

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Hisense USA Corporation

Petitioner

v.

Brightplus Ventures LLC

Patent Owner

Case IPR2023-01412

U.S. Patent No. 8,330,710

PATENT OWNER'S RESPONSE

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Exhibit List

Exhibit	Description
2003	Declaration of William K. Bohannon (“Bohannon Decl.”)
2004	Curriculum vitae of William K. Bohannon

* * * *

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 pre-AIA versions applicable to the '710 Patent.

I. INTRODUCTION

Brightplus Ventures LLC (“Patent Owner” or “Brightplus”) submits this Response showing that each of the 6 grounds set forth by Hisense USA Corporation (“Petitioner” or “Hisense”) fails to render obvious challenged claims 1-2, 5, 11-13, 16-17, and 47-48. of U.S. Patent No. 8,330,710 (“the ‘710 Patent” or “EX2001”).

As to Ground 1, a number of elements of claims 1-2, 5, 12 and 16-17 are not disclosed by Shteynberg, Arai or Zhang, and the missing elements would not be obvious to a POSITA. Further, a POSITA would not be motivated to combine the references.

As to Ground 2, a POSITA would not be motivated to combine Shteynberg, Arai, Zhang and Kobori.

As to Ground 3, a number of elements of claims 47 and 48 are not disclosed by Shteynberg, Arai or Lee and the missing elements would not be obvious to a POSITA. Further, a POSITA would not be motivated to combine the references.

As to Ground 4, a number of elements of claims 1-2, 5, 12 and 16-17 are not disclosed by Shteynberg, Arai and Kewabata and the missing elements would not be obvious to a POSITA. Further, a POSITA would not be motivated to combine the references.

As to Ground 5, a POSITA would not be motivated to combine Shteynberg, Arai, Kewabata and Kobori.

As to Ground 6, a number of elements of claim 13 are not disclosed by Shteynberg, Arai, Kewabata and Lee and the missing elements would not be obvious to a POSITA. Further, a POSITA would not be motivated to combine the references.

Accordingly, Patent Owner respectfully requests that the Board deny the petition for *inter partes* review of claims 1-2, 5, 11-13, 16-17, and 47-48 of the '710 Patent on the merits.

II. THE '710 PATENT DISCLOSES AN IMPROVEMENT TO THE CONTROL OF LED STRINGS.

The '710 Patent was filed on October 11, 2011, and claims priority to U.S. Patent Application No. 11/745,713, which was filed on May 8, 2007. The '710 Patent discloses an improved solid state lighting panel. One embodiment of the '710 Patent is directed to a system including a controller that provides controls signals and a sequence generator that generates a firing sequence for firing multiple strings of solid-state lighting devices.

The '710 Patent explicitly addresses deficiencies in the prior art. For example, it states "Sequentially firing the strings independently and/or in combinations without regards to the relative string location with the display, however, can produce undesirable display characteristics" (EX1001 2:20-24). The firing logic described in the '710 Patent allows for improved control of the LED strings. (*Id.* at 2: 27-58)

The '710 Patent teaches additional embodiments which improve upon then current control methods to the LED strings. By way of example, it states, "A control

system 800 selectively provides control signals to a current driver 808 or other type of electrical power supply circuit that responsively drives multiple solid state lighting devices in a solid-state lighting panel 801. The control system 800 can include firing logic 802 that can determine a firing logic 802 that can determine a firing order for the multiple strings. A firing order may determine an order in which individual strings of solid-state lighting devices and/or groups of strings of solid state lighting state devices are supplied current.” (*Id.* at 10:22-33) Further, “Such methods can include supplying pulsed drive currents to the strings in non-spatially sequential firing order.” (*Id.* at 3: 38-40).

III. EXPERT TESTIMONY, LEVEL OF SKILL IN THE ART, AND CLAIM CONSTRUCTION

A. Declaration Evidence

This Preliminary Response is supported by the declaration of William K. Bohannon, an expert with long-standing experience in the industry. (EX2003) Mr. Bohannon has (30) years of commercial industrial electronics experience including experience in the areas of LCD, Plasma, CRT and Large Screen Display Equipment: LCD manufacturing, substrates, drivers, and other related components for rear screen displays including avionics and cockpit displays. (EX2003 at 7-16)

B. Person of Ordinary Skill in the Art

On or before May 8, 2007, a POSITA relating to the technology of the ‘710 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 Ph.D 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. (EX2003 at 32-35)

C. Claim Construction

i. “plurality of on-state drive currents” – Claim 1

This term should be construed as “at least two different on-state drive currents.” The '710 Patent specification teaches that each current is selectively controlled so that the brightness of each string can be independently controlled:

“by selectively controlling the amount and/or duty cycle of current supplied to each string, the color hue and/or brightness of the light emitted by the bar can be controlled. The strings **404A-C** can be controlled independent of one another or as a group corresponding to the bar **402**. Although discussed with reference to solid state lighting devices configured to emit light having different dominant wavelengths, the systems and methods herein may also be utilized in systems using solid state lighting devices configured to emit light in a single dominant wavelength. Furthermore, systems, etc., may use solid state LED's including phosphors that, when energized, emit light having multiple wavelengths and/or that otherwise emit broad spectrum light. such as, for example, a phosphor coated blue LED.”

'710 Patent, 9:33-47.

For each of the plurality of on-state drive currents to be “selectively controlled” as described in ’710 Patent, the currents must be different to allow for “controlling the amount and/or duty cycle of current supplied to each string.”

ii. “display [performance]” – Claim 12

In the Institution Decision, the Board stated, “on this record, we view ‘display performance information’ as relating to a ‘lighting system,’ which includes “strings of solid state lighting devices,” and their performance. To the extent that Patent Owner believes that ‘display performance information’ should be construed to connote having an LCD display and that the information is related thereto, Patent Owner should provide de-tailed factual and legal support for such during trial, in accordance with our Rules.” (Institution Decision at pg. 26) (internal citations omitted).

As such, Patent Owner directs the board to the specification of the ’710 Patent which supports the construction that “display performance” is directed to an “LCD display.” The only figures in the ’710 Patent which discloses a display specifically discloses an LCD panel utilizing an LCD controller. *See* ’710 patent, Figs. 14-15. The ’710 Patent makes no references that its invention is operable with any displays other than LCD displays. *See Id.*, 12:37-50; 15:22-33. Indeed, the ’710 Patent is specifically entitled “Systems and Methods for Controlling a ***Solid State Lighting***

Panel.” (emphasis added). The invention would not operate with any non LCD or solid state based displays.

IV. PRIOR ART CITED BY PETITIONER.

A. Shteynberg

Shteynberg is a publication of a U.S. Patent Application filed on November 21, 2006, and published on May 22, 2008. Shteynberg is related to converters and regulators used for driving and controlling arrays of light emitting diodes (EX1007 at 0001). Further, Shteynberg states that “An exemplary apparatus comprises a power converter which generates a current which generates a current, a first multiplexer, and a controller.” (*Id.* at Abstract)

Shteynberg states that the power converter 120 is operable “to deliver a controller current level to a load.” (*Id.* at 0048) Further, the power converter 120 provides an average current I_c to all the strings. (*Id.* at 0055) “[The] average current I_c provided by the current source (in this case, power converter 120) is equal to $I_c = \sum_{i=1}^{i=n} I_{ci}$. With a period of time “ T_c ” to provide current (energize) all of the LED channels (all of the series of LEDs 110 1, 110 2, 110 3, through 110 N), then the time of energizing each channel (series of LEDs 110) will be $T_{Qi} = I_{ci} T_c / I_c$.” (*Id.* at 0055 and 0056). The multiplexer is a time duration switch, “each series of LEDs... will be provided with a selected... current level, through

control (by controller 125) of the switching state of each channel (via multiplexer 150), for a selected time period (or duration).” (*Id.* at 0054)

Shteynberg further discloses that “The controller 125 may receive input from a wide variety of sources, including open or closed-loop feedback of various signals and measurements from within the LED array driver circuit 100, as discussed in greater detail below. Not separately illustrated, the controller 125 may be coupled within a larger system, such as a computer-controlled lighting system in a building, and may interface with other computing elements using a wide variety of data transmission protocols, such as DMX 512, DALI, IC squared, etc.” (*Id.* at 0049)

B. Arai

Arai is a publication of a U.S. Patent Application filed on April 12, 2004, and published on May 31, 2007. Arai is directed to a backlight device using light emitting units in which a large number of light emitting diodes are mounted, which comprises a reflection plate comprising different surface reflection plates. (EX1008 at Abstract) Arai discloses benefits over prior art systems, stating “On the other hand, in the area litconfiguration backlight units, in place of the above-described cold cathode florescent lamp, attention is drawn to backlight of the Light Emitting Diode (hereinafter referred to as LED as occasion may demand) area light type in which a large number of red, green and blue LEDs of light three primary colors are two-dimensionally arranged in the state positioned at the rear face side of the diffusion

film to obtain white light. Such LED backlight unit permits reduction of cost with realization of reduction of cost of LED, and permits display of high luminance on large-sized liquid crystal panel by low power consumption. (*Id.* at 0006)

C. Zhang

Zhang is a publication of a Chinese Patent Application filed on September 17, 2004, and published on March 22, 2006. Zhang discloses a method of changing the light emission sequence of backlight modules to improve the phenomenon of uneven brightness of the picture. (EX1010 at 1:6-9) Zhang primarily pertains to CCFL backlight modules “in order to save power consumed by the liquid crystal display, all backlight modules will not be illuminated at the same time... so as to achieve the purpose of clearly displaying and saving power... while several (*Fluorescent*) **lamps** in the upper half are illuminated, several (*Fluorescent*) **lamps** in the lower half of the screen are turned off.” (*Id.* at 1:39 – 2:1) (*Term Added for Emphasis*)

Zhang further discloses turning on one backlight module at a time, stating “The display screen is showed in the order in 15 which the backlight modules are illuminated, such as: Step S11 is to illuminate the first backlight module 11; Step S12 is to illuminate the second backlight module 12 and turn off the first backlight module [12]; Step S13 is to illuminate the third backlight module 13 and turn off the second backlight module 12... When the display screen 1 is not turned off, take steps S11 through S16 as a continuous cycle for lighting.” (*Id.* at 5:16-23)

D. Kawabata

Kawabata is a publication of a U.S. Patent Application filed on July 17, 2004, and published on January 23, 2003. Kawabata discloses a lighting unit that includes a reflector, a plurality of light emitting elements and a controller. (EX1012 at Abstract) Kawabata discloses lighting units that are cold cathode tubes, “A cold-cathode tube may be used as the light-emitting element 2.” (*Id.* at 0060) “A cold-cathode tube is used as each of the light-emitting elements 2.” (*Id.* at 0062) “For example, each of the light-emitting elements (or cold-cathode tubes) 2.” (*Id.* at 0070)

E. Lee

Lee is a publication of a U.S. Patent Application filed on July 13, 2006, and published on January 18, 2007. Lee discloses a surface light source using LEDs. (EX1013 at Abstract) The surface light source includes a plurality of red, green, and blue LEDs arranged on each divided region, and a plurality of LED driving units each having red, green, and blue LED driving circuits for respectively driving the red, green and blue LEDs (*Id.*). Lee further describes a method to prevent driving excessive current, “interconnecting the proper number of LEDs, which can be driven by a proper voltage, in series and by interconnecting the proper number of series connections, that can be driven by a proper current, in parallel.” (*Id.* at 0050)

F. Koberi

Koberi is a publication of a U.S. Patent Application filed on August 24, 2005, and published on June 29, 2006. Koberi discloses a drive circuit of light emission device arrays each having at least one light emission device. (EX1011 at Abstract) In the invention of Koberi “when at least one light emission device array driven with a different phase is OFF, a processing circuit acquires the luminiferous level of each of the other light emission device arrays by using the at least one light emission device array which is OFF as a light reception device. Furthermore, a control circuit controls the drive level of the drive circuit for the light emission device arrays which are ON. (*Id.*) One embodiment of Koberi teaches “light emission driving of the LED is explained referring to the case of pulse driver for intermittently driving the LED.” (*Id.* at 0025)

