UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.
Petitioner

v.

LYNK LABS, INC.
Patent Owner

Patent No. 10,652,979

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 10,652,979

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I. INTRODUCTION

Samsung Electronics Co., Ltd. ("Petitioner") requests *inter partes* review of claims 1-18 of U.S. Patent No. 10,652,979 ("the '979 patent") (Ex. 1001) assigned to Lynk Labs, Inc. ("Patent Owner" or "PO"). For the reasons below, the Board should find the challenged claims unpatentable.

II. MANDATORY NOTICES

Real Parties-in-Interest: Petitioner identifies the following as the real parties-in-interest: Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.

Related Matters: The '979 patent is at issue in the following matters:

- *Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.*, No. 1-21-cv-02665 (N.D. Ill.) (seeking declaratory judgment of non-infringement as to the '979 patent ("Illinois-I").[1] (Ex. 1077.)

[1] The following Lynk Labs patents are also at issue: U.S Patent Nos. 11,019,697, 10,966,298, 10,750,583, 10,687,400, 10,517,149, 10,506,674, 10,499,466, 10,492,252, 10,492,251, and 10,154,551.

- *Lynk Labs, Inc. v. Samsung Electronics Co. Ltd.*, No. 6-21-cv-00526 (W.D. Tex.) ("Texas Litigation").[2] (Ex. 1078.)
- *Lynk Labs, Inc. v. Samsung Electronics Co. Ltd.*, No. 1-21-cv-05126 (N.D. Ill.) ("Illinois-II"). (Ex. 1079.)
- *Lynk Labs, Inc. v. The Home Depot USA, Inc. et al.*, No. 6-21-cv-00097 (W.D. Tex.) ("HD-Litigation"). (Ex. 1081.)

Patents related to the '979 patent are at issue in the following matters:

- U.S. Patent No. 10,154,551, which is at issue in Illinois-I, Illinois-II, and HD-Litigation.
- U.S Patent Nos. 10,492,251 and 10,517,149, which are at issue in Illinois-I and HD-Litigation.
- U.S Patent Nos. 11,019,697, 10,966,298, 10,750,583, 10,687,400, 10,506,674, 10,499,466, and 10,492,252, which are at issue in Illinois-I.

The '551 patent claims the benefit of priority to two provisional applications (U.S. Provisional Application Nos. 60/574,653, filed February 25, 2004, and 60/559,867,

[2] The Texas Litigation was transferred to the Northern District of Illinois on September 27, 2021 and entered as1-21-cv-05126 (Illinois-II) on September 28, 2021. (Ex. 1078, 7 (Texas docket); Ex. 1080 (Order No. 28 Granting Motion to Transfer); Ex. 1079, 7 (Illinois-II docket).)

filed April 6, 2004). The following patents claim the same benefit of priority to the ’653 and ’867 applications and have corresponding IPR proceedings:

- U.S. Patent No. 8,531,118 at issue in A*cuity Brands Lighting, Inc., v. Lynk Labs, Inc.*, IPR2016-01133 (terminated);
- U.S. Patent No. 10,506,674 at issue in *Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.*, IPR2021-01299 (pending);
- U.S Patent No. 11,019,697 at issue in *Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.*, IPR2021-01300 (pending);
- U.S Patent No. 10,492,252 at issue in *Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.*, IPR2021-01345 (pending);
- U.S Patent No. 10,499,466 at issue in *Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.*, IPR2021-01346 (pending);
- U.S Patent No. 10,966,298 at issue in *Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.*, IPR2021-01347 (pending);
- U.S Patent No. 10,492,251 at issue in *The Home Depot USA, Inc. v. Lynk Labs, Inc.*, IPR2021-01369 (pending).

Counsel and Service Information: Lead counsel: Naveen Modi (Reg. No. 46,224), and Backup counsel are (1) Joseph E. Palys (Reg. No. 46,508), (2) Arvind Jairam (Reg. No. 62,759). Service information is Paul Hastings LLP, 2050 M St., Washington, D.C., 20036, Tel.: 202.551.1700, Fax: 202.551.1705, email: PH-

Samsung-LynkLabs-IPR@paulhastings.com. Petitioner consents to electronic service.

III. PAYMENT OF FEES

The PTO is authorized to charge any fees due during this proceeding to Deposit Account No. 50-2613.

IV. GROUNDS FOR STANDING

Petitioner certifies the '979 patent is available for review and Petitioner is not barred or estopped from requesting review on the grounds identified herein.

V. PRECISE RELIEF REQUESTED AND GROUNDS

Claims 1-18 should be canceled as unpatentable based on the following grounds:

Ground 1: Claims 1, 2, 6-8, and 10 are unpatentable under pre-AIA 35 U.S.C. § 103(a) as being obvious over *Wojnarowski* in view of *Martin*;

Ground 2: Claims 13-17 are unpatentable under §103(a) as being obvious over *Wojnarowski* in view of *Martin* and *Duggal-II*;

Ground 3: Claims 3 and 11 are unpatentable under §103(a) as being obvious over *Wojnarowski* in view of *Martin* and *Chen*;

Ground 4: Claims 4, 5, and 12 are unpatentable under §103(a) as being obvious over *Wojnarowski* in view of *Martin* and *Weng*;

Ground 5: Claim 18 is unpatentable under §103(a) as being obvious over *Wojnarowski* in view of *Martin, Duggal-II,* and *Weng*; and

Ground 6: Claim 9 is unpatentable under §103(a) as being obvious over *Wojnarowski* in view of *Martin* and *Soules-II*.

The application for the '979 patent was filed on November 22, 2019 and claims the benefit of priority through numerous applications to a provisional application dated February 25, 2004. (Ex. 1001, Cover.) Without conceding the '979 patent is entitled to any claimed priority date, the asserted prior art qualify as prior art even if the challenged claims were entitled to the February 25, 2004 date.

Wojnarowski issued on July 2, 2002 and *Weng* published on Aug. 28, 2002, and thus each qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(b).

Chen was filed on Aug. 22, 2000 and issued on June 17, 2003. *Martin* was filed on Apr. 16, 2003 and published on October 21, 2004. *Duggal-II* was filed on November 14, 2000 and issued October 5, 2004. *Soules-II* is an international application published in English, filed on Aug. 29, 2003, and designates the United States. Accordingly, *Chen*, *Martin*, *Duggal-II*, and *Soules-II* qualify as prior art under at least pre-AIA 35 U.S.C. §102(a) and/or §102(e).

Wojnarowski, *Martin*, *Weng*, *Duggal-II*, and *Soules-II* were not considered during prosecution. (*See generally* Ex. 1004.) Although *Chen* was cited during prosecution, as explained in §X.B, the lack of substantive consideration/application of the reference by the Office, among other things, supports institution.

VI. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art as of the claimed priority date of the '979 patent ("POSITA") would have had at least a bachelor's degree in electrical engineering, computer engineering, computer science, physics, or the equivalent, and two or more years of experience with LED devices and/or related circuit design, or a related field. (Ex. 1002, ¶¶20-21.)[3] More education can supplement practical experience and vice versa. (*Id.*)

VII. THE '979 PATENT

The '979 patent purports to identify an invention directed to an LED lighting system having various components and configurations (*e.g.*, Ex. 1001, 1:45-47, 4:43-8:67), and the challenged claims are broadly directed to a lighting system including conventional/well-known components arranged to operate according to their known functions, such as LED chips, flexible substrates, driver circuit, *etc*. As

[3] Petitioner submits the declaration of R. Jacob Baker, Ph.D., P.E. (Ex. 1002), an expert in the field of the '979 patent. (Ex. 1002, ¶¶1-21; Ex. 1003.)

such, the claimed lighting systems were demonstrably obvious.[4] (*Infra* §IX; Ex. 1002, ¶¶47-58; *see also id.*, ¶¶22-46 (citing, *inter alia*, Exs. 1082, 1083, 1091, 1092, 1093, 1094); Exs. 1023-1043.)

VIII. CLAIM CONSTRUCTION

The Board only construes the claims when necessary to resolve the underlying controversy. *Toyota Motor Corp. v. Cellport Systems, Inc.*, IPR2015-00633, Paper No. 11 at 16 (Aug. 14, 2015) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). For purposes of this proceeding, no special constructions are necessary to assess whether the challenged claims are unpatentable over the asserted prior art as the asserted grounds demonstrate unpatentability under any reasonable interpretation of the claimed terms.[5] (Ex. 1002, ¶59.)

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[4] The '979 patent issued with first Office Action without any substantive prior art analysis. (*See* Ex. 1004, 97-98.)

[5] Petitioner reserves all rights to raise claim construction and other arguments, including challenges under 35 U.S.C. § 101 or §112, in district court as relevant to those proceedings. *See*, *e.g.*, *Target Corp. v. Proxicom Wireless, LLC*, IPR2020-00904, Paper 11 at 11-13 (Nov. 10, 2020). A comparison of the claims to any accused products in litigation may raise controversies that are not presented here given the similarities between the references and the patent.

IX. DETAILED EXPLANATION OF GROUNDS

A. Ground 1: Claims 1, 2, 6-8, and 10 Are Obvious over *Wojnarowski* in View of *Martin*

1. Claim 1

a) An LED lighting device comprising:

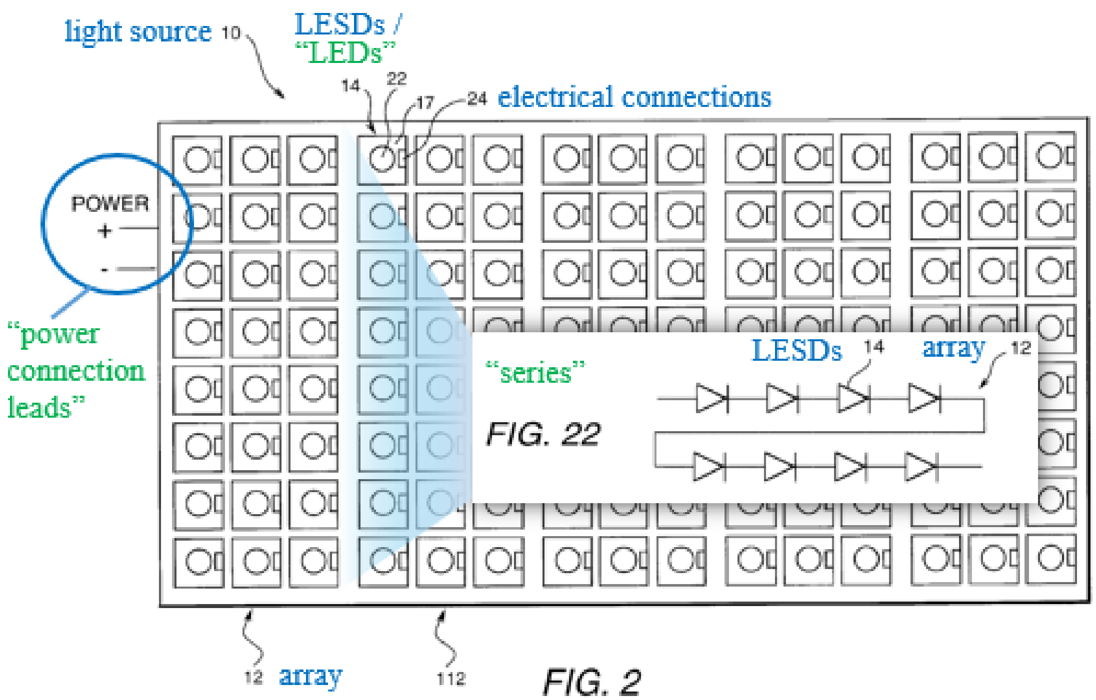
Wojnarowski discloses an LED lighting device including an array of "light emitting semiconductor devices (LESDs)." (Ex. 1005, 1:23-32, 2:25-26 ("LESDs 14 may comprise light emitting devices such as ***light emitting diodes*** (LEDs)….").)[6] *Wojnarowski*'s lighting device is configured for various applications, including, *e.g.*,

[6] To the extent it is argued/suggested that *Wojnarowski*'s embodiments relating to other configurations are distinct, the challenged claims remain obvious over the asserted combination(s) as explained herein because a POSITA would have been motivated, and found it obvious, to configure any of *Wojnarowski*'s identified embodiments with features from *Wojnarowski*'s other related embodiments. (Ex. 1002, ¶95.) Indeed, a POSITA would have had reasons to consider the collective teachings in *Wojnarowski* to configure a lighting device (and/or system) as explained herein, and would have done so with a reasonable expectation of success given *Wojnarowski*'s descriptions of working systems with lighting devices as explained. (*Id.*; §§X.A.1(b)-(e), X.A.4, X.B.1; *infra* n.9)

ceiling or wall lights, displays, and focused light sources. (*Id.*, 2:59-64, 4:36-5:30; Ex. 1002, ¶¶60-75, 94-95; *infra* §IX.A.1(b)-(e).)

b) an LED package comprising a plurality of LED chips electrically connected in series and power connection leads connected to respective input and output ends of the series connected LED chips;

Wojnarowski in view of *Martin* and the state of the art discloses/suggests this limitation. (Ex. 1002, ¶¶60-75, 96-113.) In particular, *Wojnarowski* discloses an LED package (*e.g.*, light source 10 top view illustrated in) comprising a plurality of LED chips (*e.g.*, LESDs 14) electrically connected in series connected in series. (Ex. 1005, 2:25-26, 7:39-43 FIGS. 2, 22 (below); Ex. 1002, ¶¶96-100, 104-109.) A POSITA would have understood the LESDs are LED chips, though *Wojnarowski* does not use the term. (Ex. 1002, ¶¶96-99; *see also* Ex. 1005, 2:16-19 (LESDs mounted on a substrate), 2:25-26 (LESDs described as light emitting diodes), 2:29-32 (describing LESDs as "derived from the wafer state" and having "electrical connections patterned thereon"), 7:19-22 (LESDs mounted on "***chip*** pads"), FIG. 27 (same); Ex. 1018, 380 (describing "chip" as a "shaped and processed semiconductor die that is mounted on a substrate to form a transistor, diode, or other semiconductor device"); Ex. 1017, 204.) *Wojnarowski* also teaches that "[c]onventional LESDs can be used as well as new types of light emitting devices as [they] are developed" (Ex. 1005, 2:27-29), and conventional LESDs included LED chips. (Ex. 1002, ¶100.)



(Ex. 1005, FIGS. 2, 22 (annotated).)

