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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MAXLITE, INC.
Petitioner

v.

JIAXING SUPER LIGHTING ELECTRIC APPLIANCE CO., LTD.
Patent Owner

Inter Partes Review Case No. Unassigned
Patent No. 9,723,662

**PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,723,662
UNDER 35 U.S.C. §§ 311-319 AND
37 C.F.R. §§ 42.1-.80, 42.100-.123**

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I. INTRODUCTION

Petitioner MaxLite, Inc. (“MaxLite”) petitions for *inter partes* review (“IPR”) of claims 1, 2, 5-7, 9-10, 15-18, 21, 23-24, 29-32, 34-39, and 41-42 of U.S. Patent No. 9,723,662 (“the ‘662 patent”).

The ‘662 patent is directed to certain known aspects of an LED lamp retrofit replacement for fluorescent lamps. That is, the ‘662 patent technology is useful for LED lights in the same tube form factor as prior-art fluorescent tube bulbs that can be installed as a “retrofit” into existing fluorescent fixtures (such as those found in the ceilings of many commercial spaces). Specifically, the ‘662 patent claims require a “filament-simulating circuit” in order to mimic the characteristics of the filaments in fluorescent lamps so that the LED replacement can work properly without removing a ballast and associated starter that ignite and power traditional fluorescent lamps. Certain claims of ‘662 patent require additional elements, including a circuit to limit the current delivered to the LEDs, a rectifier to convert the AC signal from the ballast to a DC signal that will work with the LEDs, and a filter to smooth the current from the rectifier to the LEDs.

The problem, the solution, and the *specific* claimed components and their arrangements, were previously known in the art. One prior art reference cited in this Petition (“Zhang”), assigned to Cree, Inc., discloses each and every element of the majority of the claims of the ‘662 patent. Indeed, Zhang discloses a practically

identical circuit to the embodiments of the ‘662 patent. The other prior art reference (“OSRAM”), originally assigned to OSRAM GmbH, discloses each and every element of many claims of the ‘662 patent, and likewise discloses a practically *identical* circuit to the embodiments of the ‘662 patent.

Accordingly, for the reasons discussed in the grounds presented below, Petitioner requests that the Board institute *inter partes* review and cancel each of the challenged claims.

II. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Pursuant to Rules 42.22(a)(1) and 42.104(b)(1)-(2), the Petitioner challenges claims 1, 2, 5-7, 9-10, 15-18, 21, 23-24, 29-32, 34-39, and 41-42 of U.S. Patent No. 9,723,662 (the “‘662 patent”) (Ex. 1001).

A. Prior Art

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

1. U.S. Patent No. 10,045,406, (“Zhang” (Ex. 1005)), which is prior art under at least § 102(a)(2).
2. German Patent No. DE 20 2013 000 880 (“OSRAM” (Ex. 1014)), which is prior art under at least § 102(a)(1).

B. Grounds for Challenge

The Petitioner requests cancellation of claims 1, 2, 5-7, 9-10, 15-18, 21, 23-24, 29-32, 34-39, and 41-42 of the '662 patent ("challenged claims") as unpatentable under 35 U.S.C. § 102. This Petition, supported by the declaration of Regan Zane, Ph.D. ("Zane Decl." (Ex. 1003)), filed herewith, demonstrates that there is a reasonable likelihood that the Petitioners 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 1, 2, 5-7, 9-10, 15-18, 21, 23-24, 29, 31-32, 34-39, and 41-42 are anticipated by Zhang.

Ground 2: Claims 21, 23-24, 30, 36-37, 39, and 41-42 are anticipated by OSRAM.

III. 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.

IV. OVERVIEW OF THE '662 PATENT

A. Background

The '662 patent issued on August 1, 2017, is a continuation of an earlier patent application filed on April 29, 2015, which claims priority to a single Chinese patent application filed on October 17, 2014. Zhang was filed on April 18, 2014 and is therefore prior art under 35 U.S.C. § 102(a)(2). The '662 patent is directed to “a power source module for an LED lamp for use in a fluorescent lamp base including a ballast.” Ex. 1001, 2:12-14. That is, the '662 patent is directed to certain aspects of an LED lamp retrofit replacement for fluorescent lamps.

1. Fluorescent Lamps

As the '662 patent notes, “[f]luorescent lamps have been widely used in the world for illumination.” *Id.*, 1:25-26. These lamps are “detachably installed on a fluorescent lamp base,” *id.*, 1:26-27, typically with a bi-pin connection on each end (*see* Fig. 1 below).

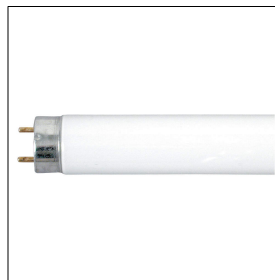


Fig. 1 Fluorescent lamp with bi-pin connection

Usually, “a starter and a ballast to drive the traditional fluorescent lamp” are required. *Id.*, 1:30-31. “The starter is used for heating filaments in the fluorescent

lamp and raising a voltage between the two terminals of the fluorescent lamp, so as to ignite the fluorescent lamp to light.” *Id.*, 1:31-34. The ballast controls how much current is delivered to the lamp, and the starting and operating conditions of the lamp. Ex. 1003 ¶ 17. The filaments (electrodes) are coupled to the power connectors, and when heated, electrons from the filaments collide with mercury vapor atoms, which themselves release photons resulting in light, as explained further below. Ex. 1003 ¶ 20.

Figure 7.27 | Fluorescent Lamp Operation

Schematic illustration of the process of creating optical radiation with a fluorescent lamp.

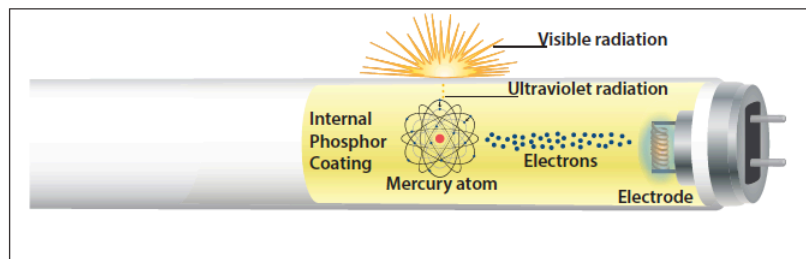


Fig. 2 Ex. 1007 at 7.26

2. Pre-Heat Process

In certain applications, when a ballast is used with a typical prior-art fluorescent lamp as intended, a pre-heat process helps the lamp light up by heating the electrodes [filaments] prior to initiating discharge. Ex. 1003 ¶ 17; *see also* Ex. 1006, 7:22-50. A timed switch called a “starter” allows current to flow through filaments at each end of the tube. Ex. 1003 ¶¶ 18-23. There are two types of ballasts, magnetic and electronic—for purposes of this Petition, the difference between them is that magnetic ballasts employ an external (discrete) starter that

utilizes a bimetallic or electronic switch, but electronic ballasts incorporate the starter into the ballast housing (i.e., self-contained). Ex. 1003 ¶¶ 19-20, 23.

While the pre-heat mechanism differs for the two types, they share the same general process. When the lamp is initially switched on, the pre-heat mode forces current to flow through the filaments, which heats the filaments, thereby creating a cloud of electrons in the tube. After a second or two, the flow of current through the filaments stops and there is a voltage applied across the tube, which causes the cloud of electrons to flow (arc) across the tube and ionize the mercury vapor in the tube. Ex. 1003 ¶¶ 15-17, 20, 32; Ex. 1006, 7:22-50. This ionization initiates the ignition of the lamp. Ex. 1003 ¶ 17. Without the starter, there can be no substantial stream of electrons to ionize the gas in the tube, and the lamp flickers. Ex. 1003 ¶ 22. Without the ballast, the arc creates a short circuit between the filaments, which can either vaporize the filaments or causes the bulb to explode. *Id.*

3. Purported Problems with Replacing Fluorescent Lamps with LED Lamps

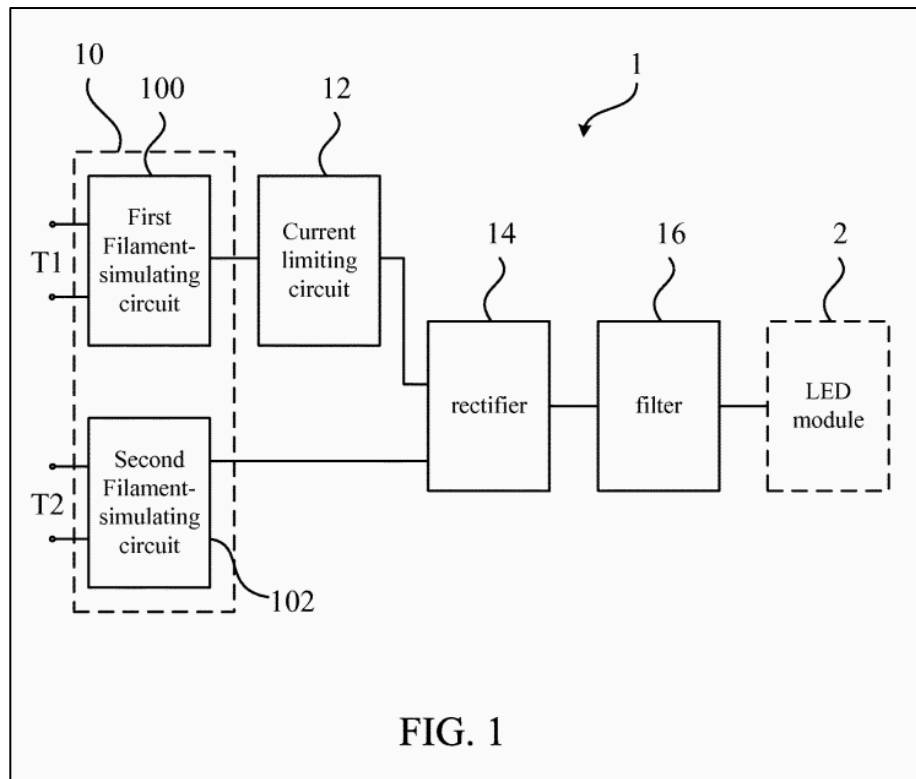
According to the '662 patent, in order to install a LED retrofit lamp into an existing fluorescent tube fixture using a ballast and associated starter, as discussed above, “the electrical ballast needs to be removed away by the user, and further the circuit in the fluorescent lamp base must be modified correspondingly for the LED lamp.” Ex. 1001, 1:64-67. This modification is “complicated to the user, even to

the professional” and is “inconvenient,” which “keeps the users from replacing the traditional fluorescent lamp with the LED lamp.” *Id.*, 2:1-6.

Specifically, “[t]he starter and the electrical ballast generate a gaseous electric discharge in the fluorescent lamp by raising the voltage, and so it would cause the LED lamp to burn away.” *Id.*, 1:56-59. This voltage “would cause the LED lamp to burn away” because the LED lamp does not contain appropriate filaments, and in the absence of such filaments, the ballast may “erroneously judg[e] that the filaments are open-circuited or short-circuited during the pre-heating process of the ballast.” *Id.*, 3:55-61. Although the ‘662 patent does not explicitly describe the alleged problem with this erroneous judgment by this type of ballast, the problem appears to be that the erroneous judgment could cause such ballasts to increase the voltage to levels dangerous to relatively low-voltage LEDs. Ex. 1003 ¶ 34. As the prior art reference Zhang describes, “some fluorescent lighting ballasts may be configured to detect the state of an attached lamp by monitoring the AC and/or DC impedance between terminals of pins connected to the ends of the filament, and may shut down the ballast if the impedance indicated a failed/failing lamp.” Ex. 1005, 5:27-32. That is, in the absence of a filament in the circuit, this type of ballast may simply shut down. Ex. 1003 ¶ 34.

B. Summary of Alleged Invention of the '662 Patent

The '662 patent purports to solve the problems described above by including “filament-simulating circuits” in the power source module of the LED lamp. The '662 patent describes its filament-simulating circuit solution in reference to the block diagram of Figure 1 as follows:



During a pre-heat process executed by the ballast of the fluorescent lamp base, a current flows from one pin to the other pin of the first bi-pin terminal T1 via the first filament-simulating circuit 100, and similarly a current from one pin to the other pin of the second bi-pin terminal T2 via the second filament-simulating circuit 102 respectively.

...

The ballast may execute a pre-heat process to the filaments of the traditional fluorescent lamp for pre-heating the filaments. The

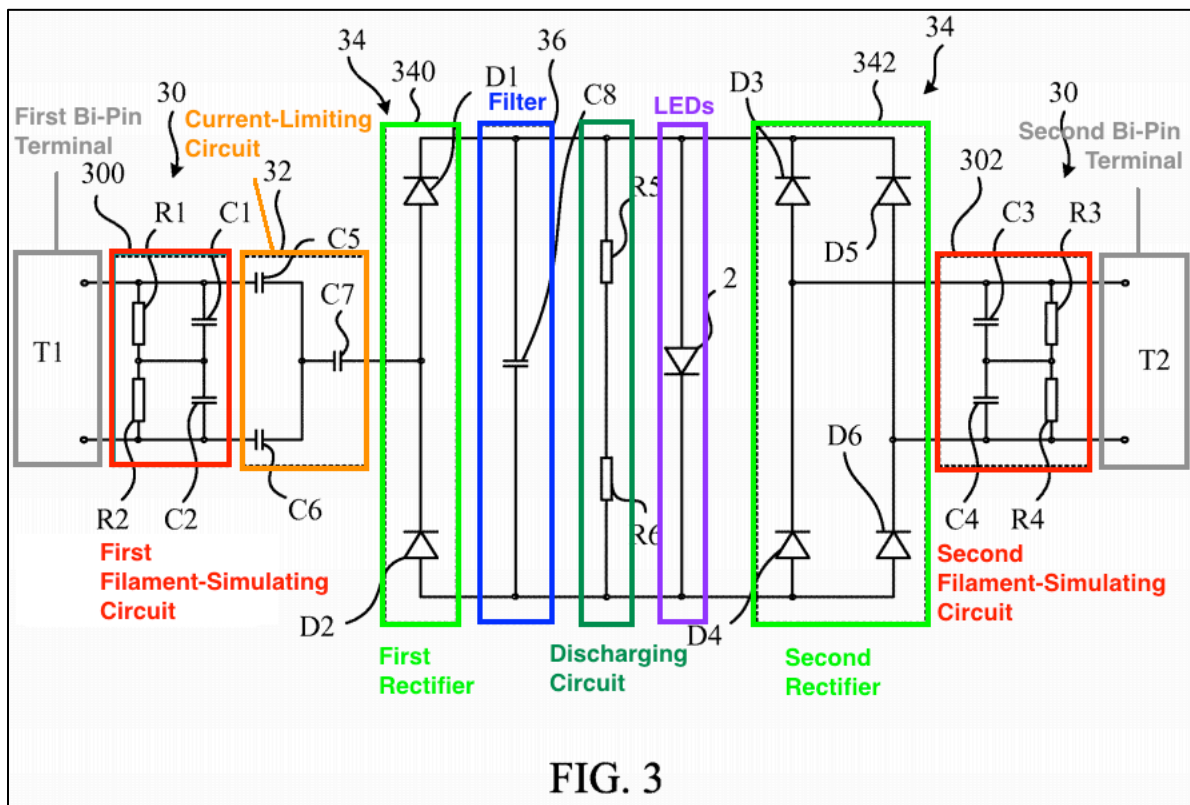
filament-simulating unit 10 can simulate a filament of the traditional fluorescent lamp, so as to prevent the ballast from erroneously judging that the filaments are open-circuited or short-circuited during the pre-heating process of the ballast.

Ex. 1001, 3:32-61.

In addition to the filament-simulating circuits, the purported solution also includes “a rectifier, a filter, and a discharge circuit. The rectifier [is] electrically connected to the terminals of the LED lamp for receiving a current, the filter is electrically connected between the rectifier and at least one LED of the LED lamp to stor[e] energy for smoothing the current, and the discharging circuit is electrically connected to the filter in parallel for discharging the energy in the filter.” *Id.*, 2:48-55. The “rectifier” may include two rectifiers, a “first rectifier” and a “second rectifier.” *Id.*, 5:16-20. The rectifier “rectifies the alternating current to be a direct current.” *Id.*, 3:49-51. The “filter” is used to smooth the current from the “first rectifier.” *Id.*, 2:24-28. The ‘662 patent further discloses “a current limiting circuit” which “is electrically connected to a first terminal of the LED lamp for limiting a [current] from the terminal.” *Id.*, 2:38-40. Specifically, the “current limiting circuit” “protect[s] the LED lamp” by “limiting the current from the first bi-pin terminal T1 to be in a suitable range for driving the LED module 2” during normal operation—i.e., after the pre-heat process is completed. *Id.*, 2:33-35, 3:41-45; Ex. 1003 ¶ 38.

