

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

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 8,884,546
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §§ 42.1-100, ET SEQ.**

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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 Dr. E. Fred Schubert
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)

I. INTRODUCTION

Pursuant to 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq.*, Xu Peicheng (Hong Kong) Optoelectronic Technology Co., Limited (“Xu Peicheng” or “Petitioner”) respectfully requests that the Board initiate *inter partes* review (“IPR”) of claims 1-6 and 8 (the “Challenged Claims”) of U.S. Patent No. 8,884,546 (EX1001, the “’546 patent”), which is assigned to Semisilicon Technology Corp (“Patent Owner”). As explained herein, a reasonable likelihood exists that Petitioner will prevail with respect to the Challenged Claims.

II. STATEMENT OF PRECISE RELIEF REQUESTED

A. Prior Art

The ’546 patent issued from U.S. Patent App. No. 13/232,932, which was filed on September 14, 2011, purports to claim the benefit of Taiwanese Patent App. No. 099220340, filed on October 21, 2010. Solely for purposes of evaluating prior art in this proceeding, this Petition will treat October 21, 2010, as the earliest effective filing date of the ’546 patent and may refer to the same as “the priority date” or “the time of the alleged invention” without conceding the propriety of the priority claim. The references on which this Petition relies qualify as prior art to the ’546 Patent for the reasons explained below.

Although Debevec was substantively discussed during prosecution, the Petition only relies on Debevec as a secondary reference in combination with

primary references Kuang and Lys. Prior art references Kuang, Lys, and Hiroyuki were not cited during prosecution of the '546 Patent.

The following references are pertinent to the grounds of unpatentability:¹

- U.S. Publication No. 2009/0021955 to Kuang et al. (EX1004, “Kuang”) was published on January 22, 2009. Because Kuang was published more than a year prior to the priority date of the '546 patent, it qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(b).

- U.S. Publication No. 2012/0050606 to Debevec et al. (EX1005, “Debevec”) was filed on August 31, 2010 and published on March 1, 2012. Because Debevec was filed prior to the priority date of the '546 patent, it qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(e).

- Japanese Patent Publication No. JP2006-228529 to Hiroyuki (EX1007, “Hiroyuki”) was published on August 31, 2006. Because Hiroyuki was published more than a year prior to the priority date of the '546 patent, it qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(b).

- U.S. Patent No. 6,774,584 to Lys et al. (EX1008, “Lys”) was issued on August 10, 2004. Because Lys was issued more than a year prior to the priority

¹ Petitioner has used the pre-AIA statutory framework to refer to the prior art.

date of the '546 patent, it qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(b).

B. Grounds for Challenge

This Petition, supported by Dr. E. Fred Schubert's declaration (EX1003), requests cancellation of the Challenged Claims on the following grounds:

Ground	Claims	Basis
Ground 1	1-2	35 U.S.C. § 103: These claims are obvious over Kuang in view of the general knowledge of a POSITA.
Ground 2	3	35 U.S.C. § 103: This claim is obvious over Kuang in view of Debevec.
Ground 3	1-2, 8	35 U.S.C. § 103: These claims are obvious over Lys in view of the general knowledge of a POSITA.
Ground 4	3	35 U.S.C. § 103: This claim is obvious over Lys in view of Debevec.
Ground 5	4	35 U.S.C. § 103: This claim is obvious over Hiroyuki in view of the general knowledge of a POSITA.
Ground 6	5-6, 8	35 U.S.C. § 103: These claims are obvious over Hiroyuki in view of Kuang.

III. OVERVIEW OF THE '546 PATENT

The '546 patent, entitled "Driving Apparatus for Light-Emitting Diode Curtain Lamp," generally discloses a "driving apparatus" for "a light-emitting diode light string." EX1001, Title, Abstract. The "driving apparatus" consists of a slave control unit that is connected to both a light-emitting diode ("LED") light

string and a master control unit. *Id.* at 2:55-66. The slave control unit is controlled by the master control unit to drive the LED light string in response to control signals and synchronous signals. *Id.* at 60-67. The master control unit can be powered by either a direct current power source or an alternating current power source. *Id.* at FIGS. 1, 4; 2:52-60; 4:11-16. Figures 1 and 4 illustrating direct current (element 20 in Fig. 1) and alternating current power sources (element 40 in Fig. 4) for the disclosed “driving apparatus” are reproduced below:

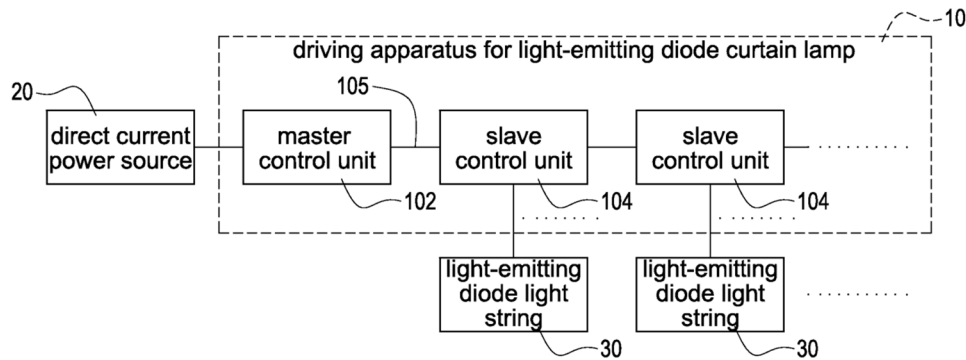


FIG.1

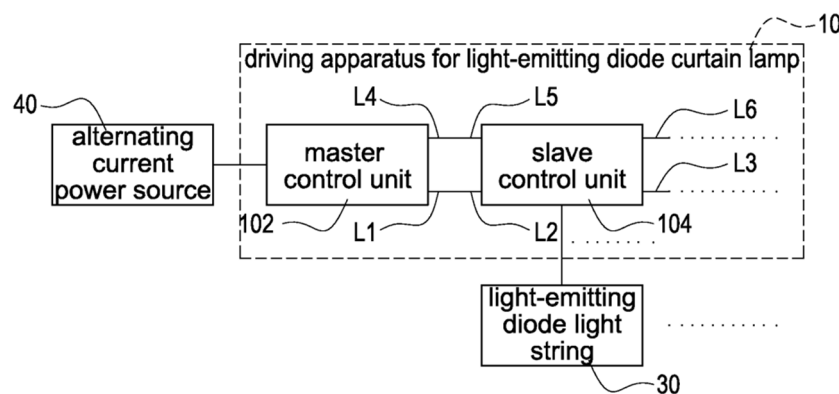


FIG.4

EX1003, ¶ 28.

A. Level of Ordinary Skill in the Art

A person of ordinary skill in the art (“POSITA”) as of October 21, 2010 (earliest purported priority date) or September 14, 2011 (actual filing date) would have had a bachelor’s degree in electrical engineering, physics, materials science, or a related discipline, and 6 years of practical experience in designing or fabricating LED lighting systems, including controlling and driving LEDs. Alternatively, a POSITA would have had a master’s degree and four years of experience, or a Ph.D. degree and two years of experience. EX1003, ¶ 31.

B. Claim Construction Under 37 C.F.R. § 42.104(b)(3)

The Challenged Claims are interpreted using the same claim construction standard used to construe claims in a civil action in federal district court, namely the *Phillips* standard. 37 C.F.R. § 42.100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005).

For purposes of this proceeding only, Petitioner contends that no formal claim constructions are necessary because the challenged claims are invalid under their plain and ordinary meanings, and “claim terms need only be construed ‘to the extent necessary to resolve the controversy.’” *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

C. The Challenged Claims of the '546 Patent

For ease of reference, the Challenged Claims are reproduced in Appendix A with numbered claim limitations corresponding to the numbering used throughout this Petition.

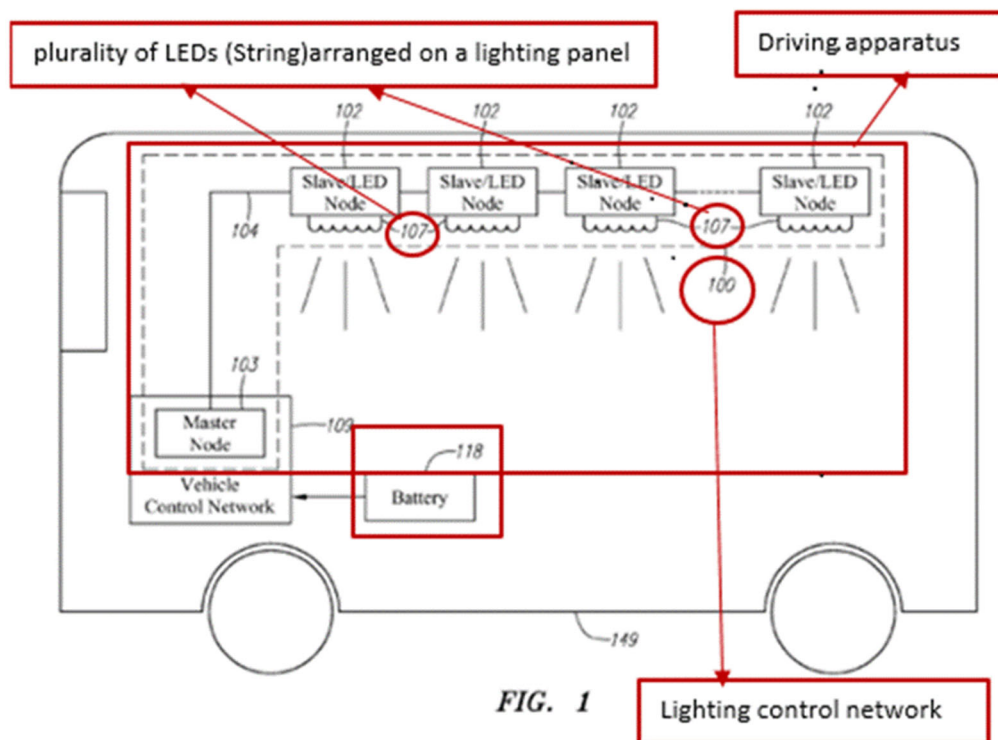
IV. GROUND 1: CLAIMS 1-2 ARE OBVIOUS OVER KUANG IN VIEW OF THE GENERAL KNOWLEDGE OF A POSITA

A. Analysis

1. Claim 1

- a. 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:*

To the extent the claim preamble is construed as limiting, Kuang discloses a “driving apparatus” for a plurality of LEDs arranged on a lighting panel or other fixture, which are powered by a direct current power source:



Kuang, Fig. 1 (annotated); EX1003, ¶ 34.

As illustrated in Figure 1, “power may be provided to the vehicle control network 109 and/or lighting control network 100 via an on-board battery 118” *Id.* at [0032]. A POSITA would have understood that a battery 118 as disclosed in Kuang functions as a “direct current power source” as claimed because a battery is commonly known as a DC voltage source consisting of two or more cells that convert one form of energy (such as chemical energy) into electrical energy. EX1003, ¶ 35.

Kuang further explains that “[t]he lighting control network 100 ... comprises a plurality of network nodes including a master node 103 and a series of slave/LED nodes 102, each of which constitutes or is associated with an LED-based lighting

fixture having local electronic control but responsive to the master node 103.” *Id.* Therefore, the battery 118 in Kuang provides power to a series of LEDs, which a POSITA would have understood constitutes a “light-emitting diode light string” as claimed. *See also id.* (“A power/data bus 104 preferably ***interconnects the series of slave/LED nodes 102 in a daisy-chain fashion.*** Each of the slave/LED nodes 102 may include a plurality of LEDs 107 arranged on a lighting panel or other fixture to provide illumination for a particular interior region of the transit vehicle 149.”) (Emphasis added). EX1003, ¶ 36.

Moreover, a POSITA would have understood Kuang to disclose a “curtain lamp,” which is commonly understood to be one or more light strings: “the LED-based lighting fixture 400 may include five LED units or modules 424 each having, e.g., eight LEDs, for a total of 40 LEDs on a single LED-based lighting fixture 400.” *Id.* at [0045]. *See also, e.g.,* the ’546 patent at 2:34-40 (describing Figures 7 and 8 in the ’546 patent as illustrating circuit diagrams for curtain lamps with a single LED string and a plurality of LED strings, respectively). Kuang discloses that “[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.” Kuang at [0122]. EX1003, ¶ 37.

Because the term “driving apparatus” is not further specified in the ’546 patent specification, a POSITA would have understood that various driving circuits

can be used to implement the claimed “driving apparatus.” That is, the term “driving apparatus” is a general placeholder in the claim to describe whatever “drives” or powers the claimed LED “curtain lamp.” As such, it consists of all the components disclosed in Kuang’s Figure 1 that contribute to powering and operating the plurality of LEDs 107. EX1003, ¶ 38.

- b. 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;*

Kuang discloses a “master control unit” as a “master node” that is electrically connected to the battery (the claimed “direct current power source”). *E.g.*, Kuang, Fig. 1 (depicting a master node 103 coupled to the battery 118). EX1003, ¶ 39.

Kuang explicitly discloses a master node (the claimed “master control unit”) that includes a “microcontroller” and a “voltage regulator” electrically connected to the “microcontroller” as claimed:

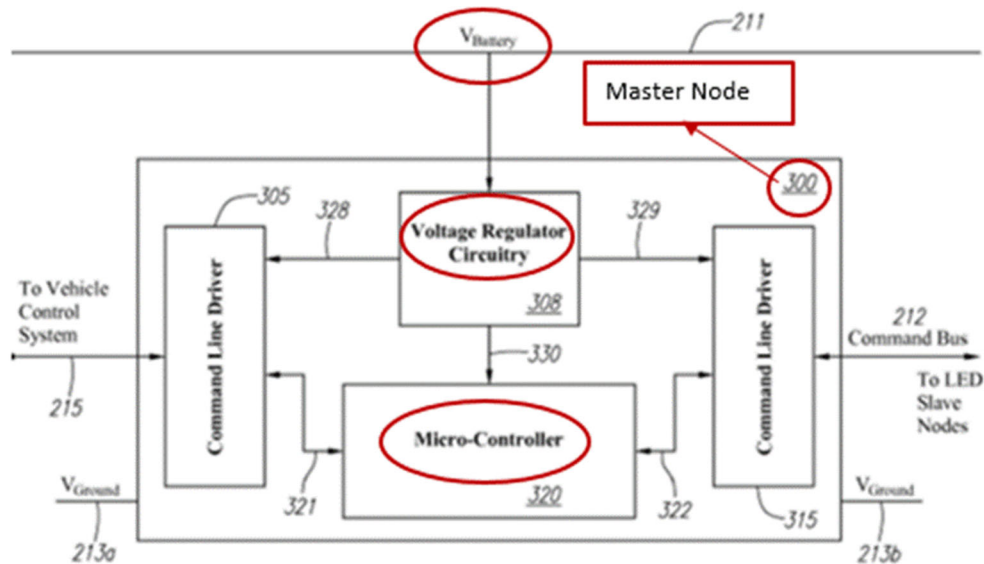


FIG. 3

Kuang, Fig. 3 (annotated). “FIG. 3 is a block diagram of a preferred master node 300” *Id.* at [0039]. “The master node 300 preferably **includes a voltage regulator 308** which receives a power signal from the power supply line 211, and converts the (typically 24 Volt) input power signal to a stable low voltage power output signal for digital electronics and other components within the master node 300.” *Id.* The master node 300 also includes a “microcontroller 320” as claimed. *See id.* at [0040] (“The master node 300 also preferably **includes a micro-controller 320** for performing the supervisory control and logic functions of the lighting control system.”). EX1003, ¶ 40.

As shown in Kuang’s FIG. 3, the voltage regulator 308 is “electrically connected” to the microcontroller 320. Kuang, Fig. 3 (showing output 330 from voltage regulator 308 to micro-controller 320); [0039] (“The voltage regulator 308

outputs appropriate internal power supply signals 328, 329 and 330 to other components of the master node 300.”). Kuang further explains that the “voltage regulator 308 outputs appropriate internal power supply signals ... 330” to the microcontroller 320. *Id* at [0039]. EX1003, ¶ 41.

- c. **1[B]:** *at least a slave control unit electrically connected to the master control unit and the light-emitting diode light string; and*

Kuang discloses at least one “slave/LED node” (the claimed “slave control unit”) electrically connected to the master node (the claimed “master control unit”) and the LEDs:

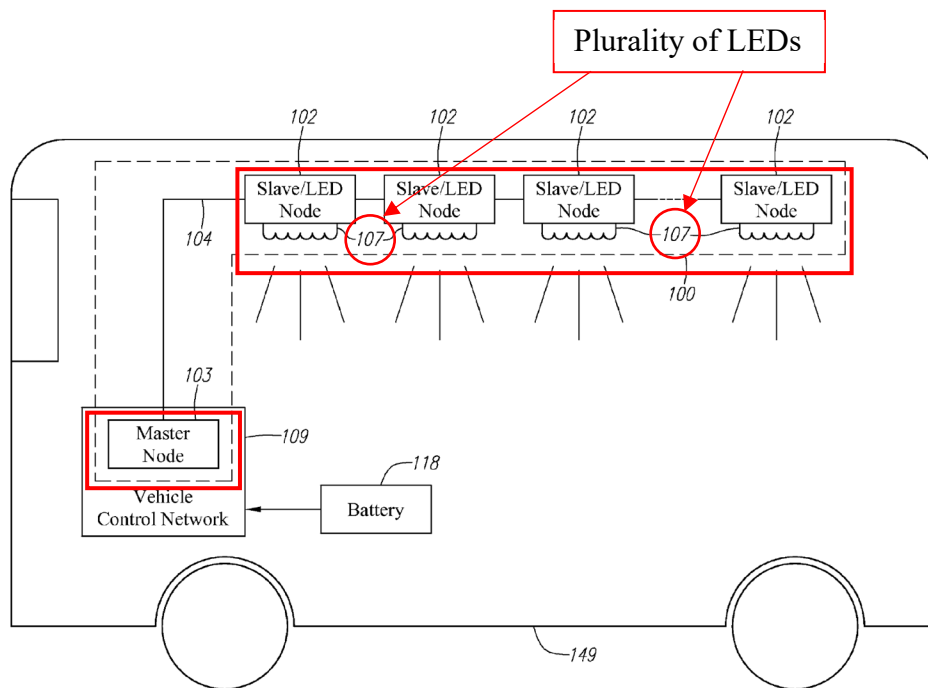


FIG. 1

Kuang, Fig. 1 (annotated). EX1003, ¶ 42.

In typical master/slave configuration, Kuang discloses a plurality of slave/LED nodes that are under the control of a master node. *See id.* at [0032] (“The lighting control network 100 ... comprises a plurality of network nodes including a **master node 103** and a **series of slave/LED nodes 102**, each of which constitutes or is associated with an LED-based lighting fixture having local electronic control but **responsive to the master node 103.**”) (emphasis added), [0033] (“[T]he lighting control system 200 comprises a master node 203 and a series of LED-based lighting fixtures 202, each of which constitutes or is associated with **a slave/LED network node having local control electronics responsive to the master node 203....**”) (emphasis added). EX1003, ¶ 43.

