

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Xu Peicheng (Hong Kong) Optoelectronic Technology Co., Limited,
Petitioner

v.

Semisilicon Technology Corp.,
Patent Owner

U.S. Patent No. 8,884,546

Filing Date: Sept. 14, 2011

Issue Date: Nov. 11, 2014

Title: Driving Apparatus for Light-Emitting Diode Curtain Lamp

Inter Partes Review No.: IPR2024-00156

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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LIST OF PETITIONER’S EXHIBITS

No.	Description
1001	U.S. Patent No. 8,884,546
1002	Prosecution File History of U.S. Patent No. 8,884,546
1003	Declaration of E. Fred Schubert, Ph.D.
1004	U.S. Publication No. 2009/0021955 to Kuang et al. (“Kuang”)
1005	U.S. Publication No. 2012/0050606 to Debevec et al. (“Debevec”)
1006	Japanese Unexamined Patent Application Publication No. JP2006-228529
1007	Certified English Translation of Japanese Unexamined Patent Application Publication No. JP2006-228529 (“Hiroyuki”)
1008	U.S. Patent No. 6,774,584 to Lys et al. (“Lys”)
1009	Excerpts from <u>Modern Dictionary of Electronics</u> (7th ed. 1999)
1010	Reply Declaration of E. Fred Schubert, Ph.D.
1011	Jarske et al., <u>Signal Processor Implementation of Variable Digital Filters</u> , IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, Volume 37, Issue 3 (Sept. 1988)
1012	Renfors et al., <u>Signal Processor Implementation of Digital All-Pass Filters</u> , IEEE TRANSACTIONS ON ACOUSTICS, SPEECH, AND SIGNAL PROCESSING, Volume 36, Issue 5, (May 1988)
1013	Excerpts from <u>The Illustrated Dictionary of Electronics</u> (8th ed. 2001)
1014	Excerpts from <u>The American Heritage Science Dictionary</u> (2005)
1015	Excerpts from <u>The Computer Glossary: The Complete Illustrated Edition</u> (9th ed. 2001)
1016	Excerpts from <u>Modern Dictionary of Electronics</u> (7th ed. 1999)

No.	Description
1017	Excerpts from <u>McGraw-Hill Dictionary of Scientific and Technical Terms</u> (6th ed. 2003)
1018	Excerpts from <u>Dictionary of Computer Science, Engineering, and Technology</u> (2001)

I. INTRODUCTION

The Petition demonstrated that claims 1-6 and 8 of U.S. Patent No. 8,884,546 (EX1001, the “’546 patent”) are unpatentable. After the Board determined that Petitioner established a reasonable likelihood of prevailing on at least independent claim 1, Patent Owner (“PO”) served a Patent Owner’s Response (Paper 14, “POR”). Although PO noticed the deposition of Petitioner’s expert, Dr. E. Fred. Schubert (Paper 13), PO declined to depose him.

For the following additional reasons in response to the POR, Petitioner respectfully requests that the Board maintain its preliminary finding of unpatentability of claim 1, and determine that claims 2-6 and 8 are also unpatentable. Petitioner’s Reply is supported by the Reply Declaration of Dr. Schubert (EX1010, “Schubert Decl.”). *See* Patent Trial and Appeal Board Consolidated Trial Practice Guide 73 (Nov. 2019) (permitting rebuttal evidence including a new expert declaration in support of petitioner’s reply).

II. CLAIM CONSTRUCTION

A. “synchronous signals”

In response to the Board’s invitation for briefing on “synchronous signals,” Petitioner has no objections to the Board’s construction, “transmitting signals related to an activity(ies) occurring at the same time.” Paper 11 at 44. As Dr. Schubert opines, the only material distinction between the Board’s construction and his, which was “signals that are sent to the slave nodes to control their

corresponding LED strings at the same time,” is that Dr. Schubert construed “synchronous signals” in the broader context of the surrounding claim language. EX1010, ¶¶ 7-9.

Dr. Lebby opines that “synchronous signals” are “signals related to activities governed by synchronized timing.” EX2001, ¶ 55. Dr. Lebby introduces the concept of “synchronized timing” into the definition of “synchronous signals,” which has no support in the specification. EX1010, ¶ 10. From the standpoint of a POSITA, Dr. Schubert does not understand what “synchronized timing” means, and defining “*synchronous* signals” with a phrase “*synchronized* timing” parrots the claim language with a different form of the same word. As such, Dr. Lebby’s proposed construction should be rejected for impermissibly importing limitations (i.e., “synchronized timing”) from a dictionary into the claim without any supporting intrinsic evidence.

III. GROUNDS 1 AND 3

A. Kuang discloses a “curtain lamp” as claimed in 1[Pre]

According to Dr. Lebby, Kuang does not disclose a “curtain lamp” as recited in the preamble of claim 1. EX2001, ¶¶ 67-70. Dr. Lebby, however, does not contest Dr. Schubert’s opinion that a “curtain lamp” “is commonly understood to be one or more light strings.” EX1003, ¶ 37.

Since Dr. Lebby agrees that “curtain lamp” can be a single light string, the ’546 patent makes clear that such a “string” may consist of only one LED:

The light-emitting diode light string 30 mentioned above includes a plurality of light-emitting diodes. However, ***the light-emitting diode light string 30 could include single light-emitting diode.***

EX1001 at 6:15-20. The minimum configuration for a “curtain lamp” according to the ’546 specification is one LED. Therefore, the reverse must be true as well: one LED constitutes the claimed LED “curtain lamp.” EX1010, ¶ 13.

Kuang discloses a “curtain lamp” considering the ’546 patent specification’s guidance on the term’s scope. Dr. Lebby’s argument that Kuang discloses ceiling light panels that are not curtain lamps (EX2001, ¶ 68) must be rejected because the ’546 patent specification broadly discloses the scope of a “curtain lamp” as possibly encompassing only one LED. EX1010, ¶ 14.