V. GROUND 1 – CLAIMS 1-2, 5, 12 AND 16-17 ARE NOT RENDERED OBVIOUS OVER THE COMBINATION OF SHTEYNBERG, ARAI AND ZHANG IN VIEW OF THE KNOWLEDGE OF A POSITA**A. A POSITA would not be motivated to combine Shteynberg, Arai and Zhang**

Petitioner states that a “POSITA would be motivated to modify the display system in Shteynberg to introduce the non-spatially-sequential firing order described in Zhang and the LED string arrangement described in Arai... Shteynberg, Arai, and Zhang are in the same field of endeavor, i.e. achieving the emission of light perceived as white light.” (Petition at 23) However, while Shteynberg describes

blending the emissions of red, green and blue LEDs to achieve light that is perceived by a viewer as “white” neither Arai nor Zhang describe that process. The word “white” in Arai appears only in reference to the liquid crystal display panel:

...the deflection film and the phase difference film allow the waveform characteristic to be non-colored and to be changed into white to perform realization of full color by the color filters to perform color display of receive image, etc. (EX1008 at 0026)

The word “white” does not appear at all in Zhang. Thus, it is not clear at all that Shteynberg, Arai and Zhang are “in the same field of endeavor” as Petitioner would have it. (EX2003 at 51)

Second, Shteynberg relates to providing ambient lighting for a building and the like, not providing backlighting for an LCD panel as in Arai or Zhang. Petitioner does not substantiate how such a system would be adapted to a backlight for an LCD panel as the power, switching and output demands for the two applications are very different. (*Id.* at 52)

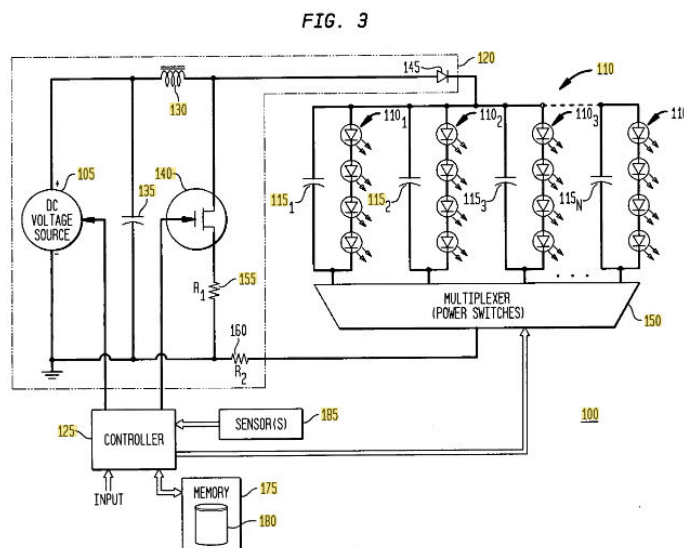
Third, Petitioner states “a primary motivation of one of ordinary skill in the art would have been to improve brightness uniformity, as described in Zhang, and to achieve high luminance of large-size display, as described in Arai.” (Petition at 24). However, Arai already discloses a method of brightness uniformity, namely “corner reflection plates... in which the bottom surface reflection plate (16a) and the side surface reflection plates (16b) to (16e) ... serves to permit rays of light incident onto a display panel (1) to be **uniform to realize uniformity of brightness of the**

entire surface thereof.” (EX1008 at Abstract). Arai intends for all the backlights to be illuminated, which allows the optical layers to distribute light uniformly. Thus, it is not apparent how Zhang would improve the brightness uniformity when combined with Arai. Indeed, Arai's invention would lose uniformity if the LED strings were cycled on and off as described in Zhang, since the optical layers in Arai would become unevenly distributed and the resulting image would be non-uniform. (*Id.* at 53) Zhang would not be a suitable option for combination with Arai as the combination would lead to an unevenly distributed optical layers.

Further, while Zhang doesn't explicitly describe the type of backlight module, it can be understood that Zhang is focused on CCFL Lamps. Zhang states “in order to save power consumed by the liquid crystal display, all backlight modules will not be illuminated at the same time... so as to achieve the purpose of clearly displaying and saving power... while several (*Fluorescent*) **lamps** in the upper half are illuminated, several (*Fluorescent*) **lamps** in the lower half of the screen are turned off” (EX1009 at 1:39–2:1) (*Term Added for Emphasis*). A POSITA would understand that LEDs consume low amounts of power and therefore that the backlight modules in Zhang comprise CCFL Lamps. (EX2003 at 54) Arai explicitly states the problem with CCFL backlighting and offers LEDs as an improved invention. (EX1008 at 0004-0006) Arai is also unsuitable for combination with

Zhang as they pertain to completely different types of lighting systems. Therefore, a POSITA would not combine Arai and Zhang.

Fourth, Petitioner also proposes modifying Shteynberg “to include non-spatially firing order disclosed by Zhang” to meet the goal of brightness uniformity and high luminance on large-sized display. (Petition at 24) Petitioner does not state how this would be accomplished. However, in examining the preferred embodiments of Shteynberg and Zheng, such a combination would not be functional. (EX2003 at 55) First, figure 3 of Shteynberg, disclosed below, is “a circuit and block diagram illustrating a first exemplary LED array driver circuit” (EX1007 at 0030); second, as stated above, Zhang is directed to a CCFL backlight module. This is further demonstrated by the tube structures present in Fig. 1A of Zhang.



EX1007, Figure 3

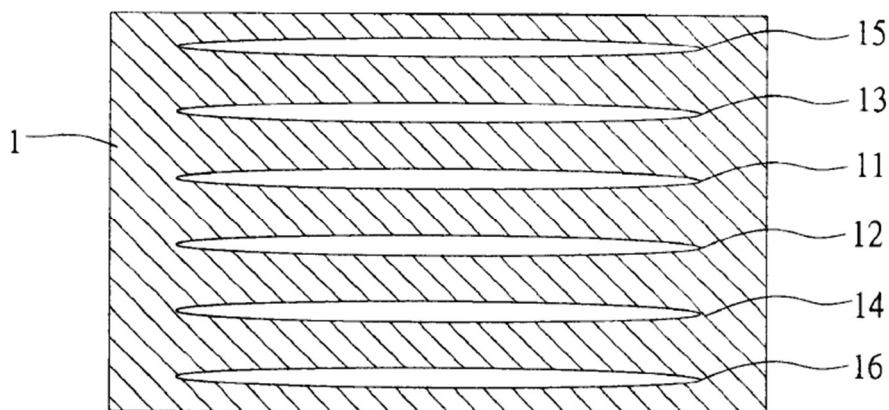


Figure 1A
EX1010, Fig. 1A

This presents several issues for Petitioner's argued motivation to combine Zhang with Shteynberg. First, unlike LEDs, cold cathode tubes require high AC voltages; therefore, they require an inverter. (*Id.*) There is no inverter in Shteynberg's disclosure, nor is it expected that an inverter would function with Shteynberg's multiplexer. (*Id.*) Second, at the time of the invention of the '710 patent, the technology for adapting LEDs to CCFL systems had not yet been invented. (*Id.*) Zhang would, therefore, not be suitable for combination with Shteynberg in the eyes of a POSITA. Thus, given the gap in technology, a POSITA would not look to a completely different and largely incompatible system of backlighting an LCD panel to combine with an LED based system. (*Id.*)

B. The combination of Shteynberg and Arai Fails to Disclose or Render Obvious Claim 1A: "A plurality of strings of solid state lighting devices... positioned at intervals in at least one second direction"

Claim 1 recites:

1. A lighting system, comprising: a plurality of strings of solid state lighting devices arranged in a first direction and positioned at intervals in at least one second direction; a current Supply circuit configured to selectively supply a plurality of on-state drive currents to the plurality of strings responsive to a plurality of control signals; and a control system configured to receive a user input and to Selectively provide control signals to the current Supply circuit responsive to the user input to selectively drive the plurality of strings, the control system further including firing logic configured to determine a firing order of the plurality of strings. (EX1001, Claim 1)

Petitioner states that “Shteynberg discloses an array of LEDs 110 arranged in the manner recited in claim 1A and Arai discloses a two-dimensional LED arrangement...Shteynberg discusses [that] the lighting system includes a parallel array of LEDs 110, which includes a plurality of series-connected LEDs, and these independent series or strings (or channels) of LEDs are illustrated as “N” individual series of LEDs...Since the LEDs are organized in an ‘array,’ the LEDs are organized in columns (each column corresponding to one LED string) and rows (multiple LED strings are distributed to form a row i.e. positioned at intervals).” (Petition at 25, 26)

Shtenyberg does not disclose the physical orientation of the LED strings. Indeed, Shtenyberg is explicit that Fig. 3 is a circuit/block diagram (EX1007 at 0030)

and 0043). A circuit/block diagram is not an exact physical representation of the device it is representing (EX2003 at 56). It would not be obvious to a POSITA how to orient and design a lighting panel simply based on the diagram in Fig. 3. (*Id.*) Shteynberg's disclosure is directed towards providing ambient lighting such as for a building not a backlight for an LCD panel: "Arrays of light emitting diodes ("LEDs") are utilized for a wide variety of applications, including for ambient lighting" and "the controller 125 may be coupled within a larger system, such as a computer-controlled lighting system in a building." (EX1007 at 0002 and 0049) Thus, while Petitioner would argue that a circuit block diagram is representative of the realized design of a system employing the disclosure of Shteynberg, Shteynberg does not disclose the specific arrangement of the strings of LEDs relative to one another. Rather, when deploying ambient lighting, a designer would take into account a number of factors such as the shape of rooms, the height of ceilings, the color of the walls, ceiling and floors, the use of the space etc. which would not be part of the decision for designing a backlighting unit for an LCD panel. (EX2003 at 57)

Petitioner relies on Figure 5 of Arai to backstop its flawed case that the combination of Shteynberg and Arai renders obvious the arrangement of strings of LEDs per claim 1 of the '710 patent. Petitioner states that "Arai discloses a backlight

unit 3 of a transmission type liquid crystal panel display 1, having LEDs 12 that are two-dimensionally arranged.” (Petition at 26 referencing EX1008 at 0006 and 0024)

Arai does not describe the lighting strings being positioned at “intervals” in a second direction. Arai only discloses that “LEDs of light three primary colors are two-dimensionally arranged in the state positioned at the rear face side of the diffusion film.” (EX1008 at 0006). Petitioner incorrectly assumes that Fig. 5 displays LED strings being positioned at intervals, nowhere does Arai disclose such an implementation. Further, Petitioner mischaracterizes Arai by stating “Arai explains that such a two-dimensional arrangement could permit ‘display of high luminance on large-sized liquid crystal panel by lower power consumption.’” (EX1007 at 0006) Petitioner is attempting to draw the inference that the two dimensional arrangement plays a part in maintaining high luminance in the display. This is incorrect, Arai is comparing the benefits of LEDs over CCFL as backlighting units:

On the other hand, in the area litconfiguration backlight units, **in place of the above-described cold cathode florescent lamp**, attention is drawn to backlight of the Light Emitting Diode (hereinafter referred to as LED as occasion may demand) area light type in which a large number of red, green and blue **LEDs of light three primary colors are two-dimensionally arranged in the state positioned at the rear face side of the diffusion film to obtain white light**. Such LED backlight unit permits reduction of cost with realization of reduction of cost of LED, and permits display of high luminance on large-sized liquid crystal panel by low power consumption. (EX1008 at 0006) (emphasis added)

Arai contemplates the use of LEDs to allow for lower power consumption.

