Filed on behalf of Wangs Alliance Corporation
By: David C. Radulescu, Ph.D., Reg. No. 36,250
Angela Chao, Reg. No. 71,991
RADULESCU LLP
Empire State Building
350 Fifth Avenue, Suite 6910
New York, NY 10118
Tel: 646-502-5950
david@radulescullp.com
angela@radulescullp.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WANGS ALLIANCE CORPORATION D/B/A WAC LIGHTING CO.
Petitioner

v.

Patent Owner of
U.S. Patent No. 7,038,399 to Ihor A. Lys, Kevin J. Dowling, and
Frederick M. Morgan

Inter Partes Review Case No. Unassigned

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,038,399 UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §§ 42.1-.80, 42.100-.123

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I. MANDATORY NOTICES AND FEES

A. Real Parties-in-Interest

Wangs Alliance Corporation d/b/a WAC Lighting Co. is the real party-in-interest.

B. Related Matters

The following matter may affect or be affected by a decision herein: *Koninklijke Philips N.V. et al. v. Wangs Alliance Corporation*, Case No. 14-cv-12298-DJC (D. Mass.). Additionally, the Patent Owner is suing the Petitioner and/or other parties under one or more of U.S. Patent Nos. 6,013,988; 6,147,458; 6,586,890; 6,250,774; 6,561,690; 6,788,011; 7,352,138; 6,094,014; and 7,262,559, all of which generally relate to light emitting diodes ("LEDs"). On the same week as this petition, the Petitioner is also filing additional petitions for *Inter Partes* Review for six other patents asserted by the Patent Owner against the Petitioner: U.S. Patent Nos. 6,013,988; 6,147,458; 6,586,890; 6,250,774; 6,561,690; and 7,352,138.

C. Counsel

Lead counsel in this case is David Radulescu, Ph.D. (PTO Reg. No. 36,250); backup counsel is Angela Chao (PTO Reg. No. 71,991). Powers of attorney accompany this Petition.

D. Service Information

Email: david@radulescullp.com; angelaradulescullp.com

Address: Radulescu LLP, The Empire State Building, 350 Fifth Avenue, Suite 6910, New York, NY 10118

Telephone: (646) 502-5950 Facsimile: (646) 502-5959

Please direct all correspondence to lead counsel at the above address. The Petitioner consents to email service at the above addresses.

E. Payment

Under 37 C.F.R § 42.103(a), the Office is authorized to charge the fee set forth in 37 C.F.R. § 42.15(a) to Deposit Account No. 506352 as well as any additional fees that might be due in connection with this Petition.

II. CERTIFICATION OF GROUNDS FOR STANDING

The Petitioner certifies pursuant to 37 C.F.R § 42.104(a) that the patent for which review is sought is available for *inter partes* review and that the Petitioner is not barred or estopped from requesting an *inter partes* review challenging the patent claims on the grounds identified in this Petition.

III. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Pursuant to Rules 42.22(a)(1) and 42.104(b)(1)-(2), the Petitioner challenges claims 7, 8, 17, 18, 28, and 34 of U.S. Patent No. 7,038,399 (the "'399 Patent") (Ex. 1001).

A. Prior Art Patents and Printed Publications

The Petitioner relies upon the patents and printed publications listed in the Table of Exhibits, including:

1. U.S. Patent No. 5,661,645 to Hochstein, ("Hochstein" (Ex. 1003)), which is prior art under § 102(b).
2. U.S. Patent No. 6,225,759 ("Bogdan" (Ex. 1004)), which is prior art at least under § 102(e) and/or § 102(b).
3. U.S. Patent No. 5,818,705 ("Faulk" (Ex. 1005)), which is prior art under § 102(b).

B. Grounds for Challenge

The Petitioner requests cancellation of claims 7, 8, 17, 18, 28, and 34 of the '399 Patent ("challenged claims") as unpatentable under 35 U.S.C. §§ 102 and/or 103. This Petition, supported by the declaration of Robert Neal Tingler ("Tingler Decl." (Ex. 1006)), filed herewith, demonstrates that there is a reasonable likelihood that the Petitioner will prevail with respect to at least one challenged claim and that each challenged claim is not patentable. *See* 35 U.S.C. § 314(a).

Ground 1: Claims 7, 8, 17, 28, and 34 are anticipated by Hochstein.

Ground 2: Claims 7, 8, 17, 28, and 34 are obvious over Bogdan in view of Hochstein.

Ground 3: Claims 7, 8, 17, 18, 28, and 34 are obvious over Hochstein in view of Faulk.

IV. CLAIM CONSTRUCTION

A claim in *inter partes* review is given the "broadest reasonable construction in light of the specification in which it appears." 37 C.F.R. § 42.100(b). The broadest reasonable construction is the broadest reasonable interpretation of the claim language. *See In re Yamamoto*, 740 F.2d 1569, 1571-72 (Fed. Cir. 1984). Any claim term which lacks a definition in the specification is therefore also given a broad interpretation. *In re ICON Health & Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007).[1] Should the Patent Owner contend that the claims have a construction different from their broadest reasonable construction in order to avoid the prior art, the appropriate course is for the Patent Owner to seek to amend the claims to expressly correspond to its contentions in this proceeding. *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48756, 48764 (Aug. 14, 2012).

A. "Duty Cycle"

Duty cycle means "the ratio of pulse duration to pulse period, expressed as a percentage." *Wiley Electrical and Electronics Engineering Dictionary* (Steven M.

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[1] Petitioner adopts the "broadest reasonable construction" standard as required by the governing regulations. 37 C.F.R. § 42.100(b). Petitioner reserves the right to pursue different constructions in a district court, where a different standard is applicable.

Kaplan, 2004) (definition of "duty cycle") (Ex. 1006); *see also McGraw-Hill Dictionary of Scientific and Technical Terms* (4th Ed.) (1989) (definition of "duty cycle") ("2. The ratio of working time to total time for an intermittently operating device, usually expressed as a percent"); '399 Patent, 13:13-20 ("In one implementation, the dimmer circuit may output an A.C. signal 500 having a duty cycle of as low as 50% 'on' (i.e., conducting) that provides sufficient power to cause light to be generated by the LED-based light source 104. In yet another implementation, the dimmer circuit may provide an A.C. signal 500 having a duty cycle of as low as 25% or less 'on' that provides sufficient power to the light source 104.") (Ex. 1001).

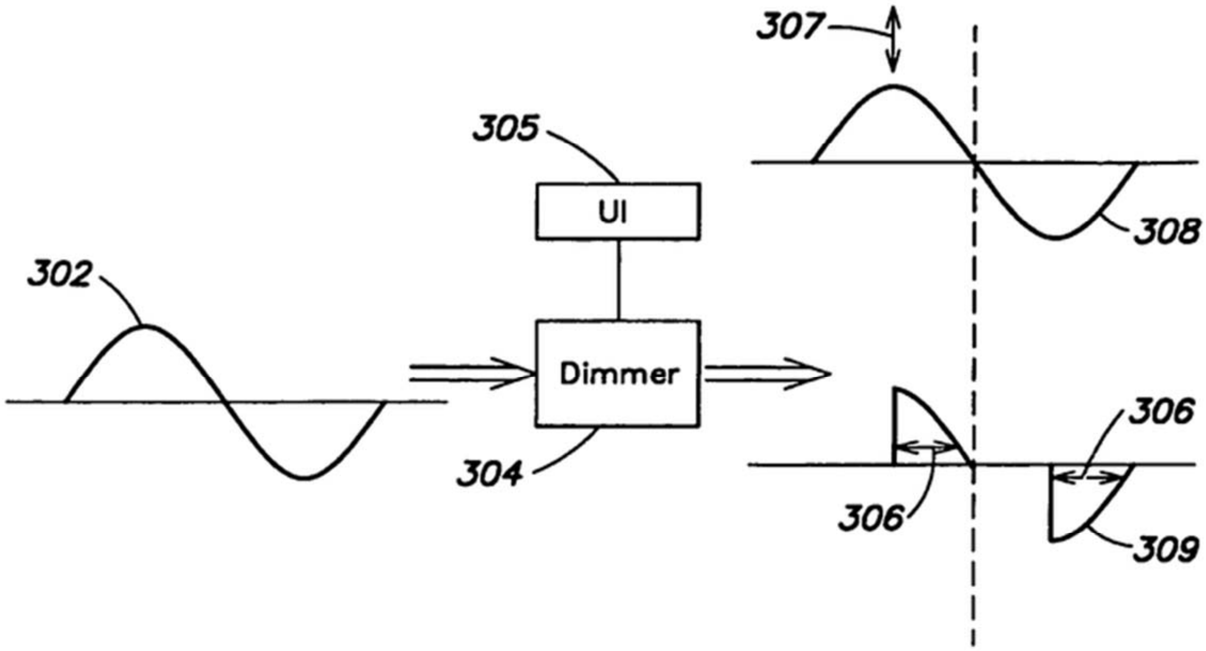
V. OVERVIEW OF THE '399 PATENT

A. Background

The '399 patent is purportedly directed to solving certain problems associated with powering newer lighting sources, such as light emitting diode (LED) based sources, that are deployed in conventional A.C. power circuits which traditionally provided power to older lighting sources such as incandescent light bulbs. '399 Patent, 1:25-29; 2:50-56 (Ex. 1001). In particular, the '399 patent addresses the problem of using devices such as conventional A.C. dimmer switches to control LED lights. *Id.* 2:57-64. Although conventional dimmer switches can control conventional incandescent lights without any additional circuitry, LEDs are generally are incompatible with conventional A.C. dimmer switches. *Id.* 1:53-63; 9:4-13. As a result, LED light sources cannot easily be substituted for conventional light sources in lighting systems using conventional A.C. dimmer switches. *Id.* 9:13-16.

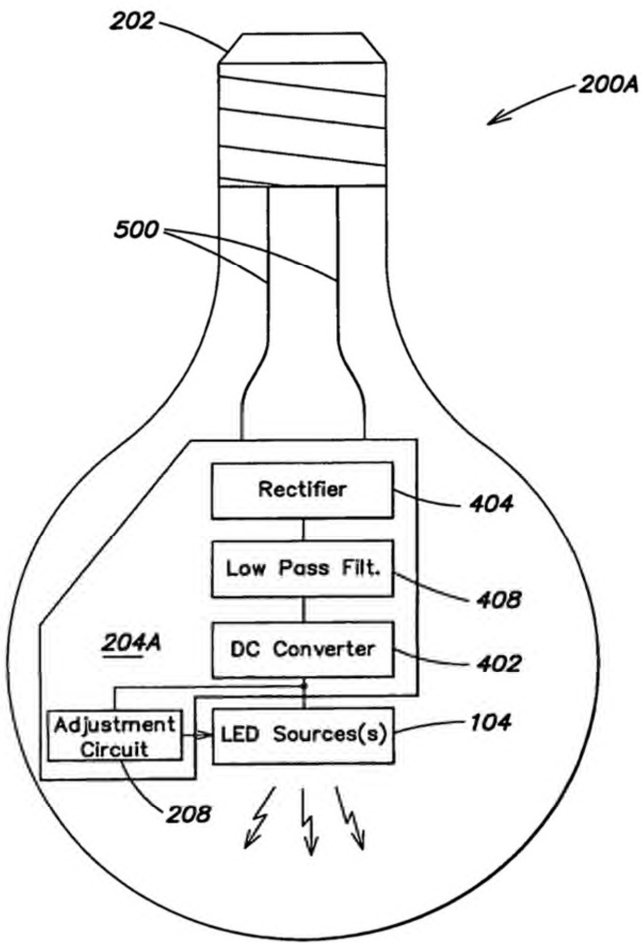
B. Summary of Alleged Invention of the '399 Patent

The '399 patent purports to relate to a circuit arrangement and method for providing power to LED-based light sources via an alternating current (AC) power source and for facilitating the use of AC power circuits that provide signals "other than standard line voltages." '399 Patent at Abstract (Ex. 1001); Tingler Decl. ¶ 29 (Ex. 1006). An AC dimmer circuit may provide such a signal "other than a standard line voltage," which signal may be used to control one or parameters of light, such as its intensity or color. '399 Patent at Abstract (Ex. 1001); Tingler Decl. ¶ 29 (Ex. 1006). Figure 1 of the '399 patent shows examples of such signals, where signal 302 represents a standard AC line voltage and signals 307 and 309 represent dimmer output signals:



’399 Patent at Figure 1 (Ex. 1001); Tingler Decl. ¶ 29 (Ex. 1006). The dimmer circuit adjusts the amplitude (307) of signal 308 and the duty cycle (306) of signal 309. ’399 Patent, 2:17-29 (Ex. 1001); Tingler Decl. ¶ 29 (Ex. 1006).

