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. 10,154,551

PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,154,551

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I. INTRODUCTION

Samsung Electronics Co., Ltd. ("Petitioner") requests *inter partes* review of claims 1-9 and 37 of U.S. Patent No. 10,154,551 ("the '551 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 '551 patent is at issue in the following matters:

- *Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.*, No. 1-21-cv-02665 (N.D. Ill.) ("Illinois-I").[2] (Ex. 1077.)
- *Lynk Labs, Inc. v. Samsung Electronics Co. Ltd.*, No. 6-21-cv-00526 (W.D. Tex.) ("Texas Litigation").[3] (Ex. 1078.)

[2] The following Lynk Labs patents are also involved: 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 10,652,979.

[3] 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,

- *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.)
- *The Home Depot USA, Inc. et al. v. Lynk Labs, Inc.*, IPR2021-001367 ("HD-IPR").

Patents related to the '551 patent are at issue in the following matters:

- U.S. Patent No. 10,652,979, which is also at issue in Illinois-I, Illinois-II, and HD-Litigation.
- 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, and 10,492,251 are also 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, filed April 6, 2004). The following patents claims the same benefit of priority to the '653 and '867 applications and have corresponding IPR proceedings:

2021. (Ex. 1078, 7 (Texas docket); Ex. 1080 (Order No. 28 Granting Motion to Transfer); Ex. 1079, 7 (Illinois-II docket).)

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

V. PRECISE RELIEF REQUESTED

Claims 1-9 and 37 should be canceled as unpatentable based on the following grounds:

Ground 1: Claims 1, 2, 4-6, and 8-9 are unpatentable under pre-AIA 35 U.S.C. § 103(a) as being obvious over *Saito* in view of *Catalano*.

Ground 2: Claims 3 and 7 are unpatentable under § 103(a) as being obvious over *Saito* in view of *Catalano* and in further view of *Johnson*.

Ground 3: Claims 1, 2, 4-6, and 8-9 are unpatentable under pre-AIA 35 U.S.C. § 103(a) as being obvious over *Saito* in view of *Wojnarowski*.

Ground 4: Claims 3 and 7 are unpatentable under § 103(a) as being obvious over *Saito* in view of *Wojnarowski* and in further view of *Johnson*.

Ground 5: Claim 37 is unpatentable under pre-AIA 35 U.S.C. § 103(a) as being obvious over *Hamaguchi* in view of *Wojnarowski*.

The application for the '551 patent was filed on October 30, 2017 and claims the benefit of priority to numerous provisional (9) and non-provisional applications (11), most of which are continuation-in-part applications (9). (Ex. 1001, Cover.) Specifically, the '551 patent claims benefit to Provisional Application Nos. 60/559,867 (Ex. 1041), filed April 6, 2004, and 60/547,653 (Ex. 1040), filed February 25, 2004. However, as discussed in §IX.B, claims 1-9 and 37 do not have written description support for the challenged claims in these provisional applications. The '551 patent is thus not entitled to the earliest priority dates of February 25, 2004 and April 6, 2004.[4] Regardless of the benefit of priority, Grounds 1-4 are based on references that separately qualify as prior art, as discussed below.

Saito, *Catalano*, *Hamaguchi*, and *Johnson* were not considered during prosecution. (*See generally* Ex. 1004.) While *Wojnarowski* was cited during prosecution, as explained in §XI.C, the lack of substantive consideration/application of the reference by the Office, among other things, supports institution.

Saito published on October 31, 2002. *Wojnarowski* issued on July 2, 2002. *Johnson* issued on October 31, 1995. Accordingly, *Saito*, *Wojnarowski*, and

[4] Because all references have qualifying dates of April 8, 2004 or earlier, further examination of the critical date is unnecessary.

Johnson qualify as prior art at least under §102(b) ***regardless of any priority claim of the '551 patent***.

Catalano was filed on April 8, 2004 and published on March 17, 2005. *Hamaguchi* published on April 8, 2004. Accordingly, *Catalano* qualifies as prior art at least under pre-AIA 35 U.S.C. § 102(e) and *Hamaguchi* qualifies as prior art at least under §102(a) because the '551 is not entitled to the benefit of priority prior to April 8, 2004.

Additionally, *Catalano* claims the benefit of and is entitled to priority under 35 U.S.C. § 119(e) based on provisional application No. 60/502,495 ("the '495 application") filed September 12, 2003 (Ex. 1007). The '495 application properly supports the subject matter in compliance with §112(a). Further, as shown below, at least one claim of *Catalano* is supported by the written description of the '495 application. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1381 (Fed. Cir. 2015); MPEP § 2136(I) (9th ed. rev. 10.2019, June 2020); MPEP § 2136.03(III). Thus, for this independent reason, *Catalano* qualifies as prior art at least under §102(e) irrespective of the '551 patent's critical date.

Specifically, the drawings/specification of the '495 application are nearly identical to *Catalano*'s and thus provide the same support for the claims of *Catalano* as *Catalano*'s specification itself. (*Compare* Ex. 1006 *with* Ex. 1007). This Petition properly provides parallel citations to *Catalano* and the '495 application. *See*,

e.g., *Unified Patents, Inc. v. Longhorn HD LLC*, IPR2020-00879, Paper 10 at 15-16.

The chart below maps *Catalano*'s claim 23 to corresponding support in the '495 application. (*See also* Ex. 1002, ¶¶71-72.)

Catalano	**'495 application (specification) (Ex. 1007)**
23. An improved illuminating device comprising	*See*, *e.g.*, 1:6-8 (explaining invention relates to LED "***illumination device*** and method" and integrated LED and driving circuitry in "a component module that will retrofit common incandescent lightbulb applications"), 2:11-13
a standard bulb power connector equivalent to the power connector of a conventional incandescent bulb, which the improved device is capable of replacing,	*See*, *e.g.*, 1:6-8 (above), 10:12-25 ("Figure 6 illustrates…a universal LED illumination device that can be ***retrofit [for] an incandescent lightbulb application***" where LED 602 and converter/logic circuit 606 "are connected to a 3-pin connector 612 [*i.e.*, a power connector] that facilitates an easy connection to a standard bulb base 616."), FIG. 6
at least one light emitter, which may be a light emitting diode; and	*See*, *e.g.*, 1:6-8, 2:11-13, 5:10-11 ("LED illumination device 100…made up of an LED lamp 102"), 10:12-15 ("a universal LED illumination device…[including] LED 602"), FIGS. 1, 2, 4-9.
a driver circuit electrically connected to the light emitter and to the power connector;	*See*, *e.g.*, 6:25-26 ("LED lamp 202 driven by a logic circuit 206 in connection with a standard bulb base 216,"), 10:19-20 (LED 602 and

Catalano	**'495 application (specification) (Ex. 1007)**
	associated converter/logic circuit 606 "are connected to a 3-pin connector 612" for "easy connection to a standard bulb base 616."), FIGS. 2, 3, 5-7.
where said improvement comprises an improved circuit which is compact enough to fit into the volume envelope of the standard incandescent bulb, consumes power more efficiently than the incandescent bulb, and provides substantially constant illumination over an input voltage range with a maximum-to-minimum ratio of 2 to 1 or more, and	*See*, *e.g.*, 1:6-8, 3:13-16 ("disclosed embodiments offer the advantage of providing a universal LED light bulb module with long life and high efficiency at a wide operating voltage range with ***a very small size allowing for the incorporation within the envelope and form of existing lightbulb bases***."), 8:15-20 ("circuit shown in Figure 3 can be extremely compact" and "can be incorporated in nearly any standard bulb base. With this implementation, the ***operating voltage of the circuit is very wide (at least 1.5 V to 7 Volts),*** effectively drawing nearly all of the energy present in the battery pack, making excellent utilization of available power. The disclosed circuit will allow the LED light bulb to maintain ***constant light output*** under a wide range of voltage input."), FIG. 3
a module incorporating the driving circuit and physically attached to the power	*See*, *e.g.*, 10:3-25 (describing LED 602 mounted to PC board 604 and converter/logic circuit 606 "mounted on either or both sides of the wafer PC board 604" and that "LED 602 and associated

Catalano	'495 application (specification) (Ex. 1007)
connector and to the light emitter.	converter and logic circuit 606 are connected to a 3-pin connector 612 that facilitates an easy connection to a standard bulb base 616."), FIG. 6, 11:10-21.

VI. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art as of the claimed priority date of the '551 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, ¶¶19-20.)[5] More education can supplement practical experience and vice versa. (*Id.*)

VII. THE '551 PATENT

While the '551 patent purports to identify an invention directed to lighting system having various features (*e.g.*, Ex. 1001, 3:55-10:39), the challenged claims are broadly directed to a lighting system having an aggregation of conventional and well-known components (LED circuit, bridge rectifier, capacitor, substrate, and

[5] Petitioner submits the declaration of R. Jacob Baker, Ph.D., P.E. (Ex. 1002), an expert in the field of the '551 patent. (Ex. 1002, ¶¶3-12; Ex. 1003.)

driver) arranged to operate according to their known functions. As such, the lighting systems recited in the challenged claims were demonstrably obvious.[6] (§X; Ex. 1002, ¶¶86-232; *see also id.*, ¶¶21-48, 59-85 (citing, *inter alia*, Exs. 1013-1014, 1027-1047.)

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.[7] (Ex. 1002, ¶58.)

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[6] The '551 patent issued with on first Office Action without substantive prior art analysis. (Ex. 1004, 154-156.)

[7] 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

IX. THE CHALLENGED CLAIMS ARE NOT ENTITLED TO A PRIORITY DATE PRIOR TO FEBRUARY 25, 2005[8]

A. Legal Standard for Priority

To rely on an earlier application filing date, §120 requires that the earlier application include a disclosure complying with the written description requirement of §112. *Lockwood v. Am. Airlines*, Inc., 107 F.3d 1565, 1571-72 (Fed. Cir. 1997). To do so, the specification "must describe the invention sufficiently to convey to a person of skill in the art that the patentee had possession of the claimed invention at the time of the application, *i.e.*, that the patentee invented what is claimed." *Lizardtech, Inc. v. Earth Res. Mapping, Inc.*, 424 F.3d 1336, 1345 (Fed. Cir. 2005). Though verbatim language is not required, "one skilled in the art, reading the original disclosure, must immediately discern the limitation at issue in the claims." *Purdue Pharma L.P. v. Faulding Inc.*, 230 F.3d 1320, 1323 (Fed. Cir. 2000). "Entitlement to a filing date extends only to the subject matter that is disclosed; not to that which is obvious…. Therefore the parent application must actually or inherently disclose

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accused products in litigation may raise controversies that are not presented here given the similarities between the references and the patent.

[8] Petitioner does not concede that the claims are entitled to any other date in the claimed priority chain, and reserves the right to challenge such issues here or in other proceedings as appropriate.

the elements of the later-filed claims." *Research Corp. Techs., Inc. v. Microsoft Corp.*, 627 F.3d 859, 870 (Fed. Cir. 2010) (citations omitted); *see also Purdue Pharma*, 230 F.3d at 1326-1327 ("[O]ne cannot disclose a forest in the original application, and then later pick a tree out of the forest and say here is my invention.").

B. The '653 and '867 Applications Do Not Contain Written Description Support for claims 1-9 and 37

Independent claims 1, 5, and 37 each requires a "driver" with specific configurations and/or features. (Ex. 1001, 18:56-63, 19:8-13, 24:10-21.) In contrast, neither of the '653 and '867 provisional applications from which the '551 patent claims priority discloses, describes, or even mentions a "driver," much less a driver having all of the claimed features required by claims 1, 5, and 37 of the '551 patent.

Regarding claim 1, the '653 and '867 applications do not disclose or describe (1) a driver and/or the driver (2) "connected to a bridge rectifier"; (3) "mounted on a reflective substrate" along with a bridge rectifier, capacitor and LED circuit; (4) "providing rectified AC and current to the LED circuit"; and/or (5) "having an input of a first rectified AC voltage and a first frequency from a mains power source" as claimed. (*Compare* Ex. 1001, 18:56-63 *with* Ex. 1040, 3-15 (specification), 16-22 (claims), 23-83 (FIGS. 1-61) *and* Ex. 1041, 2-14 (specification), 15-23 (claims), 24-89 (FIGS. 1-66); Ex. 1002, ¶¶50-52.)

Similarly, regarding claim 5, the '653 and '867 applications do not disclose or describe a (1) a driver and/or the driver (2) "mounted on a reflective substrate"

along with a bridge rectifier, capacitor and LED; (3) "having an input of a first rectified AC voltage/current from a bridge rectifier"; and/or (4) "providing a second rectified AC voltage/current to the LED circuit" as recited by claim 5. (*Compare* Ex. 1001, 19:8-13 *with* Ex. 1040, 3-15 (specification), 16-22 (claims), 23-83 (FIGS. 1-61) *and* Ex. 1041, 2-14 (specification), 15-23 (claims), 24-89 (FIGS. 1-66); Ex. 1002, ¶¶53-54.)

Likewise, regarding claim 37, the '653 and '867 applications do not disclose or describe (1) a driver and/or a driver (2) "connected to the bridge rectifier" and "mounted on a reflective substrate" along with the bridge rectifier and LED circuit; (3) "providing AC voltage and AC current to the bridge rectifier"; and/or (4) "an input of a first AC voltage and a first frequency," as recited in claim 37. (*Compare* Ex. 1001, 34:10-21 *with* Ex. 1040, 3-15 (specification), 16-22 (claims), 23-83 (FIGS. 1-61) *and* Ex. 1041, 2-14 (specification), 15-23 (claims), 24-89 (FIGS. 1-66); Ex. 1002, ¶¶55-56.)

Because the '551 patent is not entitled to the benefit of the '653 and '867 applications (respectively filed Feb. 25, 2004 and Apr. 6, 2004), *Catalano* qualifies as prior art under §102(e) as of it non-provisional filing date of April 8, 2004. This prior art qualification is independent of *Catalano* qualifying as of its provisional date. (§V (*Catalano* qualifies as prior art: (1) via its provisional filing date (to which it is entitled to claim benefit), **and** (2) via its non-provisional filing date and that

claims 1, 5, and 37 (and dependent claims) of the '551 patent lack support in the '653 and '867 provisional applications).) Likewise, *Hamaguchi* qualifies as prior art under §102(a) as of its publication date of April 8, 2004.

X. DETAILED EXPLANATION OF GROUNDS

A. Ground 1: Claims 1, 2, 4-6, 8, and 9 Are Obvious over *Saito* in View of *Catalano*

1. Claim 1

a) A lighting system comprising:

Saito discloses a lighting system (*e.g.,* power supply unit and LED lamp device). (Ex. 1008, ¶0001 ("lamp device using LEDs (Light Emitting Diodes) for purposes of indication or ***illumination***, and more particularly, [] an LED lamp device which can be directly connected (directly coupled) to an alternating-current power supply"), 0042, 0094-0105, 0165, FIGS. 7-9; Ex. 1002, ¶¶59-65, 86-115; §§X.A.1(b)-(h); Ex. 1008, FIGS. 3, 6, ¶¶0072-0087, 0089-0093.)