The slave/LED nodes must be “electrically connected” to the LEDs as claimed because the slave/LED nodes “control[] the LED-based lighting fixtures”. *See id.* at [0011] (“In various forms and embodiments, the lighting fixture may be part of an LED-based control network in which a plurality of LED-based lighting fixtures each comprise a plurality of LEDs for illuminating an area of a transit vehicle, **a plurality of slave nodes for controlling the LED-based lighting fixtures**, and a master node in communication with the slave nodes.”) (emphasis added). The embodiment illustrated in FIG. 2B further depicts an “electrically connected” coupling between slave nodes and various LED units:

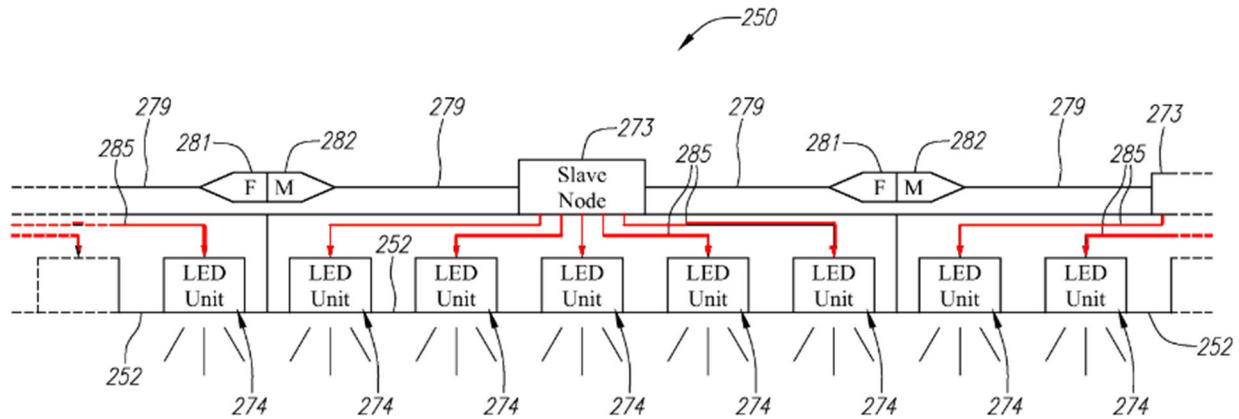


FIG. 2B

Kuang, Fig. 2B (highlighting electrical connections between slave nodes 273 and LED units 274 in **red**); *see also id.* at [0037] (“As generally described previously, the slave nodes 273 provide local control of the various LED units 274 on a particular LED-based lighting fixture 252. The slave nodes 273 are accordingly coupled to the various LED units 274 via one or more control and/or power signals 285.”). EX1003, ¶ 44.

- d. 1[C]:** *a transmission line electrically connected to the master control unit and the slave control unit,*

Kuang discloses a power/data bus (the claimed “transmission line”) electrically connected to the master node (the claimed “master control unit”) and the slave/LED node (the claimed “slave control unit”):

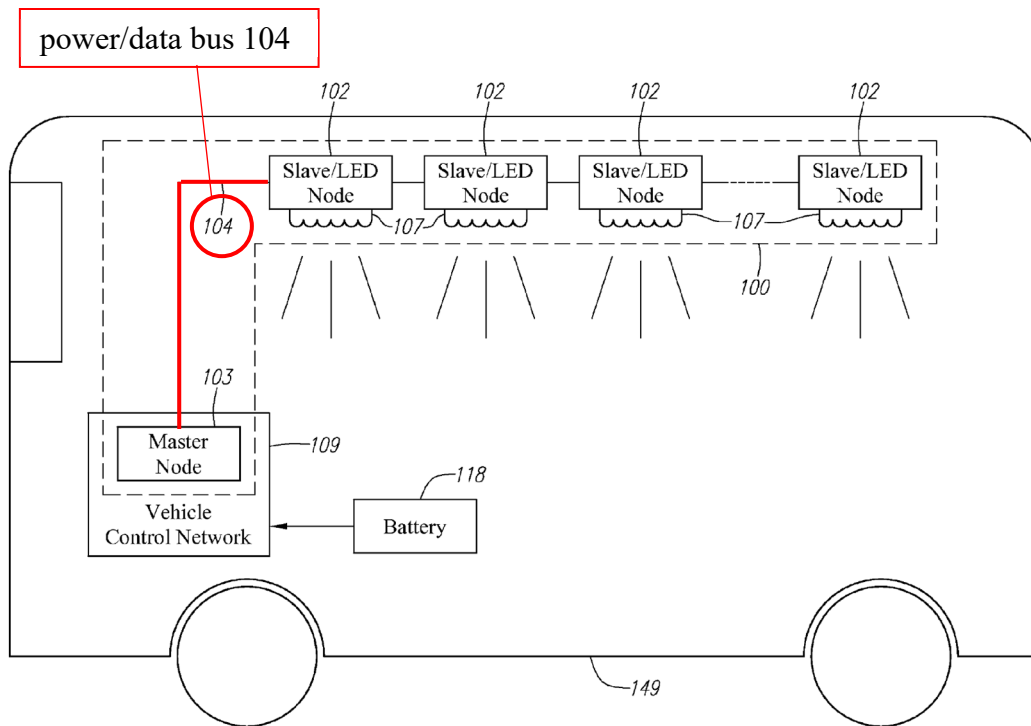


FIG. 1

Kuang, Fig. 1 (annotated). EX1003, ¶ 45.

A POSITA would have understood Kuang’s power/data bus 104 as meeting the “transmission line” limitation. For example, a POSITA would have understood that a data bus is commonly defined as a wire or group of wires used to transmit data to or from a number of different locations. *See also id.* at [0032] (“A power/data bus 104 preferably interconnects the series of slave/LED nodes 102 in a daisy-chain fashion.”). And, FIG. 1 shows that the power/data bus 104 electrically connects the master node to the series of slave/LED nodes. *See id.* at Fig. 1. EX1003, ¶ 46.

FIG. 2A in Kuang also illustrates a “transmission line” as claimed as a power supply line 211 or a command line 212, either of which are electrically connected to the master node (master node) and slave nodes 202:

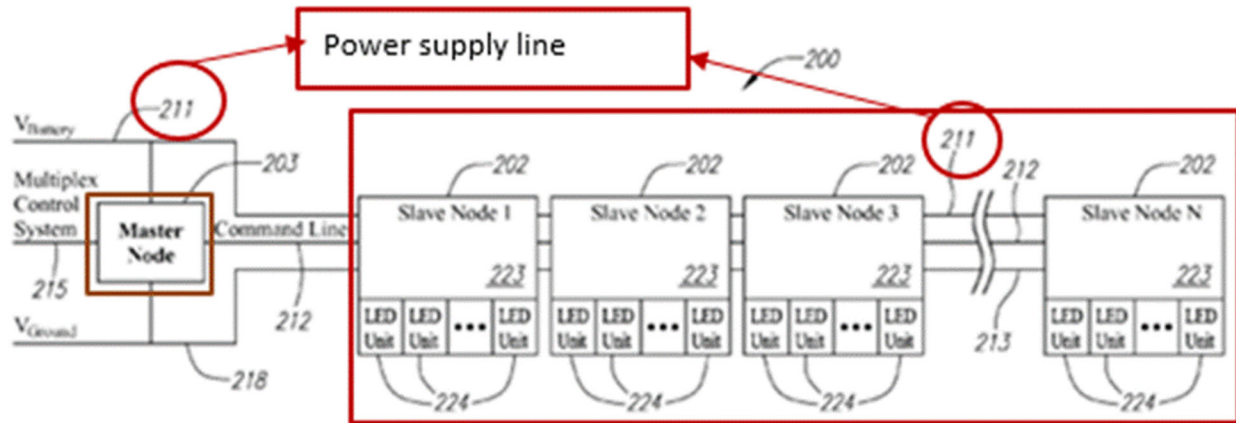
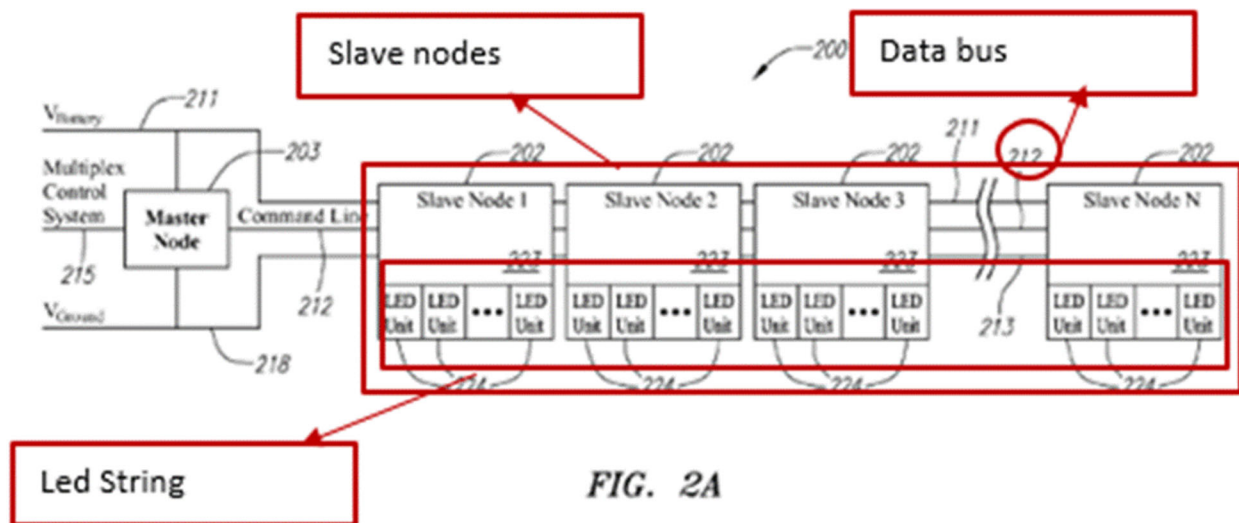


FIG. 2A

Kuang, Fig. 2A (annotated). *See also id.* at [0033] (“A power bus comprising a power supply line 211 from the vehicle battery and a ground line 213 is preferably connected from the master node 203 to each LED-based lighting fixture 202 and slave node 223 thereof, in series. Likewise, a command/data bus 212 may be connected from the master node 203 to each LED-based lighting fixture 202 and slave node 223 thereof, in series.”). EX1003, ¶ 47.

- e. **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.

Kuang discloses a master node (the claimed “master control unit”) driving slave nodes (the claimed “slave control units”) to drive the LEDs, including by transmitting control signals and synchronous signals:



Kuang, Fig. 2A (annotated). EX1003, ¶ 48.

With respect to the claimed “control signals,” Kuang explains that the master node sends “commands or queries” to the slave nodes: “The master node 203 may ... **control** the various LED-based lighting fixtures 202, and slave nodes 223 thereof, through commands or queries transmitted over the command/data bus 212.” *Id.* at [0034] (emphasis added). EX1003, ¶ 49.

Kuang also discloses a master node that sends synchronous signals to all slave nodes, and in turn, all LEDs. In this context, a POSITA would have

understood the term “synchronous signals” to mean signals that are sent to the slave nodes to control their corresponding LED strings at the same time. As explained in Kuang, “[a] master light shutoff command may also be sent from the master node 203 instructing *all* LED/slave nodes to turn off. The micro-controller 420 may also respond to commands from the master node 203 to dim the LEDs 442 *on all or selected ones of the LED units 424*, in which case the micro-controller 420 may instruct the current control circuitry 421 to reduce the PWM duty cycle for the affected LED units 424 by an appropriate amount.” *Id.* at [0054] (emphasis added). EX1003, ¶ 50.

2. Claim 2

- a. 2:** *The driving apparatus for light-emitting diode curtain lamp in claim 1, wherein the slave control unit includes a signal processor.*

Kuang discloses a slave node (the claimed “slave control unit”) that includes a signal processor. For example, FIG. 4 illustrates a slave node 423 that includes a voltage boost regulator circuitry 408, which processes signals:

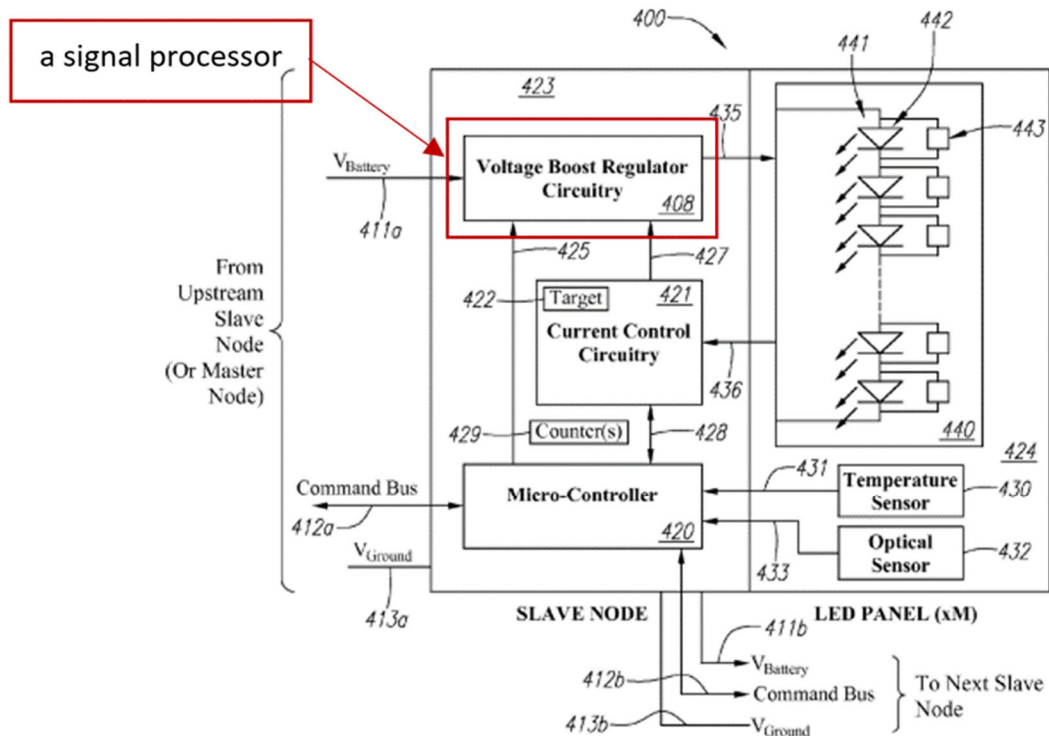


FIG. 4

Kuang, Fig. 4 (annotated), [0042]. EX1003, ¶ 51.

A POSITA would have understood that a “signal processor” as claimed is very broad and encompasses an electronic component that converts or transforms signals. Therefore, Kuang discloses a “signal processor” as a “voltage boost regulator.” The “voltage boost regulator 408 ... *converts the input power signal* to both a stable low voltage power output signal for digital electronics and other components within the slave node 423, and a regulated boosted voltage level for the LEDs on the various LED units 424.” *Id.* at [0042]; *see also id.* at [0046] (“[T]he micro-controller 420 may receive a command to dim the lighting by a specified amount, and in response thereto, the micro-controller 420 would lower or

adjust the target parameters utilized by the current control circuitry 421 and/or voltage boost regulator circuitry 408 accordingly.”). EX1003, ¶ 52.

Alternatively, the slave node 423 of FIG. 4 also includes a micro-controller 420 which can serve as the claimed “signal processor”:

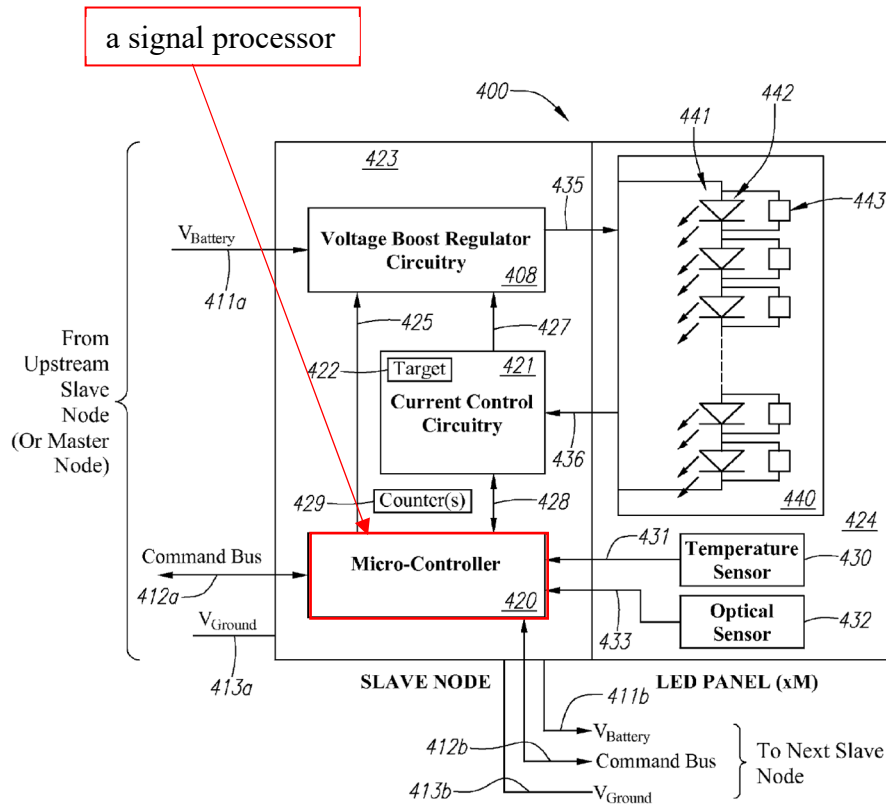


FIG. 4

Kuang, Fig. 4 (annotated), [0043] (“The micro-controller 420 performs the local control and logic functions required by the lighting control system for causing the LEDs of the LED units 424 to turn on and off, dim, flash if necessary, and so on. Although not expressly shown in FIG. 4, the micro-controller 420 would be understood to include appropriate memory (e.g., RAM and/or ROM), interfaces, and drivers, as well as logic circuitry including, for example, a microprocessor,

FPGA, or other programmable logic.). Given that the micro-controller 420 processes signals, it too is an implementation of the claimed signal processor. That is, the micro-controller, with its universal signal processing capability, implements the signal processing function of the claimed signal processor. EX1003, ¶ 53.

V. GROUND 2: CLAIM 3 IS OBVIOUS OVER KUANG IN VIEW OF DEBEVEC

A. Analysis

1. Claim 3

- a. 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.*

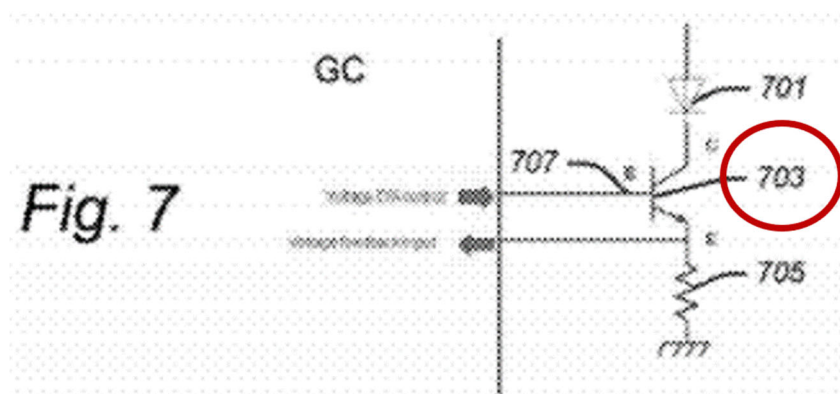
Kuang discloses the “driving apparatus for light-emitting diode curtain lamp in claim 2” for the reasons already stated *supra* at Section IV.A.2. EX1003, ¶ 54.

Although Kuang does not explicitly disclose a “slave control unit” that includes “a transistor electrically connected to the signal processor,” Debevec does. EX1003, ¶ 55.

Debevec discloses a “controllable lighting system” with “a plurality of light source groups.” Debevec at [0008]. The controllable lighting system of Debevec includes a similar master/slave controller configuration as Kuang. Debevec’s lighting system includes a “group controller for each light source group” and a “master controller” such that the master controller issues “a group control command to each of the group controllers that effectuate compliance with the master control command.” *Id.* A “network communication system” communicates

master controller commands to the group controllers. *Id.* Therefore, the “group controllers” in Debevec are the claimed “slave control unit.” EX1003, ¶ 56.

FIG. 7 in Debevec discloses a brightness feedback circuit used by a group controller (i.e., the claimed “slave control unit”) to calibrate the brightness of each LED 701, which is “controlled by an electronic switch or valve, such as by a *transistor 703*”:



Debevec, Fig. 7 (annotated), [0078]. “If the instantaneous and/or average current is above or below what is expected, the drive to the switch or valve, such as the signal on a base 707 of the transistor 703, may be adjusted to compensate.” *Id.* at [0078]. EX1003, ¶ 57.

