



Petitioner's Demonstratives for Oral Argument

Xu Peicheng (Hong Kong) Optoelectronic Technology Co., Limited, Petitioner v. *Semisilicon Technology Corp.*, Patent Owner
IPR2024-00156 (U.S. Patent No. 8,884,546)

February 24, 2025

Xu Peicheng Ex. 1019

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

'546 Patent – Instituted Grounds, Claims 1-6, 8

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.

Grounds/Claims Disputed by Patent Owner

Grounds 1 (Kuang) and 3 (Lys)

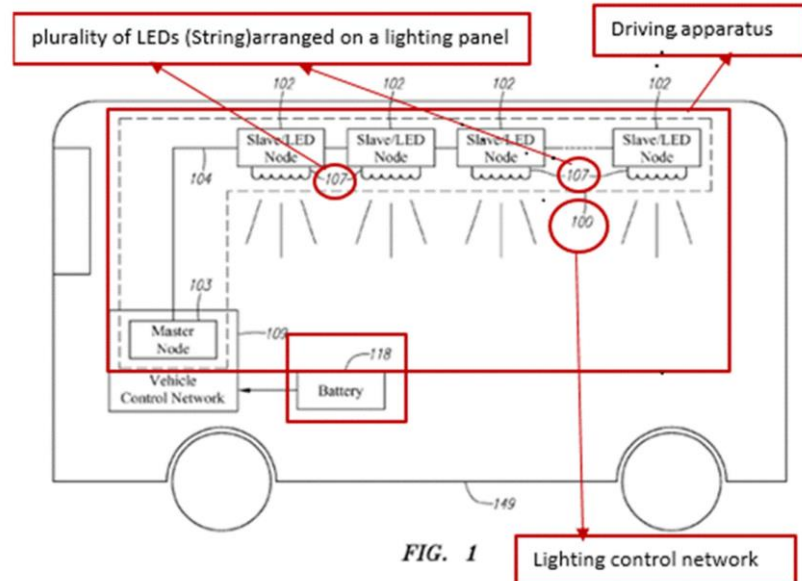
Claim	Limitation
1[Pre]	A driving apparatus for light-emitting diode curtain lamp applied to a direct current power source and at least a light-emitting diode light string, the driving apparatus for light-emitting diode curtain lamp including:
1[A]	a master control unit electrically connected to the 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.

Grounds/Claims Disputed by Patent Owner

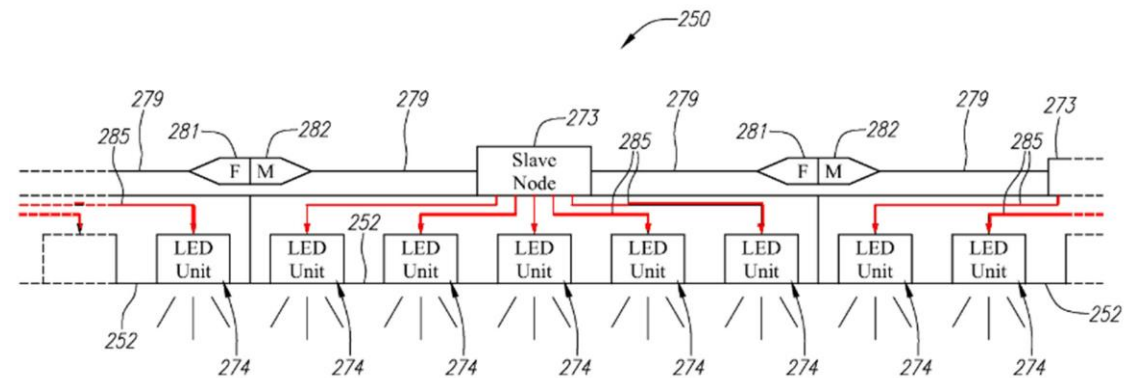
Ground 1 (Kuang)

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:

- Dr. Lebby does not dispute Dr. Schubert's opinion that “curtain lamp” is “commonly understood to be one or more light strings.” *Paper 17 (Reply) at 2 (citing EX 1003 (Schubert Decl.) ¶ 37*



Paper 1 (Petition) at 7 (citing Schubert Decl. ¶ 34)



Reply at 3-4 (citing Schubert Decl. ¶ 44; Schubert Reply Decl. ¶¶ 14-15)

Grounds/Claims Disputed by Patent Owner

Ground 1 (Kuang)

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:

- Dr. Lebby does not dispute Dr. Schubert's opinion that "**curtain lamp**" is "**commonly understood to be one or more light strings.**" *Paper 17 (Reply) at 2 (citing EX 1003 (Schubert Decl.) ¶ 37*

tions. The lighting control network **100** in this example 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**. 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**.

