

Petition for *Inter Partes* Review
U.S. Patent No. 8,330,710

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Hisense USA Corporation
Petitioner

v.

Brightplus Ventures LLC
Patent Owner

Patent No. 8,330,710
Filing Date: October 11, 2011
Issue Date: December 11, 2012
Title: SYSTEMS AND METHODS FOR CONTROLLING A SOLID STATE
LIGHTING PANEL

Inter Partes Review No. IPR2023-01412

PETITION FOR *INTER PARTES* REVIEW

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LIST OF EXHIBITS

EXHIBIT	DESCRIPTION
1001	U.S. Patent No. 8,330,710 (“the ’710 Patent”)
1002	Prosecution History of U.S. Patent No. 8,330,710
1003	U.S. Patent No. 8,049,709 (“the ’709 Patent”)
1004	Prosecution History of U.S. Patent No. 8,049,709
1005	Declaration of Rafael Betancourt
1006	Curriculum Vitae of Rafael Betancourt
1007	U.S. 2008/0116818 to Shteynberg (“Shteynberg”)
1008	U.S. 2007/0121320 to Arai (“Arai”)
1009	CN 1750732 to Zhang (“Zhang”)
1010	Certified Translation of Zhang
1011	U.S. 2006/0139954 to Kobori (“Kobori”)
1012	U.S. 2003/0016205 to Kawabata (“Kawabata”)
1013	U.S. 2007/0013647 to Lee (“Lee”)
1014	Counterclaim filed by Patent Owner in <i>Hisense USA Corp. v. Brightplus Ventures LLC</i> , No. 1:22-cv-02774, Dkt. 9 (N.D. Ga. Sep. 16, 2022)
1015	Scheduling Order in <i>Hisense USA Corp. v. Brightplus Ventures LLC</i> , No. 1:22-cv-02774, Dkt. 35 (N.D. Ga.)
1016	Judicial Caseload Profile for the Northern District of Georgia
1017	Cover Pleading to Patent Owner’s Infringement Contentions in <i>Hisense USA Corp. v. Brightplus Ventures LLC</i> , No. 1:22-cv-02774 (N.D. Ga.)
1018	Cover Pleading to Patent Owner’s Supplemental Infringement Contentions in <i>Hisense USA Corp. v. Brightplus Ventures LLC</i> , No. 1:22-cv-02774 (N.D. Ga.) served June 21, 2023

I. Mandatory Notices (37 C.F.R. § 42.8(b))

A. Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

The real party-in-interest, Hisense USA Corporation, is a Georgia corporation with a principal place of business at 7310 McGinnis Ferry Road, Suwanee, GA, 30024. No other entity is controlling, directing, or funding the submission of this petition and any proceeding initiated as a result thereof. Petitioner is a subsidiary of Hisense Group, which is organized under the laws of China.

B. Related Matters (37 C.F.R. § 42.8(b)(2))

The '710 Patent is asserted against Petitioner in a Counterclaim in *Hisense USA Corp. v. Brightplus Ventures LLC*, No. 1:22-cv-02774 (N.D. Ga.) (the “Underlying Litigation”). The Underlying Litigation was initially filed by Petitioner on July 14, 2022, and the '710 Patent was first asserted in a Counterclaim filed in the Underlying Litigation on September 16, 2022. *See* Ex. 1014. The current schedule in the Underlying Litigation is attached as Exhibit 1015. In addition to Petitioner, the following entities are Counterclaim defendants in the Underlying Litigation: Hisense Co., Ltd. Hisense International (HK) Co. Ltd., Hisense Visual Technology Co. Ltd., and TVS Regza Corp.

On July 14, 2023, Petitioner filed a petition for IPR challenging certain claims of U.S. 9,605,835, which is also asserted in the Underlying Litigation. That

petition has been assigned proceeding no. IPR2023-01168. On August 11, 2023 Petitioner filed a petition for IPR challenging certain claims of U.S. 8,177,382, which is also asserted in the Underlying Litigation. That petition has been assigned proceeding no. IPR2023-01311. On September 6, 2023, Petitioner filed a petition for IPR challenging certain claims of U.S. 7,690,812, which has been assigned proceeding no. IPR2023-01385. On September 14, 2023, Petitioner filed a petition for IPR challenging certain claims of U.S. 8,941,331, which has been assigned proceeding no. IPR2023-01401. On or around the time Petitioner files this Petition, it will also file Petitions challenging other patents asserted in the Underlying Litigation, including U.S. 8,294,075 and U.S. 7,872,705.

C. Designation of Lead and Backup Counsel (37 C.F.R. § 42.8(b)(3)) and Service Information (37 C.F.R. § 42.8(b)(4)).

<u>Lead Counsel</u>	<u>Backup Counsel</u>
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Petitioner may be served via email to its lead and backup counsel at the email addresses above.

II. Introduction

The '710 patent is invalid. The independent claims recite little more than a plurality of strings of solid state lighting devices, a current supply circuit, and a

control system to selectively provide control signals to the current supply circuit. Some independent claims further recite a firing order of the plurality of strings. Each of these elements was well-known in the art, and each of these elements had been used in combination for exactly the same purpose—adjustable solid state lighting panels with a desired hue and/or brightness level—for years prior to the earliest claimed priority date. The combination of these known elements would have been obvious to a Person of Ordinary Skill in the Art as of the earliest claimed priority date of the '710 Patent, May 8, 2007. The challenged claims should be cancelled as obvious.

III. IPR Requirements

A. Standing (37 C.F.R. § 42.104(a))

Petitioner certifies that the '710 Patent is available for IPR and that Petitioner is not barred or estopped from requesting IPR. The '710 Patent was issued on December 11, 2012, and this Petition is filed within one year of service of the Complaint against Petitioner alleging infringement of the '710 Patent (*see* Ex. 1014) and is not barred under 35 U.S.C. §315(b).

B. Fees (37 C.F.R. § 42.103)

This Petition requests review of ten (10) claims of the '710 Patent and is accompanied by a payment of \$41,500, which includes the \$19,000 IPR request fee, and the \$22,500 post-institution fee. *See* 37 C.F.R. § 42.15(a). Thus, this

Petition meets the fee requirements under 35 U.S.C. § 312(a)(1). The Board is hereby authorized to charge any additional fees required by this action to Deposit Account No. 20-1430.

C. Challenge Under 37 C.F.R. § 42.104(b)

This petition requests cancellation of claims 1-2, 5, 11-13, 16-17, and 47-48 as rendered obvious under 35 U.S.C. § 103 based on the following prior art references:

- U.S. 2008/0116818 to Shteynberg (“Shteynberg”) (Ex. 1007);
- U.S. 2007/0121320 to Arai (“Arai”) (Ex. 1008);
- CN 1750732 to Zhang (“Zhang”) (Exs. 1009, 1010);
- U.S. 2006/0139954 to Kobori (“Kobori”) (Ex. 1011);
- U.S. 2003/0016205 to Kawabata (“Kawabata”) (Ex. 1012); and
- U.S. 2007/0013647 to Lee (“Lee”) (Ex. 1013).

The statutory grounds for the challenge of each claim are set forth below:

Ground	35 U.S.C.	Claims	References
1	103	1-2, 5, 12, 16-17	Combination of Shteynberg, Arai, and Zhang in view of the Knowledge of a POSITA
2	103	11	Combination of Shteynberg, Arai, Zhang, and Kobori in view of the Knowledge of a POSITA
3	103	47-48	Combination of Shteynberg and Lee in view of the Knowledge of a POSITA
4	103	1-2, 5, 12, 16-17	Combination of Shteynberg, Arai,

			and Kawabata in view of the Knowledge of a POSITA
5	103	11	Combination of Shteynberg, Arai, Kawabata, and Kobori in view of the Knowledge of a POSITA
6	103	13	Combination of Shteynberg, Arai, Kawabata, and Lee in view of the Knowledge of a POSITA

The record establishes a reasonable likelihood of prevailing as to each ground of invalidity with respect to the Challenged Claims.

IV. Background

A. The '710 Patent

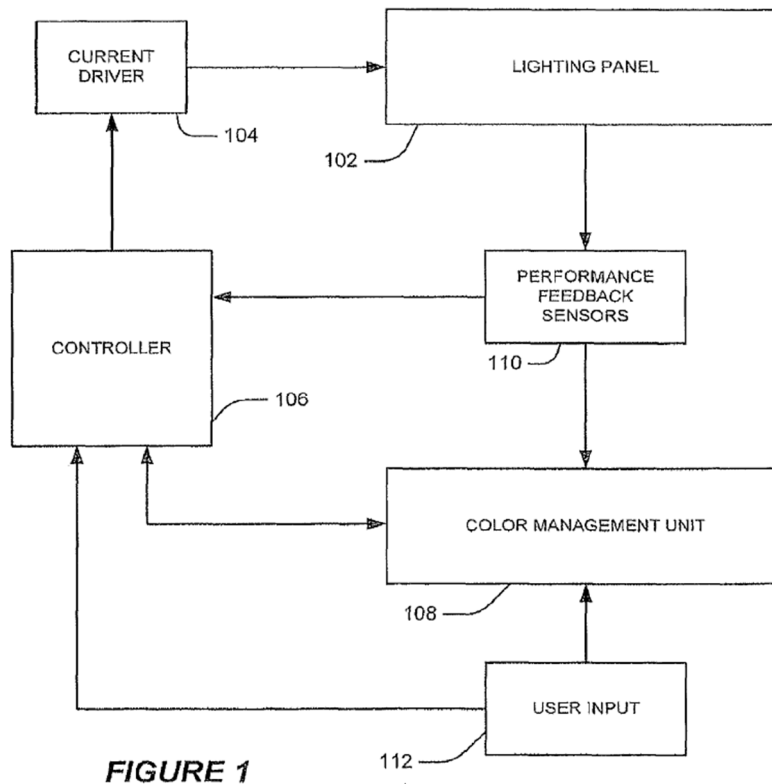
The '710 Patent was filed on October 11, 2011, and claimed priority as a continuation of U.S. Patent Application No. 11/745,713, now U.S. Patent No. 8,049,709 (“the '709 Patent”), filed on May 8, 2007.¹

The claims of the '710 Patent relate to a lighting system including a plurality of strings of solid state lighting devices, a current supply circuit, and a control system that provides control signals to the current supply circuit and includes a firing logic that determines a firing order of the plurality of strings.

Fig. 1 is described “as a [high-level] view of systems and method for controlling a solid state lighting panel” and includes a solid state lighting panel 102 driven by a current driver 104 that is configured to provide current to light emitting

¹ All of the prior art relied upon this Petition predates the filing date of the '709 Patent and thus this Petition does not address whether the claims of the '710 Patent are entitled to that priority date.

devices in the lighting panel 102. '710 Patent, 8:17-23. The controller 106, in conjunction with a color management unit 108, can use performance data from, for example, performance feedback sensors and user input 112 to perform necessary processing tasks to generate the control signals for the current driver “to achieve the desired display performance.” *Id.*, 8:23-32.



Id., Fig. 1.

As shown in Figure 8, a control system 800 selectively provides control signals to a current driver 808 that selectively drives multiple solid state lighting devices in a solid state lighting panel 810, and the control system 800 includes a firing logic 802 that can determine a firing order for multiple strings. '710 Patent,

10:22-30. The firing order determines “an order in which individual strings of solid state lighting devices and/or groups of strings of solid state lighting devices are supplied current.” *Id.*, 10:30-33.

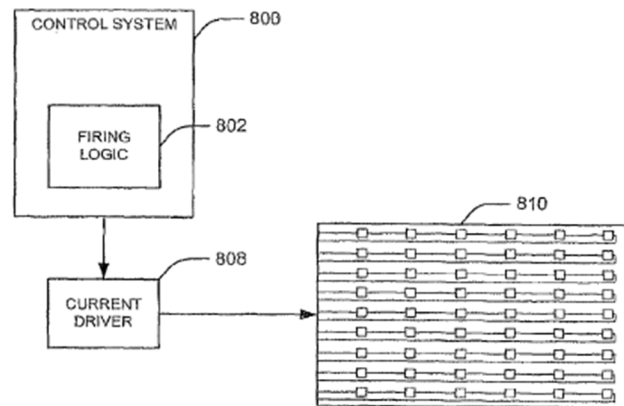


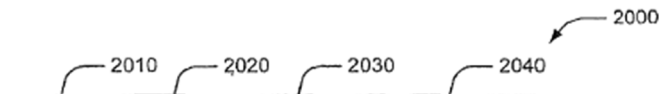
FIGURE 8

Id., Fig. 8.

The firing logic 802 can include rule-based logic that generates a “non-spatially-sequential firing order.” *Id.*, 10:51-53. The ’710 Patent introduces what a “non-spatially-sequential firing order” means by providing examples. *Id.*, 10:53-57. In one example, a second string fired after a first string is “not adjacent [to] the first string in the panel.” ’710 Patent, 10:53-55. In another example, the first and second strings “can be fired simultaneously and are not adjacent [to] one another.” *Id.*, 10:55-57.

Additionally, the firing order can be operative to fire different strings “based on the location of the bar that the strings are in.” *Id.*, 10:58-64. For example, the firing order may be such that “each subsequently fired string is located in a bar on

a different side of the previously fired string.” *Id.*, 10:66-11:2 (providing an example where first, second, and third strings are fired sequentially, “the second string can be in a bar below that of the first string and the third string can be in a bar above that of the second string”). This example is further exemplified by the string firing sequence in one embodiment described in conjunction with Fig. 20. *Id.*, 17:17-41 (discussing “spatial delta from previous firing [string]” alternating between positive integers and negative integers).



COLOR	FIRING SEQUENCE	STRING # (TOP TO BOTTOM)	SPATIAL DELTA FROM PREVIOUS FIRING
RED	1	4	3
RED	2	7	-5
RED	3	2	6
RED	4	8	-3
RED	5	5	4
RED	6	9	-6
RED	7	3	3
RED	8	6	-5
RED	9	1	3
GREEN	10	4	3
GREEN	11	7	-5
GREEN	12	2	6
GREEN	13	8	-3
GREEN	14	5	4
GREEN	15	9	-6
GREEN	16	3	3
GREEN	17	6	-5
GREEN	18	1	3
BLUE	19	4	3
BLUE	20	7	-5
BLUE	21	2	6
BLUE	22	8	-3
BLUE	23	5	4
BLUE	24	9	-6
BLUE	25	3	3
BLUE	26	6	-5
BLUE	27	1	3

Id., Fig. 20.

B. Prosecution of the '710 Patent

The Application that led to the '710 Patent was originally filed on December 11, 2011. Claims 1-57 were rejected under the nonstatutory, judicially created doctrine of obviousness-type double patenting over claims 1-55 of U.S. Patent No. 8,049,709 in a Non-Final Office Action dated April 27, 2012. The Applicant responded by submitting a Terminal Disclaimer disclaiming the additional term over U.S. Patent No. 8,049,709. Ex. 1002, 91. The Examiner issued a notice of allowance afterward. Ex. 1002, 112-116.

C. The '709 Patent

The Application that led to the '709 Patent was filed on May 8, 2007. As a patent matured from the parent application of the '710 Patent, the '709 Patent has the same specification as that of the '710 Patent. The '709 Patent includes fifty-five claims.

D. Prosecution of the '709 Patent

The Application that led to the '709 Patent was originally filed on May 8, 2007. In the Response to Office Action filed by the Applicant on April 6, 2011, the Applicant argued, without claim amendments, that the cited reference “does not disclose or suggest selectively providing current to the *strings of* solid state lighting devices.” Ex. 1004, 47. The Examiner issued a notice of allowance

afterward. Ex. 1004, 341-345.

V. Expert Testimony, Level of Skill in the Art, and Claim Construction

A. Declaration Evidence

This Petition is supported by the declaration of Rafael Betancourt. Ex. 1005. As describe in his declaration, Mr. Betancourt is an expert with decades of experience the relevant industry. Ex. 1005, ¶¶6-13.

B. Person of Ordinary Skill in the Art

A person of ordinary skill in the art of the '710 Patent would have had at least a graduate degree in mechanical engineering, physics, materials science, electrical engineering, or a related discipline, coupled with at least four years' experience in designing backlighting systems for displays; the level of ordinary skill in the art is approximate and additional education could make up for a lack of experience or vice-versa.

C. Claim Construction

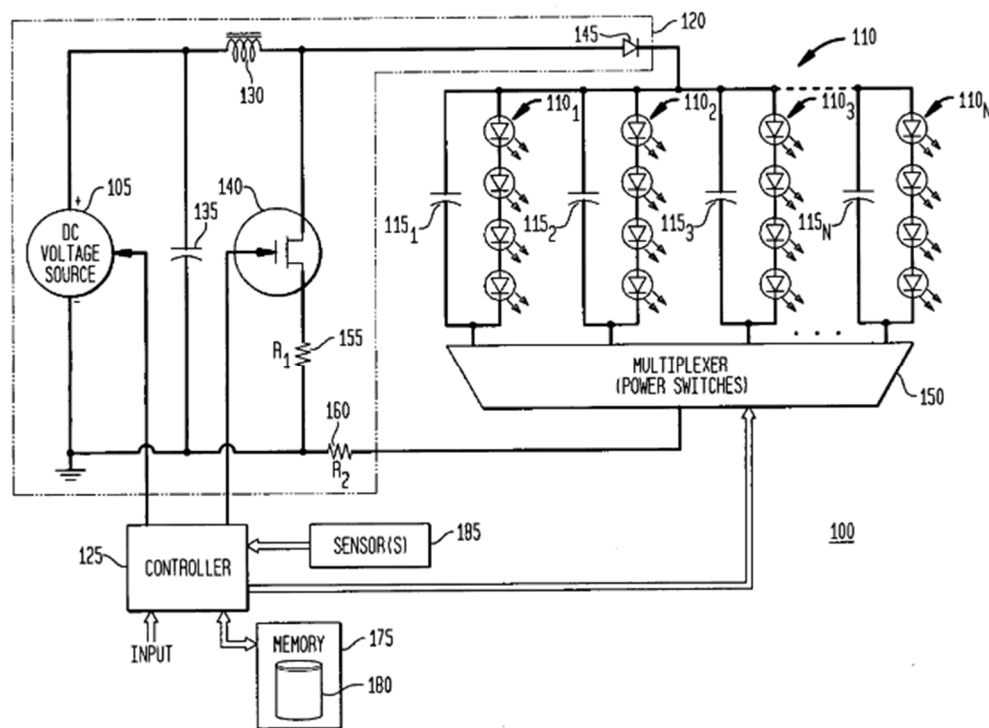
Nothing in the specification or prosecution history of the '710 Patent expressly defines any term appearing in any challenged claim of the '710 Patent. Further, the Board does not need to construe any claim term for purposes of evaluating the prior art in this Petition, and thus for purposes of this proceeding only, Petitioner believes that no claim term requires construction.

VI. Prior Art

A. Shteynberg

Shteynberg is a publication of a U.S. Application filed on November 21, 2006, and published on May 22, 2008. Shteynberg is thus prior art to the '710 Patent under at least 35 U.S.C. § 102(e).

Shteynberg discloses a lighting system, which “comprises a plurality of series of light-emitting diodes, a power converter, a first multiplexer, and a controller.” Shteynberg, [0021]. As shown in Fig. 3, 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. Shteynberg, [0043]-[0044].