B. A POSITA Would Have Been Motivated to Combine Kuang and Debevec With a Reasonable Expectation of Success

A POSITA would have been motivated to combine Kuang with Debevec, and would have had a reasonable expectation of success. Both references are from the same field of endeavor: Controllable lighting systems that can be adjusted in terms of their brightness, color, and temporal dynamics. In order to adjust the

brightness of LEDs, or to switch them ON or OFF, an electric switch or valve is needed. A transistor is a common electrical switch or valve used in electrical circuits. A POSITA would be aware of the suitability of a transistor as an electronic switch or valve. Furthermore, Debevec discloses the use of a transistor as an electronic switch or valve for the purpose of switching the current to an LED light source or driving an LED light source with a certain calibrated current. Electric circuits are known to be predictable. That is, transistor circuits are common in the field and their functioning is not subject to unexpected results. Accordingly, a POSITA would have been motivated to use Debevec's transistor as an electronic switch or valve in Kuang's lighting system to control the current flow through the LED light source; the combination of Kuang and Debevec would have been obvious and predictable. EX1003, ¶ 58.

VI. GROUND 3: CLAIMS 1-2 AND 8 ARE OBVIOUS OVER LYS IN VIEW OF THE GENERAL KNOWLEDGE OF A POSITA

A. Analysis

1. Claim 1

- a. **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:*

To the extent the claim preamble is construed as limiting, Lys discloses a “driving apparatus” applied to a direct current power source and a plurality of LED light sources:

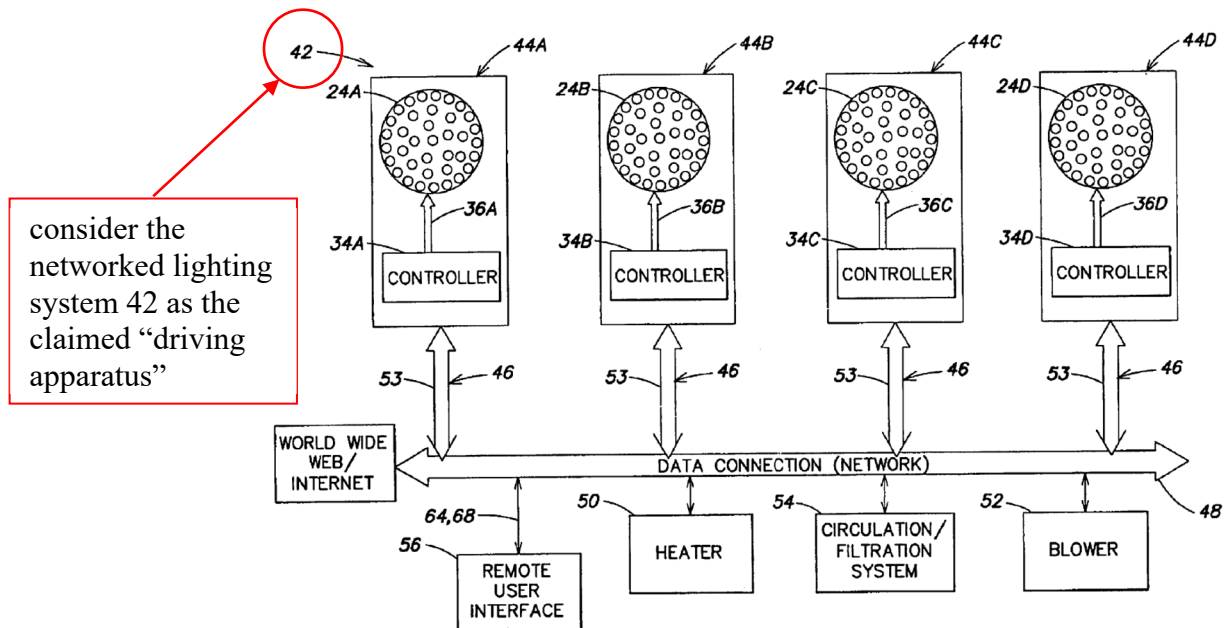


FIG. 4

Lys, Fig. 1 (annotated). As illustrated in FIG. 4, a plurality of “light sources 24A-24D” are “coupled together to form the networked lighting system 42[.]” *Id.* 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). *Id.* at 10:61 to 11:5; 11:6-20. EX1003, ¶ 59.

Moreover, each controller 34 "receives a power signal 47 to provide power to the light source 24. In various aspects of this embodiment, the power signal 47 may be provided directly by either an A.C. *or D.C. power source.*" *Id.* at 12:32-46 (emphasis added). This power signal 47 (satisfying the claimed "direct current power source") is illustrated in FIG. 2, for example:

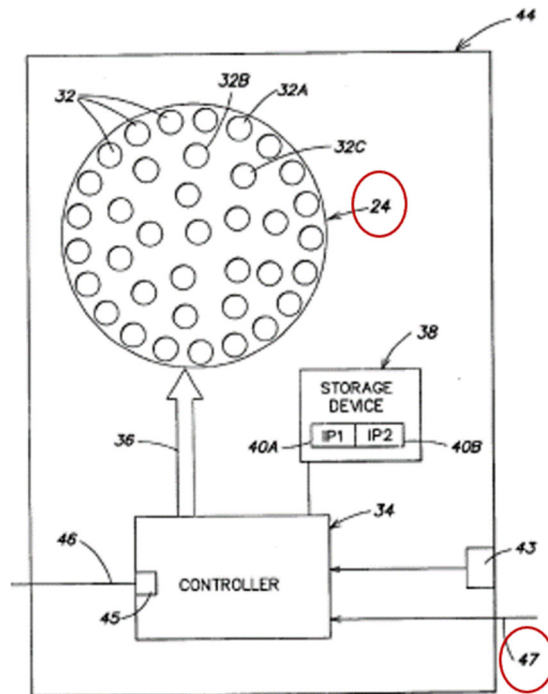


FIG. 2

Id. at Fig. 2 (highlighting power signal 47 to controller 34 that in turn powers the light source 24). EX1003, ¶ 60.

A POSITA would have understood the broad disclosure of Lys to disclose a “light-emitting diode curtain lamp,” which is commonly understood to be one or more light strings: “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.” *Id.* at 33:18-36. *See also, e.g.,* the ’546 patent at 2:34-40 (describing Figures 7 and 8 in the ’546 patent as illustrating circuit diagrams for curtain lamps with a single LED string and a plurality of LED strings, respectively). EX1003, ¶ 61.

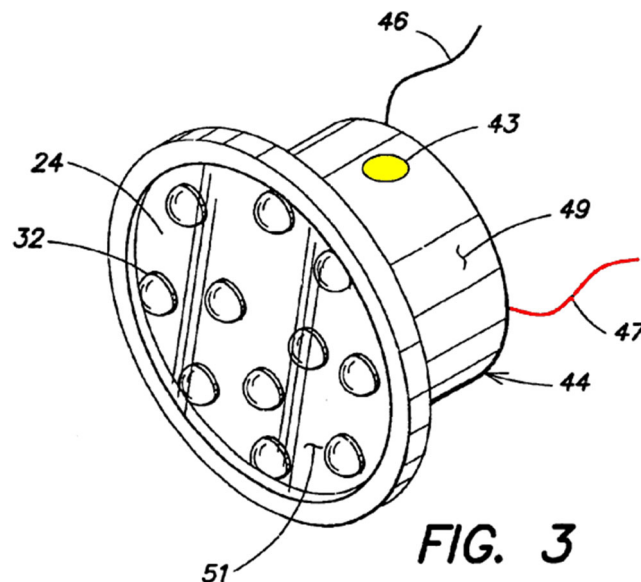
- b. 1[A]:** *a master control unit electrically connected to the direct current power source, including a microcontroller and a voltage regulator electrically connected to the microcontroller;*

Lys discloses a remote or local user interface (the claimed “master control unit”) electrically connected to the power source and combined with the teachings of other embodiments also includes a microcontroller and a voltage regulator. EX1003, ¶ 62.

As Lys discloses, “***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. For example, in one aspect of this embodiment, the local user interface 43 may be a button, switch, dial, or any other interface or combination of interfaces that facilitates selection of one or more of the illumination programs 40A and 40B stored in the storage device 38.” Lys,

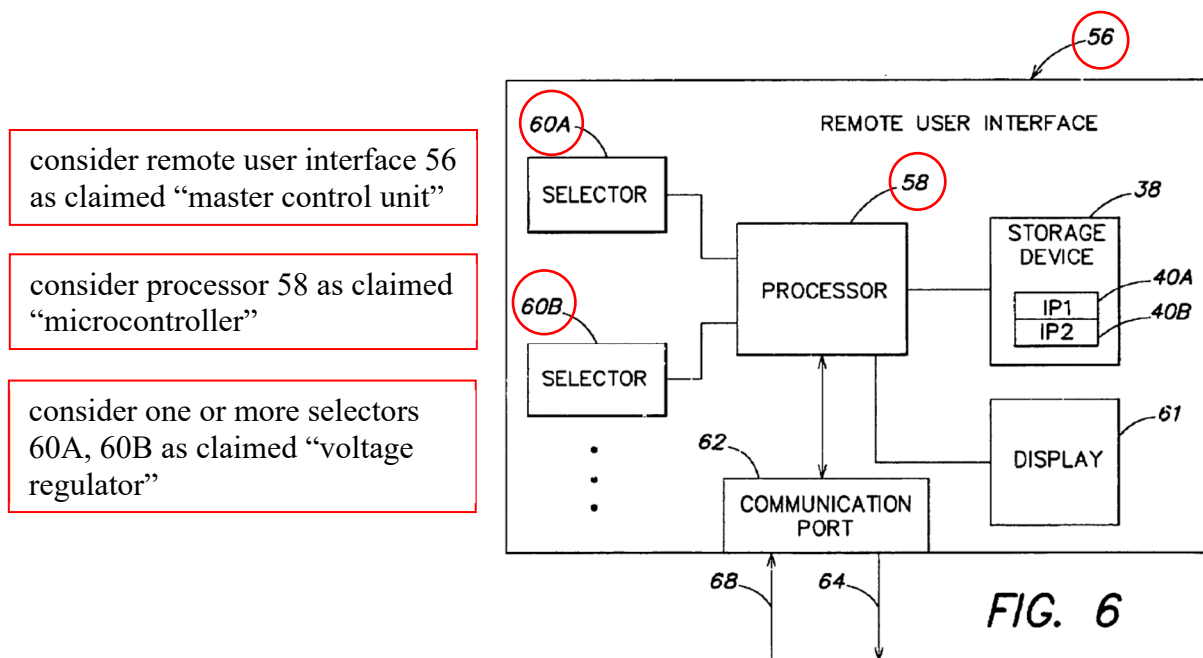
14:17-29. A housing 44, such as that illustrated in FIG. 3, “may be adapted to support one or more local user interfaces 43, and be equipped with connections to receive one or more external signals 46 *and a power signal 47.*” *Id.* at 14:63-67 (emphasis added). EX1003, ¶ 63.

A POSITA, therefore, would understand FIG. 3 to illustrate a local user interface 43 that receives power from power signal 47:



Id. at Fig. 3 (highlighting local user interface 43 electrically connected to power signal 47). EX1003, ¶ 64.

Moreover, Lys discloses a remote user interface 56 that also meets the “master control unit” limitation, and its specific teachings could be readily combined and associated with the local user interface 43 disclosed in other embodiments. FIG. 6 illustrates components of the remote user interface 56:



Lys, Fig. 6 (annotated). EX1003, ¶ 65.

A POSITA would have understood that a “voltage regulator” as claimed can cause a voltage to vary according to a predetermined plan. The remote user interface’s selectors 60A, 60B, etc. “allow a user to remotely control at least one parameter associated with variable color radiation generated by one or more light sources.” Lys at 19:61 to 20:4. Lys does not limit what the at least one parameter associated with variable color radiation may be, and provides an example of such a parameter as “the electrical current of the at least one light source.” *See id.* at claim 68. As a result, a POSITA would have recognized that the selectors in Lys meet the “voltage regulator” limitation because controlling/changing current is proportional to a changing voltage (per Ohm’s law). For example, in the transistor circuit of Debevec’s Figure 7, the voltage across the emitter resistance is

proportional to the LED current. Furthermore, the base-to-GND voltage of the transistor is approximately proportional to the LED current. EX1003, ¶ 66.

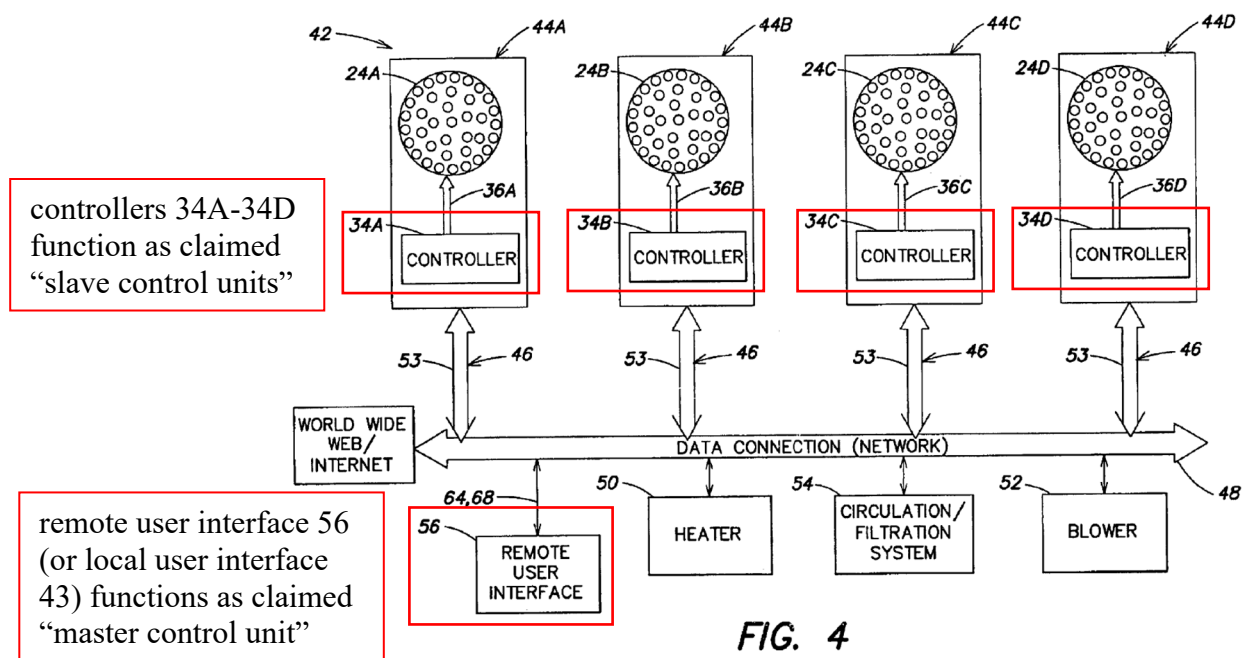
The remote user interface also includes a processor as illustrated in FIG. 6: “FIG. 6 also shows that the remote user interface 56 ... may include one or more displays coupled to the processor 58, to indicate to the user a status of one or more parameters associated with the radiation generated by one or more light sources[.]”

Id. at 21:17-21. A POSITA would have understood that the claimed

“microcontroller” is an integrated circuit that necessarily includes processing capabilities for specific tasks. As a result, the processor in Lys either literally discloses this “microcontroller” limitation, or in combination with the general knowledge of a POSITA, renders it obvious. *See also id.* at 33”8-11 (“[V]arious processors and controllers can be implemented in numerous ways, such as with dedicated hardware, or using one or more processors (e.g., microprocessors) that are programmed using software (e.g., microcode) to perform the various functions[.]”). For example, in the art, a POSITA would have understood that a microcontroller is a microprocessor having lower-end performance suitable for simple tasks such as controlling a light source, microwave oven, or washing machine. EX1003, ¶ 67.

- c. **1[B]:** at least a slave control unit electrically connected to the master control unit and the light-emitting diode light string; and

Lys discloses at least one controller (the claimed “slave control unit”) electrically connected to the remote or local user interface (the claimed “master control unit”) and the LEDs:



Lys, Fig. 4 (annotated). EX1003, ¶ 68.

A POSITA would recognize the controllers 34A-34D to function as “slave control units” because they operate in response to received control signals originating from a remote (or local) user interface (and therefore must be “electrically connected” to the remote or local user interface). *Id.* at 20:9-19 (“[O]ne or more control signals 64 output by the remote user interface 56 may be

applied as one or more external signals 46 to a controller 34 associated with a light source 24). EX1003, ¶ 69.

- d. **1[C]:** *a transmission line electrically connected to the master control unit and the slave control unit,*

Lys discloses a transmission line electrically connected to the remote user interface (the claimed “master control unit”) and the controller(s) (the claimed “slave control unit(s)”):

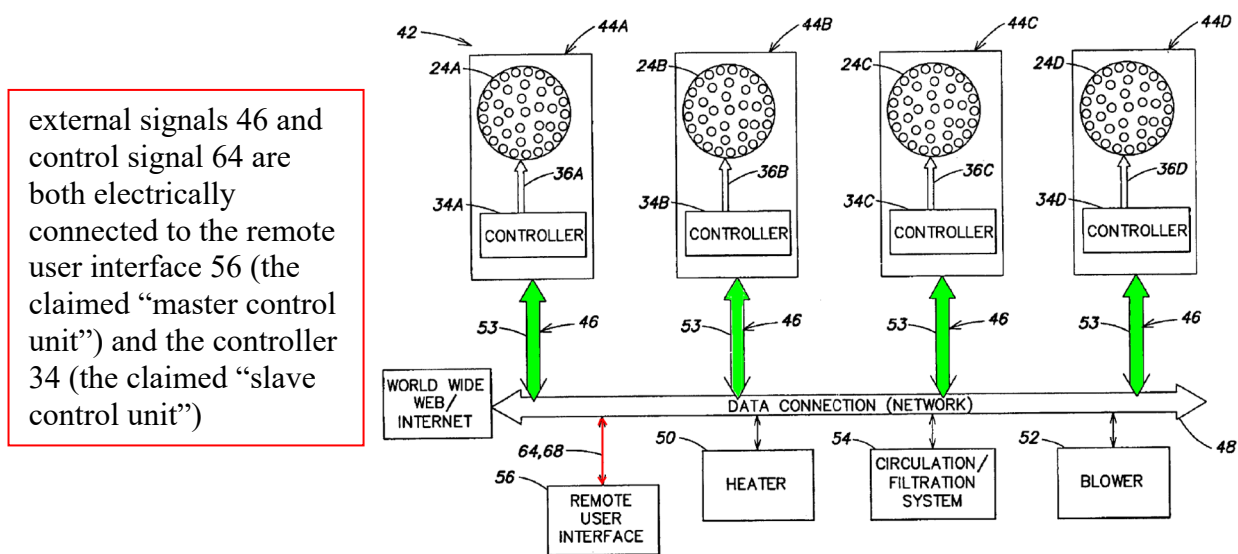


FIG. 4

Lys, Fig. 4 (external signals 46 highlighted in green and control signal 64 highlighted in red). “FIG. 4 illustrates that each of the light sources 24A-24D receives one or more external signals 46 from a data connection or network 48.” *Id.* at 15:55 to 16:3. Moreover, “one or more control signals 64 output by the remote user interface 56 may be applied as one or more external signals 46 to a controller 34 associated with a light source 24 [and] the remote user interface 56

may output one or more control signals 64 to the network 48 to control one or more light sources coupled to the network 48” *Id.* at 20:9-19. EX1003, ¶ 70.