Moreover, Kuang is not so limited, since “[t]he principles described have applicability beyond transit vehicles, and may be used, for example, in connection with lighting systems in buildings, factories, and other facilities.” EX1003, ¶ 37 (quoting Kuang at [0122]). As such, Dr. Schubert concludes that a POSITA would have understood Kuang’s schematics to disclose a string of LEDs (labeled 274) to satisfy the “curtain lamp” limitation:

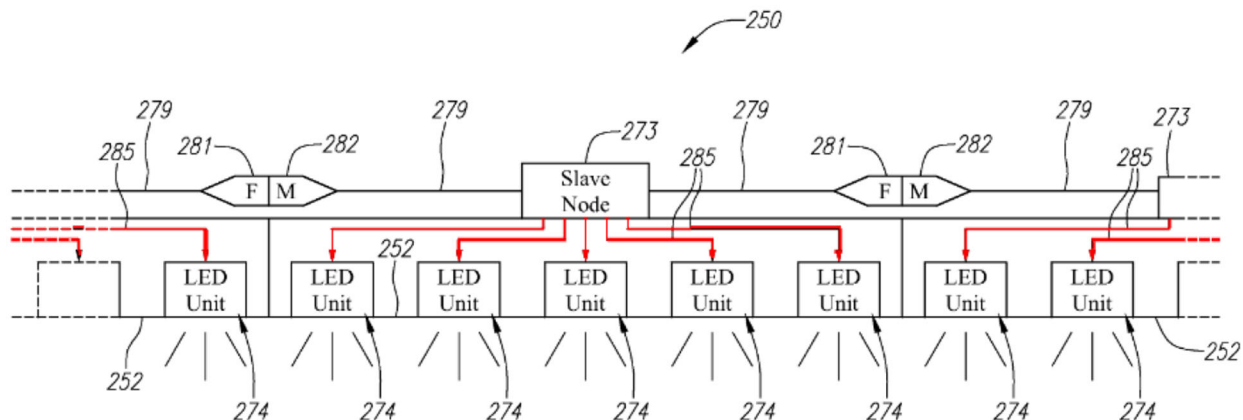


FIG. 2B

EX1003, ¶ 44; EX1010 ¶¶ 14-15.

Like Kuang, the “string” of LEDs disclosed in the ’546 patent is only illustrated in schematics without any description of physical aspects of “strings”:

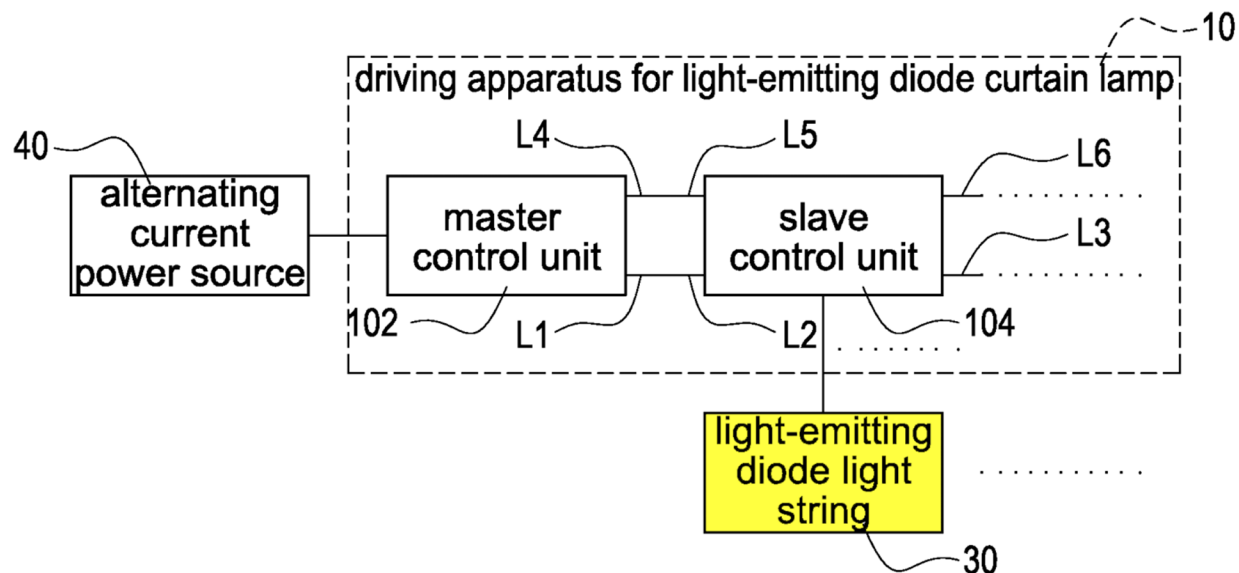


FIG.4

EX1001 at Fig. 4 (“light-emitting diode light string 30” highlighted).

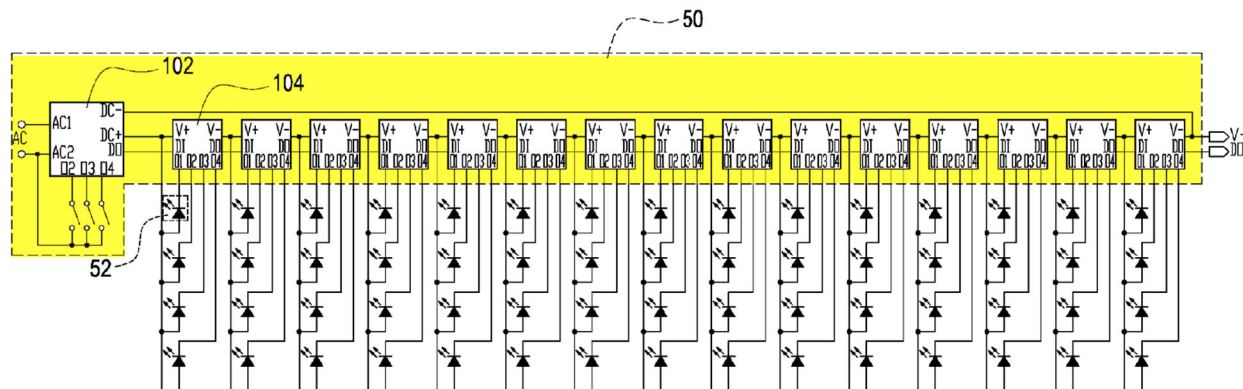


FIG.7

EX1001 at Fig. 7 (“light-emitting diode string 50” highlighted). This further demonstrates why Dr. Lebby’s critique of the application of Kuang should be rejected: there is nothing in the ’546 patent to suggest an LED “string” is limited to a certain physical configuration. EX1010, ¶ 16.

B. Lys discloses a “curtain lamp” as claimed in 1[Pre] or 8[Pre]

According to Dr. Lebby, Lys does not disclose a “curtain lamp” as recited in the preamble of claims 1 and 8. EX2001, ¶¶ 71-72. As explained above in Section III(A), the claimed “curtain lamp,” which Dr. Lebby does not dispute may be only one LED string, includes at least a single LED. The minimum configuration for a “curtain lamp” according to the ’546 specification is one LED. EX1010, ¶ 18.

Dr. Lebby’s argument that Lys discloses pool lighting fixtures that are not curtain lamps (EX2001, ¶ 71) must be rejected because the ’546 patent specification broadly discloses the scope of a “curtain lamp” as possibly encompassing only one LED. EX1010, ¶ 19.

