

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Hisense USA Corporation

Petitioner

v.

Brightplus Ventures LLC

Patent Owner

Case IPR2023-01401

U.S. Patent No. 8,941,331

PATENT OWNER'S RESPONSE

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Exhibit List

Exhibit	Description
2001	Declaration of William K. Bohannon (“Bohannon Decl.”)
2002	Curriculum vitae of William K. Bohannon
2001	Joint Claim Construction Statement
2004	Brightplus Ventures LLC’s Opening Claim Construction Brief
2005	Hisense’ Opening Claim Construction Brief

* * * *

USE OF EMPHASIS IN QUOTATIONS

All emphases in quotations and exhibit citations have been added, unless otherwise indicated.

APPLICABLE STATUTES

References to 35 U.S.C. §§ 102 and 103 are to the AIA versions applicable to the of U.S. Patent No. 8,941,331 (“the ’331 Patent”).

I. INTRODUCTION

Brightplus Ventures LLC (“Patent Owner” or “Brightplus”) submits this response showing that the grounds set forth by Hisense USA Corporation (“Petitioner” or “Hisense”) fail to render obvious challenged claims 17-25 of the ’331 Patent. Brightplus addresses these grounds below.

II. THE ’331 PATENT DISCLOSES IMPROVING SOLID STATE LIGHTING TILES AND/OR PANELS.

The ’331 Patent discloses an improved solid state lighting panel system. Specifically, the ’331 Patent is directed to a lighting system, including a lighting panel with strings of solid state lighting devices and current supply circuits that supply on-state drive currents in response to control signals.

III. EXPERT TESTIMONY, LEVEL OF SKILL IN THE ART, AND CLAIM CONSTRUCTION**A. Declaration Evidence**

This Response is supported by the declaration of William K. Bohannon. EX2001.

B. Person of Ordinary Skill in the Art

On or before November 18, 2005, a POSITA relating to the technology of the ’331 Patent would have (a) a Bachelor's of Science degree in a technical field and at least four years of experience in the field of design and/or manufacture of display systems; (b) a Master's of Science degree in a technical field and at least two years

of experience in the field of design and/or manufacture of display systems; or (c) a PhD in a technical field relating to the design and/or manufacture of display systems. Additional graduate education could substitute for professional experience, or significant experience in the field could substitute for formal education. EX2001, ¶¶ 36-39.

IV. PRIOR ART CITED BY PETITIONER.

A. Lys

International Application WO 2005/089293 (EX1005 – “Lys”)

Lys primarily relates to networked lighting systems, “The methods disclosed herein include a method of determining an identifier of a networked lighting device among a group of networked lighting devices... delivering a plurality of signals to the lighting devices, observing a condition of the network in response to each one of the plurality of signals, and inferring an identifier of at least one of the plurality of lighting devices based on the condition of the network.” Lys, 1:11-17 (Background). Lys further describes a variety of lighting embodiments, for example “[t]he lighting system may include an architectural lighting fixture. The lighting system may include a theatrical lighting system. The lighting system may include a lighting system for a transportation environment. The lighting system may include a general illumination lighting system for a venue. The venue may include an entertainment venue. The venue may include a restaurant...” Lys, 26: 2-6.

Lys further describes a variety of high voltage systems. Lys describes “high output linear lighting systems for various environments” and “power systems for driving light sources in high-voltage environments.” *Id.* at Abstract. In an embodiment described in Fig. 17, Lys details a single stage power factor correction/DC to DC converter facility 1908. *Id.* 60:18-20. The converter facility takes in high voltage and converts it into a suitable voltage for the lighting units 102. Further, the embodiment of Fig. 17 allows “lighting units 102 to be configured in long strings over very large geometries [...] Accordingly, it is one preferred embodiment of a power supply for disposing lighting units 102 on building exteriors and other large environments.” *Id.* 60:25-61:4. Unlike the '331 Patent which is directed to back lighting LCDs with low voltage LEDs, Lys is directed primarily to power systems for driving light sources in high-voltage environments.

B. Mueller

U.S. Application 2005/0047134 (Ex. 1009 – “Mueller”).

Mueller relates to a networked lighting system for lighting displays for use in various applications. The networked lighting elements of Mueller may comprise different systems or be in many disparate locations, “[t]he lighting units can be used on the interior ceiling 2714 or along the floor 2712, such as being used as directional lights 2704. The lights can be used to light the seating environment 2710...The lighting units 100 can thus be used to provide aesthetic lighting, alarm lighting,

safety lighting, lighting entertainment, indication of conditions or data, or many other purposes... Lighting units 100 can be disposed along the ceiling 2802, above seats 2808, or along the aisle 2804, to provide a variety of illumination effects, ranging from white light illumination or varying color temperatures to colored lighting for aesthetic, indication, safety, data, warning, entertainment or other purposes.” Mueller, [0248-49].

Additionally, Mueller teaches the use of lighting unit controllers (“LUCs”) that communicate control signals to lighting units. Mueller teaches that “the LUCs and the central controller may be coupled together in a variety of configurations using a variety of different communication media and protocols to form the networked lighting system 200...central controller 202 shown in FIG. 2 may be configured to implement Ethernet-based communications with the LUCs, and in turn the LUCs may be configured to implement an industrial, DMX-based communications with the lighting units 100. In particular, in one aspect of this embodiment, each LUC may be configured as an addressable Ethernet-based controller and accordingly may be identifiable to the central controller 202 via a particular unique address (or a unique group of addresses) using an Ethernet-based protocol.” *Id.*, [0190-91]. Mueller further teaches that the LUCs and lighting units need not be in electrical connection with one another or with the central controller: “FIG. 48 shows a system 4800 for controlling a plurality of lighting units 100 in a

home network. A home network controller 4802 delivers control signals through a network 4804 (which may be a conventional network, a wire, a power line, a wireless network or other data facility). Each lighting unit 100 is responsive to a lighting unit controller 208A, 208B, 208C, 208D to provide illumination changes in response to signals from the home network controller 4802.” *Id.*, [0271].

C. Grootes

U.S. Application 2007/0046485 (Ex. 1006 – “Grootes”)

Grootes discloses methods for setting voltages and currents for LEDs. An exemplary embodiment describes that “the transistors are each controlled by a separate PWM controller... a separate set of PWM controllers is provided for each LED color.” Grootes, [0017]. Further, another embodiment teaches that “[t]he amount of current through an LED controls the brightness. The most straightforward way to control the current of an LED driver, as shown in Fig. 1, is to measure the voltage across a current sense resistor 6 in series with the LEDs 8.” *Id.*, [0005].

D. Xu

Chinese Application 1588523 (Exhibits 1007, 1008 – “Xu”)

Xu teaches a driving device for LEDs in series and to make the light-emitting diode series to be quickly lit or extinguished. *See* Xu, Pg. 5; Summary of the Invention. Xu primarily discloses methods that use a switch in order for the LEDs to be quickly lit, for example, “When the switch is turned on, the light emitting diode

series is driven by a direct current voltage, and a direct-current flows through the light-emitting diode series... when the switch is turned on, the light emitting diode series is quickly lit to a predetermined brightness,” Xu, Abstract.

E. Blum

U.S. Patent No. 5,663,667 (Ex. 1010 – “Blum”)

Blum discloses switching regulator controller circuits, in particular methods that reduce leading edge current spikes. As stated by Blum, “[s]witching regulator controllers operate by monitoring the amount of current flowing into a switching device such as a transistor driving a transformer” Blum, 1:9-16.

V. GROUND 1 – LYS AND GROOTES IN VIEW OF A POSITA FAILS TO RENDER OBVIOUS CLAIM 17.

A. A POSITA Would Not be Motivated to Combine Lys and Grootes

The invention of Lys is directed towards a completely different purpose than that of the '331 patent and employs a number of components that are extraneous to the purpose of the '331 patent. For example, Lys summarize its invention as: “*high output linear lighting systems for various environments*” and “*power systems for driving light sources in high-voltage environments.*” Lys, Abstract (emphasis added). None of the embodiments in Lys relates to the purpose of the '331 Patent, which is for backlighting an LCD display.

Despite Lys being unrelated to the technology, Petitioner makes mere conclusory statements regarding the combination of Lys and Grootes. For example,

Petitioner argues “*First*, both Lys and Grootes are in the same field of endeavor, *i.e.*, setting the voltages and currents for LED strings”. Petition at 18. However, this statement is reductive at best. While Grootes relates to LED backlighting for LCD panels, Lys concerns an unrelated high voltage, high output lighting system. The electrical design and circuitry for the systems of Lys and Grootes vary greatly.

For example, this contrast is apparent in the stark difference between Fig. 24a and Fig. 17 of Lys and Fig 4 of Grootes.

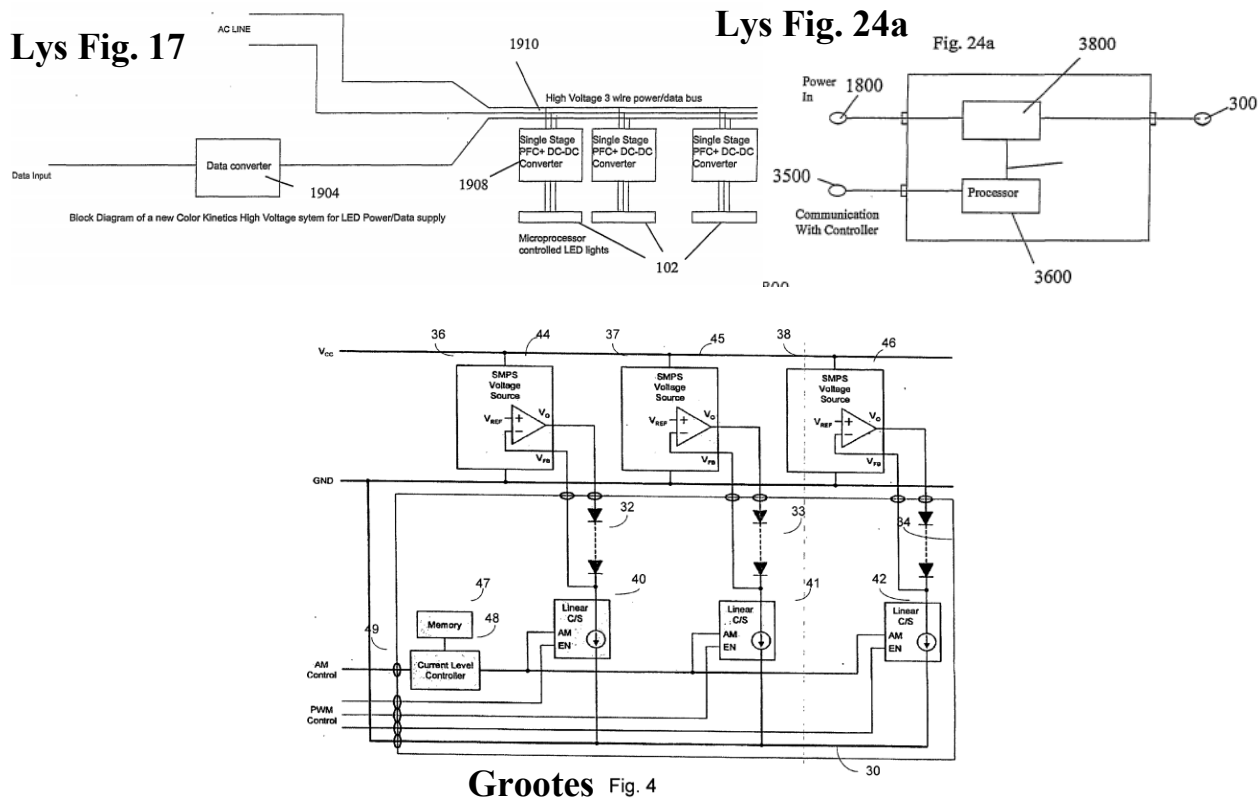


Fig 17 of Lys shows a high voltage system in which a DC to DC conversion circuit supplies lower voltage to a lighting unit, that lighting unit comprises a microprocessor and drive circuitry to supply the LEDs. Whereas Grootes shows

multiple voltage sources and current supply sources connected directly to the LEDs.