Moreover, a POSITA would have found it obvious to configure *Wojnarowski*'s LESDs as LED chips connected in series because LED chips as integrated circuits were well known to have advantages over discrete components, including cost-effectiveness, smaller footprint/higher density, easier integration, and improved reliability. (Ex. 1002, ¶¶101-102; Ex. 1022, 1:51-2:16, 3:60-4:1, FIG. 1; Ex. 1044, Abstract, 1:23-34, 2:5-12; Ex. 1045, FIG. 3, 2:51-3:43; Ex. 1047, FIG. 15, 1:18-2:14, 4:14-15 (known use of "LED chips").)[7] A POSITA would have recognized the use of LED chips in the design of the lighting device would promote compact and efficient footprint/device designs and expand versatility in *Wojnarowski*'s applications. (Ex. 1002, ¶¶101-102.)

Given such knowledge in the art including *Wojnarowski*, a POSITA would have been motivated to configure the LESDs as integrated circuits (LED chips) connected in series, as discussed above. (Ex. 1002, ¶¶54, 97, 101-102.) Such a configuration would have benefited *Wojnarowski*'s modified light system, making use of readily available, low-cost chips that would accommodate various applications and package configurations. (*Id.*) A POSITA had the skills to implement the claimed configuration with a reasonable expectation of success, especially given ordinary knowledge of the art, including *Wojnarowski*. (*Id.*; Ex. 1005, 3:48-53 (discussing prior connection fabrication techniques), 5:2-7 (discussing prior molding and multilayer structure coupling techniques); Ex. 1051, 19:7-23 (listing known LED configurations, including packaged, non-packaged, chip-on-board, *etc.*).)

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[7] Exs. 1022, 1044-1045, 1047 demonstrate the state of the art. Further, the '979 patent does not describe any criticality with the use of an LED "chips" or their series configurations. (*E.g.*, Ex. 1001, 4:43-48, 7:1-8, 8:4:9; Ex. 1002, ¶¶54, 101-102.)

As shown in FIG. 2 (above), the LED package also includes power connection leads (blue circle) connected to respective input and output ends of the series connected LED chips (*e.g.*, LESDs 14). (Ex. 1005, 2:9-14 ("electrical connections 24 [are] coupled for providing power to a respective LESD…."), 4:17-19 ("[A]n ***input/output*** … may additionally be present or patterned on substrate surface 15 of an LESD."), 7:40-42 (LESDs 14 of array 12 are coupled "***in series orientation***").) A POSITA would have understood that the power connection leads illustrated in Figure 2 are "connected to respective input and output ends of the series connected LED chips," as claimed, since otherwise the LESDs (*e.g.*, LED chips (*see below*) would not receive power to operate as disclosed. (Ex. 1002, ¶¶103-104; Ex. 1005, 2:9-14).) Thus, a POSITA would have understood that the conventional power connection leads (*e.g.*, FIG. 2) that provide power to the LESDs are necessarily "connected to respective input and output ends of the series connected LED chips" (*e.g.*, LESDs). (Ex. 1002, ¶¶103-104.)

Wojnarowski explains that the LESDs may be "un-packaged," meaning such configurations are "derived from the wafer state and may have some electrical connections 24 patterned thereon."[8] (Ex. 1005, 1:24-25, 2:26-36.) An "un-packaged" LESD may include a wafer that "includes multiple LESDs" with electrical connections (*e.g.*, connections 24) for power. (*Id.*, 2:29-26.) The use of "un-packaged" LESDs 14 by *Wojnarowski* does not affect the mapping for claim element 1(b) because, as explained below, *Wojnarowski* discloses or suggests the claimed "LED package" that includes the LESDs (whether or not the LESDs are individually un-packaged) with input/output power connections as claimed. (Ex. 1002, ¶¶105-109.)

For instance, although *Wojnarowski* does not expressly use the term "LED package," the arrays of LESDs (*e.g.*, FIGS. 1-2) are integrated with substrate 16 along with circuit interconnections 24, *etc*. to form a monolithic package. *Wojnarowski* describes ways to fabricate the LESDs such that, after fabrication, multiple LESDs are "positioned substantially edge-to-edge." (Ex. 1005, FIGS. 3-4, 3:37-4:4; *id.*, FIGS. 6, 8, 9, 5:8-37, 6:22-27 (configurations where "LEDs share a common reflector"). Such arrangements are consistent with the descriptions in the '979 patent. (*See*, *e.g.*, Ex. 1001, 5:59-6:13, 7:55-57, 8:46-51, 11:27-32, 12:1-4,

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[8] *Wojnarowski*'s description of "un-packaged" LESDs should not be confused with a lack of packaging of the light source. The LESDs are simply not *individually* pre-packaged prior to forming the lighting device. (Ex. 1002, ¶¶106-109.)

12:54-57, 13:52-54, 14:22-24, 17:8-12; Ex. 1002, ¶¶105-109.) Indeed, *Wojnarowski* teaches that the array may be encapsulated by a molding material 58 formed around LESDs 14 with an optional mold frame 56 (Ex. 1005, 4:61-5:7, FIG. 7) and that the light source may be used in a number of "packaged" applications, as discussed above (*id.*, 2:59-64). (Ex. 1002, ¶¶105-109.)

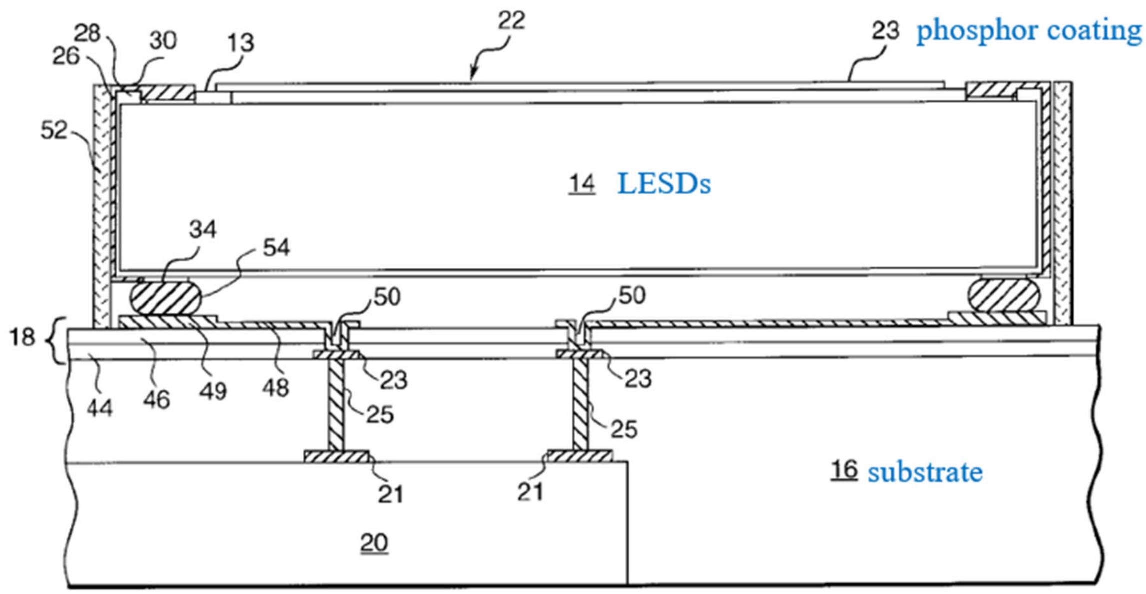
Moreover, in connection with FIG. 21, *Wojnarowski* explains that the LED lighting device may be in the shape of a conventional incandescent light bulb. (Ex. 1005, 1:58-60, FIG. 21.) As exemplified by *Martin* (Ex. 1006), a POSITA would have understood this embodiment to be a "package." (*See* Ex. 1006, ¶0028 (describing a similar LED array and conventional base arrangement as a "package.") Accordingly, a POSITA would have understood the above-discussed *Wojnarowski's* LED lighting device includes configurations within a package that contained the LESDs array and associated circuitry/connections which reflect an "LED package" like that claimed. (Ex. 1002, ¶¶105-109.)

Additionally, it would have been obvious to configure the *Wojnarowski* lighting device with an LED package that included the above-discussed LESDs and associated input/output power connection leads, like that claimed in view of *Martin* and state of the art. A POSITA would have been motivated to implement such a modification to promote efficient circuit design techniques/arrangements by consolidating components in integrated fashion and to allow an ordinary artisan to design *Wojnarowski*'s lighting device for different light source applications. (Ex. 1005, 2:59-64; Ex. 1002, ¶¶110-113.) A POSITA would have been further motivated given *Wojnarowski*'s disclosed versatile configurations and manners for fabricating the LESDs for subsequent "side to side" positioning and the guidance offered by *Martin* and knowledge in the art. (*See* above; Ex. 1002, ¶¶105-113.)

Such a modification would have involved known design techniques and components consistent with that known by a POSITA and contemplated by *Wojnarowski*. (Ex. 1002, ¶112; Ex. 1005, 2:27-29; Ex. 1022, 1:51-2:16, 3:60-4:1, FIG. 1; Ex. 1044, Abstract, 1:23-34, 2:5-12; Ex. 1045, FIG. 3, 2:51-3:43; *see also* Ex. 1001, 3:1-3 (acknowledging, "LED packages" with "series" LED circuit configurations were known).) Given such knowledge, a POSITA had the skills and reasons to implement such a modification with a reasonable expectation of success that predictably resulted in a lighting device with an LED package including multiple LESDs (LED chips) with associated power connections, consistent with the features described by *Wojnarowski*. (Ex. 1002, ¶¶105-113.)

c) wherein the LED chips comprise a phosphor coating to produce a change in a color or a quality of light emitted from the LED chips, wherein the LED chips, the power connection leads, and the phosphor coating are formed or mounted to a flexible substrate that is sufficiently flexible to be formed into a cylindrical shape;

Wojnarowski discloses the LED chips (LESDs 14) comprise a phosphor coating (*e.g.*, phosphor coating 23) to produce a change in a color or a quality of light emitted from the LED chips. (Ex. 1005, 2:37-45 ("light emitting device ***with phosphor composition for providing white light***"), 3:36-45, 4:34-37, 8:34-39, FIG. 6 (phosphor coating 23 on LESD 14).)



(Ex. 1005, FIG. 6 (annotated).)

Wojnarowski informed a POSITA of known color LED characteristics, including "commercially available" white LEDs. (*Id.*, 2:37-39.) Indeed, *Wojnarowski* specifically references (*id.*, 2:39-43) the phosphor composition of a patent application corresponding to *Soules-254* (Ex. 1007), which describes the conventional technique of using a blue LED to excite a phosphor composition to produce white light. (Ex. 1007, 4:62-64; Ex. 1002, ¶¶55, 91, 114-115.) A POSITA would have understood that *Wojnarowski* worked in similar fashion (*e.g.*, changing LED color or quality of light via the phosphor coating). (Ex. 1002, ¶115.) Indeed, consistent with that known in the art, *Wojnarowski* discloses adding phosphor layer(s) to reradiative components "***to provide a specific colored light***." (Ex. 1005, 5:54-58, 6:1-5, 3:42-45.)

Wojnarowski also discloses the LED chips (LESDs 14), the power connection leads, and the phosphor coating (*e.g.*, phosphor coating 23) are formed or mounted to a flexible substrate (*e.g.*, substrate 16) that is sufficiently flexible to be formed into a cylindrical shape like that claimed. (Ex. 1002, ¶¶116-117; Ex. 1005, 2:20-21 ("[I]f desired, the substrate may comprise a curved, conformal, or ***flexible substrate***."), 5:8-30, FIGS. 1, 2 (power connection leads), FIG. 6 (phosphor coating 23 on LESDs 14), 8 (illustrating flexible, cylindrical substrate), and 9.) FIGS. 8-9 (annotated below) are side views "showing ***a flexible and/or curved substrate*** 216, 316" to form respective convergent and divergent light patterns. (Ex. 1005, 5:8-30.)[9] As shown below, the substrate is sufficiently flexible to be formed into a

[9] *Wojnarowski*'s disclosures regarding FIGS. 1-9 are related and thus a POSITA would have collectively considered such disclosures in context of the above-described LED lighting device. (Ex. 1002, ¶117, Ex. 1005, 1:44-53, 5:8-11 ("embodiments of the present invention").)

cylindrical shape, which was a configuration well known by a POSITA before the '979 patent. (Ex. 1002, ¶¶56, 116-117; Ex. 1010, 3:32-37; Ex. 1011, 2:46-48.)[10]

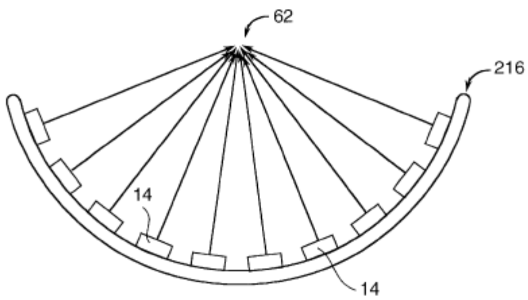


FIG. 8

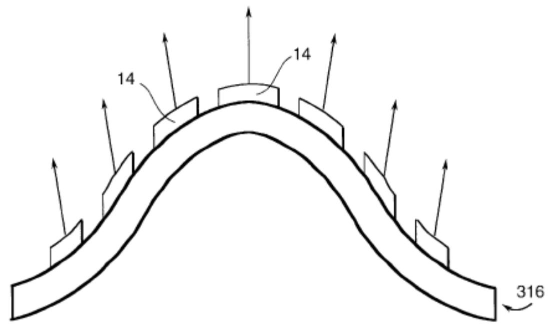


FIG. 9

(Ex. 1005, FIGS. 8-9.)

Indeed, *Wojnarowski* explains, "[t]he term 'flexible' is intended to encompass substrates that are ***capable of being bent under normal conditions or substrates that can have their shapes altered*** by processes such as heat forming" and "bending is facilitated by bonding or ***conforming a substrate to a curved surface*** (not shown)." (Ex. 1005, 5:9-22; Ex. 1002, ¶¶116-117.) Such flexibility depends on "the material properties and the thickness of the substrate." (*Id.*)

[10] Exs. 1010-1011 demonstrate the state of art.

d) an LED driver circuit comprising a bridge rectifier and a capacitor, the LED driver circuit configured to receive an AC voltage from a mains voltage power source and provide a DC voltage output to the LED package through the power connection leads;

Wojnarowski discloses an LED driver circuit (*e.g.*, control system 84) including a rectifier and a filter. (Ex. 1005, FIG. 24 (annotated below).) Rectifier and filter 80 and power conditioner 82 are electrically connected to LESD array 12 "providing the electrical power to each respective one of the LESDs." (Ex. 1005, 7:49-55, FIGS. 2, 24 (annotated below).)