The '662 patent discloses two additional embodiments in Figures 2 and 3. Each of these embodiments include each of the elements described above, and the only difference between these two embodiments is the inclusion of a third capacitor (C7) in the current-limiting circuit of Figure 3.

Each of these elements are shown in annotated Figure 3 below. Ex. 1003 ¶ 39.



C. Claims

The '662 patent has six independent claims: 1, 17, 21, 23, 41, and 42. Each of the independent claims recites a “power source module” and/or “LED lamp” including a filament-simulating circuit, a rectifier, and a filter. Each independent

claim except claim 17 requires a current limiting circuit. Claims 17 includes a discharging circuit. Dependent claims 2, 5-7, 9-10, 15, 16, 18, 24, 29-32, and 34-39 recite further limitations involving the filament-simulating circuit, rectifier, filter, and discharging circuit.

The claimed elements are indicated by color in representative claims 1 and 17 corresponding with annotated Figure 3 above.

1. A power source module for an LED lamp, comprising:

a **filament-simulating circuit** electrically connected to a **first bi-pin terminal** and a **second bi-pin terminal** of the LED lamp, each of the first bi-pin terminal and the second bi-pin terminal configured to allow a current to flow from one pin to the other pin via the filament-simulating circuit during a pre-heat process executed by a ballast;

a **current limiting circuit** electrically connected to the filament-simulating circuit and configured to limit a current from the filament-simulating circuit;

a **first rectifier** electrically connected to the current limiting circuit and configured to rectify the current from the current limiting circuit; and

a **filter** electrically connected between the first rectifier and **at least one LED** of the LED lamp and configured to smooth the current from the first rectifier.

17. A power source module for an LED lamp, comprising:

a **rectifier** electrically connected to terminals of the LED lamp and configured to receive a current;

a **filter** electrically connected between the rectifier and **at least one LED** of the LED lamp and configured to store energy from the rectifier and to smooth the current from the rectifier;

a **discharging circuit** electrically connected to the filter in parallel and configured to discharge the energy stored in the filter; and

a **filament-simulating circuit** electrically connected to a first bi-pin terminal and a second bi-pin terminal of the LED lamp, the filament-simulating circuit comprising at least one resistor connected in parallel to at least one capacitor and configured to simulate a filament of a fluorescent lamp during a pre-heat process executed by a ballast.

Claim 30, which depends from independent claim 23, which itself substantively identical to claim 1, is shown below.

30. The LED lamp of claim 24, wherein the first rectifier comprises two diodes electrically connected in series, and the first rectifier is electrically connected to the first filament-simulating circuit in parallel.

D. Prosecution History

In a non-final rejection on March 20, 2017, the Examiner rejected claims 1-10, 17-19, 21-25, and 29 on the ground of obviousness-type double patenting over claims 4-11, 13, and 14 of U.S. Patent No. 9,480,109. Ex. 1002 at 83. In response, on April 24, 2017, the Applicant filed a terminal disclaimer to obviate the double patenting rejection. Ex. 1002 at 332. The Applicant also amended claim 5. Ex. 1002 at 342. That amendment is as follows:

5. (Currently Amended) The power source module of claim 2, wherein the first rectifier comprises two diodes electrically connected in series, and the first rectifier is electrically connected to the first filament-simulating circuit in ~~parallel~~ series.

Id. The Applicant also added new independent claims 41 and 42, and dependent claims 31-40 and 43. Ex. 1002 at 360. The Examiner issued the Notice of Allowance allowing claims 1-43 on June 2, 2017. Ex. 1002 at 367.

Neither Zhang nor OSRAM was cited during the prosecution of the '662 patent.

E. Person of Ordinary Skill in the Art

Petitioner submits that a person of ordinary skill in the art as of the filing dates of the '662 patent would have a B.S. degree in electrical engineering, or an equivalent field, as well as at least 2-4 years of academic or industry experience in lighting design, including knowledge of LEDs and related technology for driving LEDs. Ex. 1003 ¶ 10. A person of ordinary skill in the art with a higher level of education may have fewer years of academic or industry experience, or vice versa. *Id.*

V. OVERVIEW OF THE PRIOR ART

A. Overview of Zhang (Ex. 1005)

U.S. Patent No. 10,045,406 to Zhang, entitled "Solid-State Lighting Apparatus For Use With Fluorescent Ballasts," was filed on April 18, 2014 (claiming priority to a provisional application filed on June 28, 2013), and issued on August 7, 2018. Zhang is also a continuation-in-part to several applications, two of

which Zhang incorporates by reference in their entireties. Ex. 1001, 7:60-8:7.

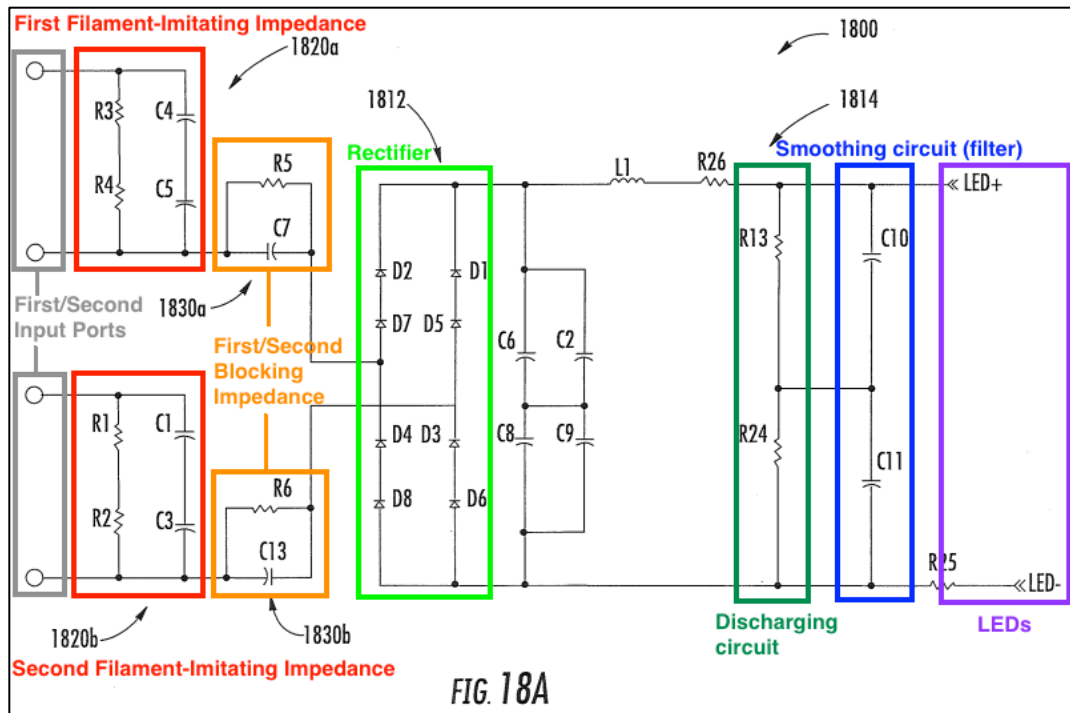
Zhang is a prior art reference to the '662 patent under 35 U.S.C. § 102(a)(2).

Like the '662 patent, Zhang discloses “a lighting apparatus including a solid-state lighting circuit [e.g., LEDs] and first and second ballast connection ports configured to be coupled to a ballast.” Ex. 1005, 1:63-65. Like the '662 patent, Zhang is directed to certain aspects of an LED lamp retrofit replacement for fluorescent lamps – indeed, the same aspects to which the '662 patent is directed. For instance, Zhang discloses:

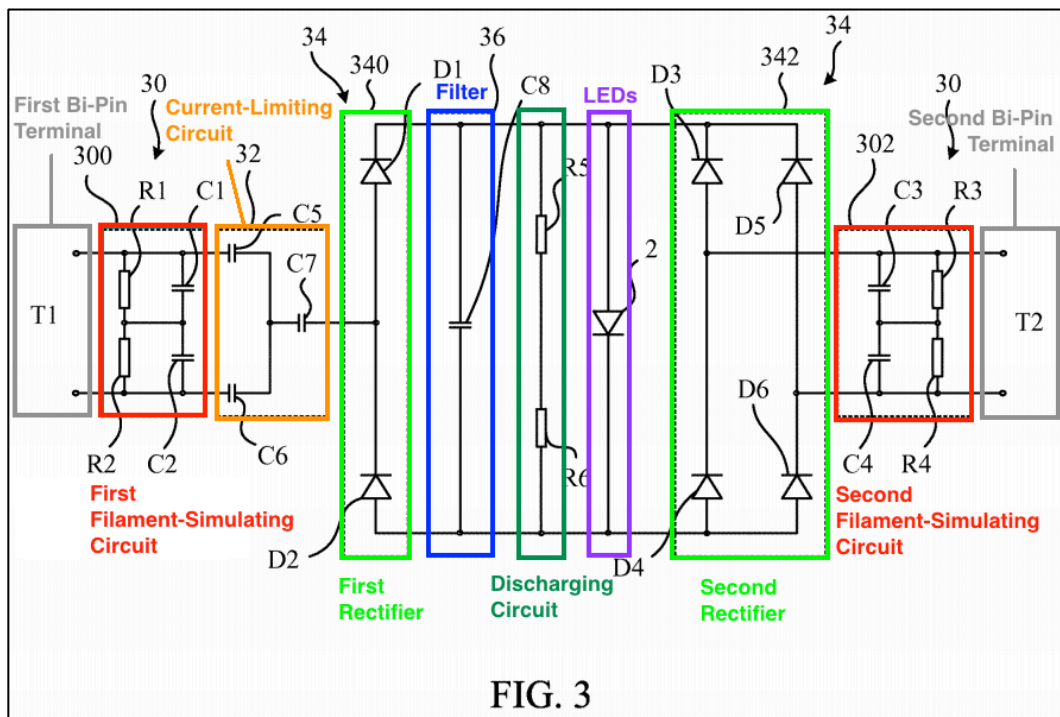
- “*Filament-imitating impedance*” coupled to the bi-pin terminals (i.e., ballast connection ports): “A [first/second] filament-imitating impedance is coupled to the [first/second] ballast connection port....” *Id.*, 1:65-2:4.
- “*Blocking impedance*” which is a current *limiting* circuit (*see infra* Section VI.A.1.c: “[A] [first/second] low-frequency blocking impedance couples the [first/second] filament-imitating impedance to [first/second] input terminal....” *Id.*, 1:67-2:6.
- “*Rectifier*”: “[T]he solid-state lighting circuit may include a *rectifier* circuit having an input port coupled to the first and second low-frequency blocking impedances and at least one light emitting diode (LED) coupled to an output port of the rectifier circuit.” *Id.*, 2:34-38 (emphasis added).

- Filter to “*smooth*” the current from the rectifier (with respect to the embodiment of Figure 18 (annotated below)): “Capacitors C10, C11 ... may provide additional *smoothing* of the output provided to the LED segments 1816a, 1816b.” *Id.*, 9:64-67 (emphasis added).
- “*Discharge*” circuit (with respect to the embodiment of Figure 18 (annotated below)): “Resistors R13, R24 may be coupled in parallel with respect ones of the capacitors C10, C11, and may be used to *discharge* the capacitors C10, C11 when power to the apparatus 1800 is removed, thus enabling a crisper turnoff of the LED segments 1816a, 1816b.” *Id.*, 9:67-10:6 (emphasis added).

See generally Ex. 1003 ¶¶ 41-48. Annotated Figure 18A below identifies each of these elements, in the language of Zhang, for clarity. Annotated Figure 3 from the ‘662 patent is also reproduced below for ease of comparison.



Zhang Figure 18A (annotated) (Ex. 1003 ¶ 48)



'662 Patent Figure 3 (annotated)

B. Overview of OSRAM (Ex. 1014)

German Patent No. DE 20 2013 000 880, titled “Circuit arrangement for operating at least one LED and system of a ballast device and a retrofit lamp,” was filed on January 29, 2013, issued on April 11, 2013, and was initially assigned to OSRAM GmbH. OSRAM is a prior art reference to the ‘662 patent under 35 U.S.C. § 102(a)(1).

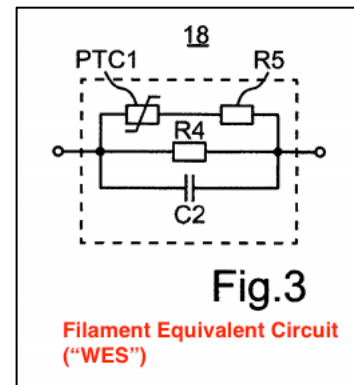
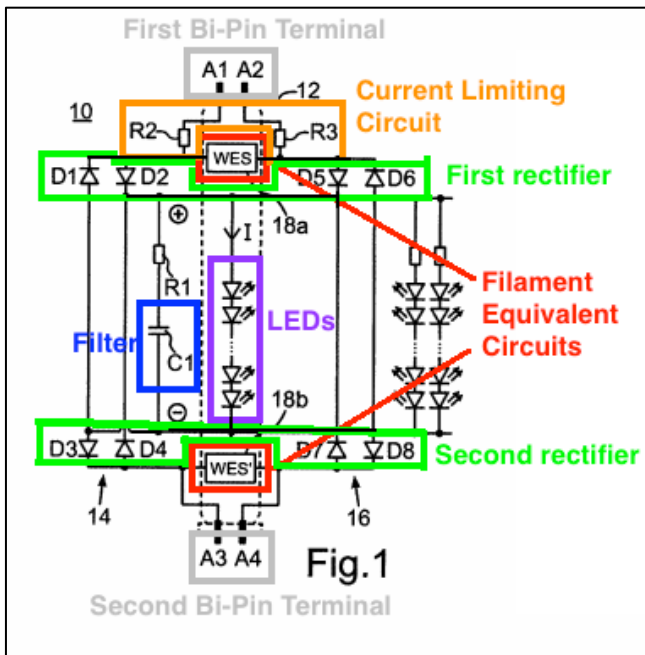
Like the ‘662 patent, OSRAM is directed to an LED “retrofit lamp[] ... replacement product for existing fluorescent lamps ... that can be used in the same lamp without requiring changes in the wiring of the lamp [that] shall function for both conventional ballasts ... and electronic ballasts....” Ex. 1014, [0002]. Like the ‘662 patent, OSRAM is directed to certain aspects of an LED lamp retrofit replacement for fluorescent lamps – indeed, the same aspects to which the ‘662 patent is directed. For instance, OSRAM discloses:

- “*Filament equivalent circuit*” coupled to the bi-pin terminals (“WES” in the figure below): “Preferably, the first and/or the second filament equivalent circuit is designed to emulate a filament resistance of a respective filament of a fluorescent lamp.” *Id.*, [0010]; “a [first/second] filament equivalent circuit [(18a)/(18b)] is coupled between the [first/third] terminal pole [(A1)/(A3)] and the [second/fourth] terminal pole [(A2)/(A4)]” *Id.*, claim 1.

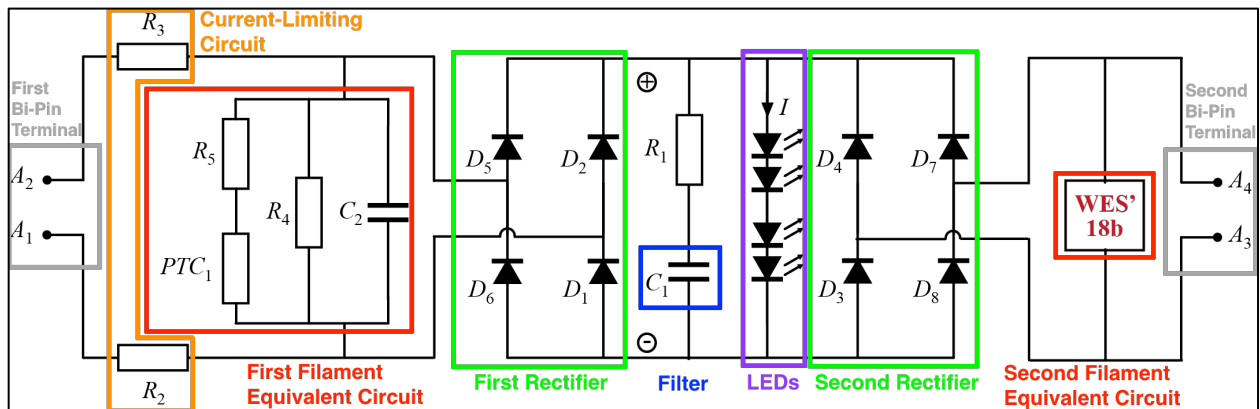
- *Current limiting circuit*: “In the supply lines on at least one side of the circuit arrangement 10, serial resistances can be connected, of which the resistances R2, R3 are shown by way of example....” *Id.*, [0026].
- “*Rectifier*”: “[T]he rectifier output of the first rectifier (14), the rectifier output of the second rectifier (16) and the at least one LED are connected in parallel.” *Id.*, claim 1. The eight diodes D1-D8 of the first and second rectifiers work in conjunction and comprise a “rectifier.” Ex. 1003 ¶ .
- *Filter* to smooth the current from the rectifier: “The generated DC voltage is filtered by means of a filter capacitor C1.” *Id.*, [0024]; “A filtering is carried out by means of a capacitor, which is connected in parallel with the LEDs.” *Id.*, [0002].