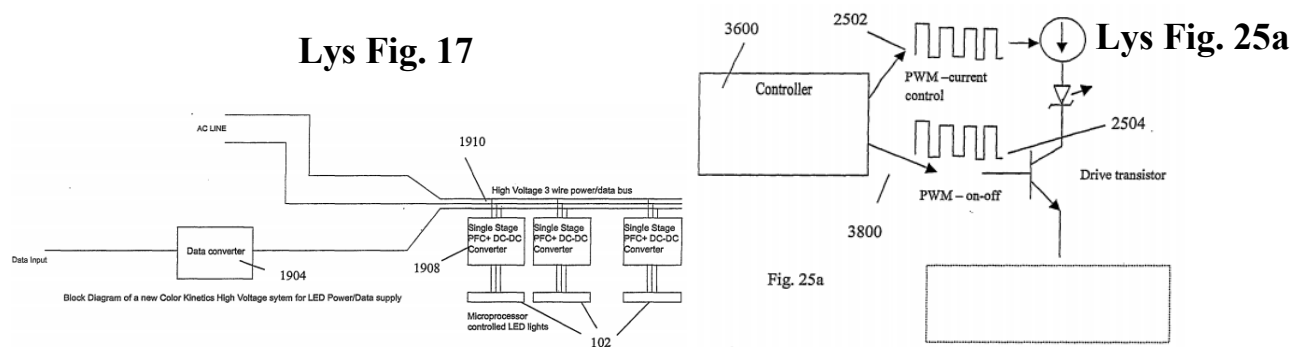
See Groot Fig. 4. A POSITA would know that such systems have little in common in terms of operation, specifically the method of current control and supply to the LEDs. EX2001, ¶ 64. Thus, a POSITA would not be motivated to combine Lys and Grootes because there would be no improvement of either invention. EX2001, ¶ 64

Petitioner argues secondly, that modifying Lys to include a current source for each string of LEDs, as disclosed by Grootes would meet, “the goal of providing ‘a pulse current with a constant level to achieve color and brightness uniformity’” Petition at 18. It would be impractical if not impossible to modify Lys to include Grootes’ independent current source for each string of LEDs. EX2001, ¶ 65. First, the way in which the invention of Lys is arranged precludes an independent current source. EX2001, ¶ 65. In Petitioner’s arguments in Ground 1 regarding claim element 17B, relating to the current supply circuit of the ’331 patent, Petitioner states that the PFC/DC to DC converters of Lys are analogous to the current supply circuits of the ’331 patent. Petition at 22-23. Therefore, Petitioner would need to either modify the converter to include a current supply circuit or place the current supply circuit after the converter and before the lighting unit. EX2001, ¶66. Either configuration is unworkable as PFC/DC to DC converters are only used on AC line voltage sources which need to be isolated from low voltage LED drive systems in

consumer electronics. *See* EX2001, ¶ 66. As such, a POSITA would not be motivated to combine Lys and Grootes.

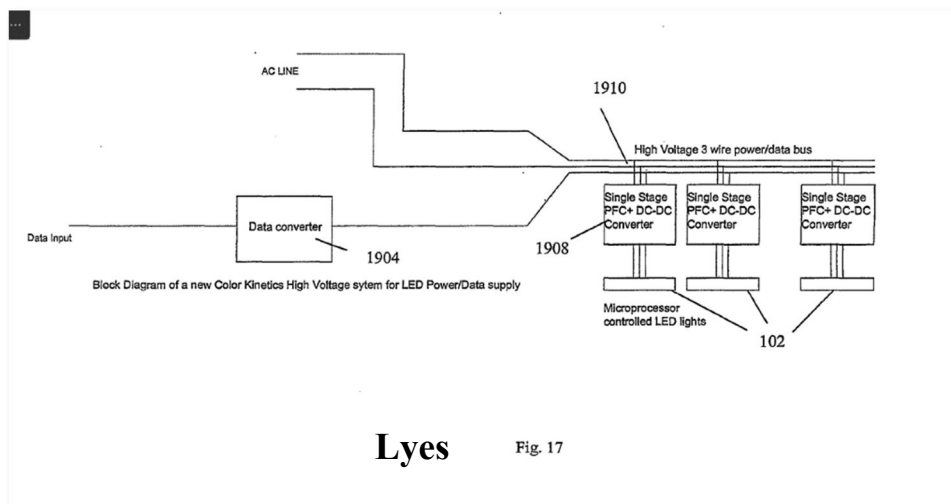
B. Combining the Multiple Embodiments of Lys and Grootes Leads to Other Problems.

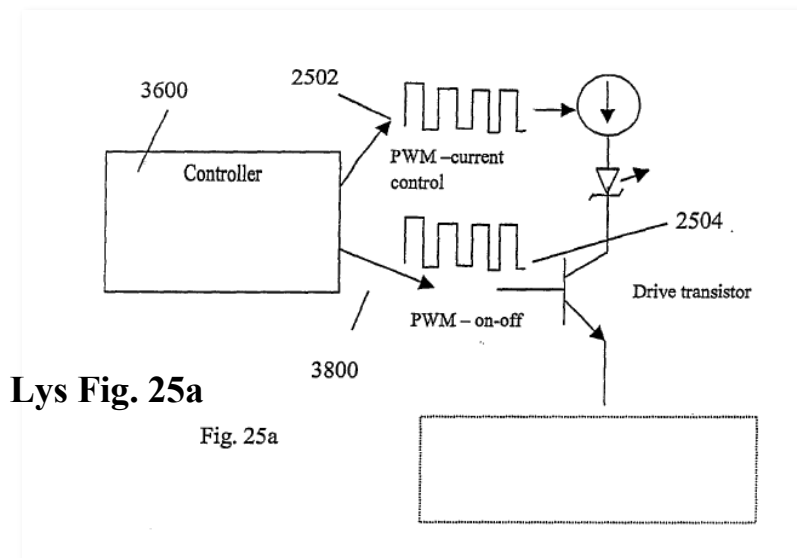
In Petitioner's discussions regarding Lys and claim elements 17A and 17B, Petitioner refers to the multiple strings described in Fig. 25a and combines those strings with the embodiment in Fig. 17 to argue that the combination discloses claim elements 17A and 17B. Petition at 21. However, Fig. 25a is a light fixture comprising multiple microprocessor-controlled LED lights. EX2001, ¶67.



Lys does not specify the connection between Fig. 25a and the lighting system 102, so presumably, there are two possible implementations of the combined system. The system either has each light string as a separate lighting unit 102 or has multiple strings built into one lighting unit 102. In the first implementation the microprocessor or controller 3600 would supply current control signals (2502 and 2504) to the drive transistor, which would supply the LEDs. This circuit would then be replicated multiple times, and each would be connected to a separate converter

1908. This combination of embodiments is not equivalent to claims 17A or 17B, since the converter 1908 would be supplying an on-state drive to the first or second string of lighting devices. Additionally, the PWM controller in the first embodiment wouldn't be coupled to the first and second current supply circuits. In the second implementation, many different microprocessor-controlled lighting strips would be implemented into one lighting unit 102. In this embodiment even if the converter 1908 was a current supply circuit, which it is not, there would only be one converter 1908 coupled to the microprocessors controlling each string. Therefore, there would not be a first and second current supply for a first and second string. In both potential embodiments, Lys does not describe a first and second current supply circuit coupled to, and supplying an on-state drive current to, the first and second light strings respectively.





A POSITA would not be motivated to combine the embodiment found in Fig. 17 with Grootes. Combining a compact backlight in an LCD panel to modify a large-scale lighting system is impractical. EX2001, ¶67.

With respect to element 17B, Petitioner states that a “POSITA would be motivated to combine Lys and Grootes to modify the current supply circuit(s) describe in Lys with the individually controllable current sources for each LED string described in Grootes to achieve the desired white point.” Petition at 24. This is a gross misrepresentation of both Lys and Grootes. EX2001, ¶ 67. As stated above, Petitioner has pointed to Lys’s PFC/DC to DC converters, which are intended to convert high voltage input into voltage suitable for lighting systems. However, Grootes describes the following, “The voltage dropped across the current source should be less than 2 volts.” Grootes, ¶ 38. Applying the high voltage in Lys would cause a breakdown in the lighting system supply voltage and would cause the current

sources of Grootes to stop functioning. Thus, it would be impracticable and incorrect to implement the low voltage current supply in Grootes with the high voltage DC to DC converters in Lys. EX2001, ¶ 67. (This would ignore safety and isolation from high voltage AC in consumer electronics design). Further, the controllable current sources 40, 41, and 42 in Grootes are connected to the cathode of each string and adjust the current to each LED. The PFC/DC to DC converter in Lys does not connect to the anode or cathode of each string. Instead, they connect to control circuitry which then controls the LED. Thus, the combination of such embodiments would be inconceivable to a POSITA, as it would result in an entirely unusable system that would not control current to the LEDs. EX2001, ¶67.

C. Petitioner Fails to Recite a Proper Motivation to Combine the Current Supplies of Grootes with the Structure of Lys

Additionally, Petitioner fails to provide any “reason, suggestion, or motivation” as to why a POSITA would combine the references in the manner proposed. “An invention is not obvious simply because all of the claimed limitations were known in the prior art at the time of the invention. Instead, we ask ‘whether there is a reason, suggestion, or motivation in the prior art that would lead one of ordinary skill in the art to combine the references, and that would also suggest a reasonable likelihood of success.’” *Forest Laboratories, LLC v. Sigmapharm Laboratories, LLC*, 918 F.3d 928, 934 (Fed. Cir. 2019), citing *Smiths Indus. Med. Sys., Inc. v. Vital Signs, Inc.*, 183 F.3d 1347, 1356 (Fed. Cir. 1999). Additionally,

an expert must provide “meaningful explanation for why one of ordinary skill in the art would be motivated to combine these references at the time of this invention.” *Id.* at 1353–54.

The Board routinely denies obviousness grounds, when as here, a Petitioner does not provide any factual basis for its assertions. In *Kinetic Technologies, Inc. v. Skyworks Solutions, Inc.*, the Board found Petitioner's motivation to combine arguments inadequate, as the Petition and expert declaration failed to “explain the ‘how,’ ‘what,’ and ‘why’ of the proposed combination of references.” IPR2014-00529, Paper 8, at 15 (Patent Tr. & App. Bd. 2014). More specifically, in *Kinetic*, the Board were not persuaded by the Petitioner's assertions as the Petitioner did not explain how the references could be combined, how such a combination would yield a predictable result, or why the Person of Ordinary Skill in the Art would have combined elements from the two references in the specific manner of the claimed invention at issue in that case. *Id.* Hisense' obviousness grounds suffer from the same deficiencies.

Petitioner offers only conclusory statements regarding motivation to combine the current supplies of Grootes with Lys. Petitioner contends that a POSITA would include a separate current source for each string of LEDs to improve the color and brightness uniformity of the lighting system described in Lys. Petition, 19. Petitioner then contends that the current supply in Grootes balances the white point

between three colors, which would improve the color and brightness uniformity of Lys. *Id.* Petitioner does not describe or explain how the current supply in Grootes addresses the issue of color and brightness uniformity. Both Lys and Grootes teach the same method of controlling LED brightness by utilizing a PWM control signal to drive a transistor; this method is referred to as on-off control, wherein the transistor is turned on and off according to the duty cycle of the PWM signal which causes the LED to change in perceived brightness. *See* Lys, 84:15-16, 77:9-16, and. 74:7-15; *see also* Grootes, ¶6, ¶41-42, ¶46, Fig. 2-3. No motivating factor exists as to why a POSITA would modify Lys to include the same circuitry (from Grootes) that Lys already describes; this would not address a deficiency of either reference. *See Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 800 (Fed. Cir. 2021) (requiring a known element to address the known issue).

Additionally, there is no design need or market pressure motivating a POSITA to replace the on-off control of Lys with the on-off control of Grootes. Both references control LED brightness in the same manner, therefore the combination, were it workable, does not improve the functioning of either design. Petitioner relied on improper hindsight to combine known elements in a that fit the Challenged Claims, rather than offering factual support for why a POSITA, when confronted with the problem of color and brightness uniformity, would combine them in the manner claimed. *See In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992) (citing *In*

re Gorman, 933 F.2d 982, 987 (Fed. Cir. 1991) (“It is impermissible to use the claimed invention as an instruction manual or ‘template’ to piece together the teachings of the prior art so that the claimed invention is rendered obvious”)).

Implementing the current sources of Grootes into Lys would undermine the key inventive feature of Lys and a POSITA would understand that the negative impact would have outweighed any motivation to combine. *Polaris Indus. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1061, 1067-69 (Fed. Cir. 2018) (vacating Board decision that failed to consider whether modifying prior art references would undermine its goal, shared with the challenged claims, of constructing stable all-terrain vehicles). Lys explained the key benefits of LED wavelength adjustment over typical stable color control, “[t]he light output from a semiconductor illuminator may shift in wavelength as a result [of] changes in current... [which has] been thought to be undesirable for most applications, since a stable color is often preferred to an unstable one...different wavelengths of light can be provided by changing the current supplied to the LEDs... to produce improved quality white light.” Lys, pg. 83. As shown in Fig. 25a, Lys describes the use of two PWM signals to control the lighting unit. The first signal, current control mode 2502, adjusts the wavelength of light emitted by the semiconductor, and the second is an on-off control 2504 used to control the output intensity of the semiconductor. Petitioner proposes a combination where two PWM signals (as per Lys) would comprise the input to current sources

40, 41, and 42 described by Grootes. However, this would obviate the benefit of Lys (*i.e.*, improved quality of white light via PWM wavelength control signal 2502). Grootes' current source only adjusts the brightness of each string, "[i]n a backlight, the white point is controlled by the balance of the R, G, and B intensities." Grootes, ¶42. Thus, the current control mode 2502 illustrated in fig. 25a would not adjust the current across the LEDs thereby adjusting the wavelength. This combination would abandon the key inventive feature of Lys. *See Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784 (Fed. Cir. 2021) (affirmed that the Board correctly "weighed the competing evidence regarding the relevant tradeoffs and concluded, based on the stated importance of low impedance as 'key' to Valla, that negating this benefit during 'the majority of the operation' would have outweighed any reason to combine"); Petitioner offers no further example or explanation for why a POSITA would modify the current source in Grootes to input two PWM signals or how a POSITA would modify the current source of Grootes so as to maintain the inventive concept of Lys.