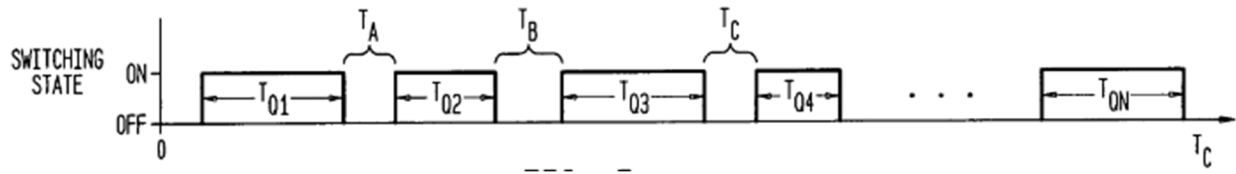
Id., Fig. 3.

The lighting system includes a power converter 120, which is operable to “**deliver a controlled current level** to a load.” Shteynberg, [0048]. In the example shown in Fig. 3, the load is the LED strings 110₁, 110₂, 110₃, ... , 110_N.

The lighting system further includes a multiplexer 150, which “provides for **individually and selectively allowing current to flow through** each of the series of LEDs 110₁, 110₂, 110₃, through 110_N.” Shteynberg, [0047]. As a result, any selected one of the LED strings is turned on or off accordingly. *Id.* The LED strings are energized using time-division modulation. Shteynberg, [0044]. “**Under the control of the controller 125,**” the multiplexer 150 is configured to “allow current through one or more of the series of LEDs 110₁, 110₂, 110₃, through 110_N **in any combination**, and **for any selected duration.**” Shteynberg, [0047].

In addition, 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.” *Id.*, [0049]. As shown in Fig. 3, the controller 230 may receive input from one or more sensors 185. Alternatively, the controller 230 may “be coupled within a larger system, such as a computer-controlled lighting system in a building, and may interface with other computing elements.” Shteynberg, [0049].

Shteynberg further describes that each of the LED strings is provided with a selected and independent current level, “***through control (by controller 125)*** of the switching state of each channel (via multiplexer 150),” for a selected time period (or duration).” Shteynberg, [0054].



Id., Fig. 4.

Importantly, Shteynberg stresses that “[e]ach ***energizing time period*** may be provided ***in any order or combination.***” Shteynberg, [0054]. As one example, ***LED string 1103*** is provided with current for third time period T_{Q3} , ***followed by LED string 1102*** being provided with current for second time period T_{Q4} . In the example shown in Fig. 4, the “flipping” firing order (i.e., LED string 1103 is fired before LED string 1102 is fired) is non-spatially sequential.

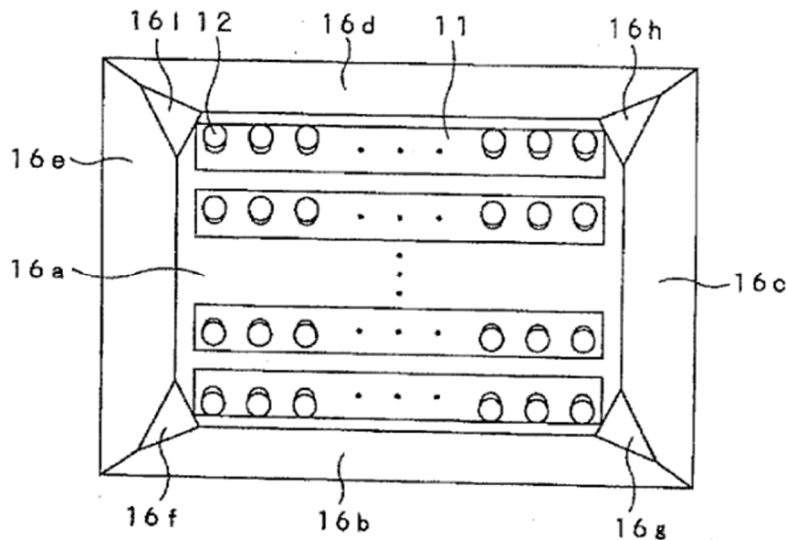
B. Arai

Arai is a publication of a U.S. Application filed on April 12, 2006², and published on May 31, 2007. Arai is thus prior art to the '710 Patent under at least 35 U.S.C. § 102(e).

Arai discloses a backlight unit 3 of a transmission type liquid crystal display

² Arai is a national stage application of a PCT Application filed on August 15, 2005.

panel 1, having LEDs 12 that are “two-dimensionally arranged.” Arai, [0006]; [0024]. As shown in Fig. 5, the LEDs 12 are arranged in a first direction (from left to right) to form LED strings and positioned at intervals in a second direction (from top to bottom). Arai explains that such a two-dimensional arrangement could permit “display of high luminance on large-sized liquid crystal panel by low power consumption.” Arai, [0006].



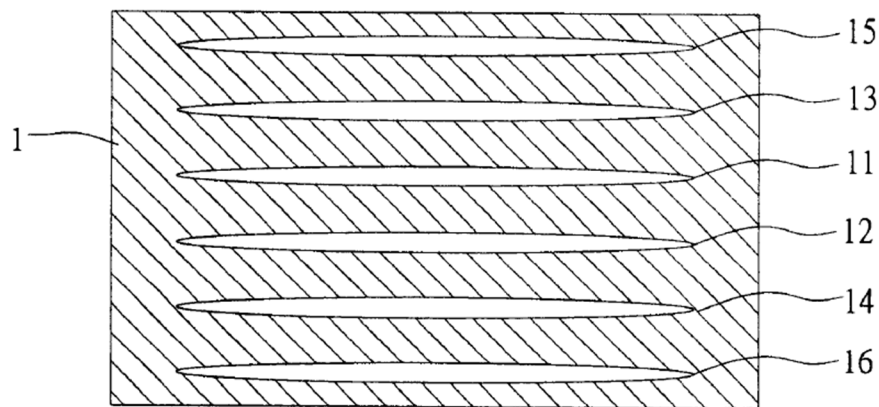
Arai, Fig. 5.

C. Zhang

Zhang is a publication of a Chinese Application filed on September 17, 2004, and published on March 22, 2006. Zhang is thus prior art to the '710 Patent under at least 35 U.S.C. § 102(b).

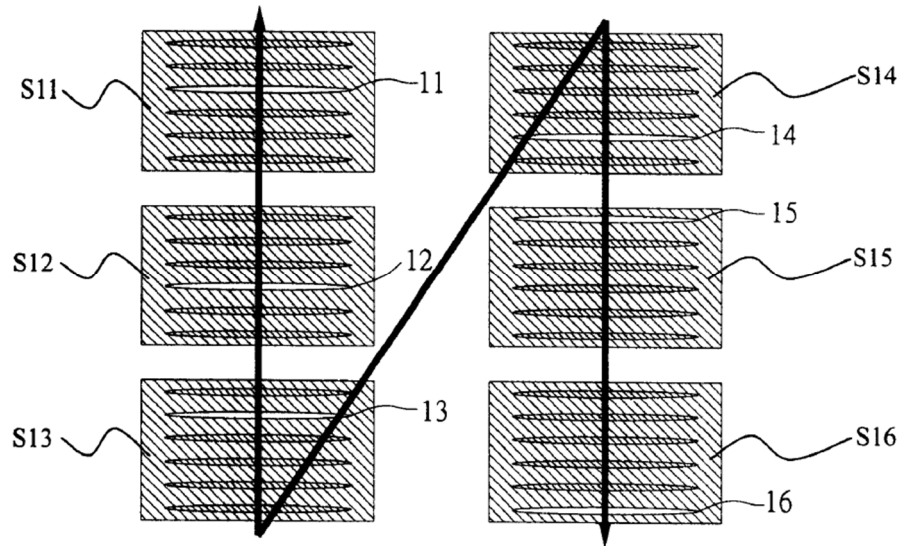
Zhang discloses, with reference to Fig. 1A, a display panel 1, which corresponds to an even number (e.g., six) of backlight modules. Zhang, 5:8-11.

The first backlight module 11 and the second backlight module 12 are located at the center of the display panel 1. Zhang, 5:12-14. The third backlight module 13 and the fourth backlight module 14 are situated on two sides, respectively, toward the outside of the first backlight module 11 and the second backlight module 12. *Id.* The fifth backlight module 15 and the sixth backlight module 16 are situated on two sides, respectively, toward the outside of the four backlight modules 11-14. *Id.*



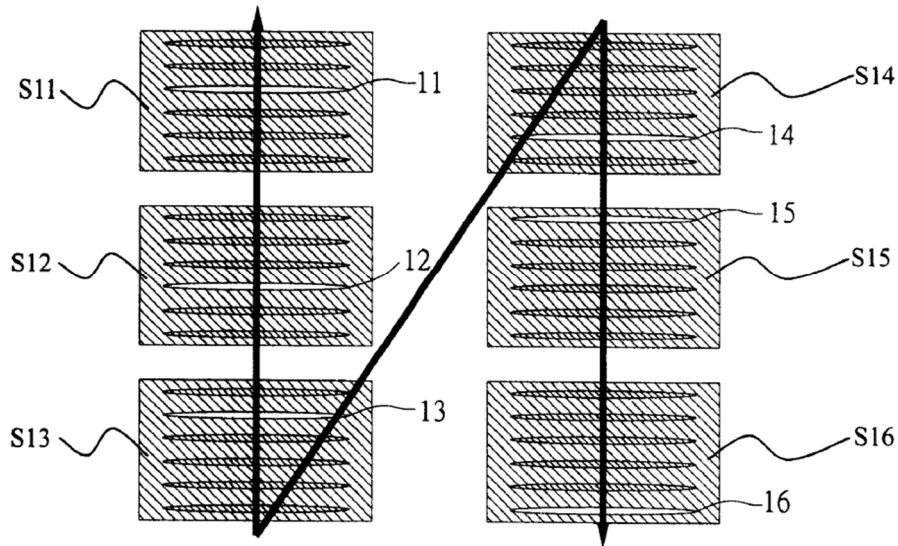
Zhang, Fig. 1A.

Zhang describes, with reference to Fig. 1B, a lighting sequence as follows: the first backlight module 11, the second backlight module 12, the third backlight module 13, the fourth backlight module 14, the fifth backlight module 15, and the sixth backlight module 16. Zhang, 5:14-23.



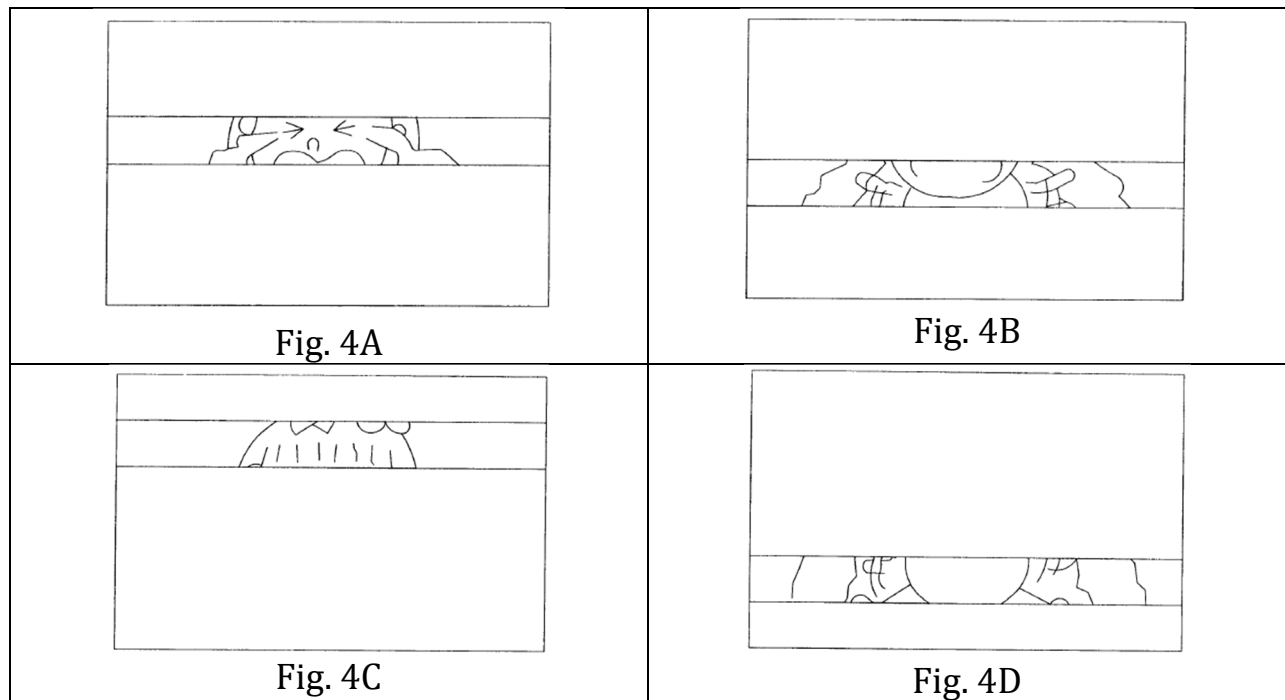
Zhang, Fig. 1B.

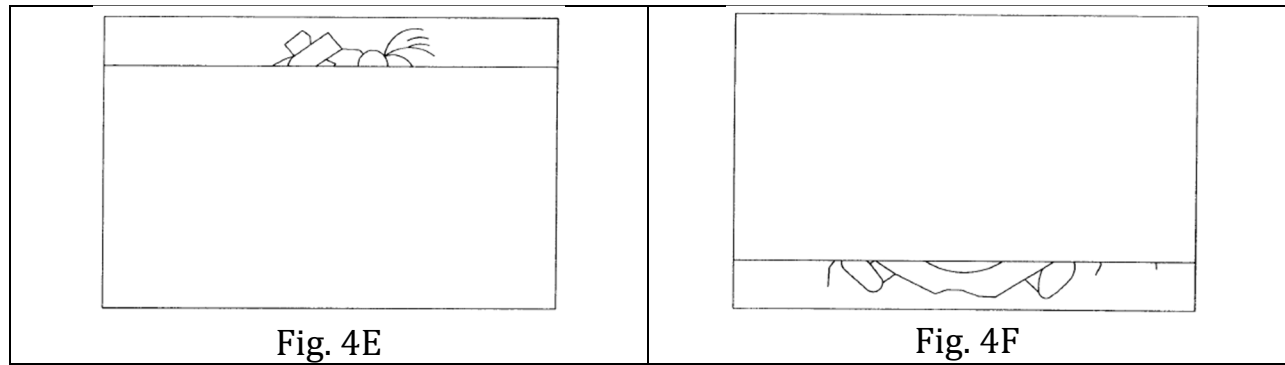
Zhang discloses non-spatially-sequential firing orders. For instance, the firing order shown in Fig. 1B is: the *third* backlight module from the top, the *fourth* backlight module from the top, the *second* backlight module from the top, the *fifth* backlight module from the top, the *first* backlight module from the top, and the *sixth* backlight module from the top (i.e., III→IV→II→V→I→VI). Zhang, 5:14-23.



Zhang, Fig. 1B.

The resultant display image is shown in Figs. 4A-4F. Zhang, 6:13-36.



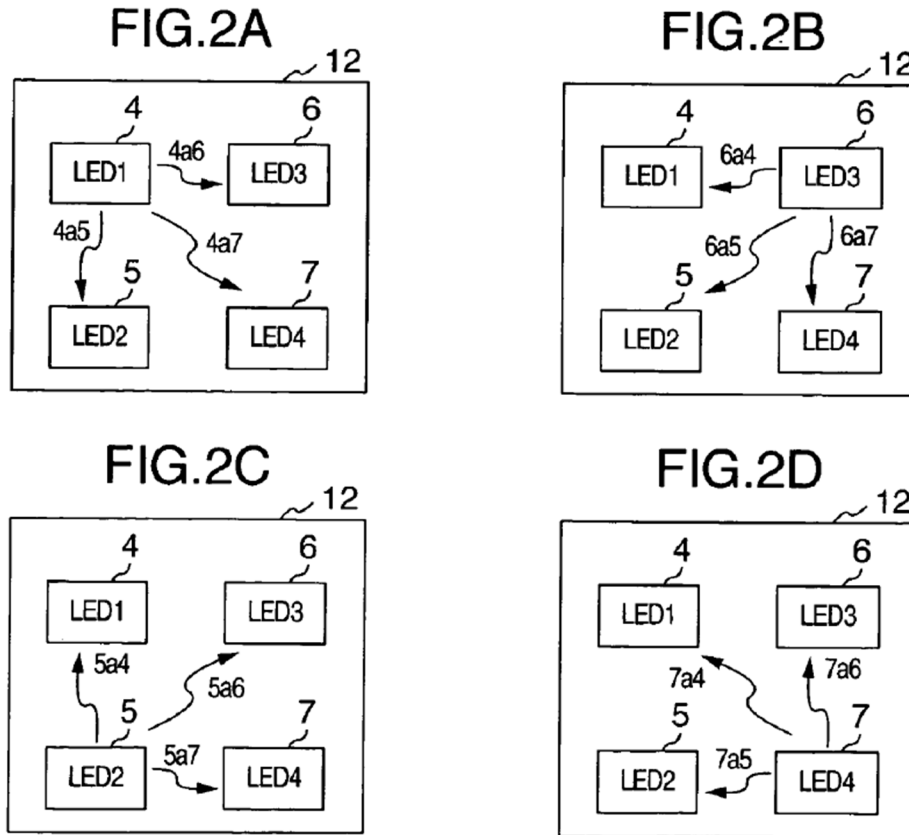


Zhang, Figs. 4A-4F.

D. Kobori

Kobori is a publication of a U.S. Application filed on August 24, 2005, and published on June 29, 2006. Kobori is thus prior art to the '710 Patent under at least 35 U.S.C. § 102(a).

Kobori admits the need to “obtain highly-accurate *uniform luminiferous characteristics* at a low cost.” Kobori, [0007]. Kobori describes, with reference to Figs. 2A-2D, “*arbitrarily changing* the PWM interval, the number of times, the phase for each LED so as to diversify the ON/OFF relationship.” Kobori, [0035].

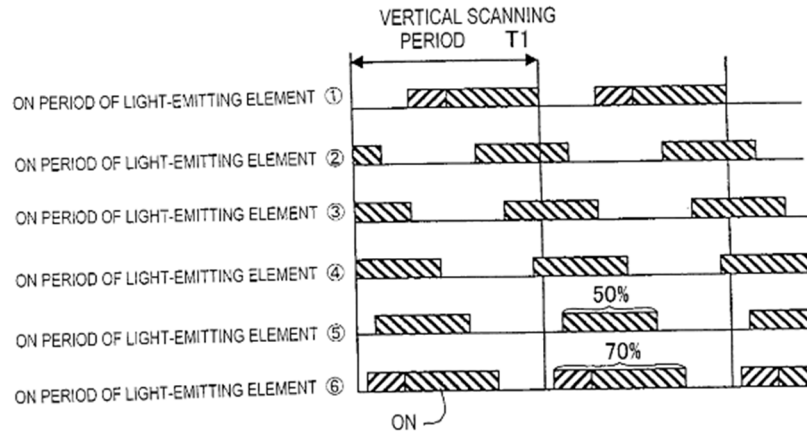


Kobori, Figs. 2A-2D.

E. Kawabata

Kawabata is a publication of a U.S. Application filed on July 17, 2002, and published on January 23, 2003. Kawabata is thus prior art to the '710 Patent under at least 35 U.S.C. § 102(b).

Kawabata describes, with reference to Figure 5, “scan lighting.” Kawabata, [0070]. 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.