Moreover, Lys is not so limited in its application, since “the term ‘LED’ does not restrict the package type of an LED; for example, the term ‘LED’ may refer to packaged LEDs, non-packaged LEDs, surface mount LEDs, chip-on-board LEDs, and LEDs of all other configurations.” EX1003, ¶ 61 (quoting Lys at 33:18-36). As such, a POSITA would have understood Lys to disclose a string of LEDs (labeled 24A-24D) to satisfy the “curtain lamp” limitation:

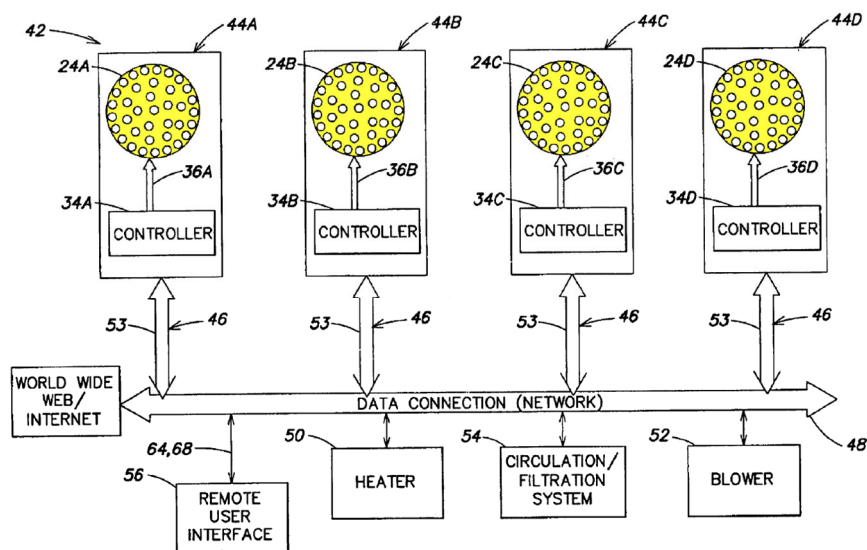


FIG. 4

Lys at Fig. 4 (“light sources 24A-24D” highlighted); EX1010, ¶ 20. In addition, “light sources 24A-24D” are “coupled together to form the networked lighting system 42[.]” EX1003, ¶ 59 (quoting Lys at 15:46-56). These light sources “may include one or more LEDs 32” and may further include “two or more differently colored LEDs” 32A-32C (e.g., red, green and blue LEDs). EX1003, ¶ 59 (quoting Lys at 10:61 to 11:5; 11:6-20); EX1010, ¶¶ 20-21.

C. Kuang discloses “synchronous signals” as claimed in 1[D]

In the illustration below, Dr. Lebby contends that Kuang’s “shutoff command” propagates from slave controller to slave controller. EX2001, ¶ 76. Dr. Lebby also contends that the sequential propagation (from one slave controller and associated lighting unit to the next one) would preclude the lighting units from being shut OFF “at the same time”:

Image shown in Paragraph 76 of the Lebby Declaration:

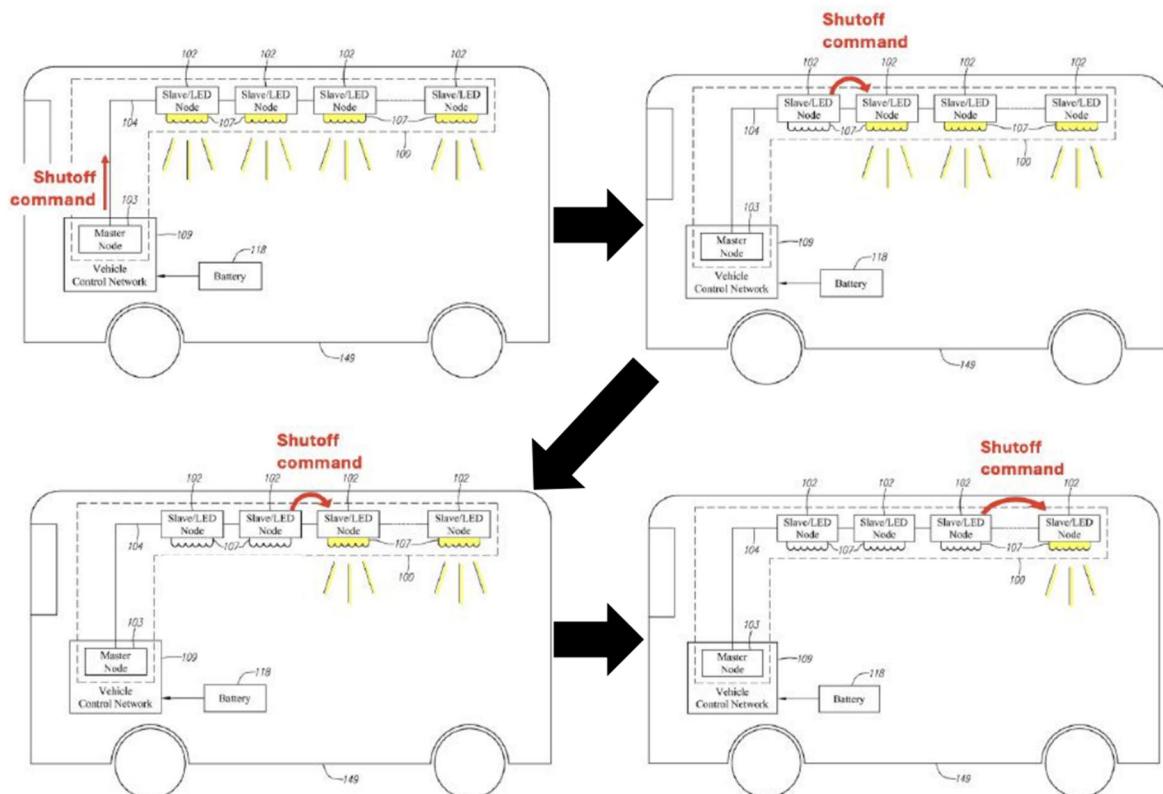


Diagram of Kuang’s signal propagation based on Kuang Fig. 1 and [0034]

EX2001, ¶ 76 (figure prepared by Dr. Lebby).

Dr. Lebby tries to distinguish “synchronous signals” from those that propagate on transmission lines located between adjacent slave controllers. First,

Dr. Schubert explains that a POSITA would have understood that an electrical signal propagates as an electromagnetic guided wave over the transmission line.

Dr. Schubert further explains that the propagation velocity of electromagnetic waves on a transmission line is related to the velocity of light, c , which is known to be very high (2.99×10^8 m/s). For light to propagate a distance of 10 feet takes only about 10 ns. EX1010, ¶ 25.