EX 1004 (Kuang) at [0032] (cited in Petition at 8)

Grounds/Claims Disputed by Patent Owner

Ground 1 (Kuang)

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:

- Like Kuang, the “string” of LEDs disclosed in the '546 patent is only illustrated in schematics without any description of physical aspects of “strings” (Reply at 4)
- Nothing in the '546 patent to suggest an LED “string” is limited to a certain physical configuration (Reply at 5)

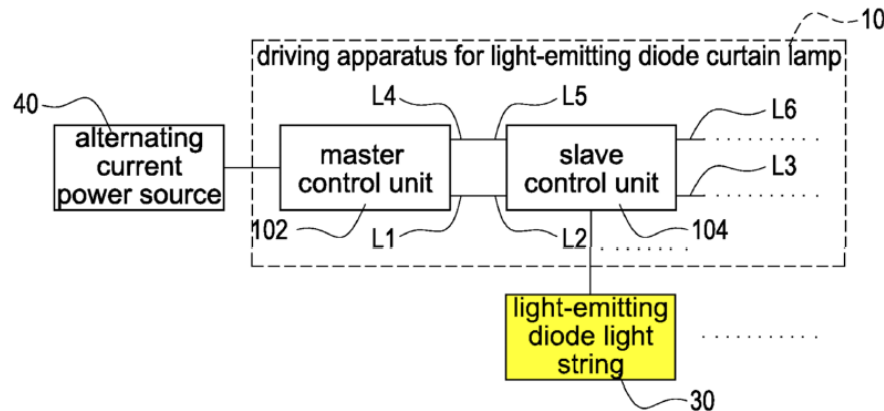


FIG. 4

EX 1001 ('546 patent) at Fig. 4 (cited in Reply at 5)

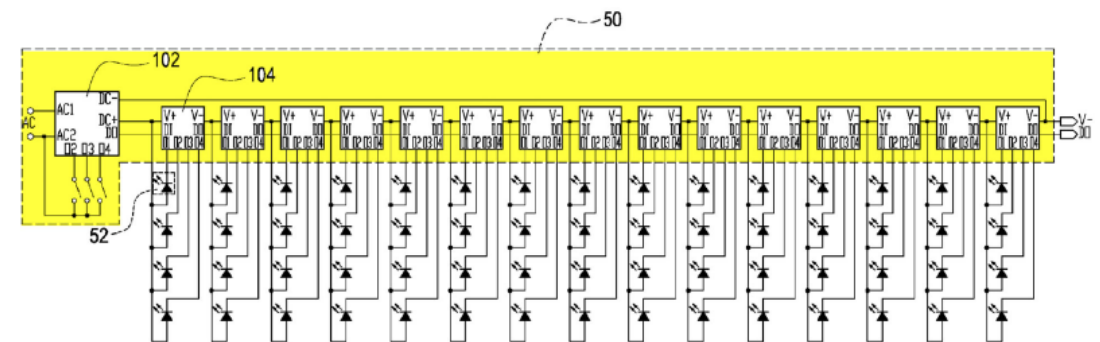


FIG. 7

'546 patent at Fig. 7 (cited in Reply at 5)

Grounds/Claims Disputed by Patent Owner

Ground 3 (Lys)

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:

For purposes of the present disclosure, the 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 (including semi-conductor and organic light emitting diodes), semiconductor dies that produce light in response to current, light emitting polymers, electroluminescent strips, and the like. Furthermore, the term “LED” may refer to a single light emitting device having multiple semiconductor dies that are individually controlled. It should also be understood that 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. The term “LED” also includes LEDs

EX 1008 (Lys) at 33:18-36 (cited in Petition at 25)

Grounds/Claims Disputed by Patent Owner

Grounds 1 (Kuang) and 3 (Lys)

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:

- Minimum configuration for a “curtain lamp” according to the '546 specification is **one LED**. *Reply at 3*

The light-emitting diode light string **30** mentioned above includes a plurality of light-emitting diodes. However, the light-emitting diode light string **30** could include single light-emitting diode. It is called the driving apparatus for light-emitting diode curtain lamp with single light-emitting diode in one light-emitting diode string of the present invention.

'546 patent at 6:15-20 (cited in Reply at 3)

Grounds/Claims Disputed by Patent Owner

Grounds 1 (Kuang) and 3 (Lys)

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 .