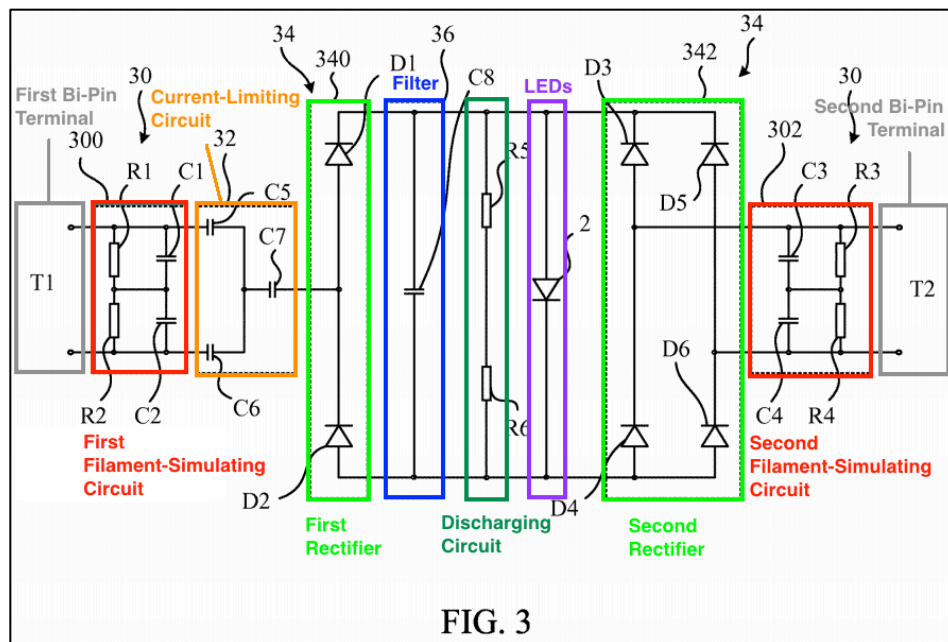
See generally Ex. 1003 ¶¶ 49-55. Annotated Figure 1 below identifies each of these elements for clarity.¹ The Figure 3 embodiment of OSRAM’s “filament equivalent circuit” is also shown below. Additionally, a redrawn version of OSRAM’s Figure 1, with the filament-equivalent circuit “WES” (18a) box replaced by the circuitry of the embodiment of Figure 3. Annotated Figure 3 from the ‘662 patent is also reproduced once again for ease of comparison.

¹ OSRAM identifies a “first rectifier” as element 14 and “second rectifier” as element 16, but as explained further below, the functionality of OSRAM is better understood in the context of this Petition with the “first rectifier” and “second rectifier” identified as below. Ex. 1003 ¶ 53.



OSRAM Figures 1 and 3 (annotated) (Ex. 1003 ¶ 55)





‘662 Patent Figure 3 (annotated)

VI. UNPATENTABILITY OF THE CHALLENGED CLAIMS

Pursuant to Rule 42.104(b)(4)-(5), the below section, and as confirmed in the Declaration of Regan Zane, Ph.D. (Ex. 1003), Petitioner demonstrates in detail how the prior art discloses every limitation of the challenged claims of the ’662 patent.

A. Ground 1: Claims 1, 2, 5-7, 9-10, 15-18, 21, 23-24, 29, 31-32, 34-39, and 41-42 are Anticipated by Zhang

Zhang discloses each and every limitation of the alleged inventions claimed in claims 1, 2, 5-7, 9-10, 15-16, 17-18, 21, 23-24, 29-32, and 34-39, and 41-42 of the ’662 patent.

1. Claim 1

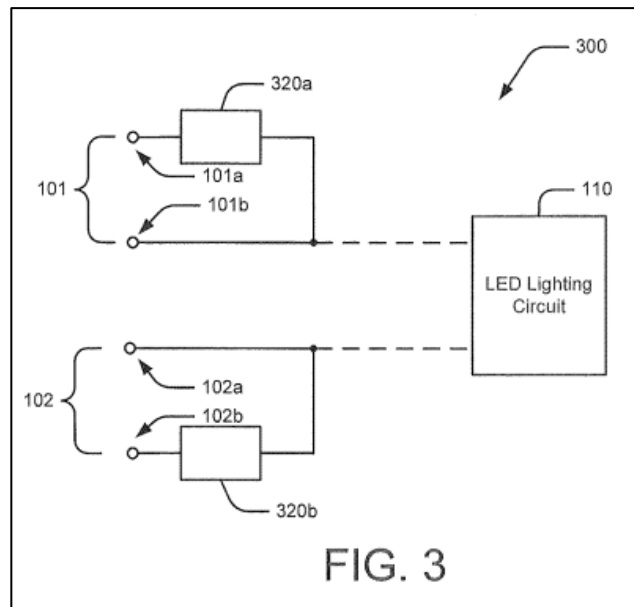
(a) Preamble: “A power source module for an LED lamp, comprising:”

To the extent the preamble is limiting, Zhang discloses a power source module for an LED lamp. Ex. 1003 ¶ 56. For instance, Zhang discloses that “the filament-imitating impedance may be configured to present an impedance between the first and second terminals of a ballast connection port that mimics the impedance provided by a filament of a fluorescent lamp, while at the same time allowing power transfer between the ballast connection port 101 and the LED lighting circuit 110 so that the one or more LEDs of the LED lighting circuit 110 may be driven by the ballast.” Ex. 1005, 5:20-27.

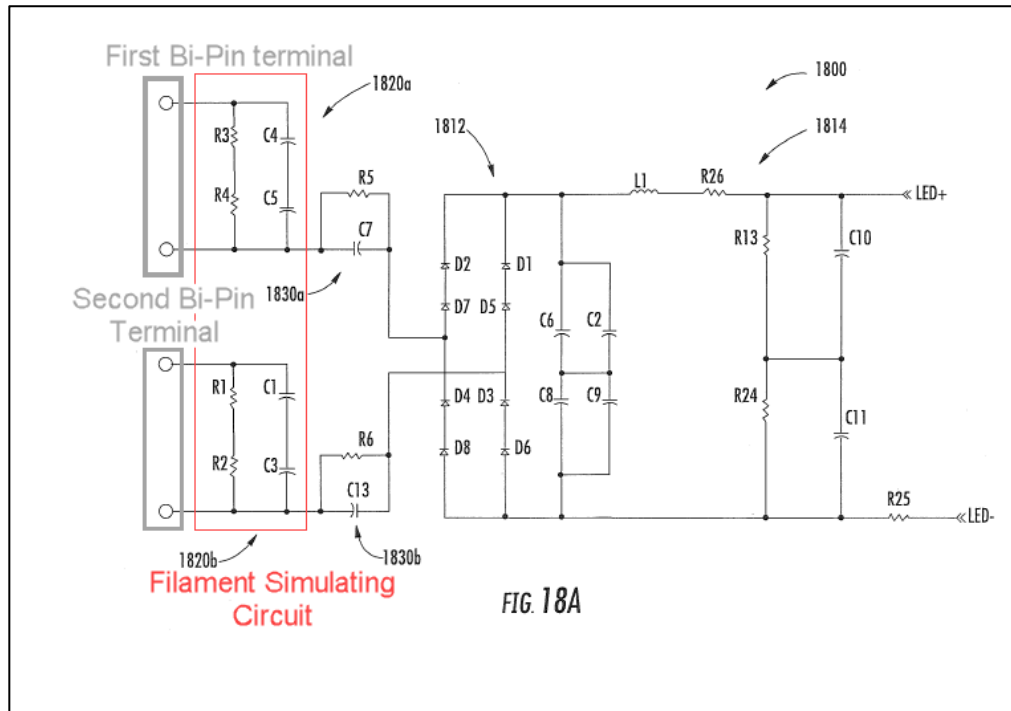
(b) 1[a]: “a filament-simulating circuit electrically connected to a first bi-pin terminal and a second bi-pin terminal of the LED lamp,”

Zhang discloses a filament-simulating circuit electrically connected to the bi-pin terminals of the LED lamp. Ex. 1003 ¶¶ 57-61. Zhang’s “filament-imitating impedance may be configured to present an impedance between the first and second terminals of a ballast connection port that mimics the impedance provide by a filament of a fluorescent lamp, while at the same time allowing power transfer between the ballast connection port [] and the LED lighting circuit [] so that the one or more LEDs of the LED lighting circuit [] may be driven by the ballast.” Ex. 1005, 5:20-27. The Summary discloses that “[a] first filament-imitating impedance

is coupled to the first ballast connection port” and “[a] second filament-imitating impedance is coupled to the second ballast connection port.” Ex. 1005, 1:65-2:6, claim 1. “Each of the first and second filament-imitating impedances may further include at least one resistor coupled in parallel with the at least one capacitor thereof.” *Id.*, 2:21-23, claim 5. Zhang generally discloses that “[v]arious embodiments may provide differing arrangements of filament-imitating impedances. For example, FIG. 3 illustrates a lighting apparatus 300 including a first filament-imitating impedance 320a coupled between a first and second terminals 101a, 101b of a first ballast connection port 101 and a second filament-imitating impedance coupled between first and second terminals 102a, 102b of a second ballast connection port 102.” *Id.*, 5:59-66, claim 1.



Zhang discloses that the embodiment of Figure 18A, which matches the generic filament-imitating impedance disclosure of Figure 3, includes “first and second filament-imitating impedances 1820a, 1820b.” *Id.*, 9:5-8.



Note that the ‘662 patent discloses that the claimed filament-simulating circuit can comprise two separate filament-simulating circuits, each connected to a bi-pin terminal on opposite sides of the lamp. In connection with Figure 1, the specification states that “[t]he filament-simulating unit 10 also includes a first filament-simulating circuit 100 and a second filament-simulating circuit 102 connected to the pins of the first bi-pin terminal T1 and the second bi-pin terminal T2, and therefore, the filament-simulating unit 10 may also be referred to as a filament-simulating circuit 10.” Ex. 1001, 3:14-29; Ex. 1003 ¶ 60.

Thus, Zhang discloses the claimed filament-simulating circuit.

- (c) **1[b]: “each of the first bi-pin terminal and the second bi-pin terminal configured to allow a current to flow from one pin to the other pin via the filament-simulating circuit during a pre-heat process executed by a ballast;”**

Zhang discloses that each of the first bi-pin terminal and the second bi-pin terminal are configured to allow a current to flow from one pin to the other pin via the filament-simulating circuit during a pre-heat process executed by a ballast. Ex. 1003 ¶¶ 62-69. Indeed, a purpose of the filament-simulating circuit is to allow current to flow from one pin to the other during the pre-heat process. Ex. 1003 ¶ 64. Without the filament-simulating circuit, “the starter and the electrical ballast generate a gaseous electrical discharge in the fluorescent lamp by raising the voltage, and so it would cause the LED lamp to burn away.” Ex. 1001, 1:56-59; Ex. 1003 ¶ 34. In other words, without the filament-simulating circuit, the voltage during pre-heat is dangerously high for LEDs and can cause them to burn out. *Supra* Section IV.A.3; Ex. 1003 ¶ 34.

As discussed above, the pre-heat process utilized by fluorescent tubes utilizing either magnetic or electronic ballasts is as follows: (1) when the lamp is initially switched on, a pre-heat circuit provides current to the filaments; (2) the filaments are heated, creating a cloud of electrons in the tube; (3) the lamp voltage

across the filaments is increased, which ultimately ignites the lamp, while the pre-heat current is significantly reduced. *Supra* Section IV.A.2, Ex. 1003 ¶ 63.

Zhang discloses that its filament-imitating impedances are configured to allow current to flow from one pin to the other in each of the bi-pin connectors during the pre-heat process. The fact that Zhang discloses resistive filament-imitating impedance circuits electrically connected between the pins of each bi-pin connector means that those circuits are configured as claimed – that is, because these are at least in part resistive impedances directly connecting one pin to the other, there is necessarily a path for current to flow between those pins during the pre-heat process. Ex. 1003 ¶ 64.

Further, in connection with Figures 7 and 10, which disclose parallel resistor/capacitor embodiments of the filament-imitating impedance that are equivalent to the filament-imitating impedance of Figure 18, Zhang discloses the following:

The filament-imitating impedance 1020 may also include a resistor R1 coupled in parallel with the capacitor C1. Some fluorescent lamp ballasts are configured to detect a DC resistance between pins connected to ends of a filament, and may prevent operation of the lamp if the DC resistance is too great. The resistor R1 may provide sufficient continuity between the terminals 101a, 101b to prevent such a shutdown. According to further embodiments, the resistor R1 may have a resistance operative to limit current through an attached starter circuit (not shown) to inhibit starter operation, i.e., the resistor R1 may provide a resistance sufficient to reduce or prevent glow discharge in the starter such that a bimetallic switch in the starter remains open.

Ex. 1001, 6:19-30; *see also id.* at 7:17-25; Ex. 1003 ¶ 64. The described bimetallic switch starters that use glow discharge (also known as glow switch starters) are necessarily used in ballasts that have a pre-heat starting mode. Ex. 1003 ¶ 65. These glow switch starters are used specifically for the pre-heat operation with certain ballasts. Zhang also cites a reference that discloses that “[a] fluorescent lamp does not ignite at a normal operation voltage without preheating.” Ex. 1018 at 1:16-17; Ex. 1003 ¶ 65. A POSITA reading Zhang would have understood that its filament-imitating impedances function for the purpose of providing a path for current to flow between the two pins of each bi-pin terminal during the pre-heat process. Ex. 1003 ¶ .65

Zhang also discloses that the filament-imitating impedance “*may* have a resistance operative to limit current through an attached starter circuit ... to inhibit starter operation ... to reduce or prevent glow discharge in the starter such that a bimetallic switch in the starter remains open.” Ex. 1005, 6:19-30 (emphasis added). From this disclosure, a POSITA would understand that at least some embodiments of the filament-imitating impedance *do not* have such a resistance, so the bimetallic switch in the starter closes, which is another way to describe the pre-heat operation. Ex. 1003 ¶ 66. Thus, a POSITA would understand that the filament-imitating impedance of Zhang is normally designed to allow a current to flow during the pre-

heat process. Ex. 1003 ¶ 66. Zhang also describes how current flows through a resistive component of one of its filament-imitating impedance embodiments, which a POSITA would understand as describing current flowing during the pre-heat process. Ex. 1003 ¶ 68.

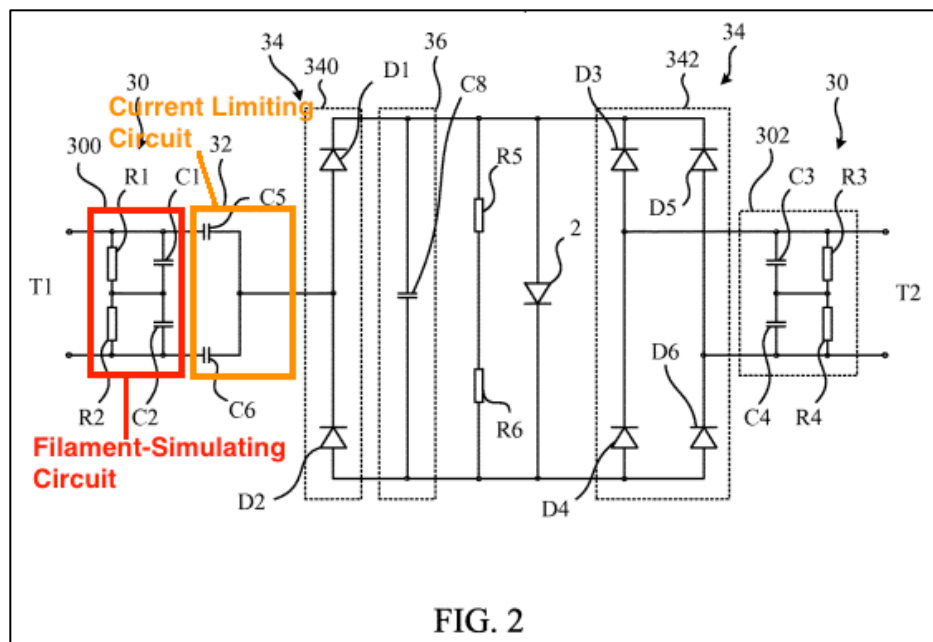
Additionally, a POSITA would understand that Zhang is configured to operate with filament pre-heating due to the fact that, combined with the disclosures above, Zhang's lamp has two bi-pin connectors. Ex. 1003 ¶ 67. Lamps that have two bi-pin connectors (i.e., four electrical connection, two at each end of the tube) have them to "allow[] a circuit path for electrode heating prior to lamp ignition." Ex. 1003 ¶ 67; Ex. 1007, 7.3.2.5.