As further explained by Dr. Schubert, the propagation velocity of light in vacuum is $c = 2.99 \times 10^8$ m/s. The propagation velocity of a guided electrical signal on a transmission line is given by $c / (\epsilon_r \mu_r)^{1/2}$ where ϵ_r and μ_r are the relative electric and magnetic constants of the transmission line material, respectively. Because these propagation velocities are high, the propagation delays are short, far below 1 ms, and not noticeable to a human observer. EX1010, ¶ 26.

Second, the embodiments in the '546 patent *only* disclose the same propagation delays that Dr. Leiby alleges would distinguish Kuang from meeting this limitation. As explained by Dr. Schubert, the slave control units 104 are connected by wirings that have a physical length. It is simply impossible for the propagation delay to be zero. The propagation delay is at least given by the propagation velocity of the guided electromagnetic wave propagating on the transmission line (wirings).

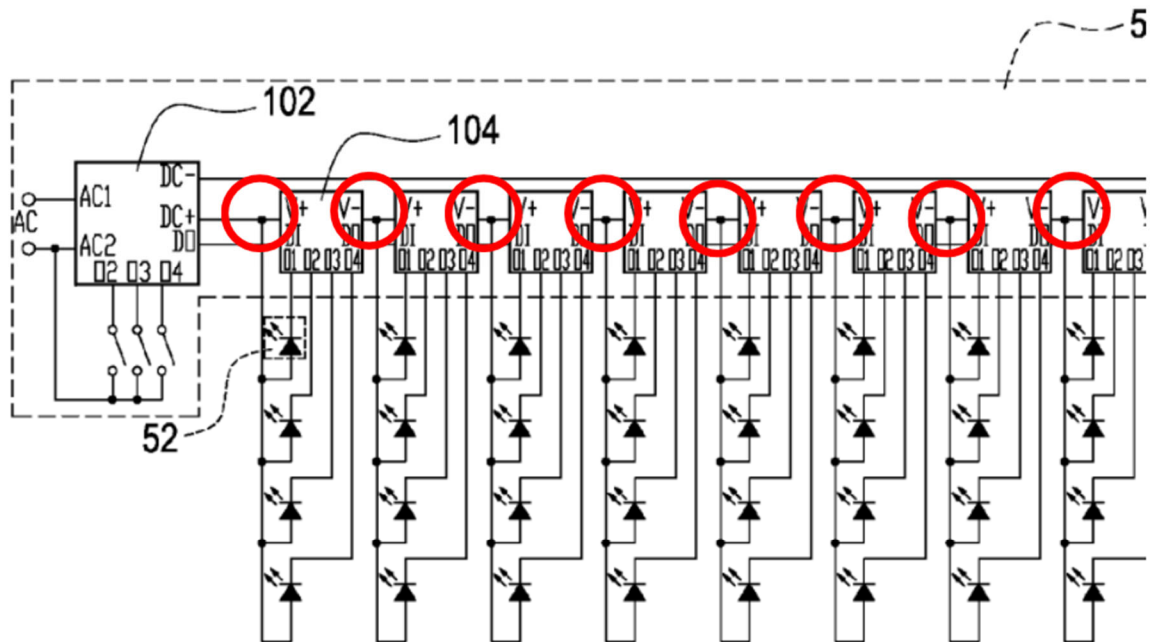


FIG.7

EX1001 at Fig. 7 (excerpt of Fig. 7, annotated, showing the locations of electromagnetic wave propagation delays between slave control units 104).

EX1010, ¶ 27.

Accordingly, the physical limitations that Dr. Lebbly argues distinguish the prior art from meeting the “synchronous signals” limitation equally affect all illustrated embodiments of the ’546 patent. Because the propagation delays are exceedingly small, below 1 ms according to Dr. Schubert, propagation delays would not prevent the lighting units in Kuang or the ’546 patent from being operated synchronously, that is, at the same time as supported by the Board’s or Petitioner’s construction of the term “synchronous signals.” EX1010, ¶ 28.

D. Kuang discloses “control signals” and “synchronous signals” as claimed in 1[D]

Dr. Lebby opines that “synchronous signals are separate from control signals in 1[D], at least because there are two separate ‘signal’ claim elements.” EX2001, ¶ 81. Dr. Lebby cites the ’546 patent specification recitation of “[t]he transmission line [105] is used to transit control signals and synchronous signals,” which merely parrots the claim language. EX2001, ¶ 81.

First, the claim language does not read “... is used to transit control signals *or* synchronous signals,” which would indicate that a control signal cannot also be a synchronous signal. Rather, the plain language of this claim element informs a POSITA in view of the ’546 patent specification that a control signal *may* also be a synchronous signal. That is, a signal may contain control instructions (e.g. shut LEDs OFF) as well as synchronous instructions (e.g. execute the control instructions for multiple LEDs at the same time). Dr. Schubert is unable to identify a basis for Dr. Lebby’s exclusion of such signals (that constitute control signals and synchronous signals) in the ’546 patent. EX1010, ¶ 31.

This understanding is supported by the ’546 patent specification, which only discloses control signals which may also be synchronous if controlling more than one slave control unit at the same time. There is nothing in the ’546 patent specification to suggest that a control signal can never be synchronous, or that a

synchronous signal cannot be a control signal. Indeed, the only “signals” explicitly described in the ’546 patent specification are control signals. For example:

[T]he second terminal pin viewed from top to bottom direction *is used to transmit signals for controlling the slave control units 104 to drive the light-emitting diode light strings 30*

EX1001 at 3:38-48.

[T]he second terminal pin viewed from top to bottom direction *is used to receive signals from the master control unit 102, to drive the light-emitting diode light string 30*

EX1001 at 3:49-58.

[T]he second terminal pin viewed from top to bottom direction *is used to transmit signals for controlling the next slave control units 104 to drive the next light-emitting diode light strings 30*

EX1001 at 3:59 to 4:3.

The signal controlling the light-emitting diode light strings 30 is transited to the first slave control unit 104 through the second terminal pin viewed from top to bottom direction in the right side of the master control unit 102.

EX1001 at 6:7-10; EX1010, ¶ 32.

In view of the above, Dr. Schubert explains that a POSITA would not understand the claim language to exclude a control signal that is also a synchronous signal. Dr. Lebby’s opinion to the contrary is belied by the plain language in the claims (i.e., using the conjunction “and” instead of “or”), and the ’546 patent specification which only describes control signals and provides no

examples of a synchronous signal that does not control the slave control units.

EX1010, ¶ 33.

In further response to Dr. Lebby, Kuang discloses: “Via commands or inquiries conveyed over the command/data bus 212, the master node 203 may control, individually *or by group*, the individual LED units 224 of each LED-based lighting fixture 202. The master node 203 may, for example, command certain LED units 224 to turn on, turn off dim by a specified amount, intensify by a specified amount, flash (e.g., in emergency situations), or activate according to a predetermined pattern.” EX1004 at [0035]. Based on Kuang’s disclosure, Dr. Schubert explains that a POSITA would understand that by controlling LED units *by group* as opposed to just individually, Kuang further discloses both control signals *and* synchronous signals as claimed in element 1[D]. EX1010, ¶ 34.

