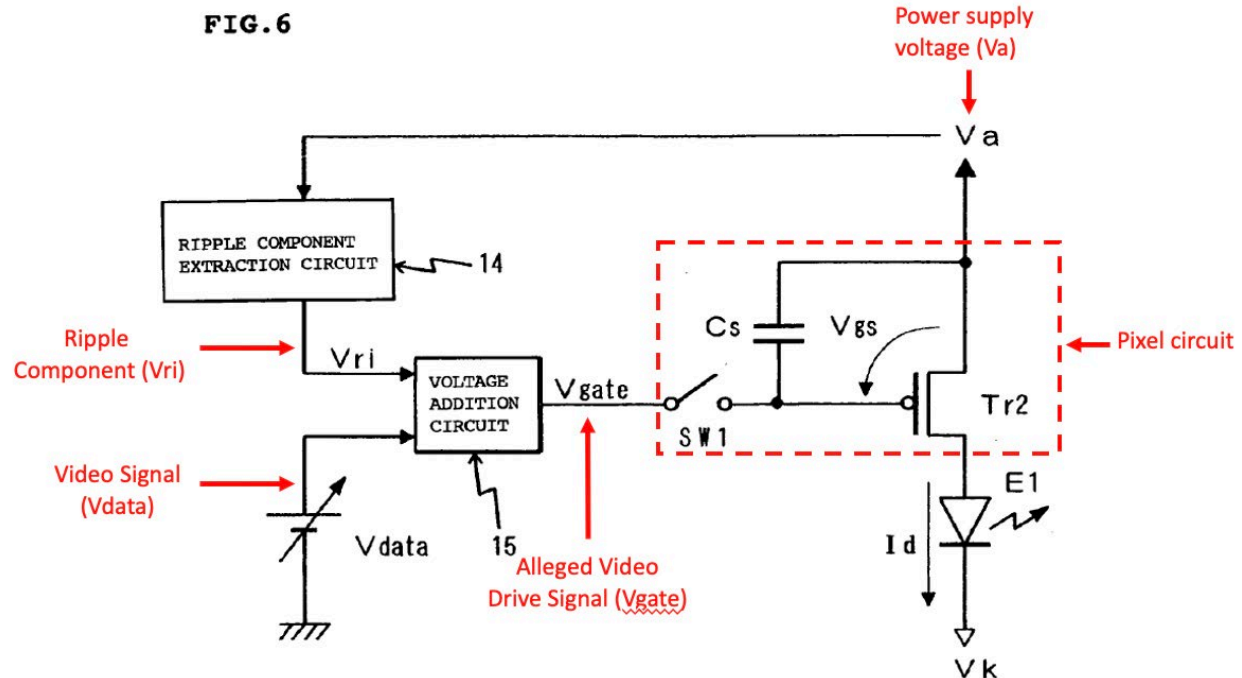
EX1001, 5:5-15, 6:20-29, 7:36-43.

Additionally, as illustrated in the equations above, each embodiment of the '521 patent removes undesirable voltage drift from the current drive voltage. *Id.*

The Petition argues that Hayafuji discloses this limitation because the drive current that drives the OLED pixel does not include the ripple component voltage portion of the power supply voltage. Pet., 58-60. Petitioner's argument is incorrect because, in Hayafuji's circuit, the DC portion (V_{DC}) of the positive power supply voltage V_a does not drop out of the equation for the current drive voltage signal that determines the drive current for the OLED pixel. EX1006, ¶¶[0048]-[0049]; EX2011, ¶135.

Hayafuji generates an alleged video drive signal V_{gate} that is the sum of the video signal V_{data} and the ripple component voltage V_{ri} : $V_{\text{gate}} = V_{\text{data}} + V_{\text{ri}}$. EX1006, ¶[0049]; Pet., 59. V_{gate} is applied to the gate terminal of drive transistor Tr_2 and the power supply voltage V_a is applied to the source terminal. EX1006, ¶[0049], FIG. 6. The current flowing through drive transistor Tr_2 to the pixel element is determined by the gate-source voltage (i.e., current drive voltage), described by the following equation: $V_{\text{gs}} = V_a - (V_{\text{data}} + V_{\text{ri}})$. EX2011, ¶137.

Because V_a is part of the equation for the current drive voltage, the drive current is not independent of the power supply voltage. *Id.*



EX1006, FIG. 6 (annotated).

The Petition argues that, because the ripple component voltage V_{ri} is not included in the current drive voltage equation, the drive current is independent of the power supply voltage. Pet., 58-60. The Petition alleges that V_a can be expressed as the sum of DC power and the ripple component V_{ri} : $V_a = V_{dc} + V_{ri}$. *Id.*, 59. The Petition substitutes this expression of V_a into the equation for V_{gs} : $V_{gs} = V_{dc} + V_{ri} - V_{data} - V_{ri}$, which simplifies to: $V_{gs} = V_{dc} - V_{data}$, which does not include the ripple component V_{ri} . *Id.* Petitioner's argument is incorrect for two reasons.

First, Petitioner's own admissions confirm that the drive current is not independent of the power supply voltage because the main component of the positive power supply voltage (i.e., V_{DC}) is part of Petitioner's admitted equation for the current drive voltage: $V_{gs} = V_{DC} - V_{data}$. *Id.*; EX2011, ¶139.

Second, Petitioner's argument ignores the undesirable voltage drift that each embodiment of the '521 patent removes from the current drive voltage. Pet., 59; EX1001, 5:18-23, 6:33-37, 7:46-51. The limited teachings of Hayafuji relate to removing only the ripple component of the power supply voltage that is consistently and predictably introduced by a DC-DC converter, which is distinct from voltage drift and noise addressed by the '521 patent's teachings. EX1006, ¶[0022]; EX1001, 1:40-55, 2:38-46, 2:67-3:4, 5:18-23, 6:33-37, 7:46-51; EX2011, ¶140. Thus, a more accurate formulation of Hayafuji's power supply voltage than provided in the Petition is: $V_a = V_{dc} + V_{ri} + V_{drift} + V_{noise}$. EX2011, ¶140. Using this formulation of V_a , we can see that the Hayafuji's current drive voltage includes both V_{drift} and V_{noise} , as well as the DC power component:

$$\begin{aligned} V_{gs} &= V_{dc} + V_{ri} + V_{drift} + V_{noise} - V_{data} - V_{ri} \\ &= V_{dc} + V_{drift} + V_{noise} - V_{data} \end{aligned}$$

EX2011, ¶140.