Taken together, a POSITA would understand these disclosures to mean that Zhang necessarily discloses a configuration with a ballast using a pre-heat process.² Ex. 1003 ¶ 69. Thus, Zhang necessarily discloses a circuit that is configured to allow current to flow from one pin to the other pin via the filament-simulating circuit during a pre-heat process executed by the ballast. *Id.*

² A POSITA would understand that Zhang discloses such a configuration regardless of whether Zhang explicitly uses the words "pre-heat" for the reasons described above. However, to the extent that the Board finds that such a disclosure must be inherent, it is, since the pre-heat process is necessarily present for the reasons described above.

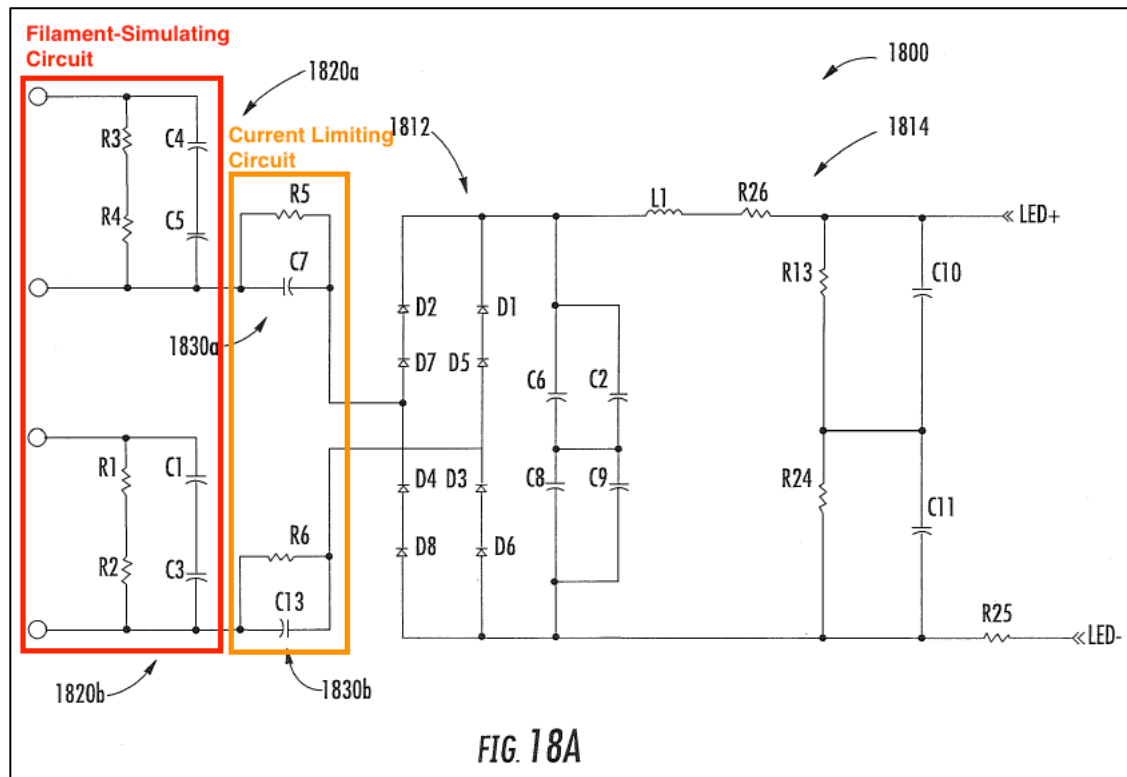
(d) 1[c]: “a current limiting circuit electrically connected to the filament-simulating circuit and configured to limit a current from the filament-simulating circuit;”

Zhang discloses a current limiting circuit electrically connected to the filament-simulating circuit and configured to limit a current from the filament-simulating circuit. Ex. 1003 ¶¶ 70-74. The ‘662 patent discloses that the “current limiting circuit” “protect[s] the LED lamp,” Ex. 1001, 2:33-35, and is “used for limiting the current from the first bi-pin terminal T1 to be in a suitable range for driving the LED module 2,” *id.* at 3:41-45. The ‘662 patent discloses, for example, current limiting circuit 32 in connection with Figure 2 comprising capacitors C5 and C6. *Id.*, 4:50-51.



Zhang discloses a “blocking impedance,” which is the claimed “current limiting circuit.” In connection with Figure 18, Zhang discloses that “first and

second blocking impedances 1830a, 1830b,” comprising R5 and C7 and R6 and C13, respectively, are electrically connected to filament-imitating impedance 1820a, 1820b. Ex. 1005, 9:5-8, 9:25-33.



Zhang discloses that these blocking impedances “may be configured to block a lower frequency component that may be provided by the ballast, such as a DC offset produced by the ballast.” *Id.*, 9:37-41. Zhang further discloses that “transfer of power to the LED lighting circuit [] may be reduced or prevented [by the blocking impedance], thus preventing damage and/or improper operation.” *Id.*, 9:41-48. These disclosures indicate that the blocking impedances limit current from the filament-simulating circuit thereby protecting the LEDs. Ex. 1003 ¶ 72.

Further, while the blocking impedance may be provided by capacitors alone as the ‘662 patent discloses, *id.* at 7:10, the embodiment of Figure 18 also includes resistors in parallel with the capacitors, which “may be configured to discharge a DC voltage that may develop across the blocking capacitor [] when the apparatus is used with certain types of electronic ballasts,” *id.* at 7:27-30; *see also* Ex. 1003 ¶ 72. A person of ordinary skill in the art would have understood that resistors such as R5 and R6 in the blocking impedances also limit current, as resistors are current-limiting devices. Ex. 1003 ¶ 72. Indeed, a person of ordinary skill in the art at the time of the alleged invention would have understood that both the “blocking impedance” of Zhang and the “current limiting circuit” of the ‘662 patent limit current to, and protect, the LEDs. *Id.*

Further, two U.S. patent applications that were copending with Zhang, Ser. Nos. 13/749,082 (issued as U.S. Patent No. 10,117,295, attached as Ex. 1010) and 13/943,455 (issued as U.S. Patent No. 9,439,249, attached as Ex. 1011), and whose disclosures Zhang incorporated by reference in their entirety, disclose that Zhang’s “blocking impedance” limits current to the LEDs. *Id.*, 7:63-8:7.³ Zhang discloses

³ Zhang’s incorporation by reference complies with 37 C.F.R. § 1.57(c), which requires a “clear intent to incorporate by reference by using the root words ‘incorporat(e) and ‘reference’,” and to “clearly identify the referenced patent, application, or publication.” Further, Zhang specifically incorporates the circuits and surrounding descriptions from these references: “[S]ome embodiments of the inventive subject matter may use filament-imitating impedances in combination

that “some embodiments of the inventive subject matter may use filament-imitating impedances in combination with a variety of different solid-state lighting circuits described in” these copending references. *Id.*, 7:63-8:7. Each of these references disclose that “a blocking capacitor C_B may be connected between the diode bridge and the ballast 10. The blocking capacitor C_B may be used to block lower-frequency AC currents which may be undesirable for the operation of LED assembly 430.” Ex. 1010 at 6:20-24; Ex. 1011 at 6:63-67. A person of ordinary skill in the art would understand that this description of the blocking capacitor is applicable to the blocking impedance described above. Ex. 1003 ¶ 73.

Thus, Zhang discloses the claimed current-limiting circuit as the blocking impedance of Figure 18. Ex. 1003 ¶ 74.

(e) 1[d]: “a first rectifier electrically connected to the current limiting circuit and configured to rectify the current from the current limiting circuit; and”

Zhang discloses a first rectifier electrically connected to the current limiting circuit and configured to rectify the current from the current limiting circuit. Ex. 1003 ¶¶ 75-76. Zhang discloses, with respect to the embodiment of Figure 18, that “[t]he rectifier circuit 1812 is a diode bridge including diodes D1-D8. The diode bridge is configured to provide redundancy by including respective serially-

with a variety of different solid-state lighting circuits described in [the copending applications].” Ex. 1005, 7:60-8:7. The disclosures of Exs. [-] are thus incorporated into Zhang’s disclosure.

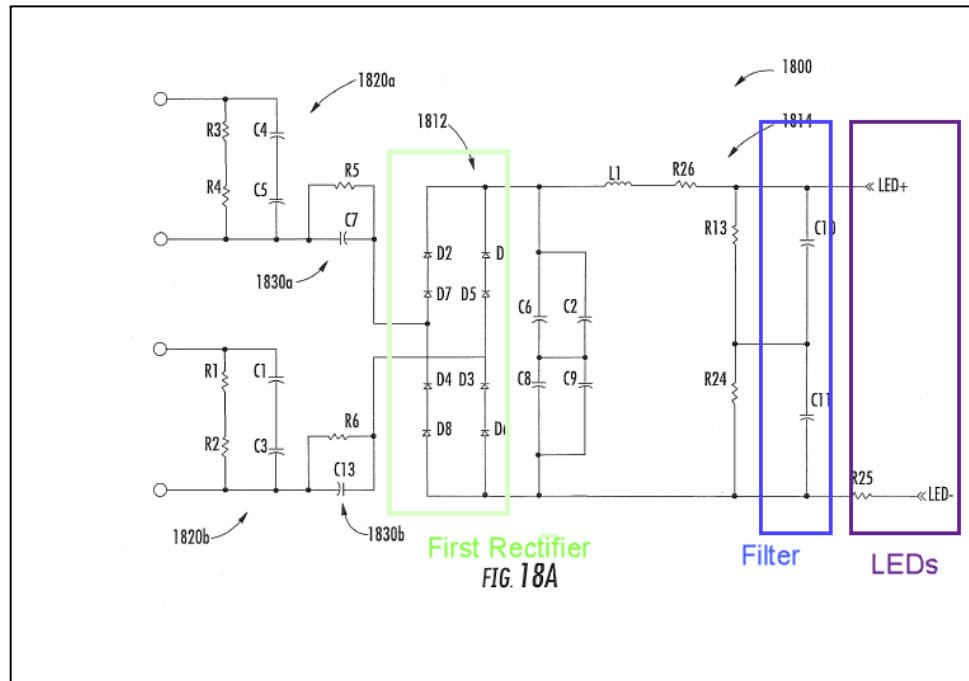
connected diode pairs D1/D5, D2/D7, D4/D8, D3/D6 in each branch of the diode bridge. Thus, if one of the diodes in a given branch fails in a shorted condition, the bridge may still operate in an acceptable manner.” Ex. 1005, 9:8-14. “The first-filament imitating impedance 1820a is coupled to a first terminal of an input port of the rectifier circuit 1812 by the first blocking impedance 1830a, which includes a capacitor C7 and resistor R5,” and “[t]he second filament-imitating impedance 1820b includes capacitors C1, C3 and resistors R1, R2 and is coupled to a second terminal of the input port of the rectifier circuit 1812 by the second blocking impedance 1830b, which includes a capacitor C13 and a resistor R6.” *Id.* at 9:25-32; *see also* claim 11.

Thus, the rectifier rectifies current from the current limiting circuit. Ex. 1003 ¶ 76.

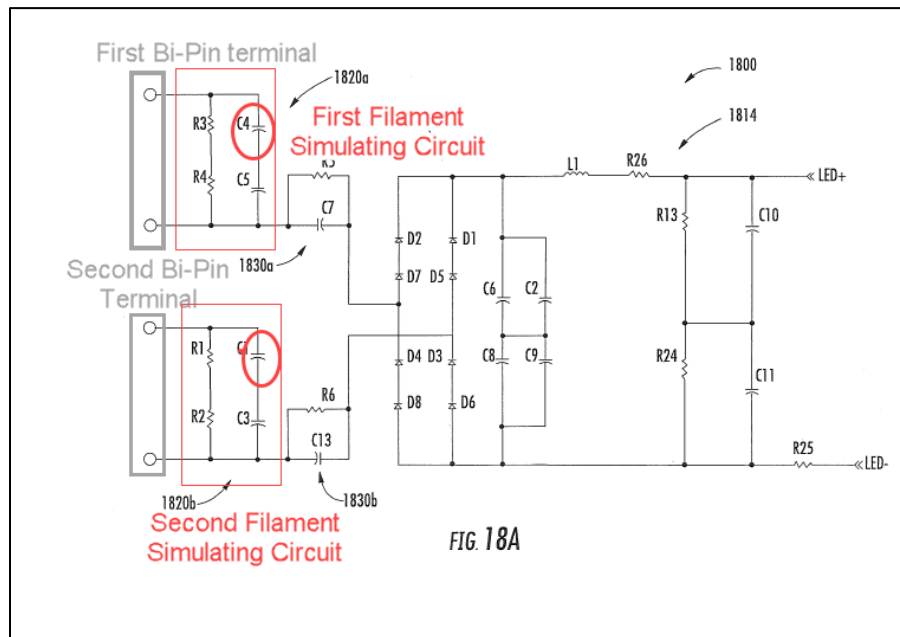
- (f) **1[e]: “a filter electrically connected between the first rectifier and at least one LED of the LED lamp and configured to smooth the current from the first rectifier.”**

Zhang discloses a filter electrically connected between the first rectifier and at least one LED of the LED lamp and configured to smooth the current from the first rectifier. Ex. 1003 ¶¶ 77-78. The claimed filter of the ‘662 patent is a capacitor. *See supra* Section IV.B; Ex. 1003 ¶ 77. Likewise, the filter of Zhang is comprised of capacitors. “Capacitors C10, C11 may be connected across the output of the

matching circuit 1814, and may provide additional smoothing of the output provided to the LED segments 1816a, 1816b.” Ex. 1005, 9:64-67; *see also* claim 16.

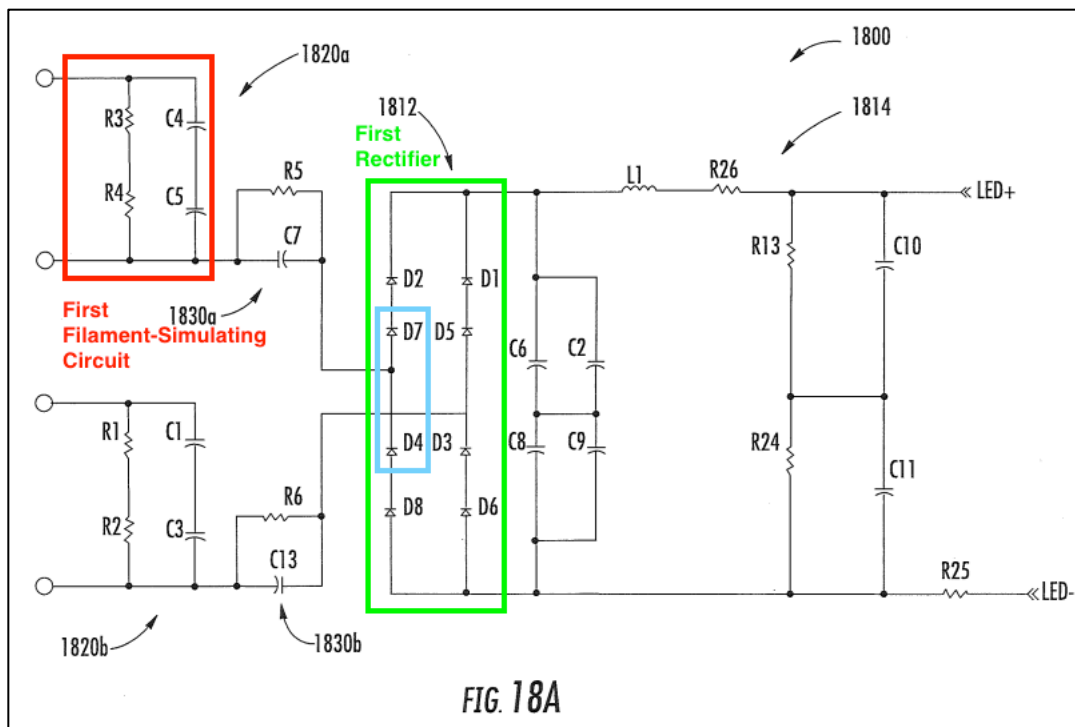


Each filament-simulating circuit includes at least one capacitor as shown in the annotated figure below, and therefore “comprises” a first and second capacitor, respectively. In addition to the annotation below, the two capacitors connected in series are equivalent to a single capacitor. Ex. 1003 ¶ 80. “These circuits are also configured to provide component redundancy by using serially-connected components in each of the circuit branches. For example, if the capacitor C4 shorts, the capacitor C5 may still provide a suitable filament-impedance imitating function to maintain acceptable operation of the apparatus 1800.” Ex. 1005, 9:19-24. Thus, each capacitor pair in each filament-imitating impedance circuit comprises the equivalent of one capacitor. Ex. 1003 ¶ 80.