Yet in further response to Dr. Lebby, Kuang also discloses that “[t]he master node 203 may convey commands to the slave nodes 223 *at each LED-based lighting fixture 202*, and, in response thereto, the slave nodes 223 may be responsible for locally controlling the electronics *at each LED based lighting fixture 202* in order to implement the command received from the master node 203.” EX1004 at [0035]. When conveying commands to “the slave nodes 223 at each LED-based lighting fixture 202,” the commands are conveyed to a group that includes “each LED-based lighting fixture 202.” That is, the group is controlled

collectively at the same time (synchronously). The “convey commands” action requires control signals. The control of a group (“each LED-based lighting fixture 202”) means that the control signals include synchronous information. EX1010, ¶ 35.

Therefore, Dr. Lebby’s contention that “control signals and synchronous signals” precludes any control signals from also being synchronous must be rejected. PO provides no compelling evidence from the ’546 specification aside from parroting of the claim language itself, which by its plain words does not support such a narrow and unsupported reading of this limitation. EX1010, ¶ 36.

E. Lys discloses “synchronous signals” as claimed in 1[D]

Dr. Lebby argues that Lys does not disclose “synchronous signals.” EX2001, ¶¶ 82-89.

As explained above in Section III(D), PO’s argument that a “control signal” cannot also be a “synchronous signal” must be rejected. As such, Dr. Lebby’s critique that “the Petition does not articulate precisely which signals in Lys are mapped to the ‘control signals’ of 1[D], and which signals in Lys are mapped to the ‘synchronous signals’ of 1[D]” (EX2001, ¶ 82) is irrelevant. The claimed “control signals” may be “synchronous signals.” EX1010, ¶ 40.

Dr. Lebby also contends that Lys’s disclosure of controlling light sources in a “coordinated fashion” does not meet the “synchronous signal” limitation because

it relates to “exchanging control signals with pool devices other than light sources.” EX2001, ¶ 87. This is an erroneous interpretation of Lys’s disclosure. According to Lys, “[i]n one embodiment of the invention, one or more of the light sources 24A-24I are controlled in a *coordinated fashion* with one or more other accessories (e.g., heaters, blowers, filtration and circulation systems, etc.) in the pool or spa environment.” EX1008 at 10:3-8. Lys further explains:

Some illustrative examples of this embodiment include changing illumination conditions in the pool or spa *to a particular color when the heater 50 is activated*, or changing the illumination conditions *to one or more other particular colors when one or more blowers 52 comes on* to agitate the liquid 22 in the pool or Spa 20.

EX1008 at 16:56 to 17.2 (emphasis added). The disclosed “coordinated fashion,” therefore, is not merely coordinating with pool devices other than light sources. Rather, Lys explains that control activities, such as changing the “light sources 24A-24D” to a particular color(s) when other pool devices are turned on or activated, may occur at the same time to signify an event associated with another pool device. This requires “synchronous signals” as claimed. EX1010, ¶ 41.

Other disclosures in Lys support Petitioner’s understanding. For example, “[i]n another embodiment of the invention, two or more independently controllable light sources of the pool or spa environment shown in FIG. 1 may be synchronized without necessarily being coupled to a network[.]” EX1008 at 19:29-32. The disclosed “controllable light sources” require “control signals” to accomplish this

control. And, performing control in a “synchronized” manner requires “synchronous signals” as claimed. EX1010, ¶ 42.

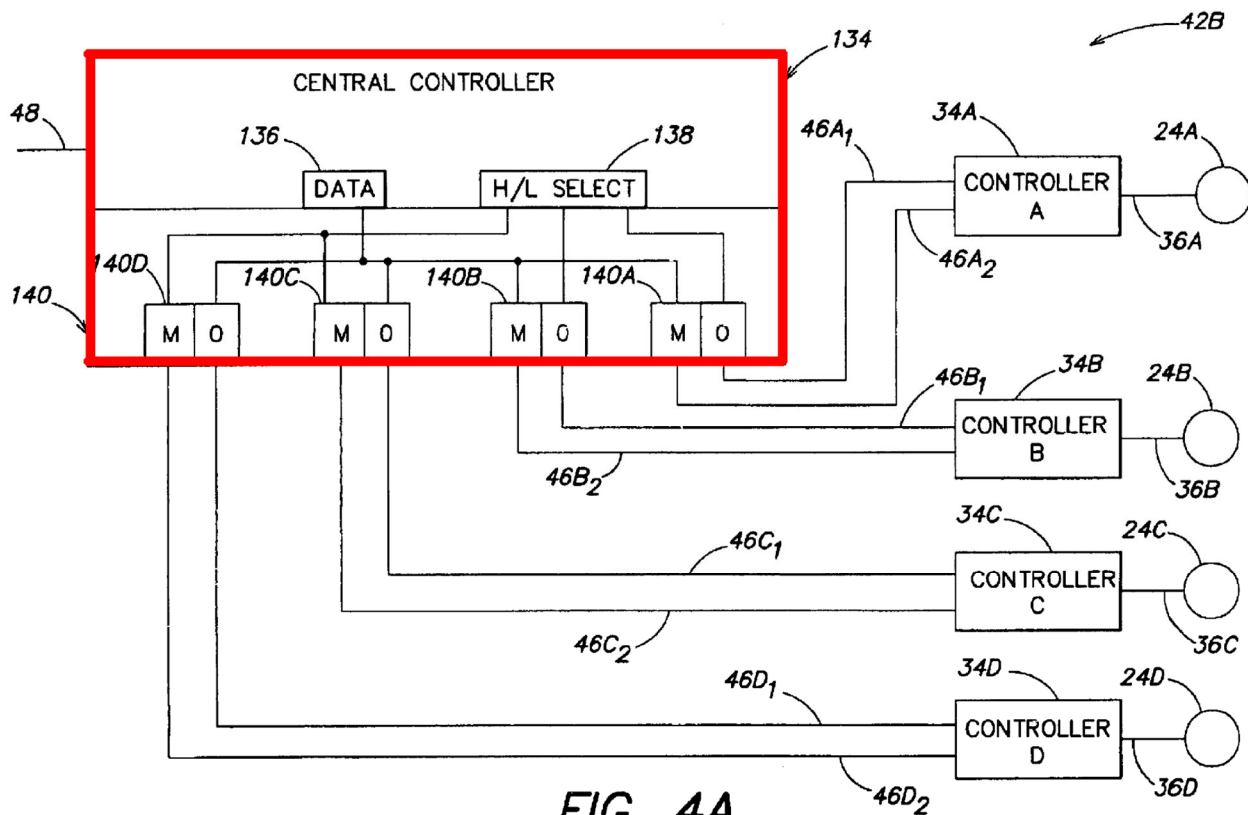
Dr. Lebby also critiques Dr. Schubert’s opinion that Figure 4A in Lys discloses synchronous data paths because “nothing in ... Lys *requires* the simultaneous transmission of control signals” and “Lys’s controller *could have* transmitted signals to different light controllers at different times, to reduce the complexity and computing power required of the central controller.” EX2001, ¶ 88 (emphasis added). Dr. Lebby does not (and cannot) dispute Dr. Schubert’s opinion that Figure 4A “illustrates data signal 136 that is transmitted synchronously to each controller 34A-34D (either via ‘mode’ or ‘option’ data paths).” EX1003, ¶ 76. Rather, Dr. Lebby can only proffer that it is possible that asynchronous signals are also transmitted to “reduce the complexity and computing power required of the central controller.” EX2001, ¶ 88. There is nothing in Lys to support such a conclusion, and Dr. Schubert opines that “there is no effect on complexity and/or computing power when addressing light sources individually or collectively.” EX1010, ¶ 43.