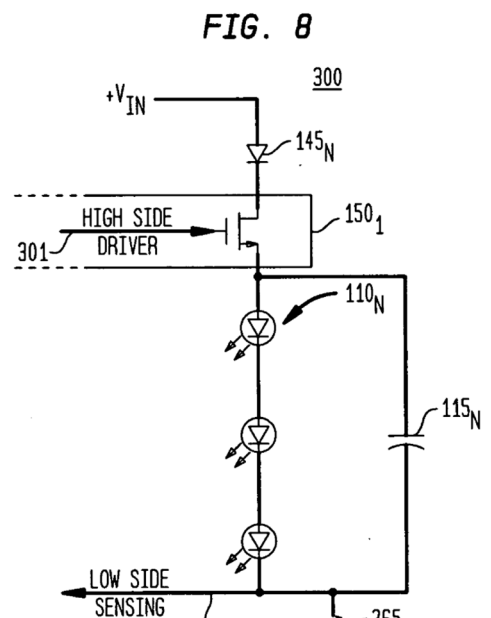
(EX2003 at 58)

**C. Shtenyberg fails to disclose or Render Obvious Claim 1B:
“current supply circuit configured to selectively supply a
plurality of on-state drive currents to the plurality of
strings responsive to a control signals.”**

The ‘710 Patent teaches that “to selectively drive the plurality of strings” corresponds to supplying a plurality of on-state drive currents to the plurality of strings. Furthermore, as discussed above in III(C)(i), plurality of on-state drive currents must be different on-state drive currents.

As described in element B of Claim 1, the system in Shteynberg, namely the controller 125, power converter 120, and multiplexer 150 does not “selectively drive the plurality of strings” as described in the ‘710 Patent. For example, the power converter 120 only supplies one current to all the LED strings. Further, the multiplexer 150 doesn’t “drive” the strings but allows current to flow through the strings for a certain amount of time. (EX2003 at 59-62). To clarify, the multiplexer 150 is best described as a switch, which activates each string for a selected duration. (*Id.*) The power converter of Shteynberg supplies an averaged current (as opposed to an individually determined current for each string) to the LEDs based on the required energizing time provided by the controller. Thus, the power converter supplies a single current to all of the LED strings. (*Id.*) In Arai, the multiplexer and controller only act as time duration switches, that either turn an LED string on

or off. (*Id.*) Unlike the '710 Patent and claim 1B which uses *different* on-state drive currents, Shteynberg does not provide “a plurality of on state drive currents to [a] plurality of strings” as per the '710 Patent, rather Shteynberg discloses providing the *same* drive current (110_N in Shteynberg) to any or all of its strings. (*Id.*)



Shteynberg FIG. 8

D. Shteynberg fails to disclose or render obvious Claim 1C: a “control system configured to receive a user input and to selectively provide control signals to the current supply circuit responsive to the user input to selectively drive the plurality of strings.”

Petitioner is overstating the disclosure of Shteynberg by claiming that the input shown in Fig. 3 is equal to the user input described by the '710 Patent. (EX2003 at 63-64) As shown in Fig. 1 of the '710 Patent “User Input” is directly

connected to the controller. Further, user input is best understood as input from a user.

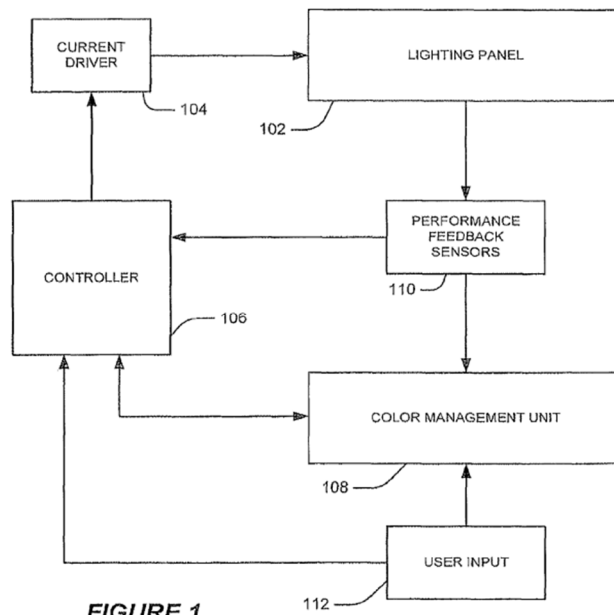


FIGURE 1

Petitioner states that “Shteynberg discloses these elements because the controller 125...receives **input coming from a larger system, which includes user input**, and selectively provides control signals to the power converter 120 and the multiplexer 150 to individually and selectively drive the LED strings.” (Petition at 29) (emphasis added) Petitioner substantiates this claim, i.e. that this “larger system” may include user input, by quoting Shteynberg stating that the “controller may ‘be coupled within a larger system, such as a computer-controlled lighting system in a building, and may interface with other computing elements...Therefore, Shteynberg describes a variety of sources where the input for the controller 125 comes from...and, a POSITA would understand that user input could be one

example of input coming from a larger system.” (Petition at 30) First, it is important to note again that Shteynberg relates to providing ambient lighting for a building, not backlighting an LCD panel. Second, the section from Shteynberg which Petitioner references is reproduced in its entirety below:

The controller 125 may receive input from a wide variety of sources, including open or closed-loop feedback of various signals and measurements from within the LED array driver circuit 100, as discussed in greater detail below. Not separately illustrated, the controller 125 may be coupled within a larger system, such as a computer-controlled lighting system in a building, and may interface with other computing elements using a wide variety of data transmission protocols, such as DMX 512, DALI, IC squared, etc.

(EX1007 at 0049)

This is the only reference to the “larger system” that forms the basis of Petitioner’s assertion that Shteynberg includes “user input” as per the ‘710 patent. The system disclosed in Shteynberg receives input from “open or closed-loop feedback of various signals and measurements,” these signals may be transmitted over “a wide variety of data transmission protocols.” (*Id.*) However, nothing in this limited disclosure describes *user* input or feedback. Shteynberg, being a system for providing lighting to a building, does not include reference to a user controlled switch or a system that tracked occupancy in a room. In fact, Shteynberg relates a list of sensors which “may be sensors for: electrical (output voltage, string current), optical (brightness, wavelengths emission, color temperature, chromaticity, radiant power, luminous power in), thermal (junction temperature, ambient temperature),

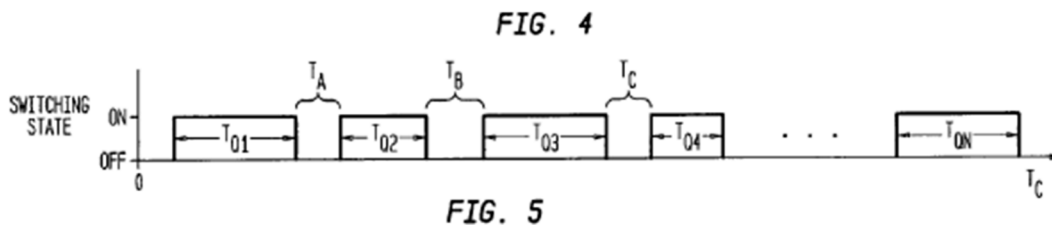
environmental (ambient lighting), mechanical (displacement, angular, strain, velocity, acceleration), magnetic, hall sensors [NOTE: a hall sensor detects the presence of a magnetic field].” (EX1007 at 0079) What Shteynberg does not propose in any of its rather long disclosure on the topic of sensors is a sensor that interacts *with a user*. Thus, Shteynberg does not disclose user input as per the ‘710 patent as being an element of the control system of the current supply circuit. (EX2003 at 63-64)

In the Institution Decision, the Board stated it agreed find persuasive for institution Mr. Betancourt’s testimony that one of ordinary skill in the art would have understood that “user input is one possible input coming from a larger system.” Institution Decision at 17 citing Ex. 1005 ¶ 65. Patent Owner respectfully disagrees. The “input” described in Shteynberg is described primarily as measurements within the “LED array driver circuit.” Shteynberg [0049], and “potentially the larger lighting system environment” *Id.* [0079]. However, Petitioner does not explain how or why a POSITA would understand the disclosures made in Shteynberg equate to a “user input,” as all the sensors are components of Shteynberg are devoid of any actual user input. In Shteynberg, the sensors measure and send signals related to the panel and not the environment, there is no mention of “user input” used in lieu of or in tandem with the sensor input. Petitioner relies on Shteynberg’s statement of a “wide variety of source” to suggest that Shteynberg’s can encompass

user input without any actual evidence. *See* Petition at 12, 30. This is insufficient to disclose “user element” of 1C.

**E. Shteynberg and Zhang fail to disclose or render obvious
Claim 1D: “control system further including firing logic
configured to determine a firing order of the plurality of
strings.”**

As discussed above regarding element B of Claim 1, the multiplexer of Shteynberg does not supply current, nor does the multiplexer determine the current level as Petitioner argues. Shteynberg uses the switching period to determine the current through each string (See discussion of element B of claim 1 above). Shown in Fig. 4 of Shteynberg, the multiplexer either turns on or off each LED string, for a time period T_{qn} . The length of this on/off cycle is a function of the current supplied to the multiplexer as described above, not of firing logic interpreted by the controller. (EX2003 at 65-67) Thus, there are not a plurality of currents being supplied to strings. (*Id.*) These energizing time periods are not equivalent to the firing logic as described in the ‘710 Patent.

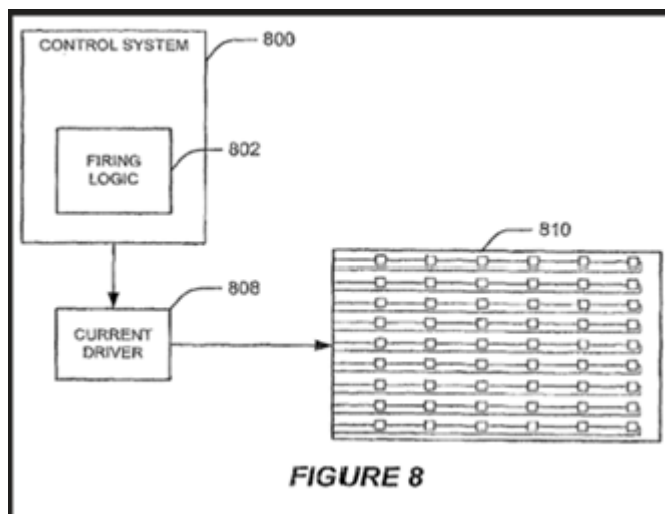


The ‘710 Patent describes firing logic as follows:

A control system 800 selectively provides control signals to a current driver 808 or other type of electrical power supply circuit that

responsively drives multiple solid state lighting devices in a solid state lighting panel 801. The control system 800 can include firing logic 802 that can determine a firing logic 802 that can determine a firing order for the multiple strings. A firing order may determine an order in which individual strings of solid state lighting devices and/or groups of strings of solid state lighting state devices are supplied current. (EX1001 at 10:22-33).

Further, Fig. 8 of the '710 Patent illustrates that the firing logic is passed to the current driver 808 which supplies current signals to panel 810 according to the firing logic. (*Id.*) As described above, a multiplexer is not a current driver. (*Id.*) As implemented in Shteynberg, the multiplexer functions as a rapid on/off switch, it does not supply or modulate the power provided to the LED strings.