Saito's teachings are not limited to its fourth embodiment, nor is the analysis herein so limited.[9] Indeed, *Saito* repeatedly references other embodiments and uses

[9] To the extent it is argued that *Saito*'s embodiments are distinct, the challenged claims remain obvious over the asserted combination as explained herein because a POSITA would have been motivated, and found it obvious, to configure any of

identical reference numerals to denote elements corresponding to those in other embodiments. (*See*, *e.g.*, Ex. 1008, ¶¶0014, 0066, 0073 (FIG. 3 embodiment with reference numerals "used to denote elements identical with or equivalent to those appearing in FIG. 1."), 0079, 0088, 0089 (FIG. 6 using identical elements with "those appearing in FIG. 3."), 0095 (FIG. 7 using identical elements "with or equivalent to those appearing in FIG. 6."), 0100, 0105, 0123, 0152, 0158; Ex. 1002, ¶¶88-90.)

b) an LED circuit having at least one LED;

Saito's lighting system includes an LED circuit having at least one LED (*e.g.*, circuitry relating to LEDs in LED lamp 106). (Ex. 1008, ¶¶0062, 0095 ("In this

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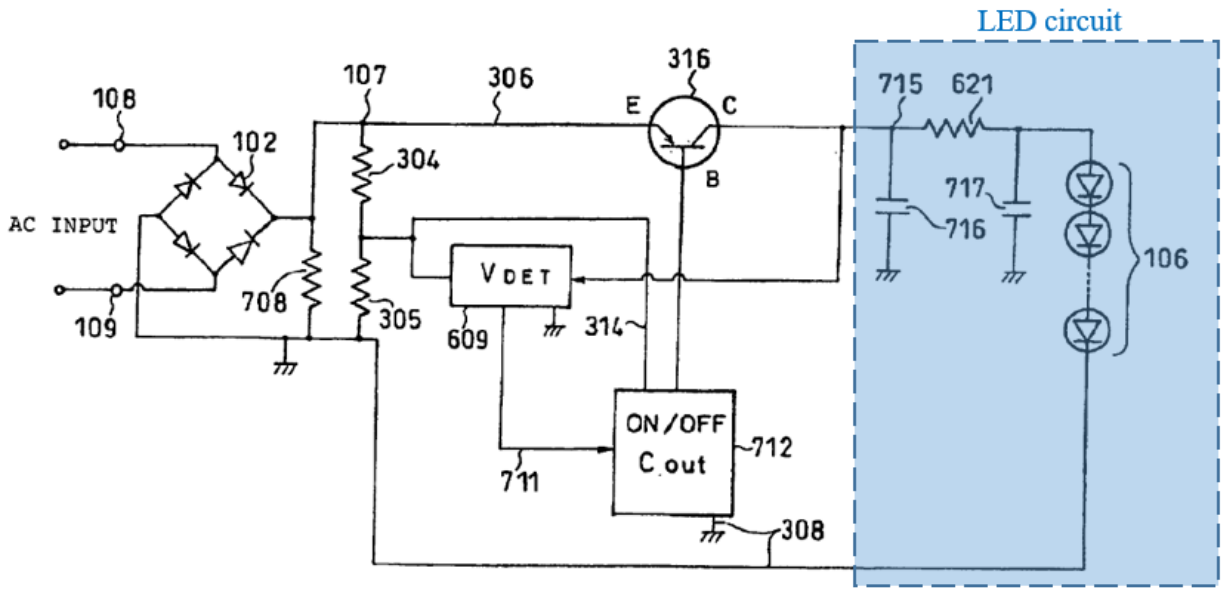
Saito's identified embodiments with features from *Saito*'s other related embodiments. (Ex. 1002, ¶¶88-90.) Indeed, a POSITA would have had reasons to consider the collective teachings in *Saito* to configure a lighting device as explained below, and would have done so with a reasonable expectation of success given *Saito*'s descriptions of a working system and processes. (*Id.*; §X.A.1(a)-(h).)

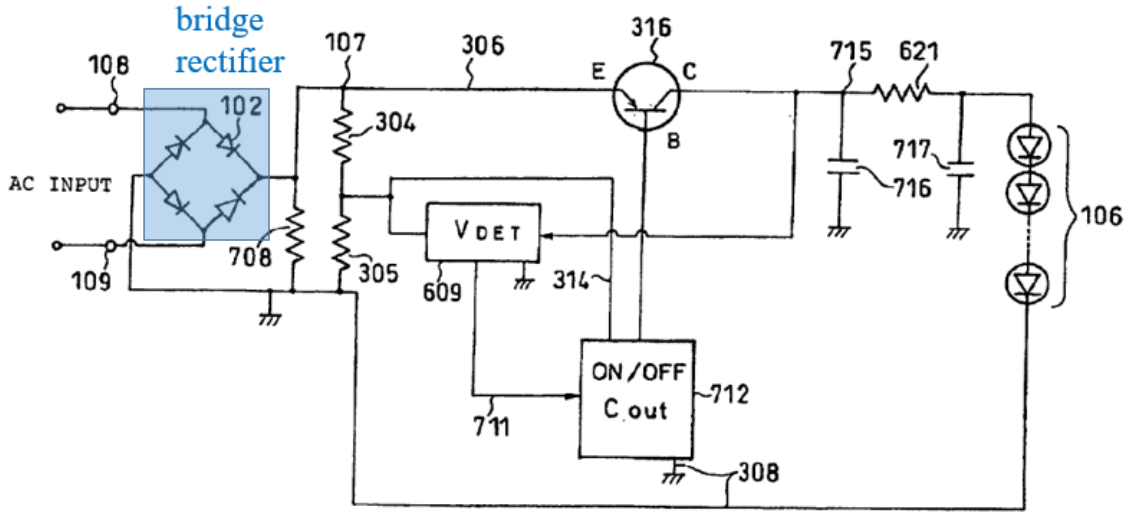
embodiment, the LED lamp 106 comprises ***two to several hundreds of serially connected LEDs***."), Fig. 7 (annotated below)[10]; Ex. 1002, ¶91.)



c) a bridge rectifier;

Saito discloses a bridge rectifier (*e.g.*, full-wave rectifying diode bridge 102). (Ex. 1008, 0062 ("[R]eference numeral 102 denotes a full wave rectifying diode bridge (BrD1)…"), FIG. 7; Ex. 1002, ¶92; §§X.A.1(e)-(h).)

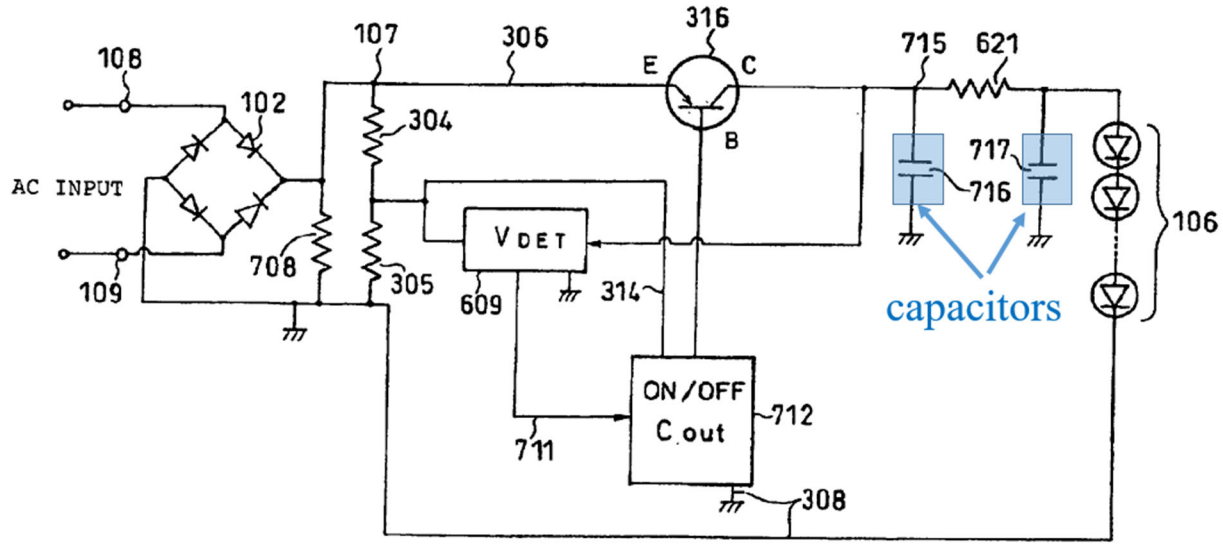
[10] Annotations here and below are exemplary. For example, the LED "circuit" (like other exemplified circuits herein) can include additional/fewer components consistent with the prior art disclosures. (Ex. 1002, ¶91.)



(Ex. 1008, FIG. 7 (annotated).)

d) at least one capacitor;

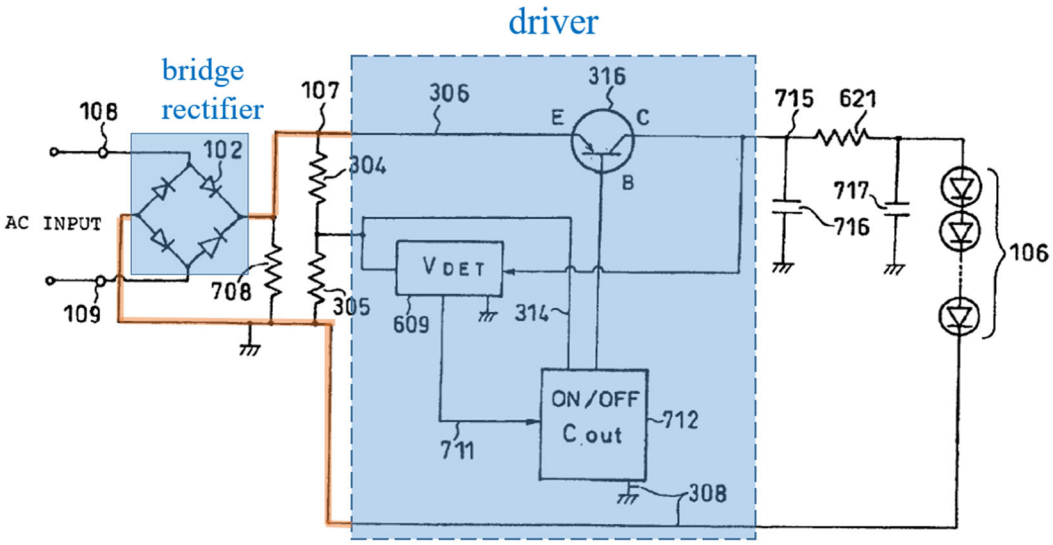
Saito discloses at least one capacitor (*e.g.*, capacitors 716 and 717). (Ex. 1008, ¶0095 (disclosing "capacitor 716" and "capacitor 717"), 0102, FIG. 7 (annotated below); Ex. 1002, ¶93.)



(Ex. 1008, Fig. 7 (annotated).)

e) a driver connected to the bridge rectifier;

Saito discloses a driver connected to the bridge rectifier. (Ex. 1008, FIG. 7; Ex. 1002, ¶¶93-95.) Exemplary connections between the bridge rectifier 102 and the driver circuitry are highlighted in orange below.



(Ex. 1008, FIG. 7 (annotated).)

Saito's driver circuitry provides features for *Saito*'s power supply unit such as outputting electric power for driving a load, namely LED lamp 106. (Ex. 1008, ¶0018; ¶¶0032, 0034 ("power supply unit capable of driving an LED lamp"), 0085, 0094-0103; *see also id.*, ¶¶0144-0146; Ex. 1002, ¶¶93-95.)

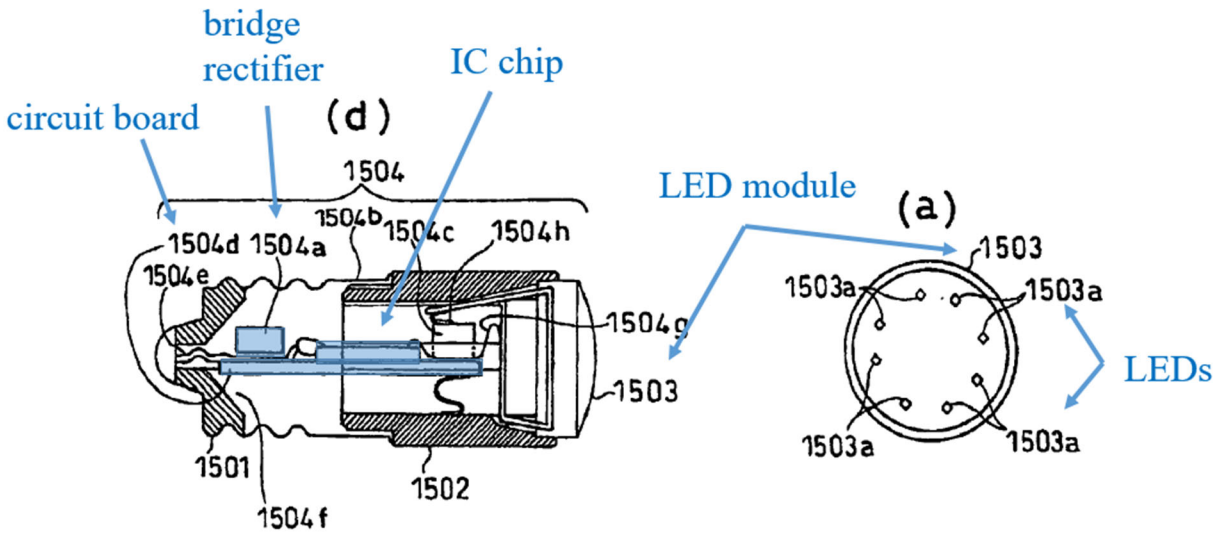
f) the driver, bridge rectifier, at least one capacitor and at least one LED circuit all mounted on a reflective substrate;[11]

Saito in view of *Catalano* discloses and/or suggests this limitation. (Ex. 1002, ¶¶96-109.) While *Saito*'s disclosures relating to the lighting system discussed above for claim elements 1(a)-1(e) do not expressly describe the driver, bridge rectifier, LED circuit, and capacitor(s) being mounted on a reflective substrate, it would have been obvious to configure the device in such a manner in light of *Saito* and *Catalano*. (Ex. 1002, ¶¶96-108.) Such a modification would have been no more than the predictable use of prior art elements according to their established functions. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007); Ex. 1002, ¶¶96-108.)

For example, in connection with FIG. 15, *Saito* discloses "an exemplary *structure* of a device according to the present invention," that encompasses the fourth embodiment of FIG. 7 discussed above. (Ex. 1008, ¶¶0050, 0144; *id.*, ¶¶0145, 0146-0147 (referencing the "aforementioned individual embodiments, and "fourth embodiment[]"), FIG. 15.) The LED lamp device "according to the present invention" includes a power supply unit 1504 ("**the circuit section excluding the**

[11] The written description of '551 patent does not mention a "reflective substrate." At most, the '551 patent discloses in connection with Fig. 26 a reflector 202 integrated into the package 30 for optimized light dispersion." (Ex. 1001, 17:4-15.)

LED lamp 106 in the aforementioned individual embodiments"). (*Id.*, ¶0146.) Unit 1504 includes a similar driver (included in IC chip 1504b), a bridge rectifier (full-wave rectifying diode bridge 1504a), and at least one capacitor all mounted on a substrate (printed circuit board 1504d). (Ex. 1008, ¶0147 ("The power supply unit 1504 includes a full-wave rectifying diode bridge 1504a, an IC chip 1504b, an inductor 1504c, and **a circuit board 1504d on which these elements 1504a to 1504c are mounted** (**in the case of the** second to **fourth embodiments**)."); Ex. 1002, ¶97.)



(Ex. 1008, Fig. 15(a),(d) (annotated).)