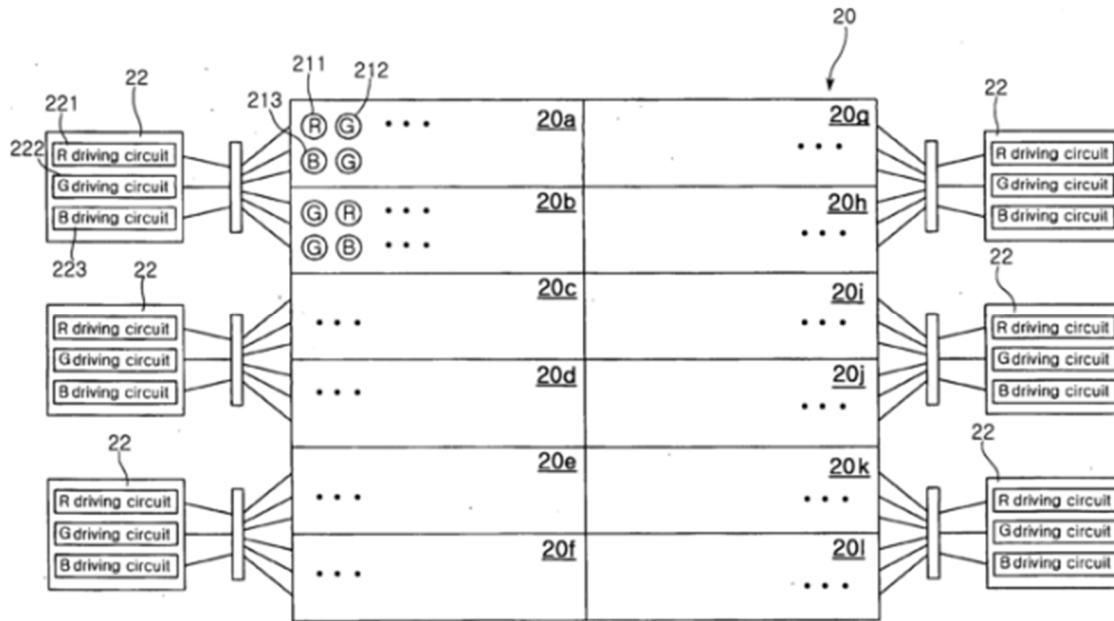
Kawabata, Fig. 7.

Kawabata discloses non-spatially-sequential firing orders in additional embodiments. *See* Kawabata, Figs. 8, 23.

F. Lee

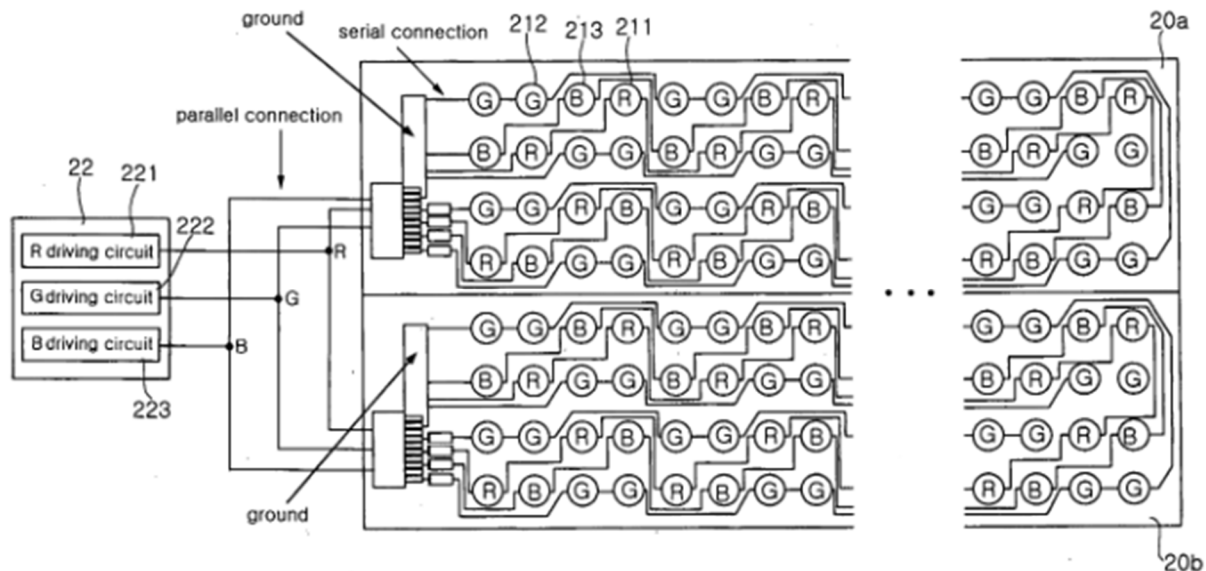
Lee is a publication of a U.S. Application filed on July 13, 2006, and published on January 18, 2007. Lee is thus prior art to the '710 Patent under at least 35 U.S.C. § 102(a).

Lee discloses a plurality of LED driving units 22 are provided, each having red, green, and blue LED driving circuits 221, 222, and 223 for respectively driving the red, green, and blue LEDs 211, 212, and 213. Lee, Figs. 2, 3.



Lee, Fig. 2.

Lee describes that each driving unit 22 has red, green, and blue LED driving circuits 221, 222, and 223 for respectively driving the red, green, and blue LEDs 211, 212, and 213. Lee, [0029]. As shown in Fig. 3, the series connection structure of the identical color LEDs in the divided region 20a is connected to the series connection structure of the identical color LEDs in the divided region 20b. *Id.*, [0034].



Lee, Fig. 3.

VII. Full Statement of the Reasons for the Relief Requested

A. Ground 1 – Claims 1-2, 5, 12, and 16-17 are Obvious Under 35 U.S.C. § 103 Over the Combination of Shteynberg, Arai, and Zhang in view of the Knowledge of a POSITA.

The combination of Shteynberg, Arai, and Zhang in view of the knowledge of a POSITA discloses each element of claims 1-2, 5, 12, and 16-17. Shteynberg discloses an array of light emitting diodes and the independent control thereof using a multiplexer. In a similar field, Zhang discloses improving the uneven brightness of a display by changing the lighting sequence of backlight modules of a display. Arai discloses a two-dimensional arrangement of LEDs. Thus, a POSITA would be motivated to combine Shteynberg, Arai, and Zhang. Claims 1-2, 5, 12, and 16-17 are obvious over the combination of Shteynberg, Arai, and Zhang.

1. Motivation to Combine Shteynberg, Arai, and Zhang

A POSITA would be motivated to combine Shteynberg, Arai, and Zhang. A combination of familiar elements according to known methods, which yields no more than predictable results is likely obvious to one of skill in the art. One rationale to support a conclusion of obviousness is the use of a known technique to improve similar devices (methods, or products) in the same way. MPEP 2143(C). To establish that a combination and/or modification is the use of a known technique to improve similar devices and methods in the same way, it is necessary to establish (1) that the prior art contained a “base” device/method upon which the claimed invention can be seen as an “improvement,” (2) a finding that the prior art contained a “comparable” device/method that is not the same as the base device/method and that has been improved in the same way as the claimed invention, and (3) that the skilled artisan could have applied the known “improvement” in the same way to the base device/method with predictable results. *See* MPEP 2143(C).

A POSITA would have been 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. Ex. 1005, ¶103.

First, Shteynberg, Arai, and Zhang are in the same field of endeavor, i.e., achieving the emission of light perceived as white light. Ex. 1005, ¶104.

Consequently, a POSITA would have had a reasonable expectation of success in combining their various disclosures to achieve the emission of light perceived as white light. Ex. 1005, ¶104. Furthermore, it was well within the technical ability of a POSITA at the time to incorporate the improvements to brightness uniformity by changing the firing order described in Zhang and the LED string two-dimensional arrangement described in Arai into the independent control of an array of LEDs disclosed by Shteynberg. *Id.*

Second, 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 on large-sized display***, as described in Arai. Ex. 1005, ¶105. Modifying Shteynberg to include the non-spatially-sequential firing order, as disclosed by Zhang, and the two-dimensional arrangement, as disclosed by Arai, would meet this goal. Ex. 1005, ¶105. Zhang states that the display delay and the brightness non-uniformity can be mitigated by changing the lighting sequence of backlight modules. Zhang, 2:8-12. Arai states: “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.” Arai, [0006].

Thus, combining these three references—Shteynberg, Arai, and Zhang—that all use the same components to achieve the same goal would have been obvious to

a POSITA. Ex. 1005, ¶106.

2. Independent Claim 1.

[’710 Claim 1 Preamble] A lighting panel system, comprising:

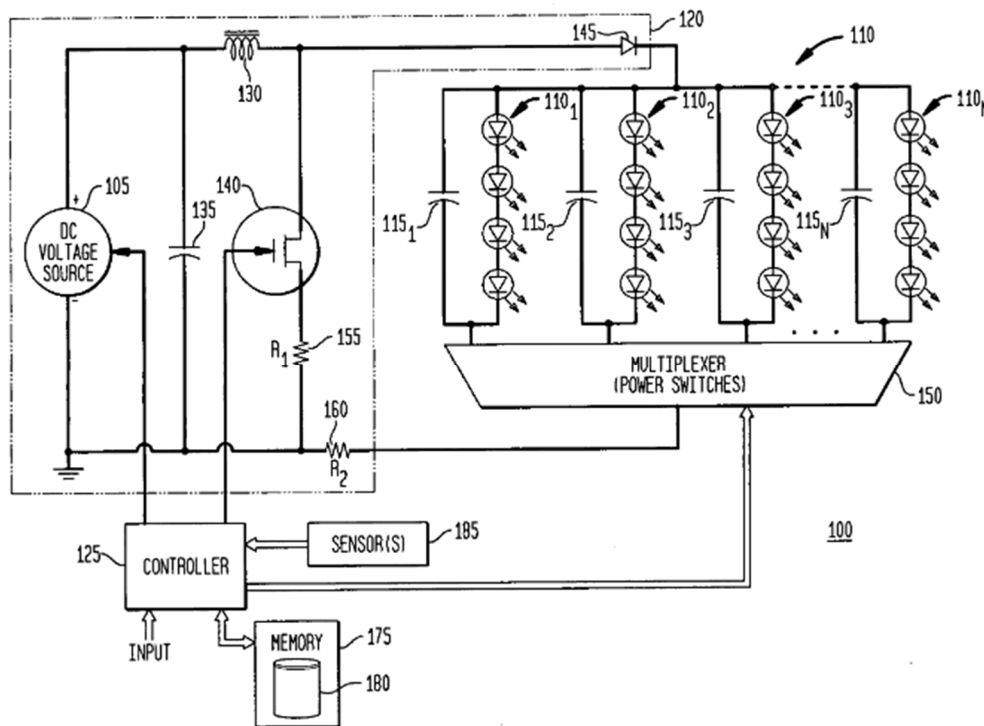
Shteynberg discloses a lighting system, which “comprises a plurality of series of light-emitting diodes, a power converter, a first multiplexer, and a controller.” Shteynberg, [0021].

[’710 Claim 1A] a plurality of strings of solid state lighting devices arranged in a first direction and positioned at intervals in at least one second direction;

These elements would have been obvious to a POSITA in view of the teachings of Shteynberg because 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 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 110₁, 110₂, 110₃, ... , 110_N. Shteynberg, [0043]-[0044]. As shown in Fig. 3, LEDs in each LED string are arranged in a first direction (from top to bottom, as shown in Fig. 3), and these strings of LEDs are positioned at intervals in a second direction (from left to right, as shown in Fig. 3). Since the LEDs are organized in an “array,” the LEDs are organized in columns (each column corresponding to one

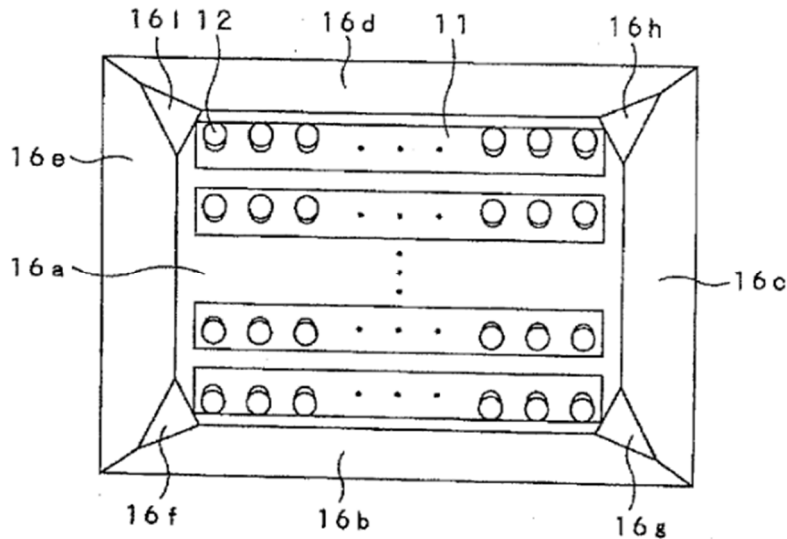
LED string) and rows (multiple LED strings are distributed to form a row, i.e., positioned at intervals), as shown in Fig. 3.



Id., Fig. 3.

To the extent that someone would argue that Fig. 3 fails to show LED strings “arranged in a first direction and positioned at intervals in at least one second direction,” Arai discloses a backlight unit 3 of a transmission type liquid crystal display panel 1, having LEDs 12 that are “two-dimensionally arranged.” Arai, [0006] and [0024]. As shown in Fig. 5, the LEDs 12 are arranged in a first direction (from left to right, as shown in Fig. 5) to form LED strings and positioned at intervals in a second direction (from top to bottom, as shown in Fig. 5). Arai explains that such a two-dimensional arrangement could permit “display of high

luminance on large-sized liquid crystal panel by low power consumption.” Arai, [0006].



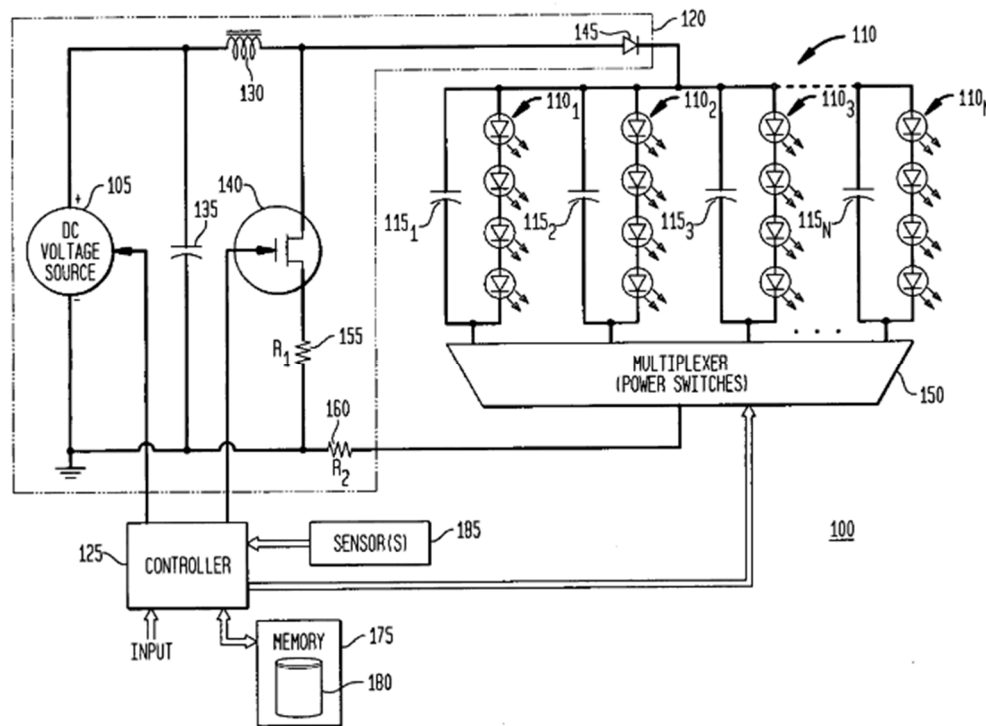
Arai, Fig. 5.

[’710 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; and

Shteynberg discloses these elements because the DC voltage source 105 and the multiplexer 150 discussed in Shteynberg selectively supply on-state drive currents to the LED strings 110₁, 110₂, 110₃, ... , 110_N. Shteynberg, [0044], [0047]-[0048].

As discussed in paragraph [0048], the lighting system includes a power converter 120, which includes “a DC voltage source 105, a filter capacitor 135, an inductor 130, a switch 140, and a peak current sense resistor (R1) 155.” Shteynberg, [0048]. The power converter 120 is operable to “*deliver a controlled*

current level to a load.” *Id.* In the example shown in Fig. 3, the load is the LED strings 110₁, 110₂, 110₃, ... , 110_N. The DC voltage source 105 may be an AC/DC converter in some embodiments or an AC/DC converter connected to a phase modulation AC device. *Id.*



Id., Fig. 3.

The lighting system further includes a multiplexer 150, which “provides for **individually and selectively allowing current to flow through** each of the series of LEDs 110₁, 110₂, 110₃, through 110_N.” Shteynberg, [0047]. As a result, any selected one of the LED strings is turned on or off accordingly. *Id.* The LED strings are energized using time-division modulation. Shteynberg, [0044]. “**Under the control of the controller 125,**” the multiplexer 150 is configured to “allow

current through one or more of the series of LEDs 110₁, 110₂, 110₃, through 110_N *in any combination*, and *for any selected duration*.” Shteynberg, [0047].

Importantly, the multiplexer 150 may be implemented as *multiple* power switches, as shown in Fig. 3. Shteynberg, [0043]. A POSITA would appreciate that multiple control signals could be used to control the multiple power switches to achieve individual and selective control over the LED strings. *See* Ex. 1005, ¶64. Moreover, Shteynberg further states that the controller 125 “may be embodied as” *multiple controllers*, “adapted to perform the functionality.” Shteynberg, [0051].

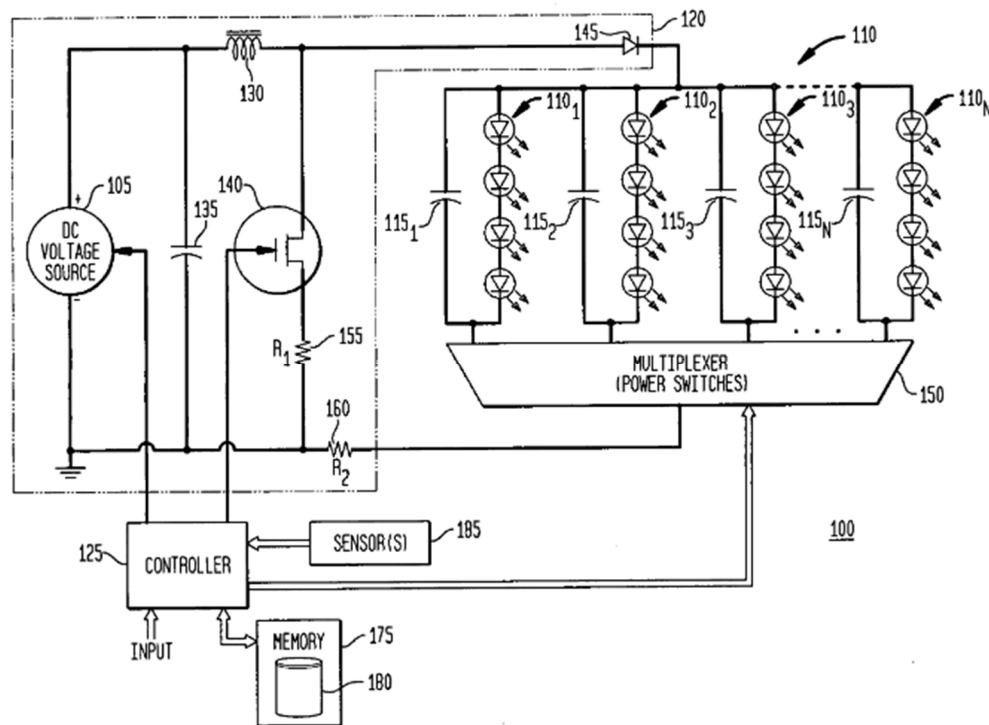
Therefore, the “controlled current level” generated by the power converter 120 is selectively supplied to, with the help of the multiplexer 150, the LED strings responsive to the control signals generated by the controller 125.