Only the power converter 120 supplies current. The power converter 120 supplies one current to all strings. It does not selectively supply current based on a timing signal from the multiplexer or determine the order in which to supply current to the LED strings. Therefore, Shteynberg does not disclose a control system

including firing logic configured to determine a firing order of the plurality of strings. (*Id.*)

Similar to Shteynberg, Zhang discloses lights that are either in an on or off state. Zhang discloses lights being activated one after another. In other terms, only one “backlight module” is being supplied current at a time according to Zhang. As stated in Zhang,

The display screen is showed in the order in 15 which the backlight modules are illuminated, such as: Step S11 is to illuminate the first backlight module 11; Step S12 is to illuminate the second backlight module 12 and turn off the first backlight module [12]; Step S13 is to illuminate the third backlight module 13 and turn off the second backlight module 12; Step S14 is to illuminate the fourth backlight module [13] and turn off the third backlight module [12]; Step S15 is to illuminate the fifth 20 backlight module [12] and turn off the fourth backlight module [13]; Step S16 is to illuminate the sixth backlight module [11] and turn off the fifth backlight module [12]. When the display screen 1 is not turned off, take steps S11 through S16 as a continuous cycle for lighting. (EX1010 at 5:16-23)

At each step, a backlight module is turned off and another turned on, to cycle through all the backlight modules. Thus, Zhang only contemplates one backlight module being activated at a time, this is illustrated in Figs. 1B, 2B, 4A-4F, 5, and 6. (*Id.*) As stated above, the firing order described in Claim 1D is a firing order to supply a plurality of currents to the plurality of LED strings. (*Id.*) Thus, Zhang's method of only activating one lighting module at a time is not the same as the firing logic or firing order contemplated by the '710 Patent. (*Id.*) As shown neither

Shteynberg nor Zhang disclose or render obvious the firing logic or firing order as described in Claim 1D.

F. Shteynberg and Zhang fail to disclose or render obvious Claim 2: “The system of claim 1, wherein the firing logic comprises rule-based logic operative to generate a non-spatially sequentially firing order.”

For the reasons described above regarding element D of Claim 1, the elements of this claim are not disclosed or rendered obvious by Shteynberg in view of Zhang.

G. Arai fails to disclose or render obvious Claim 5: “The system of claim 1, wherein ones of the plurality of strings are arranged corresponding to a plurality of bars that include portions of the plurality of strings, wherein the plurality of bars extend in the first direction and are positioned adjacent one another in a substantially parallel arrangement.”

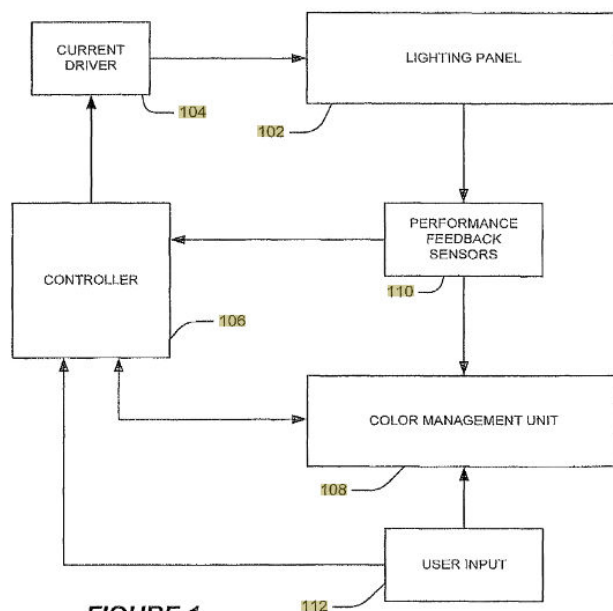
Petitioner states that a POSITA would understand that the plurality of bars (the laterally elongated rectangular wiring boards 12a [of Arai]) could be incorporated into the lighting system described in Shteynberg. Whether or not that is true is irrelevant as adding elongated rectangular wiring boards to a system for providing ambient lighting to a building would not create a backlight for an LCD panel. As stated above, a POSITA would not be motivated to combine Shteynberg and Arai. The combination suggested by Petitioner with regard to claim 5 does not disclose a system that would be functional as a backlight for those reasons. (EX2003 at 69)

**H. Shteynberg fails to disclose or render obvious Claim 12:
“The system of claim 1, further comprising a means for
generating a feedback signal configured to provide display
performance information to the control system.”**

Petitioner states that “Shteynberg describes that the controller 125 ‘may receive input from a wide variety of sources, including open or closed-loop feedback of various signals and measurements **from within the LED array driver circuit 100.**’ Therefore, Shteynberg discloses a means (the sensor 185) for generating a feedback signal (open or closed-loop feedback.” (Petition at 40-41) But that is not the kind of feedback signal the ‘710 Patent refers to. (EX2003 at 70) The claim itself makes this clear, stating “configured to provide display performance information to the control system.” Again, Shteynberg discloses a system for providing ambient lighting to a building, it does not disclose a display. Indeed, Petitioner equates display performance to the performance/functioning of the LED array not an LCD display as in claim 12.

The “feedback of various signals” as disclosed in the Shteynberg is not equivalent to the “**feedback** signal configured to provide display performance information to the control system.” (*Id.*) As stated in Shteynberg, “the actual output voltage across each series of LEDs 110(1), 110(2), 110(3) through 110(N) is measured, also using a sensor 185. Corresponding to such measurements... utilized for subsequent output voltage prediction by the controller 125.” (EX1007 at 0072) Petitioner, argues that “Fig. 3 shows that the sensor 185 provides (illustrated as an

arrow in Fig. 3) display performance information (e.g., the actual output voltage across each of the LED strings) to be controller 125.” (Petition at 41) However, Shteynberg does not teach an LCD display (as stated in Petitioner’s motivation to combine arguments). The ‘710 patent, on the other hand states that “The color management unit 108 and/or the controller 106 can use, for example, **performance data from display performance feedback sensors 110** and user input 112 to achieve the desired display performance...Some embodiments can also **include means for generating a feedback signal that can provide display performance information to the control system 800**. The means can include **performance sensors, such as thermal sensors and color sensors, among others.**” (EX1001 at 8:28-32 and 11:30-34) (emphasis added) Figure 1 of the ‘710 patent, reproduced below, further demonstrates this difference.



The performance feedback sensors receive information from the lighting panel and transmit it to the color management unit and the controller. (*Id.*) The controller uses this information to regulate both the color management unit and thereby the display as well as the current driver and thereby the lighting panel. This is in contrast with the sensor 185 of Shteynberg which, according to Petitioner, “provides...the actual output voltage across each of the LED strings to the controller.” (Petition at 41)

Shteynberg does not include a display within the meaning of the LCD display of the '710 Patent, therefore, it cannot disclose a “means for generating a feedback signal configured to provide display performance information to the control system.” (*Id.*).

**I. Shteynberg and Arai fail to disclose or render obvious
Claim 16: “The system of claim 1, wherein the second
direction is substantially orthogonal to the first direction.”**

For the same reasons discussed above regarding element A of claim 1, Shteynberg in view of Arai does not disclose or render obvious the elements of this claim.

**J. Shteynberg and Arai fail to disclose or render obvious the
preamble of Claim 17: “A method for controlling a
plurality of strings of solid state lighting devices configured
to extend in a first direction and to be arranged in
substantially adjacent positions relative to one another in a**

second direction that is different from the first direction, the method comprising.”

For the same reasons discussed above regarding element A of claim 1, Shteynberg in view of Arai does not disclose or render obvious this element.

K. Shteynberg fails to disclose Claim 17A: “receiving an input from a user; and”

For the same reasons discussed above regarding element C of claim 1, Shteynberg does not disclose or render obvious this element.

L. Shteynberg and Zhang, alone or in combination, fail to disclose or render obvious Claim 17B: “supplying, based in part on the input from user, a plurality of pulsed driver currents to the plurality of strings in a non-spatially-sequential firing order.”

For the same reasons discussed above regarding elements B, C and D of claim 1 and claim 2, Shteynberg does not disclose this element.

Furthermore, the multiplexer of Shteynberg is a simple on/of switch, the length of its cycle is a function of the current supplied to it, not user input. (EX2003 at 74-75) Further, the currents supplied to the strings of LEDs in Shteynberg are constant, not pulsed drive currents:

[The] average current I_C provided by the current source (in this case, power converter 120) is equal to $I_c = \sum_{i=1}^{i=n} I_{ci}$ With a period of time “ T_c ” to provide current (energize) all of the LED channels (all of the series of LEDs 1101, 1102, 1103, through 110N), then the time of energizing each channel (series of LEDs 110) will be $T_{Qi} = I_{ci} T_c / I_c$. (EX1007 at 0055 and 0056)

The power supply of Shteynberg supplies an averaged current (as opposed to an individually determined current for each string) to the LEDs 110 based on the required energizing time provided by the controller. (EX2003 at 74-75) Thus, the power converter supplies a single current to all of the LED strings. (*Id.*)

In addition, Zhang does not disclose a non-spatially firing order. According to the '710 Patent (as stated in element C of claim 1) the firing order is associated with when the plurality of driver currents are supplied to the plurality of strings. (*Id.*) As shown in the above discussion of element D of claim 1, Zhang does not disclose any method of supplying a plurality of currents to a plurality of strings. Zhang only discloses turning on one backlight module at a time. The non-sequential firing order in the '710 Patent is not the same as activating one LED string at a time in a non-sequential order, which is the method disclosed in Zhang. (*Id.*) Thus, Zhang does not disclose or render obvious the firing order as taught in the '710 Patent.

VI. GROUND 2 – CLAIM 11 IS NOT OBVIOUS OVER THE COMBINATION OF SHTEYNBERG, ARAI, ZHANG AND KOBORI

A. A POSITA would not be motivated to combine Shteynberg, Arai, Zhang and Kobori

For the same reasons stated above regarding the combination of Shteynberg, Arai and Zhang, a POSITA would not be motivated to combine Shteynberg, Arai, Zhang and Kobori because Kobori is directed to a display panel and Shteynberg is directed to ambient lighting for a building. (EX2003 at 76)

Also, for reasons similar to those stated above regarding the combination of Zhang and Arai, a POSITA would not be motivated to combine Kobori with Zhang because different LEDs being turned on or off in a display would not lead to better light uniformity. (*Id.* at 77) A POSITA would also not combine Kobori with Zhang because Zhang is directed to CCFLs and Kobori is directed to LEDs. (*Id.*) The electrical requirements of the two systems are entirely different. (*Id.*) Also, CCFLs have luminiferous levels and lighting characteristics. (*Id.*) Using the luminiferous calculation disclosed in Kobori with Zhang would not lead to better light uniformity and could, in fact, be detrimental to the purpose of the invention. (*Id.*) Accordingly, a POSITA would not consider Kobori suitable for combination with Zhang. (*Id.*)

VII. GROUND 3 – CLAIMS 47 AND 48 ARE NOT OBVIOUS OVER THE COMBINATION OF SHTEYNBERG, ARAI AND LEE

A. A POSITA would not be motivated to combine Shteynberg, Arai and Lee

First, Petitioner argues that the “Shteynberg-Arai combination and Lee are in the same field or endeavor... achieving the emission of light perceived as white light.” (Petition at 53) As stated above, Shteynberg describes blending the emissions of red, green and blue LEDs to achieve light that is perceived by a viewer as “white” and Arai does not describe that process. The word “white” in Arai appears only in reference to the liquid crystal display panel. A POSITA would not combine Arai and Shteynberg. (EX2003 at 78)

Second, Petitioner states “a primary motivation of a POSITA would have been to avoid excessive driving voltage or current as described in Lee...Modifying the Shteynberg-Arai combination to include string groups, as disclosed by Lee, would meet this goal.” (Petition at 54). As Arai does not include disclosure as to how its light emitting elements are driven, it is assumed that Petitioner means to combine the arrangement of Shteynberg with that of Lee. However, Petitioner has overlooked the advantages Shteynberg touts over prior art systems. Shteynberg states:

The referenced prior art with multi-output or separate power converters and controllers for each LED string of an LED array... reduces the functionality and efficiency of the driver... Accordingly, a need remains for multistring LED driver which utilizes a single power converter and controller for an entire LED array and does not utilize these multiple, separate power converters and controllers for each LED string.”

(EX1007 at 0010).