Saito further discloses the at least one LED circuit (including LEDs 1503a) mounted on a substrate (*e.g.*, module 1503) (Ex. 1008, ¶0146 ("The LED lamp module 1503 has eight LED chips 1503a … which are connected in series, are connected to the output terminal of a power supply unit 1504 ... ."); Ex. 1002, ¶98;

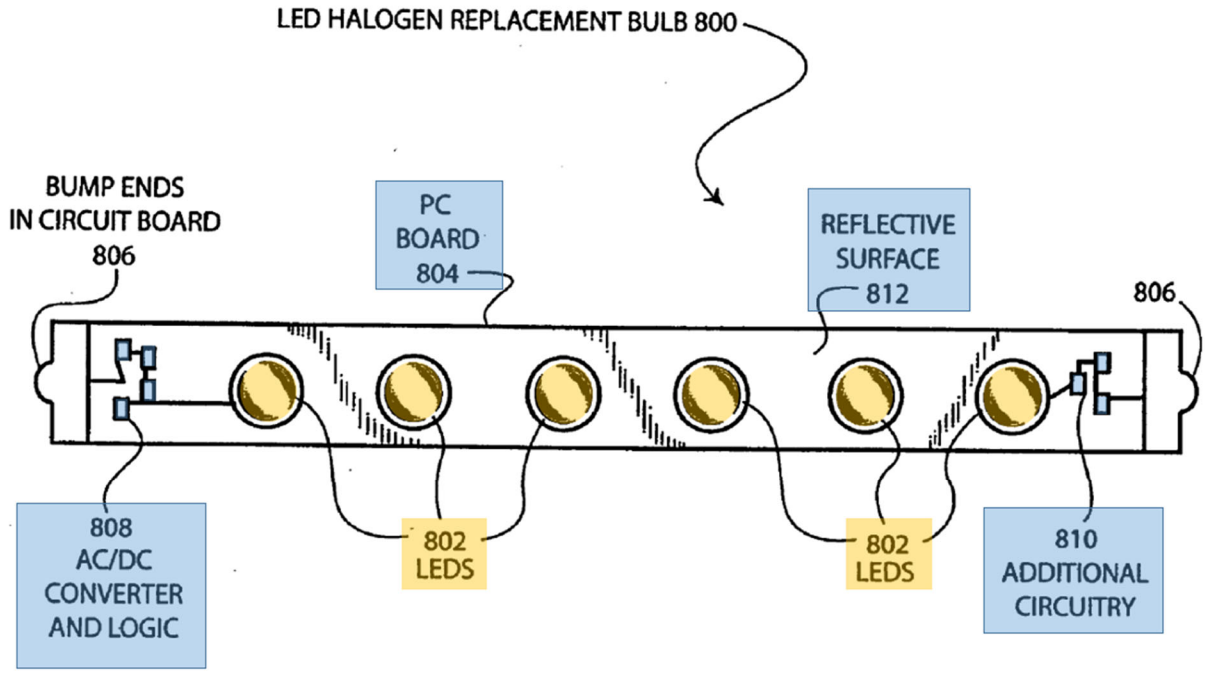
see also Ex. 1008, ¶¶0150-0156, FIGS. 16-19 (showing views of LED lamp device of the "present invention" where power supply unit 1504 "of the aforementioned individual embodiments" is mounted on a flexible printed circuit board 1601).)

Accordingly, a POSITA would have recognized via the disclosures of FIG. 15 (and FIGS. 16-19), that *Saito* discloses configurations where components are mounted on a common substrate. Indeed, in connection with the fourth embodiment of FIG. 7 (and FIG. 15), *Saito* discloses an LED lighting system including a driver, bridge rectifier, at least one capacitor coupled to the same substrate, and an LED circuit mounted on another substrate. (Ex. 1002, ¶¶97-100.)

Catalano is directed to "a light emitting diode illumination device and method and more specifically to a light emitting diode and driving circuitry integrated into a component module that will retrofit common incandescent lightbulb applications." (Ex. 1006, FIGS. 7-8, ¶¶0002, 0029-0031; Ex. 1007, FIGS. 7-8, 1:5-8, 10:12-11:21.) Accordingly, *Catalano* is in the same field as *Saito* and the '551 patent and addresses the same problem of integrating LEDs and driving circuitry. (Ex. 1006, ¶¶0002-0007; Ex. 1007, 1:5-2:23; Ex. 1001, 2:23-26; Ex. 1002, ¶¶66-69.) Thus, a POSITA would have had reason to consider the teachings of *Catalano*. (Ex. 1002, ¶¶101-102.)

Catalano discloses driver circuitry and LEDs all mounted on a common reflective substrate. (*See*, *e.g.*, Ex. 1006, ¶0031, FIG. 8 (annotated below); Ex. 1007,

11:10-21; *see also id.* FIG. 8, 10:26-11:9; Ex. 1002, ¶103.) *Catalano* further discloses the top surface of the PC (printed circuit) board is "coated with a reflective surface 812 to increase light output intensity by reflecting light otherwise lost and enhance heat dissipation of the LEDs and circuitry." (Ex. 1006, ¶0031.)



(Ex. 1006, FIG. 8 (annotated).)

"The converter and logic circuit 808 can be mounted on either or both sides of the wafer PC board 804 and are shown in FIG. 8 on the top surface." (*Id.*; *see also id.*, ¶0028 (describing the various electronic components that may be mounted to a PC board, "such as ICs, resistors, capacitors and the like"); Ex. 1007, 9:26-30). *Catalano* describes configurations to overcome prior art "disadvantages" by providing a light emitting diode and driving circuitry integrated into a component module that will retrofit common incandescent light bulb applications" and allows

very small size "for the incorporation within the envelope and form of existing lightbulb bases." (Ex. 1006, ¶¶0005, 0009; Ex. 1007, 2:11-13, 3:13-16.)

In light of *Catalano*'s teachings/suggestions and the knowledge of a POSITA, it would have been obvious to modify *Saito*'s lighting system to mount the driver, bridge rectifier, capacitor and LED circuit (§§X.A.1(a)-(e)) on a reflective substrate.

First, a POSITA would have recognized that configuring a lighting system in accordance with *Saito*'s fourth embodiment (FIG. 7) with a substrate (*e.g.*, a printed circuit board, etc.) that mounts the various components of the system (*e.g.*, driver, rectifier, LED circuit, capacitor, *etc*.) would have reduced the number of parts (by eliminating a separate substrate), increased compactness, and expanded the versatility and applications of the lighting system. (Ex. 1002, ¶105.) A POSITA would have recognized the benefits of mounting components on a single substrate in reducing material costs/size and allowing the configuration to retrofit lighting devices in accordance with *Saito*'s designs. (*Id.*; Ex. 1008, ¶0005 (recognizing desirability of lower costs and size).) Indeed, it was known to mount components of lighting devices, including LED circuits, LEDs, and other components on a single substrate, as demonstrated by *Catalano* and the state of art. (Ex. 1002, ¶106; Ex. 1006, FIGS. 6-8, ¶¶0029-0031; Ex. 1007, FIGS. 6-8, 10:12-11:21; *see also* Ex. 1009,

15:15-16-10.)[12] Accordingly, a POSITA would have been motivated to modify the above-discussed *Saito* lighting system similarly and with a reasonable expectation of success. (Ex. 1002, ¶¶104-109.)

Moreover, a POSITA would have been motivated to use various known design concepts, components, and techniques in implementing the above-discussed *Saito* lighting system, and would have recognized the predictable benefit of mounting such components on a reflective substrate (including, *e.g.*, a reflective surface/material, in the *Saito*-*Catalano* combined system "to increase light output intensity by reflecting light otherwise lost and enhance heat dissipation of the LEDs and circuitry" and "light emitting diode and driving circuitry integrated into a component module that will retrofit common incandescent lightbulb applications" as suggested by *Catalano*. (Ex. 1006, FIGS. 6-8, ¶¶0002, 0005, 0009, 0029-0031; Ex. 1007, FIGS. 6-8, 2:11-13, 3:13-16, 10:12-11:21; Ex. 1008, ¶0017 (*Saito*'s invention provides a device that is high in efficiency and low in loss); Ex. 1011, Abstract, FIG. 2.1, ¶¶0018 ("coat a layer of high reflection material on the board" for LED lighting device), 0034, 0081; Ex. 1005, 2:6-10, 7:49-8:46, 6:6-7:34, FIGS. 1, 24-25; Ex. 1002, ¶¶105-108.) Thus, a POSITA would have been motivated to modify *Saito*'s lighting system to use a reflective substrate to mount the above-

[12] Ex. 1009 demonstrates the state of the art.

mentioned components given such guidance and because the use of reflective substrates in lighting systems was known to increase the optical efficiency. (*Id.*; Ex. 1049, 16:24-45.)[13]

Given the disclosures of *Saito* (describing applications involving mounting multiple components on a substrate) and *Catalano* (describing similar features with a reflective substrate to include an LED circuit and LEDs), and the knowledge of a person of ordinary skill in the art of such mounting and optical techniques (*see, e.g.*, Ex. 1009), a POSITA would have had a reasonable expectation of success in implementing such a modification. Such a design would have involved the use of known components and mounting techniques to produce the predictable result of a combined LED and driver circuitry on a reflective printed circuit board. (Ex. 1002, ¶¶104-109.) Indeed, a POSITA would have considered mounting options when implementing *Saito*'s lamp, including the teachings/suggestions of *Catalano* and *Saito*, which explain that LEDs and drive circuitry can be incorporated into an extremely compact module to retrofit common lightbulb/lighting device configurations. (Ex. 1008, FIGS. 15-19, ¶¶0145-0156; Ex. 1006, FIGS. 6-9, abstract, ¶¶0029-0032; Ex. 1007, FIGS. 6-9, 10:12-12:2; Ex. 1002, ¶¶96-103.) Further, a POSITA would have recognized benefits of providing a reflective substrate for the

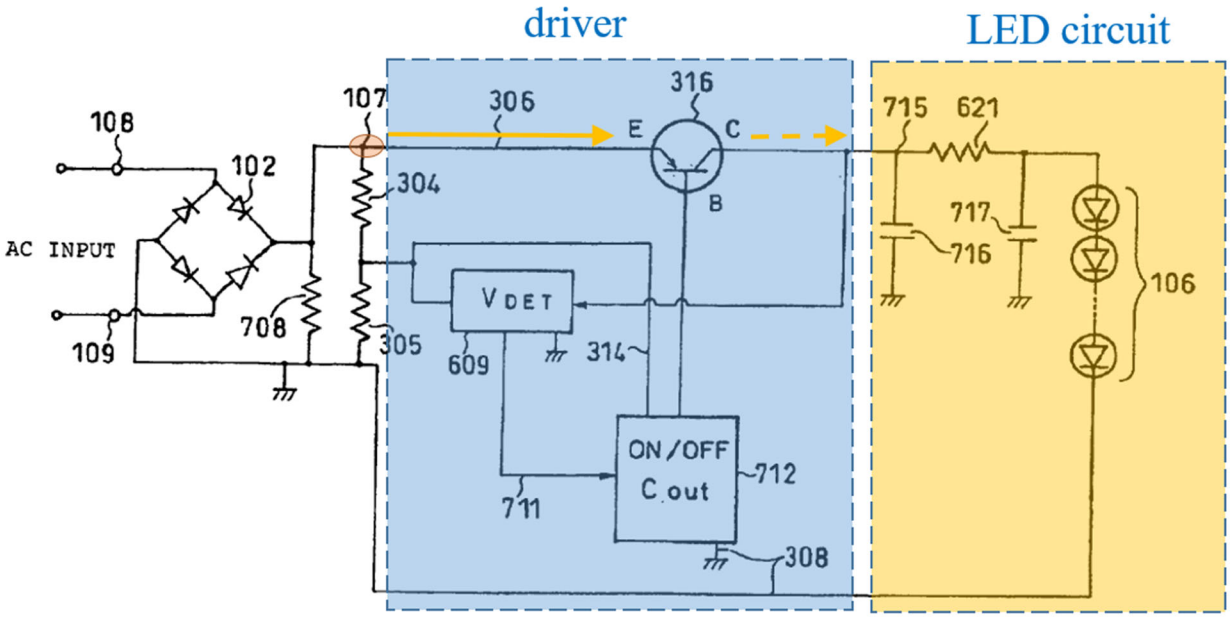
[13] Exs. 1005, 1011, 1049 reflect the state of the art.

above-noted components in the *Saito-Catalano* lighting system because it would have offered a predictable way to provide a base structure for the circuitry components that also improved illumination and heat dissipation characteristics associated with LED lamp 106 in the modified system, as suggested by *Catalano*. (Ex. 1002, ¶¶104-109; Ex. 1006, ¶0031; Ex. 1007, 11:15-17.)

g) the driver providing rectified AC voltage and current to the LED circuit;

Saito discloses the driver providing rectified AC voltage/current to the LED circuit. (Ex. 1008, ¶0102 ("[I]n the fourth embodiment, the AC input voltage of 100 V is subjected to ***full-wave rectification*** by the diode bridge 102, and the ON/OFF control circuit 712 causes the switching element 316 to turn ON during a time period in which the voltage of the ***rectified wave*** is equal to or lower than 30 V and also the output voltage (voltage at the node B 715) is below 16 V."), FIGS. 7, 8; Ex. 1002, ¶¶110-111.) Thus, the rectified AC waveform 801 and corresponding current is provided intermittently to the LED circuit. (Ex. 1008, ¶¶0100-0103, FIGS. 7, 8.) This results in the driver (*see* §X.A.1(e)) providing a (pulsed) rectified AC voltage/current to the LED circuit (*see* §X.A.1(b)), as exemplified below and

explained further for limitation 1(h) (§X.A.1(h)).[14] (Ex. 1002, ¶110; Ex. 1008, ¶¶0033, 0068-0071, 0079-0087, FIGS. 2, 4 (describing and illustrating the intermittent effect of a switching control circuit).)



(Ex. 1008, FIG. 7 (annotated).)

h) the driver having an input of a first rectified AC voltage and a first frequency from a mains power source.

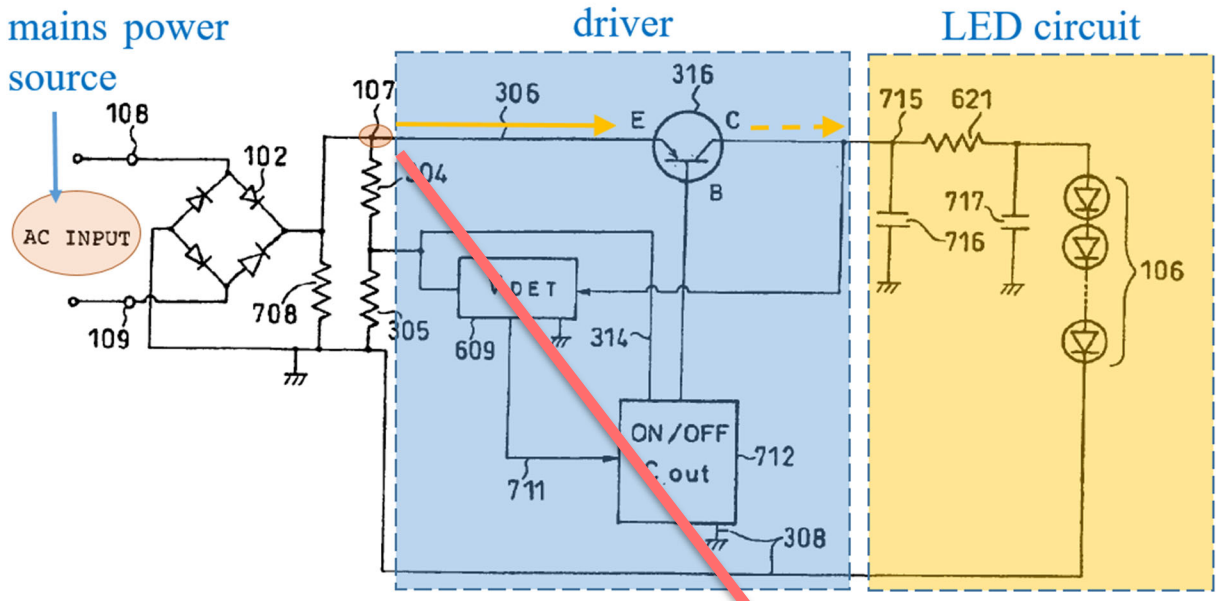
Saito discloses the driver having an input of a first rectified AC voltage and a first frequency (*e.g.*, 801 waveform at node 107) from a mains power source (*e.g.*,

[14] PO asserts a compilation of components (including what it alleges is a "bridge rectifier") is a driver that provides a "rectified AC voltage and current to the LED circuit, ***as is required to illuminate the LEDs*** of the LED circuit." (Ex. 1072, App'x K-2 at 2-5.)