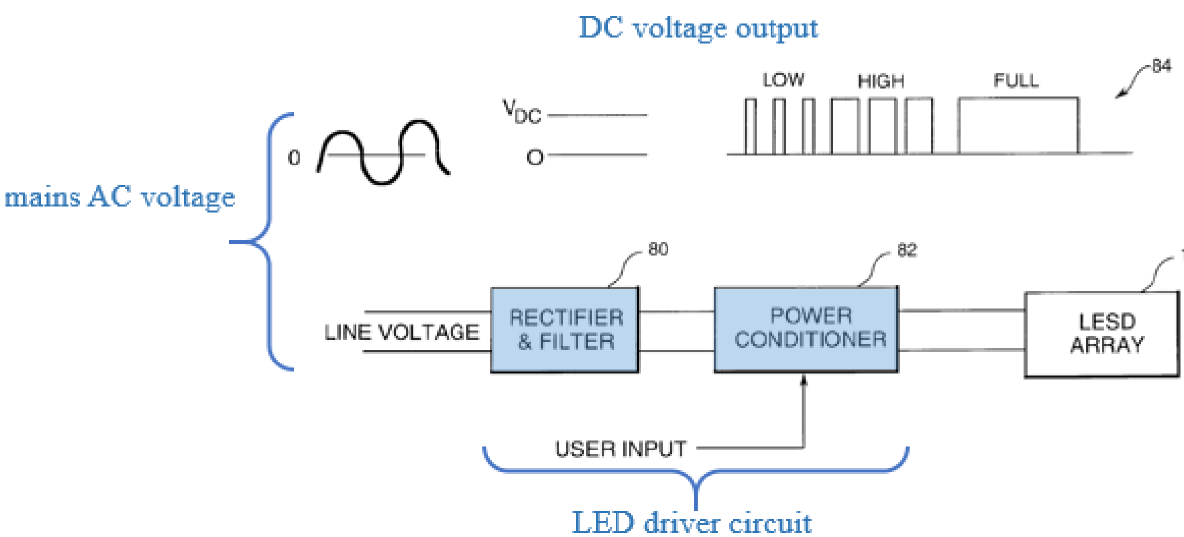


FIG. 24

In particular, *Wojnarowski* discloses, "ac (alternating current) line voltage (***from a 120 volt or 140 volt power supply***, for example) is rectified and filtered by rectifier & filter 80 ***to provide dc voltage***." (*Id.*, 7:59-62.) "A power conditioner 82 can modulate the signal to supply power ***to LESD array 12***." (*Id.*, 7:66-8:1, 7:35-

38 ("residential 120 volt socket").) A POSITA would have understood that the described AC 120V/140V power supply is a "mains voltage source" as such voltage levels were consistent with that provided by an AC mains power source and with *Wojnarowski*. (Ex. 1005, 7:62-64 (factory applications can use "standard 120 volt[]" power supply); Ex. 1017, 708 (describing "mains" as "[s]ource of electric power; normally the electricity supply system"); Ex. 1046, ¶0004 (describing a "***commercial alternating-current power supply***"); Ex. 1050, 1:37-42 ("conventionally high voltage alternating current electric mains source (*e.g.*, 120/140 V ac)"); Ex. 1002, ¶¶118-121.)[11] Hence, *Wojnarowski*'s LED driver circuit is configured to receive an AC voltage (a line voltage) from a mains voltage power source (*i.e.*, a 120-volt or 140-volt power supply) and provide a DC voltage output to the LED package through the power connection leads. (Ex. 1002, ¶¶118-121.)

Though *Wojnarowski* discloses a rectifier and filter, it understandably does not provide details regarding such well-known components. Accordingly, for practical implementation, a POSITA would have looked to known rectifying/filtering circuitry used to convert an AC power source to a DC voltage.

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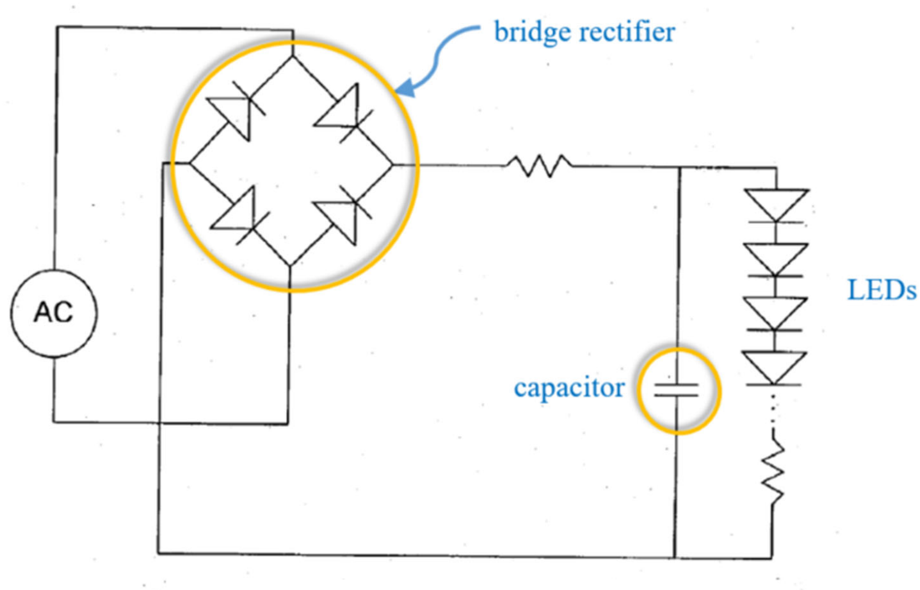
[11] PO asserts a description of "Operating Voltage 120 V" of an accused device demonstrates that the device is "configured to be directly connected to a mains AC voltage power source." (Ex. 1072, App'x K-3, 1.)

(*Id.*, ¶122.) *Martin* describes a conventional example of such circuitry including a bridge rectifier and capacitor. Thus, it would have been obvious to a POSITA to consider/implement such features in the *Wojnarowski* lighting device, especially in view of *Martin* and the state of art. (Ex. 1002, ¶¶122-129.)

Martin is directed to arrays of semiconductor light emitting devices powered by alternating current (AC) sources. (Ex. 1006, ¶0002.) As such, *Martin* is in the same field and addresses similar issues as *Wojnarowski* (including, for example, converting an AC voltage for use by a series of LEDs). (Ex. 1002, ¶123; Ex. 1006, ¶¶0002, 0024.) In implementing a device like that of *Wojnarowski*, a POSITA would have considered the choice of specific components for providing rectifying and filtering to supply a DC voltage to the LEDs. Thus, a POSITA would have found the teachings of *Martin* relevant, which similarly provides a DC voltage to a series of LEDs. (Ex. 1002, ¶¶123.)

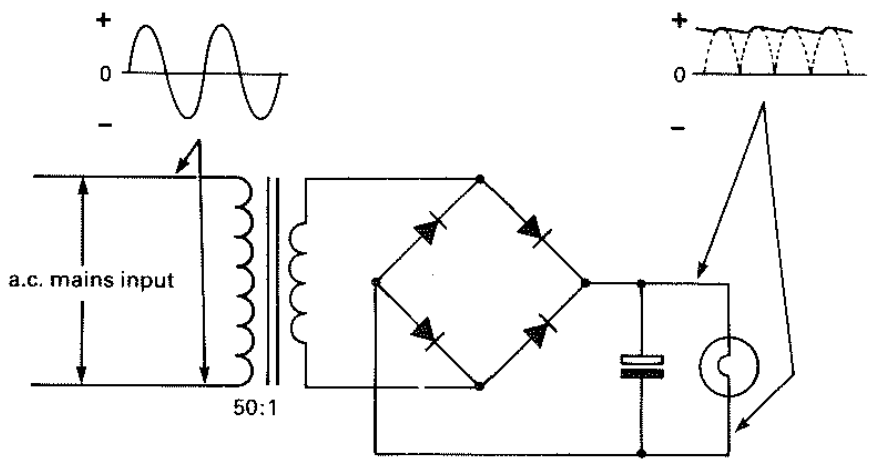
Martin discloses conventional circuitry for converting AC to DC via known rectifying and filtering circuitry, (*e.g.*, bridge rectifier and a capacitor). (Ex. 1006, ¶¶0002, 0024, FIG. 5 (annotated below).) *Martin*'s circuitry includes a full-wave bridge rectifier and capacitor arrangement "for rectifying the alternating current source" and "filter[ing] the rectified voltage to provide nearly direct current to the LED array." (*Id.*, ¶0024.)



(Ex. 1006, Fig. 5 (annotated).)

Martin's teachings/suggestions are consistent with that known by a POSITA at the time. (Ex. 1002, ¶¶37-38, 44-46, 125-126; *see also* Ex. 1012, FIG. 3.21 (below), 45-46 (describing arrangement to rectify and smooth AC mains power as "***the basis of almost all power supply systems used in electronic circuits***"); Ex. 1008, FIG. 4 (AC-to-DC converter composed of a bridge rectifier 403 and capacitor), ¶¶0003-0009, 0041-0043, 0043 (capacitor may be added to filter/reduce ripple), 0055.)

fig 3.21 *the bridge rectifier with smoothing capacitor; a large capacitor is used to provide power during the 'gaps' in the rectified waveform*



(Ex. 1012, FIG. 3.21)

A POSITA would have thus known and considered the conventional and routine application of a bridge rectifier and capacitor arrangement for providing a DC voltage from an AC mains in lighting devices (as demonstrated above) when implementing the above *Wojnarowski* lighting device. (Ex. 1002, ¶¶37-38, 44-46, 125-126.) Indeed, as *Martin* explains, such an arrangement was desirable because "[d]riving the LEDs with a near-direct current source is common and an efficient drive waveform." (Ex. 1006, ¶0024.) By converting to DC voltage, the "LEDs are constantly on when the array is connected to the alternating current source, eliminating any visible flickering that may have occurred had unfiltered alternating current been used to power the array." (*Id.*, ¶0004; Ex. 1002, ¶127.) Accordingly, it would have been obvious to a POSITA to implement the rectifier and filter circuitry of *Wojnarowski* as a bridge rectifier and capacitor to convert AC voltage from an AC mains to DC voltage to power the LED package including the LESDs as discussed above. (Ex. 1002, ¶¶122-129.)

A POSITA had reason to consider and implement such a modification, especially given that *Martin specifically* suggests improving *Wojnarowski* by providing integrated filtering and rectifying circuitry. (Ex. 1006, ¶0004.) And although *Martin* describes *Wojnarowski*'s devices as bulky and difficult to build and package (*id.*), such representations would have encouraged a POSITA to look to *Martin*'s capacitive filtering and bridge rectifying circuitry because "[d]evices without external LED electrical drivers (or with rectifying and filtering circuitry integrated in the submount) offer the advantages of being small and simple to build and package," increasing reliability and cost efficiency. (Ex. 1006, ¶0006; Ex. 1002, ¶¶122-128.)

Given the skills and knowledge of a POSITA at the time, coupled with the disclosures/guidance of *Wojnarowski* and *Martin*, a POSITA had motivation to implement the above modification with a reasonable expectation of success. (Ex. 1002, ¶¶122-129.) The modification would have involved the use of known technologies and techniques (*e.g.*, known rectifier and filtering circuit designs/components) to produce the predictable result of providing LED driver circuitry that converts AC voltage from a mains power source to DC voltage to power a series of LED chips in an LED package like that describe above in *Wojnarowski*. (*Id.*)

e) wherein the LED chips connected in series have a total forward voltage drop that matches the DC voltage output of the LED driver circuit.

Wojnarowski in view of *Martin* discloses or suggests this limitation. (Ex. 1002, ¶¶130-138.) As explained, *Wojnarowski* discloses that the line voltage in the lighting device may be from a 120-volt or 140-volt power supply, for example. (Ex. 1005, 7:59-62; *supra* §IX.A.1(d).) This voltage would have been converted to direct current via the bridge rectifier and capacitor filter and output to power the LED package including the LESDs 14 in the above-modified *Wojnarowski* lighting device. (Ex. 1002, ¶¶120-127, 131; §IX.A.1(d).) A POSITA understood the DC output voltage of the bridge rectification and capacitive filtering circuitry in the modified *Wojnarowski* device was approximately 120 volts or 140 volts. (Ex. 1002, ¶131; *see also* Ex. 1005, 7:64-66 (where an *optional* transformer lowers the input 120 volts to 24 volts).)