Grounds/Claims Disputed by Patent Owner

Claim Construction

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 .
------	---

- **Board:** “transmitting signals related to an activity(ies) occurring at the same time” *Paper 11 at 44*
- **Dr. Schubert:** “signals that are sent to the slave nodes to control their corresponding LED strings at the same time” *Petition at 16-17 (citing Schubert Decl. ¶ 50)*
- **Dr. Lebby:** “signals related to activates governed by synchronized timing” *EX 2001 ¶ 55*

Grounds/Claims Disputed by Patent Owner

Claim Construction

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 .
------	---

- No support for interpreting “synchronous signals” as excluding “control signals” *Reply at 10-14*

[T]he second terminal pin viewed from top to bottom direction **is used to transmit signals for controlling the slave control units 104 to drive the light-emitting diode light strings 30** EX1001 at 3:38-48.

[T]he second terminal pin viewed from top to bottom direction **is used to receive signals from the master control unit 102, to drive the lightemitting diode light string 30** EX1001 at 3:49-58.

[T]he second terminal pin viewed from top to bottom direction **is used to transmit signals for controlling the next slave control units 104 to drive the next light-emitting diode light strings 30** EX1001 at 3:59 to 4:3.

The signal controlling the light-emitting diode light strings 30 is transited to the first slave control unit 104 through the second terminal pin viewed from top to bottom direction in the right side of the master control unit 102. EX1001 at 6:7-10; EX1010, ¶ 32.

Grounds/Claims Disputed by Patent Owner

Ground 1 (Kuang)

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*.

[0054] In some embodiments, the micro-controller 420 provides a range of capabilities and useful features relating to the LED-based lighting fixture 400. For example, the micro-controller 420 may respond to commands from the master node 203 to shut off all or selected ones of the LED units 424. 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. This feature may be useful, for

Kuang at [0054] (cited in Petition at 16-17)

[0035] Via commands or inquiries conveyed over the command/data bus 212, the master node 203 may control, individually or by group, the individual LED units 224 of each LED-based lighting fixture 202. The master node 203 may, for example, command certain LED units 224 to turn on, turn off, dim by a specified amount, intensify by a specified amount, flash (e.g., in emergency situations), or activate according to a predetermined pattern. Dimming may be

Kuang at [0035] (cited in Reply at 12)

Grounds/Claims Disputed by Patent Owner

Ground 1 (Kuang)

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**.

- Dr. Lebby's "propagation delay" argument cannot distinguish Kuang when '546 patent only discloses the same schematics *Reply at 8-9 (citing Schubert Reply Decl. ¶ 27)*

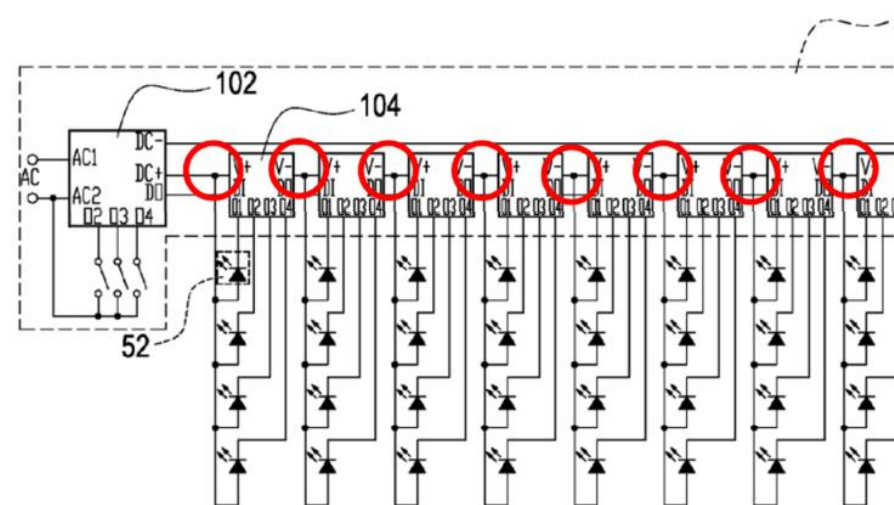


FIG.7

Grounds/Claims Disputed by Patent Owner

Ground 3 (Lys)

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*.

accessories may enhance enjoyment of the pool or spa environment by heating the liquid **22** and/or creating various soothing or invigorating flows of the liquid **22**. In one embodiment of the invention, one or more of the light sources **24A–24I** are controlled in a coordinated fashion with one or more other accessories (e.g., heaters, blowers, filtration and circulation systems, etc.) in the pool or spa environment. In particular, according to one embodiment,

Lys at 10:3-8 (cited in Petition at 33, Reply at 14)

pool or spa. Some illustrative examples of this embodiment include changing illumination conditions in the pool or spa to a particular color when the heater **50** is activated, or changing the illumination conditions to one or more other particular colors when one or more blowers **52** comes on to agitate the liquid **22** in the pool or spa **20**. Similarly, one or more of the light sources **24A–24D** can generate a particular illumination condition in the pool or spa **20** indicating any number of events associated with one or more other devices or accessories associated with the pool or spa **20**.