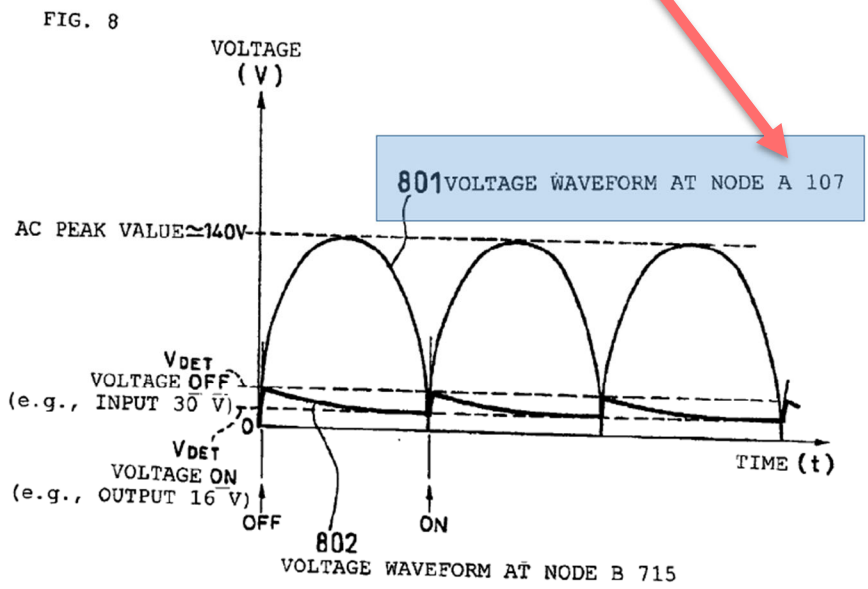
AC input). (Ex. 1008, ¶¶0100, FIGS. 7-8 (annotated below); Ex. 1002, ¶¶112-115.) As explained with reference to FIG. 8, the rectified voltage fluctuates from 0V to 140V at a regular frequency. (Ex. 1008, FIG. 8, ¶0100 ("FIG. 8 shows voltage waveforms appearing at nodes A and B indicated, respectively, at 107 and 715 in FIG. 7….").) "Thus, in the fourth embodiment, the AC input voltage of 100 V is ***subjected to full-wave rectification*** by the diode bridge 102." (Ex. 1008, ¶0102.)

Saito discloses that "[t]he AC input voltage is a ***commercial voltage of 100 V***" and thus would have been considered a mains power source. (Ex. 1008, ¶0063; *id*., ¶¶0004 (Lamps for "illumination purposes are usually put to use on condition that they are directly connected to ***commercial alternating-current power supply*** (100 V in Japan, 110 V in the United States, 230 V in Europe)."), 0005, 0009, 0149 ("With the device of the present invention constructed as described above, the base 1501 is screwed into a commercial alternating-current power input socket…"); Ex. 1002, ¶¶114-115.)[15]

[15] PO asserts this limitation is fully met by a general reference to "Operating Voltage 120V." (Ex. 1072, App'x K-2 at 5-6.)



(Ex. 1008, Fig. 7 (annotated).)



(Ex. 1008, Fig. 8 (annotated).)

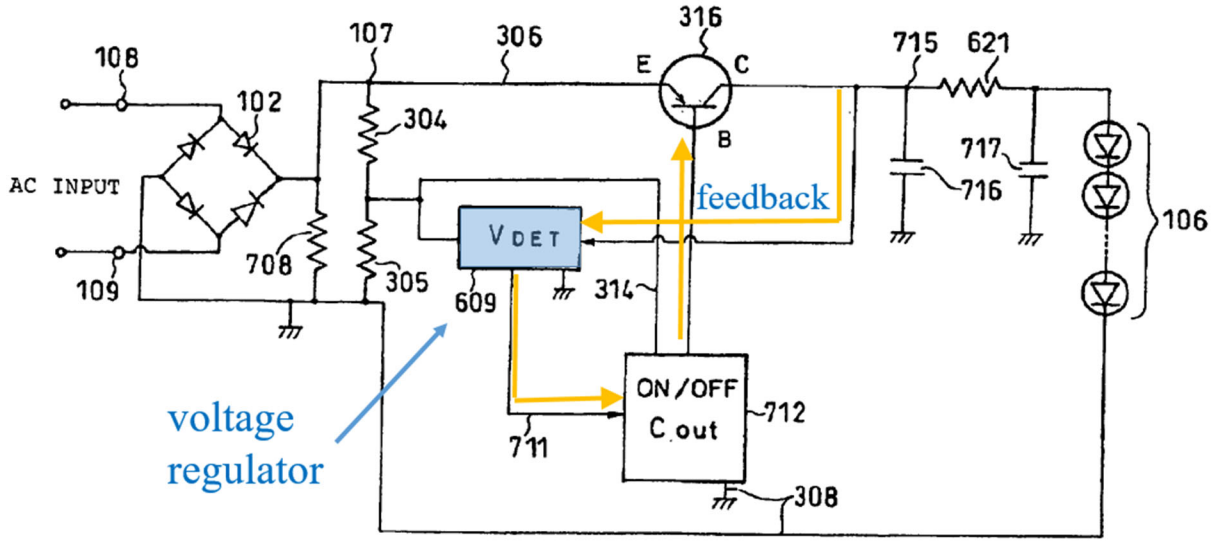
This is consistent with the conventional arrangement of a bridge rectifier configuration used to provide full-wave rectification of an AC power supply. (Ex. 1012, 38; Ex. 1002, ¶¶114-115.) Mains power sources were known not to directly

provide *rectified* AC voltage but rather provided AC voltage and frequency. (Ex. 1002, ¶114; Ex. 1012, 12.) For example, in the United States, residential mains power is standardized to a nominal 110/120V and an AC frequency of around 60Hz. (Ex. 1002, ¶114; Ex. 1015, 1:10-25, FIG. 1; Ex. 1016, 1:9-28, 1:35-48; Ex. 1024, 708; Ex. 1023, 1:15-18; Ex. 1050, 1:11-13.) A POSITA would have thus understood that the input voltage provided to the above-described "driver" in the *Saito-Catalano* system would have had a voltage attributable to the voltage coming from the AC mains and a frequency likewise proportional (double) to the received frequency. Accordingly, the driver has an input of a first rectified AC voltage and a first frequency from a mains power source as claimed. (Ex. 1002, ¶¶112-115.)

2. Claim 2 – The lighting system of claim 1 having a voltage regulator with feedback voltage regulator circuitry.

Saito discloses a voltage regulator (*e.g.*, input/output voltage detection circuit 609) with feedback voltage regulator circuitry. For example, *Saito* explains that "the input/output voltage detection circuit 609 serves as ***an output voltage regulator*** for keeping the output voltage for the LED lamp at a fixed level." (Ex, 1005, ¶0092). "The input/output voltage detection circuit 609 detects the output voltage, and a detected value of the output voltage is applied to the switching control circuit 322, like the detected value of the input voltage." (*Id.*, ¶0091.) Input/output voltage detection circuit 609 "functions as a limiter through detection of the output voltage, and controls the switching control circuit 322 such that the power supply section

(circuit section excluding the LED lamp 106) usually acts as a voltage ***feedback*** switching power supply but acts as a current ***feedback*** switching power supply when the LED lamp 106 is connected." (*Id.*) "Further, the fourth embodiment … includes, instead of the switching control circuit 322, the ON/OFF control circuit 712" that is "supplied with a signal from the input/output voltage detection circuit 609 and performs ON/OFF control of the switching element 316." (*Id.*, ¶0096; *see also id.*, 0097-0103, FIG. 7 (annotated below).) Thus, as exemplified below, *Saito*'s driver includes a voltage regulator with feedback voltage regulator circuitry as claimed. (Ex. 1002, ¶116.)



(Ex. 1008, Fig. 7 (annotated).)

3. Claim 4 – The lighting system of claim 1, wherein the substrate is a heat sinking material.

Saito-Catalano does not expressly disclose that the substrate in the combined system is a heat sinking material. At the time of the alleged invention, however, it was conventional to include heat sinking materials with an LED lighting system to efficiently remove heat generated by the LED circuit, which would otherwise be detrimental to the operation of the system. (Ex. 1002, ¶¶117-120.) For example, *Catalano* discloses a substrate is a heat sinking material (*e.g.*, metal core PC board 908). (Ex. 1006, ¶0035 ("Because the generation of excessive heat is a great detriment to the LED and associated circuitry, ***additional elements can easily be added to the disclosed embodiments such as the incorporation heat sink devices 920 or materials in or on the PC board***. A ***metal core PC board 908*** is shown in this embodiment to *demonstrate the ease in which heat dissipation techniques can be adapted to the aforementioned embodiments*."); Ex. 1007, 12:25-29; Ex. 1002, ¶¶118-120.)

In light of *Catalano*, it would have been obvious to a POSITA to modify/configure the substrate in the *Saito-Catalano* system with heat sinking material. (*Id.*) As explained (§X.A.1), a POSITA would have been motivated to use known heat dissipation techniques in implementing the *Saito-Catalano* lighting device, and would have recognized that "the generation of excessive heat is a great detriment to the LED and associated circuitry." (Ex. 1006, ¶0035; Ex. 1007, 12:25-

27). Forming the reflective substrate of the combined system from heat sinking material would predictably enhanced heat dissipation of the LEDs and circuitry. (*Id*.; Ex. 1002, ¶¶117-120; §X.A.1(f); Ex. 1007, 11:15-17.)

Given the knowledge of a POSITA of such known heat dissipation techniques coupled with the disclosures/guidance provided by *Saito* and *Catalano*, a POSITA could implement the above-modification with a reasonable expectation of success. (Ex. 1002, ¶¶119-120; Ex. 1048, Abstract, 2:2-7, 2:24-67, 4:23-5:14, 5:29-6:26; Ex. 1049, Abstract, 10:30-65, 11:9-21, FIG. 3a.)[16] Such a modification would have involved the use of known substrate materials and techniques to produce the predictable result of a reflective substrate made from a heat sinking material. (*Id.*) *KSR*, 550 U.S. at 416. A POSITA would have had the skills and motivation to configure the *Saito*-*Catalano* lighting system such that the substrate provided reflective properties as noted above while also improving the heat dissipation via heat sink properties. (Ex. 1002, ¶¶117-120.)

[16] Exs. 1048-1049 demonstrate the state of art.

4. Claim 5

a) A lighting system comprising:

b) an LED circuit having at least one LED;

c) a bridge rectifier;

d) at least one capacitor;

e) a driver;

Saito discloses these limitations. (§§X.A.1.a-X.A.1.e; Ex. 1002, ¶¶121-125.)

f) the driver, bridge rectifier, at least one capacitor and LED circuit all being mounted on a reflective substrate;

Saito-Catalano discloses/suggests this limitation. (§X.A.1.f; Ex. 1002, ¶126.)

g) the driver having an input of a first rectified AC voltage and current from the bridge rectifier and the driver providing a second rectified AC voltage and current to the LED circuit;

The driver in the *Saito-Catalano* system has an input of a first rectified AC voltage/current from the bridge rectifier. (§X.A.1.h (explaining that the bridge rectifier rectifies an AC voltage/current from the mains power source to produce a first rectified AC voltage/current that is provided to an input of the driver in the *Saito-Catalano* system); Ex. 1002, ¶127.)

Moreover, the driver in the *Saito-Catalano* system provides a second rectified AC voltage/current to the LED circuit (as discussed for limitation 1(g)).[17] (§X.A.1.g; Ex. 1002, ¶¶128-129.)

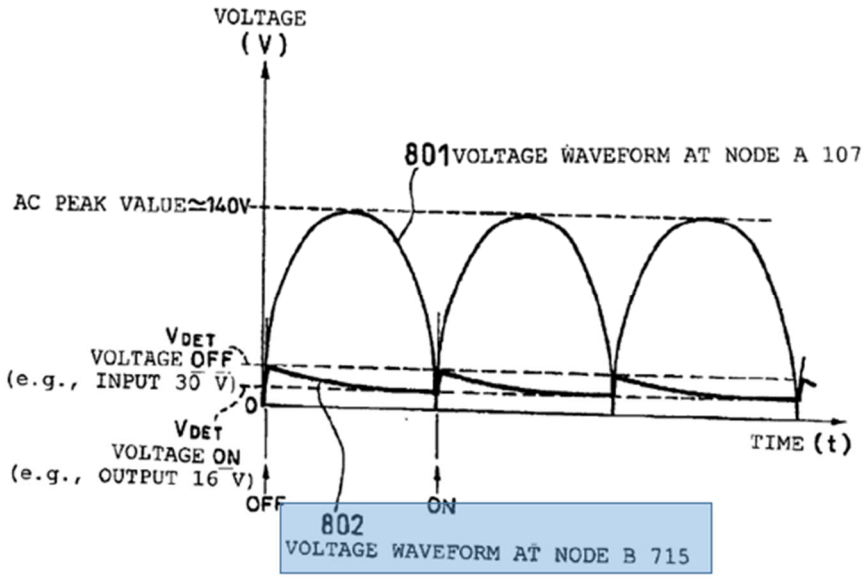
h) the at least one capacitor connected to the at least one LED and smoothing the rectified AC voltage waveform.

Saito discloses the at least one capacitor (*e.g.*, capacitor 716) connected to the at least one LED and smoothing the rectified AC voltage waveform. (Ex. 1002, ¶¶130-132.) As explained above, *Saito* discloses capacitors 716, 717. (*See* §§X.A.1(d), X.A.4(d); Ex. 1008, FIG. 7.)

Saito explains that "[t]he capacitor 716 has the function of smoothing the output voltage of the switching element 316 (voltage at a node B 715)," as exemplified in FIG. 8 (annotated below).[18] (Ex. 1008, ¶0095; *see also id.*, ¶¶0100-0102, FIGS. 7-8; Ex. 1002, ¶¶131-132.)

[17] PO provides no details as to how this limitation is met by accused instrumentalities. (Ex. 1072, App'x K-2 at 11.)

[18] PO provides no details as to how this limitation is met by accused instrumentalities. (Ex. 1072, App'x K-2 at 11.)



(Ex. 1008, FIG. 8 (annotated).)

5. Claim 6 – The lighting system of claim 5 having a voltage regulator with feedback voltage regulator circuitry.

Saito discloses this limitation. (§X.A.2; Ex. 1002, ¶133.)

6. Claim 8 – The lighting system of claim 5, wherein the substrate is a heat sinking material.

Saito-Catalano discloses/suggests this limitation. (*See* analysis in §X.A.3; Ex. 1002, ¶134.)

7. Claim 9 – The lighting system of claims [sic] 5 having a dimmer coupled to the driver.

As discussed in §X.A.4, *Saito-Catalano* discloses/suggests the limitations of claim 5. Though *Saito* does not expressly disclose a dimmer coupled to the driver, dimmers were well known to be used with lighting devices. (Ex. 1002, ¶¶135-142.) For example, *Catalano* discloses that additional features may be added such "***dimming***." (Ex. 1006, ¶0006; Ex. 1007, 6:12-20; Ex. 1002, ¶136; *see also* Ex.

1006, ¶¶0024, 0026; Ex. 1007, 8:2-3, 8:28-9:3.) According to *Catalano*, "[v]arious logic signals can be easily adapted to introduce added functionality to the embodiments. ***For example, a single activation of a power switch could provide a low output light, a second activation producing a medium output light, a third activation producing a high output light, and a fourth activation shutting off the light***." (Ex. 1006, ¶0006.)

In light of *Catalano* and knowledge of a POSITA, it would have been obvious to modify the lighting device of the *Saito*-*Catalano* system to include desirable dimming circuitry/functionality to allow the system to benefit from known controlled light level control features. (Ex. 1002, ¶¶137-142.) A POSITA would have contemplated ways to include such functionality and recognized coupling such dimmer components/circuitry to the driver in the *Saito*-*Catalano* system was one predictable way among a finite number of options to control the amount of light emitted from the LED circuit in the system. (*Id*.; *see also*, *e.g.*, state of art such as, Ex. 1017, FIGS. 1-2, 1:17-57, 2:34-3:4; Ex. 1019, FIGS. 3-4, ¶¶0004-0008, 0014-0027; Ex. 1020, FIGS. 1-8, Abstract, 1:6-12, 1:41-55, 3:65-5:29.)