Similarly, a transmission line electrically connecting local user interface 43 with a controller 34 is illustrated in FIG. 2:

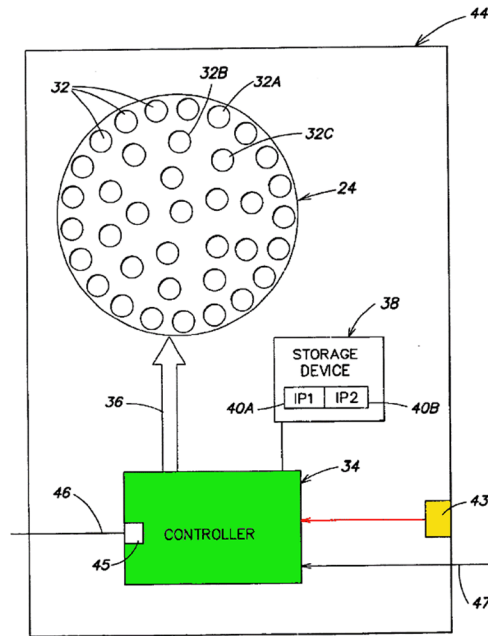


FIG. 2

Lys, Fig. 2 (electrical connection between controller 34 and local user interface highlighted in red). EX1003, ¶ 71.

- e. **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.

Lys discloses a remote or local user interface (the claimed “master control unit”) driving controllers (the claimed “slave control units”) to drive the LEDs, including by transmitting control signals and synchronous signals. EX1003, ¶ 72.

With respect to the claimed control signals, “the controller 34 adapted to receive the mode and options signals may be controlled using a remote user interface 56 having two or more selectors 60A and 60B In one aspect, a first selector 60A of the remote user interface 56, when activated by a user, would generate a ‘mode’ signal, whereas a second selector 60B would generate an ‘options’ signal.” *Id.* at 13:40-54. A “mode” signal may “select one of a number of illumination programs[.]” *Id.* at 13:55-58. An “options” signal may “adjust one or more variable parameters of a selected illumination program.” *Id.* at 13:59-62. EX1003, ¶ 73.

A POSITA would have understood Lys to also disclose synchronous signal transmissions as claimed. For example, Lys describes “illumination programs” that must require the local or remote user interface to send synchronous signals to a plurality of LEDs to generate a desired overall effect for a particular “illumination program.” *See id.* at 21:4-16 (“FIG. 6 also shows that the remote user interface 56 may include one or more storage devices 38, on which are stored one or more illumination programs 40A and 40B, in a manner similar to that described above in connection with FIG. 2. According to one aspect of this embodiment, the one or more selectors 60A and 60B ***allow the user to remotely select a particular illumination program*** stored on the storage device 38. According to another aspect of this embodiment, one or more selectors 60A and 60B of the remote user

interface 56 may be operated to allow the user to control one or more variable parameters associated with a particular illumination program.”) (emphasis added). EX1003, ¶ 74.

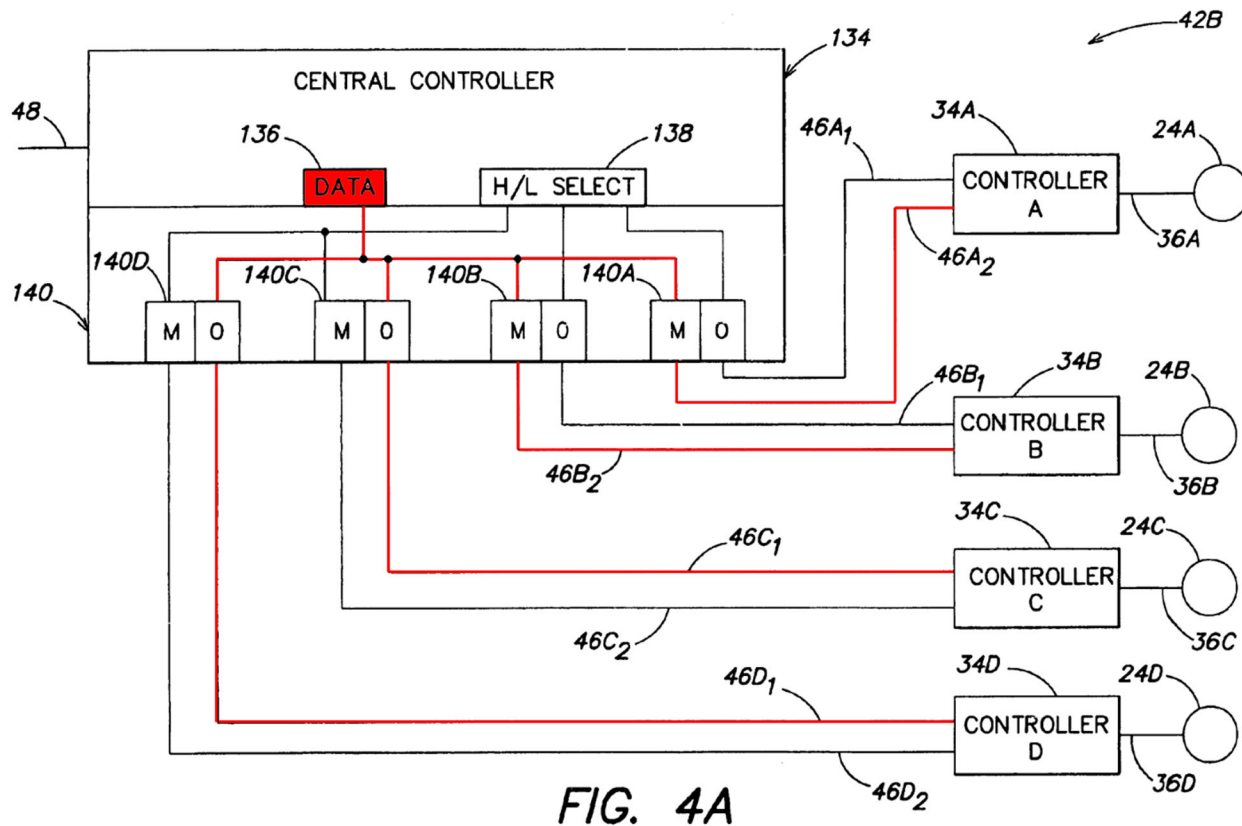
Furthermore, Lys discloses “[i]n one embodiment of the invention, one or more of the light sources 24A-24I are controlled in a *coordinated fashion*[.]” Lys at 10:3-5 (emphasis added). A POSITA would have understood that “coordinated fashion” is a fashion in which control signals are transmitted to multiple light sources (and associated slave controllers) in a synchronous fashion. EX1003, ¶ 75.

A POSITA would further understand that, as illustrated in FIG. 4A, the remote user interface 36 can transmit a synchronous signal to each controller 34A-D. In 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 34A-34D.” Lys at 17:64-66. The central controller 134 transmits “a data signal 136” and a “logic high/low (H/L) select signal 138” to the controllers 34A-34D. Designated “M” and “O” in FIG. 4A, each of the four controllers 34A-34D receive two signals: A “mode” signal (designated “M”) and an “options” signal (designated “O”). *See id.* at 18:2-8. The table in FIG. 4B shows possible combinations of “mode” and “option” signals where data signal 136 is outputted to all of the controllers 34A-34D:

CONTROLLER	MODE (M)	OPTION (O)
A	DATA	LOGIC HIGH
B	DATA	LOGIC LOW
C	LOGIC HIGH	DATA
D	LOGIC LOW	DATA

FIG. 4B

Lys at Fig. 4B (showing data signal 136 being transmitted as either a “mode” signal or an “option” signal); *see also id.* at 18:36-64 (describing how the “particular interconnections between the controllers 34A-34D and the central controller 134” may result in different combinations of “mode” and “option” signals). A POSITA would have understood that these different combinations of “mode” and “option” signals would only be necessary if the data signal 136 was synchronous such that it was transmitted to each of the controllers 34A-34D simultaneously. Otherwise, asynchronous data signals would be employed to distinguish how each controller 34A-34D responds. This conclusion is further evinced by the diagram in FIG. 4A, which illustrates data signal 136 that is transmitted synchronously to each controller 34A-34D (either via “mode” or “option” data paths):



(Lys at Fig. 4A (synchronous data paths highlighted). EX1003, ¶ 76.

2. Claim 2

- a. **2:** *The driving apparatus for light-emitting diode curtain lamp in claim 1, wherein the slave control unit includes a signal processor.*

Lys discloses a controller (the claimed “slave control unit”) that includes a signal processor:

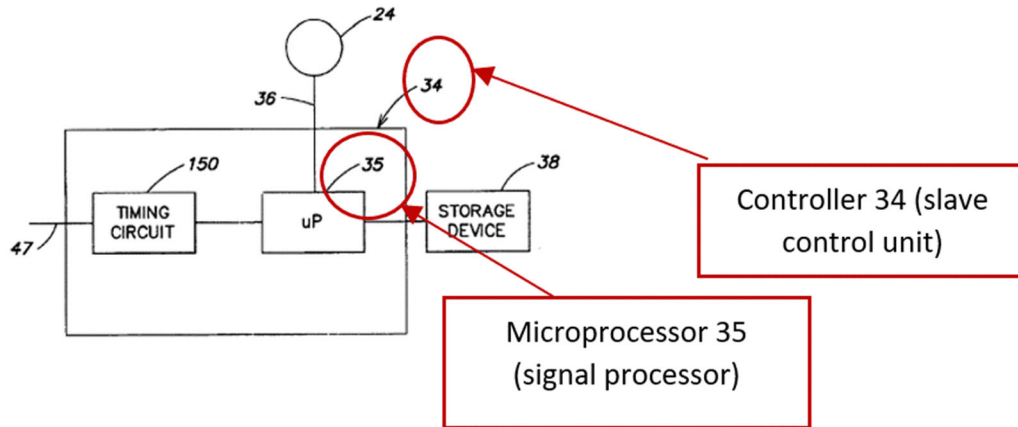


FIG. 10

Lys, Fig. 10 (annotated). Specifically, a POSITA would have understood the microprocessor 35 in Lys to satisfy the “signal processor” limitation because it can process control signals to be sent to the LEDs: “[T]he controller 34 also may include one or more microprocessors 35, coupled to the timing circuit 150, to provide one or more control signals 36 to the light source 24 *based on the monitored power signal 47*.... [A] time constant of the RC circuit may be particularly selected based on a desired predetermined duration of an interruption in the power signal 47 that causes the controller 34 (e.g., via the microprocessor 35) to effect some change in the radiation output by the light source 24.” *Id.* at 25:1-15 (emphasis added). EX1003, ¶ 77.

3. Claim 8

- a. **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:*

To the extent the claim preamble is construed as limiting, Lys discloses a plurality of LED light sources powered by a “driving apparatus”:

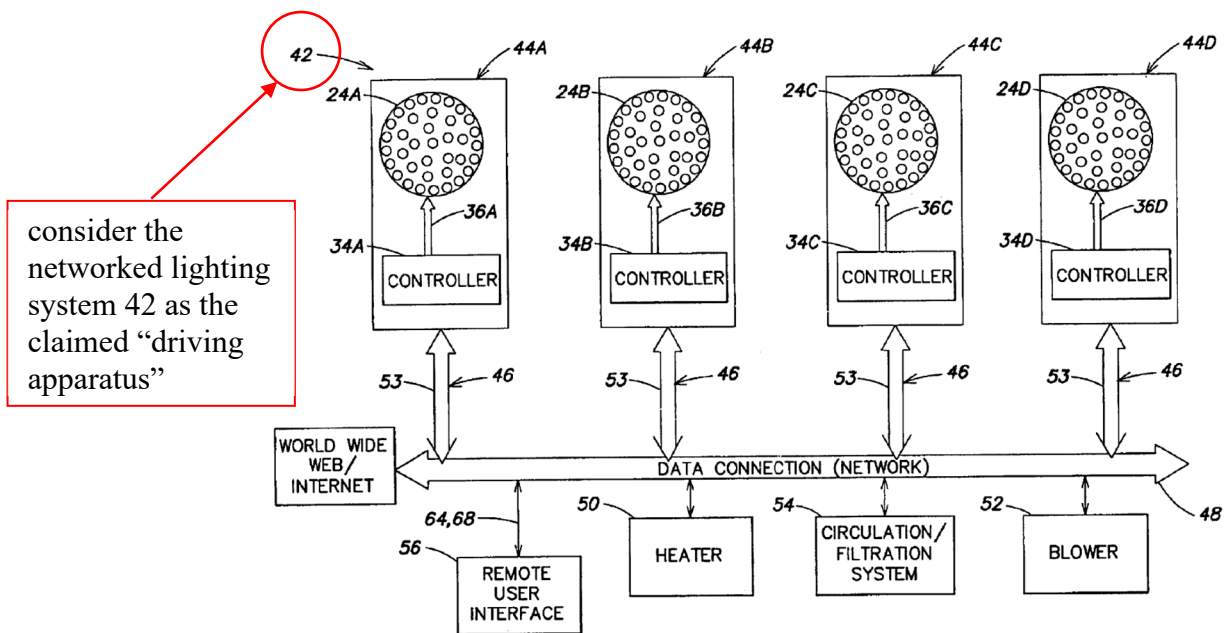


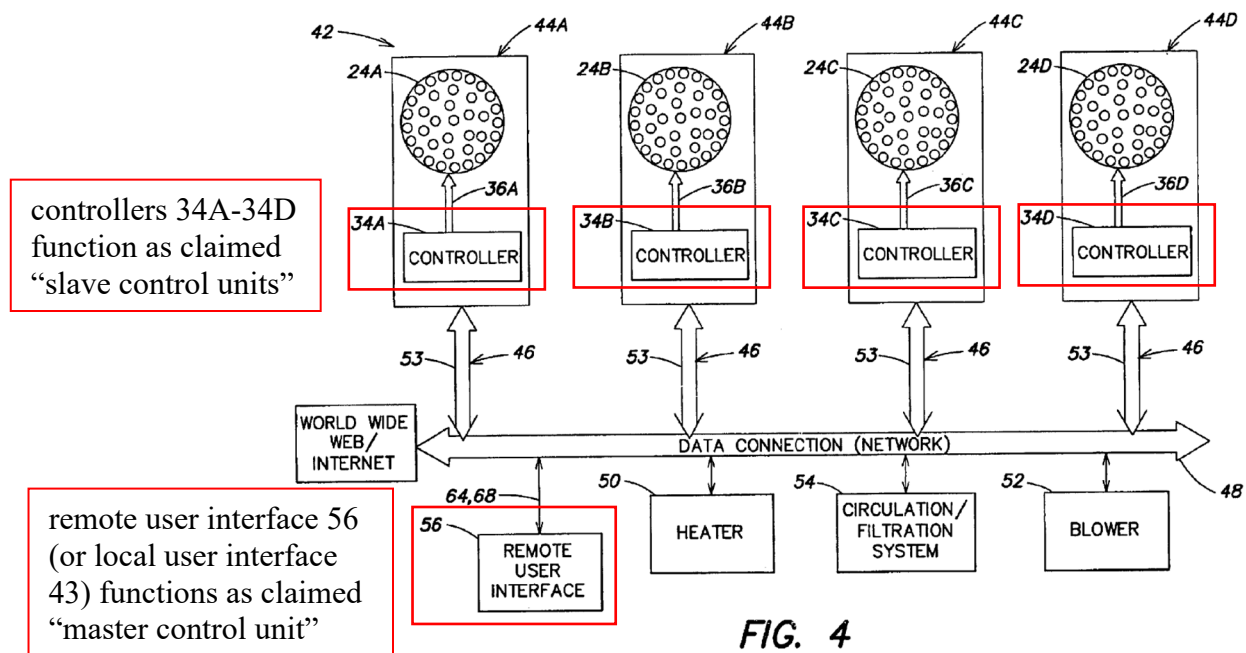
FIG. 4

Lys, Fig. 1 (annotated). As illustrated in FIG. 4, a plurality of “light sources 24A-24D” are “coupled together to form the networked lighting system 42[.]” *Id.* 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). *Id.* at 10:61 to 11:5; 11:6-20. EX1003, ¶ 78.

Moreover, a POSITA would have understood the broad disclosure of Lys to disclose a “light-emitting diode curtain lamp,” which is commonly understood to be one or more light strings: “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.” *Id.* at 33:18-36. *See also, e.g.,* the ’546 patent at 2:34-40 (describing Figures 7 and 8 in the ’546 patent as illustrating circuit diagrams for curtain lamps with a single LED string and a plurality of LED strings, respectively). EX1003, ¶ 79.

- b. 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,*

Lys discloses a remote or local user interface (the claimed “master control unit”) and at least one controller (the claimed “slave control unit”) electrically connected to the local user interface and the LEDs:



Lys, Fig. 4 (annotated). EX1003, ¶ 80.

As Lys discloses, “*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*. For example, in one aspect of this embodiment, the local user interface 43 may be a button, switch, dial, or any other interface or combination of interfaces that facilitates selection of one or more of the illumination programs 40A and 40B stored in the storage device 38.” Lys, 14:17-29 (emphasis added). EX1003, ¶ 81.

Moreover, Lys discloses a remote user interface 56 that also meets the “master control unit” limitation, and its specific teachings could be readily combined and associated with the local user interface 43 disclosed in other embodiments. EX1003, ¶ 82.

The remote user interface functions as the claimed “master control unit” because it sends control signals to effect control of the LED light sources. *See* Lys at 20:9-19 (“FIG. 5 also shows that the remote user interface 56 outputs one or more control signals 64 to effect control of one or more light sources. For example, in one aspect of this embodiment, one or more control signals 64 output by the remote user interface 56 may be applied as one or more external signals 46 to a controller 34 associated with a light source 24, as illustrated in FIG. 2. Alternatively, as shown in FIG. 4, the remote user interface 56 may output one or more control signals 64 to the network 48 to control one or more light sources coupled to the network 48”). EX1003, ¶ 83.

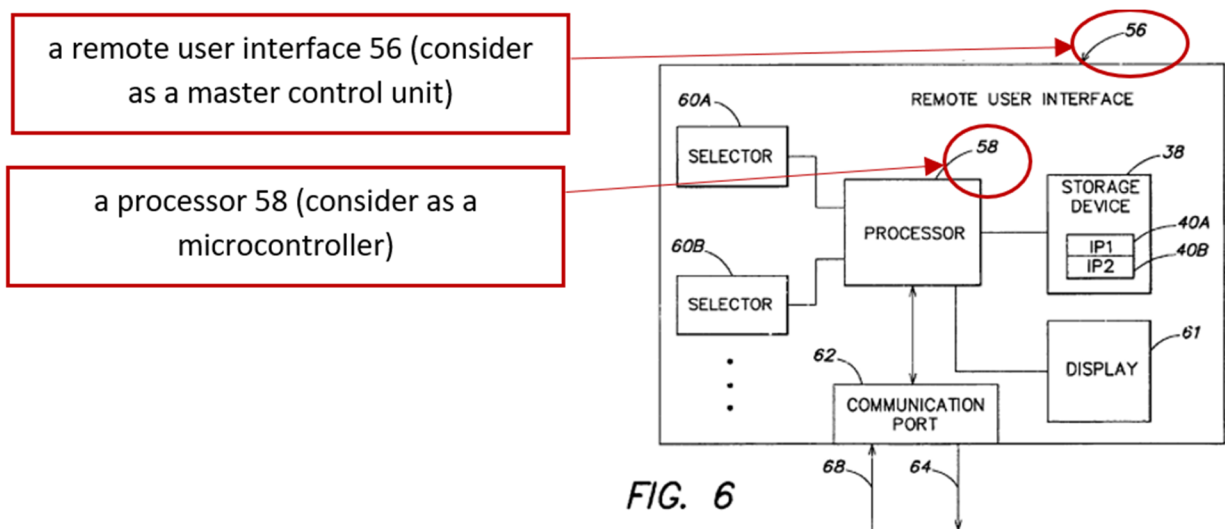
Moreover, a POSITA would recognize the controllers 34A-34D to function as “slave control units” because they operate in response to received control signals originating from a remote (or local) user interface. *Id.* at 20:9-19 (“[O]ne or more control signals 64 output by the remote user interface 56 may be applied as one or more external signals 46 to a controller 34 associated with a light source 24). The controllers 34A-34D are “electrically connected” to light source 24, which is an LED-based light source. *Id.* at 20:37-42 (“Upon receiving the one or more external signals 46, the controller 34 selects the appropriate pre-programmed illumination program from the storage device 38 and executes the program, thereby generating one or more control signals 36 *to control the light source 24* in

a predetermined manner.”) (emphasis added); 33:37-40 ([T]he term ‘light source’ should be understood to include all illumination sources, including ... LED-based sources as defined above[.]”); 33:18-23 (“[T]he term ‘LED’ refers to any diode or combination of diodes that is capable of receiving an electrical signal and producing a color of light in response to the signal. Thus, the term ‘LED’ as used herein should be understood to include light emitting diodes of all types[.]”).