This result is similar to the prior art described in the '521 patent that the claimed invention sought to overcome, which also includes Vnoise and Vdrift in the current drive voltage:

$$\begin{aligned} \text{(Eq 4) Video.OLED} &= \text{VDD} - v(t) \\ &= \text{VDDI} + \text{Vdrift} + \text{Vnoise} - \text{Video.DAC} - \text{VDDI} \\ &= \text{Vdrift} + \text{Vnoise} - \text{Video.DAC} \end{aligned}$$

EX1001, 2:53-60; EX2011, ¶141.

Thus, because the current drive voltage in Hayafuji includes the power supply voltage, Va, including the undesirable variable voltage components Vnoise and Vdrift, the drive current of Hayafuji is not independent of the positive power supply voltage. Accordingly, Hayafuji does not disclose this claim limitation.

4. Claim 2: Hayafuji does not disclose “wherein the video drive signal is indicative of the sum of or the difference between the positive power supply voltage and the video signal.”

Claim 2 depends from claim 1 and recites “wherein the video drive signal is indicative of the sum of or the difference between the positive power supply voltage and the video signal[.]” Because Hayafuji’s voltage addition circuit does not add the positive power supply voltage to the video signal, it does not disclose a video drive signal that is “indicative of the sum of or the difference between the positive power supply voltage and the video signal.”

As set forth above, the Petition admits that the power supply voltage V_a can be expressed as a DC voltage component V_{DC} and a ripple component V_{ri} . Pet., 59. In Hayafuji, the alleged video drive signal V_{gate} is the output of the addition circuit, which calculates the sum of the video signal and the ripple component V_{ri} : $V_{gate} = V_{data} + V_{ri}$. EX1006, FIG. 6, ¶[0049]. The DC voltage component V_{DC} is filtered out of the signal that is provided to Hayafuji's addition circuit. *Id.* Thus, the power supply voltage V_a is not summed with the video signal, and the video drive signal is *not* indicative of either the sum of or the difference between the positive power supply voltage (V_a) and the video signal. EX2011, ¶145.

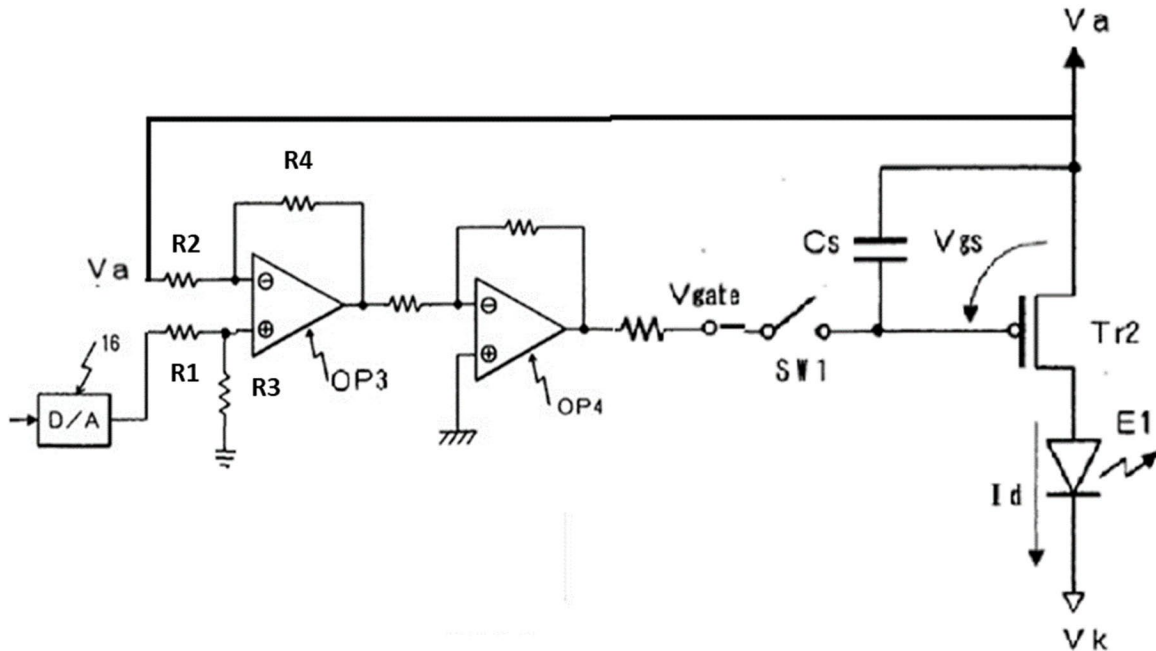
C. Ground 4: Hayafuji and the Knowledge of a POSITA Do Not Render Obvious Claims 1-3 and 5.

The Petition argues that it would have been obvious to a POSITA to modify the system disclosed in Hayafuji by removing the ripple component extraction circuit and changing the configuration of the voltage addition circuit so that it would output the difference between, rather than the sum of, the inputs (which, as modified, would be power supply voltage V_a and video signal V_{data}). However, because (i) the ripple component extraction circuit is central to the teachings of Hayafuji, (ii) the ripple component extraction circuit and summing amplifier circuit go hand-in-hand in Hayafuji's proposed solution for eliminating undesirable ripple from the power supply voltage, and (iii) the modifications proposed in the Petition are the result of impermissible hindsight bias, they would not have been obvious to

a POSITA. Therefore, Hayafuji and the knowledge of a POSITA do not render obvious claims 1-3 and 5 of the '521 patent.