Although *Wojnarowski* does not expressly disclose that the total forward voltage drop matches the DC voltage output of the LED driver circuit in the modified device, it would have been obvious to configure the device to provide such features to ensure proper operation of the LED circuitry as taught by *Wojnarowski*. (Ex. 1002, ¶¶132-138.) Indeed, when designing and implementing the above-modified

Wojnarowski device, a POSITA understood and would have considered the following: (a) the total voltage drop of the circuit would dictate the current drawn by the LED circuitry, which would have been known to be inversely proportional to the voltage; (b) fewer LEDs in the design would lead to a larger current compared to a circuit with a greater number of LEDs; (c) excessive current would have been harmful to the LEDs in the above *Wojnarowski* device that could lead to failure; (d) too small a current may be insufficient to power the LEDs in a manner that enabled the lighting device operate as intended. (*Id.*, ¶134) Accordingly, typical of LED circuit design at the time, a POSITA would have taken into consideration the number of LEDs and the total voltage drop of the LED circuit when designing and implementing the above *Wojnarowski* lighting device. (*Id.*)

Indeed, a POSITA had guidance on such design issues from *Martin*, which explains that "[e]xcessive forward voltage can damage the LEDs irreversibly" and that "[s]eries interconnection reduces the voltage drop across each LED to a level that does not exceed the maximum forward voltage of each LED." (Ex. 1006, ¶0021; Ex. 1002, ¶135.) Further, "[t]he number of LEDs in the monolithic array may be selected to achieve a particular voltage drop across each device … such that the maximum voltage across each individual LED during the peak in the alternating current cycle is low enough so as to not damage the LEDs." (Ex. 1006, ¶0022.) Thus, a POSITA would have recognized when configuring the *Wojnarowski* device, the total forward voltage drop of the series connected LEDs should approximately match the DC voltage output of the above-described LED driver circuit, as suggested by *Martin* and known in the art. (Ex. 1002, ¶¶132-138; *see also* Ex. 1008, Abstract (explaining how the voltage of each series block of LEDs "must be matched to the input source voltage"), ¶¶0032, 0033, 0042, 0060 ("For AC or any other regularly varying input voltage, there is an additional requirement to direct drive voltage matching").) Indeed, were it otherwise not addressed, the design may be unstable, potentially leading to large current inputs and "the device will fail immediately or almost immediately." (Ex. 1008, ¶0068; Ex. 1002, ¶¶132-136.)[12]

Therefore, it would have been obvious to choose an appropriate number of LEDs connected in series such that a total forward voltage drop matches the DC voltage output of the LED driver circuit in the device. (Ex. 1002, ¶¶132-138.) A POSITA was motivated to implement such a modification because of the known risks and potential failure associated with such arrangements. (*Id.*) Thus, to avoid such problems and provide a stable circuit design, a POSITA would have chosen the number of series-connected LED chips consistent with the teachings of *Wojnarowski* and *Martin* (and state of the art) to ensure the LED chips have a total forward voltage

[12] Ex. 1008 demonstrates the state of the art; *see also* Ex. 1033.

drop that matches the DC voltage output of the above-described LED driver circuit. (*Id.*)

Given the knowledge of a POSITA at the time and the disclosures/suggestions of *Wojnarowski* and *Martin*, a POSITA had the skills and rationale to consider and implement the above modification and would have done so with a reasonable expectation of success. (*Id.*, ¶138.) Such a modification would have involved the use of known technologies and techniques (as demonstrated above) to produce the predictable result of providing LED driver output that matches a total forward voltage drop of the LED circuit to minimize failure and provide stable operations of the *Wojnarowski-Martin* lighting device. (*Id.*)

2. Claim 2 – The LED lighting device of claim 1, wherein the DC voltage output of the driver matched the AC voltage output from the mains power source[13]

As explained, *Wojnarowski* discloses that the line voltage may be from a 120/140 volt power supply, which is from an AC mains. (*Supra* §§IX.A.1(d)-(e); Ex. 1005, 7:59-62.) The rectifier/filter convert the AC voltage from the mains and output DC voltage to the LESDs 14 without the use of a voltage step-down component. (Ex. 1002, ¶139; Ex. 1005, 7:64-67 (optional use of transformer (and thus not required).) Thus, for similar reasons explained above (§IX.A.1(e)), the DC

[13] The ’979 patent does not include or describe such language used by claim 2.

voltage output of the LED driver would match the AC voltage output from the mains voltage power source. (Ex. 1002, ¶139; *see also* Ex. 1001, 4:3-15.)

Additionally, it would have been obvious to implement such features in the modified *Wojnarowski* device based on *Martin* and the knowledge of a POSITA. (Ex. 1002, ¶¶140-141.) Configuring the driver to output DC voltage matches the AC voltage from the mains voltage power source would have been a predictable design option from those available to a POSITA contemplating the various applications to implement *Wojnarowski*'s device. (*Id.*; Ex. 1005, 2:59-64.) *Martin* explains that compared to a mains source input of 120 RMS (root means square) volts, "[s]ources with 240 RMS volts would require twice as many LEDs connected in series, while 60 RMS volt sources would require half as many LEDSs connected in series." (Ex. 1006, ¶0022.) Thus, "the number of LEDs is selected to accommodate common alternating current sources, such as 100V in Japan, 120V in the United States, and 240V in Europe and parts of Asia." (*Id.*; *see also id.*, ¶¶0015, 0021; Ex. 1008, ¶¶0031-0032 (state of art knowledge of LED circuit designs that do not step down mains input voltage).)

Therefore, it would have been obvious to configure the LED driver in the modified *Wojnarowski* device such that it outputs a DC voltage that "matches" the AC voltage from the mains voltage power source. (Ex. 1002, ¶¶140-141; Ex. 1005, 2:54-64; Ex. 1006, ¶¶0015, 0021-0022; Ex. 1008, ¶¶0031-0032.) Given the knowledge of a POSITA and the disclosures and guidance of *Wojnarowski* and *Martin*, a POSITA was motivated to implement such a modification and would have done so with a reasonable expectation of success. (*Id.*) A POSITA would have appreciated that such a modification involved the use of known technologies and techniques (*e.g.*, known LED drive circuitry and power/voltage design concepts/components) to predictably provide an LED driver circuit that outputs DC voltage that "matches" the AC voltage from the mains source to accommodate applications contemplated by *Wojnarowski*. (*Id.*)

3. Claim 6 – The LED lighting device of claim 1, wherein the LED package and the LED driver circuit are encapsulated in a housing

The *Wojnarowski-Martin* combination discloses or suggests this limitation. (Ex. 1002, ¶¶142-147.) As explained, *Wojnarowski-Martin* discloses or suggests an LED package and LED driver. (*See* §IX.A.1.) *Wojnarowski* also discloses that "[i]f more structural support is desired, molding material 58 can be formed around the LESDs with an optional molding frame 56." (Ex. 1005, 4:67-5:7, FIG. 7.) Although *Wojnarowski* does not use the term "housing," a POSITA would have considered such an encapsulating frame to be a housing. (Ex. 1002, ¶143; Ex. 1017, 572 (housing as "[c]ontainment of [an] apparatus to prevent damage in handling or operation").)

Additionally, it would have been obvious to configure the *Wojnarowski-Martin* combined lighting device with a housing that includes the LED driver and LED package. (Ex. 1002, ¶¶144-147.) A POSITA was motivated to implement such a modification given *Wojnarowski* contemplates applying the disclosed lighting device in various ways, including ceiling and wall lighting and display devices (known to typically be provided with encompassing housings) with an LESD array that "can be situated on a common substrate." (Ex. 1005, 2:56-64; Ex. 1002, ¶145.) Further, a POSITA would have recognized *Wojnarowski*'s exemplary application as a light source in the shape of known light bulbs. (Ex. 1005, FIG. 21, 1:58-60, 7:35-38.) A POSITA would have recognized that such applications were consistent with known lighting devices that included housings that enclosed the LED circuitry and lighting source components. (Ex. 1002, ¶145.) For example, *Martin* discloses an LED package (*e.g.*, light emitting device array and submount 104) and LED driver circuit (*e.g.*, rectifier and filtering circuitry formed on and/or in the submount) encapsulated in a housing (*e.g.*, heat-sinking slug 100, leadframe 105, and optical lens 108). (Ex. 1006, ¶¶0024-0028, FIGS. 7, 9-10 (showing Edison and other monolithic configurations similar to *Wojnarowski*'s FIG. 21 application (Ex. 1005, FIG. 21).)

A POSITA would have known the benefits of encapsulating circuitry within a housing. For example, a POSITA would have appreciated encapsulating the LED package and driver circuit in the modified *Wojnarowski* LED lighting device would have provided protection from the environment or ambient conditions and support for electronics of the device. (Ex. 1002, ¶146.) Accordingly, given the knowledge of a POSITA and the disclosures of *Wojnarowski* and *Martin*, a POSITA would have been motivated to configure the *Wojnarowski-Martin* combined lighting device to use a housing to encapsulate the above-described LED package and LED driver circuit as discussed above. (Ex. 1002, ¶¶144-147.) For similar reasons, a POSITA had the skills to implement such modifications with a reasonable expectation of success, especially given the known applications contemplated by *Wojnarowski* and *Martin*. Indeed, such a modification would have involved the use of known technologies/techniques (*e.g.*, encapsulation in a known lamp housing, such as an Edison base/bulb) to produce the predictable result of providing a lighting device with a protectable housing encompassing the device's LED package and LED driver circuit as discussed. (*Id*.)

4. Claim 7

a) An LED lighting system comprising:

Wojnarowski discloses an LED lighting system including an array of LESDs, e.g., a system encompassing the disclosed lighting components and LESDs and circuitry (e.g., lighting system(s) including e.g., light source 10 (FIGS. 1-9), system 100 (FIG. 21)). (*Supra* §IX.A.1(a); Ex. 1005, 1:23-32, 2:25-26, 2:59-64, 4:36-5:30, FIGS. 1-9, 21 (describing various lighting system applications with a LED lighting system); Ex. 1002, ¶¶148; *see also infra* §§.A.4(b)-(g).)[14]

b) a lighting device configured to be connected directly to a mains AC voltage power source,

Wojnarowski discloses this limitation for reasons similar to those explained for claims 1-2 and below. (*See* §§IX.A.1-IX.A.2); Ex. 1002, ¶¶149-150.) *Wojnarowski*'s various exemplary lighting systems (*e.g.*, a system encompassing the disclosed lighting components and LESDs and circuitry, *e.g.*, Ex. 1005, 2:59-64, 7:35-38, FIG. 21 (non-limiting example) each includes a lighting device connected directly to a mains AC voltage power source. (*Supra* §§IX.A.1(a)-(b), IX.A.1(d); Ex. 1005, FIGS. 1-2, 24, 1:23-32 ("***a light source*** includes a substrate … (LESDS),…"), 7:59-62 (disclosing an "***ac (alternating current) line voltage*** (from a 120 volt or 140 volt ***power supply***"), FIG. 24; *see also id.*, 4:35-5:30, 7:11-34, FIGS. 1-9, 27, .) Control system 84 may be part of a light source 10 ("lighting device") which connects directly to a 120-volt or 140-volt power supply. (Ex. 1002, ¶149; Ex. 1005, 3:11-15, 7:49-55, 7:66-8:1, 7:35-38 (residential 120-volt socket).)[15] For the same reasons as discussed in §§IX.A.1(d), IX.A.4(d), and IX.A.4(f),

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[14] *See supra* n.6, n.9.

[15] PO asserts a description of "Operating Voltage 120 V" of an accused device meets this claim limitation. (Ex. 1072, App'x K-3, 1.)

Wojnarowski discloses that the LED driver circuit, which is included in such a lighting device, is configured to receive an AC voltage (a line voltage) from a ***mains AC voltage power source*** (*e.g.*, a 120-volt or 140-volt ac power supply) and provides a DC voltage output to the LEDs. (Ex. 1002, ¶150.)

c) wherein the lighting device comprises: an LED circuit comprising two or more LEDs connected together in series to match a forward voltage drop of the mains AC power source;[16]

Sections IX.A.1 and IX.A.4(a) explain how *Wojnarowski*'s lighting system (and thus the lighting device) includes multiple LESDs (including LEDs) connected in series. (§IX.A.1(b); Ex. 1002, ¶¶151-155.) For example, the lighting device comprises an LED circuit comprising two or more LEDs (*e.g.,* array 12 or portion thereof including LESDs)) connected together in series. (Ex. 1005, 2:9-14 ("electrical connections 24 [are] coupled for providing power to a respective LESD…."), 2:25-26, 7:40-42 ("LESDs 14 of array 12 [are] coupled ***in series orientation***."), 7:39-47, FIGS. 2, 22 (annotated above in §IX.A.1(b)); §IX.A.1(b) (explaining .)

[16] The '979 patent does not explain how (or even mention) a mains power source can or does have a "forward voltage drop" like that claimed. (*See generally* Ex. 1001; Ex. 1002, ¶¶42-43, 58, 139.)

Section IX.A.1(e) explains how *Wojnarowski-Martin* and the state of the art discloses/suggests that the series-connected LEDs (with the LESDs) would have been configured to match a forward voltage drop of an LED driver circuit. (§IX.A.1(e); Ex. 1002, ¶¶153-155.) For similar reasons, the *Wojnarowski-Martin* combination discussed above discloses/suggests that the LEDs connected in the combined lighting system (and lighting device) are in series to match a forward voltage drop of the mains AC power source.[17] (*Id.*)

A POSITA would have appreciated *Martin*'s concerns of damage caused by excessive forward voltage and how series interconnections can reduce the voltage drop across each LED and thus understood that the number of LEDs should be selected to ensure the maximum voltage across each LED during "the peak in the alternating current cycle is low enough so as to not damage the LEDs." (Ex. 1006, ¶¶0021-0022; Ex. 1002, ¶154.) *Martin*'s guidance is consistent with a POSITA's knowledge in the art that the voltage of each series block of LEDs must be matched to the input source voltage. (Ex. 1002, ¶154; Ex. 1008, ¶0042, ¶¶0032, 0033, 0060

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[17] PO asserts "multiple LEDs connected together in series to match a forward voltage drop of the mains AC power source" (like that claimed) is "***required*** to illuminate the LEDs. (Ex. 1072, App'x K-3, 2.)

("For AC or any other regularly varying input voltage, there is an additional requirement to direct drive voltage matching"), 0068; *supra* §IX.A.1(e).)

Therefore, it would have been obvious to choose an appropriate number of LEDs in the above-discussed *Wojnarowski-Martin* LED circuit such that the series-connected LEDs had a total forward voltage drop that matches the voltage drop (including forward voltage drop) of the AC mains power source discussed above. (Ex. 1002, ¶¶58, 75, 132-136, 140-141, 152-155.) A POSITA had similar motivations, capabilities, and expectations of success in implementing such a modification in the *Wojnarowski-Martin* device relating to claim 7 as those explained above for claims 1 and 2. (*Id.*; §IX.A.1(e), §IX.A.2.)

d) an LED driver circuit comprising a driver integrated circuit, a bridge rectifier, and a capacitor;

The *Wojnarowski-Martin* combination discloses/suggests an LED driver circuit comprising a bridge rectifier and a capacitor for reasons similar to those discussed above regarding claim 1. (*See* §IX.A.1(d); Ex. 1002, ¶¶156-158.) A POSITA would have been further motivated to configure the LED driver circuit in the combined *Wojnarowski-Martin* device to include a driver ***integrated circuit*** for similar reasons. (*Id.*)

As explained, *Wojnarowski* discloses the lighting device comprises a control system 84 comprising a rectifier and filter 80. (*Id.*) *Wojnarowski* further discloses a driver integrated circuit (*e.g.*, power conditioner 82) to "modulate the signal to supply power to LESD array 12." (Ex. 1005, 7:66-8:1, 8, 27-28 (describing the control system as "formed from active or passive electronics"); Ex. 1002, ¶156.)