F. Lys discloses a “master control unit” as claimed in 1[A]

Dr. Lebby argues that Lys does not disclose a “master control unit” because the “local user interface 45” or “remote user interface 56” are only “buttons, switches, and dials.” EX2001, ¶¶ 82-89. According to Lys, “a local user interface

43 *may be associated with the controller 34* shown in FIG. 2 to facilitate user selection of one or more operating modes of the controller 34 and the light source 24.” EX1003, ¶ 63 (citing Lys at 14:17-29). Dr. Schubert never opined that the claimed “master control unit” was merely the “buttons, switches, and dials” and nothing more. EX1010, ¶¶ 44-45.

In further response to Dr. Lebby, Dr. Schubert explains that a POSITA would have recognized that the “central controller 134” as illustrated in Figure 4A could also comprise the controller of either the local or remote user interfaces disclosed in Lys:



EX1008 at Fig. 4A (central controller 134 highlighted). According to Lys, “[i]n the embodiment of FIG. 4A, a central controller 134 coupled to the network 48 is adapted to control four light sources 24A-24D respectively associated with four controllers 334A-34D.” EX1008 at 17:64-66. EX1010, ¶ 46.

Dr. Lebby also argues that a “voltage regulator” is absent from the claimed “master control unit” because “selectors 60A-60D are simply buttons of remote user interface 56, which operates like a remote control.” EX2001, ¶ 93. Dr. Schubert explains in response to Dr. Lebby’s criticism that Lys is capable of changes in lighting color. Color is changed by changing the current through LEDs. Each current change is associated with a voltage change (due to Ohm’s law). Since Lys is capable of changing / regulating current, it is equally capable of changing voltage. Accordingly, Lys changes, controls, or regulates current and voltage and therefore includes a voltage regulator. Dr. Schubert also notes that the ’546 patent discloses “direct current voltages outputted from the voltage regulator 108” (EX1001 at 3:57-58). That voltages (plural) are outputted from the voltage regulator is consistent with the capability to change voltage values. EX1010, ¶ 47.

G. Lys discloses a “second curtain lamp” as claimed in 8[D]

Dr. Lebby argues that Lys does not disclose a “second curtain lamp.” EX2001, ¶¶ 95-97. As explained above in Section III(A), the minimum configuration for a “curtain lamp” according to the ’546 specification is one LED.

Each one of Lys's plurality of light sources 24A to 24D meets the claim limitation "a second curtain lamp electrically connected to the alternating current voltage transferring to direct current voltage circuit." Each lighting module operates with DC current and, accordingly, must be connected to a "alternating current voltage transferring to direct current voltage circuit." EX1003, ¶¶ 89-90; EX1010, ¶ 50.

IV. GROUNDS 2 AND 4

A. Kuang and Lys already disclose a "transistor" in claim 3

Dr. Lebby contends that a POSITA would not have been motivated to combine Kuang with Debevec or to combine Lys with Debevec in support of the "transistor" limitation in claim 3. EX2001, ¶¶ 100-108.

According to Dr. Lebby, "the Petition does not identify any deficiency in Kuang warranting the addition of Debevec's transistor. And in fact, Kuang already discloses the same functionality that Petitioner seeks to add via Debevec's transistor." EX2001, ¶ 101. Dr. Lebby concludes that "Kuang's system already has the capabilities of 'an electronic switch or valve' because it can switch power to the LEDs and dim the light output." EX2001, ¶ 102.

Similarly, Dr. Lebby opines that "Lys discloses a controller 34 that changes lighting parameters without modification, such as by adjusting a PWM signal or providing variable analog signals." EX2001, ¶ 106 (citing Lys at 11:21-52). Dr.

Lebby concludes that “Lys already has a type of ‘electric switch or valve.’”

EX2001, ¶ 106.

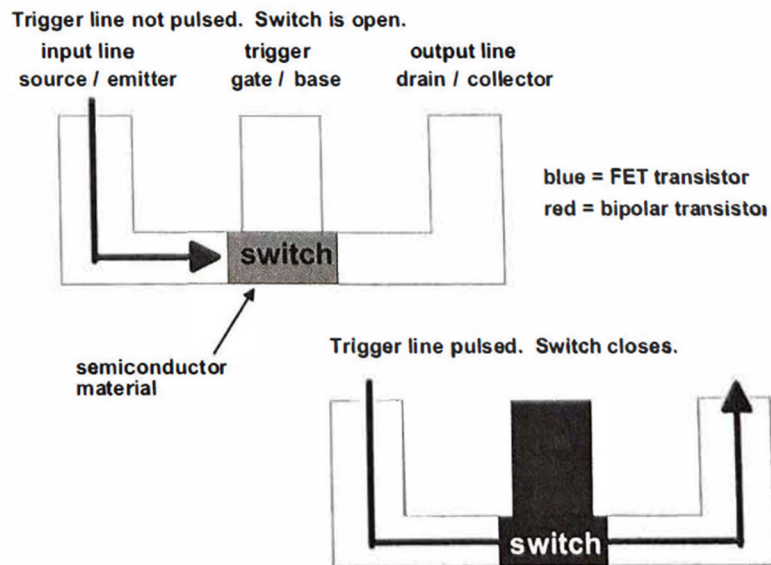
In the alternative and in response to Dr. Lebby’s admissions, Dr. Schubert agrees with Dr. Lebby that “Kuang’s system already has the capabilities of ‘an electronic switch or valve’” and “Lys already has a type of ‘electric switch or valve.’” EX1010, ¶ 54. As such, Kuang and Lys each independently disclose the “transistor” limitation without combining with Debevec. *Id.*

According to Dr. Schubert, a transistor may be referred to as an electronic switch or electronic valve. The Illustrated Dictionary of Electronics defines “transistor” as “[a]n active (commonly three-terminal) semiconductor device capable of amplification, oscillation, and **switching action**.” EX1013 at 691. Similarly, the American Heritage Science Dictionary defines “transistor” as “[a]n electronic device that controls the flow of an electric current, most often used as an amplifier or switch.” EX1014 at 637. And the Computer Glossary defines “transistor” as “[a] semiconductor device used to amplify a signal or open and close a circuit. In a computer, it functions as an electronic switch.” EX1015 at 407. The Computer Glossary further illustrates the “transistor concept” and defines “[t]he transistor as an electronic switch”:

The Transistor Concept

The transistor is an electronic switch. The switching element is made of semiconductor material which conducts electricity when it is pulsed.