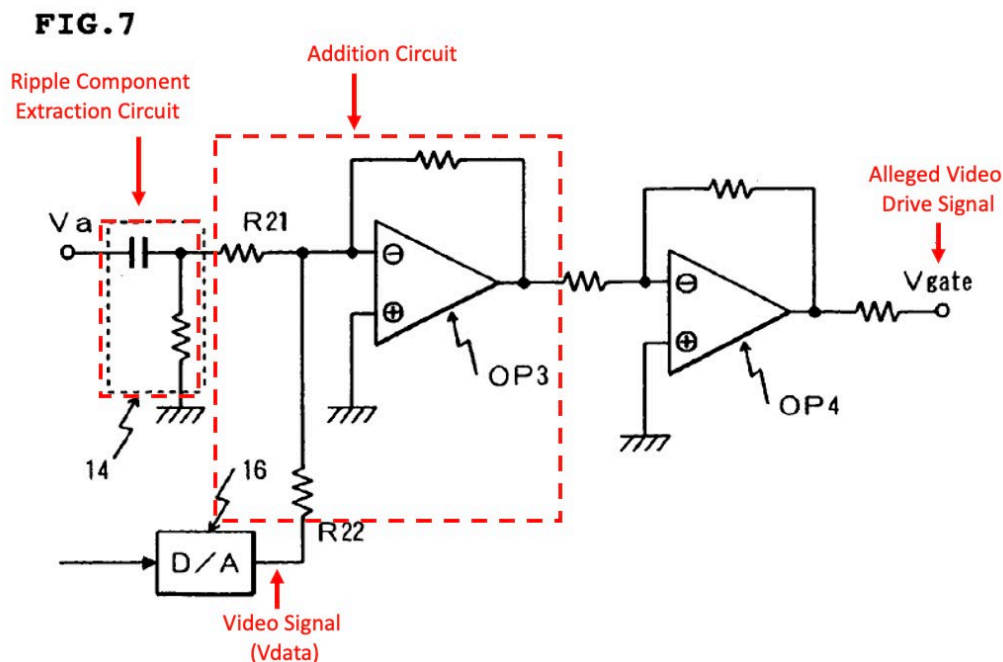
1. **Claim [1-A]: Hayafuji and the knowledge of a POSITA do not render obvious “a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel.”**

Claim 1 requires “a video driver ... generating a video drive signal ... referenced to a positive power supply voltage of the AMOLED display panel.” In alleging obviousness, Petitioner argues that a POSITA would have been motivated to modify the circuit disclosed in Figures 6 and 7 of Hayafuji such that the alleged video drive signal V_{gate} would be the difference between power supply voltage V_a and video signal V_{data} and thus referenced to V_a . Pet., 68-72. Because a POSITA would not have been motivated to modify the circuits of Figures 6 and 7 in this manner, this claim element would not have been obvious. EX2011, ¶148.



Pet., 69 (EX1006, FIGs. 6 and 7, combined and modified).

According to the Petition, a POSITA would have been motivated to modify the circuit described in Figures 6 and 7 of Hayafuji such that the alleged video drive signal V_{gate} would equal the difference between the video signal (V_{data}) and power supply voltage V_a . Pet., 68-69. The Petition argues that a POSITA would have been motivated to remove the ripple component extraction circuit and connect V_a to the negative terminal of amplifier OP3. *Id.* The Petition further argues that a POSITA would further modify Hayafuji by connecting the video signal to the positive input terminal of amplifier OP3. *Id.* The result of the proposed modifications is a circuit that outputs the difference between power supply voltage V_a and video signal V_{data} .



EX1006, FIG. 7 (annotated).

The Petition argues that the proposed modifications would have been an obvious design choice and would have simplified material needs and cost because the capacitor of the high-pass filter of the ripple component extraction circuit would be unnecessary. Pet., 69-70. The Petition further argues that a POSITA would have been motivated to make these modifications because it was allegedly well known that in conventional differential instrumentation amplifier circuits, the positive input terminal is the reference voltage (often ground) to which the negative terminal voltage is compared. *Id.*, 70. The Petition further argues that a POSITA would have been motivated to make the proposed modifications because the resulting circuit would be improved by eliminating power supply noise and drift, in addition to removing the ripple component as taught by Hayafuji. *Id.* The

Petition also alleges that a POSITA would have had a reasonable expectation of success when making these modifications because implementing a differential amplifier circuit was a well-known configuration. *Id.*

Contrary to Petitioner’s allegations, a POSITA would not have modified the circuit disclosed in Figures 6 and 7 of Hayafuji as proposed by the Petition. First, a POSITA would not have removed Hayafuji’s ripple component extraction circuit. Hayafuji attempted to address a very specific problem in OLED displays, namely the deterioration of image display quality “caused by a *ripple component* generated in a power supply circuit represented by a DC-DC converter.” EX1006, ¶[0028] (emphasis added); EX2011, ¶151. Hayafuji purportedly addressed this problem by teaching a circuit employing a *ripple component extraction circuit* that provides the ripple component of the power supply voltage. *Id.*, FIGs. 6, 7, ¶[0048]. There is no discussion in Hayafuji of voltage drift and noise as those terms are used in the ’521 patent. EX1006. The ripple component extraction circuit is, therefore, central to the teachings of Hayafuji. EX2011, ¶151. It would not have been obvious to a POSITA to remove it, as that would be contrary to the operating principles of Hayafuji and would have rendered it inoperable for its intended purpose. *Id.*; *Plas-Pak Indus., Inc. v Sulzer Mixpac AG*, 600 F. App’x. 755, 758 (Fed. Cir. 2015) (“However, combinations that change the ‘basic principles under which the [prior art] was designed to operate,’ *In re Ratti*, 270 F.2d 810, 813 (C.C.P.A. 1959), or

that render the prior art ‘inoperable for its intended purpose,’ *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984), may fail to support a conclusion of obviousness.”).

Second, a POSITA would not have been motivated to modify amplifier OP3 such that the power supply voltage and video signal are connected to the negative and positive input terminals, respectively. EX2011, ¶152. The proposed modifications transform what was a summing amplifier circuit into a differential amplifier. Pet., 71; EX2011, ¶152. But summing the ripple component V_{ri} extracted by the ripple component extraction circuit with the video signal V_{data} was necessary for eliminating the undesirable ripple component of the power supply voltage, which is the entire purpose of Hayafuji. EX2011, ¶152; EX1006, ¶¶[0028]-[0030]. Thus, the ripple component extraction circuit and summing amplifier circuit go hand-in-hand in Hayafuji’s proposed solution for eliminating undesirable ripple from the power supply voltage. Thus, a POSITA would not have been motivated to modify amplifier OP3, as that would be contrary to the operating principles of Hayafuji and would have rendered it inoperable for its intended purpose. EX2011, ¶152; *Plas-Pak*, 600 F. App’x. at 758 (“However, combinations that change the ‘basic principles under which the [prior art] was designed to operate,’ *In re Ratti*, 270 F.2d 810, 813 (C.C.P.A. 1959), or that render the prior art ‘inoperable for its intended purpose,’ *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984), may fail to support a conclusion of obviousness.”).