[’710 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,

Shteynberg discloses these elements because the controller 125 disclosed in Shteynberg 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. Shteynberg, [0047]; [0049].

Shteynberg describes that the lighting system includes a controller 125.

Shteynberg, [0043]. The controller may “receive input from a wide variety of sources.” *Id.*, [0049]. The controller 230 may “be coupled within a larger system, such as a computer-controlled lighting system in a building, and may interface with other computing elements.” Shteynberg, [0049]. Therefore, Shteynberg describes a variety of sources where the input for the controller 125 comes from. More importantly, Shteynberg suggests input coming from “a larger system” (as illustrated by the arrow in Fig. 3), and a POSITA would understand that ***user input could be one example of input coming from a larger system.*** See Ex. 1005, ¶65.



Id., Fig. 3.

As discussed *supra* in relation to claim 1B, the multiplexer 150 “provides for ***individually and selectively allowing current to flow through*** each of the series of

LEDs ... *[u]nder the control of the controller 125.*” Shteynberg, [0047].

Therefore, Shteynberg discloses a control system (the controller 125) configured to receive a user input (input coming from a larger system and illustrated as the arrow in Fig. 3) and to selectively provide control signals (control signals generated by the controller 125) to the current supply circuit (the power converter 120 and the multiplexer 150) responsive to the user input to selectively (individually and selectively allowing current to flow through) drive the plurality of strings (LED strings 110₁, 110₂, 110₃, through 110_N).

[’710 Claim 1D] the control system further including firing logic configured to determine a firing order of the plurality of strings.

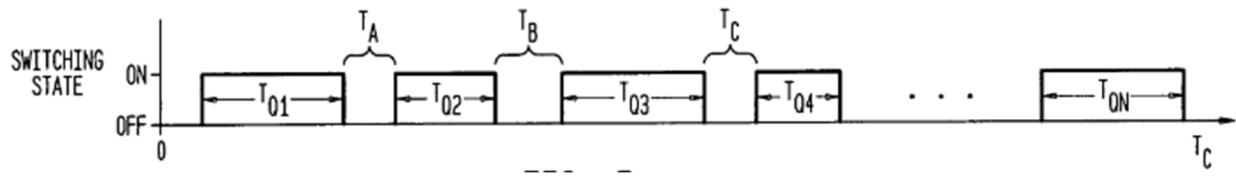
The Shteynberg-Zhang combination discloses these elements because Shteynberg discloses that the controller 125 determines the order of the energizing time periods, which is equivalent to the firing order. Shteynberg, [0047] and [0054]. Zhang also discloses a firing logic (a process) that determines the firing order (lighting sequence of the backlight modules). Zhang, 7:1-33.

As an initial matter, the ’710 Patent defines the “firing order” as “an order in which individual strings of solid state lighting devices and/or groups of strings of solid state lighting devices are supplied current.” ’710 Patent, 10:30-33.

Shteynberg describes that the multiplexer 150 is configured to “allow current through one or more of the series of LEDs 110₁, 110₂, 110₃, through 110_N *in any combination*, and *for any selected duration*” under the

control of the controller 125. Shteynberg, [0047].

Shteynberg further describes that each of the LED strings is provided with a selected and independent current level, “***through control (by controller 125) of the switching state of each channel (via multiplexer 150),***” for a selected time period (or duration).” Shteynberg, [0054].



Id., Fig. 4.

Importantly, Shteynberg stresses that “[e]ach ***energizing time period*** may be provided ***in any order or combination.***” Shteynberg, [0054]. As one example, and as illustrated in the annotated Fig. 4, ***LED string 1103*** is provided with current for third time period T_{Q3} , ***followed by LED string 1102*** being provided with current for second time period T_{Q4} .

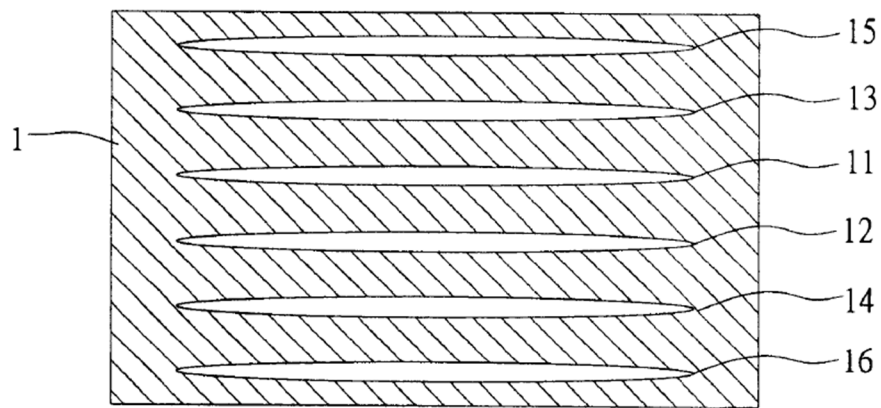
Therefore, the controller 125, via the multiplexer 150, determines the order of the energizing time periods, which is equivalent to the firing order according to the definition of the “firing order” discussed *supra*, for the LED strings. Thus, Shteynberg discloses “to determine a firing order of the plurality of strings” recited in claim 1D.

Shteynberg at least 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). Shteynberg, [0054]. Thus, a *POSITA* would understand that the control system could include a *firing logic* configured to determine the firing order. *See* Ex. 1005, ¶73.

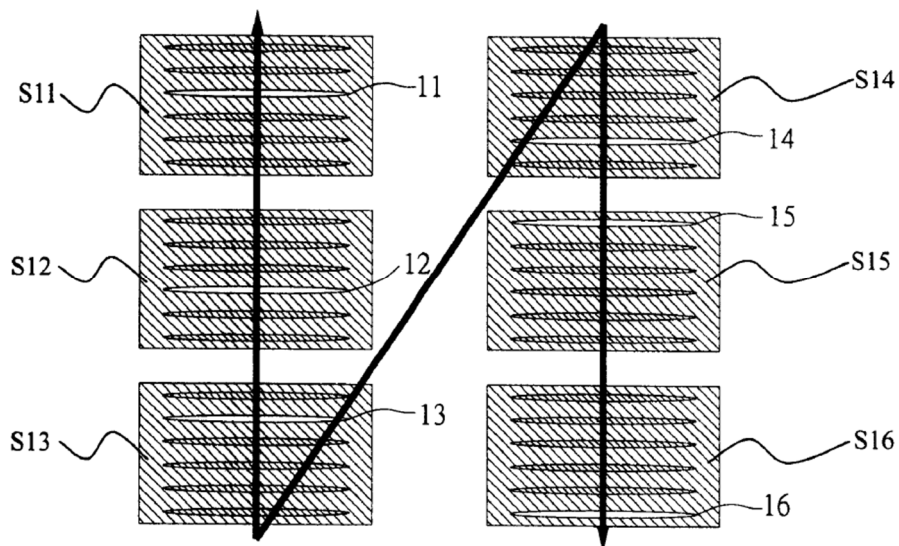
To the extent that Shteynberg does not expressly disclose the firing logic that determines the firing order, Zhang describes a firing logic that determines the firing order.

Zhang discloses, with reference to Fig. 1A, a display panel 1, which corresponds to an even number (e.g., six) of backlight modules. Zhang, 5:8-11. The first backlight module 11 and the second backlight module 12 are located at the center of the display panel 1. Zhang, 5:11-14. The third backlight module 13 and the fourth backlight module 14 are situated on two sides, respectively, toward the outside of the first backlight module 11 and the second backlight module 12. *Id.* The fifth backlight module 15 and the sixth backlight module 16 are situated on two sides, respectively, toward the outside of the four backlight modules 11-14. *Id.*



Zhang, Fig. 1A.

Zhang describes, with reference to Fig. 1B, a lighting sequence as follows: the first backlight module 11, the second backlight module 12, the third backlight module 13, the fourth backlight module 14, the fifth backlight module 15, and the sixth backlight module 16. Zhang, 5:14-23.



Zhang, Fig. 1B.

In addition, Zhang describes, with reference to Figs. 2A and 2B, another

embodiment with an odd number (e.g., five) of backlight modules. Zhang, 5:24-37. Zhang stresses that the lighting sequence is from the central backlight module(s) to the outside backlight modules, or vice versa, regardless of an even number or an odd number of backlight modules. Zhang, 5:38-42.

Therefore, Zhang discloses a firing order (the lighting sequence) under the definition stated in the '710 Patent.

Moreover, the flowchart shown in Fig. 5 illustrates a process, by which the lighting sequence is determined, and the process includes, in part, the following steps: (i) step 32, determine whether the number of backlight modules is even or odd; (ii) step 33, when the number is odd, drive and turn on the central backlight module; and (iii) step 34, when the number is even, drive and turn on one of the two central backlight modules. Zhang, 7:1-16. The flowchart shown in Fig. 6 illustrates a similar process, except that the lighting sequence is from the outmost backlight modules to the central backlight module(s). Zhang, 7:17-33.

Thus, Zhang discloses a firing logic (a component that executes the processes shown in Figs. 5 and 6) that is configured to determine a firing order.

3. Dependent Claim 2.

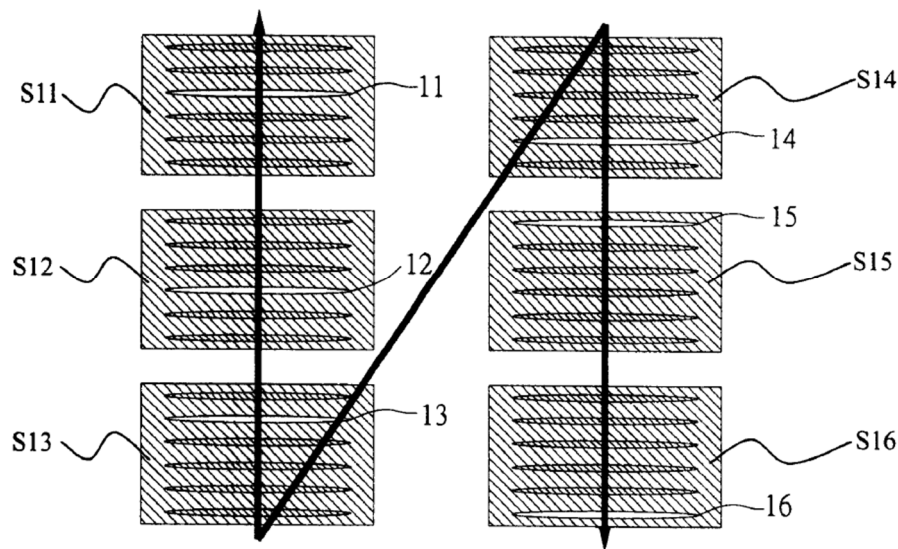
[’710 Claim 2] The system of claim 1, wherein the firing logic comprises rule-based logic operative to generate a non-spatially-sequential firing order.

As discussed above in relation to claim 1D, Zhang discloses a firing logic

that determines a firing order.

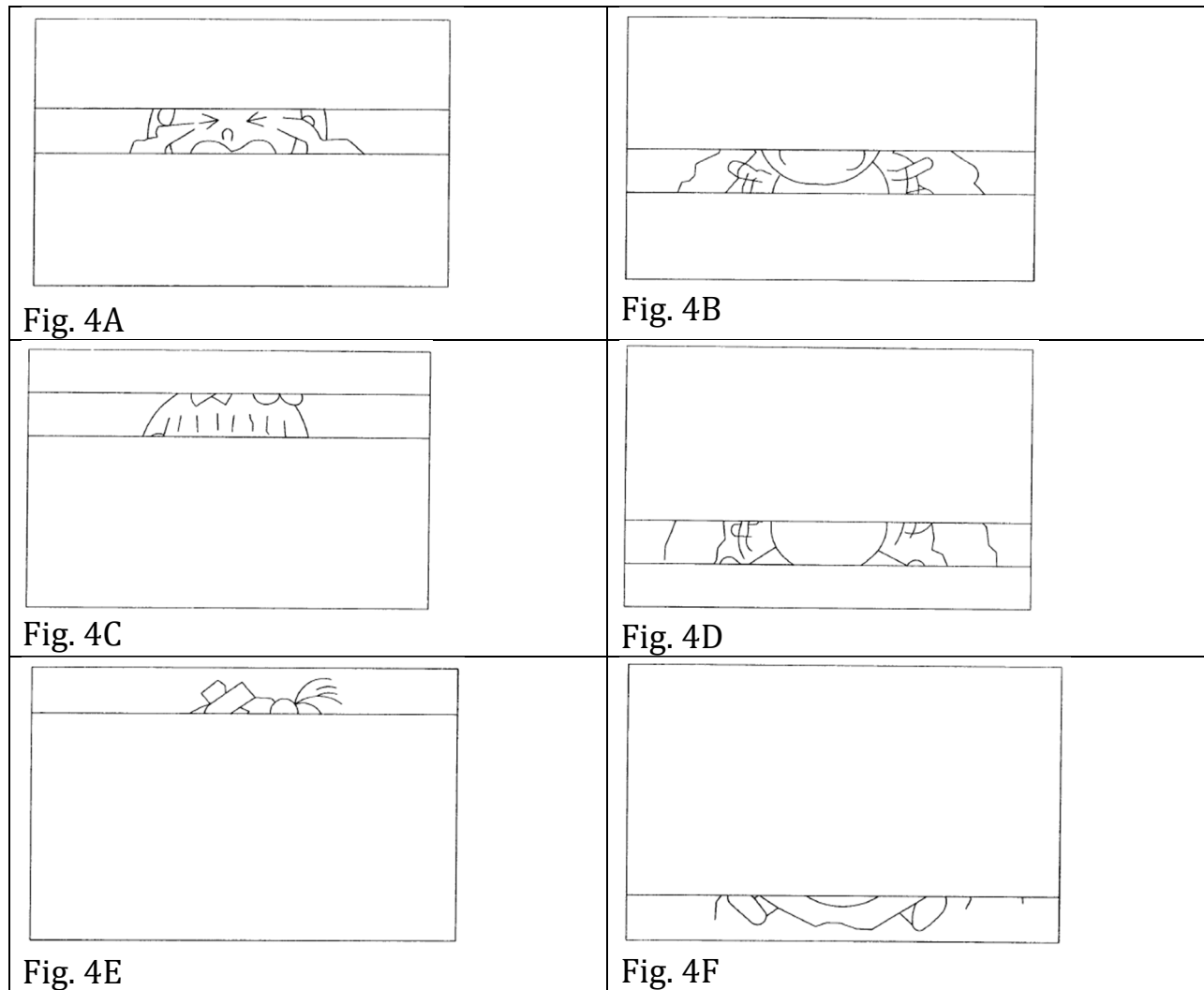
As shown in Figs. 5 and 6, the firing logic comprises rule-based logic because the processes shown in Figs. 5 and 6 are based on rules (e.g., step 33, when the number is odd, drive and turn on the central backlight module; step 34, when the number is even, drive and turn on one of the two central backlight modules). Zhang, 7:1-33. Thus, Zhang discloses rule-based logic.

Importantly, the firing order discussed in Zhang is a non-spatially-sequential firing order. For instance, the firing order shown in Fig. 1B is as follows: the ***third*** backlight module from the top, the ***fourth*** backlight module from the top, the ***second*** backlight module from the top, the ***fifth*** backlight module from the top, the ***first*** backlight module from the top, and the ***sixth*** backlight module from the top (i.e., a simplified illustration being III→IV→II→V→I→VI). Zhang, 5:14-23.



Zhang, Fig. 1B.

The resultant display image is shown in Figs. 4A-4F. Zhang, 6:13-36. Figs. 4A-4F clearly show that the firing order is not spatially-sequential (i.e., one-by-one from the top to the bottom).



Zhang, Figs. 4A-4F.

A POSITA would recognize that the non-spatially-sequential firing order discussed in Zhang could be used as the firing order discussed in Shteynberg to achieve desired benefits, such as mitigating display artifacts and increasing the

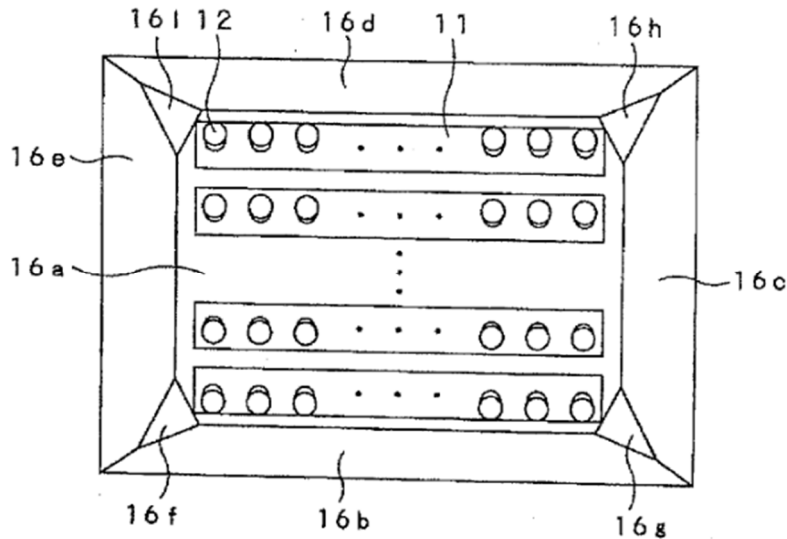
brightness uniformity. *See* Ex. 1005, ¶81. Thus, these elements are obvious in view of the combination of Shteynberg and Zhang.

4. Dependent Claim 5.

[’710 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.

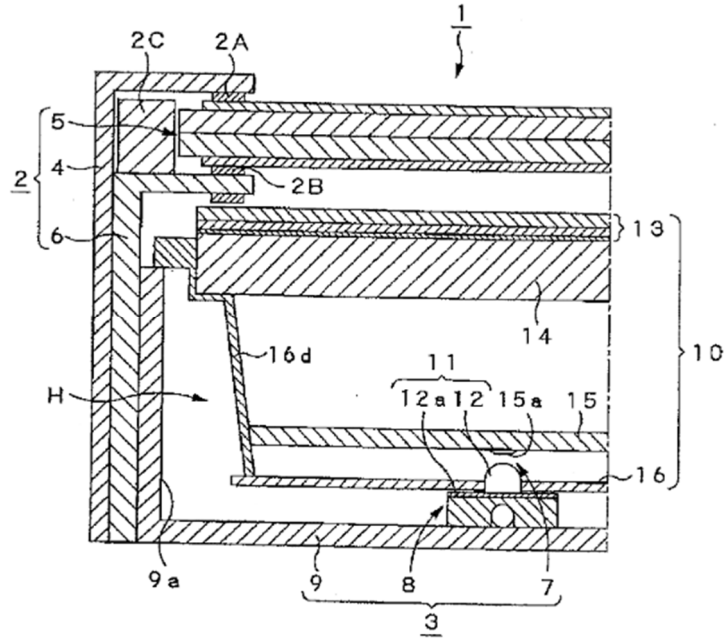
Arai discloses these elements because Arai describes parallel elongated rectangular wiring boards 12a. Arai, [0029].