The signals in Figure 1 cannot be directly applied to an LED light source. Thus, the ’399 patent discloses the use of a controller to receive an AC signal and provide power to an LED light source. ’399 Patent, 12:50-54, 14:6-9 (Ex. 1001); Tingler Decl. ¶ 30 (Ex. 1006). The controller includes a rectifier to convert an AC input to DC output, a low pass filter to filter out high frequencies such as noise on the input line, and a DC converter which converts a source of direct current from one voltage level to another and provides a stable DC voltage as a power supply for the LEDs. ’399 Patent, 12:61-13:8 (Ex. 1001); Tingler Decl. ¶ 30 (Ex. 1006). Additionally, the controller includes an adjustment circuit that conditions the signal output from the DC converter, providing a variable drive signal to the LEDs based on variations in the input AC signal from the dimmer circuit. ’399 Patent, 14:11-18 (Ex. 1001); Tingler Decl. ¶ 30 (Ex. 1006). This arrangement is shown in Figure 5:



’399 Patent, Figure 5 (Ex. 1001). The ’399 patent discloses pulse width modulation (PWM), among other power regulation techniques, for conditioning the signal. ’399 Patent, 10:43-50 (Ex. 1001).

C. Prosecution History

The ’399 patent claims priority to two provisional applications: No. 60/391,627, filed on June 36, 2002, and No. 60/379,079, filed on May 9 2002. The ’399 patent also claims priority (continuation in part) to U.S. Application No. 09/805,368, and U.S. Application No. 09/805,590, both filed on March 13, 2001. During the prosecution of the ’399 patent, original claims 1-2, and 33-34 were rejected as anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 5,430,356 to Ference et al.; claims 1-2, 9, 11-15, 19, 33-34, 39, 53, and 64 were rejected under 35 U.S.C. 102(e) as anticipated by U.S. Patent No. 6,495,964, to Muthu et al. PH 7/10/05 Office Action (Ex. 1002). After Patent Owner withdrew these claims and amended some of the others, the remaining claims were allowed. PH 11/18/05 Amendment (Ex. 1002); PH 2/6/06 Office Action (Ex. 1002). None of the prior art relied upon herein was of record during the prosecution of the ’399 Patent.

VI. OVERVIEW OF THE PRIMARY PRIOR ART REFERENCES

A. Summary of the Prior Art

As shown below, there is nothing new or non-obvious in the Patent Owner’s claims. The claimed methods and apparatus for controlling the power of an LED light installed in an AC power circuit was well known.

B. References Are Not Cumulative

Hochstein, Bogdan, and Faulk should not be considered cumulative because their focus and type of disclosure are different. Hochstein and Bogdan disclose the central concept behind the '399 patent – using a controller to control the power of a light source deployed in an AC power circuit – but are nevertheless different. In particular, Hochstein is directed to supplying regulated voltage DC electrical power to an LED array using a filter to ensure that interference does not feed back into the power lines and cause problems to other circuitry on the line. Bogdan discloses a dimmer circuit for controlling an electrical lighting device having an input AC waveform and an encoding circuit, and a decoder and controller for receiving the dimmer signal and powering the light source. Bogdan does not explicitly disclose powering an LED light source per se. Faulk is generally directed to a space-efficient AC power supply adapter that converts AC to DC power using a full wave diode bridge rectifier and an electromagnetic interference (EMI) filter. Like Bogdan, Faulk does not explicitly disclose powering an LED light source. Importantly, a most appropriate prior art reference may not be apparent until it is known if and how the Patent Owner intends to respond, whether the Patent Owner will seek to amend claims, and whether the Patent Owner will argue for independent patentability of dependent claims, and which ones.

C. Overview of Hochstein (Ex. 1003)

U.S. Patent No. 5,661,645 to Hochstein, entitled "Power Supply for Light Emitting Diode Array," filed on June 27, 1996, and issued on August 26, 1997, is a prior art reference to the '399 patent under 35 U.S.C. § 102(b). (The '399 patent's earliest claim of priority is a continuation-in-part claim to a pair of March 13, 2001, applications.) Hochstein was not cited during the prosecution of the ’399 patent. Like the ’399 patent, Hochstein discloses a circuit that supplies a regulated DC voltage to an LED array in an AC power system.

Hochstein “relates generally to an apparatus for generating power to a light emitting diode array and, in particular, to a power supply for operating light emitting diode array traffic signals.” Hochstein, 1:5-8 (Ex. 1003); Tingler Decl. ¶ 39 (Ex. 1006). Hochstein addresses the issue of retrofitting conventional traffic signals with LED lighting sources and improving the power factor (the ratio of real power to real power plus reactive power) of the LED loads. Hochstein, 1:62-2:42 (Ex. 1003).

More particularly, Hochstein discloses, “an apparatus for supplying regulated voltage [DC] electrical power to an LED array,” where the apparatus includes:

(1) “a rectifier having and an output, the rectifier being responsive to [AC] power at the input for generating rectified [DC] power at the output”;

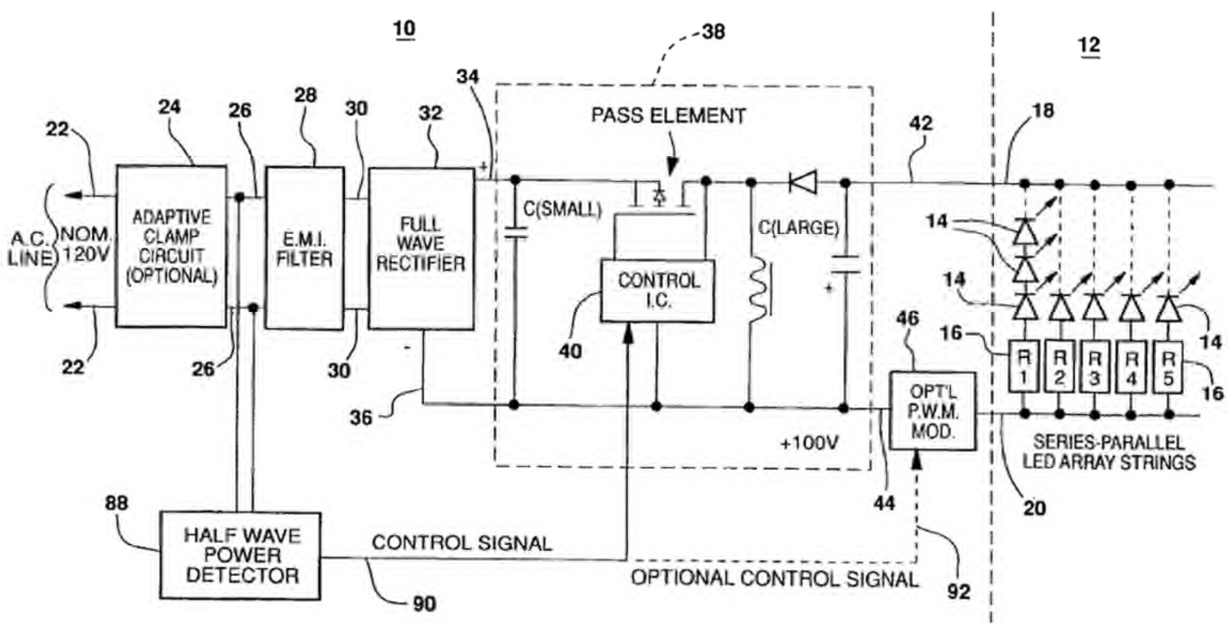
(2) “a power factor correction converter having an input connected to the rectifier output and an output, the power factor correction converter being responsive to the rectified [DC] power at the power factor correction converter input for generating regulated voltage”;

(3) “[DC] power at the power factor correction output”; and

(4) "an LED array having an input connected to the power factor correction converter output for receiving the [DC] power to illuminate the LED array." Hochstein at 3:18-31 (Ex. 1003); Tingler Decl. ¶ 39 (Ex. 1006). In addition, Hochstein discloses that, "the power factor correction converter can be a power factor correcting and voltage regulating buck/boost switchmode converter. Hochstein, 3:31-33 (Ex. 1003); Tingler Decl. ¶ 39 (Ex. 1006).

Hochstein's apparatus additionally employs an electromagnetic interference (E.M.I.) filter that "keeps conducted interference from feeding back into the power lines where it might cause problems to other circuitry on the line." Hochstein, 5:31-36 (Ex. 1003); Tingler Decl. ¶ 39 (Ex. 1006).

Hochstein's apparatus is shown in his Figure 5:



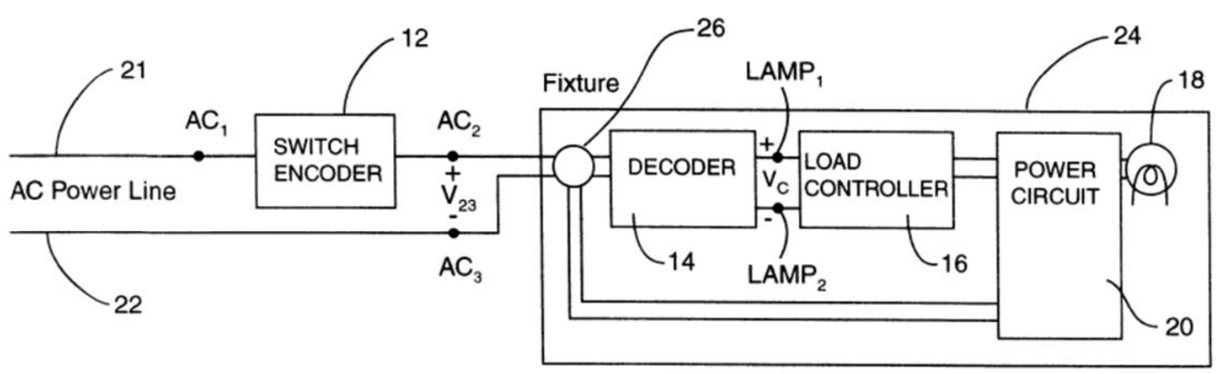
Hochstein, Figure 5 (Ex. 1003); Tingler Decl. ¶ 39 (Ex. 1006).

In reference to Figure 5, Hochstein further discloses that "[a] negative polarity output of the converter 38 is connected by a negative polarity converter output line 44 to the second input line 20 of the LED array 12 through an optional pulse width modulated (P.W.M.) modulator 46." Hochstein, 5:61-65 (Ex. 1003); Hochstein at 5:31-36 (Ex. 1003); Tingler Decl. ¶ 40 (Ex. 1006). The output voltage from the buck/boost switchmode converter may be fed through the PWM modulator. Hochstein, 5:66-6:1 (Ex. 1003); Tingler Decl. ¶ 40 (Ex. 1006). The switchmode power converter in Hochstein has an "inherent pulse modulating nature" that is used "to provide voltage regulation to the LED array." Hochstein, 6:17-30 (Ex. 1003); Tingler Decl. ¶ 40 (Ex. 1006).

D. Overview of Bogdan (Ex. 1004)

U.S. Patent No. 6,225,759 to Bogdan, entitled "Method and Apparatus for Controlling Lights," filed on March 11, 1999, and issued on May 1, 2001, is a prior art reference to the '399 patent under at least 35 U.S.C. § 102(e) or § 102(b). (The '399 patent's earliest claim of priority is a continuation-in-part claim to a pair of March 13, 2001, applications.) If Patent Owner's claim of priority is successful, then Bogdan is prior art under § 102(e), if not, Bogdan is prior art under § 102(b)). Bogdan was not cited during the prosecution of the '399 patent. Bogdan discloses dimmer and lighting control circuitry to solve similar problems for controlling gas discharge lamp ballasts as those addressed in the ’399 patent for controlling LED light sources.

Bogdan’s apparatus includes “a dimmer circuit for controlling an electrical lighting device having a load input” which further includes “a power input terminal” with “an input AC waveform” and “an encoding circuit . . . for selectively wave chopping the half cycles of said input AC waveform . . . .” Bogdan, 2:42-51 (Ex. 1004); Tingler Decl. ¶ 87 (Ex. 1006). “The transmitted AC power waveform is used to power the electrical lighting device by connection to a decoder. The decoder decodes the transmitted AC power waveform by generating a voltage pulse waveform having pulse widths corresponding to the duration of the zero crossing step delays . . . . A load controller receives the decoder output and appropriately controls the operation of the electrical lighting device.” Bogdan at Abstract (Ex. 1004); Tingler Decl. ¶ 87 (Ex. 1006). Bogdan’s solution is in Figure 1:



Bogdan, Figure 1(Ex. 1004); Tingler Decl. ¶ 87 (Ex. 1006).

Although Bogdan does not explicitly disclose an LED as the electrical lighting device, as discussed below, it would have been obvious to a person of ordinary skill in the art at the time of the ’399 invention to modify the apparatus of Bogdan, in view of Hochstein, to utilize LEDs as the lighting device.

E. Overview of Faulk (Ex. 1005)

U.S. Patent No. 5,818,705 to Faulk, entitled “ Portable Computer Having Built-In AC Adapter Incorporating A Space Efficient Electromagnetic Interference Filter,” filed on March 16, 1997, and issued on October 6, 1998, is a prior art reference to the ’399 patent under 35 U.S.C. § 102(b). (The ’399 patent’s earliest claim of priority is a continuation-in-part claim to a pair of March 13, 2001, applications.) Faulk was not cited during the prosecution of the ‘399 patent.