Petitioner does not explain how the combination of Grootes and Lys would yield a predictable solution or result. Petitioner offers no reason why a POSITA would understand that two PWM signals sent to the current sources of Grootes would predictably result in improved color and brightness uniformity. The current sources in Grootes accept one PWM signal to adjust LED brightness. Lys supplies two separate PWM signals, both with different functions, one to adjust brightness

via on-off control and a second to adjust the current supplied to the LEDs to adjust LED wavelength. A POSITA would not find that sending two different PWM signals to the cathode side of an LED or to the gate of a transistor offers a predictable solution to the problem of improving color and brightness control in LED systems.

D. Lys and Grootes Fail to Disclose [Claim 17B]

Even assuming *arguendo* that they could be combined, the combination fails.

The power supplies of the '331 Patent are current supply circuits configured to supply an on-state drive current. *See* '331 Patent, Abstract. More specifically, the current supply circuit of the '331 Patent performs the following:

may include a charging inductor coupled to the voltage input terminal and an output capacitor coupled to the first output terminal...may be configured to operate in continuous conduction mode in which a varying or constant current continuously flows through the charging inductor while the on-state drive current is supplied to the string of solid state light emitting devices...may include a rectifier having an anode coupled to the charging inductor and a cathode coupled to the storage capacitor, a controller having a control input and first and second control outputs, and a first control transistor coupled to the anode of the rectifier and having a control terminal coupled to the first control output of the controller...may be a variable voltage boost current supply circuit.

'331 Patent, 1:48-2:31. None of the above elements are present in Lys. EX2001, ¶ 68. More importantly, none of the power supplies in Lys, such as the PFC/DC to DC converter 1908, supply an on-state drive current to the first and second LED strings. EX2001, ¶ 68. The purpose of the converter 1908, as stated in Lys, is to “output voltages suitable for light sources 300 such as LEDs occurs at the lighting

units in 102.” Lys at 60:24-25. Lys does not mention or disclose supplying an on-state drive current to the strings. EX2001, ¶ 69. Petitioner appears to recognize this lack of disclosure and falls back to the argument: “Lys discloses or at *least implies* the user of a single power supply circuit for each string of LEDs.” Petition, 23 (emphasis added). However, the disclosed generic power supply circuit does not teach or render obvious the improved supply circuit described in the ’331 Patent. EX2001, ¶69.

E. Lys and Grootes Fail to Disclose [Claim 17C]

Petitioner mischaracterizes Lys and provides conclusory statements not supported by Lys. Petition at 25-28. As stated above, Petitioner improperly combined multiple Lys embodiments to satisfy claims 17A, 17B, and 17C. With respect to this element, Petitioner attempts to unexplainedly combine the embodiment in Fig. 17 with embodiments 24a, 24b, 24c and 25a. *See* Lys, Figs. 17, 24a, 24b, 24c and 25a.

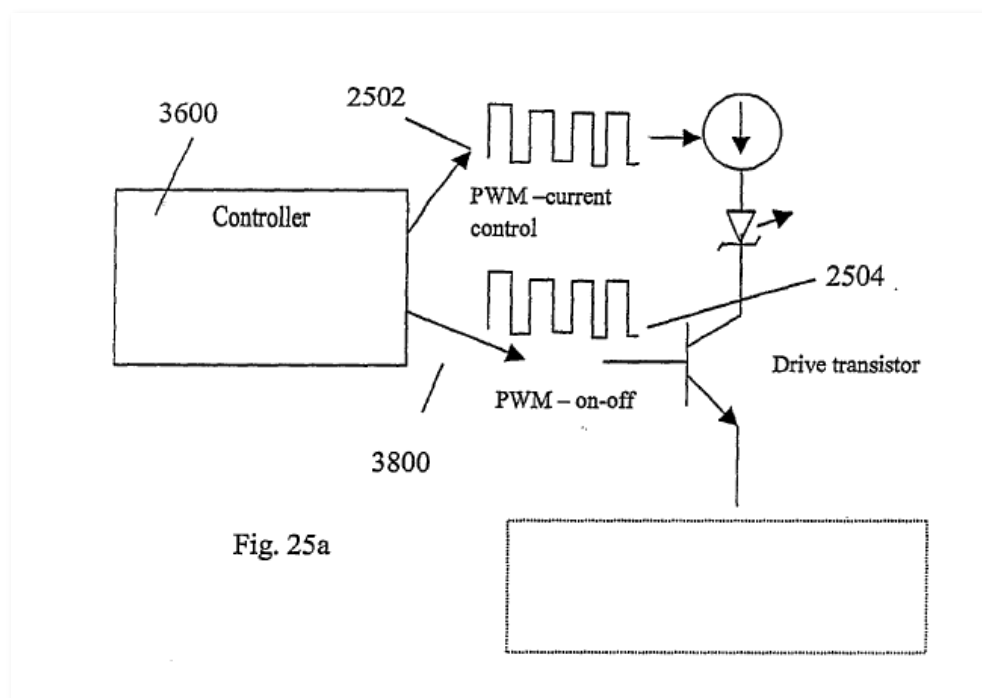
As an initial matter, Petitioner cited many different instances where Lys taught Pulse-Width Modulation (“PWM”). Petition, 25-28. In every example, except for one, the PWM signals are transmitted by the Control facility 3500 to a drive facility 3800 or processor 3600. *Id.*, *citing* Lys. In one example, which is unclear, states that “the control facility 3500 can switch between a current-control mode 2502 (which itself could be controlled by a PWM stream) and a separate PWM

mode 2504.” Lys, 83:17-18. A proper interpretation of this portion of Lys is that the current control mode 2502 is controlled by a PWM stream, not that the control facility is controlled by a PWM stream. EX2001, ¶70. This interpretation is supported by fig. 25a of Lys, which shows the current control mode 2502 to be a PWM controlled mode. EX2001, at ¶70.

It is important to highlight that Lys intended for PWM signals to be transmitted in one orientation. EX2001, ¶71. In contrast, Petitioner argues that the converter facility 1908 discloses current supply circuit of the '331 Patent. Petition at 28. This argument incorrectly assumes that the PWM signal sent from the control facility 3500 is transmitted to the converter 1908. EX2001, ¶71. This argument deviates entirely from Fig. 17 and Lys, since the converter 1908 only takes input from the AC line and the data converter. There is no purpose or teaching in Lys of the lighting unit generating and sending a PWM control signal to the converter 1908, indeed this would likely cause issues with the system. EX2001, ¶71; *see also* Lys at 60:18-24. Also, even if a PWM signal is sent to the converter 1908, it would not then be supplied to the first and second strings. EX2001, ¶71.

Petitioner further claims argues “[Lys] expressly discloses controlling multiple LED strings, with each LED string receiving two PWM control signals (one for current control to adjust the wavelength, and the other for on-off control to adjust the output intensity)” Petition at 26. This again misrepresents and misunderstands

the teachings of Lys. Lys instead states “Fig. 25a shows a schematic diagram with one possible embodiment for creating the two control signals from a controller, such as a microprocessor to control one or more LEDs in a string. Multiple **such strings** can be used to create a light fixture...” Lys, 83:20-24 (emphasis added). The figure is reproduced below:

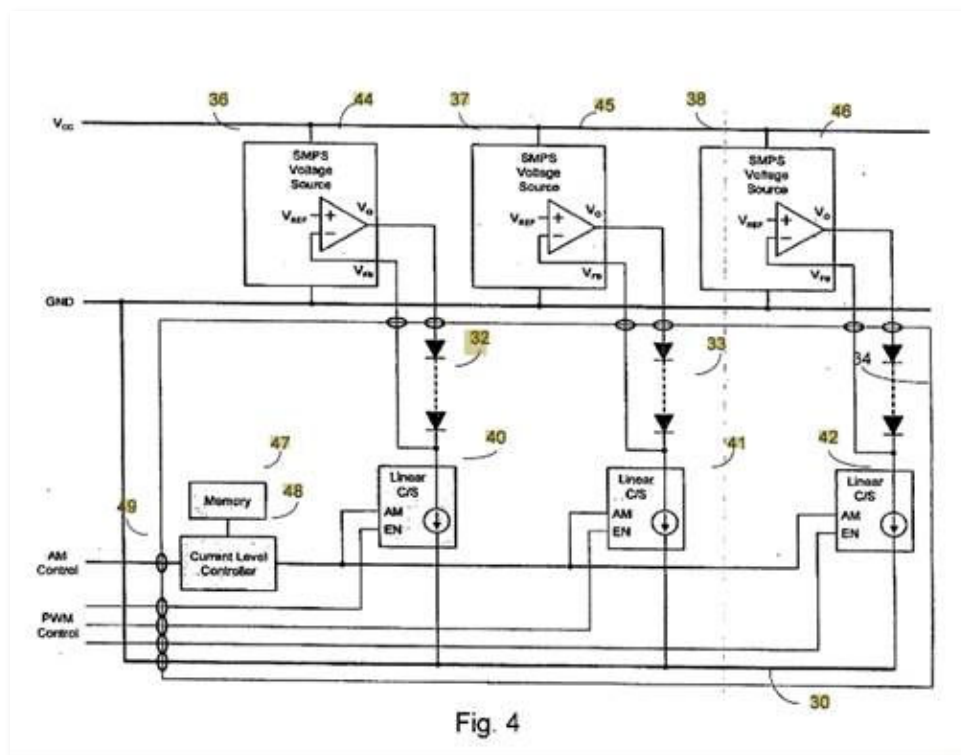


The system in Lys explicitly describes that each light string would have its *own microprocessor*, and therefore each string would have its own *PWM controller*. EX2001, ¶ 72. Lys only describes one PWM controller generating a signal for one string, not one PWM controller for multiple strings. EX2001 at ¶72. This embodiment is entirely different from claim 17 and element 17C, which recites “a

PWM controller configured to **generate a first** PWM control signal **and second** PWM control signal that are supplied to each of the at least first and second strings.”

The control system 3600 functions as a current controller with a modulating PWM controller which can switch between “a current control mode...and a **separate** PWM mode.” Thus, while petitioner states that each LED string receives two PWM control signals, it is just one signal that may be modulated by the PWM controller. This is not the same as two distinct signals. EX2001, ¶73. This is apparent by examining the diagram of Figure 25a. The two signals are linked, the signal is passed between the drive circuitry 3800 to **control one LED string**.

Petitioner also alleges that a POSITA would combine the PWM arrangement of Lys with the current sources of Grootes. Figure 4 of Grootes is reproduced below.



However, inserting a PWM between the cathode of the LED and the linear current supplies of Grootes would introduce a potential fault point in the system. In lighting applications such as the ones currently discussed, it would be common to employ a MOSFET PWM. EX2001, ¶74. (toggling the current source enable pin is not practical and would result in surges and current spikes). Employing an output side series switch as Petitioner contends would cause an instantaneous high voltage spike across the LED at the time of switch on which would cause damage to the LEDs. *Id.*

More importantly, Petitioner's mishmash system would then include a "current source for each string...controlled by an individual PWM." Petition at 28. This does not teach Claim 17. The '331 Patent teaches a PWM controller coupled to at least two current supply circuits; Petitioner's mishmash system would have a PWM controller for each current supply circuit. Petitioner has posited a system that would perform poorly if at all and still does not anticipate the invention of the '331 patent. EX2001, ¶74.

In conclusion, Petitioner has failed to demonstrate an effective way to combine the PWM signals of Lys with the linear current supply of Grootes. EX2001, ¶74. Further, Petitioner has failed to demonstrate that a PWM controller of Lys generate "a first PWM control signal and a second PWM control signal." Petitioner

has also failed to demonstrate that the combination of Lys and Grootes supplies a first and second PWM control signal “to each of the at least first and second strings.”

The Board stated that it found unavailing Brightplus' argument that Lys teaches that “the converter 1908 only takes input from the AC line and the data converter,” and that Lys does not teach that the lighting unit generates and sends a PWM control signal to converter 1908. Lys' disclosure is not limited to what is illustrated in Figure 17. Rather, Lys teaches that control facility 3500 provides current control for power facility 1800 of which the DC/DC. Paper 7 at 21-22.