EX1003, ¶ 84.

- c. **8[B]:** *wherein the master control unit includes a microcontroller; the slave control unit includes a signal processor;*

Lys discloses a remote or local user interface (the claimed “master control unit”) that includes a processor (the claimed “microcontroller):



Lys, Fig. 6 (annotated). EX1003, ¶ 85.

The remote user interface includes a processor as illustrated in FIG. 6: “FIG. 6 also shows that the remote user interface 56 ... may include one or more displays

coupled to the processor 58[.]” *Id.* at 21:17-19. A POSITA would have understood that the claimed “microcontroller” is an integrated circuit that necessarily includes processing capabilities for specific tasks. As a result, the processor in Lys either literally discloses this “microcontroller” limitation, or in combination with the general knowledge of a POSITA, renders it obvious.

EX1003, ¶ 86.

Lys also discloses a controller (the claimed “slave control unit”) that includes a signal processor:

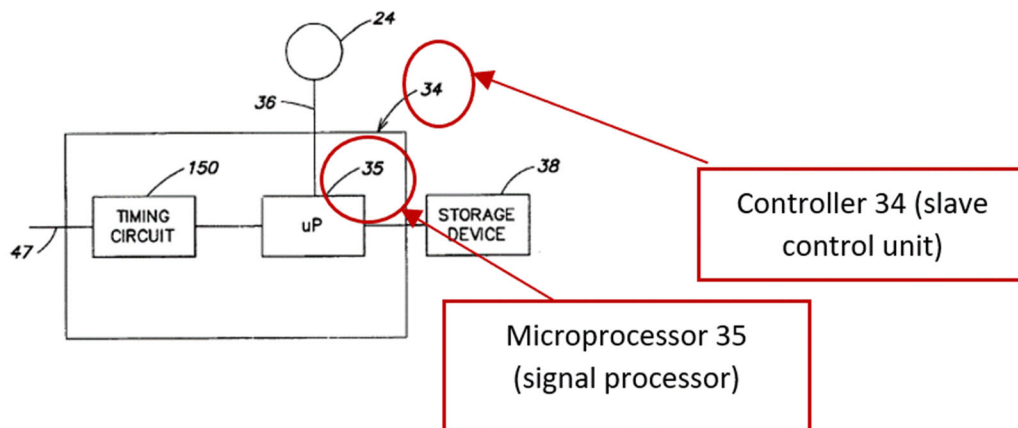


FIG. 10

Lys, Fig. 10 (annotated). Specifically, a POSITA would have understood the microprocessor 35 in Lys to satisfy the “signal processor” limitation because it can process control signals to be sent to the LEDs: “[T]he controller 34 also may include one or more microprocessors 35, coupled to the timing circuit 150, to provide one or more control signals 36 to the light source 24 *based on the*

monitored power signal 47.... [A] time constant of the RC circuit may be particularly selected based on a desired predetermined duration of an interruption in the power signal 47 that causes the controller 34 (e.g., via the microprocessor 35) to effect some change in the radiation output by the light source 24.” *Id.* at 25:1-15 (emphasis added). EX1003, ¶ 87.

- d. **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*

Lys discloses an AC to DC converter electrically connected to the controllers (the claimed “slave control units”). Each controller 34 “receives a power signal 47 to provide power to the light source 24. In various aspects of this embodiment, the power signal 47 may be provided directly by either an A.C. or D.C. power source.” Lys, 12:32-46. This power signal 47 is illustrated in FIG. 2, for example:

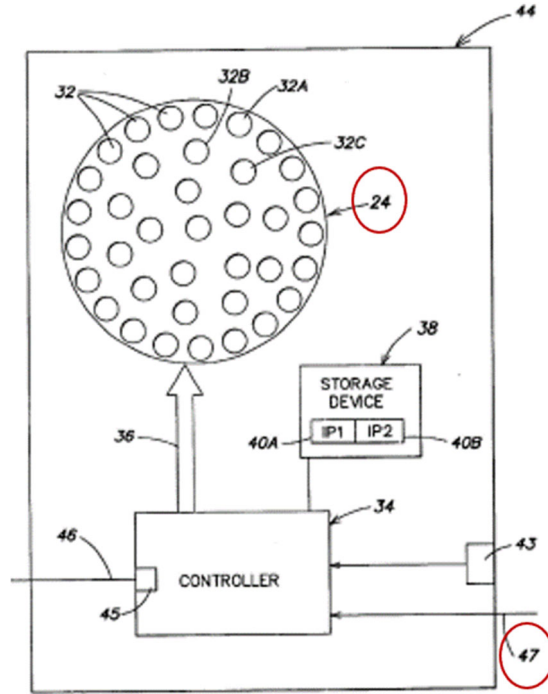


FIG. 2

Id. at Fig. 2 (power signal 47 highlighted). Lys further explains that “*an A.C. to D.C. converter* (not shown in FIG. 2) may be utilized to convert an A.C. power source to a D.C. voltage. The A.C. to D.C. converter may be included in the controller 34 itself, *or may be located externally to the controller 34*, such that a low voltage D.C. power signal (derived from an A.C. power signal) is provided to the controller 34 as the power signal 47.” *Id.* at 12:37-43 (emphasis added).

EX1003, ¶ 88.

- e. **8[D]:** *a second curtain lamp electrically connected to the alternating current voltage transferring to direct current voltage circuit.*

Lys discloses a plurality of light sources driven by the same power signal:

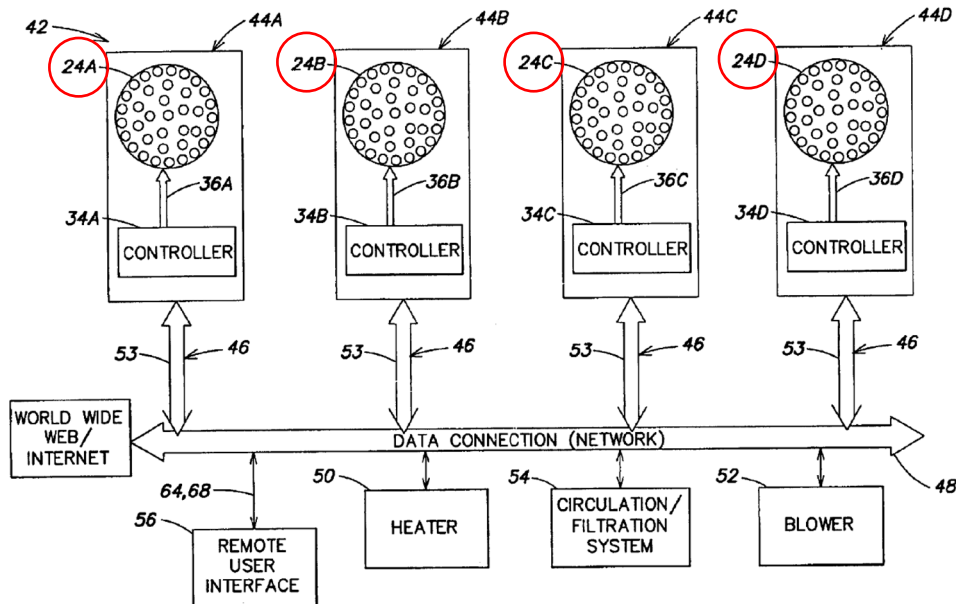


FIG. 4

Lys, Fig. 4 (plurality of light sources 24A to 24D highlighted). “FIG. 4 illustrates four of the light sources 24A-24D shown supported by the pool or spa 20 in FIG.

1. Although FIG. 4 shows four light sources 24A-24D coupled together to form the networked lighting system 42, it should be appreciated that the invention is not limited in this respect, as any two or more of the light sources shown in FIG. 1 may be coupled together to form the networked lighting system 42.” *Id.* at 15:46-56; EX1003, ¶ 89.

As explained *supra* for element 8[C], Lys discloses an AC to DC converter electrically connected to the controllers (the claimed “slave control units”). Each controller 34 “receives a power signal 47 to provide power to the light source 24. In various aspects of this embodiment, the power signal 47 may be provided directly by either an A.C. or D.C. power source.” Lys, 12:32-46. Lys further

explains that “*an A.C. to D.C. converter* (not shown in FIG. 2) may be utilized to convert an A.C. power source to a D.C. voltage. The A.C. to D.C. converter may be included in the controller 34 itself, *or may be located externally to the controller 34*, such that a low voltage D.C. power signal (derived from an A.C. power signal) is provided to the controller 34 as the power signal 47.” *Id.* at 12:37-43 (emphasis added). EX1003, ¶ 90.

A POSITA would have understood that by disclosing an external power source to the controller 34, that same power source could have been responsible for supplying power to any of the other controller 34A to 34D as illustrated in FIG. 4. For example, the power signal 47 as illustrated in FIG. 2 could be electrically connected to any number of other controllers 34A to 34D:

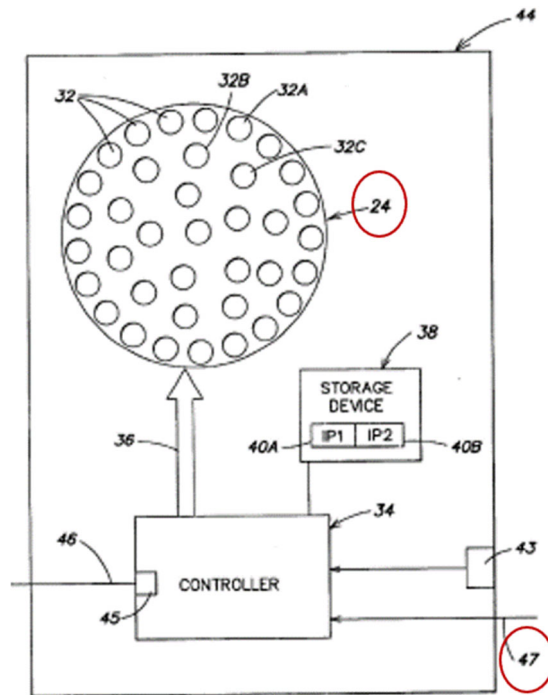


FIG. 2

Lys at Fig. 2 (power signal 47 highlighted). For example, a POSITA would have understood that it is customary and more economical to use a single shared AC-to-DC-converting power source for multiple applications (such as multiple of Lys's light sources) rather than multiple AC-to-DC-converting power sources, one for each application. Additionally, it is safer to supply the light sources with low DC voltage, such as 24 V DC, than with high AC voltage, such as 120 V AC. A low DC voltage reduces the risk of an electrical shock. EX1003, ¶ 91.

VII. GROUND 4: CLAIM 3 IS OBVIOUS OVER LYS IN VIEW OF DEBEVEC

A. Analysis

1. Claim 3

- a. 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.*

Lys discloses the “driving apparatus for light-emitting diode curtain lamp in claim 2” for the reasons already stated *supra* at Sections VI.A.1-2. EX1003, ¶ 92.

Although Lys does not explicitly disclose a “slave control unit” that includes “a transistor electrically connected to the signal processor,” Debevec does. *See supra* at Section V.A.1.a; EX1003, ¶ 93.

B. A POSITA Would Have Been Motivated to Combine Lys and Debevec With a Reasonable Expectation of Success

A POSITA would have been motivated to combine Lys with Debevec, and would have had a reasonable expectation of success. A POSITA would have been motivated to combine Lys with Debevec, and would have had a reasonable expectation of success. Both references are from the same field of endeavor: Controllable lighting systems that can be adjusted in terms of their brightness, color, and temporal dynamics. In order to adjust the brightness of LEDs, or to switch them ON or OFF, an electric switch or valve is needed. A transistor is a common electrical switch or valve used in electrical circuits. A POSITA would be aware of the suitability of a transistor as an electronic switch or valve.

Furthermore, Debevec discloses the use of a transistor as an electronic switch or valve for the purpose of switching the current to an LED light source or driving an LED light source with a certain calibrated current. Electric circuits are known to be predictable. That is, transistor circuits are common in the field and their functioning is not subject to unexpected results. Accordingly, a POSITA would have been motivated to use Debevec's transistor as an electronic switch or valve in Lys's lighting system to control the current flow through the LED light source; the combination of Lys and Debevec would have been obvious and predictable.

EX1003, ¶ 94.

VIII. GROUND 5: CLAIM 4 IS OBVIOUS OVER HIROYUKI IN VIEW OF THE GENERAL KNOWLEDGE OF A POSITA.

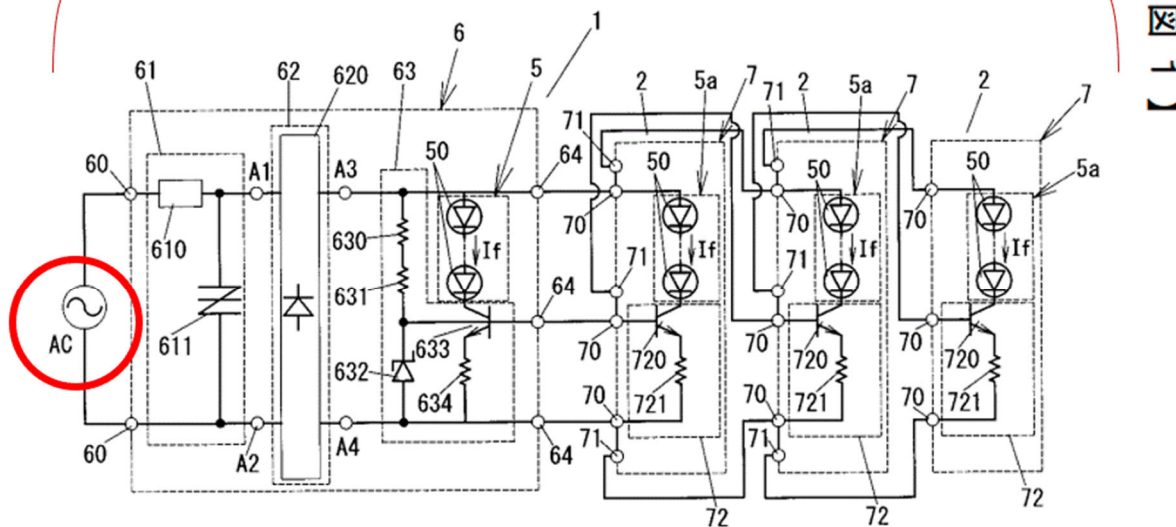
A. Analysis

1. Claim 4

- a. 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:*

To the extent the claim preamble is construed as limiting, Hiroyuki discloses a lighting fixture that comprises a “driving apparatus” and is powered by an AC power source for groups of LEDs.

The entire structure is functioning as the claimed feature,
i.e., a driving apparatus for the light emitting diodes.

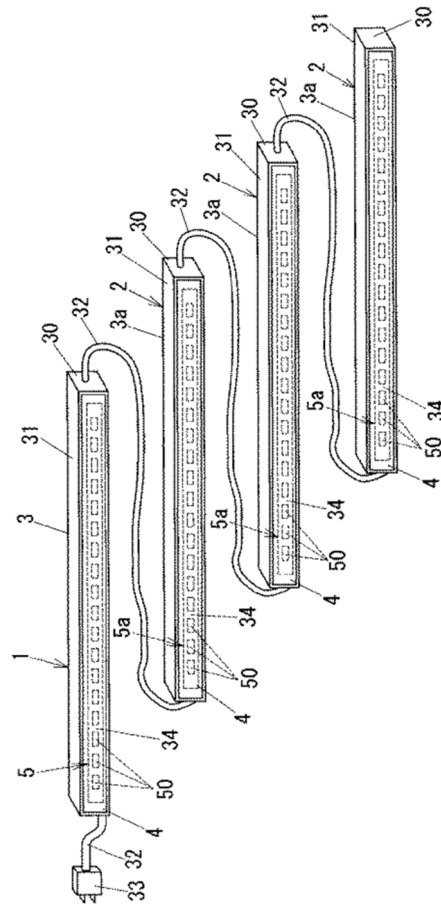


Hiroyuki, Fig. 1 (annotated and highlighting AC power source); *see also id.* at [0001] (“The present invention relates to an illumination apparatus comprising a plurality of lighting units connecting a plurality of LEDs in series.”); [Abstract] (“In the master driving unit 6 of the master unit 1, the pulsating DC power **converted from the AC power of the power supply AC** by the conversion circuit unit 62 and the constant current signal generated by the constant current circuit unit 63 are used to output the pulsating DC power in which the current is maintained at a constant level to the LED group 5, and in which a plurality of LEDs 50 are connected in series, to light the LED group 5.”) (emphasis added); [0048] (explaining meanings of symbols, “1 Master unit; 2 Slave unit; 5, 5a LED group;

50 LEDs; 6 Master drive unit; 62 conversion circuit unit; 7 Slave drive unit; 63, 72 constant current circuit units AC power supply”). EX1003, ¶ 95.

Moreover, a POSITA would have understood Hiroyuki to disclose a “light-emitting diode curtain lamp,” which is commonly understood to be one or more light strings. *See id.* at [0015] (“The illumination apparatus of Embodiment 1, for example, ***is arranged linearly on a wall surface***, such as a building, ***to perform line lighting***, and as shown in FIG. 2, the apparatus comprises of a master unit (first lighting unit) 1 and a plurality of (3 in FIG. 2) slave units (second lighting units) 2, 2, and 2 that are connected in sequence.”). *See also, e.g.*, the ’546 patent at 2:34-40 (describing Figures 7 and 8 in the ’546 patent as illustrating circuit diagrams for curtain lamps with a single LED string and a plurality of LED strings, respectively). FIG. 3 illustrates another example of a plurality of LED light strings connected by cables:

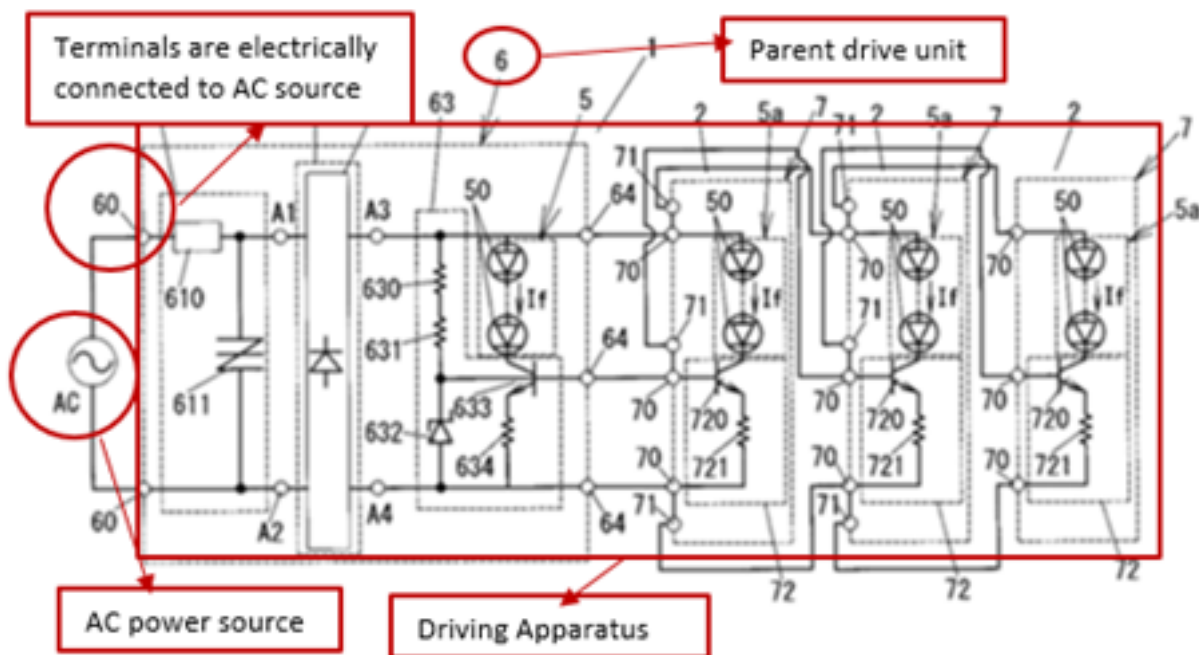
【図3】



Hiroyuki, Fig. 3; *see also id.* at [0033] (“[T]he master unit 1 and the plurality of slave units 2, 2, 2 may also be connected by cables 32, 32, 32 as shown in FIG. 3.”). EX1003, ¶ 96.