Shteynberg clarifies that “The various embodiments of the invention provide innumerable advantages for energizing a plurality of series of LEDs, using a **single power converter and controller for an entire LED array, and does not utilize multiple, separate power converters and controllers for each LED string.**” (EX 1007 at 0011) The prior art system in Shteynberg describes Lee exactly. Lee illustrates three separate LED driving circuits each driving a particular color LED string(s), “the identical color LEDs are interconnected in series between a terminal

for the connection to the driving circuit 221, 222 or 223” (EX1007 at 0034)

(emphasis added) Fig. 3 clearly demonstrates that each LED driving circuit is separate and intended to control a specific string of LEDs.

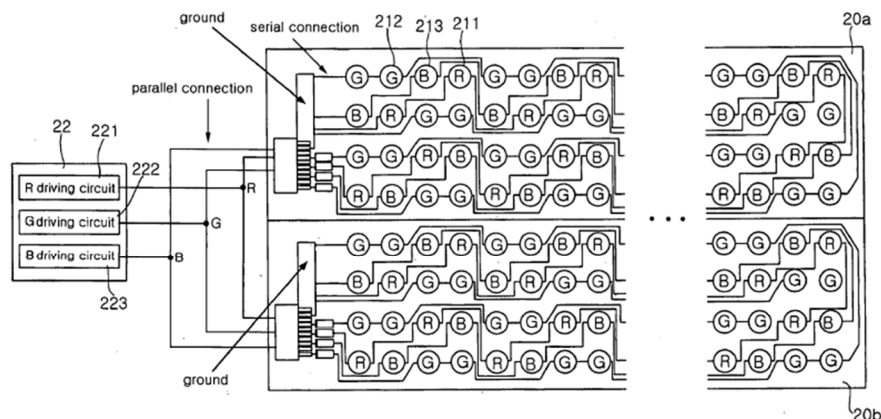
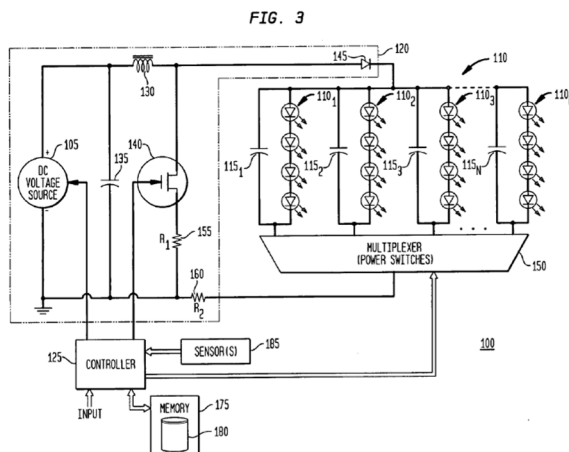


FIG. 3

Shteynberg teaches away from the invention of Lee and, therefore, a POSITA would not seek to combine the two. (EX2003 at 79)

Also, Petitioner argues that Lee's solution to "the problems of conventional LED connection" structures, which require "an excessive driving voltage or current" should be combined with Shteynberg to improve the driving voltage and currents disclosed by Shteynberg. (Petition at 54) However, as stated above, Shteynberg is an improvement to Lee. Shteynberg specifically has improved LED driver efficiency, which is assumed to include driving voltage and current. (EX2003 at 80) Thus, it is not clear why, and Petitioner offers no example of how Lee would improve excessive driving voltage or current in Shteynberg. First, a POSITA would

recognize Shteynberg already teaches a better functioning system that has less likelihood of driving excessive voltage or current. (*Id.*) Second, a POSITA would recognize that implementing more driving circuits (as disclosed in Lee) would require additional power converters 120, controllers 125 and multiplexers 150 (as disclosed in Shteynberg), which would cause the combined system to preform worse than when separate. (*Id.*) In addition, combining the systems would be counter to the teachings of Shteynberg. Shteynberg discloses a single power converter supplying or driving a current to all LED strings. Those LED strings can comprise a variety of red, green, or blue LED strings. To implement individual color LED driving circuits (as disclosed in Lee) would require independent, separate LED array driver circuits (See Shteynberg Fig. 3), which departs from the teachings of Shteynberg.



Therefore, a POSITA would not be motivated to combine Shteynberg and Lee (and Lee and Shteynberg are unsuitable for combination) as the inventions are incompatible and any combination would result in a system worse than what Shteynberg and Lee disclose individually. (*Id.*)

B. Shteynberg and Arai fail to disclose or render obvious the preamble of Claim 47: “A method for controlling a plurality of strings of solid state lighting devices configured to extend in a first direction and arranged substantially adjacent to one another.”

For the reasons set forth above regarding the preamble of claim 17, Shteynberg in view of Arai fails to render this element obvious.

C. Shteynberg, Arai, and Lee fail to disclose or render obvious Claim 47A: “the method comprising supplying a plurality of pulsed drive current to a plurality of groups of the plurality of strings.”

For the reasons set forth above regarding element A of claim 17, Shteynberg in view of Arai and Lee fail to render this element obvious.

Shteynberg does not supply a plurality of pulse currents to a plurality of strings; the power converter supplies a single current, and the multiplexer does not supply a current. (EX2003 at 83-86) Since Shteynberg only supplies one current and does not disclose any grouping of the plurality of strings, Shteynberg does not disclose or render obvious the requirements of Claim 47A. (*Id.*)

Lee teaches three separate LED driving circuits that each drive a red, green, or blue LED string, respectively. (*Id.*) Lee does not contemplate the operation of

each driving circuit, nor how that circuit supplies current. (*Id.*) Lee only states that excessive driving current can be solved by “interconnecting the proper number of LEDs, which can be driven by a proper voltage, in series and by interconnecting the proper number of series connections, that can be driven by a proper current, in parallel.” (EX1013 at 0050) There is no mention that each driver circuit (221, 222, and 223) supplies a plurality of pulsed drive currents as required by the ‘710 Patent. Indeed, a POSITA would not gather that Lee intends each driver circuit to supply multiple drive currents. (EX2003 at 83-86) Even more concerning is that each driver circuit is only connected to one group (i.e., one color of LED strings) of the plurality of strings. (*Id.*) As one example, the red driving circuit (221) shown in Fig. 3 only connects to two strings of red LEDs in parallel. (*Id.*) Thus, the driving circuit 221 only supplies current to one group of the strings. (*Id.*) Petitioner goes so far as to equate the parallel connections to “(string groups)” (Petition at 59) so there is no debate whether Lee discloses a different type of “groups” of LED strings. (*Id.*) Lee, therefore, does not disclose supplying a plurality of pulsed currents to a plurality of groups of the plurality of strings. (*Id.*)

To the extent Petitioner argues that the LED driving unit 22 supplies the plurality of drive currents, it is clear Lee intends each individual driving circuit to supply individual current. The LED driving unit 22 simply contains the three driving circuits and has no other disclosed functionality, “LED driving unit 22

includes the red LED driving circuit 221, the green LED driving circuit 222, and the blue LED driving circuit 223. The LED driving circuits 221, 222, and 223 function to apply electric power to the LEDs.” (EX1012 at 0041) A POSITA would understand that only each individual LED driving circuit supplies current to one group of the plurality of strings. (EX2003 at 85)

Further, Petitioner states that “a POSITA would understand that the string groups discussed in Lee could be incorporated into the lighting system disclosed by Shteynberg-Arai... to achieve the benefits stated in Lee (‘properly controlling luminance... a color temperature to drive the LEDs under a desired condition’).” (Petition at 59) As stated in the motivation to combine arguments, a POSITA would understand that there would be no benefit in combining Lee and Shteynberg.

**D. Shteynberg, Arai, and Lee fail to disclose or render obvious
Claim 48: “The method of claim 47, further comprising
receiving a user input, wherein supplying the plurality of
pulsed drive currents is based on user input.”**

For the reasons set forth above regarding elements B and C of claim 1, elements A and C of claim 17, and the preamble and element A of claim 47, the combination of Shteynberg, Arai and Lee fails to disclose or render obvious the elements of this claim.

VIII. GROUND 4—CLAIMS 1-2, 5, 12 AND 16-17 ARE NOT OBVIOUS OVER THE COMBINATION OF SHTEYNBERG, ARAI AND KAWABATA IN VIEW OF THE KNOWLEDGE OF A POSITA

A. A POSITA would not be motivated to combine Shteynberg, Arai and Kawabata

Petitioner states that a “POSITA would be motivated to modify the display system in the Shteynberg-Arai combination to introduce the non-spatially-sequential firing order described in Kawabata...both the Shteynberg-Arai combination and Kawabata are in the same field of endeavor, i.e. achieving the emission of light perceived as white light.” (Petition at 61-62) However, while Shteynberg describes blending the emissions of red, green and blue LEDs to achieve light that is perceived by a viewer as “white” neither Arai nor Kawabata describe that process. (EX2003 at 88) The word “white” in Arai appears only in reference to the liquid crystal display panel:

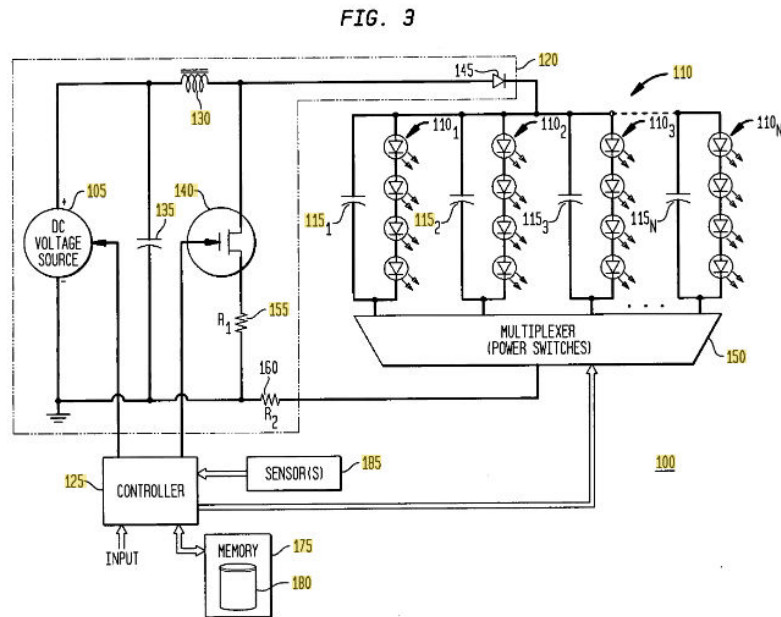
...the deflection film and the phase difference film allow the waveform characteristic to be non-colored and to be changed into white to perform realization of full color by the color filters to perform color display of receive image, etc. (EX1008 at 0026)

The word “white” does not appear at all in Kawabata. Thus, Shteynberg, Arai and Kawabata are not “in the same field of endeavor” as Petitioner would have it. (EX2003 at 88)

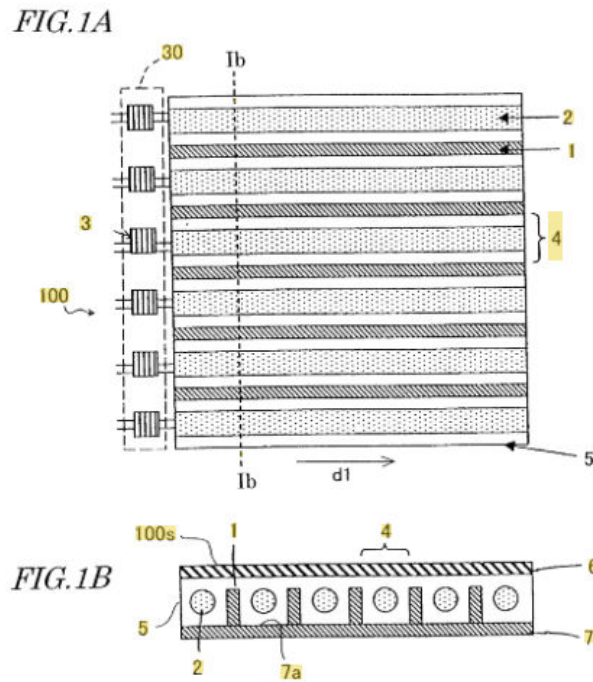
Second, Shteynberg relates to providing ambient lighting for a building and the like, not providing backlighting for an LCD panel as in Arai or Kawabata.