3. **Claim 5: “The power source module of claim 2, wherein the first rectifier comprises two diodes electrically connected in series, and the first rectifier is electrically connected to the first filament-simulating circuit in series.”**

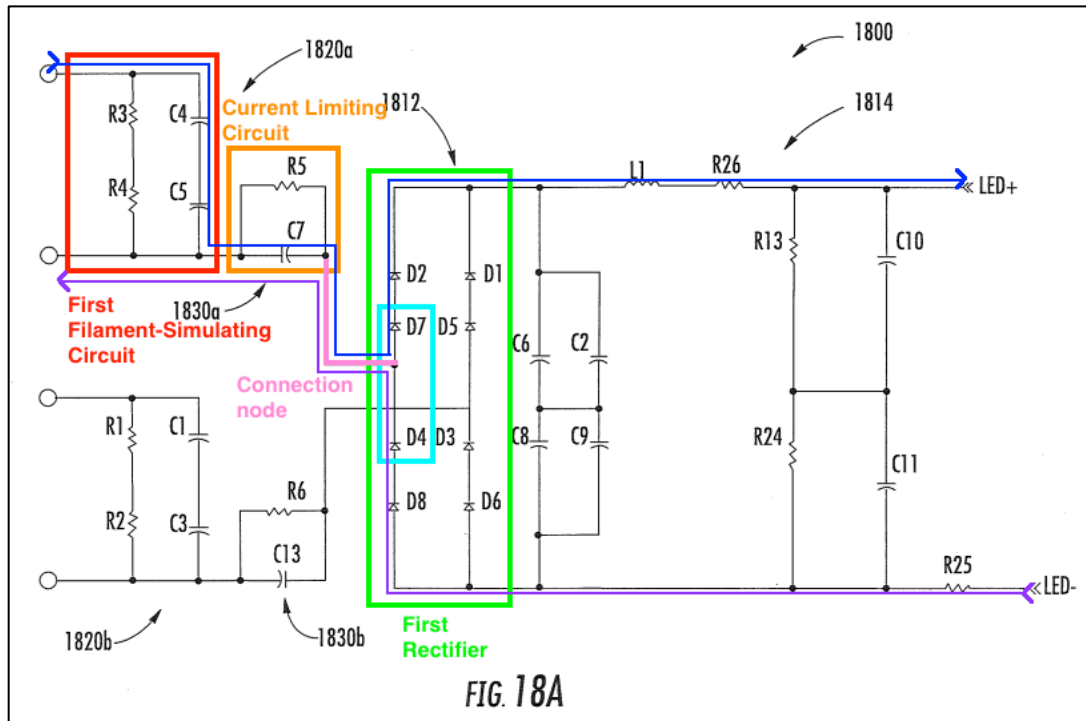
Zhang discloses that the first rectifier comprises two diodes electrically connected in series, and the first rectifier is electrically connected to the first filament simulating circuit in series. Ex. 1003 ¶ 81. The annotated figure below shows these elements, with the claimed “two diodes electrically connected in series” are shown in the light blue box. The first rectifier is “electrically connected ... in series” to the first filament-simulating circuit because there is a single node connecting the two circuits through the R5/C7 current-limiting circuit, and therefore current flows serially through this node, as opposed to in parallel, where the current would be broken up between the two circuits. Ex. 1003 ¶ 81.



4. **Claim 6:** “The power source module of claim 2, wherein the first rectifier comprises two diodes electrically connected in series and a connection node connecting the two diodes is coupled to the current limiting circuit, wherein a current flows from the at least one LED to one pin of the first bi-pin terminal through one of the two diodes and the current limiting circuit, or from one pin of the first bi-pin terminal to the at least one LED through the other of the two diodes and the current limiting circuit.”

Zhang discloses this limitation, as shown by annotated Figure 18 below. The claimed “two diodes electrically connected in series” in the “first rectifier” are shown in the light blue box. The connection node connecting these two diodes is coupled to the current limiting circuit as shown. That is, the connection node connecting diodes D4 and D7 is coupled to the current limiting circuit. Current flows from one pin of the first bi-pin terminal to the LEDs through D7, as illustrated

by the blue line below; current flows from the LEDs to one pin of the first bi-pin terminal through D4, as shown by the purple line below. Ex. 1003 ¶ 82.



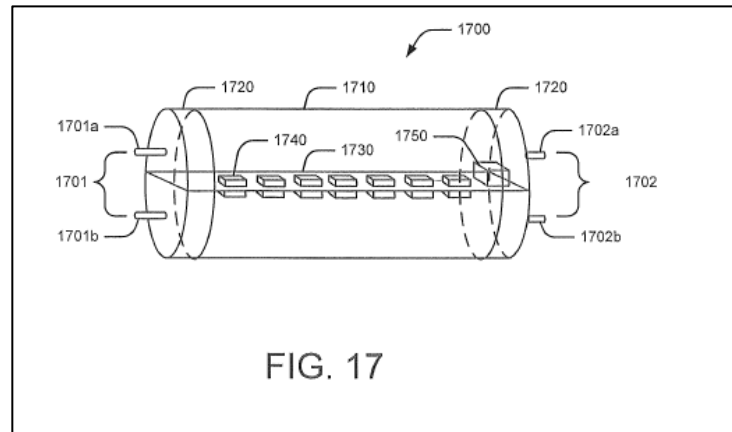
5. **Claim 7:** “The power source module of claim 6, wherein the current limiting circuit comprises at least a capacitor.”

Zhang discloses that the current limiting circuit comprises at least capacitor C7 as shown in the annotated figure above. *See also supra* discussion of claim 1[c].

6. **Claim 9:** “The power source module of claim 1, wherein the power source module is configured inside a casing of the LED lamp.”

Zhang discloses that the power source module is configured inside a casing of the LED lamp. Ex. 1003 ¶¶ 84-85. “The apparatus 1800 [of FIG. 18] may be included in a fluorescent tube replacement lamp along the lines illustrated in FIG. 17.” Ex. 1005, 10:19-20. “FIG. 17 illustrates a fluorescent tube replacement lamp

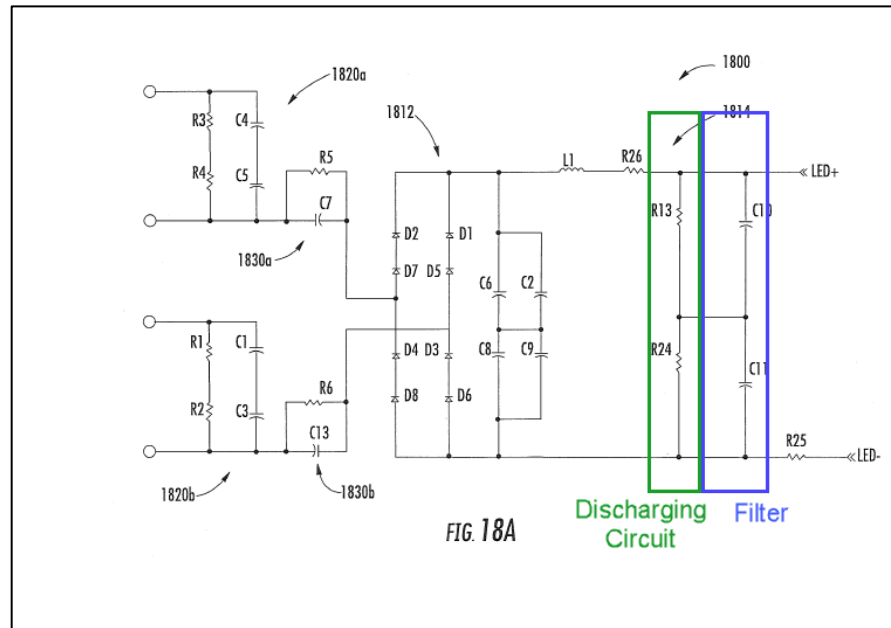
1700.... The lamp 1700 includes a tubular housing 1710 including a translucent portion 1710a and end caps 1720.” *Id.*, 8:49-52.



7. Claim 10: “The power source module of claim 1, further comprising a discharging circuit electrically connected to the filter in parallel for discharging the filter.”

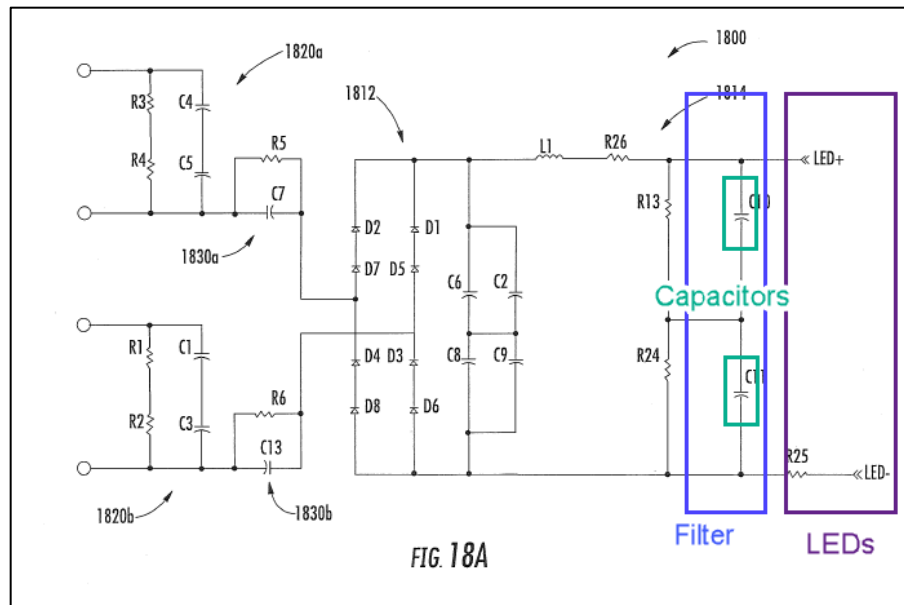
Zhang discloses a discharging circuit electrically connected to the filter in parallel for discharging the filter. Ex. 1003 ¶¶ 86-87. “Resistors R13, R24 may be coupled in parallel with respective ones of the capacitors C10, C11, and may be used to discharge the capacitors C10, C11 when power to the apparatus 1800 is removed, thus enabling a crisper turnoff of the LED segments 1816a, 1816b. As further shown, a resistor R25 may be coupled in series with the LED segments 1816a, 1816b. The value of the resistors R25 may be adjusted (e.g., in a manner similar to that described above for the resistor R26) to adjust a load presented to the driver circuitry. For example, the resistor R25 may be varied to allow use of the driver circuitry with different LED loads.” Ex. 1005, 9:67-10:11; *see also* Section

VI.A.1.f (claim 1[e]) above showing that the C10/C11 circuit comprises the claimed filter.



8. **Claim 15:** “The power source module of claim 1, wherein the filter comprises a filtering capacitor electrically connected to the at least one LED.”

Zhang discloses that the filter comprises a filtering capacitor electrically connected to the at least one LED. Ex. 1003 ¶¶ 88. “Capacitors C10, C11 may be connected across the output of the matching circuit 1814, and may provide additional smoothing of the output provided to the LED segments 1816a, 1816b.” Ex. 1005, 9:64-65; *see also* Section VI.A.1.f (claim 1[e]) above showing that the C10/C11 circuit comprises the claimed filter. Both filtering capacitors are electrically connected to the LEDs as shown. Ex. 1003 ¶ 88.



9. **Claim 16:** “The power source module of claim 1, further comprising a discharging circuit electrically connected to the filter in parallel for discharging the filter.”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.7 regarding claim 10.

10. **Claim 17**

- (a) **Preamble:** “A power source module for an LED lamp, comprising:”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.a regarding claim 1[pre].

- (b) **17[a]:** “a rectifier electrically connected to terminals of the LED lamp and configured to receive a current;”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.e regarding claim 1[d].

- (c) **17[b]: “a filter electrically connected between the rectifier and at least one LED of the LED lamp and configured to store energy from the rectifier and to smooth the current from the rectifier;”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.f regarding claim 1[e]. The capacitors of the filter are energy storage devices because they store energy in the form of electrical charge accumulated on their plates, thereby forming an electric field which stores the energy. Ex. 1003 ¶ 92.

- (d) **17[c]: “a discharging circuit electrically connected to the filter in parallel and configured to discharge the energy stored in the filter; and”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.7 regarding claim 10. “Discharging the filter” and “discharging the energy stored in the filter” are equivalent, as “discharging” with respect to energy storage devices such as capacitors is shorthand for “discharging the energy.” Ex. 1003 ¶ 93.

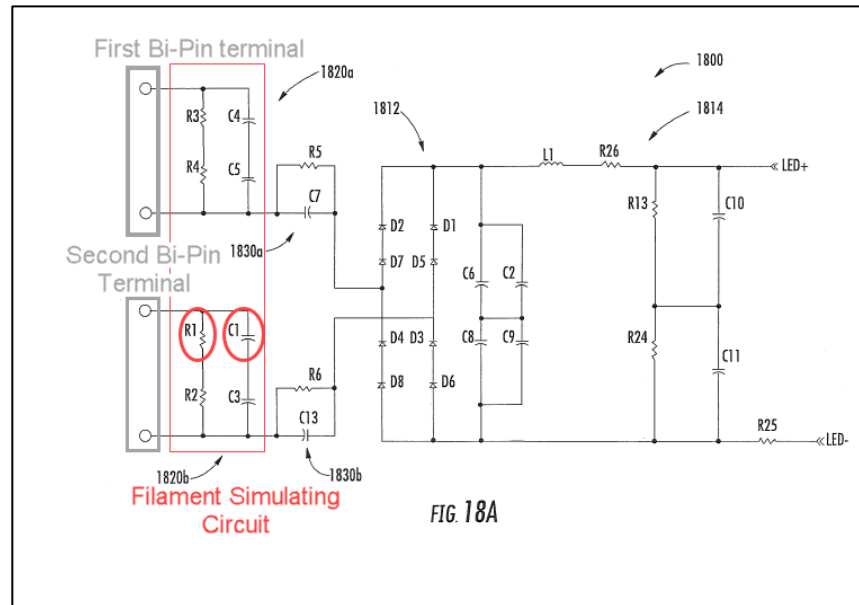
- (e) **17[d]: “a filament-simulating circuit electrically connected to a first bi-pin terminal and a second bi-pin terminal of the LED lamp, the filament-simulating circuit comprising at least one resistor connected in parallel to at least one capacitor and configured to simulate a filament of a fluorescent lamp during a pre-heat process executed by a ballast”**

Zhang discloses this claim element. The analysis of the claim element “a filament-simulating circuit electrically connected to a first bi-pin terminal and a

second bi-pin terminal of the LED lamp” is identical to the discussion in Section VI.A.1.b regarding the same claim element of claim 1[a]. The analysis of the claim element “configured to simulate a filament of a fluorescent lamp during a pre-heat process executed by a ballast” is identical to the discussion in Section VI.A.1.c regarding the claim element “each of the first bi-pin terminal and the second bi-pin terminal configured to allow a current to flow from one pin to the other pin via the filament-simulating circuit during a pre-heat process executed by a ballast” of claim 1[b]. This analysis applies equally to whether Zhang’s circuit is “configured to simulate a filament of a fluorescent lamp during a pre-heat process” as the discussion in claim 1[b] depends upon the filament-simulating circuit mimicking the impedance of the filament. Ex. 1003 ¶ 94.

Zhang discloses that the filament-simulating circuit comprises at least one resistor connected in parallel to at least one capacitor. The two resistors and two capacitors connected in series in each filament-simulating circuit are equivalent to a single resistor and single capacitor, respectively. Ex. 1003 ¶ 95. “These circuits are also configured to provide component redundancy by using serially-connected components in each of the circuit branches. For example, if the capacitor C4 shorts, the capacitor C5 may still provide a suitable filament-impedance imitating function to maintain acceptable operation of the apparatus 1800.” Ex. 1005, 9:19-24. Thus,

each filament-imitating impedance circuit comprises the equivalent of one resistor in parallel with one capacitor. Ex. 1003 ¶ 95.



