

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. 8,124,988

Filing Date: May 28, 2008

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Title: Light Emitting Diode Lamp Package Structure and Assembly Thereof

Inter Partes Review No.: IPR2024-00157

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 8,124,988
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. 8,124,988
1002	Prosecution File History of U.S. Patent No. 8,124,988
1003	Declaration of Dr. E. Fred Schubert
1004	Chinese Patent No. CN201017882Y to Lai
1005	Certified English Translation of Chinese Patent No. CN201017882Y to Lai (“Lai”)
1006	U.S. Publication No. 2008/0087903 to Stoyan (“Stoyan”)
1007	U.S. Publication No. 2004/0240890 to Morgan et al. (“Morgan”)
1008	U.S. Publication No. 2006/0012978 to Allsop et al. (“Allsop”)
1009	U.S. Patent No. 7,473,933 to Yan (“Yan”)
1010	Excerpts from <u>Comprehensive Dictionary of Electrical Engineering</u> (2nd ed. 2005)
1011	Excerpts from <u>The Computer Glossary</u> (8th ed. 1998)
1012	Excerpts from <u>Modern Dictionary of Electronics</u> (7th ed. 1999)
1013	Excerpts from <u>The Illustrated Dictionary of Electronics</u> (8th ed. 2001)

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 1-17, and 20-21 (the “Challenged Claims”) of U.S. Patent No. 8,124,988 (EX1001, the “’988 patent”).

II. STATEMENT OF PRECISE RELIEF REQUESTED

A. Prior Art

The ’988 patent issued from U.S. Patent App. No. 12/153,910 and was filed on May 28, 2008 without any further claims of priority. Therefore, this Petition may refer to May 28, 2008 as either “the priority date” or “the time of the alleged invention.”

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

- Chinese Patent No. CN201017882Y to Lai (EX1005, “Lai”) was published on February 6, 2008. Lai qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(a).
- U.S. Publication No. 2008/0087903 to Stoyan (EX1006, “Stoyan”) was filed on September 26, 2007 and published on April 17, 2008. Stoyan qualifies as prior art at least under pre-AIA 35 U.S.C. §§ 102(b) and (e).

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

- U.S. Publication No. 2004/0240890 to Morgan et al. (EX1007, “Morgan”) was filed on May 10, 2004 and published on December 2, 2004. Morgan qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(b).
- U.S. Publication No. 2006/0012978 to Allsop et al. (EX1008, “Allsop”) was filed on May 16, 2005 and published on January 19, 2006. Allsop qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(b).
- U.S. Patent No. 7,473,933 to Yan (EX1009, “Yan”) was filed on October 26, 2005, and issued on January 6, 2009. Yan qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(e).

B. Grounds for Challenge

This Petition requests cancellation of the Challenged Claims on the following grounds:

Ground	Claims	Basis
Ground 1	1-3, 5-10, 13-14	35 U.S.C. § 103: These claims are obvious over Lai in view of the general knowledge of a POSITA.
Ground 2	4, 11-12	35 U.S.C. § 103: These claims are obvious over Lai in view of Stoyan and in further view of the general knowledge of a POSITA.
Ground 3	1-3, 5-6, 9-10, 13, 16-17, 20-21	35 U.S.C. § 103: These claims are obvious over Morgan in view of the general knowledge of a POSITA.

Ground 4	4, 11-12	35 U.S.C. § 103: These claims are obvious over Morgan in view of Stoyan and in further view of the general knowledge of a POSITA.
Ground 5	16	35 U.S.C. § 103: This claim is obvious over Allsop in view of the general knowledge of a POSITA.
Ground 6	15	35 U.S.C. § 103: This claim is obvious over Lai in view of Yan
Ground 7	15	35 U.S.C. § 103: This claim is obvious over Morgan in view of Yan

III. OVERVIEW OF THE '988 PATENT

The '988 patent generally discloses an “LED lamp package with light emitting diodes, control integrated circuit (IC) and circuit board encapsulated inside a package body.” EX1001, 1:7-11. FIG. 1 illustrates an “LED lamp **10**” with a “package body **19**” that encapsulates a “circuit board **13** mounted with a plurality of LEDs **11**.” *Id.* at 32-41.

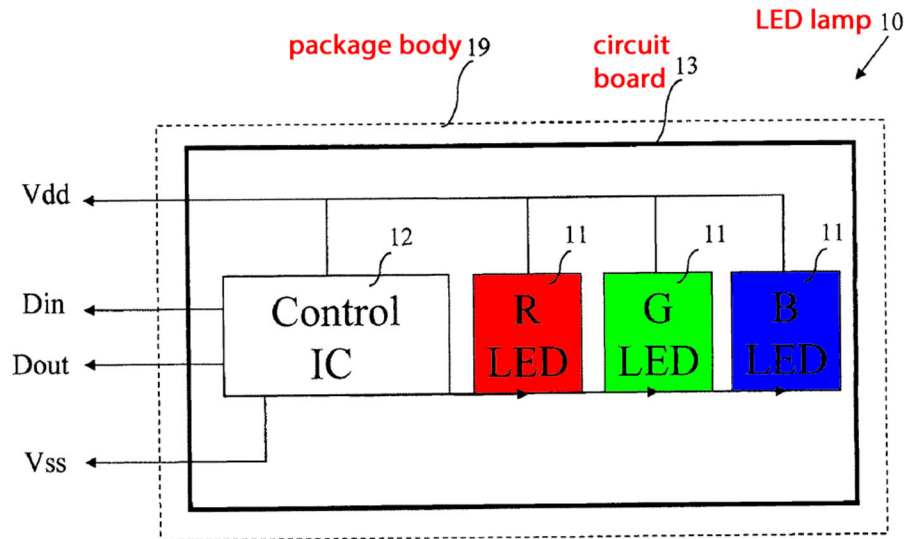


FIG.1

Id. at Fig. 1 (annotated with LEDs highlighted). EX1003, ¶ 28.

The LED lamp has control data pins for the LEDs, and power supply pins to receive a DC voltage:

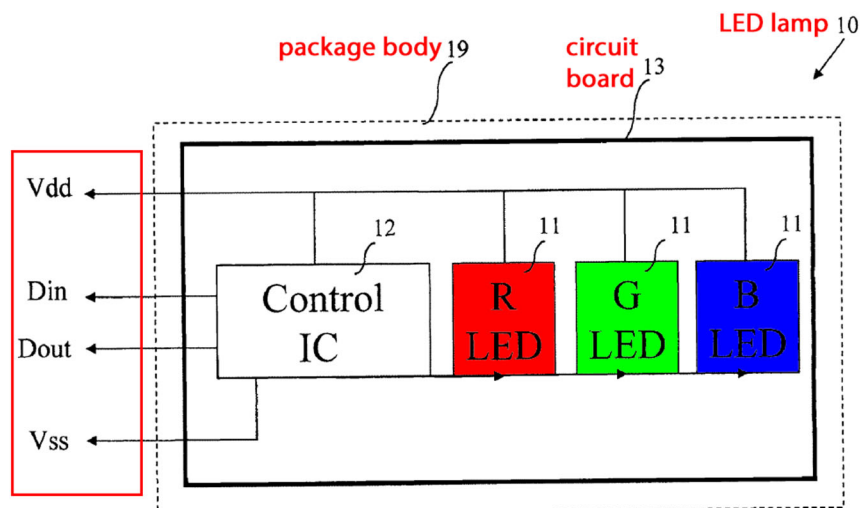


FIG.1

EX1001 at 4:26-31; *id.* at Fig. 1 (annotated with LEDs highlighted). EX1003, ¶ 29.

A. Level of Ordinary Skill in the Art

A person of ordinary skill in the art (“POSITA”) as of May 28, 2008 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, ¶ 32.

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

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).

C. The Challenged Claims of the ’988 Patent

The Challenged Claims are reproduced in Appendix A.

IV. GROUND 1: CLAIMS 1-3, 5-10, AND 13-14 ARE OBVIOUS OVER LAI IN VIEW OF THE GENERAL KNOWLEDGE OF A POSITA

A. Analysis

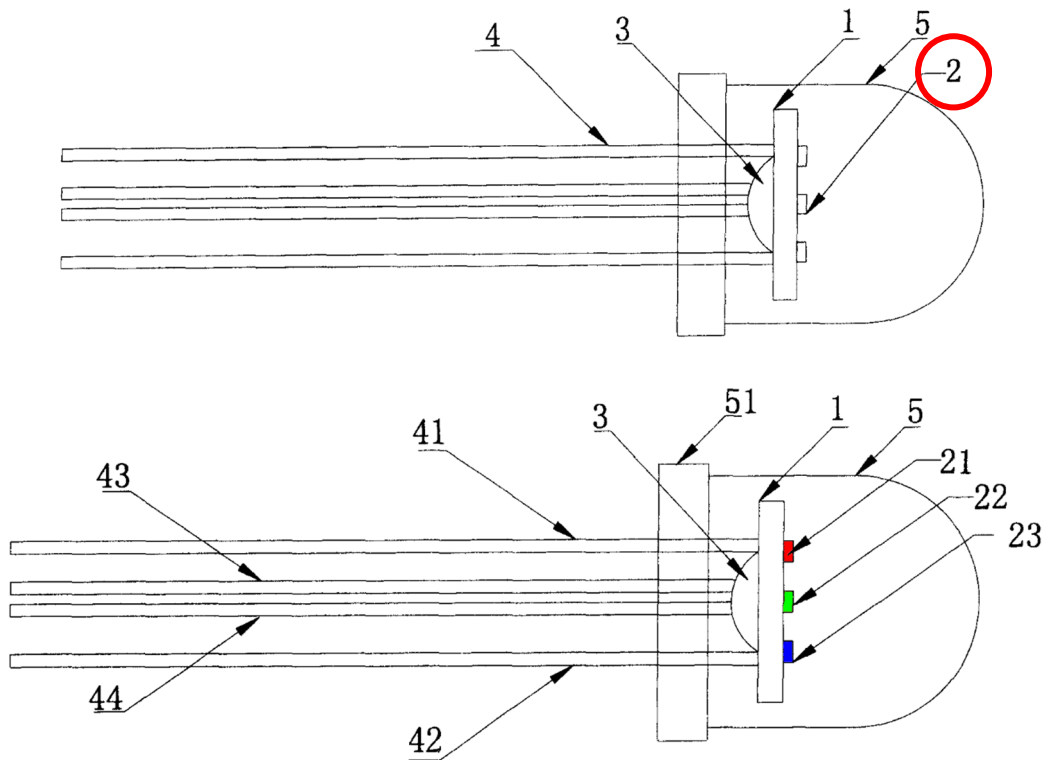
1. Claim 1

a. 1[Pre]: *A LED lamp package structure, comprising:*

Lai discloses “a programmable full-color LED light, comprising LED chips, a control IC board, pins, and a housing[.]” Lai at 3. EX1003, ¶ 35.

- b. **1[A]:** a plurality of light emitting diodes, each light emitting diode having two electrode ends and one of the electrode ends being a common electrode end;

FIG. 1 illustrates an LED lamp with multiple LED chips to control red, green, and blue LEDs. Lai at 4.



Lai, Figs. 1, 2. EX1003, ¶ 36.

Lai discloses LEDs with two electrode ends, one of which is a common electrode end:

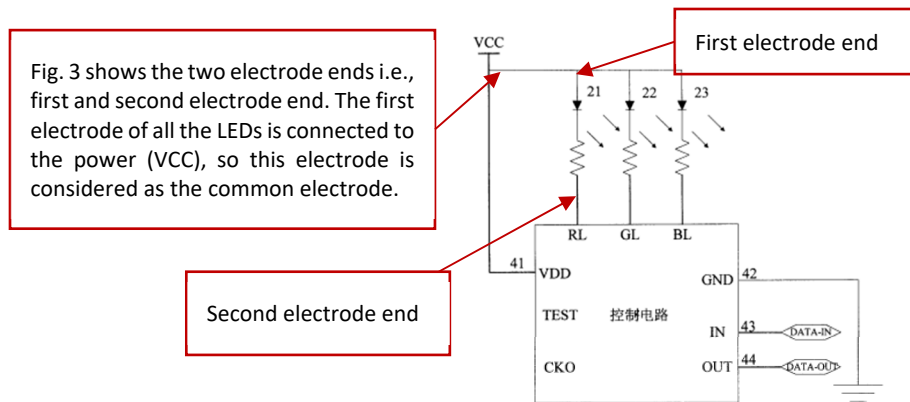


图 3

Lai, Fig. 3; *id.* at 4. EX1003, ¶ 37.

- c. **1[B]:** a control integrated circuit, having a data input electrode, a data output electrode, a positive power-in electrode, and a negative power-in electrode, and electrically connected to the light emitting diodes,

Lai discloses a control integrated circuit with a data input electrode, a data output electrode, a positive power-in electrode, and a negative power-in electrode:

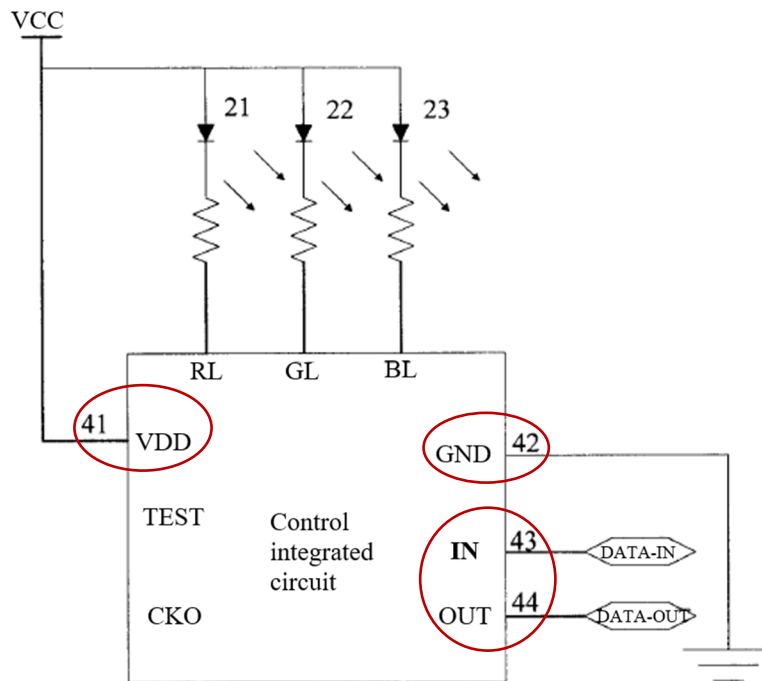


Figure 3

Lai, Fig. 3. A POSITA would have understood FIG. 3 to illustrate a control integrated circuit with a data input electrode (labeled 43), data output electrode (labeled 44), positive power-in electrode (labeled 41 VDD), and negative power-in electrode (labeled 42 GND). *See id.* at 4. A POSITA would have understood that a VDD pin represents positive power voltage connected to the IC and the anodes of the LED chips. A POSITA understands that a GND or ground pin as labeled in FIG. 3 can reasonably be negative supply voltage. The term GND is often used interchangeably with the term VSS, which refers to negative voltage. EX1003, ¶ 38.

The IC in Lai is electrically connected to the LEDs: “[T]he LED chips are fixedly connected to the control IC board and *electrically connected to the control IC[.]*” *Id.* at 3. EX1003, ¶ 39.

- d. **1[C]:** *wherein the control integrated circuit receives external control data via the data input electrode to control the illumination state of each light emitting diode according to the external control data;*

Lai discloses this limitation: “[W]hen using the LED light disclosed in the present utility model, *the emission timing of the red, green, and blue LED chips may be controlled through the built-in driver program in the control IC* to achieve full-color display; by utilizing the data input pin (43) and data output pin (44), the LED light *may be controlled by an external driver program* or a new driver program may be written to the control IC (3) by external means, to realize programmable updates.” Lai at 5. EX1003, ¶ 40.

- e. **1[D]:** *a first conductor, a second conductor, a third conductor, and a fourth conductor,*

Lai discloses four separate conductors:

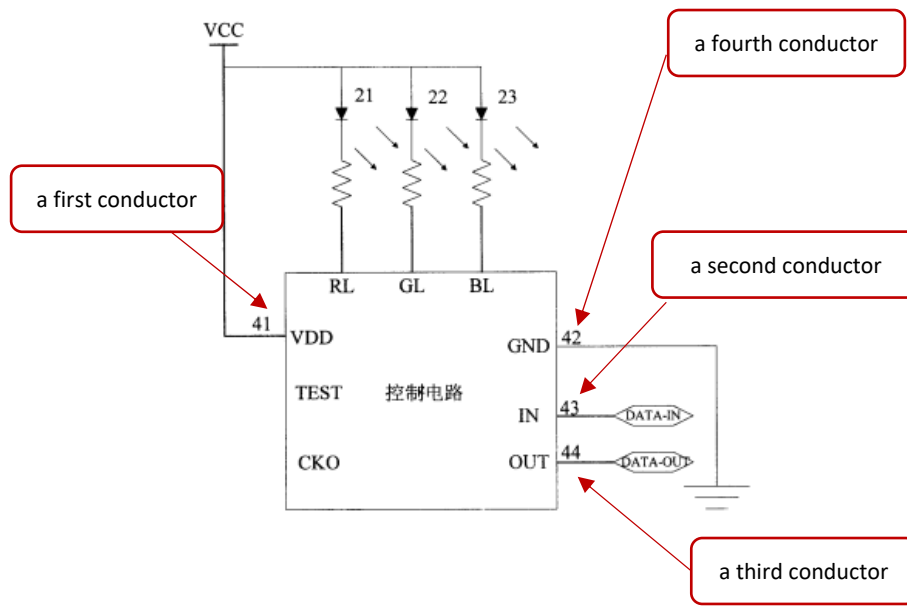
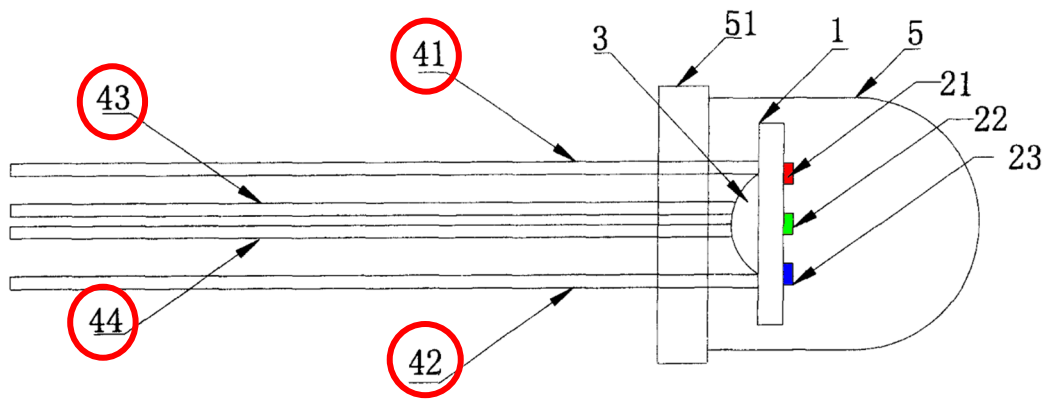


图 3

Lai, Fig. 3. The above-labeled conductors, 41-44, correspond to the “pins” illustrated in FIG. 2:



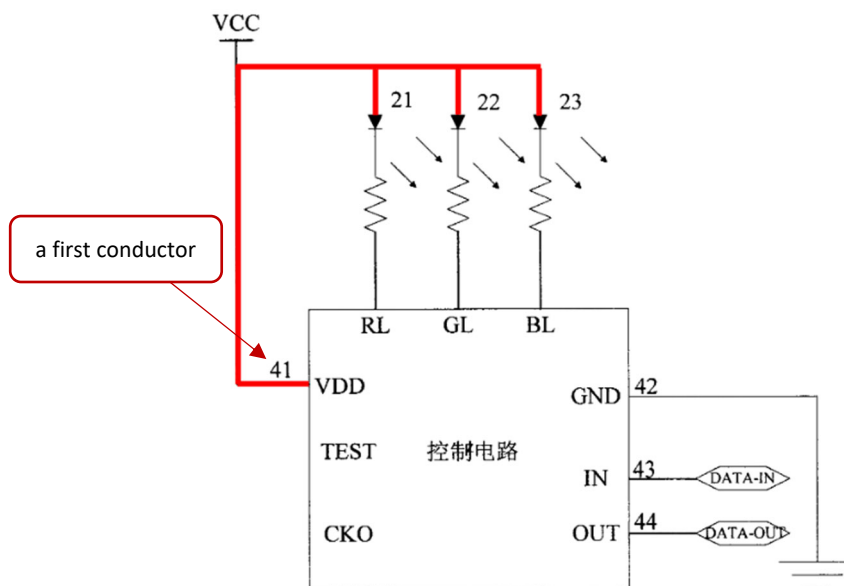
Id. at Fig. 2. As Lai explains, “These pins (4) comprise **a power supply pin (41), a ground pin (42), a data input pin (43), and a data output pin (44)**, each of which is electrically connected to the corresponding terminals of the control IC, namely VCC terminal, GND terminal, data input pin, and data output pin.” *Id.* at 4. A POSITA would have understood the references to “pins” to be metallic conductors.

EX.1013 (“pin” means “[a] slender, straight, stiff prong used as a terminal”).

EX1003, ¶ 41.

- f. **1[E]:** *the first conductor being a positive DC voltage pad and connected to the common electrode of each light emitting diode and the positive power-in electrode of the control integrated circuit,*

The VDD power supply pin (“first conductor”) is connected to both the control IC and the common electrode end of each LED:



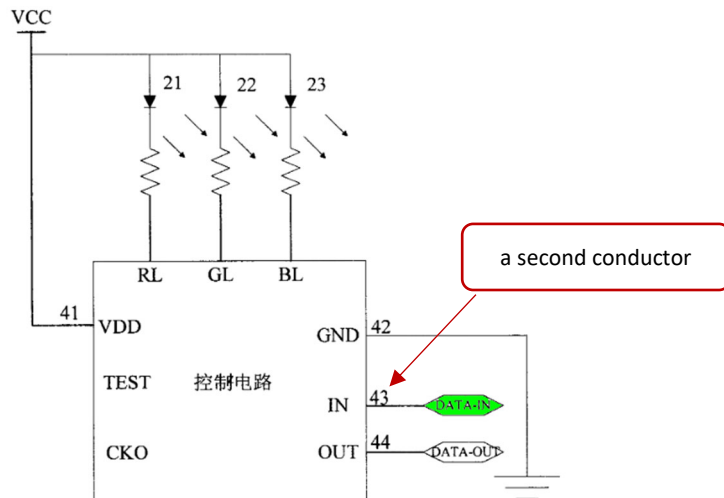
Lai, Fig. 3. EX1003, ¶¶ 42, 43.

A POSITA would have understood the VDD power supply pin to act as a positive DC voltage pad because “VDD” represents positive DC voltage. In electronic circuits having bipolar transistors, VCC stands for the “common collector voltage.” Since NPN transistor are common transistors, VCC typically is a positive voltage. Correspondingly, the emitter voltage is negative and can be

referred to as VEE. In integrated circuits using MOSFETs, there is no collector and emitter, but rather a drain and a source. Since n-channel MOSFETs are common MOSFETs, VDD typically is a positive voltage. Correspondingly, the source voltage is negative and can be referred to as VSS. This is consistent with the '988 patent's disclosure of "negative DC voltage pad (Vss)." (EX1001, 2:13). Additionally, in Lai, VCC and GND are connected to the LED anodes and cathodes (see Figure 3 of Lai) and accordingly are a positive and negative voltage, respectively. Moreover, a POSITA would have understood the terms "pad" and "pin" to both refer to a terminal which connects a device to a mounting substrate. That is, "pad" and "pin" are implementations of a terminal, with both serving the same function. A POSITA would also have understood that a "pad" is a terminal having a flat shape, whereas a "pin" is a terminal having a pointed shape. EX1012 at 535 ("pad" means "[a] *metallized area* on the surface of an active substrate as an integral portion of the conductive interconnection pattern to which bonds or test probes may be applied."); EX.1013 ("pin" means "[a] slender, straight, stiff prong used as a terminal"). EX1003, ¶ 44.