If there is no pulse on the trigger line, the semiconductor element is in a non-conductive state. When it is pulsed, it becomes conductive and current flows from the input to the output.



EX1015 at 407. As explained by Dr. Schubert, the above illustration shows the current flow in an FET (field-effect transistor) between source and drain is controlled by the gate, which can regulate (switch on/off) the current flow.

EX1010, ¶ 55.

In sum, because Dr. Lebby agrees that a transistor, including Debevec's transistor, can be characterized as an "electronic switch or valve," and a POSITA would understand a "transistor" as claimed to be the equivalent of an electronic switch or valve as supported by the above technical resources, in the alternative Petitioner agrees with Dr. Lebby and concludes that Kuang and Lys disclose a "transistor" as claimed. EX1010, ¶ 56.

V. GROUND 5

A. Hiroyuki discloses “pins” in claim 4

According to the Board, “the Schubert Declaration at paragraph 100 does not offer evidentiary support for its statements that ‘[t]he words “terminal” and “pin” typically imply an electrical end point at which an electrical connection is made to another unit’ and that ‘[a] “pin” can be understood as a pointed terminal, indicating that ‘terminal’ encompasses a ‘pin.’” Paper 11 at 52. The Board invited additional briefing on “issues related to claim 4” including claim construction regarding “power negative terminal pin” and “signal output pin.” Paper 11 at 52.

In response to the Board’s invitation and Dr. Lebby’s argument that Hiroyuki “does not disclose physical connections such as the pins of 4[A] or 4[B] (EX2001, ¶ 112), the Modern Dictionary of Electronics defines “terminal” as “1. *A point of connection for two or more conductors* in an electrical circuit. 2. A device attached to a conductor to facilitate connection with another conductor.” EX1016 at 769. And, the McGraw-Hill Dictionary of Scientific and Technical Terms defines “pin” as “[ELECTR] A *terminal* on an electron tube, semiconductor, integrated circuit, plug, or connector.” EX1017 at 1600. Therefore, consistent with Dr. Schubert’s original opinion, a POSITA would understand the “terminal” disclosures in Hiroyuki to reference a connection point in an electrical circuit. EX1010, ¶ 58.

Of note, the '546 patent does not describe the physical structure of any claimed “pins.” The '546 patent only provides schematics without further discussion or depiction of the physical nature of claimed “pins.” Therefore, a POSITA would understand Hiroyuki to disclose the claimed “pins” because both “terminals” and “pins” imply an electrical end point at which an electrical connection is made to another unit. As shown above, not all definitions of “pin” are tied to a specific physical structure. Rather, they may be synonymous with “terminals” generally, and Hiroyuki does not teach away from “terminals” that may be pointed – to the extent such a physical distinction is relevant. EX1010, ¶ 59.

VI. GROUND 6

A. Hiroyuki discloses a “signal processor” in claim 8

The Board noted that “petitioner does not offer an interpretation of ‘signal processor.’” Paper 11 at 55. As such, “[i]t is therefore not clear, at this juncture, why, according to the Schubert Declaration at paragraph 127, ‘a POSITA would have understood the constant current circuit 72 in Hiroyuki to meet the “signal processor” limitation as claimed because it regulates the power supply to keep its output current constant in spite of changes in load, line, or temperature.’” Paper 11 at 55. The Board invited additional briefing on this point.

Dr. Schubert explains that a POSITA would understand that signal processors come in two varieties: digital signal processors and analog signal processors. Signal processors are electrical circuits that, for example, process, filter, convert, modify, or decode a received electrical signal (such as command signal). The Illustrated Dictionary of Electronics defines a “signal processor” as follows: “Any device, (e.g., preamplifier, expander, amplitude limiter, delay network) inserted into or added onto a system to modify an input or output signal.” EX1013 at 628; EX1010, ¶ 61.

As explained by Dr. Schubert, digital signal processors work with digital signals having discrete voltage values that are associated with at least two logical states such as the “0” state and the “1” state. In contrast, analog signal processors are not limited to discrete voltage values but instead can employ a continuous range of voltage values. An electrical circuit unit (analog or digital) receiving a signal and processing the signal into another type of signal constitutes a signal processor. For example, the filtering of an electrical signal is understood as processing of the signal. This is consistent with the technical literature, for example the 1988 Jarske IEEE article, “Signal Processor Implementation of Variable Digital Filters,” and the 1988 Renfors IEEE article, “Signal Processor Implementation of Digital Filters”, which characterize the filtering of an electronic signal as an act of signal processing. *See generally* EX1011, EX1012. Such

understanding is consistent with the plain and ordinary meaning of the term “signal processor” and for this reason would be shared by a POSITA. For example, an electric circuit receiving an informational signal (command signal) as well as a power signal to process the received signals into a signal that is suitable for driving an LED, constitutes a signal processor. EX1010, ¶ 62.

Dr. Lebby admits that the circuit of Hiroyuki processes a signal. According to Dr. Lebby, “The function performed by Hiroyuki’s constant current circuit unit 72 is essentially a filter” EX2001, ¶ 121. Filtering a signal constitutes the processing of a signal because the act of filtering constitutes a modification of a signal, specifically the modification of an unfiltered signal into a filtered signal. For example, the Dictionary of Computer Science and Technology defines “filter” as “an electronic device that *modifies* some characteristic of an input signal for conditioning or other purposes.” EX1018 at 184. Such modification is consistent with the dictionary definition of a signal processor, which classifies “[a]ny device ... to modify an input or output signal” as a signal processor. EX1013 at 628. Indeed, it is a common function of signal processors to filter signals as disclosed numerous times in the technical literature. In addition, the technical literature is replete with reports that identify filtering as one of the common processes performed by signal processors. Indeed, it is a common function of signal processors to filter signals. *See generally* EX1011, EX1012; EX1010, ¶ 64.