Lys at 16:56 to 17:2 (cited in Reply at 14)

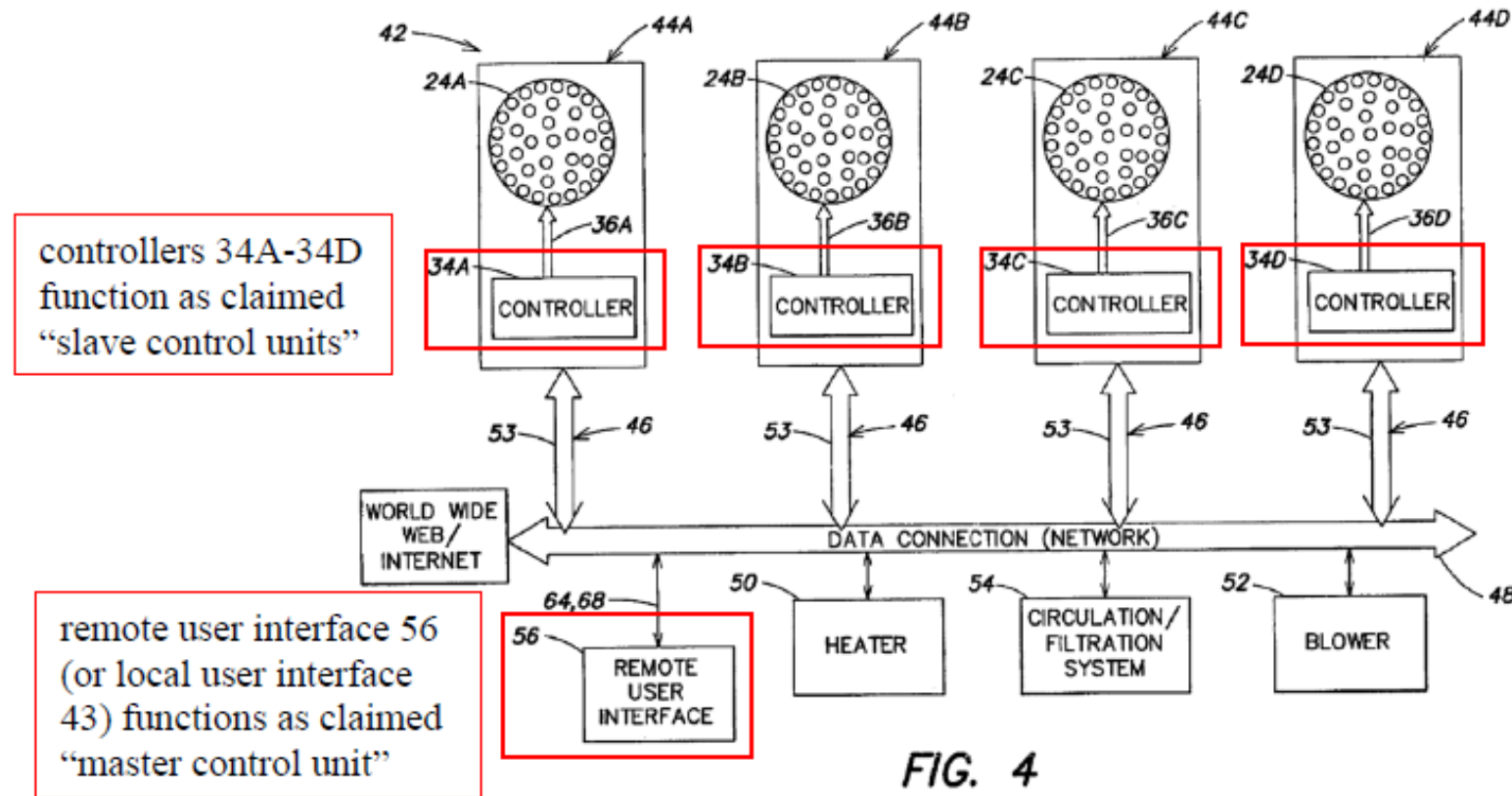
Grounds/Claims Disputed by Patent Owner

Ground 3 (Lys)

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.