- g. 1[F]:** *the second conductor being connected to the data input electrode,*

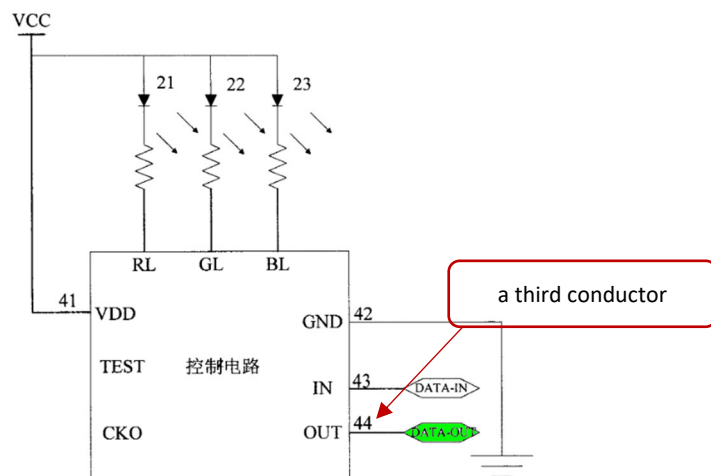
The data input pin 43 (i.e., the "second conductor") is connected to the data input electrode:



Lai, Fig. 3; *id.* at 4. EX1003, ¶¶ 45, 46.

h. **1[G]:** *the third conductor being connected to the data output electrode,*

As illustrated in FIG. 3, The data output pin 44 (“third conductor”) is connected to the data output electrode:



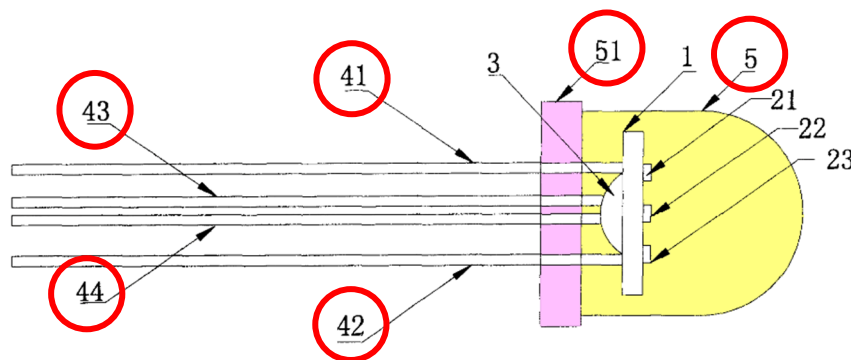
Lai, Fig. 3; *see also id.* at 4. EX1003, ¶¶ 47, 48.

- i. **1[H]:** *the fourth conductor being a negative DC voltage pad and connected to the negative power-in electrode of the control integrated circuit; and*

A POSITA would have understood the ground GND pin (“fourth conductor”) to act as a negative DC voltage pad because the GND pin is where the current exits the control IC. Ground (GND) is neutral and literally connected to the ground (the Earth). Accordingly, when compared to VCC and VDD, GND is more negative, or simply negative. EX1003, ¶¶ 49, 50.

- j. **1[I]:** *a package body encapsulating the light emitting diodes, the control integrated circuit and the conductors, a portion of the first conductor, the second conductor, the third conductor, and the fourth conductor being exposed outside the package body.*

FIG. 2 illustrates the four conductors labeled 41-44 sitting partially outside of the housing 5 and housing base 51:



Lai, Fig. 2 (housing 5 and housing base 51 highlighted). “[The] LED light comprises a substrate (1), LED chips (2), a control IC board (3), pins (4), and *an encapsulating housing (5) ... the pins (4) are extended from the substrate (1) and/or the control IC board (3) to the exterior of the housing (5).* These pins (4)

comprise a power supply pin (41), a ground pin (42), a data input pin (43), and a data output pin (44), each of which is electrically connected to the corresponding terminals of the control IC, namely VCC terminal, GND terminal, data input pin, and data output pin.” *Id.* at 4. EX1003, ¶ 51.

2. Claim 2

- a. *The light emitting diode lamp package structure according to claim 1, wherein the common electrode end is a positive DC voltage pad or a negative DC voltage pad.*

Lai discloses LEDs with two electrode ends, one of which is a common electrode end:

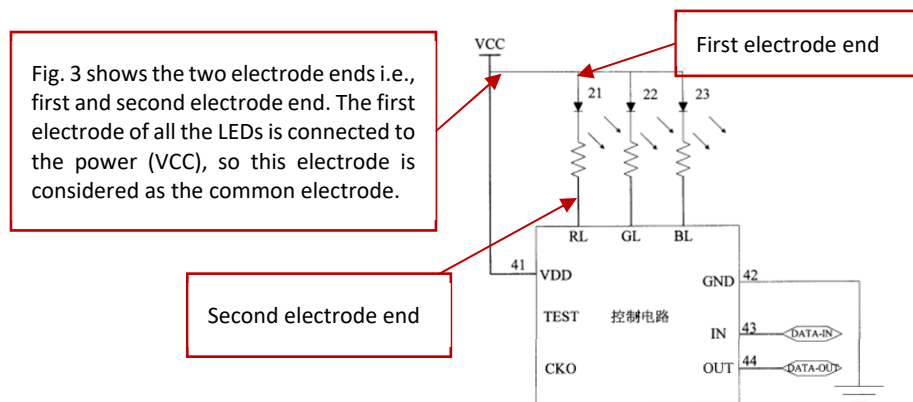


图 3

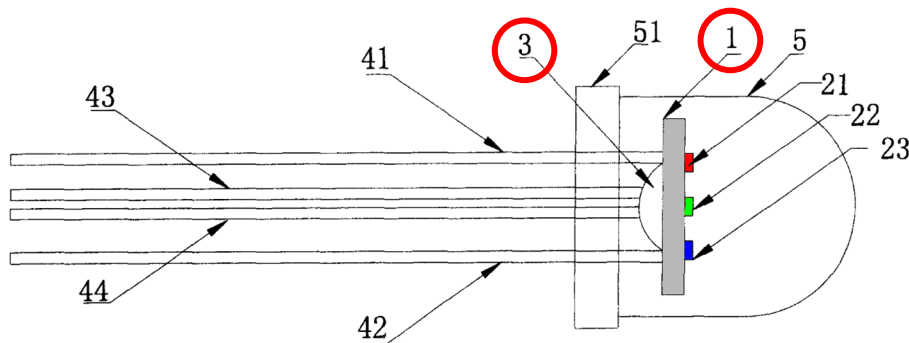
Id. at Fig. 3; *supra* at IV.A.1.b. A POSITA would have understood that the VCC end, which is connected to the common electrode end of the LEDs, typically refers to a positive DC power-supply pin and therefore the common electrode ends act as a positive DC voltage pad. The LEDs shown in Lai’s Figure 3 have their anode (positive terminal) connected to VCC and their cathode (negative terminal)

connected to GND. Accordingly, a POSITA would have understood that VCC is a positive voltage and GND is a negative voltage. Moreover, as explained *supra* at Section VI.A.1.h, a POSITA would have understood the term “pad” to refer to a terminal having a flat shape (amenable for surface mounting). EX1012 at 535 (“pad” definition). Both pad-shaped terminals as well as pin-shaped terminals are suitable for mounting a device on a substrate, such as a printed circuit board. EX1003, ¶ 52.

3. Claim 3

- a. *The light emitting diode lamp package structure according to claim 1, further comprising a circuit board carrying the light emitting diodes and the control integrated circuit.*

Lai discloses a substrate labeled 1 (the claimed “circuit board”) that carries the LEDs and the control IC:



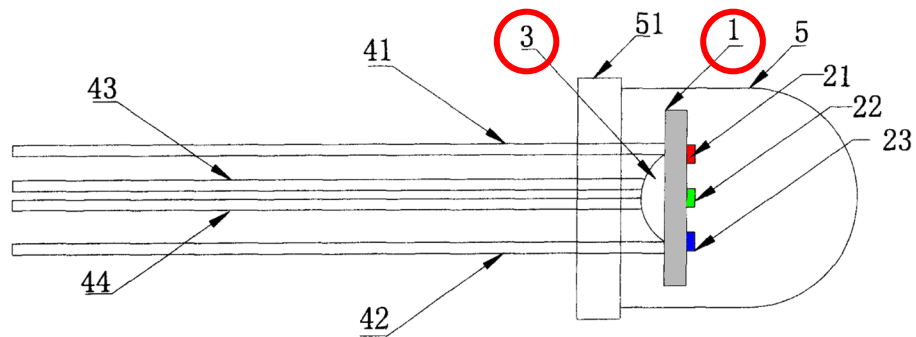
Lai, Fig. 2 (LEDs 21, 22, 23; substrate 1; and control IC board 3). A POSITA would have understood that a “substrate” in electronics refers to the physical material that holds the components of a printed circuit board, and may be

synonymous with a printed circuit board (PCB). EX1010 at 667 (“substrate” means “a dielectric or semiconductor slab over which ... circuit components are fabricated. *This can be a PCB*, a ceramic, or a silicon or other semiconductor wafer that has electronic components interconnected to perform a circuit function.”). See Lai at 3-4. EX1003, ¶ 53.

4. Claim 5

- a. *The light emitting diode lamp package structure according to claim 3, wherein the light emitting diodes are mounted on one surface of the circuit board and the control integrated circuit is mounted on the other surface of the circuit board.*

FIG. 2 shows the LEDs are mounted on one side of the substrate (“circuit board”) and the control IC is mounted on the other surface of the substrate:



Lai, Fig. 2 (LEDs 21, 22, 23; substrate 1; and control IC board 3); see also *id.* at 4. EX1003, ¶ 54.

5. Claim 6

- a. *The light emitting diode lamp package structure according to claim 1, wherein the conductors are an electric conductivity support or a conductive wire.*

An example of the claimed “electric conductivity support” is illustrated in FIG. 5 of the '988 patent as items 21-24:

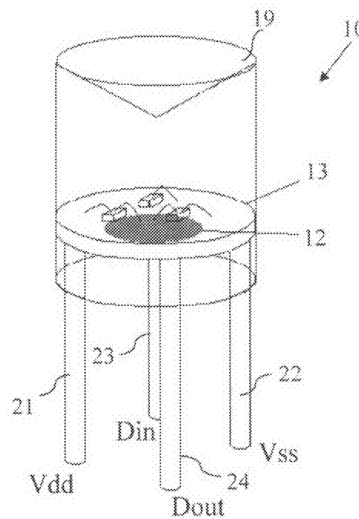
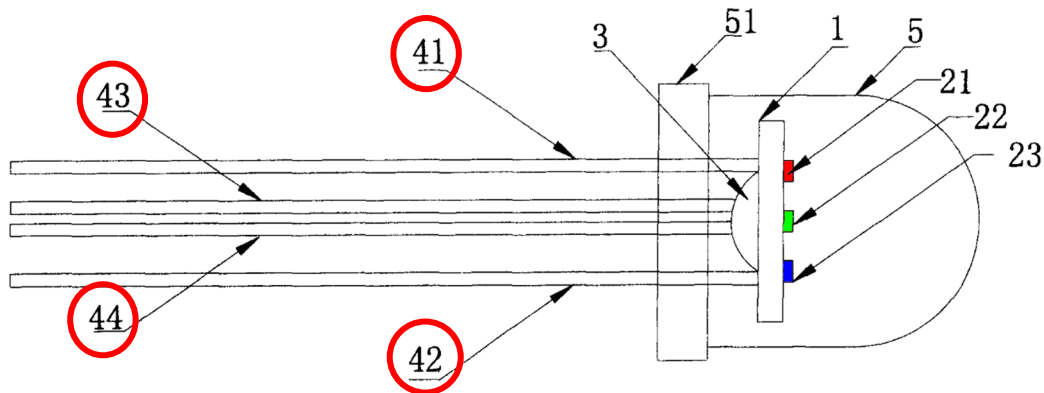


FIG.5

“[T]he package body 19 of the third package structure has a cylindrical shape with *four electric conductivity supports 21, 22, 23, 24* exposed from the bottom of the cylindrical package.” '988 patent at 6:8-11. EX1003, ¶ 55.

The '988 patent's disclosure of “electric conductivity supports” are materially similar to Lai's power supply pin 41, ground pin 42, data input pin 43, and data output pin 44 conductors as illustrated in, for example, FIG. 2:

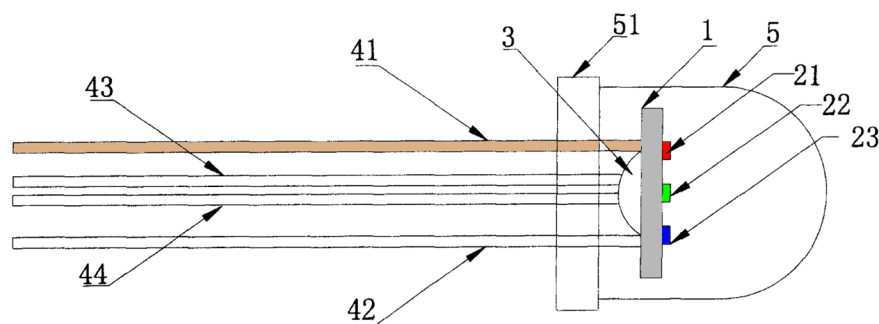


Lai, Fig. 2. Therefore, a POSITA would recognize Lai's pins labeled 41-44 as disclosing conductors that are electric conductivity supports as claimed. EX1003, ¶ 56.

6. Claim 7

- a. *The light emitting diode lamp package structure according to claim 1, wherein the first conductor forms a platform inside the package body, said platform carrying the light emitting diodes, and the first conductor being electrically connected to the light emitting diodes.*

Lai discloses substrate 1 ("circuit board") with LEDs mounted on the substrate:



Lai, Fig. 2 (LEDs 21, 22, 23; substrate 1; and power supply pin 41); *see also id.* at 4. EX1003, ¶¶ 57, 58.

Lai in combination with the general knowledge of a POSITA would have been motivated to modify the first conductor (power supply pin 41) in Lai to form a platform carrying the LEDs. The power supply pin 41 being “extended” from the substrate 1 could form the upper surface of substrate 1 carrying the LEDs.

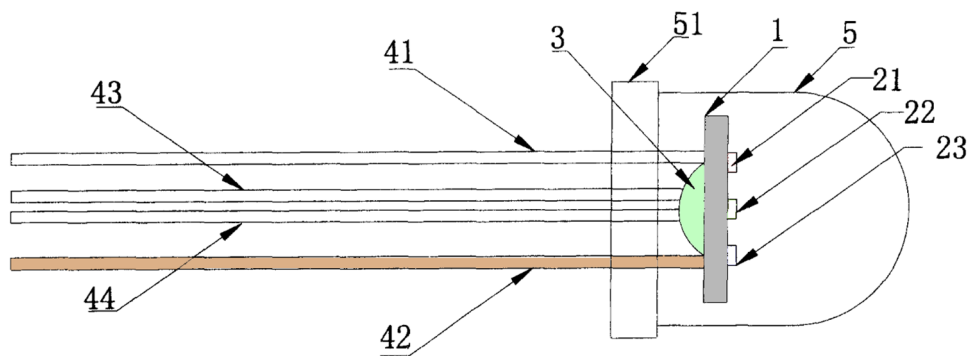
Inspection of Lai’s circuit diagram (Lai’s Figure 3) shows that the anodes of the three LEDs are jointly connected to the VCC supply voltage. Since all three LEDs are electrically connected on the anode side, a POSITA would realize that the LEDs can be mounted on the same conductive substrate such that all three anodes are electrically connected to the substrate. The substrate in turn is connected to VCC through the power supply pin 41. Shared anodes, all connected to Lai’s substrate, would represent a simplification of the electrical interconnections, which a POSITA would have found desirable. That is, a POSITA would have been motivated to keep the electrical interconnection structure simple by mounting the LEDs on a conductive substrate that is electrically connected to the anodes of the LEDs as well as the VCC supply voltage through power supply pin 41.

Furthermore, a POSITA would have realized that a joint conductive substrate would serve as an effective heat sink for the heat generated by the LEDs. This would have further motivated a POSITA to mount the LEDs on a joint substrate and connect their anodes to the substrate. EX1003, ¶ 59.

7. Claim 8

- a. *The light emitting diode lamp package structure according to claim 1, wherein the fourth conductor forms a platform inside the package body, the platform carrying the control integrated circuit, and the fourth conductor being electrically connected to the control integrated circuit.*

Lai discloses substrate 1 (“circuit board”) with the control IC board 3 mounted on the substrate:



Lai, Fig. 2 (substrate 1; control IC board 3; and ground pin 42); *id.* at 4. Lai further explains that “the pins (4) **are extended from the substrate (1)** and/or the control IC board (3) to the exterior of the housing (5). These pins (4) comprise ... a ground pin (42)[.]” *Id.* EX1003, ¶¶ 60, 61.

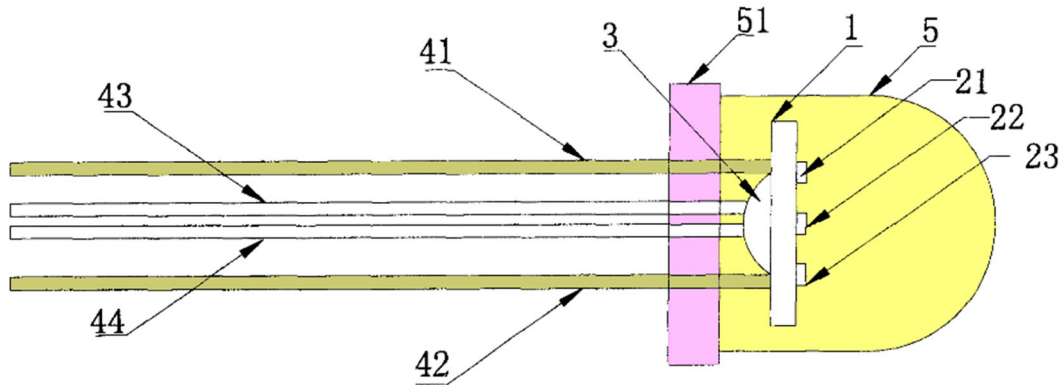
Lai in combination with the general knowledge of a POSITA would have been motivated to modify the fourth conductor (ground pin 42) in Lai to form a platform carrying the control IC. For example, the ground pin 42 being “drawn” from the substrate 1 could form the lower surface of substrate 1 carrying the control IC. Inspection of Lai’s device structure (shown in Lai’s Figure 1) shows

that the control IC is mounted on a substrate. Although the substrate can be a PCB, a POSITA would have been aware of other substrates such as metal substrates including metal platforms that are formed by one of the metal pins of the device. Indeed, this has been very common in the field of LEDs where the LED chips are commonly mounted on the platform or reflector cup formed by one of the leads. The ground lead is suitable to form such a platform onto which the control IC can be mounted. A POSITA would have been motivated to keep the mechanical and electrical structure simple by mounting the control IC on a conductive platform that in turn is grounded. Furthermore, a POSITA would have realized that a conductive substrate (or platform) would serve as an effective heat sink for the heat generated by the LEDs and Control IC. This would have further motivated a POSITA to mount the control IC on a grounded, thermally conductive platform. EX1003, ¶ 62.

8. Claim 9

- a.** *The light emitting diode lamp package structure according to claim 1, wherein the first conductor and the fourth conductor are connected to two opposing sides of the package body, and the second conductor and the third conductor are connected to two opposing sides of the package body.*

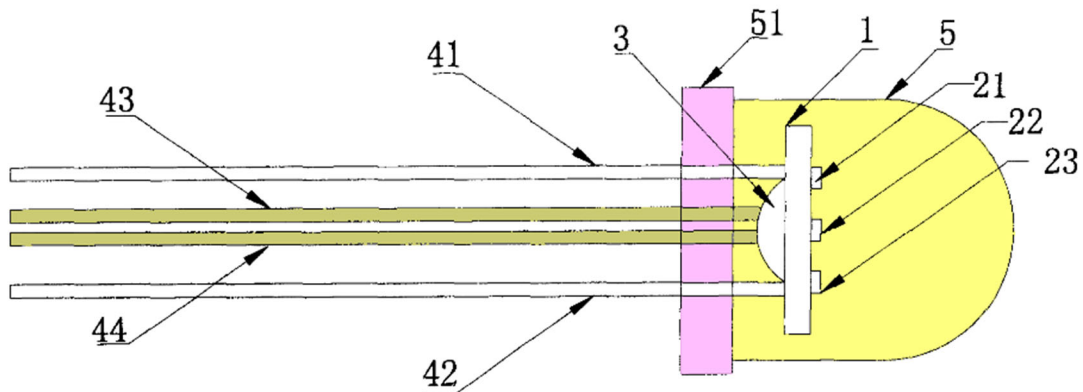
The claimed “first conductor” is the power supply pin 41 (positive voltage), and the claimed “fourth conductor” is ground pin 42 (negative voltage). The “package body” is the package housing 5, which is connected to housing base 51:



Lai, Fig. 2. EX1003, ¶ 63.

A POSITA could interpret the first and fourth conductors to be “connected to two opposing sides of the package body” as claimed given their relative positioning on opposite sides of package housing 5 in FIG. 2. EX1003, ¶ 64.

The claimed “second conductor” is data input pin 43, and the claimed “fourth conductor” is data output pin 44:



Lai, Fig. 2 (package housing 5; housing base 51; data input pin 43; and data output pin 44). EX1003, ¶ 65.

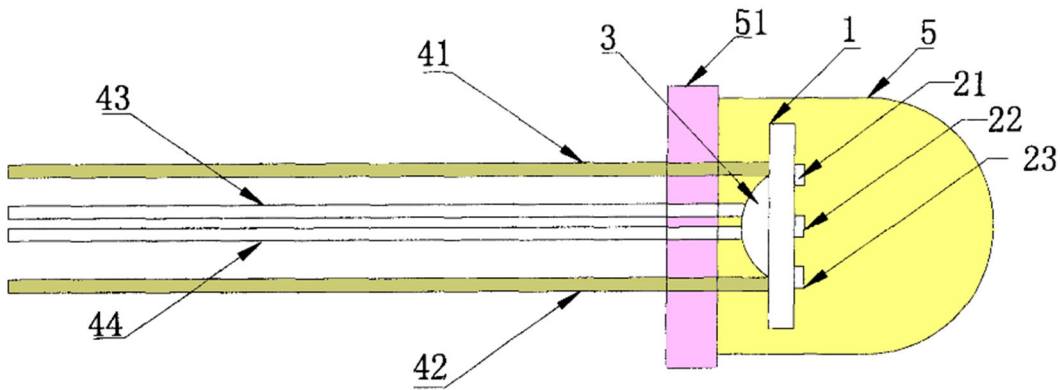
A POSITA would have understood that even though the pins 43 and 44 may not necessarily be illustrated in FIG. 2 as being “connected to two opposing sides

of the package body” as claimed, it would be obvious to modify Lai to ensure that those pins are. A POSITA has general knowledge that conductor placement for electrical connection to a circuit board (“circuit board” is the substrate 1) depends on a variety of factors, including how the circuit board is designed. A POSITA would have been aware that multiple LEDs can be connected in a series circuit in a linear (straight line) manner, reminiscent of a daisy chain. When devices are connected in such a manner, a POSITA would understand that the conductors (leads) advantageously should enter and exit the device package on opposite sides, so that multiple devices can be easily connected in a series circuit manner. A POSITA would be motivated to keep the conductor structure simple and choose a device geometry that has the conductors enter and exit the device package on opposite sides. Similarly, the input data and output data conductors are advantageously located on opposite sides of the package so that they match the layout of a daisy chain geometry. A POSITA would understand that such a geometrical layout would avoid crossing wires. Therefore, Lai in combination with the general knowledge of a POSITA, render the limitation “the first / second conductor and the third / fourth conductor are connected to two opposing sides of the package body” obvious. EX1003, ¶ 66.