Third, the modifications proposed in the Petition are the result of impermissible hindsight bias. *InTouch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1348 (Fed. Cir. 2014). The teachings of Hayafuji relate to a different problem than the '521 patent and propose a different solution. EX2011, ¶153. Petitioner only modifies Hayafuji in the manner proposed in the Petition with the inventions of the '521 patent in mind, as the proposed modification would defeat the entire purpose of Hayafuji's system. *Id.*

Finally, Petitioner's own expert admits that it would not have been obvious to use the power supply voltage as an offset to the video signal as required by claim 1. The Petition's proposed modifications to Hayafuji allegedly provide a video drive signal V_{gate} that is the difference between power supply voltage V_a and video signal V_{data} : $V_{gate} = V_a - V_{data}$. Pet., 72. However, when asked about the '521 patent's first embodiment, which generates a video drive signal that is the difference between the positive power supply voltage V_{DD} and the video signal V_{DAC} , Dr. Kattamis stated that he would *not* expect to use the power supply voltage as an offset to the video signal and, instead, would expect to use a lower voltage as an offset:

Q If you turn to the -- if you continue down from the bottom of column 4 to the top of column 5 [of the '521 patent], *there's a formula for the signal $v(t)$ going to the pixel V_{DD} minus V_{DAC} . Would you consider that to be an offset from V_{DD} ?*

...

A Usually, I mean, I wouldn't -- *usually an offset is not power rail.*
So that's the only reason I would say no.

Q What does "power rail" mean in this context?

A So "power rail" meaning the highest voltage I can achieve. So for example, if the highest voltage I have is VDD, *if I put an offset of VDD to my signal, then I can't use it against VDD. So I would expect it to be less in the traditional sense of offset.*

EX2012, 73:5-22 (emphasis added).

For the above reasons, a POSITA would not have made the modifications to Hayafuji proposed in the Petition. Therefore, this claim limitation is not rendered obvious for the same reasons Hayafuji does not anticipate this limitation as set forth in Section C.1, *supra*.

2. Claim [1-C]: Hayafuji does not disclose or render obvious "the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage."

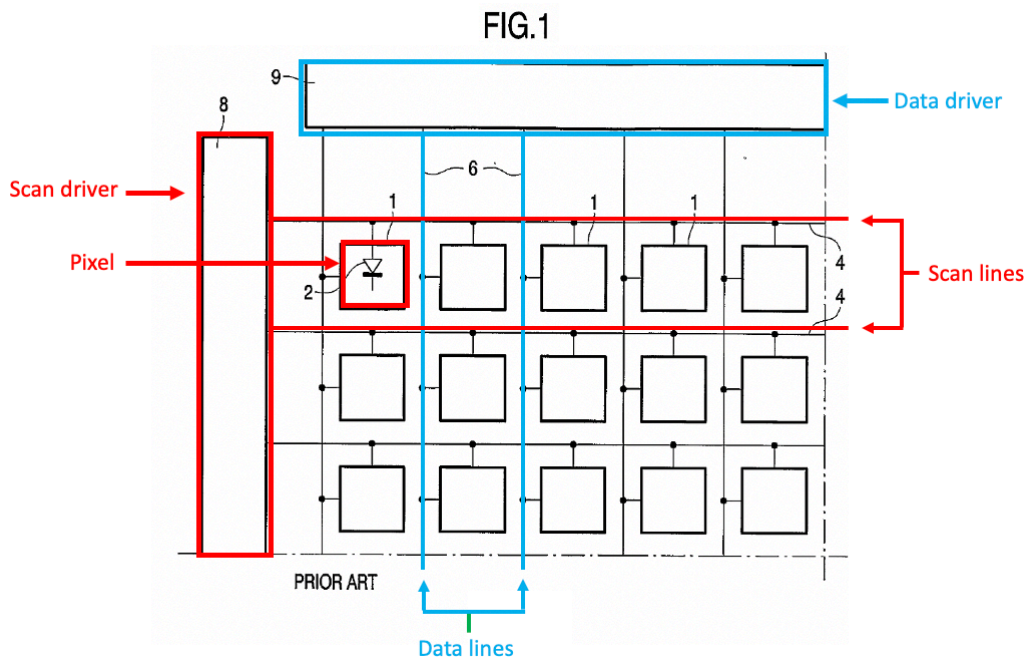
Claim 1 requires "the drive current being ... independent of the positive power supply voltage." The Petition argues that, with the proposed modifications, a POSITA would have been motivated to make to Hayafuji, the current voltage signal would not include the power supply voltage and the current would therefore be independent of the power supply voltage. Pet., 72. Because a POSITA would not have been motivated to modify the circuit as proposed in the Petition, this

claim limitation is not rendered obvious for the same reasons presented in Section C.2, *supra*.

D. Ground 5: Steer and the Knowledge of a POSITA Do Not Render Obvious Claims 1-4.

1. Summary of Steer

Steer teaches a conventional active matrix display architecture comprising OLED pixels, selection lines, and data lines. EX1008, 2:3-9, FIG. 1. Steer teaches a data driver that provides image data to the pixels and a scanning driver that provides selection signals. *Id.*, 2:9-13, FIG. 1.



EX1008, FIG. 1 (annotated).

Steer teaches a conventional voltage-programmed pixel circuit, illustrated in Figure 2. The pixel circuit includes a drive transistor (22), an address transistor

(16), a storage capacitor (24), and an OLED pixel element (2). When the pixel circuit receives a pulse on row conductor 4, the address transistor 16 is turned on, and the data voltage on column conductor 6 passes to storage capacitor 24 and the gate of drive transistor 22. After the row address pulse has ended, the data voltage remains stored in capacitor 24 and is applied to the gate of drive transistor 22. The drive transistor draws current from power supply line 26.