However, Lys does not teach that the control facility 3500 provides current control for power facility 1800 (*see* Lys, 32:6–12, 34:23–30, 60:13–27, 73:7–13, 85:17–30, Figs. 17, 25a) in a way that satisfies claim elements 17B and 17C. According to Petitioner, the power facility 1800, more specifically the PFC/DC to DC converter 1908, is equivalent to the current supply circuits for the lighting unit 102. However, Lys does not describe an embodiment where the control facility 3500 supplies PWM control signals to the power facility 1800, whether that power facility is an PFC + DC to DC converter or some other embodiment. This distinction is important because Petitioner alleges that power facility 1800 is the current supply circuit of claim 17B. Petitioner then relies on Fig. 25a to satisfy the multiple PWM signals element of claim 17C. This argument illustrates Petitioner's contradiction. As stated in Lys, “Fig. 25a shows an embodiment of a drive facility 3800 for

simultaneous current control and on-off control under the control of a processor 3600.” EX1005, 84. Fig. 25a shows a schematic diagram with one possible embodiment for creating the two control signals from a controller... to control one or more LEDs in a string.” *Id.* pg. 85. Nowhere does Lys disclose that the current-control mode 2502 and separate PWM mode 2504 are supplied to a power facility 1800. Lys and Petitioner acknowledge that PWM is used as control signals that may be generated by the processor to control the light sources. Lys, 78. Therefore, it is not obvious why a POSITA would view Lys as teaching the processor 3800 using PWM signals to control a power facility 1800. Indeed, Fig 25a illustrates that the PWM signals are directly supplied to the LED, 2502 to the anode side of the LED, and 2504 to the cathode side via a BJT. To reiterate, Lys does not disclose that PWM control signals from 3500 are supplied to power facility 1800 in order to drive the LED strings, and Petitioner does not offer any other “current supply” circuit disclosed by Lys that receives PWM control signals from a PWM controller. Lys, therefore, does not show a “(PWM) controller that... is configured to generate, for each of the first current supply circuit and the second current supply circuit, a first PWM control signal and a second PWM control signal” as claimed.

The Board also stated that it found unavailing Brightplus’ argument that “Lys explicitly describes that each light string would have its own microprocessor, and therefore each string would have its own PWM controller,” and that “Lys only

describes one PWM controller generating a signal for one string, not one PWM controller for multiple strings.” Paper 7, 22. *Citing* Prelim. Resp. 23–24 (citing EX1005, 83:20–24, Fig. 25a; EX2001, ¶ 72). But this argument ignores Grootes’s teachings.

Respectfully, the Board’s view on this is in error. Grootes does not teach a single PWM controller connected to at least a first and second current supply circuit in order to emit a first and second light as required by Claims 17 (see elements, 17a, 17b, 17c). Grootes explicitly shows that each string comprises either red, green or blue LEDs. Grootes, ¶ 36. The brightness of each string is controlled by a current source 40-42, where each current supply is connected to separate PWM. *Id.*, ¶ 46. As stated by Grootes, “Conventional PWM controllers may be used to output a square wave of the desired frequency and duty cycle. Since the same change in duty cycle may not control the brightness of red, green, and blue LEDs by the same amount, a separate PWM input is usually needed for each color. The change in duty cycle for each color to maintain the white point is determined empirically, and the outputs of the PWM controllers are adjusted accordingly.” *Id.* Grootes explains that, “FIG. 5 illustrates any of the PWM controllers 50, connected to a PWM control line in FIG. 4, that receive a control signal to vary the duty cycle of an oscillator operating at a fixed frequency.” *Id.*, ¶ 49. Grootes’ other embodiments include the use of multiple PWM controllers, therefore the PWM controller in Grootes is not

equivalent to the single PWM controller contemplated by the '331. The use of multiple PWM controllers is directly related to the key inventive concept of Grootes, namely improved LED driving methods in order to have better color and brightness uniformity. While Grootes describes a printed circuit board having separate current supply circuits for each of a string of LEDs, there is no specific implementation of a single PWM controller coupled to the first and second strings to emit first and second light.

Furthermore, Lys explicitly describes that each light string would have its own microprocessor, and therefore each string would have its own PWM controller. Lys only describes one PWM controller generating a signal for one string, not one PWM controller for multiple strings.

Additionally, the combination of Lys¹ and Grootes would not teach this element. First, as stated above a POSITA would not be motivated to combine the prior art references. Second, the arbitrary introduction of the current supplies from Grootes into Lys wouldn't make up for the lack of disclosure of a single PWM controller connected to multiple strings. Assuming that each string in Lys had the current supply of Grootes connected to the microprocessor 3600, Petitioner does not offer an explanation as to why that combination would disclose a single PWM

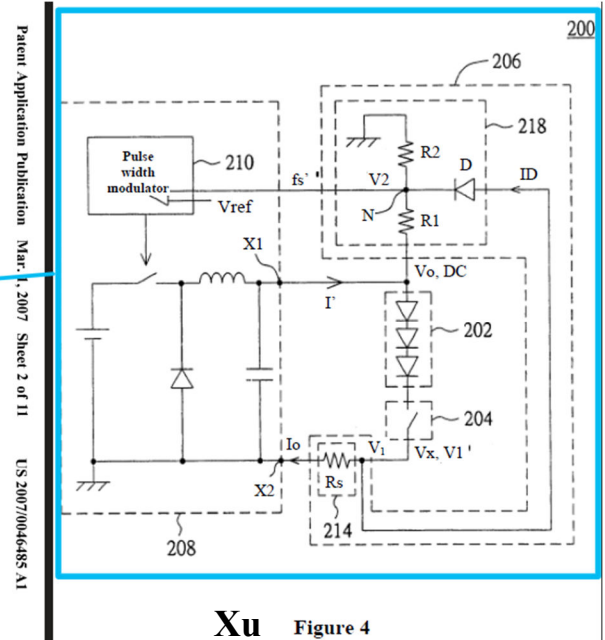
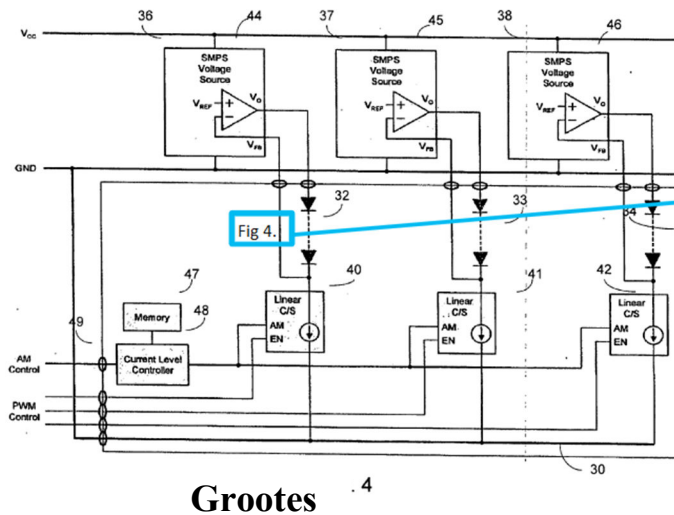
¹ Petitioner incorrectly quoted Lys on Petition 25.

controller connected to multiple strings. More importantly, since Lys and Grootes describe an improved method for driving LEDs using a single PWM controller for each string, it is not apparent why a POSITA would look to modify that specific implementation or how that modification would offer a predictable solution to the problem of color/brightness uniformity. Neither Petitioner nor their expert offer any explanation as to why a POSITA would be motivated to modify the teachings of Lys and Grootes to use the PWM controller taught by the '331 Patent.

VI. GROUND 2 - LYS, GROOTES, AND XU

A. A POSITA Would Not be Motivated to Combine Lys, Grootes, and Xu.

Petitioner contends that “a POSITA would be motivated to combine Xu to the Lys-Grootes combination in order to provide greater control of the overall light output, especially the constant color temperature.” Petition at 33. However, combining these systems would result in a non-functional system. EX2001, ¶75. For example, the feedback circuit in Xu is connected to the boost converter circuit 208, the cathode of the LED string 202, and Vref. *See* Xu at pg. 11; Fig. 4. To implement Xu into Grootes, the feedback circuit 206 and current converter circuit 208 would need to be connected between the cathode of LEDs 32 to the Vfb line and the voltage source 44, as seen below:



This combination of Grootes and Xu would introduce a number of faults. EX2001, ¶ 75. First, the boost converter circuit 208 would be connected to the anode of LEDs 32 in Grootes. Consequently, this would mean that the stable DC voltage output of circuit 208 in Xu would be connected in series with the output voltage of the voltage source 44 in Grootes. The effect of this could cause the voltage across LEDs 32 to be greater than intended, thus likely causing the diodes to operate at higher voltage than intended. *Id.* Worse yet, the voltage outputs would interfere with either the feedback circuit 206, the boost converter 208, the PWM control/voltage source 44 in Grootes, or any combination of those circuits. *Id.*

Another problem with this proposed combination is that the feedback signal in Grootes would interfere with the feedback loop of Xu. *Id.*, ¶ 76. Essentially, the feedback signal would have to be connected in parallel with the two different circuits

causing interference. *Id.* Consequently, there would be two separate voltage supply circuits to the same LED strips. *Id.* These two voltage supply circuits would operate independently but would have the outputs connected in series. This would likely cause the diodes to not operate correctly, or to breakdown due to over supplying voltage. *Id.* Further, the combination would totally neglect the current control/PWM control methods described in each patent and cause more undue complexity.

Each of Lys, Xu, and Grootes have a specific method and completed circuit design to control the LEDs which are not easily combinable without. *Id.*, ¶ 77. Lys, Xu and Grootes each describe unique PWM control systems. *See* Lys, Fig. 25a; Grootes, [0017], [0038], [0043]; Xu, [Embodiments 1 and 2]. If combined, there is a high possibility of a signal mismatch between the three PWM signals and control methodologies that would result in disaster. EX2001, ¶ 77.

The petitioner has not offered any reasonable argument as to why a POSITA would want to add more PWM control methods, or other circuitry (feedback resistor, boost converter, etc.) such as those in Xu, to Lys or Grootes. *Id.*, ¶78. Petitioner merely relies on the statement that “it was well within the technical ability of a POSITA at the time to incorporate Xu’s improvements to an LED driving circuit into the lighting system disclosed by Lys and Grootes as all of the references employ or use well known electrical techniques in electronic circuitry” without addressing the issues in combining those systems or the lack of improvement to the overall

system. Petition, 29. A POSITA would not be motivated to combine them since they would not want to add additional and unstable complexity and would not find the combination to be an improvement over any one of the individual systems (*e.g.*, the individual systems described by Xu, Grootes and Lys). EX2001, ¶78.

As a further example, Lys describes supplying a constant current to the LEDs for ideal color temperature control: “Pulse width modulation (PWM) involves supplying a substantially **constant current to the LEDs**... and each color is driven with PWM to vary its apparent intensity” Lys, 77:9-10. Petitioner argues that “a primary motivation of one of ordinary skill in the art would have been to provide a turn-on current with a constant level and achieve a constant color temperature” by adding Xu. Petition, 29. However, this is illogical why Petitioner believes that a POSITA would be motivated by this reasoning to combine Lys with Xu to add additional redundant circuitry, given that Lys already includes this feature (*i.e.* the PWM supplying constant current to the LEDs).

B. Petitioner Fails to Offer Evidence Supporting a Motivation to Combine Elements of Xu with Lys and Grootes.

The crux of Petitioner's argument is that a POSITA would include the constant-on current and the sense resistor of Xu to achieve improved color and brightness uniformity as compared to Grootes and Lys. Petition, 29-30. The only evidence Petitioner offers is that the circuit in Xu allows for the LED to turn on to allow a fixed current and that the sense resistor generates a feedback signal allowing

for a constant color temperature, which would improve the color and brightness uniformity of Lys-Grootes. The Petitioner does not explain how a POSITA would understand that the fixed current in Xu would improve the color and brightness uniformity of Lys-Grootes. The petitioner does not explain how Xu's circuit resulting in constant current improves the functioning of the Lys-Grootes combination. *KSR*, 550 U.S. at 421 ("When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.")

Petitioner relied on hindsight to combine known elements in a way that fit the claims of the '331, rather than offering factual support for why a POSITA, when confronted with the problem of color and brightness uniformity, would combine them in the manner claimed. *In re Gorman*, 933 F.2d 982, 987 (Fed. Cir. 1991) ("It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious").

Contrary to Petitioner's assertions, implementing the LED driving circuit of Xu into Lys-Grootes would undermine the key inventive features of both Lys and Grootes independently and the proposed combination and a POSITA would understand that the negative impact would have outweighed any motivation to

combine. *Polaris Indus. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1061, 1067-69 (Fed. Cir. 2018) (vacating Board decision that failed to consider whether modifying prior art references would undermine its goal, shared with the challenged claims, of constructing stable all-terrain vehicles). Lys explained the key inventive feature of LED wavelength adjustment via a change in current supplied to the LED in order to produce “improved quality white light.” Lys at pg. 83). Grootes’ key inventive feature is related to the current source adjusting the brightness of each string via a change in a PWM signal input into a transistor, “[i]n a backlight, the white point is controlled by the balance of the R, G, and B intensities.” Grootes, ¶ 42). Petitioner further argues that the key benefit of Grootes when combined with Lys would be to “independently ‘control... the brightness of each LED’”. Petition, pg. 18. Thus, both Lys and Grootes describe the importance of adjusting current or a PWM signal to allow for better color and brightness uniformity. Petitioner’s argument that a POSITA would be motivated to implement a reference that pertains to constant current control in order to improve color and brightness and uniformity is incorrect.