9. Claim 10

- a.** *The light emitting diode lamp package structure according to claim 1, wherein the first conductor and the fourth conductor are connected to the same side of the package body, while the second conductor and the third conductor are connected to two opposing sides of the package body.*

The claimed “first conductor” is power supply pin 41, and the claimed “fourth conductor” is ground pin 42. The “package body” is the package housing 5, which is connected to housing base 51:

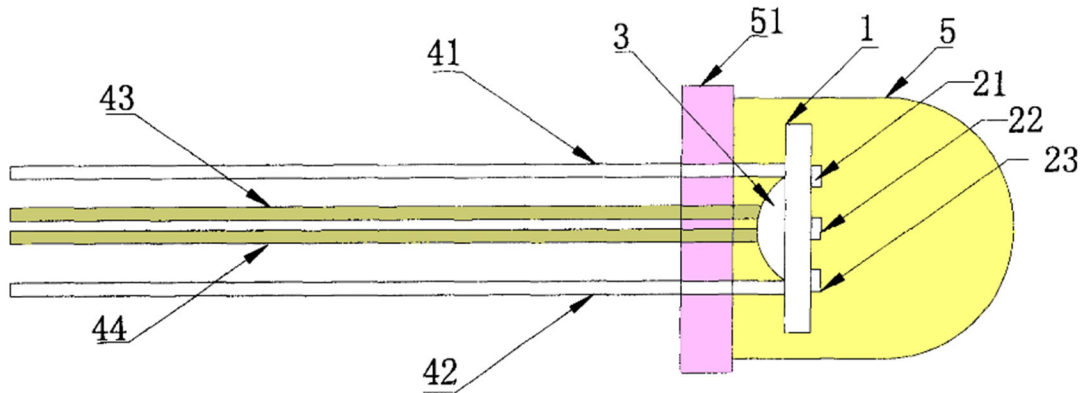


Lai, Fig. 2. EX1003, ¶ 67.

A POSITA could understand the first and fourth conductors to be “connected to the same side of the package body” as claimed given that FIG. 2 can be interpreted as pins 41 and 42 being positioned near the close side of control IC board 3 as compared to pins 43 and 44, which could be interpreted as being positioned near the opposite or far side of control IC board 3 (considering the pins’ relative placement along a plane perpendicular to the flat image in Lai, Fig. 2).

EX1003, ¶ 68.

The claimed “second conductor” is data input pin 43, and the claimed “fourth conductor” is data output pin 44:



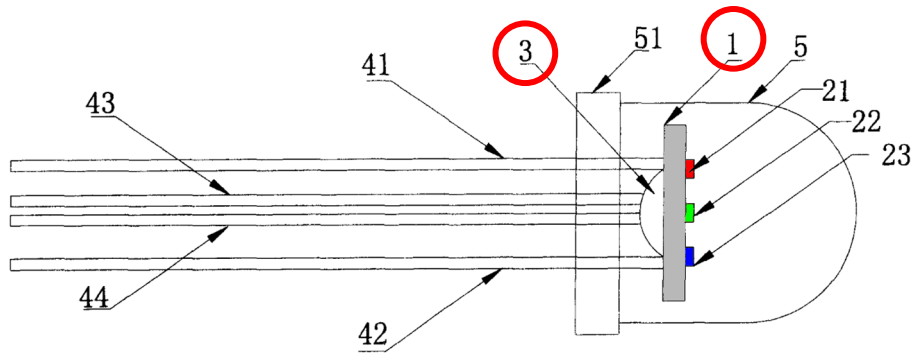
Lai, Fig. 2. EX1003, ¶ 69.

The reasoning regarding “the second conductor and the third conductor are connected to two opposing sides of the package body” in connection with claim 9 applies here. *Supra* at Section IV.A.8. Therefore, Lai in combination with the general knowledge of a POSITA render the limitation “the second conductor and the third conductor are connected to two opposing sides of the package body” obvious. EX1003, ¶ 70.

10. Claim 13

- a. *The light emitting diode lamp package structure according to claim 3, wherein two opposing surfaces of the circuit board each carrying a redlight emitting diode, a green light emitting diode, and a bluelight emitting diode.*

The LEDs are mounted on one side of the substrate (“circuit board”) and the control IC is mounted on the other surface of the substrate:



Lai, Fig. 2 (LEDs 21, 22, 23; substrate 1; and control IC board 3); *id.* at 4.

EX1003, ¶ 71.

Lai in combination with the general knowledge of a POSITA renders this claim obvious. A POSITA would have understood, based on general knowledge of how LEDs are coupled to circuit boards, that any particular arrangement of LEDs – in total number and orientation – is a matter of design choice and would be obvious to try depending on particular lighting needs. For example, if a POSITA would desire omni-directional RGB emission (emission in all directions), he/she would choose to mount two red (R) LEDs on opposing sides of the circuit board, two green (G) LEDs on opposing sides of the circuit board, and two blue (B) LEDs on opposing sides of the circuit board, as claimed. Therefore, the claim would have been obvious to a POSITA. EX1003, ¶ 72.

11. Claim 14

- a. *The light emitting diode lamp package structure according to claim 1, wherein the package body is an injection-molded transparent glue in spherical or hemispherical shape.*

For the components within the package housing 5 (the claimed “package body”) to be secured, Lai explains that “the housing comprises a housing base, wherein the areas between the housing base and the control IC board with the substrate are filled with *insulating thermally conductive gel*.” Lai at 3. EX1003, ¶ 73.

Lai’s Figure 1 reveals that housing (5) is hemispherical as claimed. Therefore, Lai discloses the claim limitation, or at a minimum, it would have been obvious for a POSITA to modify Lai such that the housing base 51 and housing 5 were integrally formed with transparent insulating heat-conducting glue (or gel) to enhance this heat dissipation effect and further preserve its service life. *See* Lai at 4-5. EX1003, ¶ 74.

V. GROUND 2: CLAIMS 4 AND 11-12 ARE OBVIOUS OVER LAI IN VIEW OF STOYAN AND IN FURTHER VIEW OF THE GENERAL KNOWLEDGE OF A POSITA

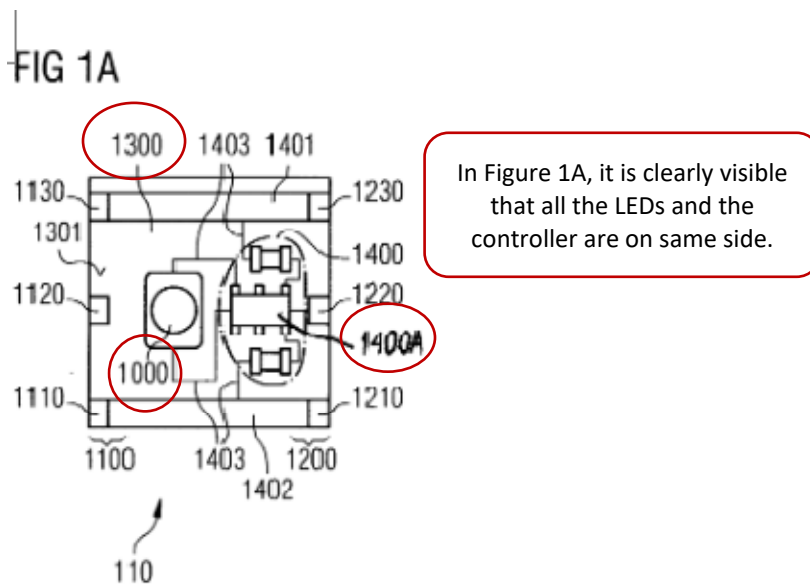
A. Analysis

1. Claim 4

- a.** *The light emitting diode lamp package structure according to claim 3, wherein the light emitting diodes and the control integrated circuit are mounted on the same surface of the circuit board.*

Lai in view of Stoyan discloses the control IC and LEDs being mounted on the same surface of the substrate. EX1003, ¶¶ 75, 76.

Stoyan discloses LEDs 1000 and control integrated circuit 1400A that are mounted on one surface of carrier body or substrate 1300 (“circuit board”):



Stoyan, Fig. 1A. EX1003, ¶ 77.

The radiation emitting semiconductor component 1000 in Stoyan “is a light emitting diode.” See Stoyan at [0063], [0064]. Similar to Lai, Stoyan discloses a

carrier body or substrate 1300 that a POSITA would have understood to be a claimed circuit board. *See* Stoyan at [0047], [0063]. Moreover, Stoyan element 1400A is “an encapsulated microchip” which a POSITA would recognize as a “control integrated circuit” as claimed because the term “microchip” is often used interchangeably for the term “integrated circuit.” EX1011 at 60 (definition of “chip” explaining that “[t]he terms *chip*, *integrated circuit* and *microchip* are synonymous”). EX1003, ¶ 78.

A POSITA would have been motivated to combine Lai with Stoyan to modify the substrate in Lai (“circuit board”) such that the LEDs and control IC are mounted on the same side of the substrate, and would have had a reasonable expectation of success in doing so. Both Lai and Stoyan are from the same field of endeavor, that is, LED packages including a control integrated circuit (IC). A POSITA would be aware of the two options: First, mounting the control IC and the LED chips on opposite sides of the substrate (such as a PCB), as taught by Lai. Second, mounting the control IC and the LED chips on the same side of the substrate (as taught by Stoyan). The latter option will facilitate the fabrication process, because all components are mounted on the same side of the substrate. To facilitate the fabrication process, a POSITA would be motivated to use the process taught by Stoyan (mount the control IC and the LED chips on the same side of the substrate (such as a PCB)). EX1003, ¶ 79.

2. Claim 11

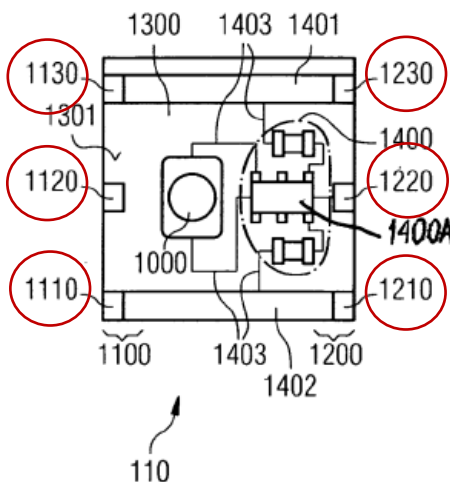
- a. *The light emitting diode lamp package structure according to claim 1, further comprising a fifth conductor and a sixth conductor, the fifth conductor being a positive DC voltage pad and the sixth conductor being a negative DC voltage pad.*

Lai in view of Stoyan discloses a fifth and sixth conductor being another positive DC voltage pad and negative DC voltage pad, respectively. EX1003, ¶¶ 80, 81.

Relevant aspects of Stoyan are summarized *supra* at Section V.A.1. EX1003, ¶¶ 82-83.

Stoyan FIG. 1A also discloses six separate “electrical terminals 1111, 1120, 1130, 1210, 1220, and 1230:

FIG 1A



Stoyan, Fig. 1A. According to Stoyan, the terminal pairs 1130/1230 and 1110/1210 facilitate power distribution to the carrier substrate 1300. Stoyan at [0066]; *id.* [0065]. EX1003, ¶ 84.

Therefore, Stoyan discloses a circuit board with six separate conductors with four of them providing supply voltage. As such, a POSITA would have been motivated to combine Lai with Stoyan to modify the substrate in Lai (“circuit board”) to include two additional conductor pins, one of which being a positive DC voltage pad and the other a negative DC voltage pad to mirror the power supply pin 41 and ground pin 42 as described *supra* in Section IV (Ground 1). EX1003, ¶ 85.

A POSITA would have been motivated to make this modification and would have had a reasonable expectation of success. When arranging LED modules in a linear (serial) manner (as disclosed in Stoyan), it would be advantageous to have a power rail (VCC) and ground rail (GND) reaching all LED modules. A POSITA would have understood that each LED module would then have an input VCC and GND pad on one side (e.g., the left-hand side in Stoyan) and an output VCC and GND pad on the other side (e.g., the right-hand side in Stoyan). Then, the output VCC pad constitutes the claimed 5th conductor and the output GND pad constitutes the claimed 6th conductor. A POSITA would have understood that such

electrical circuit arrangements are advantageous because they avoid crossing wires, as well as well-known and predictable. EX1003, ¶ 86.

3. Claim 12

- a. **12:** *The light emitting diode lamp package structure according to claim 11, wherein the first conductor and the fifth conductor are connected to two opposing sides of the package body, the second conductor and the third conductor are connected to two opposing sides of the package body, while the fourth conductor and the sixth conductor are connected to two opposing sides of the package body.*

The conductors are arranged as follows:

Connected to one side of package body	Connected to opposite side
first conductor positive DC voltage pad	fifth conductor positive DC voltage pad
second conductor data input	third conductor data output
fourth conductor negative DC voltage pad	sixth conductor negative DC voltage pad

A POSITA would have understood that it would be obvious to modify Lai to ensure that the conductor pins are placed as oriented in the above table. A POSITA has general knowledge that conductor placement for electrical connection to a circuit board (in Lai the claimed “circuit board” is the substrate 1) depends on a variety of factors, including how the circuit board is designed. A POSITA would be aware that there are different circuit configurations, specifically the parallel-circuit and series-circuit configuration. Furthermore, a linear layout of devices is

desirable for a string-shaped light source. If a POSITA would desire a parallel electrical circuit configuration with each device being connected to a serial data line, a POSITA would understand that the two positive power connectors (VCC), the two negative power connectors (GND), and the data-in and data-out connectors should each be located on two opposing sides of the package, in order to avoid the crossing of wires. A POSITA would understand that such avoidance of crossing wires is desirable to obtain a clean, retraceable, transparent circuit layout. Lai in combination with the general knowledge of a POSITA renders this limitation obvious because whether one conductor is opposite from or on the same side as another conductor in relation to the package housing 5 is a design choice guided by electrical configurations (parallel or series circuit configuration) as well as the layout configuration (e.g., a linear string), and would have been obvious to try depending on particular lighting needs. EX1003, ¶¶ 87, 88.

VI. GROUND 3: CLAIMS 1-3, 5-6, 9-10, 13, 16-17, 20-21 ARE OBVIOUS OVER MORGAN IN VIEW OF THE GENERAL KNOWLEDGE OF A POSITA

A. Analysis

1. Claim 1

a. 1[Pre]

Morgan discloses an “LED lamp package structure” as illustrated in FIG. 13:

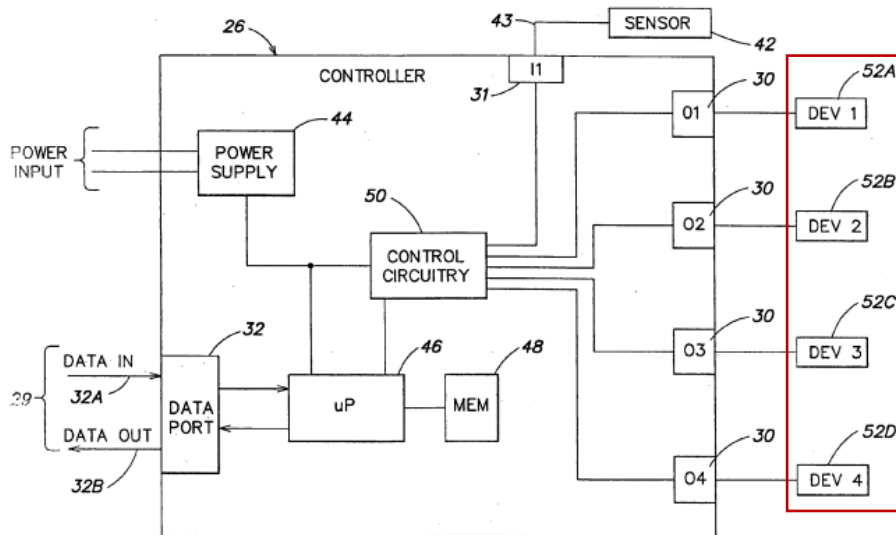


FIG. 2

Morgan at FIG. 2; *id.* at [0090], [0152], [0153]. EX1003, ¶ 90.

Morgan also discloses LEDs with two electrode ends, one of which is a common electrode end. A POSITA would have understood FIG. 5 to disclose these two electrode ends as claimed:

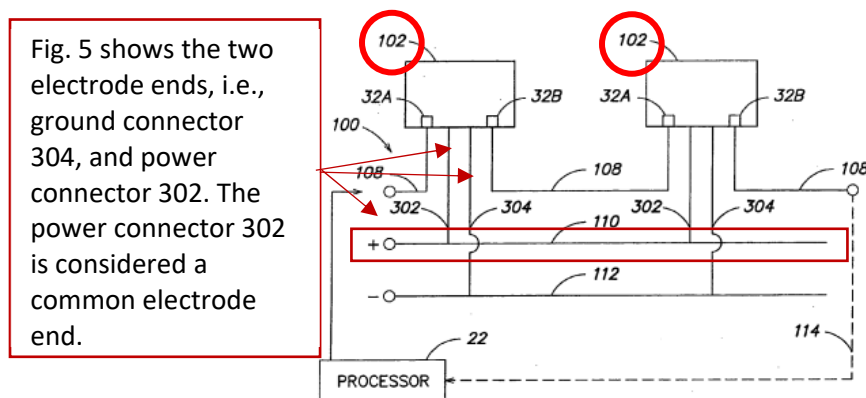


FIG. 5

Morgan at FIG. 5, [0140]. The lighting system 102 as illustrated in FIG. 5 includes the LEDs. *Id.* at [0140]. EX1003, ¶ 91.

c. 1[B]

Morgan discloses a controller 26 (“control integrated circuit”) with a data input electrode, a data output electrode, a positive power-in electrode, and a negative power-in electrode:

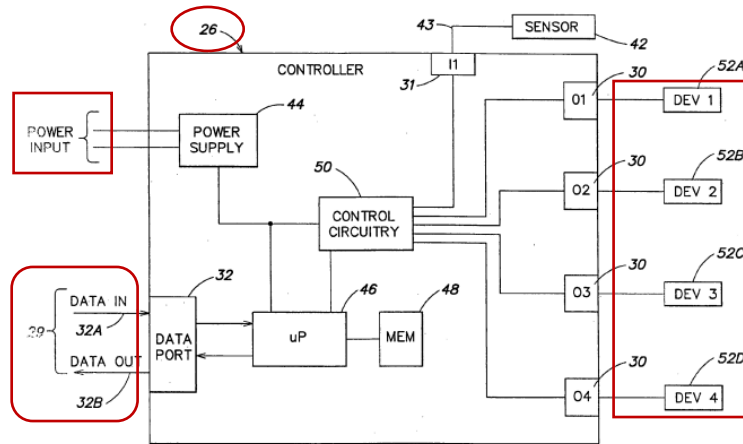


FIG. 2

Morgan at FIG. 2. EX1003, ¶ 92.

“The controller 26 of FIG. 2 also includes control circuitry 50, coupled to a *power supply* 44 and the microprocessor 46.” Morgan at [0089]. A POSITA would have understood the labeled “POWER INPUT” lead pair to include both a positive power-in electrode and a negative power-in electrode as claimed. Morgan has a control integrated circuit that inherently is driven by DC power through a positive power electrode and a negative power electrode. Since Morgan does not specify which one of the two electrodes is the positive and negative one, the top lead may be considered the positive power-in electrode, and the bottom lead negative power-in electrode. EX1003, ¶ 93.

The controller 26 as shown in FIG. 2 “includes a data port 32 having an *input terminal 32A* and an *output terminal 32B*, through which data 29 is transported to and from the controller 26.” *Id.* at [0088]. EX1003, ¶ 94.

Data is outputted to the LEDs via “one or more output ports 30 of the controller 26.” *Id.* at [0090]. EX1003, ¶ 95.

The data output functionality to the LEDs is also shown in FIG. 9, which illustrates a controller 26 (“control integrated circuit”) that transmits “data processing and lighting control functions” to red, green, and blue LEDs:

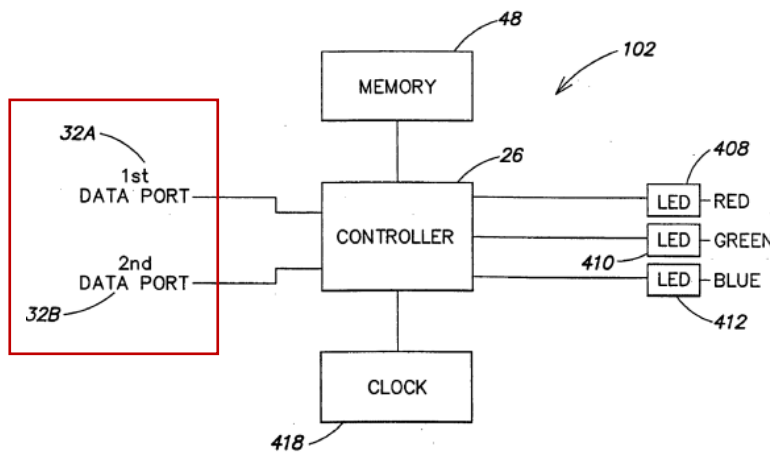


FIG. 9

Morgan at Fig. 9, [0132]. EX1003, ¶ 96.

d. 1[C]

Morgan discloses a controller 26 (“control integrated circuit”) that receives external control data via the data input electrode to control the illumination state of each LED. Morgan at [0132]. Such “data processing and lighting control

functions” include controlling the intensity for the LEDs. *See id.* at [0087].

EX1003, ¶ 97.

e. 1[D]

Morgan discloses four separate conductors:

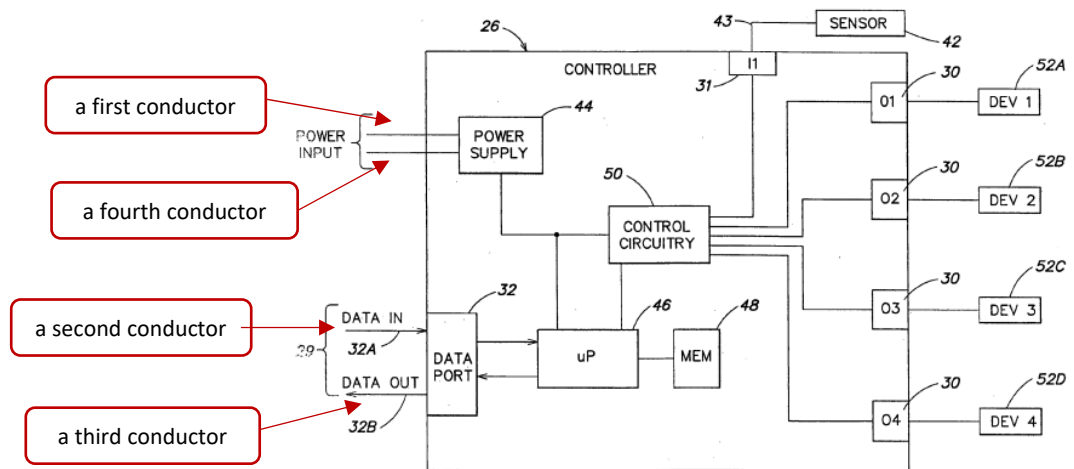


FIG. 2

Morgan at Fig. 2. EX1003, ¶ 98.

f. 1[E]

A POSITA would have understood that the “first conductor” represented in FIG. 2 as corresponding to the “POWER INPUT” positive power-in conductor:

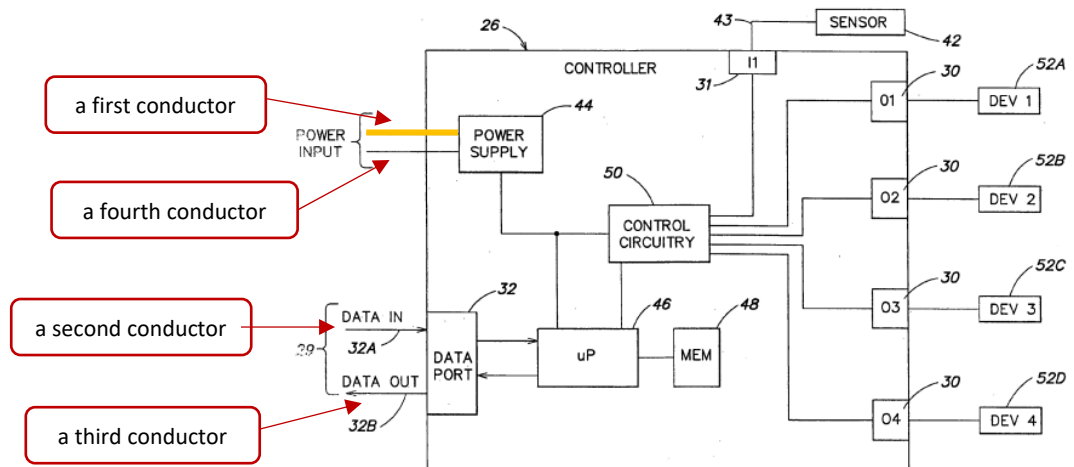


FIG. 2

Morgan at Fig. 2. “The controller 26 of FIG. 2 also includes control circuitry 50, coupled to a *power supply* 44 and the microprocessor 46.” *Id.* at [0089]; *supra* Section VI.A.1.c. A POSITA would have understood the labeled “POWER INPUT” lead pair to include both a positive power-in electrode and a negative power-in electrode as claimed. *Supra* Section VI.A.1.c. EX1003, ¶ 99.