- b. **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*

Hiroyuki discloses a master drive unit labeled 6 (the claimed “master control unit”) electrically connected to the AC power source.

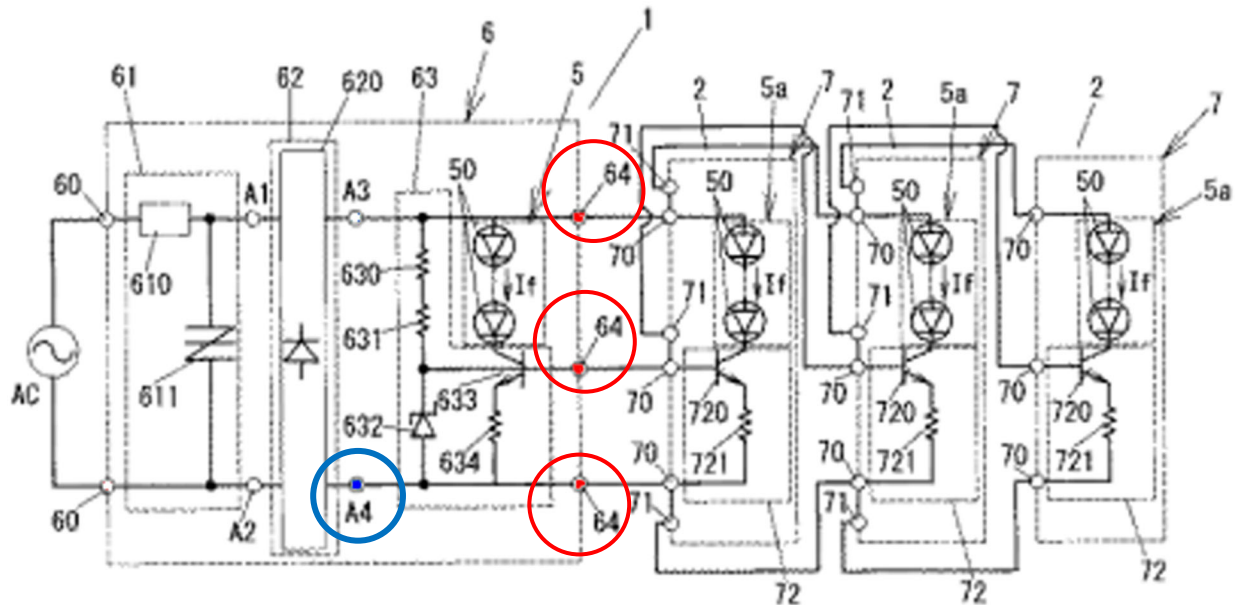


Hiroyuki, Fig. 1 (annotated). The master drive unit 6 is electrically connected to the AC power source. *See id.* at [0022] (“As shown in FIG. 1, the master drive unit 6 includes the terminal units 60, 60” and “[t]he terminals 60, 60 ***are electrically connected to the AC power supply*** via a cable 32 and an AC outlet 33 (see FIG. 2).”) (emphasis added). EX1003, ¶ 97.

The master drive unit 6 sends output signals to the slave drive unit 7: “[T]he terminal units 64, 64, 64 (see FIG. 1) of the master drive unit 6 of the master unit 1 are electrically connected to the terminal units 70, 70, 70 (see FIG. 1) of the slave drive unit 7 of the slave unit 2 via a cable 32. As described above, the master drive unit 6 (see FIG. 1) supplies the pulsating DC power converted by the conversion circuit unit 62 (see FIG. 1) and the constant current signal generated by the

constant current circuit unit 63 (see FIG. 1) to the constant current circuit unit 72 of the slave drive unit 7 via the terminal units 64, 64.” Id. at [0033] (emphasis added). EX1003, ¶ 98.

A POSITA would have understood the terminal units 64 at the master drive unit 6 to represent “signal output pins” and the negative terminal unit A4 at the master drive unit 6 to represent a “power negative terminal pin” as claimed. For example:



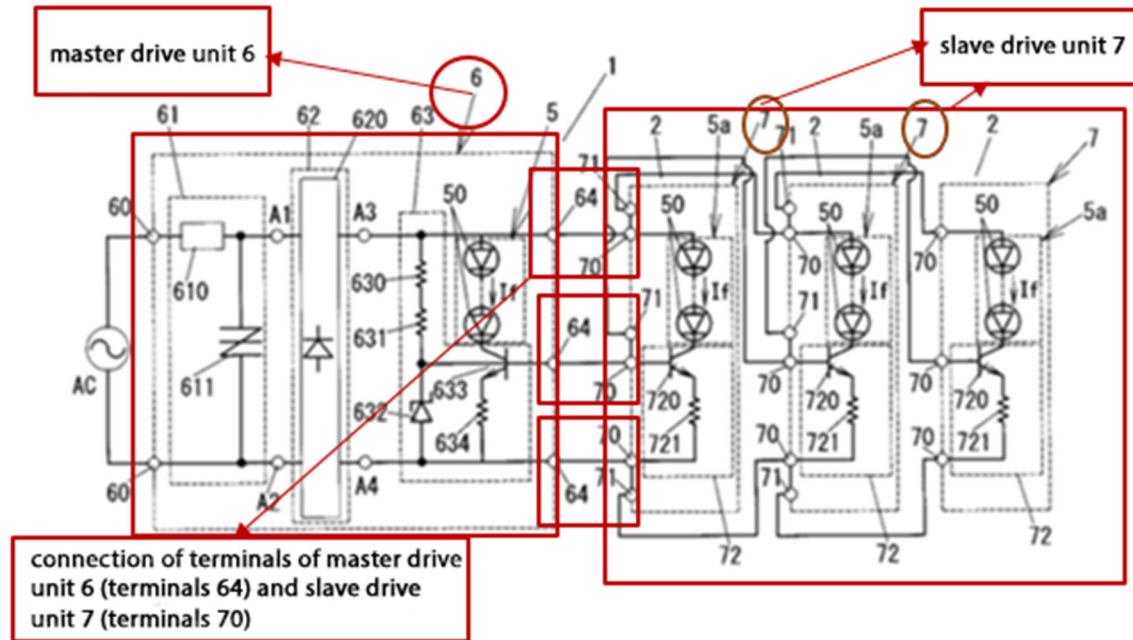
Hiroyuki, Fig. 1 (Fig. 1 with terminal units 64 and negative terminal unit A4 highlighted in red and blue, respectively). The terminal units 64 output a “*constant current signal*” generated by the constant current circuit unit 63” to the slave drive unit 7 via terminal units 64. Id. at [0033] (emphasis added). And, terminal units A3 and A4 are coupled to the “diode bridge 620” that “converts AC

power supplied from the AC power source into pulsating DC power to the constant current circuit unit 63[.]” *Id.* at [0024]. Given the orientation of the Zener diode 632 and of the transistors 720, it can be concluded that terminal A4 is the power negative terminal (and terminal A3 is the power positive terminal). EX1003, ¶ 99.

Finally, a POSITA would have understood Hiroyuki’s “terminal” notation to correspond to “terminal pin” or “output pin” as claimed. For example, a POSITA would have understood a “pin” to be “[a] **terminal** on a connector, plug, or tube base.” EX1009 at 566 (definition of “pin”). The words “terminal” and “pin” typically imply an electrical end point at which an electrical connection is made to another unit. A “pin” can be understood as a pointed terminal, indicating that “terminal” encompasses a “pin.” EX1003, ¶ 100.

- c. **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,*

Hiroyuki discloses a slave drive unit labeled 7 (the claimed “slave control unit”) electrically connected to the master drive unit 6 (the claimed “master control unit”) and the LEDs:



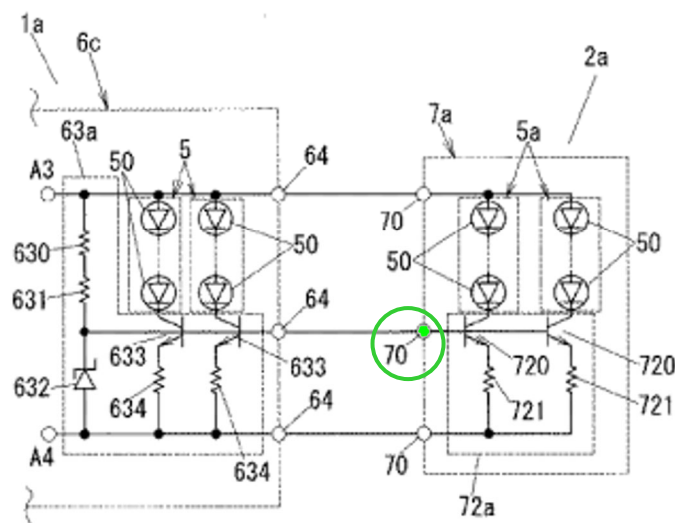
Hiroyuki, Fig. 1 (annotated). The slave drive unit 7 is connected to the master drive unit 6: “The slave drive unit 7 includes terminal units 70, 70, 70, and terminal units 71, 71, 71 The ***terminal units 70, 70, 70 are electrically connected to the terminal units 64, 64, 64 of the master drive unit 6*** or to the terminal units 71, 71, 71 of the other slave drive unit 7. The terminal units 71, 71, 71 are electrically connected to the terminal units 70, 70, 70 of the other slave drive unit 7.” *Id.* at [0028] (emphasis added). EX1003, ¶ 101.

As also shown in the embodiment of FIG. 7 (reproduced below), the slave drive unit 7 (or 7a) is connected to LED groups 5a. Hiroyuki at [0044] (“[T]he slave unit 2a of Embodiment 4 is provided with multiple LED groups 5a, 5a (two rows in FIG. 6(b)) connected in parallel to the same LED substrate (not shown), as

shown in FIG. 6(b). *The LED groups 5a and 5a are connected to the slave drive unit 7a as shown in FIG. 7.*” (emphasis added). EX1003, ¶ 102.

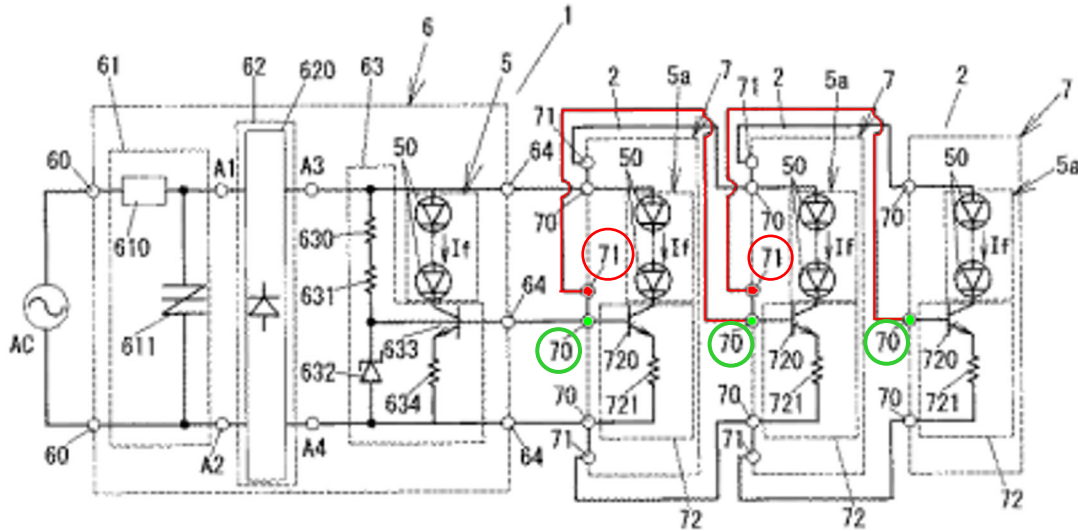
A POSITA would have understood the *middle* terminal unit 70 in FIG. 7 (or FIG. 1) to be a signal input pin of the slave drive unit 7 because it is “electrically connected” to the middle terminal unit 64 of the master drive unit 6. See Hiroyuki at [0028]. As explained for claim element 4[A], the terminal units 64 output a “*constant current signal* generated by the constant current circuit unit 63” to the slave drive unit 7 via terminal units 64. *Id.* at [0033] (emphasis added). Moreover, a POSITA would have understood that the middle terminal 70 is connected to the base of the transistor. The transistor’s base is the controlling electrode of the transistor which receives a control signal from the control signal input pin, that is, the middle terminal 70.

[FIG. 7]



Hiroyuki, Fig. 7 (showing LED groups 5a connected to slave drive unit 7a with middle signal input pin 70 highlighted **green**). EX1003, ¶ 103.

A POSITA would have also understood that terminal 71 in FIG. 1, for example, represents a signal output pin of slave drive unit 7:

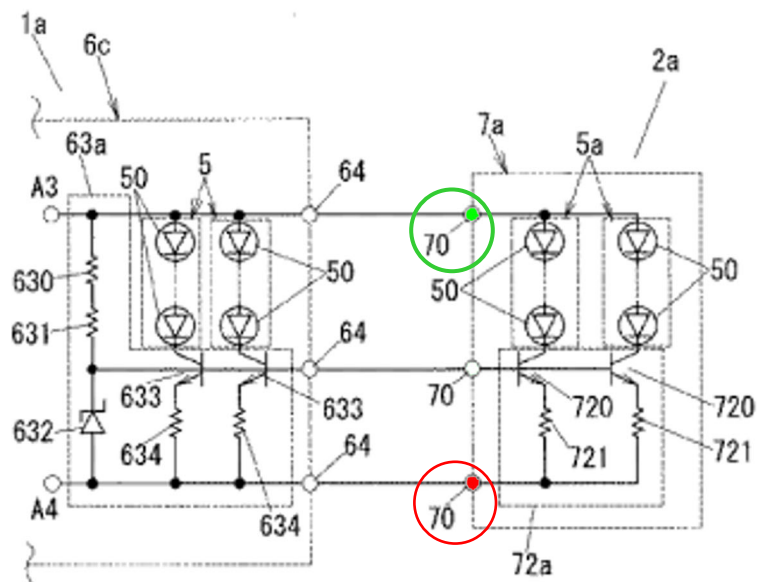


Hiroyuki, Fig. 1 (highlighting middle terminal 71 output pins and their output paths in **red**; middle terminal 70 input pins in **green**). These middle terminal 71 output pins connect to corresponding input terminals 70 at other slave drive units 7: “[T]he terminal units 71, 71, 71 of the slave drive unit 7 (see FIG. 1) are electrically connected to the terminal units 70, 70, 70 of the other slave drive unit 7 via a cable 32.” *Id.* at [0033]. Moreover, a POSITA would have understood that the middle terminal 71 of a first slave drive unit is connected to the middle terminal 70 of a second slave drive unit (which in turn is connected to the base of the transistor); a POSITA would have understood that the signal output pin of a

first slave drive unit is connected to the signal input pin of a second slave drive unit. EX1003, ¶ 104.

Hiroyuki also discloses a power positive terminal pin of the slave drive unit 7 and a power negative terminal pin of the slave drive unit 7. These are represented in FIG. 7 (or FIG. 1) as the top 70 terminal pin and bottom 70 terminal pin, respectively:

[FIG. 7]



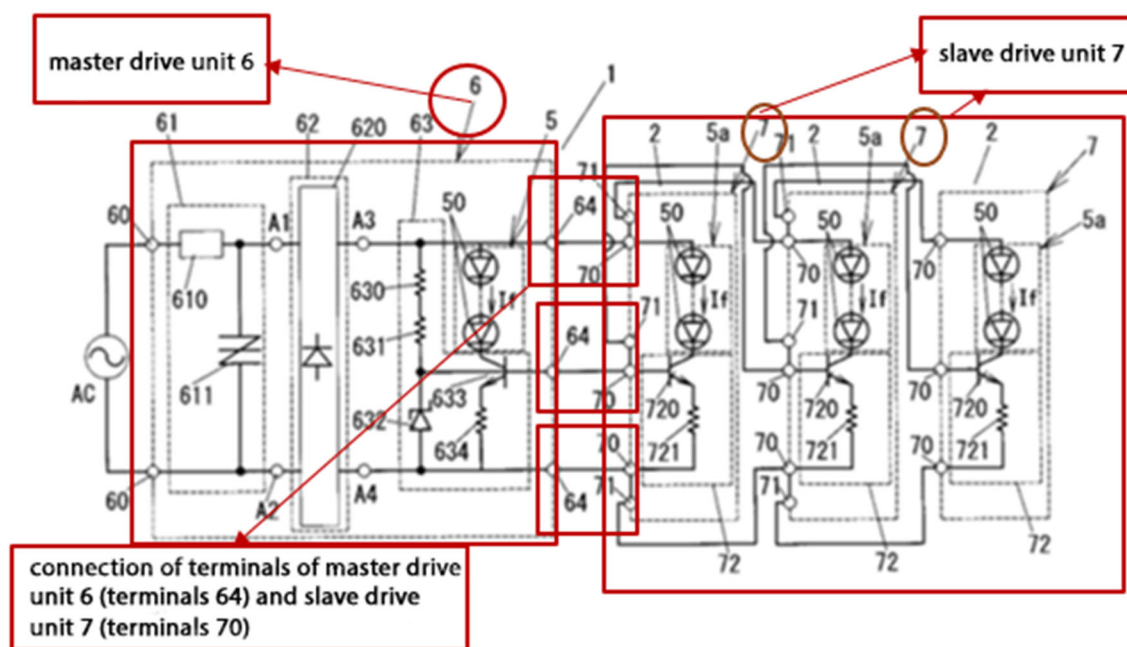
Hiroyuki, Fig. 7 (showing top power positive terminal pin 70 highlighted **green** and bottom power negative terminal pin 70 highlighted **red**). Hiroyuki teaches that the “constant current circuit unit 63 supplies DC power to the LED group 5 ... and illuminates the LED group 5. *See id.* at [0026]. A POSITA would have understood that the DC power supplied to LED group 5 (derived from the AC power source) must pass through a power positive terminal pin and a power

negative terminal pin at the slave drive unit 7a. A POSITA would also have understood that a DC drive apparatus inherently has a positive terminal and a negative terminal. Given the orientation of the Zener diode 632 (shown in FIG. 1) and of the transistors 720, it would have been concluded that the terminal A3 is the power positive pin and A4 is the power negative pin of the master drive unit 6c, which correspond to top power positive terminal pin 70 highlighted **green** and bottom power negative terminal pin 70 highlighted **red** in FIG. 7 above. EX1003, ¶ 105.

Finally, a POSITA would have understood Hiroyuki's "terminal" notation to correspond to "terminal pin" or "input pin" or "output pin" as claimed. For example, a POSITA would have understood a "pin" to be "[a] *terminal* on a connector, plug, or tube base." EX1009 at 566 (definition of "pin"). The words "terminal" and "pin" typically imply an electrical end point at which an electrical connection is made to another unit. A "pin" can be understood as a pointed terminal, indicating that "terminal" encompasses a "pin." EX1003, ¶ 106.

- d. **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;

Hiroyuki discloses a slave drive unit labeled 7 (the claimed “slave control unit”) controlled by the master drive unit labeled 6 (the claimed “master control unit”) to drive the LEDs.