Moreover, a POSITA would have understood that power supplying/conditioning circuits, like that described *Wojnarowski* and *Martin*, were often integrated circuits to provide compact and efficient circuit arrangements. (Ex. 1002, ¶¶54, 74, 112, 128, 156-157.) Indeed, *Martin* discloses that the bridge rectifier and capacitor can be formed "using conventional integrated circuit fabrication techniques." (Ex. 1006, ¶0024, claim 4 ("silicon integrated circuit"), Abstract ("integrated rectifying and filtering circuitry"); *see also* Ex. 1001, 2:42-43 (confirming the prior art included designs with a "single-chip LED device through the use of integrated circuit technology").)

Thus, it would have been obvious to a POSITA to configure the above-discussed LED driver circuit of the *Wojnarowski-Martin* device (and system) to include a driver integrated circuit leveraging conventional circuit fabrication techniques to provide a compact and efficient device. (Ex. 1002, ¶¶156-158.) Such a modification would have been a predictable application within the capabilities and knowledge of a POSITA.[18] (*Id.*) As such, for similar reasons above, such a person would have had reasonable expectation of success in the implementation. (*Id.*)

e) wherein the driver integrated circuit, the bridge rectifier, the capacitor, and the LEDs are all mounted on a single insulating substrate, and

Wojnarowski-Martin discloses or suggests this limitation. (Ex. 1002, ¶¶159-162.) *Wojnarowski* discloses multiple components (*e.g.*, control device 20, LESDs 14, *etc.*) mounted on a single insulating substrate (*e.g.*, substrate 16). (Ex. 1005, 2:15-18 (Substrate 16 may comprise … ***ceramic***, a ***molded plastic material*** … or a ***printed circuit board***")[19], FIG. 1 (below).) Further, *Wojnarowski* discloses a control system may be "included within a control device 20" and describes a control system 84, including rectifier/filter 80 and power conditioner 82. (*Id.*, 7:52-8:1.) The LESDs 14 and control device 20 can be mounted on substrate 16. (*See* Ex. 1005, 2:3-14 ("…LESDs are arranged on the substrate…"); 3:11-12 ("FIG. 1 additionally illustrates a control device 20 situated in substrate 16"), 7:52-62.)

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[18] The '979 patent specification does not describe any criticality of such an integrated circuit. (Ex. 1001, 17:4-15.)

[19] A POSITA would have understood circuit boards and substrates made from ceramic or plastic materials to be insulating substrates. (Ex. 1002, ¶160.)

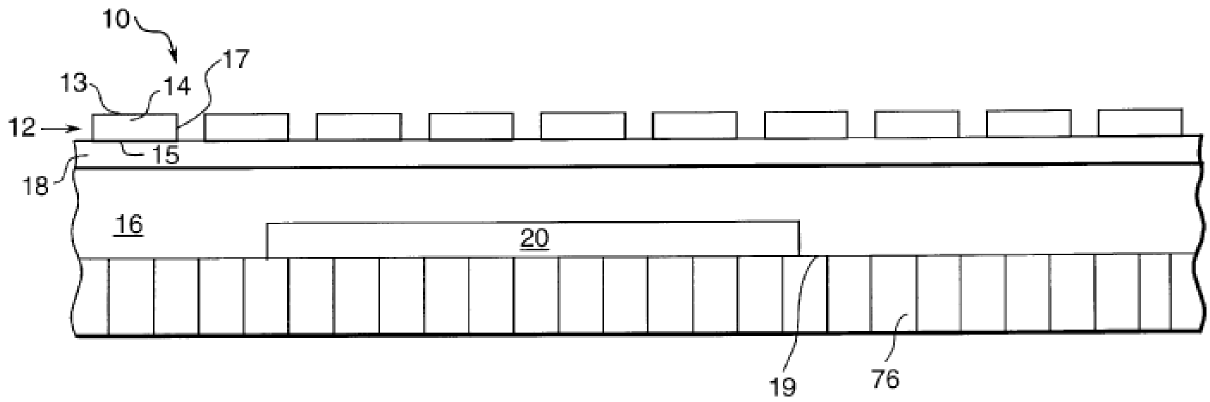

FIG. 1

(Ex. 1005, FIG. 1; *id.*, FIGS. 2-9, 24-26; Ex. 1002, ¶159.)

Given the disclosures of *Wojnarowski* and *Martin*, a POSITA would have been motivated to configure the *Wojnarowski-Martin* device to mount the above-discussed driver integrated circuit, bridge rectifier, capacitor, and LEDs on a single insulating substrate proving a common base for the electronics and predictably promoting stability for the lighting system based on its application. (Ex. 1002, ¶¶161-162; Ex. 1005, 2:56-64; §§IX.A.4(b)-(d).) In light of such guidance and knowledge of a POSITA at the time, a POSITA would have been motivated, and found obvious, to implement the above modification with a reasonable expectation of success. Such a modification would have involved the use of known technologies/techniques (*e.g.*, known substrate materials and circuit designs) to predictably provide a lighting device with commonly mounted components that would have been applicable to the various types of lighting systems contemplated by *Wojnarowski*. (*Id.*)

f) wherein the LED driver circuit comprises an input configured to receive a first AC voltage from the mains AC voltage power source and to provide a DC voltage output to the LEDs;

The *Wojnarowski-Martin* combination discloses or suggests this limitation. (Ex. 1002, ¶¶163-165.) As explained above, the LED driver circuit in the *Wojnarowski-Martin* lighting device comprises an input configured to receive a first AC voltage from the mains AC voltage power source and to provide a DC voltage output to the LEDs. (*See* §§IX.A.1(d), IX.A.4(a), IX.A.4(d); Ex. 1002, ¶¶164-165; *see also supra* §IX.A.1 (*Wojnarowski*'s lighting device receives power from a mains AC voltage power source).) Further, *Wojnarowski* discloses driver circuitry (*e.g.*, control system 84) comprising a rectifier/filter, which is connected to LESD array 12 to provide electrical power to each LESD. (Ex. 1005, FIG. 24 (annotated below), 7:49-8:1, FIG. 2.)

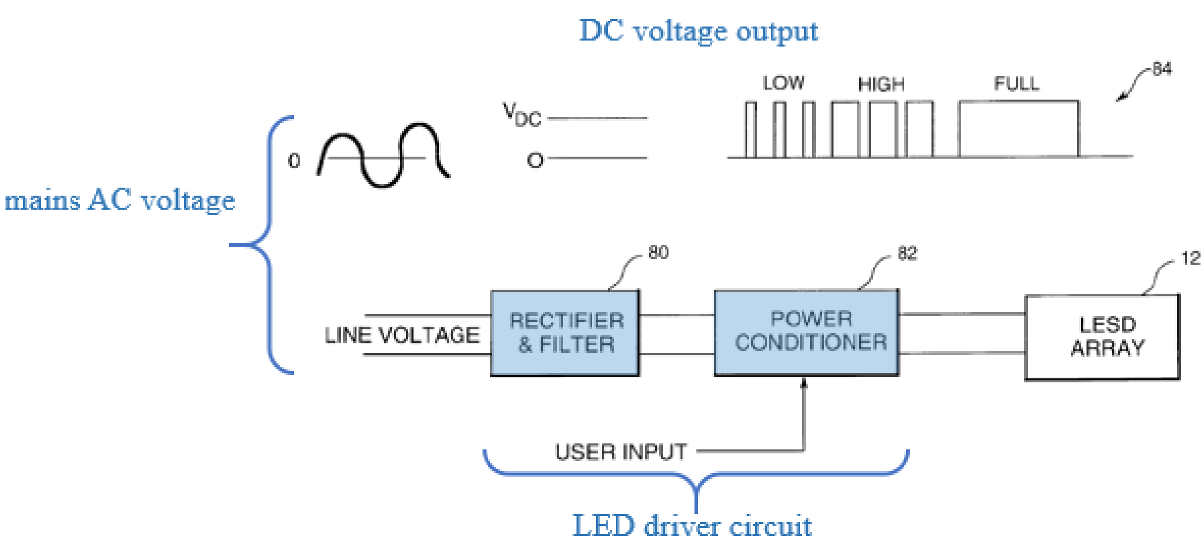

FIG. 24

Control system 84 rectifies and filters the AC line voltage from, e.g., 120V/140V, supply to "provide dc voltage." (*Id*, 7:59-62.) Power conditioner 82 modulates the signal to supply power to LESD array 12 at different levels. (*Id.*, 7:66-8:1.)

In light of *Wojnarowski* and *Martin*, a POSITA would have found it obvious to configure the LED driver circuit (§§IX.A.4(d)-(e)) in the *Wojnarowski-Martin* device to include an input to receive a first AC voltage from the mains AC voltage power source and to provide a DC voltage output to the LEDs in order to provide the necessary power to the LEDs so that the combination could operate as a lighting system according to its application. (Ex. 1002, ¶¶163-165; Ex. 1005, 2:56-64.) A POSITA would have been motivated to implement such features because, as explained, *Wojnarowski* provides power to the LESDs via a system that receives power from an AC mains source, and in light of its teachings/suggestions with *Martin*, would have been guided to ensure the driver circuit in the combined system properly provided a proper DC voltage output to the LEDs. (*Id.*; *see also supra* §§IX.A.4(d)-(e).) In light of the skills/knowledge of a POSITA at the time, coupled with the disclosures/guidance of *Wojnarowski-Martin*, a POSITA would have been motivated to implement the above modification with a reasonable expectation of success. (Ex. 1002, ¶¶164-165.) Indeed, the modification would have involved the use of known technologies/techniques (*e.g.*, known LED circuit design with AC power input) to predictably provide an LED driver circuit designed to provide proper

DC voltage to LEDs based on received AC mains input, consistent with the lighting system applications contemplated by *Wojnarowski*. (*Id.*)

g) a first lens covering the lighting device.

Wojnarowski-Martin discloses/suggests this limitation. (Ex. 1002, ¶¶166-168.) *Wojnarowski* discloses applications that use a first lens (*e.g.*, lenses 64 or reradiative component 80 including Fresnel lenses 84) covering the lighting device. (Ex. 1005, 5:31-49, 5:58-65, 6:19-47, FIGS. 10, 12, 14-16; Ex. 1002, ¶167.) *Martin* also describes configurations with lenses. (Ex. 1006, FIG. 7, ¶0026, claim 9, *see also* FIGS. 9-10, ¶0028 (cover which would act as a lens); Ex. 1002, ¶167.)

Given such disclosures/suggestions in context of the above *Wojnarowski-Martin* combination discussed above, a POSITA would have been motivated, and found it obvious, to implement a first lens with the lighting device (§§IX.A.4(b)-(f)) in the above discussed *Wojnarowski-Martin* lighting system. (Ex. 1002, ¶168.) A POSITA would have been motivated to provide such features because such a modification would have provided the predictable benefits of protecting the LED lighting components in the lighting device while also "aid[ing] in focusing and light distribution control" as described by *Wojnarowski*. (Ex. 1005, 5:46-49; Ex. 1002, ¶168.) A POSITA had the skills and reasons to implement such a modification with a reasonable expectation of success. Such a modification would have involved the use of known technologies/techniques (*e.g.*, use of lenses in LED lighting systems) to predictably provide a lighting device with features for protecting components and directing/focusing illumination, which would have been consistent with and benefited the lighting systems contemplated by *Wojnarowski*. (Ex. 1007, 1:14-28, 3:45-49; Ex. 1008, ¶¶0048, 0050, Ex. 1011, FIGS. 1-2, Abstract (cover acting as a lens); Ex. 1002, ¶¶167-168.)

5. Claim 8 – The LED lighting system of claim 7, wherein the substrate is a reflective substrate

Wojnarowski-Martin discloses/suggests this limitation. (Ex. 1002, ¶¶169-171.) In particular, *Wojnarowski* discloses that the substrate (like that discussed above for limitation 7(e)) may include an optional integral reflective coating (*e.g.*, aluminum or gold), thus making it a reflective substrate. (Ex. 1005, 6:6-7:34 ("substrate 716 includes reflector component assembly 770 … as an integral … assembly"); Ex. 1002, ¶170.) *Wojnarowski* teaches that "reflector portions 766 and 866 serve both as light reflectors and as electrical couplers for coupling the LESDS" and that reflectors aid to ensure "light is not lost and can be effectively used." (Ex. 1005, 6:10-12, 7:19-23, FIG. 27 (below).)

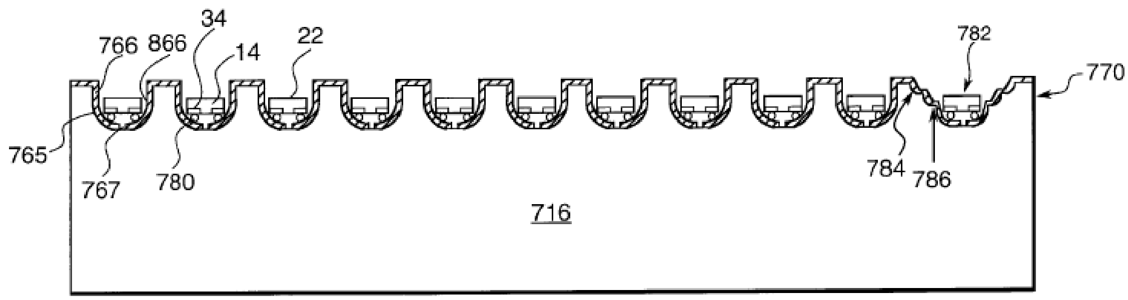

FIG. 27

Similar to *Wojnarowski*, *Martin* also discloses the use of reflective surfaces/components for directing light. (Ex. 1006, FIG 7, ¶0026; Ex. 1005, 5:34-36, 6:6-12.)

Given the disclosures and suggestions by *Wojnarowski-Martin*, a POSITA would have been motivated, and found it obvious, to configure the insulating substrate in the *Wojnarowski-Martin* lighting device discussed above for claim 7 (§IX.A.4(e)) as a reflective substrate to provide known illumination direction properties for ensuring "light is not lost and can be effectively used," as was known in the art. (Ex. 1002, ¶170; *see also* Ex. 1052, ¶0018 ("reflection material" on board for LED lighting device), ¶0081, ¶0034.)