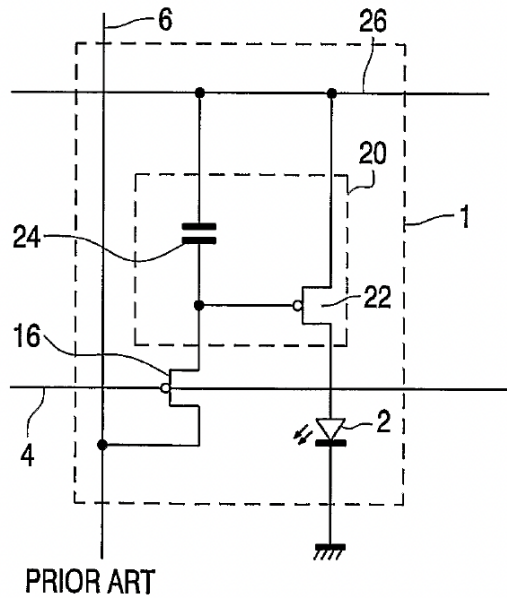
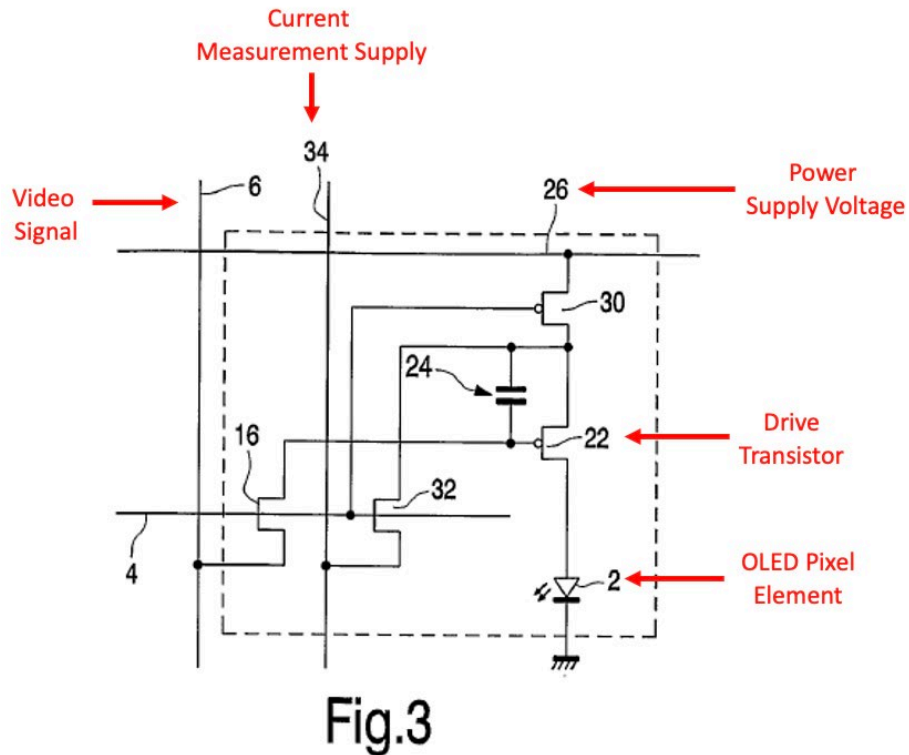


FIG. 2

EX1008, FIG. 2.

Steer teaches that conventional voltage-programmed AMOLED pixel circuits have problems with variations in transistor characteristics, particularly threshold voltage. EX1008, 3:17-21. Variations in threshold voltage across different pixel circuits in a display negatively affect the display image quality. *Id.*

Steer teaches a modified pixel circuit and current feedback system to address these challenges. The modified pixel circuit, depicted in Figure 3, includes current supply line 34 that has a current path to drive transistor 22 and display element 2.



EX1008, FIG. 3 (annotated).

A feedback circuit, illustrated by Figure 4, is interposed between the current-measurement supply line 34 and data line 6 and adjusts the gate voltage level stored on the storage capacitor 24 to compensate for variations in transistor characteristics. EX1008, 7:6-9, 29-32, 8:21-26.

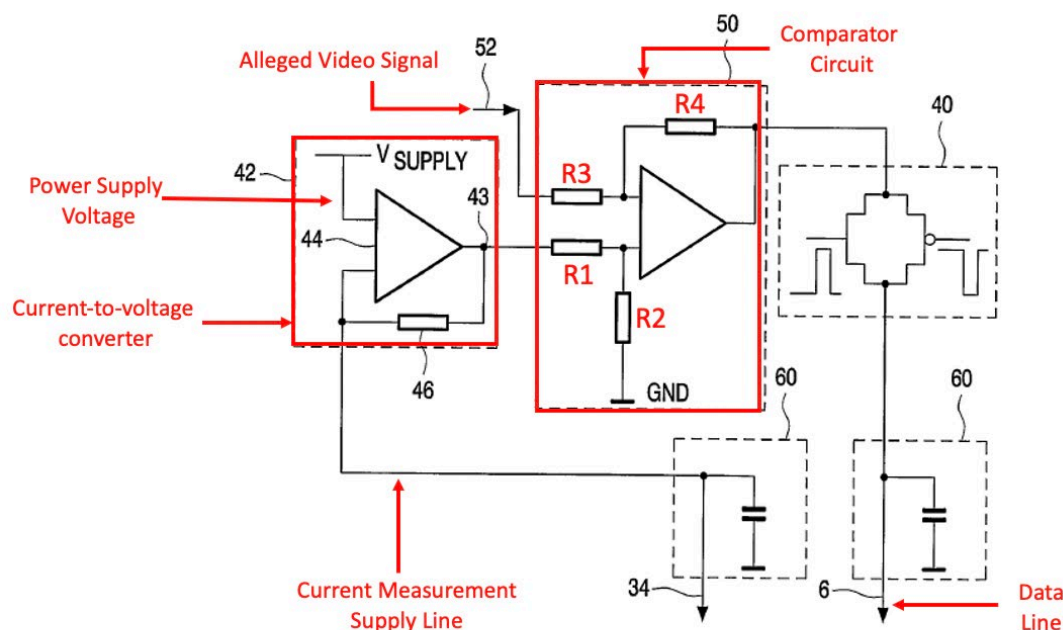


Fig.4

EX1008, FIG. 4 (annotated).