Arai describes that a light emitting block 11 is composed of LEDs 12 and a “*laterally elongated rectangular wiring board* 12a on which these LEDs 12 are mounted *in a predetermined order*.” Arai, [0029]. Fig. 5 shows that the laterally elongated rectangular wiring boards 12a extend in the first direction (from left to right, as shown in Fig. 5) and are positioned adjacent to one another in substantially parallel arrangement (parallel to each other in the first direction, as shown in Fig. 5).



Arai, Fig. 5.

Additionally, as shown in Fig. 4, the LEDs 12 are arranged corresponding to the laterally elongated rectangular wiring boards 12a as the LEDs 12 are “mounted *in a predetermined order*” on the laterally elongated rectangular wiring boards 12a. Arai, [0029]. Thus, Arai discloses that ones of the plurality of strings (a series of LEDs as shown in Fig. 5) are arranged corresponding (arranged, in a predetermined order, on) to a plurality of bars (the laterally elongated rectangular wiring boards 12a).



Arai, Fig. 4.

A POSITA would understand that the plurality of bars (the laterally elongated rectangular wiring boards 12a) could be incorporated into the lighting system described in the Shteynberg. *See* Ex. 1005, ¶90.

5. Dependent Claim 12.

[’710 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.

Shteynberg discloses these elements because Shteynberg discloses that the controller 125 receives input from a wide variety of sources, including feedback signals generated by the sensor 185. Shteynberg, [0049].

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.” *Id.* In one embodiment, the sensor 185 is used to measure, for example, the actual output voltage across each of the LED strings. Shteynberg, [0072].

Therefore, Shteynberg discloses a means (the sensor 185) for generating a feedback signal (open or closed-loop feedback).

Shteynberg further states: “Corresponding to such measurements, compensation coefficients are introduced, stored in memory 175, and *utilized* for subsequent output voltage prediction *by the controller 125.*” *Id.* Also, 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 the controller 125.

Thus, Shteynberg discloses “a means (e.g., the sensor 185) for generating a feedback signal (open or closed-loop feedback) configured to provide display performance information (the actual output voltage across each LED string) to the control system (the controller 125).”

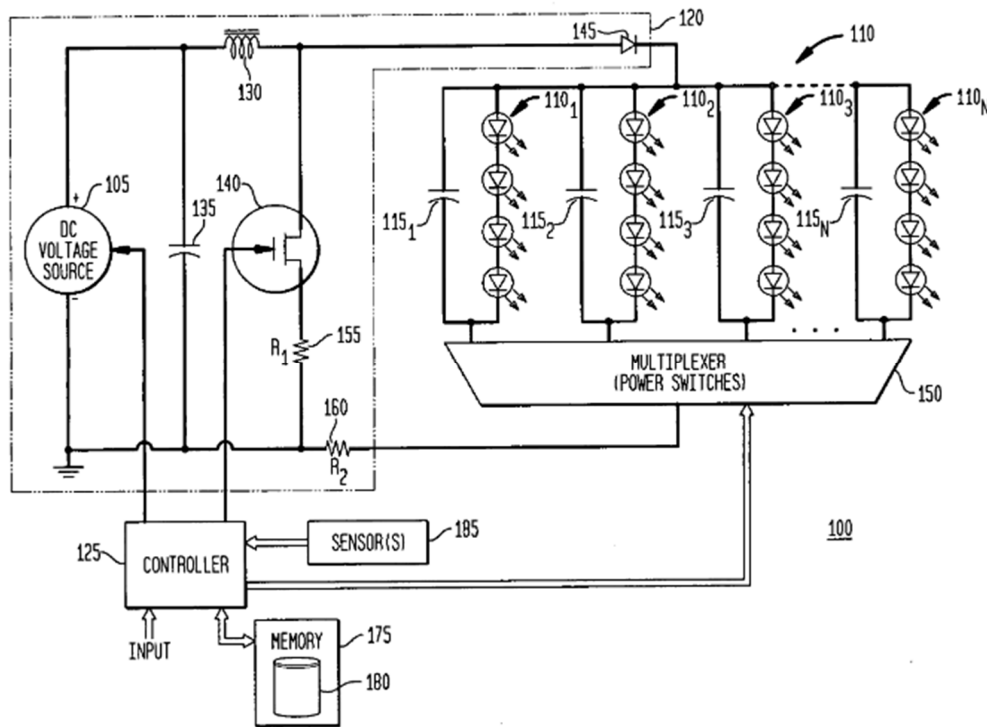
6. Dependent Claim 16.

[’710 Claim 16] The system of claim 1, wherein the second direction is substantially orthogonal to the first direction.

Both Shteynberg and Arai disclose these elements, as illustrated in Fig. 3 of Shteynberg and Fig. 5 of Arai.

As discussed *supra* in relation to claim 1A, Shteynberg discloses that the

LEDs are organized in an “array,” i.e., the LEDs being 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), as shown in Fig. 3. Shteynberg, therefore, discloses that LEDs in each LED string are arranged in a first direction (from top to bottom, as shown in Fig. 3), and these strings of LEDs are positioned at intervals in a second direction (from left to right, as shown in Fig. 3) and the second direction is substantially orthogonal to the first direction.



Id., Fig. 3.

To the extent that someone would argue that Fig. 3 fails to show “the second direction is substantially orthogonal to the first direction,” Arai discloses these elements. As discussed *supra* in relation to claim 1A, the LEDs 12 are arranged in

a first direction (from left to right, as shown in Fig. 5) to form LED strings and positioned at intervals in a second direction (from top to bottom, as shown in Fig. 5), and the second direction is substantially orthogonal to the first direction.

7. Independent Claim 17.

[’710 Claim 17 Preamble] 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:

Shteynberg discloses these elements because Shteynberg discloses a method for operating the LED strings, while Arai discloses a two-dimensional arrangement of LEDs. Shteynberg, [0044]; [0110]; Arai, Fig. 5.

Shteynberg discusses, with reference to Figs. 14A and 14B, a method of time-division modulation for “separately and independently energizing” a selected LED string of the **LED strings**. Shteynberg, [0110].

As discussed *supra* in relation to claim 1A, Shteynberg describes that a parallel array of LEDs 110 includes a plurality of **LED strings**. Shteynberg, [0044]. As shown in Fig. 3, Shteynberg discloses that the LEDs are organized in an “array,” i.e., the LEDs being organized in columns (each column corresponding to one LED string) and rows (multiple LED strings are distributed to form a row, i.e., arranged in substantially adjacent positions relative to one another), as shown in Fig. 3. LEDs in each LED string are arranged in a first direction (from top to

bottom, as shown in Fig. 3), and these strings of LEDs are arranged in substantially adjacent positions relative to one another in a second direction (from left to right, as shown in Fig. 3). As shown in Fig. 3, the second direction is substantially orthogonal to, therefore, different from the first direction.

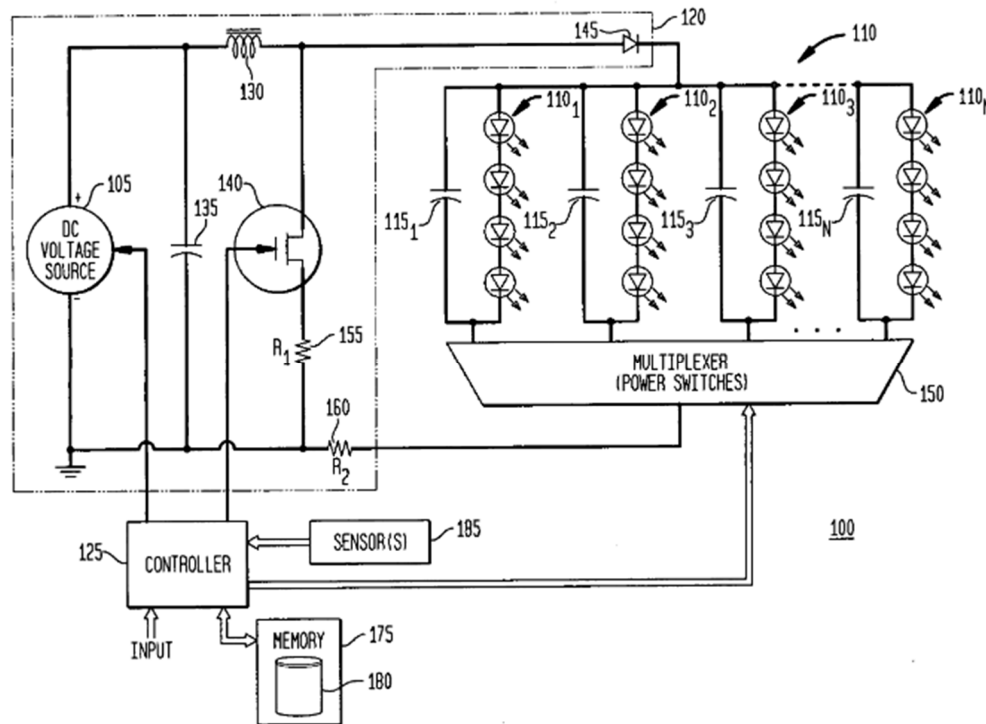
To the extent that someone would argue that Shteynberg fails to disclose these elements, Arai discloses these elements. As discussed *supra* in relation to claim 1A, the LEDs 12 extend in a first direction (from left to right, as shown in Fig. 5) to be arranged in substantially adjacent positions relative to one another in a second direction (from top to bottom, as shown in Fig. 5).

[’710 Claim 17A] receiving an input from a user; and

Shteynberg discloses these elements because the controller 125 disclosed in Shteynberg receives input coming from a larger system, which includes a user input. Shteynberg, [0049].

As discussed *supra* in relation to claim 1C, Shteynberg describes that controller 125 may “receive input from *a wide variety of sources*.” *Id.* The controller 230 may “be *coupled within a larger system*, such as a computer-controlled lighting system in a building, and may interface with other computing elements.” Shteynberg, [0049]. Therefore, Shteynberg describes receiving, by the controller 125, *input* coming from “*a wide variety of sources*.” Importantly, a POSITA would understand that *user input* could be one example of “the wide

variety of sources,” in view of the teachings of a “larger system.” See Ex. 1005, ¶65.



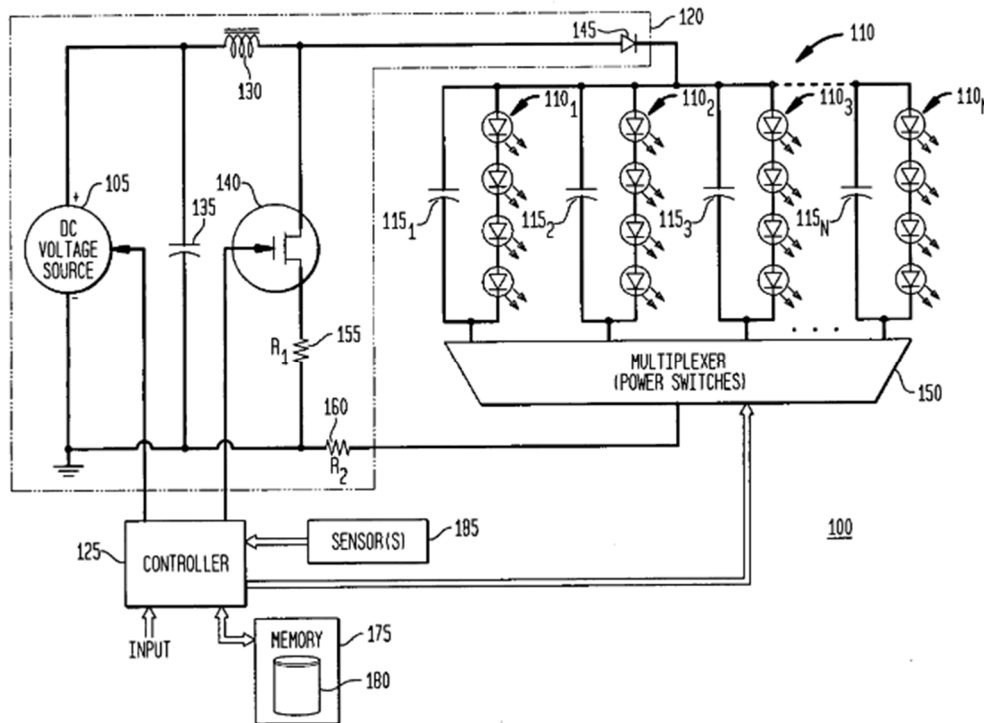
Id., Fig. 3.

[’710 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.

Shteynberg discloses these elements because Shteynberg discloses that the DC voltage source 105 and the multiplexer 150, based on the user input received by the controller 125, selectively supply on-state drive currents to the LED strings 110₁, 110₂, 110₃, ... , 110_N, according to an order of the energizing time periods. Shteynberg, [0047]; [0049]; [0054].

As discussed *supra* in relation to claim 1B, Shteynberg describes that the

power converter 120 is operable to “deliver a controlled current level to” the LED strings. Shteynberg, [0048]. Under the control of the controller 125, the multiplexer 150 is configured to “*individually and selectively*” allow current through one or more of the LED strings 110₁, 110₂, 110₃, through 110_N “*in any combination, and for any selected duration.*” Shteynberg, [0047].



Id., Fig. 3.

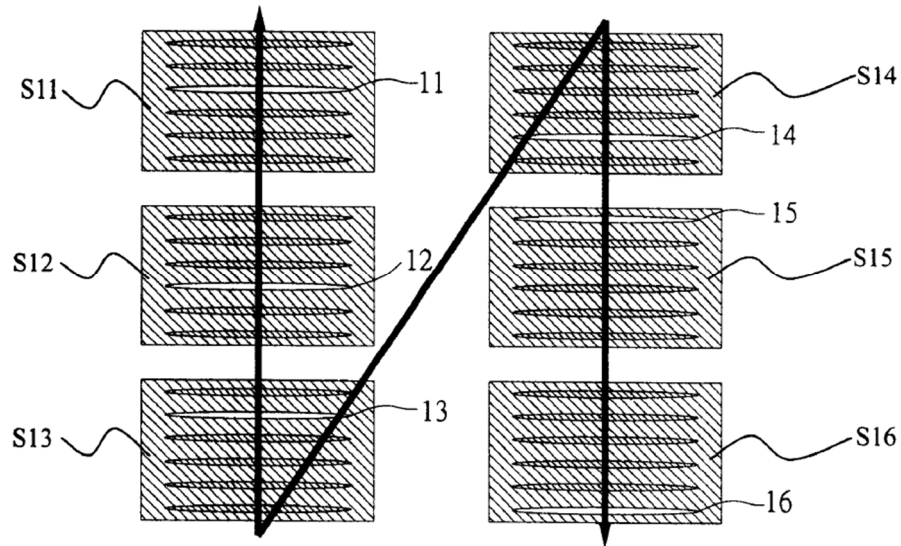
As discussed *supra* in relation to claim 1C and claim 17A, Shteynberg describes that the controller 125 receives input coming from a larger system, which includes *input from the user*. Shteynberg, [0049]. *Under the control of the controller 125*, the multiplexer 150 “provides for *individually and selectively allowing current to flow through* each of the LED strings.”

Therefore, Shteynberg discloses supplying (the power converter 120 delivering a controlled current level, subject to the modulation of the multiplexer 150), based in part on the input from the user (based on the user input received by the controller 125), a plurality of pulsed drive currents to the plurality of strings (individually and selectively allowed current flowing through the LED strings 110₁, 110₂, 110₃, through 110_N).

Furthermore, as discussed in relation to claim 1D, Shteynberg discloses that the controller 125 determines the order of the energizing time periods, which is equivalent to the *firing order*. Shteynberg, [0047]; [0054]; Ex. 1005 ¶73. Shteynberg stresses that “[e]ach *energizing time period* may be provided *in any order or combination*.” Shteynberg, [0054].

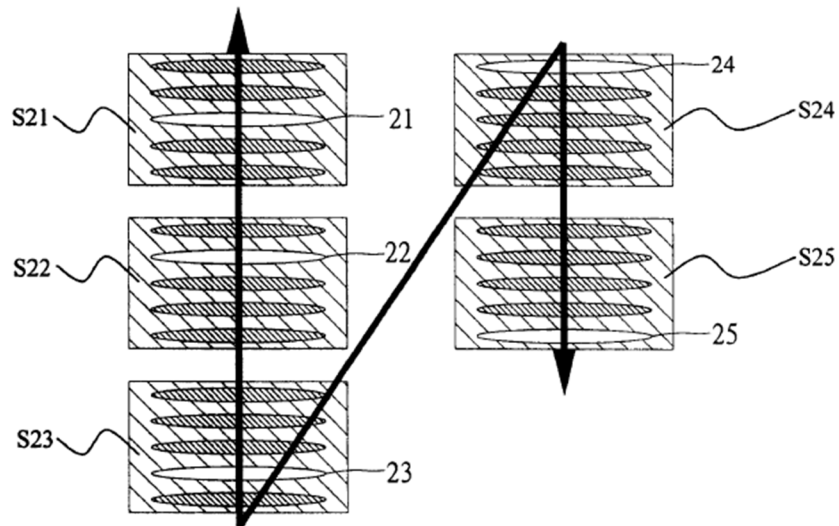
However, to the extent that Shteynberg does not disclose the “non-spatially-sequential firing order,” Zhang discloses the same because Zhang teaches the non-spatially-sequential firing order. Zhang, 5:14-23.

As discussed supra in relation to claim 2, Zhang discloses a non-spatially-sequential firing order. The firing order shown in Fig. 1B can be represented by a simplified illustration being *III→IV→II→V→I→VI*. Zhang, 5:14-23. The resultant display image is shown in Figs. 4A-4F, which clearly show that the firing order is not spatially-sequential (i.e., one-by-one from the top to the bottom).



Zhang, Fig. 1B.

Similarly, in another embodiment shown in Fig. 2B, the simplified illustration of the lighting sequence is $III \rightarrow II \rightarrow IV \rightarrow I \rightarrow V$, which is not spatially-sequential. Zhang, 5:30-37.



Zhang, Fig. 2B.

A POSITA would recognize that the non-spatially-sequential firing order

discussed in Zhang could be used as the firing order discussed in Shteynberg to achieve desired benefits, such as mitigating display artifacts and increasing the brightness uniformity. *See* Ex. 1005, ¶81. Thus, these elements are obvious in view of the combination of Shteynberg and Zhang.

B. Ground 2 – Claim 11 is Obvious Under 35 U.S.C. § 103 Over the Combination of Shteynberg, Arai, Zhang, and Kobori and in View of the Knowledge of a POSITA.

The combination of Shteynberg, Arai, Zhang, and Kobori in view of the knowledge of a POSITA discloses each element of claim 11. The Shteynberg-Arai-Zhang combination discloses a lighting system that selectively drives the plurality of LED strings in a firing order. In a similar field, Kobori discloses randomizing the time sequence, which is equivalent to the random firing order. Kobori, [0035].