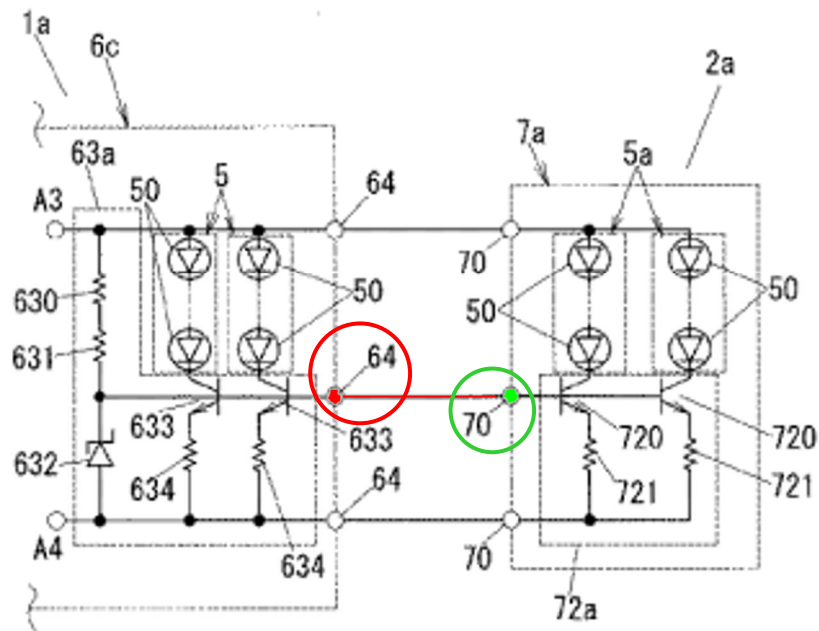
Hiroyuki, Fig. 1 (annotated). The slave drive unit 7 is controlled by the master drive unit 6: “[T]he terminal units 64, 64, 64 (see FIG. 1) of the master drive unit 6 of the master unit 1 are electrically connected to the terminal units 70, 70, 70 (see FIG. 1) of the slave drive unit 7 of the slave unit 2 via a cable 32. As described above, the master drive unit 6 (see FIG. 1) supplies the pulsating DC power converted by the conversion circuit unit 62 (see FIG. 1) and the constant current

signal generated by the constant current circuit unit 63 (see FIG. 1) to the constant current circuit unit 72 of the slave drive unit 7 via the terminal units 64, 64.” *Id.* at [0033] (emphasis added). EX1003, ¶ 107.

The slave drive unit 7, in turn, drives the LEDs. *Id.* at [Abstract] (“In the slave drive unit 7 of the slave unit 2, the constant current circuit unit 72 maintains the current at a constant level and ***outputs a pulsating DC power to the LED group 5a***, in which the plurality of LEDs 50 are connected in series, to light the LED group 5a.”) (emphasis added). EX1003, ¶ 108.

A POSITA would have understood the terminal units 64 at the master drive unit 6 to represent “signal output pins” and the middle terminal unit 70 at the slave drive unit 7 to represent a “signal input pin” as claimed. *See supra* at Sections VIII.A.1.b (claim element 4[A]) and VIII.A.1.c (claim element 4[B]). As explained for claim element 4[A], the terminal units 64 output a “***constant current signal*** generated by the constant current circuit unit 63” to the slave drive unit 7 via terminal units 64. *Id.* at [0033] (emphasis added). This electrical connection between the master drive unit 6 and slave drive unit 7 is illustrated in FIG. 7 (and FIG. 1):

[FIG. 7]

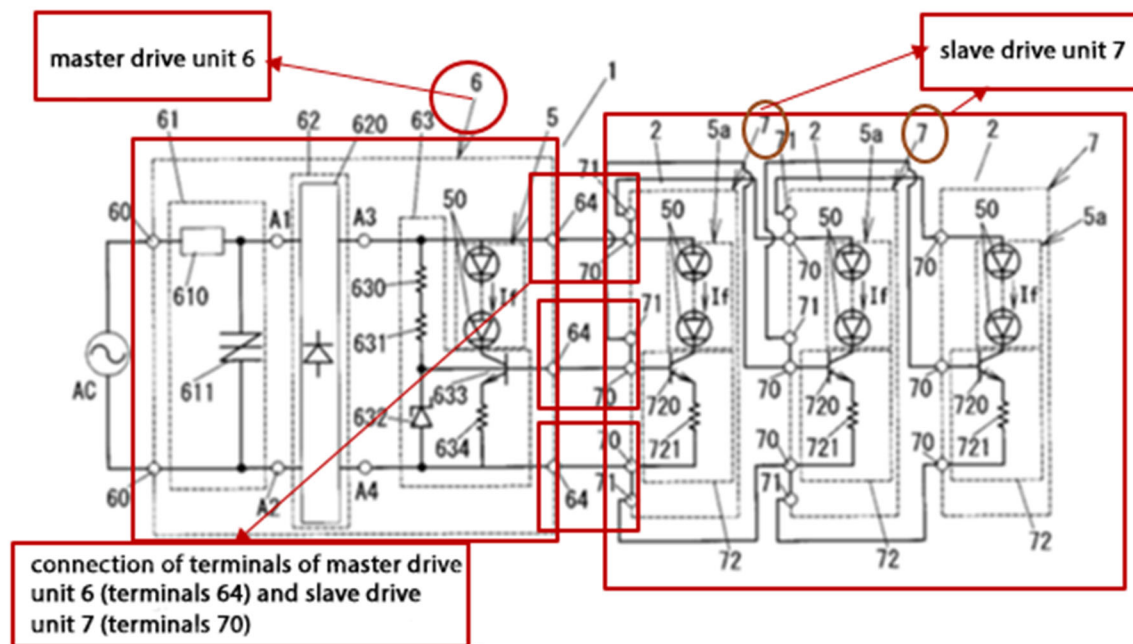


Hiroyuki, Fig. 7 (highlighting a signal output pin 64 of master drive unit 6c electrically connected to signal input pin 70 of slave drive unit 7a). EX1003, ¶ 109.

Finally, a POSITA would have understood Hiroyuki's "terminal" notation to correspond to "input pin" or "output pin" as claimed. For example, a POSITA would have understood a "pin" to be "[a] terminal on a connector, plug, or tube base." EX1009 at 566 (definition of "pin"). The words "terminal" and "pin" typically imply an electrical end point at which an electrical connection is made to another unit. A "pin" can be understood as a pointed terminal, indicating that "terminal" encompasses a "pin." EX1003, ¶ 110.

- e. **4[D]:** *the power negative terminal pin of master control unit is electrically connected to the power positive terminal pin of slave control unit.*

Hiroyuki discloses a slave drive unit labeled 7 (the claimed “slave control unit”) electrically connected to the master drive unit labeled 6 (the claimed “master control unit”):



Hiroyuki, Fig. 1 (annotated). The slave drive unit 7 is connected to the master drive unit 6 and the master drive unit 6 supplies the slave drive unit 7 with power:

“[T]he terminal units 64, 64, 64 (see FIG. 1) of the master drive unit 6 of the master unit 1 are electrically connected to the terminal units 70, 70, 70 (see FIG. 1) of the slave drive unit 7 of the slave unit 2 via a cable 32. As described above, the master drive unit 6 (see FIG. 1) supplies the pulsating DC power converted by the conversion circuit unit 62 (see FIG. 1) and the constant current signal

generated by the constant current circuit unit 63 (see FIG. 1) to the constant current circuit unit 72 of the slave drive unit 7 via the terminal units 64, 64, 64.” *Id.* at [0033] (emphasis added). EX1003, ¶ 111.

This claim limitation is obvious over Hiroyuki in view of the general knowledge of a POSITA. In the field of electrical circuits, there are two basic circuit configurations: A parallel electrical circuit and a series electrical circuit. For example, two LEDs can be circuited in a parallel or in series. A parallel circuit is preferred, if the available supply voltage is low. A series electrical circuit is preferred, if the available supply voltage is high. Given that the common supply voltage (line voltage) is 120 V, both parallel and series electrical circuits are suitable for circuiting the Master and Slave components disclosed by Hiroyuki. A POSITA would have been aware that the Master and Slave components can be circuited in both a parallel circuit as well as a series circuit. A POSITA would also have been aware of the fact that for a series connection, the negative terminal of the Master controller would be connected to the positive terminal of the first Slave controller. The two options (parallel circuit and series circuit) are both viable and could be readily practiced by POSITA. However, a POSITA would be motivated to implement a series circuit, because the available line voltage (120 V AC) is much higher than the LED supply voltage (typically about 3 V DC). Furthermore, the total current in a series circuit is smaller, so that thinner wires can be used. A

POSITA would not have found the transition from a parallel circuit to a series circuit challenging, because parallel and series electrical circuits are among the most basic and elementary circuit configurations found in the field of electrical engineering. EX1003, ¶ 112.

Finally, a POSITA would have understood Hiroyuki's "terminal" notation to correspond to "terminal pin" as claimed. For example, a POSITA would have understood a "pin" to be "[a] *terminal* on a connector, plug, or tube base." EX1009 at 566 (definition of "pin"). The words "terminal" and "pin" typically imply an electrical end point at which an electrical connection is made to another unit. A "pin" can be understood as a pointed terminal, indicating that "terminal" encompasses a "pin." EX1003, ¶ 113.

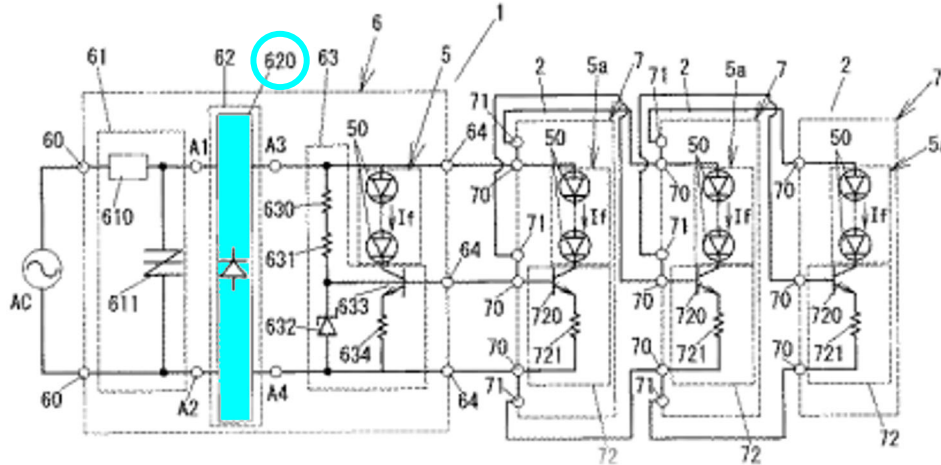
IX. GROUND 6: CLAIMS 5-6 AND 8 ARE OBVIOUS OVER HIROYUKI IN VIEW OF KUANG

A. Analysis

1. Claim 5

- a. 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.*

Hiroyuki in view of Kuang discloses a master drive unit labeled 6 (the claimed "master control unit") that includes a microcontroller and a bridge rectifier electrically connected to the microcontroller:



Hiroyuki, Fig. 1 (conversion circuit unit 62 includes a diode bridge 620 highlighted in blue that acts as the claimed “bridge rectifier”). EX1003, ¶ 114.

“The conversion circuit unit 62 includes a *diode bridge 620* including four diodes (not shown), and converts AC power supplied from the power source AC into pulsating DC power. The conversion circuit unit 62 outputs pulsating DC power to the constant current circuit unit 63, and also outputs to the constant current circuit unit 72 of the slave drive unit 7” Hiroyuki at [0024] (emphasis added). A “diode bridge” for the purpose of rectification is a “bridge rectifier.” A POSITA would have considered the two terms to be synonymous. A diode bridge typically includes four diodes that are arranged to accept an incoming AC signal to produce an outgoing DC signal. Diode bridge circuits are a common method, indeed the most common method, to convert an AC signal to a DC signal. EX1003, ¶ 115.

Although there is no explicit disclosure of a microcontroller in Hiroyuki, a POSITA would have been aware of, and would have found it obvious, to include a microcontroller in Hiroyuki's illumination apparatus such as the microcontroller disclosed in Kuang. *See supra* at Section IV.A.1.b (claim element 1[A]). Hiroyuki discloses that “the master drive unit 6 includes the terminal units 60, 60, a protective circuit unit 61, a conversion circuit unit 62, a constant current circuit unit (lighting circuit unit) 63, and terminal units 64, 64, 64 in order from the AC power supply side ***on a circuit board (not shown) different from the LED board (not shown)***.” Hiroyuki at [0022]. “The circuit board (not shown) is housed within the housing 3 shown in FIG. 2, for example, on the side opposite the side where the LED board (not shown) is provided with the LED group 5 (the back side in FIG. 2).” *Id.* at [0023]. A POSITA would have understood Hiroyuki's disclosure of the master drive unit's circuit board as optionally including a microcontroller such that the diode bridge 620 is electrically connected to the microcontroller as claimed. EX1003, ¶ 116.

Kuang explicitly discloses a master node (the claimed “master control unit”) that includes a “microcontroller” and a “voltage regulator” electrically connected to the “microcontroller” as claimed:

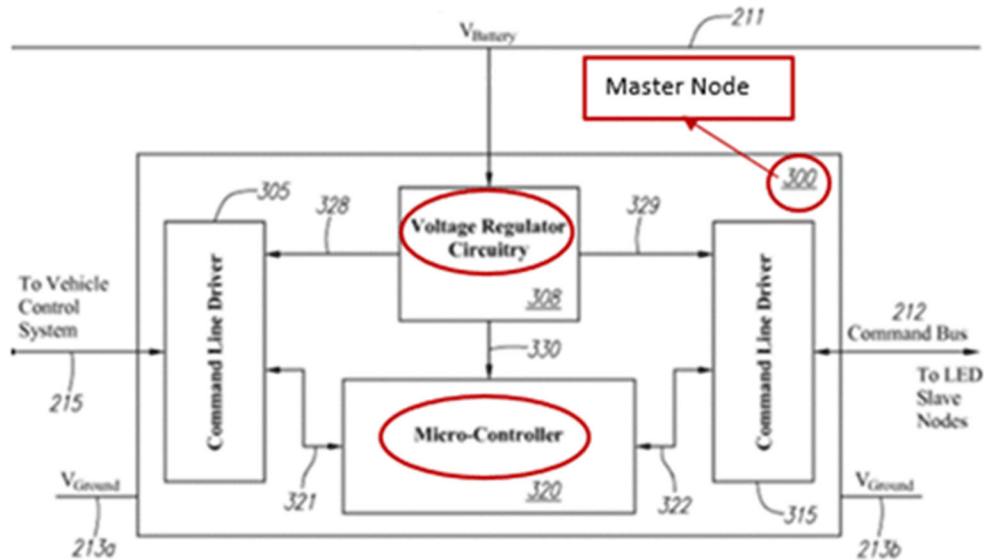


FIG. 3

Kuang, Fig. 3 (annotated). “FIG. 3 is a block diagram of a preferred master node 300” *Id.* at [0039]. “The master node 300 preferably **includes a voltage regulator 308** which receives a power signal from the power supply line 211, and converts the (typically 24 Volt) input power signal to a stable low voltage power output signal for digital electronics and other components within the master node 300.” *Id.* The master node 300 also includes a “microcontroller 320” as claimed. *See id.* at [0040] (“The master node 300 also preferably **includes a micro-controller 320** for performing the supervisory control and logic functions of the lighting control system.”). EX1003, ¶ 117.

As shown in Kuang’s FIG. 3, the voltage regulator 308 is “electrically connected” to the microcontroller 320. Kuang further explains that the “voltage

regulator 308 outputs appropriate internal power supply signals ... 330” to the microcontroller 320. *Id* at [0039]; EX1003, ¶ 118.

A POSITA would have been motivated to include Kuang’s microcontroller because such a microcontroller would enable features (such as dynamically flashing LED lights) that are considered attractive and desirable. *See, e.g.,* Kuang at [0040] (“The master node 300 also preferably ***includes a micro-controller 320*** for performing the supervisory control and logic functions of the lighting control system.”). EX1003, ¶ 119.

2. Claim 6

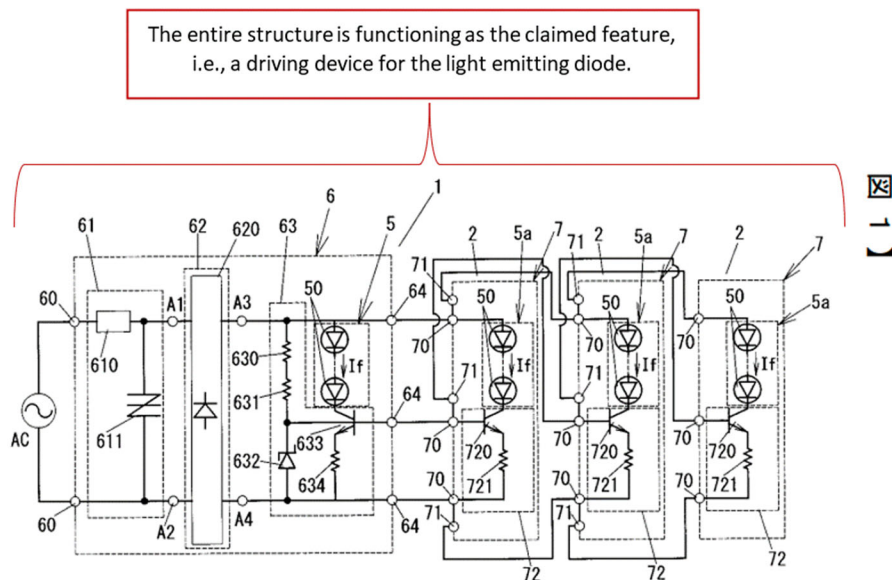
- a. 6:** *The driving apparatus for light-emitting diode curtain lamp in claim 5, wherein the master control unit includes a first Zener diode electrically connected to the bridge rectifier.*

Hiroyuki discloses a master drive unit labeled 6 (the claimed “master control unit”) that includes a Zener diode electrically connected to the bridge rectifier:

3. Claim 8

- a. **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:*

To the extent the claim preamble is construed as limiting, Hiroyuki discloses a plurality of LED light sources powered by a “driving apparatus”:



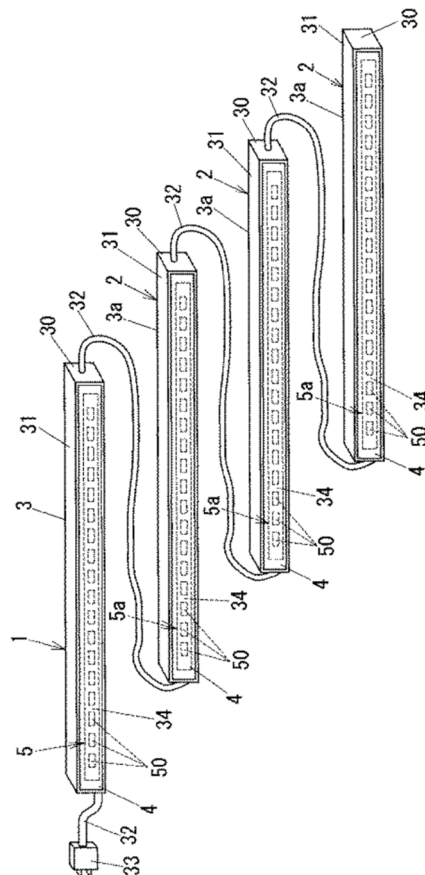
Hiroyuki, Fig. 1 (annotated); *see also id.* at [0001] (“The present invention relates to an illumination apparatus comprising a plurality of lighting units connecting a plurality of LEDs in series.”). EX1003, ¶ 121.