Faulk generally relates to a space-efficient AC power supply adapter for use in portable computers that converts from AC to DC power. Tingler Decl. ¶ 160 (Ex. 1006). Faulk discloses reducing the size of what was formerly an external adapter in order that it could be used within the main housing chassis of the computer. *See, e.g.,* Faulk at 3:48-53 (Ex. 1005); Tingler Decl. ¶ 161 (Ex. 1006). Faulk’s AC adapter converts “high voltage AC power provided from the AC main, for example, an electrical outlet, to low voltage DC power . . . .” Faulk at 2:55-57 (Ex. 1005); Tingler Decl. ¶ 160 (Ex. 1006). The power supply disclosed in Faulk utilizes a full wave diode bridge rectifier and a space efficient EMI filter. *See, e.g.,* Faulk at Abstract, Figure 5; 9:56-61 (Ex. 1005); Tingler Decl. ¶ 160 (Ex. 1006).

VII. SPECIFIC GROUNDS FOR PETITION

Pursuant to Rule 42.104(b)(4)-(5), the below section, and as confirmed in the Declaration of Robert Neal Tingler (Ex. 1006), demonstrate in detail how the prior art discloses each and every limitation of the claims of the '399 patent, and how those claims are rendered obvious by the prior art.

A. Ground 1: Claims 7, 8, 17, 28, and 34 are anticipated by Hochstein

1. Independent Claim 7

(a) *An illumination apparatus, comprising:*

Hochstein discloses an illumination apparatus. Hochstein discloses a "a regulated voltage, switchmode power supply 10…connected to LED array 12." Hochstein, 5:3-5 (Ex. 1003); Tingler Decl. ¶ 42 (Ex. 1006).

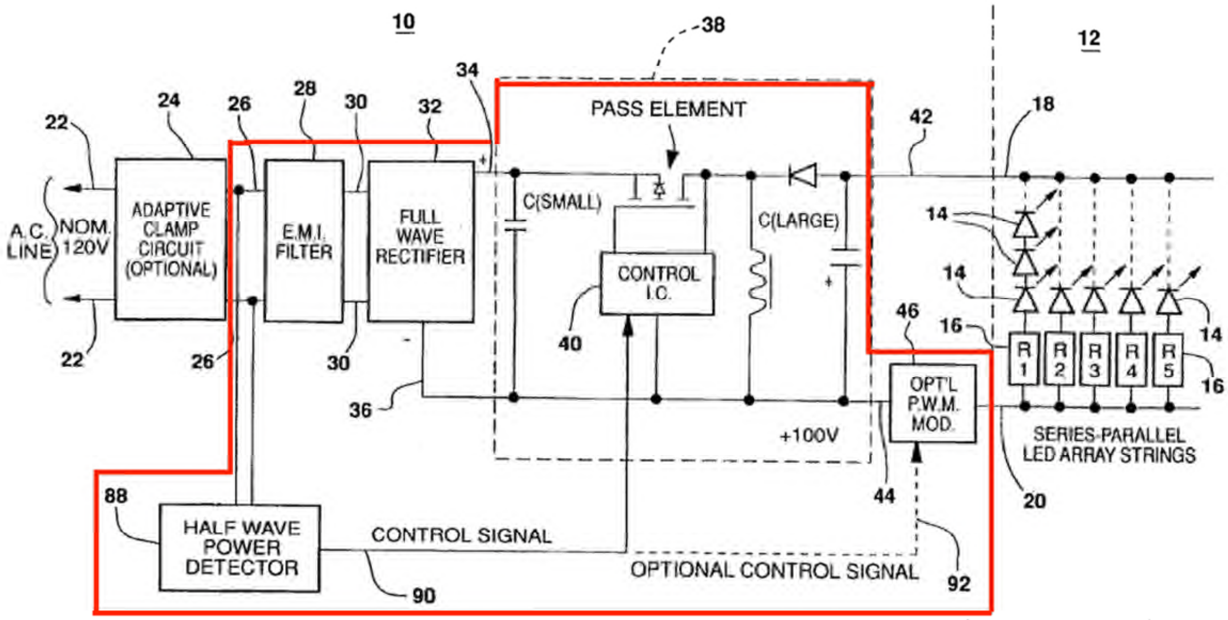
(b) *at least one LED*

Hochstein discloses at least one LED. As shown in Figure 5, Hochstein discloses series-parallel LED array strings. Hochstein, Figure 5 (Ex. 1003); Tingler Decl. ¶¶ 42, 43 (Ex. 1006).

(c) *at least one controller coupled to the at least one LED*

Hochstein discloses at least one controller coupled to the at least one LED. Indeed, Hochstein discloses a controller that contains each of the elements in the embodiment disclosed in the '399 patent specification. According to the '399 patent, the controller "is configured to receive an A.C. signal 500 via the connector 202 and provide operating power to the LED-based light source 104 [and] includes various components to ensure proper operation of the lighting unit for A.C. signals 500 that are provided by a dimmer circuit . . . . To this end, according to the embodiment of FIG. 3, the controller 204 includes a rectifier 404, a low pass (i.e., high frequency) filter 408 and a DC converter 402." '399 Patent, 12:51-63 (Ex. 1001); Tingler Decl. ¶ 44 (Ex. 1006). Additionally, "the controller 204A shown in FIG. 5 includes an additional adjustment circuit 208 that further conditions a signal output from the DC converter 402. The adjustment circuit 208 in turn provides a variable drive signal to the LED-based light source 104 . . . ." '399 Patent, 14:11-16 (Ex. 1001); Tingler Decl. ¶ 44 (Ex. 1006).

Hochstein discloses a controller (red box) connected to at least one LED 14:



Hochstein, Figure 5 (Ex. 1001); Tingler Decl. ¶ 45 (Ex. 1006). As is apparent, the controller of Hochstein contains each of the components that the controller disclosed in the '399 patent contains: a rectifier 32, a low pass (i.e., high frequency) filter 28 and a DC converter 38. Tingler Decl. ¶ 45 (Ex. 1006).

(d) ***and configured to receive a power-related signal from an alternating current (A.C.) power source that provides signals other than a standard A.C. line voltage,***

Hochstein discloses that the controller is configured to receive a power-related signal from an AC power source that provides signals other than a standard AC line voltage. Indeed, the power-related signals in Hochstein are the same types of power-related signals disclosed in the specification of the '399 patent. According to the '399 patent, the power-related signal that provides signals other than a standard AC line voltage may come from an AC dimmer circuit. '399 Patent, 3:20-

23, 3:25-26, 3:30-33 (Ex. 1001); Tingler Decl. ¶ 46 (Ex. 1006). The ’399 patent provides several examples of AC dimmer output signals, including an “increase or decrease [in] voltage amplitude” and “adjust[ing] the duty cycle of the A.C. dimmer output signal (e.g., by ‘chopping-out’ portions of A.C. voltage cycles).” ’399 Patent, 1:66-2:6 (Ex. 1001); Tingler Decl. ¶ 46 (Ex. 1006). The ’399 patent provides a specific example concerning the dimming of traffic lights, wherein an AC dimmer circuit in such a scenario “provides a duty cycle-controlled (i.e., angle modulated) A.C. signal 309 such as that shown in FIG. 1” which chops off portions of voltage cycles. ’399 Patent, 9:17-49 (Ex. 1001); Tingler Decl. ¶¶[46-47 (Ex. 1006).

Like the ’399 patent, Hochstein discusses as an example the dimming of traffic lights such that his controller is configured to receive such power-related signals:

> LED signals can be dimmed by reducing the average current through the LED array. A problem arises however because existing traffic signal controllers dim incandescent signals by providing half-wave rectified a.c. to the devices. Normally the traffic lamps are powered by switched a.c. line power which has, in virtually all cases, a sinusoidal wave form. Simply rectifying this power allows the traffic signal controller to reduce the average voltage and current to the load in a loss free manner. This technique has been in common use for many years and has become the “defacto” standard dimming technique.

Hochstein, 10: 39-49 (Ex 1003); Tingler Decl. ¶ 48 (Ex. 1006). As explained by Tingler, like the amplitude and angle modulated signals in the examples of the ’399 patent, the half-wave rectified signals, “have the effect of adjusting the average voltage applied to the light source(s), which in turn adjusts the intensity of light generated by the source(s).” ’399 Patent, 2:30-33 (Ex. 1001); Tingler Decl. ¶ 49 (Ex. 1006).

Thus, Hochstein addresses the same problem as the ’399 patent: replacing incandescent lamps that are dimmed, such as traffic signals, with LEDs. Hochstein, 10:51-61 (Ex. 1003); Tingler Decl. ¶ 50 (Ex. 1006). And, more importantly, Hochstein provides the same solution as the ’399 patent: providing a half wave detector circuit 88 that “can determine whether the traffic signal controller is sending a ‘dimming’ command.” Hochstein, 10:64-66; Figure 5 (Ex. 1003); Tingler Decl. ¶ 50 (Ex. 1006). Since Hochstein’s controller detects a half wave signal that is indicative of a “dimming command” it is “configured to receive a power-related signal from an alternating current (A.C.) power source that provides signals other than a standard A.C. line voltage.” Tingler Decl. ¶¶ 50-51 (Ex. 1006).

(e) ***the at least one controller further configured to provide power to the at least one LED based on the power-related signal;***

The controller of Hochstein is configured to provide power to the at least one LED based on the power-related signal. Upon detection of the half wave signal by half wave detector circuit 88, the controller "can be programmed or adjusted to reduce its output voltage to the LED array." Hochstein, 11:1-2; (Ex. 1003); Tingler Decl. ¶ 52 (Ex. 1006). Specifically, "by adjusting either the pulse width or the frequency (at constant pulse width) of the switchmode power supply, the output voltage (and/or current) can be reduced." Hochstein, 11:2-5; (Ex. 1003); Tingler Decl. ¶ 52 (Ex. 1006). The half wave detector can similarly be used "to change the average current through the LED array by reducing the effective pulse width of a pulse width modulation controller that drives the LEDs." Hochstein, 11:7-10; (Ex. 1003); Tingler Decl. ¶ 52 (Ex. 1006). "In either method, the average LED current and intensity are reduced in response to the detection of a half wave rectified input current." Hochstein, 11:10-12; (Ex. 1003); Tingler Decl. ¶ 52 (Ex. 1006). *See also* Hochstein, 11:23-37; (Ex. 1003); Tingler Decl. ¶¶ 53-54 (Ex. 1006).

(f) *wherein the A.C. power source is an A.C. dimmer circuit,*

Hochstein discloses that the A.C. power source is an A.C. dimmer circuit. Hochstein explains that, "a half wave power detector circuit 88 has inputs connected to the inputs of the full wave rectifier 32 at the clamp circuit output lines 26 to monitor the input a.c. power on the power input lines 22 to the power supply 10." Hochstein, 11:16-21 (Ex. 1003); Tingler Decl. ¶ 55 (Ex. 1006). As discussed above, the half wave power detector circuit detects a dimming signal. *See supra* section VII.A.1(d). And Hochstein's dimming signal—which is the source of power—is generated by an A.C. dimmer circuit: "Normally the traffic lamps are powered by switched a.c. line power which has, in virtually all cases, a sinusoidal wave form. Simply rectifying this power allows the traffic signal controller to reduce the average voltage and current to the load in a loss free manner. This technique has been in common use for many years and has become the 'defacto' standard dimming technique." Hochstein, 10:43-50 (Ex. 1003); Tingler Decl. ¶ 56 (Ex. 1006).

(g) ***wherein the A.C. dimmer circuit is controlled by a user interface to vary the power-related signal,***

Hochstein discloses that the A.C. dimmer circuit is controlled by a user interface to vary the power-related signal. Hochstein discloses a user interface in discussing the detection of the dimming signal: "the average LED current and intensity are reduced in response to the detection of a half wave rectified input current. In this way, the LED signal is 'transparent' to the user who may now utilize the LED device in the same manner as conventional incandescent signals." Hochstein, 11:10-15 (Ex. 1003); Tingler Decl. ¶ 57 (Ex. 1006). Further, Hochstein indicates that the dimming signal is sent in response to a "dimming command." Hochstein, 11:24-27 (Ex. 1003); Tingler Decl. ¶ 57 (Ex. 1006). (Ex. Finally, Hochstein provides at least one example of a situation where the user would desire to interface with the system and issue such a dimming command, namely, at night to reduce glare and power consumption. Hochstein, 11:24-27 (Ex. 1003); Tingler Decl. ¶ 57. Thus, Hochstein discloses an apparatus controlled by a user who has set a dimming command, in response to which a dimming signal is generated by the A.C. dimmer circuit. Tingler Decl. ¶ 57 (Ex. 1006).

(h) ***and wherein the at least one controller is configured to variably control at least one parameter of light generated by the at least one LED in response to operation of the user interface,***

Hochstein discloses that the controller is configured to variably control at least one parameter of light generated by the LED array in response to operation of the user interface. As discussed above, operation of the user interface generates the dimming signal. *See supra* section VII.A.1(g). Specifically, Hochstein discloses that the intensity of light output from the LED array is reduced in response to the dimming command: "the average LED current and intensity are reduced in response to the detection of a half wave rectified input current." Hochstein, 11:10-13; Tingler Decl. ¶ 59 (Ex. 1006). Hochstein explains this process as follows:

> The detector 88 generates a control signal on the line 90 in response to the detection of a half wave dimming signal on the a.c. power lines 22. The control signal is directed to the power supply regulator circuit 38, where it causes the output voltage of the switchmode power supply 10 to be reduced in response to the dimming command. For current regulated power supplies, the average output current to the LED arrays can be reduced to effect dimming. In cases where the LED array is

> powered by a pulse width modulator, such as the modulator 46, the connection of the line 90 to the control I.C. 40 is eliminated and the output of detector 88 is connected by a control signal line 92 to an input of the modulator 46 such that the average current delivered to the LED array may be reduced by decreasing the pulse width of the modulator.