11. **Claim 18:** “The power source module of claim 17, further comprising a current limiting circuit electrically connected to the first bi-pin terminal of the LED lamp, and configured to limit a current from the first bi-pin terminal.”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.d regarding claim 1[c].

12. **Claim 21**

- (a) **Preamble:** “A power source module for an LED lamp, comprising:”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.a regarding claim 1[pre].

- (b) **21[a]: “a first circuit comprising a first capacitor element electrically connected between two pins of a first bi-pin terminal of the LED lamp, and a second circuit comprising a second capacitor element electrically connected between two pins of a second bi-pin terminal, wherein the first and second circuits are configured to simulate a filament of a fluorescent lamp during a pre-heat process executed by a ballast;”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.10.e regarding claim 17[d].

- (c) **21[b]: “a current limiting circuit electrically connected to the first bi-pin terminal and configured to limit a current from the first bi-pin terminal;”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.d regarding claim 1[c].

- (d) **21[c]: “a rectifier electrically connected between the current limiting circuit and the second circuit and configured to rectify the current from the current limiting circuit and a current from the second bi-pin terminal; and”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.e regarding claim 1[d].

- (e) **21[d]: “a filter electrically connected between the rectifier and at least one LED of the LED lamp to store energy from the rectifier and configured to smooth the current from the rectifier.”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.f regarding claim 1[e].

13. Claim 23

(a) Preamble: “An LED lamp, comprising:”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.a regarding claim 1[pre] and in Section VI.A.6 regarding the “LED lamp” of claim 9.

(b) 23[a]: “a current limiting circuit electrically connected to a first terminal of the LED lamp for limiting a current from the first terminal;”

Zhang discloses a The analysis of this claim element is identical to the discussion in Section VI.A.1.d regarding claim 1[c].

(c) 23[b]: “a first rectifier electrically connected to the current limiting circuit for rectifying the current from the current limiting circuit;”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.e regarding claim 1[d].

(d) 23[c]: “a filter electrically connected between the first rectifier and at least one LED of the LED lamp for smoothing the current from the first rectifier; and”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.f regarding claim 1[e].

- (e) **23[d]: “a filament-simulating circuit electrically connected to a first bi-pin terminal and a second bi-pin terminal of the LED lamp, each of the first and the second bi-pin terminals having a current flowing from one pin to the other pin of the respective bi-pin terminal via the filament-simulating circuit during a pre-heat process executed by a ballast.”**

Zhang discloses this claim element. The analysis of the claim element “a filament-simulating circuit electrically connected to a first bi-pin terminal and a second bi-pin terminal of the LED lamp” is identical to the discussion in Section VI.A.1.b regarding the same claim element of claim 1[a]. The analysis of the claim element “each of the first and the second bi-pin terminals having a current flowing from one pin to the other pin of the respective bi-pin terminal via the filament-simulating circuit during a pre-heat process executed by a ballast” is identical to the discussion in Section VI.A.1.c regarding the claim element “each of the first bi-pin terminal and the second bi-pin terminal configured to allow a current to flow from one pin to the other pin via the filament-simulating circuit during a pre-heat process executed by a ballast” of claim 1[b].

14. **Claim 24: “The LED lamp of claim 23, wherein the filament-simulating circuit comprises: a first filament-simulating circuit comprising a first capacitor element electrically connected between two pins of the first bi-pin terminal; and a second filament-simulating circuit comprising a second capacitor element electrically connected between two pins of the second bi-pin terminal.”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.2 regarding claim 2.

15. **Claim 29: “The LED lamp of claim 23, further comprising a discharging circuit electrically connected to the filter in parallel for discharging the filter.”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.10.d regarding claim 17[c].

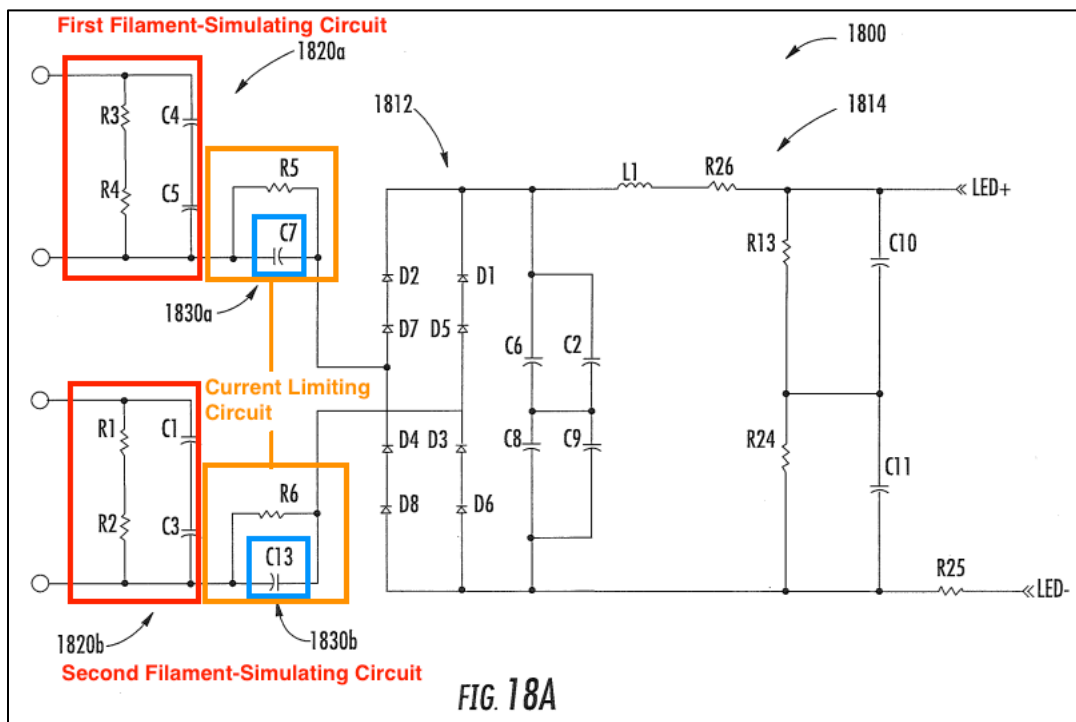
16. **Claim 31: “The power source module of claim 1, wherein the current limiting circuit comprises at least a capacitor.”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.5 regarding claim 7.

17. **Claim 32: “The power source module of claim 1, wherein: the filament-simulating circuit comprises a first filament-simulating circuit connected between two pins of the first bi-pin terminal, and a second filament-simulating circuit connected between two pins of the second bi-pin terminal; and the current limiting circuit comprises at least a capacitor connected to the first filament-simulating circuit, and at least a capacitor connected to the second filament-simulating circuit.”**

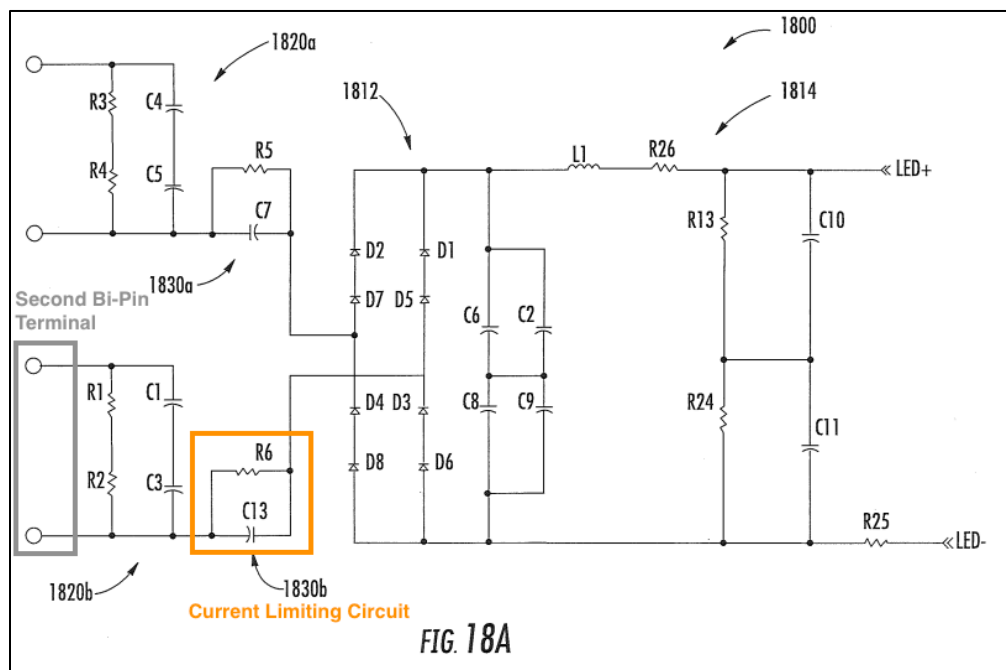
Zhang discloses this claim element. Zhang discloses that the filament-simulating circuit comprises a first and second filament-simulating circuit connected

between their respective bi-pin terminals, and that the current limiting circuit comprises at least a capacitor connected to the first and second filament-simulating circuits, respectively. This is shown in annotated Figure 18 below, with the capacitors shown in light blue boxes. Ex. 1005, Fig. 18. The first and second filament-simulating circuits are shown below connected between two pins of the first and second bi-pin terminals; their parallel resistor/capacitor arrangement couples their two respective bi-pin terminals. Ex. 1003 ¶ 110. The current limiting circuit connected to each of the first and second filament-simulating circuits comprises two capacitors, C7 and C13, respectively. *Id.*



18. **Claim 34:** “The power source module of claim 17, further comprising a current limiting circuit electrically connected to the second bi-pin terminal of the LED lamp, and configured to limit a current from the second bi-pin terminal.”

Zhang discloses this claim element. In the figure below, the R6/C13 combination limits a current from the second bi-pin terminal, as discussed in Section VI.A.1.d above regarding claim 1[c]. Ex. 1003 ¶ 111.



19. **Claim 35:** “The power source module of claim 17, wherein the filament-simulating circuit comprises a first filament-simulating circuit connected between two pins of first bi-pin terminal, and a second filament-simulating circuit connected between two pins of the second bi-pin terminal.”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.2 regarding claim 2.

- 20. Claim 36: “The power source module of claim 21, further comprising another current limiting circuit electrically connected to the second bi-pin terminal of the LED lamp, configured to limit a current from the second bi-pin terminal.”**

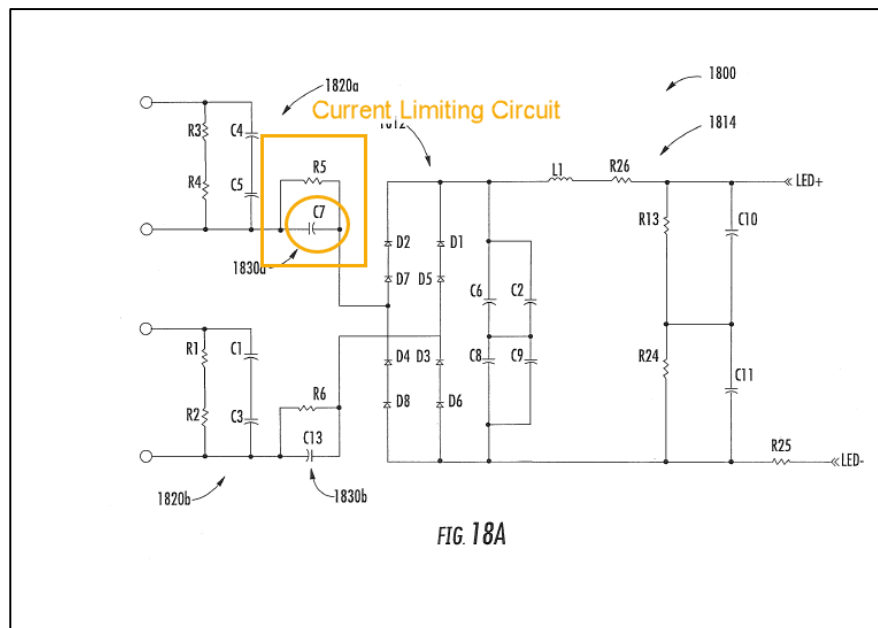
Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.18 regarding claim 34.

- 21. Claim 37: “The LED lamp of claim 23, further comprising another current limiting circuit electrically connected to a second terminal of the LED lamp, configured to limit a current from the second terminal.”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.18 regarding claim 34.

- 22. Claim 38: “The LED lamp of claim 23, wherein the current limiting circuit comprises at least a capacitor.”**

Zhang discloses that the current limiting circuit comprises at least capacitor C7. Ex. 1003 ¶ 115.



- 23. Claim 39: “The LED lamp of claim 23, wherein the filament-simulating circuit comprises a first filament-simulating circuit connected between a first pin and a second pin of the first bi-pin terminal, and a second filament-simulating circuit connected between a first pin and a second pin of the second bi-pin terminal.”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.14 regarding claim 24[a].

24. Claim 41

- (a) Preamble: “An LED lamp, comprising:”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.a regarding claim 1[pre] and in Section VI.A.6 regarding the “LED lamp” of claim 9.

- (b) 41[a]: “a current limiting circuit electrically connected to a first terminal of the LED lamp for limiting a current from the first terminal;”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.d regarding claim 1[c].

- (c) 41[b]: “a first rectifier electrically connected to the current limiting circuit for rectifying the current from the current limiting circuit;”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.e regarding claim 1[d].

- (d) **41[c]: “a filter electrically connected between the first rectifier and at least one LED of the LED lamp for smoothing the current from the first rectifier; and”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.f regarding claim 1[e].

- (e) **41[d]: “a first filament-simulating circuit electrically connected to a first bi-pin terminal of the LED lamp and a second filament-simulating circuit electrically connected to a second bi-pin terminal of the LED lamp, each of the first and the second bi-pin terminals arranged to have a current flowing from one pin to the other pin of the respective bi-pin terminal via the respective first or second filament-simulating circuit during a pre-heat process executed by a ballast.”**

Zhang discloses this claim element. The analysis of the claim element “a first filament-simulating circuit electrically connected to a first bi-pin terminal of the LED lamp and a second filament-simulating circuit electrically connected to a second bi-pin terminal of the LED lamp” is identical to the discussion in Section VI.A.17 regarding the same claim element of claim 32. The analysis of the claim element “each of the first and the second bi-pin terminals arranged to have a current flowing from one pin to the other pin of the respective bi-pin terminal via the respective first or second filament-simulating circuit during a pre-heat process executed by a ballast” is identical to the discussion in Section VI.A.1.c regarding the claim element “each of the first bi-pin terminal and the second bi-pin terminal configured to allow a current to flow from one pin to the other pin via the filament-

simulating circuit during a pre-heat process executed by a ballast” of claim 1[b].

See also claim 24.

25. Claim 42

(a) Preamble: “An LED lamp, comprising:”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.a regarding claim 1[pre] and in Section VI.A.6 regarding the “LED lamp” of claim 9.

(b) 42[a]: “a current limiting circuit electrically connected to a first terminal of the LED lamp for limiting a current from the first terminal;”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.d regarding claim 1[c].

(c) 42[b]: “a first rectifier electrically connected to the current limiting circuit for rectifying the current from the current limiting circuit;”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.e regarding claim 1[d].

(d) 42[c]: “a filter electrically connected between the first rectifier and at least one LED of the LED lamp for smoothing the current from the first rectifier; and”

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.1.f regarding claim 1[e].

- (e) **42[d]: “a first filament-simulating circuit electrically connected to a first bi-pin terminal of the LED lamp, and a second filament-simulating circuit electrically connected to a second bi-pin terminal of the LED lamp, each of the first and the second bi-pin terminals arranged to have a current flowing from one pin to the other pin of the respective bi-pin terminal via the respective first or second filament-simulating circuit after the LED lamp is connected to a ballast and before a normal operation state of the LED lamp.”**

Zhang discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.24.e regarding claim 41[d]. The claim limitation “after the LED lamp is connected to a ballast and before a normal operation state of the LED lamp” is equivalent to “during a pre-heat process executed by a ballast.” Ex. 1003 ¶ 126.

B. Ground 2: Claims 21, 23-24, 30, 36-37, 39, and 41-42 are Anticipated by OSRAM

OSRAM discloses each and every limitation of the alleged inventions claimed in claims 21, 23-24, 30, 36-37, 39, and 41-42 of the '662 patent.