Grounds/Claims Disputed by Patent Owner

Ground 3 (Lys) – “master control unit” (Claim 1)

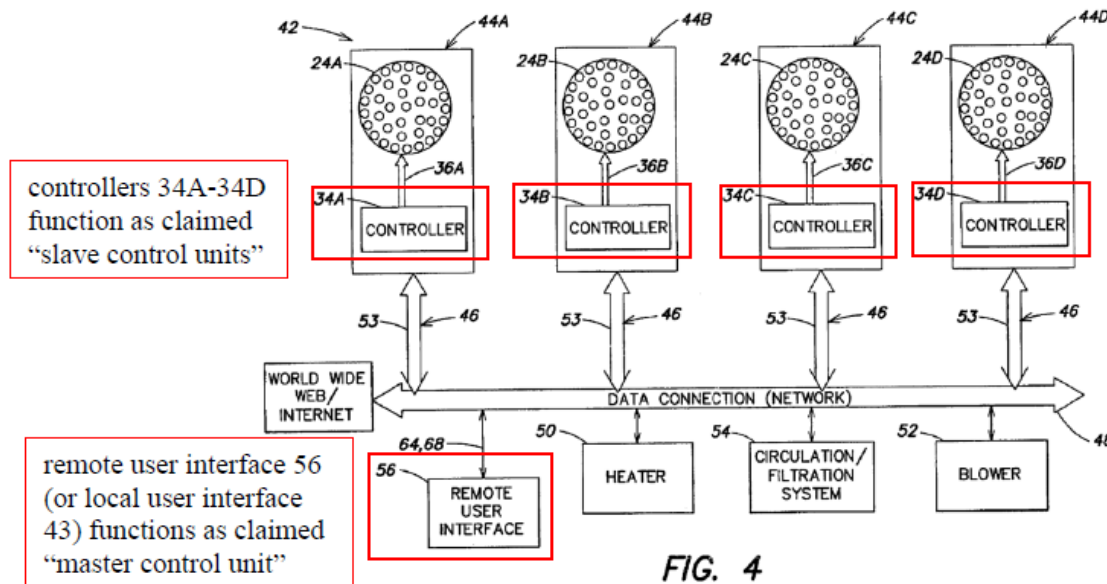


Lys at Fig. 4 (cited in Petition at 29)

Grounds/Claims Disputed by Patent Owner

Ground 3 (Lys) – “master control unit” (Claim 1)

- “user interface” is not just buttons, switches, and dials:
(Reply at 15-16)



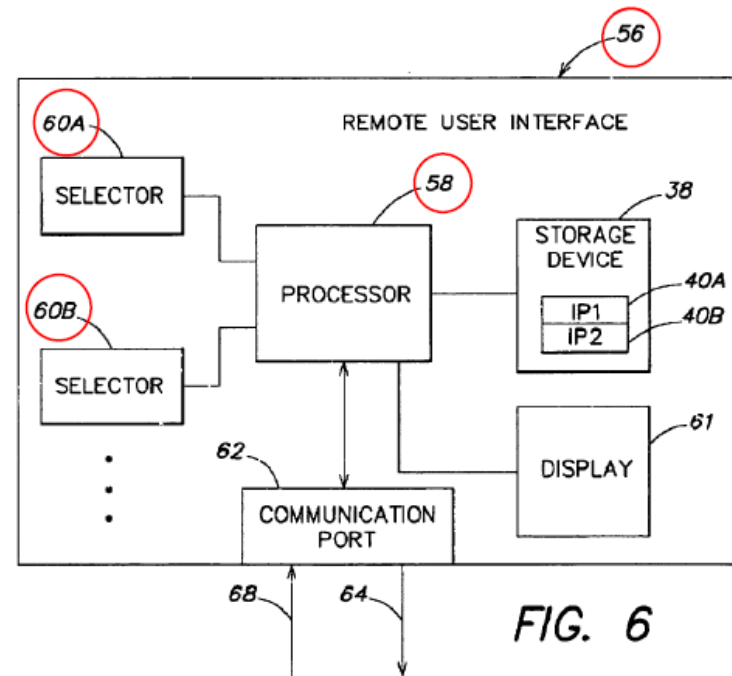
According to one embodiment, a local user interface 43 may be associated with the controller 34 shown in FIG. 2 to facilitate user selection of one or more operating modes of the controller 34 and the light source 24. For example, in one aspect of this embodiment, the local user interface 43 may be a 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. Additionally, according to another aspect of this embodiment, each illumination program may have one or more adjustable parameters, and the local user interface 43 may be employed to vary one or more of the adjustable parameters of the illumination programs.