Hochstein, 11:23-37 (Ex. 1003); Tingler Decl. ¶ 59 (Ex. 1006).

(i) ***wherein the operation of the user interface varies a duty cycle of the power-related signal,***

Hochstein discloses that the operation of the user interface varies a duty cycle of the power-related signal. The '399 patent explains that one way to "adjust the duty cycle of the A.C. dimmer output signal" is "by 'chopping-out' portions of A.C. voltage cycles." '399 Patent, 2:2-6 (Ex. 1001); Tingler Decl. ¶ 60 (Ex. 1006). The operation of the user interface of Hochstein, which generates a half wave dimming A.C. signal, likewise chops out portions of AC voltage cycles. Tingler ¶¶ 46-49, 60 (Ex. 1006). Half-wave rectified signals have a 50% duty cycle, as half of the waveform is chopped out. Tingler Decl. ¶ 60 (Ex. 1006).

(j) ***and wherein the at least one controller is configured to variably control the at least one parameter of the light based at least on the variable duty cycle of the power-related signal.***

Hochstein discloses the controller is configured to variably control at least one parameter of light based on this variable duty cycle. The power-related signal has a variable duty cycle, as its duty cycle is 50% when the dimming command is sent, and 100% when in full light mode. Tingler Decl. ¶ 61 (Ex. 1006). As discussed above (*see supra* Section VII.A.1(e)), Hochstein discloses that the intensity of light output from the LED array is reduced in response to the dimming command: "the average current through the LED signal 12 is decreased in response to the detection of a half wave dimming signal impressed on the power supply input lines 22. The detection of half wave power by the detector 88 causes the LED power supply 10 to either adjust the output pulse width at constant frequency or adjust the frequency at constant pulse width." Hochstein, 11:38-45 (Ex. 1003); Tingler Decl. ¶ 61 (Ex. 1006).

2. Dependent Claim 8

(a) ***The apparatus of claim 7, wherein the at least one parameter of the light that is variably controlled by the at least one controller in response to operation of the user interface includes at least one of an intensity of the light, a color of the light, a color temperature of the light, and a temporal characteristic of the light.***

As discussed above, Hochstein teaches the apparatus as claimed in claim 7. And as further discussed above, Hochstein teaches that the parameter of light that can be variably controlled is the intensity of the light. *See supra* Section VII.A.1(j). Hochstein discloses that the intensity of light output from the LED array is reduced in response to the dimming command: "the average LED current and intensity are reduced in response to the detection of a half wave rectified input current." Hochstein, 11:10-13 (Ex. 1003); Tingler Decl. ¶ 62 (Ex. 1006); *see also* Hochstein, 11:23-37 (Ex. 1003); Tingler Decl. ¶ 62 (Ex. 1006).

3. Independent Claim 17

Claim 17 is identical to claim 7, except that the last limitation of claim 7 (discussed in Section VII.A.1 above) is replaced with the following limitations. As discussed above, Hochstein teaches the apparatus as claimed in claim 7.

(a) ***wherein the at least one controller includes: an adjustment circuit to variably control the at least one parameter of light based on the varying power-related signal;***

Hochstein discloses that the controller includes an adjustment circuit to variably control the at least one parameter of light based on the varying power-related signal. The adjustment circuit in Hochstein's controller includes at least a pulse width modulator that variably controls the intensity of the light based on varying power-related dimming signal:

> The detector 88 generates a control signal on the line 90 in response to the detection of a half wave dimming signal on the a.c. power lines 22. . . . In cases where the LED array is powered by a pulse width

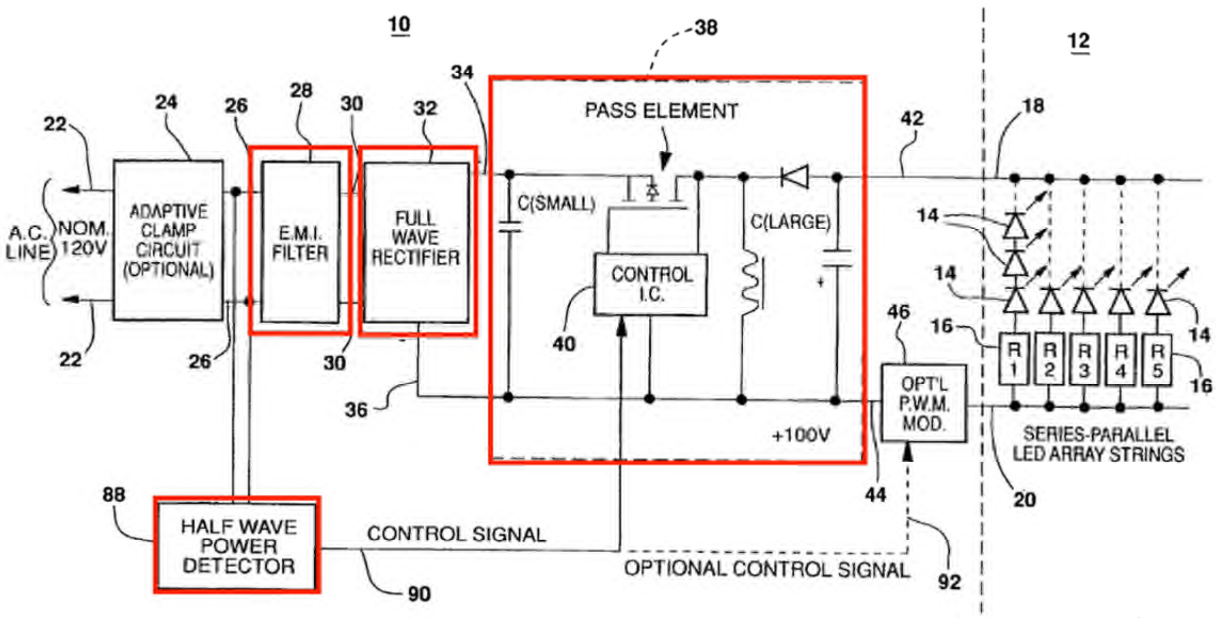
> modulator, such as the modulator 46, the connection of the line 90 to the control I.C. 40 is eliminated and the output of the detector 88 is connected by a control signal line 92 to an input of the modulator 46 such that the average current delivered to the LED array may be reduced by decreasing the pulse width of the modulator.

Hochstein, 11:23-36; Figure 5 (Ex. 1003); Tingler Decl. ¶ 64 (Ex. 1006); *see also* Hochstein, 11:7-12 ("[T]he half wave detector can be used to change the average current through the LED array by reducing the effective pulse width of a pulse width modulation controller that drives the LEDs [which causes] the average LED current and intensity [to be] reduced in response to the detection of a half wave rectified input current."); Tingler Decl. ¶ 65 (Ex. 1006).

The adjustment circuit of Hochstein additionally includes ballasting resistors 16, which are employed to limit the amount of current flowing through the LEDs. Tingler Decl. ¶ 64 (Ex. 1006).

(b) ***power circuitry to provide at least the power to the at least one LED based on the varying power-related signal.***

Hochstein discloses that the controller includes power circuitry to provide at least the power to the at least one LED based on the varying power-related signal. Indeed, Hochstein discloses the same kind of power circuitry disclosed in the specification of the '399 patent. The '399 patent states that the power circuitry 108 "is configured to derive power for the lighting unit based on an A.C. signal 500 (e.g., a line voltage, a signal provided by a dimmer circuit, etc.); and notes that FIG. 8, which includes a full wave rectifier and DC converter, "illustrates one exemplary circuit arrangement for the power circuitry 108. '399 patent, 18:44-52 (Ex. 1001); Tingler Decl. ¶ 66 (Ex. 1006). Like the power circuitry in Figure 8 of the '399 patent, Hochstein's power circuitry includes full wave rectifier 32 and buck/boost switchmode converter 38, which is a DC converter, and provides the power to one or more LEDs 14 in the LED array 12:



Hochstein, Figure 5; Abstract ("voltage regulating buck/boost switchmode converter (38) responsive to the rectified d.c. power for generating regulated voltage d.c. power to illuminate the LED array (12)") (Ex. 1003); Tingler Decl. ¶ 67 (Ex. 1006).

4. Dependent Claim 28

(a) ***The apparatus of claim 17, wherein the adjustment circuit includes drive circuitry including at least one***

voltage-to-current converter to provide at least one drive current to the at least one LED so as to control the at least one parameter of the generated light.

As discussed above, Hochstein teaches the apparatus as claimed in claim 17. Hochstein discloses that the adjustment circuit includes drive circuitry including at least one voltage-to-current converter to provide drive current to the LED array to control the intensity of the light. Indeed, Hochstein discloses drive circuitry including a voltage-to-current converter that is very similar to the disclosure in the specification of the ’399 patent. The ’399 patent states that, “the drive circuitry 109 is configured such that each differently colored light source is associated with a voltage to current converter that receives a voltage control signal (e.g., a digital PWM signal) from the processor 102 and provides a corresponding current to energize the light source.” ’399 patent, 22:58-63 (Ex. 1001); Tingler Decl. ¶ 68 (Ex. 1006). Figure 6 of the ’399 patent provides an example of a voltage-to-current converter “implemented by resistor R1 and transistor Q1 which provide a variable drive current to the LED-based light source 104 that tracks adjustments of the dimmer’s user interface.” ’399 patent, 14:29-33 (Ex. 1001); Tingler Decl. ¶ 68.

Hochstein’s adjustment circuit similarly uses a voltage control signal from the PWM circuit, which is converted to current by ballasting resistors 16. Hochstein, Figure 5 (Ex. 1003); Tingler Decl. ¶ 69 (Ex. 1006). Such ballasting resistors were well known to persons of ordinary skill in the art at the time of the invention to limit the amount of current flowing through the LEDs. Tingler Decl. ¶ 69 (Ex. 1006).Thus, these ballasting resistors provide a variable drive current to the LED array that tracks adjustments of the dimming signal. Tingler Decl. ¶ 69 (Ex. 1006).

5. Independent Claim 34

All of the limitations of claim 34 have already been addressed in the context of claim 17. The major difference between claims 17 and 34 is that Claim 17 is an apparatus claim whereas claim 34 is a method claim. As a result, WAC refers the Board to the discussion of claim 17 above and incorporates by reference that analysis here. The following discussion identifies for the Board the corresponding claim limitation in claim 17 for each limitation in claim 34 and the relevant citations to the Tingler declaration (Ex. 1006).

(a) ***An illumination method, comprising an act of:***

Hochstein discloses an illumination method. Hochstein discloses "a regulated voltage, switchmode power supply 10…connected to LED array 12." Hochstein, 5:3-5; Figure 5 (Ex. 1003); Tingler Decl. ¶ 70 (Ex. 1006).

(b) ***A) providing power to at least one LED based on a power-related signal from an alternating current (A.C.) power source that provides signals other than a standard A.C. line voltage,***

This limitation corresponds to limitations (d) and (e) of claim 17. *See supra* sections VII.A.1(d); VII.A.1(e); *see also* Tingler ¶¶ 71-79 (Ex. 1006).

(c) ***wherein the act A) includes an act of: providing power to the at least one LED based on a power-related signal from an alternating current (A.C.) dimmer circuit,***

This limitation corresponds to limitations (e) and (f) of claim 17. *See supra* sections VII.A.1(e); VII.A.1(f) *see also* Tingler ¶¶ 80-81 (Ex. 1006).

(d) ***wherein the A.C. dimmer circuit is controlled by a user interface to vary the power-related signal,***

This limitation corresponds to limitation (g) of claim 17. *See supra* section VII.A.1(g); *see also* Tingler Decl. ¶ 82 (Ex. 1006).

(e) ***and wherein the act A) includes an act of: C) variably controlling at least one parameter of light generated by the at least one LED in response to operation of the user interface,***

This limitation corresponds to limitation (h) of claim 17. *See supra* section VII.A.1(h); *see also* Tingler Decl. ¶ 83 (Ex. 1006).

(f) ***wherein the operation of the user interface varies a duty cycle of the power-related signal,***

This limitation corresponds to limitation (i) of claim 17. *See supra* sectionVII.A.1(i); *see also* Tingler Decl. ¶ 84 (Ex. 1006).

(g) ***and wherein the act C) includes an act of: D) variably controlling the at least one parameter of the light based at least on the variable duty cycle of the power-related signal.***

This limitation corresponds to limitation (j) of claim 17. *See supra* section VII.A.1(j); *see also* Tingler Decl. ¶ 85 (Ex. 1006).