A POSITA would further understand the first conductor to act as a positive DC voltage pad which is connected to the common electrode of each LED. As illustrated in FIG. 5, each “lighting system 102” is connected to a common positive power terminal, which a POSITA would have understood to be a positive DC voltage pad because the LEDs need to be in series with a current-regulating device, such as a transistor, with all LED anodes connected to the positive power voltage and each LED cathode connected to the current-regulating device (such as a BJT (bipolar junction transistor) or FET (field-effect transistor)) which in turn is connected to GND (negative power voltage) and a control input. Furthermore, in

the context of integrated circuit (IC) and lighting devices, terminals (or conductors) frequently have a flat shape that may be described as pad-shaped terminals, pad-shaped conductors, or simply as “pads.” EX1012 at 535 (definition of “pad”). At the periphery of the IC or lighting device, the pad is connected to a wire (which in turn may be called a conductor).

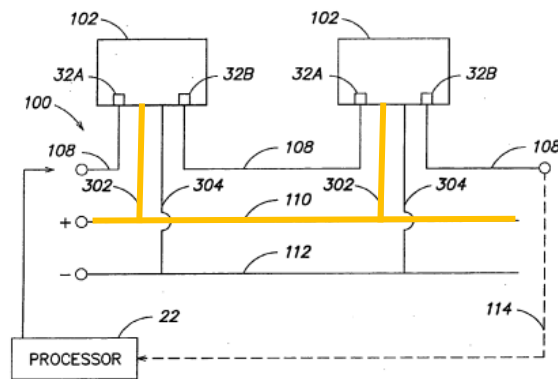


FIG. 5

Morgan at Fig. 5, [0119]. Moreover, item 110 is referred to as a “conductor.” *Id.* at [0143]. EX1003, ¶ 100.

g. 1[F]

A POSITA would have understood that the “second conductor” is represented in FIG. 2 as corresponding to the data input conductor:

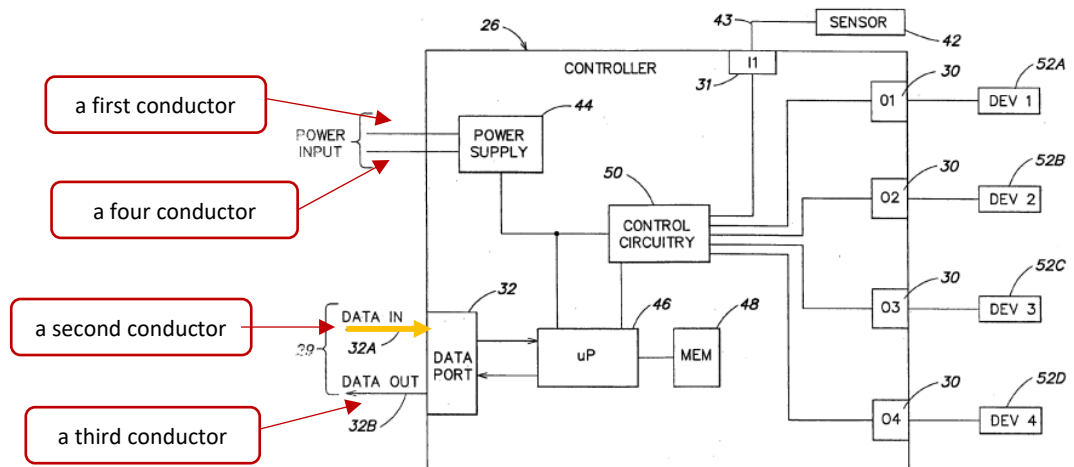


FIG. 2

Morgan at Fig. 2. As explained *supra* at Section VI.A.1.c, the controller 26 as shown in FIG. 2 “includes a data port 32 having an *input terminal 32A* and an output terminal 32B, through which data 29 is transported to and from the controller 26.” *Id.* at [0088]. EX1003, ¶ 101.

h. 1[G]

A POSITA would have understood that the “third conductor” is represented in FIG. 2 as corresponding to the data output conductor:

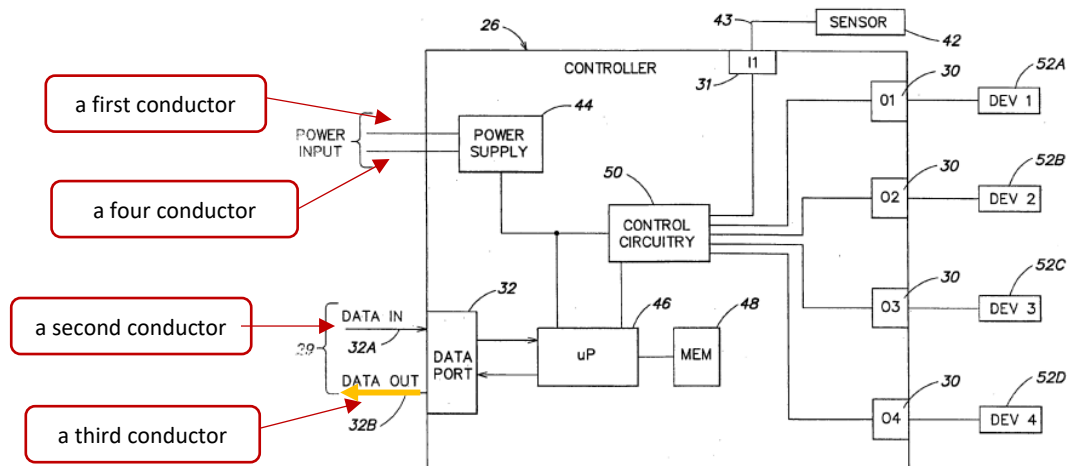


FIG. 2

Morgan at Fig. 2. As explained *supra* at Section VI.A.1.c, the controller 26 as shown in FIG. 2 “includes a data port 32 having an input terminal 32A and an *output terminal 32B*, through which data 29 is transported to and from the controller 26.” *Id.* at [0088]. EX1003, ¶ 102.

i. 1[H]

As explained *supra* in Section VI.A.1.c, a POSITA would have understood that the “fourth conductor” is represented in FIG. 2 as corresponding to the “POWER INPUT” negative power-in conductor:

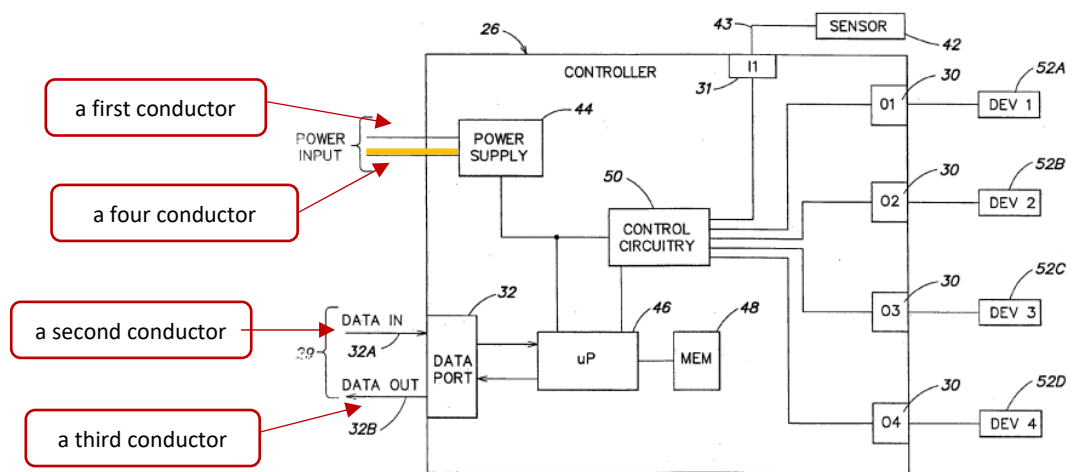


FIG. 2

Morgan at Fig. 2. And as explained *supra* at Section VI.A.1.c, “[t]he controller 26 of FIG. 2 also includes control circuitry 50, coupled to a *power supply 44* and the microprocessor 46.” *Id.* at [0089]. EX1003, ¶ 103.

A POSITA would further understand the fourth conductor to act as a negative DC voltage pad. As illustrated in FIG. 5, each “lighting system 102” is

connected to a common negative power terminal, which a POSITA would have understood to be a negative DC voltage pad:

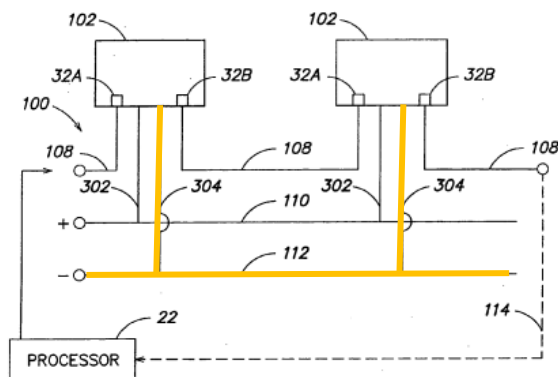
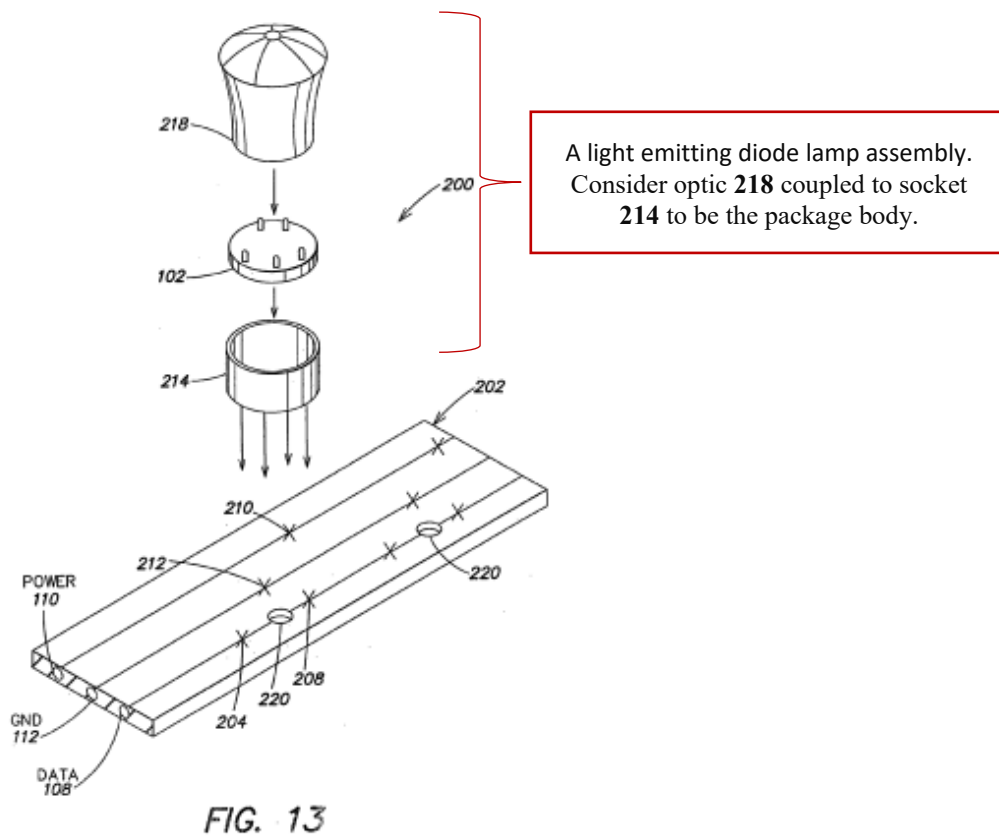


FIG. 5

Morgan at Fig. 5; *id.* at [0119]. A POSITA would have understood the ground 112 connection to act as a negative DC voltage pad because this is where the current exits the controller 26. Furthermore, in the context of integrated circuit (IC) and lighting devices, terminals (or conductors) frequently have a flat shape that may be described as pad-shaped terminals, pad-shaped conductors, or simply as “pads.” EX1012 at 535 (definition of “pad”). At the periphery of the IC or lighting device, the pad is connected to a wire (which in turn may be called a conductor). Moreover, ground (GND) is neutral and literally connected to the ground (the Earth). Accordingly, when compared to VCC and VDD (which are positive voltages as explained *supra* at Section VI.A.1.f (claim element 1[E])), GND is more negative, or simply negative. Moreover, item 112 is referred to as a “conductor.” *Id.* at [0143]. EX1003, ¶ 104.

j. 1[I]

Morgan discloses an optic 218 coupled to a socket 214 (together the “package body”) encapsulating the LEDs, controller 26 (“control integrated circuit”), and the four conductors with a portion of each conductor being exposed outside the optic 218 and socket 214:



Morgan at Fig. 13. The optic 218 is connected to the socket 214 (either removably connected or sealably connected). *Id.* at [0142]. EX1003, ¶ 105.

FIG. 14A illustrates the lighting system 102 that is encapsulated within the optic 218 and socket 214 (together the “package body”):

This fig. 14A shows a lighting system 102 that includes a plurality of LEDs mounted on the top side and a number of electrical connectors on the bottom side of the lighting system 102, i.e., a first data port 32A, a second data port 32B, a ground connector 304, and a power connector 302.

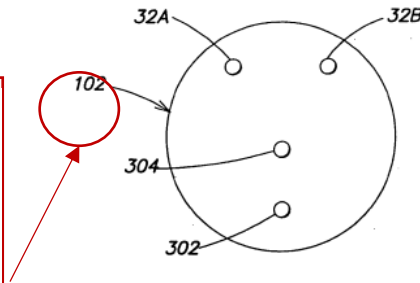


FIG. 14A

Morgan at Fig. 14A. The “lighting system 102” includes several “electrical connectors” for the four conductors. *Id.* at [0140]. EX1003, ¶ 106.

The socket 214 has conductivity supports to enable connectivity to four conductors partially exposed outside the package body:

This figure 14B shows the connectors 312, 314, 320 and 318 of socket 214 that include holes. These holes are used to align with and accommodate the light emitting diodes and enable the four electric conductivity supports.

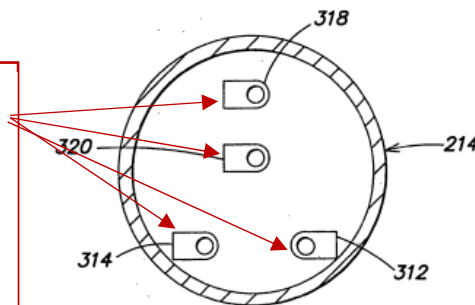


FIG. 14B

This figure 14A shows the four electric conductivity supports i.e., connectors 32A, 32B, 304 and 302 of the lighting system 102.

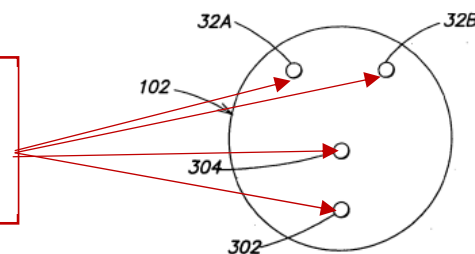


FIG. 14A

Morgan at Figs. 14A, 14B. Socket 214 “may be positioned on the conduit 202, and screws or other electrically conductive fasteners may be used to electrically and physically connect the socket 214 to the conduit 202.” Morgan at [0141]. The placement of the “connectors 312, 314, 320 and 318 of socket 214 may be arranged to be electrically connected with the conductors in the conduit 202.” *Id.* at 140. In turn, these socket connectors are arranged to match the corresponding placement of connectors 32A, 32B, 304 and 302 on the bottom side of the lighting system 102. *See id.* at 140. EX1003, ¶ 107.

This physical arrangement results in conductors for power 110, ground 112, and data 108 being partially within and partially outside of the package body:

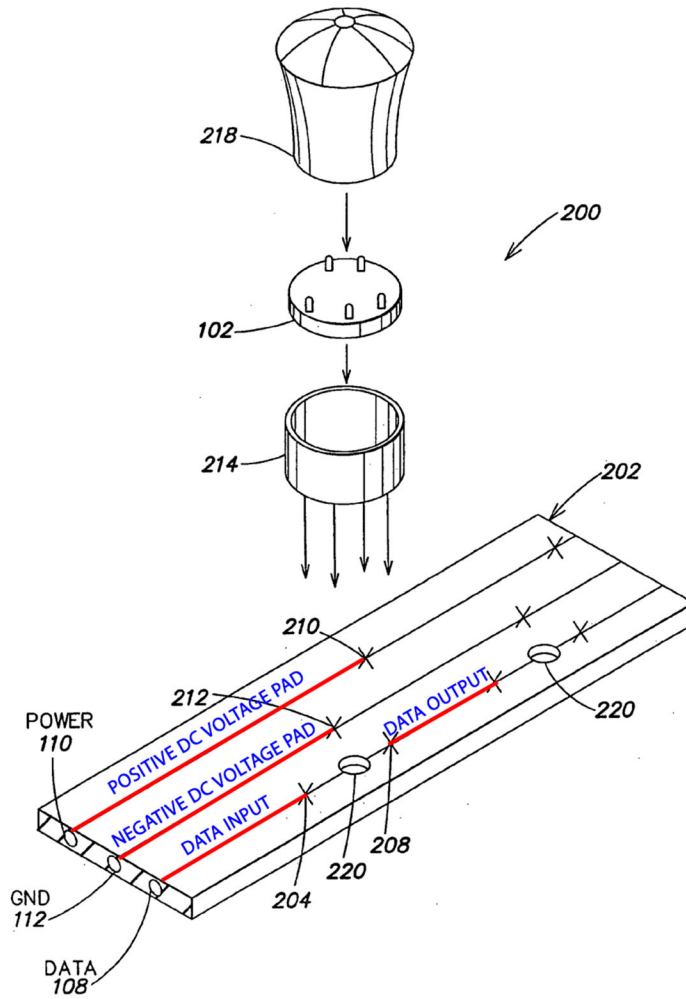


FIG. 13

Morgan at Fig. 13; *id.* at [0141]. EX1003, ¶ 108.

2. Claim 2

As explained *supra* at Section VI.A.1.b, Morgan discloses LEDs with two electrode ends, at least one of which is a common electrode end:

Fig. 5 shows the two electrode ends, i.e., ground connector 304, and power connector 302. The power connector 302 is considered a common electrode end.

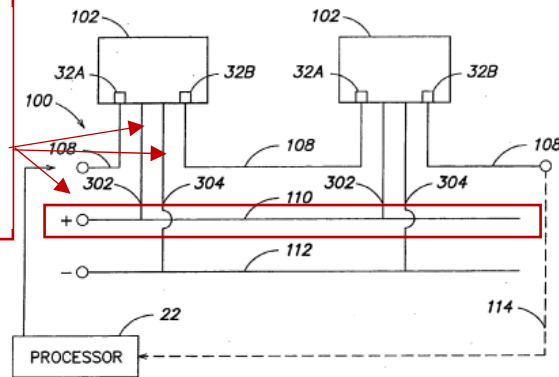


FIG. 5

Morgan at FIG. 5. EX1003, ¶ 109.

A POSITA would understand the common electrode end to connect to the first conductor which acts as a positive DC voltage pad. Each “lighting system 102” is connected to a common positive power terminal, which a POSITA would have understood to be a positive DC voltage pad:

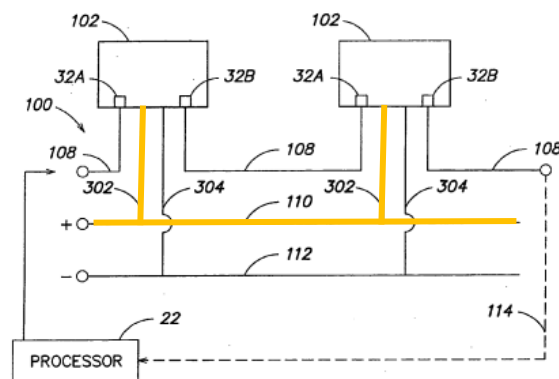


FIG. 5

Morgan at Fig. 5; *id.* at [0119]. Moreover, item 110 is referred to as a “conductor.” *Id.* at [0143]. The LEDs need to be in series with a current-regulating device, such as a transistor, with all LED anodes connected to the positive power voltage and each LED cathode connected to the current-regulating device (such as a BJT

(bipolar junction transistor) or FET (field-effect transistor)) which in turn is connected to GND (negative power voltage) and a control input. For this configuration, npn BJTs or n-channel FETs are the preferred choice to regulate the LED current (due to their low ON resistance). Accordingly, a POSITA would understand that connecting all LED anodes to the power positive voltage is an advantageous and preferred configuration. EX1003, ¶ 110.

3. Claim 3

Morgan discloses a lighting module 900 and lighting system 102 (either can be “circuit board”) that carries the LEDs and the controller 26 (“control integrated circuit”):

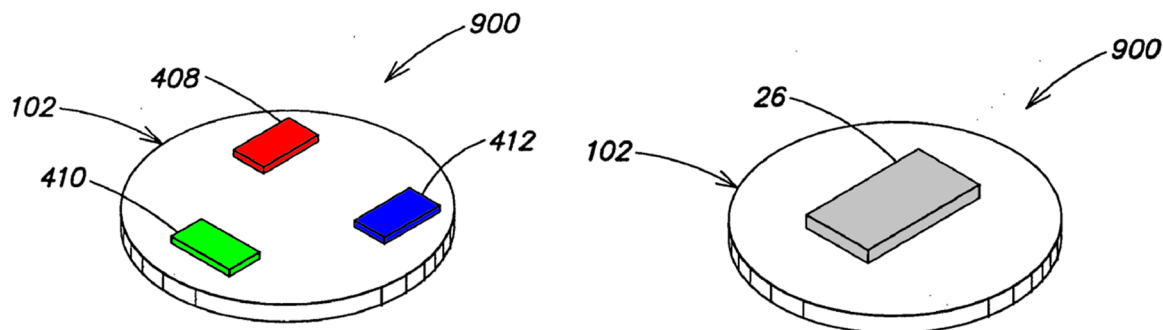


FIG. 16A

FIG. 16B

Morgan at Figs. 16A, 16B (LEDs colored red, green, and blue; controller 26 colored gray). A POSITA would have understood that the lighting module 900 or lighting system 102 in Morgan acts as a circuit board because it facilitates

connectivity between the LEDs and controller 26. *See* Morgan at [0144].

EX1003, ¶ 111.

4. Claim 5

As shown *supra* at Section VI.A.3, the LEDs are mounted on one side of the lighting module 900 and lighting system 102 (either satisfying the claimed “circuit board”) and the controller 26 (the claimed “control integrated circuit”) is mounted on the other side. EX1003, ¶ 112.