Lys at 14:17-29 (cited in Petition at 25-26)

Grounds/Claims Disputed by Patent Owner

Ground 3 (Lys) – “master control unit” (Claim 1)

- consider remote user interface 56 as claimed “master control unit”
- consider processor 58 as claimed “microcontroller”
- consider one or more selectors 60A, 60B as claimed “voltage regulator”



Lys at Fig. 6 (cited in Petition at 26-27)

- “selectors” are not simply buttons of remote user interface 56: (Reply at 24-25)

form a networked lighting system. In the embodiment shown in FIG. 5, the remote user interface 56 may include one or more selectors, shown in FIG. 5 as the selectors 60A–60D, to allow a user to remotely control at least one parameter associated with variable color radiation generated by one or more light sources. According to various embodiments of the invention, the selectors 60A–60D may include one or more buttons, adjustable dials, adjustable sliders, adjustable thumb wheels, one or more joy sticks, one or more keypads, touch sensitive pads, switches, and the like.

Lys at 19:61 to 20:3 (cited in Petition at 24)

Grounds/Claims Disputed by Patent Owner

Grounds 2 (Kuang + Debevec) and 4 (Lys + Debevec)

Claim	Limitation
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.

Grounds/Claims Disputed by Patent Owner

Grounds 2 (Kuang + Debevec) and 4 (Lys + Debevec) – “transistor” (Claim 3)

- **Dr. Lebby does not dispute Dr. Schubert’s understanding of a “transistor” as an “electrical switch or valve”** Reply at 18-20 (citing Schubert Reply Decl. ¶¶ 54-56)

transistor An active (commonly three-terminal) semiconductor device capable of amplification, oscillation, and switching action. The name is a

EX 1013 (cited by Reply at 19)

transistor (trăn-zis'tər) An electronic device that controls the flow of an electric current, most often used as an amplifier or switch.

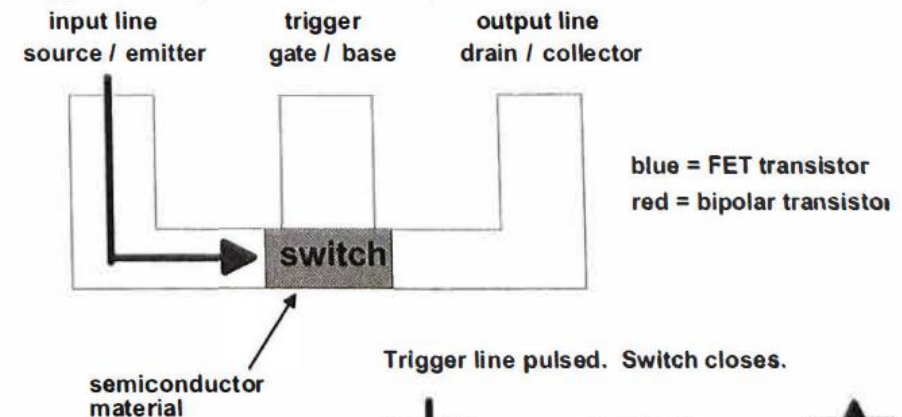
EX 1014 (cited by Reply at 19)

The Transistor Concept

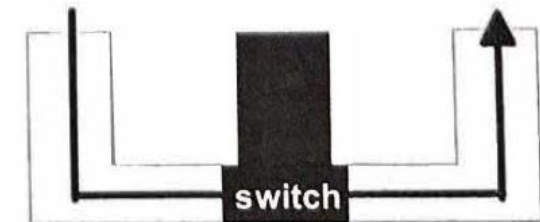
The transistor is an electronic switch. The switching element is made of semiconductor material which conducts electricity when it is pulsed.

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

Trigger line not pulsed. Switch is open.



Trigger line pulsed. Switch closes.



EX 1015 (cited by Reply at 19-20)

Grounds/Claims Disputed by Patent Owner

Grounds 2 (Kuang + Debevec) and 4 (Lys + Debevec) – “transistor” (Claim 3)

- **Dr. Schubert agrees with Dr. Lebbey's opinion that Kuang and Lys already disclose a “transistor”**
Reply at 18-20 (Schubert Reply Decl. ¶ 53)

“*Kuang's* system already has the capabilities of ‘an electronic switch or valve’ because it can switch power to the LEDs and dim the light output.” *EX 2001* ¶ 102

“*Lys* discloses a controller 23 that changes lighting parameters without modification, such as by adjusting a PWM signal or providing variable analog signals. Therefore ... *Lys* already has a type of ‘electric switch or valve.’” *EX 2001* ¶ 106

Grounds/Claims Disputed by Patent Owner

Ground 5 (Hiroyuki)

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.
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

Grounds/Claims Disputed by Patent Owner

Ground 5 (Hiroyuki) – “pin” (Claim 4)

- Dr. Schubert opines that “the words ‘**terminal**’ and ‘**pin**’ typically imply **an electrical end point at which an electrical connection is made to another unit.**” *Reply at 21*

terminal — 1. A point of connection for two or more conductors in an electrical circuit. 2. A device attached to a conductor to facilitate connection with another conductor. 3. A point in a system or communication network at