Thus, a POSITA would be motivated to combine the Shteynberg-Arai-Zhang combination and Kobori. *See* Ex. 1005, ¶108. Claim 11 is obvious over the combination of Shteynberg, Arai, Zhang, and Kobori.

1. Motivation to Combine the Shteynberg-Arai-Zhang Combination and Kobori

A POSITA would be motivated to combine the Shteynberg-Arai-Zhang combination and Kobori. Ex. 1005, ¶108.

A POSITA would have been motivated to modify the lighting system disclosed in the Shteynberg-Arai-Zhang combination to introduce the random logic that randomizes the firing order described in Kobori. Ex. 1005, ¶108.

First, both the Shteynberg-Arai-Zhang combination and Kobori are in the same field of endeavor, i.e., achieving the emission of light perceived as white light. Ex. 1005, ¶109. Consequently, a POSITA would have had a reasonable expectation of success in combining their various disclosures to achieve emission of light perceived as white light. Furthermore, it was well within the technical ability of a POSITA at the time to incorporate the improvements to a *uniform luminiferous characteristic* by incorporating the random logic that randomizes the firing order described in Kobori into the lighting system disclosed by the Shteynberg-Arai-Zhang combination. Ex. 1005, ¶109.

Second, a primary motivation of one of ordinary skill in the art would have been to *improve uniformity in the luminiferous characteristic*, as described in Kobori. Ex. 1005, ¶110. Modifying the Shteynberg-Arai-Zhang combination to include the random logic, as disclosed by Kobori, would meet this goal. *Id.*

Thus, combining these four references—Shteynberg, Arai, Zhang, and Kobori—that use the same components to achieve the same goal would have been obvious to a POSITA. *See Id.*, ¶111.

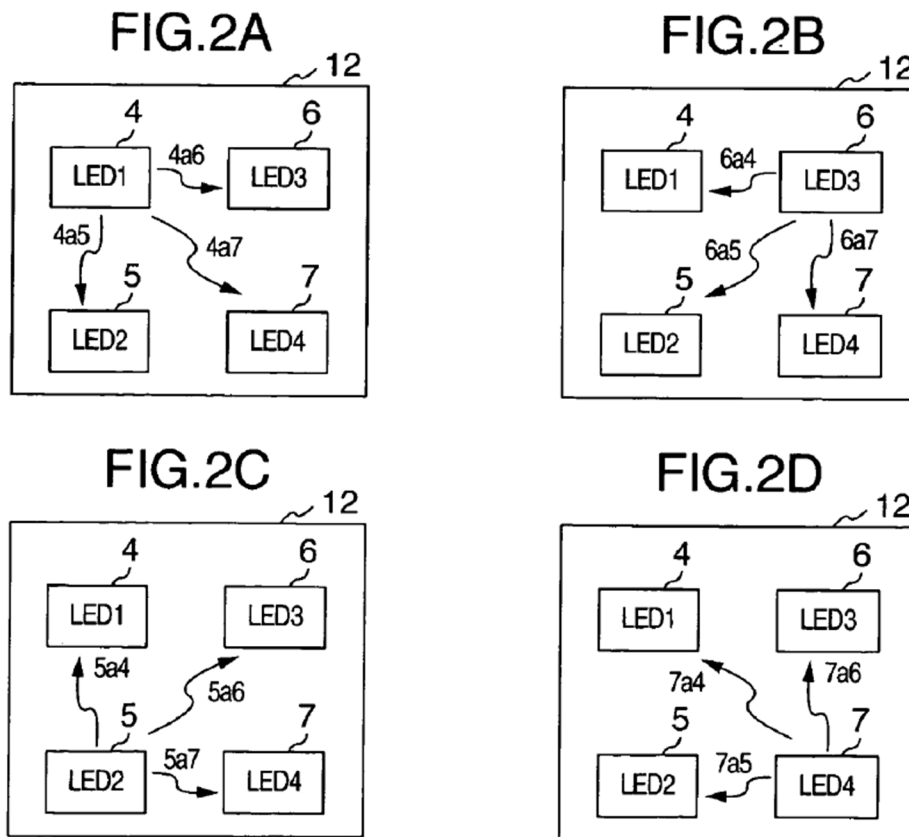
2. Dependent Claim 11.

[’710 Claim 11] The system of claim 1, wherein the firing logic comprises random logic operative to generate the firing order

Kobori discloses these elements because Kobori describes arbitrarily changing the LED ON/OFF combination in the time sequence. Kobori, [0008];

[0029]-[0030].

Kobori admits the need to “obtain highly-accurate *uniform luminiferous characteristics* at a low cost.” Kobori, [0007]. Kobori describes, with reference to Figs. 2A-2D, it is possible to realize the variety of the LED layout relationship to calculate the luminiferous level by “*arbitrarily changing* the PWM interval, the number of times, the phase for each LED so as to diversify the ON/OFF relationship.” Kobori, [0035]. Kobori further explains: “That is, by [*arbitrarily*] *changing the LED ON/OFF combination in the time sequence*, the [luminiferous] state of the LED at a particular position is detected.” *Id.* The LED ON/OFF combination in the time sequence is *equivalent to the firing order* under the definition of “firing order” in the ’710 Patent. Therefore, arbitrarily changing the ON/OFF combination in the time sequence is *equivalent to the random logic* that randomizes the firing order.



Kobori, Figs. 2A-2D.

A POSITA would understand that randomizing the firing order described in Kobori could be incorporated into the lighting system described in the Shteynberg-Arai-Zhang combination to achieve benefits, such as improving uniformity in the luminiferous characteristic. Ex. 1005, ¶¶108-111.

C. Ground 3 – Claims 47 and 48 are Obvious Under 35 U.S.C. § 103 Over the Combination of Shteynberg, Arai, and Lee and in View of the Knowledge of a POSITA.

The combination of Shteynberg, Arai, Lee in view of the knowledge of a POSITA discloses each element of claims 47 and 48. Shteynberg discloses a method for controlling a plurality of strings of solid state lighting devices and

supplying a plurality of pulsed drive currents. In a similar field, Lee discloses a plurality of groups of the plurality of strings. Benefits, such as emitting “the *uniform white light without reddish or bluish light ... even from the edge portions*” and *avoiding “excessive driving voltage or current”* can be achieved. Lee, [0036]; [0040].

Thus, a POSITA would be motivated to combine the Shteynberg-Arai combination with Lee. *See* Ex. 1005, ¶113. Claims 47 and 48 are obvious over the combination of Shteynberg, Arai, and Lee.

1. Motivation to Combine the Shteynberg, Arai, and Lee

A POSITA would be motivated to combine the Shteynberg-Arai combination and Lee. Ex. 1005, ¶113.

A POSITA would have been motivated to modify the lighting system disclosed in the Shteynberg-Arai combination to introduce the string groups described in Lee. *Id.*

First, both the Shteynberg-Arai combination and Lee are in the same field of endeavor, i.e., achieving the emission of light perceived as white light. *Id.*, ¶114. Consequently, a POSITA would have had a reasonable expectation of success in combining their various disclosures to achieve the emission of light perceived as white light. *Id.* Furthermore, it was well within the technical ability of a POSITA at the time to incorporate string groups described in Lee into the lighting system

disclosed by the Shteynberg-Arai combination to achieve benefits, such as emitting “the *uniform white light without reddish or bluish light ... even from the edge portions*” and *avoiding “excessive driving voltage or current,”* can be achieved. Lee, [0036]; [0040]; Ex. 1005, ¶114.

Second, a primary motivation of a POSITA would have been to *achieve uniform white light* and *avoid excessive driving voltage or current*, as described in Lee. Ex. 1005, ¶115. Modifying the Shteynberg-Arai combination to include the string groups, as disclosed by Lee, would meet this goal. *Id.* For example, Lee describes solving “the problems of the conventional LED connection structure requiring an *excessive driving voltage or current.*” Lee, [0036]. Lee describes that “the *uniform white light* without reddish or bluish light can be emitted even from the edge portions.” *Id.*, [0040].

Thus, combining these three references—Shteynberg, Arai, and Lee—that use the same components to achieve the same goal would have been obvious to a POSITA. Ex. 1005, ¶¶113-116.

2. Independent Claim 47.

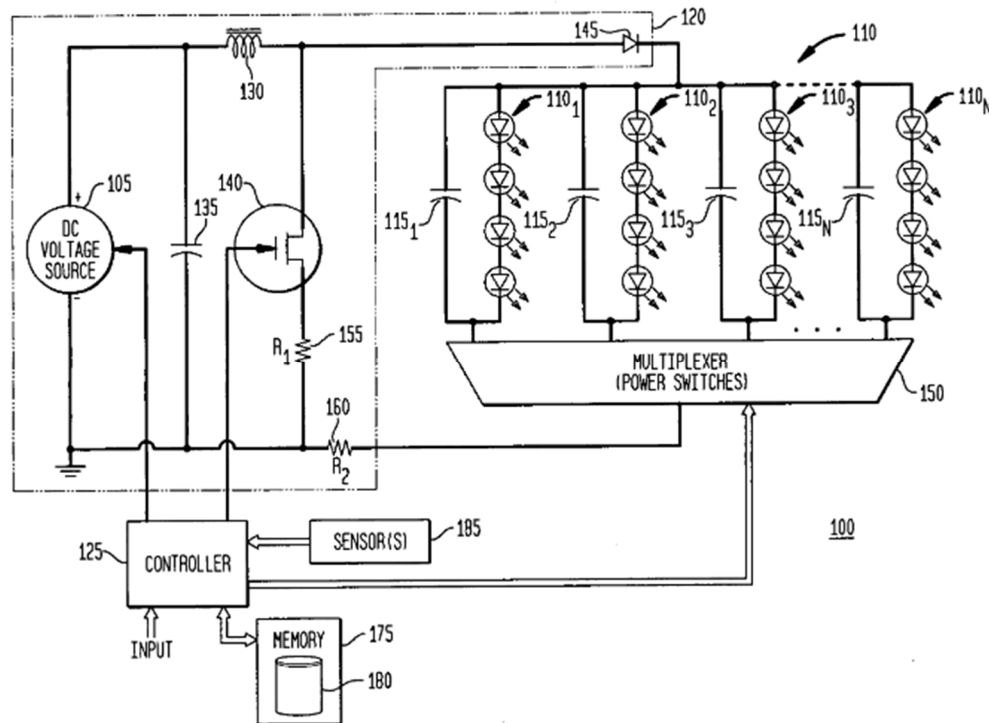
[’710 Claim 47 Preamble] A method for controlling a plurality of strings of solid state lighting devices configured to extend in a first direction and arranged substantially adjacent to one another,

As discussed *supra* in relation to claim 17, Shteynberg discloses these elements because Shteynberg discloses a method for operating the LED strings.

Shteynberg, [0044]; [0110].

Shteynberg discusses, with reference to Figs. 14A and 14B, a method of time-division modulation for “separately and independently energizing” a selected LED string of the **LED strings**. Shteynberg, [0110].

As discussed *supra* in relation to claim 1A, Shteynberg describes that a parallel array of LEDs 110 includes a plurality of **LED strings** 110₁, 110₂, 110₃, ..., 110_N. Shteynberg, [0044]. Shteynberg discloses that the LEDs are organized in an “array,” i.e., the LEDs being organized in columns (each column corresponding to one LED string) and rows (multiple LED strings are distributed to form a row, i.e., arranged in substantially adjacent positions relative to one another), as shown in Fig. 3. The LEDs in each LED string are arranged in a first direction (from top to bottom, as shown in Fig. 3), and these strings of LEDs are arranged substantially adjacent to one another (the **LED strings** are arranged substantially adjacent to one another, as shown in Fig. 3).



Id., Fig. 3.

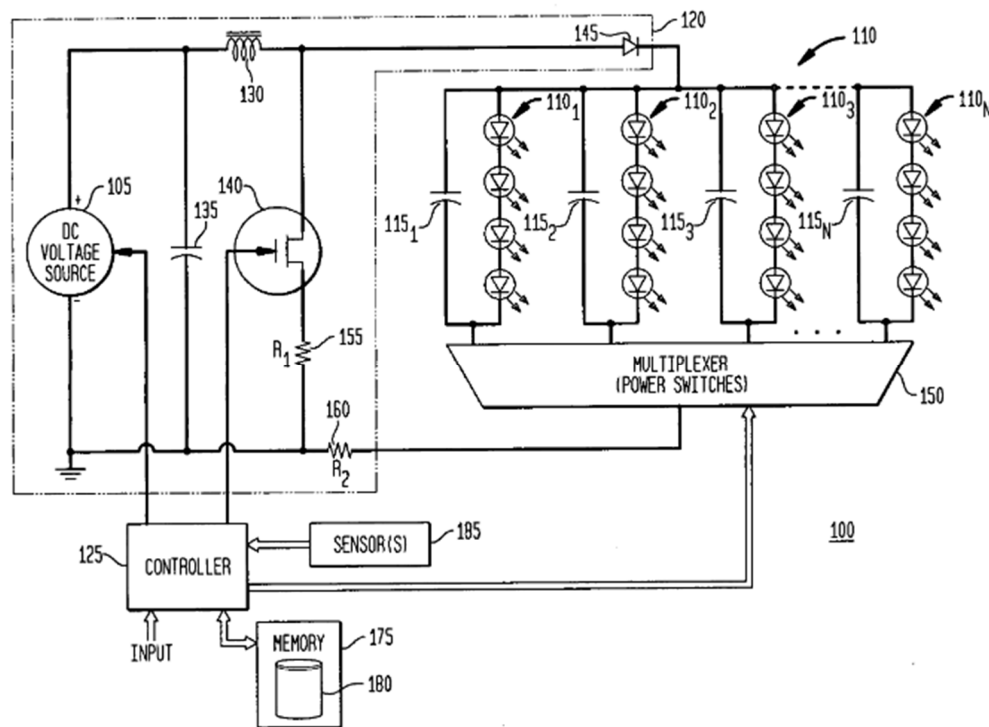
To the extent that someone would argue that Shteynberg fails to disclose these elements, Arai discloses these elements. As discussed *supra* in relation to claim 1A, the LEDs 12 extend in a first direction (from left to right, as shown in Fig. 5) to be arranged in substantially adjacent positions relative to one another in a second direction (from top to bottom, as shown in Fig. 5).

[’710 Claim 47A] the method comprising supplying a plurality of pulsed drive currents to a plurality of groups of the plurality of strings.

The Shteynberg-Arai-Lee combination discloses these elements because Shteynberg discloses that the DC voltage source 105 and the multiplexer 150 selectively supply on-state drive currents to the LED strings 110₁, 110₂, 110₃, ... ,

110_N and Lee discloses string groups. Shteynberg, [0047]-[0048]; Lee, [0029], [0034]-[0035].

Shteynberg describes that the power converter 120 is operable to “deliver a controlled current level to” the LED strings 110₁, 110₂, 110₃, ... , 110_N. Shteynberg, [0048]. Under the control of the controller 125, the multiplexer 150 is configured to “*individually and selectively*” allow current through one or more of the LED strings in any combination, and for any selected duration.” Shteynberg, [0047].



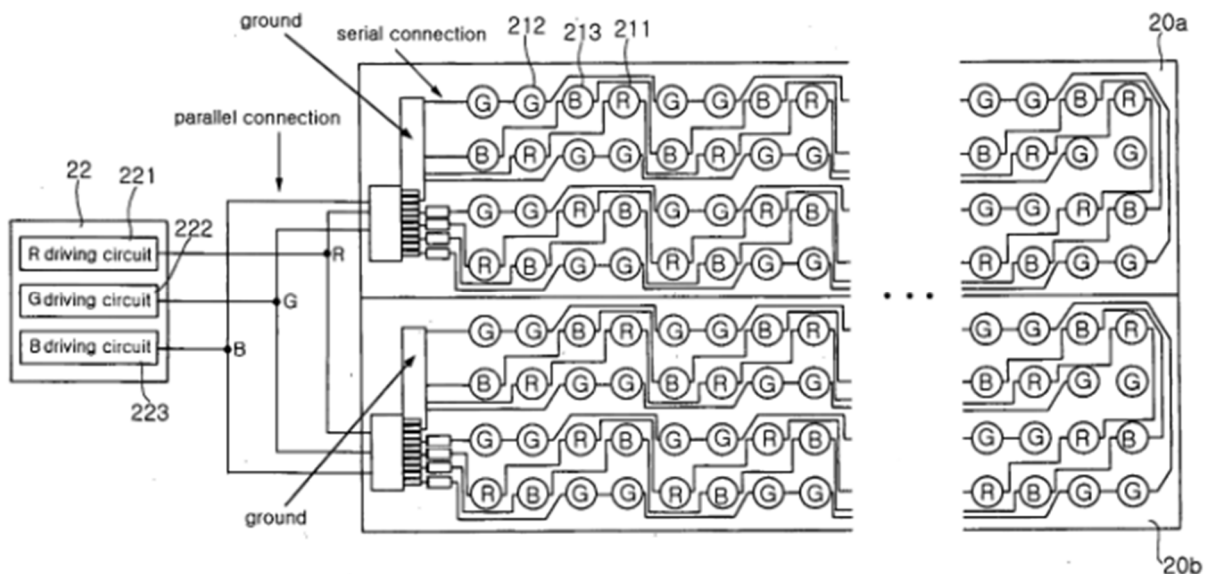
Id., Fig. 3.

Therefore, Shteynberg discloses supplying (the power converter 120 delivering a controlled current level, subject to the modulation of the multiplexer 150) a plurality of pulsed drive currents to the plurality of strings (individually and

selectively allowed current flowing through the LED strings 110₁, 110₂, 110₃, through 110_N).

However, to the extent that Shteynberg fails to disclose a plurality of groups of the plurality of strings, Lee discloses that the LEDs are electrically connected to each other by the combination of the series (*strings*) and parallel connections (*string groups*). Lee, [0029], [0034]-[0035].

Lee describes that each driving unit 22 has red, green, and blue LED driving circuits 221, 222, and 223 for respectively driving the red, green, and blue LEDs 211, 212, and 213. Lee, [0029]. As shown in Fig. 3, the series connection structure of the identical color LEDs in the divided region 20a is connected to the series connection structure of the identical color LEDs in the divided region 20b. *Id.*, [0034].



Lee, Fig. 3.

The parallel connection structure is electrically connected to the corresponding color LED driving circuit (i.e., the red driving circuit 221, the green driving circuit 222, or the blue driving circuit 223). Lee, [0034]. Therefore, the LEDs are electrically connected to each other by the combination of the series (*strings*) and parallel connections (*string groups*). *Id.*

A POSITA would understand that the string groups discussed in Lee could be incorporated into the lighting system discussed in the Shteynberg-Arai combination to achieve the benefits stated in Lee (“properly controlling a luminance, a color coordinate, or a color temperature to drive the LEDs under a desired condition”). *See* Ex. 1005, 113-116.

3. Dependent Claim 48.

[’710 Claim 48] The method of claim 47, further comprising receiving a user input, wherein supplying the plurality of pulsed drive currents is based on the user input.

Shteynberg discloses these elements because (i) the controller 125 disclosed in Shteynberg receives input coming from a larger system, which includes a user input; and (ii) the DC voltage source 105 and the multiplexer 150 disclosed in Shteynberg, based on the user input received by the controller 125, selectively supply on-state drive currents to the LED strings. Shteynberg, [0047]-[0049].