Moreover, a POSITA would have understood Hiroyuki to disclose a “light-emitting diode curtain lamp,” which is commonly understood to be one or more light strings. Hiroyuki at [0015] (“The illumination apparatus of Embodiment 1,

for example, is arranged linearly on a wall surface, such as a building, to perform line lighting, and as shown in FIG. 2, the apparatus comprises of a master unit (first lighting unit) 1 and a plurality of (3 in FIG. 2) slave units (second lighting units) 2, 2, and 2 that are connected in sequence.”). *See also, e.g.*, the ’546 patent at 2:34-40 (describing Figures 7 and 8 in the ’546 patent as illustrating circuit diagrams for curtain lamps with a single LED string and a plurality of LED strings, respectively). EX1003, ¶ 122.

FIG. 3 illustrates another example of a plurality of LED light strings connected by cables:

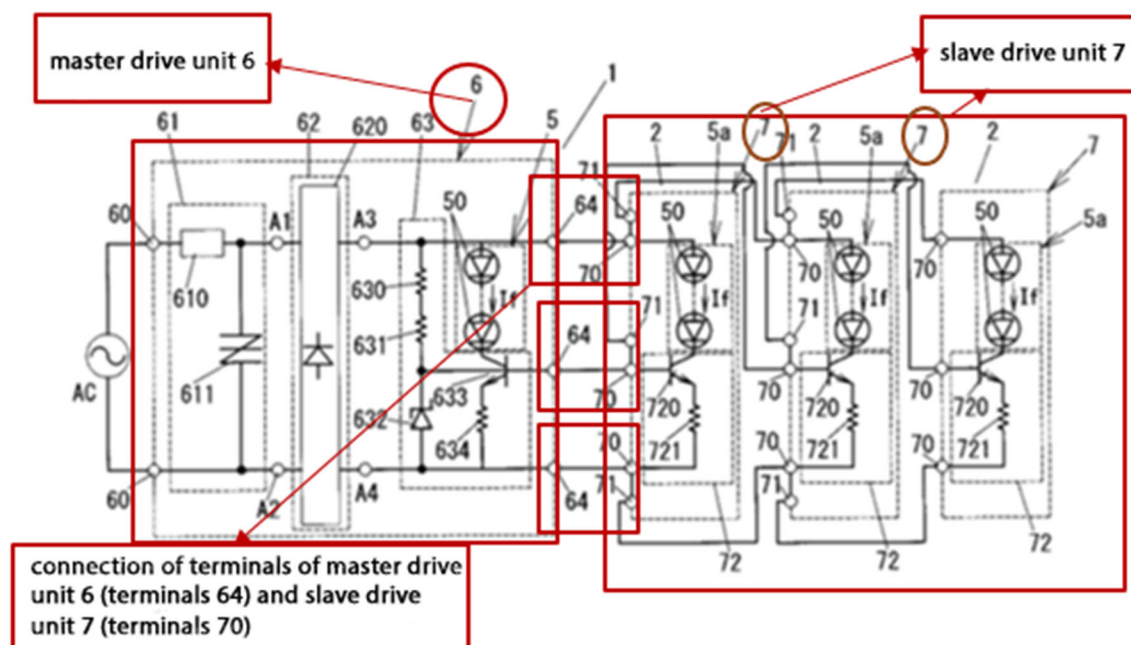
【図3】



Hiroyuki, Fig. 3; *see also id.* at [0033] (“[T]he master unit 1 and the plurality of slave units 2, 2, 2 may also be connected by cables 32, 32, 32 as shown in FIG. 3). EX1003, ¶ 123.

- b. **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,*

Hiroyuki discloses a master drive unit labeled 6 (the claimed “master control unit”) and at least one slave drive unit labeled 7 (the claimed “slave control unit”) electrically connected to the master drive unit and the LEDs:



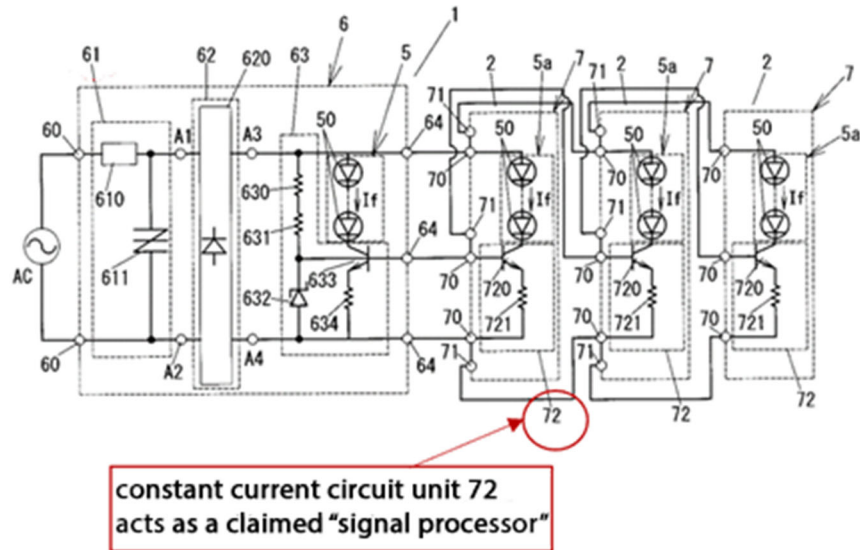
Hiroyuki, Fig. 1 (annotated). The slave drive unit 7 is connected to the master drive unit 6: “The slave drive unit 7 includes terminal units 70, 70, 70, and terminal units 71, 71, 71, and a constant current circuit unit 72 on a circuit board (not shown) different from the LED board (not shown). **The terminal units 70, 70,**

70 are electrically connected to the terminal units 64, 64, 64 of the master drive unit 6 or to the terminal units 71, 71, 71 of the other slave drive unit 7.” Id. at [0028] (emphasis added); see also id. at [0033] (“[T]he terminal units 64, 64, 64 (see FIG. 1) of the master drive unit 6 of the master unit 1 are electrically connected to the terminal units 70, 70, 70 (see FIG. 1) of the slave drive unit 7 of the slave unit 2 via a cable 32.) (emphasis added). EX1003, ¶ 124.

The slave drive unit labeled 7 is also connected to LED groups 5a. *Id.* at [0044] (“The LED groups 5a and 5a are connected to the slave drive unit 7a as shown in FIG. 7.”); [Abstract] (“In the slave drive unit 7 of the slave unit 2, the constant current circuit unit 72 maintains the current at a constant level and **outputs a pulsating DC power to the LED group 5a**, in which the plurality of LEDs 50 are connected in series, to light the LED group 5a.”) (emphasis added). EX1003, ¶ 125.

- c. **8[B]:** *wherein the master control unit includes a microcontroller; the slave control unit includes a signal processor;*

Hiroyuki discloses a master drive unit labeled 6 (the claimed “master control unit”) that includes a microcontroller and a slave drive unit labeled 7 (the claimed “slave control unit”) that includes a signal processor:



Hiroyuki, Fig. 1 (annotated); *see also id.* at [0024] (“The conversion circuit unit 62 outputs the pulsating DC power to the constant current circuit unit 63, and also outputs it to the constant current circuit unit 72 of the slave drive unit 7”).

EX1003, ¶ 126.

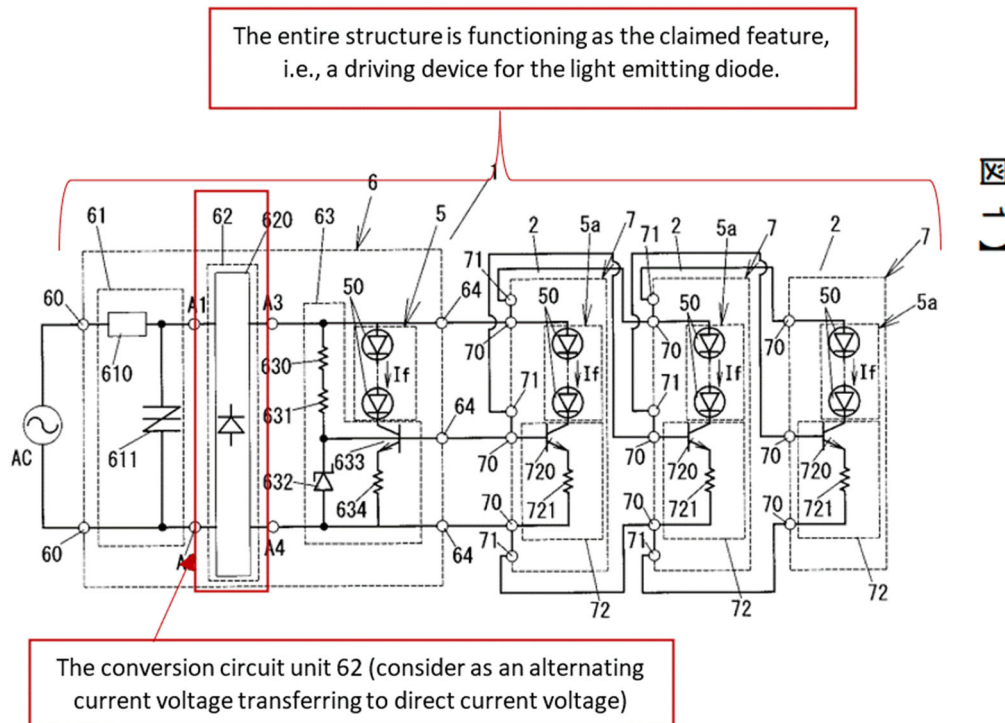
The constant current circuit unit 72 of the slave drive unit acts as a signal processor as claimed. As explained in Hiroyuki, “[t]he constant current circuit unit 72, as shown in FIG. 1, includes a transistor 720 and a resistor 721 connected in series with the LED group 5a. The constant current circuit unit 72 inputs the pulsating DC power from the master drive unit 6 through the terminal units 70, 70, 70 and also inputs the constant current signal to the base of the transistor 720. As a result, *the constant current circuit unit 72 supplies the LED group 5a with a pulsating DC power whose current is maintained at a constant level* according to the constant current signal, thereby lighting the LED group 5a.” *Id.* at [0030]

(emphasis added). Therefore, a POSITA would have understood the constant current circuit unit 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. EX1003, ¶ 127.

It would have been obvious to include a microcontroller such as that disclosed in Kuang in Hiroyuki’s master control unit for the reasons stated *supra* at Section IX.A.1.a (claim 5). EX1003, ¶ 128.

- d. **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*

Hiroyuki discloses a lighting fixture that comprises a “driving apparatus” and is powered by an AC power source, and a conversion circuit unit 62 that includes a diode bridge 620 that converts an AC power supply to pulsed DC power:

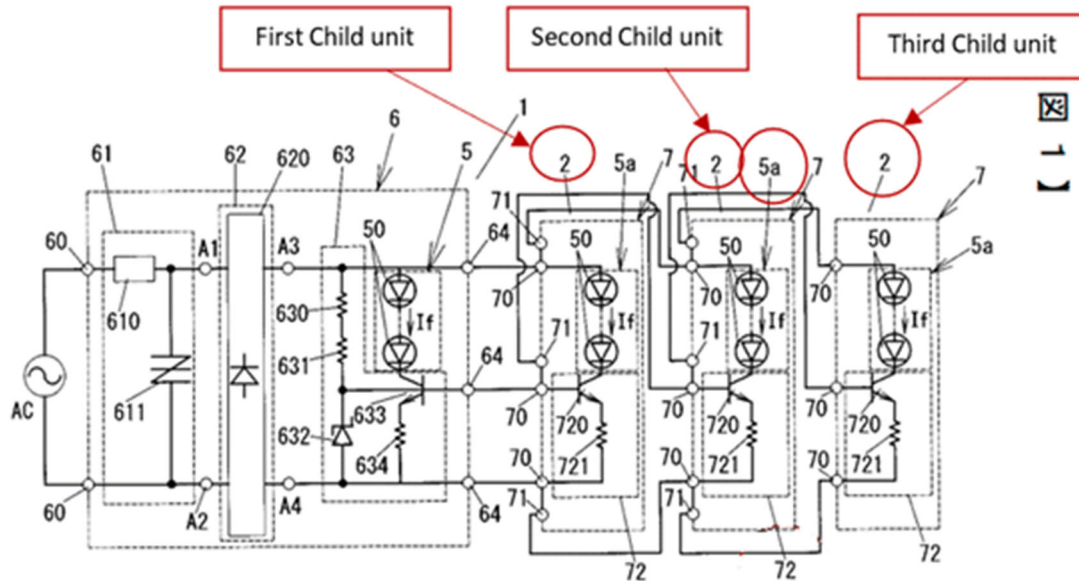


Hiroyuki, Fig. 1 (annotated). EX1003, ¶ 129.

“The protection circuit unit 61 includes a fuse 610 and a surge absorber (varistor, ZNR) 611 in order from the AC power side, as shown in FIG. 1, to protect the master drive unit 6 from lightning surges, etc. *The conversion circuit unit 62 includes a diode bridge 620 composed of four diodes (not shown), and converts AC power supplied from the AC power source into pulsating DC power.*” Hiroyuki at [0024] (emphasis added). EX1003, ¶ 130.

- e. **8[D]:** a second curtain lamp electrically connected to the alternating current voltage transferring to direct current voltage circuit.

Hiroyuki discloses three child units attached to one parent unit, each with its own group of LEDs that can be considered a curtain lamp:



Hiroyuki, Fig. 1 (annotated); *see also id.* at [0015] (“The illumination apparatus of Embodiment 1, for example, is arranged linearly on a wall surface, such as a building, to perform line lighting, and as shown in FIG. 2, the apparatus comprises of a master unit (first lighting unit) 1 and a plurality of (3 in FIG. 2) slave units (second lighting units) 2, 2, and 2 that are connected in sequence.”). Moreover, “each slave unit 2 includes a housing 3a, a panel 4, an LED group 5a, and a slave drive unit 7 (see FIG. 1), and *is electrically connected to the master unit 1.*” *Id.* (emphasis added). EX1003, ¶ 131.

FIG. 3 illustrates another example of a plurality of LED light strings connected by cables:

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B. A POSITA Would Have Been Motivated to Combine Hiroyuki and Kuang With a Reasonable Expectation of Success

A POSITA would have been motivated to combine Hiroyuki with Kuang, and would have had a reasonable expectation of success. Both references are from the same field of endeavor: Controllable lighting systems that can be adjusted in terms of their brightness, color, and temporal dynamics. EX1003, ¶ 133.

Although there is no explicit disclosure of a microcontroller in Hiroyuki, a POSITA would have been aware of, and would have found it obvious, to include a microcontroller in Hiroyuki's illumination apparatus such as the microcontroller disclosed in Kuang. *See supra* at Section IV.A.1.b (claim element 1[A]). Hiroyuki discloses that “the master drive unit 6 includes the terminal units 60, 60, a protective circuit unit 61, a conversion circuit unit 62, a constant current circuit unit (lighting circuit unit) 63, and terminal units 64, 64, 64 in order from the AC power supply side *on a circuit board (not shown) different from the LED board (not shown).*” Hiroyuki at [0022]. “The circuit board (not shown) is housed within the housing 3 shown in FIG. 2, for example, on the side opposite the side where the LED board (not shown) is provided with the LED group 5 (the back side in FIG. 2).” *Id.* at [0023]. A POSITA would have understood Hiroyuki's disclosure of the master drive unit's circuit board as optionally including a microcontroller such that the diode bridge 620 is electrically connected to the microcontroller. EX1003, ¶ 134.

Kuang explicitly discloses a master node (the claimed “master control unit”) that includes a “microcontroller” and a “voltage regulator” electrically connected to the “microcontroller.” *See supra* at Section IX.A.1.a. A POSITA would have been motivated to include Kuang’s microcontroller because such a microcontroller would enable features (such as dynamically flashing LED lights) that are considered attractive and desirable. *See, e.g.*, Kuang at [0040] (“The master node 300 also preferably *includes a micro-controller 320* for performing the supervisory control and logic functions of the lighting control system.”). Accordingly, a POSITA would have been motivated and would have found it obvious to include Kuang’s microcontroller in Hiroyuki’s illumination apparatus; the combination of Hiroyuki and Kuang would have been obvious and predictable. EX1003, ¶ 135.

X. PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION

A. The PTAB’s Discretion under Section 314(a)

Petitioner is unaware of any judicial or administrative matters that would affect, or be affected by, a decision in this IPR proceeding. Therefore, the non-dipositive factors from *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) cannot support discretionary denial of this Petition under Section 314(a).

B. The PTAB's Discretion under Section 325(d)

Discretionary denial under § 325(d) is not warranted. Of the prior art relied upon in this Petition, only Debevec was previously considered during examination. The Examiner relied on Debevec to support an obviousness rejection, but did not combine Debevec with any other references in doing so. EX1002 at Nonfinal Office Action (Mar. 26, 2014) (rejecting pending claim 1 under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Debevec). The Petition only relies on Debevec as a secondary reference to support obviousness Grounds 2 and 4, which show that claim 3 is obvious over Kuang in view of Debevec, and that claim 3 is also obvious over Lys in view of Debevec, respectively.

Under similar circumstances where previously relied upon prior art is combined with new references not yet before the USPTO, the Board has declined to exercise its discretion under § 325(d). For example, in *Edwards Lifesciences Corp. v. Boston Scientific SciMed, Inc.*, the Board denied the patent owner's argument that institution should be denied under § 325 (d), stating "we determine that the Petition's and the Examiner's reliance on [the reference] is substantially different.... The Examiner ... did not consider whether such a feature may have been obvious, under 35 U.S.C. § 103(a), over [the reference] in combination with additional prior art Thus, in this circumstance, we agree with Petitioner's contention that such an obviousness analysis was appropriate during prosecution,

and remains appropriate now, in this *inter partes* review proceeding.” *Edwards Lifesciences Corp. v. Bos. Sci. Scimed, Inc.*, No. IPR2017-01295, 2017 WL 4862064, at *11 (PTAB Oct. 25, 2017) (Paper 9).

XI. COMPLIANCE WITH FORMAL REQUIREMENTS

A. Mandatory Notices Under 37 C.F.R. §§ 42.8(b)(1)-(4)

1. Real Party-In-Interest

Petitioner certifies that it is the real party-in-interest.

2. Related Matters

Petitioner is unaware of any judicial or administrative matters that would affect, or be affected by, a decision in this IPR proceeding.

3. Lead and Backup Counsel

Petitioner provides the following counsel information. Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition.

LEAD COUNSEL	BACK-UP COUNSEL
John Handy Registration No. 68,906 RIMON PC Suite 900 1765 Greensboro Station Place Tower I McLean, VA 22102 703-559-7360 (phone)	Jason Xu <i>Pro hac vice forthcoming</i> RIMON PC 1990 K Street, N.W., Suite 420 Washington, DC 20006 202-470-2141 (phone)

4. Service Information

Petitioner consents to service by email on the following email addresses:

john.handy@rimonlaw.com; jason.xu@rimonlaw.com.

B. Standing

In accordance with 37 C.F.R. § 42.104(a), Petitioner certifies that the '546 patent is available for *inter partes* review and that Petitioner is not barred or estopped from requesting an *inter partes* review challenging the Challenged Claims on the grounds identified in this Petition.

C. Fees

The Office is hereby authorized to charge the fee set forth in 37 C.F.R. § 42.15(a) and any additional fees that might be due in connection with this Petition to Deposit Account No. 50-5992.

XII. CONCLUSION

For the foregoing reasons, Petitioner requests that the Board institute trial and cancel the Challenged Claims of the '546 patent.

DATE: November 8, 2023

Respectfully submitted,

/s/ John Handy

John Handy
Registration No. 68,906
Counsel for Petitioner

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 13,823 words, excluding the parts of the brief exempted by 37 C.F.R. § 42.24(a), as calculated by Microsoft Word, which is less than the 14,000 allowed under 37 C.F.R. § 42.24(a)(i).

DATE: November 8, 2023

Respectfully submitted,

/s/ John Handy

John Handy
Registration No. 68,906
Counsel for Petitioner

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 FedEx® overnight shipping to the correspondence address of record for the '546 patent:

HDLS IPR Services
P.O. Box 220776
Chantilly, VA 20153

DATE: November 8, 2023

Respectfully submitted,

/s/ John Handy

John Handy
Registration No. 68,906
Counsel for Petitioner

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.