For Ground 1, Petitioner emphasizes the improvement caused by changing the current, and now Petitioner is stating that improved brightness and color uniformity is the result of a constant current methodology. The implementation of the constant current circuit described by Xu would abandon the key inventive features of Lys and Grootes independently and when combined. Petitioner offers no further example or

explanation for why a POSITA would modify the Lys-Grootes combination to remove the transistor coupled to the PWM controller, why a POSITA would want to send two PWM signals into the circuit of Xu, or how a POSITA would modify the circuit of Xu so as to maintain the inventive concept of Lys and Grootes.

Lastly, Petitioner does not explain how the combination of Xu, Grootes and Lys would yield a predictable solution or result. Petitioner offers no reason why a POSITA would understand that two PWM signals sent to the switch of Xu would predictably result in improved color and brightness uniformity. As stated above, the Xu's circuit is intended to input one PWM signal. Lys supplies two separate PWM signals, both with different functions, one to adjust brightness via on-off control and a second to adjust the current supplied to the LEDs to adjust LED wavelength. A POSITA would not believe sending two different PWM signals into the circuit of Xu offers a predictable solution to the problem of improving color and brightness control in LED systems.

Contrary to Petitioner's assertions, implementing the LED driving circuit of Xu into Lys and Grootes would undermine the key inventive features of both Lys and Grootes independently and the proposed combination and a POSITA would understand that the negative impact would have outweighed any motivation to combine. Lys explained the key inventive feature of LED wavelength adjustment via a change in current supplied to the LED in order to produce "improved quality

white light.” Lys, 83 Grootes’ key inventive feature is related to the current source adjusting the brightness of each string via a change in a PWM signal input into a transistor, “[i]n a backlight, the white point is controlled by the balance of the R, G, and B intensities.” Grootes, ¶0042. Petitioner further argues that the key benefit of Grootes when combined with Lys would be to “independently ‘control... the brightness of each LED’”. Petition, 18. Thus, both Lys and Grootes describe the importance of adjusting current or a PWM signal to allow for better color and brightness uniformity. Petitioner’s argument here fails.

Finally, Petitioner does not explain how the combination of Xu with Grootes-Lys would yield a predictable solution or result. Petitioner offers no reason why a POSITA would understand that two PWM signals sent to the switch of Xu would predictably result in improved color and brightness uniformity. As stated above, the Xu’s circuit is intended to input one PWM signal. Lys supplies two separate PWM signals, both with different functions, one to adjust brightness via on-off control and a second to adjust the current supplied to the LEDs to adjust LED wavelength. A POSITA would not find that sending two different PWM signals into the circuit of Xu offers a predictable solution to the problem of improving color and brightness control in LED systems. In summary, numerous reasons exist why a POSITA would not combine Xu with Lys and Grootes and these reasons are completely ignored by Petitioner.

C. Dependent Claim 18**i. There is no motivation to combine.**

Claim 18 states:

“The lighting system according to claim 17,

wherein each of the first and second current supply circuits comprises a variable voltage boost, constant current power supply circuit configured to operate in continuous current mode.

'331 Patent, claim 18.

“The current supply circuit may act as a voltage boost converter to provide the high voltage that may be required to drive and LED string 24... Furthermore, the constant current may be supplied with a variable voltage boost to account for differences in average forward voltage from string to string.”

Id., 12:59-65.

The PFC/DC to DC converter 1908 of Lys reduces the high AC voltage to suitable level for the lighting unit 102. The PFC/DC to DC converter 1908 does not require a boost converter, as it does not need a voltage boost nor be constant with PFC. EX2001, ¶ 80. A POSITA would not combine the boost converter of Xu with the high voltage PFC/DC to DC converter of Lys, as it would likely destroy the lighting unit 102. *Id.* Xu, Lys, and Grootes in combination or separately do not disclose a current supply circuit comprising a variable voltage boost, constant current power supply circuit configured to operate in constant current mode.

Petitioner improperly equated the PWM controller of Lys to the “current supply circuits” of the '331 Patent (this is a contradiction to its position on Claim 17B).

Petitioner offer no explanation how a POSITA would find that the circuit in Xu would improve control of the light output, especially the constant color temperature. Xu pertains to a LC (Inductor and Capacitor) or similar circuit that allows the LED to be quickly extinguished or lit. Xu does not describe adjusting the current or PWM to change brightness, or how a constant current allows for greater control of the light output. Thus, no motivation exists here.

ii. Lys, Grootes and Xu Do Not Teach Claim 18.

Petitioner states that “Lys describes multiple color LEDs driven by PWM and that the power supply may supply ‘a substantially constant current.’” Petition, at 31-32. However, this is a misrepresentation of Lys and contradicts Petitioner’s prior position in Claim 17C. First, Petitioner has conflated the PWM controller and the current supply circuit in its argument. Lys states only that the PWM supplies a constant current to LED (*e.g.*, “Pulse width modulation (PWM) involves supplying a substantially constant current to the LEDs for particular periods of time”), not that the power supply does so in combination with the PWM. Lys, ¶ 35. Petitioner fails to explain which element in Lys corresponds to the “power supply” in its arguments for this element. However, based on Petitioner’s arguments for Claim 17C, it may be assumed that Petitioner intended the power supply would be represented by the PFC/DC to DC converter 1908. In that regards, Petitioner has not provided any evidence that the PFC/DC to DC converter is a constant current power supply circuit.

Further, the PFC/DC to DC converter does not use a PWM signal, nor does it supply a PWM signal to the LEDs. Therefore, Lys does not disclose that the power supply is a constant current power supply. Further, as previously noted, a PFC/DC to DC converter is not equivalent to the current supply circuit.

Petitioner has not provided any reasoning as to how Xu would be combined with Grootes. As described above (see motivation to combine arguments), Xu and Grootes are incompatible, since adding a boost converter as taught by Xu to the cathode of the LED string in Grootes would interfere with the voltage power supplies and circuitry in Grootes. The resulting system would be non-operational. Additionally, Grootes already discloses a “constant current source.” Grootes, ¶ 61. A POSITA would not see any benefit or improvement to Grootes by adding a variable voltage boost or constant current power supply. Lastly, Grootes does not teach that its current supply sources comprise a “variable voltage boost” as required by the '331 Patent. Thus, Grootes, nor the combination of Xu and Grootes satisfies all elements of Claim 18.

D. Dependent Claim 19

i. There is no motivation to combine.

In Lys the output voltage of the PFC/DC to DC converter goes to the lighting unit 102. *See* Lys at Fig. 17. A POSITA would not add another switch, sense resistor and a feedback loop with a voltage reference and a comparator as shown in Xu's

figure 2 to Lys's PFC/DC to DC converter. EX2001, ¶ 81. The referenced circuitry in Lys is dedicated to high voltage conversion. Adding unnecessary circuitry, such as what is disclosed in Xu, would not improve the control of the lighting unit 102. Furthermore, in the combined system, the feedback output would not be provided to the PWM. *Id.* This combined system would not result in a better method of controlling the LEDs. *Id.*

ii. Lys, Grootes and Xu Fail to Render Obvious Dependent Claim [19A]

As stated in the argument for Claim 18. Petitioner equates the “first and second current supply circuits” in the '331 Patent to the power supplies such as the PFC/DC to DC converter 1908 in Lys. Claim 19 requires the first and second supply circuits to comprise a “temperature sensor” that is configured to generate a sensor output signal to the PWM controller. '331 Patent, Claim 19. Petitioner fails to show that a signal source 8400 or temperature sensor is implemented in the PFC/DC to DC converter 1908 of Lys.

Petitioner relies on Fig. 2 of Lys and a variety of embodiments showing signal source 8400, but those embodiments do not include the power supply or the PFC/DC to DC conversion elements. Additionally, Lys doesn't teach that the PFC/DC to DC conversion elements utilize a temperature sensor to send a temperature signal to the lighting unit or a PWM controller.

A POSITA would not be motivated to include a temperature sensor in the high voltage PFC/DC to DC conversion unit for a multitude of reasons. First, the temperature sensor value would be incorrect when surrounded by high voltage circuits. EX2001, ¶ 82. Second, the temperature sensor signal would interfere with, or be degraded by, the high voltage circuitry. *Id.* Lastly, the PCF/DC to DC conversion unit is to convert high voltage to the lower voltage for the lighting unit – its purpose is not to supply signals such as temperature signals *Id.*,

Petitioner also claims, “Lys describes the use of one or more temperature sensors, as one example of a signal source 8400.” Petition at 33-34. However, this is misrepresentation of Lys. Rather, Lys discloses only the following, “a fan 2702 or other convection facility 2700 can be under control of a processor 3600, and a temperature sensor such as a thermostat to provide cooling when necessary...” Lys, 61:16-18. This is the only discussion in Lys of a temperature sensor, but it is referred to as a thermostat to supply cooling. In summary, Lys mentions a temperature sensor that is used in an unrelated function to controlling the LEDs. Petitioner's arguments require that signal source 8400 of Lys include a temperature sensor. However, Lys does not describe the signal source 8400 as comprising a temperature sensor.

Lastly, Petitioner makes the claim, “[a] temperature sensor, ‘which gives a good indication of the temperature at which the LEDs are running,’ enables precise prediction... of the running temperature of the LEDs.” Petition at 35. However, the

portion of Lys cited by Petitioner actually states, “a feedback system can use a [current measurement] sensor to measure the forward voltage of the LEDs.” Lys, 134:27-28. Lys is merely discussing a current measurement sensor, which is not a temperature sensor that is configured to generate a sensor output signal that the PWM controller uses to generate the first PWM or second PWM signals.

As such, this element is not disclosed.

iii. Lys, Grootes and Xu Fail to Render Obvious Dependent Claim [19B]

Brightplus reiterates its arguments against the Petitioner's motivation to combine and the arguments presented in Claims 18 and 19A, namely that Petitioner claimed the power supply circuits, such as the PFC/ DC to DC in Lys as the “current supply circuits” in the '331 Patent.

Claim 19B requires “a sense resistor that is coupled to an output terminal of the current supply circuit and that is configured to provide a feedback signal to the PWM controller.” '331 Patent, Claim 19. Lys does not teach that the PFC/DC to DC conversion unit utilizes a sense resistor, or any type of feedback signal sent to the microprocessor in Fig. 25a. *See* Discussion of Claim 17B above.

E. Dependent Claim 20

As discussed above, Petitioner has failed to show a motivation to combine Lys, Grootes, and Xu. However, Claim 20 adds the additional limitation of requiring **each** current supply circuit to comprise a sense resistor coupled to the output of the

circuit and to the feedback input. However, the power supplies, such as the PFC/DC to DC converter 1908 in Lys do not disclose any feedback control. EX2001, ¶ 83. Further, Petitioner has not presented any support as to how Lys teaches or describes a method of feedback in the PFC/DC to DC converter 1908.

Additionally, Xu does not teach first and second current supply circuits coupled to the feedback input. *Id.*, ¶ 83. Xu only describes one feedback loop. Xu does not describe a sense resistor coupled to the output of a current control supply, but a sense resistor coupled to the cathode side of the LEDs. *Id.* As such, none of the references cited by Petitioner discloses or teaches the elements of claim 20.

F. Dependent Claim 23

See discussion in Claim 17B.

G. Dependent Claim 25

See discussion in claims 17B and 23.