A POSITA would have recognized the predictable benefits of such a configuration (*e.g.*, enhancing illumination by effectively using available emitted light), and thus had reason to implement such a modification with a reasonable expectation of success. (Ex. 1002, ¶171.) Indeed, such a modification would have involved the implementation of known technologies/techniques (*e.g.*, reflective substrate materials for lighting systems). (*Id.*) A POSITA would have recognized the benefits of providing a reflective substrate for mounting the above-noted components in the *Wojnarowski-Martin* lighting system because it would have offered a predictable alternative to provide a base structure for the circuitry components that also improved illumination and heat dissipation characteristics, as suggested by *Wojnarowski* and known in the art. (*Id.*; Ex. 1005, 2:56-64.) A POSITA would have considered various designs to configure the above-discussed substrate with reflective material to ensure the substrate maintained its insulating properties (§IX.A.4(e)) while also providing light reflective properties, similar to that described by *Wojnarowski*. (*Id.*)

6. Claim 10 – The LED lighting system of claim 7, wherein the lighting device is dimmable

Wojnarowski-Martin discloses/suggests this limitation. (Ex. 1002, ¶¶172-173.) *Wojnarowski* teaches "power conditioner 82 can modulate the signal to supply power to LESD array 12 at different levels in accordance with a user input selection … [so that] a light source can be dimmed," and thus discloses a lighting device that is dimmable. (*Id.*; Ex. 1005, 7:66-8:6.) Accordingly, in addition to the reasons explained above for claim 7, a POSITA would have been motivated, and found obvious, to incorporate such features in the combined *Wojnarowski-Martin* lighting device to ensure the device provides similar dimming functionalities, especially given *Wojnarowski* discloses the implementation of such features. (*Id.*; §IX.A.4 (regarding reasons for combining *Wojnarowski-Martin*).)

B. Ground 2: Claims 13-17 are Obvious over *Wojnarowski* in view of *Martin* and *Duggal-II*

1. Claim 13

a) An LED lighting device comprising:

Wojnarowski discloses an LED lighting device for the reasons explained for limitation 1(a). (*See* §IX.A.1(a); Ex. 1002, ¶174.)[20]

b) a plurality of LED packages connected in series, wherein each of the LED packages comprises a plurality of LED chips electrically connected in series and power connection leads connected to respective input and output ends of the series connected LED chips

Wojnarowski in view of *Martin* discloses/suggests this limitation. (Ex. 1002, ¶¶175-180.) The analysis for limitation 1(b) explains how *Wojnarowski* in view of *Martin* discloses/suggests an LED package comprising a plurality of LED chips electrically connected in series and power connection leads connected to respective input and output ends of the series connected LED chips. (*Supra* §IX.A.1(b); Ex. 1002, ¶¶96-113.) For similar reasons, the combination of *Wojnarowski* and *Martin*

[20] *Supra* n.6, n.9.

further discloses a "plurality of LED packages" connected in series, each including "LED chips" as claimed here.

Wojnarowski discloses a plurality of sub-arrays connected in series. (Ex. 1005, 2:56-59, 7:41-42, 7:47-48 ("Sub-arrays can additionally be used for the ***series orientation*** couplings of FIG. 22.").) As explained, each LED array (or sub-array) constitutes an LED package, which may be connected in series. (§IX.A.1.) Moreover, as explained, *Wojnarowski* discloses that power connection leads connected to respective input and output ends of the series connected LEDs, and thus would likewise be so connected in the chips. (*Supra* §IX.A.1(b); Ex. 1005, FIG. 26, 8:13-15 (power conditioner 82 in control system 88 "***multiplexes power and selectively supplies it to sub-arrays*** 112, 212, 312, and 412."), FIGS. 2 (power connection leads for LED array), 20 (similar), 22 (LEDs in series), 26 (power supplied to multiple sub-arrays)[21].)

Martin similarly discloses, "more than one monolithic array may be mounted on one or more submounts, in order to achieve the desired maximum voltage drop across each LED in the arrays." (Ex. 1006, ¶0022.) Thus, *Martin* discloses the LED

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[21] Though the FIG. 26 sub-arrays are shown in parallel, as noted above, *Wojnarowski* discloses that "[s]ub-arrays can additionally be used for the ***series orientation*** couplings of FIG. 22." (Ex. 1005, 7:47-48.)

submounts packages are connected in series since "the voltage across each of the individual LEDs in the array is the line voltage divided by the number of LEDs in series." (*Id*.)

Accordingly, for reasons explained for claim 1 and above, it would have been obvious to configure the *Wojnarowski-Martin* combined device to include a plurality of LED packages connected in series, such that each package includes LED chips electrically connected in series and power connection leads connected to respective input and output ends of the series connected LED chips "to achieve the desired maximum voltage drop across each LED in the arrays." (*Id.*; Ex. 1002, ¶¶177-180; §IX.A.1(b).)

c) wherein the LED chips and the power connection leads are mounted to a glass substrate;[22]

Wojnarowski in view of *Martin* and *Duggal-II* discloses/suggests this limitation. (Ex. 1002, ¶¶181-187.) Section IX.A.1(e) explains how *Wojnarowski-Martin* discloses/suggests the LED chips and power connection leads are mounted on a substrate. (§IX.A.1(e); Ex. 1002, ¶¶96-107; Ex. 1005, FIGS. 1-2, 2:3-18, 3:11-12.) *Wojnarowski* discloses that the LED chips and power connection leads can be

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[22] The '979 patent specification does not describe or mention a "glass substrate," much less one as claimed. (*See generally* Ex. 1001.)

mounted to a substrate, and that certain substrate components (for reflective components) can be made from glass or ceramic particles (Ex. 1005, 59-7:2), but the *Wojnarowski-Martin* combination does not expressly disclose a glass substrate mounting the LED chips and power connection leads. However, it would have been obvious to modify the *Wojnarowski-Martin* device to use such a glass substrate in view of the knowledge of a POSITA and *Duggal-II.* (Ex. 1002, ¶¶183-187.)

The use of glass substrates in lighting devices (including LED applications) was known to a POSITA. (Ex. 1002, ¶184; state of art disclosures in Ex. 1013, 1:15-28. 1:40-43, 2:65-67, FIG. 2; Ex. 1014, 3:42-43, 7:31-43; Ex. 1047, FIGS. 1-2, 15, 3:12-16, 3:30-33, 4:14-15, 6:36 (glass substrate for cover); Ex. 1015, FIGS. 1-2, 4, 9, 7:64-66, 15:65-66; Ex. 1016, FIGS. 1, 3-5, Abstract, 1:50-54 (LED light source), 2:33-39, 4:8-36, 5:51-66.) Indeed, *Duggal-II* (in same field as *Wojnarowski*), discloses the well-known use of glass substrates in LED lighting applications. (Ex. 1002, ¶¶86-89, 185-187.)

Duggal-II describes an AC power LED lighting device that includes series connected LED modules to provide a lighting apparatus similar to the configurations described by *Wojnarowski*. (Ex. 1049, FIGS. 1-3, Abstract, 2:51-67, 3:43-4:45, 4:50-63 (discussing power conducting lines connected to either end of an OLED series group), 5:37-6:7.) Similar to the *Wojnarowski-Martin* combination, *Duggal-II* discloses arrangements that use a converting circuit (including a rectifier and filter

410) for converting the voltage waveform from an AC power source to another form to provide the optimum voltage across the LED modules. (*Id.*, FIGS. 5-10, 7:39-8:57, 9:1-24.) *Duggal-II* describes that, in such configurations, a glass substrate can be used. (*Id.*, FIGS. 2, 11-13, 18-20, 4:17-23, 9:25-29, 10:61-11:2, 16:1-2, 18:35-38.) Like *Wojnarowski*, *Duggal-II* also describes the mounting of multiple components on a substrate. (*See, e.g.*, *id.*, FIGS. 1-4, 20-21, 10:57-11:8, 16:31-36, 16:58-65, 18:35-67, 19:4-21:41; Ex. 1002, ¶¶86-89, 185-187.)

Given the knowledge of the state of art, and the disclosures of *Wojnarowski* and *Duggal-II*, a POSITA would have been motivated to configure the *Wojnarowski-Martin* device to mount the above-discussed LED chips and power connection leads on a glass substrate. (Ex. 1002, ¶187.) A POSITA would have been motivated to implement such features because, as demonstrated above, the use of glass substrates for lighting applications, including those involving LEDs, was well known. (*Id.*) As explained, *Duggal-II* describes an LED device (with LED array on a substrate) for display and lighting applications similar to *Wojnarowski*. (Ex. 1005, 2:56-64; Ex. 1049, 1:15-40.) Thus, a POSITA would have appreciated the options and trade-offs in selecting a material for the *Wojnarowski-Martin* substrate, such as glass. In light of a POSITA's skills and knowledge at the time, coupled with the disclosures/guidance of *Wojnarowski* and *Duggal-II*, a POSITA would have been motivated to configure the combined device with a glass substrate with a reasonable expectation of success. (Ex. 1002, ¶187.) Indeed, the modification would have involved the use of known technologies/techniques (*e.g.*, as demonstrated above) to predictably provide a lighting device with a substrate constructed of conventional material (*e.g.*, glass) for mounting components, which would have complimented the various types of lighting device applications contemplated by *Wojnarowski*. (*Id.*)

d) a phosphor coating on the LED chips and the glass substrate to produce a change in a color or a quality of light emitted from the LED chips

Wojnarowski-Martin-Duggal-II discloses/suggests this limitation. (Ex. 1002, ¶¶188-192.)

As discussed, *Wojnarowski* discloses providing a phosphor coating on the LED chips and the LED chips on the glass substrate to produce a change in a color or a quality of light emitted from the LED chips. (*See* §IX.A.1(c); Ex. 1002, ¶¶55, 114-115, 189.) Accordingly, a POSITA would have been guided by such teachings/suggestions to consider the use of phosphor coatings on the LED chips to provide color change options regarding the light emitted from the LESDs in the *Wojnarowski-Martin-Duggal-II* device. (Ex. 1002, ¶¶190-192.) The application of phosphor coatings on LED components and the substrate was known in the art. (*Id.*). Indeed, *Duggal-II* discloses such features, consistent to that known by a POSITA. (Ex. 1049, FIGS. 18-20, 17:1-9, 17:25-35, 17:52-18:6, 18:16-21, 18:60-62 ("an inorganic phosphor, is applied to the device substrate 125").) (*See also* Ex. 1002,

¶¶190-192; Ex. 1047, FIGS. 1-2, 15, 3:9-29, 4:14-15, 6:24-26 (state of art use of phosphor layer on glass substrate of cover); Ex. 1016, FIGS. 3-5, 3:8-35, 4:49-54, 6:52-60 (state of art knowledge of phosphor film covering glass substrate and other components (*e.g.*, spacer 19) of lighting device).)

Given the knowledge of the state of art, and the disclosures of *Wojnarowski-Duggal-II*, a POSITA would have been motivated to configure the above-described lighting device to cover the glass substrate and LED chips mounted thereon with a phosphor substrate to facilitate the change of color emitted by the LEDs. (Ex. 1002, ¶¶190-192.) Guided by *Wojnarowski* and *Duggal-II*'s disclosures/suggestions regarding the use of phosphor coatings to produce a change in a color (*see* §IX.A.1(c)) and by the knowledge in the art regarding the same, a POSITA would have considered/implemented similar features in the combined *Wojnarowski-Martin-Duggal-II* device. (*See* §§IX.A.1(c), IX.B.1(c); Ex. 1002, ¶¶190-192.) Such a modification would have involved the use of known technologies/techniques (*e.g.*, use of phosphor coatings in lighting devices), and thus a POSITA had the skills and reasons, with reasonable expectation of success, to implement the modification. (*Id.*) Moreover, the modification would have predictably resulted in the *Wojnarowski-Martin-Duggal-II* device benefiting from the known color change features provided by the use of phosphor coatings, which would have been applicable to the various types of lighting systems contemplated by *Wojnarowski*. (*Id.*; Ex. 1005, 2:56-64.)

e) an LED driver circuit comprising a bridge rectifier and a capacitor, the LED driver circuit configured to receive an AC voltage from a mains voltage power source and provide a DC voltage output to the LED packages through the power connection leads

Wojnarowski-Martin-Duggal-II discloses/suggests this limitation. (Ex. 1002, ¶¶193-195.) As discussed for limitations 1(d) and 13(b), the *Wojnarowski-Martin* combined device would have included an LED driver circuit (with bridge rectifier and capacitor-based filter) configured to receive an AC voltage from a mains voltage power source and provide a DC voltage output to the LED packages through power connection leads. (§§IX.A.1(d), IX.B.1(b); *see also* §IX.A.1(b); Ex. 1002, ¶193.) Accordingly, a POSITA would have been motivated, and found it obvious, to include an LED driver circuit (as claimed here) in the *Wojnarowski-Martin-Duggal-II* device for the similar reasons discussed above for limitations 1(d) and 13(a)-(d). (*Id.*) Indeed, a POSITA would have found further motivation for such a modification given *Duggal-II* also discloses arrangements where a lighting device receives AC power that is converted using a rectifier and filter, similar to that explained above for the *Wojnarowski-Martin.* (*See*, *e.g.*, Ex. 1047, FIGS. 5-10, 7:39-8:57, 9:1-24; §IX.A.B.1(c); Ex. 1002, ¶195.)

2. Claim 14 – The LED lighting device of claim 13, wherein the glass substrate is a reflective substrate

Wojnarowski-Martin-Duggal-II discloses or suggests this limitation. (Ex. 1002, ¶¶196-198.) As explained for claim 8, a POSITA would have been motivated, and found it obvious, to configure the substrate in the *Wojnarowski-Martin* lighting device to include reflective material to form a reflective substrate. (*See* §IX.A.5; Ex. 1005, FIG. 27, 6:6-12, 5:34-36, 6:53-7:5, 7:11-34; Ex. 1006, FIG 7, ¶0026; Ex. 1002, ¶197.) Further, as explained for claim 13, a POSITA would have found it obvious to configure the *Wojnarowski-Martin-Duggal-II* device with a glass substrate. (*See* §IX.B.1(c); Ex. 1002, ¶198.)