The feedback system is used during the pixel circuit programming phase, when the pixel does not emit light. EX1008, 8:29-32, 9:30-10:1. A current representing the desired pixel drive current is drawn from the current-measurement supply line 34 and the feedback system generates the corresponding gate voltage for the drive transistor. *Id.*, 9:30-10:1. The data voltage for the drive transistor is stored on capacitor 24 of the pixel circuit.

After the pixel programming phase, the voltage stored in capacitor 24 is applied to the gate of drive transistor 22 and power supply line 26 provides a power supply voltage, resulting in current flowing to the OLED pixel. *Id.*

2. **Claim [1-A]: Steer and the knowledge of a POSITA do not disclose or render obvious “a video driver receiving the video signal and generating a video drive signal indicative of the video signal and referenced to a positive power supply voltage of the AMOLED display panel.”**

Claim 1 requires “a video driver ... generating a video drive signal ... referenced to a positive power supply voltage of the AMOLED display panel.” Petitioner argues that Steer’s feedback system, depicted in Figure 4 above, discloses the claimed video driver and that signal V_6 discloses the claimed video drive signal. Pet., 85-86. However, because the alleged video drive signal (i) is a function of the feedback current, and (ii) is amplified by the alleged video driver, it is not referenced to the positive power supply voltage.

In the context of the ’521 patent, a video drive signal is “referenced to the positive power supply voltage” if the positive power supply is used as a baseline to measure the voltage against. As illustrated by the following equations, each embodiment of the ’521 patent uses either the entire power supply voltage, VDD, or the main component of the power supply voltage, VDC, as a baseline to measure the voltage of the video drive signal. The video drive signal is not referenced to any other significant voltage component.

First embodiment: $v(t) = VDD - \text{Video.DAC}$

Second embodiment: $v(t) = VDD - \text{Video.DAC}$

Third embodiment: $v(t) = VDC + V_{\text{drift}} + \text{Video.DAC}$

EX1001, 4:65-5:1, 6:8-13, 7:28-33. In light of these teachings, Steer's alleged video drive signal V_6 is not referenced to the power supply voltage.

First, the alleged video drive signal is not referenced to the positive power supply voltage because the alleged video drive signal depends on the current in the feedback circuit.

Steer teaches a current feedback system, depicted in Figure 4, that is used to modify the voltage, V_6 , supplied to the columns of the display (line 6) to adjust for non-uniform transistor characteristics. EX1008, 8:21-29, FIG. 4. The current feedback system of Figure 4 includes amplifier circuit 44, which takes as inputs the positive power supply voltage V_{SUPPLY} and a reference current 34. *Id.*, FIG. 4, 8:30-9:13. The amplifier circuit 44 operates to convert the reference current into output voltage V_{43} , which equals the sum of V_{SUPPLY} and $R_{46} \cdot I$, where I is the reference current 34 and R_{46} is the resistance of resistor 46: $V_{43} = V_{\text{SUPPLY}} + R_{46} \cdot I$. *Id.*

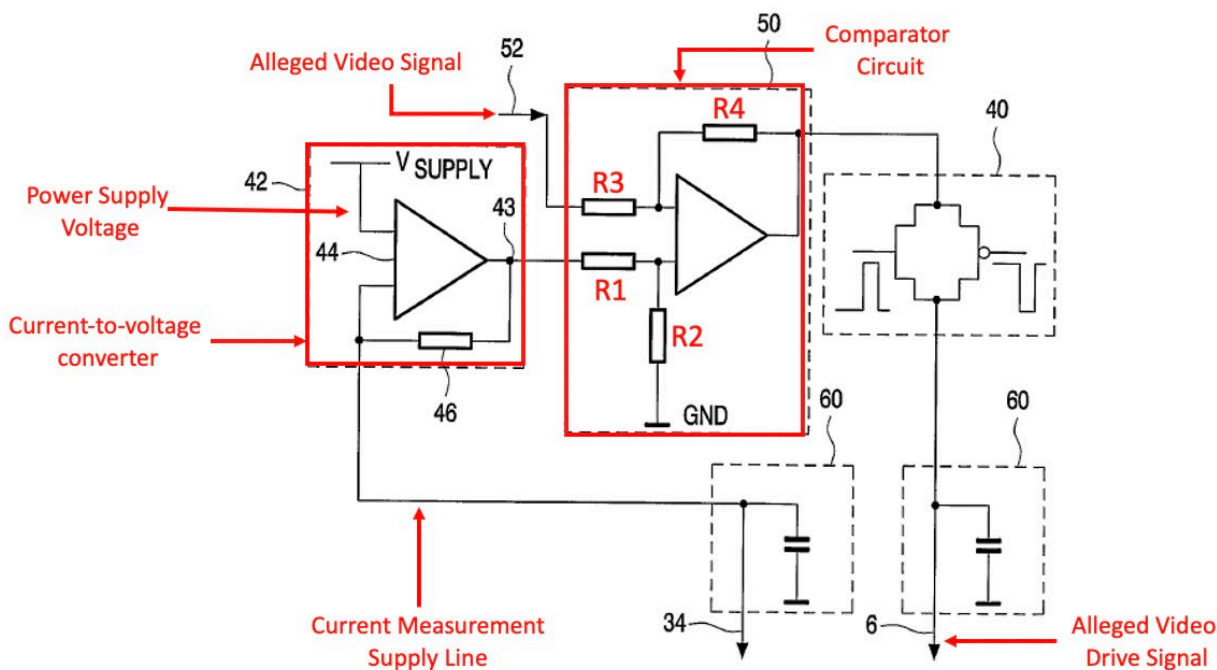


Fig.4

EX1008, FIG. 4 (annotated).

The feedback system also includes an amplifier configured as a comparator circuit 50, which Petitioner alleges is the claimed “video driver.” Pet., 84. Comparator 50 takes as inputs V_{43} ($V_{\text{SUPPLY}} + R_{46} \cdot I$) and the alleged video signal V_{52} , (referred to as *input(t)* by Petitioner). EX1008, 9:14-19. Comparator 50 provides amplification and outputs the difference between V_{43} and V_{52} as V_6 , which Petitioner alleges is the claimed video drive signal. *Id.* The alleged video driver does not compare the video signal with the power supply voltage; instead, it compares the video signal with V_{43} , which is the sum of V_{SUPPLY} and $R_{46} \cdot I$. *Id.* Therefore, unlike the ’521 patent, where the video drive signal is calculated as an offset of the positive power supply voltage, in Steer the alleged video drive signal

calculation includes the value of the reference current in the feedback system: $V_6 = V_{\text{SUPPLY}} + R_{46} * I - \text{input}(t)$. EX2011, ¶167. Furthermore, Steer expressly describes comparator 50 as comparing the value of the alleged video signal V_{52} with the measured feedback current, not with V_{SUPPLY} :

A Comparator section 50 compares the voltage at node 43 with an input voltage at input 52 representing the desired current. These sections 42, 50 effectively *provide measurement of the current drawn and comparison with the desired current [52]*.