VII. GROUND 3 - PETITIONER'S COMBINATION OF LYS, GROOTES, XU, AND BLUM FAIL TO RENDER OBVIOUS DEPENDENT CLAIM 21.

A. Dependent Claim 21 is not Rendered Obvious.

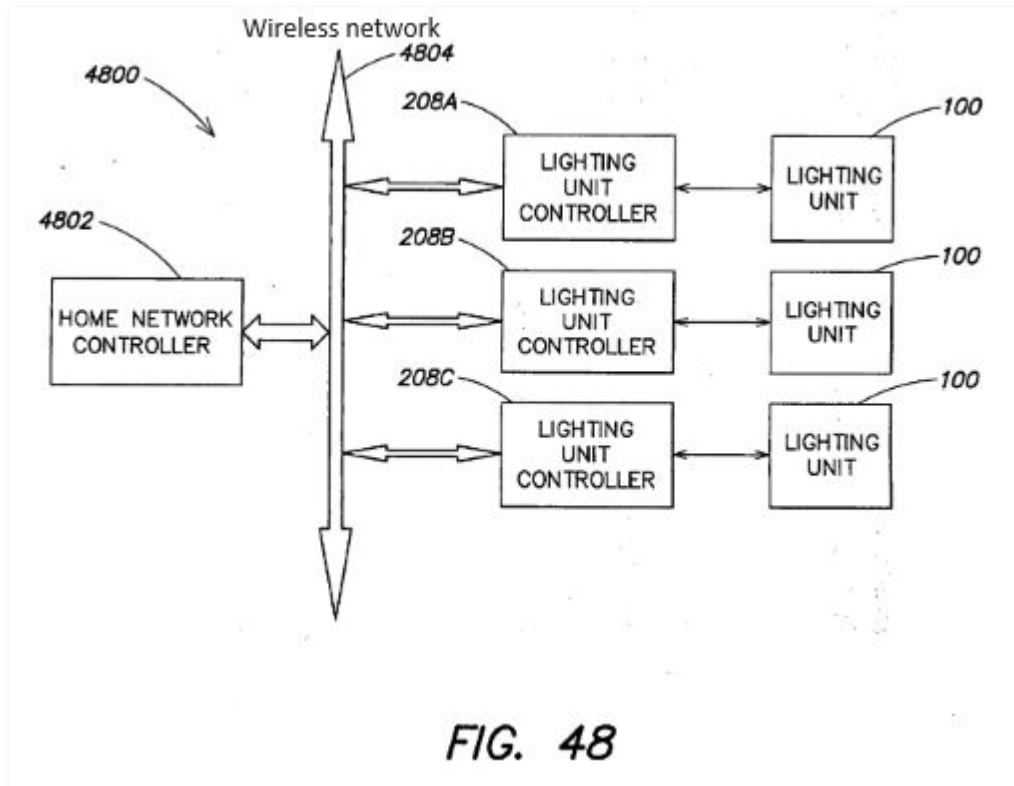
Since Lys and Grootes do not render claim 17 obvious, claims 21 is not rendered obvious.

VIII. GROUND 4 – THE COMBINATION OF MUELLER AND GROOTES IN VIEW OF A POSITA FAILS TO RENDER OBVIOUS CLAIM 17.**A. Motivation to Combine Mueller and Grootes.**

The invention of Mueller is directed towards a completely different purpose than that of the '331 patent and as such employs a number of components that are extraneous to the purpose of the '331 patent. None of these applications are for backlighting an LCD:

Instead, Petitioner makes a series of conclusory statements regarding the combination of Mueller and Grootes. Petitioner claims, “[f]irst each of Mueller and Grootes are in the same field of endeavor, namely setting the voltages and currents for LED strings.” Petition, 45. This statement is a reductive view of the references. Mueller relates to a networked lighting system for lighting displays in a variety of applications (none of which is backlighting an LCD panel). EX2001, ¶ 84. Grootes, on the other hand, relates to LED backlighting for LCD panels. *Id.* As described above the networked lighting elements of Mueller may be in many disparate locations such as “along the ceiling, above the seats or along the aisle to provide a variety of illumination effects” as opposed to within a compact spatial area such as an LCD panel. In fact, Mueller states that the LUCs and lighting units need not be in electrical connection with one another or with the central controller. (“FIG. 48 shows a system 4800 for controlling a plurality of lighting units 100 in a home network. A home network controller 4802 delivers control signals through a network

4804 (which may be a conventional network, a wire, a power line, a wireless network or other data facility). Each lighting unit 100 is responsive to a lighting unit controller 208A, 208B, 208C, 208D to provide illumination changes in response to signals from the home network controller 4802.”) Mueller, ¶ 0271.



The arrangement of components in Mueller is directed towards accomplishing the goal of creating a networked lighting display. EX2001, ¶ 85. The Petition does not explain why a POSITA would look to a compact backlight from an LCD panel to modify a networked lighting system for lighting displays, as the two have no relation. *Id.*...

Second, Petitioner contends that “[m]odifying Mueller to include a current source for each string of LEDs, as disclosed by Grootes would meet” the goal of providing “a pulse current with a constant level to achieve color and brightness uniformity.” However, it would be impractical if not impossible to modify Mueller to include Grootes' independent current source for each string of LEDs. *Id.* ¶, 86. First, the way in which the invention of Mueller is arranged precludes an independent current source. *Id.*, ¶86. Additionally, in Petitioner's arguments in Ground 4 regarding claim element 17B (relating to the current supply circuit of the '331 Patent), Petitioner states that the LUCs of Mueller are analogous to the current supply circuits of the '331 patent. Therefore, a POSITA would need to either modify the LUCs to include a current supply circuit or place the current supply circuit after the LUC and before the lighting unit. *Id.*, ¶86. Either configuration is unworkable, especially given that Mueller states that processor is used to control the lamp's drive electronics. *Id.*, ¶ 86; *See* Mueller, [0156]

Petitioner provides nothing more than conclusory statements but does not offer evidence to support a motivation to combine Grootes with Mueller. The crux of Petitioner's argument is that a POSITA would include a separate current source for each string of LEDs to improve the color and brightness uniformity of the lighting system described in Mueller. Petition, 45, 47. The only evidence offered by Petitioner is that the current supply in Grootes balances the white point between

three colors, which would improve the color and brightness uniformity of Mueller. Petitioner does not describe how the current supply in Grootes addresses the issue of color and brightness uniformity. Both Mueller and Grootes teach the same method of controlling LED brightness by utilizing a PWM control signal to drive a transistor; this method is referred to as on-off control, wherein the transistor is turned on and off according to the duty cycle of the PWM signal which causes the LED to change in perceived brightness. Mueller, ¶ 0158, ¶ 0300, ¶ 0315; Grootes, ¶ 0006, ¶ 0041, ¶ 0042, ¶ 0046, Fig. 2, and Fig. 3. There is no clear motivating factor as to why a POSITA would modify Mueller to include the same circuitry it already describes, as this would not address a deficiency of either reference. Further, there is no design need or market pressure motivating a POSITA to replace the on-off control of Mueller with the on-off control of Grootes. Both references control LED brightness in the same manner, therefore the combination, were it workable, does not improve the functioning of either design. Petitioner relies on hindsight to combine known elements in a way that fit the claims of the '331 Patent, rather than offering factual support for why a POSITA, when confronted with the problem of color and brightness uniformity, would combine them in the manner claimed.

Contrary to Petitioner's assertions, implementing the current sources of Grootes into Mueller would undermine the key inventive feature of Mueller and a POSITA would understand that the negative impact would have outweighed any

motivation to combine. *Polaris*, 882 F.3d at 1061, 1067-69. Mueller explained the key benefits of LED wavelength adjustment over typical stable color control, “[t]he light output from and LED may shift in wavelength as a result [of] changes in current... [which has] been thought to be undesirable for most applications, since a stable light color has previously been preferred to an unstable one... the embodiments of the present invention include... systems for supplying light of different wavelengths by changing the current supplied to the LEDs in a manner that is intended to generate different wavelengths of light... [to] produce improved quality white light.” Muller, ¶¶ 0298-99. As shown in Fig. 69, Mueller describes the use of two PWM signals to control the LED. The first signal, current control mode 6904, adjusts the wavelength of light emitted by the LED, and the second is an on-off control 6908 used to control the output intensity of the LED. Petitioner proposes a combination where two PWM signals (as per Mueller) would comprise the input to current sources 40, 41, and 42 described by Grootes. However, this would obviate the benefit of Mueller (i.e. improved quality of white light via PWM wavelength control signal 6904). Grootes' current source only adjusts the brightness of each string, “[i]n a backlight, the white point is controlled by the balance of the R, G, and B intensities.” (Grootes, ¶ 0042. Thus, the current control mode 6904 illustrated in Fig. 69 would not adjust the current across the LEDs thereby adjusting the wavelength. This combination would abandon the key inventive feature of Mueller.

See *Intel*, 21 F.4th 784 ; see also *Medtronic*, 69 F.4th at 1341. Thus, a POSITA would not be motivated to combine the prior art elements. Petitioner offers no further example or explanation for why a POSITA would modify the current source in Grootes to input two PWM signals or how a POSITA would modify the current source of Grootes so as to maintain the inventive concept of Mueller.

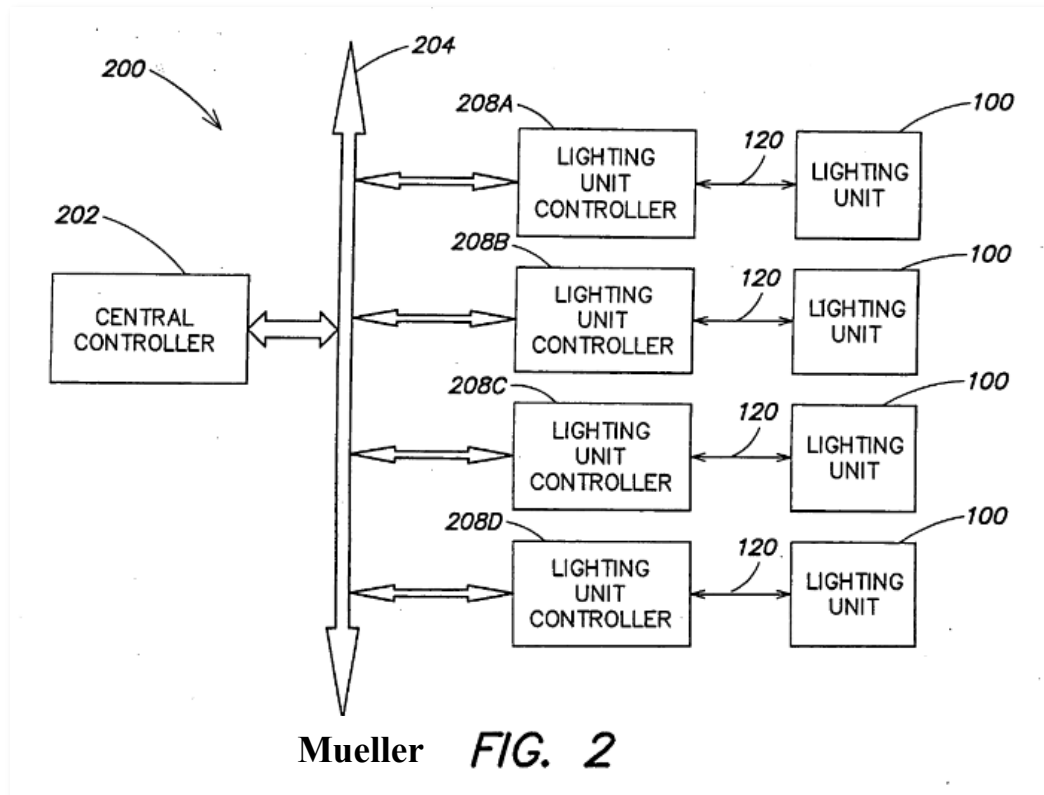
Lastly, Petitioner does not explain how the combination of Grootes and Mueller would yield a predictable solution or result. Petitioner offers no reason why a POSITA would understand that two PWM signals sent to the current sources of Grootes would predictably result in improved color and brightness uniformity. As stated above, the current sources in Grootes accept one PWM signal to adjust LED brightness. Mueller supplies two separate PWM signals, both with different functions, one to adjust brightness via on-off control and a second to adjust the current supplied to the LEDs to adjust LED wavelength. A POSITA would not find that sending two different PWM signals to the cathode side of an LED or to the gate of a transistor offers a predictable solution to the problem of improving color and brightness control in LED systems. *KSR*, 550 U.S. at 421.

Based on at least these facts, this Ground should be rejected.

B. Mueller and Grootes Fail to Disclose [Claim 17B]

Even assuming *arguendo* that Mueller and Grootes could be combined, this element is not taught by the combination. EX2001, ¶ 87

With respect to this element, Petitioner analogizes the lighting unit controllers (LUCs) of Mueller to the current supply circuits configured to supply an on-state drive current of the '331 patent. However, this argument fails and can be easily demonstrated, Figure 2 of Mueller is reproduced below:

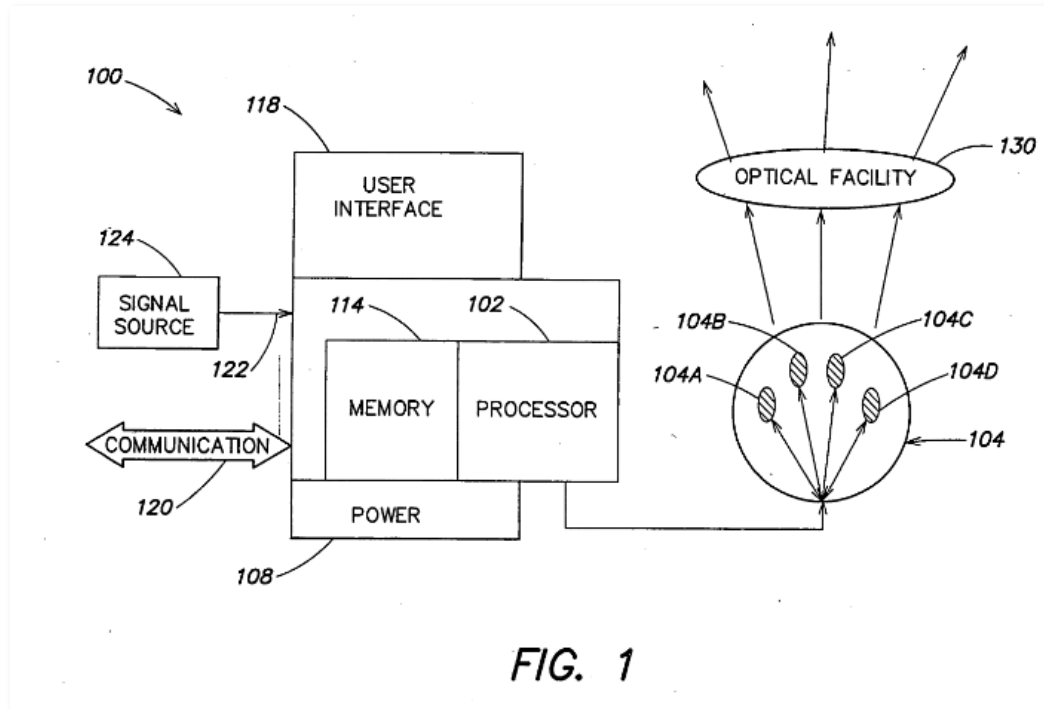


Petitioner, citing Mueller, states that the “LUCs...shown in FIG.2 may be configured to be ‘intelligent’ in that the central controller may be configured to communicate higher level commands to the LUCs that need to be interpreted by the LUCs before lighting control information can be forwarded to the lighting units 100.” Petition at 51. Petitioner then concludes that a “POSITA would recognize that this discloses or at least suggests that each lighting unit includes its own power

supply.” *Id.* However, it is unclear how a POSITA one could draw such an inference from the above information. EX2001, ¶ 88. The referenced section of Mueller in no way states that the LUCs provide power to the lighting units.