A POSITA would have recognized the predictable benefit of adding a dimmer coupled to the driver to provide the versatility of controlled light levels, consistent with that suggested by *Catalano* and the known art. (*Id*.; *see also* Ex. 1010, Abstract,

FIGS. 1-6, ¶¶0007, 0011-0018, claims 1-4, 16-17.)[19] Though *Saito* discusses preventing *unintended* dimming of the LEDs (Ex. 1008, ¶¶0025, 0035, 0162), a POSITA would have understood *Saito*'s discussions relate to illumination issues specific to the circuitry for *Saito*'s fifth and seventh embodiments (*id.*, FIGS. 10, 20-21) and are not directed to any *controlled* dimming like that discussed in *Catalano*. (Ex. 1002, ¶140.) Further, even if a POSITA would have considered unintended dimming, a POSITA would have ensured controlled dimming as discussed above while preventing inadvertent dimming to maintain proper operation of the LED lighting device and avoid unwanted light emission reduction at the various controlled dimming levels. (*Id.*)

Given the disclosures of *Saito*, *Catalano*, and the knowledge of a POSITA of such dimming configurations/techniques, a POSITA would have had the capability and reasons to implement the above modification with a reasonable expectation of success. (*Id.*, ¶¶139-142.) Indeed, such a modification would have involved the use

[19] Ex. 1010 demonstrates the state of the art.

of known technologies and techniques (*e.g.*, switching and dimming circuit design) to produce the predictable result of a lighting device with a dimming function.[20] (*Id.*)

B. Ground 2: Claims 3 and 7 are Obvious over *Saito* in View of *Catalano* and *Johnson*

1. Claim 3 – The lighting system of claim 1, wherein the driver further includes power factor correction circuitry.

2. Claim 7 – The lighting system of claim 5, wherein the driver further includes power factor correction circuitry.

As discussed in §§X.A.1, X.A.4, the *Saito-Catalano* combination suggests all the limitations of claims 1 and 5. Though *Saito* does not expressly disclose the driver further includes power factor correction circuitry, power factor correction circuitry was commonly employed in LED driver circuitry at the time. (Ex. 1002, ¶¶143-148.) For example, it was well understood by a POSITA that the use of capacitors in a power supply/driver circuitry often negatively impacted its power factor and thus power factor correction circuitry was commonly used to improve the power factor to improve efficiency of the circuitry. Indeed power factor controllers to correct power factor were commercially available and had been included in the drive

[20] PO provides no details as to how this limitation is met by accused instrumentalities. (Ex. 1072, App'x K-2 at 11.)

circuitry of LED-based lighting systems, as demonstrated, for example, by *Johnson*. (Ex. 1002, ¶¶144-147.)

Johnson is directed to "retrofittable lamps configured as standard incandescent lamps but with LED illumination [sources]." (Ex. 1022, 1:6-8.) Accordingly, *Johnson* is in the same field as *Saito* and the '551 patent and addresses similar problems associated with integrating LEDs and driving circuitry, and thus would have been considered by a POSITA when contemplating the design and implementation of the *Saito-Catalano* lighting system. (Ex. 1002, ¶¶73-75, 145; Ex. 1001, 2:23-26.)

Johnson discloses driver circuitry that includes power factor correction circuitry. (Ex. 1022, 7:5-10 ("The switching power supply 106 can take the form of a ***power factor controller*** which would cause this embodiment of the invention to have a desirably high power factor. A power factor controller ... produced by Motorola ... is suitable in this circuitry."); Ex. 1002, ¶¶146-147.) In light of *Johnson* and the knowledge of a POSITA, it would have been obvious to modify the driver in the *Saito-Catalano* lighting device to include power factor correction circuitry like that claimed. (Ex. 1002, ¶¶73-75, 144-148.)

A POSITA would have been motivated to use various known design concepts and components in implementing the above-discussed modified *Saito* lighting device, and in light of the state of art knowledge and *Johnson*, would have

recognized the predictable benefit of a power factor correction circuit to provide a desirably high power factor in the *Saito*-*Catalano* system. (Ex. 1002, ¶146.) Indeed, a POSITA would have known of the desire for sufficiently high power factors (near unity) and that power factor control/correction was commonly implemented and commercially available in circuitry. (Ex. 1002, ¶¶144-148; Ex. 1022, 7:5-10; Ex. 1026, 2:22-26, 2:52-53, 5:53-59.) Such a modification would have provided similar desirable benefits known to be provided by such circuits, as suggested by *Johnson*. (*Id.*)

A POSITA had the skills and rationale to consider how to configure the driver in the combined system to provide power factor correction functionalities, and thus could design and implement the above modification with a reasonable expectation of success, especially given the disclosures of *Saito*, *Catalano*, and *Johnson*, and the knowledge of a POSITA. (*Id*.) Indeed, such a modification would have involved the use of known technologies and techniques to produce the predictable result of providing a driver in the combined *Saito*-*Catalano* lighting system with such power

factor correction circuitry that provided desirable high power factor benefits, like that suggested by *Johnson*.[21] (*Id.*)

C. Ground 3: Claims 1, 2, 4-6, 8, and 9 Are Obvious over *Saito* in View of *Wojnarowski*

As mentioned, *Saito* and *Wojnarowski* are prior art regardless of priority date claimed in the '551 patent. (§V.)

1. Claim 1

a) Claim Limitation 1(a)

b) Claim Limitation 1(b)

c) Claim Limitation 1(c)

d) Claim Limitation 1(d)

e) Claim Limitation 1(e)

Saito discloses limitations 1(a)-1(e). (§§X.A.1.a-X.A.1.e; Ex. 1002, ¶¶149-154.)

f) Claim Limitation 1(f)

As explained, *Saito* discloses with reference to FIG. 15 an exemplary structure of a device "according to the present invention," that encompasses the fourth

[21] The '551 patent's has a single mention of "[p]ower factor correction means 232" without identifying any criticality associated with the component. (Ex. 1001, 18:1-3.)

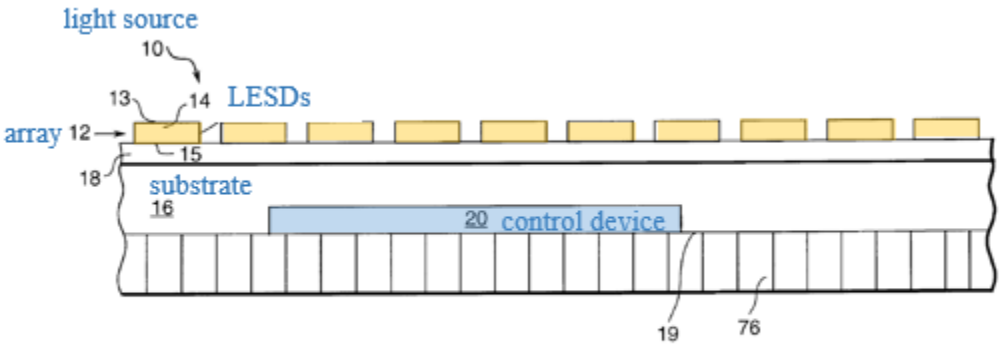
embodiment of FIG. 7 discussed above. (§X.A.1(f); Ex. 1008, ¶¶0050, 0144-0147, FIGS. 7, 15.) As discussed, *Saito*'s lighting system in such exemplary applications includes a driver, bridge rectifier, and at least one capacitor all mounted on a substrate (circuit board) and the at least one LED circuit mounted on a substrate. (*See* analysis in §X.A.1(f); Ex. 1002, ¶¶96-109, 155.)

While *Saito* does not expressly describe the driver, bridge rectifier, LED circuit, and capacitor(s) being mounted on the same reflective substrate, it would have been obvious to a POSITA to configure the lighting system in such a manner, especially in light of *Saito* and *Wojnarowski*. (Ex. 1002, ¶¶155-163.) Indeed, such a modification would have been the predictable use of prior art elements according to their established functions. *KSR*, 550 U.S. at 417; Ex. 1002, ¶¶155-163.)

Wojnarowski "relates generally to light sources" (Ex. 1005, 1:12) and specifically to a light source including a "substrate," "light emitting semiconductor devices (LESDs) having at least one surface for emitting light and a substrate surface being attached to the substrate" arranged to provide "irradiation from the light source" (*id.*, 1:23-32; *see also id*. 2:26-27 (LESDs may include light emitting diodes (LEDs)), 2:59-64 (LESDs may be arranged into arrays for lighting applications)). Accordingly, *Wojnarowski* is in the same field as *Saito* and the '551 patent and addresses similar problems associated with integrating/implementing, *inter alia*, LED and driver circuitry. (*See*, *e.g.*, Ex. 1005, 1:10-32.) Thus, a POSITA would

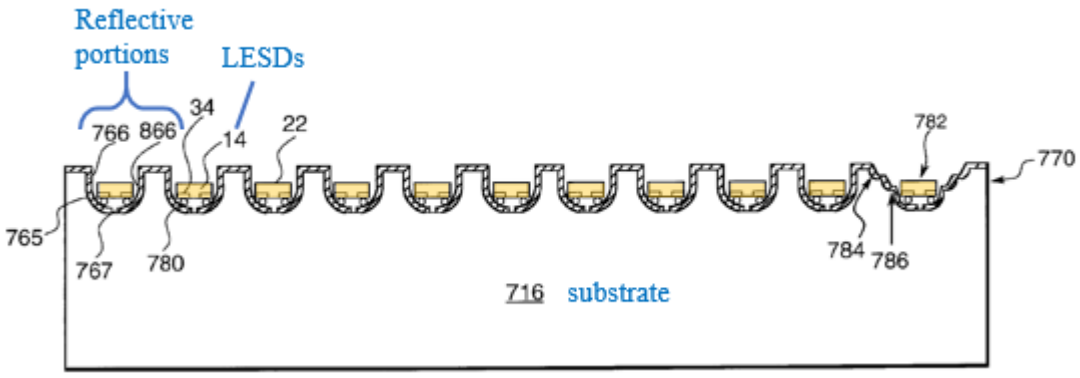
have had reason to consider the teachings/suggestions of *Wojnarowski*. (Ex. 1002, ¶¶76-83.)

As exemplified below, *Wojnarowski* discloses driver circuitry (*e.g.*, control device 20 (annotated in blue below)) and LEDs (*i.e.*, LESDs 14 (yellow)) mounted on a common substrate (*e.g.*, substrate 16). (Ex. 1005, 2:6-10 ("In FIGS. 1 and 2 light source 10 includes a substrate 16 and an array 12 of unpackaged light emitting semiconductor devices (LESDs) 14. Each LESD has at least one light emitting surface 13 and/or 17 for emitting light and a substrate surface 15 attached to the substrate."), 3:11-15 ("FIG. 1 additionally illustrates a control device 20 situated in substrate 16. The control device can be coupled to the LESD array by any appropriate connection technique. As discussed below with respect to FIGS. 24-26, this can be useful for controlling the operation of the LESDs."), 7:49-8:46, FIG. 1 (annotated below), FIGS. 24-26 (illustrating rectifier, filter, and power conditioner of control device 20); Ex. 1002, ¶157.)



(Ex. 1005, Fig. 1 (annotated).)

Wojnarowski further discloses that the substrate 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, ¶158.) *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, 7:19-23, FIG. 27.)



(Ex. 1005, FIG. 27 (annotated).)

In light of *Wojnarowski*, it would have been obvious to modify *Saito*'s lighting system to mount the driver, bridge rectifier, at least one capacitor and at least one LED circuit all on a reflective substrate, like that claimed. (Ex. 1002, ¶¶159-163.)

A POSITA would have recognized that configuring a lighting system in accordance with *Saito*'s fourth embodiment (FIG. 7) with a substrate (*e.g.*, a printed circuit board, *etc.*) that mounts the various components of the system (*e.g.*, driver,

rectifier, LED circuit, capacitor, *etc*.) would have reduced the number of parts by eliminating a separate substrate, increased compactness, and expanded the versatility in retrofit designs and applications of the lighting system. (Ex. 1002, ¶160.) For instance, a POSITA would have recognized the benefits of mounting components on a single substrate in reducing materials (thereby reducing costs) and reducing size (thereby allow the device to retrofit prior lamp designs). (*Id.*) Indeed, it was known to mount components of lighting devices, including LED circuits, LEDs, and other components on a single substrate, as demonstrated by *Wojnarowski* and the state of art. (*Id.*; *see also* Ex. 1009, 15:15-16-10.)[22] Accordingly, a POSITA would have been motivated to modify the above-discussed *Saito* lighting system in similar fashion and would have done so with a reasonable expectation of success. (Ex. 1002, ¶160.)

Moreover, a POSITA would have been motivated to use various known design concepts, components, and techniques in implementing the above-discussed *Saito* lighting system, and would have recognized the predictable benefit of adding a reflective surface to the substrate in the *Saito-Wojnarowski* combined system "light is not lost and can be effectively used" (as suggested by *Wojnarowski*) and to enhance heat dissipation of the LEDs and circuitry, as known in the art. (Ex. 1005,

[22] Exs. 1009, 1049 demonstrate the state of the art.

6:10-12; Ex. 1002, ¶162.) Thus, a POSITA would have been motivated to modify *Saito*'s lighting system to use a reflective substrate to mount the above-mentioned components given such guidance and because the use of reflective substrates in lighting systems was known to increase optical efficiency. (Ex. 1002, ¶162; *see also* Ex. 1011, ¶0018, ¶0081, ¶0034; Ex. 1006, ¶¶0002, 0005, 0009, 0031; Ex. 1007, 2:11-13, 3:13-16, 11:10-21; Ex. 1049, 16:24-45.)

A POSITA would have likewise recognized the predictable benefit of mounting the driver, bridge rectifier, capacitor and LED circuit all on a same substrate allowing use of conventional coupling techniques between LEDs and corresponding power and control circuitry, as suggested by *Wojnarowski*. (Ex. 1005, 3:11-14, 3:48-5:7 (describing with reference to other prior art various ways to configure components on a substrate); *see id.*, 4:5-31).) Indeed, a POSITA would have known/recognized use of common substrates in circuit designs reduces the number of parts (compared to *Saito*), allows for a more compact device, and thus been led to incorporate such known features in the *Saito-Wojnarowski* system to promote versatility in implementing various designs for different applications, including those for replacing/retrofitting conventional lamp configurations as known

in the art. (Ex. 1002, ¶¶155-163; Ex. 1008, ¶¶0005, 0145-0149; Ex. 1006, ¶¶0005, 0009; Ex. 1007, 2:11-13, 3:13-16.)[23]

Given the disclosures of *Saito* and *Wojnarowski*, and the knowledge of a POSITA regarding such mounting and optical techniques (*see*, *e.g.*, Exs. 1009, 1011), a POSITA would have had a reasonable expectation of success in implementing such a modification, which would have involved the use of known technologies and techniques to produce the predictable result of a combined LED and driver circuitry on a reflective substrate. (Ex. 1002, ¶¶155-163.) Further, a POSITA would have recognized the benefits of providing a reflective substrate for mounting the above-noted components in the *Saito-Wojnarowski* 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 associated with the LED lamp 106 in the modified system, as suggested by *Wojnarowski* and known in the art. (*Id*.)

g) Claim Limitation 1(g)

h) Claim Limitation 1(h)

Saito discloses limitations 1(g)-1(h). (§§X.A.1.g-h; Ex. 1002, ¶¶164-165.)