Petitioner does not substantiate how such a system would be adapted to a backlight for an LCD panel as the power, switching and output demands for the two applications are very different. (EX2003 at 88-90)

Third, Petitioner states that “a primary motivation of one of ordinary skill in the art would have been to reduce a variation in luminance, as described in Kawabata.” (Petition at 62) Petitioner then proposes modifying the “Shteynberg-Arai” combination “to include the non-spatially-sequential firing order” of Kawabata. (*Id.*) As Arai does not include disclosure as to how its light emitting elements are driven, it is assumed that Petitioner means to combine the arrangement of Shteynberg with that of Kawabata. Petitioner does not explain how this would be accomplished. However, in examining the preferred embodiments of Shteynberg and Kawabata, such a combination would not be functional. First, figure 3 of Shteynberg, disclosed below, is “a circuit and block diagram illustrating a first exemplary LED array driver circuit” (EX1007 at 0030); second, figures 1A and 1B of Kawabata, disclosed below are “respectively a plan view and a cross-sectional view, taken along the line Ib-Ib shown in FIG. 1A, of a lighting unit.” (EX1012 at 0028)



Shteynberg Figure 3



Kawabata Figures 1A and 1B

Examining the figures and the labels thereof, one will note that the light emitting elements of Kawabata are cold cathode tubes. (“A cold-cathode tube may be used as the light-emitting element 2.” (EX1012 at 0060) “A cold-cathode tube is used as each of the light-emitting elements 2.” (*Id.* at 0062) “For example, each of the light-emitting elements (or cold-cathode tubes) 2” (*Id.* at 0070) Kawabata is quite explicit about the nature of its light emitting elements. This presents several issues for Petitioner’s argued motivation to combine Kawabata with Shteynberg. First, unlike LEDs, cold cathode tubes require high AC voltages; therefore, they require an inverter. (EX2003 at 88-90). There is no inverter in Shteynberg’s disclosure, nor is it expected that an inverter would function with Shteynberg’s multiplexer. (*Id.*) Second, at the time of the invention of the ‘710 patent, the technology for adapting LEDs to glass tube shapes like CCFL systems had not yet been invented. (*Id.*) Thus, given the gap in technology, a POSITA would not look to a completely different, wholly unsuitable and largely incompatible system of backlighting an LCD panel to combine with an LED based system. (*Id.*)

B. The combination of Shteynberg and Arai fails to disclose or render obvious the elements of Claim 1A: “a plurality of strings of solid state lighting devices...positioned at intervals in at least one second direction.”

For the reasons stated above regarding element A of Claim 1, the combination of Shteynberg and Arai fails to render this element obvious.

C. Shteynberg fails to disclose or render obvious Claim 1B: “a current supply circuit configured to selectively supply a plurality of on state drive currents to the plurality of strings responsive to a plurality of control signals.”

For the reasons stated above regarding element B of Claim 1, Shteynberg fails to render this element obvious.

D. Shteynberg fails to disclose or render obvious Claim 1C: “a control system configured to receive a user input and to selectively provide control signals to the current supply circuit responsive to the user input to selectively drive the plurality of strings.”

For the reasons stated above regarding element C of Claim 1, Shteynberg fails to render this element obvious.

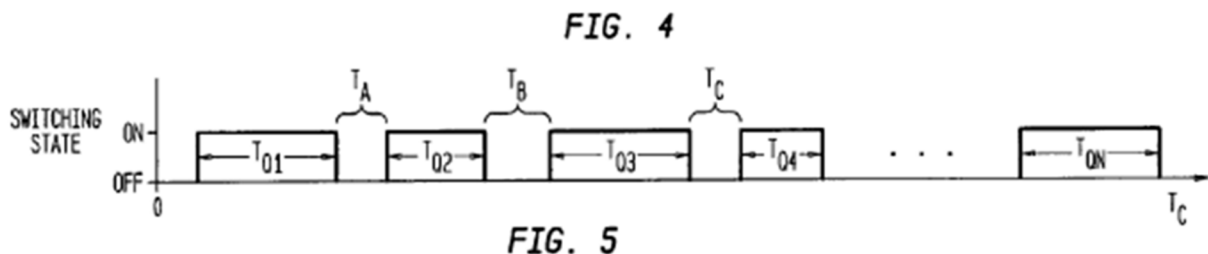
E. Shteynberg and Kawabata alone or in combination fail to disclose or render obvious Claim 1D: “a control system further including firing logic configured to determine the firing order of the plurality of strings.”

Petitioner states that “Shteynberg discloses that the controller 125 determines that order of the energizing time periods, which is equivalent to the firing order...Kawabata also discloses a firing logic that determines the firing order.” (Petition at 64) Petitioner attempts to conflate the “energizing time period” of Shteynberg with the firing order of the ‘710 patent: “Shteynberg suggests that the control system (the controller 125) includes a firing logic because the firing order (the order of the energizing time periods) is determined ‘through control of’ the control system (the controller 125)...Thus a POSITA would understand that the

control system could include a firing logic configured to determine the firing order.”

(Petition at 65)

As discussed above regarding element B of Claim 1, the multiplexer of Shteynberg does not supply current, nor does the multiplexer determine the current level as Petitioner argues. Shteynberg uses the switching period to determine the current through each string (see discussion of element B of claim 1 above). (EX2003 at 94) Shown in Fig. 4 of Shteynberg, the multiplexer either turns on or off each LED string, for a time period T_{qn} . The length of this on/off cycle is a function of the current supplied to the multiplexer as described above, not of firing logic interpreted by the controller. (*Id.*) Thus, there are not a plurality of currents being supplied to strings. (*Id.*) These energizing time periods are not equivalent to the firing logic as described in the '710 Patent.

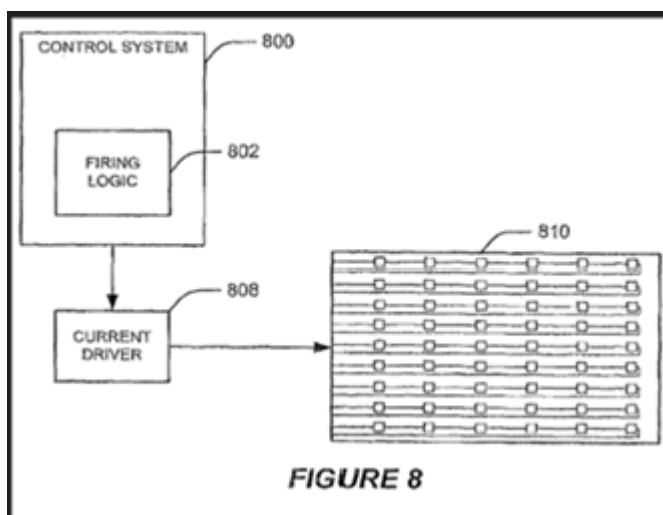


The '710 Patent describes firing logic as follows,

A control system 800 selectively provides control signals to a current driver 808 or other type of electrical power supply circuit that responsively drives multiple solid state lighting devices in a solid state lighting panel 801. The control system 800 can include firing logic 802 that can determine a firing order for the multiple strings. A firing order may determine an order in which

individual strings of solid state lighting devices and/or groups of strings of solid state lighting state devices are supplied current. (EX1001 at 10:22-33)

Further, Fig. 8 of the '710 Patent illustrates that the firing logic is passed to the current driver 808 which supplies current signals to panel 810 according to the firing logic. As described above, a multiplexer is not a current driver. As implemented in Shteynberg, the multiplexer functions as a rapid on/off switch, it does not supply or modulate the power provided to the LED strings.



Only the power converter 120 supplies current. (EX2003 at 95) The power converter 120 supplies one current to all strings. (*Id.*) It does not selectively supply current based on a timing signal from the multiplexer or determine the order in which to supply current to the LED strings. (*Id.*) Therefore, Shteynberg does not disclose a control system including firing logic configured to determine a firing order of the plurality of strings. (*Id.*)

Similar to Shteynberg, Kawabata discloses lights that are either in an on or off state. The on signal corresponds to a first signal intensity, which is the maximum voltage or current value and the off signal corresponds to a second signal intensity, which is a zero voltage or current value. (EX1012 at 0070) Kawabata only supplies a single current to each light emitting element. (EX2003 at 96) Therefore, Kawabata does not supply a plurality of on-state drive currents in a certain firing order. (*Id.*) Even Petitioner states that Kawabata discloses lights being activated in sequence: “Kawabata describes, with reference to figure 5, ‘scan lighting’... As shown in Fig. 5 of Kawabata, each of the six light emitting elements 2 are turned on at different times. The timing rule in this example is the ‘adjacent one’ of the light elements 2 is turned next.” (Petition at 66)

Further, as noted above in the arguments against the motivation to combine Kawabata and Shteynberg, a POSITA find a CCFL based system suitable to combine with an building ambient lighting system in order to produce a backlight for an LCD panel. (EX2003 at 97).

Also, Kawabata describes, similar to Shteynberg, a simple on/off pre-programmed system for lighting a panel. (*Id.* at 98-101) As can be seen in the above figures, each light element 2 is activated for a portion of a vertical scanning period. Kawabata describes a system for lighting “at regular intervals” to achieve “scan lighting”:

A drive signal (i.e., a voltage signal or a current signal) to be supplied to each of the light-emitting elements is a periodic signal, of which one period is as long as one vertical scanning period of the liquid crystal panel 300. For example, each of the light-emitting elements (or cold-cathode tubes) 2 may be turned ON in 50% of one vertical scanning period T1 and turned OFF in the remaining 50% of the period T1 as shown in FIG. 5, thereby getting light emitted from one of the light-emitting elements 2 after another at mutually different points of times (or at regular intervals). In this manner, so-called “scan lighting” is carried out. (EX1012 at 0069 and 0070)

Kawabata describes scan lighting as follows:

By sequentially lighting one of these light-emitting regions after another in the vertical scanning direction (i.e., scan lighting), an image is displayed only during a predetermined period at each pixel while the liquid crystal layer is responding. As a result, a quality motion picture may be displayed. (*Id.* at 0006)

Thus, Kawabata discloses a system for lighting its elements in a sequential manner so as to provide adequate display brightness while reducing power consumption. (EX2003 at 98-101) As noted above, CCFL lamps use significantly more power than LEDs. (*Id.*) Thus, it makes sense why Kawabata would apply such a technique to a backlighting system employing CCFLs, however, it is not relevant to LED light strips which can be run at higher brightness levels without interruption and drawing far less power than a comparable CCFL. (*Id.*)

Petitioner improperly views the “firing logic” of the ‘710 Patent by stating that “the firing logic 802 can include rule based logic...rule-based logic is viewed as firing logic. Therefore, Kawabata discloses firing logic.” (Petition at 66) Kawabata

does not use the words “rule” or “logic” anywhere in its specification. The “timing rule” that Petitioner describes not disclosed in the references at all.

The section of the ‘710 Patent that Petitioner relies on, in its entirety, reads as follows:

In some embodiments, the firing logic 802 can include rule-based logic that can generate a non-spatially-sequential firing order. For example, the rule based logic may include a rule that a second string fired after a first string is not adjacent the first string in the panel 810. In some embodiments, a rule may be that the first and second strings can be fired simultaneously and are not adjacent one another. (EX1001 at 10:51 – 57)

The above quotation demonstrates that the ‘710 patent describes more than just a simple sequential firing of lighting elements as in Kawabata. The ‘710 patent describes multiple other types of firing logic that may be used, such as:

Some embodiments can use firing logic to determine a firing order in a deterministic manner. Other embodiments can include a sequence generator that generates a firing sequence. Some embodiments can include a polyphase power supply configured to provide power to emitter strings in a temporally distributed manner. Some embodiments include receiving a synchronizing signal from a display controller. Moreover, in some embodiments, the subsequent firing of a string can be determined by the location and/or dominant wavelength of a previously fired string. In this manner, a noticeable “sweep” effect can be reduced. (EX1001 at 8:5-16)

Petitioner infers non-existent limitations from the specification of Kawabata, inventing a new term (“timing rule”) and then arguing that the ‘710 Patent is rendered obvious by the passing similarity of the claim term “firing logic” to this term that it has created out of thin air. (EX2003 at 98-101) Thus, Petitioner’s misdirection

attempts fall flat, Kawabata does not disclose a “rule” or “logic” much less “firing logic configured to determine the firing order of the plurality of strings” within the meaning of the ‘710 patent.