Contrary to Petitioner's contention, Mueller does not characterize the LUCs as current supply circuits, rather the LUCs of Mueller are akin to routing nodes in a network that passage information from a central controller to the lighting units. EX2001, ¶89. The “DMX-based communications” referenced above are described as “a lighting command protocol conventionally employed in the lighting industry for some programmable lighting applications.” Mueller ¶,0183; EX2001, ¶89.

The only reference to current control that relates to a discrete element in Mueller is as follows: “[s]dditional examples of a signal source 124 include various metering/detection devices that monitor electrical signals or characteristics (e.g. voltage, current, power, resistance, capacitance, inductance, etc.)” Mueller, ¶0178. However, referenced signal source 124 is not a part of the LUCs of Mueller. EX2001, ¶ 90. Rather, as shown below in figure 1, communication 120, which is the communication from the LUCs to the lighting units, is separate from signal source 124 and signal 122.



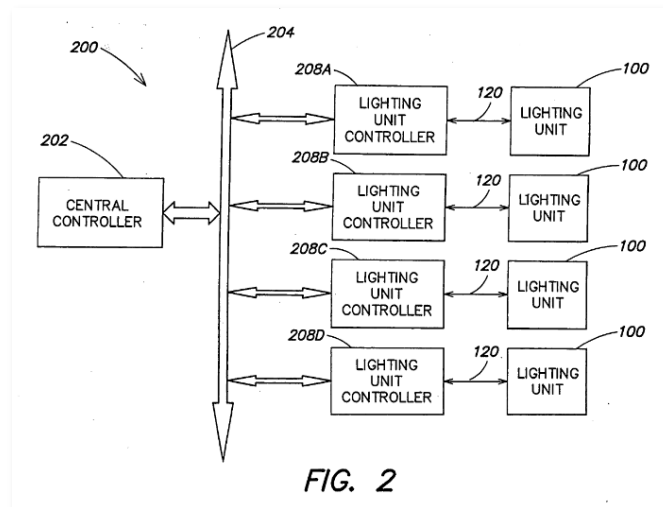
Had Petitioner fully disclosed the specification of Mueller, it would've been apparent that the lighting units of Mueller are not strings of solid state lighting devices. EX2001, ¶ 91. Lighting units 100 referenced in Fig. 2 of Mueller refers to the whole apparatus of Fig. 1. Mueller includes multiple components between the LUCs and the light sources 104 that are not claimed or required by the '331 Patent but Mueller does not disclose or describe a current supply circuit anywhere in the specification. Because LCD display backlight systems are stand-alone systems, unlike the system of Mueller, some of these components from Mueller would be extraneous in an LCD display backlight while others of these components from Mueller would be detrimental to the performance of an LCD backlight. EX2001 ¶ 91.

Returning to Petitioner's assertion that a "POSITA would recognize that this discloses or at least suggests that each lighting unit includes its own power supply," a mere power supply is not the same as a current supply circuit configured to supply an on-state drive current as claimed in the '331 patent. The current supply circuit of the '331 patent is described in col. 2:55-3:31

None of this is present in Mueller. Most importantly, the LUC of Mueller does not provide an on-state drive current. EX2001, ¶ 92. The way in which the LUCs are described in Mueller and depicted in the figures, they cannot provide an on state drive current. *Id.* The LUCs are on the other side of connection 120 from the power supply 108. The invention of Mueller is arranged in a completely different manner than that of the '331 patent and in a way that precludes the LUCs from providing an on-state drive current. *Id.*

Petitioner next argues that "it would have been obvious to modify Mueller to include Grootes' individual current source control for each string to achieve the desired benefit better color and brightness uniformity." Petition at 52. Combining Mueller with Grootes does not overcome the issues described above. EX2001, ¶ 93. Petitioner does not explain at all how Mueller would be combined with Grootes to satisfy this element because such a combination would be impractical, if not impossible. *Id.*, Presumably, Petitioner intended the LUCs to be modified so as to

provide individual current control for each string. However, Petitioner does not state this or explain how this would be achieved. *Id.*,



As shown in Figure 2, the lighting units of Mueller include power sources 108. Thus, placing the current circuit in the LUC would have the on state drive current being transmitted over communication facility 120 which is expressly not an electrical connection but rather a data transmission line (“Thus, the lighting unit 100 can receive data, such as from a network. By allowing connection of the lighting unit 100 to a communications facility 120, the system allows a lighting designer or installer to send data to a plurality of lighting units 100”). Mueller at ¶ 0280; EX2001, ¶94. Further, placing the current supply circuit before the power supply, that is in the LUC, is not workable. EX2001, ¶ 94.

Petitioner has failed to demonstrate that the LUCs of Mueller are operable to “supply an on state drive current to” a first and second string of LEDs. Petitioner

has also failed to demonstrate that the combination of Mueller with Grootes wherein the on state drive current would be delivered *over a communications channel* would be workable. Thus, Petitioner has failed to demonstrate that Mueller and Grootes alone or in combination teaches this element of claim 17.

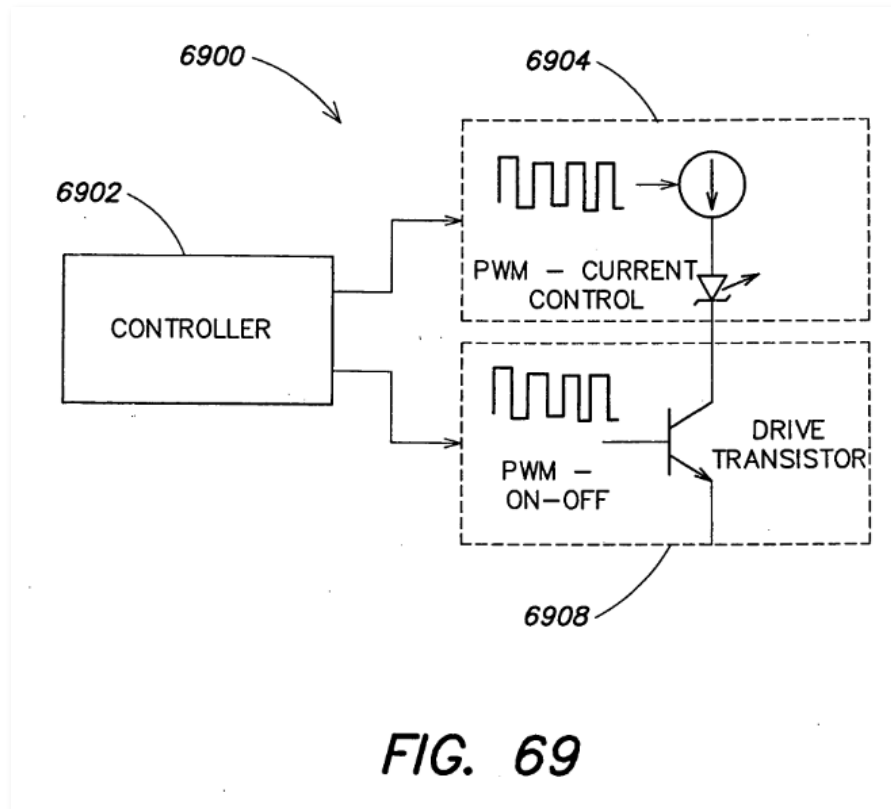
The Board correctly identified that Mueller does not teach that the lighting controllers provide power to the lighting units or that each of Mueller's lighting units includes its own power supply. Paper 7, 30. Therefore, Mueller does not teach current supply circuits as disclosed in the '331 Patent. To make up for this lack of disclosure by Mueller, Petitioner argues that a POSITA would be motivated to modify Mueller with Grootes. However, as discussed above, Petitioner does not offer support as to why a POSITA would find the combination to meet the goal of improved brightness color or brightness uniformity, or how a POSITA would implement Grootes into Mueller.

C. Mueller and Grootes Fail to Disclose [from Claim 17C]

Mueller in combination with Grootes fail to disclose the limitation in 17C. In its arguments, Petitioner relies on Fig. 69 of Mueller. Petitioner, quoting Mueller in part states that “‘the control facility 6902 can switch between a current control mode 6904 (which itself can be controlled by a PWM stream) and a separate PWM mode 6908...Multiple such strings can be used to create a light fixture that can vary in color (HSB) and spectrum based on the current and on-off control.’ This expressly

discloses controlling multiple LED strings, with each LED string receiving two PWM control signals.” Petition, 54 *citing* Mueller, ¶ 0315. Petitioner either grossly misunderstands Fig. 69 of Mueller or is intentionally misrepresenting the reference.

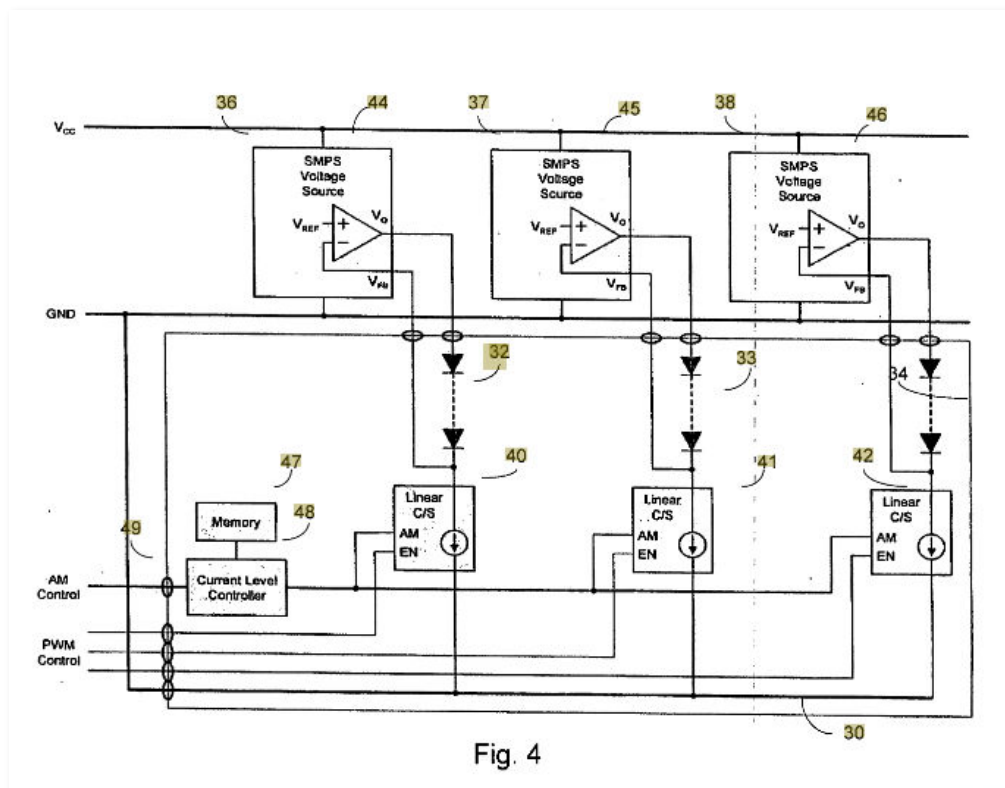
Figure 69 of Mueller is reproduced below.



In Mueller, the control system 6900 functions as a current controller with a modulating PWM controller which can switch between “a current control mode...and a **separate** PWM mode.” Mueller, ¶0315 (emphasis added). Thus, while petitioner states that each LED string receives two PWM control signals, it is really just one signal that may be modulated by the PWM controller. EX2001, ¶ 95. This is not the same as two distinct signals and cannot drive two separate strings of LEDs. *Id.*, ¶ 95.