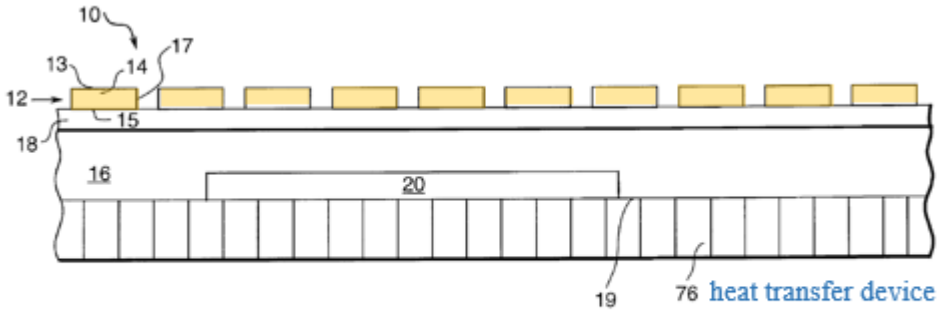
[23] Exs. 1006-1007 and/or Ex. 1011 demonstrate the state of the art.

2. Claim 2

Saito discloses this limitation. (§X.A.2; Ex. 1002, ¶166.)

3. Claim 4

Saito-Wojnarowski does not expressly disclose that the substrate in the combined system is a heat sinking material. It was conventional, however, to include heat sinking materials with an LED circuit to efficiently remove heat generated by the LED circuit and which may be otherwise detrimental to the operation of circuit or the LEDs. (Ex. 1002, ¶¶117, 167-170.) For example, *Wojnarowski* discloses a substrate is a heat sinking material. (Ex. 1005, 3:16-29 (describing with reference to FIG. 1 a heat transfer device 76 coupled to surface 19 of substrate 16 "for optimizing thermal management of the array" and explaining such a device may include "a thermally conductive substrate such as sapphire, aluminum nitride, aluminum silicon carbide, diamond, or thermally conductive ceramic blends").) *Wojnarowski* further explains that "[c]ooling becomes important as the density and intensity of the emitted light increases" and that the "heat transfer device may comprise a heat sink or a coolant assembly" or "***a heat sink material*** such as aluminum silicon carbide, aluminum, aluminum nitride, or beryllium oxide." (*Id.*; *id.*, FIG. 1; Ex. 1002, ¶169.) Use of such heat sink features was consistent with that known in the art. (*Id.*; Ex. 1048, Abstract, 2:2-7, 2:24-67, 4:23-5:14, 5:29-6:26; Ex. 1049, Abstract 10:30-65, 11:9-21, FIG. 3a; Ex. 1006, ¶0035; Ex. 1007, 12:25-29.)



(Ex. 1005, Fig. 1 (annotated).)

In light of *Wojnarowski* and the state of the art, it would have been obvious to utilize a heat sinking material as a substrate in the lighting device of *Saito*. A POSITA would have been motivated to use known design concepts in implementing the *Saito-Wojnarowski* lighting device, and, in particular, recognized that excessive heat would have been detrimental to *Saito*'s lighting circuitry. (Ex. 1002, ¶¶170-173.) Thus, forming the reflective substrate of the combined system from heat sinking material would have had the predictable benefit of enhanced heat dissipation of the LEDs and circuitry, which would have been consistent with the benefits of providing reflective material on the substrate. (*Id*.; §X.C.1(f).)

Given the knowledge of a POSITA of such known substrate design techniques, coupled with the disclosures/guidance provided by *Saito* and *Wojnarowski*, a POSITA could implement the above-modification with a reasonable expectation of success in its implementation. (*Id*.) Such a modification would have involved the use of known technologies and techniques to produce the predictable

result of a reflective substrate made from a heat sinking material. (*Id.*) *KSR*, 550 U.S. at 416. A POSITA would have had the skills and motivation to configure the modified *Saito-Wojnarowski* lighting system such that the substrate provided reflective properties as noted above while also improving the heat dissipation via heat sink properties. (*Id*.)

4. Claim 5

a) Claim Limitation 5(a)

b) Claim Limitation 5(b)

c) Claim Limitation 5(c)

d) Claim Limitation 5(d)

e) Claim Limitation 5(e)

Saito discloses these limitations. (§§X.A.1.a-e, X.A.4.a-e; Ex. 1002, ¶¶174-178.)

f) Claim Limitation 5(f)

Saito-Wojnarowski discloses/suggests this limitation. (§X.C.1.f; Ex. 1002, ¶179.)

g) Claim Limitation 5(g)

Saito-Wojnarowski discloses this limitation for similar reasons explained in §X.A.5.g and §X.A.1.h (explaining that the bridge rectifier in *Saito* rectifies an AC voltage/current from the mains power source to produce a first rectified AC voltage/current, which combined with the discussions above (§§X.C.3.a-f) would

have been provided to an input of the driver in the *Saito-Wojnarowski* system); Ex. 1002, ¶180.) Moreover, the driver in the *Saito-Wojnarowski* system would have also provided a second rectified AC voltage/current to the LED circuit for similar reasons explained above. (§§X.A.1.g, X.A.1.h, X.C.4.a-f; Ex. 1002, ¶180.)

h) Claim Limitation 5(h)

Saito discloses this limitation. (§X.A.4.h; Ex. 1002, ¶181.)

5. Claim 6

Saito discloses this limitation. (§§X.A.4, X.A.5; Ex. 1002, ¶182.)

6. Claim 8

Saito-Wojnarowski discloses/suggests this limitation. (§§X.A.6, X.C.3; Ex. 1002, ¶183.)

7. Claim 9

As discussed above in §X.A.4, *Saito-Wojnarowski* discloses/suggests the limitations of claim 5. While *Saito* does not expressly disclose a dimmer coupled to the driver, dimmers were well known to be used with LED lighting devices. (Ex. 1002, ¶184.) For example, *Wojnarowski* discloses "a power conditioner 82 ***can modulate the signal to supply power to LESD array 12 at different levels in accordance with a user input selection***," which "can provide flexibility if an operator wants the option of buying a light source that can be ***dimmed…..***" (Ex. 1005, 7:66-8:6.) *Wojnarowski* also discloses that "[a] control system, whether

formed from active or passive electronics, can provide flexibility for the light source" such as "if old LESDs change color over time, the amount of power supplied to LESDs and/or the LESDs to which power is supplied can be varied to correct any undesired change in light or to allow the light source to be used in different forms" and can be used to "affect tint control, light hue, and color shift." (Ex. 1005, 8:26-39.)

In light of *Wojnarowski* and knowledge of a POSITA, it would have been obvious to modify the lighting device of the *Saito-Wojnarowski* system to include dimming circuitry/functionality to allow the system to benefit from known controlled light level control features via dimmers. (Ex. 1002, ¶¶184-187.) In configuring such a design, a POSITA would have contemplated various ways to facilitate such functionality, and recognized that coupling such dimmer components/circuitry to the driver in the *Saito-Wojnarowski* system was one predictable way among a finite number of options to control the amount of light emitted from the LED circuit in the system in a controlled manner. (*Id*.; *e.g.,* Ex. 1017, FIGS. 1-2, 1:17-57, 2:34-3:4; Ex. 1019, FIGS. 3-4, ¶¶0004-0008, 0014-0027 (controlling LED dimming via LED power adjustment); Ex. 1020, FIGS. 1-8, Abstract, 1:6-12 (dimming functions), 1:41-55, 3:65-5:29 (LED driver switching schemes/configurations for multiple illumination levels, including "dimming control" and on/off functions).)

A POSITA would have been motivated to consider and use various known LED driver/lighting circuit design concepts to implement the above-discussed *Saito* lighting device, and thus would have recognized the predictable benefit of adding a dimmer coupled to the driver to provide the versatility of controlled light levels, consistent with that suggested by *Wojnarowski* and known in the art. (*Id*.; *see also* Ex. 1006, ¶¶0006, 0024, 0026; Ex. 1007, 6:12-20, 8:2-3, 8:28-9:3; Ex. 1010, Abstract, claims 1-4, ¶¶0007, 0009-00017, FIGS. 1-5.)[24] Thus, having recognized the advantages of providing dimmer functionality to the *Saito-Wojnarowski* lighting device and the options available to implement such features, a POSITA would have been motivated to modify *Saito-Wojnarowski* as explained above. (*Id.*).

A POSITA would not have been deterred from such a modification even though *Saito* discusses designs to prevent *unintentional* dimming of the LEDs. (Ex. 1008, ¶¶0025, 0035, 0162.) A POSITA would have understood *Saito*'s discussions relate to illumination issues specific to *Saito*'s fifth and seventh embodiments (*id.*, FIGS. 10, 20-21) and are not directed to any *controlled* dimming like that discussed above in the *Saito-Wojnarowski* lighting device. (Ex. 1002, ¶188.) Nonetheless, a POSITA would have considered such circuit characteristic issues in implementing the *Saito-Wojnarowski* device to provide controlled dimming as discussed above

[24] Exs. 1006-1007, 1010 demonstrate the state of the art.

while preventing unintentional dimming to maintain proper operation of the LED lighting device and avoid unwanted reduction in light output at the various selected light levels provided by the dimmer-driver configuration. (*Id.*)

Given the knowledge/skills of a POSITA and the teachings/suggestions of *Saito*, a POSITA had the capability and reasons to implement the above modification with a reasonable expectation of success. (Ex. 1002, ¶189.) Indeed, such a modification would have involved the use of known technologies and techniques to produce the predictable result of providing a dimmer connected to the driver circuitry in the combined *Saito*-*Wojnarowski* device to provide the known benefits of controlled dimming of the LEDs. (*Id.*)

D. Ground 4: Claims 3 and 7 Are Obvious over *Saito* in View of *Wojnarowski* and *Johnson*

As discussed in §§X.C.1, X.C.4, *Saito*-*Wojnarowski* discloses/suggests the limitations of claims 1 and 5.

While *Saito* does not expressly disclose the driver further includes power factor correction circuitry, power factor correction circuitry was commonly employed in LED driver circuitry at the time. (Ex. 1002, ¶¶190-192.) For example, it was understood by those of ordinary skill that capacitors in a power supply/driver circuitry often negatively impacted its power factor and thus power factor correction circuitry was used to increase the power factor (near unity) to improve efficiency of the circuitry. (Ex. 1002, ¶¶192-194.) At the time of the invention, power factor

controllers to correct power factor were commercially available and had been included in the drive circuitry of LED-based lighting systems, as demonstrated by *Johnson*. (*Id*.)

As explained in Ground 2, *Johnson* is in the same field as *Saito* and the '551 patent. (§X.B.) Thus, *Johnson* would have been considered by a POSITA when contemplating the design and implementation of the *Saito-Wojnarowski* system. (Ex. 1002, ¶¶192-196.) *Johnson* discloses a driver that includes power factor correction circuitry. (Ex. 1022, 7:5-10 ("The switching power supply 106 can take the form of a ***power factor controller.*** ... A power factor controller ... produced by Motorola ... is suitable in this circuitry."); Ex. 1002, ¶193.) Indeed, a POSITA would have desired a high power factor and known that power factor correction was commonly implemented and commercially available in circuitry. (Ex. 1002, ¶194; Ex. 1026, 2:22-26, 2:52-53, 5:53-59.) In light of the knowledge of a POSITA and the disclosures/suggestions of *Johnson*, it would have been obvious to modify the driver in the *Saito-Wojnarowski* lighting device to include power factor correction circuitry like that claimed. (Ex. 1002, ¶¶192-196.)

A POSITA would have been motivated to use various known design concepts and components in implementing the above-discussed modified *Saito* lighting device, and in light of *Johnson*, would have recognized the predictable benefit of providing a power factor correction circuit to increase the power factor of the driver

in the *Saito-Wojnarowski* system. (*Id*.) Such a modification would have provided similar desirable benefits known to be provided by such circuits, as suggested by *Johnson*. (*Id.*) A POSITA had the skills and rationale to consider the various ways to configure the driver in the combined system to provide power factor correction functionalities, and thus could design and implement the above modification with a reasonable expectation of success, especially given the disclosures of *Saito*, *Wojnarowski*, and *Johnson*, and the knowledge of a POSITA. Indeed, such a modification would have involved the use of known technologies and techniques to produce the predictable result of providing a driver in the combined *Saito-Wojnarowski* lighting system with such power factor correction circuitry that provided desirable high power factor benefits, like that suggested by *Johnson*.[25] (*Id.*)

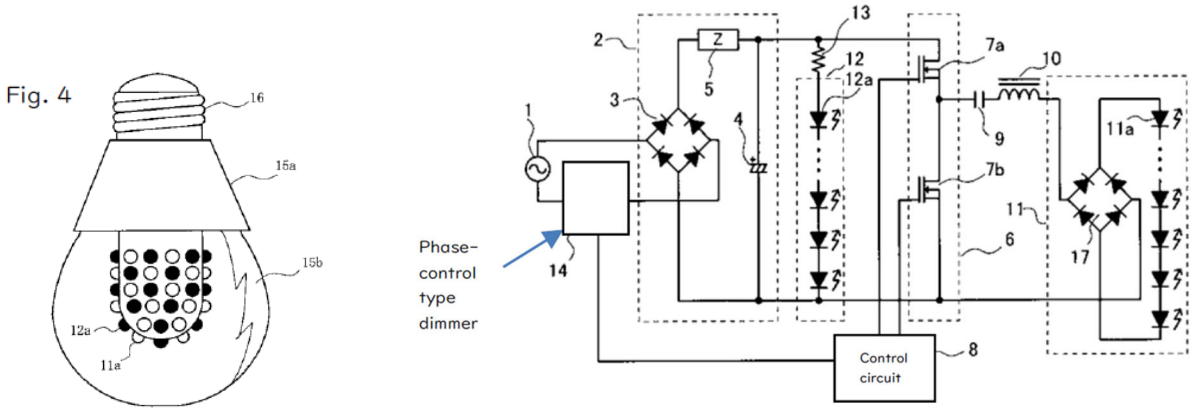
E. Ground 5: Claim 37 Is Obvious over *Hamaguchi* in View of *Wojnarowski*

1. Claim 37

a) A lighting system comprising:

Hamaguchi discloses a lighting system. (Ex. 1010, ¶0001 ("LED lighting device and illumination apparatus") FIGS. 4, 6 (below), *see also* FIGS. 1-3, 5, ¶¶0008-0018; claims 1-16-17 , claims 5, 7, 16-17; Ex. 1002, ¶¶84-85, 197-204.)

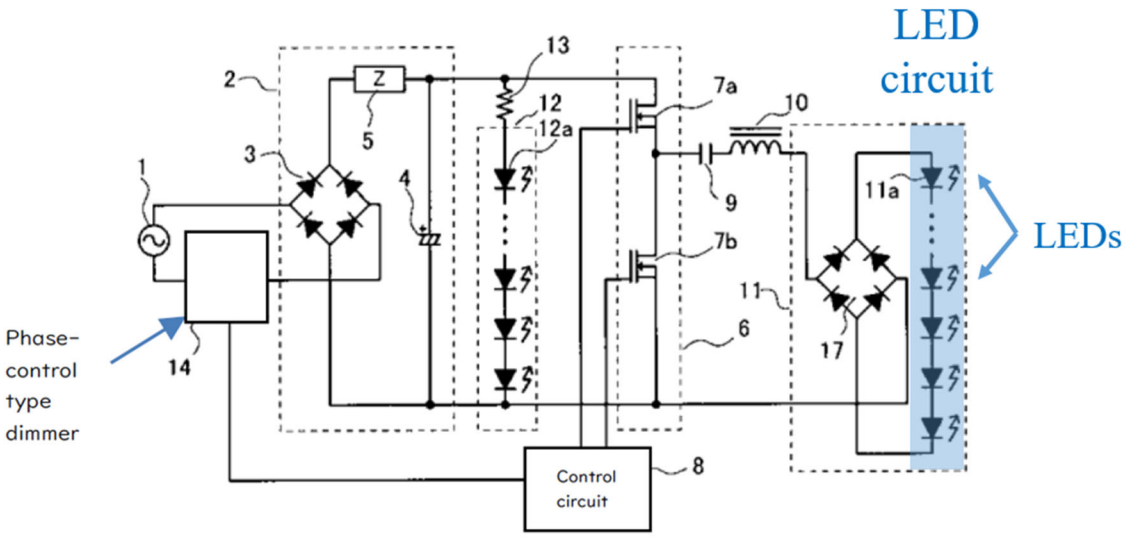
[25] *Supra* n.21.