5. Claim 6

As explained *supra* at Section VI.A.1.j, there are four conductors in the conduit 202:

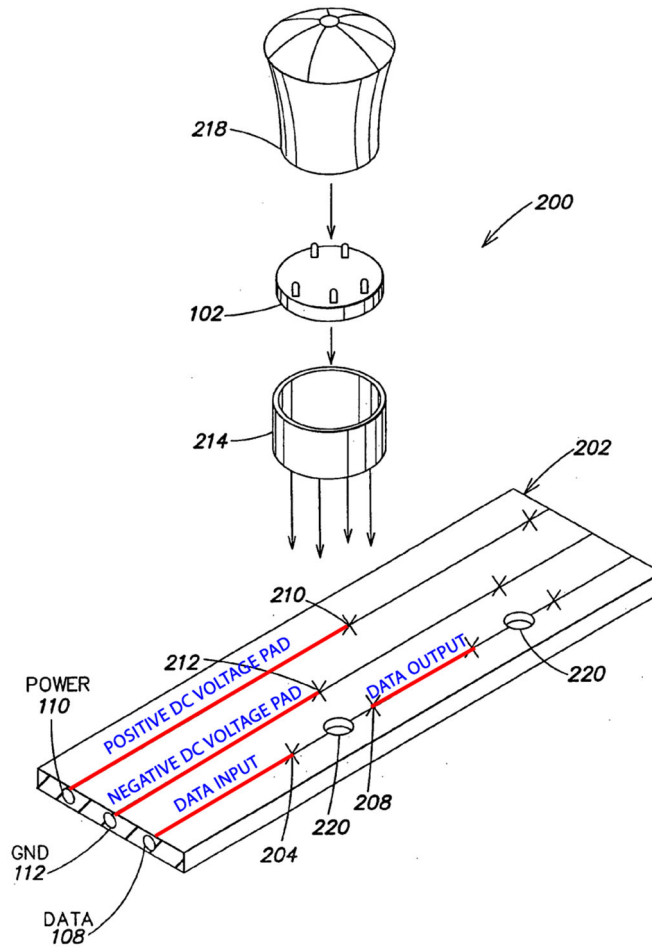


FIG. 13

Morgan at Fig. 13. A POSITA would have understood that a conduit in this context includes tubular channels designed for holding wires or cables. EX1012 at 146 (“conduit” means “A tubular raceway designed for holding wires or cables”); EX1013 at 140 (“conduit” means “A hollow tube, made of plastic or metal, through which wires, cables, and other transmission media are fed.”). This understanding is reinforced by Morgan, which discloses that “conduit 202 includes conductors for power 110, ground 112 and data 108 *running through the conduit 202*”. *Id.* at [0139]. Morgan makes clear in an embodiment that “cutting contacts

1002 may be pressed through the insulation on *wires* of the conduit 202 to make electrical contact.” *Id.* at [0148]. Therefore, a POSITA would further understand that the conductors are a conductive wire. EX1003, ¶ 113.

6. Claim 9

For a summary of relevant aspects of Morgan already presented, *see* EX1003, ¶¶ 114, 115.

The four conductors are connected within the “package body” at “holes 204, 208, 210 and 212 in the conduit 202, as shown in FIG. 13 in the socket 214[.]” *See* Morgan at [0141].

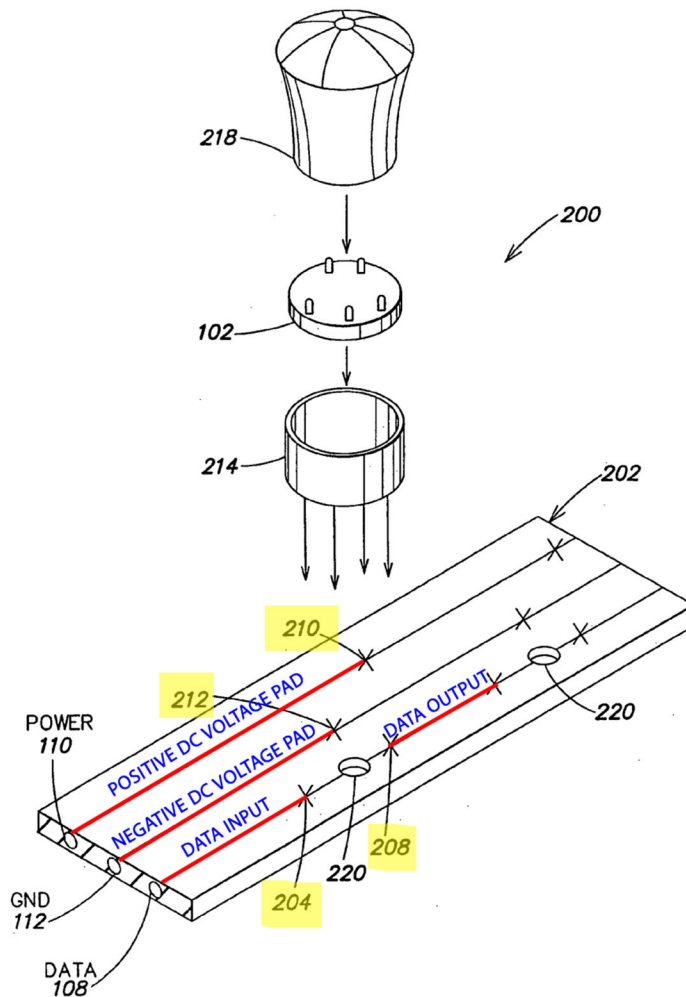


FIG. 13

Morgan at Fig. 13 (conductor connection points highlighted). EX1003, ¶ 116.

A POSITA would have understood that it would be obvious to modify Morgan to ensure that the conductor connection points are arranged as claimed. A POSITA has general knowledge that conductor placement for electrical connection to a circuit board (in Morgan the claimed “circuit board” is either the lighting module 900 or lighting system 102) depends on a variety of factors, including how the circuit board is designed. A POSITA would be aware that LED lighting units

can be electrically connected in a parallel or a series circuit and that LED lighting units can be arranged in the form of a linear string. For example, if stringed LED lighting units are arranged on a conduit and wired in a parallel electrical circuit (as in Morgan), the two power wires preferably enter and exit the package on the same side. In contrast, if stringed LED lighting units are wired in a series circuit, the two power wires preferably enter and exit the package on opposite sides. Furthermore, a POSITA would preferably choose a configuration that prevents wires from crossing over each other so that a neatly organized layout of connecting conductors can be attained. To summarize, if not literally disclosed, Morgan in combination with the general knowledge of a POSITA, render this limitation obvious because whether one conductor connection point is opposite from or on the same side as another conductor connection point in relation to the claimed “package body,” is a design choice guided by the design principles discussed above (option of parallel and series electrical circuits as well as choosing a configuration that avoids crossing wires) and would be obvious to try depending on particular lighting needs. EX1003, ¶¶ 117, 118.

7. Claim 10

For a summary of relevant aspects of Morgan already presented, *see* EX1003, ¶¶ 119-121.

A POSITA would have understood that it would be obvious to modify Morgan to ensure that the conductor connection points are arranged as claimed for the same reasons as explained in connection with claim 9. *Supra* at Section VI.A.6. EX1003, ¶¶122, 123.

8. Claim 13

Morgan discloses a lighting module 900 and lighting system 102 (either can be “circuit board”) that carries LEDs.

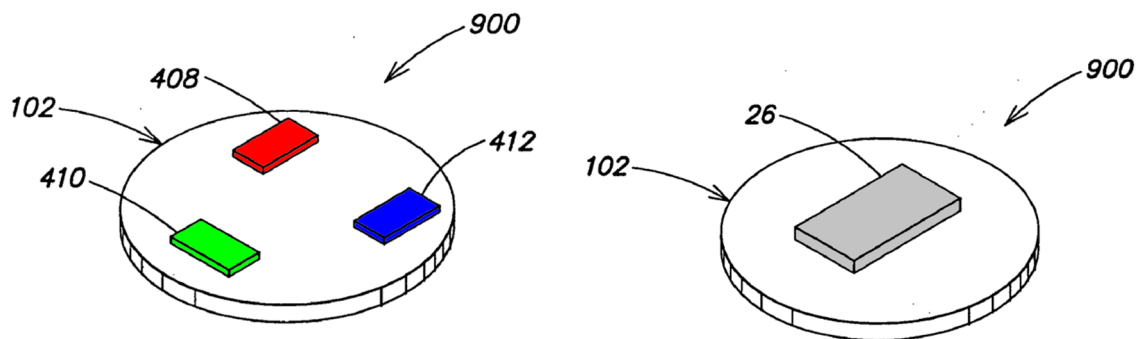


FIG. 16A

FIG. 16B

Morgan at Figs. 16A, 16B (LEDs colored red, green, and blue). EX1003, ¶ 124.

Morgan in combination with the general knowledge of a POSITA renders this claim obvious. A POSITA would have understood, based on general knowledge of how LEDs are coupled to circuit boards, that any particular arrangement of LEDs – in total number and orientation – is a matter of design choice and would be obvious to try depending on particular lighting needs. For example, if the POSITA would desire omni-directional RGB emission (emission in

all directions), a POSITA would choose to mount two red (R) LEDs on opposing sides of the circuit board, two green (G) LEDs on opposing sides of the circuit board, and two blue (B) LEDs on opposing sides of the circuit board. EX1003, ¶ 125.

9. Claim 16

- a. 16[Pre]:** *A light emitting diode lamp assembly, comprising:*

Morgan discloses a “light emitting diode lamp assembly” as illustrated, for example, in FIG. 13:

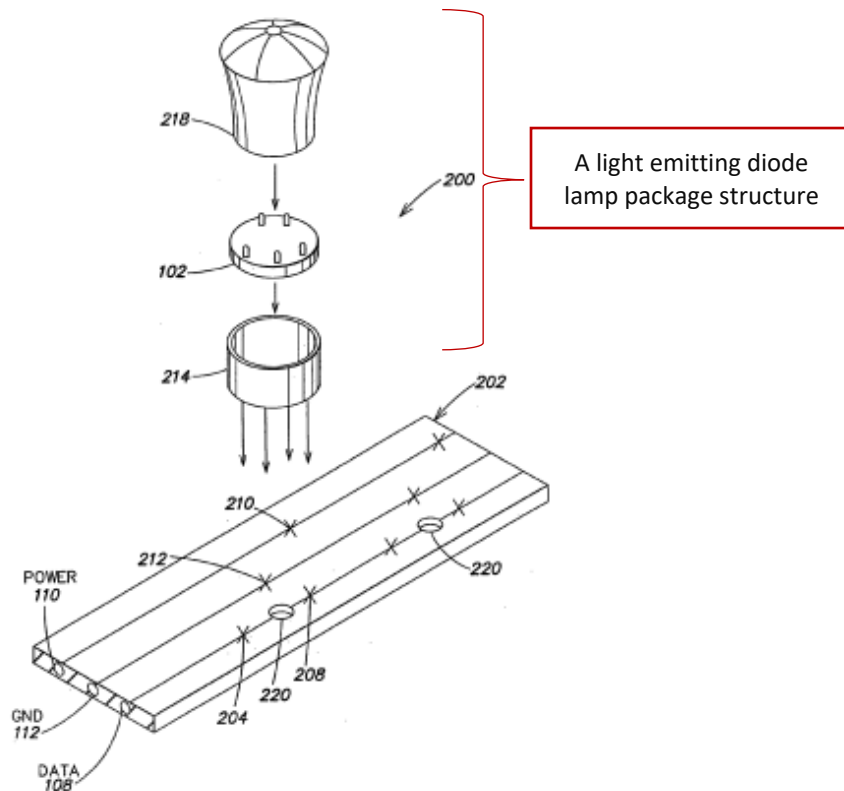


FIG. 13

Morgan at Fig. 13; *id.* at [0140]. EX1003, ¶ 126.

- b. **16[A]:** a light emitting diode lamp having a plurality of light emitting diodes and four electric conductivity supports encapsulated in a package body;

Morgan describes a controller 26 with output ports 30 that are connected to a plurality of light emitting diodes (LEDs) (indicated as DEV1 to DEV4 in FIG. 2):

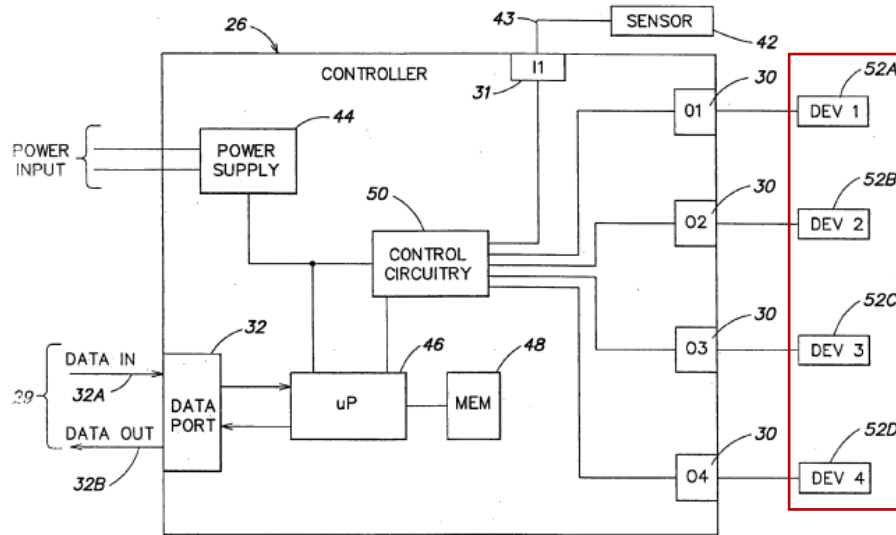
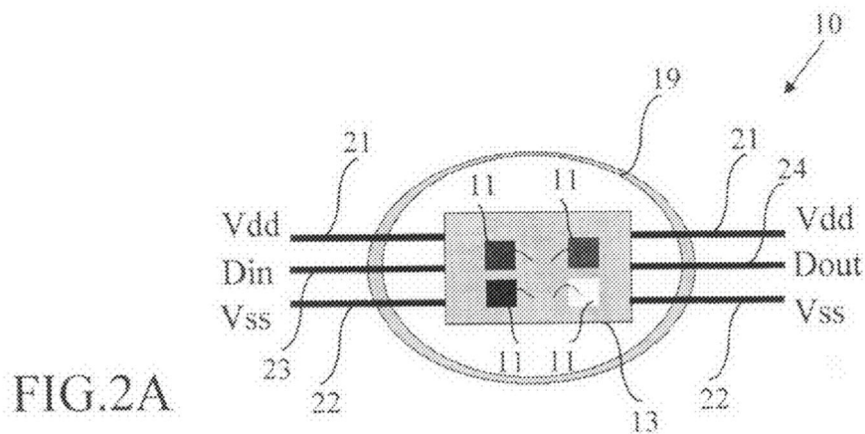


FIG. 2

Morgan at FIG. 2; *id.* at [0090]. As used in Morgan, the term “light source” includes “LED-based sources”. *Id.* at [0152], [0153]. EX1003, ¶ 127.

The term “electric conductivity supports” as used in the challenged ’988 patent encompasses conductors generally. FIG. 2A in the ’988 patent illustrates 6 “electric conductivity supports” that are partially exposed outside a package body

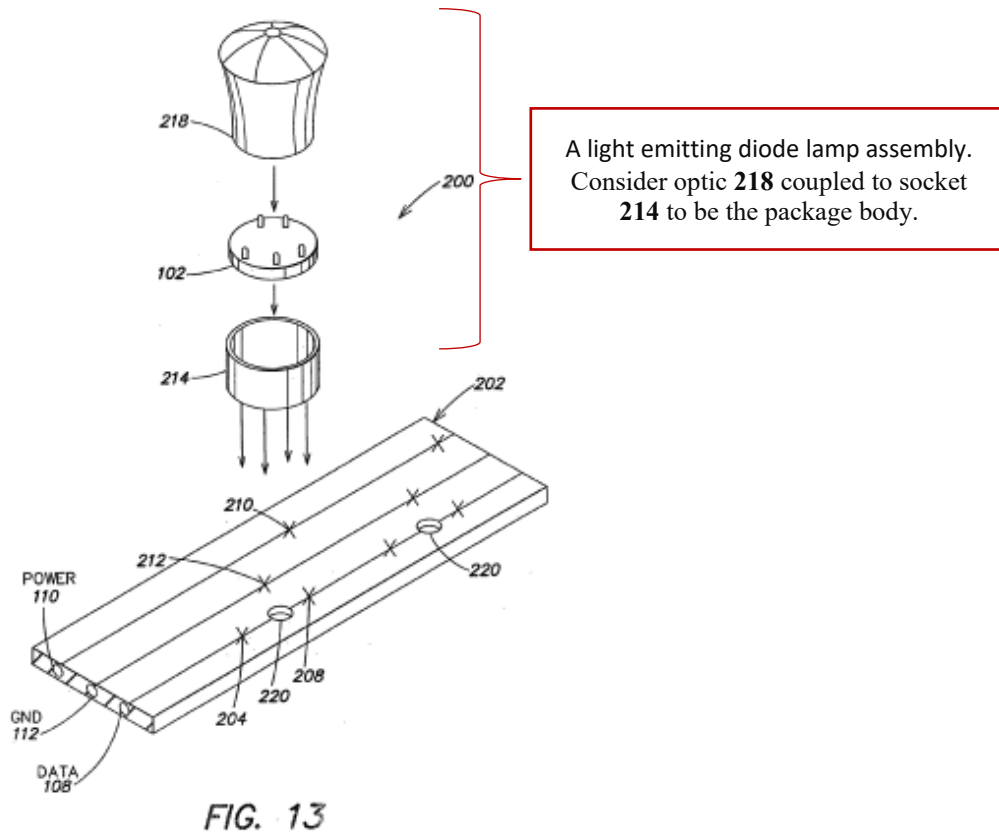
19:



’988 patent at Fig. 2A. As explained in the ’988 patent, “the LED lamp 10 contains six electric conductivity supports exposed outside the package body 18 with three electric conductivity supports each being disposed at two opposing sides of the circuit board 13” ’988 patent at 4:60-64. Moreover, “the six electric conductivity supports *can be replaced by a conductive wire* to form a lamp string.” ’988 patent at 5:4-6. Therefore, a POSITA would have understood that conductive wires fall within the scope of the claim term “electric conductivity supports.”

EX1003, ¶ 128.

Morgan discloses an optic 218 coupled to a socket 214 (“package body”) encapsulating the LEDs and the four conductors with a portion of each conductor being exposed outside the optic 218 and socket 214:



Morgan at Fig. 13. Morgan makes clear that the optic 218 is connected to the socket 214 (either removably connected or sealably connected). *Id.* at [0142]. EX1003, ¶ 129.

FIG. 14A illustrates the lighting system 102 that is encapsulated within the optic 218 and socket 214 (together the “package body”):

This fig. 14A shows a lighting system 102 that includes a plurality of LEDs mounted on the top side and a number of electrical connectors on the bottom side of the lighting system 102, i.e., a first data port 32A, a second data port 32B, a ground connector 304, and a power connector 302.

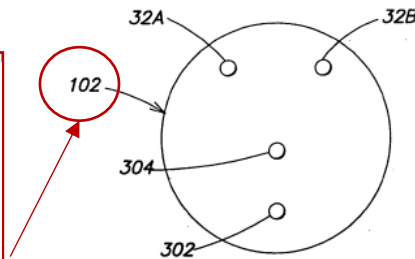


FIG. 14A

Morgan at Fig. 14A. The “lighting system 102” includes several “electrical connectors” for the four conductors. *Id.* at [0140]. EX1003, ¶ 130.

The socket 214 has conductivity supports to enable connectivity to four conductors partially exposed outside the package body:

This figure 14B shows the connectors 312, 314, 320 and 318 of socket 214 that include holes. These holes are used to align with and accommodate the light emitting diodes and enable the four electric conductivity supports.

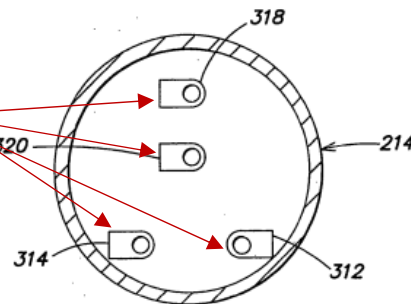


FIG. 14B

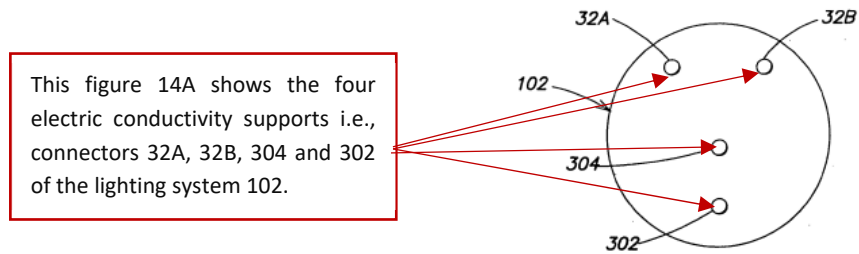


FIG. 14A

Morgan at Figs. 14A, 14B. Socket 214 illustrated above “may be positioned on the conduit 202, and screws or other electrically conductive fasteners may be used to electrically and physically connect the socket 214 to the conduit 202.” Morgan at [0141]. The placement of the “connectors 312, 314, 320 and 318 of socket 214 may be arranged to be electrically connected with the conductors in the conduit 202.” *Id.* at 140. In turn, these socket connectors are arranged to match the corresponding placement of connectors 32A, 32B, 304 and 302 on the bottom side of the lighting system 102. *See id.* at 140. EX1003, ¶ 131.

This physical arrangement results in conductors for power 110, ground 112, and data 108 being partially within and partially outside of the package body:

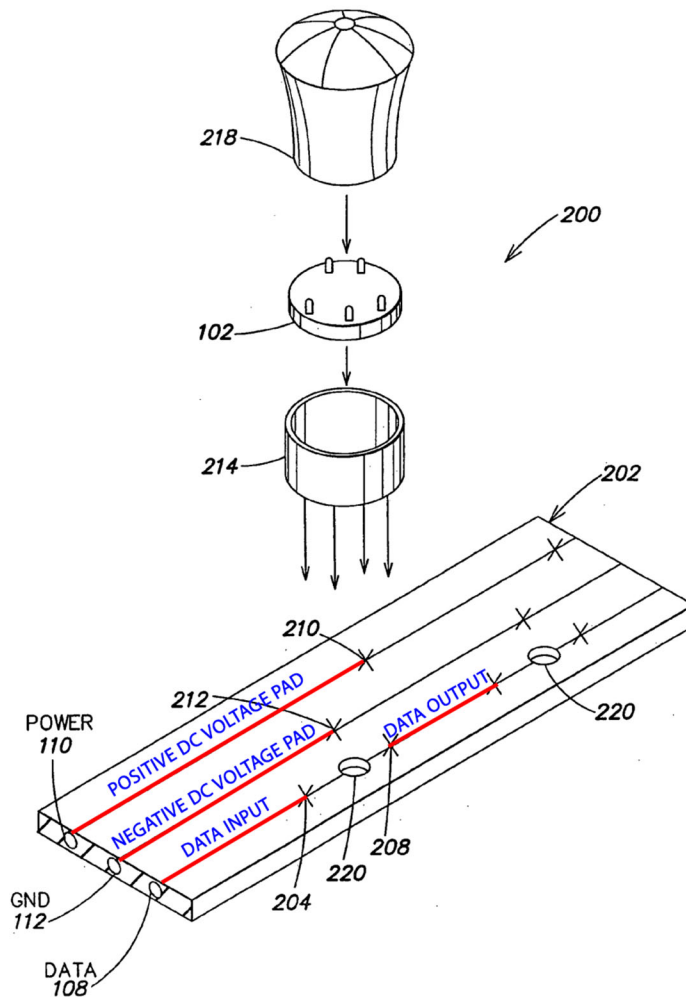


FIG. 13

Morgan at Fig. 13, [0141]. EX1003, ¶ 132.

- c. **16[B]:** *a lampshade covering the package body of the light emitting diode lamp;*

A POSITA would recognize that a separate “lampshade” would be an obvious addition to the LED lamp assembly disclosed in Morgan. A lampshade diffuses the light originating from point sources such as LEDs thereby creating a more pleasant lighting environment. Furthermore, lampshades reduce glare which

is a common undesirable phenomenon associated with bright point-like sources.

EX1003, ¶ 133.