**F. Kawabata fails to disclose or render obvious Claim 2”
“wherein the firing logic comprises rule-based logic
operative to generate a non-spatially sequential firing
order.”**

For the reasons stated above regarding element D of Claim 1, Kawabata fails to render this element obvious.

**G. Arai fails to disclose or render obvious Claim 5: “The
system of Claim 1, wherein ones of the plurality of strings
are arranged corresponding to a plurality of bars that
include portions of the plurality of strings, wherein the
plurality of bars extend in the first direction and are
positioned adjacent one another in a substantially parallel
arrangement.”**

For the reasons set forth above regarding claim 5, Arai fails to disclose or render the elements of this claim obvious.

**H. Shteynberg fails to disclose or render obvious Claim 12:
“The system of Claim 1 further comprising a means for
generating a feedback signal configured to provide display
performance information to the control system.”**

For the reasons set forth above regarding claim 12, Shteynberg fails to disclose or render the elements of this claim obvious.

**I. Shteynberg and Arai, individually or in combination, fail to
disclose or render obvious Claim 16: “The system of claim**

1, wherein the second direction is substantially orthogonal to the first direction.”

For the reasons set forth above regarding claim 16, Shteynberg and Arai, individually or in combination, do not disclose or render obvious the elements of this claim.

J. The combination of Shteynberg and Arai fails to disclose or render obvious the preamble of Claim 17: “A method for controlling a plurality of strings of solid state lighting devices configured to extend in a first direction and to be arranged in substantially adjacent positions relative to one another in a second direction that is different from the first direction.”

For the reasons set forth above regarding the preamble of claim 17, Shteynberg in view of Arai fails to disclose or render this element of the claim obvious.

K. Shteynberg fails to disclose or render obvious Claim 17A: “receiving an input from a user.”

For the reasons set forth above regarding element A of claim 17, Shteynberg in view of Arai fails to disclose or render this element of the claim obvious.

L. Shteynberg and Kawabata, alone or in combination, fail to disclose or render obvious Claim 17B: “supplying, based in part on the input from the user, a plurality of pulsed drive currents to the plurality of strings in a non-spatially sequential firing order.”

For the reasons set forth above regarding elements B and D of claim 1, this element of the claim is not rendered obvious.

IX. GROUND 5—CLAIM 11 IS NOT OBVIOUS OVER THE COMBINATION OF SHTEYNBERG, ARAI, KAWABATA AND KOBORI AND IN VIEW OF THE KNOWLEDGE OF A POSITA.

A. A POSITA would not be motivated to combine Shteynberg, Arai, Kawabata and Kobori

The arguments against the combination of Shteynberg, Arai and Kawabata are set forth above. Furthermore, a POSITA would not be motivated to combine Kobori and Kawabata since Kawabata is directed to a CCFL lighting system. (EX2003 at 108) The electrical requirements of a CCFL differ from an LED system. (*Id.*) Further, LEDs and CCFLs have different luminiferous levels and lighting characteristics. (*Id.*) Accordingly, the combination would not lead to better lighting uniformity and a POSITA would not be motivated to combine the references. (*Id.*)

X. GROUND 6—CLAIM 13 IS NOT OBVIOUS OVER THE COMBINATION OF SHTEYNBERG, ARAI, KAWABATA AND LEE IN VIEW OF THE KNOWLEDGE OF A POSITA

A. A POSITA would not be motivated to combine Shteynberg, Arai, Kawabata and Lee

As shown above, Shteynberg, Arai and Kawabata are not suitable for combination. Petitioner also argues that “the Shteynberg-Arai-Kawabata combination and Lee are in the same field of endeavor i.e. achieving the emission of light perceived as white light.” (Petition at 75) As stated above regarding Ground I, Shteynberg describes blending the emissions of red, green and blue LEDs to achieve light that is perceived by a viewer as “white” and Arai does not describe that process.

“The word “white” in Arai appears only in reference to the liquid crystal display panel”. A POSITA would, therefore, not be motivated to combine Arai and Shteynberg.

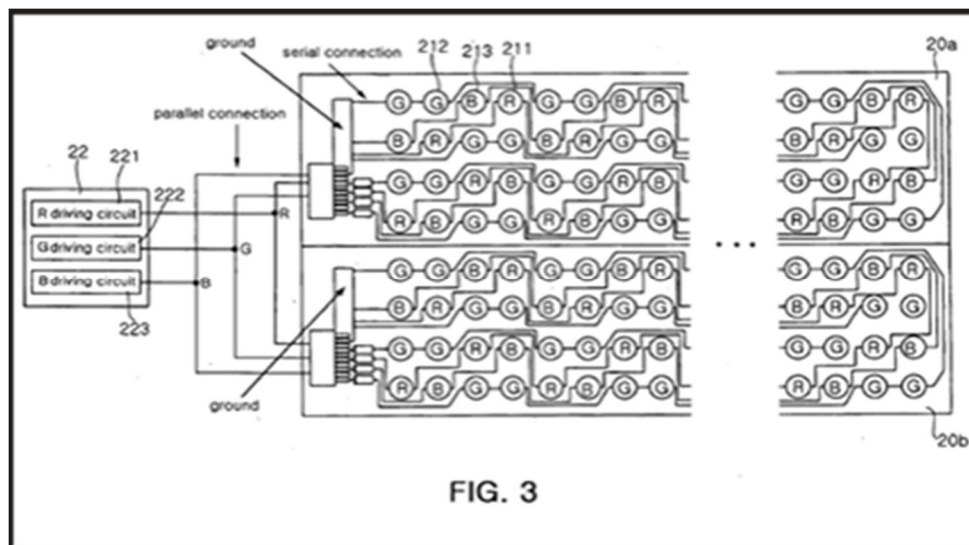
Second, Petitioner states “a primary motivation of a POSITA would have been to avoid excessive driving voltage or current as described in Lee... Modifying the Shteynberg-Arai-Kawabata combination to include string groups, as disclosed by Lee, would meet this goal.” (Petition at 54) As Arai does not include disclosure as to how its light emitting elements are driven, it is assumed that Petitioner means to combine the arrangement of Shteynberg and Kawabata with that of Lee. However, Petitioner has overlooked the advantages Shteynberg touts over prior art systems.

Shteynberg states:

The referenced prior art with multi-output or separate power converters and controllers for each LED string of an LED array... reduces the functionality and efficiency of the driver... Accordingly, a need remains for multistring LED driver which utilizes a single power converter and controller for an entire LED array and does not utilize these multiple, separate power converters and controllers for each LED string. (EX1007 at 0010)

Shteynberg clarifies that “The various embodiments of the invention provide innumerable advantages for energizing a plurality of series of LEDs, using a single power converter and controller for an entire LED array, and does not utilize multiple, separate power converters and controllers for each LED string.” (*Id.* at 0011) The prior art system in Shteynberg describes Lee exactly. Lee illustrates three separate

LED driving circuits each driving a particular color LED string(s), “the identical color LEDs are interconnected in series between a terminal for the connection to the driving circuit 221, 222 or 223” (EX1013 at 0034) Fig. 3 of Lee clearly demonstrates that each LED driving circuit is separate and intended to control a specific string of LEDs.



Third, Petitioner argues that Lee's solution to “the problems of conventional LED connection” structures, which require “an excessive driving voltage or current.” (Petition at 76) should be combined with Shteynberg to improve the driving voltage and currents disclosed by Shteynberg. However, as stated above, Shteynberg is an improvement to Lee. Shteynberg specifically has improved LED driver efficiency, which is assumed to include driving voltage and current. (EX2003 at 110-112) Thus, it is not clear why, and Petitioner offers no example of how Lee would improve excessive driving voltage or current in Shteynberg. Further, Petitioner states that

Kawabata “discloses a non-spatially sequential firing order. As shown in Fig. 7, the light emitting element corresponding to region 6 is turned on before, not after, the light emitting element corresponding to region 5.” Figures 5 and 7 of Kawabata are shown below:

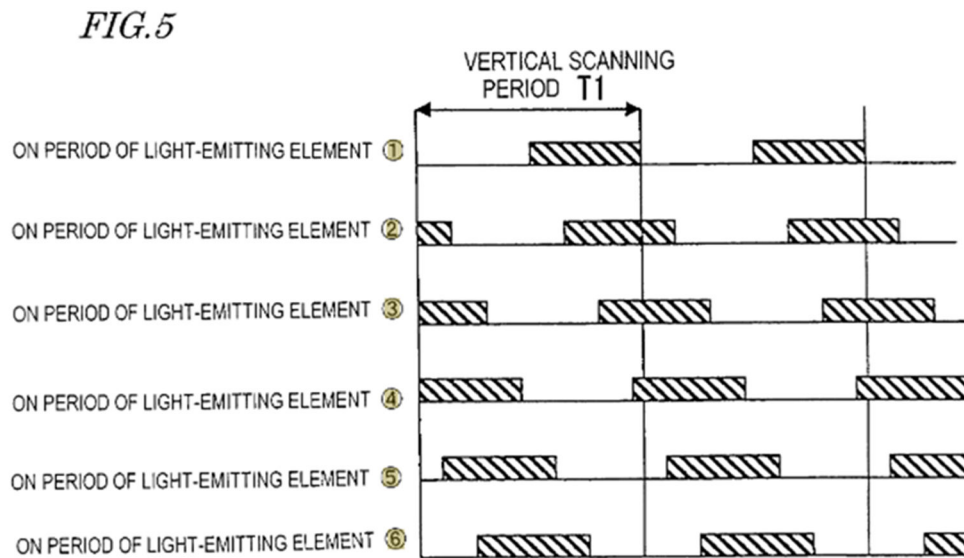


Figure 5 of Kawabata

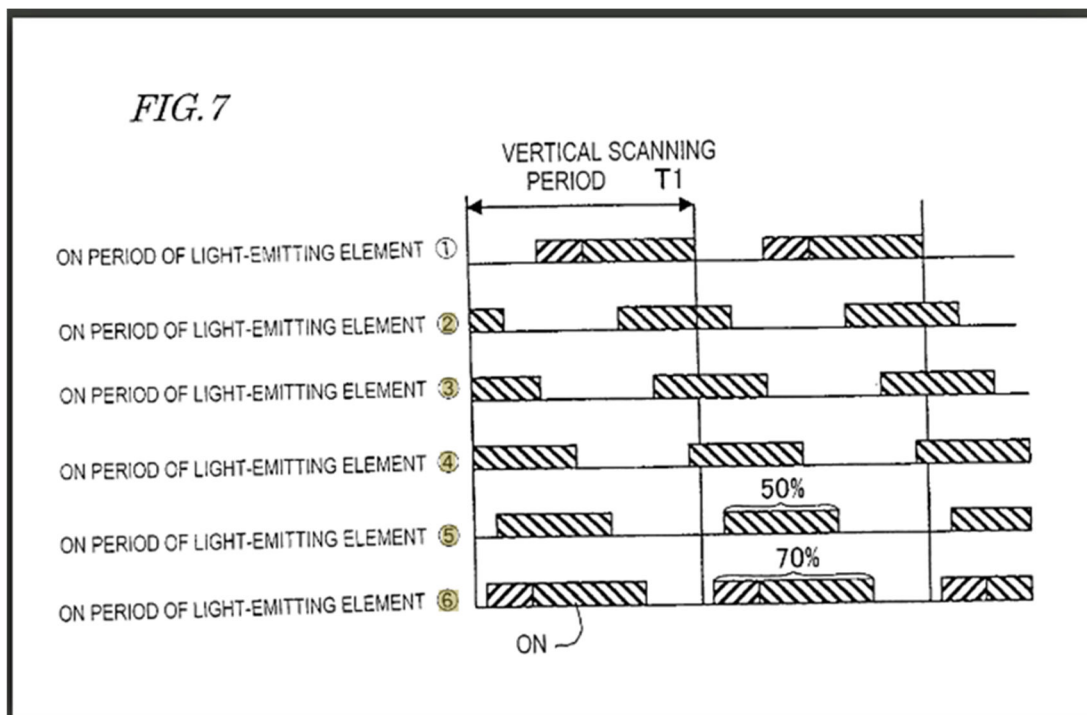


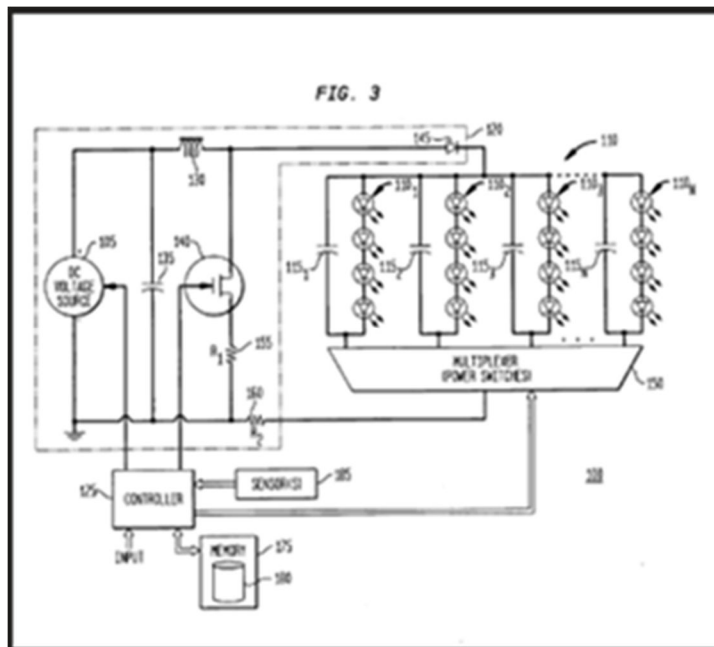
Figure 7 of Kawabata

Comparing the two figures, Petitioner's argument is that, because in Figure 7 element 6 is activated earlier in the vertical scanning period than element 5, the sequence is not spatially sequential. The '710 patent describes the motivation for implementing a non-spatially sequential firing order as:

Some embodiments of the invention may arise from the recognition that where emitter strings in a panel are fired in a spatially sequential order, a noticeable "sweep" or "waterfall" across the display may result. This effect can be more exaggerated at a beat frequency that is related to the difference between the refresh frequency of the panel and the pulse-width-modulation (PWM) frequency of a pulse-width modulation signal used to adjust the brightness of the display. Accordingly, some embodiments establish a non-spatially sequential firing order to avoid or reduce the formation of a "sweep" across the panel. (EX1001 at 8:60 - 9:3)

Thus, the purpose of the non-spatially-sequential firing order is to avoid a perceivable sweeping effect of the backlight as the system fires each light in vertical sequence. It should be noted that even though, in Figure 7 of Kawabata, element 6 is fired before element 5 it still turns off after element 5 turns off. The sweeping effect would still be present. The sequence of Kawabata represented in figure 7 is still spatially sequential within the meaning of the '710 patent. Therefore, Kawabata does not disclose a "rule-based logic operative to generate a non-spatially sequential firing order" within the meaning of claim 2 of the '710 patent.

A POSITA would recognize Shteynberg already teaches a better functioning system that has less likelihood of driving excessive voltage or current. EX2003, ¶80. A POSITA would recognize that implementing more driving circuits (as disclosed in Lee) would require additional power converters 120, controllers 125 and multiplexers 150 (as disclosed in Shteynberg), which would cause the combined system to perform worse than when separate. (EX2003 at 110-112) In addition, combining the systems would be counter to the teachings of Shteynberg. (*Id.*) Shteynberg discloses a single power converter supplying or driving a current to all LED strings. Those LED strings can comprise a variety of red, green, or blue LED strings. To implement individual color LED driving circuits (as disclosed in Lee) would require independent, separate LED array driver circuit (See Shteynberg Fig. 3), which departs from the teachings of Shteynberg. (*Id.*)



Therefore, a POSITA would not be motivated to combine Shteynberg and Lee as the inventions are incompatible and any combination would result in a system worse than what Shteynberg and Lee disclose individually. (*Id.*)

Kawabata is no more likely to be combined with Lee by a POSITA than Shteynberg or Arai. Kawabata discloses a backlighting system employing CCFLs and a sequential “sweep” of the on/off cycle of each light source. A POSITA would not seek to combine an LED based system such as Lee with a CCFL system such as Kawabata. (EX2003 at 113)

B. Lee and Kawabata alone or in combination fail to disclose or render obvious Claim 13A: “wherein the current supply circuit comprises a plurality of phase drivers configured to supply a plurality of on-state drive currents at a plurality of times.”

Petitioner states that the combination of Lee and Kawabata “disclose these elements because (i) Lee discloses that the LED driving unit 22 comprises the red

LED driving circuit 221, the green LED driving circuit 222 and the blue LED driving circuit 223; and (ii) Kawabata discloses phase shifting.” (Petition at 76 and 77) Petitioner then describes how Lee discloses all of the elements of the instant claim save for the “phase drivers”. For this Petitioner relies on Kawabata. Petitioner states that “Phase shifting is equivalent to having the current signals starting at different times in a firing cycle...In other words, Kawabata discloses phase drivers configured to supply a plurality of on-state drive currents at a plurality of times in a firing cycle.” (Petition at 79) Petitioner makes a logical leap from “phase shifting” to “phase drivers” without an explanation. “Kawabata uses the term “phase shifting” precisely once in its disclosure. That section is reproduced below:

“For example, each of the light-emitting elements (or cold-cathode tubes) 2 may be turned ON in 50% of one vertical scanning period T1 and turned OFF in the remaining 50% of the period T1 as shown in FIG. 5, thereby getting light emitted from one of the light-emitting elements 2 after another at mutually different points of times (or at regular intervals). In this manner, so-called “scan lighting” is carried out. Then, the controller 30 may supply a drive signal, which has a first signal intensity high enough to turn each of the light-emitting elements 2 ON in 50% of one period thereof and a second signal intensity low enough to turn the light-emitting element 2 OFF in the remaining 50% of the one period, to one of the light-emitting elements 2 after another at different points of times. In this case, the drive signal supplied to one of the light-emitting elements 2 should have its phase shifted from that of the drive signal supplied to adjacent one of the light-emitting elements 2.” (EX1012 at 0070)

Ignoring that Kawabata is discussing CCFLs and not LEDs and therefore is operating under a completely different power consumption and delivery regime, this simply is

not the same as the action of the phase drivers disclosed in the '710 Patent. The '710

Patent, describing its phase drivers states:

The current drivers 1008 can include multiple phase drivers 1014 corresponding to N different power phases, for example. Each of the phase drivers 1014 is configured to provide power to one or more different strings 1012 corresponding to that phase...The firing order of the strings 1012 within each phase group may be configured to be non-spatially sequential. Further, the determination regarding which strings 1012 are in each phase group may also be non-spatially sequential...By providing multiple phases, each phase driver 1014 can be configured to begin firing at a different time within the period, as determined by, for example, the firing logic. In this manner, the firing of the strings 1012 can be performed in a more uniform manner within each period.” (EX1001 at 12: 25 – 41)

Kawabata in describing “phase shifting” is describing turning one light on and then turning on another in a pre-programmed sequence. The '710 Patent, on the other hand, is describing a dynamic system that can adapt via feedback sensors to the inputs of the display via a vis the color management unit. Figures 1 and 10 of the '710 patent illustrate this system.

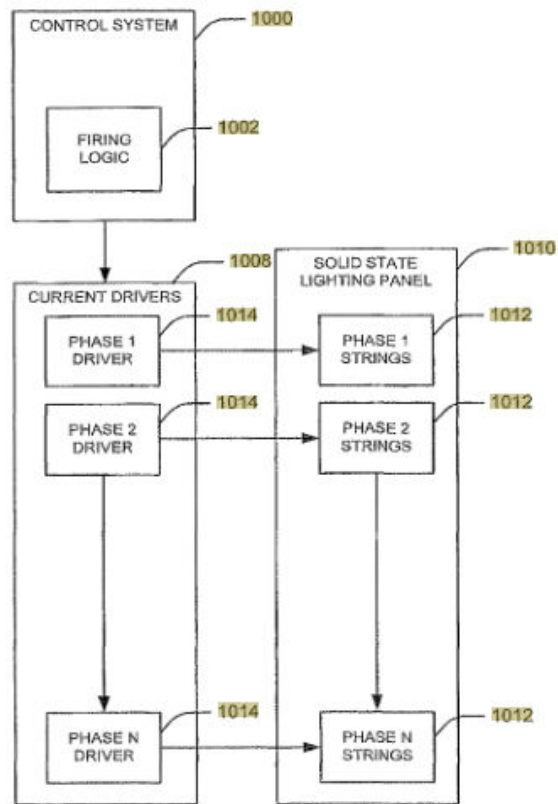
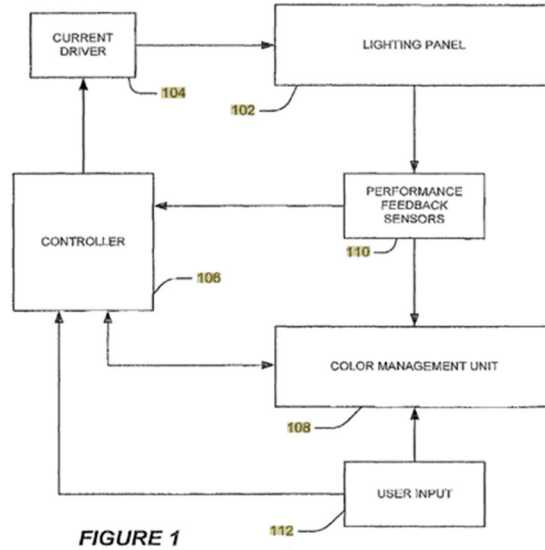


FIGURE 10

The phase drivers are part of the current drivers, which receive instruction from the control system (as per Figure 10). (EX2001 at 114-115) The control system receives information from the performance feedback sensors, the color management unit and user input to determine the appropriate behavior of the phase drivers within the current drivers. Rather than a dumb system that seeks to keep the display at a uniform level of brightness as in Kawabata employing “phase shifting”, the phase drivers of the ‘710 patent allow for a dynamic response to the behavior of the display on the part of the lighting panel. *Id.*

Petitioner has failed to demonstrate the combination of Lee and Kawabata disclose or imply “a plurality of phase drivers configured to supply a plurality of on-state drive currents at a plurality of times.”

C. Lee and Kawabata, alone or in combination, fail to disclose Claim 13B and Claim 13C: “wherein the plurality of strings of solid state lighting devices comprise a plurality of string groups, each configured to receive current from one of the plurality of phase drivers” and “wherein the control system is further configured to determine the plurality of times that each of the plurality of phase drivers begin to supply current to the plurality of string groups.”

As set forth above regarding the combination of Lee and Kawabata do not disclose a plurality of phase drivers. Accordingly, the combination does not render these elements obvious.

XI. CONCLUSION

Accordingly, Patent Owner respectfully requests the Board find the Challenged Claims not obvious under Grounds 1-6.

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 13,215 words as counted by the word-processing program used to prepare it.

Dated: July 25, 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: July 25, 2024,

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