As Dr. Schubert also points out, Dr. Lebby further admits that it is sufficient for an exemplary signal processor to simply provide a signal that controls a transistor which in turn regulates the current flow to an LED. According to Dr. Lebby, “the ’546 patent discloses a signal processor 116 that outputs a signal to control transistor 118.” EX2001, ¶ 122. That is, Dr. Lebby points to an exemplary implementation of a signal processor, in which the signal processor provides an output signal that is used to drive an LED. EX1010, ¶ 65.

B. A POSITA would have been motivated to add Debevec’s microcontroller to Hiroyuki

The Kuang prior art reference includes a microcontroller. In contrast, the Hiroyuki prior art reference does not include a microcontroller. Dr. Lebby contends that the Petition fails to establish that a POSITA would have been motivated to add Kuang’s microcontroller to Hiroyuki. EX2001, ¶ 125.

In response to Dr. Lebby’s arguments, Dr. Schubert further opines that adding the microcontroller of Kuang in Hiroyuki would have provided the following advantages: First, a microcontroller would have added flexibility in driving LEDs. A microcontroller can be programmed and re-programmed, whereas a hard-wired circuit cannot. The flexibility allows the circuit to be responsive to future needs. Second, a microcontroller would have enabled advanced functionalities of the system by being able to tune lighting parameters such as brightness and color. Such brightness and color tunability are desirable features

that a consumer would appreciate. Third, adding a microcontroller, such as the one used by Kuang, is predictable and has a high associated probability of success. Microcontrollers are digital circuits based on logic that are widely used and have an associated low cost. EX1010, ¶ 68.

Dr. Schubert further opines that the prospect of a more advanced functionality enabled by microcontrollers would motivate a POSITA to include a microcontroller (such as Kuang's microcontroller) in Hiroyuki's lighting device. A more advanced functionality would include the ability to individually and collectively address the LED strings, or the LEDs within a string, which is a functionality that would be appreciated by consumers. EX1010, ¶ 69.

For at least these additional reasons, Dr. Schubert explains that a POSITA would be motivated to include Kuang's microcontroller in Hiroyuki.

VII. DR. SCHUBERT'S OPINIONS ARE NOT ATTORNEY ARGUMENT

PO rehashes its tired argument that Dr. Schubert's opinions are "unsupported attorney argument" because the Petition repeats his opinions. POR at 61-62. The Board does not consider arguments incorporated by reference. *See, e.g., Group III Int'l, Inc. v. Targus Int'l LLC*, IPR2021-00371, Paper 21 at 28 ("To the extent Petitioner attempts to incorporate arguments from the exhibits into the Petition, we do not consider such arguments." (citing 37 C.F.R. § 42.6(a)(3) ("Arguments must not be incorporated by reference from one document into another document."))).

Therefore, copying expert opinion into the Petition in whole or in part is the most fail-safe way to ensure those expert opinions are fully considered by the Board. Dr. Schubert declares that the opinions in his original and reply declarations are his own, and therefore should not be misconstrued as repeating the reasoning of the Petition or Petitioner's Reply when the opposite is the case. EX1010, ¶ 3.

VIII. CONCLUSION

For the foregoing additional reasons in rebuttal of the POR and supporting declaration by Dr. Lebby, claims 1-6 and 8 of the '546 patent should be found unpatentable.

DATE: Nov. 4, 2024

Respectfully submitted,

/s/ John Handy

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CERTIFICATE OF WORD COUNT UNDER 37 C.F.R. § 42.24(d)

Under the provisions of 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the word count for this Petition totals 5,160 words, excluding the parts of the brief exempted by 37 C.F.R. § 42.24(c), as calculated by Microsoft Word, which is less than the 5,600 allowed under 37 C.F.R. § 42.24(c)(1).

DATE: Nov. 4, 2024

Respectfully submitted,

/s/ John Handy

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(b), the undersigned hereby certifies that a copy of the foregoing Petition for *Inter Partes* Review and all supporting Exhibits was served via email to Patent Owner's counsel of record.

DATE: Nov. 4, 2024

Respectfully submitted,

/s/ John Handy

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APPENDIX A: CHALLENGED CLAIMS

Claim	Limitation
1[Pre]	A driving apparatus for light-emitting diode curtain lamp applied to a direct current power source and at least a light-emitting diode light string, the driving apparatus for light-emitting diode curtain lamp including:
1[A]	a master control unit electrically connected to the direct current power source, including a microcontroller and a voltage regulator electrically connected to the microcontroller;
1[B]	at least a slave control unit electrically connected to the master control unit and the light-emitting diode light string; and
1[C]	a transmission line electrically connected to the master control unit and the slave control unit,
1[D]	wherein the slave control unit is controlled by the master control unit to drive the light-emitting diode light string; the transmission line is used to transit control signals and synchronous signals.
2	The driving apparatus for light-emitting diode curtain lamp in claim 1, wherein the slave control unit includes a signal processor.
3	The driving apparatus for light-emitting diode curtain lamp in claim 2, wherein the slave control unit includes a transistor electrically connected to the signal processor.
4[Pre]	A driving apparatus for light-emitting diode curtain lamp applied to an alternating current power source and at least a light-emitting diode light string, the driving apparatus for light-emitting diode curtain lamp including:

Claim	Limitation
4[A]	a master control unit including a power negative terminal pin of master control unit and a signal output pin of master control unit, the master control unit being electrically connected to the alternating current power source; and
4[B]	at least a slave control unit including a signal input pin of slave control unit, a signal output pin of slave control unit, a power positive terminal pin of slave control unit, and a power negative terminal pin of slave control unit, the slave control unit being electrically connected to the master control unit and the light-emitting diode light string,
4[C]	wherein the slave control unit is controlled by the master control unit to drive the light-emitting diode light string; the signal output pin of master control unit is electrically connected to the signal input pin of slave control unit;
4[D]	the power negative terminal pin of master control unit is electrically connected to the power positive terminal pin of slave control unit.
5	The driving apparatus for light-emitting diode curtain lamp in claim 4, wherein the master control unit includes: a microcontroller; and a bridge rectifier electrically connected to the microcontroller.
6	The driving apparatus for light-emitting diode curtain lamp in claim 5, wherein the master control unit includes a first Zener diode electrically connected to the bridge rectifier.
8[Pre]	A driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string applied to at least a light-emitting diode, the driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string including:

Claim	Limitation
8[A]	a master control unit; and at least a slave control unit electrically connected to the master control unit and the light-emitting diode,
8[B]	wherein the master control unit includes a microcontroller; the slave control unit includes a signal processor;
8[C]	the driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string further including: an alternating current voltage transferring to direct current voltage circuit electrically connected to the slave control unit; and
8[D]	a second curtain lamp electrically connected to the alternating current voltage transferring to direct current voltage circuit.