Alternatively, the claimed “package body” can consist only of the socket 214 (within which the lighting system 102 sits and is electrically connected to the socket connectors 312, 314, 320 and 318), and the coupled optic 218 can be considered the “lampshade” that covers the package body:

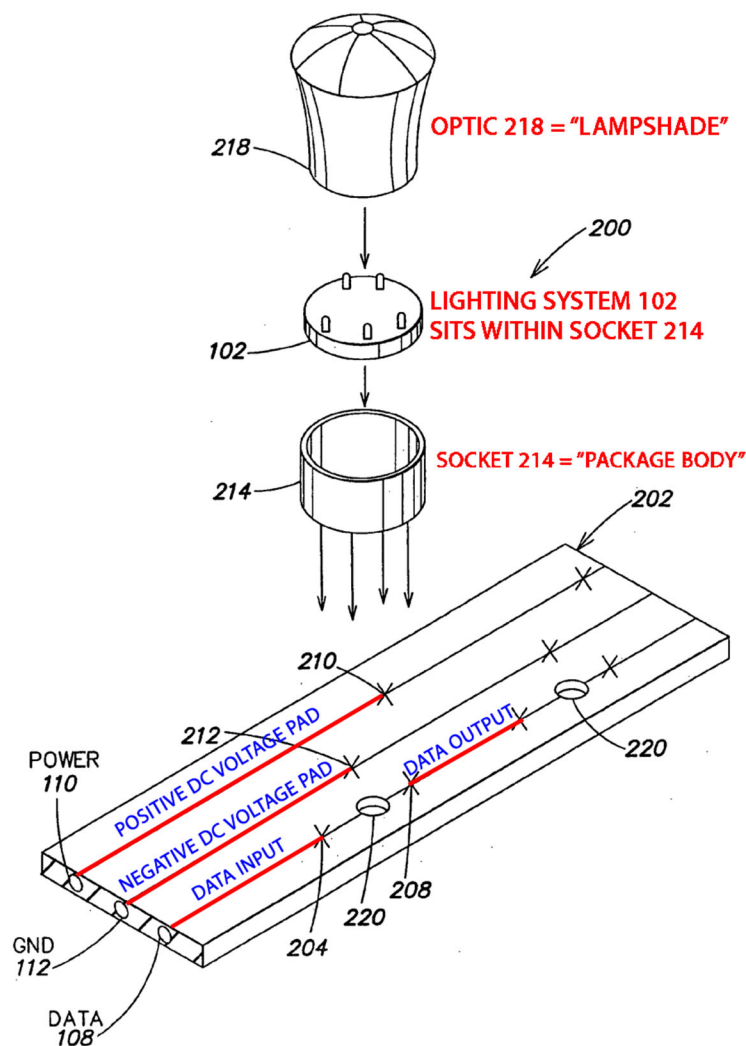


FIG. 13

Morgan at Fig. 13. EX1003, ¶ 134.

- d. **16[C]:** *a socket being a body having a perforation and extended with a plug-in member, the perforation accommodating the light emitting diodes and enabling the four electric conductivity supports to expose outside the body; and*

Morgan's socket 214 is a "socket being a body having a perforation and extended with a plug-in member" as claimed. The socket 214 has holes (i.e., the claimed "perforation" that are extended with a "plug-in-member" such as connectors 312, 314, 320, and 318:

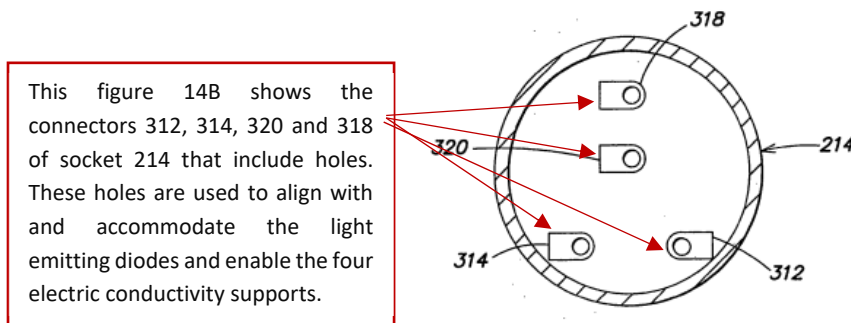


FIG. 14B

Morgan at Fig. 14B. EX1003, ¶ 135.

The connectors 312, 314, 320 and 318 ("plug-in members") accommodate the LEDs and enable an electrical connection with the conduit 202 conductors such that four conductors ("electric conductivity supports") are exposed outside the socket's body. EX1003, ¶ 136.

Socket 214 "may be positioned on the conduit 202, and screws or other electrically conductive fasteners may be used to electrically and physically connect

the socket 214 to the conduit 202.” Morgan at [0141]. The placement of the “connectors 312, 314, 320 and 318 of socket 214 may be arranged to be electrically connected with the conductors in the conduit 202.” *Id.* at 140. In turn, these socket connectors are arranged to match the corresponding placement of connectors 32A, 32B, 304 and 302 on the bottom side of the lighting system 102. *See id.* at 140. EX1003, ¶ 137.

This physical arrangement results in conductors for power 110, ground 112, and data 108 being partially within and partially outside of the package body:

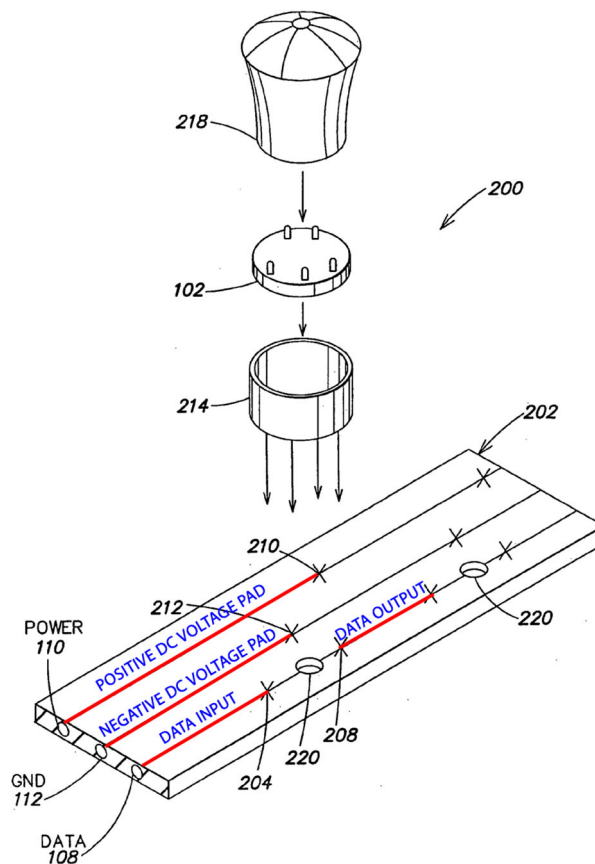


FIG. 13

Morgan at Fig. 13; *id.* at [0141]. EX1003, ¶ 138.

- e. **16[D]:** *a mount formed with a socket, the socket having four electrode contacts inside such that when the socket is plugged into the socket, the four electrode contacts being in contact with the four electric conductivity supports respectively.*

The conduit 202 in Morgan operates as a “mount formed with a socket” as claimed. When the socket 214 is coupled to the conduit 202, connectors 312, 314, 320, and 318 of socket 214 are arranged to be electrically connected with the conductors in the conduit 202. Further, each of the connectors 312, 314, 320, and 318 of socket 214 includes holes, and the holes in the connectors are aligned with holes 204, 208, 210, and 212 in the conduit 202, such that when a screw or other electrically conductive fastener is passed through the hole and into the conduit, an electrical connection is formed between the electrical connector of the socket and the electrical conductor of the conduit 202.

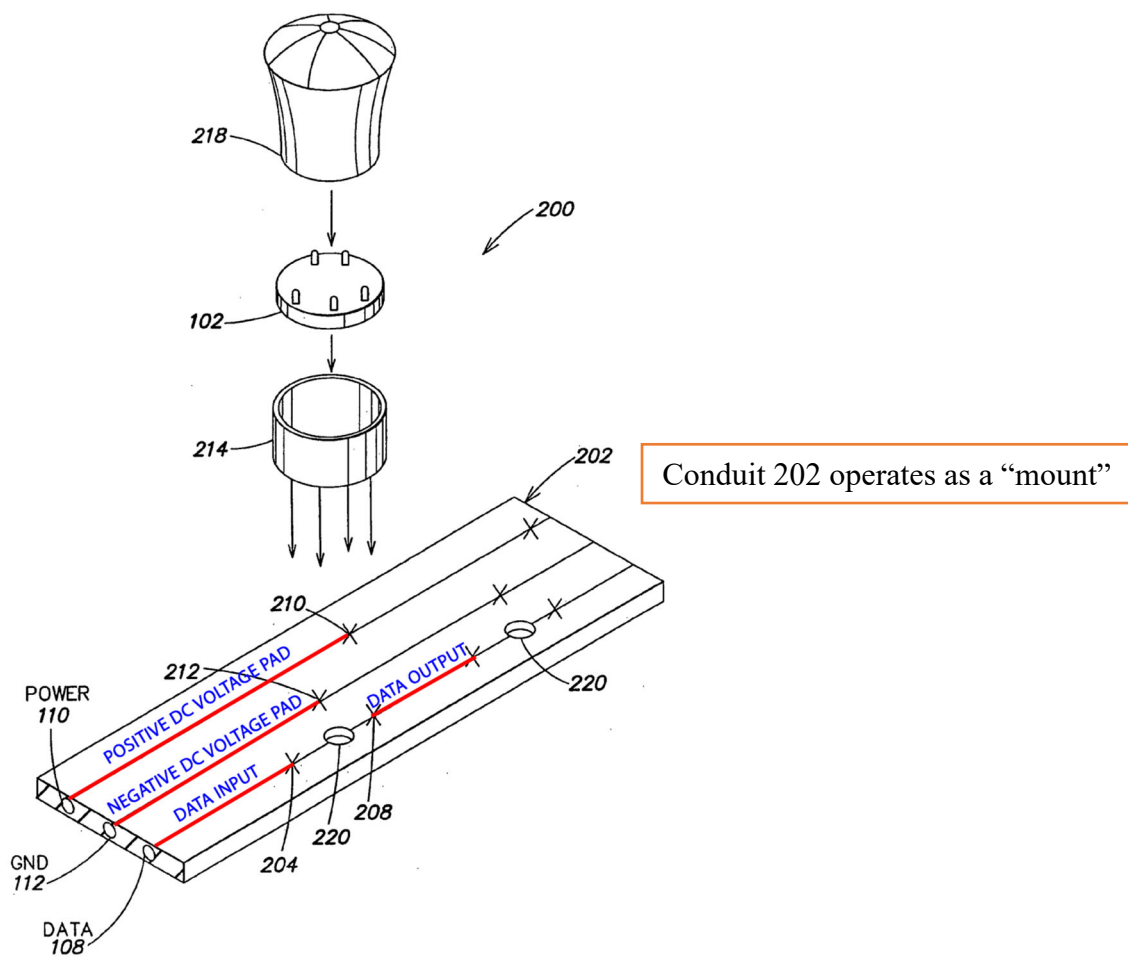


FIG. 13

Morgan at Fig. 13; *id.* at [0141]. EX1003, ¶ 139.

10. Claim 17

- a.** *The light emitting diode lamp assembly according to claim 16, wherein the plurality of light emitting diodes are mounted on a circuit board, the circuit board carrying a control integrated circuit, the four electric conductivity supports being respectively a positive DC voltage pad, a data input end, a data output end, and a negative DC voltage pad.*

Morgan discloses a lighting module 900 and lighting system 102 (either can be “circuit board”) that carries the LEDs and the controller 26 (“control integrated circuit”):

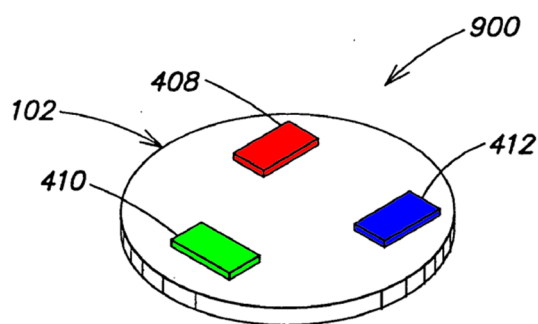


FIG. 16A

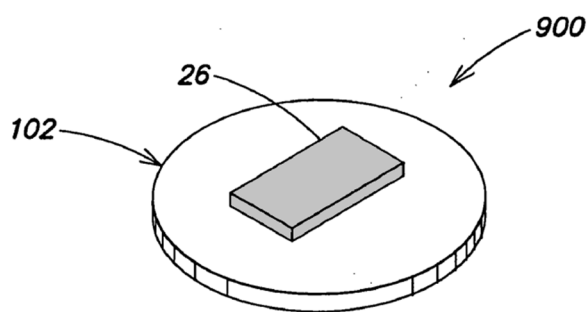


FIG. 16B

Morgan at Figs. 16A, 16B (LEDs colored red, green, and blue; controller 26 colored gray). A POSITA would have understood that the lighting module 900 or lighting system 102 in Morgan acts as a circuit board because it facilitates connectivity between the LEDs and controller 26. *See Morgan at [0144].*

EX1003, ¶ 140

Morgan further discloses “the four electric conductivity supports being respectively a positive DC voltage pad, a data input end, a data output end, and a negative DC voltage pad” as claimed. *See supra* at Sections VI.A.1.e, f, g, h, and i. EX1003, ¶ 141.

11. Claim 20

- a.** *The light emitting diode lamp assembly according to claim 16, wherein the socket forms a through-hole, the four electrode contacts passing through the through-hole to connect with four external wires respectively.*

Morgan discloses this claim by virtue of the socket 214’s holes that are extended with a “plug-in-member” such as connectors 312, 314, 320, and 318 as shown *supra* at Section VI.A.9.d. EX1003, ¶ 142.

Additionally, the illustrated tubular shape of socket 214 in FIG. 13 discloses the claimed “through-hole to connect with four external wires respectively”:

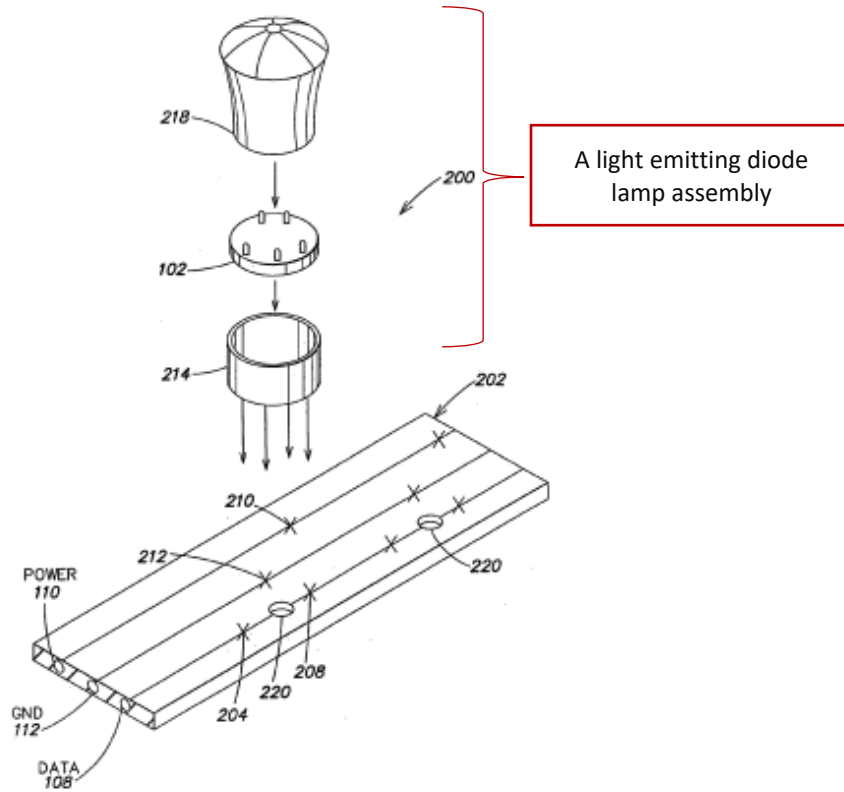


FIG. 13

Morgan at Fig. 13; *id.* at [0140]. EX1003, ¶ 144.

- b. 21[A]:** *a light emitting diode lamp having a package body and a circuit board,*

Morgan discloses a lighting module 900 and lighting system 102 (either can be “circuit board”) that carries LEDs and a controller 26:

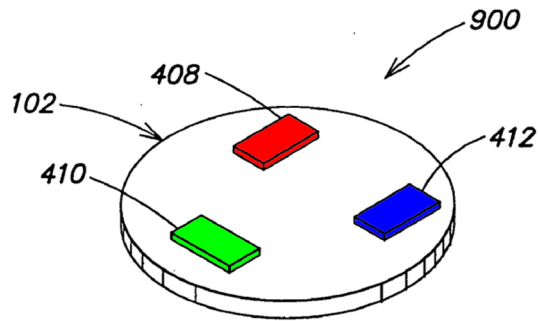


FIG. 16A

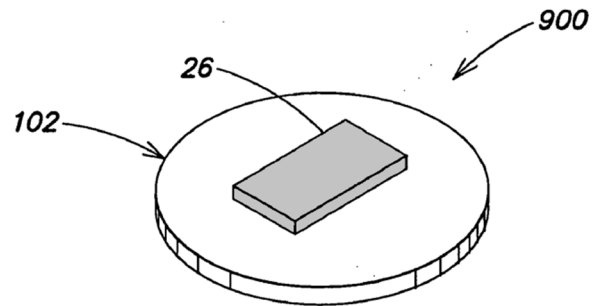
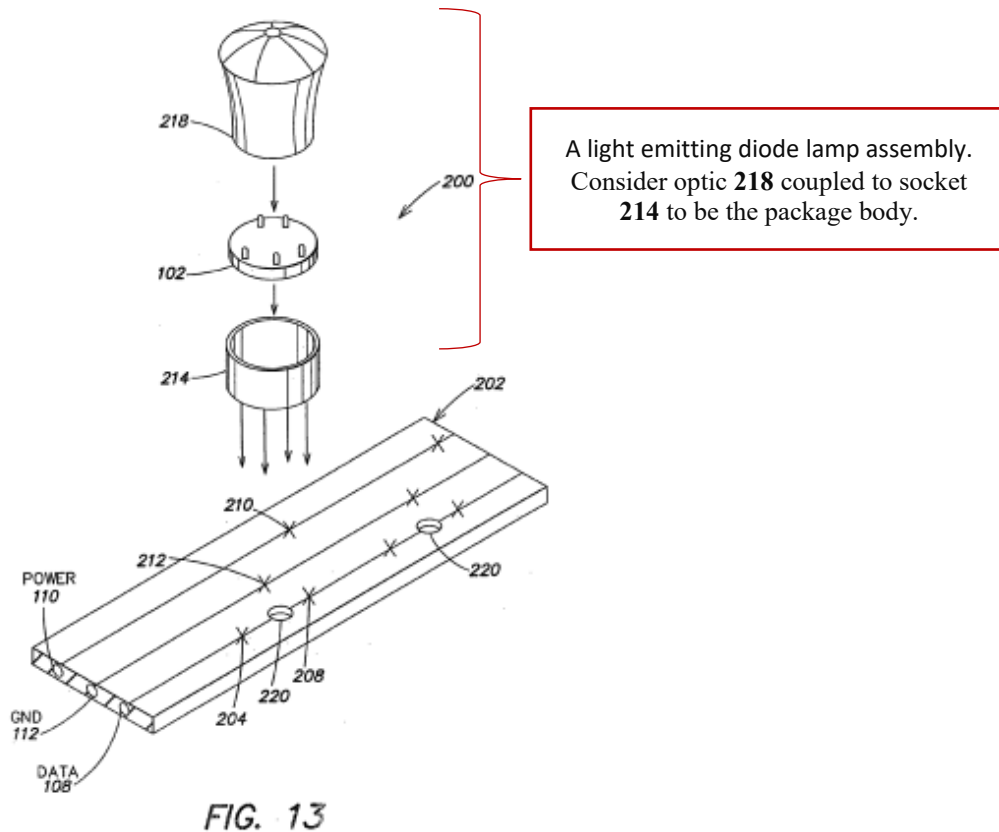


FIG. 16B

Morgan at Figs. 16A, 16B (LEDs colored red, green, and blue; controller 26 colored gray). A POSITA would have understood that the lighting module 900 or lighting system 102 in Morgan acts as a circuit board because it facilitates connectivity between the LEDs and controller 26. Morgan at [0144]. EX1003, ¶ 145.

Morgan discloses an optic 218 coupled to a socket 214 (“package body”):



Morgan at Fig. 13. Morgan makes clear that the optic 218 is connected to the socket 214 (either removably connected or sealably connected). *Id.* at [0142]. EX1003, ¶ 146.

- c. **21[B]:** *the package body encapsulating a plurality of light emitting diodes and four electric conductivity supports, the four electric conductivity supports being electrically connected to the circuit board, and*

Morgan discloses an optic 218 coupled to a socket 214 (“package body”) encapsulating the LEDs and four conductors (“electric conductivity supports”) which are electrically connected to the lighting module 900 or lighting system 102 (either can be “circuit board”). EX1003, ¶ 147.

FIG. 14A illustrates the lighting system 102 that is encapsulated within the optic 218 and socket 214 (together “package body”):

This fig. 14A shows a lighting system 102 that includes a plurality of LEDs mounted on the top side and a number of electrical connectors on the bottom side of the lighting system 102, i.e., a first data port 32A, a second data port 32B, a ground connector 304, and a power connector 302.

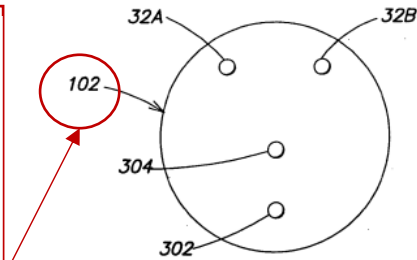


FIG. 14A

Morgan at Fig. 14A. As Morgan explains, the “lighting system 102” includes several “electrical connectors” for the four conductors. *Id.* at [0140]. EX1003, ¶ 148.

The socket 214 has conductivity supports to enable connectivity to four conductors:

This figure 14A shows the four electric conductivity supports i.e., connectors 32A, 32B, 304 and 302 of the lighting system 102.

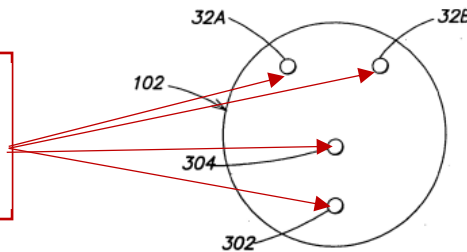


FIG. 14A

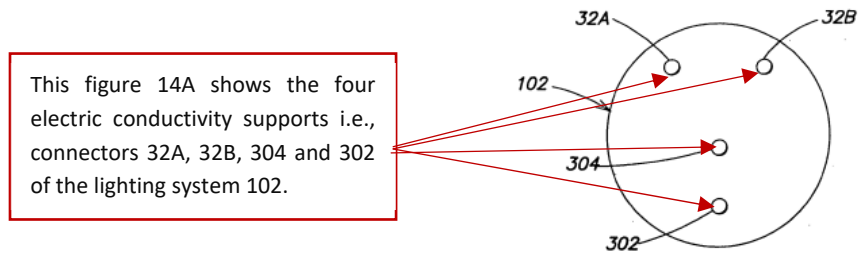


FIG. 14A

Morgan at Figs. 14A, 14B. Socket 214 illustrated above “may be positioned on the conduit 202, and screws or other electrically conductive fasteners may be used to electrically and physically connect the socket 214 to the conduit 202.” Morgan at [0141]. The placement of the “connectors 312, 314, 320 and 318 of socket 214 may be arranged to be electrically connected with the conductors in the conduit 202.” *Id.* at 140. In turn, these socket connectors are arranged to match the corresponding placement of connectors 32A, 32B, 304 and 302 on the bottom side of the lighting system 102. *See id.* at 140. EX1003, ¶ 149.

This physical arrangement results in conductors for power 110, ground 112, and data 108 to be “electrically connected to the circuit board” as claimed:

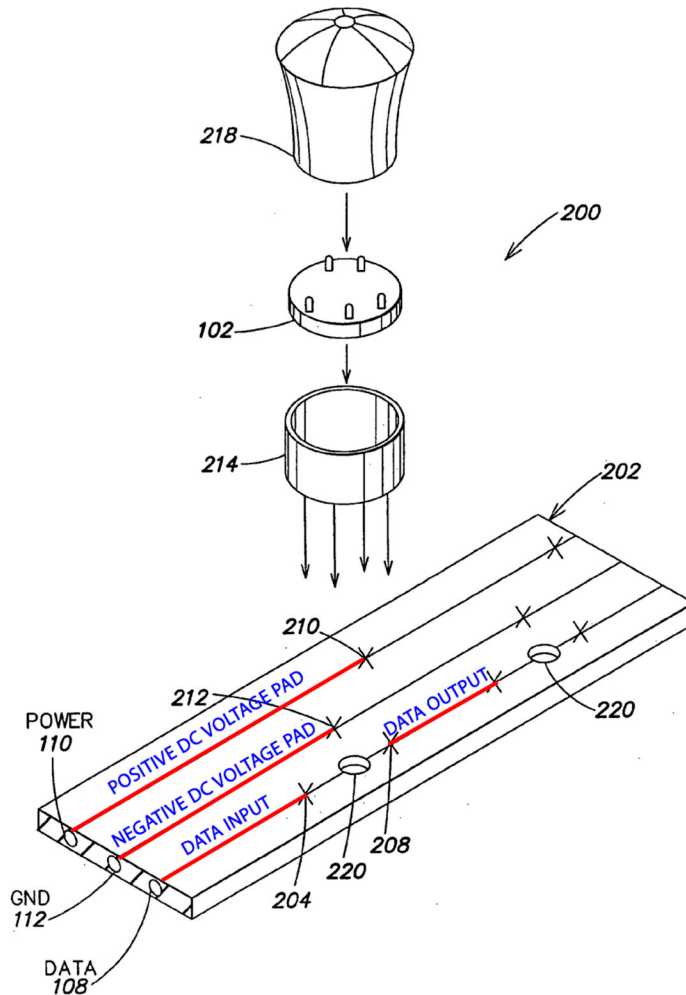


FIG. 13

Morgan at Fig. 13; *id.* at [0141]. EX1003, ¶ 150.