EX1008, 9:14-17 (emphasis added). Thus, “the output voltage is a function of the current drawn from the current-measurement supply line,” *id.*, 9:12-13, and the alleged video drive signal is not referenced to the power supply voltage.

The Petition argues that, during certain instances of the programming phase, no current flows to the feedback circuit and, therefore, the value of V_{43} is momentarily equal to V_{SUPPLY} . Pet., 100; EX1002, ¶¶315-317. This is irrelevant, however, because there can be no dispute that the current does flow to the feedback circuit when the alleged video drive signal is programming the pixel circuit.

EX2011, ¶168. The entire purpose of Steer’s teaching is to “use[] current feedback during pixel programming” in order to provide “per-pixel compensation of the drive transistor characteristics.” EX1008, 7:6-9. If no current is flowing into the feedback circuit during the programming phase, then the feedback circuit provides

no compensation to alleged video drive signal V_6 and serves no purpose. EX2011, ¶168.

The inclusion of the reference current in the alleged video drive signal is significant because the value of current I is not constant. *Id.*, ¶169. The reference current is based on the current flowing to the OLED pixel, which varies based on the data voltage for any given cycle. EX1008, 9:16-20; EX2011, ¶169. The current also varies based on the drive transistor characteristics, such as threshold voltage, that vary between pixel circuits. EX1008, 7:29-32.

The use of the current rather than the power supply voltage is central to the operation of Steer's feedback system. EX2011, ¶170. Steer's feedback system uses the current feedback during pixel programming "so that any effects of differences between characteristics of the drive transistor of different pixels are avoided." EX1008, 7:29-32. Thus, Steer does not seek to mitigate power supply voltage variations by referencing the alleged video drive signal to the positive power supply voltage. EX2011, ¶170. Instead, Steer's feedback system is designed to measure a feedback current to compensate for differences in transistor characteristics between the various pixel circuits. EX1008, 7:6-9, 7:29-32.

Therefore, because Steer's alleged video drive signal is a function of the current being fed into the feedback system, the video drive signal is not referenced to the positive power supply voltage.

Second, the alleged video drive signal is not referenced to the positive power supply voltage for the additional reason that the alleged video driver amplifies the signal based on the values of the resistors in the comparator circuit. Petitioner argues that V_6 is referenced to the positive power supply voltage because its voltage is determined by the following equation, in which the data signal V_{52} (referred to as *input(t)* by the Petitioner) is subtracted from V_{SUPPLY} :

$$\text{Steer (2): } V_6 = V_{\text{SUPPLY}} + R \cdot I - \text{input}(t).$$

Pet., 86.

Petitioner's argument that V_6 is referenced to the power supply voltage V_{SUPPLY} is incorrect because the value of V_6 also depends on the values of resistors R_3 and R_4 , labeled in the figure above (as well as depending on R_{46} and the feedback current as discussed above), which Petitioner ignored. EX2011, ¶173. According to Steer, comparator 50 amplifies the signal, which requires resistors R_3 and R_4 to have different values. *Id.*; EX1008, 9:17-18 ("The amplified output of the comparator section 50 is provided to the column conductor through the gate 40."). Thus, V_6 is multiplied by R_4/R_3 where R_3 is not equal to R_4 :

$$\begin{aligned} V_6 &= (V_{43} - V_{52}) \cdot R_4/R_3 \\ &= [V_{\text{SUPPLY}} + R_{46} \cdot I - V_{52}] \cdot R_4/R_3 \end{aligned}$$

EX2011, ¶173.

The alleged video drive signal V_6 of Steer is *not* “referenced to the positive power supply voltage” because the entire equation is multiplied by R_4/R_3 as shown above, resulting in a value for V_6 that is not an offset from V_{SUPPLY} . *Id.*, ¶174.

In sum, the alleged video drive signal V_6 is *not* “referenced to a positive power supply voltage.” The voltage at V_{43} that is compared with the video signal at comparator circuit 50 depends not only on V_{SUPPLY} but also the value of R_{46} multiplied by the current flowing to the feedback circuit ($R_{46} \cdot I$). Additionally, the equation for the video drive signal is multiplied by R_4/R_3 . Therefore, V_{SUPPLY} does not serve as a baseline to measure the alleged video drive signal. *Id.*

3. Claim [1-C]: Steer and the knowledge of a POSITA do not disclose or render obvious “the drive current being proportional to a current drive voltage being indicative of the video signal and independent of the positive power supply voltage.”

Claim 1 requires “the drive current being ... independent of the positive power supply voltage.” Petitioner argues that the drive current in Steer meets the “independent of the positive power supply voltage” limitation because the positive power supply voltage V_{SUPPLY} does not appear in the equation for the current drive voltage of drive transistor 22. Pet., 91-92. Petitioner’s argument is incorrect because the amplification introduced by the feedback system onto alleged video

drive signal V_6 prevents V_{SUPPLY} from dropping out of the current drive voltage equation.

In the context of the '521 patent, the drive current flowing to the OLED pixel is independent of the power supply voltage if the power supply voltage V_{DD} is not a factor in calculating the current drive voltage. EX2011, ¶177. The equations for current drive voltage $V_{\text{Video.OLED}}$ in the '521 patent's three embodiments illustrate this concept:

First embodiment: $V_{\text{Video.OLED}} = V_{\text{Video.DAC}}$

Second embodiment: $V_{\text{Video.OLED}} = V_{\text{Video.DAC}}$

Third embodiment: $V_{\text{Video.OLED}} = V_{\text{noise}} - V_{\text{Video.DAC}}$

EX1001, 5:5-15, 6:20-29, 7:36-43.