(Ex. 1010, FIG. 4 (left), FIG. 6 (right).)

b) an LED circuit having at least two LEDs connected in series;

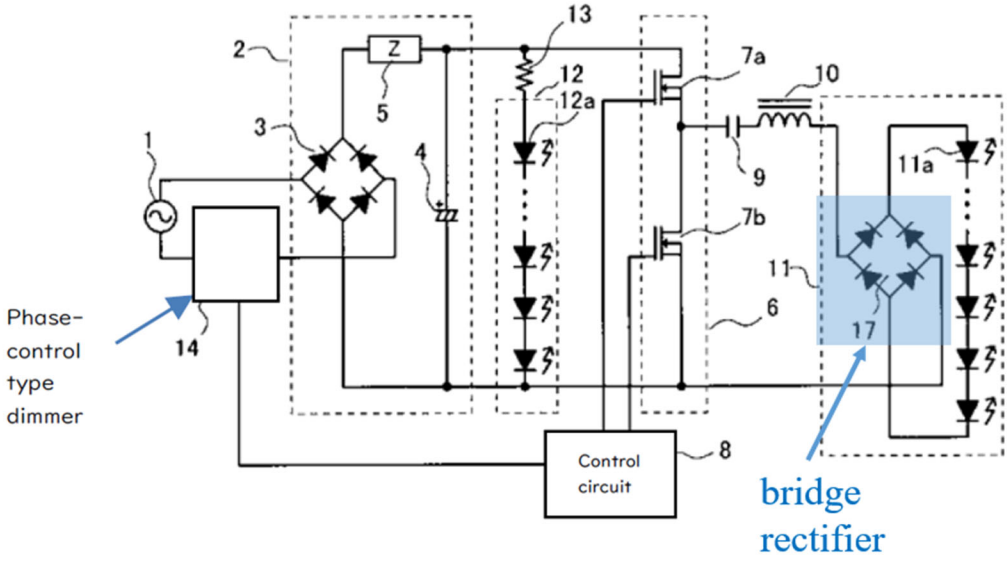
Hamaguchi's lighting system includes an LED circuit (exemplified in blue below) having at least two LEDs (*e.g.*, LEDs 11a) connected in series. (Ex. 1010, ¶0018 ("***white LEDs 11a may be connected in series*** with the anodes"); FIG. 6; Ex. 1002, ¶205.) *Hamaguchi* describes FIG. 6 in context of the same embodiment as exemplified by FIG. 4 (and FIGS. 1-3, 5). (*E.g.*, Ex. 1010, ¶¶0008-0018, claim 7 (white LEDs are connected in series).)



(Ex. 1010, Fig. 6 (annotated).)

c) a bridge rectifier;

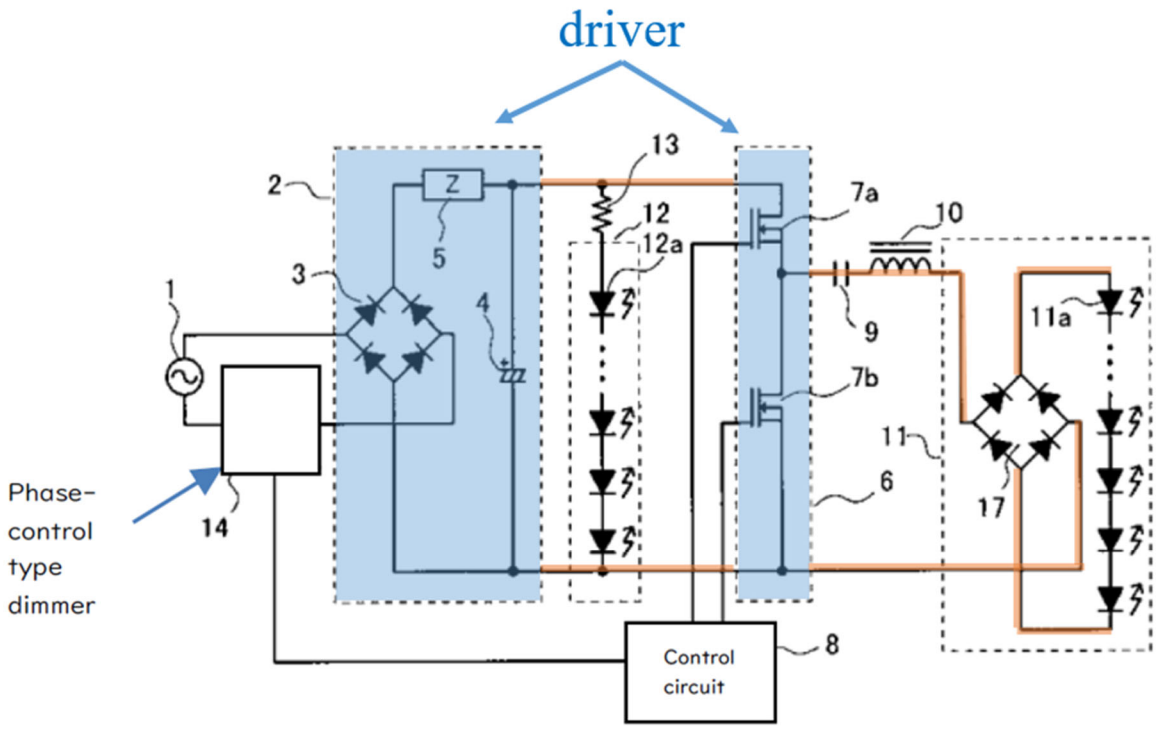
Hamaguchi's lighting system includes a bridge rectifier. (Ex. 1010, ¶0018 ("[O]utput from the inverter circuit 6 may be ***full-wave rectified with the diode bridge 17***…."), FIG. 6 (annotated below); Ex. 1002, ¶206.)



(Ex. 1010, Fig. 6 (annotated).)

d) a driver connected to the bridge rectifier;

Hamaguchi's lighting system includes a driver (*e.g.*, DC power supply 2 and inverter circuit 6) connected to the bridge rectifier (*e.g.*, rectifier 17). (Ex. 1010, ¶0009 ("[Element] 2 is a DC power supply comprising a diode bridge 3, a smoothing capacitor 4, and an impedance element 5. The numeral 6 is an inverter circuit, comprising switching elements 7a and 7b, and here MOSFET is used in switching elements 7a and 7b."), FIG. 6 (exemplary connections annotated below in orange); Ex. 1002, ¶207.)



(Ex. 1010, Fig. 6 (annotated).)

e) the driver, bridge rectifier and at least one LED circuit all being mounted on a reflective substrate;

While *Hamaguchi* does not expressly describe the driver, bridge rectifier, and at least on LED circuit being mounted on the same reflective substrate, it would have been obvious to configure the lighting system in such a manner in light of *Wojnarowski*. (Ex. 1002, ¶¶208-219.) Such a modification would have been the predictable use of prior art elements according to their established functions. (*Id*.; *KSR*, 550 at 417; *In re Japikse*, 181 F.2d 1019.)

A POSITA would have been motivated, and found obvious, to mount the above-mentioned components in *Hamaguchi*'s system on a common reflective substrate for reasons similar for modifying *Saito* as explained for claim 1 in Ground 3. (§X.C.1(f); Ex. 1002, ¶¶155-163.) As explained, *Wojnarowski* discloses an LED lighting system including similar components as those disclosed by *Hamaguchi* (*e.g.*, LEDs, rectifier, circuitry providing power to LEDs) for use in various lighting applications. (*Id.*; Ex. 1005, FIGS. 1-2, 24-25, 1:12-32, 2:26-27, 2:59-64.) Also as explained above, *Wojnarowski* discloses a substrate providing a base for its components. (§X.C.1(f); Ex. 1005, FIGS. 1-2, 24-25, 2:6-10 (substrate 16), 3:11-15, 7:49-8:46; Ex. 1002, ¶¶155-163.) Also explained, *Wojnarowski* discloses the substrate includes an integral reflective coating (*e.g.*, aluminum or gold), thus making it a reflective substrate, where reflector portions 766/866 serve as reflectors

and electrical coupling for LESDs. (§X.C.1(f); Ex. 1005, FIG. 27, 6:6-7:34; Ex. 1002, ¶158.)

Thus, for reasons similar for modifying *Saito* in light of *Wojnarowski* (§X.C.1(f) (regarding *Wojnarowski*'s suggestions/teachings), it would have been obvious to modify *Hamaguchi*'s lighting system to mount the driver, bridge rectifier, and LED circuit all on a reflective substrate. (Ex. 1002, ¶¶208-219.) A POSITA would have recognized that such a modification would have expanded the versatility and applications of *Hamaguchi*'s lighting system by minimizing materials and allowing the configuration to conform to various designs, and allowed for use of conventional coupling techniques between LEDs and corresponding circuitry, as suggested by *Wojnarowski*. (*Id*.; Ex. 1005, 3:11-14, 3:48-5:7, 7:19-23.) A POSITA would have recognized the predictable benefit of adding a reflective surface to *Hamaguchi*'s substrate to improve illumination efficiency and enhance heat dissipation of LEDs. (Ex. 1002, ¶218; Ex. 1005, 6:10-14, 7:11-34; Ex. 1049, 16:24-45.) Indeed, it was known to mount LED circuits and related components in a lighting system on a common substrate, as demonstrated by *Wojnarowski* and the state of art. (Ex. 1002, ¶¶216-217; Ex. 1005, 6:10-14, 7:11-34; §X.C.1(f); Ex. 1009, 15:15-16-10; Ex. 1011, ¶¶0018, 0081, 0034; Ex. 1006, ¶¶0002, 0005, 0009, 0031;

Ex. 1007, 2:11-13, 3:13-16, 11:10-21.)[26] Accordingly, a POSITA could modify *Hamaguchi*'s system similarly with a reasonable expectation of success. (Ex. 1002, ¶¶208-219.)

A POSITA would have known/recognized that usage of common substrates in circuit designs allows for compact device designs, and thus been led to incorporate such known features in *Hamaguchi*'s system to promote versatility in applications, including those for replacing/retrofitting conventional lamp configurations consistent with *Hamaguchi* and as known in the art. (*Id*.; Ex. 1010, ¶0013, Ex. 1008, ¶¶0005, 0145-0149; Ex. 1006, ¶¶0005, 0009; Ex. 1007, 2:11-13, 3:13-16.) Additionally, providing a reflective substrate would have provided added benefits of illumination directivity/efficiency, electrical coupling, and/or heat dissipation. (Ex. 1002, ¶¶218-219.)

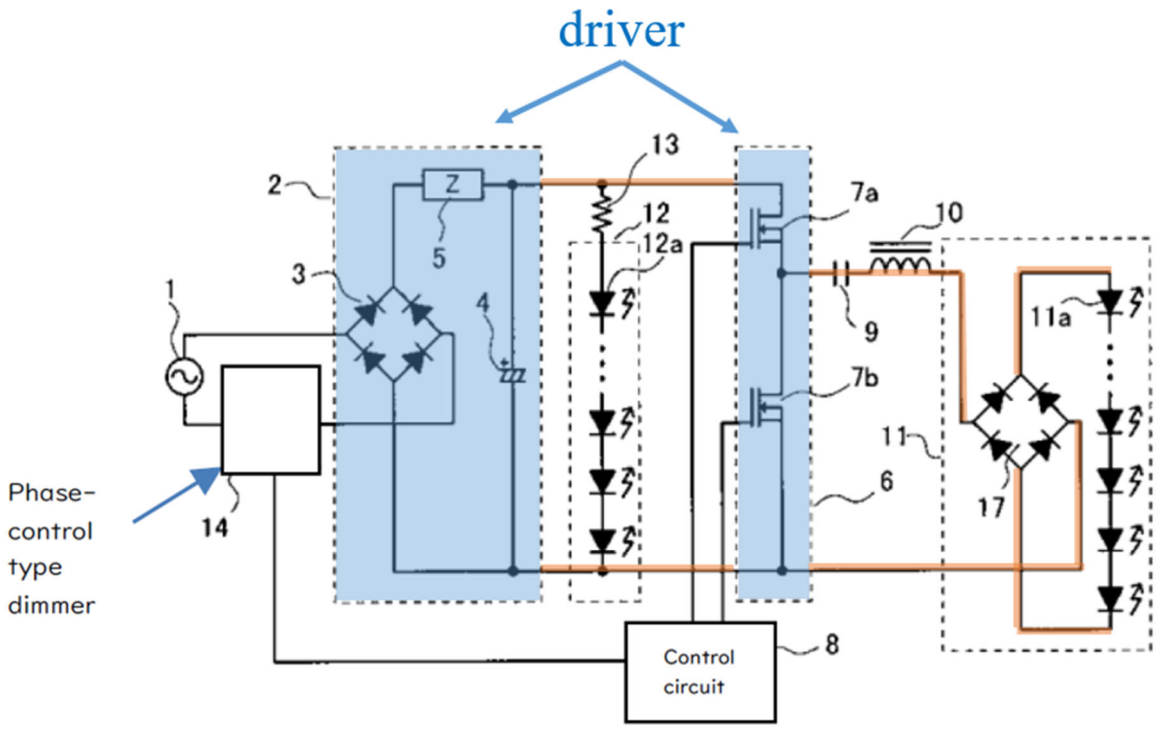
Given such a modification would have involved the use of known technologies/techniques (known substrates and reflective coatings), it would have been obvious to implement the above modification. Indeed, as noted, a POSITA would have recognized the benefits of a reflective substrate for mounting such components in *Hamaguchi*'s lighting system, including offering a predictable

[26] Exs. 1006-1007, 1009, 1011 demonstrate the state of the art.

alternative base structure for circuitry, improved illumination efficiency, and/or better heat dissipation characteristics. (*Id*.; *see also* §X.C.1(f).)

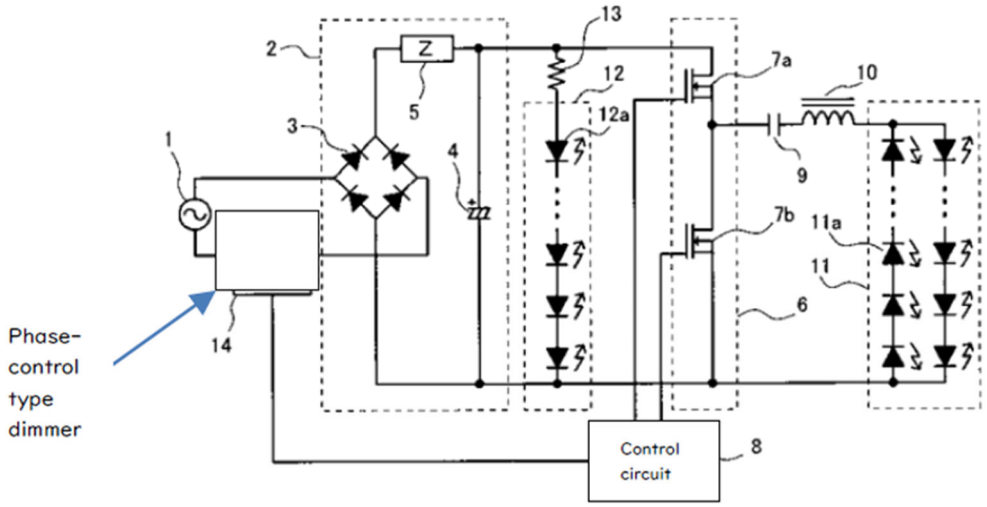
f) the driver providing AC voltage and AC current to the bridge rectifier and the bridge rectifier providing DC voltage and DC current to the LED circuit,

Hamaguchi discloses that the above-described driver (*e.g.*, DC power supply 2 and inverter circuit 6) provides rectified AC voltage/current to the at least one LED circuit. (Ex. 1010, ¶0018 ("to improve efficiency, ***output from the inverter circuit 6 may be full-wave rectified with the diode bridge 17***, and the white LEDs 11a may be connected in series"); Ex. 1002, ¶¶220-228.) FIG. 6 shows an AC power source (element "1"), which, like that described for FIG. 1, is a "commercial power supply 1" that provides AC power. (Ex. 1010, ¶0010; FIGS. 1 and 6 (sinusoidal label); Ex. 1002, ¶221.) "AC power from commercial power supply 1 is full-wave rectified by the diode bridge 3" (Ex. 1010, ¶0010), which is part of the "driver" (§X.E.1.c). Element 2 provides rectified AC voltage/current to inverter 6. (Ex. 1005, ¶¶0010-0011; Ex. 1002, ¶222.)