- d. **21[C]:** *the circuit board carrying a control integrated circuit and forming a positive DC voltage electrode, a data input electrode, a data output electrode and a negative DC voltage electrode;*

Morgan discloses a lighting module 900 and lighting system 102 (either can be “circuit board”) that carries LEDs and a controller 26 (“control integrated circuit”):

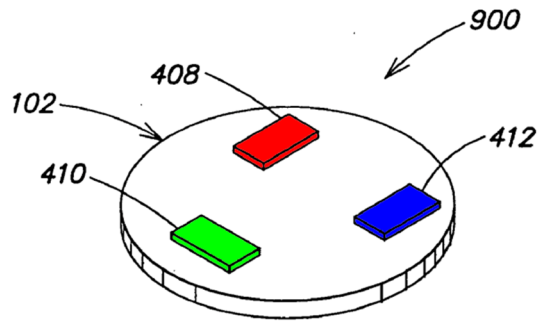


FIG. 16A

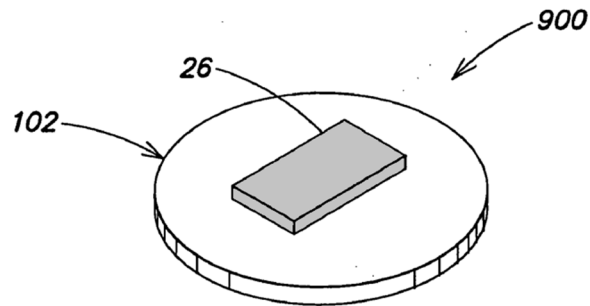


FIG. 16B

Morgan at Figs. 16A, 16B (LEDs colored red, green, and blue; controller 26 colored gray). EX1003, ¶ 151.

Morgan further discloses “the four electric conductivity supports being respectively a positive DC voltage electrode, a data input electrode, a data output electrode, and a negative DC voltage electrode” as claimed. *See supra* at Sections VI.A.1.e, f, g, h, and i. A POSITA would understand that an electrode pad can serve as an electrode. Whereas the word “electrode” is a purely function-oriented term, the word “pad” may be used to indicate a flat surface region (such as a landing pad for a bonding wire). EX1012 at 535 (definition of “pad”). EX1003, ¶ 152.

- e. **21[D]:** *a lampshade covering the package body of the light emitting diode lamp; and*

As explained *supra* at Section VI.A.9, A POSITA would recognize that a separate “lampshade” as claimed would be an obvious addition to the LED lamp assembly disclosed in Morgan. EX1003, ¶ 153.

Alternatively, the claimed “package body” can consist only of the socket 214 (within which the lighting system 102 sits and is electrically connected to the socket connectors 312, 314, 320 and 318), and the coupled optic 218 can be considered the “lampshade” that covers the package body:

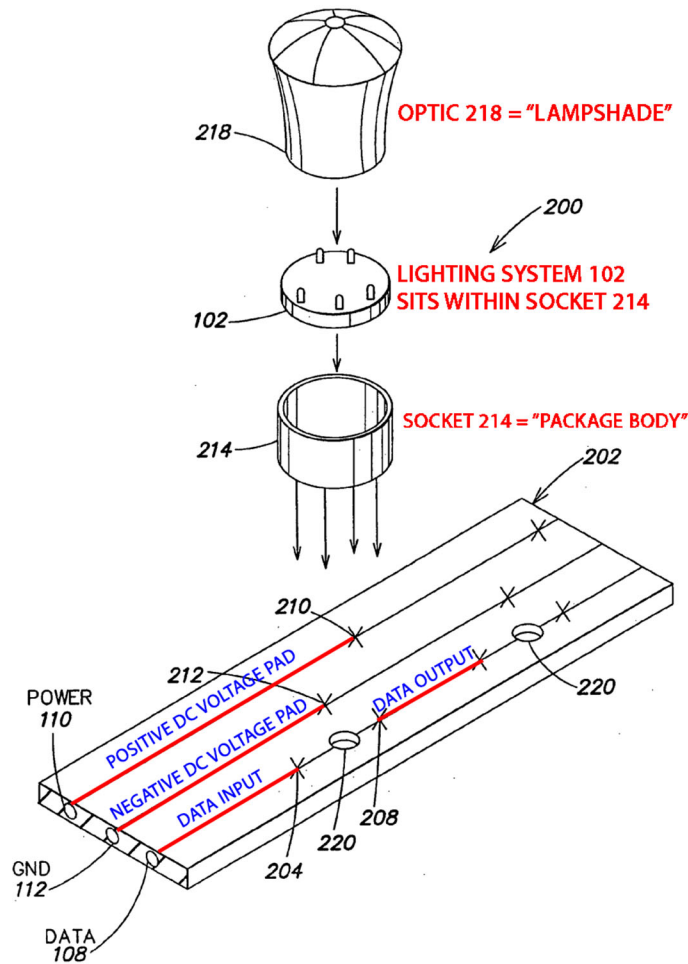


FIG. 13

Morgan at Fig. 13. EX1003, ¶ 154.

- f. **21[E]:** *a mount formed with a socket, the socket having four electrode contacts inside such that when the circuit board of the light emitting diode lamp is plugged into the socket, the four electrode contacts being in contact with the positive DC voltage electrode, the data input electrode, the data output electrode and the negative DC voltage electrode respectively.*

The conduit 202 in Morgan operates as a “mount formed with a socket” as claimed. When the socket 214 is coupled to the conduit 202, connectors 312, 314, 320, and 318 of socket 214 are arranged to be electrically connected with the conductors in the conduit 202. Further, each of the connectors 312, 314, 320, and 318 of socket 214 includes holes, and the holes in the connectors are aligned with holes 204, 208, 210, and 212 in the conduit 202, such that when a screw or other electrically conductive fastener is passed through the hole and into the conduit, an electrical connection is formed between the electrical connector of the socket and the electrical conductor of the conduit 202.

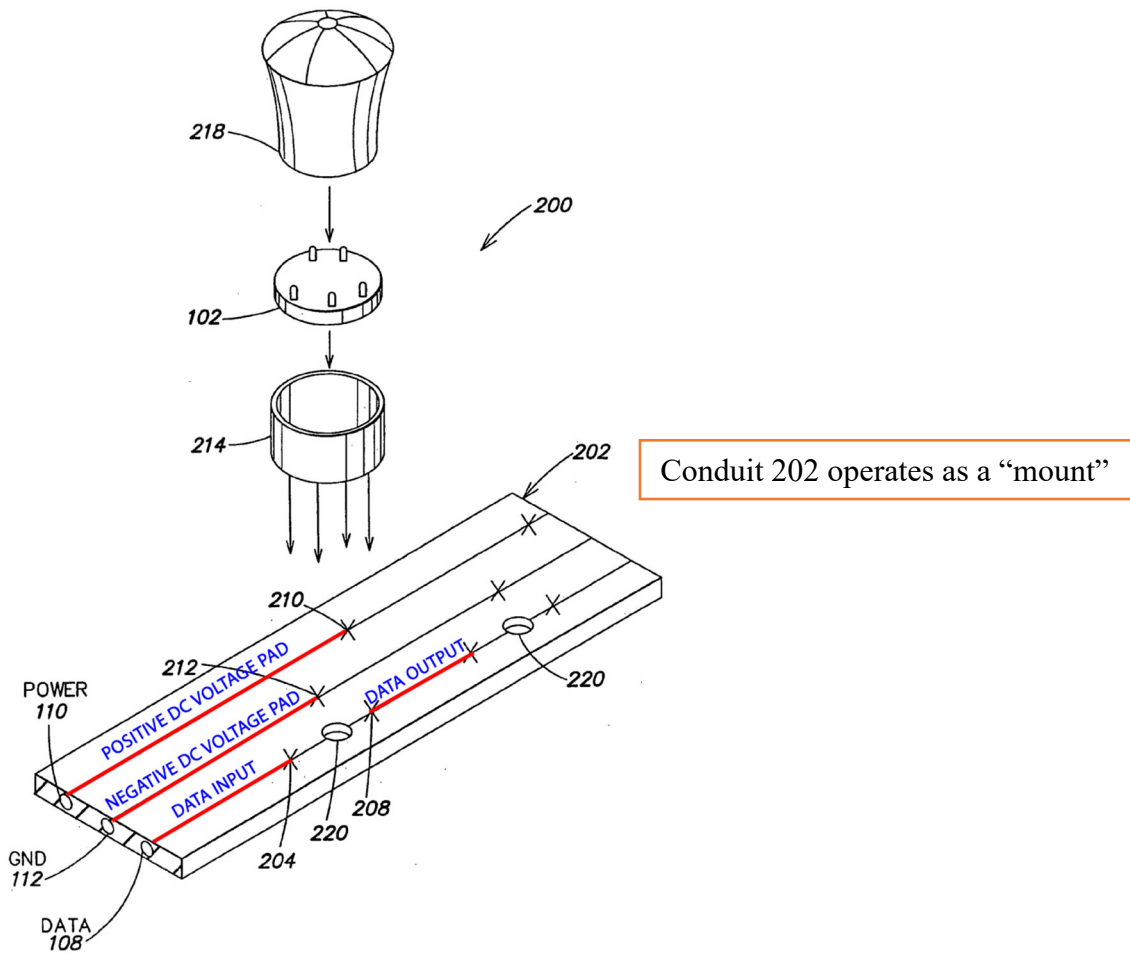


FIG. 13

Morgan at Fig. 13; *id.* at [0141]. EX1003, ¶ 155.

The placement of the “connectors 312, 314, 320 and 318 of socket 214 may be arranged to be electrically connected with the conductors in the conduit 202.” *Id.* at [0140]. In turn, these socket connectors are arranged to match the corresponding placement of connectors 32A, 32B, 304 and 302 on the bottom side of the lighting system 102:

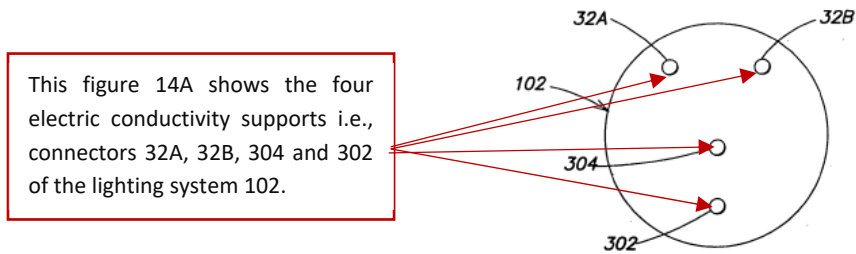


FIG. 14A

Morgan at Fig. 14A; [0140]. EX1003, ¶ 156.

VII. GROUND 4: CLAIMS 4 AND 11-12 ARE OBVIOUS OVER MORGAN IN VIEW OF STOYAN

A. Analysis

1. Claim 4

Morgan discloses a lighting module 900 and lighting system 102 (either can be “circuit board”) that carries the LEDs and the controller 26 (“control integrated circuit”):

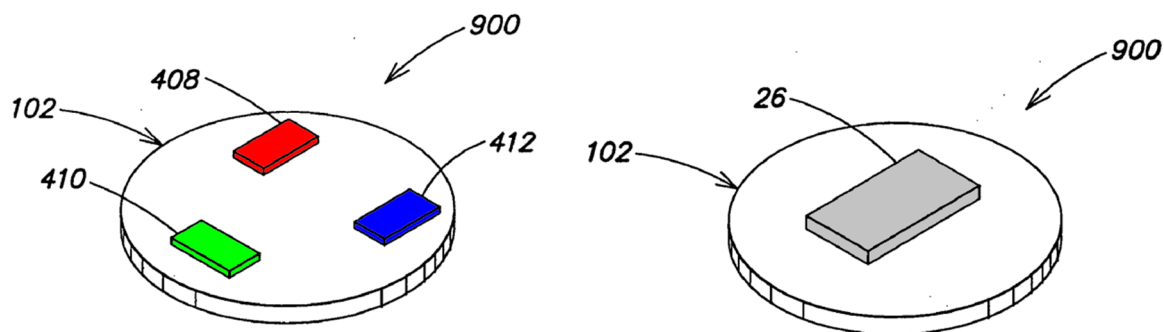


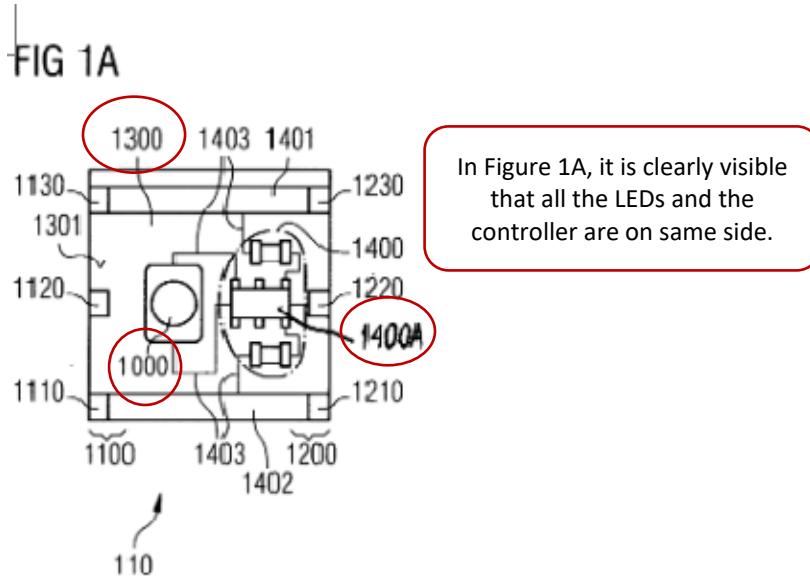
FIG. 16A

FIG. 16B

Morgan at Figs. 16A, 16B (LEDs colored red, green, and blue; controller 26 colored gray). EX1003, ¶ 157.

Morgan in view of Stoyan discloses this claim. EX1003, ¶ 158.

Stoyan discloses LEDs 1000 and control integrated circuit 1400A that are mounted on one surface of carrier body or substrate (i.e., the claimed “circuit board”) 1300:



Stoyan, Fig. 1A. EX1003, ¶ 159.

The radiation emitting semiconductor component 1000 in Stoyan “is a light emitting diode.” *See* Stoyan at [0063], [0064]. Stoyan discloses a carrier body or substrate 1300 that a POSITA would have understood to be a claimed circuit board. *See id.* at [0047], [0063]. Moreover, Stoyan element 1400A is “an encapsulated microchip” which a POSITA would recognize as a “control integrated circuit” as claimed because the term “microchip” is often used interchangeably for the term “integrated circuit.” EX1011 at 60 (definition of

“chip” explaining that “[t]he terms *chip*, *integrated circuit* and *microchip* are synonymous”). EX1003, ¶ 160.

A POSITA would have been motivated to combine Morgan with Stoyan to modify the lighting module 900 or lighting system 102 (either satisfying the claimed “circuit board”) such that the LEDs and controller 26 are mounted on the same side of the substrate, and would have had a reasonable expectation of success in doing so. Mounting the components (LEDs and control IC) on the same surface of a printed circuit board (PCB) allows for a single-sided population of the PCB which facilitates manufacturing. A POSITA would be aware of this advantage and for this reason would be motivated to use Stoyan’s single-side-populated PCB in Morgan. EX1003, ¶ 161.

2. Claim 11

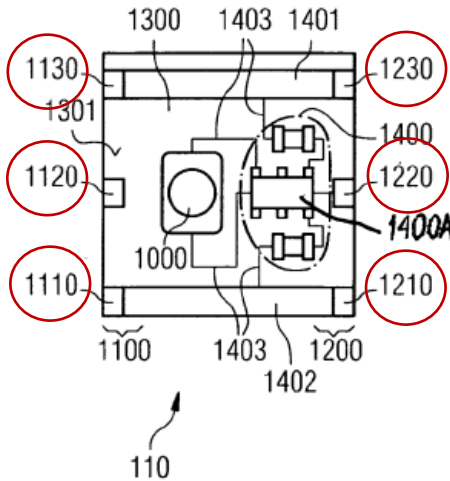
Morgan discloses the light emitting diode lamp package structure according to claim 1 for the reasons already stated *supra* at Section VI.A.1. EX1003, ¶ 162.

Morgan in view of Stoyan discloses this claim. EX1003, ¶ 163.

As explained *supra* at Section VII.A.1, Stoyan discloses LEDs 1000 and control integrated circuit 1400A that are mounted on one surface of carrier body or substrate (i.e., the claimed “circuit board”) 1300, and includes a light emitting diode as radiation emitting semiconductor component 1000. EX1003, ¶¶ 164, 165.

Stoyan FIG. 1A also discloses six separate “electrical terminals 1111, 1120, 1130, 1210, 1220, and 1230:

FIG 1A



Stoyan, Fig. 1A. The terminal pairs 1130/1230 and 1110/1210 facilitate power distribution to the carrier substrate 1300. Stoyan at [0066], [0065]. EX1003, ¶ 166.

Therefore, Stoyan discloses a circuit board with six separate conductors with four of them providing supply voltage. A POSITA would have been motivated to combine Morgan with Stoyan to modify the lighting module 900 or lighting system 102 in Morgan (either satisfying the claimed “circuit board”) to include two additional connectors on the bottom side of the lighting system 102 and two corresponding connectors on socket 214, one set of connectors being connected to a positive DC voltage pad and the other set of connectors being connected a negative DC voltage pad on the conduit 202. EX1003, ¶ 167.

A POSITA would have been motivated to make this modification and would have had a reasonable expectation of success. A POSITA would have understood that for LED module arranged linearly in a straight line, for example from left to right, it would have been beneficial for each LED module to have its power input (VCC & GND) on its LHS (left-hand side) and its power output (VCC & GND) on its RHS (right-hand side). As a result, the power can be supplied to each LED module in a well-organized manner (that is, without crossing wires) which a POSITA would have found desirable. Accordingly, a POSITA would have been motivated to implement Stoyan's six electrodes per LED module in Morgan.

EX1003, ¶ 168.

3. Claim 12

Connected to one side of package body	Connected to opposite side
first conductor positive DC voltage pad	fifth conductor positive DC voltage pad
second conductor data input	third conductor data output
fourth conductor negative DC voltage pad	sixth conductor negative DC voltage pad

A POSITA would have understood that it would be obvious to modify Morgan to ensure that the conductor connection points are arranged as oriented in the above table. A POSITA has general knowledge that conductor placement for electrical connection to a circuit board (in Morgan the claimed "circuit board" is either the

lighting module 900 or lighting system 102) depends on a variety of factors, including how the circuit board is designed. A POSITA would be aware that LED lighting units can be electrically connected in a parallel or a series circuit and that LED lighting units can be arranged in the form of a linear string. For example, if stringed LED lighting units are arranged on a conduit and wired in a parallel electrical circuit (as in Morgan), the two power wires preferably enter and exit the package on the same side. In contrast, if stringed LED lighting units are wired in a series circuit, the two power wires preferably enter and exit the package on opposite sides. Furthermore, a POSITA would preferably choose a configuration that prevents wires from crossing over each other so that a neatly organized layout of connecting conductors can be attained. In summary, if not literally disclosed, Morgan in combination with the general knowledge of a POSITA, render this limitation obvious because whether one conductor connection point is opposite from or on the same side as another conductor connection point in relation to the claimed “package body,” is a design choice guided by the design principles discussed above (option of parallel and series electrical circuits as well as choosing a configuration that avoids crossing wires) and would be obvious to try depending on particular lighting needs. EX1003, ¶¶ 169, 170.

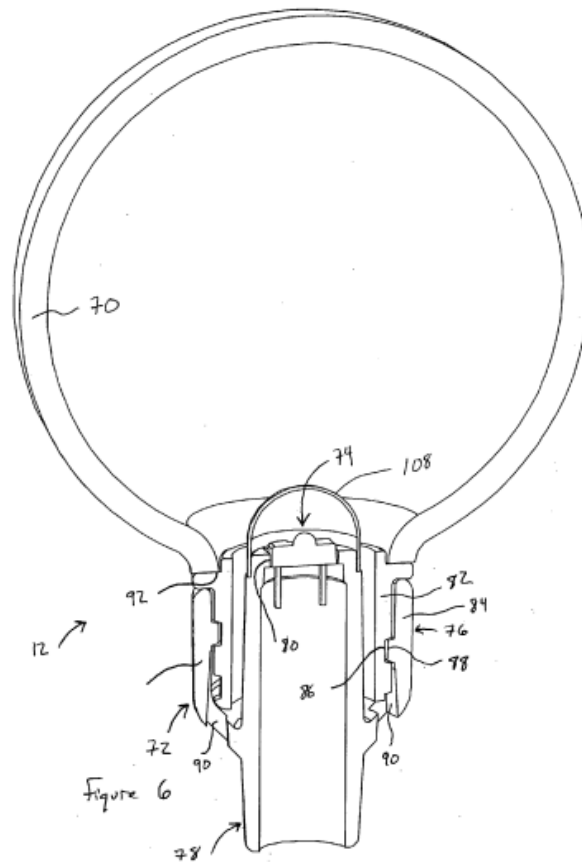
VIII. GROUND 5: CLAIM 16 IS OBVIOUS OVER ALLSOP IN VIEW OF THE GENERAL KNOWLEDGE OF A POSITA

A. Analysis

1. Claim 16

a. 16[Pre]

Allsop discloses a “light emitting diode lamp assembly” as illustrated, for example, in FIG. 6:



Allsop at Fig. 6; *id.* at [0034]. EX1003, ¶ 171.

b. 16[A]

Allsop discloses “a lighting element 74 embodied as an LED circuit board 100 having an LED mounted thereon. The LED may be amber, *or any other color*

output by LED's." Allsop at [0040]. The LED circuit board 100 is comprised of multiple LEDs (e.g., red, green, and blue LEDs) in order to output "any other color" as described. EX1003, ¶ 172.

In addition, it would be an obvious and simple modification to explicitly include two separate LEDs in Allsop's lighting element assembly. A POSITA would find it obvious and desirable to create any color of light, including magenta. A POSITA would understand that magenta is created by combining the light from a blue LED and a red LED. Since Allsop contemplates the creation of "any other color" of light, including magenta, a POSITA would understand that this can be accomplished by using two LEDs, a red one and a blue one. EX1003, ¶ 173.