1. Claim 21

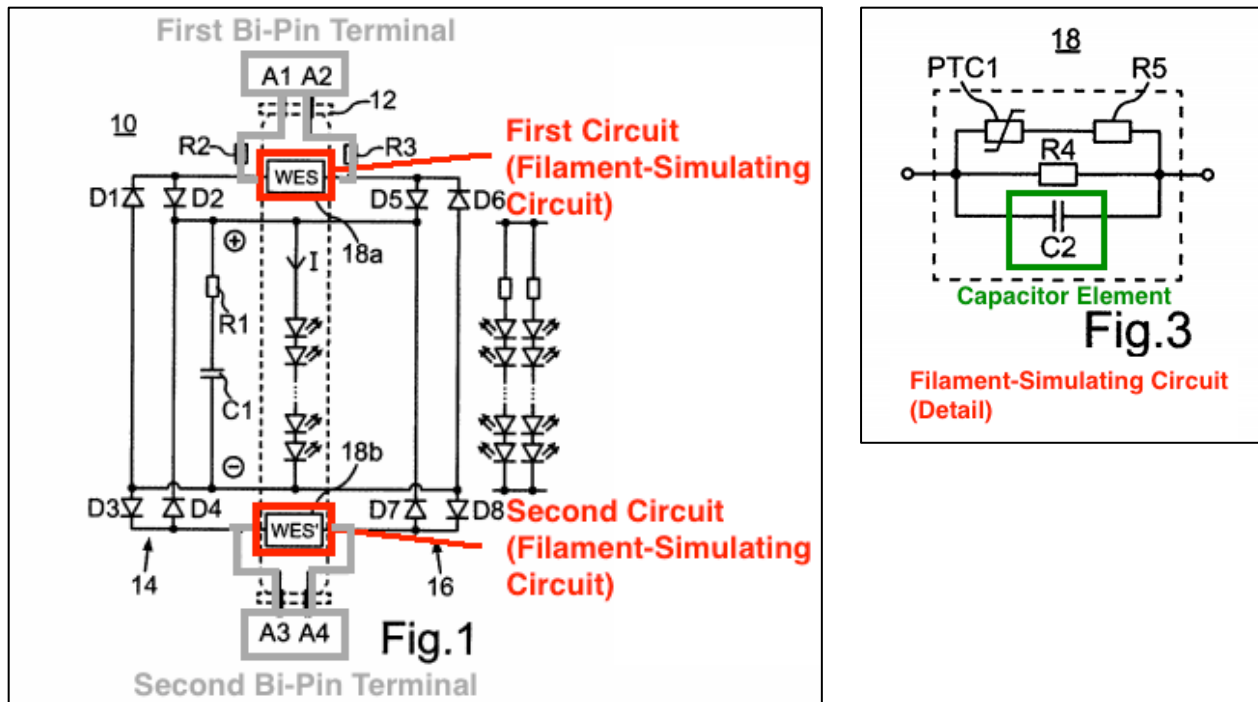
- (a) **Preamble: “A power source module for an LED lamp, comprising:”**

To the extent the preamble is limiting, OSRAM discloses a power source module for an LED lamp. Ex. 1003 ¶ 127. An embodiment of the power source module is shown in Figure 1, which includes rectifiers “serving to provide a DC voltage to the LEDs.” Ex. 1014, [0024].

- (b) 21[a]: “a first circuit comprising a first capacitor element electrically connected between two pins of a first bi-pin terminal of the LED lamp, and a second circuit comprising a second capacitor element electrically connected between two pins of a second bi-pin terminal, wherein the first and second circuits are configured to simulate a filament of a fluorescent lamp during a pre-heat process executed by a ballast;”

OSRAM discloses a first circuit comprising a first capacitor element electrically connected between two pins of a first bi-pin terminal of the LED lamp, and a second circuit comprising a second capacitor element electrically connected between two pins of a second bi-pin terminal, wherein the first and second circuits are configured to simulate a filament of a fluorescent lamp during a pre-heat process executed by a ballast. Ex. 1003 ¶¶ 128-33.

As shown in annotated Figure 1, OSRAM’s first and second “filament equivalent circuits” (labeled “WES” in the figures) are the claimed first/second circuits electrically connected between two pins of a first/second bi-pin terminal. Ex. 1003 ¶ 129. As shown by an embodiment of the “WES” of Figure 3, annotated below, the “filament equivalent circuits” each comprise a capacitor element C2. OSRAM discloses that the filament equivalent circuits are coupled between two pins of their respective bi-pin terminals: “a [first/second] filament equivalent circuit [(18a)/(18b)] is coupled between the [first/third] terminal pole [(A1)/(A3)] and the [second/fourth] terminal pole [(A2)/(A4)]” *Id.*, claim 1.



OSRAM further discloses that these first and second “filament equivalent circuits” are configured to simulate a filament of a fluorescent lamp during a pre-heat process executed by a ballast. Ex. 1003 ¶ 130. “Preferably, the first and/or the second filament equivalent circuit is designed to emulate a filament resistance of a respective filament of a fluorescent lamp.” Ex. 1014, [0010]. Throughout its written description, OSRAM discloses that this emulation of the filaments occurs at least during a pre-heat process executed by a ballast. Ex. 1003 ¶ 130.

For example, OSRAM discusses problems surrounding proper design of filament equivalent resistance circuits in, for instance, electronic ballasts (which it refers to as “EVGs,” in contrast with magnetic ballasts, or “KVGs,” *see, e.g.*, Ex. 1014, [0002]), stating that “[i]n EVGs with filament *preheating* by means of a

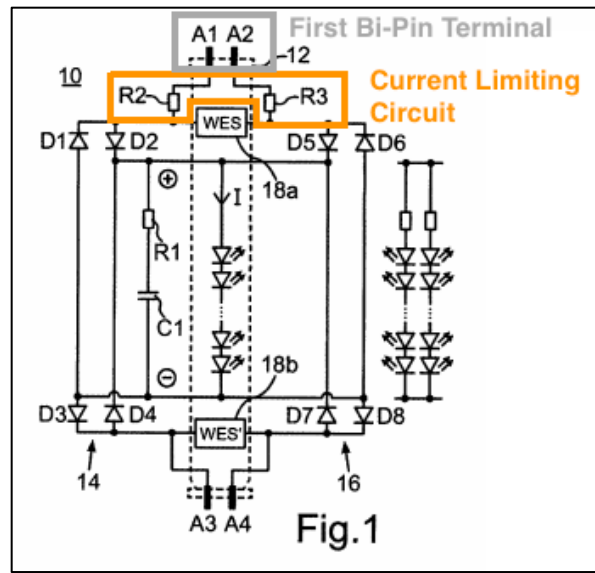
resonance capacitor, the losses in the filament equivalent resistances are not too great. However, EVGs and KVGs with transforming filament heating (especially dimmable implementations) also exist, which have the characteristics of a voltage source rather than a current source, as with the use of a resonant capacitor.” Ex. 1014, [0007] (emphasis added). In other words, certain characteristics of ballasts should be considered in design of the filament equivalent resistance, including ballasts that have characteristics of a voltage source rather than current source (as with an EVG with a resonant capacitor). Ex. 1003 ¶ 131. Thus, when designing the filament equivalent circuit, the person of ordinary skill is directed to keep a few things in mind, including that, “with an EVG with a resonant capacitor, the ***preheating current*** impressed by the resonant capacitor will cause increased losses at the permanently high fixed resistance.” Ex. 1014, [0008] (emphasis added); Ex. 1003 ¶ 131. Because of requirements and characteristics of certain ballasts, OSRAM concludes that “it is hardly possible to select the resistance values [of the filament equivalent circuit] in such a way that all types of [ballasts], with current-controlled or voltage-controlled preheating, function satisfactorily, without having to fear great losses in efficiency, excessive heating of the filament equivalent circuit and possibly destruction of the ballast.” Ex. 1014, [0008]; Ex. 1003 ¶ 131.

Thus, OSRAM discloses that the “filament equivalent circuit” should be formed in part with “variable impedance, which is achieved in that the filament

equivalent circuit comprises at least one ohmic resistance and at least one first capacitor.... [A]n excessively large capacitor in the case of voltage-controlled *preheating* by an EVG would mean too much reactive power for the heating circuit, whereas a capacitor that is too small would attenuate the resonance circuit of the electronic ballast too little.” Ex. 1014, [0009] (emphasis added); Ex. 1003 ¶ 132. That is, the claimed “first” and “second circuit” are OSRAM’s “filament equivalent circuits,” and they are “configured to simulate a filament of a fluorescent lamp during a pre-heat process executed by a ballast.” Ex. 1003 ¶ 133.

(c) 21[b]: “a current limiting circuit electrically connected to the first bi-pin terminal and configured to limit a current from the first bi-pin terminal;”

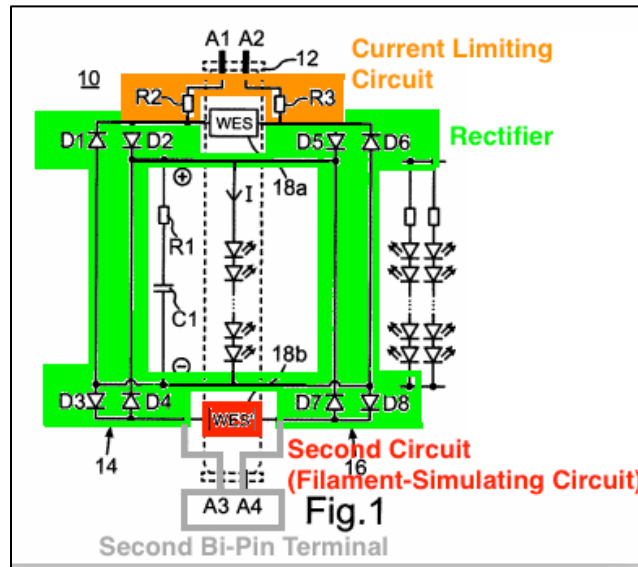
OSRAM discloses a current limiting circuit electrically connected to the first bi-pin terminal and configured to limit a current from the first bi-pin terminal. Ex. 1003 ¶¶ 134-35. “In the supply lines on at least one side of the circuit arrangement 10 [i.e., one of the bi-pin terminals], serial resistances can be connected, of which the resistances R2, R3 are shown by way of example, which can also be designed as safety resistances, or as fuses, so that in the event of a fault, for example, a winding short circuit of the KVG, the resulting greatly increased current flow is interrupted.” Ex. 1014, [0026]. These serial resistances R2 and R3 are shown in annotated Figure 1 below. These resistances are configured to limit a current from the first bi-pin terminal. Ex. 1003 ¶ 134-35.



- (d) 21[c]: “a rectifier electrically connected between the current limiting circuit and the second circuit and configured to rectify the current from the current limiting circuit and a current from the second bi-pin terminal; and”

OSRAM discloses a rectifier electrically connected between the current limiting circuit and the second circuit and configured to rectify the current from the current limiting circuit and a current from the second bi-pin terminal. Ex. 1003 ¶¶ 136-37. The claimed “rectifier” is composed of eight diodes D1-D8 in what OSRAM describes as the “first” and “second” rectifiers. Ex. 1003 ¶ 136. This rectifier, realized by two full-bridge rectifiers, rectifies the current from both the current limiting circuit R2/R3, and from the second bi-pin terminal with pins A3 and A4 as shown in the annotated figure below. *Id.* As OSRAM discloses, “by means of eight diodes, through which two rectifiers are realized, a DC voltage is generated

independently of the rotational position of the retrofit lamp during insertion into a lamp.” Ex. 1014, [0002].



As Dr. Zane, notes, while OSRAM identifies a “first rectifier” 14 and “second rectifier” 16, what is the “first” and “second” rectifier in the language of the claims of the ‘662 patent depends on how one looks at the circuit. Ex. 1003 ¶ 136. With respect to the manner in which the ‘662 patent discusses the rectifier functionality—i.e., in terms of rectifying current from the filament simulating circuits or from the bi-pin terminals—the functionality of the OSRAM rectifier is better understood in terms of which diodes are associated with and rectify that current from the filament simulating circuits or bi-pin terminals. Ex. 1003 ¶ 136. In the embodiment of Figure 1, the first rectifier is made up of diodes D1, D2, D5, and D6, whose AC inputs from the current limiting circuit R2/R3 are in parallel with the left- and right-hand-side terminals of the first filament simulating circuit (“WES”, 18a). Ex. 1003

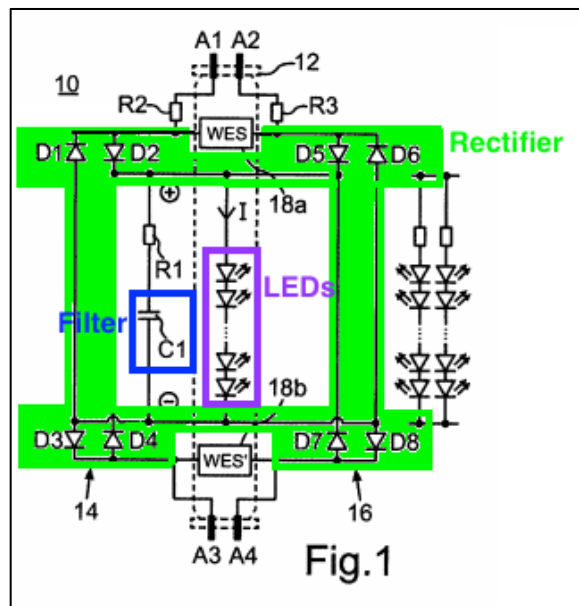
¶ 137. The second rectifier is made up of diodes D3, D4, D7, and D8, whose AC inputs from the second bi-pin terminal A3/A4 are in parallel with the left- and right-hand-side terminals of the second filament simulating circuit (“WES”, 18b). Ex. 1003 ¶ 137.

The first and second rectifiers together make up the claimed “rectifier,” and this rectifier is electrically connected between “current limiting circuit” R2/R3 and “second circuit” WES’ (18b), and is configured to rectify the current from both the “current limiting circuit” via diodes D1, D2, D5, and D6 (the first rectifier) and from the second bi-pin terminal A3/A4 via diodes D3, D4, D7, and D8. Ex. 1003 ¶¶ 136-37.

- (e) **21[d]: “a filter electrically connected between the rectifier and at least one LED of the LED lamp to store energy from the rectifier and configured to smooth the current from the rectifier.”**

OSRAM discloses a filter electrically connected between the rectifier and at least one LED of the LED lamp to store energy from the rectifier and configured to smooth the current from the rectifier. Ex. 1003 ¶¶ 138-39. The filter is identified in annotated Figure 1 below. As OSRAM discloses: (1) “[t]he generated DC voltage is filtered by means of a filter capacitor C1,” Ex. 1014, [0024], where the “generated DC voltage” is the voltage from the rectifier—i.e., the filter stores energy from the rectifier and filters it, Ex. 1003 ¶ 138; (2) “[a] filtering is carried out by means of a

capacitor, which is connected in parallel with the LEDs,” Ex. 1014, [0002]—i.e., the filter is electrically connected between the rectifier and the LEDs, Ex. 1003 ¶ 139. OSRAM further discloses that this filter smooths the current from the rectifier when it states that “the high frequency ripple of the EVG provided for operation of the retrofit lamp 12 will be smoothed.” Ex. 1014, [0024]; Ex. 1003 ¶ 140.



2. Claim 23

(a) Preamble: “An LED lamp, comprising:”

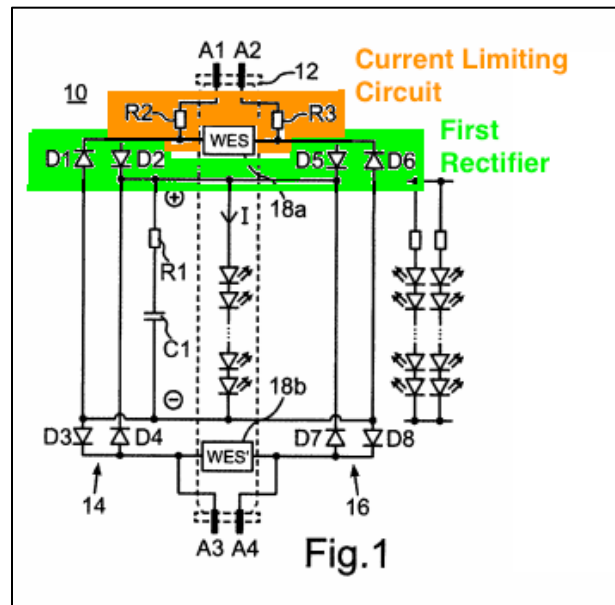
To the extent the preamble is limiting, OSRAM discloses an LED lamp. Ex. 1003 ¶ 140. For example, OSRAM “relates to a system of a ballast and a retrofit lamp” and “a circuit arrangement for operating at least one LED....” Ex. 1014, [0001].