Accordingly, for reasons similar to those explained for claims 8 and 13, a POSITA would have been motivated, and found it obvious, to configure the glass substrate in the *Wojnarowski-Martin-Duggal-II* device to include reflective material and form a reflective substrate ensuring "light is not lost and can be effectively used," as *Wojnarowski* explains and is known in the art. (Ex. 1002, ¶198; Ex. 1005, 6:10-12; §IX.A.5.) For similar reasons explained, a POSITA would have recognized the predictable benefits of such a configuration. Thus a POSITA had reason to implement such a modification with a reasonable expectation of success because such a modification would have involved the implementation of known technologies/techniques (*e.g.*, use of reflective materials on known substrates) and lead to the foreseeable result of providing a lighting device with improved spatial light distribution. (*Id.*; *see e.g.*, Ex. 1005, 2:56-64.) A POSITA would have considered various designs to configure the above-discussed glass substrate with reflective material to ensure the substrate maintained its glass properties (§IX.B.1(c)) while also providing light reflective properties, similar to that described by *Wojnarowski*. (*Id.*)

3. Claim 15 – The LED lighting device of claim 13, wherein the glass substrate comprises ceramic

Wojnarowski-Martin-Duggal-II discloses/suggests this limitation. (Ex. 1002, ¶¶199-202.) As explained, the *Wojnarowski-Martin-Duggal-II* device would have included a glass substrate. (*See* §IX.B.1(c).) Although not expressly disclosed, a POSITA would have found it obvious to configure the glass substrate to comprise ceramic material given the guidance by *Wojnarowski* and the state of art knowledge of a POSITA. (Ex. 1002, ¶¶199-202.)

Wojnarowski discloses the known use of ceramic material for its substrates. (Ex. 1005, 2:15-18.) A POSITA would have likewise been aware of the use of ceramic material for substrates, including with glass substrates. (Ex. 1002, ¶201; Ex. 1048, ¶0072 (state of art disclosures of substrate "covered with a ceramics material such as glass or the like" and "preferably … made of ceramics"), ¶0073 ("ceramics that the substrate 2 may be made of" include "glass, and mixtures thereof"), ¶¶0076, 0112.)

In light of *Wojnarowski* and the knowledge of the state of art (*e.g.*, *Takeuchi*), a POSITA would have been motivated to configure the *Wojnarowski-Martin-Duggal-II* device to configure the glass substrate with ceramic material. (Ex. 1002, ¶201; Ex. 1048, ¶¶0072-0075.) Providing such a substrate would have expanded the various types of substrates used by the combined device to accommodate the different types of lighting systems contemplated by *Wojnarowski*. (*Id.*; Ex. 1005, 2:56-64.) Moreover, such a modification would have allowed the combined device to be formed with substrates made of known materials using known technologies/techniques (as demonstrated above). As such, a POSITA would have had a reasonable expectation of success in implementing the modification, especially given *Wojnarowski*'s disclosures/suggestions. (Ex. 1002, ¶202.) Such guidance would have led a POSITA to appreciate the foreseeable result of providing a glass substrate with ceramic material in the *Wojnarowski-Martin-Duggal-II* device, which as explained would have been applicable to the various types of lighting systems contemplated by *Wojnarowski*. (*Id.*)[23]

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[23] The '979 patent does not describe a glass substrate, ceramic substrate, or both, or any criticality with such substrates. (*See generally* Ex. 1001.)

4. Claim 16 – The LED lighting device of claim 13, wherein the series connected LED packages have a total forward voltage drop that matches the AC voltage from the mains voltage power source

Wojnarowski-Martin-Duggal-II discloses/suggests this limitation. (Ex. 1002, ¶¶203-204.) The analysis for limitations 1(e), 7(c), 13(b), and claim 2 explain how the *Wojnarowski-Martin* combination discloses/suggests features like that recited in claim 16, which are applicable for the same reasons here as for the *Wojnarowski-Martin-Duggal-II* combination discussed above for claim 13. (*Id.*; §§IX.A.1(e), IX.A.2, IX.A.4(c), IX.B(b).)

5. Claim 17 – The LED lighting device of claim 13, wherein the AC voltage from the mains voltage power source matched the DC voltage output provided to the LED packages

Wojnarowski–Martin-Duggal-II discloses/suggests this limitation. (Ex. 1002, ¶¶205-207.) The analysis for limitations 1(e), 7(c), 13(b), and claim 2 explain how the *Wojnarowski-Martin* combination discloses/suggests features similar to those recited in claim 17, which are applicable for the same reasons here as for the *Wojnarowski-Martin-Duggal-II* combination disclosed above for claim 13. (*Id.*; §§IX.A.1(e), IX.A.2, IX.A.4(c), IX.B(b).) As explained, the LED driver circuit in the combined device would have been configured to provide a DC voltage output to the LED packages that matched the AC voltage output from the mains voltage power source in the *Wojnarowski-Martin* combined device, which would have been applicable to the *Wojnarowski-Martin-Duggal-II* combination for similar reasons. (*Id.*)

C. Ground 3: Claims 3 and 11 are Obvious over *Wojnarowski* in view of *Martin* and *Chen*

1. Claim 3 – The LED lighting device of claim 1, further comprising a switch having at least 3 positions that are selectable by a user

Wojnarowski in view of *Martin* and *Chen* discloses/suggests this limitation. (Ex. 1002, ¶¶208-217.)

Although the *Wojnarowski-Martin* combination does not expressly disclose a user selectable switch with at least three positions, it would have been obvious to incorporate such features in the *Wojnarowski-Martin* lighting device in light of *Chen*. (*Id.*) As explained regarding claim 10, a POSITA would have been motivated, and found it obvious, to include dimming features (like that described by *Wojnarowski*) in the combined *Wojnarowski-Martin* lighting device. (*See* §IX.A.6; Ex. 1002, ¶210.) For example, *Wojnarowski* leverages a power conditioner to provide such features (Ex. 1005, 7:66-8:6), which a POSITA would have recognized would have provided the same or similar functionality as a multi-position switch where the brightness of the emitted light may be adjusted to different levels. (Ex. 1002, ¶¶211-212.) A POSITA would have recognized the predicable benefit of known switch designs to implement brightness control of the lighting device similar to that described by *Wojnarowski*.

Chen describes known switch design for a lighting system where a plurality of LED light sources are mounted on a flexible substrate (Ex. 1011, 1:7-11, 6:56-62 Ex. 1002, ¶¶77-81, 213). In particular, *Chen* discloses a LED lamp with a switch having at least three positions that are selectable by a user similar to *Wojnarowski'*s dimming functionalities. (Ex. 1011, 6:56-7:60 ("a conventional three-way light socket of the type in which a switch having four positions (off, low light output level, medium light output level, and full light output level) is used to selectively control the brightness…"), FIGS. 6-9; Ex. 1002, ¶¶80-81, 214-216.)

Given the knowledge of the state of art, including *Wojnarowski* and *Chen*, a POSITA would have been motivated to configure the *Wojnarowski-Martin* device to implement a multi-position (*e.g.*, three-position) switch to provide the user selected dimming features described by *Wojnarowski*. (Ex. 1002, ¶¶215-217.) As described by *Chen*, providing three positions for such features via a switch was a predictable application of known dimming circuit designs that a POSITA would have considered among the finite number of known options and which were consistent with *Wojnarowski*'s features of providing controlled light levels based on user input. (*Id.*; Ex. 1005, 7:59-8:6, FIG. 24 (low, high, and full).) A POSITA had the capabilities and reasons for implementing such a modification with a reasonable expectation of success, given it would have predictably resulted in dimming using known switch designs, consistent with the disclosures/suggestions of *Chen* and *Wojnarowski*. (*Id.*)

2. Claim 11 – The LED lighting system of claim 7, further comprising a switch having at least 3 positions that are selectable by a user

Wojnarowski-Martin-Chen discloses/suggests this limitation for reasons similar to those for claim 3. (*See* §IX.C.1; Ex. 1002, ¶¶218.)

D. Ground 4: Claims 4, 5, and 12 are Obvious over *Wojnarowski* in view of *Martin* and *Weng*

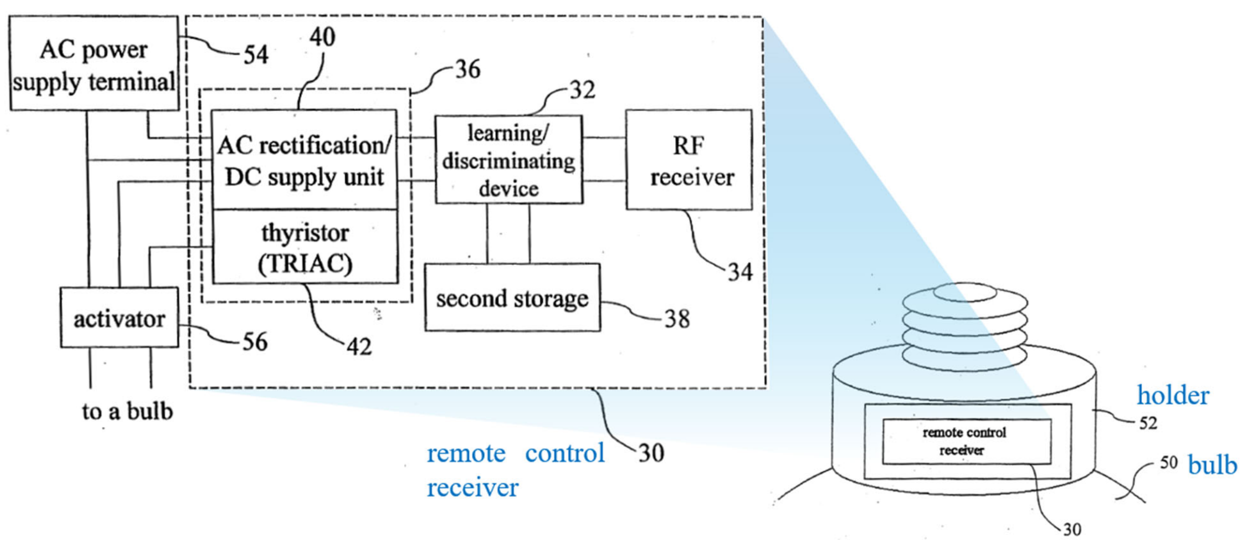
1. Claim 4 – The LED lighting device of claim 1, further comprising a data communication circuit and an antenna.

Wojnarowski in view of *Martin* and *Weng* discloses/suggests this limitation. (Ex. 1002, ¶¶219-227.)

Though the *Wojnarowski-Martin* combination does not expressly disclose a data communication circuit and an antenna, such features were well-known features for lighting devices, for example, to enable wireless remote control of the device. (Ex. 1002, ¶220; *see*, *e.g.*, Ex. 1009, 1:3-5; Ex. 1019, FIG. 3, ¶¶0017-0020; Ex. 1020, FIG. 4A, 4:7-23.) Indeed, it would have been obvious to a POSITA to modify the combined *Wojnarowski*-*Martin* lighting device to incorporate a data communication circuit and an antenna in view of *Weng*. (Ex. 1002, ¶¶220-227.)

Weng relates to lighting devices, including driver and related components, including lighting control components, including "a wireless remote control bulb device capable of controlling [light] bulbs to be turned on or off through wireless remote control way." (Ex. 1009, 1:3-5.) Thus, a POSITA had reason to consider its teachings/suggestions when considering *Wojnarowski*. (Ex. 1002, ¶¶83-84, 223-226.)

Weng describes applications where a data communication circuit and an antenna are used for wireless remote control operation of a lighting device. (Ex. 1009, Abstract.) As described in connection with FIGS. 3-4, *Weng* discloses, "a remote control receiver 30 is installed in the holder 52 of a bulb 50. The remote control receiver comprises a learning/discriminating device 32, an RF receiver 34, a DC power supply 36, and a second storage 38." (*Id.*, 4:13-5:10.)



(Ex. 1009, FIGS. 3, 4 (excerpted/annotated.)

To control the on and off state of the light bulb, the RF receiver 34 receives the remote control signal containing a remote control code (data) emitted from a remote controller module. (*Id.*, 4:18-19.) The received remote control code (data) is then discriminated and compared to a stored serial code by the learning/discriminating device 32 to verify the remote control code. (*Id.*, 4:18-24.) If the correct code is received, the remote control receiver 30 opens or closes the AC power connected to the bulb to allow it to be turned on or off. (*Id.*, 5:4-7.)

Although *Weng* does not expressly state the RF receiver includes/uses an "antenna," a POSITA would have understood *Weng* necessarily discloses such a component. *Weng*'s RF receiver 34 refers to "radio frequency," which is an electromagnetic signal. (Ex. 1009, 3:15; Ex. 1002, ¶224). A POSITA would have understood such an RF receiver must include an antenna to provide the wireless communication functions described by *Weng* consistent with that known in the art. (Ex. 1002, ¶224; *see also* Ex. 1017, 49 (antenna: "[a] structure for receiving or transmitting electromagnetic signals"); Ex. 1018, 110 (antenna: "[a] device used for radiating or receiving radio waves").) Thus, the RF receiver in *Weng* necessarily includes/operates with an antenna because, without such a component, the lighting bulb would not be able to wirelessly receive a data signal, as described by *Weng* and known in the art. (Ex. 1009, 4:18-24, 5:4-7; *see also* Ex. 1019, FIG. 3 (illustrating a similar remote control unit of lighting device with antenna as part of a wireless receiving circuit); Ex. 1020, 3:4-42, FIG. 4A (describing use of antenna 112 for receiving an RF signal); Ex. 1002, ¶224.)

Further, the "learning/discriminating device" of *Weng* is a data communications circuit because it receives and analyzes "keyed-in data from the panel keyboard 16 and the remote control serial codes and zone codes of the bulbs the user wants to control." (Ex. 1009, 3:20-23; Ex. 1002, ¶225.)

Weng teaches that remote control features of a lighting device assists individuals with a disability to control the lighting device, increases convenience, and permits long distance operation. (Ex. 1009, 1:12-2:12, 6:5-14.) Accordingly, a POSITA would have appreciated the benefits of remote control operations, like those suggested by *Weng*, and thus been motivated to modify the *Wojnarowski-Martin* lighting device to include a data communication circuit and antenna to provide remote control capabilities similar to that described by *Weng*. (Ex. 1002, ¶¶226-227.)

Further, the use of data communication components and antennas was known in the lighting applications. (*Id.*; Ex. 1020, 3:4-42, 4:45-54.) Given the knowledge of state of art, and the disclosures of *Wojnarowski-Martin-Weng*, a POSITA had reason and the skills to implement such a modification with a reasonable expectation of success. Indeed, such a design would have involved the use of known technologies/techniques (as demonstrated above) to predictably provide remote control light device operations, which would have expanded the applications of the lighting devices contemplated by *Wojnarowski*. (*Id.*)

2. Claim 5 – The LED lighting device of claim 4, wherein the data communication circuit and the antenna are encapsulated in a housing.