EX 1016 (cited by Reply at 21)

pin [DES ENG] 1. A cylindrical fastener made of wood, metal, or other material used to join two members or parts with freedom of angular movement at the joint. 2. A short, pointed wire with a head used for fastening fabrics, paper, or similar materials. [ELECTR] A terminal on an electron tube, semiconductor, integrated circuit, plug, or connector. Also known as base pin; prong. { pin }

EX 1017 (cited by Reply at 21)

Grounds/Claims Disputed by Patent Owner

Ground 5 (Hiroiyuki) – “pin” (Claim 4)

- Dr. Schubert opines that “the words ‘**terminal**’ and ‘**pin**’ typically imply **an electrical end point at which an electrical connection is made to another unit.**” *Reply at 21*

The '546 patent only provides schematics without further discussion or depiction of the physical nature of claimed “pins.”
Reply at 22.

A POSITA would understand Hiroiyuki to disclose “pins” because both “terminals” and “pins” imply an electrical end point at which an electrical connection is made to another unit.
Reply at 22.

Grounds/Claims Disputed by Patent Owner

Ground 6 (Hiroyuki)

Claim	Limitation
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:
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.

Grounds/Claims Disputed by Patent Owner

Ground 6 (Hiroyuki)

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

signal processor Any device, (e.g., preamplifier, expander, amplitude limiter, delay network) inserted into or added onto a system to modify an input or output signal.

EX 1013 (cited by Reply at 23)

Grounds/Claims Disputed by Patent Owner

Ground 6 (Hiroyuki)

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

- Dr. Schubert understands that the **filtering** of an electrical signal is an act of **processing** the signal.
Reply at 23-24 (citing Schubert's Reply Decl. ¶ 62)

***Abstract*—The implementation of two recently introduced variable digital filter schemes using a TMS320 series digital signal processor is presented. One is a method for updating the coefficients of an FIR filter**

EX 1011 (cited by Reply at 23)

***Abstract*—Digital filter structures composed of all-pass subfilters have turned out to be very useful in various applications. In this paper, we investigate the implementation of such filters using modern high-speed signal processors. We concentrate on digital all-pass filters realized as**

EX 1012 (cited by Reply at 23)

Grounds/Claims Disputed by Patent Owner

Ground 6 (Hiroyuki)

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

- Dr. Schubert understands that the **filtering** of an electrical signal is an act of **processing** the signal.
Reply at 23-24 (citing Schubert's Reply Decl. ¶ 62)

filter (1) a computer program used to modify the data submitted to its input and sending it to the output.

(2) an optical device that selectively attenuates the intensity of light passing through it according to the light's properties. Common filters attenuate light according to either wavelength or polarization state.

(3) an electronic device that modifies some characteristic of an input signal for conditioning or other purposes. *See* high-pass filter, low-pass filter, bandpass filter.

EX 1018 (cited by Reply at 24)

signal processor Any device, (e.g., preamplifier, expander, amplitude limiter, delay network) inserted into or added onto a system **to modify an input or output signal.**

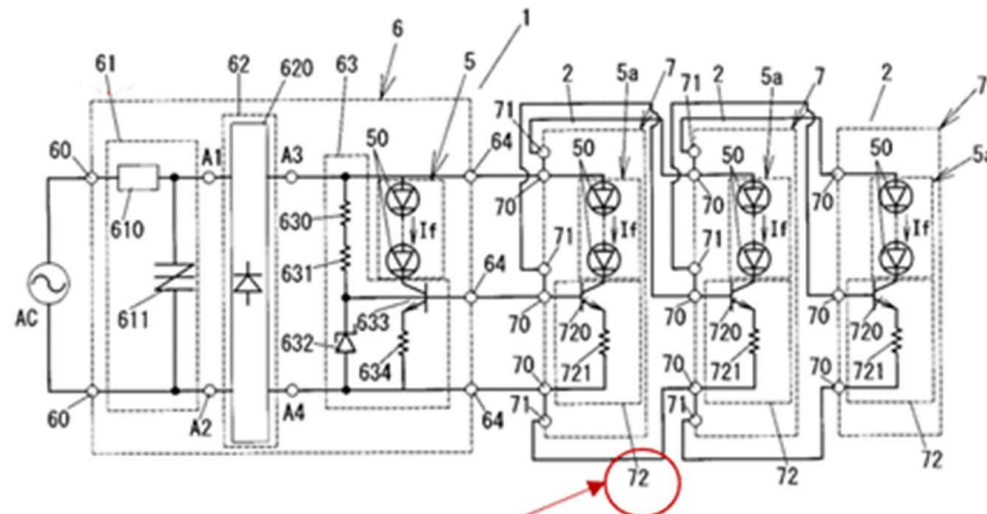
EX 1013 (cited by Reply at 24)

Grounds/Claims Disputed by Patent Owner

Ground 6 (Hiroyuki)

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

- Dr. Schubert understands that the **filtering** of an electrical signal is an act of **processing** the signal.
Reply at 23-24 (citing Schubert's Reply Decl. ¶ 62)



constant current circuit unit 72
acts as a claimed "signal processor"

"The function performed by
Hiroyuki's constant current circuit
unit 72 is essentially a filter."