B. Ground 2: Claims 7, 8, 17, 28, and 34 are obvious over Bogdan in view of Hochstein.

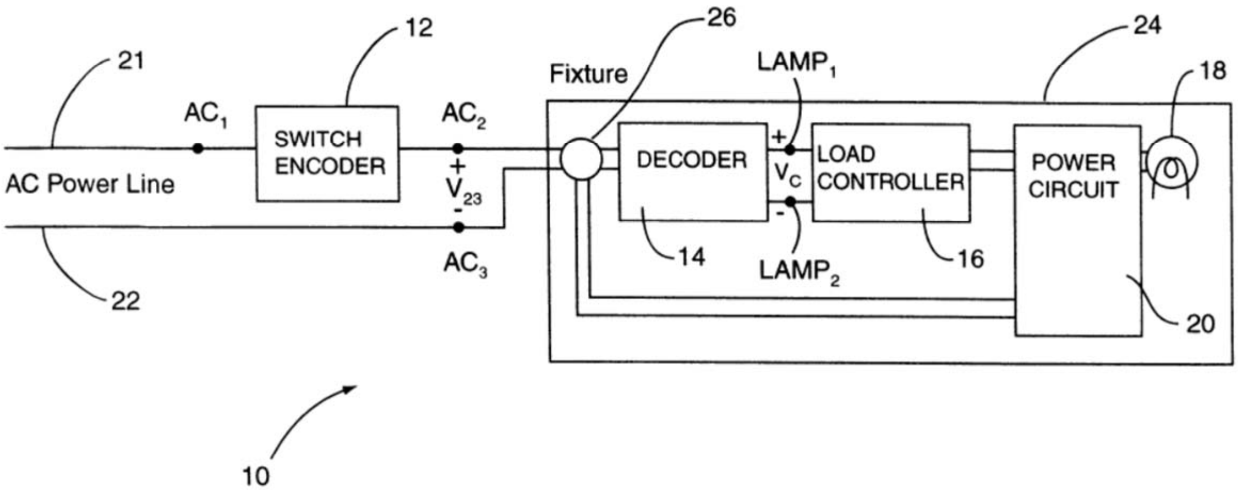
Bogdan discloses dimmer and lighting control circuitry to solve similar problems for controlling gas discharge lamp ballasts as those addressed in the '399 patent for controlling LED light sources. Bogdan at Abstract (Ex. 1004). Likewise, Hochstein discloses dimmer and lighting control circuitry to solve similar problems for controlling LED light sources as those addressed in the '399 patent. Hochstein, 1:5-8 (Ex. 1003). Both Bogdan and Hochstein disclose solutions for dimming light sources using pulse width modulation schemes in response to a dimming command from a dimmer. Bogdan, 2:41-43; 10:5-9; (Ex. 1004); Hochstein, 5:61-65; 6:17-30; 10:43-50 (Ex. 1003). Thus, Bogdan and Hochstein are references in the same technical field, attempting to solve similar problems and, as a result, a person of ordinary skill in the art would have been motivated to look to either Bogdan and/or Hochstein in order to solve problems related to dimming of non-traditional lighting sources. Tingler Decl. ¶ 88 (Ex. 1006).

1. Independent Claim 7

(a) *An illumination apparatus, comprising:*

Bogdan discloses an illumination apparatus. Bogdan discloses "a universal dimmer 10 according to a preferred embodiment of the invention. Dimmer 10 uses a switch encoder 12, a decoder 14 and a load controller 16 to dim a lamp 18 . . . by appropriately controlling the operation of a power circuit 20 associated with lamp

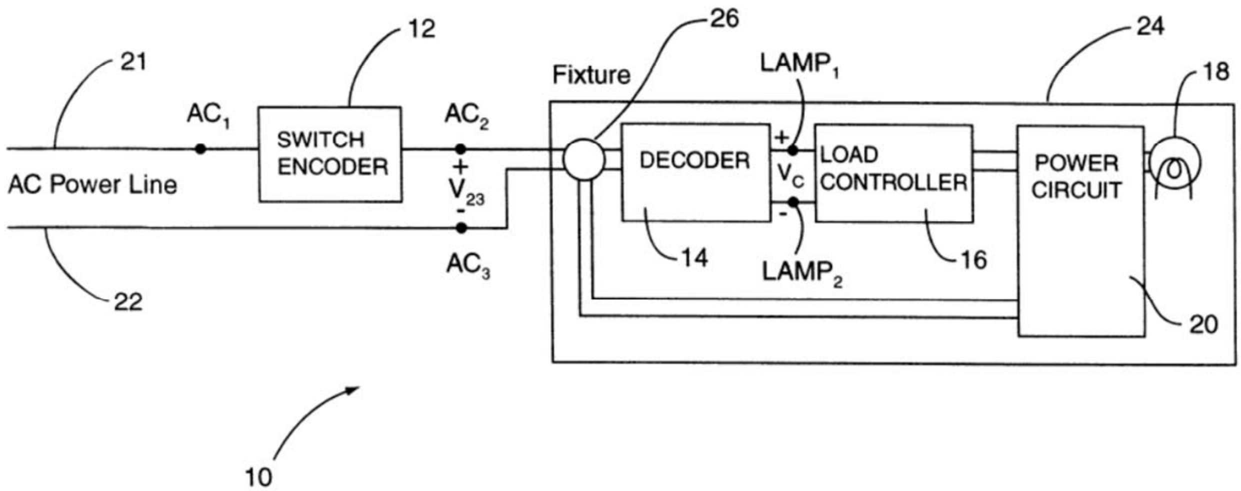
18," as shown in Figure 1 below. Bogdan, 4:29-34 (Ex. 1004); Tingler Decl. ¶ 90 (Ex. 1006).



(b) *at least one LED;*

Bogdan does not disclose an LED. However, Hochstein does disclose at least one LED. *See e.g.,* Hochstein, Figure 5 (Ex. 1003). As noted above, it would have been obvious for a person of ordinary skill in the art at the time of the '399 invention to combine Bogdan with Hochstein in order to modify Bogdan to use an LED instead of either an incandescent or gas discharge lamp. Bogdan and Hochstein are both directed to the same field of endeavor: an illumination apparatus responsive to dimming commands. Tingler Decl. ¶ 91 (Ex. 1006).

In reference to Figure 1, Bogdan's load controller 16 "is used to control the operation of a typical power circuit 20 for lamp 18, in accordance with voltage waveform V_{23} across terminals AC_2 and AC_3." Bogdan, 4:66-5:1 (Ex. 1004); Tingler Decl. ¶ 92 (Ex. 1006):



Bogdan further discloses that "[l]oad controller 16 can be used to adapt dimmer 10 for use with a gas discharge lamp, such as fluorescent, high intensity discharge and others associated with any type of power circuit 20 such as a conventional non-dimming ballast. Alternatively, load controller 16 can adapt dimmer 10 for use with a non-ballast lamp 18 such as an incandescent or halogen lamp which uses a power circuit 20 which would otherwise connect lamp 18 across hot and neutral wires 21 and 22 of the AC power lines." Bogdan, 5:1-10 (Ex. 1004); Tingler Decl. ¶ 92 (Ex. 1006).

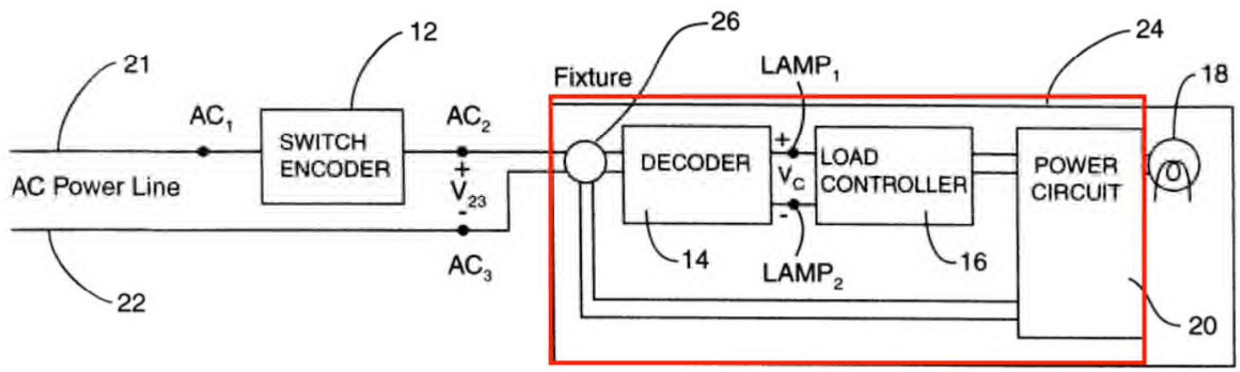
Hochstein discloses that LEDs were becoming more common in the industry: "[LED] arrays are becoming more common in many applications as they are used to replace less efficient incandescent lamps." Hochstein at 1:9-11 (Ex. 1003); Tingler Decl. ¶ 93 (Ex. 1006). *See also* Hochstein at 1:62-2:6 (Ex. 1003) ("LED traffic signals are being retrofitted in place of incandescent lamps primarily because of the energy savings common to LED signals . . . . The dramatic energy savings translate into greatly reduced operating cost, which is an important criterion, as electrical power is becoming more expensive. Also, in many parts of the country, electrical generating capacity is at its limits, and new capacity cannot be added because of environmental concerns."); Tingler Decl. ¶ 93 (Ex. 1006).

As a result of the disclosures in Bogdan and Hochstein, a person of ordinary skill in the art would have understood that the apparatus of Bogdan could be modified for use with any lighting device "associated with any type of power circuit," and would be motivated to make such a modification, replacing the load with LEDs, in view of the disclosure of Hochstein.

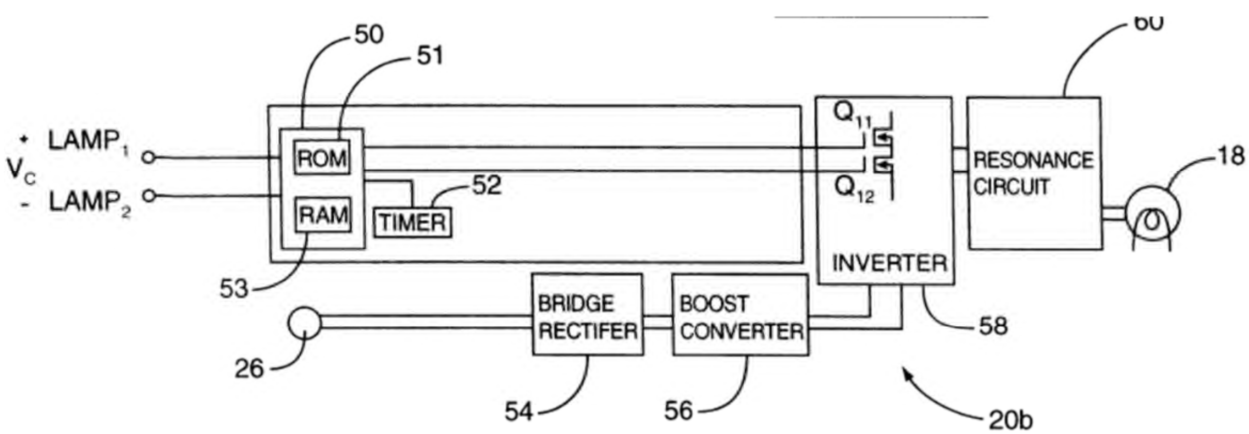
At least two such modifications are possible via simple modifications to load controller 16 in Bogdan. The first concerns a modification to the output of microcontroller 40 in Bogdan to generate an output pulse, whose pulse width varies based upon the value of control voltage V_c. Bogdan, Figure 6a (Ex. 1004). Such a pulse width modulated output could then be fed into the optional PWM modulator of Hochstein to drive LEDs. Tingler ¶¶ 95-98 (Ex. 1006). The second modification entails removal of the inverter and resonance circuit associated with gas discharge lamps and driving the LED array of Hochstein using the output of the boost converter in Figure 6b of Bogdan. Bogdan, Figure 6b (Ex. 1004); Tingler ¶¶ 99-100 (Ex. 1006). As explained by Tingler, either modification would have been obvious to a person of ordinary skill in the art in view of both Bogdan and Hochstein. Tingler ¶¶ 92-98 (Ex. 1006).

(c) ***at least one controller coupled to the at least one LED***

The combination of Bogdan and Hochstein disclose at least one controller coupled to the at least one LED. The controller of Bogdan includes the components shown in the boxed area in Figure 1 below, namely, the decoder, load controller and power circuit which, in the embodiment of Figure 6b, includes a rectifier and DC (boost) converter. Tingler Decl. ¶ 102 (Ex. 1006).



Bogdan, Figure 1 (Ex. 1004); Tingler Decl. ¶ 102 (Ex. 1006).



Bogdan, Figure 6b (Ex. 1004); Tingler Decl. ¶ 102 (Ex. 1006).

As discussed below, these components that form the controller receive a power-related signal from an AC power source, and provide power to the LED based on the power-related signal.