This is further apparent by examining the diagram of Figure 69. The two blocks are linked, the signal is passed between current controller 6904 and PWM controller 6908. *Id.*, ¶ 95.

Failing this, Petitioner next alleges that a POSITA would combine the PWM arrangement of Mueller with the current sources of Grootes. Petition at 55. Figure 4 of Grootes is reproduced below.



However, inserting a PWM between the cathode of the LED and the linear current supplies of Grootes would introduce a potential fault point in the system. *EX2001Id.* at ¶ 96. In lighting applications such as the ones currently discussed, it would be common to employ a MOSFET PWM. *Id.* at ¶ 96. Employing an output side series

switch as Petitioner would have it would cause an instantaneous high voltage spike across the LED at the time of switch on which would cause damage to the LEDs.

Id.. This is further explained in Brightplus' response to Ground 2.

More importantly, Petitioner's patched up system includes a "current source for each string...controlled by an individual PWM." Petition at 55. Whereas the claim 17 recites "a pulse width modulation (PWM) controller that is coupled to the first current supply circuit and the second current supply circuit." That is, Petitioner's patched up system does not teach a PWM controller coupled to at least two current supply circuits. Rather, Petitioner's system has a PWM controller for each current supply circuit. This is a functionally distinct invention. Petitioner has posited a system that would perform poorly if at all and still does not anticipate the claimed invention.

In summary, Petitioner has failed to demonstrate an effective way to combine the PWM signals of Mueller with the linear current supply of Grootes. Further, Petitioner has failed to demonstrate that the PWM controllers of Mueller generate "a first PWM control signal and a second PWM control signal." Petitioner has failed to demonstrate that the combination of Mueller and Grootes supplies a first and second PWM control signal "to each of the at least first and second strings." Thus, Petitioner has failed to demonstrate that Mueller and Grootes alone or in combination render obvious claim 17.

Grootes does not teach a single PWM controller connected to at least a first and second current supply circuit in order to emit a first and second light as required by Claims 17 (see elements, 17a, 17b, 17c). Grootes explicitly shows that each string comprises either red, green or blue LEDs [0036]. The brightness of each string is controlled by a current source 40-42, where each current supply is connected to separate PWM. As stated by Grootes, "Conventional PWM controllers may be used to output a square wave of the desired frequency and duty cycle. Since the same change in duty cycle may not control the brightness of red, green, and blue LEDs by the same amount, a separate PWM input is usually needed for each color. The change in duty cycle for each color to maintain the white point is determined empirically, and the outputs of the PWM controllers are adjusted accordingly." *Id.* Grootes explains that "FIG. 5 illustrates any of the PWM controllers 50, connected to a PWM control line in FIG. 4, that receive a control signal to vary the duty cycle of an oscillator operating at a fixed frequency." *Id.* at ¶ 0049. Grootes' other embodiments include the use of multiple PWM controllers, therefore the PWM controller in Grootes is not equivalent to the single PWM controller contemplated by the '331 Patent. The use of multiple PWM controllers is directly related to the key inventive concept of Grootes, namely improved LED driving methods in order to have better color and brightness uniformity. While Grootes describes a printed circuit board having separate current supply circuits for each of a string of LEDs, there is no

specific implementation of a single PWM controller coupled to the first and second strings to emit first and second light.

Mueller explicitly describes that each light string would have its own microprocessor, and therefore each string would have its own PWM controller. Mueller only describes one PWM controller generating a signal for one string, not one PWM controller for multiple strings.

Additionally, the combination of Mueller and Grootes would not teach this element. First, as stated above a POSITA would not be motivated to combine the prior art references. Second, the arbitrary introduction of the current supplies from Grootes into Mueller wouldn't make up for the lack of disclosure of a single PWM controller connected to multiple strings. Assuming that each string in Mueller had the current supply of Grootes connected to the Controller 6902, Petitioner does not offer an explanation as to why that combination would disclose a single PWM controller connected to multiple strings. More importantly, since Mueller and Grootes describe an improved method for driving LEDs using a single PWM controller for each string, it is not apparent why a POSITA would look to modify that specific implementation or how that modification would offer a predictable solution to the problem of color/brightness uniformity. Neither Petitioner nor their expert offer any explanation as to why a POSITA would be motivated to modify the

teachings of Mueller and Grootes to use the PWM controller connected to both the first and second current supplies as taught by the '331 Patent.

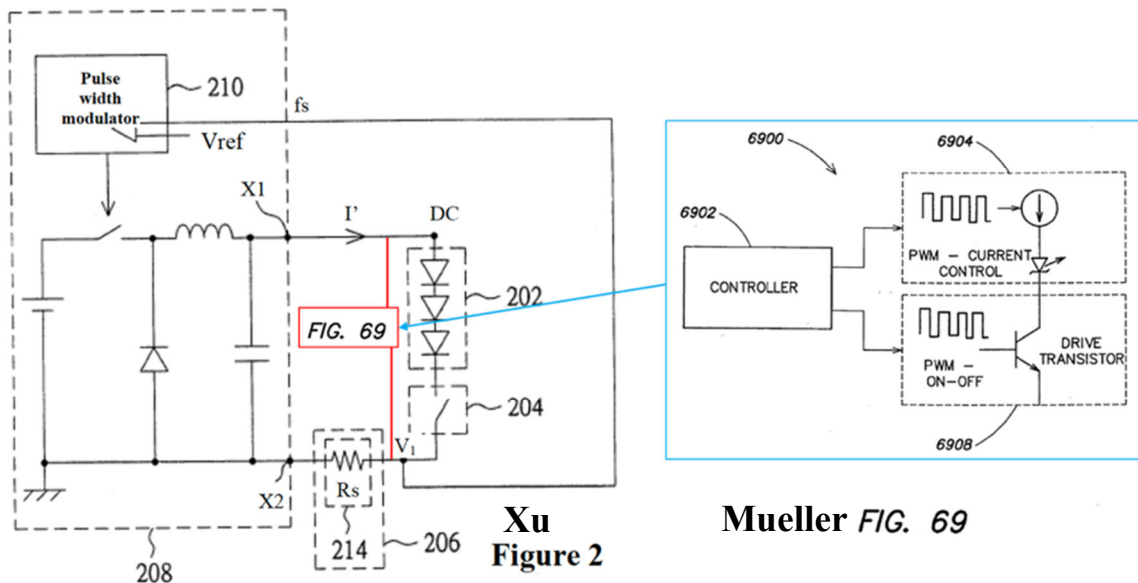
IX. GROUND 5 –MUELLER, GROOTES AND XU IN WOULD NOT RENDER OBVIOUS CLAIMS 18 & 20.

A. There is no Motivation to Combine.

A POSITA would not be motivated to combine Mueller and Xu. As discussed above in Ground 4. In combining with Xu, Petitioner argues that “a primary motivation of one of ordinary skill in the art would have been to provide a turn-on current with a constant level and achieve a constant temperature... modifying the Mueller-Grootes combination to include the constant on current and the current-voltage converter... as disclosed by Xu would meet this goal.” Petition at 57. Petitioner (in Ground 4 – claim 17B above) argued that the LUCs are the current supply circuits. So, based on Petitioner's arguments, the constant on current and current voltage current from Xu would be implemented in the LUCs of Mueller. This combination is inoperable and would not result in an improved lighting system. EX2001,¶97. First, the LUCs don't supply current to the LEDs. Therefore, implementing Xu into the LUCs of Mueller would not do anything to improve the operation or color temperature control of the LEDs. The LUCs of Mueller primarily route information to the lighting unit 100; implementing Xu into the LUC would result in either a degradation of the control information or a system malfunction. *Id.*

Second, the LUCs in Mueller don't operate using feedback controls. The LUCs do not send feedback signals into any feedback input. Implementing the feedback circuit from Xu into the LUCs of Mueller would override Mueller's control method and cause system issues. *Id.* at ¶ EX200198. For the reasons described above a POSITA would not view the Xu – Mueller combination as improvement, but as unnecessary complexity.

Additionally, similar to Ground 2 with respect to Lys, a POSITA would have to add more than simply a sense resistor to implement Xu's version of constant current control in Mueller. *Id.* at ¶ EX2001 99. A POSITA would know that another switch, along with the sense resistor and a feedback loop with a voltage reference and a comparator (partially obscured) as shown in Xu's Fig. 2 are needed to make the combination. *Id.* at ¶ EX2001 99. Alternatively, Fig. 2 of Xu would need to have Mueller's figure 69 inserted as shown below. *Id.* at ¶ EX2001 99. Additionally, some kind of 3-way control logic would need to be developed, all of which would make a POSITA realize the combination is overly burdensome and likely not functional. *Id.* at ¶ EX2001 99.



Annotations added

Additionally, a POSITA would not be motivated to combine Xu and Grootes.

See arguments for Ground 2

B. Claim 18 is Not Rendered Obvious.

As discussed above, Petitioner has failed to demonstrate that the LUCs of Mueller are operable to “supply an on state drive current to” a first and second string of LEDs. See Ground 4. Petitioner has also failed to demonstrate that the combination of Mueller with Grootes wherein the on state drive current would be delivered **over a communications channel** would be workable. Thus, Petitioner has failed to demonstrate that Mueller, Grootes and Xu alone or in combination render obvious this claim.

Petitioner has failed to demonstrate an effective way to combine the PWM signals of Mueller with the linear current supply of Grootes. Further, Petitioner has failed to demonstrate that the PWM controllers of Mueller generate “a first PWM control signal and a second PWM control signal” as claimed in the '331 Patent. Petitioner has failed to demonstrate that the combination of Mueller and Grootes supplies a first and second PWM control signal “to each of the at least first and second strings.”

Petitioner further argues that “Mueller expressly discloses using PWM to supply ‘substantially constant current to the LEDs’ Mueller, [0158]” (IPR, 59). Petitioner equated the LUCs of Mueller to the current supply circuits of the '331. Petitioner did not demonstrate that the LUCs of Muller operate based on PMW. Indeed, the PWM signal is only sent by the controller in Mueller. Further, Mueller does not teach the LUCs to comprise “constant current power supply circuits configured to operate in continuous mode.”

Further, as discussed in Ground 2 – Claim 18, Xu does not disclose “first and second current supply circuits.” Thus, Xu does not teach the elements of claim 18 of the '331.

C. Claim 20 is Not Rendered Obvious.

The feedback sensor and feedback loop in Mueller is only within the lighting unit 100. Mueller states, “the processor 102 is in operative connection to a signal

source 124, so that the processor 102 can receive input from the signal source 124 (and, optionally, operate in a feedback loop with the signal source 124).” Mueller at [0216]. The lighting unit 100 in Mueller is not a current supply circuit.

Claim 20 requires that “each of the first and second current supply circuits comprises a sense resistor coupled to the output terminal... and that is coupled to a feedback input to provide the feedback signal.” Since the lighting unit 102 is not a current supply circuit, Mueller does not teach claim 20 of the '331 Patent.

Petitioner argues that the LUCs in Mueller are equivalent to the current supply circuits. Petition at 60. However, Mueller never teaches or describes a feedback sensor or feedback loop in the LUCs. Indeed, this design is opposite to Mueller's invention, in that the LUCs (Lighting Unit Controllers) are tasked with providing control information to the lighting units. EX2001, 100. The LUCs of Mueller are not coupled to the feedback input in the lighting units. Additionally, Mueller does not disclose a sense resistor couple to the output of the LUCs. Therefore, Mueller does not teach the elements of claim 20.

Regarding Xu, see argument made in Ground 2 and claim 20..

X. GROUND 6

A. No Motivation to Combine.

Claim 21 depends from Claim 20, and since the combination of Mueller, Grootes, Xu does not render claim 20 obvious, the combination of Mueller, Grootes,

Xu and Blum do not render claim 21 obvious. Furthermore, claim 20 depends from of claim 17, and since the combination of Mueller and Grootes does not render claim 17 obvious, claims 20 and 21 are not rendered obvious by a combination that is in view of Mueller and Grootes.

XI. CONCLUSION

The Board should exercise its discretion to deny the petition on each of Grounds 1 thru 6 for the reasons above.

Respectfully submitted,

/Hao Ni/
Hao Ni
Counsel for Petitioner

CERTIFICATE OF COMPLIANCE

Per 37 C.F.R. §42.24(a) and (d), the undersigned hereby certifies that the Petition complies with the type-volume limitation of 37 C.F.R. §42.24(a)(i) because, exclusive of exempted portions, it contains 13911 words as counted by the word-processing program used to prepare it.

Dated: June 12, 2024,

Respectfully submitted,

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that the above-captioned Mandatory Notice was served on counsel of record for the Petitioner by filing this document through the Patent Review Processing System as well as by delivering a copy via electronic mail to:

MFerrario@kilpatricktownsend.com (Lead Counsel)
MMorlock@kilpatricktownsend.com (Back-Up Counsel)

Dated: June 12, 2024

/s/ Hao Ni
Hao Ni (Reg. No. 53,858)