EX 2001 ¶ 121

Petition at 76

Grounds/Claims Disputed by Patent Owner

Grounds 5-6, 8 (Hiroyuki in view of Kuang)

- A POSITA would have been motivated to add Kuang's microcontroller to Hiroyuki

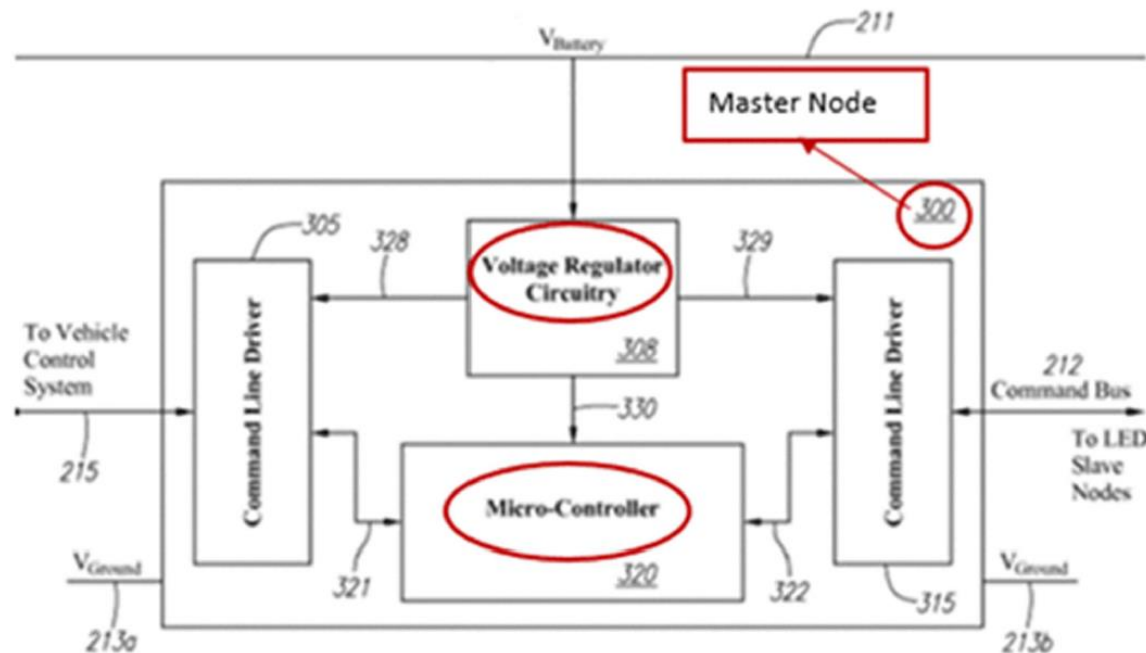


FIG. 3

Petition at 69 (reproducing Kuang at Fig. 3)

[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. Although

Petition at 69 (citing Kuang at [0040])

Grounds/Claims Disputed by Patent Owner

Grounds 5-6, 8 (Hiroyuki in view of Kuang)

- A POSITA would have been motivated to add Kuang's microcontroller to Hiroyuki
 - “supervisory control and logic functions of the lighting control system” with “micro-controller 320” would enable features (such as dynamically flashing LED lights) that are attractive and desirable *Petition at 70 (citing Schubert Decl. ¶ 119)*
 - A microcontroller would have added flexibility in driving LEDs. A microcontroller can be programmed and re-programmed, whereas a hard-wired circuit cannot. The flexibility allows the circuit to be responsive to future needs. *Reply at 25 (citing Schubert Reply Decl. ¶ 68)*
 - A microcontroller would have enabled advanced functionalities of the system by being able to tune lighting parameters such as brightness and color. *Reply at 25 (citing Schubert Reply Decl. ¶ 68)*
 - More advanced functionality enabled by microcontrollers would motivate a POSITA to include a microcontroller (such as Kuang's microcontroller) in Hiroyuki's lighting device. A more advanced functionality would include the ability to individually and collectively address the LED strings, or the LEDs within a string. *Reply at 26 (citing Schubert Reply Decl. ¶ 69)*