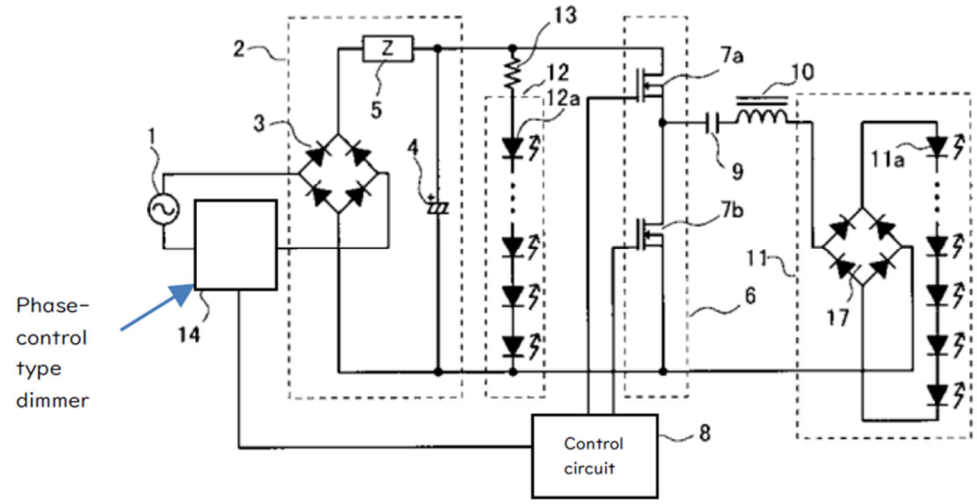


(Ex. 1010, Fig. 6 (annotated).)

The inverter 6 in the above-identified "driver" provides AC voltage/current to bridge rectifier 17, which in turn provides DC power to the series connected LEDs. (*Id.*) For instance, comparatively, *Hamaguchi*'s configuration for FIG. 1 differs from FIG. 6 in that in FIG. 1, LED circuit 11 includes "antiparallel" LEDs 11a (*e.g.*, current flows in different directions on each series connected set of LEDs) and no bridge rectifier 17. (Ex. 1010, ¶¶0009, 0018.)



(Ex. 1010, FIG. 1.)



(Ex. 1010, FIG. 6.)

As explained, in FIG. 1, inverter 6 is turned on and off to convert the DC output of circuit 2 to high frequency, and the "high frequency current from the inverter circuit 6 is restricted by the inductor 10 and deposited into the white LED array 11," which is thus "able to be lighted by high frequency current that is half-wave rectified." (*Id.*, ¶0010; *id.*, ¶¶0011-0012.) Thus, the FIG. 1 arrangement provides alternating current

(AC voltage/current) to the antiparallel LEDs 11a such that each set of LEDs is alternatively illuminated based on the sinusoidal signals provided by inverter circuit 6 (*e.g.*, one set illuminates on positive voltage of the AC signal and the other on negative voltage of the AC signal). (Ex. 1002, ¶¶223-224; Ex. 1021, FIG. 2, 3:45-58.) In the FIG. 6 configuration, a rectifier 17 is provided to rectify the incoming AC voltage/current from inverter 6 to provide DC power to the single set of series connected LEDs 11a. (*Id.*)

Though *Hamaguchi* does not expressly disclose that bridge rectifier 17 is configured with a filter and associated circuitry to provide DC voltage/current to LEDs 11a, it would have been obvious to modify the FIG. 6 configuration of *Hamaguchi* to include a filter (*e.g.*, capacitor) with the bridge rectifier 17 circuitry in order to provide smoothing of the rectified signals to provide filtered DC voltages and DC current to power the LEDs 11a. (Ex. 1002, ¶225.) A POSITA would have been motivated to implement such a modification because it would have ensured filtered DC voltage/current signals are provided to LEDs 11a, which would have ensured proper illumination of the LEDs in accordance with *Hamaguchi*'s operations. (Ex. 1002, ¶226; Ex. 1010, ¶¶0004-0007.) A POSITA would have had reason to consider such a modification given it was known to use a filter (*e.g.*, capacitor) with a rectifier to provide filtered DC voltage/current from AC source signals, for use with lighting components, such as LEDs. (Ex. 1002, ¶227.)

For example, *Wojnarowski* discloses an LED lighting system that includes a rectifier and filter "to provide dc voltage" for an LED array (Ex. 1005, 7:59-62; §X.C.1(f) (*Wojnarowski*)), consistent with that known by a POSITA. (Ex. 1002, ¶¶37, 45, 226; Ex. 1012, FIG. 3.21, 45-46 (pp. 38-39).) *Hamaguchi* even discloses the use of a capacitor with rectifier 3 in DC power supply 2. (Ex. 1010, FIGS. 1, 6, ¶0009 ("smoothing capacitor 4").)

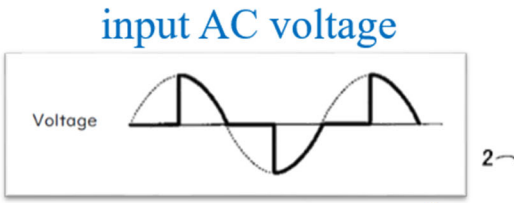
Given the knowledge in the art in context of *Hamaguchi* and *Wojnarowski*, a POSITA had the skills and motivation to configure *Hamaguchi*'s rectifier 17 circuit with a smoothing capacitor to provide DC voltage and DC current to the LEDs 11a as described above with a reasonable expectation of success. (Ex.1002, ¶ Ex. 1002, ¶¶220-228.) Indeed, such a modification would have involved the use of known technologies and techniques to produce the predictable result of powering the LEDs in *Hamaguchi*'s system with efficient/filtered/smooth DC power, consistent with *Hamaguchi*'s operations. (*Id.*)

g) the driver having an input of a first AC voltage and a first frequency from a mains power source.

Hamaguchi's "driver" has an input of a first AC voltage and a first frequency from a mains power source. (*See* §X.E.1.g; Ex. 1010, ¶0010 ("***AC power from the commercial power supply 1*** is full-wave rectified by the diode bridge 3 and smoothed by the smoothing capacitor 4, becoming a DC voltage supply"), ¶0011

("***Fig. 2 shows a waveform of the commercial power supply 1*** that is cut by the phase-control type dimmer 14"), FIGS. 2 and 6 (annotated below); Ex. 1002, ¶229.)

The commercially provided AC input into *Hamaguchi*'s driver is illustrated by the waveform of FIG. 2 including a first AC voltage and a first frequency (as modified by the dimmer).[27] (Ex. 1002, ¶230.)



(Ex. 1010, Fig. 2)

(Ex. 1010, Fig. 6 (annotated).)

A POSITA would have understood that *Hamaguchi*'s commercial AC power supply is a "mains power source" that provides first AC voltage and a first frequency because commercial AC sources were known to provide AC voltage at a known

[27] The FIG. 2 waveform pertains to the arrangement of FIG. 6 (using similar elements, *e.g.*, elements 1 and 3). (Ex. 1002, ¶¶199-204; Ex. 1005, ¶¶0008-0018.)

frequency (*e.g.*, 60 Hz. U.S.). (Ex. 1002, ¶231; Ex. 1008, ¶0004; Ex. 1015, 1:10-25, FIG. 1; Ex. 1016, 1:9-28, 1:35-48; Ex. 1024, 708; Ex. 1023, 1:15-18; Ex. 1050, 1:11-13.)

Moreover, it would have been obvious to include a mains power supply for supply 1 to allow *Hamaguchi*'s lightings system to receive power from conventional and standard sources as was known in the art and as mentioned immediately above. (Ex. 1002, ¶¶232-233; *see above* state of art citations) A POSITA would have found it obvious to use a commercial mains power supply (with standard frequency and voltage) to facilitate use of *Hamaguchi*'s lighting system based on commercially available and standardized power sources. (*Id*.) Such a modification would have been a predictable use of known power sources for devices, as demonstrated/suggested by *Hamaguchi* and known in the art, which was within the capabilities and knowledge of a POSITA at the time. (*Id.*) Thus, such a configuration would have been designed with a reasonable expectation of success. (*Id.*)

XI. 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 Illinois-I, Illinois-II, and HD-Litigation. (*See* §II).

First factor. Petitioner intends to seek stays in Illinois-I and Illinois-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 '551 patent was recently added to Illinois-I on September 8, 2021 (Ex. 1076) and added to Illinois-II on September 28, 2021.[28] No trial has been scheduled

[28] 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 trial date for purposes of this analysis is purely speculative. Thus, this factor weighs against discretionary denial.

The HD-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, 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 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 '551 patent just days ago. (Ex. 1072.) Petitioner has not served invalidity contentions for the '551 patent. The court has not issued a scheduling order. In short, virtually nothing substantive has happened 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 '551 patent (claims 1, 3-5, 7-9), while this Petition

challenges claims 1-9 and 37. (§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 claims 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 '551 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 HD-Litigation.

Sixth factor. Petitioner diligently filed this Petition with strong grounds (*supra* §X) **within four months** of PO's assertion of the '551 patent (Ex. 1075) and ***shortly after*** PO's infringement contentions 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, LLC v. SITO Mobile R&D IP, LLC et al.*, 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 '551 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 '551 patent issued on first office action without any substantive prior art analysis. (Ex. 1004, 178 (Notice of Allowability addressing only claim 22).) 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). And despite the HD-IPR, this Petition is the ***sole*** challenge to claims 2, 6, 9, and 37 of the '551 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 *General Plastic* analysis favors institution

The Board should not exercise its discretion to deny institution based on the '551 patent being at issue in the HD-IPR (§II). Indeed, the facts and issues relevant to the seven factors concerning discretionary denial under 35 U.S.C. § 314(a) favor

institution. *General Plastic Industrial Co., Ltd. v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper No. 19 at 3, 8, 15-19 (Sept. 6, 2017).

First factor. Petitioner is not (and was not) a party in HD-Litigation nor HD-IPR. And Home Depot is not a party to Illinois-I/II. In short, Petitioner has no "significant relationship" with Home Depot. *See Valve Corp. v. Electronic Scripting Product, Inc.*, IPR2019-00062, Paper No. 13 at 2 (Apr. 2, 2019) (precedential). Home Depot and Petitioner are not co-defendants and there was/is no direction or control between the parties relating to this petition and HD-IPR. The accused products in the HD-Litigation and Illinois-I/II are not the same. Although there is some overlap in the asserted and challenged claims, they are not entirely identical (*e.g.*, HD-IPR does not challenge claims 2, 5, and 9 and PO asserts claims not identified in PO's complaint(s) against Home Depot). (Exs. 1082-1083.) Petitioner and Home Depot thus remain distinct parties, with ultimately distinct interests and litigation strategies.[29] *Id.*; *Paypal, Inc. v. IOENGINE,* LLC, IPR2019-00884, Paper 22 at 3-11 (Oct. 3, 2019).

[29] A general common interest by defendants seeking to invalidate asserted unpatentable claims should not create a significant relationship to warrant discretionary denial, especially here, where Petitioner asserts different prior art and

Second to fifth factors. Since Petitioner has not previously filed a petition against the same patent, factors 2–5 bear little relevance. *Unified Patents, Inc. v. Certified Measurement*, LLC, IPR2018-00548, Paper No. 7 at 7-8 (Sept. 5, 2018). Nevertheless, Petitioner has diligently invested significant effort to prepare the detailed grounds presented in this Petition, and has not delayed the preparation or filing of this Petition. And while, at the time of filing the HD-IPR petition (August 18, 2021), Petitioner was working on its strategies and challenges against the '551 patent, Petitioner had no notice as to which claims of the '551 patent PO would assert against Petitioner. Only on September 22, 2021, did PO give notice of its asserted claims. (Ex. 1072.) Petitioner continued its efforts to prepare and file its petition soon thereafter. This is significant because of the number of claims issued in the '551 patent, and the various different compilations of conventional arrangements claimed in those claims. Thus any delay between its filing and HD-IPR was reasonable and warranted, regardless of whether Petitioner knew of the prior art it ultimately asserted in this petition at the time of the HD-IPR petition.

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challenges other claims without any coordination or direction/control, and has no relationship with Home Depot regarding the challenged patent asserted against different products.

If anything, any delay between the filing of the petitions is a product of PO's litigation strategy. Indeed, PO staggered its assertion of the '551 patent against Home Depot and Petitioner by more than 4 months. (Ex. 1075, 18; Ex. 1082, 88.) PO did not even assert the '551 patent in its original complaint. (Ex. 1074.)[30] Moreover, Petitioner filed its petition less than 2 months after HD-IPR, and as noted, shortly after receiving notice of PO's asserted claims. (Ex. 1072.) Also, Petitioner has gained no advantage in filing its own petition. At time of this filing, no preliminary response has been filed in the HD-IPR.

Moreover, as noted, Petitioner asserts different prior art, based on a different expert's opinions, against different claims (*e.g.*, 2, 6, and 9). Thus, **factors two through five** do not support discretionary denial. Indeed, Petitioner would be prejudiced by the denial of institution given its reasonable and significant efforts and invested resources to diligently file its petition following PO's recent infringement contentions.

Sixth and Seventh factors. Instituting this Petition would be no more a burden on the Board's finite resources than instituting any other petition. Indeed,

[30] PO first asserted infringement of the '551 patent against Petitioner in an amended complaint filed June 9, 2021—less than 4 months before the filing of this petition. (Ex. 1075, ¶¶56-68.)

this Petition challenges a finite set of claims based on a limited set of primary references (§X.) Nor are there any readily identifiable roadblocks for the Board to issue a final determination within the statutory one-year limit like those found in other cases where discretionary denial was exercised. *See*, *e.g.*, *Valve Corp.*, at 15.

C. The Board Should Not Exercise Discretion under § 325(d) to Deny the Petition

The grounds of the present Petition assert different prior art than those asserted in HD-IPR. Thus, the present case is distinguishable from *Becton, Dickinson and Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 16-28 (informative).

Discretionary denial under § 325(d) is inappropriate in view of the Petition's reliance on *Wojnarowski*. Though cited in an IDS during prosecution, the Office erred in a manner material to the patentability of the challenged claims by not applying the teachings of *Wojnarowski*. *Advanced Bionics, LLC v. Med-El Elekromediznische Geräete GMBH*, IPR2019-01469, Paper 6 at 8 (precedential). *Wojnarowski* was not substantively discussed or distinguished during prosecution of the '551 patent (Ex. 1004, 166.) Nor did the Examiner consider *Saito* or *Hamaguchi* (not cited during prosecution) in light of *Wojnarowski*'s material disclosures. (*See* §§X.C-X.E.) Further, the Examiner did not have the benefit of expert testimony

explaining the significance of the combinations as explained above.[31] (*Id.*) Such oversight was critical and warrants consideration of *Wojnarowski* in the above-asserted grounds during trial here. *Advanced Bionics* at 8-9.

[31] No prior art was applied before allowing the claims on first action. (Ex. 1004, 178.)

XII. CONCLUSION

Petitioner requests institution of IPR for the challenged claims 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. 10,154,551 contains, as measured by the word-processing system used to prepare this paper, 13,983 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. 10,154,551 and supporting exhibits to be served via express mail on the Patent Owner at the following correspondence address of record as listed on PAIR:

K&L Gates LLP-Chicago
P.O. Box 1135
Chicago, IL 60690

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