Wojnarowski-Martin-Weng discloses/suggests this limitation. (Ex. 1002, ¶¶228-232.)

Weng discloses that the data communication circuit (learning/discriminating device 32) and the antenna (radio frequency receiver 34) are encapsulated in a housing (holder 52) of a light bulb. (Ex. 1009, 1:3-6, 2:1-3, FIGS. 3-4.) Accordingly, in addition to the reasons discussed above for claim 4 (§IX.D.1), a POSITA was further motivated, and would have found it obvious in view of *Weng*, to encapsulate the data communication circuit and antenna in the combined *Wojnarowski-Martin-Weng* in a housing. (Ex. 1002, ¶¶229-232.)

In implementing a data communication circuit and antenna, a POSITA would have recognized the benefits of containing such components in a housing to protect them from other components in the lighting device and to provide an efficient way of configuring the lighting device circuitry in the lighting device. (Ex. 1002, ¶230.) Indeed, it was known to encapsulate similar components in an enclosure/housing. (Ex. 1020, 3:4-42, 4:45-54; *see also* §IX.A.3 (regarding known benefits for placing lighting device components in a housing).) Accordingly, a POSITA would have been motivated to use known design concepts in implementing the above-discussed modified *Wojnarowski* lighting device, and thus would have looked to take advantage of the known benefits, and thus encapsulated the *Wojnarowski-Martin-Weng* data communication circuit and antenna in a housing like that claimed. (Ex. 1002, ¶¶230-232.)

In light of the knowledge in the art (*e.g.*, Ex. 1020) and the disclosures of *Wojnarowski-Martin-Weng*, a POSITA had a reasonable expectation of success in implementing such a modification because it would have involved the use of known technologies/techniques (*e.g.*, use of housings in lighting devices) that could predictably provide a lighting device with protective coverings/housing. (*Id.*; *see also* rationale discussed in §IX.A.3.)

3. Claim 12 – The LED lighting system of claim 8, further comprising a data communication circuit and an antenna

Wojnarowski-Martin-Weng discloses/suggests this limitation for reasons similar to those for claim 4. (*See* §IX.D.3;_Ex. 1002, ¶¶233-234.)

E. Ground 5: Claim 18 is Obvious over *Wojnarowski* in view of *Martin, Duggal-II*, and *Weng*

1. Claim 18 – The LED lighting device of claim 13, further comprising a data communication circuit and an antenna

Wojnarowski-Martin discloses/suggests this limitation for reasons explained for claim 13 and claim 4 (reciting similar features). (§§IX.B.1, IX.D.1; Ex. 1002, ¶¶235-236.) A POSITA would have had the same capabilities, reasons, and expectation of success in implementing a data communication circuit and antenna in the *Wojnarowski-Martin-Duggal-II* combination discussed for claim 13 (§IX.B.1) as explained for the combination relating to claim 4 (§IX.D.1) in view of *Weng*.

F. Ground 6: Claim 9 is Obvious over *Wojnarowski* in view of *Martin* and *Soules-II*

1. Claim 9 – The LED lighting system of claim 7, wherein a second lens covering the first lens

Wojnarowski-Martin-Soules-II discloses/suggests this limitation. (Ex. 1002, ¶¶237-242.)

As explained for limitation 7(g), the *Wojnarowski-Martin* combined device discloses or suggests a first lens covering the lighting device. (*See* §IX.A.4(g).) Though the combination does not disclose a second lens covering the first lens, it would have been obvious to implement such features in light of *Soules-II*.[24] (Ex. 1002, ¶¶237-242.)

Soules-II describes a light emitting device with one or more light emitting diodes "having a specific geometry … to improve the efficiency of the LED.") (Ex. 1021, 1:4-8.) As such, a POSITA would have had reason to consider *Soules-II* in context of *Wojnarowski*. (Ex. 1002, ¶¶91-93, 239.) Specifically, *Soules-II* discloses

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[24] PO asserts without details that an accused instrumentality "designed for use" with a spotlight having a second diffuser lens meets this limitation. (Ex. 1072, App'x K-3, 7.)

"a second lens 430 can be mounted over the phosphor coated lens for protection." (Ex. 1021, 12:19-20, FIG. 5 (below).) Though one LED is shown, the described invention is applicable to a system containing multiple LED chips. (*Id.*, 12:31-33.)

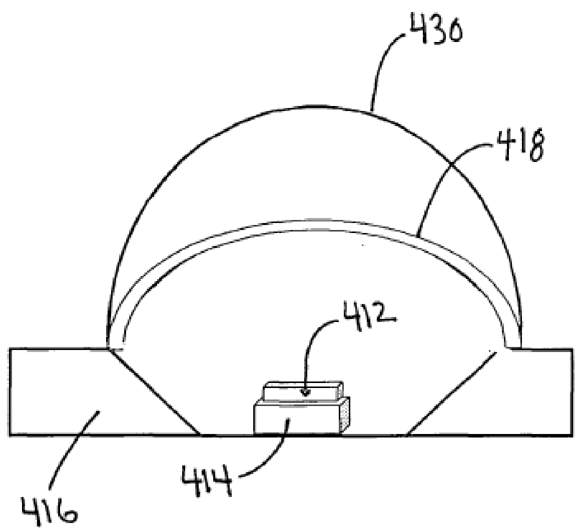

Figure 5

A POSITA would have been motivated to consider known lighting device and lens design configurations/arrangements when contemplating the implementation of the modified *Wojnarowski-Martin* device (discussed for claim 7). And in light of the guidance by *Soules-II* (consistent with that known by a POSITA at the time), a POSITA would have been motivated, and found it obvious, to modify the combined device to cover the first lens with a second lens in order to achieve the protection benefits suggested by *Soules-II*. (Ex. 1002, ¶¶241-242.)

A POSITA would have considered the trade-offs and design options when contemplating the implementation of a second lens, and configured the modification such as to ensure the second lens did not detract from the *Wojnarowski* use of a first lens to aid in focusing and light distribution control. (Ex. 1005, 5:37-49; Ex. 1002, ¶¶241-242.) Indeed, a POSITA would have been motivated and able to add a second lens such that light remained focused/distributed consistent with that contemplated by *Wojnarowski* and providing the protection suggested by *Soules-II*. (*Id*.) Thus, given the knowledge of a POSITA, and the disclosures of *Wojnarowsk-Martin-Soules-II*, a POSITA had reasons and skills to implement such a modification with a reasonable expectation of success, especially since it would have involved the use of known, predictable technologies/techniques (demonstrated above) to provide a lighting system with additional protection to underlying LED device components. (*Id*.)

X. THE CIRCUMSTANCES WEIGH AGAINST DISCRETIONARY DENIAL

A. The *Fintiv* factors favor institution

An evaluation of the six factors under *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (Mar. 20, 2020) (precedential), weigh against the Board exercising its discretion to deny institution. Rather, the strong invalidity showing on the merits favors institution, notwithstanding the Illinois-I, Illinois-II, and HD-Litigation. (*See* §II).

First factor. Petitioner intends to seek stays of Illinois-I/II upon institution of this petition. The Board has explained that it will not speculate as to the outcome of such unresolved issues before a district court, *Google LLC et al. v. Parus Holdings, Inc.*, IPR2020-00847, Paper 9 at 12, and that this factor is neutral where no such stay motion has yet been filed, *Unified Patents LLC v. Monarch Networking Sol'n's LLC*, IPR2020-01708, Paper 26. Accordingly, this factor does not weigh in favor of discretionary denial.

Second factor. Regarding Illinois-I and Illinois-II, the court has not set a trial date. The '979 patent was recently added to the Illinois-I on September 8, 2021 (Ex. 1076) and added to Illinois-II on September 28, 2021.[25] No trial has been scheduled

[25] The Texas Litigation is irrelevant to any analysis here given it was transferred to Illinois on September 27, 2021. (Ex. 1080.)

and thus any question as to a trial date for purposes of this analysis is purely speculative. Thus, this factor weighs against discretionary denial.

The Home Depot Litigation is not relevant to this analysis, but nonetheless has a "tentative" trial date for December 7, 2022. (*See* IPR2021-001367, Paper 1 at 8-9; Ex. 1081.) And as Home Depot noted in its own petition, more than a dozen other trials are scheduled before the same judge—calling into question whether trial could practically take place as scheduled. (*Id.*)

Third factor. The minimal investment by the court and the parties in Illinois-I/II weighs against discretional denial. Fact and expert discovery are not open, no depositions have occurred, and no substantive efforts toward claim construction have begun. PO served infringement contentions for the '979 patent just days ago. (Ex. 1072.) Petitioner has not served invalidity contentions for the '979 patent. The court has not issued a scheduling order. In short, virtually nothing substantive has happened in either case and the most resource intensive period in the district court case will occur after the institution decision in this proceeding. (*See* Exs. 1077, 1079.) This alone strongly weighs against denial. *See*, *e.g.*, *Hulu LLC v. SITO Mobile R&D IP, LLC*, IPR2021-00298, Paper 11 at 13 (May 19, 2021).

Fourth factor. There is no complete overlap between issues raised in the petition and in the parallel proceeding. As noted above, PO only recently identified its asserted claims for the '979 patent (claims 7-9), while this Petition challenges claims 1-18. (§X; Ex. 1072, 2.) This weighs against denial. *See Vudu, Inc. v. Ideahub, Inc.*, IPR2020-01688, Paper 16 at 14-15 (Apr. 19, 2021) (differences in claims asserted in litigation and challenged in the petition weighs against denial). Moreover, Petitioner has not yet served invalidity contentions and thus ascertaining overlap of issues at this stage is purely speculative.

Nonetheless, to mitigate any potential concerns, Petitioner stipulates that it will not pursue invalidity of the '979 patent in district court based on any instituted IPR grounds in this proceeding.

Fifth factor. Although Petitioner is a party to Illinois-I/II, this factor does not outweigh the other factors that strongly weigh against discretionary denial. Petitioner is not a party to the HD-Litigation.

Sixth factor. Petitioner diligently filed this Petition with strong grounds (*supra* §IX) **within four months** of PO's assertion of the '979 patent (Ex. 1075, ¶¶40-55; Ex. 1074) and ***shortly after*** after PO's infringement contentions for the '979 patent in Illinois-I (Ex. 1072, 2), and more than seven months before the statutory deadline for filing an IPR. Such diligence weighs against exercising discretion. *See*, *e.g.*, *Hulu*, IPR2021-00298, Paper 11 at 13; *Facebook, Inc. v. USC IP P'ship, L.P.*, IPR2021-00033 Paper 13 at 13. Further, Petitioner diligently filed this petition shortly after the court in the Texas Litigation finally resolved the transfer issues involving the '979 patent, which streamlined the *Fintiv* analysis here (e.g., eliminating the Texas Litigation from the analysis). Thus, the strength of the asserted grounds (*supra* §X) and Petitioner's diligence weigh against discretionary denial.

Further, the '979 patent issued from the first office action without any substantive prior art analysis. (Ex. 1004, 97-98.) Institution is thus consistent with the significant public interest against "leaving bad patents enforceable." *Thryv, Inc. v. Click-To-Call Techs., LP*, 140 S. Ct. 1367, 1374 (2020). This Petition is the ***sole*** challenge to the '979 patent before the Board, which also favors institution. *Google LLC v. Uniloc 2017 LLC*, IPR2020-00115, Paper 10 at 6 (May 12, 2020).

Accordingly, based on a "holistic view of whether efficiency and integrity of the system are best served," the facts here weigh against exercising discretion denial. *Samsung Elecs. Co. Ltd. v. Dynamics Inc.*, IPR2020-00505, Paper 11 at 15 (Aug. 12, 2020). At a minimum, factors 2, 3, 4, and 6 (or combinations thereof) outweigh factors 1 (which is neutral) and 5, and thus favor institution.

B. The Board Should Not Exercise Discretion Under § 325(d) To Deny the Petition

Discretionary denial under §325(d) is inappropriate in view of the Petition's reliance on *Chen*. Although cited during prosecution, the Office erred in a manner material to the patentability of the challenged claims by not applying the teachings of *Chen*. *Advanced Bionics, LLC v. Med-El Elekromediznische Geräete GMBH*, IPR2019-01469, Paper 6 at 8 (precedential).

Specifically, the Office cited *Chen* in an IDS, but it was not substantively discussed or applied during prosecution of the '979 patent. (Ex. 1004, 105.) Thus, the citation to *Chen* during prosecution should not serve as a basis for denial of institution here. *Becton, Dickinson and Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 16-28 (informative). Moreover, the Examiner erred by dismissing *Chen* given its disclosures, which as explained above are material to the patentability of the challenged claims. (*Supra* §IX.B.) Indeed, the Examiner never applied any prior art, but rather allowed the as-filed claims on first office action. (Ex. 1004, 98.) The Examiner did not indicate any of the features of dependent claims 3 and 11 (which *Chen* is applied against as a supporting prior art reference in §IX.B) as an alleged basis of allowance. (Ex. 1004, 98.) Such oversight is critical and warrants consideration of *Chen* in the proceeding here. *Advanced Bionics* at 8-9. Moreover, the examiner did not have the benefit of expert testimony explaining the significance of *Chen* in combination with *Wojnarowski* and *Martin* as explained above. (§X.)

Accordingly, institution of the Petition should not be denied because the reliance on *Chen*.

XI. CONCLUSION

Petitioner requests institution of IPR for claims 1-18 based on the specified grounds.

Respectfully submitted,

Dated: October 1, 2021 By: /Joseph E. Palys/
Joseph E. Palys (Reg. No. 46,508)
Counsel for Petitioner

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 10,652,979 contains, as measured by the word-processing system used to prepare this paper, 13,991 words. This word count does not include the items excluded by 37 C.F.R. § 42.24 as not counting towards the word limit.

Respectfully submitted,

Dated: October 1, 2021

By: /Joseph E. Palys/
Joseph E. Palys (Reg. No. 46,508)
Counsel for Petitioner

CERTIFICATE OF SERVICE

I hereby certify that on October 1, 2021, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 10,652,979 and supporting exhibits to be served via express mail on the Patent Owner at the following correspondence address of record as listed on PAIR:

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Chicago, IL 60690

By: /Joseph E. Palys/
Joseph E. Palys (Reg. No. 46,508)