Four electric conductivity supports are illustrated in FIG. 7:

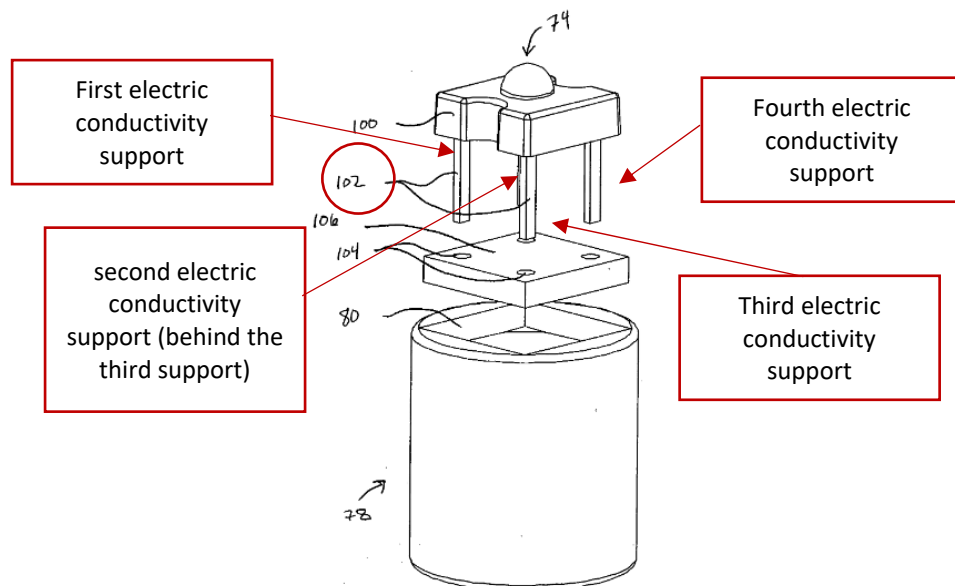
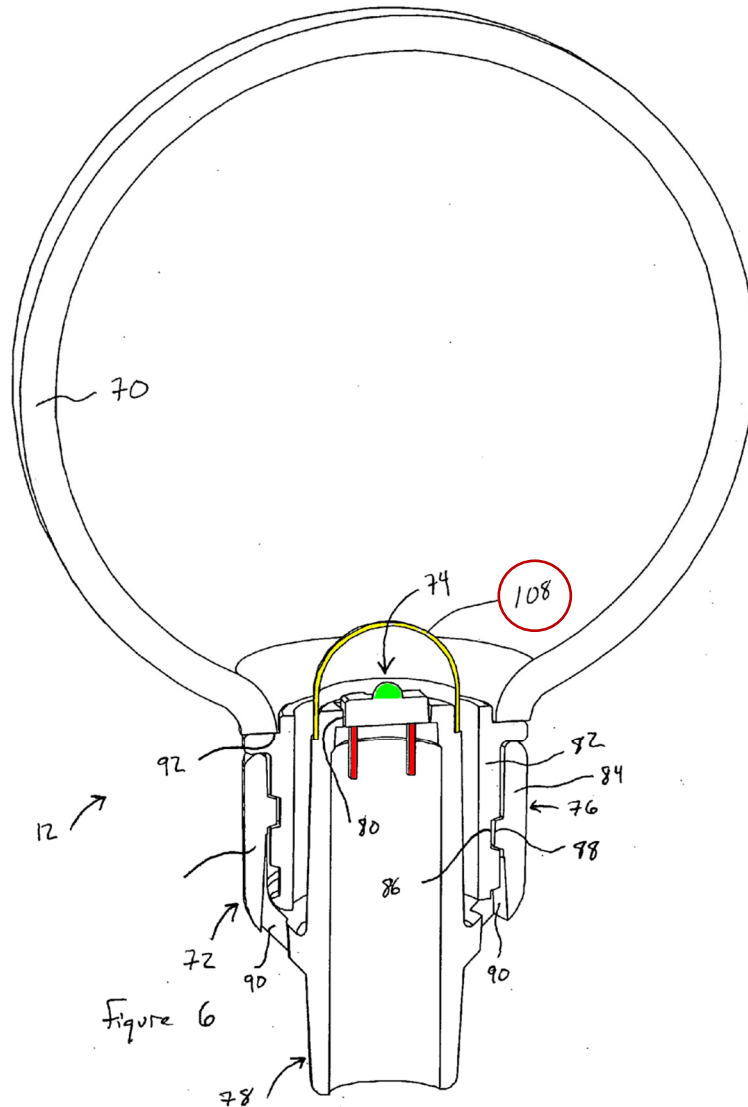


Figure 7

Allsop, Fig. 7. A circuit board 100 in FIG. 7 “*has leads 102 extending therefrom*. The leads 102 extend through apertures 104 formed in an LED mount plate 106. The mount plate 106 secures within the lighting element seat 80 by means of adhesive or a like securement means. In typical applications, *the wire 50 will be connected to the leads 102* prior to securing the mount plate 106 to the lighting element seat 80.” *Id.* at [0040]. A POSITA would have understood that these four leads 102 are conductors to facilitate an electrical connection with wire 50.

EX1003, ¶ 174.

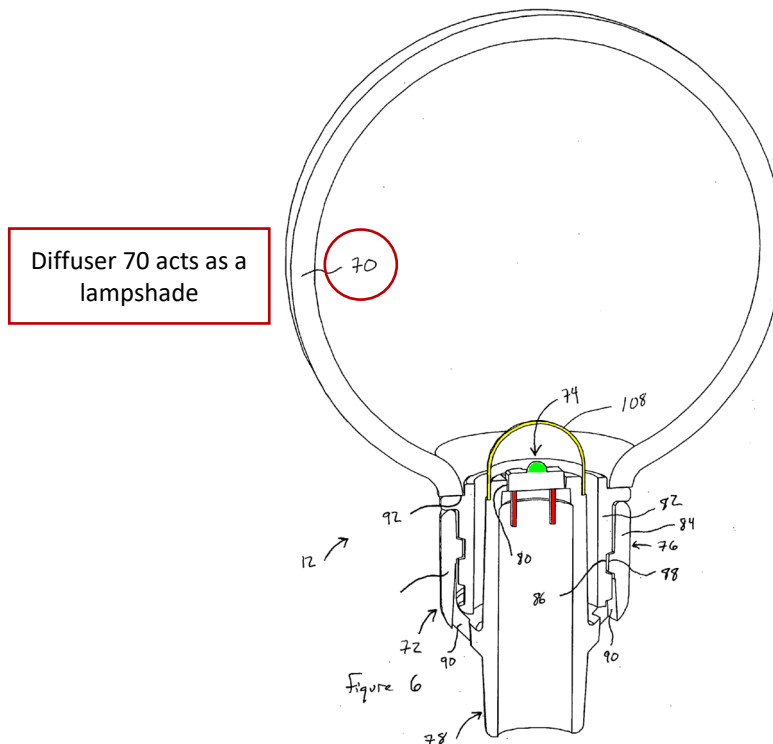
Allsop also discloses a lighting element shield 108 as the claimed “package body” that encapsulates the LEDs and four conductors. Allsop at [0040]. This lighting element shield 108 that encapsulates the LEDs (located within lighting element 74) and the four conductors is illustrated in FIG. 6:



Allsop, Fig. 6 (lighting element 108 highlighted in yellow; LEDs highlighted in **green**; conductors highlighted in **red**). EX1003, ¶ 175.

c. 16[B]

The lighting element assembly in Allsop includes a diffuser 70 which a POSITA would recognize as meeting the “lampshade” limitation:



Allsop, Fig. 6. The diffuser 70 covers the lighting element shield 108 (“package body”). *Id.* at [0034], [0042]. EX1003, ¶ 176.

d. 16[C]

Allsop discloses a mount plate 106 (“socket”) having apertures 104 (“perforation”) that accommodates the LEDs via the four leads 102 (“four electric conductivity supports”). The mount plate 106 is extended by a lighting element seat 80 (“plug-in member”).

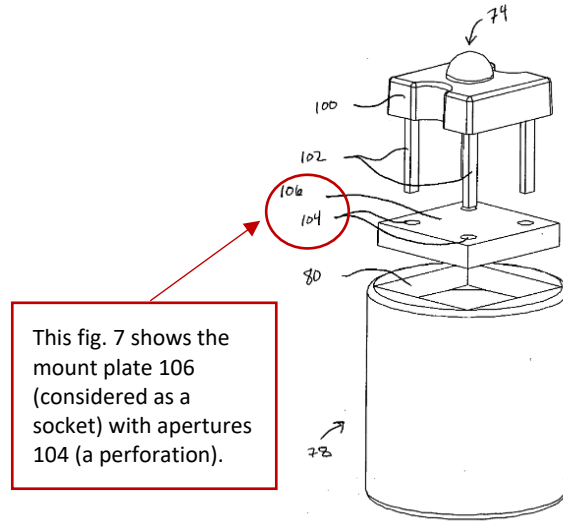
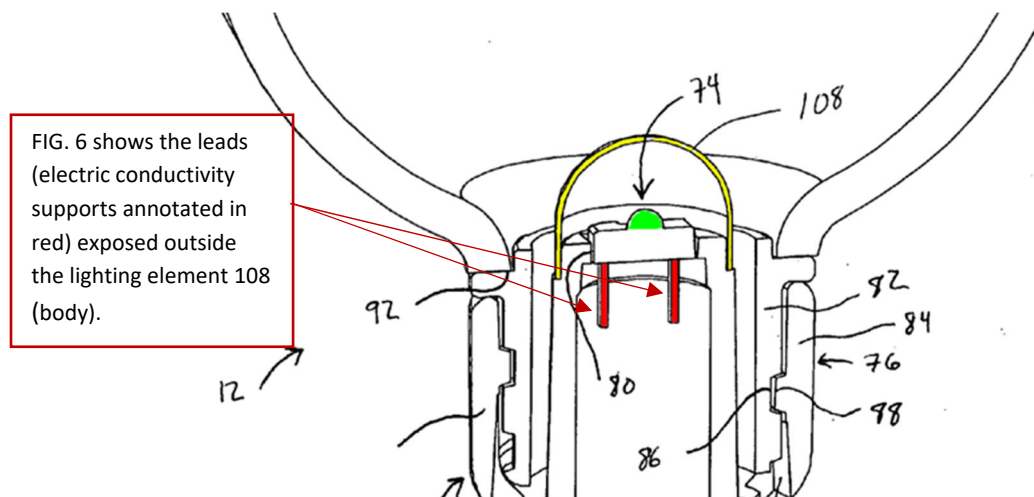


Figure 7

Allsop at Fig. 7. “The circuit board 100 typically has leads 102 extending therefrom. *The leads 102 extend through apertures 104 formed in an LED mount plate 106.* The mount plate 106 *secures within the lighting element seat 80* by means of adhesive or a like securement means. In typical applications, the wire 50 will be connected to the leads 102 prior to securing the mount plate 106 to the lighting element seat 80. The lighting element seat 80 typically opens into the support receiver sleeve 78, providing a channel through the support adapter 72 to receive the wire 50.” *Id.* at [0040]. EX1003, ¶ 177.

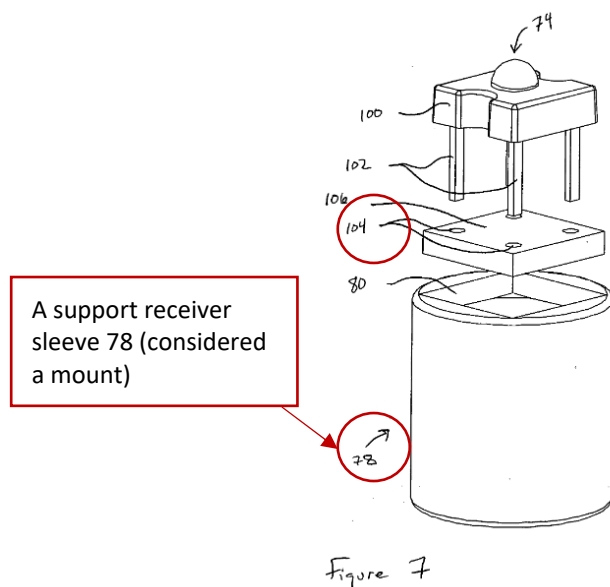
A POSITA would have understood FIG. 6 to disclose the lighting element 108 (“package body”) as enabling the four leads 102 to be partially exposed outside the lighting element 108:



Allsop at Fig. 6 (excerpt). EX1003, ¶ 178

e. 16[D]

The support receiver sleeve 78 acts as a “socket” that receives the four leads 102 through the apertures 104 in the mount plate 106:



Allsop at Fig. 7, [0040]. EX1003, ¶ 179.

A POSITA would have understood Allsop to disclose the existence of four electrode contacts to power the lighting element 74. Such electrode contacts are

necessary for the wire 50's electrical connection to the leads 102 to serve its purpose for operating the LEDs. Although Allsop does not explicitly disclose the claimed "electrode contacts" as part of the socket, a POSITA would have understood that such electrode contacts are present in Allsop. Allsop's four LED leads (electric conductivity supports) inherently need to be connected to electrical conductors that provide a current to the LED. These electrical conductors serve as the claimed "electrode contacts." EX1003, ¶ 180.

IX. GROUND 6: CLAIM 15 IS OBVIOUS OVER LAI IN VIEW OF YAN

A. Analysis

1. Claim 15

- a.** *The light emitting diode lamp package structure according to claim 1, wherein the package body is in rectangular shape, said rectangle having a light emitting window, the light emitting diodes aligning with the light emitting window inside the rectangle.*

For a summary of relevant aspects of Lai already presented, *see* EX1003, ¶ 181.

Yan discloses an LED package 100 that comprises a body 120. *See* Yan at 6:13. The body 120 has a cavity 130 with a floor 150 for bonding to an LED die 110. *Id.* at 6:13-14. The LED package 100 has a "square footprint enabling multiple light emitting devices to be densely arranged in a square array." *Id.* at 6:14-16. This LED package 100 is illustrated in Yan's FIG. 1:

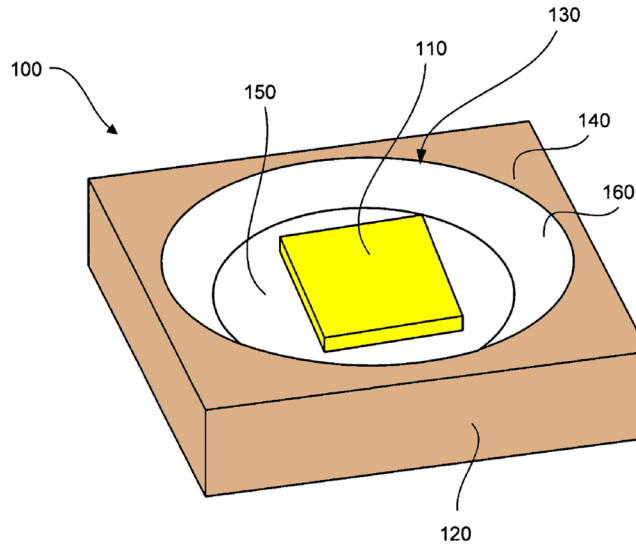


FIG. 1

Yan at Fig. 1 (LED die 110 and LED package body 120 colored in). EX1003, ¶ 182.

Yan also discloses an embodiment of the LED package that includes a lens 690: “In FIG. 6B the top body layer 610 includes a circular notch 685 to receive a *lens 690. The lens 690 can be glass or plastic*, for example. The notch 685 beneficially provides a guide that *centers the lens 690 over the LED die 640* during assembly.” Yan at 12:48-53.

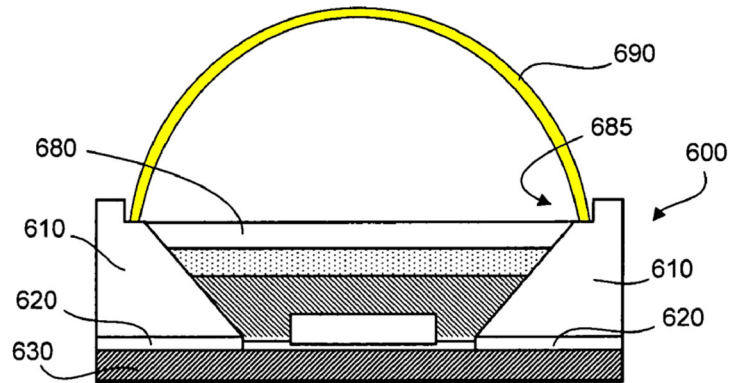


FIG. 6B

Yan at Fig. 6B (lens 690 highlighted). Yan explains that the lens can be useful “for focusing the light emitted from the LED package [or] as a protective capping layer.” *Id.* at 11:37-41. EX1003, ¶ 183.

A POSITA would be motivated to combine the teachings of Lai with Yan to modify Lai’s package housing 5 to have a rectangular shape with a lens such as that in Yan. The lens in Yan satisfies the claim limitation “a light emitting window, the light emitting diodes aligning with the light emitting window inside the rectangle” because lens 690 is centered over the LEDs. This modification to Lai would enhance and focus light emitted from the LED chips in a direction perpendicular to Lai’s package housing 5. EX1003, ¶ 184.

X. GROUND 7: CLAIM 15 IS OBVIOUS OVER MORGAN IN VIEW OF YAN

A. Analysis

1. Claim 15

As explained *supra* at Section VI.A.9.c, the claimed “package body” can consist only of Morgan’s socket 214, and the coupled optic 218 can be considered the “lampshade” that covers the package body:

The only material difference between Morgan and Yan with respect to this claim is that the socket 214 in Morgan (“package housing”) is cylindrical instead of rectangular. EX1003, ¶ 188.

A POSITA would be motivated to combine the teachings of Morgan with Yan to modify Morgan’s socket 214 (i.e., the claimed “package housing”) to have a rectangular shape. As Yan explains, “the LED package 100 has a square footprint enabling multiple light emitting devices to be densely arranged in a square array.” Yan at 6:14-16. By modifying Morgan’s socket 214 to be square/rectangular, more LEDs can be connected to the surface of lighting system 102, and more densely packed LED structures can be connected. Furthermore, Yan’s LED manufacturing method is efficient: “multiple LED packages are formed together in a batch process in which the individual LED packages are fabricated in parallel.” Yan at 14:51-53. This would have further motivated a POSITA to be guided by Yan. EX1003, ¶ 189.

XI. 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-dispositive 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 Stoyan and Yan were previously considered during examination. The Examiner relied on Stoyan to reject pending claims 1-4, 6, and 9-12 as anticipated, and to reject pending claim 15 as unpatentable over Stoyan in view of Yan. EX1002 at Nonfinal Office Action (Apr. 28, 2010) and Final Office action (Sept. 28, 2010). Following an RCE, the Examiner rejected pending claims 1-4, 6, and 9-12 as unpatentable over U.S. Patent No. 7,717,596 to Bell ("Bell") in view of Stoyan, and pending claim 15 as unpatentable over Bell in view of Stoyan and in further view of Yan. EX1002 at Nonfinal Office Action (Feb. 16, 2011). In contrast, the Petition only relies on Stoyan and Yan as secondary references to support obviousness. Ground 2 shows that claims 4 and 11-12 are obvious over Lai in view of Stoyan and in further view of the general knowledge of a POSITA, Ground 4 shows that claims 4 and 11-12 are also obvious over Morgan in view of Stoyan and in further view of the general knowledge of a POSITA, Ground 6 shows that claim 15 is obvious over Lai in view of Yan, and Ground 7 shows that claim 15 is also obvious over Morgan in view of Yan.

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).

XII. 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 '988 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.

XIII. CONCLUSION

For the foregoing reasons, Petitioner requests that the Board institute trial and cancel the Challenged Claims of the '988 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 13,892 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 '988 patent:

Bacon & Thomas, PLLC
201 N. Union St., Suite 320
Alexandria, VA 22314

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 LED lamp package structure, comprising:
1[A]	a plurality of light emitting diodes, each light emitting diode having two electrode ends and one of the electrode ends being a common electrode end;
1[B]	a control integrated circuit, having a data input electrode, a data output electrode, a positive power-in electrode, and a negative power-in electrode, and electrically connected to the light emitting diodes,
1[C]	wherein the control integrated circuit receives external control data via the data input electrode to control the illumination state of each light emitting diode according to the external control data;
1[D]	a first conductor, a second conductor, a third conductor, and a fourth conductor,
1[E]	the first conductor being a positive DC voltage pad and connected to the common electrode of each light emitting diode and the positive power-in electrode of the control integrated circuit,
1[F]	the second conductor being connected to the data input electrode,
1[G]	the third conductor being connected to the data output electrode,
1[H]	the fourth conductor being a negative DC voltage pad and connected to the negative power-in electrode of the control integrated circuit; and

Claim	Limitation
1[I]	a package body encapsulating the light emitting diodes, the control integrated circuit and the conductors, a portion of the first conductor, the second conductor, the third conductor, and the fourth conductor being exposed outside the package body.
2	The light emitting diode lamp package structure according to claim 1, wherein the common electrode end is a positive DC voltage pad or a negative DC voltage pad.
3	The light emitting diode lamp package structure according to claim 1, further comprising a circuit board carrying the light emitting diodes and the control integrated circuit.
4	The light emitting diode lamp package structure according to claim 3, wherein the light emitting diodes and the control integrated circuit are mounted on the same surface of the circuit board.
5	The light emitting diode lamp package structure according to claim 3, wherein the light emitting diodes are mounted on one surface of the circuit board and the control integrated circuit is mounted on the other surface of the circuit board.
6	The light emitting diode lamp package structure according to claim 1, wherein the conductors are an electric conductivity support or a conductive wire.
7	The light emitting diode lamp package structure according to claim 1, wherein the first conductor forms a platform inside the package body, said platform carrying the light emitting diodes, and the first conductor being electrically connected to the light emitting diodes.
8	The light emitting diode lamp package structure according to claim 1, wherein the fourth conductor forms a platform inside the package body, the platform carrying the control integrated circuit, and the fourth conductor being electrically connected to the control integrated circuit.

Claim	Limitation
9	The light emitting diode lamp package structure according to claim 1, wherein the first conductor and the fourth conductor are connected to two opposing sides of the package body, and the second conductor and the third conductor are connected to two opposing sides of the package body.
10	The light emitting diode lamp package structure according to claim 1, wherein the first conductor and the fourth conductor are connected to the same side of the package body, while the second conductor and the third conductor are connected to two opposing sides of the package body.
11	The light emitting diode lamp package structure according to claim 1, further comprising a fifth conductor and a sixth conductor, the fifth conductor being a positive DC voltage pad and the sixth conductor being a negative DC voltage pad.
12	The light emitting diode lamp package structure according to claim 11, wherein the first conductor and the fifth conductor are connected to two opposing sides of the package body, the second conductor and the third conductor are connected to two opposing sides of the package body, while the fourth conductor and the sixth conductor are connected to two opposing sides of the package body.
13	The light emitting diode lamp package structure according to claim 3, wherein two opposing surfaces of the circuit board each carrying a redlight emitting diode, a green light emitting diode, and a bluelight emitting diode.
14	The light emitting diode lamp package structure according to claim 1, wherein the package body is an injection-molded transparent glue in spherical or hemispherical shape.

Claim	Limitation
15	The light emitting diode lamp package structure according to claim 1, wherein the package body is in rectangular shape, said rectangle having a light emitting window, the light emitting diodes aligning with the light emitting window inside the rectangle.
16[Pre]	A light emitting diode lamp assembly, comprising:
16[A]	a light emitting diode lamp having a plurality of light emitting diodes and four electric conductivity supports encapsulated in a package body;
16[B]	a lampshade covering the package body of the light emitting diode lamp;
16[C]	a socket being a body having a perforation and extended with a plug-in member, the perforation accommodating the light emitting diodes and enabling the four electric conductivity supports to expose outside the body; and
16[D]	a mount formed with a socket, the socket having four electrode contacts inside such that when the socket is plugged into the socket, the four electrode contacts being in contact with the four electric conductivity supports respectively.
17	The light emitting diode lamp assembly according to claim 16, wherein the plurality of light emitting diodes are mounted on a circuit board, the circuit board carrying a control integrated circuit, the four electric conductivity supports being respectively a positive DC voltage pad, a data input end, a data output end, and a negative DC voltage pad.
20	The light emitting diode lamp assembly according to claim 16, wherein the socket forms a through-hole, the four electrode contacts passing through the through-hole to connect with four external wires respectively.

Claim	Limitation
21[Pre]	A light emitting diode lamp assembly, comprising:
21[A]	a light emitting diode lamp having a package body and a circuit board,
21[B]	the package body encapsulating a plurality of light emitting diodes and four electric conductivity supports, the four electric conductivity supports being electrically connected to the circuit board, and
21[C]	the circuit board carrying a control integrated circuit and forming a positive DC voltage electrode, a data input electrode, a data output electrode and a negative DC voltage electrode;
21[D]	a lampshade covering the package body of the light emitting diode lamp; and
21[E]	a mount formed with a socket, the socket having four electrode contacts inside such that when the circuit board of the light emitting diode lamp is plugged into the socket, the four electrode contacts being in contact with the positive DC voltage electrode, the data input electrode, the data output electrode and the negative DC voltage electrode respectively.