- (b) **23[a]: “a current limiting circuit electrically connected to a first terminal of the LED lamp for limiting a current from the first terminal;”**

OSRAM discloses a current limiting circuit electrically connected to a first terminal of the LED lamp for limiting a current from the first terminal. The analysis of this claim element is identical to the discussion in Section VI.A.12.c regarding claim 21[b].

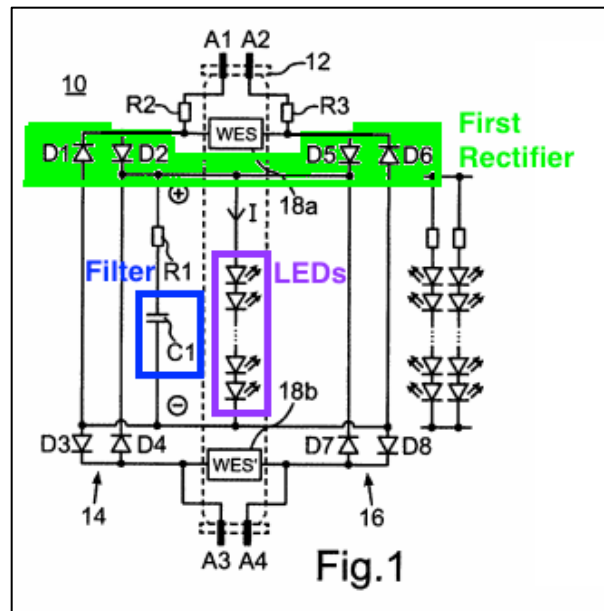
- (c) **23[b]: “a first rectifier electrically connected to the current limiting circuit for rectifying the current from the current limiting circuit;”**

OSRAM discloses a first rectifier electrically connected to the current limiting circuit for rectifying the current from the current limiting circuit. Ex. 1003 ¶ 142. As discussed above in Section VI.A.12.d regarding claim 21[c], in the embodiment of Figure 1 as annotated below, the “first rectifier” is made up of diodes D1, D2, D5, and D6, whose AC inputs from the current limiting circuit R2/R3 are in parallel with the left- and right-hand-side terminals of the first filament simulating circuit (“WES”, 18a). Ex. 1003 ¶ 142. This “first rectifier” is thus electrically connected to the current limiting circuit R2/R3 for rectifying the current from the current limiting circuit.



- (d) 23[c]: “a filter electrically connected between the first rectifier and at least one LED of the LED lamp for smoothing the current from the first rectifier; and”

OSRAM discloses a filter electrically connected between the first rectifier and at least one LED of the LED lamp for smoothing the current from the first rectifier. Ex. 1003 ¶ 143. The analysis of this claim element is identical to the discussion in Section VI.A.12.e regarding claim 21[d]. Annotated Figure 1 below shows the filter electrically connected between the first rectifier and at least one LED.



- (e) 23[d]: “a filament-simulating circuit electrically connected to a first bi-pin terminal and a second bi-pin terminal of the LED lamp, each of the first and the second bi-pin terminals having a current flowing from one pin to the other pin of the respective bi-pin terminal via the filament-simulating circuit during a pre-heat process executed by a ballast.”

OSRAM discloses a filament-simulating circuit electrically connected to a first bi-pin terminal and a second bi-pin terminal of the LED lamp, each of the first and the second bi-pin terminals having a current flowing from one pin to the other pin of the respective bi-pin terminal via the filament-simulating circuit during a pre-heat process executed by a ballast. Ex. 1003 ¶¶ 144-46. The claimed “filament-simulating circuit” here is composed of the “first” (18a) and “second” (18b) “WES” circuits of claim 21[a] (*see* Section VI.A.12.b above). Ex. 1003 ¶ 144. Each of these “first” and “second” circuits are electrically connected to the respective “first”

and “second” “bi-pin terminals of the LED lamp,” therefore, the “filament-simulating circuit” is likewise electrically connected to these terminals. *Id.* Indeed, OSRAM refers to these circuits together a single “filament equivalent circuit”: “Between each two terminal pins, which are arranged on one side of the retrofit lamp, a filament equivalent circuit 18a and 18b is inserted in each case.” Ex. 1014, [0025].

Each of these terminals has “a current flowing from one pin to the other pin...via the filament-simulating circuit during a pre-heat process executed by a ballast.” Ex. 1003 ¶ 145. A purpose of the filament-simulating circuit is to allow current to flow from one pin to the other during the pre-heat process. *Id.* Without the filament-simulating circuit, “the starter and the electrical ballast generate a gaseous electrical discharge in the fluorescent lamp by raising the voltage, and so it would cause the LED lamp to burn away.” Ex. 1001, 1:56-59; Ex. 1003 ¶ 145. In other words, without the filament-simulating circuit, the voltage during pre-heat is dangerously high for LEDs and can cause them to burn out. *Supra* Section IV.A.3; Ex. 1003 ¶ 145.

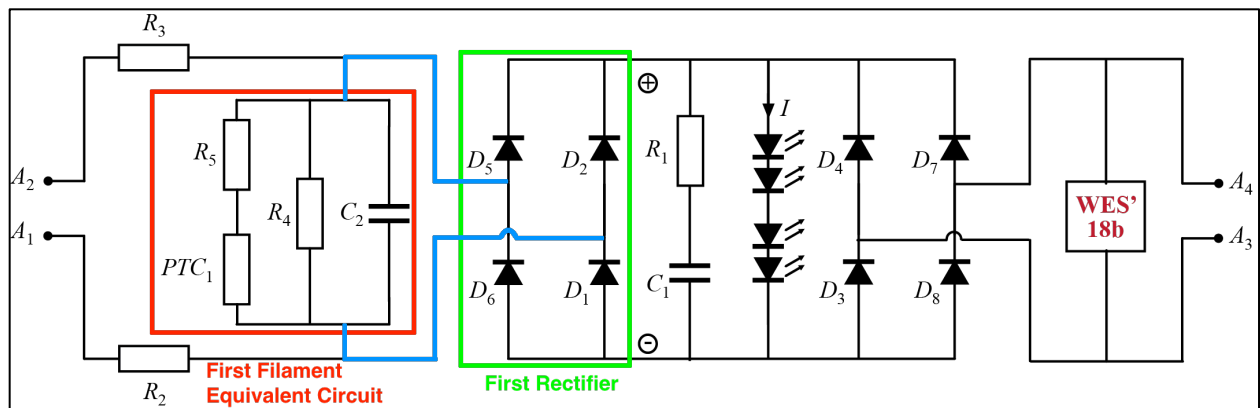
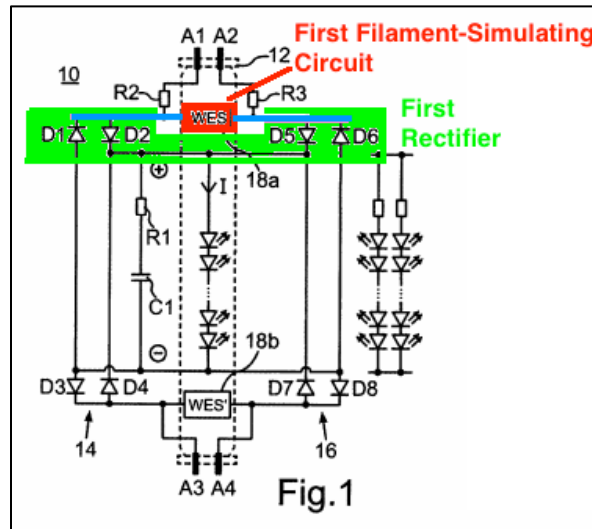
3. **Claim 24: “The LED lamp of claim 23, wherein the filament-simulating circuit comprises: a first filament-simulating circuit comprising a first capacitor element electrically connected between two pins of the first bi-pin terminal; and a second filament-simulating circuit comprising a second capacitor element electrically connected between two pins of the second bi-pin terminal.”**

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.12.b regarding claim 21[a], where the “first/second circuit” of claim 21[a] and “first/second filament-simulating circuit” of claim 24 are identical.

4. **Claim 30: “The LED lamp of claim 24, wherein the first rectifier comprises two diodes electrically connected in series, and the first rectifier is electrically connected to the first filament-simulating circuit in parallel.”**

OSRAM discloses this claim element. Ex. 1003 ¶ 148. The first rectifier and first filament-simulating circuit are shown in annotated Figure 1 below. The first rectifier is composed of diodes D1, D2, D5, and D6. Diodes D1 and D2, and diodes D5 and D6, are electrically connected in series as each share a single node as shown in Figure 1. Ex. 1003 ¶ 148. The AC inputs of the first rectifier (i.e., the input of the first rectifier that receives the AC signal to be rectified to DC on its outputs) directly in parallel with the left- and right-hand-side terminals of filament-simulating circuit “WES” (18a). Ex. 1003 ¶ 148. The parallel relationship between the filament-simulating circuit and first rectifier are redrawn for clarity below. The

two nodes shared by the filament-simulating circuit and first rectifier are shown in blue in the annotated figures below.



OSRAM Figures 1+3 (redrawn, annotated) (Ex. 1003 ¶ 148)

5. **Claim 36:** “The power source module of claim 21, further comprising another current limiting circuit electrically connected to the second bi-pin terminal of the LED lamp, configured to limit a current from the second bi-pin terminal.”

OSRAM discloses a power source module comprising another current limiting circuit electrically connected to the second bi-pin terminal of the LED lamp, configured to limit a current from the second bi-pin terminal. Ex. 1003 ¶ 149.

As discussed in Section VI.A.12.c above regarding claim 21[b], OSRAM discloses a current limiting circuit R2/R3 electrically connected to the first bi-pin terminal. OSRAM discloses an optional second current limiting circuit electrically connected to the second bi-pin terminal. *Id.* OSRAM states that “[i]n the supply lines on ***at least one side*** of the circuit arrangement 10, serial resistances can be connected, of which the resistances R2, R3 are shown by way of example....” Ex. 1014, [0026] (emphasis added). As discussed in Section VI.A.12.c above regarding claim 21[b], these serial resistances limit the current from the first bi-pin terminal. Thus, OSRAM discloses optional serial resistances to limit the current from the second bi-pin terminal. Ex. 1003 ¶ 149.

6. **Claim 37: “The LED lamp of claim 23, further comprising another current limiting circuit electrically connected to a second terminal of the LED lamp, configured to limit a current from the second terminal.”**

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.20 regarding claim 36.

7. **Claim 39: “The LED lamp of claim 23, wherein the filament-simulating circuit comprises a first filament-simulating circuit connected between a first pin and a second pin of the first bi-pin terminal, and a second filament-simulating circuit connected between a first pin and a second pin of the second bi-pin terminal.”**

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.14 regarding claim 24[a].

8. Claim 41

(a) Preamble: “An LED lamp, comprising:”

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.13 regarding the preamble of claim 23.

(b) 41[a]: “a current limiting circuit electrically connected to a first terminal of the LED lamp for limiting a current from the first terminal;”

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.13.b regarding claim 23[a].

(c) 41[b]: “a first rectifier electrically connected to the current limiting circuit for rectifying the current from the current limiting circuit;”

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.13.c regarding claim 23[b].

(d) 41[c]: “a filter electrically connected between the first rectifier and at least one LED of the LED lamp for smoothing the current from the first rectifier; and”

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.13.d regarding claim 23[c].

- (e) **41[d]: “a first filament-simulating circuit electrically connected to a first bi-pin terminal of the LED lamp and a second filament-simulating circuit electrically connected to a second bi-pin terminal of the LED lamp, each of the first and the second bi-pin terminals arranged to have a current flowing from one pin to the other pin of the respective bi-pin terminal via the respective first or second filament-simulating circuit during a pre-heat process executed by a ballast.”**

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.12.e regarding claim 23[d].

9. Claim 42

- (a) **Preamble: “An LED lamp, comprising:”**

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.13 regarding the preamble of claim 23.

- (b) **42[a]: “a current limiting circuit electrically connected to a first terminal of the LED lamp for limiting a current from the first terminal;”**

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.13.b regarding claim 23[a].

- (c) **42[b]: “a first rectifier electrically connected to the current limiting circuit for rectifying the current from the current limiting circuit;”**

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.13.c regarding claim 23[b].

- (d) **42[c]: “a filter electrically connected between the first rectifier and at least one LED of the LED lamp for smoothing the current from the first rectifier; and”**

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.13.d regarding claim 23[c].

- (e) **42[d]: “a first filament-simulating circuit electrically connected to a first bi-pin terminal of the LED lamp, and a second filament-simulating circuit electrically connected to a second bi-pin terminal of the LED lamp, each of the first and the second bi-pin terminals arranged to have a current flowing from one pin to the other pin of the respective bi-pin terminal via the respective first or second filament-simulating circuit after the LED lamp is connected to a ballast and before a normal operation state of the LED lamp.”**

OSRAM discloses this claim element. The analysis of this claim element is identical to the discussion in Section VI.A.13.e regarding claim 23[d]. The claim limitation “after the LED lamp is connected to a ballast and before a normal operation state of the LED lamp” is equivalent to “during a pre-heat process executed by a ballast.” Ex. 1003 ¶ 162.

VII. MANDATORY NOTICES AND FEES

A. Real Parties-in-Interest

Petitioner MaxLite, Inc. is a real party-in-interest. CH Lighting Technology Co., Ltd. is potentially a real party-in-interest, and should be considered so for purposes of this petition only.

B. Related Matters

The following matters may affect or be affected by a decision herein: *Jiaxing Super Lighting Electric Appliance Co., Ltd. v. MaxLite, Inc.*, Case No. 2:19-cv-04047-PSG-MAA (CDCA).

C. Counsel

Lead counsel in this case is David Radulescu, Ph.D. (PTO Reg. No. 36,250); backup counsel is Jonathan Auerbach (PTO Reg. No. 59,193). Power of attorney accompany this Petition.

D. Service Information

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

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.

VIII. CONCLUSION

Based on the foregoing, claims 1, 2, 5-7, 9-10, 15-18, 21, 23-24, 29-32, 34-39, and 41-42 of the '662 patent recite subject matter that is unpatentable. The Petitioners request institution of an *inter partes* review to cancel these claims.

Date: November 25, 2019

Respectfully submitted,

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Appendix of Exhibits

Exhibit	Description
Ex. 1001	U.S. Patent No. 9,723,662 (Ye, et al.)
Ex. 1002	File History of U.S. Patent No. 9,723,662 (Ye, et al.)
Ex. 1003	Declaration of Regan Zane, Ph.D.
Ex. 1004	Curriculum Vitae of Regan Zane, Ph.D.
Ex. 1005	U.S. Patent No. 10,045,406 (Zhang)
Ex. 1006	U.S. Patent No. 8,502,454 (Sadwick)
Ex. 1007	David L. DiLaura, et al., <i>The Lighting Handbook</i> , Illuminating Engineering Society (10th ed. 2011), Excerpts
Ex. 1008	Intentionally Left Blank
Ex. 1009	Ron Lenk, <i>Practical Design of Power Supplies</i> , pp. 12-13, IEEE (2005)
Ex. 1010	U.S. Patent No. 10,117,295 (Zhang, et al.)
Ex. 1011	U.S. Patent No. 9,439,249 (Zhang, et al.)
Ex. 1012	Samuel M. Goldwasser, <i>Principles of Operation, Circuits, Troubleshooting, Repair</i> , Fluorescent Lamps, Ballasts, and Fixtures (1999) available at http://members.misty.com/don/f-lamp.html
Ex. 1013	M. Whelan, <i>The Fluorescent Lamp</i> , Edison Tech Center (2013), available at https://edisontechcenter.org/Fluorescent.html
Ex. 1014	Certified English Translation of German Patent DE202013000880U1 (OSRAM)
Ex. 1015	German Patent DE202013000880U1 (OSRAM)
Ex. 1016	International Rectifier Reference Design Data Sheet, August 1997 – IRPLLNR1 – <i>POWIRLIGHT</i> ™ Reference Design: Linear Ballast
Ex. 1017	Wikipedia, Glow switch starter, available at https://en.wikipedia.org/wiki/Glow_switch_starter
Ex. 1018	WO2014/115010 (Philips)

CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,723,662 UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §§ 42.1-.80, 42.100-.123 complies with the type-volume limitation in 37 C.F.R. § 42.24(a)(1)(i). According to the “Word Count” feature of the word-processing system to create this Petition, the Petition contains 13,523 words, excluding the parts of the brief exempted by 37 C.F.R. § 42.24(a)(1).

Date: November 25, 2019

Respectfully submitted,

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**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 November 25, 2019, a complete and entire copy of this Petition for *Inter Partes* Review of U.S. Patent 9,723,662 was served via EXPRESS MAIL[®], postage prepaid, to the Patent Owner by serving the following parties:

Patent owner's correspondence address of record

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