As discussed *supra* in relation to claim 17A, Shteynberg describes that controller 125 may “receive input from *a wide variety of sources*.” *Id.*, [0049]. A

POSITA would understand that *user input* could be one example of “the wide variety of sources,” in view of the teachings of a “larger system.” *See* Ex. 1005, ¶65.

As discussed *supra* in relation to claim 1B, Shteynberg describes that under the control of the controller 125, the multiplexer 150 is configured to “*individually and selectively*” allow current through one or more of the LED strings in any combination, and for any selected duration.” Shteynberg, [0047].

As discussed *supra* in relation to claim 1C and claim 17A, Shteynberg describes that the controller 125 receives input coming from a larger system, which includes *input from the user*. Shteynberg, [0049]. Under the control of the controller 125, the multiplexer 150 “provides for individually and selectively allowing current to flow through” each of the LED strings. *Id.*

Therefore, Shteynberg discloses (i) receiving a user input and (ii) supplying (the power converter 120 delivering a controlled current level, subject to the modulation of the multiplexer 150) the plurality of pulsed drive current (individually and selectively allowed current flowing through the LED strings 110₁, 110₂, 110₃, through 110_N) is based on the user input (based on the user input received by the controller 125).

D. Ground 4 – Claims 1-2, 5, 12, and 16-17 are Obvious Under 35 U.S.C. § 103 Over the Combination of Shteynberg, Arai, and Kawabata in view of the Knowledge of a POSITA.

The combination of Shteynberg, Arai, and Kawabata in view of the knowledge of a POSITA discloses each element of claims 1-2, 5, 12, and 16-17. Shteynberg discloses an array of light emitting diodes and the independent control thereof using a multiplexer. Arai discloses a two-dimensional arrangement of LEDs. In a similar field, Kawabata discloses a lighting unit used as a backlight source in a liquid crystal display (LCD) device, and more particularly controlling the turn-on and turn-off operations of a number of light emitting elements by changing the turn-on timing to achieve a highly uniform light emitting panel. Thus, a POSITA would be motivated to combine Shteynberg, Arai, and Kawabata. Ex. 1005, ¶118. Claims 1-2, 5, 12, and 16-17 are obvious over the combination of Shteynberg, Arai, and Kawabata.

1. Motivation to Combine Shteynberg, Arai, and Kawabata

A POSITA would be motivated to combine Shteynberg, Arai, and Kawabata. Ex. 1005, 118.

A POSITA would have been motivated to modify the display system in the Shteynberg-Arai combination to introduce the non-spatially-sequential firing order described in Kawabata. *Id.*

First, 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. *Id.*, 119. Consequently, a POSITA would have had a reasonable expectation of success in combining their various disclosures to achieve the emission of light perceived as white light. *Id.* Furthermore, it was well within the technical ability of a POSITA at the time to incorporate the improvements to the display system described in Kawabata into the independent control of an array of LEDs disclosed by the Shteynberg-Arai combination. *Id.*

Second, a primary motivation of one of ordinary skill in the art would have been to ***reduce a variation in luminance***, as described in Kawabata. *Id.*, ¶120. Modifying the Shteynberg-Arai to include the non-spatially-sequential firing order, as disclosed by Kawabata, would meet this goal. *Id.* For example, Kawabata states that “some of the light-emitting elements 2 for some of the light-emitting regions 4 may be turned ON in a different percentage of one vertical scanning period” to reduce such a variation in luminance. Kawabata, [0073]; Ex. 1005, ¶120.

Thus, combining these three references—Shteynberg, Arai, and Kawabata—that use the same components to achieve the same goal would have been obvious to a POSITA. Ex. 1005, ¶¶118-121.

2. Independent Claim 1.

[’710 Claim 1 Preamble] A lighting panel system, comprising:

Shteynberg discloses a lighting system, which “comprises a plurality of series of light-emitting diodes, a power converter, a first multiplexer, and a controller.” Shteynberg, [0021].

[’710 Claim 1A] a plurality of strings of solid state lighting devices arranged in a first direction and positioned at intervals in at least one second direction;

As discussed *supra* in relation to ground 1, claim 1A, these elements would have been obvious to a POSITA in view of the teachings of Shteynberg by itself or with Arai because Shteynberg and Arai disclose an array of LEDs arranged in the manner recited in claim 1A.

[’710 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; and

As discussed *supra* in relation to ground 1, claim 1B, Shteynberg discloses these elements because the DC voltage source 105 and the multiplexer 150 discussed in Shteynberg selectively supply on-state drive currents to the LED strings 110₁, 110₂, 110₃, ... , 110_N. Shteynberg, [0044], [0047]-[0048].

[’710 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,

As discussed *supra* in relation to ground 1, claim 1C, Shteynberg discloses

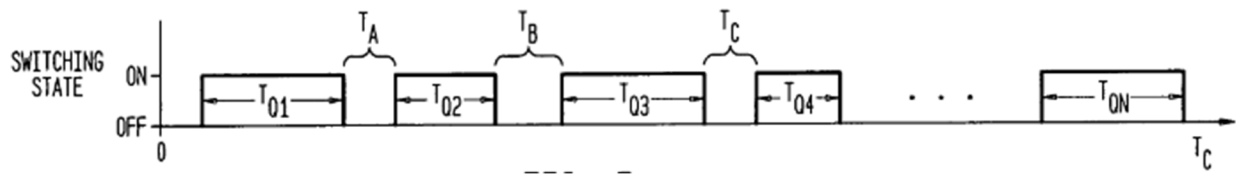
these elements because the controller 125 disclosed in Shteynberg receives input coming from a larger system, which includes user input, and selectively provides control signals to the power converter 120 and the multiplexer 150 to individually and selectively drive the LED strings. Shteynberg, [0047]; [0049].

[’710 Claim 1D] the control system further including firing logic configured to determine a firing order of the plurality of strings.

The Shteynberg-Arai-Kawabata combination discloses these elements. This is because Shteynberg discloses that the controller 125 determines the order of the energizing time periods, which is equivalent to the firing order. Shteynberg, [0047]; [0054]. Kawabata also discloses a firing logic that determines the firing order. Kawabata, [0070].

As discussed *supra* in relation to ground 1, claim 1D, Shteynberg describes that the multiplexer 150 is configured to “allow current through one or more of the series of LEDs” *in any combination*, and *for any selected duration*” under the control of the controller 125. Shteynberg, [0047].

Shteynberg further describes that each of the LED strings is provided with a selected and independent current level, *through control (by controller 125)* of the switching state of each channel (via multiplexer 150), for a selected time period (or duration). Shteynberg, [0054].



Id., Fig. 4.

Importantly, Shteynberg stresses that “[e]ach *energizing time period* may be provided *in any order or combination*.” Shteynberg, [0054]. As illustrated in Fig. 4, **LED string 1103** is provided with current for third time period T_{Q3} , **followed by LED string 1102** being provided with current for second time period T_{Q4} .

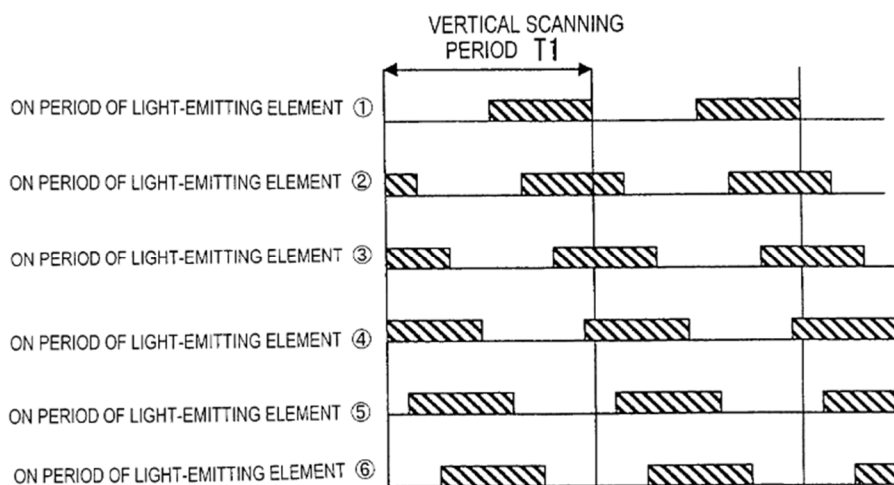
Therefore, the controller 125, via the multiplexer 150, determines the order of the energizing time periods, which is equivalent to the firing order, for the LED strings. Thus, Shteynberg discloses “to determine a firing order of the plurality of strings.”

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). Shteynberg, [0054]. Thus, a **POSITA** would understand that the control system could include a **firing logic** configured to determine the firing order. *See* Ex. 1005, ¶73.

To the extent that the Shteynberg-Arai combination does not expressly disclose the firing logic that determines the firing order, Kawabata describes the same. Kawabata, [0070].

Kawabata describes, with reference to Figure 5, “scan lighting.” Kawabata, [0070]. Specifically, Kawabata states: “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.” *Id.*

Therefore, Kawabata expressly discloses a firing order, according to the definition stated in the '710 Patent. '710 Patent, 10:30-33. 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 emitting elements 2 is turned next. According to the specification of the '710 Patent, the firing logic 802 can include rule-based logic. *Id.*, 10:51-53. In other words, *rule-based logic* is viewed as the firing logic. Therefore, Kawabata discloses the firing logic because the timing rule discussed in paragraph [0070] is a rule-based logic.



Kawabata, Fig. 5.

A POSITA would recognize that the firing logic disclosed in Kawabata could be used to determine a firing order disclosed in the Shteynberg-Arai combination. Ex. 1005, ¶87. Including a firing logic discussed in Kawabata to determine a firing order freely would achieve benefits, such as *reducing a variation in luminance. Id.*

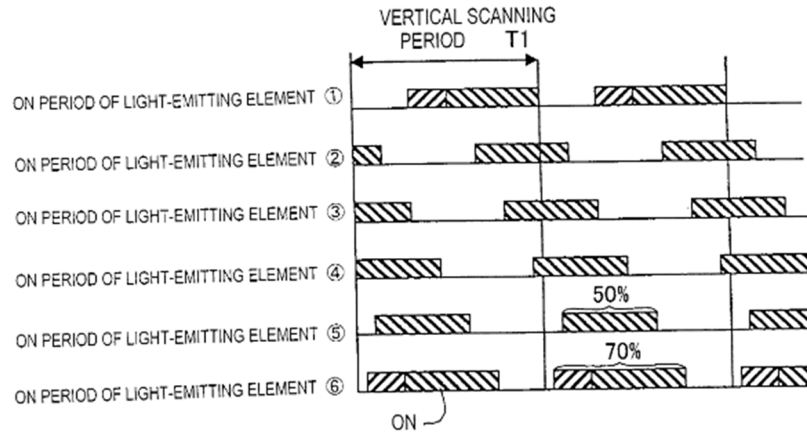
2. Dependent Claim 2.

[’710 Claim 2] The system of claim 1, wherein the firing logic comprises rule-based logic operative to generate a non-spatially-sequential firing order.

As discussed *supra* in relation to claim 1D, Kawabata discloses *rule-based logic* because the timing rule discussed in paragraph [0070] is a rule-based logic.

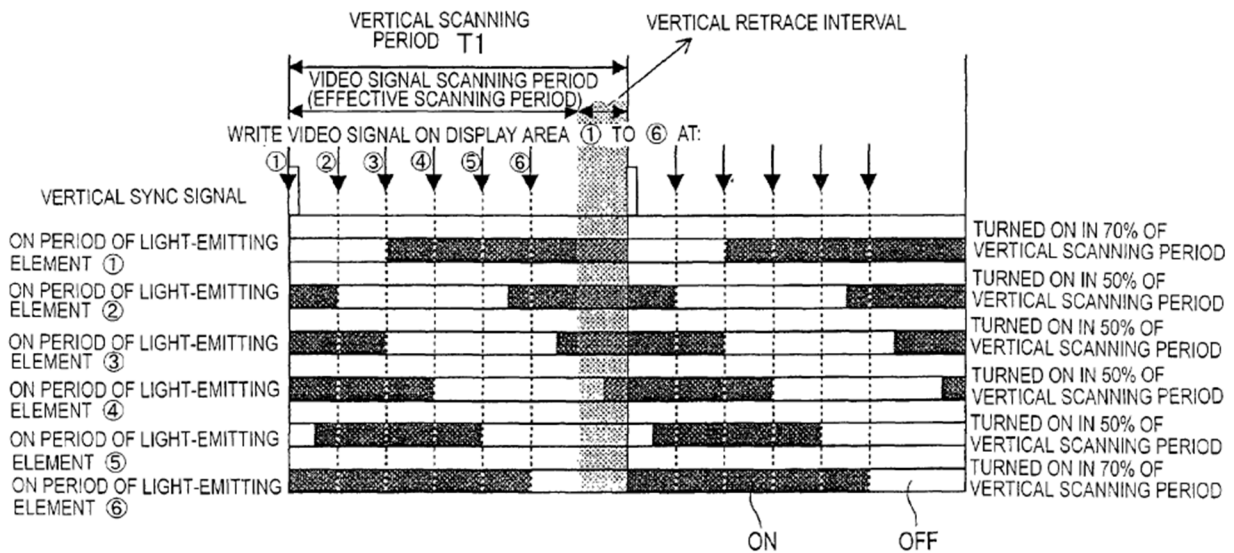
Kawabata further discloses a *non-spatially-sequential firing order*.

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. Therefore, the light emitting elements are turned on according to a *non-spatially-sequential firing order*.



Kawabata, Fig. 7.

Additionally, as shown in Fig. 8, the firing order is ①→②→③→④→⑥→⑤→①, instead of ①→②→③→④→⑤→⑥→①. *Id.*, [0076]. The flipping order of ⑤ and ⑥ makes the firing order non-spatially-sequential (i.e., the temporally sequential strings are not spatially sequential/adjacent).



Kawabata, Fig. 8.

As shown in Fig. 23, the firing order is ①→②→④→③→⑤→⑥ and ⑧

(simultaneous)→⑦→①, which is non-spatially-sequential. Kawabata, [0113].

A POSITA would recognize that the non-spatially-sequential firing order discussed in Kawabata could be used as the firing order discussed in Shteynberg to achieve desired benefits, such as mitigating display artifacts and increasing the brightness uniformity. Ex. 1005, ¶87. Thus, this element is obvious in view of the combination of Shteynberg, Arai, and Kawabata.

3. Dependent Claim 5.

[’710 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.

As discussed *supra* in relation to Ground 1, claim 5, Arai discloses these elements because Arai describes parallel elongated rectangular wiring boards 12a. Arai, [0029].

4. Dependent Claim 12.

[’710 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.

As discussed *supra* in relation to Ground 1, claim 12, Shteynberg discloses these elements because Shteynberg discloses that the controller 125 receives input from a wide variety of sources, including feedback signals generated by the sensor 185. Shteynberg, [0049].

5. Dependent Claim 16.

[’710 Claim 16] The system of claim 1, wherein the second direction is substantially orthogonal to the first direction.

As discussed *supra* in relation to Ground 1, claim 16, both Shteynberg and Arai disclose these elements, as illustrated in Fig. 3 of Shteynberg and Fig. 5 of Arai.

6. Independent Claim 17.

[’710 Claim 17 Preamble] 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:

As discussed *supra* in relation to Ground 1, claim 17 preamble, the Shteynberg-Arai combination discloses these elements because Shteynberg discloses a method for operating the LED strings, while Arai discloses a two-dimensional arrangement of LEDs. Shteynberg, [0044]; [0110]; Arai, Fig. 5.

[’710 Claim 17A] receiving an input from a user; and

As discussed *supra* in relation to Ground 1, claim 17A, Shteynberg discloses these elements because the controller 125 disclosed in Shteynberg receives input coming from a larger system, which includes a user input. Shteynberg, [0049].

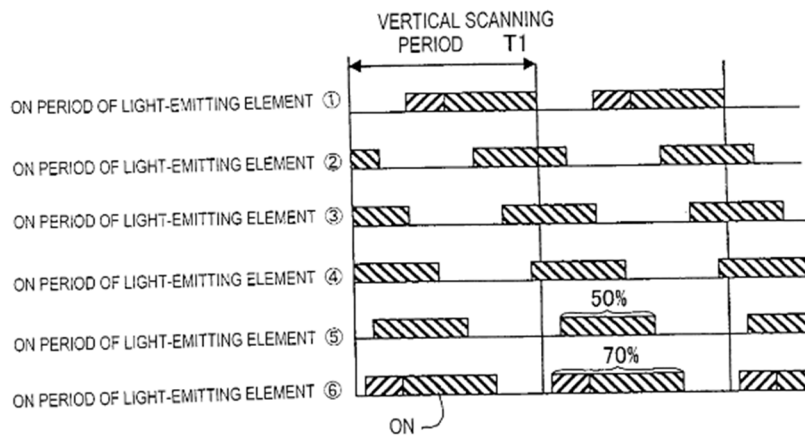
[’710 Claim 17B] supplying, based in part on the input from the user, a plurality of pulsed drive currents to the plurality of strings in a non-spatially-sequential firing order.

As discussed *supra* in relation to Ground 1, claim 17B, Shteynberg discloses

these elements because Shteynberg discloses that the DC voltage source 105 and the multiplexer 150, based on the user input received by the controller 125, selectively supply on-state drive currents to the LED strings, according to an order of the energizing time periods. Shteynberg, [0047]-[0049]; [0054].

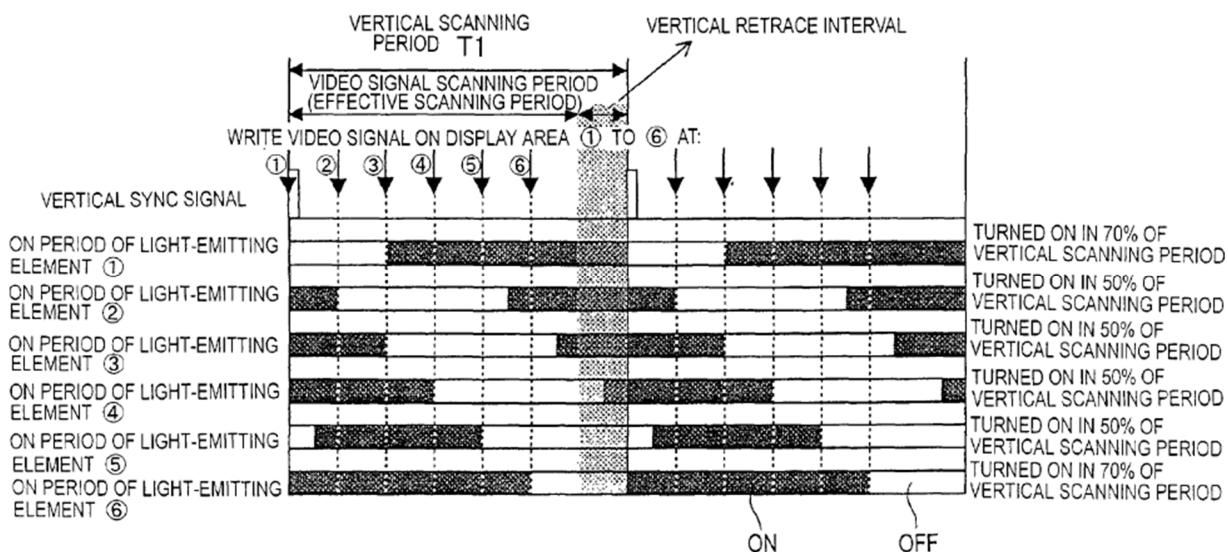
However, to the extent that the Shteynberg-Arai combination does not disclose the “non-spatially-sequential firing order,” Kawabata remedies the deficiencies.