Additionally, as illustrated in the equations above, each embodiment of the '521 patent removes undesirable voltage drift from the current drive voltage. *Id.*

As discussed in Section III.D.2, *supra*, Petitioner argues that the voltage of the alleged video drive signal V_6 is represented by the following equation, where $input(t)$ is the alleged video signal V_{52} :

$$\text{Steer (2): } V_6 = V_{\text{SUPPLY}} + R \cdot I - input(t).$$

Pet., 92.

According to Petitioner, because signal V₆ is applied to the gate of drive transistor 22 and V_{SUPPLY} is applied to the source of drive transistor 22, the current drive voltage V_{gs} is represented by the following:

$$\text{Steer (4): } V_{gs} = V_6 - V_{SUPPLY}$$

Id.

Petitioner alleges that substituting equation (2) into equation (4) yields the following equation for the current drive voltage, where V_{SUPPLY} cancels out entirely.

$$\text{Steer (4A): } V_{gs} = V_{SUPPLY} + R \cdot I - \text{input}(t) - V_{SUPPLY}$$

$$\text{Steer (4B): } V_{gs} = R \cdot I - \text{input}(t)$$

Id.

Petitioner further alleges that the drive current is, therefore, independent of the power supply voltage V_{SUPPLY}. *Id.*

However, Petitioner's argument is incorrect because the amplification introduced onto alleged video drive signal V₆ prevents V_{SUPPLY} from cancelling out of the current drive voltage equation. EX2011, ¶183. As discussed in Section III.D.2, *supra*, the equation describing the voltage of the signal generated by the video driver is multiplied by R₄/R₃:

$$\begin{aligned} V_6 &= (V_{43} - V_{52}) \cdot R_4/R_3 \\ &= [V_{SUPPLY} + R_{46} \cdot I - V_{52}] \cdot R_4/R_3 \end{aligned}$$

Id.

Using the correct equation for V₆ results in the following equation for the gate-source voltage V_{gs} on drive transistor 22:

$$\begin{aligned} V_{gs} &= V_6 - V_{26} \\ &= [V_{\text{SUPPLY}} + R_{46} * I - \text{input}(t)] * R_4 / R_3 - V_{\text{SUPPLY}} \\ &= V_{\text{SUPPLY}} * R_4 / R_3 + R_{46} * I * R_4 / R_3 - \text{input}(t) * R_4 / R_3 - V_{\text{SUPPLY}} \\ &= V_{\text{SUPPLY}}(R_4 / R_3 - 1) + R_{46} * I * R_4 / R_3 - \text{input}(t) * R_4 / R_3 \end{aligned}$$

EX2011, ¶184.

Using the correct equation for the current drive voltage rather than the Petition's equation (4B), it is apparent that the multiplier R₄/R₃ prevents V_{SUPPLY} from dropping out. *Id.*, ¶184. Therefore, Steer does not disclose a drive current independent of the positive power supply voltage. *Id.*

4. **Claim 3: Steer and the knowledge of a POSITA do not disclose or render obvious “the video driver comprises a differential instrumentation amplifier circuit for providing the video drive signal being the difference between the positive power supply voltage and the video signal.”**

Claim 3 recites that the video drive signal is “the difference between the positive power supply voltage and the video signal.” The Petition argues that the output of Steer's comparator circuit 50 is the difference between alleged video signal V₅₂ and V_{SUPPLY}.

As explained above in Section III.D.1, *supra*, in addition to the values of the alleged video signal V_{52} and power supply voltage V_{SUPPLY} , the alleged video drive signal V_6 is also influenced by the values of the feedback current I , resistor R_{46} , and the amplification dictated by the values of resistors R_3 and R_4 :

$$\begin{aligned} V_6 &= (V_{43} - V_{52}) * R_4 / R_3 \\ &= [V_{\text{SUPPLY}} + R_{46} * I - V_{52}] * R_4 / R_3 \end{aligned}$$

EX2011, ¶187. Therefore, for Petitioner’s argument to be true, there would have to be (i) no current flowing to the feedback circuit when the alleged video drive signal is generated (thus I would equal zero), *and* (ii) resistors R_3 and R_4 would have to have equal resistance values, resulting in comparator 50 providing no amplification (unity gain). *Id.*, ¶188. But both of these conditions are contrary to Steer’s teachings.

The Petition argues that, during certain instances of the programming phase, no current flows to the feedback circuit and, therefore, the value of V_{43} is momentarily equal to V_{SUPPLY} . Pet., 100; EX1002, ¶¶315-317. This is irrelevant, however, because there can be no dispute that the current does flow to the feedback circuit when the alleged video drive signal is programming the pixel circuit.

EX2011, ¶189. The entire purpose of Steer’s teaching is to “use[] current feedback during pixel programming” in order to provide “per-pixel compensation of the drive transistor characteristics.” EX1008, 7:6-9; EX2011, ¶189. If no current is

flowing into the feedback circuit during the programming phase, then the feedback circuit provides no compensation to alleged video drive signal V_6 and serves no purpose. EX2011, ¶189.

Additionally, Steer teaches that comparator 50 amplifies the signal V_6 , which requires resistors R_3 and R_4 to have different values. EX2011, ¶190; EX1008, 9:14-24. According to Steer, “[t]he *amplified output* of the comparator section 50 is provided to the column conductor through the gate 40.” EX1008, 9:17-19 (emphasis added). Steer also explains that comparator 50 could employ a lower gain if an “integrating amplifier” that is “not shown in Figure 4” is added to the circuit. *Id.*, 9:20-24. This discussion implies that comparator 50 employs some gain, otherwise it could not be lowered. *Id.* Additionally, the Petition relies on the circuit shown in Steer’s Figure 4 and does not mention using additional components to lower the gain of comparator 50. Pet., 96-101. Furthermore, there is no mention in Steer of employing unity gain in comparator 50. EX1008.

For these reasons, it is contrary to Steer’s teachings for either (i) the feedback circuit to have no current flowing when comparator 50 generates the alleged video drive signal, or (ii) comparator 50 to provide no amplification. Therefore, Steer fails to disclose or render obvious that the video drive signal is the difference between the positive power supply voltage and the video signal.

IV. CONCLUSION

For the reasons above, all of Petitioner's grounds fail to show that any of the challenged claims is unpatentable.

Respectfully submitted,

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Respectfully submitted,

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