(d) ***and configured to receive a power-related signal from an alternating current (A.C.) power source that provides signals other than a standard A.C. line voltage,***

Bogdan discloses that the controller is configured to receive a power-related signal from an A.C. power source that provides signals other than a standard A.C. line voltage. Indeed, the power-related signals in Bogdan are the same types of power-related signals disclosed in the specification of the ’399 patent. *See* Tingler ¶¶ 103-104 (Ex. 1006). According to the ’399 patent, the power-related signal that provides signals other than a standard A.C. line voltage may come from an A.C. dimmer circuit. ’399 Patent, 3:20-23, 3:25-26, 3:30-33 (Ex. 1001); Tingler Decl. ¶ 103 (Ex. 1006). The ’399 patent provides several examples of an A.C. dimmer output signal, including an “increase or decrease [in] voltage amplitude” and “adjust[ing] the duty cycle of the A.C. dimmer output signal (e.g., by ‘chopping-out’ portions of A.C. voltage cycles).” ’399 Patent, 1:66-2:6 (Ex. 1001); Tingler Decl. ¶ 103-104 (Ex. 1006).

Bogdan discloses that its apparatus is configured to receive such power-related signals. In particular, Bogdan discloses that “[t]he voltage waveform V_{23}

produced by switch encoder 12 across terminals AC_2 and AC_3 is received by decoder 14 which in turn generates an appropriate control voltage V_c across terminals $LAMP_1$ and $LAMP_2$ for input into load controller 16." Bogdan, 4:61-65 (Ex. 1004); Tingler Decl. ¶ 105 (Ex. 1006). The power-related signal of Bogdan is voltage waveform V_{23} produced by switch encoder 12. Bogdan discloses the generation of power-related signal V_{23} in connection with its discussion of switch encoder 12, which is discussed in more detail with respect to A.C. dimmer circuits below.

Bogdan discloses four examples of power-related signals V_{23} generated by such a circuit under different operating conditions in Figures 3a-3d, shown below. Each of these waveforms exhibits a zero crossing step characteristic that results from waveform chopping, like the signals from dimmers disclosed in the '399 patent. Bogdan, 6:7-13, 6:63-67, 7:17-30, 7:51-60 (Ex. 1004); Tingler Decl. ¶ 106 (Ex. 1006).

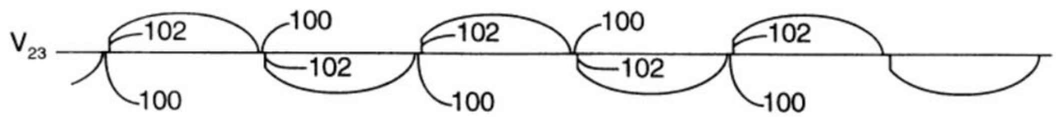


FIG. 3a

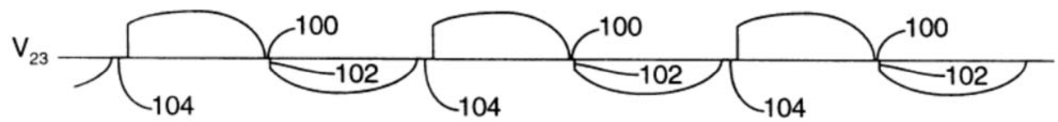


FIG. 3b

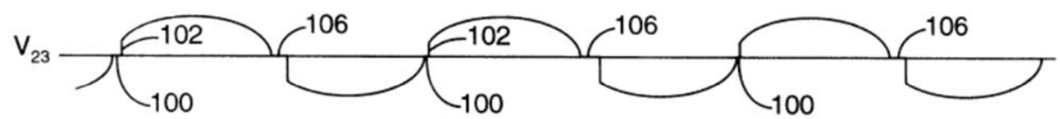


FIG. 3c

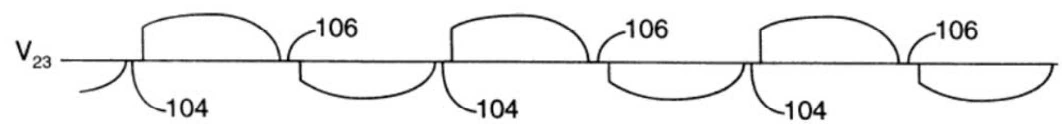


FIG. 3d

Thus, the controller of Bogdan is "configured to receive a power-related signal from an alternating current (A.C.) power source that provides signals other than a standard A.C. line voltage."

(e) ***the at least one controller further configured to provide power to the at least one LED based on the power-related signal;***

The combination of Bogdan and Hochstein discloses a controller that is configured to provide power to the at least one LED based on the power-related signal. As Bogdan explains, "[l]oad controller 16 is used to control the operation of a typical power circuit 20 for lamp 18, in accordance with [power-related signal] voltage waveform V_{23} across terminals AC_2 and AC_3." Bogdan, 4:66-5:1 (Ex.

1004); Tingler Decl. ¶ 108 (Ex. 1006). Further, "power circuit 20 is connected both to load controller 16 and to power terminal 26 (through one or two wires, depending on the type of lamp), to provide operational power and dimming functionality to lamp 18." Bogdan, 5:10-5:14 (Ex. 1004); Tingler Decl. ¶ 108 (Ex. 1006). In connection with Bogdan Figure 4, which shows Bogdan's decoder, Bogdan discloses that decoder 14 receives encoded voltage signal V_{23} across terminals AC_2 and AC_3 and outputs a proportional control voltage V_c at terminals $LAMP_1$ and $LAMP_2$ which depends on the pulse width of PWM voltage waveform V_{PWM}." Bogdan at 8:48-55, 11:50-53, Fig. 4 (Ex. 1004); Tingler Decl. ¶ 109 (Ex. 1006).

As discussed above, a person of ordinary skill in the art would have found it obvious to modify Bogdan according to the disclosure of Hochstein to add LEDs as the load on the output. First, with respect to the modification of the circuit of Figure 6a, power would be delivered to the LEDs via the PWM modulator circuit, where the average current output to the LED arrays is controlled by the power-related signal. Alternatively, with respect to the modification of the circuit of Figure 6b, the average current output would be controlled by the PWM modulator circuit and delivered by the DC boost converter. Tingler ¶¶ 111-12 (Ex. 1006).

(f) ***wherein the A.C. power source is an A.C. dimmer circuit,***

Bogdan discloses that the A.C. power source is an A.C. dimmer circuit. As discussed above, A.C. power-related signal V_{23} is generated by switch encoder 12.

This switch encoder is the A.C. dimmer circuit. *See supra* Section VII.B.1(d); Tingler ¶¶ 114-116 (Ex. 1006). As shown in Figure 1 of Bogdan, power-related signal V_{23} is the only input signal to the apparatus of Bogdan, thus it must be the A.C. power source. Tingler Decl. ¶ 114 (Ex. 1006). Further, Bogdan explains that "as long as the duration of the positive and negative going zero crossing step delays 104 and 106 [in waveform V_{23}] each have a phase angle of less than 9 degrees, the energy lost due to the step will not have any appreciable effect on the operation or light output of lamp 18." Bogdan, 8:10-15 (Ex. 1004); Tingler Decl. ¶ 114 (Ex. 1006). This means that power is delivered by waveform V_{23} to the lamp, and since V_{23} is generated by the A.C. dimmer circuit (switch encoder), the A.C. dimmer circuit is the A.C. power source. Tingler Decl. ¶ 114 (Ex. 1006).

(g) *wherein the A.C. dimmer circuit is controlled by a user interface to vary the power-related signal,*

Bogdan discloses that the A.C. dimmer circuit is controlled by a user interface to vary the power-related signal. Specifically, Bogdan discloses that the power-related signal is varied by the user interface switches: "Switch encoder 12 generates five different voltage waveforms across terminals AC_2 and AC_3. Specifically, switch SW_3 operates as an on/off switch…. The other four voltage waveforms correspond to the four possible configurations of switches SW_1 and SW_2 when switch SW_3 is "closed" (or depressed)." Bogdan, 5:20-27 (Ex. 1004); Tingler Decl. ¶ 117 (Ex. 1006). Bogdan explicitly discloses that the switches are controlled by a user, for example: "It should be noted that when a user depresses switch SW_1, switch encoder 12 will produce this encoded voltage waveform V_{23} within one full AC cycle…." Bogdan, 12:34-35 (Ex. 1004); Tingler Decl. ¶ 117 (Ex. 1006); *see also* Bogdan, 13:10-13 (Ex. 1004) ("As previously described, if the user continues to depress switch SW_2, dimmer 10 will increase the intensity of lamp 18 in gradual steps . . . ."); Tingler Decl. ¶ 117 (Ex. 1006).

(h) ***and wherein the at least one controller is configured to variably control at least one parameter of light generated by the at least one LED in response to operation of the user interface,***

The combination of Bogdan and Hochstein, discloses that the controller is configured to variably control at least one parameter of light generated by the LEDs in response to operation of the user interface. As discussed above, operation of the user interface generates encoded power-related signal V_{23}, which is input into decoder 14, which outputs a voltage control signal V_c in response. *See supra* Section VII.B.1(g); Tingler Decl. ¶ 118 (Ex. 1006). The apparatus of Bogdan is configured to variably control the intensity of light generated in response to operation of the user interface. Specifically, load controller 16 receives control signal V_c, which corresponds to various configurations of the user interface according to the position of dimmer switches SW_1 and SW_2, and on/off switch SW_3. Bogdan, 5:17-5:27 (Ex. 1004); Tingler ¶¶ 116, 118 (Ex. 1006). In the case of Bogdan Figure 6a, microcontroller 40 is programmed to "control[] the period of conduction of triac Q_{15}, [thus] the current through lamp 18 can be varied between the dim and full lamp current values." Bogdan, 14:4-6. (Ex. 1004); Tingler Decl. ¶ 119 (Ex. 1006). Likewise, in the case of Figure 6b, microcontroller 50 is programmed to "change the operating oscillation frequency or duty cycle of the inverter signal of a typical electronic ballast," and "[d]imming is typically achieved by varying the frequency of operation of inverter 58 by controlling the operation of transistors Q_{I1} and Q_{I2}." Bogdan at 14:52-54; 15:5-7 (Ex. 1004); Tingler Decl. ¶ 119 (Ex. 1006).

As discussed previously, Hochstein also discloses that its apparatus is configured to variably control the intensity of light generated by the LED array in response to operation of the user interface. Thus, a person of ordinary skill in the art at the time of the '399 invention would have been motivated to combine Bogdan with Hochstein to achieve the same goal with respect to LEDs.

(i) ***wherein the operation of the user interface varies a duty cycle of the power-related signal,***

Bogdan discloses that the operation of the user interface varies a duty cycle of the power-related signal. As discussed previously, operation of switches SW_1, SW_2, and SW_3 in the switch decoder vary a duty cycle of the power-related signal V_{23}. Bogdan, 5:17-5:27 (Ex. 1004); Tingler ¶¶ 116, 118, 121 (Ex. 1006).

The '399 patent explains that one way to "adjust the duty cycle of the A.C. dimmer output signal" is "by 'chopping-out' portions of A.C. voltage cycles." (Ex.

1001 at 2:2-6.) The operation of the user interface of Bogdan, which generates various waveforms according to the operation of the user interface switches, likewise chops out portions of A.C. voltage cycles via zero crossing step characteristics that result from waveform chopping, like the signals from dimmers disclosed in the '399 patent. Bogdan, 6:7-13, 6:63-67, 7:17-30, 7:51-60, Figs. 3a-3d (Ex. 1004); Tingler Decl. ¶ 122 (Ex. 1006).

(j) *and wherein the at least one controller is configured to variably control the at least one parameter of the light based at least on the variable duty cycle of the power-related signal*

Bogdan discloses that the controller is configured to variably control at least one parameter of light based on this variable duty cycle. As discussed above, both Bogdan alone, and Bogdan in combination with Hochstein, disclose that the intensity of light output is reduced in response to the dimming signal V_{23}. *See, e.g., supra* Section VII.B.1(h). Specifically, in relation to Bogdan Figures 5a-5c, shown below, Bogdan discusses how the variable control signal V_c is generated in response to the variable duty cycle of dimming signal V_{23}. Tingler Decl. ¶ 123 (Ex. 1006).