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. Therefore, the light emitting elements are turned on according to a *non-spatially-sequential firing order*.



Kawabata, Fig. 7.

As shown in Fig. 8, the firing order is ①→②→③→④→⑥→⑤→①, instead of ①→②→③→④→⑤→⑥→①. The flipping order of ⑤ and ⑥ makes the firing order non-spatially-sequential.



Kawabata, Fig. 8.

As shown in Fig. 23, the firing order is ①→②→④→③→⑤→⑥ and ⑧ (simultaneous)→⑦→①, which is non-spatially-sequential. Kawabata, [0113].

A POSITA would recognize that the non-spatially-sequential firing order discussed in Kawabata could be used as the firing order discussed in Shteynberg to achieve desired benefits, such as reducing a variation in luminance. *See* Ex. 1005, ¶87. Thus, this element is obvious in view of the combination of Shteynberg, Arai, and Kawabata.

E. Ground 5 – Claim 11 is Obvious Under 35 U.S.C. § 103 Over the Combination of Shteynberg, Arai, Kawabata, and Kobori and in

View of the Knowledge of a POSITA.

The combination of Shteynberg, Arai, Kawabata, and Kobori in view of the knowledge of a POSITA discloses each element of claim 11. The Shteynberg-Arai-Kawabata combination discloses a lighting system that selectively drives the plurality of LED strings in a firing order, which is a non-spatially-sequential firing order. In a similar field, Kobori discloses randomizing the time sequence, which is equivalent to the firing order. Kobori, [0035].

Thus, a POSITA would be motivated to combine the Shteynberg-Arai-Kawabata combination and Kobori. *See* Ex. 1005, ¶123. Claim 11 is obvious over the combination of Shteynberg, Arai, Kawabata, and Kobori.

1. Motivation to Combine the Shteynberg-Kawabata Combination and Kobori

A POSITA would be motivated to combine the Shteynberg-Arai-Kawabata combination and Kobori. Ex. 1005, ¶123.

A POSITA would have been motivated to modify the lighting system disclosed in the Shteynberg-Kawabata combination to introduce the random logic described in Lee. *Id.*

First, both the Shteynberg-Arai-Kawabata combination and Kobori are in the same field of endeavor, i.e., achieving the emission of light perceived as white light. *Id.*, ¶124. Consequently, a POSITA would have had a reasonable expectation of success in combining their various disclosures to achieve emission of light

perceived as white light. *Id.*, ¶124. Furthermore, it was well within the technical ability of a POSITA at the time to incorporate the improvements to a ***uniform luminiferous characteristic*** by incorporating the random logic described in Kobori into the lighting system disclosed by the Shteynberg-Arai-Kawabata combination. *Id.*

Second, a primary motivation of one of ordinary skill in the art would have been to ***improve uniformity in the luminiferous characteristic***, as described in Kobori. Ex. 1005, ¶125. Modifying the Shteynberg-Arai-Kawabata combination to include the random logic disclosed by Kobori would meet this goal. *Id.*, ¶125.

Thus, combining these three references—Shteynberg, Arai, Kawabata, and Kobori—that use the same components to achieve the same goal would have been obvious to a POSITA. *Id.*, ¶123-126.

2. Dependent Claim 11.

[’710 Claim 11] The system of claim 1, wherein the firing logic comprises random logic operative to generate the firing order

As discussed *supra* in relation to ground 2, claim 11, Kobori discloses these elements because Kobori describes arbitrarily changing the LED ON/OFF combination in the time sequence. Kobori, [0008]; [0029]-[0030].

F. Ground 6 – Claim 13 is Obvious Under 35 U.S.C. § 103 Over the Combination of Shteynberg, Arai, Kawabata, and Lee in view of the Knowledge of a POSITA.

The combination of Shteynberg, Arai, Kawabata, and Lee in view of the

knowledge of a POSITA discloses each element of claim 13. The Shteynberg-Arai-Kawabata combination discloses a lighting system that selectively drives the plurality of LED strings in a firing order, which is a non-spatially-sequential firing order. In a similar field, Lee discloses multiple driving circuits. Benefits, such as emitting “the *uniform white light without reddish or bluish light ... even from the edge portions*” and *avoiding “excessive driving voltage or current,”* can be achieved. Lee, [0036]; [0040].

Thus, a POSITA would be motivated to combine the Shteynberg-Arai-Kawabata combination and Lee. Ex. 1005, ¶128. Claims 5 and 13 are obvious over the combination of Shteynberg, Arai, Kawabata, and Lee.

1. Motivation to Combine the Shteynberg-Arai-Kawabata Combination and Lee

A POSITA would be motivated to combine the Shteynberg-Arai-Kawabata combination and Lee. Ex. 1005, ¶128.

A POSITA would have been motivated to modify the lighting system disclosed in the Shteynberg-Arai-Kawabata combination to introduce the multiple driving circuits described in Lee. *Id.*

First, both 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. *Id.*, ¶129. Consequently, a POSITA would have had a reasonable expectation of success in combining their various disclosures to achieve the emission of light

perceived as white light. *Id.* Furthermore, it was well within the technical ability of a POSITA at the time to incorporate the improvements to *excessive driving voltage or current* by incorporating the multiple driving circuits described in Lee into the lighting system disclosed by the Shteynberg-Arai-Kawabata combination. *Id.*

Second, a primary motivation of one of ordinary skill in the art would have been to *reduce excessive driving voltage or current*, as described in Lee. *Id.*, ¶130. Modifying the Shteynberg-Arai-Kawabata combination to include the multiple driving circuits, as disclosed by Lee, would meet this goal. *Id.* Lee describes solving “the problems of the conventional LED connection structure requiring an excessive driving voltage or current.” Lee, [0036]. Lee describes that “the uniform white light without reddish or bluish light can be emitted even from the edge portions.” *Id.*, [0040].

Thus, combining these four references—Shteynberg, Arai, Kawabata, and Lee—that use the same components to achieve the same goal would have been obvious to a POSITA. Ex. 1005, ¶128-131.

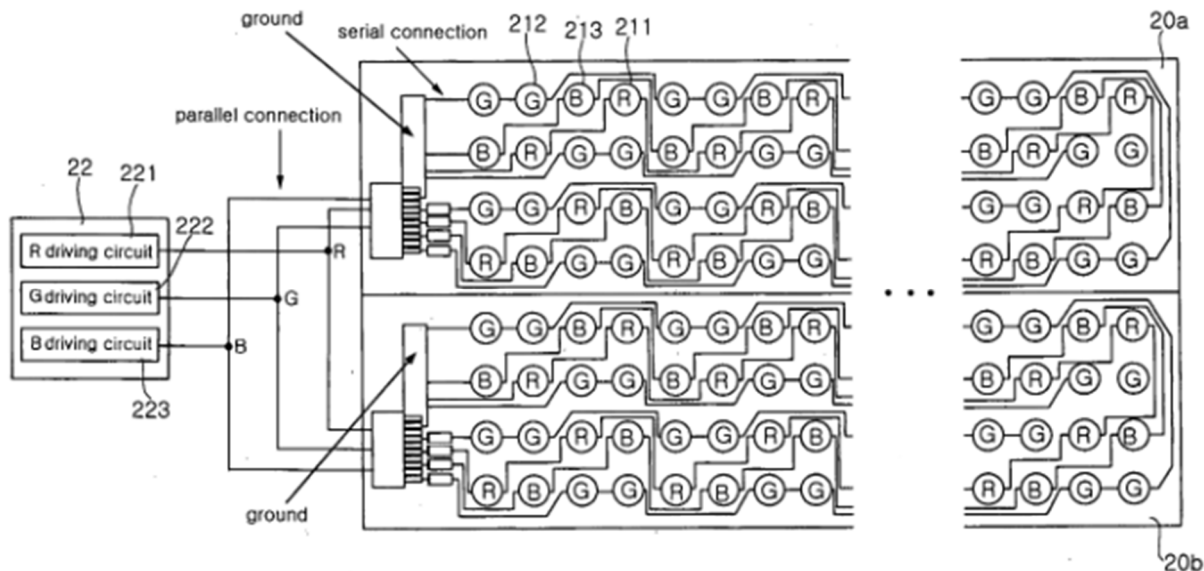
2. Dependent Claim 13.

[’710 Claim 13A] The system of claim 1, 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 in a firing cycle.

Lee and Kawabata, in combination, 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. Lee, [0029]; [0041]; Kawabata, [0070].

Lee describes that each driving unit 22 has red, green, and blue LED driving circuits 221, 222, and 223 for respectively driving the red, green, and blue LEDs 211, 212, and 213. Lee, [0029]. As shown in Fig. 3, which is an enlarged view of a part of Fig. 2, the series connection structure of the identical color LEDs in the divided region 20a is connected to the series connection structure of the identical color LEDs in the divided region 20b. *Id.*, [0034]. The parallel connection structure is electrically connected to the corresponding color LED driving circuit (i.e., the red driving circuit 221, the green driving circuit 222, or the blue driving circuit 223). Lee, [0034]. As a result, the parallel connection structure between the series connection structures of the identical color LEDs in the different divided regions 20a and 20b is connected to the corresponding driving circuit 221, 222, or 223. *Id.*, [0035]. Therefore, the LEDs are electrically connected to each other by the combination of the series and parallel connections. *Id.*



Lee, Fig. 3.

Lee further describes that the red LED driving circuit 221, the green LED driving circuit 222, and the blue LED driving circuit 223 function to *apply electric power or current* to the LEDs “while properly controlling a luminance, a color coordinate, or a color temperature to drive the LEDs under a desired condition.” Lee, [0041].

Thus, Lee discloses the current supply circuit (the LED driving unit 22) comprises a plurality of driving circuits (the red LED driving circuit 221, the green LED driving circuit 222, and the blue LED driving circuit 223) configured to supply a plurality of on-state drive currents (apply electric currents).

To the extent that Lee fails to disclose “phase drivers ... at a plurality of times in a firing cycle,” Kawabata discloses these elements. Kawabata states: “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.” Kawabata, [0070]. Phase-shifting is equivalent to having the current signals starting at different times in a firing cycle. *See* Ex. 1005, ¶97. 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 (have its phase shifted from the phase of the drive signal supplied to an adjacent LED string).

A POSITA would understand the phase-shifting described in Kawabata could be combined with the multiple driving circuits and strings described in Lee to achieve the benefits stated in Lee (“properly controlling a luminance, a color coordinate, or a color temperature to drive the LEDs under a desired condition”). *See* Ex. 1005, ¶98.

[’710 Claim 13B] 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

As discussed *supra* in relation to claim 13A, the Lee-Kawabata combination discloses a plurality of phase drivers that supply on-state drive currents.

Lee further discloses that the series connection structure of the identical color LEDs in the divided region 20a is connected to the series connection structure of the identical color LEDs in the divided region 20b. Lee, [0034]. The parallel connection structure is electrically connected to the corresponding color

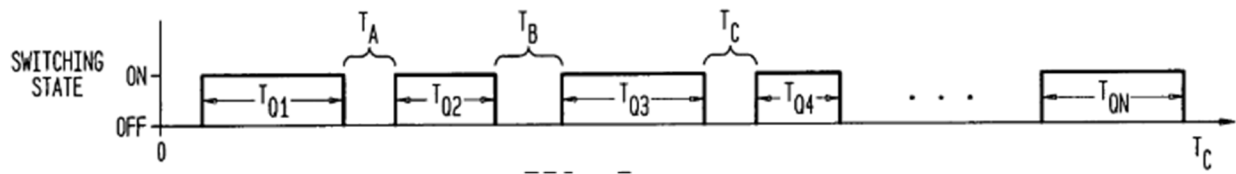
LED driving circuit (i.e., the red driving circuit 221, the green driving circuit 222, or the blue driving circuit 223). Lee, [0034]. Therefore, the LEDs are electrically connected to each other by the combination of the series (*strings*) and parallel connections (*string groups*). *Id.*

Thus, Lee discloses a plurality of string groups (a *red string group* comprising two or more red LED strings connected in parallel, a *green string group* comprising two or more green LED strings connected in parallel, and a *blue string group* comprising two or more blue LED strings connected in parallel).

A POSITA would understand that the string groups described in Lee could be combined with the phase drivers that supply on-state drive currents described in Kawabata. Ex. 1005, ¶98.

[’710 Claim 13C] 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.

Shteynberg describes that the multiplexer 150 is configured to “allow current through one or more of the series of LEDs 110₁, 110₂, 110₃, through 110_N in any combination, and *for any selected duration*” under the control of the controller 125. Shteynberg, [0047]. Importantly, Shteynberg stresses that “[e]ach *energizing time period* may be provided *in any order or combination*.” Shteynberg, [0054].



Id., Fig. 4.

Therefore, the controller 125, via the multiplexer 150, determines the order of the energizing time periods, which is equivalent to the firing order according to the definition of the “firing order,” for the LED strings. Thus, Shteynberg discloses “to determine a firing order of the plurality of strings” recited in claim 1D.

Thus, a POSITA would understand that the phase drivers and the plurality of string groups disclosed in Kawabata and Lee, respectively, could be incorporated into the lighting system disclosed in the Shteynberg-Kawabata combination, where the controller 125 determines the firing order. Ex. 1005, ¶102. In other words, the firing order disclosed in the Shteynberg-Kawabata combination could be applied to the phase drivers and the plurality of string groups disclosed in Kawabata and Lee, respectively.

VIII. Any Secondary Considerations Cannot Overcome the Clear Evidence of Obviousness.

The Board—at the institution phase—has repeatedly held that evidence of secondary considerations presented by the Patent Owner should be addressed in a trial where the parties may develop, and the Board may consider, a full record. *See, e.g., Tristar Products, Inc. v. Choon’s Design, LLC*, IPR2015-01883, Paper No. 6

at 26 (PTAB Mar. 9, 2016). That is the appropriate course here, especially given that “the inventions represent[] no more than ‘the predictable use of prior art elements according to their established functions,’” and, thus any “secondary considerations are inadequate to establish nonobviousness as a matter of law.” *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010) (quoting *KSR*, 550 U.S. at 417).

IX. Discretionary Denial is Inappropriate.

The Underlying Litigation does not warrant discretionary denial under 35 U.S.C. § 314(a). The *Fintiv* framework favors institution of this proceeding. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 6 (PTAB Mar. 20, 2020). As explained below, each of the *Fintiv* factors weighs against discretionary denial or is, at worst, neutral. The Board should institute IPR.

Factor 1 - Whether the Court Granted a Stay or Evidence Exists that One May be Granted if a Proceeding is Instituted. This factor favors institution or is, at worst, neutral. As discussed below, there has been little investment by the parties. The early stage of the litigation and potential simplification (resulting from the Board invalidating all asserted claims of the ’710 Patent) weighs against the exercise of discretion.

Factor 2 - Proximity of the Court’s Trial Date to the Board’s Projected Statutory Deadline for a Final Written Decision. This factor weighs against

discretionary denial. This case is at its early stages, the counterclaim asserting the '710 Patent was filed in September 2022. *See* Ex. 1014. Further, Patent Owner only identified asserted claims and served infringement contentions on January 30, 2023, and the schedule in the Underlying Litigation does not yet include a date for a *Markman* hearing, much less a trial date. *See* Ex. 1015. Further, the current case schedule does not include a date for the close of fact discovery, the beginning of expert discovery, or dispositive motions. Put simply, much more of the Underlying Litigation lies ahead than behind.

Further, according to the latest court management statistics, the average time from complaint to trial in the Northern District of Georgia—where the Underlying Litigation is Pending—is approximately 36 months. *See* Ex. 1016. Thus, conservatively, a jury trial would not occur in the underlying litigation until late 2025. Thus, a Final Written Decision is likely to be issued well before the date of any scheduled trial.

Factor 3 - Investment in the Parallel Proceeding by the Court and the Parties. This factor weighs against discretionary denial. The parties have made only minimal investment in this litigation to date. Plaintiff's infringement contentions identifying the asserted claims were served on January 30, 2023. *See* Ex. 1017. These contentions first identified the asserted claims, and Patent Owner supplemented these contentions on June 21, 2023. Ex. 1018. This fact weighs

against the exercise of discretion, as the Board explained in *Fintiv*, where “the petitioner filed the petition expeditiously, such as promptly after becoming aware of the claims being asserted, this fact has weighed against exercising the authority to deny institution under *NHK*.” *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 1 (PTAB Mar. 20, 2020) (precedential). Further, no substantive orders have been entered. Under these facts discretionary denial is improper. *See, e.g., Nokia of America Corp and Ericsson Inc. v. IPCOM, GMBH & Co. KG*, IPR2021-00533, Paper 10 at (PTAB Aug. 12, 2021).

Factor 4 - Overlap Between Issues Raised in the Petition and in the Parallel Proceeding. Petitioner challenges at least one claim (claim 11) of the '710 Patent that is not currently asserted in the Underlying Litigation. Exs. 1017-1018. Thus, at a minimum there is no overlap with respect to many of the challenged claims.

Factor 5 - Whether the Petitioner and the Defendant in the Parallel Proceeding are the Same Party. This factor is neutral. The parties are the same, but this is common in nearly every Petition filed where there is a co-pending litigation.

Factor 6 - Other Circumstances that Impact the Board's Exercise of Discretion, Including the Merits. As discussed in detail above, every element of the claims of the '710 patent is either expressly shown in the prior art or is obvious

in view of well-known art. The strong merits of the grounds presented in this Petition further support institution. *Fintiv*, Paper 11 at 14-15.

X. Denial Under Section 325(d) is Inappropriate.

This Petition does not present “the same or substantially the same prior art or arguments previously were presented to the Office.” 35 U.S.C. §325(d). None of the prior art references used herein were cited during prosecution of U.S. Application No. 13/270,387, which issued as the ’710 patent.

XI. Conclusion

In view of the foregoing, there is a reasonable likelihood that Petitioner will prevail with respect to claims 1-2, 5, 11-13, 16-17, and 47-48 of the ’710 Patent. Petitioner requests that the Board institute IPR.

Respectfully submitted,

By: /s/ Matias Ferrario
Matias Ferrario
Registration No. 51,082

CERTIFICATE OF WORD COUNT

The undersigned certifies pursuant to 37 C.F.R. § 42.24(d) that the foregoing **Petition for Inter Partes Review** excluding any table of contents, mandatory notices, certificates of service or word count, or appendix of exhibits or claim listing, contains 13,896 words according to the word-processing program used to prepare this paper (Microsoft Word). Petitioner certifies that this **Petition for Inter Partes Review** does not exceed the applicable type-volume limit of 37 C.F.R. § 42.24(a).

Dated: September 15, 2023

By: /s/ Matias Ferrario
Matias Ferrario
Registration No. 51,082

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on the date below a copy of this **Petition for *Inter Partes* Review** has been served by Priority Mail Express® upon the following:

MYERS BIGEL, P.A.
P.O. BOX 37428
Raleigh, NC 27627

With a courtesy copy sent via email to litigation counsel in *Hisense USA Corporation v. Brightplus Ventures LLC*, No. 1:22-cv-02774 (N.D. Ga.).

Dated: September 15, 2023

By: /s/ Matias Ferrario
Matias Ferrario
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