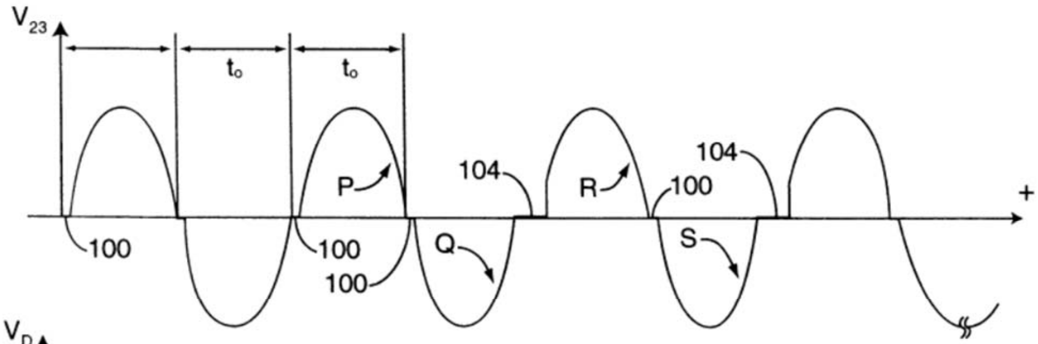


FIG. 5a

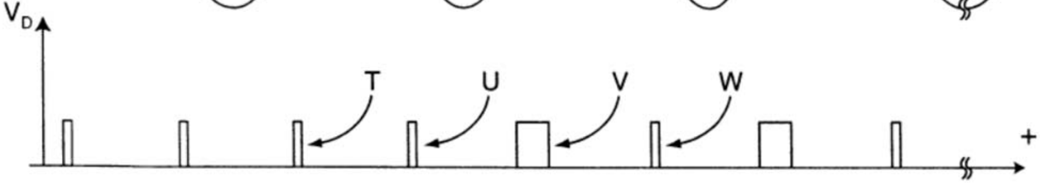


FIG. 5b

Bogdan shows a "sample encoded voltage waveform V_{23}" in Figure 5a and "the corresponding voltage pulse waveform V_D generated at node D of decoder 14" (shown in Figure 4) in Figure 5b. Bogdan,10:10-12 (Ex. 1004); Tingler Decl. ¶ 124 (Ex. 1006). "[V]oltage pulse waveform V_D is generated such that the duration of each zero crossing step delay 100 or 104 is represented by the pulse width of the corresponding pulses T, U, V, and W (FIG. 5b). Specifically, the longer duration of positive going zero crossing step delay 104 is reflected in the longer pulse width of the pulse V." Bogdan, 10:30-35 (Ex. 1004); Tingler Decl. ¶ 124 (Ex. 1006). The microcontroller generates output signal V_{PWM} based upon waveform V_D, which is in turn fed into optocoupler OC_1, which generates output control voltage V_C, which itself is fed into load controller 16. Bogdan, 9:63-10:9; 11:12-64 (Ex. 1004); Tingler ¶¶ 124-125 (Ex. 1006). Thus, Bogdan discloses that the controller is configured to variably control at least one parameter of light based on the variable duty cycle of V_{23}.

2. Dependent Claim 8

(a) ***The apparatus of claim 7, wherein the at least one parameter of the light that is variably controlled by the at least one controller in response to operation of the user interface includes at least one of an intensity of the light, a color of the light, a color temperature of the light, and a temporal characteristic of the light.***

As discussed above, the combination of Bogdan and Hochstein teaches the apparatus as claimed in claim 7. And as further discussed above, Bogdan and Hochstein teach that the parameter of light that can be variably controlled is the intensity of the light. *See, e.g., supra* Section VII.B.1(j). When Bogdan is combined with Hochstein, the PWM modulator from Hochstein will control the average current delivered to the LED array, by increasing or decreasing the pulse width of the modulator, thus controlling the intensity of the light. Hochstein, 11:23-37 (Ex. 1003); Tingler Decl. ¶ 127 (Ex. 1006).

3. Independent Claim 17

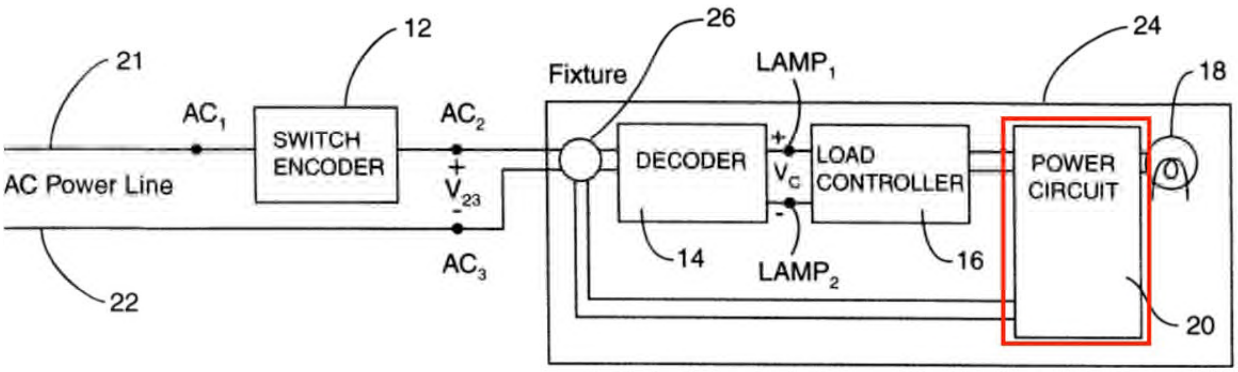
Claim 17 is identical to claim 7, except that the last limitation of claim 7 (discussed in Section VII.B.1above) is replaced with the following limitations. As discussed above, the combination of Bogdan and Hochstein teaches the apparatus as claimed in claim 7.

(a) ***wherein the at least one controller includes: an adjustment circuit to variably control the at least one parameter of light based on the varying power-related signal;***

Bogdan, in combination with Hochstein, discloses that the controller has an adjustment circuit to variably control the at least one parameter of light based on the varying power-related signal. The controller includes as the adjustment circuit at least a pulse width modulator that variably controls the intensity of the light based on the varying power-related dimming signal, as discussed above. *See e.g.,* Hochstein, 11:23-37 (Ex. 1003); Tingler Decl. ¶ 129 (Ex. 1006); *see also supra* Section VII.A.4. Additionally, the adjustment circuit includes ballasting resistors 16 disclosed in Hochstein, which were well known to persons of ordinary skill in the art at the time of the invention to limit the amount of current flowing through the LEDs. Tingler Decl. ¶ 129 (Ex. 1006).

(b) ***power circuitry to provide at least the power to the at least one LED based on the varying power-related signal.***

The combination of Bogdan and Hochstein discloses that the controller includes power circuitry to provide at least the power to the at least one LED based on the varying power-related signal. Bogdan includes power circuitry as shown below. Bogdan generally discloses power circuitry in Figure 1 as power circuit 20, which "is connected both to load controller 16 and to power terminal 26 (through one or two wires, depending on the type of lamp), to provide operational power and dimming functionality to lamp 18." Bogdan at 5:10-14 (Ex. 10004); Tingler Decl. ¶ 130 (Ex. 1006).



In particular, Bogdan discloses bridge rectifier 54 and boost converter 56, which is a DC converter that provides a regulated output. When used in combination with Hochstein, the output of the boost converter is controlled by the PWM modulator, which thereby controls the delivery of power from the boost converter to the LED array. Tingler Decl. ¶ 131 (Ex. 1006).

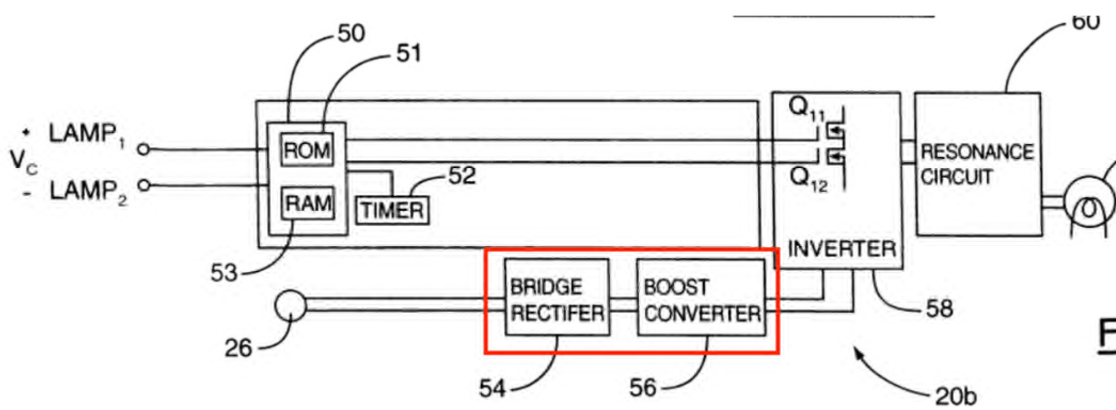


FIG. 6b

4. Dependent Claim 28

(a) ***The apparatus of claim 17, wherein the adjustment circuit includes drive circuitry including at least one voltage-to-current converter to provide at least one drive current to the at least one LED so as to control the at least one parameter of the generated light.***

As discussed above, the combination of Bogdan and Hochstein teaches the apparatus as claimed in claim 17. The combination and Bogdan and Hochstein further discloses that the adjustment circuit includes drive circuitry including at least one voltage-to-current converter to provide drive current to the LED array to control the intensity of the light. Indeed, Bogdan and Hochstein discloses drive circuitry including a voltage-to-current converter that is very similar to the disclosure in the specification of the ’399 patent. The ‘399 patent states that, “according to one embodiment, the drive circuitry 109 is configured such that each differently colored light source is associated with a voltage to current converter that receives a voltage control signal (e.g., a digital PWM signal) from the processor 102 and provides a corresponding current to energize the light source.” ’399 patent, 22:58-63 (Ex. 1001); Tingler Decl. ¶ 132 (Ex. 1006). The ’399 patent further provides an example of “a voltage-to-current converter implemented by resistor R1 and transistor Q1, which provide a variable drive current to the LED-based light source 104 that tracks adjustments of the dimmer’s user interface.” ’399 patent, 14:29-33 (Ex. 1001) Tingler Decl. ¶ 132 (Ex. 1006).

Like the '399 patent, Bogdan in combination with Hochstein, discloses an adjustment circuit, which has a voltage control signal from the PWM circuit, that is converted to current by ballasting resistors 16. Hochstein, Fig. 5 (Ex. 1003); Tingler Decl. ¶ 133 (Ex. 1006). Such ballasting resistors were well known to persons of ordinary skill in the art at the time of the invention to limit the amount of current flowing through the LEDs. Tingler Decl. ¶ 133 (Ex. 1006). These ballasting resistors provide a variable drive current to the LED array that tracks adjustments of the dimming signal. Tingler Decl. ¶ 133 (Ex. 1006).

5. Independent Claim 34

All of the limitations of claim 34 have already been addressed in the context of claim 17. The major difference between claims 17 and 34 is that Claim 17 is an apparatus claim whereas claim 34 is a method claim. As a result, WAC refers the Board to the discussion of claim 17 above and incorporates by reference that analysis here. The following discussion identifies for the Board the corresponding claim limitation in claim 17 for each limitation in claim 34 and the relevant citations to the Tingler declaration (Ex. 1006).

(a) *An illumination method, comprising an act of:*

Bogdan discloses an illumination method. Bogdan discloses "a universal dimmer 10 according to a preferred embodiment of the invention. Dimmer 10 uses a switch encoder 12, a decoder 14 and a load controller 16 to dim a lamp 18 . . .by appropriately controlling the operation of a power circuit 20 associated with lamp 18." Bogdan, 4:29-34 (Ex. 1004); Tingler Decl. ¶ 134 (Ex. 1006).

(b) ***A) providing power to at least one LED based on a power-related signal from an alternating current (A.C.) power source that provides signals other than a standard A.C. line voltage,***

This limitation corresponds to limitations (d) and (e) of claim 17. *See supra* sections VII.B.1(d); VII.B.1(e); *see also* Tingler ¶¶ 135-144 (Ex. 1006).

(c) ***wherein the act A) includes an act of: providing power to the at least one LED based on a power-related signal from an alternating current (A.C.) dimmer circuit,***

This limitation corresponds to limitations (e) and (f) of claim 17. *See supra* sections VII.B.1(e); VII.B.1(f); *see also* Tingler ¶¶[145-148 (Ex. 1006).

(d) ***wherein the A.C. dimmer circuit is controlled by a user interface to vary the power-related signal,***

This limitation corresponds to limitation (g) of claim 17. *See supra* sectionVII.B.1(g); *see also* Tingler Decl. ¶ [149] (Ex. 1006).

(e) ***and wherein the act A) includes an act of: C) variably controlling at least one parameter of light generated by the at least one LED in response to operation of the user interface,***

This limitation corresponds to limitation (h) of claim 17. *See supra* sectionVII.B.1(h); *see also* Tingler ¶¶ 150-152 (Ex. 1006).

(f) ***wherein the operation of the user interface varies a duty cycle of the power-related signal,***

This limitation corresponds to limitation (i) of claim 17. *See supra* sectionVII.B.1(i); *see also* Tingler ¶¶[153-154 (Ex. 1006).

(g) ***and wherein the act C) includes an act of: D) variably controlling the at least one parameter of the light based at least on the variable duty cycle of the power-related signal.***

This limitation corresponds to limitation (j) of claim 17. *See supra* sectionVII.B.1(j); *see also* Tingler ¶¶ [155-158] (Ex. 1006).

C. Ground 3: Claims 7, 8, 17, 18, 28, and 34 are obvious over Hochstein in view of Faulk.

Faulk generally discloses a space-efficient AC power supply adapter that converts AC to DC power. Tingler Decl. ¶ 160 (Ex. 1006). The function of such AC adapters "is to convert high voltage AC power provided from the AC main, for example, an electrical outlet, to low voltage DC power . . . ." Faulk, 2:55-57 (Ex. 1005); Tingler Decl. ¶ 160 (Ex. 1006). Likewise, Hochstein discloses a power supply that converts AC to DC power. Tingler Decl. ¶ 160 (Ex. 1006). The power supplies of both Faulk and Hochstein utilize a full wave diode bridge rectifier and an EMI filter. *See, e.g.,* Faulk at Fig. 5, 9:56-61 (Ex. 1005); Hochstein Fig. 5, 5:31-42 (Ex. 1003); Tingler Decl. ¶ 160 (Ex. 1006).

Faulk discloses such an adapter for use in portable computers, reducing the size of what was formerly an external adapter so that it could be used within the main housing chassis of the computer. Faulk, 3:48-53 (Ex. 1005); Tingler Decl. ¶ 161 (Ex. 1006). Specifically, the AC adapter of Faulk "incorporates a space efficient EMI filter." Faulk at Abstract (Ex. 1005); Tingler Decl. ¶ 161 (Ex. 1006). As Faulk explains, prior art EMI filter components, where the EMI filter was previously placed before the bridge rectifier (*see, e.g.,* Faulk, 3:19-22 (Ex. 1005)), required large, bulky, safety-rated X-type capacitors (*see, e.g.,* Faulk, 3:23-40; 7:54-63 (Ex. 1005)). Faulk seeks reduce the size of bulky components in power supplies, allowing the power supply to be space efficient and fit within a smaller area. Tingler Decl. ¶ 161 (Ex. 1006). Further, Faulk cautions against such bulky power supplies as they "typically include heat-producing components which require heat sinks to dissipate generated heat before the accumulated heat can damage nearby electronic devices." Faulk 2:13-18 (Ex. 1005); Tingler Decl. ¶ 161 (Ex. 1006). Because Faulk's AC adapter is size-efficient, it seeks to avoid the past methods of dealing with such heat dissipation, namely, "physically mounting thermally conductive structures having bulky and heavy fins or projections to the heat-producing components." Faulk, 2:18-20 (Ex. 1005); Tingler Decl. ¶ 161 (Ex. 1006).

Hochstein likewise seeks to avoid generating excess heat near the use of the LED array. Tingler Decl. ¶ 162 (Ex. 1006). For instance, Hochstein warns against the use of linear current regulators: "the use of a linear, dissipative (heat producing) regulator presents problems. LEDs are thermally sensitive devices that degrade quickly at elevated temperatures. Since most power supplies for LED signals are part of, or are attached to the LED array, heat rise from the linear regulator can be deleterious." Hochstein, 4:54-60 (Ex. 1003); Tingler Decl. ¶ 162 (Ex. 1006). Indeed, Hochstein specifically avoids the use of such regulators: "Instead of using dissipative (heat producing) linear regulators for either voltage or current (to accommodate line voltage variations), the power factor and distortion controlling switchmode power supply 10 is used as an efficient voltage regulator." Hochstein, 6:20-24 (Ex. 1003); Tingler Decl. ¶ 162 (Ex. 1006).

Thus, a person of ordinary skill in the art would be motivated by the disclosure of Hochstein to avoid, as much as possible, generating excess heat in proximity to the LEDs, given the thermally sensitive nature of LEDs and the fact that the power supply is part of, or attached to, the LED array, causing any heat rise from components in the power supply to be deleterious. Tingler Decl. ¶ 163 (Ex. 1006). A person of ordinary skill, using the apparatus of Hochstein, would face the very problem described in Faulk, where an EMI filter placed before a bridge rectifier would require large X-rated safety capacitors and therefore a bulky power supply that contains heat-producing components. Tingler Decl. ¶ 163 (Ex. 1006). Additionally, the size of the power supply would restrict the options on the location of its mounting, including its proximity to the LED array. Tingler Decl. ¶ 163 (Ex.

1006). Thus, a person of ordinary skill would be motivated to find a solution to such a problem. Tingler Decl. ¶ 163 (Ex. 1006).

A person of ordinary skill in the art would thus be motivated to look to Faulk's power supply in order to reduce the size of Hochstein's power supply in order to increase the options on the location of its mounting in order to move it as far from the LED array as possible. Tingler Decl. ¶ 164 (Ex. 1006). Like Hochstein, Faulk discloses a power supply converting AC to DC power, and like Hochstein, it utilizes a full wave bridge rectifier and an EMI filter. Tingler Decl. ¶ 164 (Ex. 1006). Also like Hochstein, Faulk's supply takes up the same physical space as important heat-sensitive components, and has the same concerns with reducing heat dissipation as much as possible. Tingler Decl. ¶ 164 (Ex. 1006).

The invalidating disclosure in Hochstein for claims 7, 8, 17, 28, and 34 of the '399 patent is discussed in Section VII.A (Ground 1). As a result, WAC refers the Board to the discussion of Ground 1 above and incorporates by reference that analysis here. The following discussion focuses on dependent claim 18, which was not addressed in Ground 1.

1. Dependent Claim 18

(a) ***The apparatus of claim 17, wherein the power circuitry includes: a rectifier to receive the power-related signal and provide a rectified power-related signal;***

As discussed above, Hochstein teaches the apparatus as claimed in claim 17. Hochstein further discloses power circuitry that includes a rectifier to receive the power-related signal and provide a rectified power-related signal, as shown in Figure 5. Hochstein, Fig. 5 (Ex. 1003); Tingler Decl. ¶ 166 (Ex. 1006). Specifically, Hochstein discloses "a rectifier having an input and an output, the rectifier being responsive to a.c. power at the input for generating rectified d.c. power at the output . . . ." Hochstein, 3:20-22 (Ex. 1003); Tingler Decl. ¶ 166 (Ex. 1006).

(b) ***a low pass filter to filter the rectified power-related signal; and***

Hochstein discloses a low pass filter, namely, E.M.I. filter 28, shown in Figure 5. Hochstein, Fig. 5 (Ex. 1003); Tingler Decl. ¶ 167 (Ex. 1006). "The E.M.I. filter 28 keeps conducted interference from feeding back into the power lines where it might cause problems to other circuitry on the line." Hochstein, 5:33-36 (Ex. 1003); Tingler Decl. ¶ 167 (Ex. 1006). A person of ordinary skill in the art at the time of the invention would understand the E.M.I. filter to be a low pass filter, as E.M.I. filters are designed to act as low-frequency pass devices for A.C. line frequencies and as high-frequency blocking devices. Faulk at 2:66-3:13 (Ex. 1005) ("all AC adapters are equipped with an electromagnetic interference (or "EMI") filter to remove high frequency noise . . . "); Tingler Decl. ¶ 167 (Ex. 1006).

It would have been obvious for a person of ordinary skill in the art, in view of Faulk, to swap the order of Hochstein's filter and rectifier such that the filter is placed on the output of the rectifier to filter the rectified power-related signal. Tingler Decl. ¶ 168 (Ex. 1006). Faulk discloses that the prior art, like Hochstein, placed the EMI filter before the bridge rectifier, as shown in Faulk Figure 1B. Faulk, 2:66-3:22, 7:21-22, 7:38-41, Fig. 1b (Ex. 1005); Tingler Decl. ¶ 169 (Ex. 1006). In such a configuration, the capacitors in the EMI filter are a type "X" capacitor, which are "relatively large and bulky." Faulk, 3:22-30; 7:54-63 (Ex. 1005); Tingler Decl. ¶ 169 (Ex. 1006). Additionally, bulky power supplies are "heat-producing" and "can damage nearby electronic devices." Faulk, 2:13-18 (Ex. 1005); Tingler Decl. ¶ 169 (Ex. 1006). Such devices include the LED arrays of Hochstein, and thus, a person of ordinary skill in the art would be motivated to avoid using such components. However, in the configuration of Hochstein, such X-rated capacitors would have to be used. Faulk therefore discloses a configuration whereby the EMI filter is placed after the bridge rectifier, as shown in Faulk Figure 5. Faulk, 9:28-44; Fig. 5 (Ex. 1005); Tingler Decl. ¶ 170 (Ex. 1006). Such a configuration allows for the use of smaller capacitors and therefore more space-efficient power supplies. Faulk, 10:4-31 (Ex. 1005); Tingler Decl. ¶ 170 (Ex. 1006). The options for mounting such power supplies in locations that would lessen the effects of the heat dissipation of the supply on the LED array would thereby be increased. Tingler Decl. ¶ 170 (Ex. 1006).

Moreover, a person of ordinary skill in the art, faced with a limited number of design choices in where to place the EMI filter in relation to the rectifier—namely, two—would be motivated to try both options in order to find the configuration that best comports with design requirements. Tingler Decl. ¶ 171 (Ex. 1006). Thus, a person of ordinary skill in the art would be motivated by the disclosures of Hochstein and Faulk, particularly where temperature sensitive LEDs are concerned, and would modify the apparatus of Hochstein according to the disclosure of Faulk, by moving Hochstein's EMI filter after its bridge rectifier, and would implement the EMI filter of Faulk. In doing so, the low pass (EMI) filter would filter the rectified power-related signal, as required. Tingler Decl. ¶ 172 (Ex. 1006).

(c) ***a DC converter to provide the power to at least the at least one LED based on the filtered rectified power-related signal.***

Hochstein discloses a DC converter to provide power to the LED array based on the filtered rectified power-related signal. Specifically, Hochstein discloses voltage regulating buck/boost switchmode converter 38, pictured in Figure 5, which is a DC converter. Hochstein, Fig. 5 (Ex. 1003); Tingler Decl. ¶ 173 (Ex. 1006). This DC converter provides power to the LED array based on filtered rectified power-related signal. Tingler Decl. ¶ 174 (Ex. 1006). " Upon detection of this half wave signal, the switchmode power supply can be programmed or adjusted to reduce its output voltage to the LED array. By adjusting either the pulse width or the frequency (at constant pulse width) of the switchmode power supply, the output voltage (and/or current) can be reduced in an efficient, nondissipative manner." Hochstein, 10:67-11:6 (Ex. 1003); Tingler Decl. ¶ 174 (Ex. 1006). Additionally, "the half wave detector can be used to change the average current through the LED array by reducing the effective pulse width of a pulse width modulation controller that drives the LEDs. In either method, the average LED current and intensity are reduced in response to the detection of a half wave rectified input current." Hochstein, 11:7-10 (Ex. 1003); Tingler Decl. ¶ 174 (Ex. 1006). *See also* Hochstein, 11:23-37 (Exh. 1003); Tingler Decl. ¶ 175 (Ex. 1006).

VIII. CONCLUSION

Based on the foregoing, Claims 7, 8, 17, 18, 28, and 34 of the '399 Patent recite subject matter that is unpatentable. The Petitioner requests institution of an *inter partes* review to cancel these claims.

RESPECTFULLY SUBMITTED,
RADULESCU LLP

Date: May 28, 2015

/s/ *David C. Radulescu*

David C. Radulescu Ph.D.
Attorney for Petitioner Wangs Alliance Corporation d/b/a WAC Lighting Co.
Registration No. 36,250

The Empire State Building
350 Fifth Avenue, Ste. 6910
New York, NY 10118
Phone: (646) 502-5950

Attachment A:

CERTIFICATE OF SERVICE ON PATENT OWNER UNDER 37 C.F.R. §§ 42.6(e) and 42.105

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105, the undersigned certifies that on May 28, 2015, a complete and entire copy of this Petition for *Inter Partes* Review of U.S. Patent No. 7,038,399 was served via EXPRESS MAIL®, postage prepaid, to the Patent Owner by serving the following parties:

Foley Hoag, LLP
Patent Group, World Trade Center West
155 Seaport Blvd.
Boston, MA 02110
Patent owner's correspondence address of record

Denise W. DeFranco
Finnegan, Henderson, Farabow, Garrett & Dunner, LLP
Two Seaport Lane
Boston, MA 02210-2001
Additional address known to Petitioner as likely to effect service

RADULESCU LLP

Date: May 28, 2015

/s/ *David C. Radulescu*
David C. Radulescu, Ph.D.
Attorney for Petitioner Wangs Alliance Corporation d/b/a WAC Lighting Co.
Registration No. 36,250

The Empire State Building
350 Fifth Avenue, Ste. 6910
New York, NY 10118
Phone: (646) 502-5950

Attachment B: Appendix of Exhibits

Exhibit	Description
Ex. 1001	U.S. Patent No. 7,038,399 to Lys
Ex. 1002	File History of U.S. Patent No. 7,038,399 to Lys
Ex. 1003	U.S. Patent No. 5,661,645 to Hochstein
Ex. 1004	U.S. Patent No. 6,225,759 to Bogdan
Ex. 1005	U.S. Patent No. 5,818,705 to Faulk
Ex. 1006	Declaration of Robert Neal Tingler
Ex. 1007	Curriculum Vitae of Robert Neal Tingler
Ex. 1008	*Wiley Electrical and Electronics Engineering Dictionary* (Steven M. Kaplan, 2004) (definition of "duty cycle")
Ex. 1009	*McGraw-Hill Dictionary of Scientific and Technical Terms* (4th Ed.) (1989) (definition of "duty cycle").
Ex. 1010	Robert W. Erickson, *Fundamentals of Power Electronics* (2nd ed. 2001) ("Erickson")
Ex. 1011	Adel S. Sedra, *Microelectronic Circuits* (4th ed. 1998) ("Sedra")
Ex. 1012	U.S. Patent No. 5,327,123 to Heimann
Ex. 1013	Application Note 84, Linear Technology Magazine Circuit Collection, Volume IV (April 2000) ("AN84")